Report

Group 5 – Central Portion of Areas III and IV RCRA Facility Investigation Report Santa Susana Field Laboratory, Ventura County, California

Volume I – RFI Group Reports Text, Tables, and Figures

Prepared for:

The Boeing Company
and
United States Department of Energy

November 2008

DRAFT IN PROGRESS AGENCY REVIEW

Jill Bensen
Program Manager

Dennis Shelton, Ph.D., DABT
Risk Assessment Program Director

Michael O. Bower, P.E.
Project Manager

John Lovenburg, P.G.
Senior Reviewer

GROUP 5 RFI REPORT – VOLUME I

Contents

Section Page

Tables

Figures

Appendices

Acronyms and Abbreviations

°F	degrees Fahrenheit
µg/dl	micrograms per deciliter
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
µg/Lv	micrograms per liter vapor
AI	Atomics International
AOC	Area of Concern
AST	aboveground storage tank
B100	Building 100
BBI	Brandeis-Bardin Institute
bgs	below ground surface
BMP	best management practice
Boeing	The Boeing Company
BTEX	benzene, toluene, ethylbenzene, and xylenes
CCR	Current Conditions Report
CF	Chatsworth Formation
CFOU	Chatsworth Formation Operable Unit
CMI	Corrective Measures Implementation
CMS	Corrective Measures Study
COEC	chemical of ecological concern
COPC	chemical of potential concern
CPEC	chemical of potential environmental concern
CSM	conceptual site model
DCA	dichlorethane
DCE	dichloroethene
DHS	Department of Health Services
DHS-RHB	Department of Health Services- Radiological Health Branch
Dioxins/Furans	(a) – *see table below*
DOE	United States Department of Energy
DQO	data quality objective
DPH	Department of Public Health
DTSC	Department of Toxic Substances Control

ECL	Environmental Chemistry Laboratory
EEL	Environmental Effects Laboratory
EIR	Environmental Impact Report
ELCR	excess lifetime cancer risk
ELV	Expendable Launch Vehicle
EPC	exposure point concentration
ERA	ecological risk assessment
ETEC	Energy Technology and Engineering Center
FLUTe	Flexible Liner Underground Technology
Freon	1,1,-trichlorofluoromethane
Freon 113	1,1,2-trichloro-1,2,2-trifluoroethane
GRC	Groundwater Resources Consultants, Inc.
GWCC	groundwater comparison concentration
GWTS	groundwater extraction/treatment system
H&A	Haley & Aldrich, Inc.
HERF	high-energy rate forging
HI	hazard index
HML	Hazardous Materials Laboratory
HMSA	Hazardous Material Storage Area
HQ	hazard quotient
HRA	human health risk assessment
HSA	Historical Site Assessment
ICF	ICF Kaiser Engineers
ILCR	incremental lifetime cancer risk
IRFNA	inhibited red-fuming nitric acid
ISI	In-Service Inspection
LF	leach field
L_{OX}	liquid oxygen
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
MMH	monomethyl hydrazine
MRCA	Mountains Recreation Conservancy Authority
msl	mean sea level
NA	not applicable
NAA	North American Aviation

NASA	National Aeronautics and Space Administration
NDMA	n-nitrosodimethylamine
NDPA	n-nitrosodiphenylamine
NFA	no further action
NPDES	National Pollutant Discharge Elimination System
NSGW	near-surface groundwater
NTO	nitrogen tetroxide
Ogden	Ogden Environmental and Energy Services Company, Inc.
OMR	Organic Moderated Reactor
OU	operable unit
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
pCi/g	picocuries per gram
PDU	Process Development Unit
pg/g	picograms per gram
pg/L	picograms per liter
ppb	parts per billion (µg/kg or µg/L)
ppm	parts per million (mg/kg or mg/L)
PRG	preliminary remediation goal
QA	quality assurance
RBSL	risk-based screening level
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RIHL	Rockwell International Hot Laboratory
RME	reasonable maximum exposure
RMHF	Radioactive Materials Handling Facility
Rocketdyne	Rocketdyne Propulsion and Power Division
RWQCB	Regional Water Quality Control Board
SAIC	Science Applications International Corporation
SCTI	Sodium Component Test Installation
SGR	Sodium Graphite Reactor
SMOU	Surficial Media Operable Unit
SNAP	Systems Nuclear Auxiliary Power Facility

SOP	standard operating procedure
SPA	Storable Propellant Area
SRAM	Standardized Risk Assessment Methodology
SRE	Sodium Reactor Experiment
SSFL	Santa Susana Field Laboratory
STI	Sonoma Technology, Inc.
STL-IV	Systems Test Laboratory IV
STP-3	Area III Sewage Treatment Plant
SVOC	semivolatile organic compound
SWMU	solid waste management unit
SWPPP	Storm Water Pollution Prevention Plan
TCA	trichloroethane
TCE	trichloroethene
TEQ	toxicity equivalency quotient
TPH	total petroleum hydrocarbons
TRPH	total recoverable petroleum hydrocarbons
TRV	toxicity reference value
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VC	VC
VCEHD	Ventura County Environmental Health Department
VOC	volatile organic compound
WDP	Waste Discharge Permit
WPA	RFI Work Plan Addendum
WPAA	RFI Works Plan Addendum Amendments

(a) Definition of dioxin/furan congeners

PCDD/PCDDs	Polychlorinated dibenzo-p-dioxins/dibenzofurans
2,3,7,8-TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
1,2,3,7,8-PeCDD	1,2,3,7,8-pentachlorodibenzo-p-dioxin
1,2,3,4,7,8-HxCDD	1,2,3,4,7,8-hexachlorodibenzo-p-dioxin
1,2,3,6,7,8-HxCDD	1,2,3,6,7,8-hexachlorodibenzo-p-dioxin
1,2,3,7,8,9-HxCDD	1,2,3,7,8,9-hexachlorodibenzo-p-dioxin
1,2,3,4,6,7,8-HpCDD	1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin
OCDD	1,2,3,4,6,7,8,9-octachlorodibenzo-p-dioxin
2,3,7,8-TCDF	2,3,7,8-tetrachlorodibenzofuran
1,2,3,7,8-PeCDF	1,2,3,7,8-pentachlorodibenzofuran
2,3,4,7,8-PeCDF	2,3,4,7,8-pentachlorodibenzofuran
1,2,3,4,7,8-HxCDF	1,2,3,4,7,8-hexachlorodibenzofuran
1,2,3,6,7,8-HxCDF	1,2,3,6,7,8-hexachlorodibenzofuran
2,3,4,6,7,8-HxCDF	2,3,4,6,7,8-hexachlorodibenzofuran
1,2,3,7,8,9-HxCDF	1,2,3,7,8,9-hexachlorodibenzofuran
1,2,3,4,6,7,8-HpCDF	1,2,3,4,6,7,8-heptachlorodibenzofuran
1,2,3,4,7,8,9-HpCDF	1,2,3,4,7,8,9-heptachlorodibenzofuran
OCDF	1,2,3,4,6,7,8,9-octachlorodibenzofuran
TEQs	toxicity equivalency quotients (normalized to 2,3,7,8-TCDD)

Executive Summary

This Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) report presents a comprehensive, integrated assessment of current and future conditions for the Group 5 Reporting Area (Group 5), located in the central portion of Areas III and IV at the Santa Susana Field Laboratory (SSFL). This report has been prepared to meet RFI requirements defined by the Department of Toxic Substances Control (DTSC) issued to the SSFL in regulatory permits or as requested in meetings or correspondence. The purpose of the RFI is to characterize the nature and extent of chemicals in environmental media, evaluate risks to potential receptors, gather data to support the next phase of the RCRA Corrective Action Program, the Corrective Measures Study (CMS), and identify areas for further work.

The Group 5 RFI Report is the fourth of 10 Group RFI reports that will present results and recommendations for large, interrelated portions of the SSFL. The Group 5 Reporting Area includes 17 RFI sites:

- Boeing Area IV Leach Field
- Compound A Facility
- Engineering Chemistry Laboratory (ECL)
- Environmental Effects Laboratory (EEL)
- Pond Dredge Area
- Coal Gasification Process Development Unit (PDU)
- Area III Sewage Treatment Plant (STP-3)
- Southeast Drum Storage Yard (SE Drum Yard)
- Systems Test Laboratory IV (STL-IV)
- Building 65 Metals Laboratory Clarifier
- Building 100 Trench
- Department of Energy Leach Field 1 (DOE LF1)
- Department of Energy Leach Field 2 (DOE LF2)
- Department of Energy Leach Field 3 (DOE LF3)
- Hazardous Material Storage Area (HMSA)
- Rockwell International Hot Laboratory (RIHL)
- Systems for Nuclear Auxiliary Power Facility (SNAP)

Known and potential chemical use areas were sampled and the nature and extent of chemicals determined. Characterization included evaluation of both lateral and vertical potential contaminant migration pathways (that is, between RFI sites, and between surficial media and groundwater). Characterization of the Group 5 Reporting Area is sufficiently complete to estimate current and future risks to potential human and ecological receptors for all the primary chemical use areas and other areas where chemicals were potentially used, and support CMS evaluations. Group 5 site action recommendations have been made to identify areas for: (a) further evaluation in the CMS ("CMS Areas"), (b) no further action ("NFA Areas"), and (c) interim surficial soil source area stabilization measures in some CMS Areas to control contaminant migration ("Stabilization Areas").

CMS or NFA Area recommendations are based on an integrated evaluation of site characterization and risk assessment results. Chemicals contributing to estimated risks above the most conservative lower end of the regulatory agency-published acceptable risk range (that is, risks of 1×10^{-6}, or 1 in 1,000,000) and/or a hazard index of greater than 1 were identified. Risk assessments have been performed for this RFI according to the approved Risk Assessment Methodology for SSFL. Determination of characterization and risk assessment requirements associated with Senate Bill 990 (SB990) is ongoing with DTSC. Once uncertainties with SB990 are resolved, Group 5 documents will be reviewed and revised as warranted.

Sampling results were reviewed to locate areas where chemicals are present at concentrations contributing to or driving the estimated risks. For Group 5, this evaluation identified 35 CMS Areas that are recommended for further evaluation. Primary chemicals contributing to or driving the estimated risks are summarized below and indicated in Table ES-1. The extent of CMS Areas shown in Figure ES-1 is approximate and comprehensive for potential receptors. Areas outside the CMS Areas shown in Figure ES-1 are recommended for NFA.

Within the Group 5 CMS Areas, no stabilization measures are recommended to control potential contaminant migration via the surface water pathway.

A brief summary of the historical operations at each RFI site is presented in Section 2 of each site report, found in Appendices D through T.

Recommendations in this report are for surficial media (such as soil and soil vapor) but are based upon the characterization data and risk estimates from all the media evaluated. Because the SSFL groundwater investigation is ongoing, specific CMS recommendations for groundwater will be presented in a future site-wide groundwater RFI report. There will also be an additional ecological risk assessment of large home range receptors (for example, bobcat, mule deer, and hawk) once the Group RFI reports for SSFL have been evaluated, and any site action recommendations resulting from the large home range evaluation will be presented in that future report. Site action recommendations presented in this Group 5 RFI Report will be reviewed once these additional evaluations are completed and, if needed, updates to this report prepared. However, the site action recommendations included herein can be confidently carried forward into the CMS since these two additional evaluations may identify areas that would be added to, not removed from, subsequent CMS decision-making.

1.0 Introduction

This Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Report presents results and recommendations for the investigation conducted within the Group 5 Reporting Area located in the central portion of Areas III and IV at the Santa Susana Field Laboratory (SSFL). The RCRA Corrective Action Program is being conducted at the SSFL under the oversight of the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC). As discussed in Section 1.2 below, the RFI is being conducted at former operational areas called "RFI sites." The Group 5 Reporting Area includes 17 RFI sites.

1.1 SSFL Facility Information

The SSFL is located approximately 29 miles northwest of downtown Los Angeles, California, in the southeast corner of Ventura County. The SSFL occupies approximately 2,850 acres of hilly terrain, with approximately 1,100 feet of topographic relief near the crest of the Simi Hills. Figure 1-1 shows the geographic location and property boundaries of the site, as well as surrounding communities. The following sections describe the site use, history, land ownership, surrounding land use, and environmental programs at the SSFL. Additional SSFL facility information is provided in the RFI Program Report (MWH, 2004).

1.1.1 SSFL Ownership and History

The SSFL is jointly owned by The Boeing Company (Boeing) and the National Aeronautics and Space Administration (NASA), and is operated by Boeing. The site is divided into four administrative areas (Areas I, II, III, and IV) and undeveloped land areas to both the north and south (Figure 1-2). Areas I, III, and IV are owned by Boeing. Area II is owned by NASA. Ninety acres of Area IV were leased to the United States Department of Energy (DOE) to conduct a broad range of energy-related research and development. The northern and southern undeveloped lands of the SSFL were not used for industrial activities and are owned by Boeing. The Group 5 Reporting Area, described further in Section 1.3, is primarily located in the central portion of administrative Areas III and IV.

Prior to development, the land at the SSFL was used for ranching. During 1948, North American Aviation (NAA), a predecessor company to Boeing, began using (by lease) what is now known as the northeastern portion, or administrative Area I of the SSFL. The majority of the SSFL was acquired with the purchase of the Silvernale property in 1954, and development of the western portion of the SSFL began soon after. Undeveloped land parcels to the south of the SSFL were acquired during 1968 and 1976 and to the north during 1998. No site-related operations were conducted in these undeveloped portions of the SSFL.

The primary site activities at the SSFL since 1948 have included research, development, and testing of liquid-fueled rocket engines and associated components (such as pumps and valves) (Science Applications International Corporation [SAIC], 1994). Since 1996, Boeing has conducted operations at the SSFL. Predecessor companies to Boeing have included the

Rocketdyne Propulsion and Power Division (Rocketdyne) of NAA and of the Rockwell Corporation. The vast majority of rocket engine testing and ancillary support operations occurred from the 1950s through the early 1970s. These were conducted by Rocketdyne in Areas I and III in support of various government space programs and in Area II on behalf of NASA. Rocket engine testing frequency decreased during the 1980s and 1990s, and ceased in 2006. Currently, no rocket engine test areas are in operation. Engine testing at the SSFL primarily used petroleum-based compounds as the "fuel" and liquid oxygen (LOX) as the "oxidizer." Solvents were used for cleaning rocket engine components. Trichloroethene (TCE) was the primary solvent used for this and other cleaning purposes.

Solid propellant testing was not conducted at the large rocket engine test stands, but solid propellants were used in small rocket motor testing and various research and development programs. Solid propellants, including perchlorate compounds, were primarily used, stored, and tested within Area I.

In addition to the primary facility operation of rocket engine testing, the SSFL was used for research, development, and testing of water jet pumps, lasers, and liquid metal heat exchanger components; nuclear energy research; and research and development of related technologies. Nuclear energy research, testing, and support facilities were located within the 90-acre portion of Area IV that was leased to DOE and designated as the Energy Technology Engineering Center (ETEC). Operations were conducted by Atomics International (AI), a division of NAA, and Rocketdyne on behalf of DOE, with operations primarily from the 1950s through the 1980s. Area IV was inactive prior to 1953, when the land was purchased by NAA. From the mid-1950s until the mid-1990s, DOE and its predecessor agencies sponsored nuclear energy research and energy development projects within Area IV of the SSFL. The research and energy development activities included nuclear energy operations (development, fabrication, disassembly, and examination of nuclear reactors, reactor fuel, and other radioactive materials) and large-scale liquid sodium metal experiments for testing liquid metal fast breeder reactor components. Nuclear energy activities within Area IV ceased in 1988 (MWH, 2004).

1.1.2 Surrounding Land Use

Land surrounding the SSFL is generally open space or rural residential, although other uses are present. A brief description of the current land use of each of the offsite adjacent properties is presented below (MWH, 2004). Adjacent land use is shown in Figure 1-1.

- Northern Adjacent Properties – The adjacent property to the northwest is occupied by the Brandeis-Bardin Institute (BBI), and the adjacent property to the northeast is occupied by the Mountains Recreation Conservancy Authority (MRCA). The BBI is zoned as rural agricultural on Ventura County zoning maps. This designation permits a wide range of agricultural uses. The specific land use permit conditions for the BBI indicate that this property contains religious, teaching, and camping facilities. The MRCA property is zoned as open space, currently operates as Sage Ranch Park, a County of Ventura Park, and has a house where the park ranger resides.
- Eastern Adjacent Properties – The properties situated immediately adjacent to the east of the SSFL are zoned light agricultural, with variances that permit higher-density use (such as mobile home parks). A residential community is present approximately

0.25 miles east of the SSFL boundary in Woolsey Canyon. A new residential community is under development 0.5 miles southeast of the SSFL boundary near Dayton Canyon.

- Southern Adjacent Properties – The properties situated adjacent to the south of the SSFL are used for residential purposes (Bell Canyon). Dense residential development begins in the San Fernando Valley about 5 miles southeast of the SSFL.
- Western Adjacent Properties – The majority of properties situated adjacent to the west of the SSFL are designated by Ventura County as open space. This land has been and is currently used for cattle grazing. Recently, a portion of Runkle Canyon located in this area has been proposed for development.

1.1.3 SSFL Environmental Programs

Four environmental programs at the SSFL are being conducted under the authority of RCRA. The RCRA Program is described further in Section 1.2. In addition to RCRA, other federal, state, and county environmental programs are being conducted at the SSFL, including permitting for air emissions, surface water discharge permitting, and other site investigation and closure activities. Information regarding environmental programs conducted at the SSFL is provided in the RFI Program Report (MWH, 2004). Since these other environmental programs overlap and are relevant to some of the RCRA RFI sites, they are briefly described below:

- Waste Discharge Permits (WDPs) have been issued to the SSFL by the Regional Water Quality Control Board (RWQCB) since 1958. Currently, surface water discharge from the SSFL is regulated under a National Pollutant Discharge Elimination System (NPDES) permit issued by the RWQCB, which began providing oversight in 1984. Surface water discharges are regularly monitored at 18 NPDES locations, shown in Figure 1-2.
- Fuel storage tanks at the site are now included in the RCRA Program under oversight by DTSC. Historically, underground storage tanks (USTs) were regulated by the Ventura County Environmental Health Division (VCEHD). Aboveground storage tanks (ASTs) were regulated by the RWQCB.
- Closure of nuclear testing and research facilities in Area IV is being performed under the jurisdiction of DOE. The California Department of Health Services-Radiologic Health Branch (DHS-RHB) oversees the Boeing-owned Radioactive Materials License, conducts facility verification surveys, evaluates the radioactive facility cleanup, and conducts environmental monitoring.

1.2 RCRA Corrective Action Program

The RCRA-related activities at the SSFL include four major environmental programs, all under the oversight and jurisdiction of the DTSC. These programs include: (1) RCRA Corrective Action, (2) Closure of inactive RCRA units, (3) Compliance/permitting of RCRA units, and (4) Interim Measures. In some instances these programs overlap (such as closed RCRA units within RFI sites that are investigated as part of Corrective Action). Although related under RCRA, each program has separate process requirements and guidelines. Collectively, these programs represent a comprehensive program for the handling and

cleanup of hazardous chemicals. The RCRA Corrective Action Program is described below, and the reader is referred to the RFI Program Report (MWH, 2004) for descriptions of the other RCRA Programs.

1.2.1 Corrective Action Process

The RCRA Corrective Action process includes four phases to achieve site cleanup and closure. These are the RCRA Facility Assessment (RFA), RCRA Facility Investigation (RFI), Corrective Measures Study (CMS), and Corrective Measures Implementation (CMI) phases. The first phase of the RFA is performed to identify Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs), which are units that have used, stored, or handled various hazardous materials. The RFA was completed in 1994 (SAIC, 1994).

The SSFL RCRA Corrective Action program is currently in the RFI phase. During the RFI, additional AOCs (beyond those listed in the RFA) have been identified and investigated at the SSFL (MWH, 2004). A total of 135 SWMUs and AOCs have been identified at the SSFL, and those undergoing closure as part of the RFI Program have been grouped by location for purposes of investigation and are called "RFI sites." RFI sites have been grouped for reporting as described in Section 1.2.3. The RFI Program Report (MWH, 2004) listed 51 RFI sites. Further evaluation of the RCRA Program has resulted in a new total of 57 RFI sites. Four sites were added to include land surrounding permitted facilities (Area I Burn Pit, Radioactive Materials Handling Facility [RMHF], Building 133, and Building 029). Two sites were added when leach fields were regrouped to allow for planned reporting. The 57 RFI sites identified for investigation are shown in Figure 1-3. For ease of presentation in this figure, and as reported in previous documents (MWH, 2004), the Boeing and DOE leach fields that are not associated with an existing RFI site have been grouped together (that is, a DOE group and a Boeing group) and listed as additional RFI sites.

The RFI includes characterization of all relevant environmental media present at the SSFL. Investigations of environmental media have been conducted following DTSC-approved work plans (ICF Kaiser Engineers [ICF], 1993; Groundwater Resources Consultants, Inc. [GRC], 1995a and 1995b; Ogden Environmental and Energy Services Company, Inc. [Ogden], 1996, 2000a, and 2000b; Montgomery Watson, 2000b; MWH, 2001, 2003a, 2005a and 2005c). The scope and extent of sampling of the SSFL during the RFI is described in the Program Report (MWH, 2004).

The objectives of the RFI are to characterize the nature and extent of chemical contamination in environmental media, evaluate risks to potential receptors, gather data for the CMS, and identify areas for additional work (DTSC, 1995). Site action recommendations resulting from the RFI are categorized into: (1) further evaluation in the CMS, (2) no further action (NFA), or (3) interim source area stabilization measures to control contaminant migration (Stabilization Areas) while cleanup plans are prepared. Stabilization Areas may be included within CMS Areas.

The CMS phase of the RCRA Corrective Action Program will be an evaluation of remedial alternatives for areas that are identified for further evaluation during the RFI. The CMS may also include further evaluation of uncertainties identified in the RFI, such as risk assessment uncertainties or delineation of chemicals requiring cleanup. CMS plans are prepared for DTSC review, and findings are published in a final CMS report for DTSC approval.

During the CMI, the Corrective Action Program moves from cleanup planning to cleanup implementation and confirmation/monitoring sampling. The complete SSFL cleanup plan will be evaluated in an environmental impact report (EIR) prior to implementation. Public review and comment will be included during several steps in this process prior to the selection and implementation of cleanup activities.

1.2.2 Operable Units at the SSFL

Since the early 1980s, SSFL site characterization has proceeded along two parallel paths: one for groundwater, the other for soil and related surficial media. In 1999, DTSC formalized this approach by identifying two Operable Units (OUs) (DTSC, 1999). As defined by United States Environmental Protection Agency (USEPA), an OU is a discrete entity that may comprise various attributes, including characteristics of the impacted media, geographical location, vertical and aerial considerations, specific site problems, and potential exposure pathways. The OUs identified at the SSFL are consistent with this definition and incorporate different geographical portions of the site, project phases, and exposure pathways. The two OUs have been identified at the SSFL through discussion with DTSC based on an understanding of where chemicals are present today, where they could migrate in the future, and how either human or ecological receptors could be exposed to those chemicals (DTSC, 1999). The OUs at the SSFL are:

- The Surficial Media OU (SMOU), composed of saturated and unsaturated soil, sediment, surface water, near-surface groundwater (NSGW), air, biota, and weathered bedrock. NSGW occurs within alluvium or weathered bedrock.
- The Chatsworth Formation OU (CFOU), is composed of the Chatsworth Formation groundwater, and both saturated and unsaturated unweathered (competent) bedrock.

The boundary between these two OUs is the boundary between weathered and unweathered bedrock. The OUs are depicted in Figure 1-4.

The SMOU consists primarily of soil, sediment, and surface water, all of which are potentially impacted by spills. Also included in this OU are NSGW, air, biota, and the upper, weathered portion of the bedrock. These additional media have been included in the SMOU because chemicals released into soil, sediment, or surface water could directly contact, or potentially be transferred to, NSGW, surface seeps or springs, air, biota, and weathered bedrock. Direct exposure to surficial media by receptors is possible, although the type of exposure might vary based on location (such as steep drainage terrain versus flat upland terrain). These potential surficial media exposures within Group 5 are evaluated in the risk assessments completed for the RFI sites within this group.

The CFOU consists of groundwater and associated unweathered, competent bedrock of the Chatsworth Formation, which is composed of thickly bedded sandstone with interbeds of siltstone and shale. This unit has been impacted by downward migration of chlorinated solvents (primarily TCE) from surficial spills and/or by dissolved-phase contaminants transported to and within Chatsworth Formation groundwater. In contrast to surficial media, due to its nature and depth (typically more than 70 feet below ground surface [bgs]), it is unlikely that human or ecological receptors would be exposed directly to chemicals within the unweathered, deeper bedrock. Direct exposures to Chatsworth Formation groundwater could occur only through installation of a drinking water well, or at a surface

seep or spring supplied by Chatsworth Formation groundwater. Indirect exposures to chemicals in Chatsworth Formation media (bedrock or groundwater) are also considered as part of the RFI site risk assessments. These potential direct and indirect groundwater exposures within Group 5 are evaluated in the risk assessments completed for the RFI sites within this group.

As stated above, a goal of the RFI Program is to characterize chemical impacts in all relevant environmental media at the SSFL. This goal is achieved by combining and integrating site data from the characterization programs for both OUs. Similarly, the goal of the RFI risk assessment is to evaluate risks from all relevant environmental media. This goal is accomplished by combining the estimated risk associated with exposure pathways for both OUs. Several possible pathways of chemical migration across or between OUs have been identified. Each of these potential pathways is included in the risk evaluations of the SMOU and the CFOU, as described further in Section 5.0.

1.2.3 RFI Program and Reporting Approach

As described in the RFI Program Report (MWH, 2004), the Data Quality Objective (DQO) process (USEPA, 1994 and 2000) was used to guide the SSFL RFI. The problem statement developed for the SMOU RFI is:

"Comply with regulatory requirements by characterizing the nature and extent of contamination in surficial media (soil matrix, soil vapor, sediment, surface water, near surface groundwater, air, biota, and weathered bedrock)."

Five decision questions were identified during DQO development and have been used to guide the data collection and evaluation process for the SMOU RFI. These five questions are:

1. Has historical information on chemical use areas and chemical releases been used to identify potential source areas?
2. Have source area sampling and analysis plans been developed to characterize the nature and extent of contamination?
3. Is the nature and extent of contamination at potential source areas within RFI sites characterized sufficiently for risk assessment?
4. Have potential human health and ecological impacts been assessed?
5. Have characterization and risk assessment results been used to make site action recommendations for the CMS?

Although developed for the SMOU, these five questions are relevant for the overall RFI Program at the SSFL. The RFI reporting approach has been designed to answer these questions in a comprehensive, integrated manner for large areas of the site.

Based on input from DTSC, the SSFL has been divided into 11 Group Reporting Areas (Groups 1a, 1b, and 2 through 10) as shown in Figure 1-5. The Group Reporting Areas have been established to accomplish the goal of providing a comprehensive, integrated description of site data from all media across large, interrelated areas of the site. As such, the Group RFI Reports include evaluation of data from both OUs to determine characterization completeness, transport and fate of contaminants, and assessment of

potential risks to receptors. As necessary, offsite areas are included in the RFI evaluation of SSFL-related impacts. Group Reporting Areas were identified generally based on natural topographic constraints at the SSFL, but groundwater plume extents, RFI site responsibility, and operational boundaries were also considered. The Group Reporting Areas shown in Figure 1-5 serve to facilitate evaluation of all migration pathways and, therefore, capture all appropriate site data for risk assessment.

The focus and objective of the Group RFI Reports is to provide DTSC sufficient information so that site action decisions regarding surficial media can be made and CMS evaluation areas can be determined. Because the CFOU investigation is ongoing while the Group Reports are being prepared, CMS recommendations regarding groundwater will be provided in a final Site-wide Groundwater Report, which will be submitted at the completion of the CFOU investigation. However, groundwater-related risks are presented in the risk assessments and considered with the SMOU risks in making CMS recommendations.

Two aspects of the surficial media RFI will be addressed after all Group RFI Reports are prepared. In both of these cases, surficial media recommendations will be in addition to those presented in the Group Reports. The first involves completion of the CFOU investigation described above. Because all media are being assessed for potential risks to receptors in the current Group RFI Reports, new data collected during the ongoing CFOU investigation must be re-assessed for contribution to surficial media risks and, if necessary, additional areas recommended for CMS evaluation. This assessment of subsequent CFOU data will be included in the Site-wide Groundwater Report.

The second aspect that affects the surficial media site action recommendations for the CMS is a site-wide evaluation for large home range receptors (for example, bobcat, mule deer, and hawk). Assessment of potential risks to these receptors will be performed once sufficiently large areas of SSFL have been evaluated and presented in the Group RFI Reports. Estimated large home range receptor risks will be reported in a Site-wide Large Home Range Risk Assessment Report, which will also identify any additional areas that should be considered for CMS evaluation resulting from that assessment.

These two additional aspects of RFI reporting will serve to confirm and finalize the areas to be evaluated in the CMS as described in this (and other) Group RFI Reports. The areas recommended for further evaluation in this report can be confidently carried forward into the CMS because it is believed that additional, not fewer, areas will be identified by subsequent site-wide RFI evaluations.

The Group 6 RFI Report for the Northeastern Portion of Area IV (MWH, 2006b), the Group 4 RFI Report for the Southern Portion of Area II (MWH, 2007e), and the Group 8 RFI Report for the Western Portion of Area IV (MWH, 2007f) were the first, second, and third RFI Report, respectively, that were completed and submitted to DTSC. The Group 5 RFI Report for the Central Portion of Areas III and IV is the fourth RFI Report to be submitted for DTSC review.

1.3 Scope and Objectives of the Group 5 RFI Report

The Group 5 RFI Report presents RFI findings and CMS recommendations for the central portion of Areas III and IV. The scope and objectives of the Group 5 Report, and the content and format of this report are described below.

1.3.1 Scope

The Group 5 Reporting Area consists of approximately 232 acres located entirely within the central and southern portion of Areas III and IV (Figure 1-6). Areas adjacent to the Group 5 Reporting Area include the RFI Group 9 Reporting Area to the east, the RFI Group 6 Reporting Area to the northeast, the RFI Group 7 Reporting Area to the northwest, the RFI Group 8 Reporting Area to the west, and the RFI Group 10 Reporting Area to the south. The Group 5 Reporting Area is, therefore, adjacent to five other RFI Group Reporting Areas, as shown in Figure 1-5. Reporting Group 5 consists of both Boeing and DOE RFI sites.

The following 17 RFI sites are included in the Group 5 Reporting Area:

Boeing Area IV Leach Field	Area IV AOCs (Building 4011 Leach Field and Building 4008 Warehouse)
Compound A Facility	SWMU 6.4 (Compound A Facility)
Engineering Chemistry Laboratory (ECL)	SWMU 6.1, 6.2, 6.3 (Engineering Chemistry Laboratory, Waste Tank, and Container Storage Area, the ECL Pond and Suspect Pond, and the ECL Collection Tank) and Area III AOCs (ECL Runoff Tanks and Building 3270 Leach Field)
Environmental Effects Laboratory (EEL)	SWMU 6.9 (Environmental Effects Laboratory)
Pond Dredge Area	Area IV AOC (Pond Dredge Area)
Process Development Unit (PDU)	SWMU 7.10 (Building 4005)
Area III Sewage Treatment Plant (STP-3)	Area IV AOC (Area III Sewage Treatment Plant)
Southeast Drum Storage Yard (SE Drum Yard)	Area IV AOC (SE Drum Storage Area)
Systems Test Laboratory IV (STL-IV)	SWMU 6.5, 6.6, and 6.7 (STL-IV Test Area, STL-IV Pond 1, and STL-IV Pond 2)
Building 65 Metals Laboratory Clarifier	Area IV AOC (Building 65 Metals Laboratory Clarifier)
Building 100 Trench	SWMU 7.5 (Building 100 Trench Area)
DOE Leach Field 1 (DOE LF1)	Area IV AOCs (Buildings 4030 and 4093 Leach Fields)
DOE Leach Field 2 (DOE LF2)	Area IV AOC (Building 4010 Leach Field)

DOE Leach Field 3 (DOE LF3)	Area IV AOCs (Building 4373, 4383, and 4393 Leach Fields)
Hazardous Material Storage Area (HMSA)	SWMU 5.7 (Building 4457)
Rockwell International Hot Laboratory (RIHL)	SWMU 7.7 (Building 4020)
Systems for Nuclear Auxiliary Power Facility (SNAP)	Area IV AOC (Building 4059)

The RFI site boundaries shown in Figures 1-3 and 1-6 (and on other maps depicted in this report) are not meant as administrative boundaries, but rather are to serve as outlines that encompass the primary operational activities at a site. As described in Appendices D through T and in Section 4, RFI sampling extended outside these boundaries, as necessary, to determine the nature and extent of potential contamination and to assess potential migration pathways. Figures 1-3 and 1-6 also show the investigation boundaries, which, for the purposes of this RFI, are drawn to include all of the sample locations that were used to evaluate the nature and extent of impacts and to perform the risk assessment for each of the RFI Sites.

1.3.2 Objectives

The objectives of this report are:

- To present characterization results in Group 5 and to identify the nature and extent of chemical contamination in environmental media.
- To present human health and ecological risk assessment results based on chemicals identified in Group 5.
- To present risk-based recommendations for site actions, including NFA areas, areas recommended for further evaluation in the CMS, and areas recommended for source stabilization.

As stated above, surficial media areas recommended for further CMS evaluation are considered defined sufficiently for CMS planning, although supplemental areas or volumes might be added following completion of the Site-wide Groundwater Report and/or the Site-wide Large Home Range Risk Assessment Report.

1.3.3 Content and Format

To present the necessary information regarding characterization findings, risk assessment results, and site action recommendations, the Group 5 RFI Report is divided into 9 sections and 21 appendices. A diagram for the Group 5 RFI report structure is shown in Figure 1-7, and presented in relationship to the overall RFI reporting approach for the SSFL. Figure 1-7 also describes the key elements of each component of the report, how and where information is presented, and the informational relationships between the components of the document.

This volume (that is, Volume I) of the Group 5 Report (Sections 1 through 9) presents an integrated summary of the detailed information presented in appendices (Volumes II through IX), and describes intra-site relationships regarding the nature, extent, transport, and fate of chemical impacts within the reporting area.

1.3.3.1 Volume I

Section 1 – Introduction. This section provides SSFL background and operations, descriptions of environmental programs, RFI strategy and reporting, and the scope and objectives of this Group 5 RFI Report.

Section 2 – Physical Setting of the Reporting Area. Section 2 provides descriptions of physical features of the reporting area including topography, climate and meteorology, geology, surface water drainages, groundwater and biological conditions. In addition, Section 2 provides descriptions historical changes to physical features (such as grading following building demolition) as they relate to characterization findings or risk assessment results.

Section 3 – Group 5 Site History and Chemical Use. Section 3 presents a summary of the history of the Group 5 RFI sites and presents the potential chemical use areas considered during the investigation. Current conditions and how they may be different from conditions during site operations are also discussed.

Section 4 – Nature and Extent of Chemicals in Group 5. Section 4 presents a summary of the results of the investigations across the entire reporting area. Detected chemical concentrations in environmental samples and the interpretation of the results are included. Detailed findings for individual RFI sites are described in Appendices D through T, as presented in subsequent volumes of the report.

Section 5 – Contaminant Transport and Fate. Section 5 contains descriptions of contaminant migration pathways, and transport and fate evaluation results used to assess chemical migration in groundwater, soil vapor, air, and surface drainages.

Section 6 – Risk Assessment Summary. Section 6 presents a summary of the results of the human health and ecological risk assessment for the Group 5 Reporting Area based on 17 RFI site risk assessments.

Section 7 – Group 5 RFI Report Summary and Site Action Recommendations. Section 7 provides descriptions of reporting requirements, and it presents the criteria and processes applied to make site action recommendations. Specific areas within the RFI sites are identified as recommended areas for further evaluation in the CMS, including those also recommended for source stabilization measures.

Section 8 – References. Section 8 provides the references cited in the text.

Section 9 – Glossary and Definition of Terms. Section 9 provides definitions of technical terms used in the document that may be unfamiliar to the reader.

A searchable database of historical documents for the Group 5 Reporting Area (Boeing, 2008a) is being submitted to DTSC along with this Group RFI Report. Included are facility records, maps and drawings, correspondence, and reports relevant to the RFI for each of

Group 5 RFI sites. Documents pertaining to the entire SSFL are also included if relevant to Group 5. Because the review of historical documents is ongoing for the other RFI Groups, if more documents that are pertinent to the Group 5 Reporting Area are identified, these will be provided to DTSC as an addendum to the Group 5 electronic document database.

1.3.3.2 Volume II

Appendix A – RFI Risk Assessment. Appendix A presents risk assessment information, including a description of any methodology variances from the Standardized Risk Assessment Methodology (SRAM) Work Plan (MWH, 2005b), RFI site risk assessments, risk calculations, result tables, and all transport and fate modeling except for groundwater transport modeling, which is presented in Appendix B.

1.3.3.3 Volume III

Appendix B – Chemicals in Groundwater. Appendix B presents information regarding groundwater conditions in the Group 5 Reporting Area. This information includes groundwater occurrence and quality, chemical transport, data set representativeness, and supporting data (monitoring results, time-series plots, and hydrographs), as well as an evaluation of naturally occurring constituents. Appendix B also provides the basis for identifying chemicals in groundwater that are site-related to support characterization and risk assessment.

Appendix C – Group 5 Sewer Inspection Report. Appendix C presents information regarding sewer manholes and sewer pipelines that are within the Group 5 Reporting Area. Information includes manhole locations, sewer conditions, and results of sewer sediment sampling. DTSC requested the sewer survey during site visits in May 2008.

1.3.3.4 Volumes IV through IX

Appendices D through T – Site RFI Reports. Appendices D through T present detailed site history, characterization findings, risk assessment results, and site action recommendations for the 17 RFI sites evaluated in the Group 5 RFI Report. Site operational histories are described, and sampling results are presented in tables for each potential chemical use area. Potential and known chemical use areas are depicted on maps. Groundwater conditions and risk assessment findings for each site are included in the individual reports. The overall format of these appendices generally follows that presented in this volume of the Group 5 Report. Each RFI site report is an independent appendix, and each appendix has three attachments. The attachments present more detail not imparted in the appendix text. Attachments for each site report (that is, each appendix) include Attachment 1: Regulatory Agency Correspondence, Attachment 2: Subsurface Information (boring logs, for example), Attachment 3: Data Quality, Validation, and Laboratory Reports, and Attachment 4: Building Surveys. Validation and Laboratory data reports for QA/QC samples such as Field blanks, and Equipment/Decontamination blanks and associated with soil samples collected during the Group 5 field sampling effort are presented in Attachment 3 of Appendix D.

1.3.3.5 Volume IX

Appendix U – Waste Debris Survey for Group 5. This document presents the results of the waste debris survey activities performed in 2008 at the SSFL in Ventura County, California. The purpose of the waste debris survey was to conduct systematic visual inspections of the SSFL for surficial evidence of solid waste disposal. Types of solid wastes that were targeted as part of this survey included but were not limited to soil piles, building demolition debris, containers, metal debris, pipe segments, skeet target (clay pigeon) fragments, and miscellaneous other nonhousehold-type debris. Waste debris identified as potentially hazardous or as being a potential source of contamination will be considered for further evaluation in the RFI sampling programs. Specific recommendations for further evaluation, including sampling as appropriate, will be developed as part of the RFI process and are not included in this report.

2.0 Physical Setting of the Reporting Area

This section describes the physical setting within the Group 5 Reporting Area. The RFI Program Report provides an overview of the physical setting at the SSFL (MWH, 2004). Additional specific information is provided within each of the RFI site reports (Appendices D through T) and in the groundwater appendix (Appendix B).

2.1 Topography

The Group 5 Reporting Area occupies approximately 226 acres with over 500 feet of topographic relief. A shaded relief map showing the site topography is provided as Figure 2-1. The Group 5 Reporting Area slopes generally to the south and east. Surface elevation of the Group 5 Reporting Area reaches a maximum of approximately 2080 feet above mean sea level (feet msl). The lowest surface elevation is approximately 1670 feet msl south of STL-IV, where the natural surface water drainage leaves the Group 5 Reporting Area at the southeastern border by the Group 10 Reporting Area. However, the majority of the site drainage goes toward the R2-Ponds in the Group 9 Reporting Area to the east. Within former operational areas of the Group 5 RFI sites, natural surface elevations range from approximately 1880 feet msl at the DOE LF 1 RFI site to approximately 1720 feet msl at the eastern edge of the Compound A Facility RFI Site. The Group 5 Reporting Area is characterized by topographically flat areas bordered by bedrock outcropping near and within the former operational areas of the RFI sites, steep slopes to the southwest, and steep drainages adjacent to and south and east of the STL-IV RFI Sites.

The lowest topographic point within the Group 5 RFI Reporting Area is the drainage stream that leads to Outfall 002, near the Group 10 Reporting Area boundary to the Group 5 Reporting Area.

2.2 Climate and Meteorology

Climate and meteorological data have been collected for the SSFL since the 1960s. The climate falls within the Mediterranean sub-classification, and monthly mean temperatures range from 50 degrees Fahrenheit (°F) during winter months to 70°F during summer months (SAIC, 1994). During the summer months (April through October), an onshore wind pattern occurs due to proximity of the adjacent Pacific Ocean; during the winter months, this is interrupted by weather fronts (SAIC, 1994). Wind measurements have been collected at the SSFL in Area IV west of the Group 5 Reporting Area. A wind rose diagram from 1994 to 1997 is presented in Figure 2-2 and indicates that the prevailing wind pattern is northwest-southeast (Sonoma Technology, Inc. [STI], 2003). This wind rose pattern is consistent with historical data collected in the 1960s. Precipitation at the SSFL is normally in the form of rain, although snow has occasionally fallen during winter months. Precipitation at the site has averaged approximately 18 inches per year between 1960 and 2006, as shown in Figure 2-3A. The annual precipitation has ranged from a low of 5.7 inches in 2002 to a

maximum of 41.2 inches in 1998. Precipitation has been measured at the SSFL daily during rainstorms at two onsite stations.

Monthly precipitation for the 6-year period from October 2000 through June 2007 is presented in Figure 2-3B. The majority of annual precipitation at the SSFL occurs between the months of November and March, consistent with the regional precipitation pattern of southern California.

2.3 Geology

The SSFL is located in the Transverse Ranges of Southern California, a geomorphic province resulting from north-south compression associated with the San Andreas Fault. As a result, geologic structures such as faults and folds generally trend approximately in an east-west direction at the SSFL. Alluvium and Chatsworth and Santa Susana Formations within Group 5 are described in this section.

2.3.1 Near-Surface Soil

Group 5 near-surface soil consists of alluvium, primarily composed of weathered Chatsworth Formation bedrock, colluvium, and fill soil. Figure 2-4 shows the approximate extent of alluvium, including fill soil areas, in the Group 5 Reporting Area. Alluvium and colluvium are present primarily in topographic lows and stream drainages, and range in thickness from less than 1 foot to approximately 20 feet. Fill materials have been used at all building demolition locations, as needed, and as backfill in soil removal actions at the Group 5 RFI Sites. Based on soil boring logs and information collected during site excavation activities (see Appendices D through T), near-surface soil thickness ranges from less than 1 foot at the STL IV and Compound A Facility RFI Sites to 20 feet at the Pond Dredge RFI Site.

Near surface soil is generally thin and composed mostly of clay, silt, and sand with trace gravel. Clayey soil in the southern portion of the Group 5 Reporting Area is common, likely due to the presence of the Santa Susana Formation, which consists primarily of micaceous claystone and siltstone with a few minor sandstone interbeds (Dibblee, 1992). Weathered sandstone and siltstone underlie the unconsolidated alluvium.

Several sites have had removal actions or excavations occur within the Group 5 RFI Reporting Area. Generally, fill material for these excavations was obtained from the onsite borrow area. Site-specific excavations are discussed in the individual RFI site reports.

2.3.2 Chatsworth and Santa Susana Formations

The geologic units exposed in Group 5 are shown in Figure 2-5. The Santa Susana Formation is present in the southernmost portion of Group 5 with the remainder of Group 5 underlain by the Chatsworth Formation. A stratigraphic column of the Chatsworth Formation is shown in Figure 2-5. The Chatsworth Formation is predominantly composed of sandstone interbedded with siltstone and shale. The Chatsworth Formation is discussed in more detail below. The Santa Susana Formation is predominantly composed of micaceous claystone and siltstone, with a few minor sandstone beds (Dibblee, 1992).

Beds of the Upper Chatsworth Formation generally strike N70°E and dip 25°NW. The seven stratigraphic members of the Chatsworth Formation within the Group 5 Reporting Area are the Upper Burro Flats, Expendable Launch Vehicle (ELV), Lower Burro Flats, Storable Propellant Area (SPA), Silvernale, Shale 2, and the Sage from the youngest to the oldest, respectively. The Upper Burro Flats Member is predominantly composed of medium-grained sandstone with minor interbeds of siltstone and shale. The ELV Member is between the Upper and Lower Burro Flats Members, and is composed of thinly interbedded fine-grained sandstone, siltstone, and shale. The Lower Burro Flats Member is predominantly composed of medium-grained sandstone with significant siltstone/shale interbeds. The SPA Member is composed of interbedded fine-grained sandstone, siltstone and shale. The Shale 2 Member is composed of thinly bedded shale, siltstone and sandstone and has a middle sandstone unit that extends throughout the site that separates the upper and lower fine-grained units of the SPA. The Sage Member is predominately composed of medium-grained sandstone with minor interbeds of siltstone and shale (Dibblee, 1992). Additional geologic information is presented in Appendix B.

The Chatsworth and Santa Susana Formations are separated by the Burro Flats Fault, located in the southernmost part of the Group 5 Reporting area, as shown in Figure 2-5. The Burro Flats Fault strikes approximately southeast-northwest to east-west.

The Coca Fault is also present in the Group 5 Reporting area. The attitude of the main trace is N76W with an approximately vertical dip. Fault gouge is exposed to the east of the Group 5 Reporting Area. The western extent of the Coca Fault, which is within the Group 5 Reporting Area, is masked by poor bedrock exposures resulting from alluvium being present on the northeastern side of the Burro Flats Fault. The Coca Fault is currently inferred to extend westward to the Burro Flats Fault (MWH, 2007d).

The bedrock underlying the SSFL has a controlling influence on groundwater flow and contaminant transport and fate. For this reason, various bedrock properties have been estimated based on laboratory measurements of bedrock samples and borehole geophysical logs collected from Group 5 Reporting Area wells. Bedrock properties are briefly discussed in Section 5 and presented in tables included with Appendices D through T.

2.4 Surface Water

The SSFL is located on top the Simi Hills and surface water runoff drains to the north into Arroyo Simi in Simi Valley and to the south into Bell Creek, which leads to the Los Angeles River (Figure 2-6). Details of Group 5 surface water drainage basins and surface water flow directions are shown in Figure 2-7. The following description of the surface flow directions and drainage patterns within the Group 5 Reporting Area first presents overall drainage patterns. More detailed surface flow directions and drainage patterns for the RFI sites are discussed in Appendices D through T.

A surface water divide forms the Group 5 Reporting Area western and northern boundary. Surface water in the Group 5 Reporting Area flows south and east toward the R-2 Pond in Group 9 or toward Outfall 002 in Group 10 through drainage channels south of the STL-IV RFI Site and depressional areas. All surface water within the Group 5 Reporting Area exists only as intermittent discharge resulting from rain events.

Surface water is monitored in one established NPDES monitoring location in the Group 5 Reporting Area, Outfall 017 at the STP-3 RFI Site, and two downstream areas of the SSFL, Outfall 018 in Group 9 at the R-2 Ponds and Outfall 002 at the southern boundary of Group 10 (Figures 2-6 and 2-7).

Surface water conditions for the individual RFI sites generally consist of precipitation runoff during rain events and are discussed further in Appendices D through T, in Section 2.4.5 of each report.

2.5 Groundwater

Discussions of the groundwater system and monitoring network in RFI Group 5 are presented in Appendix B. A conceptual diagram depicting groundwater conditions at the SSFL is shown in Figure 2-8. Figures 2-9 and 2-10 show the groundwater elevations for the NSGW and the Chatsworth Formation, respectively. Cross-sections for each site are provided in Appendices D through T.

Groundwater at the SSFL occurs in alluvium/colluvium, weathered bedrock, and unweathered bedrock. Groundwater that is present in either alluvium/colluvium and/or weathered bedrock had been referred to as *near-surface groundwater* for the purposes of human health and ecological risk assessments since mid-2001. Chatsworth Formation groundwater is defined as groundwater that occurs in unweathered bedrock beneath the SSFL. Depending upon location at the SSFL, the NSGW can be perched above or be vertically continuous with the Chatsworth Formation groundwater. The description of groundwater at SSFL has been modified in Appendix B in response to comments provided by the DTSC in the Draft Preliminary Memorandum for the Group 6 RFI Report (DTSC, 2007a). In Appendix B, groundwater definitions have been revised to reflect groundwater that might be perched versus groundwater that is vertically continuous. As shown in Figure 2-8, perching typically occurs near the transition from the weathered bedrock to unweathered bedrock, due to the reduction in the bulk hydraulic conductivity of the unweathered bedrock. Based on the results of the NSGW Investigation (MWH, 2003c), groundwater in Group 5 is vertically continuous with the Chatsworth Formation groundwater.

For purposes of presenting groundwater monitoring data in this volume and in Appendices D through T, the terms NSGW and CFOU groundwater are used consistent with DTSC-approved definitions (DTSC, 1999 and 2007b). Perched versus continuous groundwater occurrence is described for NSGW and CFOU groundwater as appropriate for characterization, fate and transport, and risk assessment. Appendix B provides a more detailed description of the occurrence of these conditions in Group 5.

Both NSGW and CFOU groundwater are present in the Group 5 Reporting Area. NSGW is present in localized areas across the SSFL. However, the CFOU groundwater is a regional unit, present throughout the area (Figure 2-8). The general relationship of the NSGW and CFOU groundwater units in the Group 5 Reporting Area is shown in Figure 2-8. Groundwater is regularly sampled at the SSFL, and the data are published in annual and quarterly groundwater reports (Haley & Aldrich [H&A], 2007a, 2007b, 2008a, and 2008b).

The monitoring wells, piezometers, and springs in and near the SSFL have been divided into 11 RFI Group Reporting Areas, which include more than 400 unique monitoring locations. Well assignments for each of the Reporting Areas and individual RFI sites were made based on location and proximity to site operations and direction of groundwater flow. Generally, wells located in or near an RFI site were assigned to that site. Data from wells for each of the RFI sites within each Group Reporting Area were included to evaluate chemical impacts and fate and transport. Similarly, springs or seeps have been assigned to RFI sites and Group Reporting Areas based on their presence in or proximity to the Group Reporting Areas. Wells, springs, and seeps are evaluated both on- and offsite, and discussions of such are included in the Group Report.

NSGW and CFOU groundwater occurrence and quality for the Group 5 Reporting Area, including springs and seeps, are described in the following sections. It is important to note that the groundwater characterization program at the SSFL is ongoing and incomplete as of the date of this report. As such, groundwater discussions included in this report are not intended to completely describe all of the elements of an RFI report for groundwater because uncertainty remains with regard to the extent of chemical impacts to groundwater. Therefore, descriptive elements of the groundwater flow system and the direction of chemical transport intentionally have been kept to a minimum in this report until such time as additional data are collected to reduce the uncertainty. Additional work was approved by DTSC (DTSC, 2007d and 2007e). Furthermore in January 2008, a work plan to complete the groundwater characterization program at the SSFL (MWH, 2008a) was submitted to DTSC. Upon completion of the groundwater RFI, the uncertainty inherent in this report and its impact on the risk assessment will be evaluated. If necessary, revision of the risk assessments will be made and reported in the final Site-wide Groundwater RFI Report.

2.5.1 Near-Surface Groundwater

NSGW conditions for the individual RFI sites are discussed in Appendices D through T, in Section 2.4.4 of each report.

2.5.1.1 Boeing Area IV Leach Field

Groundwater conditions at the Boeing Area IV Leach Field Site are characterized by data from one piezometer (PZ-106) in NSGW. As described in Appendix B of the Group 5 RFI Report, samples collected at PZ-106 were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), total petroleum hydrocarbons (TPHs), metals, inorganics, and energetics.

2.5.1.2 Compound A Facility

Groundwater conditions at the Compound A Facility RFI Site are characterized by data from 11 piezometers (PZ-13, PZ-14, PZ-18, PZ-029, PZ-030, PZ-031, PZ-033, PZ-034, PZ-035, PZ-038, and PZ-039), 9 shallow wells (extraction wells ES-14, ES-15, ES-16, ES-23, ES-24, ES-25, ES-28, ES-29, and ES-30), and 2 wells (RS-09, RS-12) to characterize NSGW. As described in Appendix B of this Group 5 RFI Report, samples from shallow wells installed in the NSGW wells at the site have been analyzed for VOCs, SVOCs, hydrocarbons, metals, inorganics, and energetics.

2.5.1.3 Environmental Chemistry Laboratory

Groundwater conditions at the ECL RFI Site are characterized by 7 piezometers (PZ-006 at multiple depths, PZ-023, PZ-024, PZ-025, PZ-026, PZ-027, PZ-028) and 12 shallow wells (ECL-FD, SH-01, SH-02, SH-03, SH-04, SH-05, SH-06, SH-07, SH-08, SH-09, SH-10, SH-11) screened in the NSGW. As described in Appendix B of the Group 5 RFI Report, samples from the NSGW wells at the site were analyzed for VOCs, SVOCs, polychlorinated biphenyls (PCBs), metals, inorganics, dioxins, energetics, and pesticides.

2.5.1.4 Environmental Effects Laboratory

Groundwater conditions at the EEL RFI Site are characterized by one piezometer (PZ-050) to characterize NSGW. As described in Appendix B of the Group 5 RFI Report, samples from the well were analyzed for VOCs, SVOCs (naphthalene), metals, and inorganics.

2.5.1.5 Coal Gasification Process Development Unit

At the PDU RFI Site, six piezometers (PZ-041, PZ-051, PZ-052, PZ-107, PZ-108, and PZ-122) and four shallow wells (ES-31, RS-11, RS-15, and RS-27) were installed to characterize groundwater conditions in alluvium and weathered bedrock (that is, in NSGW). As described in Appendix B of the Group 5 RFI Report, samples from shallow wells installed in the NSGW have been analyzed for VOCs, SVOCs, hydrocarbons, metals, inorganics, and energetics.

2.5.1.6 Southeast Drum Storage Yard

Groundwater conditions at the SE Drum Yard RFI Site are characterized by one NSGW piezometer (PZ-112) located north and upgradient of the SE Drum Yard RFI Site. The NSGW was sampled on one occasion (in April 2002) and analyzed for VOCs.

2.5.1.7 Systems Test Laboratory IV

Groundwater conditions at the STL-IV RFI Site are characterized by three piezometers (PZ-15 [screened at multiple depths], PZ-36, and PZ-37) and eight wells (ES-17, ES-26, ES-27, ES-32, HAR-32, HAR-33, HAR-34, and RS-14). As described in Appendix B of the Group 5 RFI Report, samples from the NSGW wells at the site were analyzed for VOCs, SVOCs, hydrocarbons, PCBs, metals, dioxins, energetics, and inorganics.

2.5.1.8 Department of Energy Leach Field 1

Groundwater conditions at the DOE LF1 RFI Site are characterized by one NSGW piezometer (PZ-112). As described in Appendix B of the Group 5 RFI Report, NSGW samples collected from the well were analyzed for VOCs.

2.5.1.9 Department of Energy Leach Field 3

Groundwater conditions in NSGW at the DOE LF3 RFI Site are characterized by three piezometers (PZ-005, PZ-104, and PZ-105). As described in Appendix B of the Group 5 RFI Report, samples from the NSGW wells were analyzed for VOCs, SVOCs, TPH, metals, inorganics, and energetics.

2.5.1.10 Hazardous Materials Storage Area

Groundwater conditions at the HMSA RFI Site are characterized by two piezometers (PZ-120 and PZ-121). As described in Appendix B of the Group 5 RFI Report, samples from the NSGW wells were analyzed for VOCs, SVOCs, metals, inorganics, and hydrocarbons.

2.5.1.11 Rockwell International Hot Laboratory

Groundwater conditions at the RIHL RFI Site are characterized by one piezometer (PZ-103). As described in Appendix B of the Group 5 RFI Report, samples from the NSGW piezometer were analyzed for VOCs, SVOCs, TPH, metals, and inorganics.

2.5.1.12 Systems Nuclear Auxiliary Power Facility

Groundwater conditions at the SNAP RFI Site are characterized by one piezometer (PZ-109). As described in Appendix B of the Group 5 RFI Report, samples from the NSGW well were analyzed for VOCs, SVOCs (naphthalene), metals, and inorganics.

2.5.2 Chatsworth Formation Groundwater

Summary Chatsworth Formation groundwater conditions for the individual RFI sites are discussed in Appendices D through T, in Section 2.4.4 of each report. A more detailed discussion of Group 5 regional groundwater conditions is presented in Appendix B.

2.5.2.1 Compound A Facility

Groundwater conditions at the Compound A Facility RFI Site are characterized by two CFOU wells (HAR-17 and WS-11). As described in Appendix B of the Group 5 RFI Report, CFOU groundwater samples were analyzed for VOCs, SVOCs, hydrocarbons, PCBs, metals, inorganics, dioxins, energetics, and pesticides (gamma-chlordane).

2.5.2.2 Environmental Chemistry Laboratory

Groundwater conditions at the ECL RFI Site are characterized by four wells (HAR-26, RD-08, RD-11, and RD-12). As described in Appendix B of the Group 5 RFI Report, samples collected from these four CFOU groundwater monitoring wells were analyzed for VOCs, SVOCs, hydrocarbons (as kerosene), PCBs, metals, inorganics, dioxins and furans, and energetics.

2.5.2.3 Pond Dredge Area

Groundwater conditions at the Pond Dredge Area RFI Site are characterized by one Chatsworth Formation well (RD-13). As described in Appendix B of the Group 5 RFI Report, CFOU groundwater samples from the well were analyzed for VOCs, SVOCs, metals and inorganics, and energetics.

2.5.2.4 Coal Gasification Process Development Unit

At the PDU RFI Site, one well (RD-29) was installed to characterize groundwater conditions in the unweathered bedrock (that is, in CFOU groundwater). As described in Appendix B of the Group 5 RFI Report, samples this well have been analyzed for VOCs, SVOCs, hydrocarbons, metals, inorganics, and energetics.

2.5.2.5 Southeast Drum Storage Yard

Groundwater conditions at the SE Drum Yard RFI Site are characterized by one CFOU groundwater well located onsite (RD-16), which has been sampled regularly since September 1989. The groundwater samples have been analyzed for VOCs, SVOCs, metals, inorganics, and energetics.

2.5.2.6 Systems Test Laboratory IV

Groundwater conditions at the STL-IV RFI Site are characterized by six wells (HAR-18, RD-55A, RD-55B, RD-58A, RD-58B, and RD-58C). As described in Appendix B of the Group 5 RFI Report, samples from the CFOU groundwater monitoring wells at the site were analyzed for VOCs, SVOCs, hydrocarbons, PCBs, metals, dioxins, energetics, and inorganics.

2.5.2.7 Building 100 Trench

Groundwater conditions at the Building 100 Trench RFI Site are characterized by two Chatsworth Formation wells (RD-20 and RD-91) to characterize CFOU groundwater. As described in Appendix B of the Group 5 RFI Report, CFOU groundwater samples from the monitoring wells were analyzed for VOCs, SVOCs, hydrocarbons, metals, inorganics, energetics, and dioxins.

2.5.2.8 Department of Energy Leach Field 1

Groundwater conditions at the DOE LF1 RFI Site are characterized by one CFOU groundwater well (RD-17). As described in Appendix B of the Group 5 RFI Report, CFOU groundwater samples collected from the monitoring well at the site were analyzed for VOCs, SVOCs, metals, inorganics, and energetics.

2.5.2.9 Department of Energy Leach Field 2

Groundwater conditions at the DOE LF2 RFI Site are characterized by two CFOU groundwater monitoring wells (RD-93 and RD-95). As described in Appendix B of the Group 5 RFI Report, samples from RD-93 and RD-95 were analyzed for VOCs.

2.5.2.10 Systems Nuclear Auxiliary Power Facility

Groundwater conditions at the SNAP RFI Site are characterized by three Chatsworth Formation wells (RD-24, RD-25, and RD-28). As described in Appendix B of the Group 5 RFI Report, CFOU groundwater samples from the monitoring wells at the site were analyzed for VOCs, SVOCs, inorganics, metals, and energetics.

2.6 Biology

Biological conditions at the Group 5 RFI sites, including vegetation types and sensitive species, as they existed before the 2005 Topanga Fire, are described in the Biological Conditions Report (Appendix I of the SRAM Report) and are shown in that report (MHW, 2005b). In April 2008, reconnaissance-level vegetation mapping was conducted at the Group 5 RFI Sites in support of the site-specific ecological risk assessments (ERAs), and the

vegetation map is included as Figure 2-10. More detailed information for each of the sites is included in Attachment A18 to Appendix A of this report.

Wildfires are common in this portion of California. During the September/October 2005 Topanga Fire, much of the SSFL and surrounding areas were burned, and significant ash was deposited across the Group 5 Reporting Area, especially in drainages (MWH, 2006b). Generally, in areas with limited vegetation (for example, rock outcrops or developed areas), effects of the fire were minimal. Areas with more vegetation (trees and chaparral, for example), including surface water drainages, were affected significantly by burning and deposition of ash. Evidence of this fire was visible in the form of burned trees and shrubs in many of the areas investigated. Where fire damage to native perennial vegetation was less severe, crown-sprouting was common. Previously burned annual vegetation, such as grasslands and ruderal areas, have been largely replaced with new growth since the fire. It is expected that the plant community will continue to grow and transition until a more stable plant community is established.

Most of the former operational areas of the Group 5 RFI sites comprise primarily ruderal, non-native (annual) grassland, coast live oak woodland or savannah, or coastal scrub-shrub habitats, along with substantial rock outcrops at many of the sites. Developed land exists at many of the RFI sites within the Group, with erosion control ditches and roads present throughout the area.

Sensitive species (in other words, special-status species) (as identified and described at the time of the Biological Conditions Report, which is Appendix I of the SRAM [MHW, 2005b]) that may be present at or near the RFI sites include mule deer, San Diego black-tailed jackrabbit, Southern California black walnut, Santa Susana tarplant, and coast live oak. The current status of special-status plant and animal species that could occur in the vicinity of the Group 5 sites is listed in Table 2-1.

3.0 Group 5 Site History and Chemical Use

This section presents a summary of historical operations, the current site conditions, significant changes to site conditions, and describes known or potential chemical use in the Group 5 Reporting Area. This summary is based on detailed information presented in each RFI Site Report (Appendices D through T). A Group 5 RFI map, including surface features, buildings, and monitoring wells, is shown as Figure 3-1. Changes to RFI site conditions (such as building locations and soil disturbance areas) are shown in Figure 3-2.

During the historical document review performed for this RFI, over 70,000 historical documents related to Group 5 were reviewed. This review required 12 people, dedicated to reviewing Group 5 documents, 7 months to accomplish. Historical documentation included reports, photos and drawings, handwritten notes, internal records and correspondence, analytical data, and legal depositions.

In general, a chemical use review, chemical data review, and physical data review were performed for each site as follows:

- **Chemical Use Review –** Historical documents related to the RFI sites were reviewed to assess the areas, features, processes, and locations where chemical compounds might have been used, handled, stored, spilled, leaked, released, treated, and/or disposed of. Changes between historical and current site conditions are also summarized.
- **Chemical Data Review –** Relevant analytical data are summarized, including maximum concentrations by chemical, spatial distribution of chemical groups, and comparison of chemicals against background concentrations (for metals and dioxins/furans) and risk-based screening levels (RBSLs). The data were evaluated to determine suitability for assessing risk by comparing the reporting limits to the RBSLs (see analytical data usability section).
- **Physical Data Review –** Physical data are summarized in geologic and hydrogeologic cross-sections and maps showing water level contours, surface water drainages, topography, and alluvial and fill distribution. Soil boring logs, geologic reports, water level measurements, surface water flow maps and observations, among other information, were utilized to create conceptual site models for each RFI site to help understand the fate and transport of chemicals that could have been released, potential human health and ecological receptors, and to guide potential remediation efforts.

Section 3.1 provides brief site history information for each of the Group 5 RFI sites. Detailed site information is found in Section 2 of each appendix (Appendices D through T). The reader is referred to a particular RFI site appendix for more details regarding operations, site features, chemical use areas, and information sources. Potential chemical use areas at each of the RFI sites have been identified and used to target sampling conducted under DTSC-approved work plans (Ogden, 1996, 2000a, and 2000b; GRC, 1995a and 1995b; Montgomery Watson, 2000b; MWH, 2001, 2003a, 2005a, and 2005c), or as requested by DTSC during the RFI. The known and potential chemical use areas for the Group 5

Reporting Area are described briefly in this section and combined into nine general categories:

- Solvents
- Petroleum Fuels
- Oils/PCBs
- Metals/Inorganics (excluding debris areas)
- Debris Areas
- Perchlorate
- Landfills
- Leach Fields
- Potential (areas screened for possible chemical use/impacts)

Table 3-1 summarizes the types of facility operations generally associated with each of these categories and provides typical analyte groups analyzed during the RFI at these locations. Areas of confirmed or potential chemical use are listed for each RFI site in Table 3-2 and are shown in Figure 3-3.

3.1 RFI Site Histories

The following sections summarize major operational history for each of the 17 RFI sites included in the Group 5 Reporting Area.

Primary sources of information include the RFA (SAIC, 1991 and 1994), the Current Conditions Report (CCR) (ICF, 1993), the RFI Work Plan Addendum (Ogden, 1996), review of historical aerial photographs (USEPA, 1997), the Area IV Historical Site Assessment (Sapere Consulting, Inc. [Sapere], 2005), site investigation reports or work plans (GRC, 1989, 1995a, 1995b, and 1999; ICF, 1993), facility engineering drawings, maps, site photographs, and reports, and interviews with site personnel. Detailed historical and reference information is presented in the RFI Site Reports (Appendices D through T). Historical documents for the RFI sites included in Group 5 are provided in an electronic database submitted with this report (Boeing, 2008a).

3.1.1 Boeing Area IV Leach Fields

The Boeing Area IV Leach Fields RFI Site activities over time included aerospace assembly and component manufacturing, an x-ray development laboratory, non-nuclear programs support, storage of communications equipment, calibration and repair of radiological instrumentation, and an Electric Laser Laboratory.

3.1.2 Compound A Facility

The Compound A Facility was used for manufacturing of chlorine pentafluoride (Compound A) and also manufactured laser chemicals (nitrogen, fluoride, and antimony compounds). Additionally, the Compound A Facility generated fluorine gas used at ECL.

3.1.3 Environmental Chemistry Laboratory

The ECL RFI Site activities over time included research and development of rocket and gun propellants and new fuel additives, a general chemistry laboratory, and the Continuous

Wave Laser Laboratory. The ECL Pond was used to store hazardous wastes, rainfall runoff, and spill runoff from nearby buildings. Various buildings were used for chemical, equipment, and/or drum storage to support ECL operations.

3.1.4 Environmental Effects Laboratory

The EEL RFI Site activities over time included a Cryogenic Laboratory and its associated test cells. Activities also included testing various materials under atmospheric and high-pressure hydrogen conditions.

3.1.5 Pond Dredge Area

The Pond Dredge Area RFI Site was used for disposal of dredge materials from Silvernale Reservoir and the R-2 Ponds. Construction debris was also suspected of being disposed of in the Pond Dredge Area, which was confirmed during the site debris survey.

3.1.6 Coal Gasification Process Development Unit

The PDU RFI Site activities over time included the non-nuclear testing of thermodynamic characteristics of proposed coolants for organic moderated reactor experiments and Piqua reactors, the fabrication of enriched uranium carbide fuel for the Heavy Water Organic Cooled Reactor, and a pilot plant for molten salt combustion (Molten Salt Test Facility).

3.1.7 Area III Sewage Treatment Plant

STP-3 RFI Site was used as a sanitary sewage treatment plant. In addition to sanitary wastes, the treatment plant received cooling tower discharges from non-chromated cooling tower systems and treated groundwater from the site groundwater treatment and recovery system.

3.1.8 Southeast Drum Storage Yard

The SE Drum Yard RFI Site was used to store approximately 50 to 100 drums of unknown contents. The drums were used in forklift exercises.

3.1.9 Systems Test Laboratory IV

STL-IV RFI Site was used for testing small engines, including the Apollo engines and the axial engines for the Peacekeeper missiles. Various fuels and oxidizers, including monomethyl hydrazine (MMH), nitrogen tetroxide (NTO), and inhibited red-fuming nitric acid (IRFNA), among others, were used over time at different test stands.

3.1.10 Building 65 Metals Laboratory Clarifier

The Building 65 Metals Laboratory Clarifier RFI Site activities over time included a vacuum test facility, a Chemical and Metallographic Analysis Laboratory, an Instrument Repair and Calibration Building (Instrument Laboratory) and non-nuclear support for the ETEC program.

3.1.11 Building 100 Trench

The Building 100 Trench RFI Site was used to dispose of and burn construction debris.

3.1.12 Department of Energy Leach Field 1

The DOE LF1 RFI Site activities over time included a Liquid Metals and Analytical Chemistry Laboratory, the Kinetics Experiment Water Boiler reactor, a variety of reactors, tests, and operations in support of SNAP. Activities at DOE LF1 also included removal and separation of radioactive isotopes from used nuclear fuel, trafficking and warehousing (including shipping and receiving) of nuclear and non-nuclear materials, and processing X-ray film.

3.1.13 Department of Energy Leach Field 2

The DOE LF2 RFI Site activities over time included a Power Demonstration Test Facility to verify SNAP experimental reactor designs, tritium production during operation of experimental reactors and weapons testing, the SNAP Critical Test Facility No. 2, the Heavy Metal Reflected Fast Spectrum Reactor, ETEC X-ray facility and storage, non-nuclear component assembly and packaging of SNAP 10A, SNAP 2, and SNAP 8 flight systems prior to thermal, mechanical, and nuclear qualification tests, the ETEC Sodium Component Test Installation Power Pak section of the Cogeneration Project, and generated commercial electric power using steam produced in the Sodium Component Test Installation (SCTI) sodium experiments.

3.1.14 Department of Energy Leach Field 3

The DOE LF3 RFI Site activities over time included a Nuclear Materials Development Facility, construction staging storage, general storage, sodium mass transfer studies, a metallurgical research and development experiments and laboratories for the Sodium Reactor Experiment (SRE) program, manufacturing high-energy rocket fuels, testing large rocket engines, conducting SNAP reactor criticality tests and critical assembly research to support SNAP, proof and performance testing of sodium lubricated bearings, testing SNAP control rod assemblies for the Piqua Organic Moderated Reactor (OMR), and barrel storage (possibly containing radioactive material).

3.1.15 Hazardous Material Storage Area

HMSA RFI Site activities over time included proof and performance testing of sodium lubricated bearings used in large sodium pumps, storage and maintenance, various SNAP operations including testing prototype reactors and testing components of sodium-cooled, graphite moderated reactors under simulated reactor operating conditions and SCTI operations, including component test loop and sodium steam generator testing.

3.1.16 Rockwell International Hot Laboratory

RIHL RFI Site activities over time included examination and preparation of irradiated nuclear reactor fuel, decladding, cleaning, and repackaging fuel for reprocessing, machine shop operations, and drum storage.

3.1.17 Systems Nuclear Auxiliary Power Facility

SNAP RFI Site activities over time included testing SNAP reactors under vacuum conditions and the Large Leak Test Rig Sodium Test Program.

3.2 Current Site Conditions and Significant Alterations

The focus of this Group 5 RFI Report is to characterize current conditions of the Group 5 Reporting Area with respect to chemical contamination. Current conditions at most of the Group 5 RFI sites are different from the past operating conditions. This section summarizes how current conditions differ from past operating conditions. For the majority of the Group 5 characterization activities (that is, sampling), site conditions remained approximately constant. Also, the 2005 Topanga Fire caused considerable impacts in some portions of the Group 5 Reporting Area. Any changes in site conditions affecting RFI sample information are described and detailed in the RFI site reports provided in Appendices D through T. Soil disturbance areas within the Group 5 Reporting Area include building removal areas, excavation and backfill areas, excavation areas with no backfill, and landfill areas. Group 5 disturbance areas are shown in Figure 3-2. Current conditions and remaining buildings at the RFI sites are discussed in detail in Appendices D through T. Additionally, building surveys have been conducted for remaining buildings, and the survey results are included as Attachment 4 in Appendices D through T.

3.3 Chemical Use

As described above, potential chemical use areas have been categorized into 10 general categories (Table 3-1). These include: solvent, petroleum, oils/PCBs, metals/inorganics (excluding debris areas), various fuels and oxidizers, energetics, debris, landfills, leach fields, and other miscellaneous areas screened for possible chemical use. Descriptions of each chemical use area category and typical analytical suites used for RFI characterization are included in Table 3-1. The summary is generalized and is not meant to define all sampling requirements for each Group 5 RFI site. The table is meant to provide the reader with context when reviewing the sampling results provided in Section 4. Site-specific sampling rationale and detailed discussions of analytical results are provided in Appendices D through T.

The RFI sampling program targeted confirmed or suspected chemical use areas at the 17 RFI sites, and included screening in other areas where chemical use might have occurred. Figure 3-3 depicts all potential chemical use areas identified for the Group 5 Reporting Area. Table 3-2 provides a list of potential chemical use areas present for each RFI site. The following sections present a summary of the known potential chemical use areas in the Group 5 Reporting Area.

Chemicals used for routine maintenance or construction activities are not included in the RFI as potential chemical use areas. Routine maintenance chemicals would include pesticides, herbicides, or rodenticides used to maintain weed growth or to respond to rodent infestations. Construction materials include asphalt, concrete, or small quantities of explosives that could be used at building sites where bedrock modifications were needed. Also, building insulation materials including asbestos are not included as a chemical use category unless these materials were disposed of at a site. Pesticides, herbicides, rodenticides would have been applied, and explosives would have been used according to label instructions and legal requirements. Energetic chemicals used as surface or subsurface explosives for construction or demolition purposes would have been used during short

events, and the chemicals typically consumed upon detonation. As described in Section 4 and Appendix B, groundwater monitoring is conducted for many of these chemicals, but they have not been generally targeted for this type of routine use in the surficial media investigation.

3.3.1 Solvents

Solvent use or disposal might have occurred at all RFI sites in the Group 5 Reporting Area with the exception of DOE LF1. Based on facility records and sampling results (see Section 4), the area with the highest usage was at the STL-IV, with no solvents expected to have been used at Pond Dredge, but soil in that area was sampled to assess whether dredge materials contained solvents. Potential solvent chemical use areas in the Group 5 RFI sites include the following:

- **Boeing Area IV Leach Field:** Buildings 4007 and 4008, Building 4011, Building 4611, and Building 4172
- **Compound A Facility:** Building 3418, Compound A Pond, Storage Shed, Suspect Pond, Explosive Magazines, and STL-IV Air Stripping Tower
- **ECL:** ECL, Building 3260, Building 3798, ECL Pond, ECL Suspect Pond, Building 3799, and Building 3258
- **EEL:** EEL Cryogenic Laboratory and test cells, EEL storage, EEL mechanics workshop, and hazardous materials storage pad
- **Pond Dredge Area:** Pond Dredge Area
- **PDU:** Building 4005, Building 4027, Building 4042, Former PDU Area, Building 4402, Coal Storage Yard, Bag House, Catchment Basin, and 17th Street drainage area
- **STP-3:** STP-3, STP Pond, STP Clarifier, and Former Ranch House
- **Southeast Drum Storage Yard:** SE Drum Yard
- **STL-IV:** Module 3, Fuel Storage Area/MMH Ozonator Tank, STL-IV Impoundments 1 and 2 and Associated Channels, Engine Test Stand No. 2 and Module 2, Building 3794, Hot Water Boiler Shelter, and Building 3780, Assembly Decontamination, Engine Test Stand No. 3 and Module 1, Building 3254, Building 3318/Workshop/Instrumentation Shop/Tool Crib, Hazardous Waste Storage Locker, VOC Storage and Use, General Storage and Use, Explosive Use/Storage, Engine Test Stand No. 4, Suspect Pond, Operations Trailer/Clean Room Trailer/Lunch Room, NTO Storage Area, and Leach Field
- **Building 65 Metals Laboratory Clarifier:** Building 4065 Metals Clarifier, Building 4065, Building 4066, and Building 4062
- B**uilding 100 Trench :** Building 100 Area
- **DOE LF2:** Building 4010 and TCF-2

- **DOE LF3:** Building 4363, Building 4373, Building 4383, Buildings 4375, 4874, and 4875, Building 4374, Building 4055, UT-75, and Debris Area 3005
- **HMSA:** Building 4457, Sump 1, and Sump 2
- **RIHL:** Building 4020
- **SNAP:** Building 4059, Building 4059 French drain system, Building 4057, Building 4358, and Building 4459

3.3.2 Petroleum

Areas where petroleum hydrocarbons might have been potentially used or disposed of occurred at all RFI sites in the Group 5 Reporting Area with the exception of Building 100 Trench. Areas where petroleum hydrocarbons potentially could have been stored or used in the Group 5 Reporting Area are associated primarily with supporting operations, such as pipe or equipment cleaning or fuel oil storage. Potential petroleum use areas in the Group 5 RFI sites include the following:

- **Boeing Area IV Leach Field:** Buildings 4007 and 4008, Building 4011, UT-6, and SCTI Pump Station
- **Compound A Facility:** Storage Shed and Debris Areas
- **ECL:** ECL, Building 3260, Building 3798, ECL Pond, ECL Suspect Pond, and Building 3258
- **EEL:** EEL Cryogenic Laboratory and test cells, EEL storage, EEL mechanics workshop, tanks, and hazardous materials storage pad
- **Pond Dredge Area:** Pond Dredge Area
- **PDU:** Building 4005, Coal Storage Yard, Bag House, Catchment Basin, and 17th Street drainage area
- **STP-3:** STP-3, STP Pond, STP Clarifier, and Former Ranch House
- **Southeast Drum Storage Yard:** SE Drum Yard
- **STL-IV:** Fuel Storage Area/MMH Ozonator Tank, Hazardous Waste Storage Locker, VOC Storage and Use, General Storage and Use, Explosive Use/Storage, Engine Test Stand No. 4, Suspect Pond, NTO Storage Area, and Leach Field
- **Building 65 Metals Laboratory Clarifier:** Building 4065 Metals Clarifier, Building 4065, UT-76, and UT-70
- **DOE LF1:** Building 4030/4035 and Building 4641
- **DOE LF2:** Building 4013 and CUA-11 (Emergency Generator [EMGEN] UST)
- **DOE LF3:** Building 4363, Building 4373, Buildings 4375, 4874, and 4875, Building 4462, UT-75, UST (North of Building 4363), UT-72, and UT-12 (UT-55)
- **HMSA:** Buildings 4026, 4426, 4826, and 4226

- **RIHL:** Building 4020
- **SNAP:** Building 4059, Building 4360, and UT-36

VOCs consisting of benzene, toluene, ethylbenzene, and xylenes (BTEX) and the SVOCs polynuclear aromatic hydrocarbons (PAHs) are potential components of some of the fuel-range petroleum hydrocarbons gasoline and diesel/oils, respectively. The petroleum use areas identified for the Group 5 Reporting Area have been screened for potential impacts related to these chemical compounds.

3.3.3 Oils/Polychlorinated Biphenyls

Hydraulic, lubricating, and insulating oils were used at various locations in the Group 5 Reporting Area. Areas where oils/PCBs might have been used or disposed of occurred at all RFI sites in the Group 5 Reporting Area with the exception of STP-3 and SE Drum Yard. Within Group 5, these types of oils were used for hydraulic components and as insulation against heat buildup in reactors and transformers. Transformers manufactured before 1980 might have used insulating oils containing PCBs. Areas in the Group 5 Reporting Area where oils/PCBs might have been used include the following:

- **Boeing Area IV Leach Field:** Buildings 4007 and 4008, Building 4711, and Transformer Pole D-5
- **Compound A Facility:** STL-IV Air Stripping Tower
- **ECL:** Building 3260, Building 3258, Substation adjacent to Building 3367, and Substation west of Building 3259
- **EEL:** EEL Cryogenic Laboratory and test cells, EEL storage, EEL mechanics workshop, tanks, transformers, and hazardous materials storage pad
- **Pond Dredge Area:** Pond Dredge Area
- **PDU:** Building 4005, Building 4027, Building 4032, Transformer 4706, Transformer 4742, Coal Storage Yard, Bag House, Catchment Basin, and 17th Street drainage area
- **STL-IV:** Building 3254
- **Building 65 Metals Laboratory Clarifier:** Substation 4762, Building 4066, and Building 4062
- **Building 100 Trench:** Transformer 4800
- **DOE LF1:** Electrical Substation located north of Building 4641 and transformer pole
- **DOE LF2:** Substation 4713, Substation 4708 A/B, Substation 4756, Substation on Western Side of Building 4010, Substation on Eastern Side of Building 4010, Building 4013, T-L01, EMSTG, and Substation 4413
- **DOE LF3:** Substation 4707, Substation 4883A, Substation 4760A, Substation 4755, Transformer Pole X14, Substation 4762, Substation 4760B, Substation 4883B, Substation 4853, A324, Building 4015, and Debris Area 3005

- **HMSA:** Building 4457, Sump 1, Sump 2, Building 4334, Building 4385, Building 4024, Substation 4725, Substation 4726, and Building 4355
- **RIHL:** Building 4020, hydraulic lift, and Substation 4720
- **SNAP:** Building 4057, Building 4358, Building 4459, Building 4757 transformer, Building 4759 transformer, Building 4719 transformer, and Acid and Sodium Hydroxide ASTs

3.3.4 Metals/Inorganics

Metal wastes can be associated with either site operations (such as engine testing, machining activities, and laboratory waste streams) or the degradation of scrap metal debris. Because these two types of occurrences are different, potential metal use areas in the Group 5 Reporting Area have been divided into two categories, metal wastes associated with site operations (including storage of metal wastes), and metal wastes associated with debris areas. This section focuses on metal wastes associated with site operations, while Section 3.3.5 focuses on debris areas. Included in this category are other types of inorganic compounds that were used or potentially used for site operations. For the Group 5 Reporting Area, these include fluoride compounds.

Site operations that could generate types of metal or other inorganic wastes include photographic processing, high-energy propellant testing, scrubber systems, or various machine shop and laboratory operations were not reported or documented for the Group 5 RFI sites. Potential metal waste areas associated with site operations include the following:

- **Boeing Area IV Leach Field:** Buildings 4007 and 4008, Building 4011, Building 4171, and Building 4172
- **Compound A Facility:** Building 3418, Forming Pits, Compound A Pond, Fluorine Pipeline, Storage Shed, Dump Site, Suspect Pond, and Explosive Magazines
- **ECL:** ECL, Building 3260, ECL Pond, ECL Suspect Pond, Building 3258, and Building 3269
- **EEL:** EEL Cryogenic Laboratory and test cells, EEL storage, EEL mechanics workshop, and hazardous materials storage pad
- **Pond Dredge Area:** Pond Dredge
- **PDU:** Building 4005, Building 4006, Building 4027, Building 4042, Former PDU Area, Building 4402, Coal Storage Yard, Bag House, Catchment Basin, and 17th Street drainage area
- **STP-3:** STP-3, STP Pond, STP Clarifier, and Former Ranch House
- **Southeast Drum Storage Yard:** SE Drum Yard
- **STL-IV:** Module 3, Fuel Storage Area/MMH Ozonator Tank, STL-IV Impoundments 1 and 2 and Associated Channels, Engine Test Stand No. 2 and Module 2, Building 3794, Hot Water Boiler Shelter, and Building 3780, Assembly Decontamination, Engine Test Stand No. 3 and Module 1, Building 3254, Building 3318/Workshop/Instrumentation

Shop/Tool Crib, Hazardous Waste Storage Locker, VOC Storage and Use, General Storage and Use, Explosive Use/Storage, Engine Test Stand No. 4, Suspect Pond, NTO Storage Area, and Leach Field

- **Building 65 Metals Laboratory Clarifier:** Building 4065 Metals Clarifier, Building 4065, Building 4066, and Building 4062
- **DOE LF1:** Building 4074, Building 4023, and Building 4030/4035
- **DOE LF2:** Building 4010 and Building 4012
- **DOE LF3:** Building 4363, Building 4373, Buildings 4375, 4874, and 4875, Building 4374, Building 4055, Building 4462, UT-72, and Debris Area 3005
- **HMSA:** Building 4357, Building 4457, Building 4024, and Buildings 4026, 4426, 4826, and 4226
- **RIHL:** Building 4020 and northeast portion of RFI site
- **SNAP:** Building 4057, Building 4059, Building 4358, and Building 4360

3.3.5 Debris Areas

Debris areas are generalized locations where small amounts of solid waste have been identified at the Group 5 RFI sites. The debris typically includes disturbed or hummocky soil areas, paint chips/cans, scrap metal, drums, construction debris (such as asphalt and concrete), small equipment pieces, or burned materials. These areas are typically targeted for a wider range of sample analyses than the areas containing metals wastes described in Section 3.3.4 because the former use and/or contents of some of the debris are not documented (Tables 3-1 and 3-2). Debris areas in the Group 5 RFI sites include the following:

- **Compound A Facility:** Suspect dredge materials north of the former Compound A Facility, and the debris area in the drainage south of the former Compound A Facility
- **Pond Dredge Area:** Various hummocky areas in Pond Dredge that were determined to be debris piles during weed clearing operations (Rather than assess the piles separate from the Pond Dredge investigation, the debris locations were incorporated into the RFI site evaluation and recommendations.)
- **PDU:** Debris Pile 2003
- **Southeast Drum Storage Yard:** Debris Location 3012
- **STL-IV:** Debris Piles, 2001, 3001, 3002, and 3003, and Debris Locations 1000 and 3004
- **DOE LF1:** Debris Pile 2004
- **DOE LF3:** Debris Pile 3005

3.3.6 Propellants and Energetic Compounds

Propellants or energetics use, storage, or disposal occurred or was suspected to have occurred at various locations in the Group 5 Reporting Area. Propellant compounds could have been used for testing engines and engine parts. Energetic compounds could have been

used for subsurface bedrock construction activities. These potential propellants and energetics use areas associated with site operations are included below. Based on reviewed documents and other sampling data, the use of propellants and energetics at the other Group 5 RFI sites is unlikely.

- **Boeing Area IV Leach Field:** Buildings 4007 and 4008
- **Compound A Facility:** Building 3418, Forming Pits, Compound A Pond, Storage Shed, Debris Areas, and Explosive Magazines
- **ECL:** ECL, Building 3268, Building 3798, ECL Pond, ECL Suspect Pond, and Building 3799
- **Pond Dredge Area:** Pond Dredge Area
- **PDU:** Building 4027
- **STP-3:** STP-3, STP Pond, STP Clarifier, and Former Ranch House
- **Southeast Drum Storage Yard:** SE Drum Yard
- **STL-IV:** Module 3, Fuel Storage Area/MMH Ozonator Tank, STL-IV Impoundments 1 and 2 and Associated Channels, Engine Test Stand No. 2 and Module 2, Building 3794, Hot Water Boiler Shelter, and Building 3780, Assembly Decontamination, Engine Test Stand No. 3 and Module 1, Building 3254, Hazardous Waste Storage Locker, VOC Storage and Use, General Storage and Use, Explosive Use/Storage, Engine Test Stand No. 4, Suspect Pond, NTO Storage Area, and Leach Field
- **DOE LF2:** Building 4010, Air Compressor Pad/Cooling Water Pipelines, and TCF-1
- **DOE LF3:** Building 4353, Building 4373, and Buildings 4375, 4874, and 4875
- **HMSA:** Building 4358 and Building 4355

3.3.7 Leach Fields

Sanitary leach fields were identified as AOCs during the RFA (SAIC, 1991 and 1994). Leach fields can be potential downgradient receptors for spilled or leaking chemicals used in the buildings associated with the leach field. Sanitary leach fields were operational and used prior to 1961 when the SSFL sewer system was installed.

Within the Group 5 Reporting Area, nine leach field chemical use areas were identified, the Building 4005/4006 leach field, Building 4010 leach field, Building 4011 leach field, Building 4030 leach field, Building 4093 leach field, Building 4353 leach field, Building 4363 leach field, Building 4373 leach field, and Building 4383 leach field are shown in Figure 3-3. Liquid waste from Group 5 site operations may have included solvents, kerosene, oils/PCBs (including terphenyls), and metals. As described below, chemicals screened at the leach fields were based on chemical uses at the buildings associated with the leach fields.

- **Boeing Area IV Leach Field:** VOCs, TPH, and metals
- **PDU:** VOCs
- **DOE LF1:** Metals, inorganics, and TPH (Building 4030 Leach Field); Unknown (Building 4093)

- **DOE LF2:** Propellants, metals, VOCs
- **DOE LF3:** Energetics (Building 4353 Leach Field); Metals, VOCs, and TPH (Building 4363 Leach Field); Metals, VOCs, Propellants, and TPH (Building 4373 Leach Field); VOCs (Building 4383 Leach Field)

3.3.8 Areas Screened for Potential Chemical Use or Disposal

Several additional areas at the Group 5 RFI sites were or could have been used for chemical or equipment storage, handling, or disposal. Screening areas include underground tanks designed to store radioactive waste, drum or equipment storage areas, the solar concentrator area, or possible disposal areas. Confirmed chemical storage areas are included in this category if the types of chemicals stored at the locations were not well documented (for example, the drum storage areas). Since chemical use in the potential locations can vary based on site history information or upon upgradient chemical use areas, analytical suites for RFI assessment of potential areas can also vary. The Group 5 RFI potential chemical use areas include the following:

- **Boeing Area IV Leach Field:** SCTI Pump Station and Parking Lot 4502 (PAHs)
- **ECL:** ECL, ECL Pond, and ECL Suspect Pond (Formaldehyde and SVOCs); Building 3258 (Asbestos)
- **Pond Dredge Area:** Pond Dredge (Formaldehyde and SVOCs)
- **PDU:** Building 4005, Building 4006, Building 4027, Former PDU Area, Bag House, Catchment Basin, and 17th Street drainage area (SVOCs)
- **STP-3:** STP-3, STP Pond, STP Clarifier, and Former Ranch House (Formaldehyde and SVOCs)
- **Southeast Drum Storage Yard:** SE Drum Yard (SVOCs)
- **STL-IV:** Module 3, Fuel Storage Area/MMH Ozonator Tank, STL-IV Impoundments 1 and 2 and Associated Channels, Engine Test Stand No. 2 and Module 2, Building 3794, Hot Water Boiler Shelter, and Building 3780, Assembly Decontamination, Engine Test Stand No. 3 and Module 1, Building 3254, Hazardous Waste Storage Locker, VOC Storage and Use, General Storage and Use, Explosive Use/Storage, Engine Test Stand No. 4, Suspect Pond, NTO Storage Area, and Leach Field (SVOCs)
- **Building 100 Trench:** Building 100 Trench (Asbestos); Building 100 Area (Dioxins)
- **DOE LF2:** Air Compressor Pad/Cooling Water Pipelines (Asbestos)
- **DOE LF3:** Building 4363, Buildings 4375, 4874, and 4875, and Debris Area 3005 (SVOCs)
- **HMSA:** Building 4457 and Buildings 4026, 4426, 4826, and 4226 (SVOCs)
- **RIHL:** Building 4020 (SVOCs)
- **SNAP:** Building 4057 (SVOCs)

4.0 Nature and Extent of Chemicals in Group 5

This section provides an overview of nature and extent findings for environmental media within the Group 5 RFI Reporting Area. The characterization overview provides a description of groupwide chemical concentrations for investigated media. Section 5, Transport and Fate, is based upon these findings. A discussion of characterization completeness within chemical use areas and recommendations for further evaluation in the CMS is provided in Appendices D through T.

Defining the nature and extent of chemicals in environmental media follows a weight-of-evidence process. The information used in this process has been summarized in the previous sections and presented in detail in Sections 2 and 3 of Appendices D through T. This information includes historical site operations, physical site configuration, knowledge of chemical use and insight gained from other SSFL investigations. The result is a strategy using sampling and analysis that targets those locations where chemicals are suspected or known to have been used, and where they might be today. The sampling results become information used in determining if further sampling is needed, or if the nature and extent of impacts have been defined.

Characterization results for Group 5 RFI Sites are presented by the seven major chemical groups included in the Group 5 RFI laboratory analytical program:

- VOCs
- SVOCs (including hydrazine, NTO, and related break-down products)
- TPH
- PCBs
- Metals and Inorganics (including perchlorate)
- Dioxins
- Energetics

The seven chemical groups listed above represent the primary targeted RFI sampling suites for the types of known or potential chemical use identified in the Group 5 Reporting Area as described in Section 3. Figures 4-1 through 4-8 present results for these chemical groups. The purpose of these figures is to present a summary of characterization findings in the context of site information including the overall sampling locations, surface water flow directions, RBSLs, and site action recommendation areas.

Site action recommendation areas shown in Figures 4-1 through 4-8 include CMS Areas and NFA Areas. CMS Areas are those portions of the RFI site recommended for further consideration and evaluation in the next phase of the RCRA corrective action process. These recommendations are based on characterization data and risk assessment results as described in the RFI site reports in Appendices D through T. CMS Area recommendations and the criteria used in those decisions are presented in Section 7. Portions of Group 5 outside the CMS Areas are recommended for NFA, and investigation in these areas is deemed complete. The NFA recommendation for each RFI site will be re-evaluated and, if appropriate, revised in the future after the existing structures are demolished. As part of the

planned demolition of the remaining SSFL buildings, soil sampling will be performed, as needed, according to the process specified in the Standard Operating Procedure (SOP): *Building Feature Evaluation and Sampling* (MWH, 2008b), to assess the potential for chemical impacts beneath the buildings. The NFA recommendation for each RFI site will be re-evaluated based on the data collected following building demolition.

Soil sampling results are shown in color-coded symbols in Figures 4-1 through 4-8 where samples were analyzed for that chemical group or depicted in gray if not analyzed for that group. Changes in color generally reflect concentration gradients for detected compounds. Color-coding of sample locations is based on comparison of the results to the lowest human healthresidential, industrial, recreational, and ecological RBSL, if the chemical concentration is above maximum background concentration (metals and dioxins only). RBSLs are chemical-specific, back-calculated concentrations that represent "acceptable" risk levels, based on risk assessment parameters and methodologies detailed in the SRAM and in this report. A description of RBSL derivation is provided in Appendix A. As part of the review of the first of Group RFI reports review, DTSC reviewed the RBSLs and found them acceptable for use in screening and interpretation of the data. RBSLs do not replace risk assessment data evaluation or other evaluation such as assessment of chemical gradients; rather, RBSLs are designed to aid in interpretation and presentation of the sampling results.

A summary is presented below of the basis used to generate the colored symbols shown for soil sampling data in Figures 4-1 through 4-8:

- Colors are assigned to show the most conservative result (in other words, the concentration with the greatest percentage above its RBSL) if multiple samples (for example, at different depths) or multiple analytes (that is, individual VOCs) are detected at a sampling location.
- RBSLs are based on both human and ecological receptors. In the Group 5 Reporting Area, RBSLs are used for residential or ecological receptors.
- For metals, color coding is based on a two-step comparison. First, the sampling result is compared to the maximum background concentration from the DTSC-approved background data set (MWH, 2005b). If background is exceeded, it is then compared to lowest of the RBSLs and the resultant color assigned.
- For dioxins, color coding is assigned based on a comparison of the sample toxic equivalent (TEQ) concentration to the DTSC-approved background TEQ concentration. TEQs reflect the sum of multiple dioxin congener results adjusted based on relative toxicity.
- As stated above, the lowest human health (residential, industrial, or recreational), and ecological RBSL, was used to prepare the data summary figures.

As required by RFI work plans (Ogden, 1996 and 2000a), soil data for SSFL RFI sites have been collected using screening criteria based on potential risks to potential receptors as listed above. Thus, data presented in the RFI site reports in Appendices D through T are described in text and depicted in figures in relation to RBSLs developed from the risk assessment work plan criteria for all potential human and ecological receptors. Groundwater information depicted in Figures 4-1 through 4-8 summarizes recent

representative groundwater monitoring data within the group. Data are presented compared to groundwater comparison concentrations (GWCCs). These criteria are listed in Appendix B.

The following sections present a description of RFI sampling results by chemical group.

Additional chemicals are monitored in groundwater as required by DTSC as part of the groundwater program. These results are described in Appendix B and consist of general minerals or other inorganic compounds that are indicative of general water quality (such as sulfate, bicarbonate, and total dissolved solids).

4.1 Volatile Organic Compounds

4.1.1 Soil and Soil Vapor

A total of 403 soil vapor samples and a total of 858 soil matrix samples, which includes splits and field duplicates, were analyzed for VOCs within the Group 5 Reporting Area. Locations were based on site use (known or suspected chemical use areas) and sample results (step-outs). Group 5 VOC sampling results are depicted in Figures 4-1 and 4-2. Each sample location is represented by a color corresponding to a maximum ratio of detected VOC concentrations to the lowest RBSL at that location. VOCs in Group 5 soil were generally detected at low concentrations, with most detections occurring at the STL-IV RFI Site.

VOC soil vapor and soil matrix sampling results for the RFI sites within the Group 5 Reporting Area are summarized in the following subsections.

4.1.1.1 Boeing Area IV Leach Field

A total of six soil vapor samples was collected at six locations and analyzed for VOCs. No VOCs were detected in the soil vapor samples collected at the Boeing Area IV Leach Field RFI Site. Results are shown in Figure D.3-1A of Appendix D.

A total of 13 soil samples was collected at nine locations and analyzed for VOCs. Of the 13 samples, 8 had detectable levels of VOCs. Results are shown in Figures D.3-1B and D.3-7, and discussed in Section D.3.4.2.1 of Appendix D.

- 1,1-Dichloroethene (1,1-DCE), acetone, methyl ethyl ketone, methylene chloride and styrene were detected at concentrations that did not exceed their respective RBSLs.

4.1.1.2 Compound A Facility

A total of 29 soil vapor samples was collected at 23 locations and analyzed for VOCs. Of the 29 samples, 16 had detectable levels of VOCs, and results are shown in Figures E.3-1A and E.3-8 of Appendix E.

- The following VOCs were detected at concentrations above their respective Residential and/or Ecological RBSLs:
  - 1,1,2-Trichloro-1,2,2-trifluoroethane
  - benzene,
  - tetrachloroethene (PCE)
  - 1,1-DCE
  - cis-1,2-DCE
  - toluene

- TCE

Detailed discussion of results is presented in Section E.3.4.2.1 of Appendix E.

- The following VOCs were detected but did not exceed their respective RBSLs :
  - 1,1,1-TCA
  - ethylbenzene
  - total xylenes
  - acetone
  - m,p,o-xylenes

A total of 68 soil samples was collected at 50 locations and analyzed for VOCs. Of the 68 samples, 21 samples had detectable levels of VOCs, and results are shown in Figures E.3-1B and E.3-8 of Appendix E.

- Benzene, methylene chloride, and TCE concentrations were detected at concentrations above their respective Residential RBSL. Detailed discussion of results is presented in Section E.3.4.2.1 of Appendix E.
- 1,1-DCE, acetone, methyl ethyl ketone, m-xylene & p-xylene, styrene, toluene, and total xylenes were detected in soil at concentrations that did not exceed their respective RBSLs.

4.1.1.3 Environmental Chemistry Laboratory

A total of 62 soil vapor samples was collected at 42 locations and analyzed for VOCs. Of the 62 samples collected, 46 had detectable levels of VOCs, and results are shown in Figures F.3-1A and F.3-8 of Appendix F.

- The following VOCs vinyl chloride (VC)were detected at concentrations above Residential and/or Ecological RBSLs:
  - 1,1-dichloroethane (DCA)
  - 1,2- DCA
  - 1,1,2-trichloro-1,2,2-trifluoroethane
  - carbon tetrachloride
  - cis-1,2-DCE
  - toluene
  - TCE
  - 1,1-DCE
  - 1,1,1-TCA
  - benzene
  - chloroform
  - methylene chloride
  - PCE
  - VC

Detailed discussion of results is presented in Section F.3.4.2.1 of Appendix F.

- The following VOCs were detected at concentrations that did not exceed their respective RBSLs.
  - 1,2-dichloro-1,1,2-trifluoroethane
  - chlorotrifluoroethylene
  - ethylbenzene
  - trichlorofluoromethane
  - chlorobenzene
  - dichlorodifluoromethane
  - methyl ethyl ketone,
  - xylenes

A total of 125 soil samples was collected at 76 locations and analyzed for VOCs. Of the 125 samples, 58 samples had detectable levels of VOCs. Results are shown in Figures F.3-1B and F.3-8 of Appendix F.

- The following VOCs were detected at concentrations above their respective Residential RBSLs. Detailed discussion of results is presented in Section F.3.4.2.1 of Appendix F.
  - 1,2-DCA
  - carbon tetrachloride
  - methylene chloride
  - Toluene
  - Trichlorofluoromethane
  - benzene
  - chloroform
  - PCE
  - TCE
  - VC
- Seventeen additional VOCs were detected in soil at concentrations that did not exceed their respective RBSLs.

4.1.1.4 Environmental Effects Laboratory

A total of 23 soil vapor samples was collected at 15 locations and analyzed for VOCs. Of the 23 samples, 13 had detectable levels of VOCs, and results are shown in Figures G.3-1A and G.3-7 of Appendix G.

- TCE, toluene, and benzene were detected at concentrations above their respective Residential and/or Ecological RBSLs. Detailed discussion of results is presented in Section G.3.4.2.1 of Appendix G.
- 1,1,1-TCA, ethylbenzene, and xylenes were detected at concentrations that did not exceed their respective RBSLs.

A total of 39 soil samples was collected at 24 locations and analyzed for VOCs. Of the 39 samples, 13 had detectable levels of VOCs, and results are presented in Figures G.3-1B and G.3-7 of Appendix G.

- Acetone, ethylbenzene, methylene chloride, styrene, TCE, and xylenes were detected at concentrations that did not exceed their respective RBSLs.

4.1.1.5 Pond Dredge Area

A total of 34 soil samples was collected at 17 locations and analyzed for VOCs. Of the 34 samples, 6 samples had detectable levels of VOCs, and results are shown in Figures H.3-1 and H.3-8 of Appendix H.

- Benzene was detected at concentrations above its Residential RBSL. Detailed discussion of results is presented in Section H.3.4.2.1 of Appendix H.
- Acetone, 1,1-DCE, methyl ethyl ketone, p-cymene, and styrene were detected at concentrations that did not exceed their respective RBSLs.

4.1.1.6 Coal Gasification Process Development Unit

A total of 68 soil vapor samples was collected at 54 locations and analyzed for VOCs. Of the 68 samples, 22 samples had detectable levels of VOCs, and results are shown in Figures I.3-1A and I.3-8 of Appendix I.

- Toluene and PCE were detected at concentrations above their respective Ecological and/or Residential RBSLs. Detailed discussion of results is presented in Section I.3.4.2.1

- Benzene, ethylbenzene, xylenes, and trichlorofluoromethane were detected at concentrations that did not exceed their respective RBSLs.

A total of 90 soil samples was collected at 57 locations and analyzed for VOCs. Of the 90 samples, 22 samples had detectable levels of VOCs, and results are shown in Figures I.3-1B and I.3-8 of Appendix I.

- 1,2,4-Trimethylbenzene, acetone, dichlorodifluoromethane, methyl ethyl ketone, methylene chloride, styrene, and xylenes were detected at concentrations that did not exceed their respective RBSLs.

4.1.1.7 Area III Sewage Treatment Plant

A total of four soil vapor samples was collected at four locations and analyzed for VOCs. Of the four samples, two had detectable levels of VOCs. One of the two samples exceeded the respective RBSLs of two VOCs. Results are presented in Figures J.3-1A and J.3-6 of Appendix J.

- Benzene and toluene were detected at concentrations above their respective Residential or Ecological RBSLs in soil vapor samples collected. Detailed discussion of results is presented in Section J.3.4.2.1 of Appendix J.

A total of 16 soil samples was collected at 12 locations and analyzed for VOCs. Of the 16 samples, 6 samples contained detectable levels of VOCs that did not exceed their respective RBSLs. Results are presented in Figures J.3-1B and J.3-6 of Appendix J.

- 1,1-DCE, methylene chloride, styrene, and toluene were detected at concentrations that did not exceed their respective RBSLs.

4.1.1.8 Southeast Drum Storage Yard

A total of four soil vapor samples was collected at four locations and analyzed for VOCs. VOCs were not detected in any of the soil vapor samples collected. Results are shown in Figure K.3-1A of Appendix K.

A total of 15 soil samples was collected at seven locations and analyzed for VOCs. Of the 15 samples, 2 samples had detectable concentrations of VOCs. Results are shown in Figures K.3-1B and K.3-6 of Appendix K.

- Ethylbenzene, styrene, and xylenes were detected at concentrations that did not exceed any their respective risk-based screening levels (RBSLs).

4.1.1.9 Systems Test Laboratory IV

A total of 76 soil vapor samples was collected at 52 locations and analyzed for VOCs. Of the 76 samples collected, 61 had detectable levels of VOCs. Results are shown in Figures L.3-1A and L.3-8 of Appendix L.

- The following VOCs were detected at concentrations above their respective background, Residential, and/or Ecological RBSLs.
  - 1,1,2-trichloro-1,1,2-trifluoroethane
  - 1,1-DCE
  - 1,1-DCA
  - benzene

- cis-1,2-DCE
- Toluene
- VC
- PCE
- TCE

Detailed discussion of results is presented in Section L.3.4.2.1 of Appendix L.

- The following VOCs were detected below their respective background, Residential, and/or Ecological RBSLs.
  - 1,1,1-TCA
  - Chlorotrifluoroethylene
  - ethylbenzene
  - xylenes
  - 1,2-dichloro-1,1,2-trifluoroethane
  - dichlorodifluoromethane
  - trichlorofluoromethane

A total of 202 soil samples was collected at 108 locations and analyzed for VOCs. Of the 269 samples, 100 samples had detectable levels of VOCs above RBSLs, and results are shown in Figures L.3-1B and L.3-8 of Appendix L.

- The following VOCs were detected at concentrations above their respective background, Residential, and/or Ecological RBSLs.
  - 1,1-DCA
  - formaldehyde
  - TCE
  - cis-1,2-DCE
  - methylene chloride

Detailed discussion of results is presented in Section L.3.4.2.1 of Appendix L.

- The following VOCs were detected but did not exceed their respective RBSLs.
  - 1,1,1-TCA
  - 1,2,4-trimethylbenzene
  - 1,4-dichlorobenzene
  - chlorobenzene
  - dichlorodifluoromethane
  - methyl ethyl ketone
  - PCE
  - tert-butylbenzene
  - trans-1,2,-DCE
  - 1,1,2-trichloro-1,1,2-trifluoroethane
  - 1,3,5-trimethylbenzene
  - acetone
  - cumene
  - chloromethane
  - n-propylbenzene
  - styrene
  - toluene
  - xylenes

4.1.1.10 Building 65 Metals Laboratory Clarifier

A total of eight soil vapor samples was collected at five locations and analyzed for VOCs. Of the eight samples, five samples had detectable levels of VOCs, and results are presented in Figures M.3-1A and M.3-7 of Appendix M.

- Toluene was detected at concentrations above its Ecological RBSL. Detailed discussion of results is presented in Section M.3.4.2.1 of Appendix M.
- Benzene, ethylbenzene, PCE, TCE, and xylenes were detected at concentrations that did not exceed their respective RBSLs.

A total of 15 soil samples was collected at nine locations and analyzed for VOCs. Of the 15 samples, 5 samples had detectable levels of VOCs, and results are presented in Figures M.3-1B and M.3-7 of Appendix M.

- Benzene was detected at concentrations above the Residential RBSL. Detailed discussion of results is presented in Section M.3.4.2.1 of Appendix M.
- Acetone, methylene chloride, styrene, and PCE were detected at concentrations that did not exceed their respective RBSLs.

4.1.1.11 Building 100 Trench

A total of 11 soil vapor samples was collected at 11 locations and analyzed for VOCs. No VOCs were detected in any of the soil vapor samples, and results are shown in Figure N.3-1A of Appendix N.

A total of eight soil samples was collected at eight locations and analyzed for VOCs. Of the eight samples, two samples had detectable levels of VOCs, and results are shown in Figures N.3-1B and N.3-8 of Appendix N.

- Acetone and methyl ethyl ketone were detected at concentrations that did not exceed their respective RBSLs.

4.1.1.12 Department of Energy Leach Field 1

A total of 11 soil vapor samples was collected from seven locations and analyzed for VOCs. Of the 11 samples, one had detectable levels of VOCs, and results are shown in Figures O.3-1A and O.3-7 of Appendix O.

- Toluene and xylenes were detected at concentrations that did not exceed their respective RBSLs.

A total of 15 soil samples collected from eight locations was analyzed for VOCs. Of the 15 samples, 6 samples had detectable levels of VOCs, and results are shown in Figures O.3-1B and O.3-7 of Appendix O.

- Acetone, methyl ethyl ketone, methylene chloride, and styrene were detected at concentrations that did not exceed their respective RBSLs.

4.1.1.13 Department of Energy Leach Field 2

A total of five soil vapor samples was collected at three locations and analyzed for VOCs. Of the five samples, two samples had detectable levels of VOCs, and results are shown in Figures P.3-1A and P.3-7 of Appendix P.

- The following VOCs were detected at concentrations that did not exceed their respective RBSLs.
  - Toluene
  - cis-1,2-DCE
  - 1,1,1-TCA
  - 1,1-DCA

A total of eight soil samples was collected at four locations and analyzed for VOCs. Of the eight samples, four samples had detectable levels of VOCs, and results are shown in Figures P.3-1B and P.3-7 of Appendix P.

- Formaldehyde, styrene, and xylenes were detected at concentrations that did not exceed their respective RBSLs.

4.1.1.14 Department of Energy Leach Field 3

A total of 25 soil vapor samples were collected at 22 locations and analyzed for VOCs. Of the 25 samples collected, 4 samples had detectable levels of VOCs, and results are shown in Figures Q.3-1A and Q.3-7 of Appendix Q.

- Benzene and toluene were detected above their respective Residential RBSLs and/or Ecological RBSLs. Detailed discussion of results is presented in Section Q.3.4.2.1 of Appendix Q.
- Ethylbenzene, xylenes, and TCE were detected at concentrations that did not exceed their respective RBSLs.

A total of 33 soil samples was collected at 21 locations and analyzed for VOCs. Of the 33 samples collected, 13 samples had detectable levels of VOCs, and results are shown in Figures Q.3-1B and Q.3-7 of Appendix Q.

- Benzene and total xylenes were detected at concentrations above Residential RBSLs. The extent of impact of these two VOCs was adequately defined by nearby and deeper samples that had VOC concentrations that did not exceed their respective RBSLs. Detailed discussion of results is presented in Section Q.3.4.2.1 of Appendix Q.
- 1,1-Dichloroethene, acetone, ethylbenzene, methylene chloride, styrene, and toluene were detected at concentrations that did not exceed their respective RBSLs.

4.1.1.15 Hazardous Material Storage Area

A total of 19 soil vapor samples was collected at 17 locations and analyzed for VOCs. Of the 19 samples collected, 7 samples had detectable levels of VOCs. The results are shown in Figures R.3-1A and R.3-7 of Appendix R.

- Toluene was detected at concentrations above its Ecological RBSL. Detailed discussion of results is presented in Section R.3.4.2.1 of Appendix R.
- The following VOCs were detected at concentrations that did not exceed their respective RBSLs.
  - 1,1,2-trichloro-1,2,2-trifluoroethane
  - TCE
  - xylenes
  - dichlorodifluoromethane
  - trichlorofluoromethane

A total of 38 soil samples was collected at 21 locations and analyzed for VOCs. Of the 38 samples, 23 samples had detectable levels of VOCs. The results are shown in Figures R.3-1B and R.3-7 of Appendix R.

- The following VOCs were detected at concentrations that did not exceed their respective RBSLs.
  - 1,1-DCE
  - 1,3,5-trimethylbenzene
  - methyl ethyl ketone
  - toluene
  - Xylenes
  - 1,2,4-trimethylbenzene
  - acetone
  - styrene
  - TCE

4.1.1.16 Rockwell International Hot Laboratory

A total of 13 soil vapor samples was collected at 10 locations and analyzed for VOCs. Of the 13 soil vapor samples, 1 sample had detectable levels of VOCs, and results are shown in Figures S.3-1A and S.3-6 of Appendix S.

- Benzene and toluene were detected at concentrations that did not exceed their respective RBSLs.

A total of 25 soil samples was collected at 14 sample locations. Of the 25 samples, 2 samples had detectable levels of VOCs, and results are shown in Figures S.3-1B and S.3-6.

- Acetone and methyl ethyl ketones were detected at concentrations that did not exceed their respective RBSLs.

4.1.1.17 Systems Nuclear Auxiliary Power Facility

A total of 15 soil vapor samples was collected at nine locations and analyzed for VOCs. Of the 15 samples collected, 10 samples had detectable levels of VOCs, and results are shown in Figures T.3-1A and T.3-6 of Appendix T.

- PCE, benzene, and toluene were detected at concentrations above their respective Residential RBSLs and/or Ecological RBSLs. Detailed discussion of results is presented in Section T.3.4.2.1 of Appendix T.

- Cis-1,2-dichloroethene, ethylbenzene, o,m,p- and total-xylenes, and TCE concentrations were detected at concentrations that did not exceed their respective RBSLs.

A total of 23 soil samples collected at 13 locations was analyzed for VOCs. Of the 23 samples, 20 samples had detectable levels of VOCs, and results are shown in Figures T.3-1B and T.3-6 of Appendix T.

- PCE concentrations were detected at concentrations above its Residential RBSL. Detailed discussion of results is presented in Section T.3.4.2.1 of Appendix T.

- 1,1-Dichloroethene, acetone, methyl ethyl ketone, methylene chloride, and styrene concentrations were detected at concentrations that did not exceed their respective RBSLs.

4.1.2 Near-Surface Groundwater

VOCs in NSGW are characterized by analysis of samples collected from 70 piezometers and shallow wells within Group 5. VOC sampling results above screening levels for the Group 5 Reporting Area are summarized in the following subsections.

4.1.2.1 Boeing Area IV Leach Field

NSGW samples were collected from one piezometer and analyzed for VOCs.

- Acetone and methylene chloride were detected but did not exceed their respective groundwater screening levels.

4.1.2.2 Compound A Facility

Near Surface Groundwater samples were collected from 30 wells and piezometers and analyzed for VOCs.

- VCThe following VOCs were detected at concentrations above their respective groundwater screening levels.
  - TCE
  - 1,1-DCA
  - 1,2-DCA
  - Bromodichloromethane
  - chloroethane
  - cis-1,2-DCE
  - PCE
  - VC
  - 1,1,1-TCA
  - 1,1-DCE
  - 1,4-dichlorobenzene
  - carbon tetrachloride
  - chloroform
  - methylene chloride
  - trans-1,2-DCE
  -
- The following VOCs were detected at concentrations that did not exceed their respective groundwater screening levels.
  - 1,1,2-trichloro-1,2,2-trifluoroethane
  - 1,2-dichloroethenes
  - Acetone
  - carbon disulfide
  - methyl ethyl ketone
  - toluene
  - xylenes (total)
  - 1,2-dichlorobenzene
  - 1,3-dichlorobenzene
  - bromomethane
  - chloromethane
  - m-xylene & p-xylene
  - trichlorofluoromethane

4.1.2.3 Environmental Chemistry Laboratory

Samples of NSGW were collected from four wells and analyzed for VOCs.

- The following VOCs were detected at concentrations above their respective groundwater screening levels.
  - 1,1,1-TCA
  - 1,1-DCA
  - 1,2,3-trichloropropane
  - Benzene
  - carbon tetrachloride
  - cis-1,2-DCE
  - PCE
  - trans-1,2-DCE
  - 1,1,2-trichloro-1,2,2-trifluoroethane
  - 1,1,-DCE
  - 1,2-DCA
  - bromodichloromethane
  - chloroform
  - methylene chloride
  - toluene
  - TCE

- Trichlorofluoromethane
- VC

4.1.2.4 Environmental Effects Laboratory

Samples of NSGW were collected at one piezometer and analyzed for VOCs.

- TCE was detected at concentrations above its groundwater screening level.
- Methyl ethyl ketone and methylene chloride were detected at concentrations that did not exceed their respective groundwater screening levels.

4.1.2.5 Coal Gasification Process Development Unit

Samples of NSGW were collected from 10 shallow wells and piezometers and analyzed for VOCs.

- The following VOCs were detected at concentrations above groundwater screening levels.
  - 1,1-DCE
  - cis- 1,2-DCE
  - benzene
  - TCE
- The following VOCs were detected but did not exceed their respective groundwater screening levels.
  - 1,1,1-TCA
  - 1,2,4-trimethylbenzene
  - 1,2-DCE
  - 1,4-dichlorobenzene
  - Acetone
  - chloromethane
  - PCE
  - toluene
  - 1,1,2-trichloro-1,2,2-trifluoroethane
  - 1,2-dichlorobenzene
  - 1,3,5-trimethylbenzene
  - 2,2-dichloro-1,1,1-trifluoroethane
  - carbon disulfide
  - methyl ethyl ketone
  - methylene chloride
  - trans-1,2-DCE

4.1.2.6 Systems Test Laboratory IV

Samples of NSGW were collected from 16 shallow wells and piezometers and analyzed for VOCs.

- The following VOCs were detected at concentrations above groundwater screenings in various NSGW piezometers and wells over time.

  1,1,1-trichloroethane
  1,1-dichloroethane
  1,2-dichloroethane
  cis-1,2-dichloroethene
  methylene chloride
  trans-1,2-dichloroethene
  VC
  1,1,2-trichloro-1,2,2-trifluoroethane
  1,1-dichloroethene
  carbon tetrachloride
  dichlorodifluoromethane
  tetrachloroethene
  TCE

- The following VOCs were detected at concentrations that did not exceed their respective groundwater screening levels.

1,1,2-trichloroethane	1,2-dichloroethene
2,2-dichloro-1,1,1-trifluoroethane	acetone
benzene	chlorotrifluoroethylene
chloroform	dichlorotrifluoromethane
ethylbenzene	methyl ethyl ketone
tetrahydrofuran	Toluene
trichlorofluoromethane	xylenes

4.1.2.7 Department of Energy Leach Field 1

Samples of NSGW were collected at one sample location and analyzed for VOCs.

- Acetone and methylene chloride were detected in a sample collected on April 4, 2002. Detected concentrations did not exceed their respective screening levels.

4.1.2.8 Department of Energy Leach Field 3

Samples of NSGW were collected at three piezometers and analyzed for VOCs.

- TCE was detected at concentrations above its groundwater screening level in samples collected from all three piezometers.
- The following VOCs were detected at concentrations that did not exceed their respective screening levels.
  - Acetone
  - cis-1,2-dichloroethene
  - 1,1,2-trichloro-1,2,2-trifluoroethane
  - tetrachloroethene

4.1.2.9 Hazardous Material Storage Area

Samples of NSGW were collected at two piezometers and analyzed for VOCs.

- TCE was detected at concentrations above its groundwater screening level. During the next and final sampling events performed to date, TCE was not detected.
- 1,2-dichloroethene, acetone, and cis-1,2-dichloroethene were detected at concentrations that did not exceed their respective screening levels.

4.1.2.10 Rockwell International Hot Laboratory

Samples of NSGW were collected at one location and analyzed for VOCs. VOCs were detected but did not exceed their respective screening levels.

4.1.2.11 Systems Nuclear Auxiliary Power Facility

Samples of NSGW were collected at one piezometer and analyzed for VOCs.

- PCE was detected at a concentration above its groundwater screening level.
- Cis-1,2-dichloroethene and TCE were detected at concentrations below their respective screening levels.

Additional information on NSGW occurrence, quality, and temporal variability is provided in Appendix B.

4.1.3 Chatsworth Formation Groundwater

VOCs in Chatsworth Formation groundwater are characterized by the analysis samples collected from 23 onsite monitoring wells. VOC sampling results above screening levels for the Group 5 Reporting Area are summarized in the following subsections.

4.1.3.1 Compound A Facility

Samples of Chatsworth Formation groundwater were collected from two wells and analyzed for VOCs.

- The following VOCs were detected at concentrations above their respective groundwater screening levels.

Cis-1,2-DCE	Formaldehyde
Toluene	Trans-1,2- DCE
TCE	

- The following VOCs were detected at concentrations that did not exceed their respective groundwater screening levels.

1,1,2-trichloro-1,2,2-trifluoroethane	1,1-DCA
1,1-DCE	1,2,3-Trichloropropane
2,2-dichloro-1,1,1-trifluoroethane	Acetone
chloroform	chlorotrifluoroethylene
methyl methacrylate	methylene chloride
VC	

4.1.3.2 Environmental Chemistry Laboratory

Samples of Chatsworth Formation groundwater were collected from four wells and analyzed for VOCs.

- The following VOCs were detected at concentrations above their respective groundwater screening level.

1,2-DCA	Toluene
Trans-1,2-DCE	TCE
VC	

4.1.3.3 Pond Dredge Area

Samples of Chatsworth Formation groundwater were collected from one well and analyzed for VOCs.

- Methylene chloride and TCE were detected at concentrations above their respective groundwater screening levels.
- Acetone, chloromethane, cis-1,2-dichlorethene, methyl ethyl ketone, and toluene concentrations were detected in groundwater but did not exceed their respective groundwater screening levels.

4.1.3.4 Coal Gasification Process Development Unit

Samples of Chatsworth Formation groundwater were collected from one well and analyzed for VOCs.

- The following VOCs were detected but did not exceed their respective groundwater screening levels.
  - Acetone
  - toluene
  - TCE
  - carbon disulfide
  - trans-1,2-DCE

4.1.3.5 Southeast Drum Storage Yard

Samples of Chatsworth Formation groundwater were collected from one well and analyzed for VOCs.

- The following VOCs were detected but did not exceed their respective groundwater screening levels.
  - TCE
  - 1,4-dichlorobenzene
  - toluene
  - chloromethane
  - 1,3-dichlorobenzene
  - ethylbenzene
  - cis-1,2-DCE
  - acetone

4.1.3.6 Systems Test Laboratory IV

Samples of Chatsworth Formation groundwater were collected from six wells and analyzed for VOCs.

- The following VOCs were detected at concentrations above groundwater screening levels in various wells over time.

- 1,1,2-trichloro-1,1,2-trifluoroethane
- 1,1-dichloroethane
- 1,1-dichloroethene
- Acetone
- benzene
- chloroform
- cis-1,2-dichloroethene
- formaldehyde
- methylene chloride
- PCE
- trans-1,2-dichloroethene
- TCE
- VC

- The following VOCs were detected but did not exceed their respective groundwater screening levels.
  - 1,1,1-trichloroethane
  - 1,1,2-trichloroethane
  - 1,2-dichlorobenzene
  - 1,4-dichlorobenzene
  - bromodichloromethane
  - carbon disulfide
  - chloroethane
  - chloromethane
  - ethylbenzene
  - methyl ethyl ketone
  - methyl isobutyl ketone
  - toluene
  - trichlorofluoromethane
  - xylenes

4.1.3.7 Building 100 Trench

Samples of Chatsworth Formation groundwater were collected from two wells and analyzed for VOCs.

- 1,2-DCA, cis-1,2-DCE, and TCE concentrations were detected above their respective groundwater screening levels.
- Acetone, carbon disulfide, chloromethane, methyl ethyl ketone, methylene chloride, and toluene were detected but did not exceed any their respective groundwater screening levels.

4.1.3.8 Department of Energy Leach Field 1

Samples of Chatsworth Formation groundwater were collected at one well and analyzed for VOCs.

- TCE, carbon disulfide, and toluene were detected at concentrations that did not exceed their respective groundwater screening levels.

4.1.3.9 Department of Energy Leach Field 2

Samples of Chatsworth Formation groundwater were collected at two wells and analyzed for VOCs.

- PCE, TCE, 1,1-DCE, and 1,1-DCA were detected at concentrations that did not exceed their respective groundwater screening levels.

4.1.3.10 Systems Nuclear Auxiliary Power Facility

Samples of Chatsworth Formation groundwater were collected from three wells and analyzed for VOCs.

- PCE was detected above the groundwater screening level.
- The following VOCs were detected at concentrations that did not exceed their respective screening levels.
  - Acetone
  - 1,1,2,2-tetrachloroethane
  - methyl ethyl ketone
  - TCE
  - cis-1,2-dichloroethene
  - 1,1-dichloroethane
  - methylene chloride
  - toluene

Existing soil data do not indicate that the VOC impacts to Chatsworth groundwater at the wells at the Group 5 RFI originated from these sites. However, based on operations at the STL-IV and ECL RFI Sites, which included the potential and known disposal of numerous chemicals and the sampling results of the removed and in-place soil at the site, the detections of VOCs at the wells at the STL-IV and ECL RFI Sites are considered potentially site-related. A map depicting the estimated lateral boundary of TCE in groundwater at concentrations above the MCL of 5 micrograms per liter (µg/L) is provided in (Figure B.3-11 of Appendix B, Volume III). Additional information on Chatsworth Formation groundwater occurrence, quality, and temporal variability is provided in Appendix B.

4.1.4 Surface Water

As part of NPDES monitoring, stormwater discharge has been routinely sampled at Outfall 007 and/or Outfall 017 since 2004. VOCs have not been detected in these samples above NPDES permit limits.

4.1.5 Completeness of Characterization

Soil and soil vapor samples were collected and analyzed from known or potential solvent source areas and downstream discharge areas within Group 5. In addition, soil vapor screening was conducted at representative locations to provide characterization of potential VOC impacts at the Group 5 RFI sites. The detected VOCs above RBSLs are predominantly TCE and its daughter products at several RFI sites. TCE detections are primarily attributed to site operations, which included the potential and known disposal of numerous chemicals including organic solvents. VOCs detected above RBSLs at the other Group 5 RFI sites were generally low, and either not replicated in subsequent collocated samples or considered a likely result of laboratory contamination. Groundwater has been sampled and analyzed for VOCs at locations near operational areas, and analytical results are consistent with known operations and/or with soil data in Group 5.

VOC-related chemical use areas are delineated sufficiently for risk assessment and for the support of RFI recommendations as detailed in Appendices D through T.

4.2 Semivolatile Organic Compounds

4.2.1 Soil/Sediment

A total of 829 samples, which includes splits and field duplicates, were collected and analyzed for SVOCs within the Group 5 Reporting Area. Locations were based on site use (known or suspected chemical use areas) and sample results (step-outs). Results of Group 5 Reporting Area SVOC sampling are depicted in Figure 4-3. Each sample location is represented by a color corresponding to a maximum ratio of detected SVOC concentrations to respective RBSLs in that sample.

SVOCs were detected in generally low concentrations and below RBSLs in samples collected within the Group 5 Reporting Area. Overall, SVOCs (excluding Tentetively Identified Compounds (TICs)) detected primarily encompassed PAHs. SVOC sampling results for the RFI sites within the Group 5 Reporting Area are summarized as follows:

4.2.1.1 Boeing Area IV Leach Field

A total of 30 soil samples was collected at 21 locations and analyzed for SVOCs. Of the 30 samples, 17 samples had detectable levels of SVOCs, and results are shown in Figures D.3-2 and D.3-8 of Appendix D.

- Diethyl phthalate, butyl benzyl phthalate, and n-nitrosodimethylamine were detected at concentrations that did not exceed their respective RBSLs.
- Various PAHs were detected in 15 samples collected. None of the detected concentrations exceeded its respective RBSLs

4.2.1.2 Compound A Facility

A total of 64 soil samples was collected at 45 locations and analyzed for SVOCs. Of the 64 samples, 19 samples contained detectable levels of SVOCs including 15 samples with detectable levels PAHs. Sixteen different compounds were detected including 13 PAH compounds. Results are presented in Figures E.3-2, E.3-9A, and E.3-9B of Appendix E.

- Phenol, Butyl benzyl phthalate, and bis(2-ethylhexyl) phthalate were detected in soil at concentrations that did not exceed their respective RBSLs.
- Thirteen PAH compounds were detected in samples collected from 12 of the 45 sampling locations. None of the detected concentrations exceeded their respective RBSLs.

4.2.1.3 Environmental Chemistry Laboratory

A total of 72 soil samples was collected at 47 locations and analyzed for SVOCs. Of the 72 samples, 23 samples contained detectable levels of SVOCs, and results are presented in Figures F.3-2, F.3-9A, and F.3-9B of Appendix F.

- The following SVOCs were detected at concentrations that did not exceed their respective RBSLs.
  - Benzoic acid
  - bis(2-ethylhexyl) phthalate
  - diethyl phthalate
  - di-n-butyl phthalate
  - di-n-octyl phthalate
  - phenol
- The following PAHs were detected in 13 samples collected. Concentrations did not exceed their respective RBSLs..
  - 1-methyl naphthalene
  - 2-methylnaphthalene
  - acenaphthene
  - acenaphthylene
  - anthracene
  - benzo(a) anthracene
  - benzo(a) pyrene
  - benzo(b) fluoranthene
  - benzo(ghi) perylene
  - benzo(k) fluoranthene
  - chrysene
  - dibenzo(a,h) anthracene
  - fluoranthene
  - fluorine
  - indeno(1,2,3-cd) pyrene
  - naphthalene
  - phenanthrene

4.2.1.4 Environmental Effects Laboratory

A total of 23 soil samples was collected at 15 locations and analyzed for SVOCs. Of the 23 samples, 14 samples had detectable levels of SVOCs, and results are shown in Figures G.3-2 and G.3-8 of Appendix G.

- The following SVOCs were detected at concentrations that did not exceed their respective RBSLs.
  - bis(2-ethylhexyl) phthalate
  - butyl benzyl phthalate
  - dimethyl phthalate
  - di-n-butyl phthalate
  - di-n-octyl phthalate
- PAHs were detected in seven samples collected. None of the detected concentrations exceeded their respective RBSLs.

4.2.1.5 Pond Dredge Area

A total of 37 soil samples was collected at 22 locations and analyzed for SVOCs. Of the 37 samples, 20 samples had detectable levels of SVOCs, and results are shown in Figures H.3-2 and H.3-9 of Appendix H.

- Bis(2-ethylhexyl) phthalate was detected at concentrations above Ecological RBSLs in one sample collected. The extent of bis(2-ethylhexyl) phthalate impact is defined. Detailed discussion of results is presented in Section H.3.4.2.2 of Appendix H.
- Butyl benzyl phthalate, diethyl phthalate, dimethyl phthalate, and di-n-octyl phthalate were detected but did not exceed any RBSLs.
- PAHs were detected in 13 samples collected. None of the detected concentrations exceeded their respective RBSLs.

4.2.1.6 Coal Gasification Process Development Unit

A total of 110 soil samples was collected at a total of 65 locations and analyzed for SVOCs. Of the 110 samples, 73 samples had detectable levels of SVOCs, and results are shown in Figures I.3-2, I.3-9A, and I.3-9B of Appendix I.

- The following SVOCs were detected at concentrations that did not exceed any their respective RBSLs.
  - bis(2-ethylhexyl) phthalate
  - butyl benzyl phthalate
  - diethyl phthalate
  - dimethyl phthalate
  - di-n-butyl phthalate
  - di-n-octyl phthalate
- PAHs were detected in all of the 59 samples analyzed for PAHs. The following were detected at concentrations above their respective Ecological and/or Residential RBSLs. Detailed discussion of results is presented in Section I.3.4.2.2 of Appendix I.
  - anthracene
  - benzo(a)anthracene
  - benzo(a)pyrene
  - benzo(b)fluoranthene
  - benzo(ghi)perylene
  - benzo(k)fluoranthene
  - chrysene
  - dibenzo(a,h)anthracene
  - indeno(1,2,3-cd)pyrene
  - phenanthrene
  - pyrene

4.2.1.7 Area III Sewage Treatment Plant

Eight soil samples were collected at seven locations and analyzed for SVOCs. Of the eight samples, four samples contained detectable levels of SVOCs. Results are presented in Figures J.3-2 and J.3-7 of Appendix J.

- 2-methyl naphthalene and di-ethyl phthalate detected did not exceed their respective RBSLs.
- PAHs were detected in four of the seven sampling locations. None of the detected concentrations exceeded their respective RBSLs.

4.2.1.8 Southeast Drum Storage Yard

A total of 14 soil samples was collected at seven locations and analyzed for SVOCs. Of the 14 samples, 4 samples had detectable concentrations of SVOCs, and results are shown in Figures K.3-2 and K.3-6 of Appendix K.

- Di-n-octyl phthalate was detected at concentrations that did not exceed any of its RBSLs.
- Various PAHs were detected at three of the seven sampling locations. None of the detected concentrations exceeded their respective RBSLs.

4.2.1.9 STL-IV

A total of 120 soil samples was collected at 78 locations and analyzed for SVOCs. Of the 120 samples, 47 samples had detectable levels of SVOCs, and results are shown in Figures L.3-2, L.3-9A, and L.3-9B of Appendix L.

- Di-n-butyl phthalate was detected at concentrations above its Ecological RBSL.
- The following compounds were detected at concentrations that did not exceed their respective RBSLs.
  - bis(2-ethylhexyl) phthalate
  - diethyl phthalate
  - di-n-octyl phthalate
  - monomethylhydrazine
  - n-nitrosodiphenylamine
  - butyl benzyl phthalate
  - dimethyl phthalate
  - 1,1-dimethylhydrazine
  - n-nitrosodimethylamine
- PAH compounds were detected in 30 of the 114 samples analyzed for PAHs. Benzo(a) pyrene was detected at concentrations above its Residential RBSL.

4.2.1.10 Building 65 Metals Laboratory Clarifier

A total of 13 soil samples was collected at nine locations and analyzed for SVOCs. Of the 13 samples, 4 samples had detectable levels of SVOCs, and results are shown in Figures M.3-2 and M.3-8 of Appendix M.

- Bis(2-ethylhexyl) phthalate and di-n-octyl phthalate were detected at concentrations less than their respective RBSLs.
- Of the 13 samples collected, three had detectable levels of PAHs. The following compounds were detected at concentrations that did not exceed their respective RBSLs.
  - 2-methylnaphthalene
  - benzo(b)fluoranthene
  - fluoranthene
  - naphthalene
  - pyrene
  - benzo(a) anthracene
  - benzo(ghi)perylene
  - fluorine
  - phenanthrene

4.2.1.11 Building 100 Trench

A total of 40 soil samples was collected at 33 locations and analyzed for SVOCs. Of the 40 samples, 16 samples had detectable levels of SVOCs, and results are shown in Figures N.3-2 and N.3-8 of Appendix N.

- Di-n-butyl phthalate, di-n-octyl phthalate, butyl benzyl phthalate, and dimethyl phthalate were detected at concentrations that did not exceed their respective RBSLs.
- Various PAHs were detected in 15 samples collected. None of the detected concentrations exceeded their respective RBSLs.

4.2.1.12 Department of Energy Leach Field 1

A total of 26 soil samples was collected from 15 locations and analyzed for SVOCs. Of the 26 samples, 12 samples had detectable levels of SVOCs, and results are shown in Figures O.3-2 and O.3-8 of Appendix O.

- The following compounds were detected at concentrations that did not exceed their respective RBSLs.

- bis(2-ethylhexyl) phthalate
- butyl benzyl phthalate
- diethyl phthalate
- di-n-butyl phthalate
- di-n-octyl phthalate

- Various PAHs were detected in nine samples. None of the detected concentrations exceeded their respective RBSLs.

4.2.1.13 Department of Energy Leach Field 2

A total of 21 soil samples was collected at 12 locations and analyzed for SVOCs. Of the 21 samples, 15 samples had detectable levels of SVOCs, and results are shown in Figures P.3-2 and P.3-8 of Appendix P.

- The following compounds were detected at concentrations that did not exceed their respective RBSLs.
  - bis(2-ethylhexyl) phthalate
  - butyl benzyl phthalate
  - dimethyl phthalate
  - di-n-butyl phthalate
  - di-n-octyl phthalate
  - pentachlorophenol

- Of the 20 samples collected and analyzed for PAHs, 10 had detectable concentrations of PAHs.
  - Benzo(a) pyrene was detected above its Residential RBSL. Detailed discussion of results is presented in Section O.3.4.2.2 of Appendix O.
  - Fifteen additional PAHs were detected at concentrations that did not exceed their respective RBSLs.

4.2.1.14 Department of Energy Leach Field LF3

A total of 64 samples was collected at 43 locations and analyzed for SVOCs. Of the 64 samples collected, 38 samples had detectable levels of SVOCs, and results are shown in Figures Q.3-2, Q.3-8A, Q.3-8B, and Q.3-8C of Appendix Q.

- N-nitrosodimethylamine (NDMA) was detected in a sample collected within the footprint of former Building 4873 at concentrations above its Residential RBSL. Further characterization of NDMA might be required at that location.
- Bis(2-ethylhexyl) phthalate, diethyl phthalate, dimethyl phthalate, di-n-butyl phthalate, and di-n-octyl phthalate were detected at concentrations that did not exceed their respective RBSLs.
- Of the 64 samples, collected, 32 had detectable levels of PAHs.
  - The following PAHs were detected above their respective Residential and/or Ecological RBSLs. Detailed discussion of results is presented in Section Q.3.4.2.2 of Appendix Q.
    - benzo(a)anthracene
    - benzo(a)pyrene
    - benzo(b)fluoranthene
    - benzo(k)fluoranthene

- indeno(1,2,3-cd)pyrene
- phenanthrene

– The following PAHs were detected at concentrations that did not exceed their respective RBSLs.

- 1-methyl naphthalene
- 2-methylnaphthalene
- acenaphthene
- acenaphthylene
- anthracene
- benzo(g,h,i) perylene
- chrysene
- dibenzo(a,h)anthracene
- fluoranthene
- fluorine
- naphthalene
- pyrene

4.2.1.15 Hazardous Material Storage Area

A total of 42 soil samples was collected at 26 locations and analyzed for SVOCs. Of the 42 samples, 25 samples had detectable levels of SVOCs. The results are shown in Figures R.3-2, R.3-8A, and R.3-8B of Appendix R.

- Butyl benzyl phthalate, diethyl phthalate, di-n-butyl phthalate, di-n-octyl phthalate were detected at concentrations that did not exceed their respective RBSLs.
- The maximum bis(2-ethylhexyl) phthalate was detected in a surface soil sample at U5BS1101 at a concentration of 2.16 milligrams per kilogram (mg/kg) (Ecological RBSL of 4.9 mg/kg).
- Various PAHs were detected in 42 samples collected, as presented below.
  – The following PAHs were detected above Residential RBSLs and/or Ecological RBSLs. Detailed discussion of results is presented in Section R.3.4.2.2 of Appendix R.
    - benzo(a)anthracene
    - benzo(a)pyrene
    - benzo(b)fluoranthene
    - benzo(k)fluoranthene
    - chrysene
    - acenaphthene
    - anthracene
    - fluoranthene
    - fluorene
    - phenanthrene
    - pyrene
    - indeno(1,2,3-cd)pyrene
  – 1-Ethyl naphthalene, 2-methylnaphthalene, acenaphthylene, benzo(ghi)perylene, and dibenzo(a,h)anthracene were detected at concentrations that did not exceed their respective RBSLs.

4.2.1.16 Rockwell International Hot Laboratory

A total of eight soil samples was collected at four locations and analyzed for SVOCs. Of the eight samples, seven had detectable levels of SVOCs, and results are shown in Figures S.3-2 and S.3-7 of Appendix S.

- Bis(2-ethylhexyl), di-n-butyl phthalate, and di-n-octyl phthalate were detected at concentrations that did not exceed their respective RBSLs.
- In seven samples, various PAHs were detected at concentrations that did not exceed their respective RBSLs.

4.2.1.17 Systems Nuclear Auxiliary Power Facility

A total of 20 soil samples was collected at 12 locations and analyzed for SVOCs. Of the 20 samples, 10 samples had detectable levels of SVOCs, and results are shown in Figures T.3-2 and T.3-7 of Appendix T.

- Di-n-butyl-phthalate and butyl benzyl phthalate were detected at concentrations that did not exceed their respective RBSLs, and further characterization of SVOCs in soil is not required at the SNAP RFI Site.
- Various PAHs were detected in all of the samples analyzed for PAHs. No PAH concentrations exceeded their respective RBSLs.

4.2.2 Near-Surface Groundwater

Groundwater samples have been collected and analyzed for SVOCs from several near-surface piezometers or wells in the Group 5 Reporting Area. Thirty-four SVOCs were detected in samples collected from the wells installed in the NSGW. Of the 34 SVOCs detected, bis(2-ethylhexyl) phthalate was detected in concentrations that exceeded its groundwater screening level of 4 µg/L.:

Low-level concentrations of PAH compounds including benzo(a)anthracene, benzo(k)fluoranthene, and phenanthrene were each detected once in the following wells: ES-17, PZ-122, and PZ-006E, respectively. Screening criteria for benzo(a)anthracene, benzo(k)fluoranthene, and phenanthrene have not been established.

4.2.3 Chatsworth Formation Groundwater

Groundwater samples have been collected and analyzed for SVOCs from 20 CFOU wells in the Group 5 Reporting Area (Table B-17). Seventeen SVOCs were detected in samples collected from the wells installed in the CFOU. Of the 17 SVOCs detected, the following 2 SVOCs were detected in concentrations that exceeded their respective groundwater screening levels: pentachlorophenol and bis(2-ethylhexyl) phthalate.

Low-level concentrations of PAH compounds including anthracene and benzo(ghi)perylene was detected once in RD-55B. Screening criteria for anthracene and benzo(ghi)perylene have not been established.

4.2.4 Surface Water

As part of NPDES monitoring, stormwater discharge has been routinely sampled at Outfall 007 and/or Outfall 017 since 2004. SVOCs have not been detected in these samples above NPDES permit limits.

4.2.5 Completeness of Characterization

Soil and groundwater samples were collected from known potential SVOC source areas and downstream discharge areas with Group 5. PAHs are the SVOCs most commonly detected in Group 5 soil samples, with most concentrations much less than RBSLs. SVOCs were generally not detected in Group 5 groundwater samples.

SVOC-related chemical use areas are delineated sufficiently for risk assessment and for the support of RFI recommendations as detailed in Appendices D through T.

4.3 Petroleum Fuels

4.3.1 Soil/Sediment

A total of 845 soil samples, which includes splits and field duplicates, were collected and analyzed for TPH within the Group 5 Reporting Area. Locations were based on site use (known or suspected chemical use areas) and sample results (step-outs). Group 5 TPH sampling results are depicted in Figure 4-4. Each sample location is represented by a color corresponding to a maximum ratio of detected TPH concentrations to the lowest RBSL in that sample.

Locations with maximum detections of petroleum hydrocarbons exceeding RBSLs at Group 5 RFI sites are described below. Since the RBSLs for TPH are based on the potential presence of benzene for gasoline-range hydrocarbons, or PAHs for all other hydrocarbon fractions, the following descriptions include information about these related compounds in samples that are collocated or nearby.

4.3.1.1 Boeing Area IV Leach Field

A total of 31 samples was collected at 22 locations and analyzed for TPH. Of the 31 samples, 20 samples had detectable concentrations of TPH. Results are shown in Figures D.3-3 and D.3-8 of Appendix D.

- Gasoline-range hydrocarbons (C8-C11) were detected at a concentration slightly above the residential RBSL. Detailed discussion of results is presented in Section D.3.4.2.3 of Appendix D.
- Kerosene-range hydrocarbon (C11-C14) and (C12-C14), diesel-range hydrocarbons (C14-C20) and (C15-C20), and lubricating-oil-range hydrocarbons (C20-C30 and C21-C30) were detected at concentrations that did not exceed their respective RBSLs.

4.3.1.2 Compound A Facility

Sixty-three soil samples were collected at 50 locations and analyzed for TPH. Of the 63 samples, 45 samples contained detectable levels of TPH. None of the detected concentrations exceeded their respective RBSLs. Results are presented in Appendix E in Figures E.3-3, E.3-9A, and E.3-9B, and in Table E.3-3A.

4.3.1.3 Environmental Chemistry Laboratory

A total of 61 soil samples was collected at 41 locations and analyzed for TPHs. Of the 61 samples, 22 samples contained detectable levels of TPH, and results are shown in Figures F.3-3, F.3-9A, and F.3-9B of Appendix F.

- Diesel-range hydrocarbons (C14-C20), kerosene range hydrocarbons (C11-C14), gasoline range hydrocarbons (C8-C11) were detected at concentrations above their respective Residential RBSLs. Detailed discussion of results is presented in Section F.3.4.2.3 of Appendix F.

- Diesel-range hydrocarbons (C15-C20), lubricating oil range hydrocarbons (C20-C30 and C21-C30), TPHs, and total recoverable petroleum hydrocarbons (TRPH) were detected at concentrations that did not exceed their respective Residential RBSL of 1,400 mg/kg.

4.3.1.4 Environmental Effects Laboratory

A total of 36 soil samples was collected at 27 locations and analyzed for TPH. Of the 36 samples, 21 samples had detectable levels of TPH, and results are shown in Figures G.3-3 and G.3-8 of Appendix G.

- Gasoline-range hydrocarbons (C8-C11) were detected at concentrations above Residential RBSLs. Detailed discussion of results is presented in Section G.3.4.2.3 of Appendix G.
- Diesel-range hydrocarbons (C15-C20), lubricating-oil-range hydrocarbons (C20-C30 and C21-C30), and TRPH were detected at concentrations that did not exceed their respective RBSLs.

4.3.1.5 Pond Dredge Area

A total of 34 soil samples was collected at 19 locations and analyzed for TPHs. Of the 34 samples, 24 samples had detectable levels of TPH, and results are shown in Figures H.3-3 and H.3-9 of Appendix H.

- Kerosene-range hydrocarbons (C12-C14), diesel-range hydrocarbons (C15-C20), and lubricating-oil hydrocarbons (C20-C30) and (C21-C30) were detected at concentrations that did not exceed RBSLs.

4.3.1.6 Coal Gasification Process Development Unit

A total of 104 soil samples was collected at a total of 68 locations and analyzed for TPH. Of the 104 samples, 68 had detectable levels of TPH, and results are shown in Figures I.3-3, I.3-9A, and I.3-9B of Appendix I.

- Gasoline-range hydrocarbons (C8-C11) were detected at concentrations above its Ecological RBSL. Detailed discussion of results is presented in Section I.3.4.2.3 of Appendix I.
- Kerosene-range hydrocarbons (C12-C-14), diesel-range hydrocarbons (C14-C20 and C15-C20), lubricant-oil-range hydrocarbons (C20-C30 and C21-C30), TPH, and TRPHs were detected at concentrations that did not exceed any their respective RBSLs.

4.3.1.7 Area III Sewage Treatment Plant

A total of 11 soil samples was collected at 10 locations and analyzed for TPHs. Of the 11 samples, 6 samples contained detectable levels of TPHs, and results are shown in Figures J.3-3 and J.3-7 of Appendix J.

- Diesel-range hydrocarbons (C15-C20) and lubricating-oil-range hydrocarbons (C21-C30) were detected at concentrations that did not exceed their respective RBSLs.

4.3.1.8 Southeast Drum Storage Yard

A total of 14 soil samples was collected at seven locations and analyzed for TPH. Of the 14 samples, 2 samples had detectable concentrations of TPH, and results are shown in Figures K.3-3 and K.3-6 of Appendix K.

- Kerosene-range hydrocarbon (C12-C14) and lubricating-oil-range hydrocarbons (C21-C30) were detected at concentrations that did not exceed their respective Residential and/or Ecological RBSLs.

4.3.1.9 Systems Test Laboratory IV

A total of 144 soil samples was collected at 90 locations and analyzed for TPH. Of the 144 samples, 83 samples had detectable levels of TPH, and results are shown in Figures L.3-3 and L.3-11A through L.3-11D of Appendix L.

- Gasoline-range hydrocarbons (C8-C11) were detected at concentrations above its Residential RBSLs. Detailed discussion of results is presented in Section L.3.4.2.3 of Appendix L.
- Various other petroleum hydrocarbons were detected at concentrations that did not exceed their respective RBSLs.

4.3.1.10 Building 65 Metals Laboratory Clarifier

A total of 17 soil samples was collected at 12 locations and analyzed for TPH. Of the 17 samples, 6 samples had detectable levels of TPH. TPH results are presented in Figures M.3-3 and M.3-8 of Appendix M.

- Gasoline-range hydrocarbons (C8-C11) and Diesel range hydrocarbons (C14-C20) were detected at concentrations above their respective residential RBSLs. Detailed discussion of results is presented in Section M.3.4.2.3 of Appendix M.
- Diesel-range hydrocarbons (C15-C20) and lubricating oil range hydrocarbons (C20-C30 and C21-C30) were detected at concentrations that did not exceed their respective RBSLs.

4.3.1.11 Building 100 Trench

A total of 16 soil samples was collected at 12 locations and analyzed for TPHs. Of the 16 samples, 8 samples had detectable levels of TPHs. Results are shown in Figures N.3-3 and N.3-8 of Appendix N.

- Gasoline-range hydrocarbons (C8-C11) were detected at concentrations above its Residential RBSL in two samples collected. Detailed discussion of results is presented in Section N.3.4.2.3 of Appendix N.
- Kerosene-range hydrocarbons (C12-C14), diesel- range hydrocarbons (C15-C20), and lubricating oil- range hydrocarbons (C20-C30 and C21-C30) were detected at concentrations that did not exceed their respective RBSLs.

4.3.1.12 Department of Energy Leach Field 1

A total of 23 soil samples was collected from 15 locations and analyzed for TPH. Of the 23 samples, 9 samples had detectable levels of TPH, and results are shown in Figures O.3-3 and O.3-8 of Appendix O.

- Diesel-range hydrocarbons (C15-C20) and lubricating-oil-range hydrocarbons (C21-C30) were detected at concentrations that did not exceed their respective RBSLs.

4.3.1.13 Department of Energy Leach Field 2

A total of 13 soil samples was collected at seven locations and analyzed for TPH. All of the 13 samples contained detectable levels of TPH, and results are presented in Figures P.3-3 and P.3-8 of Appendix P.

Diesel-range hydrocarbons (C15 to C20) and lubricating-oil-range hydrocarbons (C21-C30) were detected at concentrations that did not exceed their respective RBSLs.

4.3.1.14 Department of Energy Leach Field 3

A total of 82 samples was collected at 51 locations and analyzed for TPH. Of the 82 samples collected, 43 had detectable levels of TPH, and results are shown in Figures Q.3-3, Q.3-8A, Q.3-8B, and Q.3-8C of Appendix Q.

- Diesel-range hydrocarbons were detected at concentrations above Residential RBSLs in samples collected from the location of former UT-55 at the southwest corner of Building 4055. The extent of diesel-range hydrocarbon impact is adequately defined by step-out and step-down samples. Detailed discussion of results is presented in Section Q.3.4.2.3 of Appendix Q.
- Kerosene-range hydrocarbons (C11-C14 and C12-C14) and lubricating-oil-range hydrocarbons (C20-C30, C21-C30, and C25-C36) were detected at concentrations that did not exceed their respective Residential RBSL.

4.3.1.15 Hazardous Material Storage Area

A total of 45 soil samples was collected at 28 locations and analyzed for TPH. Of the 45 samples, 32 samples had detectable levels of TPH. The results are shown in Figures R.3-3, R.3-8A, and R.3-8B. Concentrations denoted with a "J" flag indicate that the results are estimated below the method reporting limits.

- Gasoline-range hydrocarbons (C8-C11) were detected at concentrations above the Residential RBSL. Although these concentrations exceed the Residential RBSL for gasoline-range hydrocarbons, no elevated benzene concentrations were detected in soil or soil vapor samples at the HMSA RFI Site. Therefore, no further investigation of TPH appears warranted in the HMSA RFI Site area.
- Kerosene-range hydrocarbons (C12-C14), diesel-range hydrocarbons (C14-C20 and C15-C20), and lubricating-oil-range hydrocarbons (C20-C30 and C21-C30) were detected at concentrations that did not exceed their respective RBSLs.

4.3.1.16 Rockwell International Hot Laboratory

A total of 11 soil samples was collected at seven locations and analyzed for TPH. Of the 11 samples collected, 9 samples had detectable concentrations of TPH. The results are shown in Figures S.3-3 and S.3-7.

- Diesel-range hydrocarbons (C15-C20), lubricating-oil-range hydrocarbons (C21-C30), and TRPH were detected at concentrations that did not exceed their respective RBSLs.

4.3.1.17 Systems Nuclear Auxiliary Power Facility

A total of 26 soil samples was collected at 15 locations and analyzed for TPH. Of the 26 samples, 24 samples had detectable levels of TPH, and results are shown in Figures T.3-3 and T.3-7 of Appendix T.

- Gasoline-range hydrocarbon (C8-C11) was detected at concentrations above its Residential RBSL in three samples collected. Detailed discussion of results is presented in T.3.4.2.3 of Appendix T.
- Diesel-range hydrocarbons (C15-C20) and lubricant-oil-range hydrocarbons (C20-C30 and C21-C30) were detected at concentrations that did not exceed their respective RBSLs.

4.3.2 Near-Surface Groundwater

Various hydrocarbon ranges between C8-C30 were analyzed, and a single detection was reported for C8-C30 in well PZ-121 at a concentration of 250 µg/L in May 2008. Screening criteria have not been established for the hydrocarbon range of C8-C30.

4.3.3 Chatsworth Formation Groundwater

Gasoline, kerosene, diesel, and total petroleum hydrocarbons were analyzed in nine Group 5 Chatsworth Formation groundwater monitoring wells: HAR-17, HAR-18, HAR-26, RD-20, RD-55A, RD-55B, RD-58A, RD-58B, and RD-58C. Total petroleum hydrocarbons (as kerosene) and gasoline range hydrocarbons were detected above screening criteria in HAR-18 with a maximumconcentrations of 2,000 µg/L for gasoline range hydrocarbons and 3,600 µg/L for TPH as kerosene).

4.3.4 Surface Water

As part of NPDES monitoring, stormwater discharge has been routinely sampled at Outfall 007 and/or Outfall 017 since 1983. TPH in these samples has not been detected above NPDES permit limits.

4.3.5 Completeness of Characterization

Soil and groundwater samples were collected from all known or suspected TPH source areas and downstream of known discharge areas. In most cases where soil TPH concentrations exceeded RBSLs, collocated or nearby soil samples were analyzed for the potential risk constituents, benzene, and PAHs. TPH detections in groundwater within the Group 5 Reporting Area were generally low.

TPH-related chemical use areas are delineated sufficiently for risk assessment and for the support of RFI recommendations as detailed in Appendices D through T. Also, TPH is not used in the risk assessment since the estimated risk relies on specific VOC and SVOC concentrations for TPH-related compounds (that is, benzene and PAHs), and many analytical results for those compounds are available for these two compounds within the Group 5 Reporting Area.

4.4 Polychlorinated Biphenyls

4.4.1 Soil/Sediment

A total of 280 soil samples, which includes splits and field duplicates, were collected and analyzed for PCBs within the Group 5 Reporting Area. Locations were based on site use (known or suspected chemical use areas) and sample results (step-outs). PCB sampling results for the Group 5 Reporting Area are depicted in Figure 4-5. Each sample location is represented by a color corresponding to a maximum ratio of detected PCB concentrations to the lowest RBSL in that sample result. Since no RBSLs are established for terphenyl compounds, these results are noted on the figure where detected in soil samples. PCBs were detected at generally low concentrations or were nondetect in samples collected within the Group 5 Reporting Area. Detected PCBs primarily consisted of Aroclors 1254 1260. PCB sampling results for the RFI sites within the Group 5 Reporting Area are summarized in the following subsections.

4.4.1.1 Boeing Area IV Leach Field

A total of three samples was collected at three locations and analyzed for PCBs. Of the three samples, two samples had detectable concentrations of PCBs. Results are presented in Figures D.3-4 and D.3-8 of Appendix D.

- Aroclor 1254 and Aroclor 1260 were detected at concentrations that did not exceed their respective RBSLs.

4.4.1.2 Compound A Facility

A total of 44 soil samples was collected at 30 locations and analyzed for PCBs. Of the 44 samples, 13 samples contained detectable levels of PCBs. Seven of the 13 detections were at concentrations above RBSLs. Results are presented in Appendix E, Figures E.3-4, E.3-9A, and E.3-9B, and in Table E.3-3A.

- Aroclor 1254 and Aroclor 1260 concentrations were detected at concentrations above their respective Residential and/or Ecological RBSL. Detailed discussion results are presented in Section E.3.4.2.4

4.4.1.3 Environmental Chemistry Laboratory

A total of 13 soil samples was collected at nine locations and analyzed for PCBs. Of the 13 samples, one sample had detectable levels of Aroclor 1260, and results are presented in Figures F.3-4 and F.3-9 of Appendix F.

- Aroclor 1260 was detected at concentrations that did not exceed its RBSLs.

4.4.1.4 Environmental Effects Laboratory

A total of six soil samples was collected at six locations and analyzed for PCBs. Of the six samples, one sample had detectable levels of PCBs, and results are shown in Figures G.3-4 and Figure G.3-8 of Appendix G.

- Aroclor 1254 was detected at concentrations that exceeded its Ecological RBSL, but it was bounded by five nearby sample locations where samples collected did not contain PCBs. Detailed discussion is presented in Section G.3.4.2.4 of Appendix G.

4.4.1.5 Pond Dredge Area

A total of seven soil samples was collected at five locations and analyzed for PCBs. Of the seven samples, four samples had detectable levels of PCBs, and results are shown in Figures H.3-4 and H.3-9 of Appendix H.

- Aroclor 1254 and Aroclor 1260 were detected at concentrations that did not exceed their respective RBSLs.

4.4.1.6 Coal Gasification Process Development Unit

A total of 82 soil samples was collected at 62 locations and analyzed for PCBs. Of the 82 samples, 36 samples had detectable levels of PCBs, and results are shown in Figures I.3-4 and I.3-9A through I.3-9D of Appendix I.

- Aroclor 1248, Aroclor 1254, and Aroclor 1260 were detected at concentrations that exceeded their respective Ecological RBSLs. Locations of samples with PCBs that exceeded RBSLs are sufficiently delineated by step-out locations with sample results below RBSLs. Detailed discussion of results is presented in Section I.3.4.2.4 of Appendix I.

4.4.1.7 Area III Sewage Treatment Plant

PCBs were not found identified as having been previously used at the STP-3 RFI Site during the review of historical documents. Consequently, PCBs were not included for analysis at any sampling locations.

4.4.1.8 Southeast Drum Storage Yard

PCBs were not found identified as having to have been previously used at the SE Drum Yard RFI Site during the review of historical documents. Consequently, PCBs were not included for analysis at any sampling locations.

4.4.1.9 Systems Test Laboratory IV

A total of six soil samples was collected at six locations and analyzed for PCBs. None of the six samples had detectable levels of PCBs. Results are shown in Figure L.3-4 of Appendix L.

4.4.1.10 Building 65 Metals Laboratory Clarifier

Two soil samples were collected at two locations and analyzed for PCBs. PCBs were not detected in either sample. Results are shown on in Figures M.3-4 of Appendix M.

4.4.1.11 Building 100 Trench

A total of two soil samples was collected at two locations and analyzed for PCBs. No PCBs were detected, and results are presented in Figure N.3-4 of Appendix N.

4.4.1.12 Department of Energy Leach Field 1

A total of nine soil samples was collected from six locations and analyzed for PCBs. Of the nine samples, three samples had detectable levels of PCBs, and results are presented in Figures O.3-4 and O.3-8 of Appendix O.

- Aroclor 1248, Aroclor 1254, and Aroclor 1260 were detected at concentrations that did not exceed their respective RBSLs.

4.4.1.13 Department of Energy Leach Field 2

A total of six soil samples was collected at six locations and analyzed for PCBs. Of the six samples, three samples contained detectable levels of PCBs, and results are shown in Figures P.3-4 and P.3-8 of Appendix P.

- Aroclor 1240 and Aroclor 1254 were detected at concentrations that did not exceed their respective RBSLs.

4.4.1.14 Department of Energy Leach Field 3

A total of 33 samples was collected at 31 locations and analyzed for PCBs. Of the 33 samples, 14 samples had detectable levels of PCBs, and results are presented in Figures Q.3-4 and Q.3-8A through Q.3-8C of Appendix Q.

- Aroclor 1260 was detected above the Ecological RBSL of 77 micrograms per kilograms (µg/kg) in five samples collected. Detailed discussion is presented in Section Q.3.4.2.4 of Appendix Q. These samples were collected from locations near the northwest corner of Building 4462. The extent of Aroclor 1260 impact was adequately defined by step-out and step-down samples.
- Aroclor 1242 and Aroclor 1254 were detected at concentrations that did not exceed their respective RBSLs.

4.4.1.15 Hazardous Material Storage Area

A total of 17 soil samples was collected at 13 locations and analyzed for PCBs. Of the 17 samples, 4 samples had detectable levels of PCBs, and results are presented in Figures R.3-4, R.3-8A and R.3-8B of Appendix R.

Aroclor 1248, Aroclor 1254, and Aroclor 1260 were detected at concentrations that did not exceed their respective RBSLs.

4.4.1.16 Rockwell International Hot Laboratory

A total of 11 soil samples was collected from eight locations and analyzed for PCBs. Of the 11 samples, 8 had detectable levels of PCBs, and results are shown in Figures S.3-4 and S.3-7.

- Aroclor 1254 and Aroclor 1260 were detected at concentrations above their respective Residential RBSL and/or Ecological RBSLs. The extent of impact of these two PCBs is adequately defined by samples that did not contain PCBs above their respective RBSLs.

4.4.1.17 Systems Nuclear Auxiliary Power Facility

A total of 11 soil samples was collected at nine locations and analyzed for PCBs. Of the 11 samples, 2 samples had detectable levels of PCBs, and results are presented in Figures T.3-4 and T.3-7 of Appendix T.

- Aroclor 1248 was detected at concentrations above its Ecological RBSL from a sample collected. The extent of Aroclor 1248 impact is adequately defined by step-out and step-down samples.

4.4.2 Near-Surface Groundwater

PCBs were not detected in any samples collected from wells installed in the NSGW.

4.4.3 Chatsworth Formation Groundwater

PCBs were not detected in any samples collected from wells installed in the CFOU.

4.4.4 Surface Water

As part of NPDES monitoring, stormwater discharge has been routinely sampled at Outfall 007 and/or Outfall 017 since 2004. PCBs have not been detected in these samples above NPDES permit limits.

4.4.5 Completeness of Characterization

Soil samples were collected from all known or suspected PCB source areas and in downstream discharge areas. Aroclor 1248, Aroclor 1254, and Aroclor 1260 are the only detected PCBs in samples collected in the Group 5 Reporting Area.

PCB-related chemical use areas are delineated sufficiently for risk assessment and for the support of RFI recommendations as detailed in Appendices D through T.

4.5 Metals and Inorganics

4.5.1 Soil/Sediment

A total of 3186 soil samples, which includes splits and field duplicates, were collected and analyzed for metals and inorganics in the Group 5 Reporting Area. Locations were based on site use (known or suspected chemical use areas) and sample results (step-outs). Group 5 metal sampling results are depicted in Figure 4-6. Each sample location is represented by a color corresponding to a maximum ratio of detected metal concentrations to the lowest RBSL in that sample if the concentration is above background. Sodium results above background are described below compared to background since no RBSL exists for this metal (it is considered an essential nutrient and not considered in risk assessment).

Metals were primarily detected above background in samples collected from all RFI sites in the Group 5 Reporting Area. The following metals were detected at concentrations exceeding background within the Group 5 Reporting Area.

- aluminum
- antimony
- arsenic
- barium
- beryllium
- boron
- cadmium
- chromium
- copper
- lead
- mercury
- molybdenum
- selenium
- sodium
- vanadium
- zinc

As described above, the 17 RFI Sites had several soil samples that detected aluminum concentrations above background (20,000 mg/kg). Within or between these sites, there are no discernable patterns or concentration gradients in the aluminum detections above background except that these occurrences are associated with higher concentrations of clay present in the soil. The clay-rich Santa Susana Formation is present in the southern portion of the Group 5 Reporting Area and exposed on the hill slope to the south. As described in Section 2, this geologic formation is composed of micaceous claystone and siltstone, and soil from this material will likely yield higher concentrations of naturally occurring aluminum. Clay-rich soil from the Santa Susana Formation could also result in other metals detected at these sites, including barium and vanadium. As described in subsections below, barium and vanadium are sometimes collocated with elevated detections of aluminum.

Metals sampling results for the RFI sites within the Group 5 Reporting Area are summarized in the following subsections.

4.5.1.1 Boeing Area IV Leach Field

A total of 34 samples was collected at 23 locations and analyzed for metals and inorganics. At least one or more metals were detected in all sampling locations, and results are shown in Figures D.3-5 and D.3-9 of Appendix D.

- Aluminum, barium, lead, and selenium were detected at concentrations that exceeded their respective background concentrations and Ecological RBSLs.
- Metals detected in soil samples above background (but below respective RBSLs) include beryllium, lithium, and sodium.

Detailed discussion of results is presented in Section D.3.4.2.5 of Appendix D.

4.5.1.2 Compound A Facility

A total of 122 soil samples was collected at 91 locations and analyzed for metals and inorganics. One or more metals were detected in every sample collected at this site. Background concentrations for metals are included in Table E.3-3A of Appendix E. Results are presented in Figures E.3-5, E.3-10A, E.3-10B, and E.3-10C of Appendix E.

- Aluminum, antimony, arsenic, barium, cadmium, cobalt, copper, lead, manganese, mercury, nickel, selenium, silver, vanadium, and zinc were detected at concentrations that exceeded their respective background concentration and above their respective Ecological RBSL and/or the Residential RBSL.

- Beryllium, chromium, iron, lithium, sodium, and thallium were detected at concentrations above background concentrations but below their respective RBSLs.
- Fluoride was detected in 19 of the 23 samples analyzed for fluoride at the Compound A Facility RFI Site. Fluoride was detected at concentrations above its background concentration in seven samples but did not exceed its RBSL.

Detailed discussion of results is presented in Section E.3.4.2.5 of Appendix E.

4.5.1.3 Environmental Chemistry Laboratory

A total of 68 soil samples was collected at 48 locations and analyzed for metals and inorganics. At least one or more metals were detected in nearly all sampling locations and results are shown in Figures F.3-5, F.3-11A, F.3-11B, and F.3-11C of Appendix F.

- Aluminum, antimony, arsenic, barium, boron, cadmium, copper, mercury, nickel, selenium, silver, vanadium, and zinc were detected at concentrations above their respective background concentration and Residential RBSLs and/or Ecological RBSLs.
- Metals detected at concentrations above background (but below their respective RBSLs) include beryllium, chromium, iron, lithium, sodium, and thallium.
- Fluoride was detected in 66 of the 76 samples analyzed for fluoride at the ECL RFI Site. Fluoride was detected at concentrations above the background in 28 samples; however, fluoride did not exceed its RBSLs.

Detailed discussion of results is presented in Section F.3.4.2.5 of Appendix F.

4.5.1.4 Environmental Effects Laboratory

A total of 61 soil samples was collected at 42 locations and analyzed for metals. At least one or more metals were detected in all sampling locations, and results are shown in Figures G.3-5, G.3-9A, and G.3-9B of Appendix G.

- Aluminum, arsenic, barium, cadmium, silver, and zinc concentrations were detected at concentrations above their respective background concentrations, and Ecological RBSLs, and/or Residential RBSLs. Additional characterization for these metals might be required.
- Metals detected at concentrations above background (but below all RBSLs) include beryllium, chromium, lithium, and sodium.

Detailed discussion of results is presented in Section G.3.4.2.5 of Appendix G.

4.5.1.5 Pond Dredge Area

A total of 58 soil samples was collected at 29 locations and analyzed for metals. At least one or more metals were detected in all sampling locations, and results are shown in Figures H.3-5 and H.3-10 of Appendix H.

- Concentrations of aluminum, barium, cadmium, molybdenum, nickel, selenium, silver, vanadium, and zinc were detected above their respective background concentrations and Ecological RBSLs.

- Metals detected at concentrations above background (but below respective RBSLs) include beryllium, chromium, potassium, sodium, and thallium.

Detailed discussion of results is presented in Section H.3.4.2.5 of Appendix H.

4.5.1.6 Coal Gasification Process Development Unit

A total of 178 soil samples was collected at 130 locations and analyzed for metals. At least one or more metals were detected in nearly all sampling locations, and results are shown in Figures I.3-5, I.3-10A through I.3-10E of Appendix I.

- Concentrations of aluminum, antimony, barium, boron, cadmium, copper, lead, mercury, nickel, selenium, silver, vanadium, and zinc were detected above their respective background concentrations, and Ecological RBSLs, and/or Residential RBSLs.
- Metals detected at concentrations above background (but below their respective RBSLs) include beryllium, chromium, lithium, sodium, and thallium.
- Fluoride was detected at concentrations above background concentrations in two samples collected but did not exceed any RBSLs.

Detailed discussion of results is presented in Section I.3.4.2.5 of Appendix I.

4.5.1.7 Area III Sewage Treatment Plant

A total of 29 soil samples was collected at 16 locations and analyzed for metals. At least one or more metals were detected in all soil samples. Background concentrations for metals are included in Table J.3-3A, and results are presented in Figures J.3-5 and J.3-8 of Appendix J.

- Concentrations of arsenic, barium, cadmium, copper, lead, mercury, nickel, selenium, silver, vanadium, and/or zinc were detected above their respective background concentration, Ecological RBSL, and/or the Residential RBSL.
- Metals detected at concentrations above background concentrations but below their respective RBSLs included lithium, sodium, and thallium.

Detailed discussion of results is presented in Section J.3.4.2.5 of Appendix J.

4.5.1.8 Southeast Drum Storage Yard

A total of eight soil samples was collected at four locations and analyzed for metals. One or more metals were detected in all sampling locations, and results are shown in Figures K.3-4 and K.3-7 of Appendix K.

- Aluminum and barium concentrations were detected at concentrations above their respective background concentrations and Ecological RBSLs and/or Residential RBSLs.
- Metals detected at concentrations above background (but below all RBSLs) include beryllium and sodium.
- .

Detailed discussion of results is presented in Section K.3.4.2.5 of Appendix K.

4.5.1.9 Systems Test Laboratory IV

A total of 132 soil samples was collected at a total of 88 locations and analyzed for metals. At least one or more metals were detected in all sampling locations, and results are shown in Figures L.3-5, L.3-10A, L.3-10B, and L.3-10C of Appendix L.

- Aluminum, arsenic, barium, cadmium, copper, lead, mercury, nickel, selenium, silver, vanadium, and zinc concentrations were detected at concentrations above their respective background concentrations and Residential and/or Ecological RBSLs. The extent of copper, lead, mercury, nickel, and silver impacts are adequately defined by rock outcroppings or by samples with concentrations below their respective RBSLs, or, as in the case of the debris pile, by the extent of the debris pile.
- Metals detected at concentrations above background (but below their respective RBSLs) include beryllium, chromium, lithium, sodium, and thallium.
- Fluoride was detected in 14 of the 55 samples. Four samples had concentrations of fluoride above its background screening level. None of the samples had concentrations that exceeded its Residential RBSL.

Detailed discussion of results is presented in Section L.3.4.2.5 of Appendix L.

4.5.1.10 Building 65 Metals Laboratory Clarifier

A total of 28 soil samples was collected at 19 locations and analyzed for metals. At least one or more metals were detected in all but two sampling locations, and results are shown in Figures M.3-5 and M.3-9 of Appendix M.

- Concentrations of mercury, selenium, and zinc were detected above their respective background concentrations and Ecological RBSLs. The extent of mercury, selenium, and zinc impacts is defined laterally and vertically.
- Metals detected above background (but below their respective RBSLs) include sodium. RBSLs for sodium have not been established.

Detailed discussion of results is presented in Section M.3.4.2.5 of Appendix M.

4.5.1.11 Building 100 Trench

A total of 65 soil samples was collected at 51 locations and analyzed for metals. At least one or more metals were detected in nearly all sampling locations, and results are presented in Figures N.3-5, N.3-9A, and N.3-9B of Appendix N.

- Concentrations of aluminum, barium, copper, lead, mercury, selenium, silver, and zinc were detected above their respective background concentrations and above respective Ecological RBSL and/or the Residential RBSL. The extent of impacts by aluminum, barium, copper, lead, mercury, selenium, silver, and zinc were adequately defined by locations that had samples with metals concentration less than background. Selenium could require further characterization to delineate the extents.
- Metals detected above background (but below their respective RBSLs) include beryllium, lithium, sodium, and thallium. Background concentrations for metals are included in Table N.3-3A of Appendix N.

- Fluoride was detected above its background concentration in two samples, but it was below its RBSLs.

Detailed discussion of results is presented in Section N.3.4.2.5 of Appendix N.

4.5.1.12 Department of Energy Leach Field 1

A total of 36 soil samples was collected from 22 locations and analyzed for metals. At least one or more metals were detected in all sampling locations, and results are shown in Figures O.3-5 and O.3-9 of Appendix O.

- Concentrations of aluminum, mercury, and selenium were detected above their respective background concentrations and Ecological RBSLs. The extent of aluminum and selenium impacts is adequately defined by samples by rock outcroppings or samples with concentrations less than background. Mercury was detected at an estimated concentration that is slightly above its background concentration.
- Metals detected above background concentrations (but below their respective RBSLs) include beryllium and sodium.

Detailed discussion of results is presented in Section O.3.4.2.5 of Appendix O.

4.5.1.13 Department of Energy Leach Field 2

A total of 27 soil samples was collected at 17 locations and analyzed for metals. At least one or more metals were detected in nearly all sampling locations, and results are shown in Figures P.3-5 and P.3-9 of Appendix P.

- Selenium, vanadium, and zinc were detected above their respective background concentrations and Ecological RBSLs.
- Metals detected above background concentrations (but below their respective RBSLs) include chromium, mercury, and sodium.

Detailed discussion of results is presented in Section P.3.4.2.5 of Appendix P.

4.5.1.14 Department of Energy Leach Field 3

A total of 120 soil samples was collected from a total 74 locations and analyzed for metals. At least one or more metals were detected at 70 of the 74 sampling locations, and results are shown in Figures Q.3-5, Q.3-9A, Q.3-9B, and Q.3-9C.

- Concentrations of aluminum, barium, boron, cadmium, copper, lead, manganese, mercury, nickel, selenium, silver, vanadium, and zinc were detected above their respective background concentrations and Ecological RBSLs.
- Metals detected above background (but below their respective RBSLs) include beryllium, chromium, sodium, and thallium.

Detailed discussion of results is presented in Section Q.3.4.2.5 of Appendix Q.

4.5.1.15 Hazardous Material Storage Area

A total of 65 soil samples was collected at 43 locations and analyzed for metals. At least one or more metals were detected in all sampling locations, and results are shown in Figures R.3-5, R.3-9A, and R.3-9B.

- Aluminum, antimony, boron, cadmium, copper, lead, mercury, selenium, silver, vanadium, and zinc concentrations were detected above their respective background concentrations and Ecological RBSLs. Additional characterization might be required.
- Metals detected above background (but below their respective RBSLs) include iron, sodium, and thallium.

Detailed discussion of results is presented in Section R.3.4.2.5 of Appendix R.

4.5.1.16 Rockwell International Hot Laboratory

A total of 34 soil samples was collected at 20 locations and analyzed for metals. At least one or more metals were detected in all sampling locations, and results are shown in Figures S.3-5 and S.3-8 of Appendix S.

- Concentrations of aluminum, barium, cadmium, mercury, nickel, selenium, vanadium, and zinc were detected above their respective background concentrations and Ecological RBSLs and/or Residential RBSLs. Additional characterization of aluminum, mercury, nickel, selenium, and zinc might be required at the RIHL.
- Metals detected above respective background levels (but below their respective RBSLs) include beryllium, chromium, and sodium.

Detailed discussion of results is presented in Section S.3.4.2.5 of Appendix S.

4.5.1.17 Systems Nuclear Auxiliary Power Facility

A total of 38 soil samples was collected at 25 locations and analyzed for metals. At least one or more metals were detected in all sampling locations, and results are shown in Figures T.3-5 and T.3-8.

- Concentrations of aluminum, barium, cobalt, selenium, silver, vanadium, and/or zinc were detected above their respective background concentrations, Ecological RBSLs, and/or Residential RBSLs.
- Metals detected above their respective background concentrations (but below their respective RBSLs) include beryllium, chromium, lithium, sodium, and thallium.

Detailed discussion of results is presented in Section T.3.4.2.5

4.5.2 Near-Surface Groundwater

Both filtered and unfiltered groundwater samples have been collected from a total of 57 NSGW piezometers and wells within the Group 5 Reporting Area. At the direction of DTSC (DTSC, 2007c), both filtered (for characterization) and unfiltered (for risk assessment) groundwater samples were collected. In general, unfiltered ("total") metals concentrations and/or detection limits are higher than filtered results due to the association of metals with

soil particulates contained in unfiltered samples. As such, unfiltered data are not directly comparable to GWCCs, which were developed using filtered ("dissolved") data. For reference, unfiltered metals results are shown in Table B-18, Appendix B.

Groundwater samples have been collected and analyzed for metals from 38 near-surface piezometers/wells located within the Group 5 Reporting Area. Dissolved metals sampling results for the near surface piezometers and wells in the Group 5 Reporting Area are ummarized as follows:

4.5.2.1 Boeing Area IV Leach Field

Samples of NSGW were collected from one piezometer and analyzed for metals and inorganics.

- Copper and selenium were detected at concentrations above their respective groundwater screening levels.
- Arsenic, barium, boron, lead, magnesium, manganese, nickel, strontium, and zinc were detected in samples of NSGW but were below their respective groundwater screening levels.

4.5.2.2 Compound A Facility

Samples of NSGW were collected from 20 wells and piezometers, and analyzed for metals.

- Manganese, molybdenum, selenium, and tin were detected in samples of NSGW at concentrations that exceeded their respective groundwater screening levels.

4.5.2.3 Environmental Chemistry Laboratory

Samples of NSGW were collected from 11 wells and piezometers and analyzed for metals.

- Antimony, barium, beryllium, cadmium, chromium, cobalt, copper, magnesium, manganese, mercury, nickel, selenium, silver, strontium, thallium, and vanadium were detected at concentrations above their respective groundwater screening levels.

4.5.2.4 Environmental Effects Laboratory

One groundwater sample was collected in 2008 and analyzed for metals.

- Copper and selenium were detected at concentrations above their respective groundwater screening levels.
- Barium, boron, lead, manganese, nickel, strontium, vanadium, and zinc were detected at concentrations below their respective groundwater screening levels.

4.5.2.5 Coal Gasification Process Development Unit

Samples of NSGW were collected from eight shallow wells and piezometers and analyzed for metals and inorganics.

- Boron and potassium were detected at concentrations that exceeded their respective groundwater screening levels.

- Magnesium, sodium, and strontium were detected at concentrations below their respective groundwater screening levels.

4.5.2.6 Systems Test Laboratory IV

Samples of NSGW were collected from nine shallow wells and piezometers and analyzed for metals and inorganics.

- Barium, boron, copper, and potassium were detected at concentrations above their respective groundwater screening levels.
- Antimony, cadmium, chromium, cobalt, lead, manganese, nickel, selenium, sodium, strontium, vanadium, and zinc were detected at concentrations below their respective groundwater screening levels.

4.5.2.7 Department of Energy Leach Field 3

Samples of NSGW were collected from three piezometers and analyzed for metals and inorganics.

- Copper, molybdenum, selenium, and vanadium were detected at concentrations above their respective groundwater screening level.
- Antimony, barium, boron, chromium, iron, lead, magnesium, nickel, strontium, and zinc were detected below their respective groundwater screening levels.

4.5.2.8 Hazardous Material Storage Area

Samples of NSGW were collected at two piezometers and analyzed for metals and inorganics.

- Aluminum, cadmium, copper, molybdenum, and vanadium were detected above their respective groundwater screening levels.
- Arsenic, barium, boron, chromium, iron, lead, magnesium, manganese, nickel, selenium, strontium, and zinc were detected below their respective groundwater screening levels.

4.5.2.9 Rockwell International Hot Laboratory

Samples of NSGW were collected at one piezometer and analyzed for metals and inorganics.

- Aluminum, manganese, and silver were detected at concentrations above their respective groundwater screening levels.
- Barium, calcium, chromium, iron, magnesium, potassium, and sodium were detected at concentrations below their respective groundwater screening levels.

4.5.2.10 Systems Nuclear Auxiliary Power Facility

Samples of NSGW were collected from one piezometer and analyzed for metals and inorganics.

- Copper, molybdenum, and selenium were detected at concentrations above their respective groundwater screening levels.

- Arsenic, barium, boron, lead, magnesium, manganese, nickel, strontium, vanadium, and zinc were detected at concentrations below their respective groundwater screening levels.
- Fluoride was detected at a concentration above its groundwater screening level in samples collected from the one piezometer located at the site.

4.5.3 Chatsworth Formation Groundwater

Metals in CFOU groundwater are characterized by analysis of filtered samples collected from 21 monitoring wells within the Group 5 Reporting Area. For reference, unfiltered metals results are shown in Table B-19, Appendix B. Dissolved metals sampling results for the CFOU wells in the Group 5 Reporting Area are summarized in the following subsections.

4.5.3.1 Compound A Facility

Samples of Chatsworth Formation groundwater were collected from two wells and analyzed for metals.

- Barium, chromium, copper, manganese, nickel, selenium, thallium and vanadium were detected at concentrations that exceeded their respective groundwater screening levels.

4.5.3.2 Environmental Chemistry Laboratory

Samples of Chatsworth Formation groundwater were collected from four wells and analyzed for metals.

- Potassium, thallium, tin, and zinc were detected in CFOU groundwater above their respective groundwater screening levels.

4.5.3.3 Pond Dredge Area

Samples of Chatsworth Formation groundwater were collected at one location and analyzed for metals.

- Copper was detected at concentrations above its groundwater screening level..
- Barium, chromium, magnesium, manganese, nickel, potassium, selenium, sodium, strontium, and zinc were detected at concentrations below their respective screening levels.
- Fluoride was detected at concentrations above its groundwater screening level in one sample collected.

4.5.3.4 Coal Gasification Process Development Unit

Samples of Chatsworth Formation groundwater were collected at one well and analyzed for metals and inorganics.

- Boron, magnesium, manganese, potassium, sodium, strontium, and zinc were detected at concentrations below their respective groundwater screening levels.

4.5.3.5 Southeast Drum Storage Yard

Samples of Chatsworth Formation groundwater were collected at one well and analyzed for metals and inorganics.

- Potassium, magnesium, calcium, sodium, silica, strontium, manganese and zinc were detected at concentrations that did not exceed their respective groundwater screening levels.

4.5.3.6 Systems Test Laboratory IV

Samples of Chatsworth Formation groundwater were collected from six wells and analyzed for metals.

- Copper, lead, molybdenum, selenium, thallium, and tin were detected at concentrations that exceeded their respective groundwater screening levels.
- Antimony, barium, beryllium, boron, cobalt, iron, magnesium, manganese, nickel, potassium, sodium, strontium, vanadium, and zinc were detected below their respective screening levels.

4.5.3.7 Building 100 Trench

Samples of Chatsworth Formation groundwater were collected from two wells and analyzed for metals and inorganics.

- Boron, cobalt, copper, lead, molybdenum, selenium, strontium, thallium, and vanadium were detected above their respective groundwater screening levels.
- Antimony, barium, calcium, chromium, magnesium, manganese, nickel, potassium, sodium, and zinc were all detected at concentrations below their respective screening levels.

4.5.3.8 Department of Energy Leach Field 1

Samples of Chatsworth Formation groundwater were collected from one well and analyzed for metals and inorganics.

- Calcium, magnesium, potassium, silica, sodium, strontium, and zinc were detected at concentrations below their respective groundwater screening levels.

4.5.3.9 Systems Nuclear Auxiliary Power Facility

Samples of Chatsworth Formation groundwater were collected at three wells and analyzed for metals and inorganics.

- boron, calcium, magnesium, manganese, potassium, silica, sodium, strontium, and zinc.

Additional information on CFOU groundwater occurrence, quality, and temporal variability is provided in Appendix B.

4.5.4 Surface Water

As part of NPDES monitoring, stormwater discharge has been routinely sampled at Outfall 007 and/or Outfall 017 since 1993. Metals have been detected in these samples above

NPDES permit limits 17 times. Most exceedances are considered sporadic detections related to background soil conditions or to naturally occurring metals (Boeing, 2005, 2006, and 2008b). Mercury, copper, cadmium, and lead have been detected above the discharge limits at Outfall 007, north of Building 4100 between 1994 and 2005. Table N.3-2C and Section N.3-6 of Appendix N provide further discussion of metals detected at Outfall 007. Evaluation of the NPDES exceedance is ongoing.

4.5.5 Completeness of Characterization

Soil and groundwater samples were collected and analyzed at known or potential metals source areas and downstream discharge areas of metals. Several metals were detected in soil and groundwater above screening levels, with the most frequent detections including aluminum, sodium, mercury, and lead in soil samples and copper, lead, and mercury in filtered groundwater samples. Aluminum detections above background are considered naturally occurring related to clayey soil resulting from the Santa Susana Formation present in the southern portion of Group 5. Similarly, some arsenic detections in soil occur at locations adjacent to and downgradient from a shale outcrop, and are considered naturally occurring. In groundwater, several metals have been detected and are considered potentially site-related based on historical operations and proximity to soil concentrations exceeding RBSLs.

Metal-related chemical use areas are delineated sufficiently for risk assessment and for the support of RFI recommendations as detailed in Appendices D through T.

4.6 Dioxins

4.6.1 Soil/Sediment

A total of 118 soil samples, which includes splits and field duplicates, were collected from the following Group 5 RFI Sites: Compound A Facility, ECL, Pond Dredge Area, PDU, STL-IV, and Building 100 Trench. The soil samples were analyzed for dioxins based on site use (known or suspected chemical use areas) and sample results (step-outs). Group 5 dioxin sampling results are depicted in Figure 4-7. Each sample location is represented by a color corresponding to the maximum TEQ from that location. (A list of dioxin congeners and TEQ definition is provided following the list of abbreviations and acronyms.) Dioxin sampling results for the RFI sites within the Group 5 Reporting Area are summarized in the following subsections.

4.6.1.1 Compound A Facility

Forty-four soil samples were collected at 29 locations and analyzed for dioxins. Of the 44 samples, 43 samples contained detectable levels of dioxins and/or furans. Three of the 43 samples contained dioxins and/or furans at concentrations for which the dioxin-furan TEQ values did not exceed the SSFL background concentrations or the RBSLs. Results are presented in Figures E.3-6 and E.3-11 and Table E.3-3A of Appendix E.

4.6.1.2 Environmental Chemistry Laboratory

A total of two soil samples was collected at one location and analyzed for dioxins and furans. Results are presented in Figures F.3-6 and F.3-10 of Appendix F. Of the two samples,

one sample contained detectable levels of dioxins at a depth of 0 to 1 foot bgs, but concentrations were below respective RBSLs.

4.6.1.3 Pond Dredge Area

A total of 33 soil samples was collected at 16 locations and analyzed for dioxins. Of the 33 samples, 30 had detectable levels of dioxins that exceeded the background concentrations of the respective congeners. None of the detected concentrations exceeded their respective RBSLs, and results are shown in Figures H.3-6 and H.3-11 of Appendix H.

4.6.1.4 Coal Gasification Process Development Unit

A total of six soil samples was collected at three locations and analyzed for dioxins. All six samples had detectable levels of dioxins. Results are presented on in Figures I.3-6 and I.3-11 of Appendix I.

1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin and 1,2,3,6,7,8-hexachlorodibenzo-p-dioxin were detected at concentrations above their respective Residential RBSLs, Ecological RBSLs, and background concentrations. Dioxins were detected at concentrations above RBSLs in the most upgradient drainage sample at the 17th Street Drainage. All downgradient samples were below RBSLs. Detailed discussion of results is presented in Section I.3.4.2.6 of Appendix I.

4.6.1.5 Systems Test Laboratory IV

A total of two samples was collected at two locations and analyzed for dioxins. Results are presented in Figures L.3-6 and L.3-12 of Appendix L. The two samples exceeded background screening levels for various dioxin congeners but did not exceed Residential or Ecological RBSLs.

4.6.1.6 Building 100 Trench

A total of 27 soil samples was collected at 24 locations and analyzed for dioxins. Of the 27 samples, 19 samples had detectable levels of dioxins, and results are presented in Figures N.3-6 and N.3-10 of Appendix N. None of the detected concentrations exceeded their respective RBSLs.

4.6.2 Near-Surface Groundwater

Dioxins were analyzed in samples of NSGW from well SH-04. Concentration ranges for dioxin-furan TEQ for mammals ranged from 0.00217 picograms per liter (pg/L) to 0.123 pg/L. Screening criteria for TEQ values have not been established.

4.6.3 Chatsworth Formation Groundwater

Samples collected from seven CFOU wells (HAR-17, HAR-26, RD-08, RD-20, RD-58A, RD-58B, and RD-58C) were analyzed for dioxins. Concentration ranges for the dioxin furan TEQs for mammals ranged from 0.00066 pg/L (RD-20) to 12.074 pg/L (RD-08). Screening criteria for TEQ values have not been established.

4.6.4 Surface Water

As part of NPDES monitoring, stormwater discharge has been routinely sampled at Outfalls 007 and 017, at the Building 100 Trench RFI Site, and at the STP-3 RFI Site, since 2004. Dioxins were detected in the NPDES samples at concentrations above the NPDES permit limits at Outfall 007 (11 times). These detections are considered related to naturally occurring dioxins in ash deposited at the site following regional fires at or very near the SSFL (Boeing, 2006, 2007, 2008b). Evaluation of NPDES exceedances is ongoing.

4.6.5 Completeness of Characterization

Soil samples were collected from areas of known or suspected dioxin source areas and downstream discharge areas. Dioxins were detected in several areas, and further evaluation of potential dioxin sources in these areas will be conducted for the Group 5 RFI Report. Detections of dioxins could be related to historical operations considering that wastes were burned in the disposal ponds. The presence of dioxins also could be related to deposition of ash from regional fires that occurred at or very near in this area in October 2003 (Piru Fire) and September/October 2005 (Topanga Fire).

Dioxin-related chemical use areas are delineated sufficiently for risk assessment and for the support of RFI recommendations as detailed in Appendices D through T.

4.7 Hydrazine and NDMA

4.7.1 Soil

Soil samples were collected from the following Group 5 RFI Sites: Boeing Area IV Leach Field, ECL, Pond Dredge Area, PDU, STP-3, STL-IV, DOE LF2, and HMSA. The soil samples were analyzed for hydrazine, NDMA, and n-nitrosodiphenylamine (NDPA). NDMA and/or NDPA were detected at low concentrations in a soil sample collected from the Boeing Area IV Leach Field and in three soil samples collected from STL-IV, but none of the detects exceeded their respective RBSLs. Hydrazine was not detected in any of the soil samples collected.

4.7.2 Near-Surface Groundwater

Hydrazine was analyzed in samples collected from four wells but was not detected. NDMA (groundwater screening level of 0.01 µg/L) was detected in samples collected from four wells. NDMA exceeded the established screening criteria in three wells (SH-03, SH-04, and SH-05) at concentrations ranging from 0.12 µg/L to 110 µg/L in SH-04.

4.7.3 Chatsworth Formation Groundwater

Hydrazine was analyzed in samples collected from two wells but was not detected. NDMA was analyzed in samples collected from 20 wells and was detected in 3 wells. NDMA exceeded the groundwater screening level of 0.01 µg/L in two wells (HAR-17 and HAR-18) at concentrations ranging between a low level of 0.016 µg/L to a maximum concentration of 1.5 µg/L in HAR-18..

4.7.4 Completeness of Characterization

Soil samples were collected from areas of known or suspected hydrazine source areas and downstream discharge areas. Hydrazine was generally not detected in soil samples collected for this RFI.

Hydrazine-related chemical use areas are delineated sufficiently for risk assessment and for the support of RFI recommendations as detailed in Appendices D through T.

4.8 Energetics

4.8.1 Soil

Based on potential historical chemical site use, a total of 277 energetic samples, which includes splits and field duplicates, were collected and analyzed at the Group 5 RFI Sites. Of the 245 samples collected, seven samples had detectable concentrations of energetics. HMX was detected in one sample collected from the Compound A Facility RFI Site. 1,2-Dinitrobenzene was detected in one sample collected from the Boeing Area IV Leach Field RFI Site, in three samples collected from the ECL RFI Site, and in two samples collected from the DOE LF3 RFI Site. RBSLs for 1,2-dinitrobenzene have not been established. Because no other energetics have been detected in soil samples collected throughout RFI Group 5, no further characterization for energetics is required at these RFI sites.

4.8.2 Near-Surface Groundwater

A total of 26 wells was sampled and analyzed for energetics. Of the 23 wells, three wells (SH-03, SH-04, and SH08) had detectable concentrations of energetics. 1,3-Dinitrobenzene was detected at concentrations ranging from 30 µg/L to 43 µg/L in SH-04. Nitrobenzene was detected in the three wells at concentrations ranging from 2.6 µg/L to 380 µg/L. Screening criteria for 1,3-dinitrobenzene and nitrobenzene have not been established.

4.8.3 Chatsworth Formation Groundwater

A total of 20 wells was sampled and analyzed for energetics. Of the 20 wells, 2 wells had detectable concentrations of energetics. 2,6-Dinitrotoluene was detected at concentrations of 13 µg/L and 0.03 µg/L in wells HAR-17 and WS-11, respectively. P-dinitrobenzene was detected once in WS-11 at a concentration of 0.03 µg/L. Screening criteria have not been established for 2,6-dinitrotoluene and p-dinitrobenzene.

4.8.4 Completeness of Characterization

Soil samples were collected from areas of known or suspected energetics source areas and downstream discharge areas. As discussed above, energetic compounds were generally not detected in soil samples collected for this RFI.

Energetics-related chemical use areas are delineated sufficiently for risk assessment and for the support of RFI recommendations as detailed in Appendices D through T.

4.9 Perchlorate

4.9.1 Soil

Based on historical chemical use, a total of 63 soil samples was collected from the following Group 5 RFI Sites and analyzed for perchlorate: Compound A Facility, ECL, Pond Dredge, STP-3, STL-IV, and DOE LF3. Of the 63 samples, only 3 samples had detectable limits of perchlorate. Perchlorate was detected at concentrations above its Ecological RBSL of 2.4×10^{-5} mg/kg in samples collected from the Pond Dredge RFI Site and the STP-3 RFI Site.

4.9.2 Near-Surface Groundwater

Perchlorate (groundwater screening level of 6 µg/L) was detected in samples collected at five locations. Perchlorate exceeded the established screening criteria in samples collected at one well, ES-24, at concentrations ranging from 6.6 µg/L to 22 µg/L.

4.9.3 Chatsworth Formation Groundwater

Perchlorate was not detected in samples collected from wells installed in the CFOU.

4.9.4 Completeness of Characterization

Soil samples were collected from areas of known or suspected perchlorate source areas and from downstream discharge areas. Perchlorate was generally not detected in soil samples collected for this RFI.

Perchlorate use areas are delineated sufficiently for risk assessment and for the support of RFI recommendations as detailed in Appendices D through T.

5.0 Contaminant Transport and Fate

This section presents a discussion of contaminant transport and fate mechanisms and evaluation results. Transport and fate evaluation is a process used to assess contaminant migration and relationships between the various environmental matrices (such as soil, groundwater, air, and surface water) at the SSFL. The transport and fate evaluation considers past migration (that is, are groundwater concentrations site related?) and potential future migration.

Section 5 is divided into three main topics. Section 5.1 provides a description of the Conceptual Site Model (CSM) for the Group 5 Reporting Area based on environmental matrices and migration pathways included in the transport and fate evaluation. Using the CSM, Section 5.2 provides a description of the various tools (such as models) used in the transport and fate evaluation. Section 5.3 presents descriptions of key transport and fate findings for the Group 5 Reporting Area.

5.1 Conceptual Site Model

A CSM describes the various environmental matrices characterized at a site, their interrelationships, and exposure pathways to potential receptors. The CSM is developed as a basis for characterization and risk assessment, and identifies potential contaminant migration pathways to be considered in the transport and fate evaluation. The CSM for the Group 5 RFI Reporting Area is shown in Figure 5-1.

The following list identifies potential migration pathways for site chemicals evaluated in the RFI. Each pathway was evaluated for all appropriate chemical groups (VOCs, SVOCs, TPH, PCBs, dioxins, metals, and perchlorates) except where noted.

Contaminants in soil/sediment could migrate:

- In soil/sediment to downslope and/or down-drainage locations
- As vapor into indoor or outdoor air (VOCs only)
- As leachate to groundwater
- Associated with dust/particulates to outdoor air
- As uptake into leaves and stems of edible plants.

Contaminants in surface water might migrate:

- In surface water to downstream soil and sediment
- As recharge to groundwater

Contaminants in groundwater may migrate:

- As vapor into indoor or outdoor air (VOCs only)
- Within groundwater to downgradient locations
- To surface water as seeps/springs

5.2 Transport and Fate Tools Used for Evaluation

The transport and fate evaluation for the Group 5 Reporting Area uses both quantitative evaluations (that is, models) and qualitative evaluations (that is, data review and interpretation). This section provides a description of the various evaluation tools for transport and fate used in the Group 5 RFI Report, including quantitative and qualitative tools.

5.2.1 Quantitative Tools

Transport and fate models have been used to evaluate many of the chemical sources and potential migration pathways identified in the CSM and in the above list. This section provides a brief description of these models, and the reader is referred to more detailed descriptions provided in Appendices D through T.

5.2.1.1 Physical and Chemical Properties of Environmental Media

The physical and chemical properties of various environmental media are needed as input parameters for the quantitative transport and fate modeling tools. This section lists the environmental matrices at the SSFL that have physical and chemical properties identified for use in the models.

5.2.1.1.1 Soil

Soil physical and chemical properties are used in transport and fate modeling. Both SSFL site-specific and generic soil parameters are presented. These parameters are used in the Johnson-Ettinger vapor flux model and are listed in spreadsheets in in Appendix A.

5.2.1.1.2 Bedrock

Physical and chemical properties of bedrock are used in transport and fate modeling. SSFL site-specific and generic bedrock parameters are presented and are used in the Johnson-Ettinger vapor flux model. The parameters are listed in spreadsheets in in Appendix A.

5.2.1.1.3 Air

Key parameters that describe transport and fate in air are presented. The transport and fate models include dust generation/dispersion and dispersion of VOC vapors in air. Input parameters for these models are presented in spreadsheets in Appendix A.

5.2.1.2 Transport and Fate Models

Several transport and fate models have been used in this evaluation. These are briefly described in the following sections.

5.2.1.2.1 Johnson-Ettinger Vapor Migration Model

Two versions of the Johnson-Ettinger vapor migration model are used for the RFI. The first is the published, standard version that has been used to predict indoor air concentrations using VOC concentrations in contaminated soil or NSGW as a source term. The second is a modified version that has been used to predict indoor air concentrations using VOC concentrations in Chatsworth Formation groundwater as a source term, which then estimates the transport of VOCs through bedrock and any overlying soil to the ground surface and then to indoor or outdoor air. This modified version has been the subject of field validation. Plans for the validation are described in the *Vapor Migration Modeling Validation*

Study Work Plan (MWH, 2005c). A report describing the results of this study has been recently submitted to DTSC (MWH, 2007c). The vapor validation study report concludes that the proposed model conservatively predicts migration from Chatsworth Formation groundwater. The results of the field validation activities will be incorporated into the application of the model following DTSC review and approval of that report, and if necessary, risk assessments and reports will be revised. Further descriptions of the standard and modified Johnson-Ettinger vapor migration models are provided in the SRAM (MWH, 2005b).

5.2.1.2.2 Dust Generation Model

Airborne dust levels are predicted so that potential exposure to airborne contamination can be estimated. The risk assessment uses a model endorsed by USEPA and is described in Appendix A. That model predicts the airborne concentration of dust that has as its source contaminated surficial soil.

5.2.1.2.3 Airborne Dispersion Model

Once volatile chemicals migrate from the subsurface to the soil surface, they may enter the air and disperse as they migrate downwind. Two dispersion models are used for SSFL risk assessments as described in the SRAM. The first is a conservative screening model from USEPA. This model predicts downwind concentrations under relatively stable conditions. The second is an SSFL site-specific air dispersion model based on measurements that have been completed as described in the *Surface Flux and Ambient Air Monitoring Work Plan* (MWH, 2005a). The dispersion factors developed from these measurements can be applied to predict downwind airborne concentrations of contaminants as a refinement to the screening approach. The screening approach was used in the Group 5 RFI Human Health Risk Assessments (HRAs). Further description of the airborne dispersion factors is presented in Appendix A.

5.2.1.2.4 Groundwater Transport

Groundwater transport evaluations predict future groundwater concentrations based on migration of groundwater contaminants. The evaluations could employ models and parameters for groundwater flow and contaminant transport through fractured bedrock, as described in the Technical Memorandum, *Conceptual Site Model, Movement of TCE in the Chatsworth Formation* (MWH, 2000a) and in the *Perchlorate Source Evaluation and Technical Report Update* (MWH, 2003b). Model results are used to predict appropriate contaminant levels for use in risk assessment when plume migration is predicted to change exposure point concentrations (EPCs).

Based on groundwater contaminant concentrations within and surrounding the Group 5 RFI sites, groundwater elevations, hydraulic gradients, and aquifer and source characteristics, location-specific modeling was deemed unnecessary for risk assessment, and current concentrations were used as future concentrations. However, transport model results previously presented in the Perchlorate Report were used to support the use of current concentrations for future concentrations as a conservative assumption. A description of this decision for the Group 5 Reporting Area is presented in Appendix B.

5.2.2 Qualitative Tools

Several qualitative tools have been used to evaluate the potential for contaminant migration at the Group 5 RFI sites. These tools are described in this section.

5.2.2.1 Surficial Soil/ Sediment Transport

Chemical migration in soil and sediment in surface water drainages, or across slopes, has been evaluated for Group 5 RFI site-related contaminants. Sampling and analysis to assess chemical distributions in surficial soil and sediments were based, in part, on potential downslope or down-drainage migration. An evaluation of chemical transport and fate via surficial migration, based on observed nature and extent (Section 4), is presented in Section 5.3.4.

5.2.2.2 Soil to Groundwater Migration

The relationship between soil chemicals and groundwater has been evaluated to assess whether soil chemical concentrations have affected groundwater quality. For organic compounds, soil chemical concentrations were reviewed and compared with appropriate (such as collocated) groundwater concentrations. The evaluation was based on chemical concentrations, DTSC-approved soil background concentrations (metals and dioxins only), spatial relationships, groundwater elevations, hydraulic gradients, and other hydrogeologic relationships (potential recharge, for example). The evaluation provides conclusions regarding soil sources for detected chemicals in groundwater (such as, is soil a source of groundwater contamination?).

For metals (and some other select inorganic compounds), groundwater concentrations were compared to DTSC-approved GWCCs. Concentrations below GWCCs were considered naturally occurring or background (that is, not site-related). Groundwater concentrations of metals that are above GWCCs were further evaluated. Based on soil concentrations compared to DTSC-approved background concentrations, spatial relationships, groundwater elevations, hydraulic gradients, and other hydrogeologic relationships, conclusions were made regarding whether each metal was potentially site-related or naturally occurring. This evaluation is summarized below in Section 5.3.5 and presented in more detail in Appendices D through T. In particular, the reader is referred to Table 3-2B in each Appendix (D through T) and Tables B-18 and B-19 in Appendix B.

Source areas located within the Group 5 Reporting Area might have contributed to detections of TCE and its daughter products at springs/seeps located to the southwest of the reporting area. However, these locations lie within the Group 9 Reporting Area, and transport to these locations will be evaluated in that group report. Sources from other RFI groups (for example, Group 5) could be the source of the chemical detections at any given location. Chemical results of spring/seep samples at these locations and subsequent response actions are described in Appendix B.

5.3 Transport and Fate Findings for Site-Related Group 5 Chemicals

The following sections provide a brief summary of transport and fate evaluation findings for the Group 5 Reporting Area for the evaluation tools previously listed. Each of these summaries has a more detailed description in either Appendix B (Groundwater) or Appendix A (Risk Assessment). For surficial soil/sediment migration, the entire evaluation is described in Section 5.3.4 and not in any of the appendices. Therefore, Section 5.3.4 contains more detail in this volume of the report than these other sections.

5.3.1 Vapor from Groundwater

Several VOCs, including TCE and its daughter products, were detected in groundwater in the Group 5 Reporting Area. The indoor and outdoor air concentrations of these and other VOCs have been predicted using the modified Johnson-Ettinger model. The predicted indoor air concentrations are listed in risk assessment results in spreadsheets provided in Appendix A

5.3.2 Vapor from Soil

Several VOCs, including PCE and TCE, were detected in soil in the Group 5 Reporting Area. The indoor and outdoor air concentrations of these VOCs have been predicted using the Johnson-Ettinger model. The predicted indoor air concentrations are listed in risk assessment results in spreadsheets provided in in Appendix A.

5.3.3 Migration Within Groundwater

As discussed in Appendix B, bedrock matrix diffusion (for all chemicals soluble in water), coupled with other physical, chemical, and biological processes, slows the transport of these soluble chemicals relative to the average linear groundwater velocity. This understanding of contaminant migration in groundwater is the basis for the description below of how groundwater concentrations representing future site conditions have been selected. For details see *Overview of the Site Conceptual Model for the Migration and Fate of Contaminants in Groundwater at the Santa Susana Field Laboratory* (Cherry, McWhorter, and Parker, 2007).

Based on an evaluation of hydrogeological characteristics, chemical concentrations, source input locations, and well positions, chemical concentrations characterized by HAR-18, located in the STL-IV RFI Site are, are considered to be representative of a source input location (that is, those that are the highest within an area of impacted groundwater). As such, the concentrations in this well were selected to represent concentrations for current indirect exposure scenarios.

This well was also selected to represent concentrations for future hypothetical exposures that include direct exposure to groundwater. However, this is a conservative assumption because existing concentrations within source areas are predicted to diminish over time as clean groundwater flows through the source zone.

Further analysis of the transport of chemicals in groundwater was not required for this group report since "source conditions" are characterized by existing wells, which have been selected to represent exposure concentrations. Dissolved concentrations of chemicals in

groundwater flowing away from source zones will be lower than those at the source; hence, the application of any modeling would result in predicted concentrations in plumes lower than those measured in the HAR-18 due to its position at or near the source input location.

5.3.4 Surficial Soil/Sediment Migration

A discussion of transport and fate is presented here for the Group 5 Reporting Area based on the distribution of site chemicals as summarized in Section 4 and presented in the RFI site reports (Appendices D through T). Surface water drainage patterns, as shown in Figure 2-7, were used to evaluate surficial migration for each chemical group.

It should be noted that best management practices (BMPs) have been implemented to control erosion and transport of contaminants in surface water at a number of areas within the SSFL. Based on sampling results and evaluations conducted for this report, no additional erosion control measures are recommended at Group 5 as discussed in Section 7 and Appendix A.

Results presented in Figures 4-1 through 4-8 are described below to illustrate chemical distribution relationships as a basis for a discussion of transport and fate. As noted in Section 4, data are presented relative to the lowest appropriate RBSL and/or DTSC-approved background concentration as reference points for overall data distribution. Areas recommended for further consideration in the CMS (see Section 7) are also shown in these figures to illustrate spatial relationships between these areas and data distributions. Following a description of surface water flow, an evaluation of soil and sediment migration is presented by chemical group.

Surface water flow patterns are described in Section 2 of this report and are shown in Figure 2-7. A discussion of flow patterns is presented here to support the transport and fate evaluation below, beginning with an overall description followed by RFI site information.

The SSFL is located on top the Simi Hills, and surface water runoff drains to the north into Arroyo Simi in Simi Valley. Surface water drains into Bell Creek to the south, which leads to the Los Angeles River (Figure 2-6). Details of Group 5 surface water drainage basins and surface water flow directions are shown in Figure 2-7. The following description of the surface flow directions and drainage patterns within the Group 5 Reporting Area first presents overall drainage patterns, followed by more detailed site descriptions.

Surface water flow patterns for the Group 5 Reporting Area are shown in Figure 2-7 and are described in more detail by site below.

Surface water is monitored in two established NPDES monitoring locations in this area of the SSFL (Figure 2-6), Outfalls 007 and 017 at the Building 100 Trench and STP-3 RFI Sites, respectively.

5.3.5 Migration from Soil to Groundwater

Group 5 Reporting Area groundwater occurrence and quality are presented in Appendix B, including an evaluation of potential migration from soil to groundwater for chemicals detected in Group 5 Reporting Area soil. A brief summary is presented below.

VOCs, primarily TCE and its breakdown products that were detected in soil and groundwater within the Group 5 Reporting Area, are considered related to site activities at STL-IV and ECL. Based on VOCs detected in Group 5 soil, on site history, and on sample data from monitoring wells and piezometers, VOC impacts resulted from solvent releases. VOCs have been detected in NSGW and Chatsworth Formation groundwater, and likely are the result of VOC transport both through soil and within underlying groundwater. Lower VOC impacts are observed in several other monitoring wells. Based on the lack of detected VOCs in current site data, VOCs in these wells are not considered to be related to operations or to identified releases at the Group 5 RFI sites.

The potential for migration of PAHs from soil to groundwater is considered negligible because only very low concentrations of naphthalene or phthalates have been detected in groundwater. Phthalates in groundwater are considered to be likely laboratory contamination. Migration of PCBs is considered highly unlikely since PCBs have not been detected at other areas where soil concentrations were elevated and ample recharge conditions were present (MWH, 2006b). The chemical groups of PCBs and PAHs are characterized by a high affinity for soil particles and, hence, poor mobility.

Dioxins (such as 2,3,7,8-TCDD TEQ) were detected above background ranges. a representative sample was collected from several NSGW wells, and dioxins were not detected. Therefore, the potential for dioxin migration to groundwater is considered negligible in Group 5.

A number of metals have been detected in NSGW and Chatsworth Formation groundwater at concentrations above the GWCC, and in site soil or in historical (that is, removed) soil above background ranges. Described in detail in Appendix E, several metals are considered likely related to Group 5 site activities in groundwater.

At the Group 5 RFI Sites, 16 metals are considered likely to be site related: arsenic, boron, cadmium, chromium, cobalt, copper, lead, manganese, mercury, molybdenum, nickel, potassium, silver, strontium, and thallium. Seven of these metals were detected above background in historical (removed) samples or in existing in-place soil. Based on significantly elevated groundwater metals concentrations (relative to GWCCs), historical recharge conditions, and the potential for unknown wastes disposed, these metals are considered likely impacted by site activities.

5.3.6 Airborne Dispersion

VOCs detected in the subsurface were modeled to enter the air and disperse downwind. The exposure point concentrations for outdoor air VOCs are presented in risk assessment spreadsheets provided in Appendix A.

5.3.7 Dust Generation

SVOCs, PCBs, dioxins, and metals in soil were modeled in airborne dust generated from soil within the Group 5 Reporting Area. The EPCs for these chemical classes in dust are presented in risk assessment spreadsheets provided in Appendix A.

6.0 Risk Assessment Summary

This section presents and integrates the risk assessment findings for the Group 5 Reporting Area. The site-specific human health and ecological risk findings are presented in Section 4 in each of the RFI Site Reports (Appendices D through T). The details of how the risk assessments were performed are presented in the SRAM Work Plan, Revision 2 (MWH, 2005b), and in Appendix A of this report.

Two types of potential risks are presented in the RFI site reports and in this section:

1. Human health risks that are based on total exposures from direct contact with soil, inhalation of ambient and indoor air, and domestic consumption of groundwater
2. Ecological risks based on direct contact with soil (terrestrial plants and soil invertebrates); incidental ingestion of soil, food, and surface water (deer mouse and hermit thrush); ingestion of food and surface water but not soil (red-tailed hawk, bobcat, and mule deer); inhalation of soil vapors (deer mouse), and direct contact/ingestion of surface water (aquatic organisms)

Each HRA addresses residential exposure scenarios. However, a more likely future use of SSFL is for recreational purposes, and recreationists are the most plausible future human receptors. Therefore, risk estimates for recreational scenarios are also quantified in the HRAs.

The ecological receptors included in the ERA are terrestrial plants (where qualitative assessment indicated plant stress), soil invertebrates, hermit thrush, red-tailed hawk, deer mouse, bobcat, mule deer, and aquatic organisms (where surface water data were available).

These potential risks have been calculated for each of the Group 5 RFI sites separately. A generalized CSM for human receptors is shown in Figure 6-1, and a generalized CSM for ecological receptors is shown in Figure 6-2. The reader might also want to refer to Figure 5-1, which is a diagrammatic representation of an illustrated CSM for SSFL, including the contaminant sources, direct and indirect exposure pathways and receptors. Site-specific human health and ecological CSMs are presented in Appendices D through T.

The estimated potential risks for each of the Group 5 RFI sites are summarized in Appendices D through T, Section 4.0. Appendix A presents the HRA and ERA approach and supporting information. Attachments A1 through A17 to Appendix A contain the RFI site-specific HRAs and ERAs.

6.1 Acceptable Risks

Acceptable risks for humans are summarized in the following statements. For comparison purposes, theoretical excess lifetime cancer risks (ELCRs) of 10^{-6} or less associated with multi-media exposures are considered acceptable. The 10^{-6} risk level is the generally

accepted point of departure for selection of remedial alternatives. Potential risk estimates that are between 10^{-6} and 10^{-4} require risk management decisions. Risk estimates greater than 10^{-4} usually require remediation to reduce potential exposures. Likewise, noncancer hazard index (HI) values less than or equal to 1 are considered acceptable, and HI values greater than 1 usually require remediation to reduce potential exposures (DTSC, 2006; USEPA, 1993). Also, blood lead concentrations less than 10 micrograms per deciliter (µg/dl) are generally considered acceptable for making remedial decisions (DTSC, 1992).

Acceptable risks for ecological receptors are summarized in the following statements. For comparison purposes, Hazard Quotient (HQ) and HI values of less than 1.0 are considered acceptable. HQ and HI values greater than 1.0 were further evaluated using a weight-of-evidence to identify chemicals of ecological concern (COECs). COECs are referred to risk managers for consideration in the CMS. The decision to perform a CMS will include consideration of the number of chemicals with HQ and HI values greater than 1, the magnitude of HQs and HIs, availability and quality of habitat available at the site, the persistence and spatial extent of the water source (for surface water), and other site-specific considerations.

In addition, an ERA was completed for wide-ranging receptors (red-tailed hawk, bobcat, and mule deer), assuming they were exposed across all the Group 5 sites. HQs and HIs for the wide-ranging receptors are presented in Appendix A, Attachment A21.

These criteria are provided to assist the reader in interpreting the risk estimates presented in this report, and they served as the basis for the recommendations for CMS site action.

6.2 Conservatism and Uncertainty in Risk Assessment Results

Both human and ecological risk assessments are based on a series of assumptions and parameters. There is inherent and intentional conservatism in the use of these assumptions and parameters, as well as uncertainty. To assist interpretation of the risk results, the main sources of conservatism and uncertainty are discussed in Appendix A.

6.3 Summary of RFI Site Risks

Risks for the individual RFI site are presented in Appendices D through T and summarized in Tables 6-1 to 6-5, which includes the human health risks for the residential scenarios. Terrestrial, avian, and aquatic receptors have been evaluated for ecological risks, as appropriate, for the given site conditions.

6.4 Chemical Risk-Drivers

Several chemicals significantly contribute to the estimated human risks, both incremental lifetime cancer risk (ILCR) and noncancer HI, and to ecological risks within the Group 5 Reporting Area. The identified chemical risk-drivers are used as the basis for the CMS site action recommendations. Since the estimated risks are different for the various receptors (adult and child residential) and for the various environmental matrices (soil/sediment

versus groundwater), the chemical risk drivers for the Group 5 Reporting Area are summarized below using these divisions.

6.4.1 Residential

Soil/sediment risk drivers include antimony, lead, arsenic, and VOCs (TCE, benzene, and PCE).

Groundwater risk drivers include VOCs (1,1-DCA, TCE, and 1,1-DCE).

6.4.2 Ecological

Soil/sediment risk drivers include VOCs (chloromethane) and inorganics (antimony, arsenic, cadmium, lead, perchlorate, and selenium).

7.0 Group 5 RFI Report Summary and Site Action Recommendations

This section presents a summary of RFI reporting requirements as they apply to the Group 5 RFI Report. Section 7.1 describes RFI reporting requirements, particularly identification of areas for further work, or "site action" recommendations. The process and criteria used for making site action recommendations are described in Section 7.2, and site action recommendations for the Group 5 Reporting Area are summarized in Section 7.3.

7.1 RFI Reporting Requirements

As described in regulatory guidance documents for the SSFL RCRA Corrective Action Program (see Section 1.2.3), the purposes of the RFI are to: (1) characterize the nature and extent of contamination, and identify potential source areas; (2) assess potential migration pathways; (3) estimate risks to actual or potential receptors; and (4) gather necessary data to support the CMS (DTSC, 1995). The RFI Report is required to: (1) present findings regarding the above information; (2) describe completeness of the investigation; and (3) indicate if additional work is needed. Regulatory guidance indicates that additional work can be identified as a second phase of the RFI, as part of the CMS, or as interim corrective measures to stabilize source areas and control potential contaminant migration (DTSC, 1995).

The Group 5 RFI Report accomplishes these requirements by:

1. Presenting detailed source area identification, characterization findings, and investigation completeness determinations by media and by chemical class for chemical use areas and, when appropriate, associated down-drainage locations for each of the RFI sites in the Group 5 RFI Reporting Area. Section 4 summarizes the overall characterization of contamination nature and extent, potential source areas, and an assessment of investigation completeness for the entire reporting area. Assessments of investigation completeness have been made for the known or potential chemical use areas identified in this report based on sampling results, based on using professional judgment, and based on considering historical site operations, chemical data concentration gradients or trends, and risk-based screening levels and risk assessment findings. RFI site characterization details are provided in Appendices D through T, Section 3 in each appendix.

2. Presenting summaries of the groundwater migration pathways for the entire reporting area and presenting a detailed, groupwide surface water pathway evaluation in Section 5. Details of the groundwater migration pathway are presented in Appendix B and other potential transport pathways in Appendix A.

3. Identifying potential receptors and estimating potential risks at each RFI site in Appendix B. Estimated risks are summarized by RFI site in Appendices D through T, and presented for the entire reporting area in Section 6.

4. Identifying areas requiring further work by RFI site in Appendices D through T (Section 5 in each appendix) and in this section for the entire reporting area. Section 7.2 describes the process and criteria used to develop site action recommendations, and Section 7.3 presents the result of applying this process for the Group 5 Reporting Area.

Regulatory guidance for RFI reporting also requires that field procedures used for the investigation, quality assurance program effectiveness, data validation results, and sampling or laboratory "upset" conditions be described (DTSC, 1995). This information is provided for the surficial media investigation in the RFI Program Report (MWH, 2004). Additional site-specific application of general procedures, recent laboratory and validation reports, and data quality assessments are provided for each Group 5 RFI site in Appendices D through T.

7.2 Basis for Site Action Recommendations

Site action recommendations include identification of areas requiring further work as required by regulatory guidance for RFI reporting (DTSC, 1995) and identification of areas where NFA is warranted. Additional work can be completed as a second phase of the RFI, as part of the CMS, or as interim corrective measures to stabilize source areas and prevent contaminant migration. In the Group RFI Reports, evaluation of potential remediation areas is recommended for the CMS and interim corrective measures for some CMS Areas are recommended to stabilize source areas while cleanup plans are prepared. These recommendations are consistent with the RCRA Corrective Action Program goals and serve to move the project forward to cleanup.

Following RCRA requirements (DTSC, 1995), a CMS work plan that describes actions to be conducted during the CMS will be prepared for agency review and approval. During the CMS, site areas recommended for further consideration undergo additional evaluation to determine if cleanup is needed, how much cleanup is necessary, and which cleanup technologies should be used during the CMI phase.

In summary, site action recommendations included in the Group 5 RFI Reports identify areas for:

- Further evaluation in the CMS (CMS Areas)
- NFA
- Interim corrective measures to stabilize source areas and control contaminant migration (Stabilization Areas)

Site action recommendations are based on the RFI evaluation presented in the Group 5 RFI Site Reports, utilizing and integrating characterization and risk assessment findings. Characterization findings provide definition of the nature and extent of site contaminants, based on chemical data and transport and fate evaluation. Risk assessments evaluate characterization data and estimate human health and ecological risks based on specified land use scenarios. Risk assessments identify chemicals that drive or contribute to those risks.

The three site action recommendations listed above result from evaluations as described below. CMS or NFA Area recommendations are based on an integrated evaluation of characterization and risk assessment results. Stabilization Area recommendations rely on characterization evaluations, including transport and fate analysis, and comparison to risk based levels.

7.2.1 CMS Site Action Evaluation Process

CMS site action recommendations are based on a four-step process, described below, which evaluates risk assessment results in the context of characterization results and considers potential migration from identified source areas. Site action recommendations are made in this Group 5 Report for surficial media based on characterization and risk assessment results from all media. However, because groundwater characterization is ongoing, CMS recommendations for groundwater will be made in the Site-wide Groundwater Report as described in Section 1.

- **Site Action Evaluation Step 1**. Risk assessment results for existing or potential human and ecological receptors are compared to "acceptable" levels published by USEPA or DTSC as guidance for site managers (DTSC, 1992; USEPA, 1992). In cases where acceptable risks are specified as a range of values (see Section 6.1), the low end of the risk range (that is, 1×10^{-6}, or 1 in 1,000,000) is used to conservatively estimate the aerial extent that is recommended for further evaluation in the CMS. During the CMS, data for these recommended areas will be further evaluated using the entirety of the acceptable risk ranges specified in regulatory guidance to make appropriate recommendations for cleanup.

- **Site Action Evaluation Step 2.** When estimated RFI site risks are greater than 1×10^{-6} (cancer risks) or HI values greater than 1 (noncancer and ecological risks), risks from each RFI site are reviewed on a chemical-by-chemical basis to identify risk drivers and significant risk contributors to cumulative, total risk for each receptor. Risk drivers are detected chemicals with associated risks greater than 1×10^{-6}. Risk contributors are those chemicals that contribute to total risk but where individual chemical associated risk is less than 1×10^{-6} or HI values less than 1. Contributions of individual chemicals to total risk was conservatively considered at risk levels of approximately 2×10^{-7} (cancer risk) or at HI values of about 0.2, but the identification of risk contributors was a best-professional-judgment decision. These risk contribution departure evaluation points are approximate and could vary based on the chemical type detected and the individual chemical risk or hazard estimated.

- **Site Action Evaluation Step 3**. Characterization findings from across the entire Group 5 Reporting Area are reviewed to spatially identify areas where higher concentrations of risk drivers and contributors are detected. The identified areas are termed in this report "CMS Areas" and represent locations recommended for further evaluation during the CMS. Areas recommended for further evaluation during the CMS are comprehensive of all receptors and land use scenarios. During the CMS, estimated risks and chemical drivers and contributors will be evaluated further, and cleanup levels will be established with agency approval. Therefore, "CMS Areas" recommended during the RFI could change during the CMS.

- **Site Action Evaluation Step 4**. Uncertainties identified in RFI characterization and risk assessments (see Section 6.2) that affect findings are addressed. In some cases, areas are recommended for evaluation in the CMS as a result of these uncertainties. For example, some chemicals are assumed to be present in soil based on TPH-extrapolation factors (for example, benzene and PAHs) and contribute to total risk for the RFI site above acceptable levels. In these cases, "CMS Areas" have been identified for evaluation because of the uncertainties associated with the extrapolation used in the risk assessment. Since this assumption is often highly conservative, its use as a basis for CMS recommendations might be further evaluated in the CMS, or addressed prior to the CMS during DTSC review of this report.

After this four-step process is completed, site action recommendations are made for surficial media within the Group Reporting Area. These are tabulated by RFI site chemical use area, and chemical risk drivers/contributors are identified for each receptor in Appendices D through T, in Table 5-1 of each appendix. CMS Areas are also shown to illustrate location and approximate aerial extent in Appendices D through T, in Figure 5-1 of each appendix, and summarized in Appendices D through T, in Table 5-2 of each appendix. Areas shown are intended to be comprehensive of all receptors and land use scenarios.

Two additional aspects of RFI reporting will serve to confirm and/or finalize the areas recommended in Group RFI Reports for evaluation in the CMS. The first is an ecological evaluation for large home range receptors (such as, mule deer and hawk). Assessment of potential risks to these receptors due to cumulative exposures at multiple RFI sites within the SSFL will be performed once sufficiently large areas of SSFL have been evaluated and the results presented in Group RFI Reports. Potential cumulative exposures and risks will be reported in the Site-wide Large Home Range Risk Assessment Report. The second is a groundwater evaluation that will be reported in the Site-wide Groundwater Report. In this report, future groundwater use and concentrations will be evaluated to estimate the contribution to overall risks. Surficial media site action recommendations made, based on these two evaluations, will augment those presented in the Group RFI Reports. Therefore, the areas recommended for further evaluation in the Group RFI Reports can be confidently carried forward into the CMS because these two SSFL-wide RFI evaluations will identify areas added to, not removed from, subsequent CMS decision-making.

It is worth noting that criteria other than characterization and risk assessment results can be applied during the CMS to identify areas for further evaluation. Additional criteria could include evaluation of other regulatory criteria (such as permit limits or requirements), aesthetics, or public input during the CMS and EIR.

7.2.2 NFA Site Action Evaluation Process

NFA site action recommendations are based on the same four-step process described in Section 7.2.1. Where CMS is not required, based on the results of this process, NFA can be considered. However, because groundwater characterization is ongoing, CMS recommendations for groundwater could be made in the Site-wide Groundwater Report as described in Section 1 changing the NFA status.

After this four-step process is completed, site action recommendations are made for surficial media within the Group Reporting Area. These are tabulated by RFI site chemical use area,

and chemical risk drivers/contributors are identified for each receptor. Areas shown are intended to be comprehensive of all receptors and land use scenarios. Based on the conservative approach used for risk assessment, locations outside the CMS Areas identified are recommended for NFA.

Two additional aspects of RFI reporting will serve to confirm and/or finalize the areas recommended in Group RFI Reports for evaluation in the CMS. The first is an ecological evaluation for large home range receptors, as described in Section 7.2.1. The second is a groundwater evaluation that will be reported in the Site-wide Groundwater Report. In this report, future groundwater use and concentrations will be evaluated to estimate the contribution to overall risks. Surficial media site action recommendations made based on these two evaluations will augment those presented in the Group RFI Reports. Because these two SSFL-wide RFI evaluations could identify further CMS sites, NFA sites might be reassigned as CMS sites in subsequent CMS decision-making processes.

7.2.3 Source Area Stabilization Site Action Evaluation Process

Chemical data collected during the RFI are evaluated for contaminant migration as described in Section 5 of this report. Resulting site action recommendations focus on stabilization measures related to sediment transport via the surface water pathway. Other migration pathways (such as groundwater and vapor) could also be considered in the Group RFI Reports, depending on conditions encountered. Criteria considered for those recommendations would be based on site-specific conditions and described as necessary in the Group RFI Report.

Criteria used to evaluate if source area stabilization measures are needed to control surface water migration include:

- Presence of concentrations above background or RBSLs in surficial (not deeper) soil
- Proximity of surficial source area to an active surface water drainage pathway or to a sensitive ecological receptor
- Moderate-to-steep topography
- Absence of containment features (such as surface coatings and dams)
- Concentration gradients

Each criterion is considered important, and a weight-of-evidence evaluation is used to make a recommendation for source area stabilization measures. For example, if high concentrations were identified in the surficial soil of a topographic low (such as in a retention pond) with no or limited surface flow conditions, then a recommendation for stabilization would not be made. Concentration data are compared to RBSLs to evaluate magnitude of impact, but a strict threshold has not been developed given the importance of the other criteria.

Source area stabilization measures to prevent migration to surface water use BMPs such as installation of straw bales, fiber rolls, or silt fencing, or covering areas with plastic tarp. Soil or sediment that meets the criteria identified above but are present within or above man-

made liners (asphalt- or concrete-lined ditches, swales, sumps, or pits) will be recommended for removal as part of facility maintenance actions.

Erosion control measures have been applied to many surficial soil source areas at the SSFL. These measures are described in the SSFL Storm Water Pollution and Prevention Plan (SWPPP) (MWH, 2006a). This document is regularly updated and describes the types and locations of BMPs, including installation and maintenance associated with each control measure.

7.3 Recommendations for Group 5 Reporting Area Sites

Based on the evaluations presented in this document, data collected for the Group 5 Reporting Area are considered sufficiently complete to make site action recommendations as described above, and support evaluations to be performed during the CMS. Although additional data might be necessary to support some CMS evaluations, those data can be collected as part of the CMS.

Group 5 site action recommendations are listed in Table 7-1 and presented in Figure 7-1. Table 7-1 lists CMS or NFA recommendations and includes identification of chemical risk drivers and contributors for each exposure scenario. Source area stabilization recommendations are also identified for two CMS Areas as noted. CMS Areas shown in Figure 7-1 are approximate and represent evaluations inclusive of all receptors and land use. A summary of the Group 5 CMS Area recommendations is presented in Table 7-2. As noted above, recommendations reported in this document will be reviewed upon completion of the Site-wide Groundwater Report and large home range receptor evaluations, and updates to this report will be prepared as needed.

Group 5 areas recommended for further evaluation in the CMS, including associated chemical drivers/contributors and areas identified for surficial soil source stabilization measures, are summarized below. Portions of Group 5 outside these CMS Areas are recommended for NFA and are shown in Figure 7-1. The NFA recommendation for the each RFI site will be re-evaluated and revised, if appropriate, in the future after the existing structures are demolished. As part of the planned demolition of the remaining SSFL buildings, soil sampling will be performed as needed according to the process specified in *SOP: Building Feature Evaluation and Sampling* (MWH, 2008b), to assess the potential for chemical impacts beneath the buildings. The NFA recommendation for each RFI site will be re-evaluated based on the data collected following building demolition.

Thirty-five CMS Areas were identified for the Group 5 RFI Sites, including:

- Compound A Facility-1: Compound A Facility (Building 3418 and pond area). The chemical risk drivers are VOCs ((TCE, cis-1,2-DCE, 1,1-DCE, 1,1,2-TCA) in soil vapor and VOCs (TCE, VC, 1,1-DCA, PCE) in shallow groundwater, and metals (cadmium, chromium, copper, nickel, zinc) in soil.
- Compound A Facility-2: Debris area and drainage to the south. The chemical risk drivers are VOCs (TCE, cis-1,2-DCE, 1,1,2-TCA) in soil vapor and VOCs (TCE, VC, 1,1-DCA, PCE) in shallow groundwater, and dioxins and metals (arsenic, cadmium, chromium, copper, nickel, silver, zinc) in shallow soil.

- Compound A Facility-3: Forming Pits. The chemical risk drivers are VOCs (TCE, cis-1,2-DCE, 1,1-DCE, 1,1,2-TCA) in soil vapor and VOCs (TCE, VC, 1,1-DCA, PCE) in shallow groundwater, and metals (cadmium, chromium, copper, nickel, zinc) in soil.
- Compound A Facility-4: Large Suspect Dredge Material Area North of Compound A Facility. The chemical risk drivers are dioxins, PCBs, and metals (arsenic, cadmium, chromium, copper, nickel, silver, zinc) in shallow soil.
- ECL-1: Former Building 3270, surrounding concrete pad (including former tank storage area), ECL Pond, ECL Suspect Pond. The chemical risk drivers are VOCs (TCE, PCE, VC, benzene, methylene chloride) in soil vaporVC. The chemical risk drivers in soil are metals (arsenic, chromium, copper, and vanadium) and SVOCs (1,2-dinitrobenzene)..
- ECL-2: Area northwest of Building 3260. The chemical risk drivers are metals (chromium, copper, and vanadium) in soil.
- ECL-3: Area south of former Building 3798. The chemical risk drivers are TCE and VC in soil vapor.
- ECL-4: Building 3270 Leach Field. The chemical risk drivers are metals (chromium, nickel, and zinc) in soil.
- ECL-5: Building 3258. The chemical risk drivers are PCE and benzene in soil vapor; the chemical risk drivers in soil are metals (chromium, copper, nickel, and zinc)..
- ECL-6: Bunker on eastern side of the site. The chemical risk drivers in soil are metals (chromium, copper, and vanadium).
- EEL Site-1: Transformer area north of the hazardous materials storage pad. The chemical risk drivers are PCBs (aroclor-1254) in near-surface soil.
- EEL Site-2: The mechanics workshop, hazardous materials storage pad, and surrounding area. The chemical risk drivers VOCs (TCE and 1,1,2-TCA) in soil vapor and metals (arsenic) in near-surface soil.
- EEL Site-3: The EEL Storage and surrounding area. The chemical risk drivers are VOCs (TCE and 1,1,2-TCA) in soil vapor and metals (arsenic) in near-surface soil.
- Pond Dredge-1: The entire Pond Dredge Area RFI Site. The chemical risk drivers are metals (barium, chromium, nickel, and vanadium), SVOCs (bis(2-ethylhexyl) phthalate), and dioxins for ecological receptors in near-surface soil.
- PDU-1: Building 4006 area. The chemical risk drivers are metals (cadmium and silver) and PCBs (aroclor 1260).
- PDU-2: Former PDU area and the area including Buildings 4005, 4705, 4042, and 4742. The chemical risk drivers are metals (cadmium, silver, and zinc) in soil.
- PDU-3: 17th Street Drainage Area. The chemical risk drivers are metals (cadmium, silver, and zinc), PCBs (aroclor 1248 and aroclor 1260), and dioxins in soil.
- PDU-4: Former Baghouse Area. The chemical risk drivers are VOCs (PCE) in soil vapor.

- STP-1: STP-3 Pond, south of the STP. The chemical risk drivers are metals (barium, chromium, copper, nickel, silver, zinc) and perchlorate in soil.
- STP-2: Former Ranch House. The chemical risk drivers are metals (barium, chromium, nickel, zinc) in soil.
- STP-3: STP-3 Clarifier. The chemical risk drivers are metals (barium, chromium, copper, nickel, silver, zinc) in soil.
- STL-IV-1: STL-IV Northern Modules, Test Stands, Drainage Channels, and STL-IV Impoundment Areas. The chemical risk drivers are VOCs (1,1,2-trichloro-1,2,2-trifluoroethane, 1,1,2-TCA, 1,1-DCE, cis-1,2-DCE, TCE, and VC) in soil, soil vapor, and shallow groundwater. SVOCs (di-n-butyl phthalate) and metals (cadmium, vanadium) are chemical risk drivers in shallow soil.
- STL-IV-2: Southern Test Stand. The chemical risk drivers are VOCs (1,1,2-trichloro-1,2,2-trifluoroethane, 1,1,2-TCA, TCE) in soil vapor and shallow groundwater. The chemical risk drivers are SVOCs (di-n-butyl phthalate), petroleum hydrocarbons, and metals in shallow soil.
- STL-IV-3: Southern Suspect Pond and Drainage. The chemical risk drivers are VOCs (1,1,2-trichloro-1,2,2-trifluoroethane, 1,1,2-TCA, 1,1-DCE, cis-1,2-DCE, TCE) in soil, soil vapor, and shallow groundwater. The chemical risk drivers are SVOCs (di-n-butyl phthalate), Metals (cadmium), and DioxinFuran in soil.
- STL-IV-4: Large Debris Area in southwestern portion of the site. The chemical risk drivers are VOCs (TCE) in soil vapor and metals (vanadium) in shallow soil.
- B-100-1: The chemical risk drivers are metals (lead) in soil.
- DOE LF3-1: Southeast corner of Building 4462. The chemical risk drivers are PAHs (benzo(a)pyrene) in soil.
- DOE LF3-2: Northeast corner of Building 4462 at Substation 4762B. The chemical risk driver is aroclor 1260. The presence of PCBs in soil is consistent with the historical use of PCBs at Substation 4762B.
- HMSA Site 1: Building 4024. The chemical risk drivers are PAHs (chrysene) in soil for both human and ecological receptors.
- HMSA Site 2: Building 4025. The chemical risk driver is zinc in surface soil for ecological receptors.
- HMSA Site 3: Piezometer PZ-120. The chemical risk driver is TCE in NSGW. TCE was detected above groundwater screening levels during one of two sampling events at PZ-120. Soil vapor and soil sampling data collected during the RFI did not indicate a source at the HMSA RFI Site. Therefore, additional groundwater monitoring is recommended to further assess the presence of TCE at this well and at the HMSA RFI Site. The chemical risk drivers are metals (zinc) in soil.
- HMSA Site 4: The chemical risk driver is PAHs (benzo(a)pyrene) in soil.

- RIHL-1: Substation 4720. The chemical risk drivers are PCBs (aroclor 1254 and aroclor 1260) in soil for both human and ecological receptors.
- RIHL-2: Northeast RIHL Area. The chemical risk drivers are metals (cadmium, nickel, and vanadium) in soil for ecological receptors.
- SNAP-1: An area encompassing portions of existing Building 4057 and the former Building 4626 with human health and ecological risk drivers, as described below.
  - Building 4057. The chemical risk drivers are PCE in soil vapor (human health) and PCE in NSGW.
  - Former Building 4626. The chemical risk drivers are PCE in soil vapor (human health) and PCBs (aroclor 1248) in surface soil (ecological effects).

8.0 References

Boeing. 2006. Santa Susana Field Laboratory, Discharge Monitoring Report, NPDES Permit CA0001309, Annual Report 2005. March 1.Boeing. 2007. Santa Susana Field Laboratory, Discharge Monitoring Report, NPDES Permit CA0001309, Annual Report 2006. March 1.

Boeing. 2008a. Group 5 Historical Document Database, Santa Susana Field Laboratory, Ventura County, California. August.

Boeing. 2008b. Santa Susana Field Laboratory, Discharge Monitoring Report, NPDES Permit CA0001309, Annual Report 2007. February 28.

Cherry, John, David McWhorter, and Beth Parker. 2007. *Overview of the Site Conceptual Model for the Migration and Fate of Contaminants in Groundwater at the Santa Susana Field Laboratory*, *Simi California*. July 13.

Department of Toxic Substances Control (DTSC). 1992. *Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities*. October.

DTSC. 1995. Hazardous Waste Facility Post-Closure Permit. May.

DTSC. 1999. Letter from Jim Pappas, DTSC, to Dave Dassler, Boeing. "Operable Unit Formalization, Standardized Risk Assessment Methodology Work Plan, Santa Susana Field Laboratory, Ventura County, California." November 2.

DTSC. 2006. Personal Communication between T.R. Hathaway (DTSC) and M. Sullivan (McDaniel Lambert), regarding SSFL RFI report text used to discuss and present acceptable human and ecological risks. March.

DTSC. 2007a. Draft Preliminary Memorandum for the *Group 6 Northeastern Portion of Area IV*, *RCRA Facility Investigation Report*, *Santa Susana Field Laboratory*, *Ventura County*, *California* (Report) dated September 2006. From Thomas Seckington to Gerard Abrams. April 4.

DTSC. 2007b. Consent Order for Corrective Action, Docket No. P3-07/08-003, In the Matter of: Santa Susana Field Laboratory, Simi Hills, Ventura County, California. August.

DTSC. 2007c. Letter from Gerard Abrams, DTSC to Dave Dassler, Boeing. "Requirement to Collect Unfiltered Groundwater Samples During Water Quality Sampling, Santa Susana Field Laboratory (SSFL), Ventura County." January 24.

DTSC. 2007d. Letter from James M. Pappas to David Dassler, Boeing. "Conditional Approval of the Work Plan for the Phase 2 Groundwater Site Conceptual Model, Santa Susana Field Laboratory, Ventura, County, California, Date June 2007." September 14.

DTSC. 2007e. Letter from James M. Pappas to David Dassler, Boeing. "Conditional Approval of the Work Plan for the Phase 3 Groundwater Site Conceptual Model, Santa Susana Field Laboratory, Ventura County, California, Dated June 2007." September 14.

Dibblee, Thomas W. 1992. Geologic Map of the Calabasas Quadrangle, Los Angeles and Ventura County, California.

Groundwater Resources Consultants (GRC). 1989. *Phase III Report, Investigation of Groundwater Conditions, Santa Susana Field Laboratory - Area IV, Rockwell International, Rocketdyne Division, Ventura County, California.* December 5. HDMSE00083695.

GRC. 1995a. *Sampling and Analysis Plan, Hazardous Waste Facility Post-Closure Permit Post-Closure-94/95-3-02, Areas II, Santa Susana Field Laboratory, Rockwell International Corporation, Rocketdyne Division*. June 5.

GRC. 1995b. *Sampling and Analysis Plan, Hazardous Waste Facility Post-Closure Permit Post-Closure-94/95-3-03, Areas I and III, Santa Susana Field Laboratory, Rockwell International Corporation, Rocketdyne Division*. June 5.

GRC. 1999. Results of Dewatering Pit B/056, Area IV, Boeing North American Inc., Rocketdyne Propulsion and Power, Ventura County, California. February.

Haley & Aldrich, Inc. (H&A). 2008a. *Annual Groundwater Monitoring, 2007. Santa Susana Field Laboratory, Ventura County, California*. February 28.

H&A. 2008b. *Quarterly Groundwater Monitoring, First Quarter 2008, Santa Susana Field Laboratory, Ventura County, California*. May 30.

H&A. 2007a. *Quarterly Groundwater Monitoring, Second Quarter 2007, Santa Susana Field Laboratory, Ventura County, California. August 31.*

H&A. 2007b. *Quarterly Groundwater Monitoring, Third Quarter 2007, Santa Susana Field Laboratory, Ventura County, California. November 30.*ICF Kaiser Engineers (ICF). 1993. *Current Conditions Report (CCR) and Draft RCRA Facility Investigation Work Plan, Area IV*. October.

Montgomery Watson. 2000a. Technical Memorandum: *Conceptual Site Model, Movement of TCE in the Chatsworth Formation. Santa Susana Field Laboratory, Ventura County. Volumes I, II, and III.* April.

Montgomery Watson. 2000b. *Work Plan for Additional Field Investigations – Chatsworth Formation Operable Unit. Santa Susana Field Laboratory, Ventura County*. October.

Montgomery Watson Harza (MWH). 2001. *Work Plan for Additional Field Investigations – Former Sodium Disposal Facility. Santa Susana Field Laboratory, Ventura County.* October.

MWH. 2003a. *RCRA Facility Investigation Work Plan Addendum Amendment Building 056 Landfill (SWMU 7.1) Investigation. Santa Susana Field Laboratory, Ventura County*. May.

MWH. 2003b. *Perchlorate Source Evaluation and Technical Report Update – January through September 2003. Santa Susana Field Laboratory, Ventura County*. November

MWH. 2003c. *Near-Surface Groundwater Characterization Report. Santa Susana Field Laboratory, Ventura County*. November.

MWH. 2003d. *Report of Results, Phase I of Northeast Investigation Area Groundwater Characterization. Santa Susana Field Laboratory, Ventura County*. September.

MWH. 2004. *RCRA Facility Investigation Program Report. Santa Susana Field Laboratory, Ventura County.* July.

MWH. 2005a. *Surface Flux and Ambient Air Modeling Work Plan – Former Liquid Oxygen (LOX) Plant Site. Santa Susana Field Laboratory, Ventura County.* February.

MWH. 2005b. *Standardized Risk Assessment Methodology (SRAM) Work Plan, Revision 2. Santa Susana Field Laboratory, Ventura County.* September.

MWH. 2005c. *Vapor Migration Modeling Validation Study Work Plan. Santa Susana Field Laboratory, Ventura County*. November.

MWH. 2006a. *Storm Water Pollution Prevention Plan for Santa Susana Field Laboratory.* June.

MWH. 2006b. *Group 6 Northeastern Portion of Area IV, RCRA Facility Investigation, Santa Susana Field Laboratory, Ventura County. Appendix A, Soil Background Report Addendum.* September.

MWH. 2007a. *Work Plan, Phase 2 Groundwater Site Conceptual Model, Santa Susana Field Laboratory, Ventura County*. April.

MWH. 2007b. *Work Plan, Phase 3 Groundwater Site Conceptual Model, Santa Susana Field Laboratory, Ventura County*. June.

MWH. 2007c. *RCRA Facility Investigation Report, Vapor Migration Modeling Validation Study and VOC Surface Flux and Ambient Air Monitoring at the Former Liquid Oxygen Plant Site. Santa Susana Field Laboratory, Ventura County.* July.

MWH. 2007d. *Geologic Characterization of the Central Santa Susana Field Laboratory, Santa Susana Field Laboratory, Ventura County, California*. August.

MWH. 2007e. *Group 4 RFI Report for the Southern Portion of Area II, RCRA Facility Investigation Report, Santa Susana Field Laboratory, Ventura County, California*. August.

MWH. 2007f. *Group 8 RFI Report for the Western Portion of Area IV RCRA Facility Investigation Report, Santa Susana Field Laboratory, Ventura County, California*. September.

MWH. 2008a. *Work Plan, Site-wide Groundwater Characterization, Santa Susana Field Laboratory, Ventura County, California.* January.

MWH. 2008b. *Standard Operating Procedure: Building Feature Evaluation and Sampling.*

Ogden Environmental and Energy Services, Company, Inc. (Ogden). 1996. *RCRA Facility Investigation Work Plan Addendum. Santa Susana Field Laboratory, Ventura County, California*. September.

Ogden. 2000a. *RCRA Facility Investigation Work Plan Addendum Amendment. Santa Susana Field Laboratory, Ventura County, California.* June.

Ogden. 2000b. *Shallow Groundwater Investigation Work Plan, Final. Santa Susana Field Laboratory, Ventura County, California*. December.

Sapere Consulting, Inc. 2005. *Historical Site Assessment of Area IV, Santa Susanna Field Laboratory, Ventura County, California*. May.

Science Applications International Corporation (SAIC). 1991. *Interim Final RCRA Facility Assessment (RFA) Report for Rockwell International Corporation, Rocketdyne Division, Santa Susana Field Laboratory, Ventura County, California.* July.

SAIC. 1994. *Final RCRA Facility Assessment (RFA) Report. Prepared for Rockwell International Corporation, Rocketdyne Division, Santa Susana Field Laboratory, Ventura County, California.* May.

Sonoma Technology Inc. (STI). 2003. Presentation regarding: *Historical Air Pollutants (HAP) Emissions from SSFL: Preliminary Analysis.* August 19.

United States Environmental Protection Agency (USEPA). 1992. *Guidance for Data Usability in Risk Assessment (Part A)*. Final. Office of Emergency and Remedial Response.

USEPA. 1993. *National Oil and Hazardous Substances Pollution Contingency Plan*.

USEPA. 1994. *Guidance for the Data Quality Objectives Process*. USEPA QA/G-4. September.

USEPA. 1997. Aerial Photographic Analysis of Rockwell Rocketdyne Santa Susana Field Laboratory, Ventura County, California. USEPA Research and Development, Characterization Research Division. EPA Region 9, TS-PIC-9709912R. May.

USEPA. 2000. *Data Quality Objectives Process for Hazardous Waste Site Investigations.* USEPA QA/G-4. Final. September.

9.0 Glossary and Definition of Terms

Alluvium. A general term used to describe unconsolidated soil deposited by water (for example, streams and rivers). At the SSFL these deposits occur above bedrock.

AOC – Area of Concern. A portion or site at a RCRA facility identified by the United States Environmental Protection Agency (USEPA) during the RCRA Facility Assessment (RFA) that may have used, stored, or handled chemicals that could potentially cause a threat to human health or the environment.

CF – Chatsworth Formation. The geologic name of the bedrock that occurs at the SSFL. The bedrock consists predominantly of sandstone and some finer-grained siltstone and shale units. Forms the large exposed outcrops (bluffs) on the hills near the site and occurs at depth beneath the surficial soil.

CFOU – Chatsworth Formation Operable Unit. Refers to the portion of the SSFL RCRA Corrective Action Program that includes investigation of unsaturated and saturated bedrock and deep groundwater within the unweathered CF bedrock.

Chemical Risk Driver. A chemical identified in the risk assessment to be a major contributor to the estimated cumulative risk.

CMI – Corrective Measure Implementation. The fourth phase of the RCRA Corrective Action Program. This phase occurs when the sites are cleaned up to meet the standards set by the DTSC in the CMS.

CMS – Corrective Measures Study. The third phase of a RCRA Corrective Action Program. In this phase, types of cleanup methods are evaluated and selected. Public comment is requested on the findings of the CMS report before cleanup is conducted in the Corrective Measures Implementation (CMI).

Colluvium. A general term used to describe unconsolidated soil or material, mainly transported by gravity, located at the bottom of a slope or cliff.

COPC – Chemical of Potential Concern. A chemical identified during the risk assessment that might pose a risk or hazard to human receptors.

CPEC – Chemical of Potential Ecological Concern. A chemical identified during the risk assessment that might pose a hazard to ecological receptors.

CTE – Central tendency exposure. Refers to the average chemical exposure for a receptor, based on a simple mathematical average of exposures at a site.

Data Validation. A quality control procedure where a qualified chemist reviews the laboratory data from samples collected during the RFI. The chemist reviews laboratory procedures to make sure the data are acceptable to use as reported. In some cases, the reviewing chemist "qualifies" datum so that it should be considered to be estimated, or that it should be rejected. Rejected data are not used in the risk assessment, but estimated data can be. Decisions made using estimated data are always carefully considered.

Discrete Depth Monitoring Point. A device placed in a monitoring well or borehole that allows collection of groundwater samples from small sections of the groundwater system. The device has small openings (typically 1 to 10 feet, depending on the type of system used) that are separated by "blanks" that are closed to the groundwater system, allowing discrete depth intervals of the groundwater to be monitored. At the SSFL, the type of device installed in some of the deep monitoring wells is a flexible liner known as a FLUTe.

DTSC – California Environmental Protection Agency, Department of Toxic Substances Control. The regulatory agency overseeing the RCRA Corrective Action Program investigation and cleanup of the SSFL.

Drainage Basin. The land area where precipitation runs off into streams, rivers, lakes, and reservoirs. Similar to watershed.

EPCs – Exposure Point Concentrations. Concentrations used to calculate risk for a chemical if selected as a Chemical of Potential Concern (COPC) in the human health risk assessment or as a Chemical of Potential Ecological Concern (CPEC).

FAL – Field Action Level. A chemical concentration in soil used to help determine if additional sampling is necessary. FALs were developed for the RFI field program at the SSFL, and were approved by DTSC in the RFI work plan. The FALs are general guidelines for making field decisions; final evaluation of data completeness and risks posed by chemicals is done in the RFI report and risk assessment.

Fill. Rock, soil, or other materials that were deposited by man. Includes soil or material that might have been moved or redistributed locally.

FLUTe – Flexible Liner Underground Technology®. A depth-discrete groundwater sampling mechanism used in open-borehole wells. As it is lowered into the well, the flexible rubber "sock" liner is inverted and filled with water to seal it against the wall of the borehole. Samples are collected by displacing groundwater with nitrogen pumped through small-diameter tubes.

HI – Hazard Index. A number that is the sum of hazard quotients (defined below), which represents the total estimated level of noncancer human health risk or ecological risk associated with exposure to chemicals. An HI less than 1 is generally considered acceptable.

HQ – Hazard Quotient. A number that indicates an estimated level of noncancer human health risk or ecological risk associated with exposure to a single chemical. An HQ less than 1 is generally considered acceptable.

ILCR – Incremental Lifetime Cancer Risk. The upperbound estimate of cancer risk based upon a lifetime-averaged exposure dose.

JP/RP Fuels – Very pure (high-grade) kerosene- or diesel-range petroleum fuels. Called Jet Propulsion (JP) or Rocket Propulsion (RP) fuels. Numbers following the JP- or RP-designation refer to a particular mixture in each fuel.

Kilogram (1,000 g). One thousand grams.

Lean clay. A very fine-grained soil consisting of mostly clay, with varying percentages of silt, and very fine sand particles, showing low to medium plasticity.

Microgram (10^{-6} g). One millionth of a gram.

Milligram (10^{-3} g). One thousandth of a gram.

MMH – Monomethyl Hydrazine. A hydrazine fuel used for rocket engine or component testing.

Nanogram (10^{-9} g). One billionth of a gram.

Near-Surface Groundwater (NSGW). Groundwater that occurs within the alluvium or the weathered portion of the Chatsworth Formation bedrock. Can be separated from or vertically continuous with a deeper groundwater system. If it occurs above and separated from a deeper groundwater system by unsaturated bedrock, the near-surface groundwater is called "perched groundwater."

Ozonator. An aboveground tank where wastewater containing small amounts of MMH was routed. Ozone was bubbled through the water, oxidizing the MMH to carbon dioxide and water.

Picogram (10^{-12} g). One trillionth of a gram.

Perched Groundwater. Near-surface groundwater that is separated from underlying, deeper groundwater by an unsaturated zone (that is, dry bedrock).

pH. A number indicating the measured acidity or alkalinity of a material. pH between 0 and 7 is acid, pH between 7 and 13 is alkaline, and a pH of 7 is neutral.

Piezometer. A temporary shallow well installed to monitor near-surface groundwater. In this report, monitoring wells and piezometers are collectively termed "monitoring wells."

RCRA – Resource Conservation and Recovery Act. USEPA regulations (1976, revised 1984) requiring safe management and disposal of wastes. Often referred to as "cradle to grave" regulations for hazardous wastes as it governs practices of waste generation, storage, and disposal.

RCRA Corrective Action Program. The investigation and cleanup of chemicals that cause a risk under RCRA guidelines. The program is conducted in four phases: RFA (preliminary assessment), RFI (investigation phase), CMS (evaluation of cleanup phase), and CMI (cleanup phase). For the SSFL, this program is under the oversight of the DTSC.

RFA – RCRA Facility Assessment. This is the first phase of the RCRA Corrective Action Program. It includes evaluation of a RCRA facility operations, records, and reports to identify areas where chemicals were handled, used, or stored (called Solid Waste Management Units, SWMUs) and areas where such practices may have occurred (Areas of Concern [AOCs]). The RFA typically includes a site visit inspection. At the SSFL, this was conducted by SAIC, a consultant for the USEPA. A draft RFA report was issued by the USEPA in 1991 and finalized in 1994.

RFI – RCRA Facility Investigation. The second phase of the RCRA Corrective Action Program. This is the investigation phase, during which chemicals that pose a risk to human health or the environment are identified. It typically includes sampling, evaluation of the results, and risk assessment. This is the phase of the work being described in this report for

one of the sites identified at the SSFL. The work is being conducted under the oversight of DTSC.

Risk Assessment. The process by which chemicals causing a risk to human health or the environment are identified and risk quantified. Based on these findings, a site is recommended for either (1) No Further Action, or (2) Evaluation of cleanup alternatives in the CMS.

RME – Reasonable maximum exposure. Defined as the maximum chemical exposure to receptors that could realistically be expected. This exposure is biased toward higher chemical concentrations and conservative exposure assumptions at a site.

Shear Zone. A geologic fault zone within the Chatsworth Formation bedrock that occurs in the eastern portion of the SSFL.

Sheet flow. Flow that occurs overland in places where there are no defined channels.

Solvents. Organic liquids used for cleaning purposes. Known for their "degreasing" properties. Examples include trichloroethene (TCE), perchloroethene (PCE), Freon compounds, and methylene chloride.

Surficial OU – Surficial Media Operable Unit. This refers to the portion of the SSFL RCRA Corrective Action Program that includes surficial media (soil, soil vapor, sediment, surface water, air, biota, and near-surface groundwater).

SVOCs – Semivolatile Organic Compounds. Chemicals that are less volatile than VOCs. Typical SVOCs detected in environmental samples include polycyclic aromatic hydrocarbons (PAHs), and phthalate compounds (used in plastics).

SWMU – Solid Waste Management Unit. A site identified during the RCRA Facility Assessment that handled, used, or stored chemicals that may pose a threat to human health or the environment.

VOCs – Volatile Organic Compounds. Compounds that easily become gases (volatilize). The most typical VOCs at the SSFL are those used as solvents (for example, TCE, PCE, Freon compounds, and acetone).

Watershed. The specific land area that drains water into a river system or other body of water.

Water Table. A generally planar surface below the ground surface where unsaturated alluvium becomes fully saturated; the "top" of groundwater.

Weathered Bedrock. The upper portion of the bedrock that is typically oxidized (brown instead of gray) and less cemented (less competent) than the underlying deeper bedrock. At the SSFL, the weathered bedrock can be directly below the alluvium or exposed at the ground surface.

Tables

Table ES-1
GROUP 5 REPORTING AREA SURFICIAL MEDIA RFI RESULTS AND SITE ACTION RECOMMENDATIONS
Santa Susana Field Laboratory, Ventura County, California

RFI Site	Risk Estimate (Values provided are maximum risks calculated for entire site)			Grouped Chemical Use Areas (d) (Chemical Use Area Number)	Chemical Groups Detected / Matrix (soil matrix unless noted)	Areas Recommended for CMS Evaluation (e) (f)
	Human Risks (Surficial Media Plus Indirect Groundwater)		Ecological Risks (HI) (c)			
	Residential Risks (a) (b)	Recreator Risks (b)				
Boeing Area IV Leach Field	**Human ELCR: 7 x 10^{-7}** **Human HI: 2** (Nitrate-NO_3 in NSGW)	**Human ELCR: 2 x 10^{-7}** **Human HI: <0.01**	**Thrush: 9.0** (PCB_TEQ_Bird) **Hawk: 0.002** **Deer Mouse: 27** (PCB_TEQ_Mammal) **Bobcat: 0.0008** **Mule Deer: 0.01**	**(1):** Building 4011 (including AT-05 and AT-06)	VOCs, SVOCs, TPHs, and Metals	*NFA*
				(2): Buildings 4007 and 4008	VOCs, TPH, PCBs, and Metals	*NFA*
				(3): Building 4711	PCBs	*NFA*
				(4): Building 4611	VOCs, SVOCs, TPHs, and Metals	*NFA*
				(5): Building 4171	Metals	*NFA*
				(6): AST 4735	TPHs and Metals	*NFA*
				(7): UT-06	SVOCs and TPHs	*NFA*
				(8): Building 4011 Leach Field	VOCs, SVOCs, TPHs, Metals, and Energetics	*NFA*
				(9): Building 4172	Metals	*NFA*
				(10): Transformer Pole D-5	Samples not collected due to presence of communication vaults	*NFA*
				(11): Sodium Component Test Installation (SCTI) Pump Station	TPHs	*NFA*
				(12): Parking Lot 4502	SVOCs, Metals, and Energetics	*NFA*
Compound A Facility	**Human ELCR: 1 x 10^{-3}** (TCE in NSGW and Arsenic in soil) **Human HI: 3,700** (TCE in NSGW)	**Human ELCR: 4 x 10^{-5}** (Arsenic in soil) **Human HI: 0.03**	**Thrush: 149** (Cadmium) **Hawk: 1.4** (Zinc) **Deer Mouse: 278** (Nickel) **Bobcat: <1** **Mule Deer: 10** (Nickel)	**(1) and (4):** Building 3418 and Fluorine Pipeline	VOCs (soil and soil vapor), SVOCs, TPHs, Metals, and Inorganics	**CMPA-1**
				(2): Forming Pits	VOCs (soil vapor), Metals and Energetics	**CMPA-3**
				(3) and (5): Compound A Pond, Storage Shed	VOCs (soil and soil vapor), SVOCs, TPHs, Metals, and Inorganics	**CMPA-1**
				(6): Suspect Pond	VOCs, SVOCs, TPHs, Metals, and Dioxins	*NFA*
				(7): Debris Area	VOCs (soil and soil vapor), SVOCs, TPH, Metals, and Dioxins	**CMPA-2**
				(8): Explosive Magazines	VOCs, SVOCs, TPHs, Metals, and Dioxins	*NFA*
				(9): STL-IV Stripping Towers	VOCs	*NFA*
				(10a): Suspect dredge material (north)	SVOCs, TPHs, PCBs, Metals, and Dioxins	**CMPA-4**
				(10b): Suspect dredge material (south)	SVOCs, TPHs, PCBs, Metals, and Dioxins	**CMPA-4**
				N/A: Transformer / substation north of CUA 9	None Detected	*NFA*
				N/A: Drainage Sampling (Downgradient of 17th Street Drainage)	TPHs, PCBs, Metals, and Dioxins	**CMPA-4**
Engineering Chemistry Laboratory	**Human ELCR: 1 x 10^{-3}** (Carbon Tetrachloride,1,2-DCA, Chloroform, 3-Chloro-2[Chloromethyl]-1-Propene, and PCE in NSGW) **Human HI: 166** (TCE and Carbon Tetrachloride in NSGW)	**Human ELCR: 2 x 10^{-5}** (Arsenic in soil) **Human HI: 0.07**	**Thrush: 38** (Chromium) **Hawk: <1** **Deer Mouse: 189** (Nickel) **Bobcat: <1** **Mule Deer: 2.4** (Nickel)	**(1):** Engineering Chemistry Laboratory (Building 3270)	VOCs (soil and soil vapor), SVOCs, Metals, and Energetics	**ECL-1**
				(2): Building 3260	VOCs (soil and soil vapor), SVOCs, TPHs, and Metals	**ECL-2**
				(3): Building 3798	VOCs (soil and soil vapor)	**ECL-3**
				(4): ECL Pond	VOCs (soil and soil vapor), SVOCs, TPHs, and Metals	**ECL-1**
				(5): ECL Suspect Pond	VOCs (soil and soil vapor), TPHs, and Metals	**ECL-1**
				(6): Building 3270 Leach Field	VOCs, SVOCs, Metals, and Energetics	**ECL-4**
				(7): Substation Adjacent to Building 3367	None Detected	*NFA*
				(8): Building 3799	SVOCs	*NFA*

Table ES-1
GROUP 5 REPORTING AREA SURFICIAL MEDIA RFI RESULTS AND SITE ACTION RECOMMENDATIONS
Santa Susana Field Laboratory, Ventura County, California

RFI Site	Risk Estimate (Values provided are maximum risks calculated for entire site)			Grouped Chemical Use Areas (d) (Chemical Use Area Number)	Chemical Groups Detected / Matrix (soil matrix unless noted)	Areas Recommended for CMS Evaluation (e) (f)
	Human Risks (Surficial Media Plus Indirect Groundwater)		Ecological Risks (HI) (c)			
	Residential Risks (a) (b)	Recreator Risks (b)				
Engineering Chemistry Laboratory (continued)				**(9):** Building 3258	VOCs (soil and soil vapor), SVOCs, TPHs, and Metals	**ECL-5**
				(10): Building 3269	Inorganics	**ECL-5**
				(11): Substation West of Building 3259	None Detected	*NFA*
				(12): Bunker South of Building 3269	VOCs, TPHs, and Metals	*NFA*
				(13): Bunker East of Engineering Chemistry Lab	VOCs and Metals	**ECL-6**
Environmental Effects Laboratory	**Human ELCR: 3 x 10^{-4}** (TCE in NSGW and Arsenic in soil) **Human HI: 7** (TCE in NSGW and Arsenic in soil)	**Human ELCR: 9 x 10^{-5}** (Arsenic in soil) **Human HI: <0.01**	**Thrush: 69** (PCB_TEQ_Bird) **Hawk: <1** **Deer Mouse: 208** (PCB_TEQ_Mammal) **Bobcat: <1** **Mule Deer: <1**	**(1):** EEL Cryongenic Laboratory and Test Cells	VOCs (soil and soil vapor), SVOCs, TPHs, and Metals	*NFA*
				(2): EEL Storage	VOCs (soil and soil vapor) and Metals	**EEL-3**
				(3): EEL Mechanics Workshop	VOCs (soil and soil vapor), SVOCs, and Metals	**EEL-2**
				(4): Office	No chemicals used	*NFA*
				(5): Tanks	VOCs (soil vapor) and TPHs	*NFA*
				(6): Transformers	PCBs	**EEL-1**
				(7): Hazardous Materials Storage Pad	VOCs (soil and soil vapor), SVOCs, TPHs, and Metals	**EEL-2**
Pond Dredge Area	**Human ELCR: 5 x 10^{-5}** (Arsenic in soil) **Human HI: 0.8**	**Human ELCR: 2 x 10^{-7}** **Human HI: <0.01**	**Thrush: 35** (Chromium) **Hawk: <1** **Deer Mouse: 201** (Nickel) **Bobcat: <1** **Mule Deer: 2** (Nickel)	**(1):** Pond Dredge	VOCs, SVOCs, TPHs, PCBs, Metals, Inorganics, and Dioxins	**Pond Dredge-1**
Coal Gasification Process Development Unit (g)	**Human ELCR: 8 x 10^{-5}** (Benzo[a]pyrene and Indeno[1,2,3-cd]pyrene in soil) **Human HI: 7** (Antimony in NSGW)	**Human ELCR: 2 x 10^{-5}** (Benzo[a]pyrene and Indeno[1,2,3-cd]pyrene) **Human HI: <0.01**	**Thrush: 58** (Cadmium) **Hawk: <1** **Deer Mouse: 76** (DioxinFuranPCB_TEQ_Mammal) **Bobcat: <1** **Mule Deer: 1.1** (Cadmium)	**(1):** Building 4005	VOCs (soil and soil vapor), SVOCs, TPHs, and Metals	**PDU-2**
				(2): Building 4006	VOCs, SVOCs, TPHs, and Metals	**PDU-1**
				(4): Building 4027	VOCs (soil vapor), SVOCs, TPHs, and Metals	*NFA*
				(5): Building 4032	VOCs, TPHs, and Metals	*NFA*
				(6): Building 4042	Metals	**PDU-2**
				(7): Former PDU Area	VOCs (soil and soil vapor), SVOCs, TPHs, PCBs, and Metals	**PDU-2**
				(11): Building 4402	VOCs	*NFA*
				(13): Building 4616	Metals	*NFA*
				(14): Coal Storage Yard	VOCs (soil and soil vapor), TPHs, and Metals	*NFA*
				(17): Transformer 4706	PCBs	*NFA*
				(20): Transformer 4742	PCBs	*NFA*
				(21): Building 4005/4006 Leach Field	VOCs, SVOCs, TPHs, and Metals	*NFA*
				(22): Bag House	VOCs (soil and soil vapor), SVOCs, TPHs, and Metals	**PDU-4**

Table ES-1
GROUP 5 REPORTING AREA SURFICIAL MEDIA RFI RESULTS AND SITE ACTION RECOMMENDATIONS
Santa Susana Field Laboratory, Ventura County, California

RFI Site	Risk Estimate (Values provided are maximum risks calculated for entire site)			Grouped Chemical Use Areas (d) (Chemical Use Area Number)	Chemical Groups Detected / Matrix (soil matrix unless noted)	Areas Recommended for CMS Evaluation (e) (f)
	Human Risks (Surficial Media Plus Indirect Groundwater)		Ecological Risks (HI) (c)			
	Residential Risks (a) (b)	Recreator Risks (b)				
Coal Gasification Process Development Unit (g) (continued)				**(23):** Catchment Basin	VOCs, SVOCs, TPHs and Metals	*NFA*
				(24): 17 St. Drainage area	SVOCs, TPHs, PCBs, Metals, and Dioxins	**PDU-3**
				(25): Building 4037	TPHs and Metals	*NFA*
Area 3 Sewage Treatment Plant	**Human ELCR: 1 x 10^{-4}** (Arsenic in soil) **Human HI: 1**	**Human ELCR: 2 x 10^{-5}** (Arsenic in soil) **Human HI: <0.01**	**Thrush: 118** (Chromium) **Hawk: 0.07** **Deer Mouse: 598** (Nickel) **Bobcat: 0.007** **Mule Deer: 1.24** (Nickel)	**(1):** Area 3 STP	VOCs (soil vapor), SVOCs, TPHs, and Metals	*NFA*
				(2): STP Pond	VOCs, SVOCs, TPHs, Metals, and Inorganis	**STP-1**
				(3): STP Clarifier	SVOCs, TPHs, and Metals	**STP-3**
				(4): Former Ranch House	VOCs, TPHs, and Metals	**STP-2**
Southeast Drum Storage Yard	**Human ELCR: 6 x 10^{-7}** **Human HI: 0.5**	**Human ELCR: 2 x 10^{-7}** **Human HI: <0.01**	**NO CPECs**	**(1):** SE Drum Storage Yard	VOCs, SVOCs, TPHs, and Metals	*NFA*
Systems Test Laboratory IV	**Human ELCR: 8 x 10^{-4}** (TCE in NSGW) **Human HI: 2,130** (TCE in NSGW)	**Human ELCR: 2 x 10^{-7}** **Human HI: <0.01**	**Thrush: 127** (Cadmium) **Hawk: <1** **Deer Mouse: 64** (Cadmium) **Bobcat: <1** **Mule Deer: 3.1** (Cadmium)	**(1):** Module 3	VOCs (soil and soil vapor), SVOCs, TPHs, and Metals	**STL-CMS-1**
				(2): Fuel Storage Area/ Monomethyl Hydrazine (MMH) Ozonator Tank	VOCs (soil and soil vapor), SVOCs, TPHs, and Metals	**STL-CMS-1**
				(3): Fuel Storage Area/ Monomethyl Hydrazine (MMH) Ozonator Tank	VOCs (soil and soil vapor) and TPHs	**STL-CMS-1**
				(4): STL-IV Impoundments 1 and 2 and Associated Channels	VOCs (soil and soil vapor), SVOCs, TPHs, and Metals	**STL-CMS-1**
				(5): Engine Test Stand No. 2 and Module 2	VOCs (soil and soil vapor), TPHs, and Metals	**STL-CMS-1**
				(6): Building 3794, Hot Water Boiler Shelter, and Building 3780, Assembly Decontamination	VOCs (soil and soil vapor), TPHs, and Metals	**STL-CMS-1**
				(7): Engine Test Stand No. 3 and Module 1	VOCs (soil and soil vapor), SVOCs, TPHs, and Metals	**STL-CMS-1**
				(8): Building 3254	VOCs, SVOCs, TPHs, and Metals	**STL-CMS-1**
				(9): Building 3318/Workshop/Instrumentation Shop/Tool Crib	VOCs, SVOCs, TPHs, and Metals	**STL-CMS-1**
				(10): Hazardous Waste Storage Locker, VOC Storage and Use, General Storage and Use	VOCs, TPHs, and Metals	**STL-CMS-1**
				(11): Explosive Use/Storage	None Detected	*NFA*
				(12): Engine Test Stand No. 4	VOCs (soil and soil vapor), SVOCs, TPHs, and Metals	**STL-CMS-2**
				(13): Suspect Pond	VOCs (soil and soil vapor), SVOCs, TPHs, Metals, and Dioxins	**STL-CMS-3**
				(14): Operations Trailer/Clean Room Trailer/Lunch Room	VOCs (soil and soil vapor), SVOCs, TPHs, and Metals	*NFA*

Table ES-1
GROUP 5 REPORTING AREA SURFICIAL MEDIA RFI RESULTS AND SITE ACTION RECOMMENDATIONS
Santa Susana Field Laboratory, Ventura County, California

RFI Site	Risk Estimate (Values provided are maximum risks calculated for entire site)			Grouped Chemical Use Areas (d) (Chemical Use Area Number)	Chemical Groups Detected / Matrix (soil matrix unless noted)	Areas Recommended for CMS Evaluation (e) (f)
	Human Risks (Surficial Media Plus Indirect Groundwater)		Ecological Risks (HI) (c)			
	Residential Risks (a) (b)	Recreator Risks (b)				
Systems Test Laboratory IV (continued)				**(15):** Nitro Tetroxide (NTO) Storage Area	VOCs (soil and soil vapor), SVOCs, TPHs, and Metals	**STL-CMS-4**
				(16): Leach Field	VOCs, SVOCs, TPHs, and Metals	**STL-CMS-1**
				(17): STL-IV Explosive Bunkers	None Detected	*NFA*
				(N/A): Debris Location 3001, Debris Location 3002	SVOCs, TPH, Metals	**STL-CMS-5**
Building 65 Metals Laboratory Clarifier	**Human ELCR: 7 x 10^{-7}** **Human HI: 0.06**	**Human ELCR: 2 x 10^{-8}** **Human HI: <0.01**	**NO CPECs.**	**(1):** Building 4065 Metals Clarifier	SVOCs, TPHs, and Metals	*NFA*
				(2): Building 4065	VOCs (soil and soil vapor), SVOCs, TPHs, and Metals	*NFA*
				(3): UT-76	VOCs (soil and soil vapor)	*NFA*
				(4): UT-70	VOCs (soil vapor)	*NFA*
				(5): Substation 4762	None Detected	*NFA*
				(6): Building 4066	VOCs (soil vapor), SVOCs, and Metals	*NFA*
				(7): Building 4062	VOCs (soil and soil vapor) and Metals	*NFA*
Building 100 Trench	**Human ELCR: 4 x 10^{-7}** **Human HI: 0.3**	**Human ELCR: 3 x 10^{-7}** **Human HI: <0.01**	**Thrush: 11,303** (Lead) **Hawk: 3.6** (Lead) **Deer Mouse: 110** (Lead) **Bobcat: <1** **Mule Deer: 2.0** (Lead)	**(1):** Bldg 100 Trench	SVOCs, TPHs, Metals, and Dioxins	**B100-1**
				(2): Building 100 Area - Potential Source of VOCs and Dioxins	VOCs, SVOCs, TPHs, Metals, and Dioxins	*NFA*
				(3a): Hummocky Area - Western	TPH and Metals	*NFA*
				(3b): Hummocky Area - Northern	SVOCs, TPHs, and Metals	*NFA*
				(4): Bldg 100 Leach Field	SVOCs, Metals, and Inorganics	*NFA*
				(6): Transformer 4800 (4710)	None Detected	*NFA*
Department of Energy Leach Field 1	**Human ELCR: 3 x 10^{-7}** **Human HI: 0.01**	**Human ELCR: 6 x 10^{-8}** **Human HI: <0.01**	**Thrush: No CPEC** **Hawk: No CPEC** **Deer Mouse: 5.7** (PCB_TEQ_Mammal) **Bobcat: 4 x 10^{-5}** **Mule Deer: 7 x 10^{-4}**	**(1):** Building 4093 Leach Field	VOCs, SVOCs, and Metals	*NFA*
				(2): Building 4030 Leach Field	SVOCs and Metals	*NFA*
				(3): Building 4074	Metals	*NFA*
				(4): Building 4023	VOCs, TPHs, and Metals	*NFA*
				(5): Building 4030/4035	SVOCs, TPHs, and Metals	*NFA*
				(6): Electrical Substation located north of Building 4641	None Detected	*NFA*
				(7): Transformer Pole	None Detected	*NFA*
				(8): Building 4641	VOCs (soil vapor), TPHs, PCBs, and Metals	*NFA*
				(9): Building 4073	SVOCs and Metals	*NFA*
				(10): Building 4083	VOCs, TPHs, and Metals	*NFA*
				(11): Buildings 4093 and 4893	TPHs and Metals	*NFA*
				(12): Building 4103	VOCs and Metals	*NFA*
				(13): Building 4123	SVOCs, TPHs, and Metals	*NFA*
				(14): Building 4453	VOCs, SVOCs, and Metals	*NFA*

Table ES-1
GROUP 5 REPORTING AREA SURFICIAL MEDIA RFI RESULTS AND SITE ACTION RECOMMENDATIONS
Santa Susana Field Laboratory, Ventura County, California

RFI Site	Risk Estimate (Values provided are maximum risks calculated for entire site)			Grouped Chemical Use Areas (d) (Chemical Use Area Number)	Chemical Groups Detected / Matrix (soil matrix unless noted)	Areas Recommended for CMS Evaluation (e) (f)
	Human Risks (Surficial Media Plus Indirect Groundwater)		Ecological Risks (HI) (c)			
	Residential Risks (a) (b)	Recreator Risks (b)				
Department of Energy Leach Field 2	**Human ELCR: 7 x 10^{-7}** **Human HI: 0.006**	**Human ELCR: 2 x 10^{-7}** **Human HI: <0.01**	**Thrush: 2** (PCB_TEQ_Bird) **Hawk: 8 x 10-5** **Deer Mouse: 6.1** (PCB_TEQ_Mammal) **Bobcat: 3 x 10-5** **Mule Deer: 5 x 10-4**	**(1):** Substation 4713	None Detected	*NFA*
				(2): Substation 4708A/4708B	None Detected	*NFA*
				(3): Substation 4756	PCBs	*NFA*
				(4): Substation on Western Side of Building 4010	PCBs	*NFA*
				(5): Substation on Eastern Side of Building 4010	PCBs	*NFA*
				(6): Building 4010	VOCs, SVOCs, and Metals	*NFA*
				(7): Building 4010 Leach Field	Metals	*NFA*
				(8): Building 4012	TPHs and Metals	*NFA*
				(9): Air Compressor Pad/Cooling Water Pipelines	VOCs and Metals	*NFA*
				(10): Building 4013	SVOCs, TPHs, and Metals	*NFA*
				(11) and (12): EMGEN and T-L01 (Turbine)	SVOCs and TPHs	*NFA*
				(13), (14), and (15): TCF-1, TCF-2, and TCF-3	VOCs and SVOCs	*NFA*
				(16): EMSTG	SVOCs and TPHs	*NFA*
				(17): Substation 4413	None Detected	*NFA*
Department of Energy Leach Field 3	**Human ELCR: 4 x 10^{-5}** (PCE and TCE in NSGW and Benzo[a]pyrene in soil) **Human HI: 12** (TCE and Nitrate-N in NSGW)	**Human ELCR: 3 x 10^{-6}** (Benzo[a]pyrene in soil) **Human HI: <0.01**	**Thrush: 18** (PCB_TEQ_Bird) **Hawk: <1** **Deer Mouse: 54** (PCB_TEQ_Mammal) **Bobcat: <1** **Mule Deer: <1**	**(1):** Building 4353	None Detected	*NFA*
				(2): Building 4363	SVOCs, TPHs, and Metals	*NFA*
				(3): Building 4373	TPHs and Metals	*NFA*
				(4): Building 4383	Metals	*NFA*
				(5): Buildings 4375, 4874, and 4875	VOCs (soil vapor), SVOCs, TPHs, and Metals	*NFA*
				(6): Substation 4707	PCBs	*NFA*
				(7): Building 4374	Metals	*NFA*
				(8): Substation 4883 A	None Detected	*NFA*
				(9): Building 4055	VOCs (soil and soil vapor), SVOCs, TPHs, PCBs, and metals	*NFA*
				(10): Building 4462	VOCs, SVOCs, TPHs, and Metals	**DOELF3-1**
				(11): UT-75	None Detected	*NFA*
				(12): UST (north of Building 4363)	None Detected	*NFA*
				(13): UT-72	SVOCs and Metals	*NFA*
				(14): UT-12 (UT-55)	VOCs (soil and soil vapor), SVOCs, and TPHs	*NFA*
				(15): Building 4353 Leach Field	VOCs, TPHs, and Metals	*NFA*
				(16): Building 4363 Leach Field	SVOCs, TPHs, and Metals	*NFA*
				(17): Building 4373 Leach Field	TPHs, Metals, and Energetics	*NFA*
				(18): Building 4383 Leach Field	Metals	*NFA*
				(19): Substation 4760 A	None Detected	*NFA*
				(20): Substation 4755	None Detected	*NFA*
				(21): Transformer Pole X14	Not Sampled due to DTSC approved protocol	*NFA*
				(22): Substation 4762 B	SVOCs	**DOELF3-2**

Table ES-1
GROUP 5 REPORTING AREA SURFICIAL MEDIA RFI RESULTS AND SITE ACTION RECOMMENDATIONS
Santa Susana Field Laboratory, Ventura County, California

RFI Site	Risk Estimate (Values provided are maximum risks calculated for entire site)			Grouped Chemical Use Areas (d) (Chemical Use Area Number)	Chemical Groups Detected / Matrix (soil matrix unless noted)	Areas Recommended for CMS Evaluation (e) (f)
	Human Risks (Surficial Media Plus Indirect Groundwater)		Ecological Risks (HI) (c)			
	Residential Risks (a) (b)	Recreator Risks (b)				
Department of Energy Leach Field 3 (continued)				**(23):** Substation 4760 B	None Detected	*NFA*
				(24): Substation 4883 B	None Detected	*NFA*
				(25): Substation 4853	None Detected	*NFA*
				(26): Transformer Pole A324	None Detected	*NFA*
				(27): Building 4473	SVOCs, TPHs, and Metals	*NFA*
				(28): Building 4854	Metals	*NFA*
				(29): Building 4863	VOCs, SVOCs, TPHs, and Metals	*NFA*
				(30): Building 4873	SVOCs, TPHs, and Metals	*NFA*
				(31): Building 4015	SVOCs and Metals	*NFA*
				(32): Debris Area 3005	VOCs, SVOCs, TPHs, and Metals	*NFA*
				(33): Building 4463	VOCs, SVOCs, TPHs, and Metals	*NFA*
				(34): Substation 4780	None Detected	*NFA*
				(35): Building 4461	SVOCs and Metals	*NFA*
				(36): Building 4628	SVOCs, TPHs, and Metals	*NFA*
				(37): Building 4662	VOCs, SVOCs, and Metals	*NFA*
Hazardous Materials Storage Area	**Human ELCR: 3 x 10^{-5}** (Benzo[a]pyrene and Benzo[b]fluoranthene in soil) **Human HI: 8** (TCE, Molybdenum, and Fluoride in NSGW)	**Human ELCR: 3 x 10^{-7}** **Human HI: <0.01**	**Thrush: 5.4** (PCB_TEQ_Bird) **Hawk: <1** **Deer Mouse: 12.6** (PCB_TEQ_Mammal) **Bobcat: <1** **Mule Deer: <1**	**(1):** Building 4357	Metals	*NFA*
				(2): Building 4457, Sump #1, and Sump #2	VOCs (soil and soil vapor), SVOCs, TPHs, and Metals	*NFA*
				(3): T-357	Not sampled because tank contained only argon.	*NFA*
				(4): Building 4025	VOCs, SVOCs, and Metals	**HMSA-2**
				(5): Building 4024	VOCs, SVOCs, TPHs and Metals	**HMSA-1**
				(6): Substation 4725	None Detected	*NFA*
				(7): Buildings 4026, 4426, 4826, and 4226	VOCs (soil and soil vapor), SVOCs, TPH, PCBs and Metals	*NFA*
				(8): Substation 4726	PCBs	*NFA*
				(9): Building 4334	VOCs, SVOCs, TPHs, PCBs, and Metals	*NFA*
				(10): Building 4358	TPHs and Metals	*NFA*
				(11): Building 4355	SVOCs, TPHs, PCBs, and Metals	*NFA*
				(12): Building 4356, including tanks and transformers located inside Building 4356	VOCs (soil vapor), SVOCs, TPHs, and Metals	*NFA*
				(13): Building 4361, including tanks located inside Building 4361	SVOCs and Metals	*NFA*
				(14): Building 4656	None Detected	*NFA*
				(15): Building 4625	VOCs and Metals	*NFA*
				(16): UT-19	None Detected	*NFA*
Rockwell International Hot Laboratory	**Human ELCR: 9 x 10^{-6}** (Aroclor 1254 and Aroclor 1260 in soil) **Human HI: 5** (TCE and Nitrate-NO_3 in NSGW)	**Human ELCR: 3 x 10^{-6}** (Aroclor 1260 in soil) **Human HI: <0.01**	**Thrush: 354** (PCB_TEQ_Bird) **Hawk: <1** **Deer Mouse: 717** (PCB_TEQ_Mammal) **Bobcat: <1** **Mule Deer: 1.3** (Nickel)	**(1):** Building 4020 and Hydraulic Lift	VOCs, SVOCs, TPHs, and Metals	*NFA*
				(2): Aboveground Tanks	Not sampled, contained only Nitrogen	*NFA*
				(3): UT-10 and UT-11	Not sampled due to no sign of contamination during excavation of two tanks.	*NFA*
				(4): Substation 4720	PCBs	**RIHL-1**
				(5): Northeast portion of RFI site	SVOCs, TPHs, and Metals	**RIHL-1**

Table ES-1
GROUP 5 REPORTING AREA SURFICIAL MEDIA RFI RESULTS AND SITE ACTION RECOMMENDATIONS
Santa Susana Field Laboratory, Ventura County, California

RFI Site	Risk Estimate (Values provided are maximum risks calculated for entire site)			Grouped Chemical Use Areas (d) (Chemical Use Area Number)	Chemical Groups Detected / Matrix (soil matrix unless noted)	Areas Recommended for CMS Evaluation (e) (f)
	Human Risks (Surficial Media Plus Indirect Groundwater)		Ecological Risks (HI) (c)			
	Residential Risks (a) (b)	Recreator Risks (b)				
Systems for Nuclear Auxilliary Power	**Human ELCR: 2 x 10^{-3}** (PCE in NSGW) **Human HI: 10** (PCE, TCE, and Fluoride in NSGW)	**Human ELCR: 1 x 10^{-7}** **Human HI: <0.01**	**Thrush: 2.8** (PCB_TEQ_Bird) **Hawk: 2 x 10^{-4}** **Deer Mouse: 8.5** (PCB_TEQ_Mammal) **Bobcat: 1 x 10^{-4}** **Mule Deer: 2 x 10^{-3}**	**(1) and (2):** Building 4059 (AOC) and Bldg 4059 French Drain System	VOCs (soil and soil vapor), TPHs, and Metals	*NFA*
				(3): Building 4057	VOCs (soil and soil vapor), SVOCs, TPHs, and Metals	**SNAP-1**
				(4): Building 4358	VOCs, TPHs, and Metals	*NFA*
				(5): Building 4360	SVOCs, TPHs, and Metals	*NFA*
				(6): Building 4459	VOCs, SVOCs, TPHs, and Metals	*NFA*
				(7): UT-36	No sampling due to documentation gap of regulatory closure of tank.	*NFA*
				(8) Building 4757 Transformer	None Detected	*NFA*
				(9): Building 4759 Transformer	None Detected	*NFA*
				(10): Building 4719 Transformer	None Detected	*NFA*
				(11) and (12): Acid and Sodium Hydroxide Aboveground Storage Tanks	pH ranged from 4.3 to 9.2	*NFA*
				(13): Building 4626	VOCs (soil and soil vapor), SVOCs, TPHs, PCBs, and metals	**SNAP-1**

General Notes:
NFA - No Further Action
CMS -Corrective Measure Study

Notes:
(a) Residential risk estimates presented above do not include direct groundwater exposures.
(b) Primary contributors to the total RME risk are listed when ELCR > 10-6 or HI > 1. Only compounds contributing 10% or more towards total risk are listed. See Appendix A for complete listing.
(c) The maximum HQ listed for ecological receptors are only for compounds carried forward as constituents of potential ecological concern. The compounds listed for HQ's > 1 are the compounds which generated the mazimum HQ value.
(d) Chemical use areas have been grouped by location and related chemical use.
(e) CMS Areas are numbered in sequence (e.g. HMSA-1, HMSA-2, etc.). Extent of CMS Areas shown on Figures ES-1 are approximate and reflect site action recommendations based on characterization and risk assessment results inclusive for all receptors (See Section 7). Interim stabilization does not appear to be warrranted at any of the recommended CMS areas.
(f) For RFI sites where the entirety of the site is NFA but the HI exceed 1 or ELCR exceeds 10^{-6} further explanation of the NFA is provided in the appropriate RFI site appendix and Section 6 tables.
(g) Chemical use area numbers skipped were moved from PDU to HMSA

TABLE 3-1
Type of Chemical Use Areas and Typical Target Analytical Suites
Group 5 RFI Report, Santa Susana Field Laboratory, Ventura County, California

		Typical Analytical Methods Used for RFI Characterization										
Chemical Use Area Type	**Chemical use description**	**VOCs**	**SVOCs**	**TPH**	**PCBs**	**Metals**	**Dioxins**	**Energetics**	**Perchlorate**	**NDMA**	**Formaldehyde**	**pH**
Solvents	Engine/component testing areas, laboratories, storage areas, clarifiers, sumps/pits, degreasers, and storage tanks and associate pipelines	X										
Petroleum fuels	Gasoline, jet or rocket fuel, diesel storage tanks and associated pipelines, and engine/component testing areas	X[(a)]		X								
Oil-related Materials	Hydraulic and lubricant oils, sumps/pits, waste oils and transformers		X	X	X	X						
Metal wastes (*not associated with debris disposal*)	Corrosive activities/area, sumps/pits, and storage tanks					X						X
Debris Areas	Landfills and debris and burn areas (incinerators)	X[(b)]	X[(b)]	X	X[(b)]	X	X[(b)]					
Perchlorate and Energetic Constituents	Storage, testing and handling					X		X	X			
Hydrazine Fuels	Small engine or system testing areas									X	X	
Other areas screened for potential chemical use/impacts	Leach fields, general storage areas, disturbed terrain	X		X		X						

Note:
(a) VOCs were analyzed in areas of gasoline use
(b) VOCs were typically screened for in these areas, and dioxins/SVOCs analyzed if visible burned materials were present. PCBs were typically analyzed if elevated concentrations of lubricant oil-range TPH were detected.
Source: Group 6 RFI Report

Table 3-2
Group 5 Reporting Area Chemical Use Investigation Areas
Santa Susana Field Laboratory, Ventura County, California

Chemical Use Area Number	Chemical Use Area Name	Potential Chemicals Used/Stored	Chemical Use Area Types and Typical Target Analytical Suites														
			Solvent	Petroleum Fuels		Hydrazine-Related Compounds	Oil-Related Materials	Metal Wastes (exclusive of debris areas)	Debris Areas/ Fill	Energetic Constituents	Trans-formers	Leach Field	Non-metal Inorganic Compounds	Non-metal Inorganic Compounds		Acids/ Bases	
			VOCs	TPH, VOCs [1]	SVOCs	VOCs, SVOCs (Hydrazines, Formaldehyde, NDMA, UDMH, and MMH)	SVOCs, TPH, PCBs, Metals	Metals, pH	TPH, Metals, VOCs, SVOCs, PCBs, Dioxins [2]	Energetics, Metals	PCBs		Fluoride, Chloride, Nitrate, Sulfate, Bromide	Perchlorate	Dioxins, Furans	pH	Asbestos
Boeing Area IV Leach Fields RFI Site (an Area IV AOC) - Appendix D																	
1	Building 4011 (including AT-05 and AT-06)	VOCs, TPH, Metals	X	X				X									
2	Buildings 4007 and 4008	Metals, hydrazine, VOCs, oils and lubricants, diesel, PCBs	X	X		X	X	X			X			X			
3	Building 4711	PCBs									X						
4	Building 4611	VOCs	X														
5	Building 4171	Silver, aluminum						X									
6	AST 4735	Fuel-oil		X													
7	UT-06	Diesel/Fuel-oil		X													
8	Building 4011 Leach Field	Assumed to be the same as those for Building 4011 [3]										X [3]					
9	Building 4172	Silver, aluminum, hydroquinone	X					X									
10	Transformer Pole D-5	PCBs									X						
11	Sodium Component Test Installation (SCTI) Pump Station	TPH, PAHs		X	X												
12	Parking Lot 4502	PAHs			X												
Compound A RFI Site (SWMU 6.4) - Appendix E																	
1	Building 3418	Chlorine Pentafluoride (Compound A) and Fluorine Production (TCA, TCE, acetone, dowtherm, corrosives [iron fluorides], hydrofluoric acid, chloride, chlorine, fluorine, fluoride salts, trifluoride), Laser Chemical Manufacturing (hydrogen fluoride, nitrogen, antimony, antimony pentafluoride, nitrogen trifluoride, fluorine gas, sodium fluoride, chloride, fluoride, hydrofluoric acid)	X		X			X		X			X			X	
2	Forming Pits	Explosives (C-4, TNT [trinitrotoluene]), aluminum						X		X							
3	Compound A Pond	Used to control wastewater from material research or used for a holding pond for caustic solutions (sodium hydroxide)	X		X	X			X	X			X	X		X	
4	Fluorine Pipeline	Fluorine											X			X	
5	Storage Shed	Hazardous Materials Storage	X	X	X					X			X			X	
6	Impoundment	Wastewater was stored in unlined surface water impoundment	X		X			X				X	X				

Table 3-2
Group 5 Reporting Area Chemical Use Investigation Areas
Santa Susana Field Laboratory, Ventura County, California

Chemical Use Area Number	Chemical Use Area Name	Potential Chemicals Used/Stored	Chemical Use Area Types and Typical Target Analytical Suites														
			Solvent	Petroleum Fuels		Hydrazine-Related Compounds	Oil-Related Materials	Metal Wastes (exclusive of debris areas)	Debris Areas/ Fill	Energetic Constituents	Trans-formers	Leach Field	Non-metal Inorganic Compounds	Non-metal Inorganic Compounds		Acids/ Bases	
			VOCs	TPH, VOCs [1]	SVOCs	VOCs, SVOCs (Hydrazines, Formaldehyde, NDMA, UDMH, and MMH)	SVOCs, TPH, PCBs, Metals	Metals, pH	TPH, Metals, VOCs, SVOCs, PCBs, Dioxins [2]	Energetics, Metals	PCBs		Fluoride, Chloride, Nitrate, Sulfate, Bromide	Perchlorate	Dioxins, Furans	pH	Asbestos
7	Dump Site	Appears to be dump site for scrap metal, drums, 5000 gallon AST (unknown contents), etc.		X					X	X			X				
8	Explosive magazines	Workshop and bunkers for storage of energetics and explosive devices	X					X		X							
9	STL-IV Air Stripping Towers	VOCs	X								X						
10a	Suspect Dredge Materials (North)	Unknown							X								
10b	Suspect Dredge Materials (South)	Unknown							X								
Engineering Chemistry Laboratory (ECL) RFI Site (SWMU 6.1, 6.2, 6.3, and an Area IV AOC) - Appendix F																	
1	Engineering Chemistry Laboratory	Solvents, petroleum hydrocarbons, SVOCs, metals, energetics, propellants, formaldehyde, general chemistry (fluoride, nitrate, chloride)	X	X	X	X		X		X			X	X			
2	Building 3260	Metals, VOCs, TPH, NTO, general chemistry (fluoride, chloride)	X	X		X	X	X					X	X			
3	Building 3798	VOCs, fuel-oil, hydrazine, NTO	X	X		X								X			
4	ECL Pond	Solvents, petroleum hydrocarbons, SVOCs, metals, energetics, propellants, formaldehyde, general chemistry (fluoride, nitrate, chloride)	X	X	X	X		X		X			X	X			
5	ECL Suspect Pond	Solvents, petroleum hydrocarbons, SVOCs, metals, energetics, propellants, formaldehyde, general chemistry (fluoride, nitrate, chloride)	X	X	X	X		X		X			X	X			
6	Building 3270 Leach Field	Assumed to be the same as those for Building 3270[4]										X [4]					
7	Substation Adjacent to Building 3367	PCBs									X						
8	Building 3799	Solvents, hydrazine, NTO	X			X								X			
9	Building 3258	Solvents, PCBs, Oil, metals, and waste construction debris (including asbestos).	X	X			X	X									X
10	Building 3269	General chemistry (fluoride, chloride, bromide)											X				
11	Substation West of Building 3259	PCBs									X						
12	Bunker South of Building 3269	Energetics, propellants				X				X				X			
13	Bunker East of Engineering Chemistry Lab	Energetics, propellants				X				X				X			

Table 3-2
Group 5 Reporting Area Chemical Use Investigation Areas
Santa Susana Field Laboratory, Ventura County, California

Chemical Use Area Number	Chemical Use Area Name	Potential Chemicals Used/Stored	Chemical Use Area Types and Typical Target Analytical Suites														
			Solvent	Petroleum Fuels		Hydrazine-Related Compounds	Oil-Related Materials	Metal Wastes (exclusive of debris areas)	Debris Areas/ Fill	Energetic Constituents	Trans-formers	Leach Field	Non-metal Inorganic Compounds	Non-metal Inorganic Compounds		Acids/ Bases	
			VOCs	TPH, VOCs [1]	SVOCs	VOCs, SVOCs (Hydrazines, Formaldehyde, NDMA, UDMH, and MMH)	SVOCs, TPH, PCBs, Metals	Metals, pH	TPH, Metals, VOCs, SVOCs, PCBs, Dioxins [2]	Energetics, Metals	PCBs		Fluoride, Chloride, Nitrate, Sulfate, Bromide	Perchlorate	Dioxins, Furans	pH	Asbestos
Environmental Effects Laboratory (EEL) RFI Site (SWMU 6.9) - Appendix G																	
1	EEL Cryogenic Laboratory and Test Cells	solvents, metals. oil	X	X			X	X					X				
2	EEL Storage	solvents, metals. oil	X					X					X				
3	EEL Mechanics Workshop	solvents, metals. oil	X	X			X	X									
4	Office	No chemicals used															
5	Tanks	hydraulic oil, gaseous hydrogen/nitrogen/helium.		X			X										
6	Transformers	PCBs			X						X						
7	Hazardous Materials Storage Pad	VOCs, metals, oil	X	X			X	X									
Pond Dredge Area RFI Site (an Area IV AOC) - Appendix H																	
1	Pond Dredge	Dredge materials from Silvernale and R-2 Ponds	X	X	X	X		X	X	X	X		X	X			
Coal Gasification Process Development Unit (PDU) RFI Site (SWMU 7.10) - Appendix I																	
1	Building 4005	PCB, benzene, calcium carbonate, coal, coal dust, coke, cyanide, green liquor (organics, sulfur compounds, and ash, pH =12), silica, chloramines, hexachlorobenzene, sodium carbonate, molten salt carbonate, chromium, toluene, xylene, aromatic hydrocarbons, heavy metals	X	X	X		X	X					X				
2	Building 4006	Tritium titanium foils, mercury, tetralin			X			X									
3	Buildings 4026, 4426, 4826, and 4226	**Moved to HMSA**															
4	Building 4027	Beryllium, lab packs, waste oil, contaminated waste solids, debris, batteries, paint waste, wastewater, flammable waste, caustics, corrosives	X	X	X	X	X	X	X	X			X				
5	Building 4032	Kerosene, PCBs, lead paint, asbestos		X			X	X			X						
6	Building 4042	Lithium, alcohol						X									
7	Former PDU Area	Terphenyl organics, aluminum, caustics, solvents, metals, SVOC, asbestos, Freon, lead paint, sodium hydroxide	X				X	X					X				

Table 3-2
Group 5 Reporting Area Chemical Use Investigation Areas
Santa Susana Field Laboratory, Ventura County, California

Chemical Use Area Number	Chemical Use Area Name	Potential Chemicals Used/Stored	Chemical Use Area Types and Typical Target Analytical Suites														
			Solvent	Petroleum Fuels		Hydrazine-Related Compounds	Oil-Related Materials	Metal Wastes (exclusive of debris areas)	Debris Areas/ Fill	Energetic Constituents	Trans-formers	Leach Field	Non-metal Inorganic Compounds	Non-metal Inorganic Compounds		Acids/ Bases	
			VOCs	TPH, VOCs [1]	SVOCs	VOCs, SVOCs (Hydrazines, Formaldehyde, NDMA, UDMH, and MMH)	SVOCs, TPH, PCBs, Metals	Metals, pH	TPH, Metals, VOCs, SVOCs, PCBs, Dioxins [2]	Energetics, Metals	PCBs		Fluoride, Chloride, Nitrate, Sulfate, Bromide	Perchlorate	Dioxins, Furans	pH	Asbestos
8	Building 4359	**Moved to HMSA**															
9	Building 4334	**Moved to HMSA**															
10	Building 4358	**Moved to HMSA**															
11	Building 4402	Solvents	X														
12	Building 4607	None															
13	Building 4616	Sodium nitrate base chemical						X					X				
14	Coal Storage Yard	Solvents, PCBs, Oil, Metals, and waste construction debris (including asbestos).	X	X			X	X					X				
15	Building 4705	None															
16	Substation 4704	PCBS															
17	Transformer 4706	PCBs									X						
18	Transformer 4727	PCBs															
19	Substation 4726	**Moved to HMSA**															
20	Transformer 4742	PCBs									X						
21	Building 4005/4006 Leach Field	Solvents										X[5]					
22	Bag House	PCB, benzene, calcium carbonate, coal, coal dust, coke, cyanide, green liquor (organics, sulfur compounds, and ash, pH =12), silica, chloramines, hexachlorobenzene, sodium carbonate, molten salt carbonate, chromium, toluene, xylene, aromatic hydrocarbons, heavy metals	X	X			X	X					X				
23	Catchment Basin	PCB, benzene, calcium carbonate, coal, coal dust, coke, cyanide, green liquor (organics, sulfur compounds, and ash, pH =12), silica, chloramines, hexachlorobenzene, sodium carbonate, molten salt carbonate, chromium, toluene, xylene, aromatic hydrocarbons, heavy metals	X	X	X		X	X					X				

Table 3-2
Group 5 Reporting Area Chemical Use Investigation Areas
Santa Susana Field Laboratory, Ventura County, California

Chemical Use Area Number	Chemical Use Area Name	Potential Chemicals Used/Stored	Chemical Use Area Types and Typical Target Analytical Suites														
			Solvent	Petroleum Fuels		Hydrazine-Related Compounds	Oil-Related Materials	Metal Wastes (exclusive of debris areas)	Debris Areas/ Fill	Energetic Constituents	Trans-formers	Leach Field	Non-metal Inorganic Compounds	Non-metal Inorganic Compounds		Acids/ Bases	
			VOCs	TPH, VOCs [1]	SVOCs	VOCs, SVOCs (Hydrazines, Formaldehyde, NDMA, UDMH, and MMH)	SVOCs, TPH, PCBs, Metals	Metals, pH	TPH, Metals, VOCs, SVOCs, PCBs, Dioxins [2]	Energetics, Metals	PCBs		Fluoride, Chloride, Nitrate, Sulfate, Bromide	Perchlorate	Dioxins, Furans	pH	Asbestos
24	17 Street Drainage Area	Iron, PCB, benzene, calcium carbonate, coal, coal dust, coke, cyanide, green liquor (organics, sulfur compounds, and ash, pH =12), silica, chloramines, hexachlorobenzene, sodium carbonate, molten salt carbonate, chromium, toluene, xylene, aromatic hydrocarbons, heavy metals	X	X	X		X	X					X				
25	Building 4037	Solvents, 1,4-dioxane, Diesel, hydraulic oil, waste oils, metals	X	X	X		X	X									
Area 3 Sewage Treatment Plant (STP-3) RFI Site (an Area III AOC) - Appendix J																	
1	Area III STP	Sanitary sewage treatment. Also received cooling tower discharge (may include VOCs and rocket fuel).	X	X	X	X		X		X			X	X			
2	STP Pond	Pond designed to hold radioactive sewage from Area IV if there was a release. Not ever used for that purpose according to site personnel.	X	X	X	X		X		X			X	X			
3	STP Clarifier	Part of treatment system	X	X		X		X		X			X	X			
4	Former Ranch House	Unknown	X	X				X					X				
SE Drum Storage Yard (SE Drum Yard) RFI Site (an Area IV AOC) - Appendix K																	
1	SE Drum Storage Yard	Unknown	X	X	X	X		X		X							
Systems Test Laboratory IV (STL-IV) RFI Site (SWMU 6.5, 6.6, and 6.7) - Appendix L																	
1	Module 3	VOCs, SVOC, propellants, metals	X			X		X					X				
2	Fuel Storage Area/ Monomethyl Hydrazine (MMH) Ozonator Tank	VOCs, SVOC, propellants, metals	X	X	X	X		X			X		X				
3	Fuel Storage Area/ Monomethyl Hydrazine (MMH) Ozonator Tank	VOCs, SVOC, propellants, metals, TPH	X	X		X		X					X				

Table 3-2
Group 5 Reporting Area Chemical Use Investigation Areas
Santa Susana Field Laboratory, Ventura County, California

Chemical Use Area Number	Chemical Use Area Name	Potential Chemicals Used/Stored	Chemical Use Area Types and Typical Target Analytical Suites														
			Solvent	Petroleum Fuels		Hydrazine-Related Compounds	Oil-Related Materials	Metal Wastes (exclusive of debris areas)	Debris Areas/ Fill	Energetic Constituents	Trans-formers	Leach Field	Non-metal Inorganic Compounds	Non-metal Inorganic Compounds		Acids/ Bases	
			VOCs	TPH, VOCs [1]	SVOCs	VOCs, SVOCs (Hydrazines, Formaldehyde, NDMA, UDMH, and MMH)	SVOCs, TPH, PCBs, Metals	Metals, pH	TPH, Metals, VOCs, SVOCs, PCBs, Dioxins [2]	Energetics, Metals	PCBs		Fluoride, Chloride, Nitrate, Sulfate, Bromide	Perchlorate	Dioxins, Furans	pH	Asbestos
4	STL-IV Impoundments 1 and 2 and Associated Channels	VOCs, SVOC, propellants, metals	X			X		X					X				
5	Engine Test Stand No. 2 and Module 2	VOCs, SVOC, propellants, metals	X		X	X		X					X				
6	Building 3794, Hot Water Boiler Shelter, and Building 3780, Assembly Decontamination	VOCs	X	X			X	X									
7	Engine Test Stand No. 3 and Module 1	VOCs, SVOC, propellants, metals	X	X		X		X					X				
8	Building 3254	VOCs, SVOC, propellants, metals	X		X	X		X			X		X				
9	Building 3318/Workshop/Instrumentation Shop/Tool Crib	VOCs, metals	X					X									
10	Hazardous Waste Storage Locker, VOC Storage and Use, General Storage and Use	VOCs, SVOC, propellants, metals, TPH	X	X				X									
11	Explosive Use/Storage	VOCs, SVOC, propellants, metals, TPH				X				X			X	X			
12	Engine Test Stand No. 4	VOCs, SVOC, propellants, metals, TPH	X	X	X	X		X					X				
13	Suspect Pond	VOCs, SVOC, propellants, metals, TPH	X	X	X	X		X					X		X		
14	Operations Trailer/Clean Room Trailer/Lunch Room	VOCs	X														
15	Nitro Tetroxide (NTO) Storage Area	VOCs, SVOC, propellants, metals, TPH	X	X		X		X									
16	Leach Field	VOCs, SVOC, propellants, metals, TPH	X	X	X	X		X					X				
17	STL-IV Explosive Bunkers	Energetics								X							

Table 3-2
Group 5 Reporting Area Chemical Use Investigation Areas
Santa Susana Field Laboratory, Ventura County, California

Chemical Use Area Number	Chemical Use Area Name	Potential Chemicals Used/Stored	Chemical Use Area Types and Typical Target Analytical Suites														
			Solvent	Petroleum Fuels		Hydrazine-Related Compounds	Oil-Related Materials	Metal Wastes (exclusive of debris areas)	Debris Areas/ Fill	Energetic Constituents	Trans-formers	Leach Field	Non-metal Inorganic Compounds	Non-metal Inorganic Compounds		Acids/ Bases	
			VOCs	TPH, VOCs [1]	SVOCs	VOCs, SVOCs (Hydrazines, Formaldehyde, NDMA, UDMH, and MMH)	SVOCs, TPH, PCBs, Metals	Metals, pH	TPH, Metals, VOCs, SVOCs, PCBs, Dioxins [2]	Energetics, Metals	PCBs		Fluoride, Chloride, Nitrate, Sulfate, Bromide	Perchlorate	Dioxins, Furans	pH	Asbestos
18	Debris Location 3001, Debris Location 3002	Metals							X								
Building 65 Metals Laboratory Clarifier (Building 65) RFI Site (an Area IV AOC) - Appendix M																	
1	Bldg 4065 Metals Clarifier	Solvents, metals, acids, bases, kerosene.	X	X				X								X	
2	Bldg 4065	Solvents, metals, acids, bases, kerosene.	X	X				X								X	
3	UT-76	Fuel oil		X													
4	UT-70	Fuel oil		X													
5	Substation 4762	PCBs									X						
6	Bldg 4066	Unknown chemicals, battery acid release	X				X	X									
7	Bldg 4062	Unknown chemicals	X				X	X									
Building 100 Trench Area (Building 100) RFI Site (SWMU 7.5) - Appendix N																	
1	Bldg 100 Trench	Debris (dioxins and metals detected onsite)							X							X	
2	Building 100 Area - Potential Source of VOCs and Dioxins	VOCs and dioxins suspected based on nearby groundwater and soil sampling results, respectively	X											X			
3a	Hummocky Area - Western	Unknown (metals detected onsite)							X								
3b	Hummocky Area - Northern	Unknown							X								
4	Bldg 100 Leach Field	Unknown										X					
5	Bldg 4463	**Moved to DOE LF3**															
6	Transformer 4800 (4710)	PCBs									X						
Department of Energy Leach Fields 1 (DOE LF1) RFI Site (an Area IV AOC) - Appendix O																	
1	Building 4093 Leach Field	Unknown										X					
2	Building 4030 Leach Field	Assumed to be the same as those for Building 4030 [6]										X [6]					
3	Building 4074	Silver						X									
4	Building 4023	Metals (including mercury), inorganic compounds						X					X				
5	Building 4030/4035	Metals (including hexavalent chromium), inorganic compounds, diesel		X				X					X				
6	Electrical Substation located north of Building 4641	PCBs									X						
7	Transformer Pole	PCBs									X						

Table 3-2
Group 5 Reporting Area Chemical Use Investigation Areas
Santa Susana Field Laboratory, Ventura County, California

Chemical Use Area Number	Chemical Use Area Name	Potential Chemicals Used/Stored	Chemical Use Area Types and Typical Target Analytical Suites														
			Solvent	Petroleum Fuels		Hydrazine-Related Compounds	Oil-Related Materials	Metal Wastes (exclusive of debris areas)	Debris Areas/ Fill	Energetic Constituents	Trans-formers	Leach Field	Non-metal Inorganic Compounds	Non-metal Inorganic Compounds		Acids/ Bases	
			VOCs	TPH, VOCs [1]	SVOCs	VOCs, SVOCs (Hydrazines, Formaldehyde, NDMA, UDMH, and MMH)	SVOCs, TPH, PCBs, Metals	Metals, pH	TPH, Metals, VOCs, SVOCs, PCBs, Dioxins [2]	Energetics, Metals	PCBs		Fluoride, Chloride, Nitrate, Sulfate, Bromide	Perchlorate	Dioxins, Furans	pH	Asbestos
8	Building 4641	VOCs, TPH		X													
9	Building 4073	Unknown															
10	Building 4083	Unknown															
11	Buildings 4093 and 4893	Unknown															
12	Building 4103	Unknown															
13	Building 4123	Unknown															
14	Building 4453	Unknown															
Department of Energy Leach Fields 2 (DOE LF2) RFI Site (an Area IV AOC) - Appendix P																	
1	Substation 4713	PCBs									X						
2	Substation 4708A/4708B	PCBs									X						
3	Substation 4756	PCBs									X						
4	Substation on Western Side of Building 4010	PCBs									X						
5	Substation on Eastern Side of Building 4010	PCBs									X						
6	Building 4010	Hydrazine, metals, TCE	X			X		X						X			
7	Building 4010 Leach Field	Assumed to be the same as those for Building 4010 [7]										X [7]					
8	Building 4012	Metals, TPH?						X									
9	Air Compressor Pad/Cooling Water Pipelines	Hydrazine				X								X			X
10	Building 4013	Oil (TPH, PCBs, metals), TPH		X			X										
11	EMGEN	#2 fuel oil		X													
12	T-L01 (Turbine)	#797 oil					X										
13	TCF-1	Hydrazine				X								X			
14	TCF-2	Morpholine	X														
15	TCF-3	Sulphuric Acid														X	
16	EMSTG	#797 oil					X										
17	Substation 4413	PCBs									X						
Department of Energy Leach Fields 3 (DOE LF3) RFI Site (an Area IV AOC) - Appendix Q																	
1	Building 4353	Energetics								X							
2	Building 4363	Metals, Solvents, Kerosene, Naphthalene	X	X	X	X		X									
3	Building 4373	TPH, solvents, metals (including mercury), propellants	X	X				X									
4	Building 4383	Solvents	X														
5	Buildings 4375, 4874, and 4875	Unknown (Barrel Storage)	X	X	X	X		X									
6	Substation 4707	PCBs									X						

Table 3-2
Group 5 Reporting Area Chemical Use Investigation Areas
Santa Susana Field Laboratory, Ventura County, California

Chemical Use Area Number	Chemical Use Area Name	Potential Chemicals Used/Stored	Chemical Use Area Types and Typical Target Analytical Suites														
			Solvent	Petroleum Fuels		Hydrazine-Related Compounds	Oil-Related Materials	Metal Wastes (exclusive of debris areas)	Debris Areas/ Fill	Energetic Constituents	Trans-formers	Leach Field	Non-metal Inorganic Compounds	Non-metal Inorganic Compounds		Acids/ Bases	
			VOCs	TPH, VOCs [1]	SVOCs	VOCs, SVOCs (Hydrazines, Formaldehyde, NDMA, UDMH, and MMH)	SVOCs, TPH, PCBs, Metals	Metals, pH	TPH, Metals, VOCs, SVOCs, PCBs, Dioxins [2]	Energetics, Metals	PCBs		Fluoride, Chloride, Nitrate, Sulfate, Bromide	Perchlorate	Dioxins, Furans	pH	Asbestos
7	Building 4374	Solvents, metals	X					X									
8	Substation 4883 A	PCBs									X						
9	Building 4055	Solvents, Metals	X					X									
10	Building 4462	TPH, metals		X				X									
11	UT-75	TPH, VOCs (including naphthalene)	X	X													
12	UST (north of Building 4363)	TPH		X													
13	UT-72	TPH, mercury		X				X									
14	UT-12 (UT-55)	TPH		X													
15	Building 4353 Leach Field	Assumed to be the same as those for Building 4353 [8]								X		X [8]					
16	Building 4363 Leach Field	Assumed to be the same as those for Building 4363 [9]										X [9]					
17	Building 4373 Leach Field	Assumed to be the same as those for Building 4373 [10]										X [10]					
18	Building 4383 Leach Fiel	Assumed to be the same as those for Building 4383 [11]										X [11]					
19	Substation 4760 A	PCBs									X						
20	Substation 4755	PCBs									X						
21	Transformer Pole X14	PCBs									X						
22	Substation 4762 B	PCBs									X						
23	Substation 4760 B	PCBs									X						
24	Substation 4883 B	PCBs									X						
25	Substation 4853	PCBs									X						
26	Transformer Pole A324	PCBs									X						
27	Building 4473	Unknown	X	X			X	X									
28	Building 4854	Unknown								X							
29	Building 4863	Unknown	X	X			X	X									
30	Building 4873	Unknown	X	X			X	X									
31	Building 4015	PCBs									X						
32	Debris Area 3005	Unknown	X		X			X			X						
33	Building 4463	solvents, TPH	X	X													
34	Substation 4780	PCBs									X						
35	Building 4461	Unknown	X	X			X	X		X			X				
36	Building 4628	Unknown	X	X			X	X		X			X				
37	Building 4662	Unknown	X	X			X	X		X			X				
Hazardous Materials Storage Area (HMSA) RFI Site (SWMU 5.7) - Appendix R																	
1	Building 4357	Metals						X									
2	Building 4457	Waste oils, acids, bases, solvents, TPH oils, lubricants	X		X		X	X					X			X	
2	Sump #1	Acids, bases, solvents, oils, lubricants	X				X						X				

Table 3-2
Group 5 Reporting Area Chemical Use Investigation Areas
Santa Susana Field Laboratory, Ventura County, California

			Chemical Use Area Types and Typical Target Analytical Suites														
			Solvent	Petroleum Fuels		Hydrazine-Related Compounds	Oil-Related Materials	Metal Wastes (exclusive of debris areas)	Debris Areas/ Fill	Energetic Constituents	Trans-formers	Leach Field	Non-metal Inorganic Compounds	Non-metal Inorganic Compounds		Acids/ Bases	
Chemical Use Area Number	Chemical Use Area Name	Potential Chemicals Used/Stored	VOCs	TPH, VOCs [1]	SVOCs	VOCs, SVOCs (Hydrazines, Formaldehyde, NDMA, UDMH, and MMH)	SVOCs, TPH, PCBs, Metals	Metals, pH	TPH, Metals, VOCs, SVOCs, PCBs, Dioxins [2]	Energetics, Metals	PCBs		Fluoride, Chloride, Nitrate, Sulfate, Bromide	Perchlorate	Dioxins, Furans	pH	Asbestos
2	Sump #2	Oils, solvents	X				X										
3	T-357	Liquid Argon															
4	Building 4025	VOCs, Acetic acid, potassium permanganate, sodium bisulfide, ammonium carbonate, ethylene diamine tetra-acetic acid (EDTA), and ferrous sulfate	X					X					X				
5	Building 4024	Metals, PCBs, General chemistry						X			X		X			X	
6	Substation 4725	PCBs									X						
7	Buildings 4026, 4426, 4826, 4359 and 4226	TPH. SVOCs, metals, and inorganic compounds		X	X			X					X				
8	Substation 4726	PCBs									X						
9	Building 4334	Aqueous ammonia, anhydrous ammonia, turbine lube oil, compressor oil, greases, and lubricants					X										
10	Building 4358	Metals, oils, and perchlorate					X						X	X			
11	Building 4355	Acid/base, oils, and general chemistry					X						X			X	
12	Building 4356, including tanks and transformers located inside Building 4356	Metals, hydrazine, morpholine, PCBs, Petroleum (diesel), sulfuric acid		X		X		X			X					X	
13	Building 4361, including tanks located inside Building 4361	Chlorine, hydrazine, acids/bases				X							X			X	
14	Building 4656	Hydrazine, Morpholine, Acids/bases				X										X	
15	Building 4625	Unknown	X	X			X	X		X			X				
16	UT-19	Fuel oil		X													
Rockwell International Hot Lab (RIHL) RFI Site (SWMU 7.7) - Appendix S																	
1	Building 4020 and Hydraulic Lift	Oil related materials, alcohols, solvents, acids, metals	X	X	X		X	X									
2	Aboveground Tanks	Liquid Nitrogen	**No sampling is needed at this location. The above ground tanks at this location contained liquid nitrogen.**														
3	UT-10 and UT-11	Fuel-Oil	**Tanks were removed under Regulatory Closure Permits #1286 and #424 with no signs of contamination after remedial excavation.**														
4	Substation 4720	PCBs									X						
5	Northeast portion of RFI site	Metals						X									
Systems for Nuclear Auxiliary Power Facility (SNAP) RFI Site (an Area IV AOC) - Appendix T																	
1	Building 4059 (AOC)	Mercury, platinum, freon, BTEX, acetone, kerosene, and Dowanol.	X	X				X									
2	Bldg 4059 French Drain System	VOCs	X														

Table 3-2
Group 5 Reporting Area Chemical Use Investigation Areas
Santa Susana Field Laboratory, Ventura County, California

Chemical Use Area Number	Chemical Use Area Name	Potential Chemicals Used/Stored	Chemical Use Area Types and Typical Target Analytical Suites														
			Solvent	Petroleum Fuels		Hydrazine-Related Compounds	Oil-Related Materials	Metal Wastes (exclusive of debris areas)	Debris Areas/ Fill	Energetic Constituents	Trans-formers	Leach Field	Non-metal Inorganic Compounds	Non-metal Inorganic Compounds		Acids/ Bases	
			VOCs	TPH, VOCs [1]	SVOCs	VOCs, SVOCs (Hydrazines, Formaldehyde, NDMA, UDMH, and MMH)	SVOCs, TPH, PCBs, Metals	Metals, pH	TPH, Metals, VOCs, SVOCs, PCBs, Dioxins [2]	Energetics, Metals	PCBs		Fluoride, Chloride, Nitrate, Sulfate, Bromide	Perchlorate	Dioxins, Furans	pH	Asbestos
3	Building 4057	Trichloroethane, paint, oil, and Dowanol	X		X		X	X									
4	Building 4358	Chemical storage (unspecified type)	X				X										
5	Building 4360	Metals, acids, bases, and combustible liquids		X				X								X	
6	Building 4459	Flammables (unspecified type)	X				X										
7	UT-36	Fuel oil, diesel		X													
8	Building 4757 Transformer	PCBs									X						
9	Building 4759 Transformer	PCBs									X						
10	Building 4719 Transformer	PCBs									X						
11+12	Acid and Sodium Hydroxide Aboveground Storage Tanks	Acids (unspecified type) and sodium hydroxide									X					X	
13	Building 4626	Unknown	X	X				X	X		X					X	

Notes:
1. VOCs are a COPC for TPH-gasoline.
2. SVOCs and dioxins are evaluated at COPCs if burned materials wee observed. PCBs are evaluated as COPCs if elevated concentrations of lubricant oil-range TPH was detected.
3. Chemical uses for the Building 4011 Leach Field are assumed to be the same as those for Building 4011 (VOCs, TPH, Metals).
4. COPCs for the Building 3270 Leach Field are assumed to be the same as those for Building 3270 (solvents, petroleum hydrocarbons, SVOCs, metals, energetics, propellants, formaldehyde, general chemistry).
5. Chemical uses for Buildings 4005 and 4006 Leach Field are assumed to be the same as those for Buildings 4005 and 4006 (VOCs, petroleum fuels, SVOCs, oil-related materials, metal wastes, non-metal inorganic compounds).
6. Chemical uses for the Building 4030 Leach Field are assumed to be the same as those for Building 4030 (metals and other inorganic compounds and diesel).
7. Chemical uses for the Building 4010 Leach Field are assumed to be the same as those for Building 4010 (hydrazine, metals, TCE).
8. Chemical uses for the Building 4353 Leach Field are assumed to be the same as those for Building 4353 (energetics).
9. Chemical uses for the Building 4363 Leach Field are assumed to be the same as those for Building 4363 (Metals, Solvents, Kerosene, Naphthalene).
10. Chemical uses for the Building 4373 Leach Field are assumed to be the same as those for Building 4373 (TPH, solvents, metals, propellants).
11. Chemical uses for the Building 4383 Leach Field are assumed to be the same as those for Building 4383 (solvents).

Table 6-1
Chemicals of Potential Concern for Human Health
Boeing Area IV Leach Field RFI Site

Medium	Depth (ft.)	Chemical	Exceeds Background? (Y/N)	Selected as COPC?	Reason
Soil Vapor	0-10	1,1,1-Trichloroethane		Y	
Soil Vapor	0-10	1,1,2-Trichloro-1,2,2-trifluoroethane		Y	
Soil Vapor	0-10	1,1-Dichloroethene		Y	
Soil Vapor	0-10	1,2-Dichloro-1,1,2-trifluoroethane		Y	
Soil Vapor	0-10	Acetone		Y	
Soil Vapor	0-10	Benzene		Y	
Soil Vapor	0-10	Chlorobenzene		Y	
Soil Vapor	0-10	Chlorotrifluoroethylene		Y	
Soil Vapor	0-10	cis-1,2-Dichloroethene		Y	
Soil Vapor	0-10	Dichlorodifluoromethane		Y	
Soil Vapor	0-10	Ethylbenzene		Y	
Soil Vapor	0-10	Methyl ethyl ketone		Y	
Soil Vapor	0-10	Tetrachloroethene		Y	
Soil Vapor	0-10	Toluene		Y	
Soil Vapor	0-10	Trichloroethene		Y	
Soil Vapor	0-10	Trichlorofluoromethane		Y	
Soil Vapor	0-10	Vinyl chloride		Y	
Soil Vapor	0-10	Xylenes, Total		Y	
Soil	0-2	1,1,2-Trichloro-1,2,2-trifluoroethane		Y	
Soil	0-10	1,1,2-Trichloro-1,2,2-trifluoroethane		Y	
Soil	0-2	1,1-Dichloroethene		Y	
Soil	0-10	1,1-Dichloroethene		Y	
Soil	0-2	1,1-Dimethylhydrazine		Y	
Soil	0-10	1,1-Dimethylhydrazine		Y	
Soil	0-2	1,2,3,4,6,7,8-Heptachlorodibenzofuran		Y	
Soil	0-10	1,2,3,4,6,7,8-Heptachlorodibenzofuran		Y	
Soil	0-2	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin		Y	
Soil	0-10	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin		Y	
Soil	0-2	1,2,3,4,7,8,9-Heptachlorodibenzofuran		Y	
Soil	0-10	1,2,3,4,7,8,9-Heptachlorodibenzofuran		Y	
Soil	0-2	1,2,3,4,7,8-Hexachlorodibenzofuran		Y	
Soil	0-10	1,2,3,4,7,8-Hexachlorodibenzofuran		Y	
Soil	0-2	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin		Y	
Soil	0-10	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin		Y	
Soil	0-2	1,2,3,6,7,8-Hexachlorodibenzofuran		Y	
Soil	0-10	1,2,3,6,7,8-Hexachlorodibenzofuran		Y	
Soil	0-2	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin		Y	
Soil	0-10	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin		Y	
Soil	0-2	1,2,3,7,8,9-Hexachlorodibenzofuran		Y	
Soil	0-10	1,2,3,7,8,9-Hexachlorodibenzofuran		Y	
Soil	0-2	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin		Y	
Soil	0-10	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin		Y	
Soil	0-2	1,2,3,7,8-Pentachlorodibenzofuran		Y	
Soil	0-10	1,2,3,7,8-Pentachlorodibenzofuran		Y	
Soil	0-2	1,2,3,7,8-Pentachlorodibenzo-p-dioxin		Y	
Soil	0-10	1,2,3,7,8-Pentachlorodibenzo-p-dioxin		Y	
Soil	0-10	1,2-Dichloroethane		Y	
Soil	0-10	1,2-Dichloroethenes		Y	
Soil	0-2	1,2-Dinitrobenzene		Y	
Soil	0-10	1,2-Dinitrobenzene		Y	
Soil	0-2	1-Methyl naphthalene		Y	
Soil	0-10	1-Methyl naphthalene		Y	
Soil	0-2	2,3,4,6,7,8-Hexachlorodibenzofuran		Y	

Table 6-1
Chemicals of Potential Concern for Human Health
Boeing Area IV Leach Field RFI Site

Medium	Depth (ft.)	Chemical	Exceeds Background? (Y/N)	Selected as COPC?	Reason
Soil	0-10	2,3,4,6,7,8-Hexachlorodibenzofuran		Y	
Soil	0-2	2,3,4,7,8-Pentachlorodibenzofuran		Y	
Soil	0-10	2,3,4,7,8-Pentachlorodibenzofuran		Y	
Soil	0-10	2,3,7,8-Tetrachlorodibenzofuran		Y	
Soil	0-2	2-Methylnaphthalene		Y	
Soil	0-10	2-Methylnaphthalene		Y	
Soil	0-2	Acenaphthene		Y	
Soil	0-10	Acenaphthene		Y	
Soil	0-2	Acenaphthylene		Y	
Soil	0-10	Acenaphthylene		Y	
Soil	0-2	Acetone		Y	
Soil	0-10	Acetone		Y	
Soil	0-2	Aluminum	Y	Y	
Soil	0-10	Aluminum	Y	Y	
Soil	0-2	Anthracene		Y	
Soil	0-10	Anthracene		Y	
Soil	0-2	Aroclor 1242		Y	
Soil	0-10	Aroclor 1242		Y	
Soil	0-2	Aroclor 1248		Y	
Soil	0-10	Aroclor 1248		Y	
Soil	0-2	Aroclor 1254		Y	
Soil	0-10	Aroclor 1254		Y	
Soil	0-2	Aroclor 1260		Y	
Soil	0-10	Aroclor 1260		Y	
Soil	0-2	Arsenic	Y	Y	
Soil	0-10	Arsenic	Y	Y	
Soil	0-2	Barium	Y	Y	
Soil	0-10	Barium	Y	Y	
Soil	0-2	Benzene		Y	
Soil	0-10	Benzene		Y	
Soil	0-2	Benzo(a)anthracene		Y	
Soil	0-10	Benzo(a)anthracene		Y	
Soil	0-2	Benzo(a)pyrene		Y	
Soil	0-10	Benzo(a)pyrene		Y	
Soil	0-2	Benzo(b)fluoranthene		Y	
Soil	0-10	Benzo(b)fluoranthene		Y	
Soil	0-2	Benzo(ghi)perylene		Y	
Soil	0-10	Benzo(ghi)perylene		Y	
Soil	0-2	Benzo(k)fluoranthene		Y	
Soil	0-10	Benzo(k)fluoranthene		Y	
Soil	0-2	Benzoic acid		Y	
Soil	0-2	Beryllium	Y	Y	
Soil	0-10	Beryllium	Y	Y	
Soil	0-2	bis(2-Ethylhexyl) phthalate		Y	
Soil	0-10	bis(2-Ethylhexyl) phthalate		Y	
Soil	0-2	Butyl benzyl phthalate		Y	
Soil	0-10	Butyl benzyl phthalate		Y	
Soil	0-2	Cadmium	Y	Y	
Soil	0-10	Cadmium	Y	Y	
Soil	0-2	Chlorobenzene		Y	
Soil	0-2	Chloroform		Y	
Soil	0-10	Chloroform		Y	
Soil	0-2	Chromium	Y	Y	

Table 6-1
Chemicals of Potential Concern for Human Health
Boeing Area IV Leach Field RFI Site

Medium	Depth (ft.)	Chemical	Exceeds Background? (Y/N)	Selected as COPC?	Reason
Soil	0-10	Chromium	Y	Y	
Soil	0-2	Chrysene		Y	
Soil	0-10	Chrysene		Y	
Soil	0-2	cis-1,2-Dichloroethene		Y	
Soil	0-10	cis-1,2-Dichloroethene		Y	
Soil	0-2	Cobalt	Y	Y	
Soil	0-10	Cobalt	Y	Y	
Soil	0-2	Copper	Y	Y	
Soil	0-10	Copper	Y	Y	
Soil	0-2	Cumene		Y	
Soil	0-2	Dibenzo(a,h)anthracene		Y	
Soil	0-10	Dibenzo(a,h)anthracene		Y	
Soil	0-2	Diethyl phthalate		Y	
Soil	0-10	Diethyl phthalate		Y	
Soil	0-2	Dimethyl phthalate		Y	
Soil	0-10	Dimethyl phthalate		Y	
Soil	0-2	Di-n-butyl phthalate		Y	
Soil	0-10	Di-n-butyl phthalate		Y	
Soil	0-2	Di-n-octyl phthalate		Y	
Soil	0-10	Di-n-octyl phthalate		Y	
Soil	0-10	DioxinFuran_TEQ_Bird		Y	
Soil	0-2	DioxinFuran_TEQ_Mammal		Y	
Soil	0-10	DioxinFuran_TEQ_Mammal		Y	
Soil	0-2	Ethylbenzene		Y	
Soil	0-10	Ethylbenzene		Y	
Soil	0-2	Fluoranthene		Y	
Soil	0-10	Fluoranthene		Y	
Soil	0-2	Fluorene		Y	
Soil	0-10	Fluorene		Y	
Soil	0-2	Fluoride		Y	
Soil	0-10	Fluoride		Y	
Soil	0-2	Formaldehyde		Y	
Soil	0-10	Formaldehyde		Y	
Soil	0-10	Heptachlorodibenzofurans	N	Y	
Soil	0-2	Heptachlorodibenzo-p-dioxins	Y	Y	
Soil	0-10	Heptachlorodibenzo-p-dioxins	Y	Y	
Soil	0-10	Hexachlorodibenzofurans	N	Y	
Soil	0-10	Hexachlorodibenzo-p-dioxins	N	Y	
Soil	0-2	HMX		Y	
Soil	0-2	Indeno(1,2,3-cd)pyrene		Y	
Soil	0-10	Indeno(1,2,3-cd)pyrene		Y	
Soil	0-2	Lithium	Y	Y	
Soil	0-10	Lithium	Y	Y	
Soil	0-2	Mercury	Y	Y	
Soil	0-10	Mercury	Y	Y	
Soil	0-2	Methyl ethyl ketone		Y	
Soil	0-10	Methyl ethyl ketone		Y	
Soil	0-2	Methylene chloride		Y	
Soil	0-10	Methylene chloride		Y	
Soil	0-2	Monomethylhydrazine		Y	
Soil	0-10	Monomethylhydrazine		Y	
Soil	0-2	m-Xylene & p-Xylene		Y	
Soil	0-2	Naphthalene		Y	

Table 6-1
Chemicals of Potential Concern for Human Health
Boeing Area IV Leach Field RFI Site

Medium	Depth (ft.)	Chemical	Exceeds Background? (Y/N)	Selected as COPC?	Reason
Soil	0-10	Naphthalene		Y	
Soil	0-2	Nickel	Y	Y	
Soil	0-10	Nickel	Y	Y	
Soil	0-2	Nitrate-N		Y	
Soil	0-10	Nitrate-N		Y	
Soil	0-2	Nitrate-NO3		Y	
Soil	0-10	Nitrate-NO3		Y	
Soil	0-2	Nitrite-N		Y	
Soil	0-10	Nitrite-N		Y	
Soil	0-2	n-Nitrosodimethylamine		Y	
Soil	0-10	n-Nitrosodimethylamine		Y	
Soil	0-2	n-Nitrosodiphenylamine		Y	
Soil	0-2	n-Propylbenzene		Y	
Soil	0-2	Octachlorodibenzofuran	Y	Y	
Soil	0-10	Octachlorodibenzofuran		Y	
Soil	0-2	Octachlorodibenzo-p-dioxin	Y	Y	
Soil	0-10	Octachlorodibenzo-p-dioxin		Y	
Soil	0-10	Pentachlorodibenzofurans		Y	
Soil	0-10	Pentachlorodibenzo-p-dioxins		Y	
Soil	0-10	Pentachlorophenol		Y	
Soil	0-2	Perchlorate		Y	
Soil	0-10	Perchlorate		Y	
Soil	0-2	Phenanthrene		Y	
Soil	0-10	Phenanthrene		Y	
Soil	0-2	Phenol		Y	
Soil	0-10	Phenol		Y	
Soil	0-2	Pyrene		Y	
Soil	0-10	Pyrene		Y	
Soil	0-2	Silver	Y	Y	
Soil	0-10	Silver	Y	Y	
Soil	0-2	Styrene		Y	
Soil	0-10	Styrene		Y	
Soil	0-10	Tetrachlorodibenzofurans		Y	
Soil	0-10	Tetrachlorodibenzo-p-dioxins		Y	
Soil	0-2	Tetrachloroethene		Y	
Soil	0-10	Tetrachloroethene		Y	
Soil	0-2	Toluene		Y	
Soil	0-10	Toluene		Y	
Soil	0-2	Trichloroethene		Y	
Soil	0-10	Trichloroethene		Y	
Soil	0-2	Trichlorofluoromethane		Y	
Soil	0-2	Vanadium	Y	Y	
Soil	0-10	Vanadium	Y	Y	
Soil	0-2	Xylenes, Total		Y	
Soil	0-10	Xylenes, Total		Y	
Soil	0-2	Zinc	Y	Y	
Soil	0-10	Zinc	Y	Y	
Groundwater		1,1,1-Trichloroethane		Y	
Groundwater		1,1,2-Trichloro-1,2,2-trifluoroethane		Y	
Groundwater		1,1-Dichloroethane		Y	
Groundwater		1,1-Dichloroethene		Y	
Groundwater		1,2,3,4,7,8-Hexachlorodibenzofuran		Y	
Groundwater		1,2,3-Trichloropropene		Y	

Table 6-1
Chemicals of Potential Concern for Human Health
Boeing Area IV Leach Field RFI Site

Medium	Depth (ft.)	Chemical	Exceeds Background? (Y/N)	Selected as COPC?	Reason
Groundwater		1,2,4-Trimethylbenzene		Y	
Groundwater		1,2-Dichlorobenzene		Y	
Groundwater		1,2-Dichloroethane		Y	
Groundwater		1,2-Dichloroethenes		Y	
Groundwater		1,3,5-Trimethylbenzene		Y	
Groundwater		1,3-Dinitrobenzene		Y	
Groundwater		1,4-Dichlorobenzene		Y	
Groundwater		1,4-Dioxane		Y	
Groundwater		2,2-Dichloro-1,1,1-trifluoroethane		Y	
Groundwater		2,4,5-T		Y	
Groundwater		2,4-Dichlorophenoxyacetic Acid (2,4-D)		Y	
Groundwater		2-Butoxyethoxyethanol		Y	
Groundwater		2-n-Butoxyethanol		Y	
Groundwater		2-Nitrophenol		Y	
Groundwater		3,3'-Dichlorobenzidine		Y	
Groundwater		3-Chloro-2(Chloromethyl)-1-Propene		Y	
Groundwater		4-Nitrophenol		Y	
Groundwater		Acetone		Y	
Groundwater		Aldrin		Y	
Groundwater		alpha-BHC		Y	
Groundwater		Aluminum		Y	
Groundwater		Aluminum, Dissolved		Y	
Groundwater		Amino Hexanoic Acid		Y	
Groundwater		Antimony	Y	Y	
Groundwater		Antimony, Dissolved	N	Y	
Groundwater		Arsenic, Dissolved	N	Y	
Groundwater		Barium	N	Y	
Groundwater		Barium, Dissolved	Y	Y	
Groundwater		Benzene		Y	
Groundwater		Benzidine		Y	
Groundwater		Benzo(a)anthracene		Y	
Groundwater		Benzo(k)fluoranthene		Y	
Groundwater		Benzoic acid		Y	
Groundwater		Beryllium	Y	Y	
Groundwater		beta-BHC		Y	
Groundwater		Biphenyl		Y	
Groundwater		bis(2-Chloroethyl) ether		Y	
Groundwater		bis(2-Ethylhexyl) phthalate		Y	
Groundwater		Boron	Y	Y	
Groundwater		Boron, Dissolved	Y	Y	
Groundwater		Bromide		Y	
Groundwater		Cadmium	Y	Y	
Groundwater		Cadmium, Dissolved	Y	Y	
Groundwater		Carbon Disulfide		Y	
Groundwater		Carbon Tetrachloride		Y	
Groundwater		Chloroform		Y	
Groundwater		Chloromethane		Y	
Groundwater		Chlorotrifluoroethylene		Y	
Groundwater		cis-1,2-Dichloroethene		Y	
Groundwater		cis-1,2-Dichloroethene		Y	
Groundwater		Cobalt	Y	Y	
Groundwater		Copper	Y	Y	
Groundwater		Copper, Dissolved	Y	Y	
Groundwater		Cyanides		Y	
Groundwater		Decanol		Y	
Groundwater		delta-BHC		Y	
Groundwater		Dibenzyl Ether		Y	

Table 6-1
Chemicals of Potential Concern for Human Health
Boeing Area IV Leach Field RFI Site

Medium	Depth (ft.)	Chemical	Exceeds Background? (Y/N)	Selected as COPC?	Reason
Groundwater		Dichloro Alkene		Y	
Groundwater		Dichlorodifluoromethane		Y	
Groundwater		Dichlorofluoromethane		Y	
Groundwater		Dichloromethylpropene		Y	
Groundwater		Dichloropropene, NOS		Y	
Groundwater		Dichlorotrifluoromethane		Y	
Groundwater		Diethyl phthalate		Y	
Groundwater		Dimethyl Decene		Y	
Groundwater		Dimethyl phthalate		Y	
Groundwater		Di-n-butyl phthalate		Y	
Groundwater		Diphenyl ether		Y	
Groundwater		Endosulfan I		Y	
Groundwater		Endosulfan II		Y	
Groundwater		Endosulfan sulfate		Y	
Groundwater		Fluoride	Y	Y	
Groundwater		Formaldehyde		Y	
Groundwater		gamma-BHC		Y	
Groundwater		Heptachlor		Y	
Groundwater		Heptachlor epoxide		Y	
Groundwater		Heptachlorodibenzo-p-dioxins		Y	
Groundwater		Iron	Y	Y	
Groundwater		Isocyanomethane		Y	
Groundwater		Isopropanol		Y	
Groundwater		Lead	Y	Y	
Groundwater		Manganese	Y	Y	
Groundwater		Manganese, Dissolved	Y	Y	
Groundwater		Mercury	Y	Y	
Groundwater		Mercury, Dissolved	Y	Y	
Groundwater		Methyl ethyl ketone		Y	
Groundwater		Methyl sulfide		Y	
Groundwater		Methylene chloride		Y	
Groundwater		Molybdenum	Y	Y	
Groundwater		Molybdenum, Dissolved	Y	Y	
Groundwater		Naphthalene		Y	
Groundwater		n-Hexane		Y	
Groundwater		Nickel	Y	Y	
Groundwater		Nitrate-NO3		Y	
Groundwater		Nitrobenzene		Y	
Groundwater		n-Nitrosodimethylamine		Y	
Groundwater		Octachlorodibenzo-p-dioxin		Y	
Groundwater		Pentachlorophenol		Y	
Groundwater		Perchlorate		Y	
Groundwater		Phenol		Y	
Groundwater		Selenium	Y	Y	
Groundwater		Selenium, Dissolved	Y	Y	
Groundwater		Silver	Y	Y	
Groundwater		Strontium, Dissolved	Y	Y	
Groundwater		Tetrachlorodibenzofurans		Y	
Groundwater		Tetrachloroethene		Y	
Groundwater		Tetrahydrofuran		Y	
Groundwater		Tin, Dissolved	Y	Y	
Groundwater		Toluene		Y	
Groundwater		trans-1,2-Dichloroethene		Y	
Groundwater		Trichloroethene		Y	
Groundwater		Vanadium	Y	Y	
Groundwater		Vanadium, Dissolved	Y	Y	
Groundwater		Vinyl chloride		Y	
Groundwater		Zinc	Y	Y	
Soil Vapor	0-10	1,2-Dichloroethane		N	< 5% Detection

Table 6-1
Chemicals of Potential Concern for Human Health
Boeing Area IV Leach Field RFI Site

Medium	Depth (ft.)	Chemical	Exceeds Background? (Y/N)	Selected as COPC?	Reason
Soil Vapor	0-10	Carbon Tetrachloride		N	< 5% Detection
Soil Vapor	0-10	Chloroform		N	< 5% Detection
Soil Vapor	0-10	Methylene chloride		N	< 5% Detection
Soil Vapor	0-10	m-Xylene & p-Xylene		N	See Xylenes, Total
Soil Vapor	0-10	o-Xylene		N	See Xylenes, Total
Soil	0-2	1,1,1-Trichloroethane		N	< 5% Detection
Soil	0-10	1,1,1-Trichloroethane		N	< 5% Detection
Soil	0-2	1,1-Dichloroethane		N	< 5% Detection
Soil	0-10	1,1-Dichloroethane		N	< 5% Detection
Soil	0-2	1,2,4-Trimethylbenzene		N	< 5% Detection
Soil	0-10	1,2,4-Trimethylbenzene		N	< 5% Detection
Soil	0-10	1,2-Dichlorobenzene		N	< 5% Detection
Soil	0-2	1,2-Dichloroethane	Y	N	< 5% Detection
Soil	0-2	1,2-Dichloroethenes		N	See cis-1,2-Dichloroethene
Soil	0-10	1,3,5-Trimethylbenzene		N	< 5% Detection
Soil	0-10	1,4-Dichlorobenzene		N	< 5% Detection
Soil	0-2	2,3,7,8-TCDD		N	See DioxinFuran_TEQ_Mammal
Soil	0-10	2,3,7,8-TCDD		N	See DioxinFuran_TEQ_Mammal
Soil	0-2	2,3,7,8-Tetrachlorodibenzofuran	N	N	Below Background
Soil	0-2	Antimony	N	N	Below Background
Soil	0-10	Antimony	N	N	Below Background
Soil	0-10	Benzoic acid		N	< 5% Detection
Soil	0-2	Boron	N	N	Below Background
Soil	0-10	Boron	N	N	Below Background
Soil	0-2	Bromide		N	No Toxicity Values
Soil	0-10	Bromide		N	No Toxicity Factors
Soil	0-2	C16-C40 Hydrocarbons		N	See BTEX, PAHs
Soil	0-10	C16-C40 Hydrocarbons		N	See BTEX, PAHs
Soil	0-2	C18 - C30		N	See BTEX, PAHs
Soil	0-10	C18 - C30		N	See BTEX, PAHs
Soil	0-2	C18 - C38		N	See BTEX, PAHs
Soil	0-10	C18 - C38		N	See BTEX, PAHs
Soil	0-10	C9 - C34		N	See BTEX, PAHs
Soil	0-2	Calcium	N	N	Essential
Soil	0-10	Calcium		N	Essential
Soil	0-2	Carbon Tetrachloride		N	< 5% Detection
Soil	0-10	Carbon Tetrachloride		N	< 5% Detection
Soil	0-2	Chloride		N	General Chemistry
Soil	0-10	Chloride		N	General Chemistry
Soil	0-10	Chlorobenzene		N	< 5% Detection
Soil	0-10	Chloromethane		N	< 5% Detection
Soil	0-10	Cumene		N	< 5% Detection
Soil	0-2	Cyanides		N	No Toxicity Factors
Soil	0-10	Cyanides		N	No Toxicity Factors
Soil	0-2	Dichlorodifluoromethane		N	< 5% Detection
Soil	0-10	Dichlorodifluoromethane		N	< 5% Detection
Soil	0-2	Diesel Range Hydrocarbons (C14-C20)		N	See BTEX, PAHs
Soil	0-10	Diesel Range Hydrocarbons (C14-C20)		N	See BTEX, PAHs
Soil	0-2	Diesel Range Hydrocarbons (C15-C20)		N	See BTEX, PAHs
Soil	0-10	Diesel Range Hydrocarbons (C15-C20)		N	See BTEX, PAHs
Soil	0-10	Diesel Range Organics		N	See BTEX, PAHs
Soil	0-2	Gasoline Range Hydrocarbons (C8-C11)		N	See BTEX, PAHs
Soil	0-10	Gasoline Range Hydrocarbons (C8-C11)		N	See BTEX, PAHs
Soil	0-2	Heptachlorodibenzofurans	N	N	See DioxinFuran_TEQ_Mammal
Soil	0-2	Hexachlorodibenzofurans	N	N	See DioxinFuran_TEQ_Mammal
Soil	0-2	Hexachlorodibenzo-p-dioxins	N	N	See DioxinFuran_TEQ_Mammal
Soil	0-2	Hexavalent Chromium	N	N	Below Background
Soil	0-10	Hexavalent Chromium	N	N	Below Background

Table 6-1
Chemicals of Potential Concern for Human Health
Boeing Area IV Leach Field RFI Site

Medium	Depth (ft.)	Chemical	Exceeds Background? (Y/N)	Selected as COPC?	Reason
Soil	0-10	HMX		N	< 5% Detection
Soil	0-10	Hydrocarbons C22-C30		N	See BTEX, PAHs
Soil	0-2	Iron	N	N	Below Background
Soil	0-10	Iron	N	N	Below Background
Soil	0-2	Kerosene Range Hydrocarbons (C11-C14)		N	See BTEX, PAHs
Soil	0-10	Kerosene Range Hydrocarbons (C11-C14)		N	See BTEX, PAHs
Soil	0-2	Kerosene Range Hydrocarbons (C12-C14)		N	See BTEX, PAHs
Soil	0-10	Kerosene Range Hydrocarbons (C12-C14)		N	See BTEX, PAHs
Soil	0-2	Lead	N	N	Below Background
Soil	0-10	Lead	N	N	Below Background
Soil	0-2	Lubricating Oil Range Hydrocarbons (C20-C30)		N	See BTEX, PAHs
Soil	0-10	Lubricating Oil Range Hydrocarbons (C20-C30)		N	See BTEX, PAHs
Soil	0-2	Lubricating Oil Range Hydrocarbons (C21-C30)		N	See BTEX, PAHs
Soil	0-10	Lubricating Oil Range Hydrocarbons (C21-C30)		N	See BTEX, PAHs
Soil	0-10	Lubricating Oil Range Hydrocarbons (C25-C36)		N	See BTEX, PAHs
Soil	0-2	Manganese	N	N	Below Background
Soil	0-10	Manganese	N	N	Below Background
Soil	0-2	Moisture		N	General Chemistry
Soil	0-10	Moisture		N	General Chemistry
Soil	0-2	Molybdenum	N	N	Below Background
Soil	0-10	Molybdenum	N	N	Below Background
Soil	0-10	m-Xylene & p-Xylene		N	See Xylenes, Total
Soil	0-10	n-Nitrosodiphenylamine		N	< 5% Detection
Soil	0-10	n-Propylbenzene		N	< 5% Detection
Soil	0-2	Orthophosphate as P		N	General Chemistry
Soil	0-10	Orthophosphate as P		N	General Chemistry
Soil	0-2	o-Xylene		N	< 5% Detection
Soil	0-10	o-Xylene		N	< 5% Detection
Soil	0-10	p-Cymene		N	< 5% Detection
Soil	0-2	Pentachlorodibenzofurans	N	N	See DioxinFuran_TEQ_Mammal
Soil	0-2	Pentachlorodibenzo-p-dioxins	N	N	See DioxinFuran_TEQ_Mammal
Soil	0-2	pH		N	General Chemistry
Soil	0-10	pH		N	General Chemistry
Soil	0-2	Phosphate		N	General Chemistry
Soil	0-10	Phosphate		N	General Chemistry
Soil	0-2	Potassium	N	N	Below Background
Soil	0-10	Potassium	N	N	Below Background
Soil	0-2	Selenium	N	N	Below Background
Soil	0-10	Selenium	N	N	Below Background
Soil	0-2	Sodium	N	N	Below Background
Soil	0-10	Sodium	N	N	Below Background
Soil	0-2	Sulfate		N	General Chemistry
Soil	0-10	Sulfate		N	General Chemistry
Soil	0-2	tert-Butylbenzene		N	< 5% Detection
Soil	0-10	tert-Butylbenzene		N	< 5% Detection
Soil	0-2	Tetrachlorodibenzofurans	N	N	See DioxinFuran_TEQ_Mammal
Soil	0-2	Tetrachlorodibenzo-p-dioxins	N	N	See DioxinFuran_TEQ_Mammal
Soil	0-2	Thallium	N	N	Below Background
Soil	0-10	Thallium	N	N	Below Background
Soil	0-2	Total Petroleum Hydrocarbons		N	See BTEX, PAHs
Soil	0-10	Total Petroleum Hydrocarbons		N	See BTEX, PAHs
Soil	0-2	Total Petroleum Hydrocarbons (as Kerosene)		N	See BTEX, PAHs
Soil	0-10	Total Petroleum Hydrocarbons (as Kerosene)		N	See BTEX, PAHs
Soil	0-2	Total Solids		N	General Chemistry
Soil	0-10	Total Solids		N	General Chemistry
Soil	0-10	trans-1,2-Dichloroethene		N	< 5% Detection
Soil	0-10	Trichlorofluoromethane		N	< 5% Detection
Soil	0-2	TRPH		N	See BTEX, PAHs
Soil	0-10	TRPH		N	See BTEX, PAHs

Table 6-1
Chemicals of Potential Concern for Human Health
Boeing Area IV Leach Field RFI Site

Medium	Depth (ft.)	Chemical	Exceeds Background? (Y/N)	Selected as COPC?	Reason
Soil	0-10	Vinyl chloride		N	< 5% Detection
Soil	0-2	Zirconium	N	N	Below Background
Soil	0-10	Zirconium	N	N	Below Background
Groundwater		1,1,2-Trichloroethane		N	< 5% Detection
Groundwater		1,2-Dibromo-3-chloropropane		N	< 5% Detection
Groundwater		1,3-Dichlorobenzene		N	< 5% Detection
Groundwater		2,4,6-Trichlorophenol		N	< 5% Detection
Groundwater		4,6-Dinitro-o-cresol		N	< 5% Detection
Groundwater		Ammonia-N		N	General Chemistry
Groundwater		Arsenic	N	N	Below Background
Groundwater		Beryllium, Dissolved	N	N	Selected higher of total/dissolved
Groundwater		bis(2-Chloroethoxy)methane		N	< 5% Detection
Groundwater		Bromodichloromethane		N	< 5% Detection
Groundwater		Bromoform		N	< 5% Detection
Groundwater		Bromomethane		N	< 5% Detection
Groundwater		Chloroethane		N	< 5% Detection
Groundwater		Chromium	N	N	Below Background
Groundwater		Chromium, Dissolved	N	N	Below Background
Groundwater		Cobalt, Dissolved	N	N	Below Background
Groundwater		Dibromochloromethane		N	< 5% Detection
Groundwater		Di-n-octyl phthalate		N	< 5% Detection
Groundwater		Ethylbenzene		N	< 5% Detection
Groundwater		Iron, Dissolved	N	N	Below Background
Groundwater		Lead, Dissolved	N	N	Below Background
Groundwater		m-Xylene		N	see Xylenes, Total
Groundwater		m-Xylene & p-Xylene		N	< 5% Detection
Groundwater		Nickel, Dissolved	N	N	Below Background
Groundwater		n-Nitrosodi-n-propylamine		N	< 5% Detection
Groundwater		n-Nitrosodiphenylamine		N	< 5% Detection
Groundwater		o + p Xylene		N	see Xylenes, Total
Groundwater		o-Xylene		N	< 5% Detection
Groundwater		Silica, Dissolved		N	No Toxicity Factors
Groundwater		Silver, Dissolved		N	
Groundwater		Strontium	N	N	Below Background
Groundwater		Tetramethylurea		N	
Groundwater		Thallium	N	N	Below Background
Groundwater		Thallium, Dissolved		N	
Groundwater		Tin	N	N	Below Background
Groundwater		Trichlorofluoromethane		N	< 5% Detection
Groundwater		Xylenes, Total		N	< 5% Detection
Groundwater		Zinc, Dissolved	N	N	Below Background

Table 6-2
Human Health Risk Estimates[1]
Group 5 RFI Report

	Boeing Area IV Leach Field					Compound A Facility				
	Total for Site Media[4]					Total for Site Media[4]				
Receptor	HI Range	CD	Risk Range	CD		HI Range	CD	Risk Range	CD	
Future Adult Recreator	<0.01 - <0.01		2E-09 - 2E-07			<0.01 - <0.01		4E-07 - 2E-05	b	
Future Child Recreator	<0.01 - <0.01		3E-08 - 2E-07			<0.01 - 0.03		5E-06 - 4E-05	b	
Future Adult Resident	0.3 - 0.5		8E-08 - 4E-07			633 - 984	c, g	3E-04 - 1E-03	b, c, d, e, f	
Future Child Resident	1 - 2		3E-07 - 7E-07	a		2,218 - 3,700	c, g, i, j	8E-04 - 1E-03	b, c, d, e, f, h	

	ECL					EEL				
	Total for Site Media[4]					Total for Site Media[4]				
Receptor	HI Range	CD	Risk Range	CD		HI Range	CD	Risk Range	CD	
Future Adult Recreator	<0.01 - <0.01		4E-07 - 1E-05	b		<0.01 - <0.01		7E-07 - 4E-05	b	
Future Child Recreator	0.01 - 0.07		5E-06 - 2E-05	b		<0.01 - <0.01		9E-06 - 9E-05	b	
Future Adult Resident	28 - 44	d, k, m, s	3E-04 - 1E-03	c, d, e, f, k, l, m, n, o, p, q, r, t		0.8 - 2	c	1E-05 - 1E-04	b, c	
Future Child Resident	99 - 166	c, j, k, l, m, h, s, u, v	8E-04 - 1E-03	c, d, e, f, k, l, m, n, o, p, q, r, t		3 - 7	c	7E-05 - 3E-04	b, c	

	Pond Dredge					PDU				
	Total for Site Media[4]					Total for Site Media[4]				
Receptor	HI Range	CD	Risk Range	CD		HI Range	CD	Risk Range	CD	
Future Adult Recreator	<0.01 - <0.01		3E-09 - 2E-07			<0.01 - <0.01		1E-07 - 3E-05	w, x, y	
Future Child Recreator	<0.01 - <0.01		4E-08 - 2E-07			<0.01 - <0.01		1E-06 - 2E-05	w, x	
Future Adult Resident	0.04 - 0.08		4E-06 - 2E-05	b		1 - 2	bb	2E-06 - 4E-05	f, w, x, y, z, aa	
Future Child Resident	0.3 - 0.8		2E-05 - 5E-05	b		4 - 7	bb	1E-05 - 8E-05	f, w, x, y, z, aa, cc	

	STP-3					SE Drum Yard				
	Total for Site Media[4]					Total for Site Media[4]				
Receptor	**HI Range**	**CD**	**Risk Range**	**CD**		HI Range	CD	Risk Range	CD	
Future Adult Recreator	<0.01 - <0.01		3E-07 - 1E-05	b		<0.01 - <0.01		2E-09 - 2E-07		
Future Child Recreator	<0.01 - <0.01		4E-06 - 2E-05	b		<0.01 - <0.01		3E-08 - 1E-07		
Future Adult Resident	0.05 - 0.2		6E-06 - 5E-05	b		0.02 - 0.05		8E-08 - 4E-07		
Future Child Resident	0.4 - 1		3E-05 - 1E-04	b		0.2 - 0.5		3E-07 - 6E-07		

	STL-IV					Building 65 Metals Laboratory Clarifier				
	Total for Site Media[4]					Total for Site Media[4]				
Receptor	HI Range	CD	Risk Range	CD		HI Range	CD	Risk Range	CD	
Future Adult Recreator	<0.01 - <0.01		4E-09 - 2E-07			<0.01 - <0.01		2E-10 - 2E-08		
Future Child Recreator	<0.01 - <0.01		4E-08 - 2E-07			<0.01 - <0.01		2E-09 - 2E-08		
Future Adult Resident	365 - 566	c, g, s, v	2E-04 - 8E-04	c, d, f, dd		0.004 - 0.02		1E-07 - 7E-07		
Future Child Resident	1,278 - 2,130	a, c, g, s, v	4E-04 - 7E-04	c, d, f, dd		0.02 - 0.06		4E-07 - 6E-07		

	Building 100 Trench					DOE LF1				
	Total for Site Media[4]					Total for Site Media[4]				
Receptor	HI Range	CD	Risk Range	CD		HI Range	CD	Risk Range	CD	
Future Adult Recreator	<0.01 - <0.01		2E-09 - 2E-07			<0.01 - <0.01		7E-10 - 6E-08		
Future Child Recreator	<0.01 - <0.01		2E-08 - 3E-07			<0.01 - <0.01		1E-08 - 5E-08		
Future Adult Resident	0.01 - 0.03		4E-08 - 3E-07			0.001 - 0.003		6E-08 - 3E-07		
Future Child Resident	0.1 - 0.3		2E-07 - 4E-07			0.008 - 0.01		2E-07 - 3E-07		

	DOE LF2					DOE LF3				
	Total for Site Media[4]					Total for Site Media[4]				
Receptor	HI Range	CD	Risk Range	CD		HI Range	CD	Risk Range	CD	
Future Adult Recreator	<0.01 - <0.01		3E-09 - 2E-07			<0.01 - <0.01		1E-08 - 3E-06	w	
Future Child Recreator	<0.01 - <0.01		4E-08 - 2E-07			<0.01 - <0.01		2E-07 - 3E-06	w	
Future Adult Resident	0.0007 - 0.001		5E-08 - 4E-07			2 - 3	c	8E-06 - 4E-05	c, f, w	
Future Child Resident	0.004 - 0.006		3E-07 - 7E-07			7 - 12	a, c	2E-05 - 4E-05	c, f, w	

	HMSA					RIHL					SNAP				
	Total for Site Media[4]					Total for Site Media[4]					Total for Site Media[4]				
Receptor	HI Range	CD	Risk Range	CD		HI Range	CD	Risk Range	CD		HI Range	CD	Risk Range	CD	
Future Adult Recreator	<0.01 - <0.01		3E-09 - 2E-07			<0.01 - <0.01		1E-08 - 3E-06	ee		<0.01 - <0.01		2E-09 - 2E-07		
Future Child Recreator	<0.01 - <0.01		3E-08 - 2E-07			<0.01 - <0.01		2E-07 - 2E-06	ee		<0.01 - <0.01		2E-08 - 1E-07		
Future Adult Resident	1 - 2		8E-07 - 2E-05	a, b		0.8 - 1		3E-07 - 5E-06	ee		2 - 3	a	5E-04 - 2E-03	a	
Future Child Resident	5 - 8	c	4E-06 - 3E-05	a, b, c, d, e		3 - 5	a, c	2E-06 - 9E-06	h, ee		6 - 10	a, b, c	1E-03 - 2E-03	a	

Notes:
1. Risk estimates shown are a sum of all exposure pathways per media; the range reported is for the central tendency and reasonable maximum exposures, respectively.
2. Soil media risk estimates are a sum of all direct exposure routes, including incidental ingestion, dermal contact, and dust inhalation.
3. Groundwater media risk estimates are for domestic use of shallow groundwater.
4. Includes combined exposure from 1) direct contact with soil, 2) inhalation of indoor and ambient air vapors originating from soil gas, subsurface soil, and groundwater, and 3) domestic use of shallow groundwater.
5. Chemical risk drivers are those COPCs detected onsite with an HI > 1 or risk > 1x10-6. Only major risk contributors listed if cumulative HI >> 1 or cancer risk >> 1x10-6.

a = Nitrate-NO_3
b = Arsenic
c = Trichloroethene
d = Vinyl Chloride
e = 1,1-Dichloroethane
f = Tetrachloroethene
g = cis-1,2-Dichloroethene
h = Aroclor 1254
i = Zinc
j = Fluoride
k = Carbon Tetrachloride
l = 1,2-Dichloroethane
m = Chloroform
n = 3-Chloro-2(Chloromethyl)-1-Propene
o = Dichloropropene
p = n-Nitrosodimethylamine
q = 1,4-Dioxane
r = 1,2,3-Trichloropropane
s = Dichlorodifluoromethane
t = Benzene
u = Manganese
v = 1, 2-Dichloroethene
w = Benzo(a)pyrene
x = Indeno(1,2,3-cd)pyrene
y = Benzo(b)fluoranthene
z = Benzo(k)fluoranthene
aa = Dioxin/Furan TEQ
bb = Antimony
cc = Benzo(a)anthracene
dd = Tetrahydrofuran
ee = Aroclor-1260

Table 6-3
Human Health Risk Assessment Uncertainty Analysis
Group 5 RFI Report

Assessment Element	Uncertainty	Magnitude of Impact	Direction of Impact
COPC Selection	A number of inorganics (for example arsenic, lead, copper, etc.) were selected as a COPC since they could not be demonstrated to be consistent with background concentrations through the Wilcoxon Rank Sum test. However, for site data sets that are small, uncertainty is introduced into the comparisons. In addition, some data sets had only a few samples with concentrations exceeding the maximum of the background data set, and as a result appear to be consistent with naturally-occurring levels.	Moderate	Conservative
	Several VOCs were selected as soil vapor COPCs since they were directly detected in soil vapor. Other VOCs were also selected as soil vapor COPCs because they were detected in soil and/or shallow groundwater but not analyzed for in soil vapor.	Moderate	Conservative
	Petroleum hydrocarbons were not selected as COPCs when TPH-related constituents (BTEX and PAHs) were analyzed for.	Low	Realistic
Exposure Pathways	Risks associated with drinking of groundwater do not reflect current risks because the groundwater beneath the SSFL is not currently used as a drinking water source and the presen of the contamination will likely require a restriction on its future use as well.	High	Conservative
	Future land use of the site is currently undecided but may be recreational, which has lower risks than for urban residential. If land use is assumed agricultural, risk estimates may be higher.	Moderate	Uncertain
	Risk estimates for fruit and vegetable consumption are based on conservative models that are based on associations with physical-chemical properties, such as Koc.	Moderate	Conservative
EPC Calculations	In some cases, EPCs are based on some data that are over 10 years old. In these cases available analytical data may not accurately reflect current site conditions. Source concentrations assumed constant over time. Chemical concentrations may decline as a result of migration or degradation.	Low	Conservative
	Use of upper confidence limits and maximum detected concentrations will likely overestimate site risks.	Low	Conservative
	Soil vapor exposure point concentrations for several VOCs are estimated using soil to soil vapor partitioning extrapolations, introducing some degree of uncertainty.	Moderate	Conservative
	The 95% UCL concentration of some chemicals is greater than the maximum concentration, therefore the maximum was used as the EPC. This is considered to be a likely overestimation of the representative EPC because samples were collected in areas with the highest likelihood to detect the highest concentrations at the site.	Moderate	Conservative
	The maximum detected concentration of each COPC detected in groundwater was used as the EPC.	Moderate	Conservative
	The extrapolation of soil Aroclor 1254 and Aroclor 1260 concentrations to individual PCB congener concentrations introduces some uncertainty into the EPC estimates for the PCB congeners.	Low	Conservative
	Vapor migration into indoor air has been estimated using a model which is being validated for the site. Migration estimates may be changed once the model validation is complete.	Moderate	Uncertain
Cancer Slope Factor	Extrapolation of dose-response data from laboratory animals to humans.	High	Conservative
	Assumes that all carcinogens do not have a threshold below which carcinogenic response occurs, and therefore, any dose, no matter how small, results in some potential risk.	Moderate	Conservative
	Not all slope factors represent the same degree of certainty. All are subject to change as new evidence becomes available. Some slope factors derived by OEHHA and considerably more conservative than corresponding factors derived by USEPA (e.g. arsenic, PCBs).	Moderate	Conservative

Table 6-3
Human Health Risk Assessment Uncertainty Analysis
Group 5 RFI Report

Assessment Element	Uncertainty	Magnitude of Impact	Direction of Impact
	Cancer slope factors derived from animal studies are the upper-bound maximum likelihood estimates based on a linear dose-response curve, and therefore, overstate carcinogenic potency.	Moderate	Conservative
Reference Dose	No dermal toxicity values are available, oral toxicity factors are used for the dermal route.	Moderate	Conservative
	High degree of uncertainty in extrapolation of dose-response data from laboratory animals to humans.	High	Conservative

Notes:
BTEX - benzene, toluene, ethylbenzene, and xylenes
COPC - chemical of potential concern
EPC - exposure point concentration
Koc - Organic carbon partition coefficient
OEHHA - Office of Environmental Health Hazard Assessment
PAH - polycyclic aromatic hydrocarbon
PCB - polychlorinated biphenyls
TPH - total petroleum hydrocarbons
UCL - upper confidence limit
USEPA - United States Environmental Protection Agency
VOC - volatile organic compound

Table 6-4
Chemicals of Ecological Concern - Soil
Group 5 RFI Report

Preferred Analyte Name	Range of HQs - RME Exposure (Refined Calculations)							Range of Incremental HQs - RME Exposure (Refined Calculations)							Rationale
	Terrestrial Plant	Soil Invertebrate	Hermit Thrush	Red-Tailed Hawk	Deer Mouse	Bobcat	Mule Deer	Terrestrial Plants	Soil Invertebrates	Hermit Thrush	Red-Tailed Hawk	Deer Mouse	Bobcat	Mule Deer	
Boeing Area IV Leach Field RFI Site															
PCB_TEQ_Bird	No TRV	0.0001	0.9 -- **9.0**	0.0002 -- 0.002	No TRV -- No TRV	No TRV -- No TRV	No TRV -- No TRV	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-When dioxin-like PCB congeners are not analyzed on site, exposure point concentrations are modeled from Aroclor 1254 and 1260. -Extrapolated values have some degree of uncertainty and may over- or under-estimate actual concentrations. -HQs exceeded one only for 2 receptors (thrush and mouse), no other HQs exceeded one. -Exceedances for the thrush were for the Low TRV only. Exceedances for the deer mouse were for both the Low and High TRV. -HI exceeded one for dioxin/furan chemical class at the Low TRV only (based on the extrapolated values).
PCB_TEQ_Mammal	No TRV	0.00004	No TRV -- No TRV	No TRV -- No TRV	**2.7** -- **27**	0.0001 -- 0.0008	0.001 -- 0.01	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	
Compound A Facility RFI Site															
Arsenic	**1.2**	**50**	<1 -- <1	<1 -- <1	<1 -- **4.1**	<1 -- <1	<1 -- <1	<1	**23**	<1 -- <1	<1 -- <1	<1 -- **1.1**	<1 -- <1	<1 -- <1	-Estimated risks >1 for 3 receptors (plants, invertebrates, and mouse). -Estimated risks driven by high detects around locations CFBS1415 and CFBS1032. -Locations CFBS1028 and CFTS01 are slightly greater than the maximum background concentration. -Remaining results are all less than the maximum background concentration.
Cadmium	<1	<1	**1.15** -- **149**	<1 -- <1	**2.8** -- **123**	<1 -- <1	<1 -- **2.6**	<1	<1	<1 -- **121**	<1 -- <1	**2.1** -- **92**	<1 -- <1	<1 -- **2.1**	-Estimated risks >1 for 3 receptors - thrush and mouse (Low and High TRV) and mule deer (Low TRV). -Incremental risks >1 for thrush and mouse (Low and High TRV) and mule deer (Low TRV).
Chromium	<1	<1	**7.2** -- **36**	<1 -- <1	No TRV -- <1	No TRV -- <1	No TRV -- <1	<1	<1	**2.5** -- **12**	<1 -- <1	-- -- <1	-- -- <1	-- -- <1	-Estimated risks to thrush (Low and High TRV). -Incremental risks >1 for thrush (Low and High TRV).
Copper	<1	**2.0**	**2.6** -- **59**	<1 -- <1	<1 -- **18**	<1 -- <1	<1 -- <1	<1	**1.6**	**2.1** -- **47**	<1 -- <1	<1 -- **12**	<1 -- <1	<1 -- <1	-Estimated risks >1 for invertebrates, thrush, and mouse. -Exceeded Low and High TRV for thrush. -Incremental risks >1 for invertebrates, thrush and mouse.
Nickel	**1.4**	<1	<1 -- **28**	<1 -- <1	**1.2** -- **278**	<1 -- <1	<1 -- **10**	<1	<1	<1 -- **18**	<1 -- <1	<1 -- **140**	<1 -- <1	<1 -- **6.5**	-Estimated risks >1 for plants (High TRV), thrush (Low TRV), mouse (Low and High TRV), and mule deer (Low TRV). -Incremental risks >1 for plants (High TRV) and thrush, mouse, and mule deer (Low TRV).
Silver	**34**	No TRV	No TRV -- <1	No TRV -- <1	<1 -- **92**	<1 -- <1	<1 -- **1.3**	**33**	--	-- -- <1	-- -- <1	<1 -- **91**	<1 -- <1	<1 -- **1.3**	-Estimated risks >1 for plants (High TRV), mouse (Low TRV), and mule deer (Low TRV) -Incremental risks >1 for plants (High TRV), mouse and mule deer (Low TRV)
Zinc	**5.3**	**3.5**	**3.0** -- **27**	<1 -- **1.4**	<1 -- **25**	<1 -- <1	<1 -- <1	**4.9**	**3.2**	**2.7** -- **24**	<1 -- **1.2**	<1 -- **22**	<1 -- <1	<1 -- <1	-Estimated risks > for plants and invertebrates (High TRV), thrush (Low and High TRV), hawk and mouse (Low TRV). -Incremental risks >1 for plants and invertebrates (High TRV), thrush (Low and High TRV), hawk and mouse (Low TRV).
Aroclor 1254	<1	<1	<1 -- **3.9**	<1 -- <1	<1 -- **3.7**	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks >1 for thrush and mouse (Low TRV). -Aroclor Chemical Class HI also exceeded 1 for thrush and mouse (Low TRV).
Aroclor 1260	<1	<1	<1 -- **1.6**	<1 -- <1	<1 -- <1	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks >1 for thrush (Low TRV). -Aroclor Chemical Class HI also exceeded 1 for thrush (Low TRV).
DioxinFuranPCB_TEQ_Bird	Not CPEC	<1	**10.2** -- **102**	<1 -- <1	Not CPEC -- Not CPEC	Not CPEC -- Not CPEC	Not CPEC -- Not CPEC	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks for thrush and mouse (Low and High TRV). -DioxinFuran Chemical Class HI also exceeded 1 for thrush and mouse (Low and High TRV).
DioxinFuranPCB_TEQ_Mammal	Not CPEC	<1	Not CPEC -- Not CPEC	Not CPEC -- Not CPEC	**23** -- **233**	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	
ECL RFI Site															
Arsenic	<1	**29**	<1 -- <1	<1 -- <1	<1 -- **5.0**	<1 -- <1	<1 -- <1	<1	**3.2**	<1 -- <1	<1 -- <1	<1 -- **2.0**	<1 -- <1	<1 -- <1	-Estimated risks >1 for 2 receptors (invertebrate and mouse) at the Low TRV -Incremental risks >1 -Only two site results (34 mg/kg at ECBS1001 and 24 mg/kg at ECBS1003) exceeded background maximum concentration (15 mg/kg)
Chromium	<1	<1	**7.5** -- **38**	<1 -- <1	No TRV -- <1	No TRV -- <1	No TRV -- <1	<1	<1	**2.9** -- **14**	<1 -- <1	-- -- <1	-- -- <1	-- -- <1	-Estimated risks >1 for thrush (Low and High TRV) -Incremental risks >1 (Low and High TRV) -16% of the site results exceed the maximum background concentration.
Copper	<1	<1	<1 -- **18**	<1 -- <1	<1 -- **8.0**	<1 -- <1	<1 -- <1	<1	<1	<1 -- **5.5**	<1 -- <1	<1 -- **2.0**	<1 -- <1	<1 -- <1	-Estimated risks >1 for 2 receptors (thrush and mouse) at the Low TRV -Incremental risks >1 -9% of the site results exceed the maximum background concentration.
Nickel	<1	<1	<1 -- **14**	<1 -- <1	<1 -- **189**	<1 -- <1	<1 -- **2.4**	<1	<1	<1 -- **3.9**	<1 -- <1	<1 -- **50**	<1 -- <1	<1 -- <1	-Estimated risks >1 for 3 receptors (thrush, mouse, and deer) at the Low TRV -Incremental risks >1 for thrush and mouse (Low TRV). -Incremental risks <1 for deer. -Only one site result (50.75 mg/kg at ECBS1035) exceeds background maximum concentration (29 mg/kg).
Vanadium	<1	<1	No TRV -- <1	No TRV -- <1	**2.9** -- **29**	<1 -- <1	<1 -- <1	<1	<1	**--** -- <1	-- -- <1	<1 -- **6.2**	<1 -- <1	<1 -- <1	-Estimated risks >1 for mouse (Low and High TRV). -Incremental risks >1 (Low TRV). -13% of the site results exceed the maximum background concentration.
Zinc	**1.1**	<1	<1 -- **5.3**	<1 -- <1	<1 -- **5.3**	<1 -- <1	<1 -- <1	<1	<1	<1 -- **2.9**	<1 -- <1	<1 -- **2.5**	<1 -- <1	<1 -- <1	-Estimated risks > 1 for 3 receptors - plant (High TRV), and thrush and mouse (Low TRV) -Incremental risks >1 for thrush and mouse (Low TRV) -Only 3 site results (6%) exceed the maximum background concentration (Locations ECBS1035, ECBS1011, and ECSS02).
1,2-Dinitrobenzene	No TRV	<1	No TRV -- No TRV	No TRV -- No TRV	**1.4** -- **6.1**	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks >1 for mouse
Environmental Effects Laboratory RFI Site															
Arsenic	**2.9**	**117**	<1 -- <1	<1 -- <1	<1 -- **11**	<1 -- <1	<1 -- <1	**2.3**	**91**	<1 -- <1	<1 -- <1	<1 -- **7.7**	<1 -- <1	<1 -- <1	-Estimated risks >1 for 3 receptors (plant, invertebrate, and mouse) at Low TRV -Incremental risks >1
Aroclor 1254	<1	<1	<1 -- **3.0**	<1 -- <1	<1 -- **3.9**	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks >1 for 2 receptors (thrush and mouse) at Low TRV only -Summed risk estimate (Hazard Index) for Aroclors exceeded 1 for thrush and mouse

Table 6-4
Chemicals of Ecological Concern - Soil
Group 5 RFI Report

	Range of HQs - RME Exposure (Refined Calculations)										Range of Incremental HQs - RME Exposure (Refined Calculations)										
Preferred Analyte Name	**Terrestrial Plant**	**Soil Invertebrate**	**Hermit Thrush**	**Red-Tailed Hawk**	**Deer Mouse**	**Bobcat**	**Mule Deer**	**Terrestrial Plants**	**Soil Invertebrates**	**Hermit Thrush**	**Red-Tailed Hawk**	**Deer Mouse**	**Bobcat**	**Mule Deer**	**Rationale**
PCB_TEQ_Bird	No TRV	<1	**6.9 -- 69**	<1 -- <1	Not CPEC -- Not CPEC	Not CPEC -- Not CPEC	Not CPEC -- Not CPEC	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks for this analyte (HQ) exceeded 1 for thrush -Summed risk estimate (HI) for Dioxin/Furans exceeded 1 for thrush
PCB_TEQ_Mammal	No TRV	<1	Not CPEC -- Not CPEC	Not CPEC -- Not CPEC	**21 -- 208**	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks for this analyte (HQ) exceeded 1 for mouse -Summed risk estimate (HI) for Dioxin/Furans exceeded 1 for mouse
Pond Dredge RFI Site															
Barium	N/A	<1	**1.3 -- 2.6**	<1 -- <1	**2.1 -- 8.3**	<1 -- <1	<1 -- <1	N/A	<1	<1 -- **1.2**	<1 -- <1	**1.03 -- 4.0**	<1 -- <1	<1 -- <1	-Estimated risks for two receptors (thrush and mouse) at both Low and High TRVs. -Incremental risks >1 -Over 1/2 of results exceed maximum background concentration (0-6 ft bgs).
Chromium	N/A	<1	**7.1 -- 35**	<1 -- <1	No TRV -- <1	No TRV -- <1	No TRV -- <1	N/A	<1	**2.4 -- 12**	<1 -- <1	-- -- <1	-- -- <1	-- -- <1	-Estimated risks for thrush at both Low and High TRVs. -Incremental risks >1 for both Low and High TRV.
Nickel	N/A	<1	<1 -- **13**	<1 -- <1	<1 -- **201**	<1 -- <1	<1 -- **2.0**	N/A	<1	<1 -- **2.8**	<1 -- <1	<1 -- **63**	<1 -- <1	<1 -- <1	-Estimated risks for thrush, mouse, and deer (Low TRV only). -Incremental risks >1 for thrush, mouse, and deer (Low TRV). -Estimated risks for mouse driven by one high result (65.4 mg/kg) at 3 ft bgs (location PDTS07). -All other data (0-6 ft bgs) are below the maximum background concentration.
Vanadium	N/A	<1	No TRV -- <1	No TRV -- <1	**3.5 -- 35**	<1 -- <1	<1 -- <1	N/A	<1	-- -- <1	-- -- <1	**1.2 -- 12**	<1 -- <1	<1 -- <1	-Estimated risks for this mouse (Low and High TRV). -Incremental risks for mouse (Low and High TRV). -Approximately 1/3 of the results (0-6 ft bgs) are greater than the maximum background concentration.
bis(2-Ethylhexyl) phthalate	N/A	No TRV	No TRV -- **22**	No TRV -- <1	<1 -- <1	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks to thrush (Low TRV).
DioxinFuranPCB_TEQ_Bird	N/A	<1	**1.1 -- 11**	<1 -- <1	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks to thrush (Low TRV). -Chemical class HI also exceeds 1 for thrush (Low TRV).
PDU RFI Site															
Cadmium	<1	<1	<1 -- **58**	<1 -- <1	**1.1 -- 48**	<1 -- <1	<1 -- **1.1**	<1	<1	<1 -- **30**	<1 -- <1	<1 -- **17**	<1 -- <1	<1 -- <1	-Estimated risks >1 for only 2 receptors (thrush and mouse) at the Low TRV only. -Estimated risks driven by single high detect (14.7 mg/kg) at PUBS1009. -Of remaining results only 8-15% exceed the maximum detected background concentration (depending on depth interval).
Silver	**2.0**	No TRV	No TRV -- <1	No TRV -- <1	<1 -- **5.1**	<1 -- <1	<1 -- <1	**1.5**	--	-- -- <1	-- -- <1	<1 -- **3.4**	<1 -- <1	<1 -- <1	-Estimated risks for two receptors (terrestrial plants and mouse). -Incremental risks >1 -Over 40% of the site results exceed the maximum background concentration.
Zinc	**1.8**	**1.2**	**1.01 -- 9.1**	<1 -- <1	<1 -- **8.5**	<1 -- <1	<1 -- <1	**1.4**	<1	<1 -- **6.8**	<1 -- <1	<1 -- **5.7**	<1 -- <1	<1 -- <1	-Estimated risks >1 for 3 receptors (plants, thrush, and mouse) at the Low TRV only. -Estimated risks driven by several high detects (>200 mg/kg) around locations PUBS06, PUBS07, PUBS08, PUBS09, PUBS10,PUBS11, PUBS1042, PUBS1044, PUBS046, and PUBS1048. -Of remaining results 13-20% exceed the maximum detected background concentration (depending on depth interval).
Aroclor 1248	<1	<1	<1 -- **1.6**	<1 -- <1	<1 -- **3.1**	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks for this analyte (HQ) exceeded 1 for thrush and mouse at the Low TRV. -Summed risk estimate (HI) for Aroclors exceeded 1 for thrush and mouse.
Aroclor 1260	<1	<1	<1 -- **1.2**	<1 -- <1	<1 -- <1	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks for this analyte (HQ) exceeded 1 for thrush at the Low TRV. -HQ for thrush was very close to 1 (1.2), but -Summed risk estimate (HI) for Aroclors exceeded 1 for thrush and mouse.
Benzo(a)anthracene	**1.2**	<1	No TRV -- <1	No TRV -- <1	<1 -- <1	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks for this analyte (HQ) exceeded 1 for terrestrial plants only, but -Summed risk estimate (Hazard Index) for PAHs exceeded 1 for thrush and mouse.
Benzo(a)pyrene	**2.7**	<1	No TRV -- <1	No TRV -- <1	<1 -- <1	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks for this analyte (HQ) exceeded 1 for terrestrial plants only, but -Summed risk estimate (Hazard Index) for PAHs exceeded 1 for thrush and mouse.
Benzo(b)fluoranthene	**2.3**	<1	No TRV -- <1	No TRV -- <1	<1 -- <1	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks for this analyte (HQ) exceeded 1 for terrestrial plants only, but -Summed risk estimate (Hazard Index) for PAHs exceeded 1 for thrush and mouse.
Benzo(ghi)perylene	**6.5**	<1	No TRV -- <1	No TRV -- <1	<1 -- <1	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks for this analyte (HQ) exceeded 1 for terrestrial plants only, but -Summed risk estimate (Hazard Index) for PAHs exceeded 1 for thrush and mouse.
Benzo(k)fluoranthene	**2.0**	<1	No TRV -- <1	No TRV -- <1	<1 -- <1	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks for this analyte (HQ) exceeded 1 for terrestrial plants only, but -Summed risk estimate (Hazard Index) for PAHs exceeded 1 for thrush and mouse.
Chrysene	**1.7**	<1	No TRV -- <1	No TRV -- <1	<1 -- <1	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks for this analyte (HQ) exceeded 1 for terrestrial plants only, but -Summed risk estimate (Hazard Index) for PAHs exceeded 1 for thrush and mouse.
DioxinFuranPCB_TEQ_Bird	No TRV	<1	**1.7 -- 17**	<1 -- <1	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks for multiple receptors for Low and High TRV.
DioxinFuranPCB_TEQ_Mammal	No TRV	<1	N/A -- N/A	N/A -- N/A	**7.6 -- 76**	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks >10 at the Low TRV
Indeno(1,2,3-cd)pyrene	**5.7**	<1	No TRV -- <1	No TRV -- <1	<1 -- <1	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks for this analyte (HQ) exceeded 1 for terrestrial plants only, but -Summed risk estimate (Hazard Index) for PAHs exceeded 1 for thrush and mouse.
Phenanthrene	No TRV	<1	<1 -- **1.0**	<1 -- <1	<1 -- <1	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks for this analyte (HQ) exceeded 1 for thrush only, but -Summed risk estimate (Hazard Index) for PAHs exceeded 1 for thrush and mouse.
Pyrene	No TRV	<1	<1 -- **2.0**	<1 -- <1	<1 -- <1	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks for this analyte (HQ) exceeded 1 for thrush only, but -Summed risk estimate (Hazard Index) for PAHs exceeded 1 for thrush and mouse.
STP-3 RFI Site															
Barium	0.27	0.42	**1.53 -- 3.06**	0.00 -- 0.00	**2.28 -- 8.84**	1.3E-04 -- 4.9E-04	0.0025 -- 0.01	<1	<1	<1 -- **1.6**	<1 -- <1	**1.2 -- 4.6**	<1 -- <1	<1 -- <1	-Estimated risks exceed High TRV for thrush and deer mouse. -Incremental risks exceed High TRV.

Table 6-4
Chemicals of Ecological Concern - Soil
Group 5 RFI Report

	Range of HQs - RME Exposure (Refined Calculations)							Range of Incremental HQs - RME Exposure (Refined Calculations)							
Preferred Analyte Name	**Terrestrial Plant**	**Soil Invertebrate**	**Hermit Thrush**	**Red-Tailed Hawk**	**Deer Mouse**	**Bobcat**	**Mule Deer**	**Terrestrial Plants**	**Soil Invertebrates**	**Hermit Thrush**	**Red-Tailed Hawk**	**Deer Mouse**	**Bobcat**	**Mule Deer**	**Rationale**
Chromium	0.18	**1.64**	**23.65 -- 118**	0.00 -- 0.01	No TRV -- 0.09	No TRV -- 5.4E-07	No TRV -- 0.0002	<1	**1.3**	**19.0 -- 94.8**	<1 -- <1	-- -- <1	-- -- <1	-- -- <1	-Estimated risks exceed High TRV for soil invertebrate and thrush -Incremental risks exceed High TRV.
Copper	0.54	**3.38**	**4.45 -- 101**	0.00 -- 0.06	0.15 -- **36**	1.6E-05 -- 0.004	0.0001 -- 0.03	<1	**3.0**	**3.9 -- 89.0**	<1 -- <1	<1 -- **30.1**	<1 -- <1	<1 -- <1	-Estimated risks exceed High TRV for soil invertebrates and thrush. -Estimated risks exceed Low TRV for deer mouse. -Incremental risks exceed High TRV for soil invertebrates and thrush.
Nickel	**1.96**	0.59	0.98 -- **40**	0.00 -- 0.00	**2.52 -- 598**	1.1E-05 -- 0.003	0.01 -- **1.24**	**1.5**	<1	<1 -- **30.2**	<1 -- <1	**1.9 -- 459.2**	<1 -- <1	<1 -- <1	-Estimated risks exceed 100 for deer mouse (Low TRV). -Incremental risks exceed High TRV for soil invertebrate and deer mouse.
Silver	**118**	No TRV	No TRV -- 0.27	No TRV -- 0.00	**1.77 -- 284**	7.9E-07 -- 1.3E-04	0.0024 -- 0.39	**117.0**	--	-- -- <1	-- -- <1	**1.8 -- 282.5**	<1 -- <1	<1 -- <1	-Estimated risks exceed 100 for deer mouse (Low TRV) and soil invertebrate (High TRV). -Incremental risks exceed High TRV for soil invertebrate and deer mouse.
Zinc	**3.02**	**1.98**	**1.67 -- 15**	0.01 -- 0.07	0.32 -- **14**	1.7E-04 -- 0.007	0.0006 -- 0.02	**2.5**	**1.7**	**1.4 -- 12.8**	<1 -- <1	<1 -- **11.0**	<1 -- <1	<1 -- <1	-Estimated risks exceed High TRV for soil invertebrate and thrush -Incremental risks exceed High TRV for terrestrial plants, soil, invertebrates, and thrush.
Perchlorate	0.00002	No TRV	No TRV -- 1.9E-03	No TRV -- 1.1E-07	0.00 -- 0.02	1.0E-08 -- 5.0E-08	1.0E-05 -- 5.2E-05	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks exceed Low TRV for thrush and deer mouse.
STL-IV RFI Site															
Cadmium	<1	<1	<1 -- **127**	<1 -- <1	**1.5 -- 64**	<1 -- <1	<1 -- **3.1**	<1	<1	<1 -- **99**	<1 -- <1	<1 -- **33**	<1 -- <1	<1 -- **2.4**	-Estimated risks >1 for 3 receptors (thrush, mouse, and mule deer) at the Low TRV. -Estimated risks >1 at the High TRV for the mouse. -Incremental risks >1 for thrush, mouse, and mule deer at the Low TRV.
Vanadium	Not CPEC	Not CPEC	Not CPEC -- Not CPEC	Not CPEC -- Not CPEC	**2.5 -- 25**	Not CPEC -- Not CPEC	Not CPEC -- Not CPEC	Not CPEC	Not CPEC	Not CPEC -- Not CPEC	Not CPEC -- Not CPEC	<1 -- **2.6**	Not CPEC -- Not CPEC	Not CPEC -- Not CPEC	-Vanadium was only a CPEC at the 0-6 ft bgs depth interval. -Estimated risks >1 for mouse at Low and High TRV. -Incremental risks >1 for the mouse at the Low TRV. -Site maximum concentration (77 mg/kg at location SLBS1020) exceeds maximum background concentration (62 mg/kg). -Estimated risks are primarily a function of background concentrations.
Di-n-butyl phthalate	<1	No TRV	<1 -- **8.3**	<1 -- <1	<1 -- <1	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks >1 for thrush at Low TRV.
DioxinFuran_TEQ_Mammal	No TRV	<1	Not CPEC -- Not CPEC	Not CPEC -- Not CPEC	<1 -- **2.1**	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks >1 for mouse at the Low TRV. -Summed risk estimate (HI) for Dioxin/Furans exceeded 1 for the mouse (Low TRV).
Building 100 Trench RFI Site															
Lead	**6.6**	<1	**18.1 -- 11,303**	<1 -- **3.6**	<1 -- **110**	<1 -- <1	<1 -- **2.0**	**6.4**	<1	**17.7 -- 11,033**	<1 -- **2.9**	<1 -- **104**	<1 -- <1	<1 -- **2.0**	-Lead exceeded background at only two locations (BHTS26 = 2550 mg/kg and BHTS51S08 = 50.35 mg/kg). -Estimated risks driven by high detect at BHTS26.
DOE Leach Fields 1 RFI Site															
PCB_TEQ_Mammal	No TRV	1.9E-06	N/A -- N/A	N/A -- N/A	0.57 -- **5.7**	4.3E-06 -- 4.3E-05	6.9E-05 -- 6.9E-04	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated exposures exceed Low TRV for deer mouse. -Estimated exposures based on EPCs extrapolated from Aroclor concentrations. -Actual presence of dioxin-like PCBs is uncertain.
DOE Leach Fields 2 RFI Site															
PCB_TEQ_Bird	No TRV	0.00002	0.20 -- **2.0**	7.6E-06 -- 7.6E-05	No TRV -- No TRV	N/A -- N/A	N/A -- N/A	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-When dioxin-like PCB congeners are not analyzed on site, exposure point concentrations are modeled from Aroclor 1254 and 1260. At this site, Aroclor 1254 was detected, but not Aroclor 1260. -Extrapolated values have some degree of uncertainty and may over- or under-estimate actual concentrations. -HQs exceeded one only for 2 receptors (thrush and mouse), no other HQs exceeded one. -Exceedances were for the Low TRV only. Neither receptor exceeded at the High TRV indicating that potential risks are somewhere between a no effect and low effect.
PCB_TEQ_Mammal	No TRV	0.00001	N/A -- N/A	N/A -- N/A	0.61 -- **6.1**	3.4E-06 -- 3.4E-05	5.4E-05 -- 5.4E-04	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-HI exceeded one for dioxin/furan chemical class at the Low TRV only (based on the extrapolated values).
DOE LF3 RFI Site															
1,2-Dinitrobenzene	No TRV	<1	No TRV -- No TRV	No TRV -- No TRV	**1.4 -- 5.9**	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks exceeded high and low TRVs for deer mouse.
Aroclor 1260	<1	<1	<1 -- **2.9**	<1 -- <1	<1 -- **1.9**	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks exceeded low TRVs for hermit thrush and deer mouse.
PCB_TEQ_Bird	No TRV	<1	**1.8 -- 18**	<1 -- <1	Not CPEC -- Not CPEC	Not CPEC -- Not CPEC	Not CPEC -- Not CPEC	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks exceeded high and low TRVs for hermit thrush.
PCB_TEQ_Mammal	No TRV	<1	Not CPEC -- Not CPEC	Not CPEC -- Not CPEC	**5.4 -- 54**	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks exceeded high and low TRVs for deer mouse.
Hazardous Materials Storage Area RFI Site															
Zinc	<1	<1	<1 -- **4.9**	<1 -- <1	<1 -- **3.7**	<1 -- <1	<1 -- <1	<1	<1	<1 -- **2.5**	<1 -- <1	<1 -- <1	<1 -- <1	<1 -- <1	-Estimated risks for two receptors (thrush and mouse) at the Low TRV only. -Four results > background at U5BS1123, U5BS1121, U5BS1100, and HSBS1000. -Estimated risks driven by single high detect (340 mg/kg) at U5BS1123. -Incremental risks >1 for thrush only; all other receptors <1. -Risks primarily due to background concentrations.
bis(2-Ethylhexyl) phthalate	No TRV	No TRV	No TRV -- **2.7**	No TRV -- <1	<1 -- <1	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks >1 for 1 receptor (thrush) at the Low TRV only.
Chrysene	<1	<1	No TRV -- <1	No TRV -- <1	<1 -- **1.1**	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks >1 for mouse at the Low TRV only. -Summed risk estimate (HI) for PAHs exceeded 1 for mouse.
PCB_TEQ_Bird	No TRV	<1	<1 -- **5.4**	<1 -- <1	No TRV -- No TRV	No TRV -- No TRV	No TRV -- No TRV	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks for this analyte (HQ) exceeded 1 for thrush at the Low TRV. -Summed risk estimate (HI) for dioxin/furans exceeded 1 for thrush and mouse.
PCB_TEQ_Mammal	No TRV	<1	No TRV -- No TRV	No TRV -- No TRV	**1.3 -- 12.6**	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks for this analyte (HQ) exceeded 1 for mouse. -Summed risk estimate (HI) for dioxin/furans exceeded 1 for thrush and mouse.
Rockwell International Hot Lab RFI Site															
Cadmium	<1	<1	<1 -- **47**	<1 -- <1	<1 -- **28**	<1 -- <1	<1 -- <1	<1	<1	<1 -- **18**	<1 -- <1	<1 -- <1	<1 -- <1	<1 -- <1	-Estimated risks >1 for two receptors (thrush and mouse) at the Low TRV only. -Incremental risks >1
Nickel	<1	<1	<1 -- **13**	<1 -- <1	<1 -- **196**	<1 -- <1	<1 -- **1.3**	<1	<1	<1 -- **3**	<1 -- <1	<1 -- **58**	<1 -- <1	<1 -- <1	-Estimated risks >1 for three receptors (thrush, mouse, and deer) at the Low TRV only. -Incremental risks >1 for thrush and mouse.

Table 6-4
Chemicals of Ecological Concern - Soil
Group 5 RFI Report

	Range of HQs - RME Exposure (Refined Calculations)							Range of Incremental HQs - RME Exposure (Refined Calculations)							
Preferred Analyte Name	**Terrestrial Plant**	**Soil Invertebrate**	**Hermit Thrush**	**Red-Tailed Hawk**	**Deer Mouse**	**Bobcat**	**Mule Deer**	**Terrestrial Plants**	**Soil Invertebrates**	**Hermit Thrush**	**Red-Tailed Hawk**	**Deer Mouse**	**Bobcat**	**Mule Deer**	**Rationale**
Vanadium	<1	<1	No TRV -- <1	No TRV -- <1	**3.3** -- **33**	<1 -- <1	<1 -- <1	<1	<1	-- -- <1	-- -- <1	**1.1** -- **11**	<1 -- <1	<1 -- <1	-Estimated risks >1 for mouse (Low and High TRV). -Incremental risks >1 for mouse (Low and High TRV).
Aroclor 1254	<1	<1	<1 -- **5**	<1 -- <1	<1 -- **3**	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks >1 for two receptors (thrush and mouse) at the Low TRV only. -Summed risk estimate (Hazard Index) for Aroclors exceeded 1 for thrush and mouse (both Low and High TRV).
Aroclor 1260	<1	<1	**3.1** -- **44**	<1 -- <1	**2.2** -- **22**	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks >1 for two receptors (thrush and mouse). -Summed risk estimate (Hazard Index) for Aroclors exceeded 1 for thrush and mouse (both Low and High TRV).
PCB_TEQ_Bird	No TRV	<1	**35** -- **354**	<1 -- <1	No TRV -- No TRV	No TRV -- No TRV	No TRV -- No TRV	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks for this analyte (HQ) exceeded 1 for thrush only. -Summed risk estimate (Hazard Index) for Dioxin_Furans exceeded 1 for thrush (Low and High TRV).
PCB_TEQ_Mammal	No TRV	<1	No TRV -- No TRV	No TRV -- No TRV	**72** -- **717**	<1 -- <1	<1 -- <1	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risks for this analyte (HQ) exceeded 1 for mouse only. -Summed risk estimate (Hazard Index) for Dioxin_Furans exceeded 1 for mouse (Low and High TRV).
SNAP RFI Site															
Aroclor 1248	0.0011	8.9E-05	0.07 -- **1.01**	1.2E-05 -- 1.6E-04	0.4 -- **4.0**	1.1E-05 -- 1.1E-04	1.7E-04 -- 1.7E-03	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-Estimated risk exceeded 1 for 2 receptors (thrush and mouse) at the Low TRV (RME exposure). -The mouse HQ>1 for the Low TRV at the CTE exposure (not shown on this table). -Aroclor HI exceeded 1 for Low TRV.
PCB_TEQ_Bird	No TRV	2.9E-05	0.28 -- **2.8**	2.2E-05 -- 2.2E-04	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-When dioxin-like PCB congeners are not analyzed on site, exposure point concentrations are modeled from Aroclor 1254 and 1260. At this site, Aroclor 1260 was detected, but not Aroclor 1254. -Extrapolated values have some degree of uncertainty and may over- or under-estimate actual concentrations.
PCB_TEQ_Mammal	No TRV	1.3E-05	N/A -- N/A	N/A -- N/A	0.8 -- **8.5**	1.0E-05 -- 1.0E-04	1.6E-04 -- 1.6E-03	N/A	N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	N/A -- N/A	-HQs exceeded one only for 2 receptors (thrush and mouse), no other HQs exceeded one. -Exceedances were for the Low TRV only. Neither receptor exceeded at the High TRV indicating that potential risks are somewhere between a no effect and low effect. -HI exceeded one for dioxin/furan chemical class at the Low TRV only (based on the extrapolated values).

Notes:
n/a - not applicable
HQs listed are based on Refined Screen
Low hazard quotient = EPC/High TRV
High hazard quotient = EPC/Low TRV
COEC - chemical of ecological concern
CTE - central tendency exposure
HI - hazard index
HQ - hazard quotient
RME - reasonable maximum exposure
TRV - toxicity reference value

Table 6-5
Chemicals of Ecological Concern - Soil Vapor
Group 5 RFI Report

Preferred Analyte Name	Inhalation of Soil Vapor (Deer Mouse)	Identification of COECs	
		COEC	Rationale
Compound A Facility RFI Site			
1,1,2-Trichloroethane	**18**	**Yes**	-Chemical was not detected. -Was retained through risk calculation process because SQL>ESL. -Actual presence/concentration is uncertain. -Was retained as a COEC because other VOCs at the site also indicated potential risk to burrowing mammals.
1,1-Dichloroethene	**2.8**	**Yes**	-Estimated risks to burrowing mammals. -Estimates based on measured data.
cis-1,2-Dichloroethene	**3.9**	**Yes**	-Estimated risks to burrowing mammals. -Estimates based on measured data.
Trichloroethene	**11**	**Yes**	-Estimated risks to burrowing mammals. -Estimates based on measured data.
ECL RFI Site			
1,1,2-Trichloroethane	**18**	**Yes**	-Chemical was not detected. -Was retained through risk calculation process because SQL>ESL. -Actual presence/concentration is uncertain. -Was retained as a COEC because other VOCs at the site also indicated potential risk to burrowing mammals.
Methylene chloride	**3.4**	**Yes**	-Estimated risks to burrowing mammals. -Estimates based on measured data.
Vinyl chloride	**19**	**Yes**	-Estimated risks to burrowing mammals. -Estimates based on measured data.
Environmental Effects Laboratory RFI Site			
1,1,2-Trichloroethane	**18**	**Yes**	-Analyte was not detected in any samples collected from either soil or soil vapor. -It was retained for evaluation because SQL>ESL. Actual presence/concentration is uncertain. -ESL and TRV are same value and have uncertainty regarding their derivation. -Retained because risk estimates for other VOCs detected on site were >1.
Trichloroethene	**1.5**	**Yes**	-Estimated risks >1 for burrowing small mammal.
STL-IV RFI Site			
1,1,2-Trichloro-1,2,2-trifluoroethane	**3.9**	**Yes**	-Estimated risks to burrowing mammals. -Estimates based on measured data.

Table 6-5
Chemicals of Ecological Concern - Soil Vapor
Group 5 RFI Report

Preferred Analyte Name	Inhalation of Soil Vapor (Deer Mouse)	Identification of COECs	
		COEC	Rationale
1,1,2-Trichloroethane	**18**	**Yes**	-Chemical was not detected. -Was retained through risk calculation process because SQL>ESL. -Actual presence/concentration is uncertain. -Was retained as a COEC because other VOCs at the site also indicated potential risk to burrowing mammals.
1,1-Dichloroethene	**2.2**	**Yes**	-Estimated risks to burrowing mammals. -Estimates based on measured data.
cis-1,2-Dichloroethene	**6.8**	**Yes**	-Estimated risks to burrowing mammals. -Estimates based on measured data.
Trichloroethene	**1.1**	**Yes**	-Estimated risks to burrowing mammals. -Estimates based on measured data.
Vinyl chloride	**33**	**Yes**	-Estimated risks to burrowing mammals. -Estimates based on measured data.

Table 6-6
ERA Uncertainty Analysis
Group 5 RFI Report

Assessment Element	Uncertainty	Magnitude of Impact	Direction of Impact
Problem Formulation			
Fate and Transport	It is assumed that chemical concentrations will not change over time, and that concentrations are constant during the exposure duration. Natural attenuation and/or other degradation processes may be significant in some areas resulting in an over-estimation of exposure.	Moderate	Over-estimation of exposure/risk
Data Collection/Analysis	Variability in analyses, laboratories, representativeness of samples, sampling errors, and homogeneity of the sample matrix can influence quality and quantity of data used in the risk assessment. Data were validated, but historical sampling programs may not have had the same standards as more recent ones.	Unknown	Over- or under-estimation of exposure/risk
Data Collection/Analysis	Detection Limits. Historical data were noted to have overly high detection limits, especially in regard to metals. Recent sampling was designed to have detection limits meeting ESLs. However, as data are combined into the EPCs, high detection limits may influence the resulting mean and 95UCLs.	Moderate	Over-estimation of exposure/risk
Data Collection/Analysis	Surface water samples were analyzed only for perchlorate making them of limited usefulness for evaluating potential exposure and risk to ecological receptors.	Moderate	Under-estimation of exposure/risk
Data Collection/Analysis	Surface water samples were not collected from surface drainages. Potential exposure and risk to aquatic receptors could not be evaluated.	Moderate	Under-estimation of exposure/risk
Representative Species	Representative species were selected to reduce uncertainty; however, differences among species including physiology, reproductive biology, and/or foraging habits can result in different exposures and sensitivities for different receptors.	Low	Over- or under-estimation of exposure/risk
CPEC Selection	Background Comparison. Background evaluation was based on the WRS test. For some inorganics, the WRS test indicated that the site exceeded background, but site maximum, CTE, and RME concentrations were similar to or below background maximum, CTE, and/or RME concentrations.	Low	Over-estimation of exposure/risk
CPEC Selection	VOC Comparison. VOCs that were detected in soil but were not analyzed for in soil gas were retained as CPECs under the matrix "Modeled Soil Vapor". Concentrations were modeled from soil concentrations using SRAM Appendix G Equation 18.	Low	Over-estimation of exposure/risk
CPEC Selection	SQL Comparison. Chemicals that were never detected at the site were included as CPECs if they met the criteria in the SQL screening process: a) SQL>ESL b) at least 5 samples were collected c) at least 2 other chemicals in the same chemical class were detected.	Low	Over-estimation of exposure/risk
Exposure Pathway Analysis	Dermal and inhalation (for surface-dwelling animals) exposure pathways were not quantified.	Low	Under-estimation of exposure/risk

Table 6-6
ERA Uncertainty Analysis
Group 5 RFI Report

Assessment Element	Uncertainty	Magnitude of Impact	Direction of Impact
Analysis			
Wildlife Exposure Factors	Assumptions regarding exposure - likelihood, contact with contaminated media, concentrations at exposure points, and frequency/duration of contact are based on available information and assumptions of wildlife habits at the SSFL. Assumptions tend to simplify actual site conditions and may over- or under-estimate actual exposure.	Moderate	Over- or under-estimation of exposure/risk
Bioaccumulation Factors	Site-specific data on CPEC concentrations in wildlife foods were used to derive BAFs for a limited number of CPECs (SRAM 2005). For the remaining CPECs, literature-based BAFs and regression models were used to estimate bioaccumulation. The suitability of these bioaccumulation models to conditions at the site is unknown. Therefore, concentrations of CPECs in biota present at the site and, consequently, the dietary exposures of birds and mammals, may be either higher or lower than values estimated in the Group 5 ERAs.	Moderate	Over- or under-estimation of exposure/risk
Bioavailability	Bioavailability of CPECs was assumed to be 100 percent. This likely overestimates risk to receptors at the site.	Low	Over-estimation of exposure/risk
Area Use Factors	Area use factors (AUFs) of less than 1 were applied to exposure estimates for wide-ranging receptors (red-tailed hawk, bobcat, and mule deer) in the "refined" assessment to account for the foraging range of the receptor. Use of the site may be greater or less than that predicted by the AUF.	Low	Over- or under-estimation of exposure/risk
Exposure Point Concentrations	CTE EPC. CTE EPC is based on the arithmetic mean per the SRAM (MWH 2005). This assumes normal distribution. In some cases the CTE was >RME and/or CTE was >Maximum detect. The mean (CTE) could be biased high by higher detection limits from historic data. The RME EPC was used for the CTE EPC when the CTE was >RME or CTE was >Maximum.	Moderate	Over-estimation of exposure/risk
Exposure Point Concentrations	RME EPC. The RME EPC is the 95UCL, unless the 95UCL exceeds the maximum detect in which case the maximum detect is used as the RME EPC. Use of the maximum detect is considered to be a likely overestimation of the representative exposure point concentration because samples were collected in areas likely to have the highest concentrations at the site.	Moderate	Over-estimation of exposure/risk
Exposure Point Concentrations	The extrapolation of soil Aroclor 1254 and Aroclor 1260 concentrations to individual dioxin-like PCB congener concentrations introduces some uncertainty into the EPC estimates for the PCB congeners.	Low	Over- or under-estimation of exposure/risk
Exposure Point Concentrations	Soil vapor concentrations extrapolated from soil concentrations were used to calculate soil vapor EPC.	Moderate	Over- or under-estimation of exposure/risk
Exposure Point Concentrations	Estimation of soil vapor concentrations overstates actual burrow concentrations: 1) Model is conservative. 2) Air flow in burrows is not accounted for. 3) Model does not account for attenuation between depth to soil and 0-6 ft bgs interval for burrows.	Moderate	Over- or under-estimation of exposure/risk

Table 6-6
ERA Uncertainty Analysis
Group 5 RFI Report

Assessment Element	Uncertainty	Magnitude of Impact	Direction of Impact
Toxicity Reference Values	Toxicity data were not available for all CPECs or media considered in the Group 5 ERAs. CPECs for which toxicity data were unavailable were not evaluated, or surrogate toxicity data were used. Risks may be overestimated or underestimated.	Moderate	Over- or under-estimation of exposure/risk
Toxicity Reference Values	Literature-derived toxicity data from laboratory studies were the only toxicity data used to evaluate risk to all receptor groups. Effects observed in laboratory species were assumed to be indicative of effects that would occur in wild species. The suitability of this assumption is unknown. Therefore, risk may be either overestimated or underestimated.	Moderate	Over- or under-estimation of risks
Toxicity Reference Values	There is uncertainty in extrapolation of dose-response data from laboratory animals to other wildlife.	Moderate	Over- or under-estimation of risks
Toxicity Reference Values	Use of standardized uncertainty factors to estimate chronic NOAEL-equivalent TRVs.	Moderate	Over- or under-estimation of risks
Toxicity Reference Values	Use of chronic NOAEL-equivalent TRVs may overestimate risk.	High	Over-estimation of exposure/risk
Toxicity Reference Values	TRVs based on high dose laboratory exposures (LD50) were adjusted to a NOAEL-equivalent TRV. The more variables that are normalized using uncertainty factors, the greater the uncertainty in the resulting value.	Moderate	Over-estimation of exposure/risk
Toxicity Reference Values	Sources of TRVs occasionally apply different uncertainty factors than those used in the SRAM to adjust a study to what they label a "Chronic NOAEL". When details of the study were available, SRAM-specified uncertainty factors were used. If the details of the study were not presented or were not sufficiently complete to make a determination, then the interpretations made by the source document were used.	Low	Over- or under-estimation of risks
Risk Characterization			
Risk Estimation	Potential ecological risks were quantified using the HQ approach. The magnitude of the HQ indicates potential for ecological risk, but is not an exact estimation of risk. For example, the actual risk from a chemical with an HQ of 70 could be less than that for a chemical with an HQ of 20 because of uncertainties involved in estimating exposure, selection of effects criteria (TRVs), or field conditions affecting exposure.	Moderate	Over- or under-estimation of risks
Risk Estimation	Data necessary to estimate potential risks from all pathways for all chemicals in the food-chain uptake model were not always available. For these chemicals and/or areas, the food-chain uptake model was completed using the available data.	Moderate	Under-estimation of exposure/risk
Risk Estimation	Risks estimated for exposure to some inorganics may represent a background risk, rather than a site-related risk. Although the WRS test sometimes indicated that the site exceeded background, the Maximum, CTE, and/or RME EPC concentrations, it was sometimes found that site values were less than or comparable to the background Maximum, CTE, and/or RME concentrations.	Moderate	Over- or under-estimation of exposure/risk

Table 6-6
ERA Uncertainty Analysis
Group 5 RFI Report

Assessment Element	Uncertainty	Magnitude of Impact	Direction of Impact
Risk Description	The soluble and toxic forms of aluminum are only present in soil under soil pH values of less than 5.5 (USEPA 2003), and the average pH for the soils at the Group 5 sites exceeds 5.5. Aluminum, while evaluated in the ERA as a CPEC and identified as a risk driver, most likely does not cause effects to the various ecological receptors due to the soil pH range.	Moderate	Over-estimation of exposure/risk

Notes:
BAF - bioaccumulation factor
CPEC - chemical of potential ecological concern
CTE - central tendency exposure
EPC - exposure point concentration
ERA - ecological risk assessment
ESL - ecological screening level
LD50 - lethal doses to 50% of test animals
NOAEL - no observed adverse effect level
RME - reasonable maximum exposure
SQL - sample quantitation limit
TRV - toxicity reference value
UCL - upper confidence limit on the mean
VOC - volatile organic chemical
WRS - Wilcoxon Rank Sum test

Table 7-1
Group 5 Reporting Area Surficial Media Site Action Recommendations
Santa Susana Field Laboratory, Ventura County, California

Area	Chemical Use Area Name	CMS Area (1)	Recommended for further consideration in CMS based on:		
			Residential Receptor (2)	Recreational Receptor (2)	Ecological Receptor (2)
Boeing Area IV Leach Fields RFI Site (an Area IV AOC) - Appendix D					
1	Building 4011 (including AT-05 and AT-06)	NFA	No HRA COCs identified	No HRA COCs identified	***Soil Results***
2	Buildings 4007 and 4008	NFA			Any HQ>1 / COEC / Rationale
3	Building 4711	NFA			Barium / No / ERA-2
4	Building 4611	NFA			Chromium / No / ERA-2
5	Building 4171	NFA			Vanadium / No / ERA-2
6	AST 4735	NFA			PCB_TEQ_Bird / Yes / ERA-6
7	UT-06	NFA			PCB_TEQ_Mammal / Yes / ERA-6
8	Building 4011 Leach Field	NFA			
9	Building 4172	NFA			
10	Transformer Pole D-5	NFA			***Soil Vapor Results***
11	Sodium Component Test Installation (SCTI) Pump Station	NFA			Any HQ>1? / COEC / Rationale
12	Parking Lot 4502	NFA			None / None / ERA-7
Compound A Facility RFI Site (SWMU 6.4) - Appendix E					
1	Building 3418	CMPA-1	HRA COCs: ***Near Surface Groundwater Results:*** Trichloroethene, Vinyl Chloride, 1,1-Dichloroethane, Tetrachloroethene ***Soil Results:*** Arsenic Aroclor 1254 ***Soil Vapor Results:*** Trichloroethene	HRA COCs: ***Soil Results:*** Arsenic	***Soil Results***
2	Forming Pits	CMPA-3			Any HQ>1? / COEC / Rationale
3	Compound A Pond	CMPA-1			Aluminum / No / ERA-1
4	Fluorine Pipeline	CMPA-1			Arsenic / Yes / ERA-28
5	Storage Shed	NFA			Cadmium / Yes / ERA-4
6	Suspect Pond	NFA			Chromium / Yes / ERA-4
7	Debris Area	CMPA-2			Copper / Yes / ERA-4
8	Explosive magazines	NFA			Nickel / Yes / ERA-4
9	STL-IV Air Stripping Towers	NFA			Silver / Yes / ERA-4
10	Suspect Dredge Materials (P2) North of Compound A Facility Site	CMPA-4			Zinc / Yes / ERA-4
					2,4-Dinitrophenol / No / ERA-11
					2,4,6-Trinitrotoluene / No / ERA-11
					Aroclor 1254 / Yes / ERA-8
					Aroclor 1260 / Yes / ERA-8
					DioxinFuranPCB_TEQ (bird and mammal) / Yes / ERA-29
					Hexachlorobnezene / No / ERA-11
					Soil Vapor Results
					Any HQ>1? / COEC / Rationale
					1,1,2-Trichloroethane / Yes / ERA-27
					1,1-Dichloroethene / Yes / ERA-26
					cis-1,2-Dichloroethene / Yes / ERA-26
					Trichloroethene / Yes / ERA-26

Table 7-1
Group 5 Reporting Area Surficial Media Site Action Recommendations
Santa Susana Field Laboratory, Ventura County, California

Area	Chemical Use Area Name	CMS Area (1)	Recommended for further consideration in CMS based on:				
			Residential Receptor (2)	Recreational Receptor (2)	Ecological Receptor (2)		
Engineering Chemistry Laboratory (ECL) RFI Site (SWMU 6.1, 6.2, 6.3, and an Area IV AOC) - Appendix F							
1	Engineering Chemistry Laboratory	ECL-1	HRA COC:	HRA COC:	***Soil Results***		
2	Building 3260	ECL-2	***Near Surface Groundwater Results:***	***Soil Results:***	<u>Any HQ>1?</u>	<u>COEC</u>	<u>Rationale</u>
3	Building 3798	ECL-3	1,4-Dioxane,	Arsenic	Aluminum	No	ERA-1
4	ECL Pond	ECL-1	1,1-Dichloroethane,		Arsenic	Yes	ERA-30
5	ECL Suspect Pond	ECL-1	1,2,3-Trichloropropane		Cadmium	No	ERA-13
6	Building 3270 Leach Field	ECL-4	1,2-Dichloroethane,		Copper	Yes	ERA-4
7	Substation Adjacent to Building 3367	NFA	3-Chloro-2(chloromethyl)-1-Propene,		Nickel	Yes	ERA-31
8	Building 3799	NFA	Carbon Tetrachloride,		Vanadium	Yes	ERA-4
9	Building 3258	ECL-5	Chloroform,		Zinc	Yes	ERA-32
10	Building 3269	ECL-5	Dichloropropene,		1,2-Dinitrobenzene	Yes	ERA-4
11	Substation West of Building 3259	NFA	n-Nitrosodimethylamine,		bis(2-Ethylhexyl) phthalate	No	ERA-33
12	Bunker South of Building 3269	NFA	Tetrachloroethene,		Toluene	No	ERA-34
13	Bunker East of Engineering Chemistry Lab	ECL-6	Trichloroethene,				
			Vinyl Chloride,				
			Soil Results:				
			Arsenic				
			Soil Vapor Results:		***Soil Vapor Results***		
			Benzene,		<u>Any HQ>1?</u>	<u>COEC</u>	<u>Rationale</u>
			Tetrachloroethene,		1,1,2-Trichloroethane	Yes	ERA-27
			Trichloroethene,		Methylene chloride	Yes	ERA-26
			Vinyl Chloride		Vinyl chloride	Yes	ERA-26
Environmental Effects Laboratory (EEL) RFI Site (SWMU 6.9) - Appendix G							
1	EEL Cryongenic Laboratory and Test Cells	NFA	HRA COC:	HRA COC:	***Soil Results***		
2	EEL Storage	EEL-3	***Near Surface Groundwater Results:***	***Soil Results:***	<u>Any HQ>1?</u>	<u>COEC</u>	<u>Rationale</u>
			Trichloroethene	Arsenic	Aluminum	No	ERA-1
			Soil Results:		Arsenic	Yes	ERA-4
			Arsenic		Vanadium	No	ERA-2
			Soil Vapor Results:		Aroclor 1254	Yes	ERA-8
			Trichloroethene		PCB_TEQ_Bird	Yes	ERA-6
					PCB_TEQ_Mammal	Yes	ERA-6
3	EEL Mechanics Workshop	EEL-2					
5	Tanks	NFA			***Soil Vapor Results***		
6	Transformers	EEL-1			<u>Any HQ>1?</u>	<u>COEC</u>	<u>Rationale</u>
					1,1,2-Trichloroethane	Yes	ERA-27
7	Hazardous Materials Storage Pad	EEL-2			Trichloroethene	Yes	ERA-26

Table 7-1
Group 5 Reporting Area Surficial Media Site Action Recommendations
Santa Susana Field Laboratory, Ventura County, California

Area	Chemical Use Area Name	CMS Area (1)	Recommended for further consideration in CMS based on:		
			Residential Receptor (2)	Recreational Receptor (2)	Ecological Receptor (2)
Pond Dredge Area RFI Site (an Area IV AOC) - Appendix H					
1	Pond Dredge	Pond Dredge Area-1	No HRA COCs identified	No HRA COCs identified	***Soil Results***
					Any HQ>1? / COEC / Rationale Aluminum: No / ERA-1 Barium: Yes / ERA-4 Chromium: Yes / ERA-4 Copper: No / ERA-2 Nickel: Yes / ERA-22 Vanadium: Yes / ERA-4 Zinc: No / ERA-4 bis(2-Ethylhexyl) phthalate: Yes / ERA-23 DioxinFuranPCB_TEQ_Bird: Yes / ERA-8
					Soil Vapor Results
					Any HQ>1? / COEC / Rationale None / None / ERA-7
Coal Gasification Process Development Unit (PDU) RFI Site (SWMU 7.10) - Appendix I					
1	Building 4005	PDU-2	HRA COC: ***Soil Results:*** Benzo(a)anthracene Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dioxin/Furan TEQ, Indeno(1,2,3-cd)pyrene, ***Near Surface Groundwater Results:*** Antimony	HRA COC: ***Surface Soil Results:*** Benzo(a)pyrene, Benzo(b)fluoranthene, Indeno(1,2,3-cd)pyrene	***Soil Results***
2	Building 4006	PDU-1			Any HQ>1? / COEC? / Rationale Cadmium: Yes / ERA-9 Silver: Yes / ERA-4 Zinc: Yes / ERA-10 2,4-Dintrophenol: No / ERA-11 Aroclor 1248: Yes / ERA-12 Aroclor 1260: Yes / ERA-12 Benzo(a)anthracene: Yes / ERA-12 Benzo(a)pyrene: Yes / ERA-12 Benzo(b)fluoranthene: Yes / ERA-12 Benzo(ghi)perylene: Yes / ERA-12 Benzo(k)fluoranthene: Yes / ERA-12 Chrysene: Yes / ERA-12 DioxinFuranPCB_TEQ_Bird: Yes / ERA-8 DioxinFuranPCB_TEQ_Mammal: Yes / ERA-8 Hexachlorobenzene: No / ERA-11 Indeno(123-cd)pyrene: Yes / ERA-12 Phanthrene: Yes / ERA-12 Pyrene: Yes / ERA-12
4	Building 4027	NFA			
5	Building 4032	NFA			
6	Building 4042	PDU-2			
7	Former PDU Area	PDU-2			
11	Building 4402	NFA			
13	Building 4616	NFA			
14	Coal Storage Yard	NFA			
17	Transformer 4706	NFA			
20	Transformer 4742	NFA			
21	Building 4005/4006 Leach Field	NFA			
22	Bag House	PDU-4			***Soil Vapor Results***
23	Catchment Basin	NFA			Any HQ>1? / COEC / Rationale None / None / ERA-7
24	17 St. Drainage area	PDU-3			***Surface Water Results***
25	Building 4037	NFA			Any HQ>1? / COEC / Rationale None / None / ERA-7

Table 7-1
Group 5 Reporting Area Surficial Media Site Action Recommendations
Santa Susana Field Laboratory, Ventura County, California

Area	Chemical Use Area Name	CMS Area (1)	Recommended for further consideration in CMS based on:				
			Residential Receptor (2)	Recreational Receptor (2)	Ecological Receptor (2)		
Area 3 Sewage Treatment Plant (STP-3) RFI Site (an Area IV AOC) - Appendix J							
1	Area 3 STP	NFA	No HRA COCs identified	No HRA COCs identified	***Soil Results***		
2	STP Pond	STP-1			Any HQ>1	COEC	Rationale
					Aluminum	No	ERA-1
					Arsenic	No	ERA-2
					Barium	Yes	ERA-4
					Chromium	Yes	ERA-4
					Cobalt	No	ERA-2
					Copper	Yes	ERA-4
					Nickel	Yes	ERA-4
					Silver	Yes	ERA-4
					Vanadium	No	ERA-2
					Zinc	Yes	ERA-4
					Perchlorate	Yes	ERA-4
					Chrysene	No	ERA-3
3	STP Clarifier	STP-3			***Soil Vapor Results***		
4	Former Ranch House	STP-2			Any HQ>1?	COEC	Rationale
					None	None	ERA-7
SE Drum Storage Yard (SE Drum Yard) RFI Site (an Area IV AOC) - Appendix K							
1	SE Drum Storage Yard	NFA	No HRA COCs identified	No HRA COCs identified	***Soil Results***		
					Any HQ>1	COEC	Rationale
					Aluminum	No	ERA-1
					Barium	No	ERA-2
					Chromium	No	ERA-2
					Vanadium	No	ERA-2
					Soil Vapor Results		
					Any HQ>1?	COEC	Rationale
					None	None	ERA-7
Systems Test Laboratory IV (STL-IV) RFI Site (SWMU 6.5, 6.6, and 6.7) - Appendix L							
1	Module 3	STL-CMS-1	HRA COC:	No HRA COCs identified	***Soil Results***		
2	Fuel Storage Area/ Monomethyl Hydrazine (MMH) Ozonator Tank	STL-CMS-1	***Soil Vapor Results:***		Any HQ>1?	COEC	Rationale
3	Fuel Storage Area/ Monomethyl Hydrazine (MMH) Ozonator Tank	STL-CMS-1	Vinyl Chloride		Cadmium	Yes	ERA-4
4	STL-IV Impoundments 1 and 2 and Associated Channels	STL-CMS-1	Trichloroethene		Vanadium	Yes	ERA-24
5	Engine Test Stand No. 2 and Module 2	STL-CMS-1			Zinc	No	ERA-25
6	Building 3794, Hot Water Boiler Shelter, and Building 3780, Assembly Decontamination	STL-CMS-1	***Near Surface Groundwater Results:***		di-n-butyl phthalate	Yes	ERA-4
7	Engine Test Stand No. 3 and Module 1	STL-CMS-1	Trichloroethene,		DioxinFuran_TEQ_Mammal	Yes	ERA-8
8	Building 3254	STL-CMS-1	Tetrachloroethene,				
9	Building 3318/Workshop/Instrumentation Shop/Tool Crib	STL-CMS-1	Vinyl Chloride,		***Soil Vapor Results***		
			Tetrahydrofuran				

Table 7-1
Group 5 Reporting Area Surficial Media Site Action Recommendations
Santa Susana Field Laboratory, Ventura County, California

Area	Chemical Use Area Name	CMS Area (1)	Recommended for further consideration in CMS based on:				
			Residential Receptor (2)	Recreational Receptor (2)	Ecological Receptor (2)		
10	Hazardous Waste Storage Locker, VOC Storage and Use, General Storage and Use	STL-CMS-1			Any HQ>1? 1,1,2-Trichloro-1,2,2-trifluoroethane 1,1,2--Trichloroethane 1,1-Dichloroethene cis-1,2-Dichloroethene Trichloroethene Vinyl chloride	COEC Yes Yes Yes Yes Yes Yes	Rationale ERA-26 ERA-27 ERA-26 ERA-26 ERA-26 ERA-26
11	Explosive Use/Storage	NFA					
12	Engine Test Stand No. 4	STL-CMS-2					
13	Suspect Pond	STL-CMS-3					
14	Operations Trailer/Clean Room Trailer/Lunch Room	NFA					
15	Nitro Tetroxide (NTO) Storage Area	STL-CMS-4					
16	Leach Field	STL-CMS-1					
17	STL-IV Explosive Bunkers	NFA					
N/A	Debris locations 3001 and 3002	STL-CMS-5					
Building 65 Metals Laboratory Clarifier (Building 65) RFI Site (an Area IV AOC) - Appendix M							
1	Building 4065 Metals Clarifier	NFA	No HRA COCs identified	No HRA COCs identified	***Soil Results***		
2	Building 4065	NFA			Any HQ>1? None	COEC None	Rationale ERA-7
3	UT-76	NFA					
4	UT-70	NFA					
5	Substation 4762	NFA			***Soil Vapor Results***		
6	Building 4066	NFA			Any HQ>1?	COEC	Rationale
7	Building 4062	NFA			1,1,2-Trichloroethane	No	ERA-5
Building 100 Trench RFI Site (SWMU 7.5) - Appendix N							
1	Bldg 100 Trench	B100-1	HRA COC: ***Soil Results:*** Lead	No HRA COCs identified	***Soil Results***		
2	Building 100 Area - Potential Source of VOCs and Dioxins	NFA			Any HQ>1? Aluminum 2,4-Dintrophenol	COEC? No No	Rationale ERA-1 ERA-5
3a	Hummocky Area - Western	NFA					
3b	Hummocky Area - Northern	NFA					
4	Bldg 100 Leach Field	NFA			***Soil Vapor Results***		
5	Bldg 4463	**Moved to DOE LF3**			Any HQ>1? 1,1,2-Trichloroethane	COEC No	Rationale ERA-5
6	Transformer 4800 (4710)	NFA					
Department of Energy Leach Field 1 (DOE LF1) RFI Site (an Area IV AOC) - Appendix O							
1	Building 4093 Leach Field	NFA	No HRA COCs identified	No HRA COCs identified	***Soil Results***		
2	Building 4030 Leach Field	NFA			Any HQ>1 Hexachlorobenzene PCB_TEQ_Mammal	COEC? No Yes	Rationale ERA-5 ERA-6
3	Building 4074	NFA					
4	Building 4023	NFA					
5	Building 4030/4035	NFA					
6	Electrical Substation located north of Building 4641	NFA					
7	Transformer Pole	NFA					
8	Building 4641	NFA					
9	Building 4073	NFA					

Table 7-1
Group 5 Reporting Area Surficial Media Site Action Recommendations
Santa Susana Field Laboratory, Ventura County, California

Area	Chemical Use Area Name	CMS Area (1)	Recommended for further consideration in CMS based on:				
			Residential Receptor (2)	Recreational Receptor (2)	Ecological Receptor (2)		
10	Building 4083	NFA					
11	Buildings 4093 and 4893	NFA					
12	Building 4103	NFA			***Soil Vapor Results***		
13	Building 4123	NFA			Any HQ>1?	COEC	Rationale
14	Building 4453	NFA			1,1,2-Trichloroethane	No	ERA-5
Department of Energy Leach Field 2 (DOE LF2) RFI Site (an Area IV AOC) - Appendix P							
1	Substation 4713	NFA	No HRA COCs identified	No HRA COCs identified	***Soil Results***		
2	Substation 4708A/4708B	NFA			Any HQ>1	COEC	Rationale
3	Substation 4756	NFA			PCB_TEQ_Bird	Yes	ERA-6
4	Substation on Western Side of Building 4010	NFA			PCB_TEQ_Mammal	Yes	ERA-6
5	Substation on Eastern Side of Building 4010	NFA					
6	Building 4010	NFA			***Soil Vapor Results***		
7	Building 4010 Leach Field	NFA			Any HQ>1?	COEC	Rationale
8	Building 4012	NFA			1,1,2-Trichloroethane	No	ERA-5
9	Air Compressor Pad/Cooling Water Pipelines	NFA					
10	Building 4013	NFA					
11	EMGEN	NFA					
12	T-L01 (Turbine)	NFA					
13	TCF-1	NFA					
14	TCF-2	NFA					
15	TCF-3	NFA					
16	EMSTG	NFA					
17	Substation 4413	NFA					
Department of Energy Leach Field 3 (DOE LF3) RFI Site (an Area IV AOC) - Appendix Q							
1	Building 4353	NFA	HRA COC:	HRA COC:	***Soil Results***		
2	Building 4363	NFA			Any HQ>1?	COEC	Rationale
3	Building 4373	NFA	***Near Surface Groundwater Results:***	***Soil Results:***	Aluminum	No	ERA-1
4	Building 4383	NFA	Nitrate-NO3	Benzo(a)pyrene	Barium	No	ERA-2
5	Buildings 4375, 4874, and 4875	NFA	Tetrachloroethene,		Cadmium	No	ERA-14
6	Substation 4707	NFA	Trichloroethene		Chromium	No	ERA-13
7	Building 4374	NFA			Copper	No	ERA-15
8	Substation 4883 A	NFA			Mercury	No	ERA-16
9	Building 4055	NFA	***Soil Results:***		Nickel	No	ERA-2
10	Building 4462	DOELF3-1	Benzo(a)pyrene		Vanadium	No	ERA-19
11	UT-75	NFA			Zinc	No	ERA-18
12	UST (north of Building 4363)	NFA			1,2-Dinitrobenzene	Yes	ERA-4
13	UT-72	NFA			Aroclor 1260	Yes	ERA-4
14	UT-12 (UT-55)	NFA			PCB_TEQ_Bird	Yes	ERA-6
15	Building 4353 Leach Field	NFA			PCB_TEQ_Mammal	Yes	ERA-6
16	Building 4363 Leach Field	NFA					
17	Building 4373 Leach Field	NFA					
18	Building 4383 Leach Field	NFA					
19	Substation 4760 A	NFA					
20	Substation 4755	NFA					
21	Transformer Pole X14	NFA					
22	Substation 4762 B	DOELF3-2					
23	Substation 4760 B	NFA					
24	Substation 4883 B	NFA					

Table 7-1
Group 5 Reporting Area Surficial Media Site Action Recommendations
Santa Susana Field Laboratory, Ventura County, California

Area	Chemical Use Area Name	CMS Area (1)	Recommended for further consideration in CMS based on:				
			Residential Receptor (2)	Recreational Receptor (2)	Ecological Receptor (2)		
25	Substation 4853	NFA					
26	Transformer Pole A324	NFA					
27	Building 4473	NFA					
28	Building 4854	NFA					
29	Building 4863	NFA			***Soil Vapor Results***		
30	Building 4873	NFA			Any HQ>1?	COEC	Rationale
31	Building 4015	NFA			None	None	ERA-7
32	Debris Area 3005	NFA					
33	Building 4463	NFA					
34	Substation 4780	NFA					
35	Building 4461	NFA					
36	Building 4628	NFA					
37	Building 4662	NFA					
Hazardous Materials Storage Area (HMSA) RFI Site (SWMU 5.7) - Appendix R							
1	Building 4357	NFA	HRA COC:	No HRA COCs identified	***Soil Results***		
2	Building 4457	NFA			Any HQs>1?	COEC	Rationale
2	Sump #1	NFA	***Near Surface Groundwater***		Vanadium	No	ERA-20
2	Sump #2	NFA	***Results:***		Zinc	Yes	ERA-21
3	T-357	NFA	Trichloroethene		bis(2-Ethylhexyl) phthalate	Yes	ERA-4
4	Building 4025	HMSA-2			Chrysene	Yes	ERA-8
5	Building 4024	HMSA-1	***Soil Results:***		PCB_TEQ_Bird	Yes	ERA-6
6	Substation 4725	NFA	Benzo(a)pyrene,		PCB_TEQ_Mammal	Yes	ERA-6
7	Buildings 4026, 4426, 4826, and 4226	NFA	Benzo(b)fluoranthene,				
8	Substation 4726	NFA	Benzo(a)anthracene,		***Soil Vapor Results***		
9	Building 4334	NFA	Benzo(k)fluoranthene		Any HQ>1?	COEC	Rationale
10	Building 4358	NFA			1,1,2-Trichloroethane	No	ERA-5
11	Building 4355	NFA					
12	Building 4356, including tanks and transformers located inside Building 4356	NFA					
13	Building 4361, including tanks located inside Building 4361	NFA					
14	Building 4656	NFA					
15	Building 4625	NFA					
16	UT-19	NFA					
Rockwell International Hot Lab (RIHL) RFI Site (SWMU 7.7) - Appendix S							
1	Building 4020	NFA	HRA COC:	No HRA COCs identified	***Soil Results***		
1	Hydraulic Lift	NFA			Any HQ>1?	COEC	Rationale
			Soil Results:		Aluminum	No	ERA-1
			Aroclor-1254		Cadmium	Yes	ERA-4
			Aroclor-1260		Chromium	No	ERA-2
					Cobalt	No	ERA-2
			Near Surface Groundwater		Copper	No	ERA-2
			Results:		Nickel	Yes	ERA-4
			Trichloroethene		Vanadium	Yes	ERA-4
					Aroclor 1254	Yes	ERA-8
					Aroclor 1260	Yes	ERA-8
					PCB_TEQ_Bird	Yes	ERA-6
					PCB_TEQ_Mammal	Yes	ERA-6

Table 7-1
Group 5 Reporting Area Surficial Media Site Action Recommendations
Santa Susana Field Laboratory, Ventura County, California

Area	Chemical Use Area Name	CMS Area (1)	Recommended for further consideration in CMS based on:				
			Residential Receptor (2)	Recreational Receptor (2)	Ecological Receptor (2)		
2	Aboveground Tanks	NFA			***Soil Vapor Results***		
3	UT-10 and UT-11	NFA			Any HQ>1?	COEC	Rationale
4	Substation 4720	RIHL-1			1,1,2-Trichloroethane	No	ERA-5
5	Northeast portion of RFI site	RIHL-2					
Systems for Nuclear Auxilliary Power Facility (SNAP) RFI Site (an Area IV AOC) - Appendix T							
1	Building 4059 (AOC)	NFA	HRA COC:	No HRA COCs identified	***Soil Results***		
2	Bldg 4059 French Drain System	NFA			Any HQ>1	COEC	Rationale
3	Building 4057	SNAP-1	***Soil Vapor Results:***		Barium	No	ERA-2
4	Building 4358	NFA	Tetrachloroethene		Aroclor 1248	Yes	ERA-8
5	Building 4360	NFA			PCB_TEQ_Bird	Yes	ERA-6
6	Building 4459	NFA	***Near Surface Groundwater***		PCB_TEQ_Mammal	Yes	ERA-6
7	UT-36	NFA	***Results:***				
8	Building 4757 Transformer	NFA	Tetrachloroethene				
9	Building 4759 Transformer	NFA	Trichloroethene				
10	Building 4719 Transformer	NFA			***Soil Vapor Results***		
11+12	Acid and Sodium Hydroxide Aboveground Storage Tanks	NFA			Any HQ>1?	COEC	Rationale
13	Building 4626	SNAP-1			1,1,2-Trichloroethane	No	ERA-5

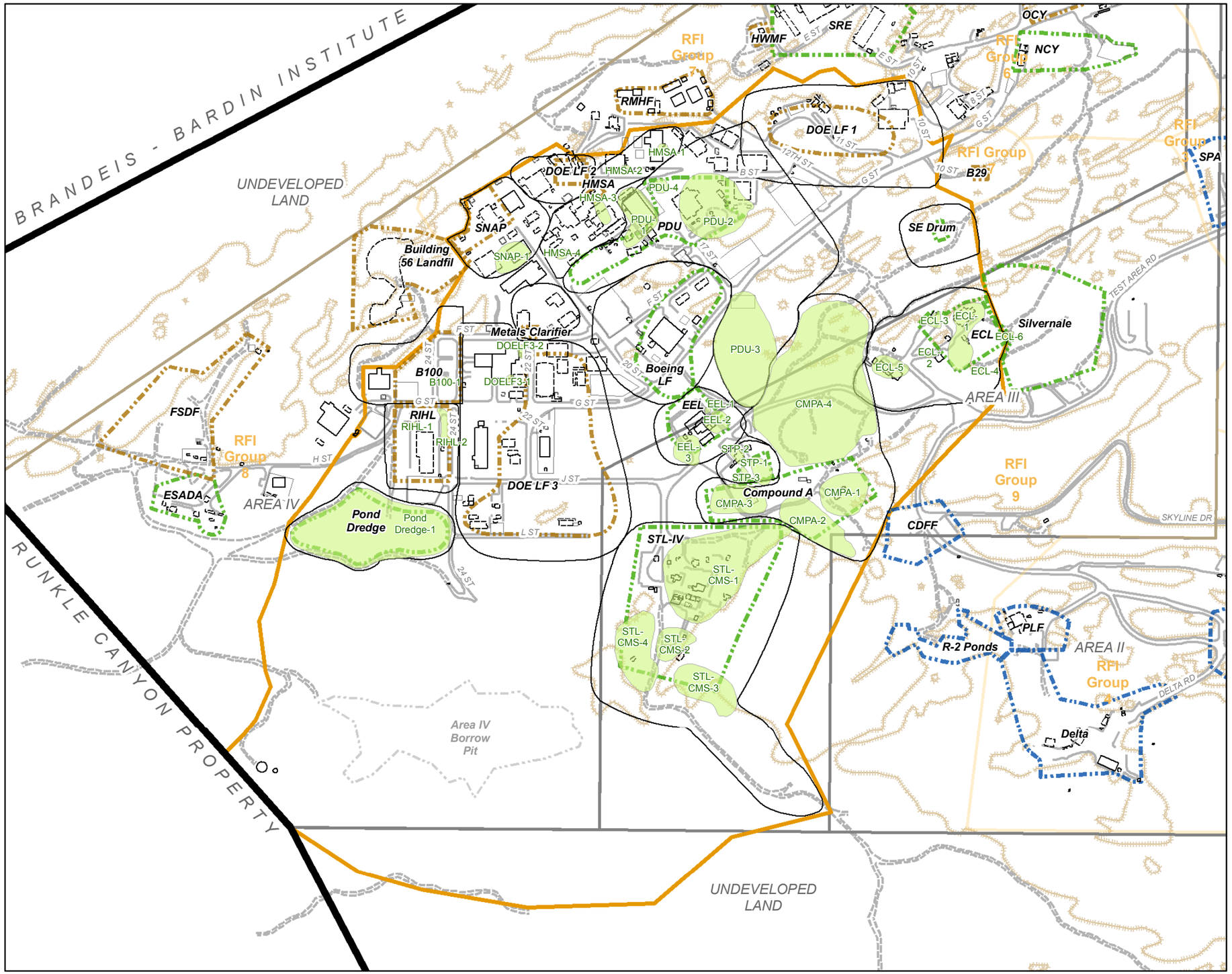
Notes:
1. NFA - Indicates area is recommended for No Further Action (NFA) for the CUA; not recommended for CMS evaluation.
2. CMS recommendations are based on compounds considered risk drivers (excess cancer risk > 1 x 10-6 or hazard index > 1) and/or significant risk contributors.

ERA-1 USEPA guidance indicates no risk from aluminum when pH is greater than 5.5. Site pH >5.5.
ERA-2 Site maximum concentration is below background maximum concentration. Site RME is similar to background RME.
ERA-3 Terrestrial plants were the only receptor showing potential risk. HQ close to 1.
ERA-4 Estimated risks and or incremental risks >1 for 1 or more receptors. Magnitude of exceedance indicate potential risk.
ERA-5 Analyte was not detected in either soil or soil vapor. It was retained for risk calcs because SQL> ESL. Estimated risk is Low. Actual presence is uncertain.
ERA-6 Estimated risks >1 for 1 or more receptors and chemical class hazard index>1. NOTE- eposure point concentrations were extrapolated from Aroclor 1254 and 1260 (not directly measured).
ERA-7 No chemicals of potential ecological concern exceeded Low or High TRVs under either the CTE or RME scenarios.
ERA-8 Estimated risks >1 for 1 or more receptors. Chemical class Hazard Index >1.
ERA-9 Estimated risks >1 at the Low TRV only. Estimated risks driven by single high detect (14.7 mg/kg) at PUBS1009.
ERA-10 Estimated risks 3 receptors at the Low TRV only. Estimated risks driven by several high detects (>200 mg/kg) around locations PUBS06, PUBS07, PUBS08, PUBS09, PUBS10,PUBS11, PUBS1042, PUBS1044, PUBS046, and PUBS1048.
ERA-11 Chemical was not detected on site, but was retained in the evaluations as part of the SQL/ESL sceen. Actual presence and concentration is uncertain
ERA-12 Retained primarily because individual chemical HQ and chemical class HI >1.
ERA-13 Site RME and Maximum concentrations are similar to background RME and Maximum concentrations. Incremental risk <1 for all receptors except hermit thrush.
ERA-14 Site RME concentration is below background RME concentration All estimated risk is due to background.
ERA-15 Site CTE similar to background CTE concentration. All incremental HQs<1 with exception of hermit thrush.
ERA-16 Estimated risks are driven by single high detect (6.7 mg/kg) at location L7BS1404S01. HQs >1 only for terrestrial plants and hermit thrush and HQ for thrush was close to 1.
ERA-17 Maximum site concentration close to maximum background concentration. HQs>1 for deer mouse only. Incremental risks>1 only at the Low TRV.
ERA-18 Estimated risks are driven by single high detect (333 mg/kg) at location L8BS1003S01.Only 3 resutls exceeded the maximum background value. -Estimated risks exceeded Low TRVs for a single receptor (hermit thrush), all other HQs were <1.
ERA-19 Site CTE concentration similar to background CTE. Deer mouse on receptor with HQs>1.
ERA-20 Site concentrations (RME and CTE) are similar to background. Estimated risk driven by one higher result although it is still within 1.5x background.
ERA-21 Estimated risks are driven by single high detect (340 mg/kg) at location HSBS1000. Only 4 results exceeded the maximum background value. -Estimated risks exceeded Low TRVs for a hermit thrush and deer mouse, all other HQs were <1.

Table 7-1
Group 5 Reporting Area Surficial Media Site Action Recommendations
Santa Susana Field Laboratory, Ventura County, California

Area	Chemical Use Area Name	CMS Area (1)	Recommended for further consideration in CMS based on:		
			Residential Receptor (2)	Recreational Receptor (2)	Ecological Receptor (2)
ERA-22	Estimated risks for thrush, mouse, deer. Risks for mouse driven by single high result (65.4 mg/kg) at 3 ft bgs. All other results from 0-6 ft bgs are below the maximum background concentration.				
ERA-23	Estimated risks to thrush only (Low TRV). All incremental risks <1.				
ERA-24	Chemical was a CPEC for the deer mouse (0-6 ft bgs) depth interval. Other depth intervals were within background based on WRS-Gehan evaluation. Site maximum detect (77 mg/kg) exceeds maximum background concentration (62 mg/kg). However,most risk is due to background.				
ERA-25	Estimated risk to thrush and mouse, but incremental risks for all receptors <1.				
ERA-26	Estimated risks to small burrowing mammals (dee mouse) based on measured concentrations in soil vapor.				
ERA-27	Chemical was not detected on site, but was retained in the evaluations as part of the SQL/ESL sceen. Actual presence and concentration is uncertain. However, it was retained as a COEC because other VOCs exceeded TRVs for soil vapor and were retained as COECs.				
ERA-28	Estimated risks driven by high detects around locations CFBS1515 and CFBS1032. Most of remaining locations are below maximum background concentrations. Estimated risks for these are due to background.				
ERA-29	Estimated risks >1 for 1 or more receptors and chemical class hazard index>1. NOTE- eposure point concentrations based on measured data for dioxin/furans and extrapolated data for dioxin-like PCBs (not directly measured).				
ERA-30	Estimated risks for soil invertebrates and mouse. Results driven by 2 sample locations that exceed background (ECBS1001 and ECBS1003). All other data < background.				
ERA-31	Estimated risks for thrush, mouse and deer. Estimates driven by 1 sample location that exceeds background (ECBS1035). All other data < background.				
ERA-32	Estimated risks for plants, thrush, and mouse. Results driven by 3 sample locations that exceed background (ECBS1035, ECBS1011, and ECSS02). All other data < background.				
ERA-33	Estimated risks close to 1 and analyte is often associated with laboratory error/contamination.				
ERA-34	Estimated risk shown only for soil invertebrates. No estimated risks to any other receptor group.				

Figures



CMS Area

Basemap Legend

- Building - Existing
- Building - Removed
- Building - Not Yet Determined
- Transformer - Existing
- Transformer - Removed
- Transformer - Not Yet Determined
- RFI Site - Boeing
- RFI Site - DOE
- RFI Site - NASA
- Investigation Boundary
- RFI 5 Group Boundary
- RFI Group Boundary
- Administrative Area
- Property Boundary
- Road - Asphalt
- Roads - Dirt
- Rocks
- Streams
- Pond

Surficial Media Site Action Recommendations

Date: October 30, 2008

WORKING DRAFT

1 inch equals 500 feet

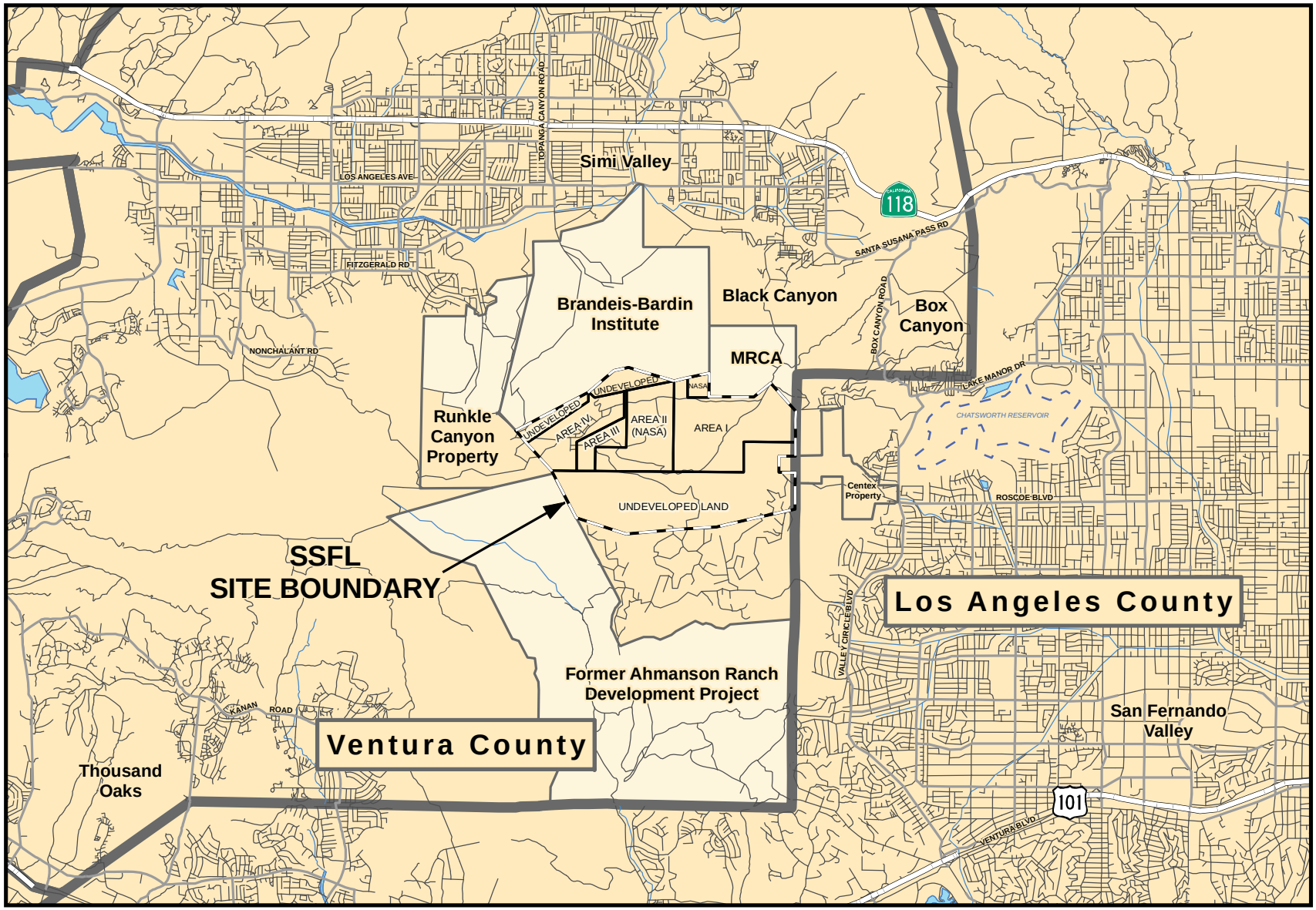
0 500 1,000 Feet

Document: \\..MapFiles\RFI_05\RFI_Report\RFIGrp5_CMS_ES1_BL.mxd

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure ES-1



1 inch equals 1.5 miles

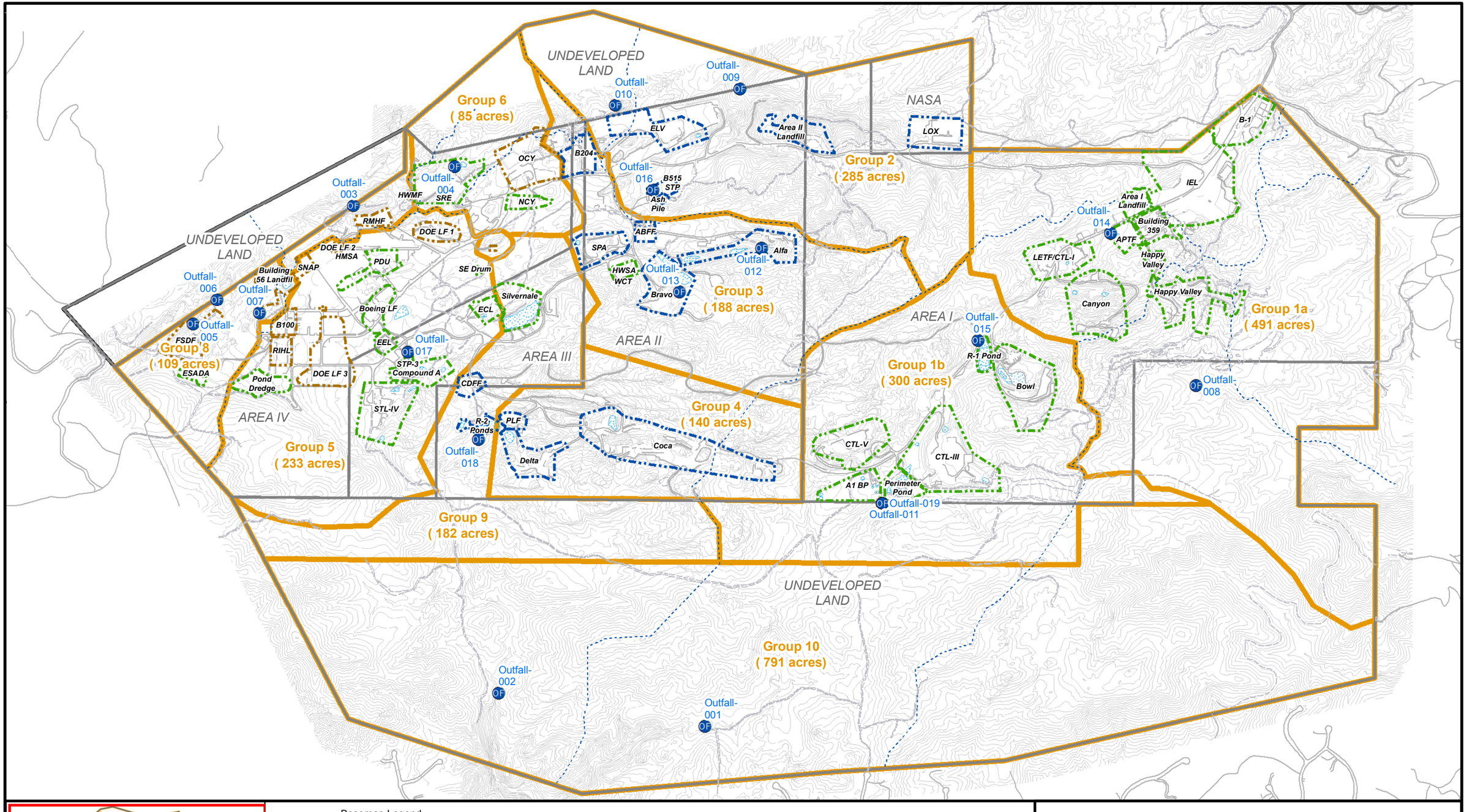
Miles

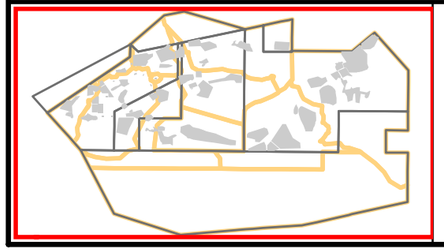
0 1.5 3

FIGURE 1-1
Regional Map
Group 5 RFI Report

SCO362070.FP.5A.05.BO regional_map.ai 10/08

CH2MHILL





Basemap Legend

- RFI Group Boundary
- Administrative Area
- Property Boundary
- Pond
- RFI Site - Boeing
- RFI Site - DOE
- RFI Site - NASA
- Surface Drainage Divide
- NPDES Outfalls
- Road - Asphalt
- Roads - Dirt

SSFL Site Plan

1 inch equals 1,200 feet

0 1,200 2,400 Feet

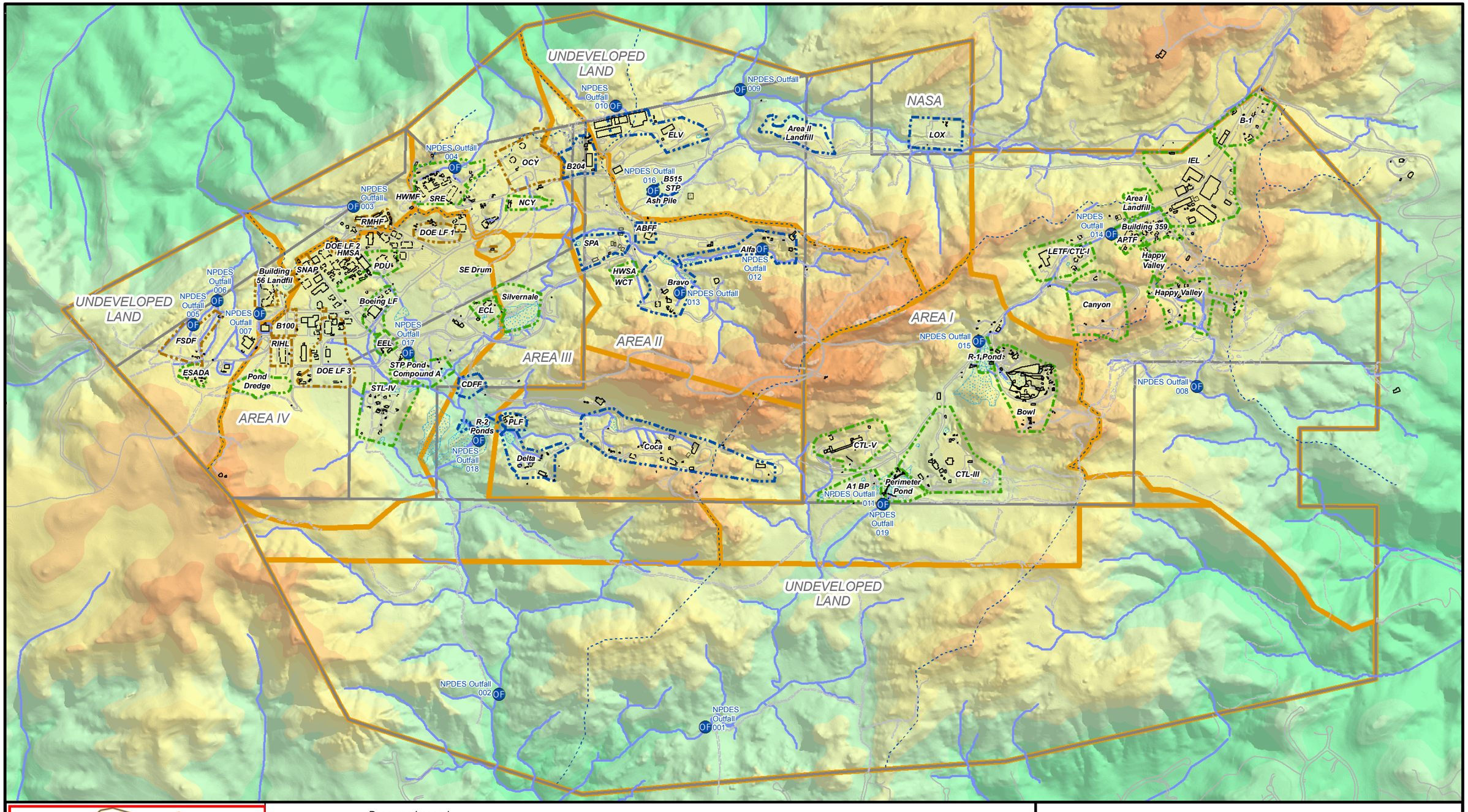
October 28, 2008

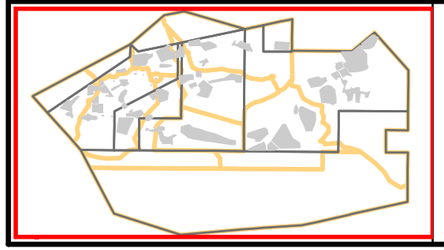
CH2MHILL

\\...RFI_05\RFI_Report\SSFL_SitePlan_BL.mxd

WORKING DRAFT

FIGURE 1-2





Basemap Legend

- Building - Existing
- Building - Removed
- Building - Not Yet Determined
- RFI Group Boundary
- Administrative Area
- Property Boundary
- RFI Site - Boeing
- RFI Site - DOE
- RFI Site - NASA
- NPDES Outfalls
- Rocks
- Drainage
- Streams
- Road - Asphalt
- Pond
- Roads - Dirt

RFI Site Location Map

SANTA SUSANA FIELD LABORATORY

1 inch equals 1,200 feet

0 1,200 2,400 Feet

CH2MHILL

\\..RFI_Report\RFIGroups_BL.mxd

WORKING DRAFT

FIGURE 1-3

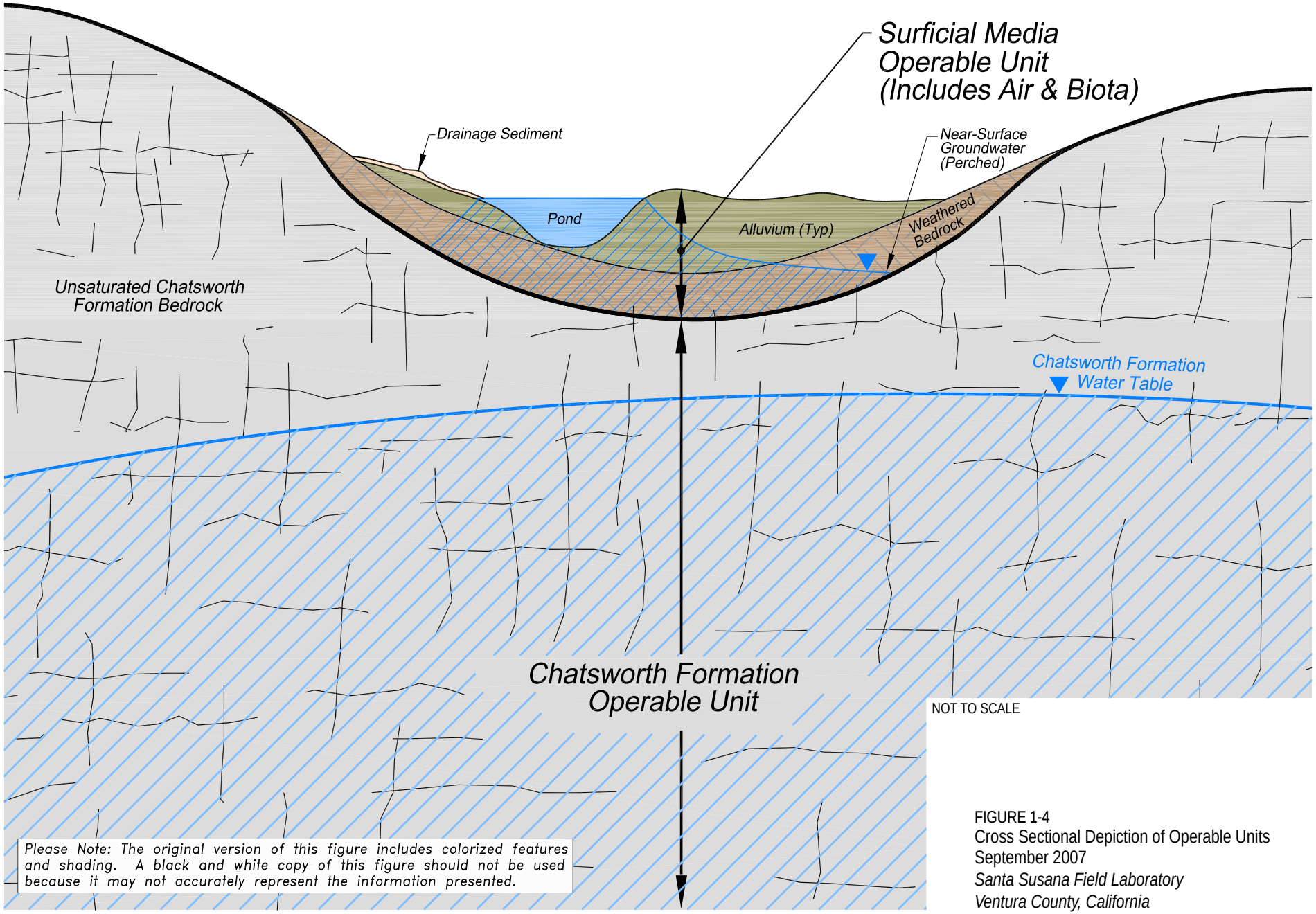
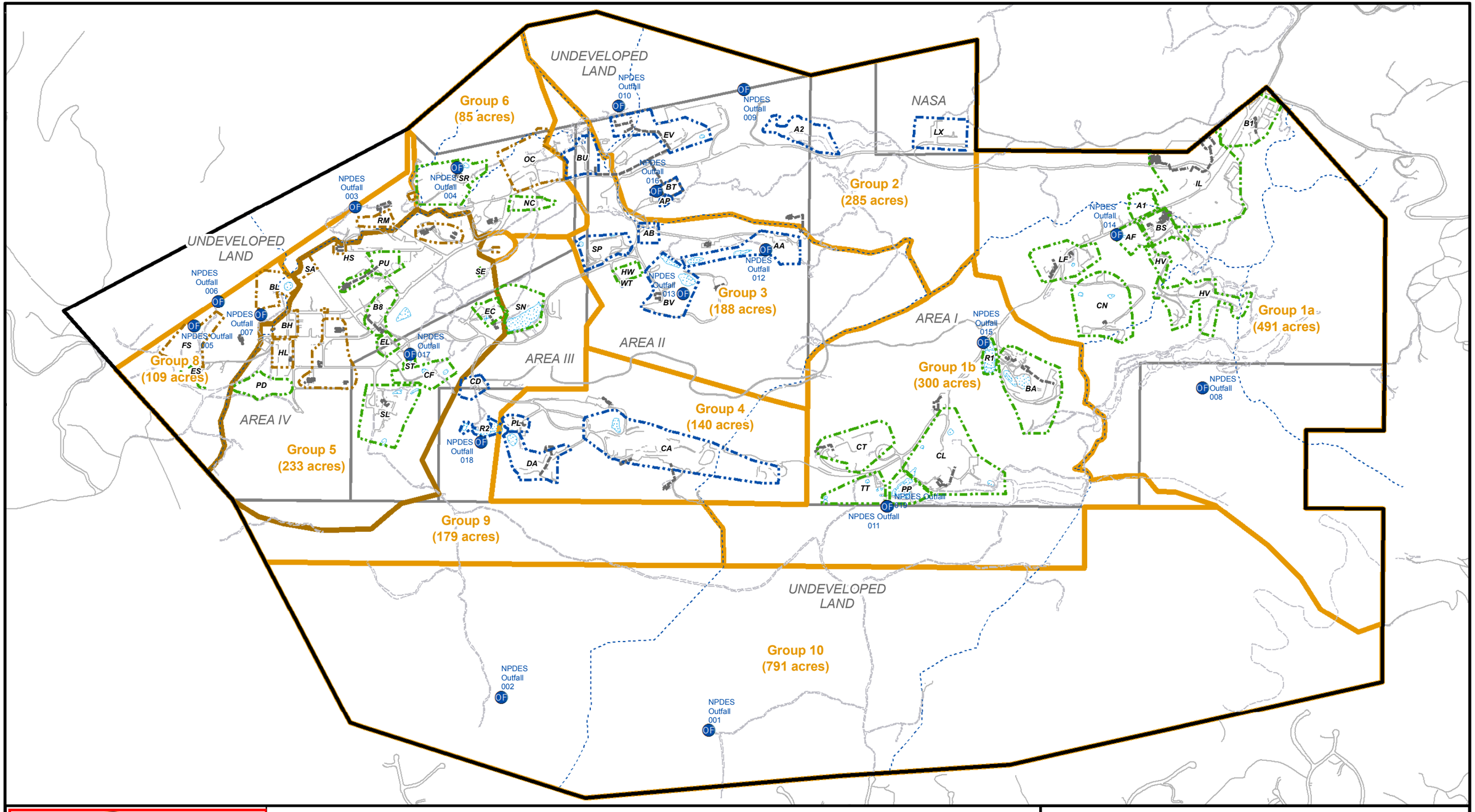
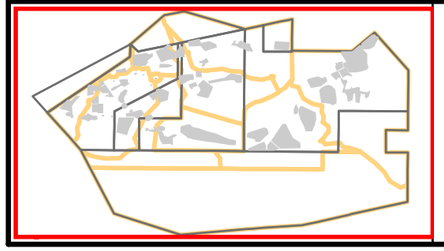


FIGURE 1-4
Cross Sectional Depiction of Operable Units
September 2007
Santa Susana Field Laboratory
Ventura County, California





Basemap Legend

- RFI 5 Group Boundary
- RFI Group Boundary
- Administrative Area
- Property Boundary
- Pond
- RFI Site - Boeing
- RFI Site - DOE
- RFI Site - NASA
- Surface Drainage Divide
- Road - Asphalt
- Roads - Dirt
- Leachfields
- NPDES Outfalls

SSFL RFI Report Groupings
Group 5 RFI Report

SANTA SUSANA FIELD LABORATORY

1 inch equals 1,200 feet

Feet

0 1,200 2,400

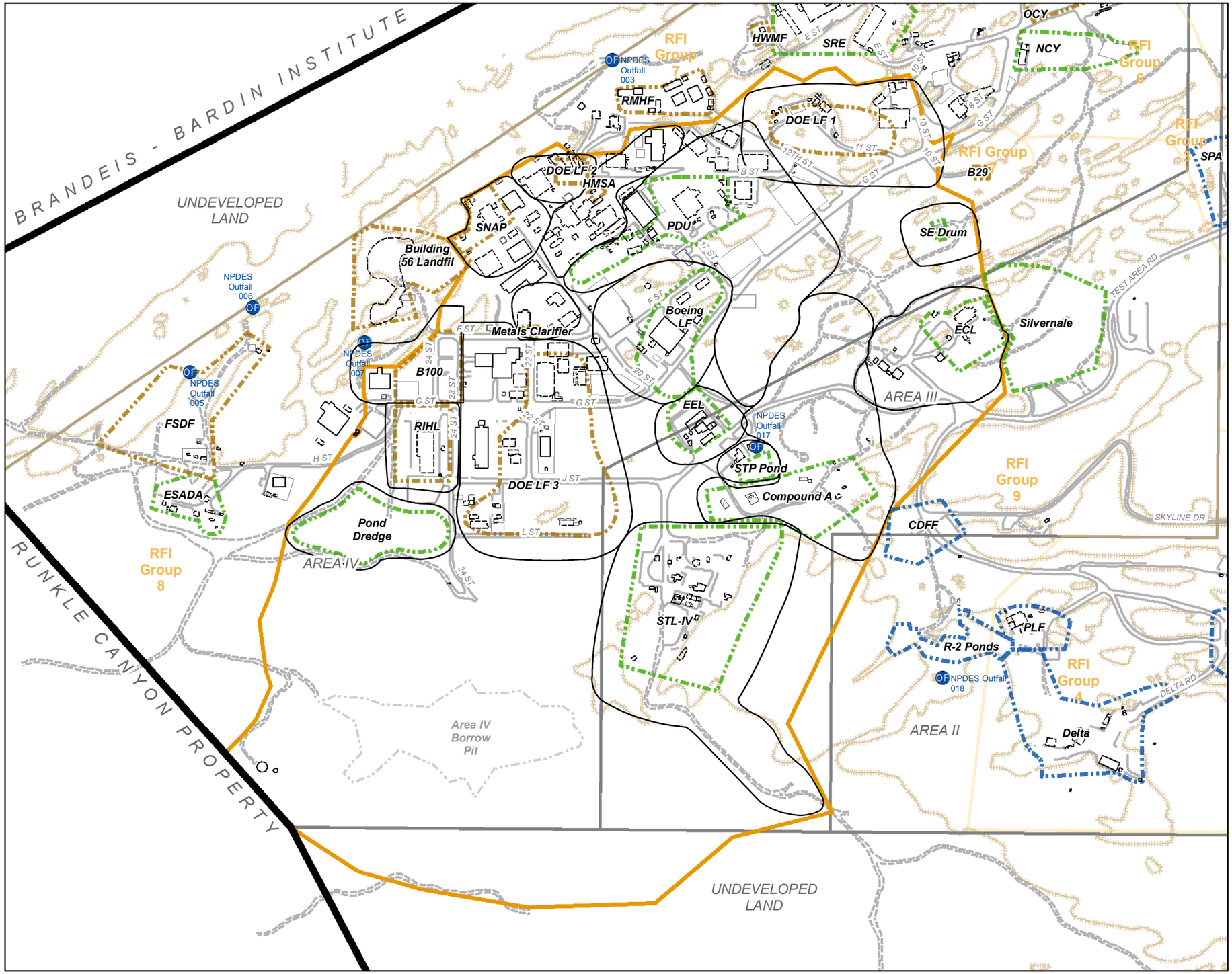
October 30, 2008

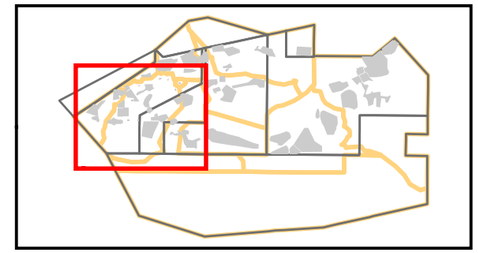
CH2MHILL

\\...RFI_05\RFI_Report\RFIGroupings_BL.mxd

WORKING DRAFT

FIGURE 1-5





Basemap Legend

- Building - Existing
- Building - Removed
- Building - Not Yet Determined
- Transformer - Existing
- Transformer - Removed
- Transformer - Not Yet Determined
- RFI Site - Boeing
- RFI Site - DOE
- RFI Site - NASA
- Investigation Boundary
- RFI 5 Group Boundary
- RFI Group Boundary
- Administrative Area
- Road - Asphalt
- Roads - Dirt
- Rocks
- Streams
- Pond
- Property Boundary
- NPDES Outfalls

Group 5 Reporting Area

Date: October 29, 2008

WORKING DRAFT

1 inch equals 500 feet

0 500 1,000 Feet

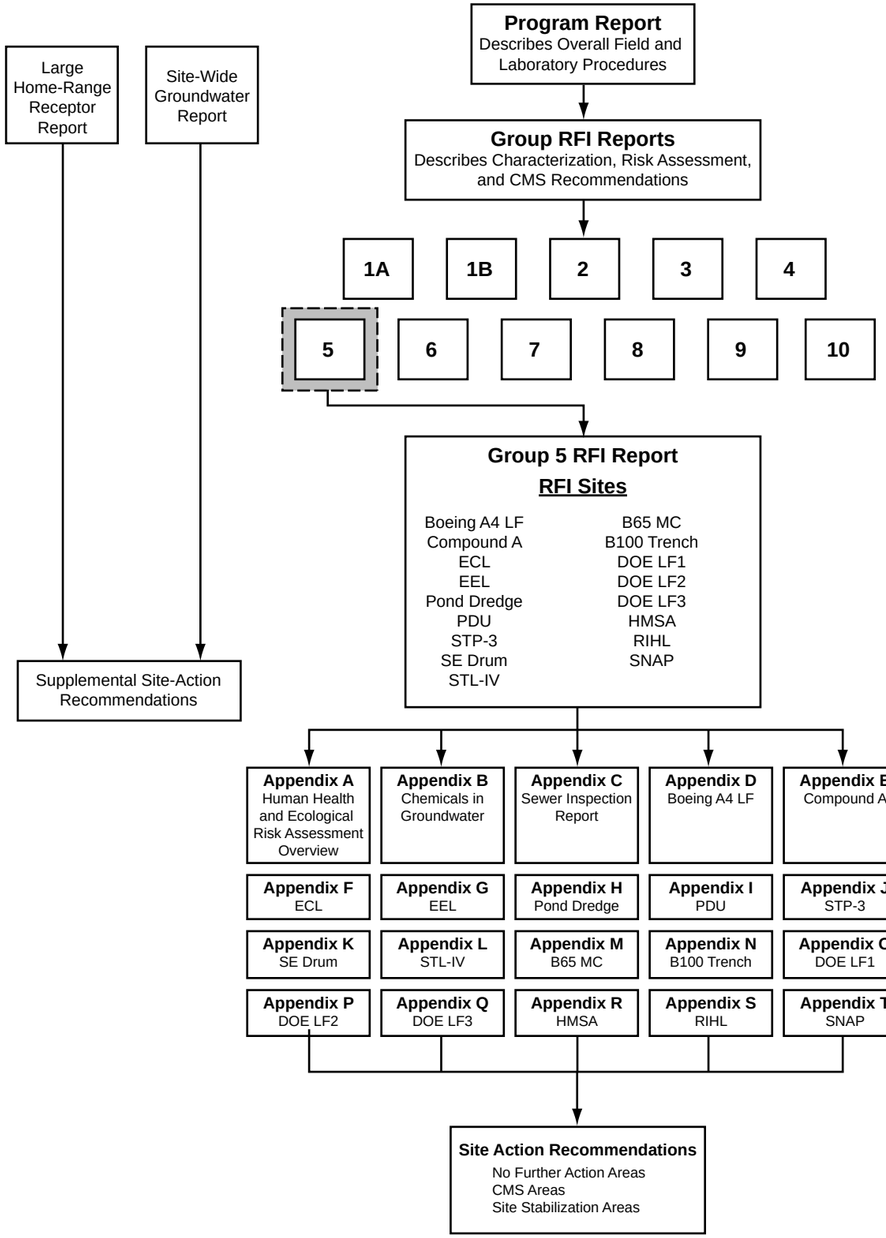
Document: \\..MapFiles\RFI_05\RFI_Report\RFIGrp5_ReportingArea_BL.mxd

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure 1-6

RFI Reporting Process



Group 5 Map of RFI Report Contents

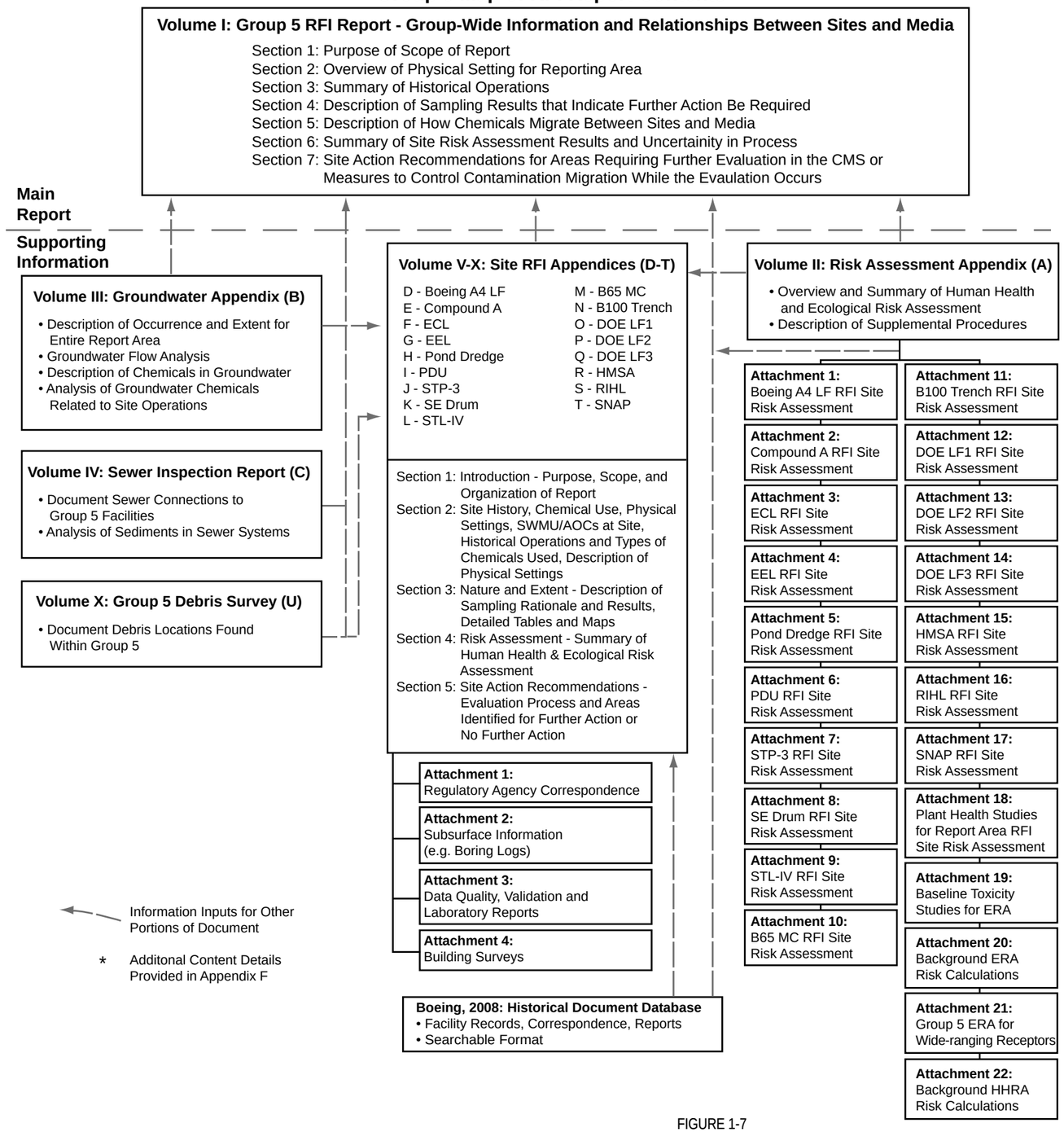
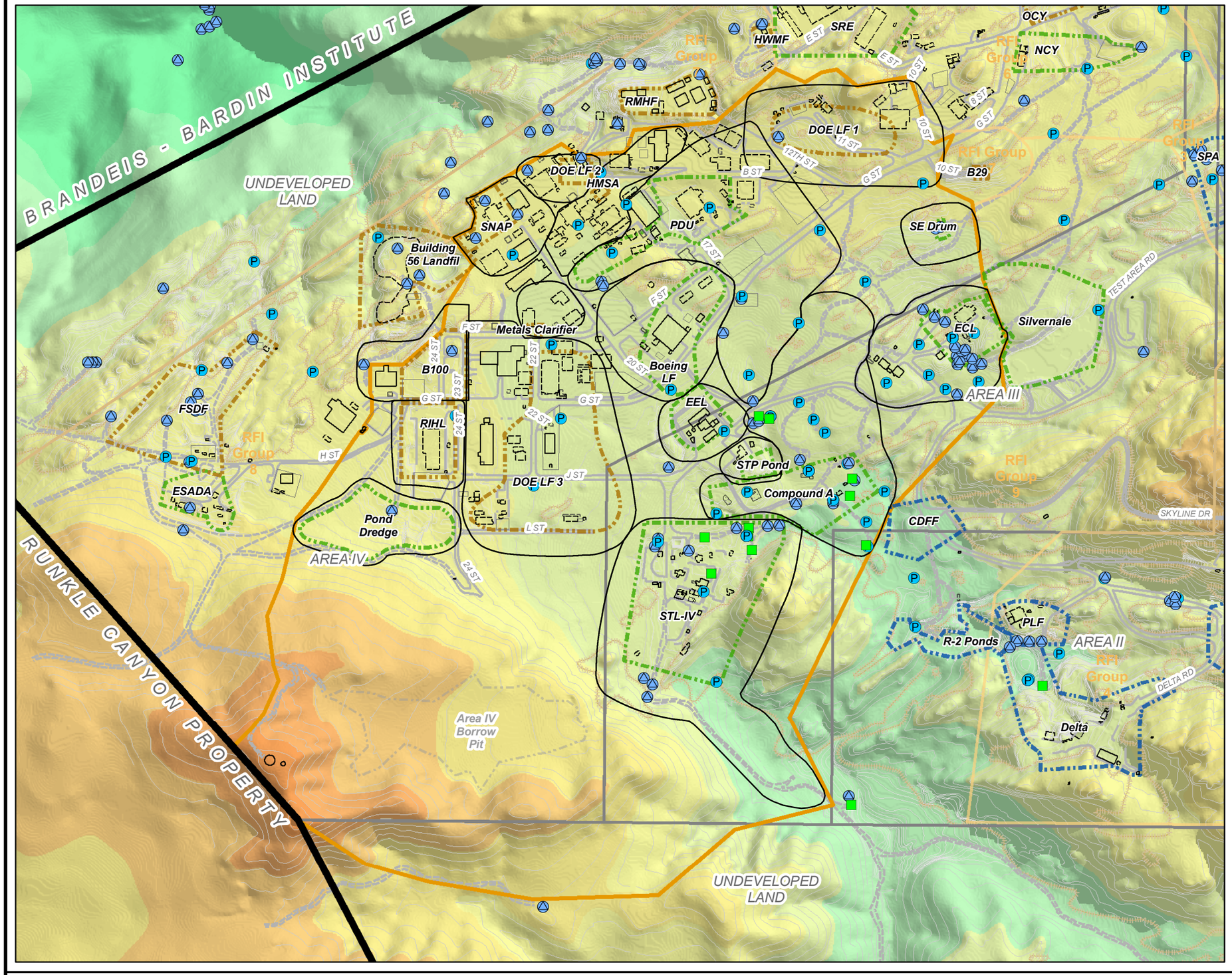
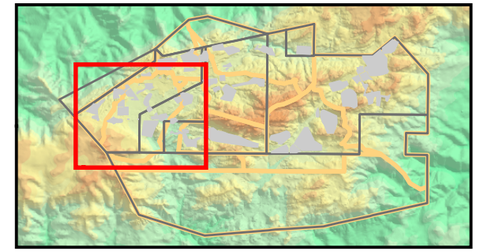


FIGURE 1-7
Group 5 Map of RFI Contents
Santa Susana Field Laboratory
Ventura County, California

CH2MHILL





Basemap Legend

- Building - Existing
- Building - Removed
- Building - Not Yet Determined
- Transformer - Existing
- Transformer - Removed
- Transformer - Not Yet Determined
- Groundwater Monitoring Well
- Piezometer
- Groundwater Extraction Well
- RFI Site - Boeing
- RFI Site - DOE
- RFI Site - NASA
- Investigation Boundary
- RFI 5 Group Boundary
- RFI Group Boundary
- Administrative Area
- Road - Asphalt
- Roads - Dirt
- Rocks
- Property Boundary

Topographic Relief Map
Group 5 Reporting Area

Date: October 29, 2008

WORKING DRAFT

Document: \\..MapFiles\RFI_05\RFI_Report\RFIGrp5_Topographic_BL.mxd

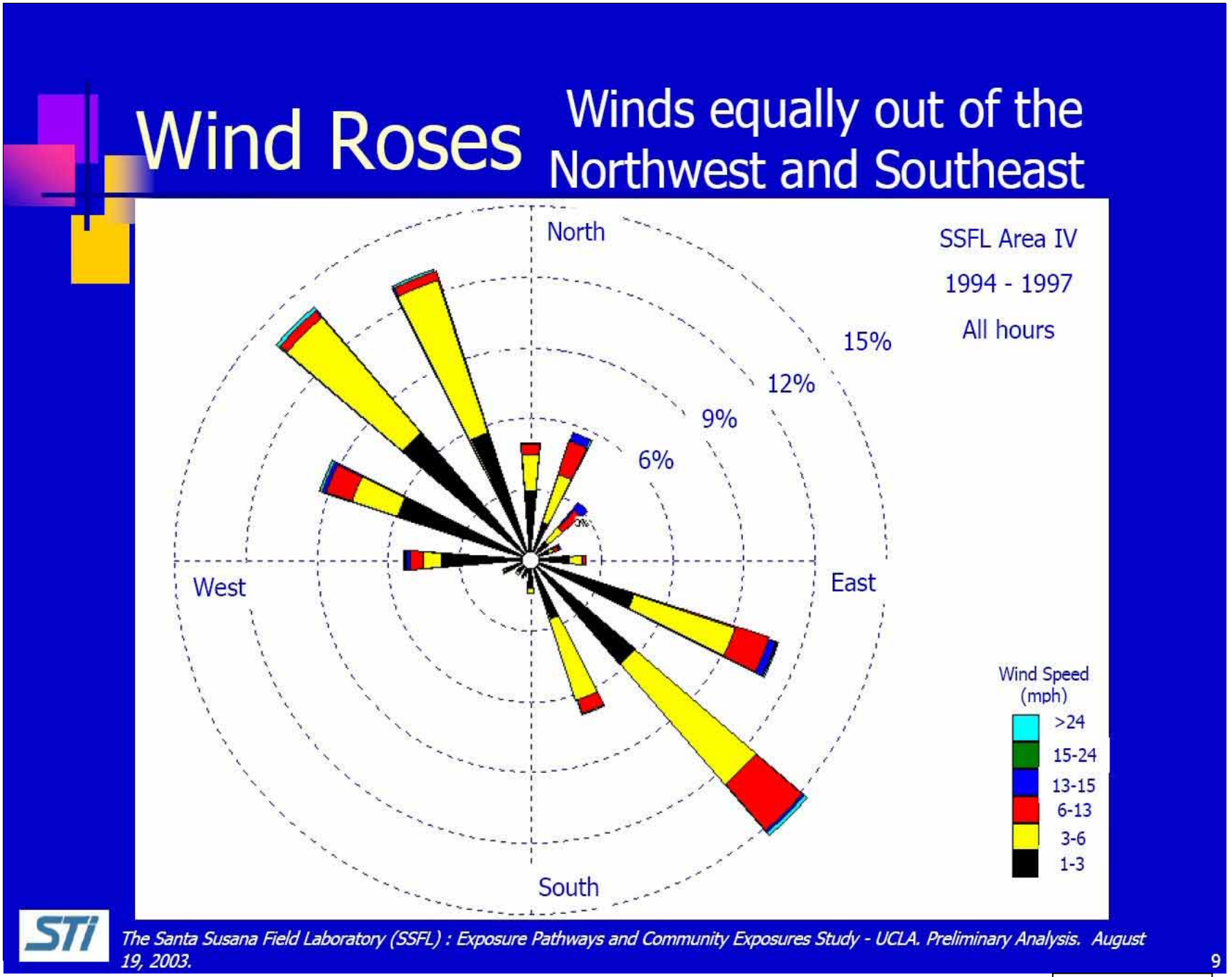
1 inch equals 500 feet

0 500 1,000 Feet

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure 2-1



Source: STI (2003)

Figure 2-2

FIGURE 2-3A
ANNUAL PRECIPITATION AT SSFL, 1960-2006

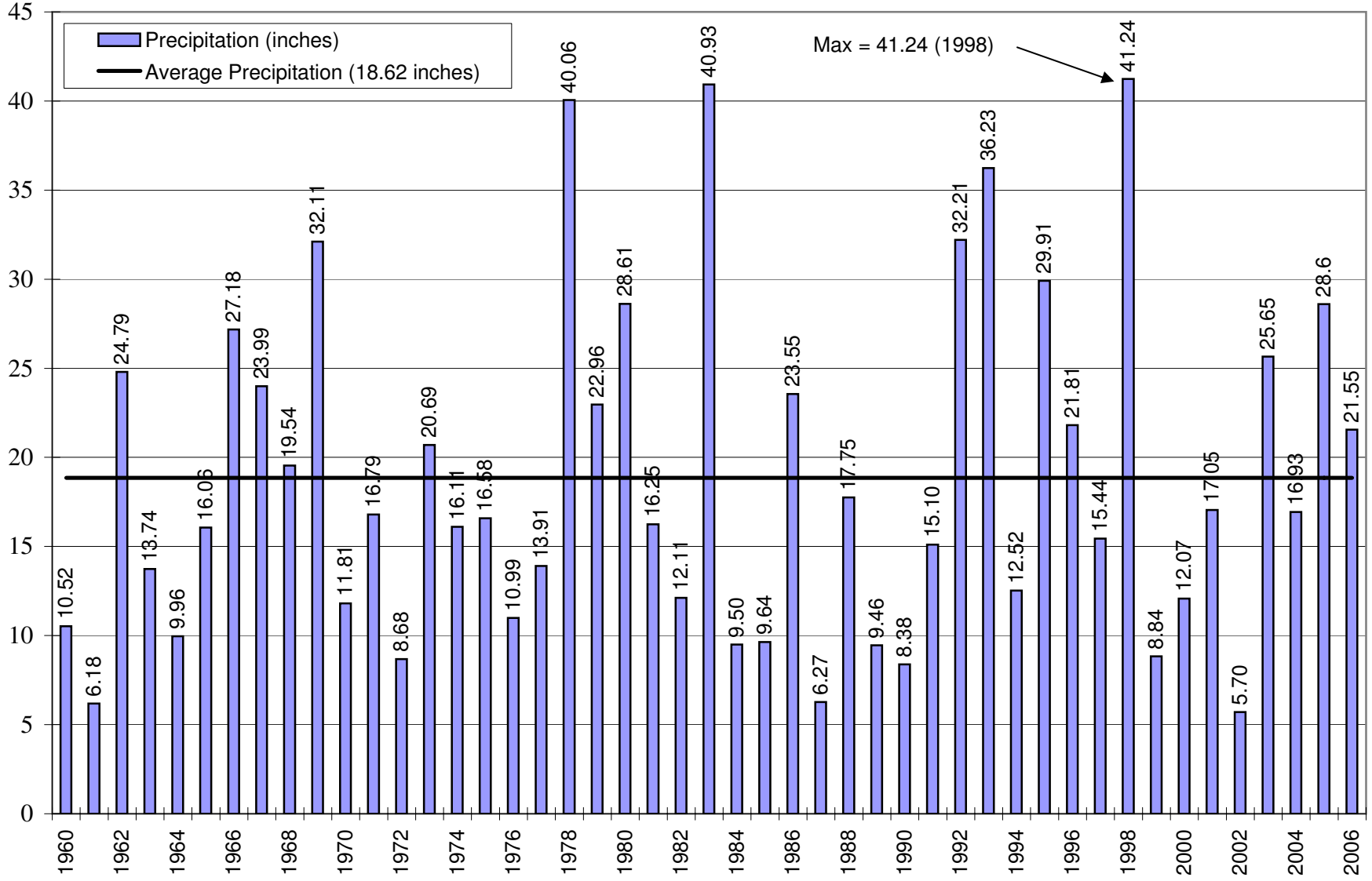
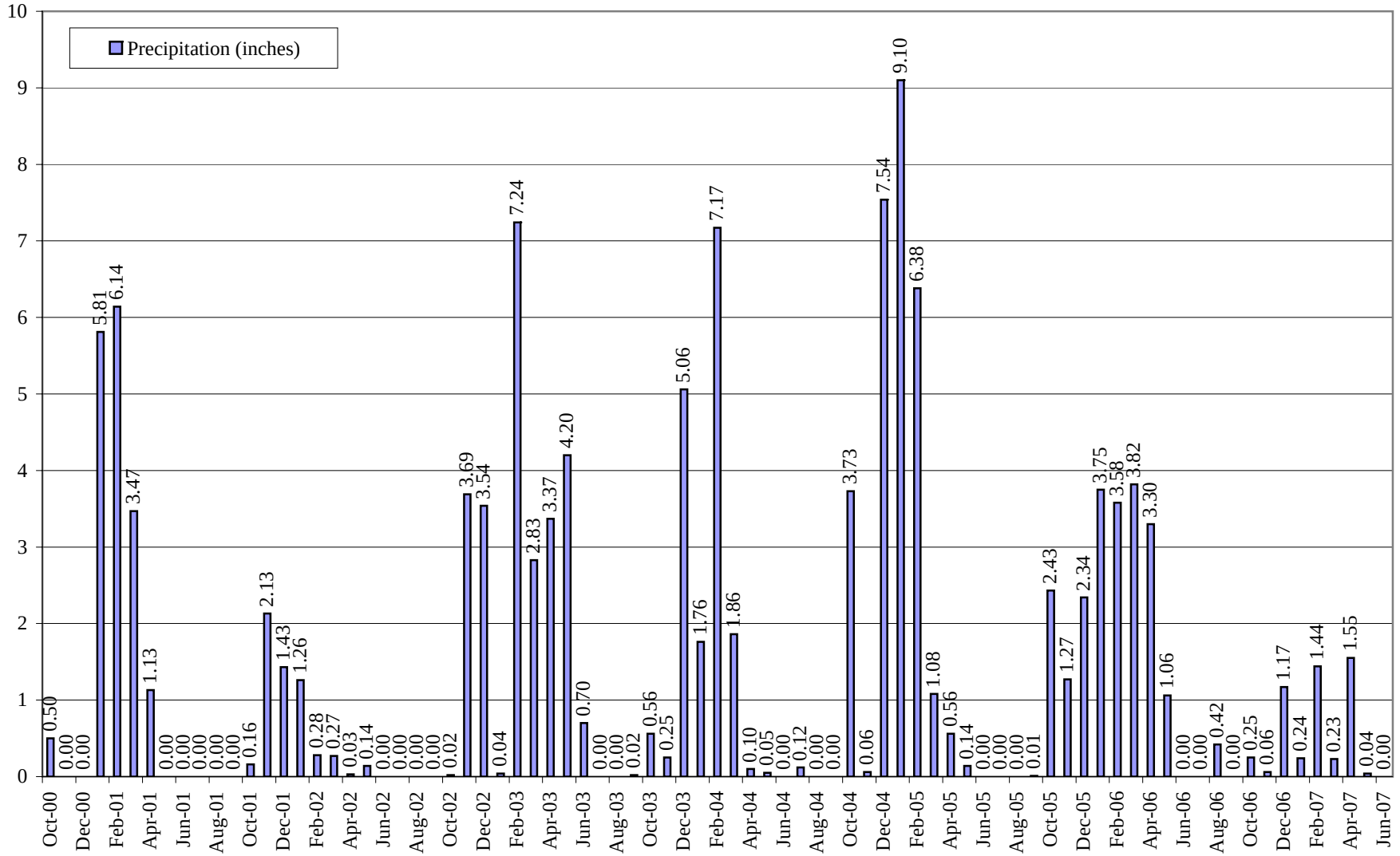
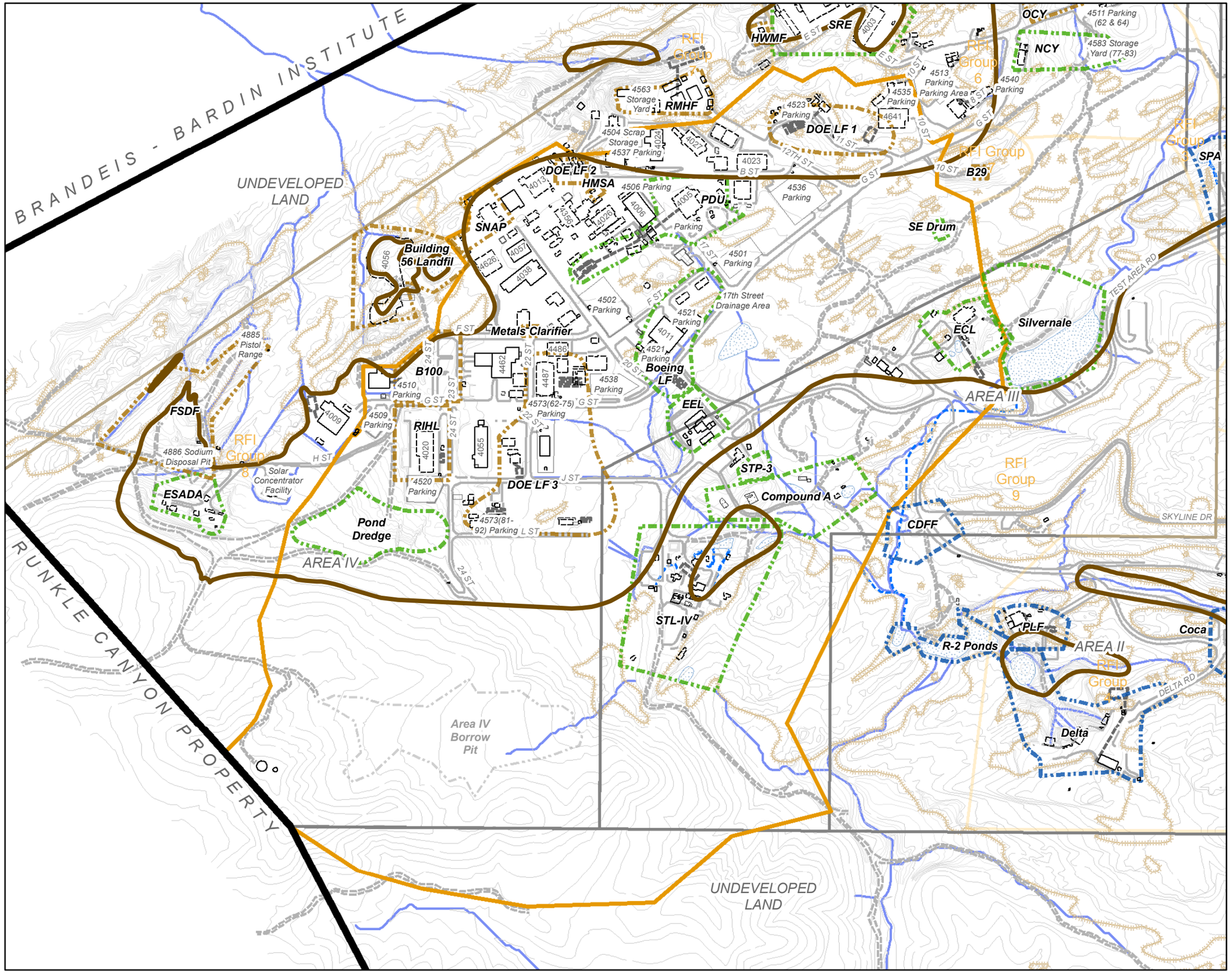
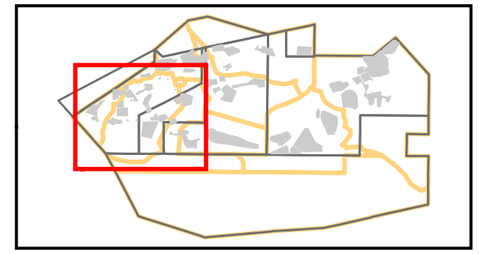


FIGURE 2-3B
MONTHLY PRECIPITATION AT SSFL, OCTOBER 2000 - JUNE 2007







Approximate Extent of Alluvium Thickness Greater Than 5 Feet

Basemap Legend

- Building - Existing
- Building - Removed
- Building - Not Yet Determined
- Transformer - Existing
- Transformer - Removed
- Transformer - Not Yet Determined
- Leachfield
- RFI Site - Boeing
- RFI Site - DOE
- RFI Site - NASA
- RFI 5 Group Boundary
- RFI Group Boundary
- Administrative Area
- Property Boundary
- Drainage
- Road - Asphalt
- Roads - Dirt
- Rocks
- Streams
- Pond

Generalized Extent of Alluvium Group 5 Reporting Area

Date: October 29, 2008 WORKING DRAFT

1 inch equals 500 feet

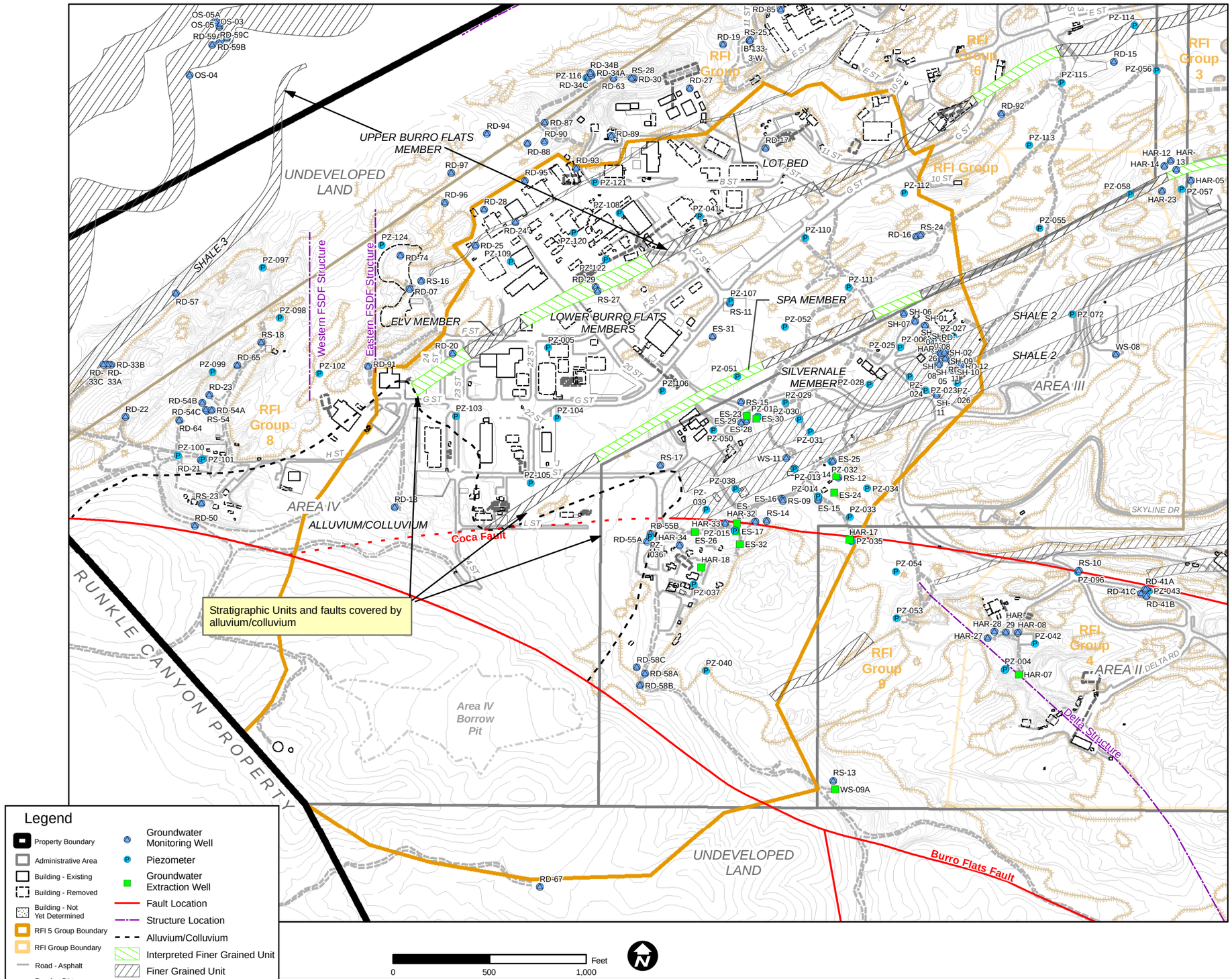
0 500 1,000 Feet

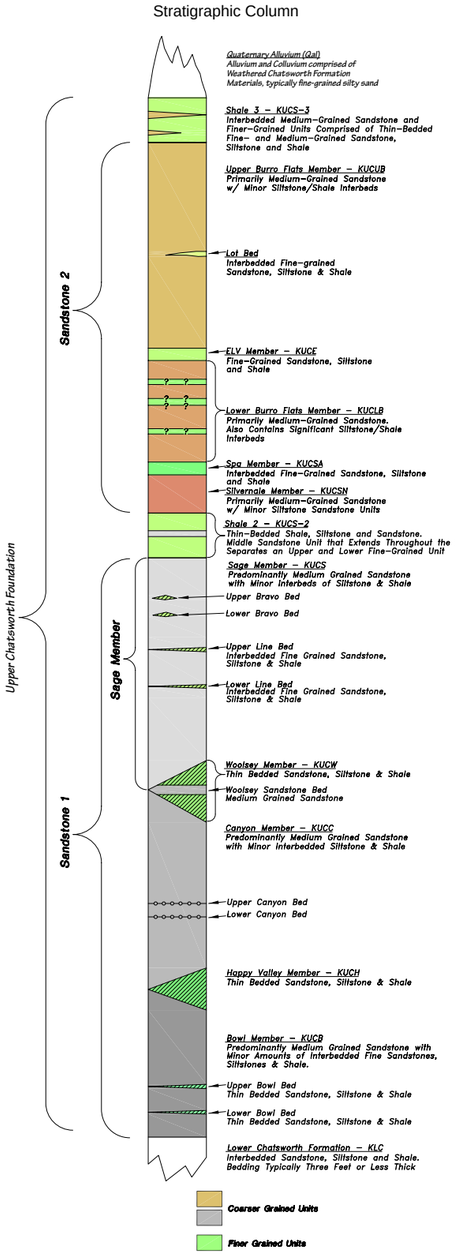
Document: \\..MapFiles\RFI_05\RFI_Report\RFIGrp5_AlvmThck_BL.mxd

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure 2-4





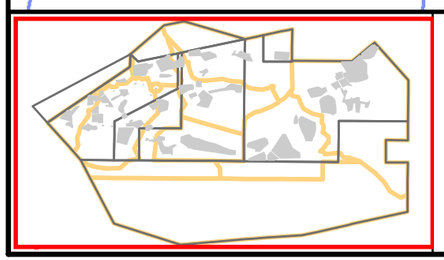
Source: Modified from MWH, 2007, Geologic Characterization of the Central Susana Field Laboratory, August.

FIGURE 2-5
Geological Conditions at Group 5
Santa Susana Field Laboratory
Ventura County, California

CH2MHILL

SCO362070.FP.5A.05.BO Boeing_geo.ai 11/08

UNDEVELOPED LAND
UNDEVELOPED LAND
UNDEVELOPED LAND
UNDEVELOPED LAND
NASA
AREA I
AREA II
AREA III
AREA IV
Outfall-001
Outfall-002
Outfall-003
Outfall-004
Outfall-005
Outfall-006
Outfall-007
Outfall-008
Outfall-009
Outfall-010
Outfall-011
Outfall-012
Outfall-013
Outfall-014
Outfall-015
Outfall-016
Outfall-017
Outfall-018
Outfall-019
RFI Group 1a
RFI Group 1b
RFI Group 2
RFI Group 3
RFI Group 4
RFI Group 5
RFI Group 6
RFI Group 7
RFI Group 8
RFI Group 9
RFI Group 10
Group (233 acres)
A1
A2
AA
AB
AF
AP
B1
B8
BA
BH
BL
BS
BT
BU
BV
CA
CD
CF
CL
CN
CT
DA
EC
EL
ES
EV
FS
HL
HS
HV
HW
IL
LF
LX
NC
OC
PD
PL
PP
PU
R1
R2
RM
SA
SE
SL
SN
SP
SR
ST
TT
WT



Basemap Legend

- RFI 5 Group Boundary
- RFI Group Boundary
- Administrative Area
- Property Boundary
- Pond
- RFI Site - Boeing
- RFI Site - DOE
- RFI Site - NASA
- Streams
- Surface Drainage Divide
- Road - Asphalt
- Roads - Dirt
- NPDES Outfalls

Drainages Leading from SSFL Group 5 RFI Report

SANTA SUSANA FIELD LABORATORY

1 inch equals 1,200 feet

Feet

0 1,200 2,400

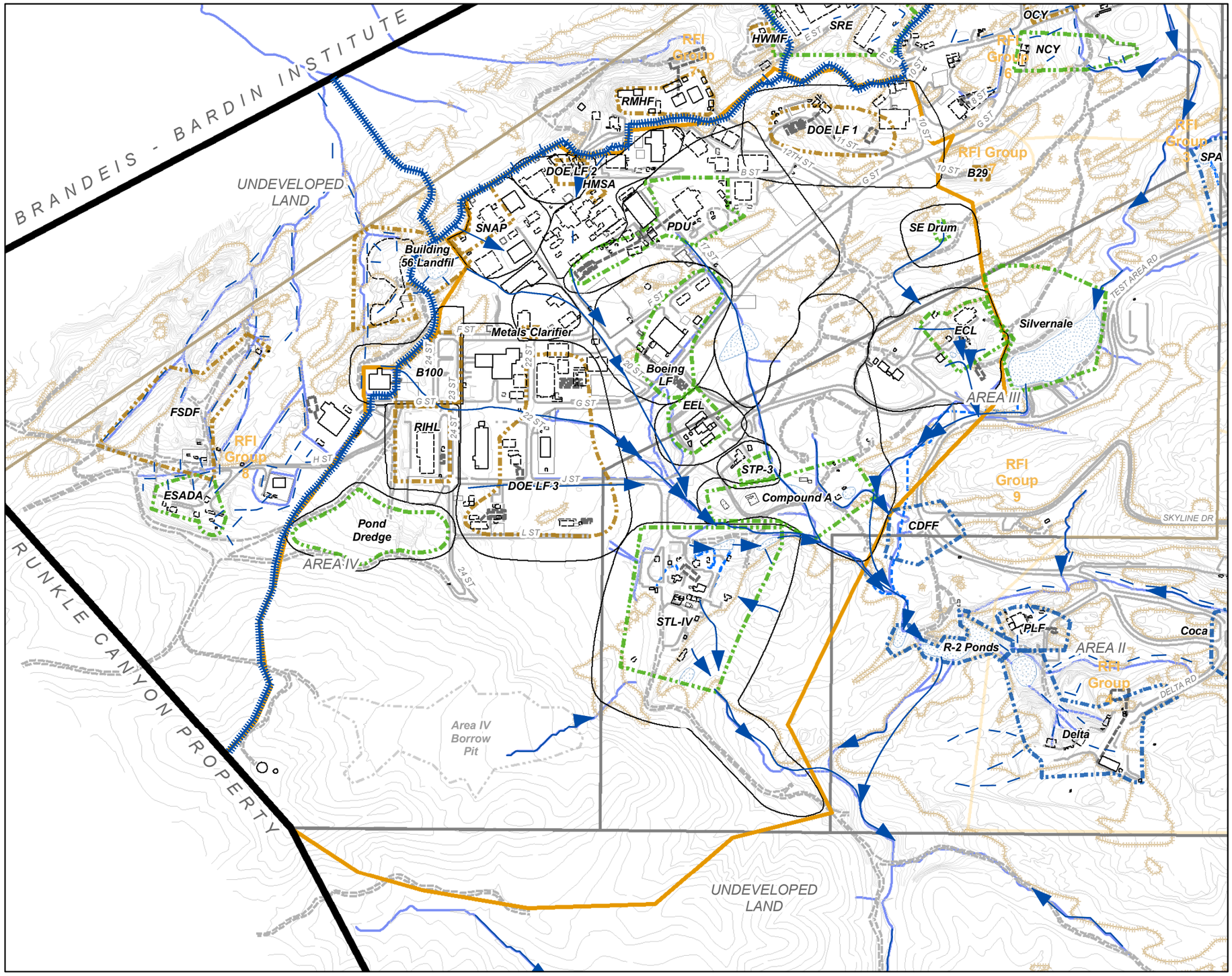
October 29, 2008

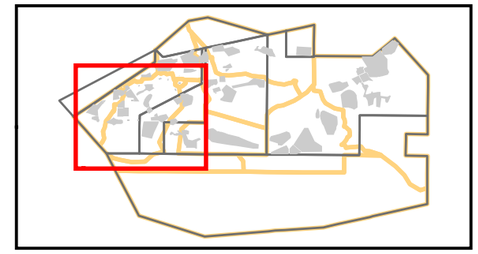
CH2MHILL

\\...RFI_05\RFI_Report\RFIGrp5_Outfalls_BL.mxd

WORKING DRAFT

FIGURE 2-6





Surface Water Flow

Surface Water Divide

Basemap Legend

- Building - Existing
- Building - Removed
- Building - Not Yet Determined
- Transformer - Existing
- Transformer - Removed
- Transformer - Not Yet Determined
- RFI Site - Boeing
- RFI Site - DOE
- RFI Site - NASA
- Investigation Boundary
- RFI 5 Group Boundary
- RFI Group Boundary
- Administrative Area
- Property Boundary
- Leachfield
- Drainage
- Road - Asphalt
- Roads - Dirt
- Rocks
- Streams
- Pond

Surface Water Drainages
Group 5 Reporting Area

Date: October 29, 2008

WORKING DRAFT

Document: \\..MapFiles\RFI_05\RFI_Report\RFIGrp5_SrfcWtrDrain_BL.mxd

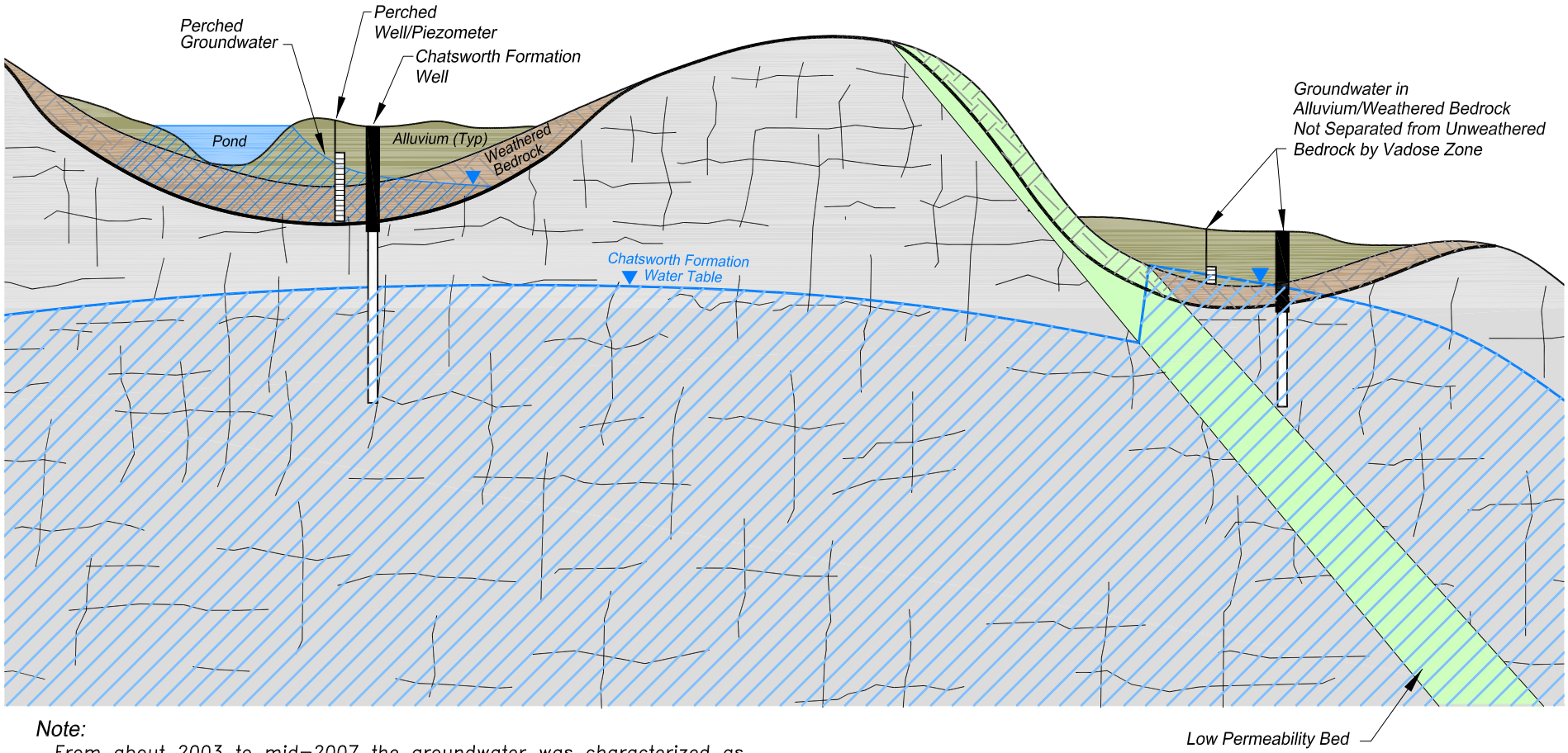
1 inch equals 500 feet

0 500 1,000 Feet

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure 2-7



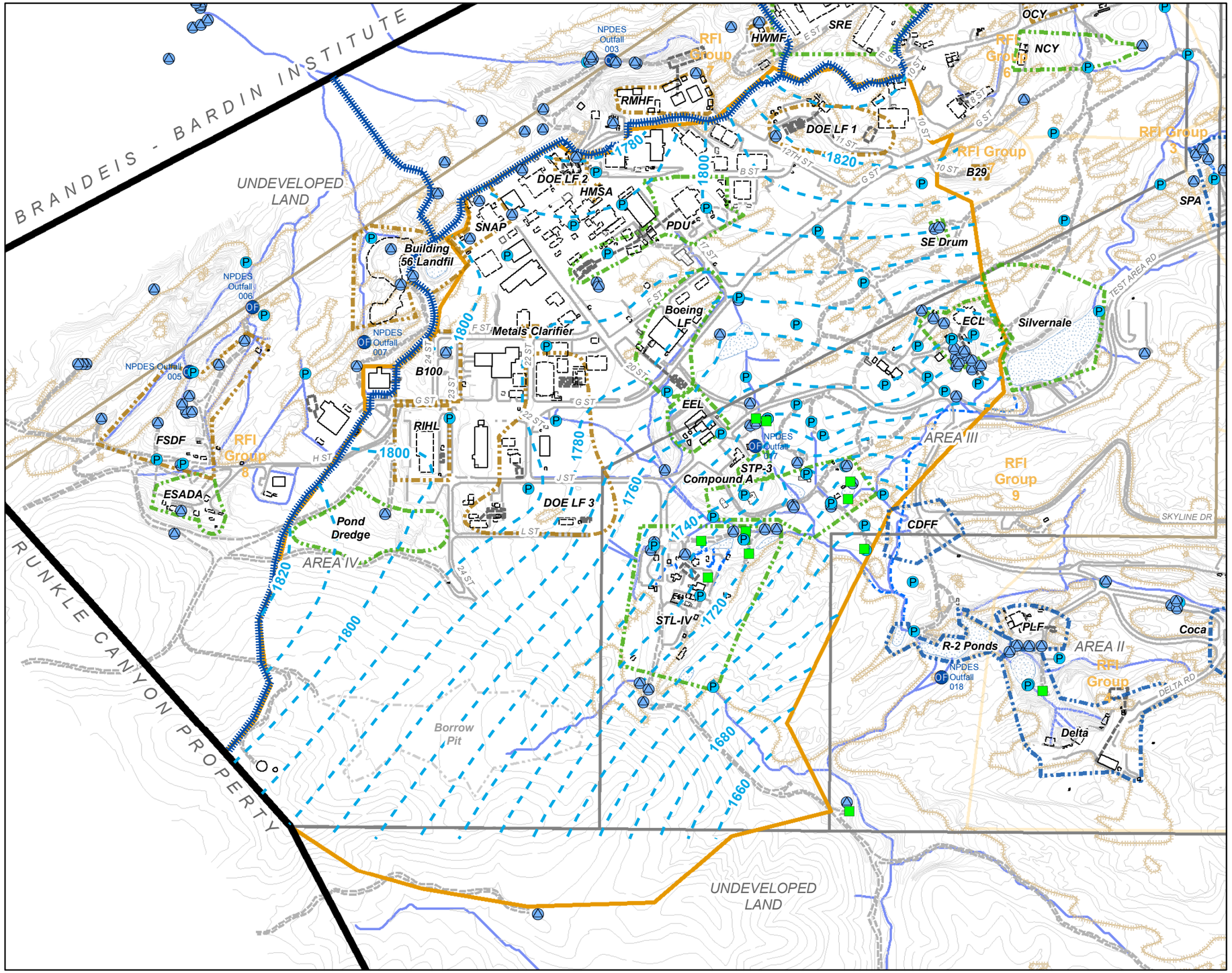
Note:

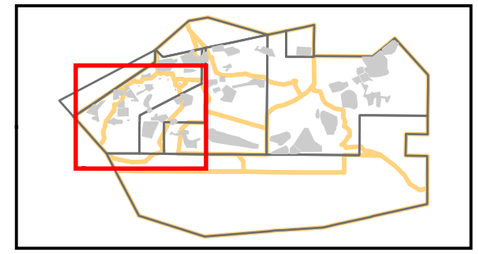
From about 2003 to mid–2007 the groundwater was characterized as either "near–surface" or "Chatsworth formation". The terminology has been modified to also include "perched" and "Chatsworth formation" groundwater starting in mid–2007 pursuant to DTSC's comments in their draft memorandum dated April 4, 2007 on the Group 6 RFI Report, and a meeting held on June 7, 2007 between DTSC and the SSFL.

NOT TO SCALE

Please Note: The original version of this figure includes colorized features and shading. A black and white copy of this figure should not be used because it may not accurately represent the information presented.

FIGURE 2-8
Conceptual Cross Section of Groundwater Occurence
September 2007
Santa Susana Field Laboratory
Ventura County, California





Inferred Near-surface Groundwater Elevation Contours Based on Data Collected Between 4th Quarter 2001 and 3rd Quarter 2007 (10ft Contour Interval)

Basemap Legend

- Building - Existing
- Building - Removed
- Building - Not Yet Determined
- Transformer - Existing
- Transformer - Removed
- Transformer - Not Yet Determined
- Groundwater Monitoring Well
- Piezometer
- Groundwater Extraction Well
- RFI Site - Boeing
- RFI Site - DOE
- RFI Site - NASA
- RFI 5 Group Boundary
- RFI Group Boundary
- Administrative Area
- Property Boundary
- Leachfield
- Drainage
- Road - Asphalt
- Roads - Dirt
- Rocks
- Streams
- Surface Water Divide
- Pond

Near-Surface Groundwater Occurrence Plan View Group 5 RFI Report

Date: October 31, 2008

WORKING DRAFT

1 inch equals 500 feet

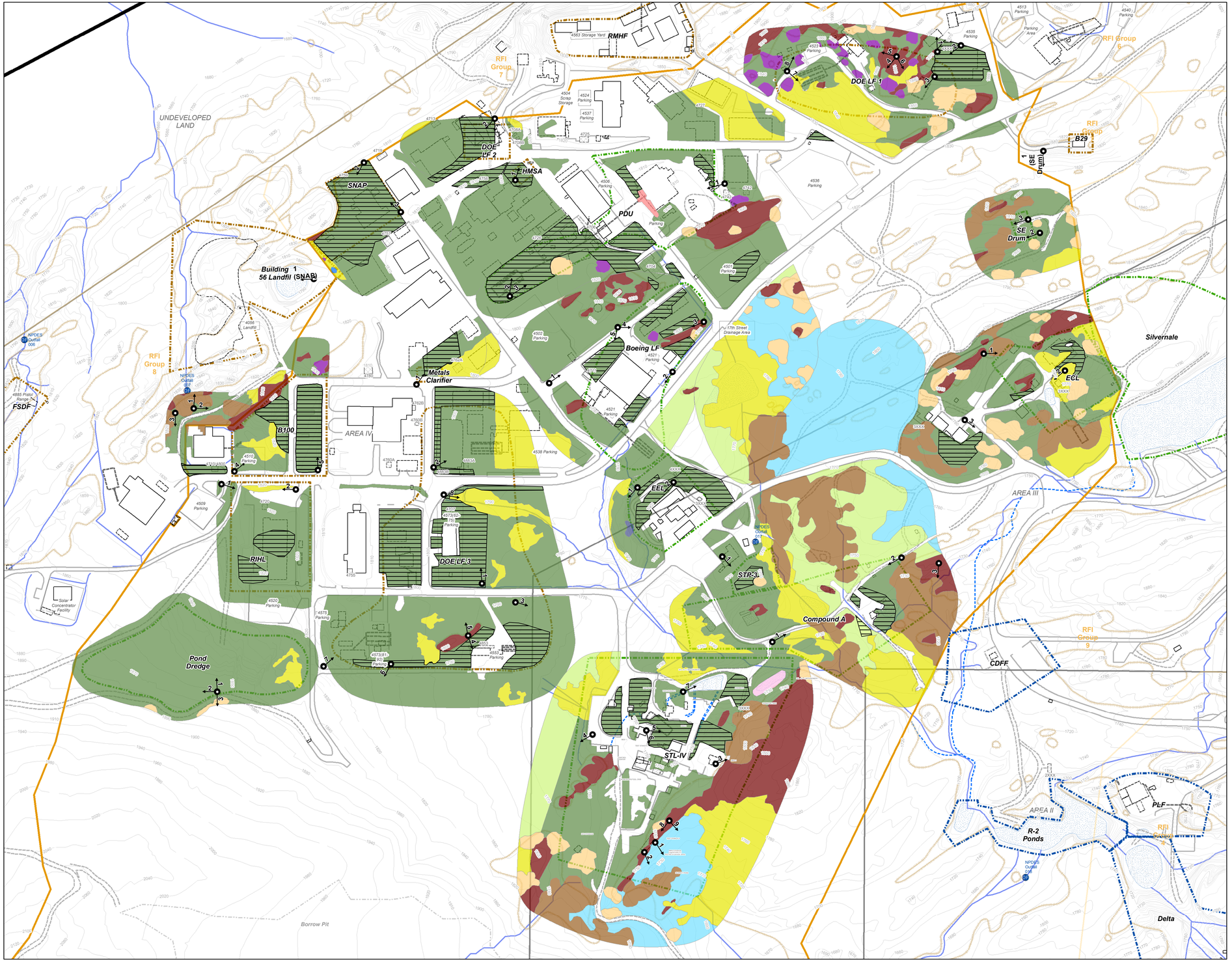
0 500 1,000 Feet

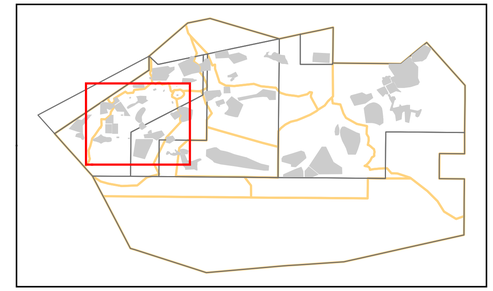
Document: \\..MapFiles\RFI_05\RFI_Report\RFIGrp5_NearSrfcePlanView_BL.mxd

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure 2-9





Vegetation Legend

- Stressed Vegetation
- Annual Grassland
- CAP
- CLO
- Elderberry
- Junipers
- LS
- Oak Savannah
- Oak Woodland
- Rock
- Ruderal
- Scrub-Shrub
- Willow
- Photo Location
- Photo Direction

Notes:
1 - Stressed vegetation is due to dry soil condition/drought stress
2 - Vegetative cover for areas outside of 2008 survey are shown in SRAM (MWH, 2005), Appendix I, Figure 3-1
3 - The original version of this figure includes colorized features and shading. A black and white copy of the figure should not be used because it may not accurately represent the information presented.

Basemap Legend

- Leachfield
- Drainage
- Road - Asphalt
- Roads - Dirt
- Rocks
- Streams
- Pond
- Building - Existing
- Building - Removed
- Building - Not Yet Determined
- Transformer - Existing
- Transformer - Removed
- Transformer - Not Yet Determined
- RFI Site - Boeing
- RFI Site - DOE
- RFI Site - NASA
- RFI 5 Group Boundary
- RFI Group Boundary
- Administrative Area
- Property Boundary

Biological Conditions Group 5 Reporting Area

October 29, 2008

WORKING DRAFT

1 inch equals 150 feet

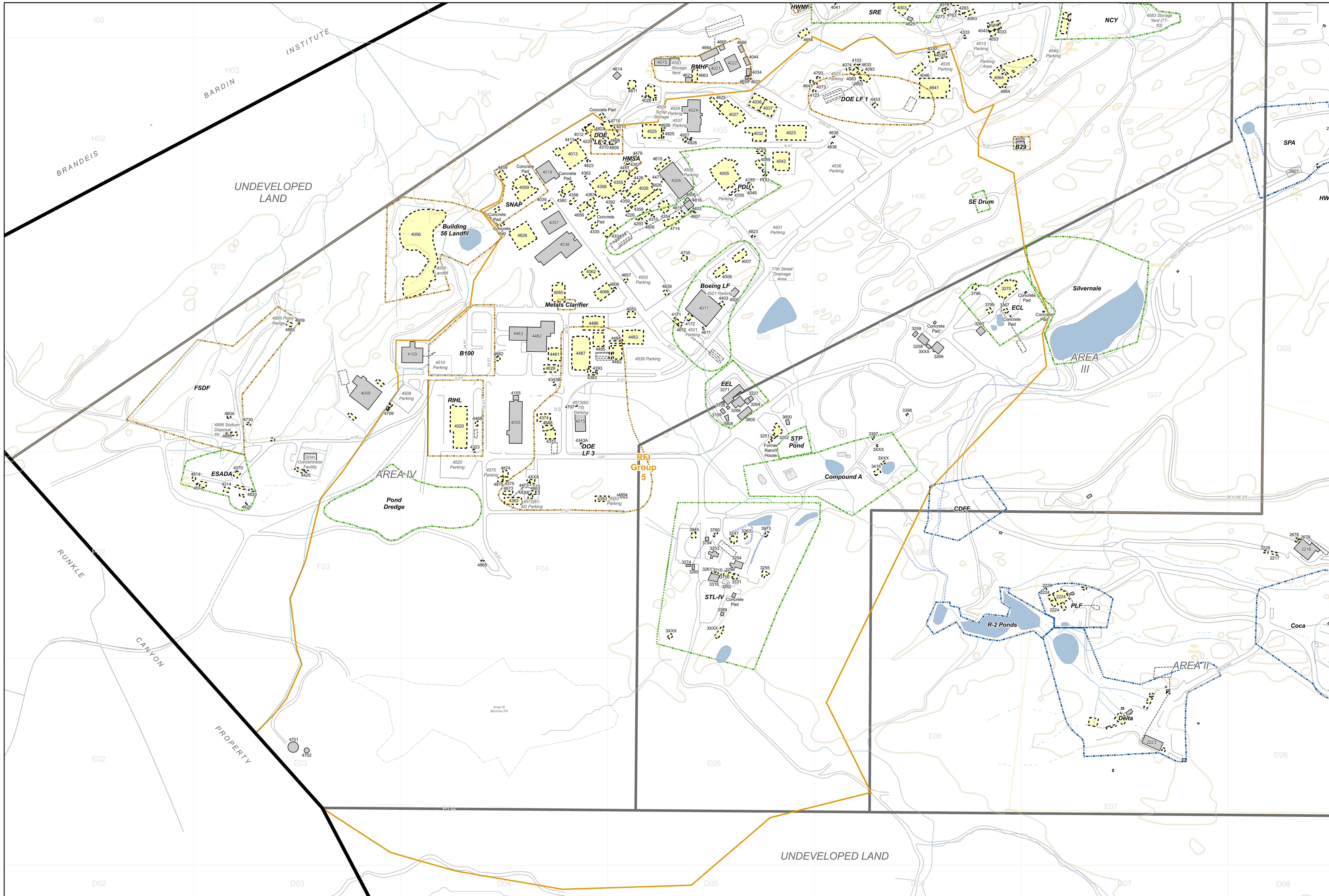
0 150 300 450 600 Feet

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure 2-10

\\...RFI_05\RFI_Report\RFIGrp5_Veg_DL.mxd



RFI Group 5 Buildings Summary (05/22/2008)

3805 NYD
4485 Engineering Office
4062 Instrumentation Lab
4008 Flammable Material Storage
3270 Engineering Chemistry Lab
4066 Instrumentation Lab
4065 ETEC Chemistry Lab
Concrete Pad Concrete Pad
4172 X-Ray Building
3418 ECL Compound A Production
4375 Control Shelter Building
4XXX NYD
4473 Hydraulic Test Instrumentation and Development Test
4863 Hydraulic Test Facility
4XXX NYD
3254 STL-IV Control Center
3274 STL-IV Clean Room Trailer
3265 STL-IV Operations Trailer
3255 STL-IV Module III
Concrete Pad NYD
4093 Neutron Radiography
4641 Shipping and Receiving
4357 SCTI Supply Storage
4355 SCTI Control Center
4459 Uninterruptable Power Supply
4356 Sodium Component Test Installation
Concrete Pad NYD
4059 Large Leak Test Rig
4026 SCTL Control Center
4362 SCTI Water Sampling Enclosure
4426 Uninterruptable Power Supply
4359 SCTI Compressor Building
4360 Chemical Storage Building
4816 Hydrogen Recombiner Test Canopy
4361 SCTI Hazardous Material Storage
4293 Construction Shack or Time Clock Station
4806 Time Clock Building
4626 ETEC Inventory Storage and Space Station Storage
Concrete Pad NYD
4486 Engineering Office
4171 Storage Building
Concrete Pad NYD
4462 Sodium Pump Test Facility
4612 Storage and Maintenance Building
3260 CWLL Storage
4463 Components handling and cleaning
4483 Engineering Office
3259 CWLL Chemical Storage
4461 Motor Generator Building
4343B Time Clock Building
3271 EEL Cryogenic Test Cells
3227 EEL Test Cell
3268 EEL Cryogenics Lab
4707 Substation
4020 Hot Laboratory
3108 NYD
4710 SNAP Experimental Reactor Testing Facility
4228 SCTI Power Pak Facility
4012 ETEC X-Ray Facility
4025 ETEC Tool Crib and SCTI Main Shop
4035 AE-6 Office Annex
4030 Traffic and Warehousing and AE-6 counting Room and Workshop
3210 STL-IV Lunch and Smoke Room
3798 ECL Drum and Bottle Storage
4023 Liquid Metals Chemistry
4926 SRE Mock Up Equipment Area
4925 Mechanical Equipment Slab
4413 Uninterruptable Power Supply
4013 Thermal Transient Facility
4836 Time Clock Building
4636 Guard Shack
4633 Reactor Cooling Water Pad
4457 Pump Bearing Test Facility
4927 Nitrogen Storage Tank
4928 Cooling Tower
4709 Substation
4354 Control Element Test
4616 Cooling Tower
4735 86k Gallon Fuel Storage Tank
4893 AE-6 Pad
4048 PDU Instrumentation Building
4611 Paint Spray Canopy
4874 Control Rod Test Tower and Pad
4477 NYD
4806 Time Clock Building
4657 Guard Shack
4639 Not Built
4403 Traffic Dispatch
4500 Compressed Gas Bottle Storage Dock
4383 LMEC Construction Building
4393 Tower at 4383
4662 Small Parts Cleaning Pad
4343A Time Clock Building
4865 Gammagraph X-Ray Building, formerly Sodium Storage Pad
4353 General Storage
4854 Radiation Fuel Gauge Test Structure
4402 MHD Experiment
3109 NYD
4015 Construction Staging and Storage
3398 NYD
3908 EEL Storage
3600 Sewer Treatment Plant in Area 3
4468 Hot Lab Holdup Tank
4373 Development Test
3397 NYD
Former Ranch House NYD
3XXX NYD
4823 Time Clock Building
4358 SCTI and Kalina Chemical Storage Building
4793 NYD
4055 Nuclear Material Development and Lasers Classified
3252 Ranch House Forming Stores and Machine Shop
4005 PDU Molten Salt Test Facility and Low NOX/SOX Burner Test Facility
4010 NYD
4807 Electrical Equipment Pad
3XXX NYD
3XXX NYD
3XXX NYD
3XXX NYD
3794 NYD
3XXX NTO Storage
3XXX MMH/Titanium Compatability Testing Storage Area
3331 STL-IV Instrumentation Shop
3750 STL-IV Storage
4628 NYD
4074 Storage Building
4011 Machine Shop/QA and Prop. Warehouse and Nuclear Safety
Concrete Pad NYD
3799 ECL Air Compressor Shelter

3367 ECL Chemical Supply Room
3389 STL-IV Workshop
4036 ETEC Advanced Programs
4606 Hydrogen Recombiner Test
4046 Material Office Annex
4083 Control Building Neutron Radiography
4049 PDU Control Center
4019 ETEC Computer Cntr. and Construction Staging
4006 Sodium Laboratory
4039 Office Building
4656 Cooling Stacks
4226 SCT Motor Generator Building
4392 SCTI Electrical Equipment Building
Concrete Pad NYD
4358 SCTI and Kalina Chemical Storage Building
Concrete Pad NYD
4607 Hydrogen Recombiner Test and Storage Building (Sodium Lab Instrument)
4057 ETEC General Test
4714 NYD
4826 SCTL Test Facility
4848 Pad at Building 4373
4103 Reactor Kinetics Lab and Storage
4155 Control Center
4625 Non-Nuclear Component Storage Building
3264 EEL Materials Test Lab Office
4701 Water Tank (Deer Flats)
4702 Water Tank (Deer Flats)
4615 Combustion Test Facility
3747 STL-IV Cell 24
3945 STL-IV Wire Storage
3262 STL-IV Equipment Storage
3261 STL-IV Tool Crib
4873 Hydraulic Test Laboratory
4323 Guard Building
4XXX NYD
4310 Portable Change Room
4185 Steam Generator Control Building
PDU NYD
4823 Time Clock Building
4310 Portable Change Room
4808 Electrical Equipment Pad
4809 Air Blast Heat Exchanger Pad
3318 LETF Workshop and Storage
3251 Ranch House Storage
4024 Development Test Building
4875 Pad and Creep Loop Tower
4374 Test Loop Enclosure
Concrete Pad NYD
4032 ETEC General Test and LMFBR Development Test
4705 Substation
3263 STL-IV Module II
4793 KEWB Electrical Building
4643 KEWB Exhaust Building
4073 KEWB Reactor Kinetics Test Building
4123 KEWB Waste Storage Building
3258 CWLL Laser Lab
4487 Engineering Office
4484 Restroom Facility
3269 CWLL Laser Lab
4100 LMFBR Safety Development and CT Lab
3XXX NYD
4482 Engineering Office
4363 Research and Deverlopment Lab Building
3780 STL-IV Hot Water Boiler Shelter
4037 SNAP Office Building
4027 ETEC Quality Assurance or Hazardous Waste Storage Yard
4050 NYD
3XXX Magazine
3256 STL-IV Instrumentation Shop
3253 STL-IV Module I
3973 STL-IV Cell 29
4453 Neutron Radiography Storage
4042 LMFBR Development Testing
4478 SCTI and ETEC Support Trailer
Concrete Pad NYD
4335 Kalina Turbine Generator Room
4334 Kalina Control Center
4038 ETEC Headquarters and DOE Site Office
4007 Sodium Storage

A1 BP - Area I Burn Pit - Area I Thermal Treatment Facility (TTF): SWMU 4.8 - Area I Burn Pit
ABFF - Alfa/Bravo Fuel Farm: AOC - Alfa/Bravo Fuel Farm
Alfa - Alfa Area: SWMU 5.9,5.10, 5.11, AOCs - Alfa Area
APTF - Advanced Propulsion Test Facility: SWMU 4.9, AOCs - Advanced Propulsion Test Facility
Area I Landfill - Area I Landfill: SWMU - 4.2 Area I Landfill
Area II Landfill - Area II Landfill: SWMU 5.1 - Area II Landfill
Ash Pile - Former Area II Incinerator Ash Pile: SWMU 5.6 - Former Area II Incinerator Ash Pile
B-1 - B-1 Area: SWMU 4.1, AOC - B-1 Area
B100 - Building 100 Trench: SWMU 7.5 - Building 100 Trench
B204 - Building 204 USTs: AOC - Building 204 USTs
B29 - Building 29: AOC - Building 29
B29 - Reactive Metal Storage Yard: SWMU 7.11 - Building 029 Reactive Metal Storage Yard
B515 STP - Building 515 Sewage Treatment Plant: AOC - Building 515 Sewage Treatment Plant
Boeing LF - Boeing Leach Field:
Bowl - Bowl Test Area and Ponds: SWMU 4.15, AOCs - Bowl Area
Bravo - Bravo Area: SWMUs 5.13, 5.14, 5.15, AOCs - Bravo Area
Building 359 - Building 359 Area: AOCs - Building 359 Area
Building 56 Landfil - Building 56 Landfill: SWMU 7.1 - Building 56 Landfill
Canyon - Canyon Area: SWMU 4.14, AOCs - Canyon Area
CDFF - Coca/Delta Fuel Farm (CDFF): AOC - Coca/Delta Fuel Farm
Coca - Coca Area: SWMUs 5.18, 5.19, AOCs - Coca Area
Compound A - Compound A Facility: SWMU 6.4 - Compound A Facility
CTL-III - Component Test Laboratory III: SWMU 4.7, AOCs - Component Test Laboratory-III

CTL-V - Component Test Laboratory V: AOCs - Component Test Laboratory V
Delta - Delta Area: SWMU 5.23, AOC - Delta Area
DOE LF 1 - Department of Energy - Leach Field 1:
DOE LF 2 - Department of Energy - Leach Field 2:
DOE LF 3 - Department of Energy - Leach Field 3:
ECL - Engineering Chemistry Laboratory - Building 270, Waste Tank and Container Storage Area: SWMUs 6.1, 6.2, 6.3, AOCs - ECL Area
EEL - Environmental Effects Laboratory: SWMU 6.9 - Environmental Effects Laboratory
ELV - Expendable Launch Vehicle Final Assembly, Building 206: SWMU 5.2 - ELV Final Assembly, Building 206
ESADA - Empire State Atomic Development Authority: SWMU 7.9 - Empire State Atomic Development Authority Storage Yard
FSDF - Former Sodium Disposal Facility: SWMU 7.3 - Former Sodium Disposal Facility
Happy Valley - Happy Valley: AOC - Happy Valley
Happy Valley - Happy Valley: AOC - Happy Valley
HMSA - Hazardous Materials Storage Area: AOC - Building 457, Former HMSA
HWMF - Hazardous Waste Management Facility: SWMU 7.2 - Building 133 Hazardous Waste Management Facility
HWSA - Hazardous Waste Storage Area - Container Storage Area: SWMU 5.8 - HWSA Container Storage Area
IEL - Instrument and Equipment Laboratories - Instrument Lab Hazardous Waste Tank Equipment Lab, TCE Distillation Unit and Used Product Tank: SWMUs 4.3, 4.4, AOCs -Instrument and Equipment Laboratories
LETF/CTL-I - Laser Engineering Test Facility/Component Test Lab I: SWMU 4.12, AOC - Laser Engineering Test Facility/Component Test Lab I
LOX - Liquid Oxygen Plant: SWMUs 4.5, 4.6 - Liquid Oxygen Plant
Metals Clarifier - Building 65, Metals Laboratory Clarifier: AOC - Building 65, Metals Laboratory Clarifier
NCY - New Conservation Yard: SWMU 7.8 - New Conservation Yard
OCY - Old Conservation Yard: SWMU 7.4 - Old Conservation Yard
PDU - Coal Gasification Process Development Unit: SWMU 7.10, AOC - Building 005 Coal Gasification PDU, Bldg 5/6 Leachfield
Perimeter Pond - Perimeter Pond: SWMU 4.17 - Perimeter Pond

PLF - Propellant Load Facility: SWMUs 5.20, 5.21, 5.22, AOCs - Propellant Load Facility
Pond Dredge - Pond Dredge Area: AOC - Pond Dredge Area
R-1 Pond - Area I Reservoir (R-1 Pond): SWMU 4.16 - Area I Reservoir (R-1 Pond)
R-2 Ponds - R-2A and R-2B Ponds and Drainage: SWMU 5.26 - R-2A and R-2B Ponds and Drainage
RIHL - Rockwell International Hot Laboratory: SWMU 7.7, AOC - Rockwell International Hot Laboratory
RMHF - Radioactive Materials Handling Facility: SWMU 7.6, AOC - Radioactive Materials Handling Facility and Building 021 Leach Field
SE Drum - Southeast Drum Storage Yard: AOC - SE Drum Storage Yard
Silvernale - Silvernale Reservoir and Drainage: SWMU 6.8 - Silvernale Reservoir and Drainage
SNAP - Systems for Nuclear Auxiliary Power Facility: AOC - Building 59, SNAP Facility
SPA - Storable Propellant Area: AOC - Storable Propellant Area
SRE - Sodium Reactor Experiment Area: AOC - Sodium Reactor Experiment Area
STL-IV - Systems Test Laboratory IV: SWMU 6.5, AOC - STL-IV Test Area and Ozonator Tank
STP-3 - Sewage Treatment Plant Pond: AOC - Sewage Treatment Plant Pond
WCT - Hazardous Waste Storage Area Waste Coolant Tank: SWMU 5.7 - HWSA Waste Coolant Tank

Explanation

Buildings
Status
Existing
Removed
Unknown

RFI Sites
Owner
Boeing
DOE
NASA
RFI Group Boundary
Administrative Boundary
Property Boundary

Drainage
Leachfield
Rocks
Surface Drainage
Streams
Pond

N

300 150 0 300 600
Feet

Site Plan,
Group 5 Reporting Area

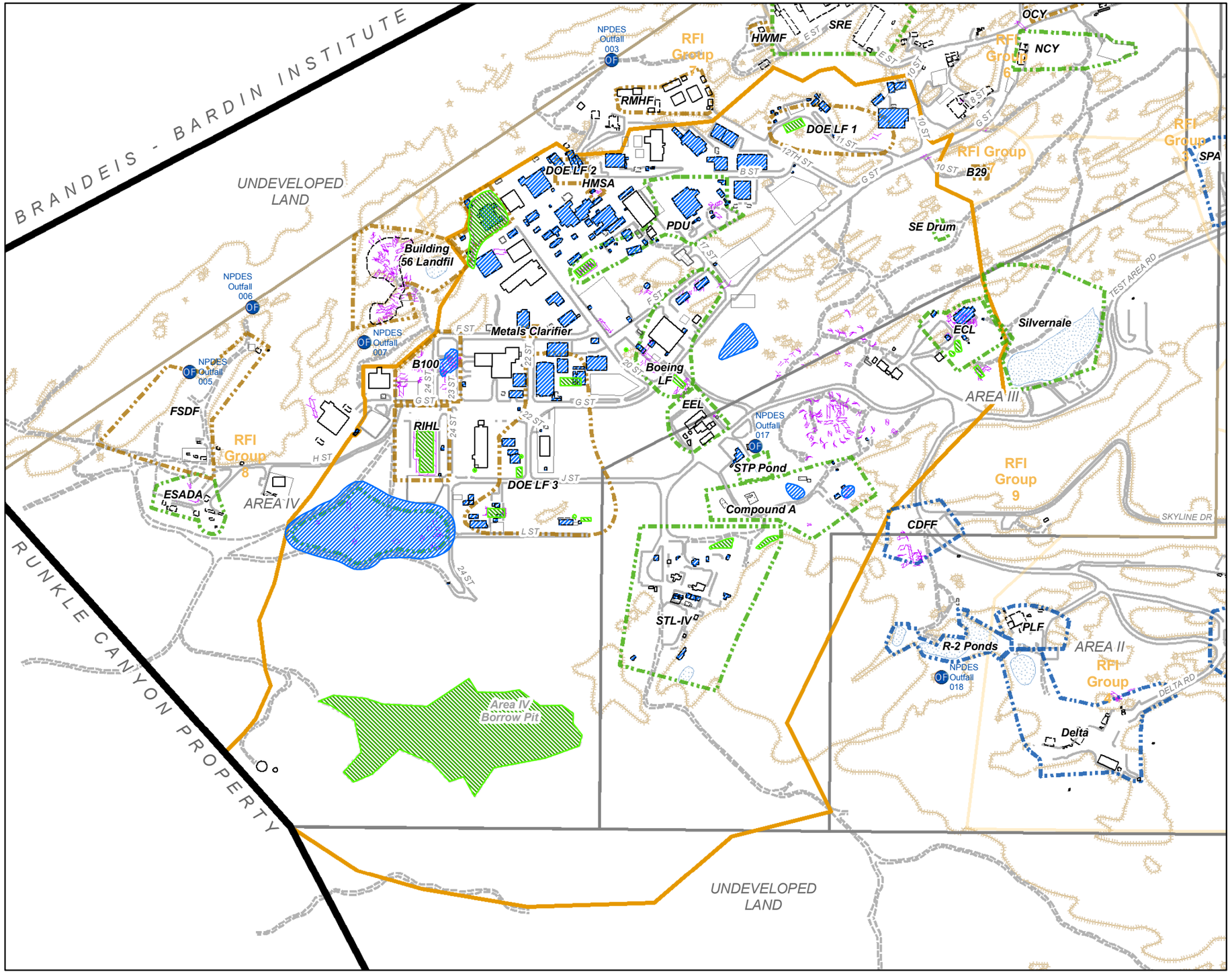
WORKING DRAFT

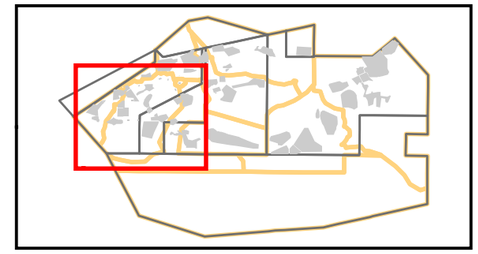
SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure 3-1

\MapFiles\RFI_Grp05\RFI_Report\RFIGrp5_SitePlan.mxd September 17, 2007





Approximate Areas of Soil Disturbance

- Grading
- Excavation - Backfill

Basemap Legend

- Building - Existing
- Building - Removed
- Building - Not Yet Determined
- Transformer - Existing
- Transformer - Removed
- Transformer - Not Yet Determined
- RFI Site - Boeing
- RFI Site - DOE
- RFI Site - NASA
- RFI 5 Group Boundary
- RFI Group Boundary
- Administrative Area
- Property Boundary
- Road - Asphalt
- Roads - Dirt
- Rocks
- Excavation
- Trenches
- NPDES Outfalls

Buildings, Improvements, and Soil Disturbances, within Group 5 Reporting Area

Date: October 29, 2008

WORKING DRAFT

1 inch equals 500 feet

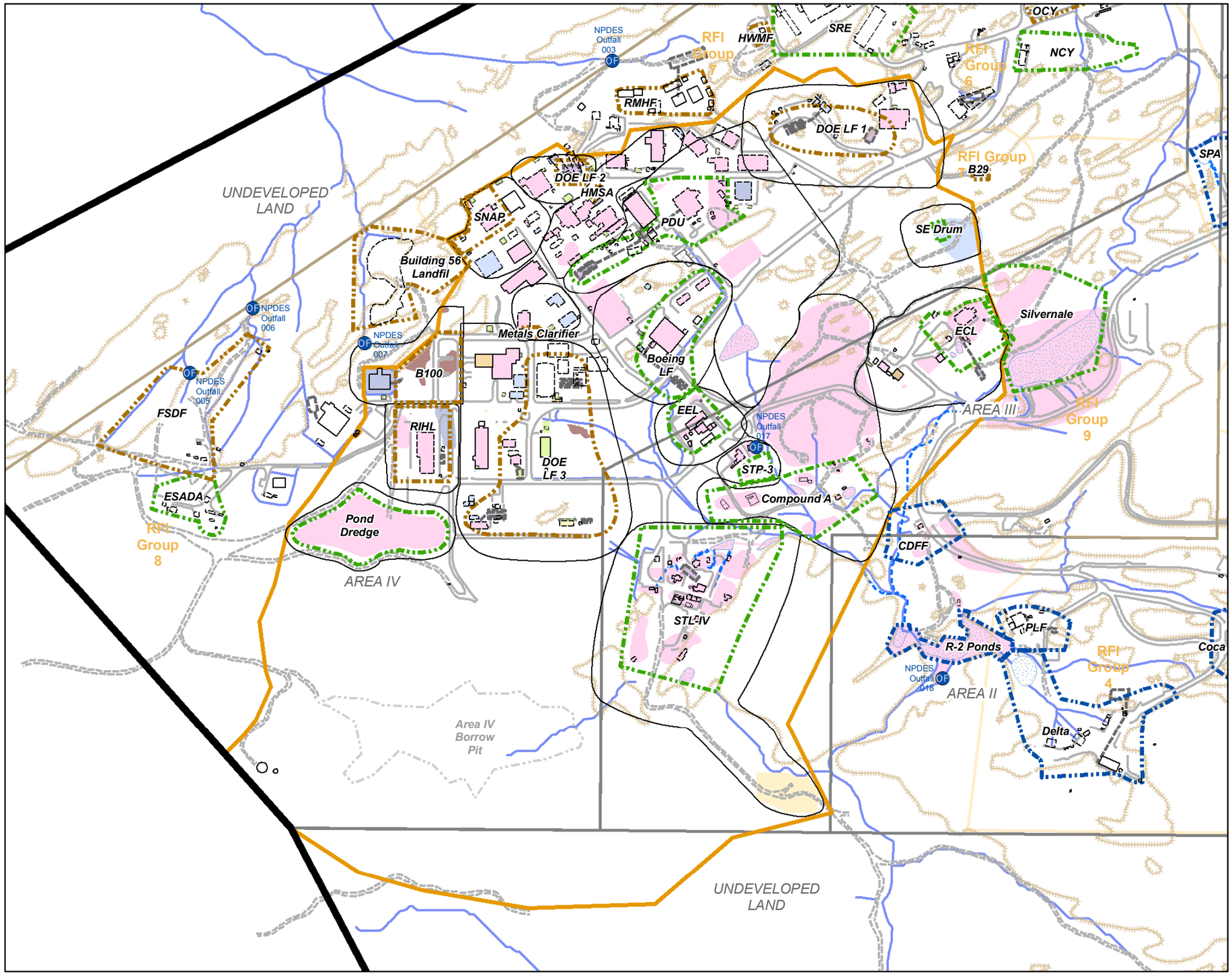
0 500 1,000 Feet

Document: \\..MapFiles\RFI_05\RFI_Report\RFIGrp5_Buildings_SoilDist_BL.mxd

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure 3-2



Chemical Use Areas

- Multiple Use
- Solvent
- Petroleum
- Oil/PCBs
- Metals
- Energetic Constituents
- Propellants
- Debris
- Leach Field
- Non-metal Inorganic Constituents
- Screening for Potential Impacts

Basemap Legend

- Leachfield
- Drainage
- Road - Asphalt
- Roads - Dirt
- Rocks
- Streams
- Pond
- Building - Existing
- Building - Removed
- Building - Not Yet Determined
- Transformer - Existing
- Transformer - Removed
- Transformer - Not Yet Determined
- RFI Site - Boeing
- RFI Site - DOE
- RFI Site - NASA
- Investigation Boundary
- RFI 5 Group Boundary
- RFI Group Boundary
- Administrative Area
- Property Boundary

Potential Chemical Use Areas
Group 5 Reporting Area

Date: October 29, 2008 WORKING DRAFT

1 inch equals 60 feet

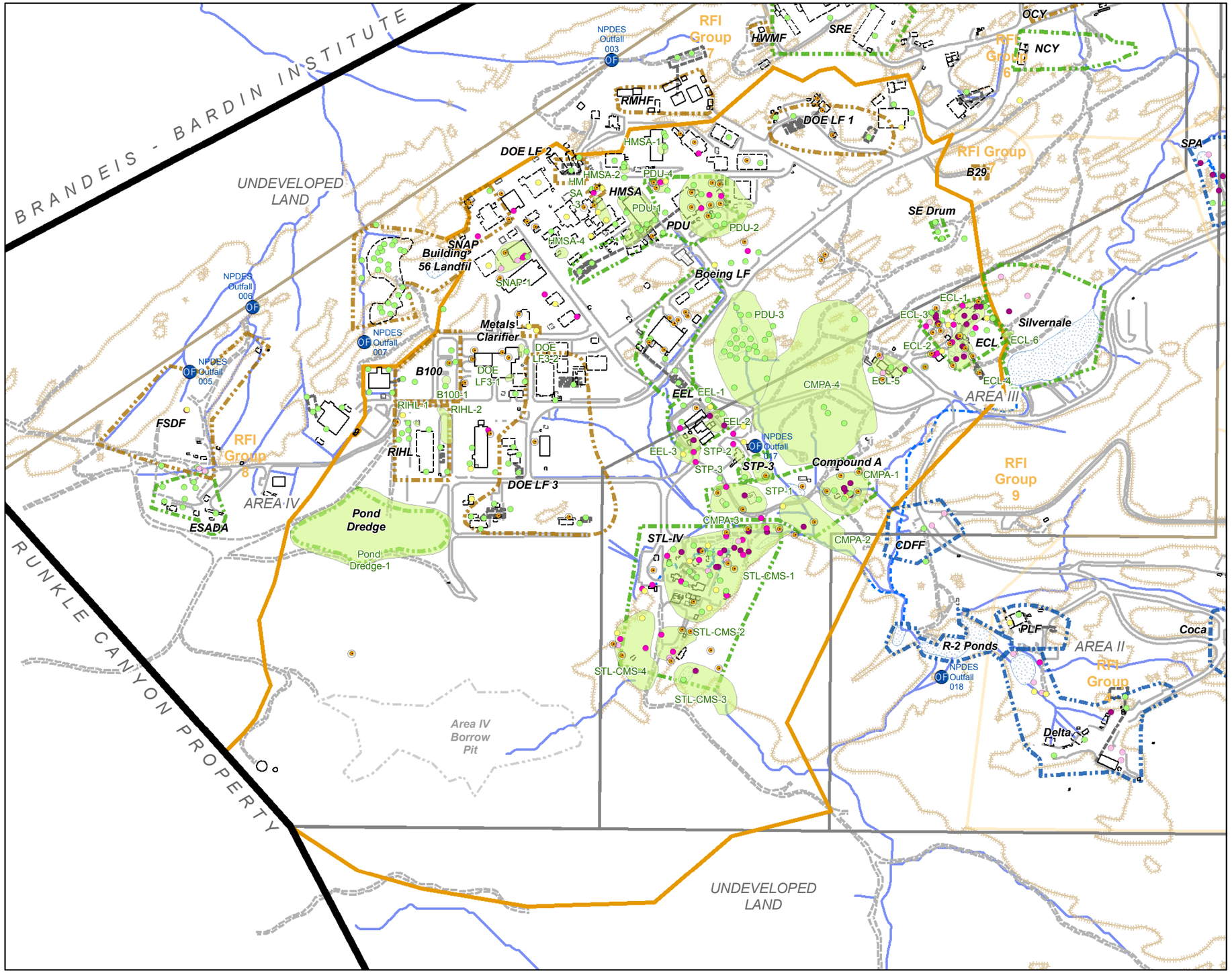
0 500 1,000 Feet

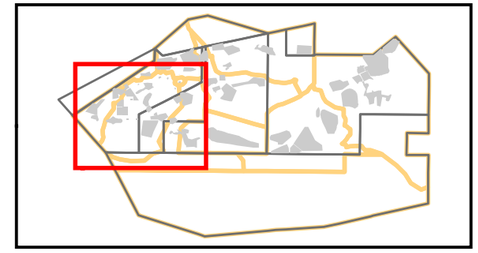
Document: \\..MapFiles\RFI_05\RFIGrp5_ChemUse_BL.mxd

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure 3-3





VOCs in Soil Vapor

- Exceeds Residential RBSL + Eco RBSL
- Exceeds Eco RBSL
- Exceeds Residential RBSL
- Detect, Below All Screening Levels
- Non-detect
- SV points that were not sampled due to refusal or poor air flow

Note: RBSLs do not replace risk assessment data evaluation or other evaluation such as assessment of chemical gradients; rather, RBSLs are designed to aid in interpretation and presentation of the sampling results

Basemap Legend

- Leachfield
- Drainage
- Road - Asphalt
- Roads - Dirt
- Rocks
- Streams
- Pond
- NPDES Outfalls
- Building - Existing
- Building - Removed
- Building - Not Yet Determined
- Transformer - Existing
- Transformer - Removed
- Transformer - Not Yet Determined
- RFI Site - Boeing
- RFI Site - DOE
- RFI Site - NASA
- RFI 5 Group Boundary
- RFI Group Boundary
- Administrative Area
- Property Boundary
- CMS Area

VOCs Summary for Soil Vapor Group 5 Reporting Area

Date: October 29, 2008 WORKING DRAFT

1 inch equals 500 feet

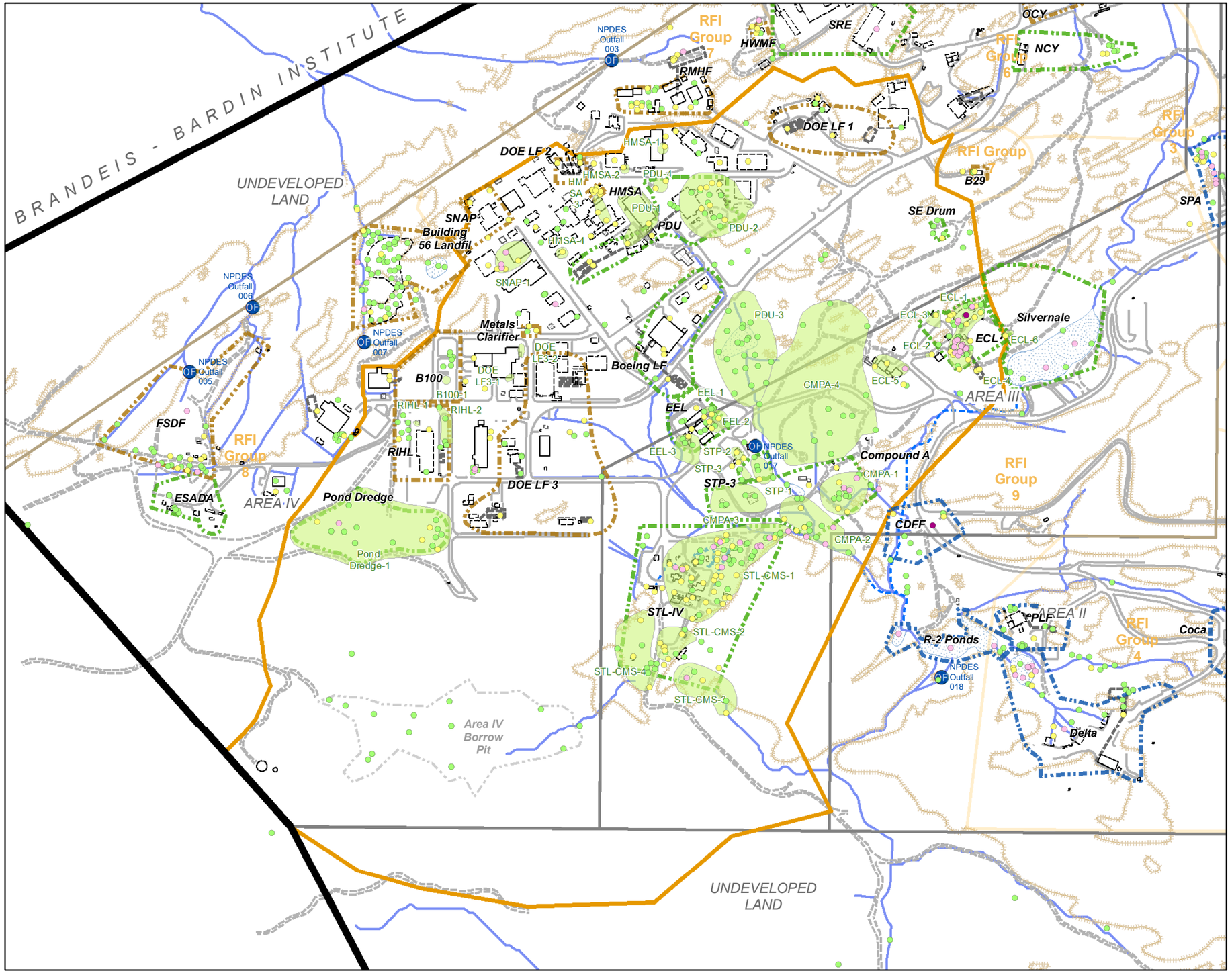
0 500 1,000 Feet

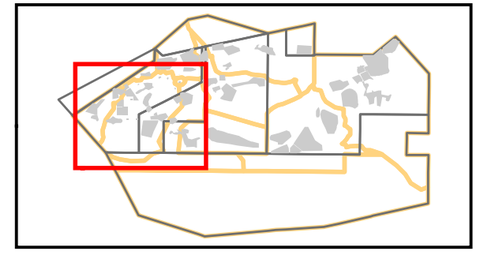
Document: \\..MapFiles\RFI_05\CDot_Sitewide_BL\RFIGrp5_VOCsSVapr_BL.mxd

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure 4-1





VOCs in Soil

- Exceeds Residential RBSL + Eco RBSL
- Exceeds Residential RBSL
- Detect, Below All Screening Levels
- Non-detect

Note: RBSLs do not replace risk assessment data evaluation or other evaluation such as assessment of chemical gradients; rather, RBSLs are designed to aid in interpretation and presentation of the sampling results

Basemap Legend

- Leachfield
- Drainage
- Road - Asphalt
- Roads - Dirt
- Rocks
- Streams
- Pond
- NPDES Outfalls
- Building - Existing
- Building - Removed
- Building - Not Yet Determined
- Transformer - Existing
- Transformer - Removed
- Transformer - Not Yet Determined
- RFI Site - Boeing
- RFI Site - DOE
- RFI Site - NASA
- RFI 5 Group Boundary
- RFI Group Boundary
- Administrative Area
- Property Boundary
- CMS Area

VOCs Summary for Soil and Groundwater Group 5 Reporting Area

Date: October 29, 2008 WORKING DRAFT

1 inch equals 500 feet

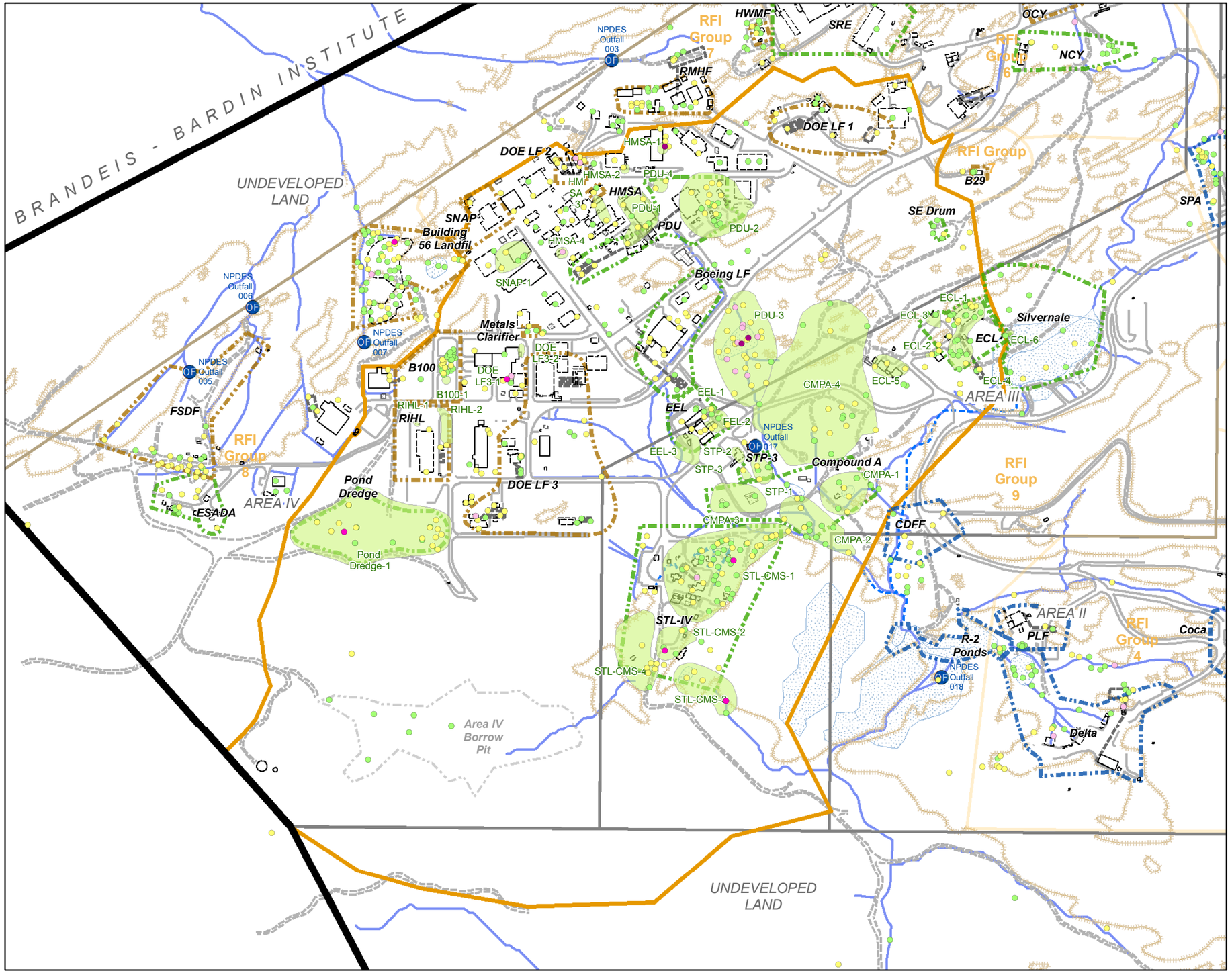
0 500 1,000 Feet

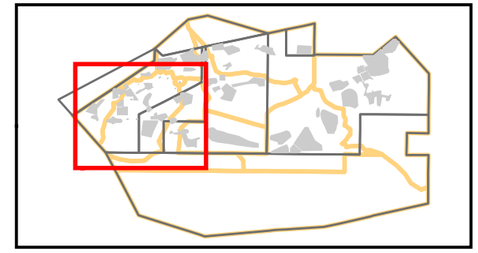
Document: \\..MapFiles\RFI_05\CDot_Sitewide_BL\RFIGrp5_VOCsSoil_BL.mxd

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure 4-2





SVOCs in Soil

- Exceeds Residential RBSL + Eco RBSL
- Exceeds Eco RBSL
- Exceeds Residential RBSL
- Detect, Below All Screening Levels
- Non-detect

Note: RBSLs do not replace risk assessment data evaluation or other evaluation such as assessment of chemical gradients; rather, RBSLs are designed to aid in interpretation and presentation of the sampling results

Basemap Legend

- Leachfield
- Drainage
- Road - Asphalt
- Roads - Dirt
- Rocks
- Streams
- Pond
- NPDES Outfalls
- Building - Existing
- Building - Removed
- Building - Not Yet Determined
- Transformer - Existing
- Transformer - Removed
- Transformer - Not Yet Determined
- RFI Site - Boeing
- RFI Site - DOE
- RFI Site - NASA
- RFI 5 Group Boundary
- RFI Group Boundary
- Administrative Area
- Property Boundary
- CMS Area

SVOCs Summary for Soil and Groundwater Group 5 Reporting Area

Date: October 29, 2008 WORKING DRAFT

1 inch equals 500 feet

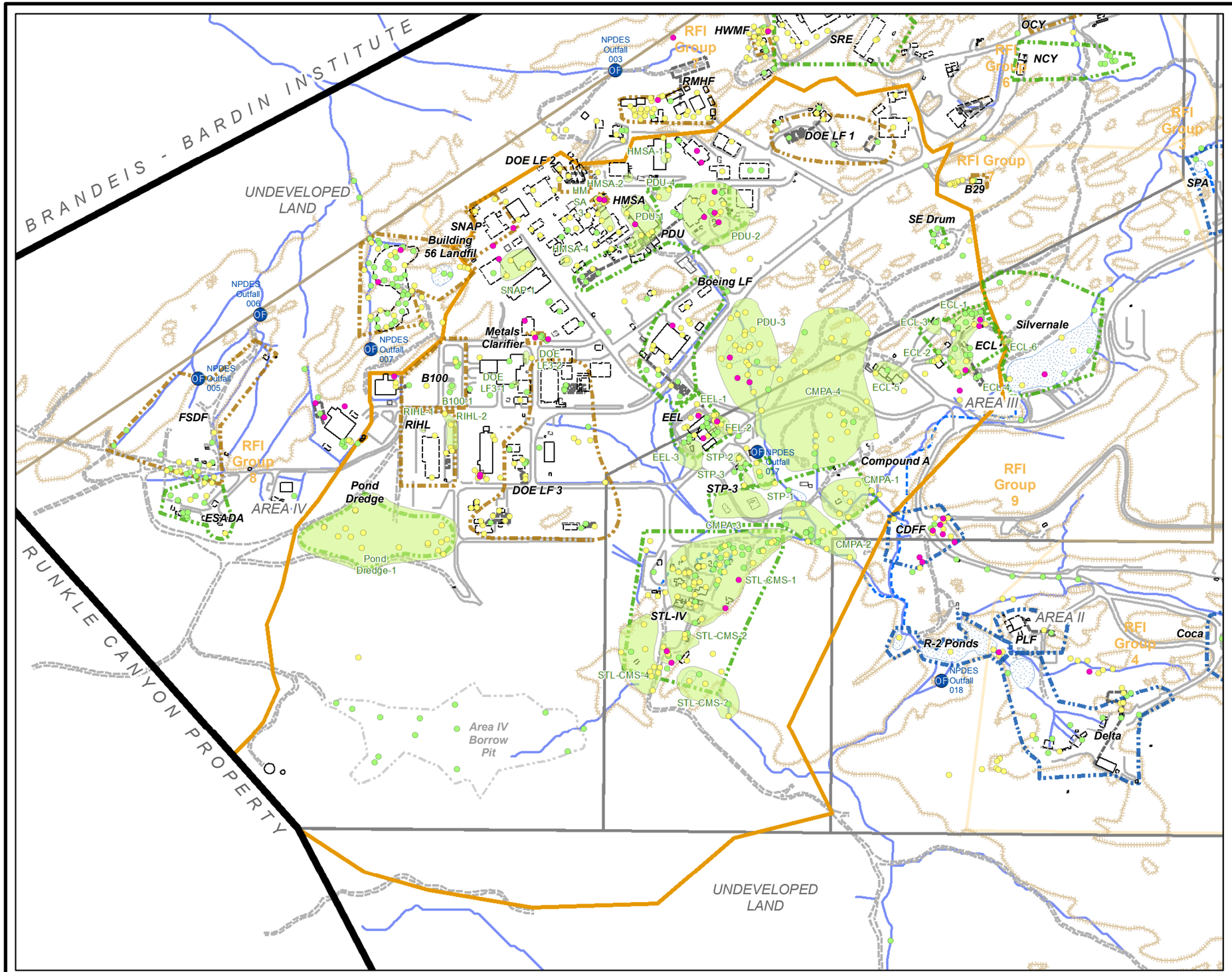
0 500 1,000 Feet

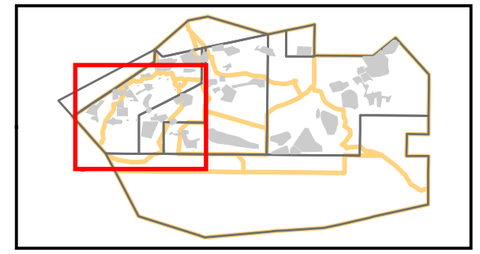
Document: |\..MapFiles\RFI_05\CDot_Sitewide_BL\RFIGrp5_SVCsSoil_BL.mxd

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure 4-3





TPH in Soil

- Exceeds Residential RBSL
- Detect, Below Residential RBSL
- Non-detect

Note: RBSLs do not replace risk assessment data evaluation or other evaluation such as assessment of chemical gradients; rather, RBSLs are designed to aid in interpretation and presentation of the sampling results

Basemap Legend

- Leachfield
- Drainage
- Road - Asphalt
- Roads - Dirt
- Rocks
- Streams
- Pond
- NPDES Outfalls
- Building - Existing
- Building - Removed
- Building - Not Yet Determined
- Transformer - Existing
- Transformer - Removed
- Transformer - Not Yet Determined
- RFI Site - Boeing
- RFI Site - DOE
- RFI Site - NASA
- RFI 5 Group Boundary
- RFI Group Boundary
- Administrative Area
- Property Boundary
- CMS Area

TPH Summary for Soil and Groundwater Group 5 Reporting Area

Date: October 29, 2008 WORKING DRAFT

1 inch equals 500 feet

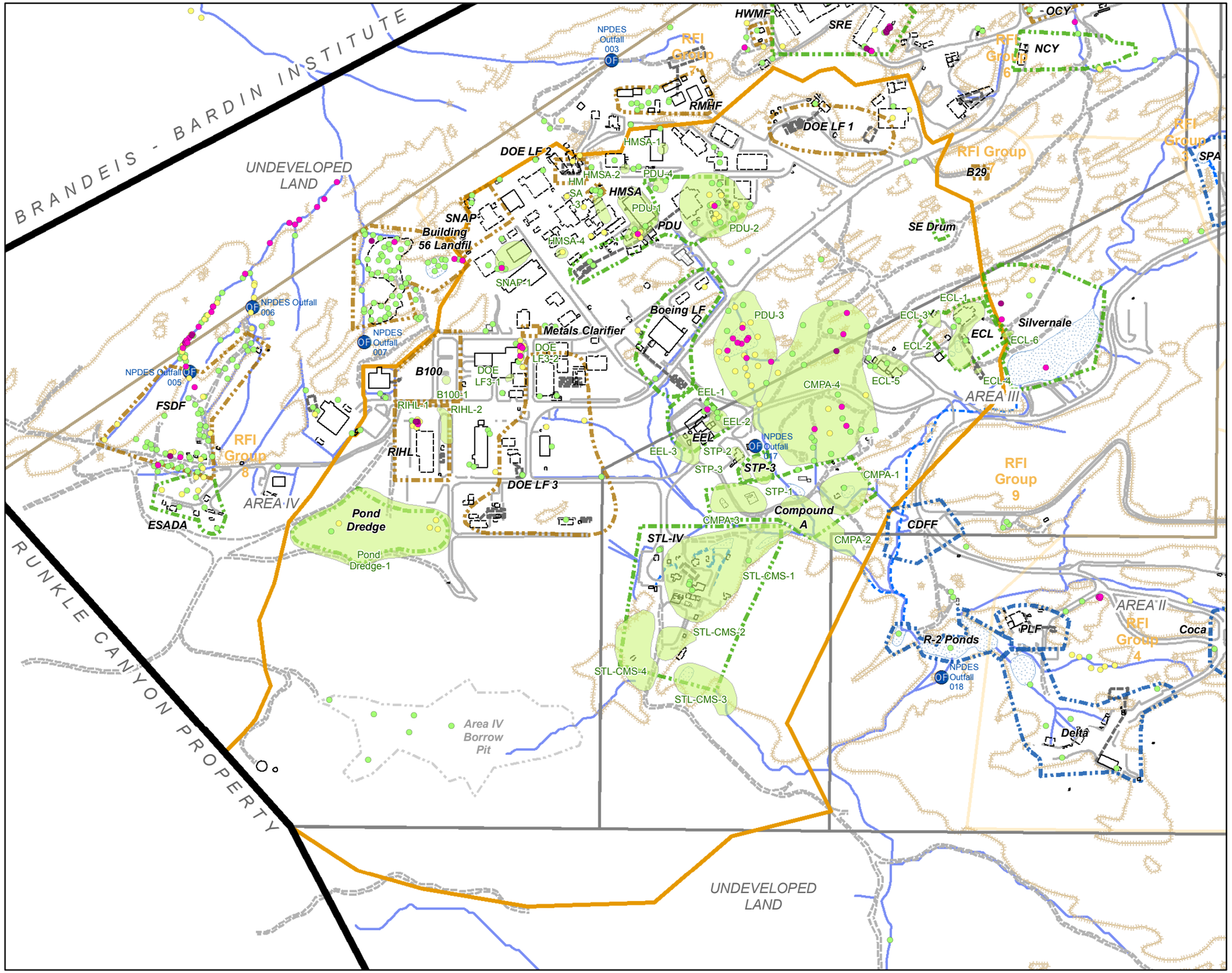
0 500 1,000 Feet

Document: |\..MapFiles\RFI_05\CDot_Sitewide_BL\RFIGrp5_TPHSoil_BL.mxd

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure 4-4



PCBs in Soil

- Exceeds Residential RBSL + Eco RBSL
- Exceeds Eco RBSL
- Detect, Below All Screening Levels
- Non-detect

Note: RBSLs do not replace risk assessment data evaluation or other evaluation such as assessment of chemical gradients; rather, RBSLs are designed to aid in interpretation and presentation of the sampling results

Basemap Legend

- Leachfield
- Drainage
- Road - Asphalt
- Roads - Dirt
- Rocks
- Streams
- Pond
- NPDES Outfalls
- Building - Existing
- Building - Removed
- Building - Not Yet Determined
- Transformer - Existing
- Transformer - Removed
- Transformer - Not Yet Determined
- RFI Site - Boeing
- RFI Site - DOE
- RFI Site - NASA
- RFI 5 Group Boundary
- RFI Group Boundary
- Administrative Area
- Property Boundary
- CMS Area

PCBs Summary for Soil and Groundwater Group 5 Reporting Area

Date: October 29, 2008

WORKING DRAFT

1 inch equals 500 feet

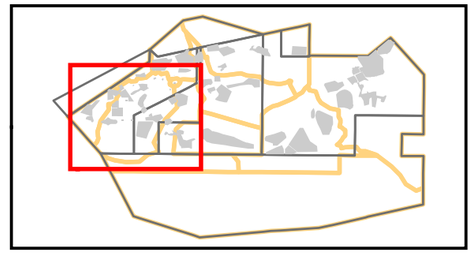
0 500 1,000 Feet

Document: |\..MapFiles\RFI_05\CDot_Sitewide_BL\RFIGrp5_PCBsSoil_BL.mxd

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure 4-5



Metals in Soil

- Exceeds Background + Residential RBLS + Eco RBLS
- Exceeds Background + Eco RBSL
- Exceeds Background
- Dectect, Below Background Concentration
- Non-detect

Note: RBSLs do not replace risk assessment data evaluation or other evaluation such as assessment of chemical gradients; rather, RBSLs are designed to aid in interpretation and presentation of the sampling results

Basemap Legend

- Leachfield
- Drainage
- Road - Asphalt
- Roads - Dirt
- Rocks
- Streams
- Pond
- NPDES Outfalls
- Building - Existing
- Building - Removed
- Building - Not Yet Determined
- Transformer - Existing
- Transformer - Removed
- Transformer - Not Yet Determined
- RFI Site - Boeing
- RFI Site - DOE
- RFI Site - NASA
- RFI 5 Group Boundary
- RFI Group Boundary
- Administrative Area
- Property Boundary
- CMS Area

Metals Summary for Soil and Groundwater Group 5 Reporting Area

Date: October 29, 2008 WORKING DRAFT

1 inch equals 500 feet

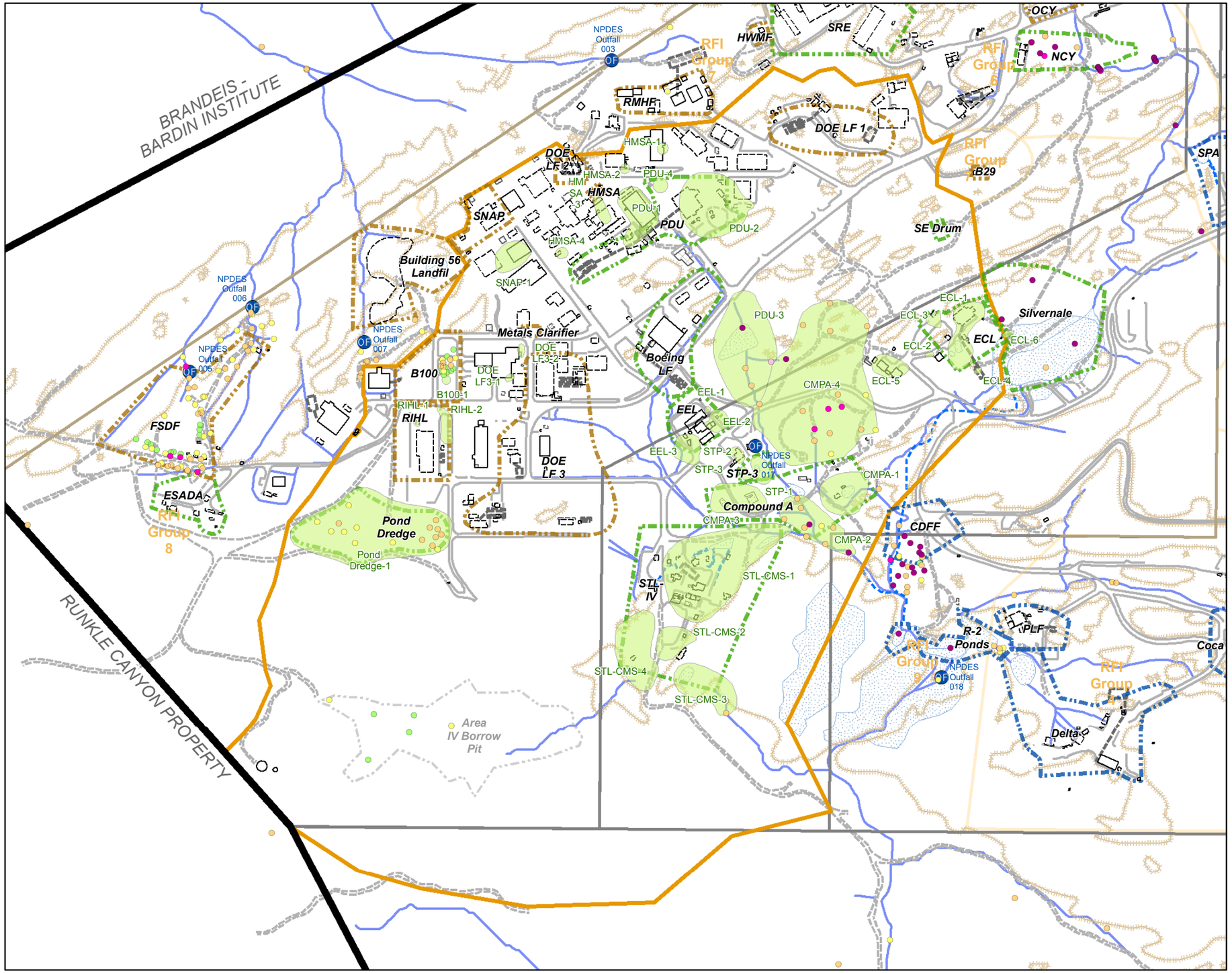
0 500 1,000 Feet

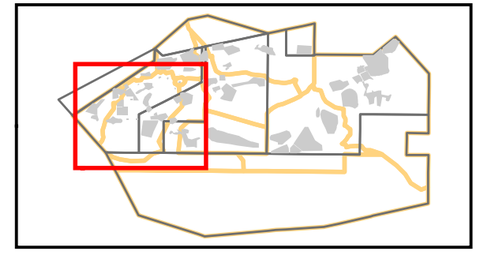
Document: I\..MapFiles\RFI_05\CDot_Sitewide_BL\RFIGrp5_MtlsSoil_BL.mxd

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure 4-6





Dioxins in Soil

- Exceeds Background + Residential RBSL + Eco RBSL
- Exceeds Background + Eco RBSL
- Exceeds Background + Residential RBSL
- Exceeds Background
- Detect, Below Background Concentration
- Non-detect

Note: RBSLs do not replace risk assessment data evaluation or other evaluation such as assessment of chemical gradients; rather, RBSLs are designed to aid in interpretation and presentation of the sampling results

Basemap Legend

- Leachfield
- Drainage
- Road - Asphalt
- Roads - Dirt
- Rocks
- Streams
- Pond
- NPDES Outfalls
- Building - Existing
- Building - Removed
- Building - Not Yet Determined
- Transformer - Existing
- Transformer - Removed
- Transformer - Not Yet Determined
- RFI Site - Boeing
- RFI Site - DOE
- RFI Site - NASA
- RFI 5 Group Boundary
- RFI Group Boundary
- Administrative Area
- Property Boundary
- CMS Area

Dioxins Summary for Soil and Groundwater Group 5 Reporting Area

Date: October 29, 2008

WORKING DRAFT

Document: [\..MapFiles\RFI_05\RFI_Report\CDot_Sitewide_BL\RFIGrp5_DxnsSoil_BL.mxd

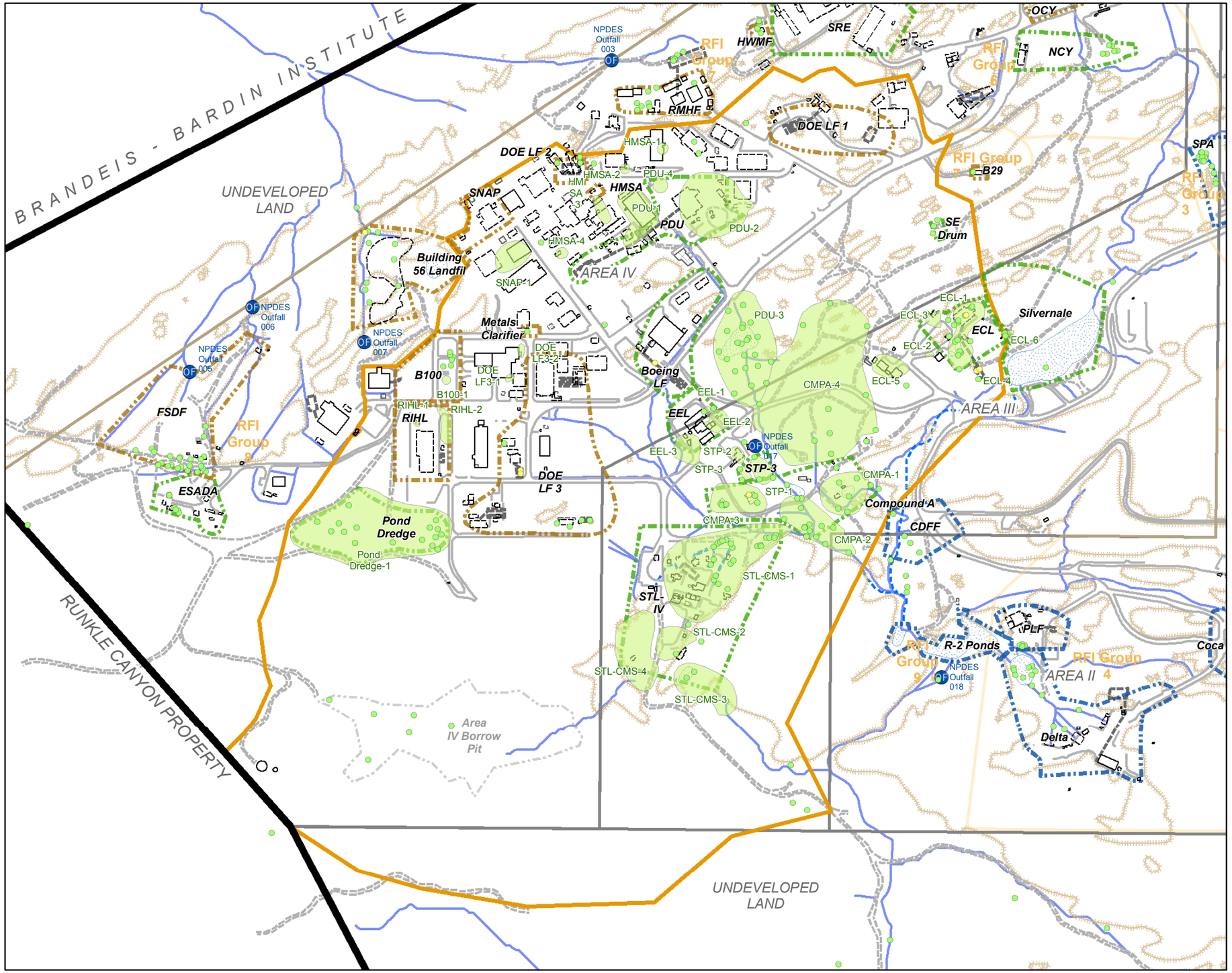
1 inch equals 500 feet

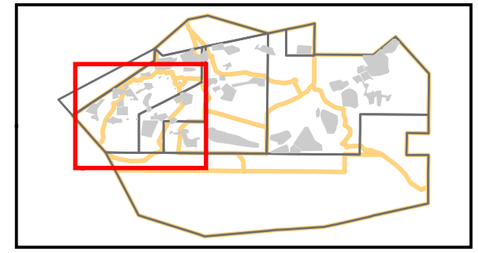
0 500 1,000 Feet

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure 4-7





Energetics in Soil

- Detect, Below All Screening Levels
- Non-detect

Note: RBSLs do not replace risk assessment data evaluation or other evaluation such as assessment of chemical gradients; rather, RBSLs are designed to aid in interpretation and presentation of the sampling results

Basemap Legend

- Leachfield
- Drainage
- Road - Asphalt
- Roads - Dirt
- Rocks
- Streams
- Pond
- NPDES Outfalls
- Building - Existing
- Building - Removed
- Building - Not Yet Determined
- Transformer - Existing
- Transformer - Removed
- Transformer - Not Yet Determined
- RFI Site - Boeing
- RFI Site - DOE
- RFI Site - NASA
- RFI 5 Group Boundary
- RFI Group Boundary
- Administrative Area
- Property Boundary
- CMS Area

Energetics Summary for Soil and Groundwater Group 5 Reporting Area

Date: October 29, 2008 WORKING DRAFT

1 inch equals 500 feet

0 500 1,000 Feet

Document: \\..MapFiles\RFI_05\CDot_Sitewide_BL\RFIGrp5_EngtSoil_BL.mxd

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure 4-8

Representative Ecological Receptors:

- Generic aquatic species (aquatic primary/secondary consumer)
- Great blue heron (aquatic tertiary consumer)
- Deer mouse (terrestrial primary/secondary consumer)
- Thrush (terrestrial primary/secondary consumer)
- Mule deer (terrestrial primary consumer)
- Red-tailed hawk (terrestrial secondary/tertiary consumer)
- Bobcat (terrestrial secondary/tertiary consumer)

Worker Receptor:

- Inhalation of dust (Surficial OU)
- Inhalation of vapors from soil and groundwater (Surficial OU and CFOU)
- Dermal contact with soil (Surficial OU)
- Ingestion of soil (Surficial OU)
- Dermal contact with surface water and sediment (Surficial OU)
- Ingestion of surface water and sediment (Surficial OU)
- Inhalation of vapors from bedrock

Future Residential Receptor:

- Inhalation of dust (Surficial OU)
- Inhalation of vapors from soil and groundwater (Surficial OU and CFOU)
- Ingestion of plants (Surficial OU)
- Dermal contact with soil (Surficial OU)
- Ingestion of soil (Surficial OU)
- Dermal contact with surface water and sediment (Surficial OU)
- Ingestion of surface water and sediment (Surficial OU)
- Ingestion of groundwater (Surficial OU and CFOU)
- Inhalation of vapors during domestic use (Surficial OU and CFOU)
- Dermal contact with groundwater (Surficial OU and CFOU)
- Inhalation of vapors from bedrock

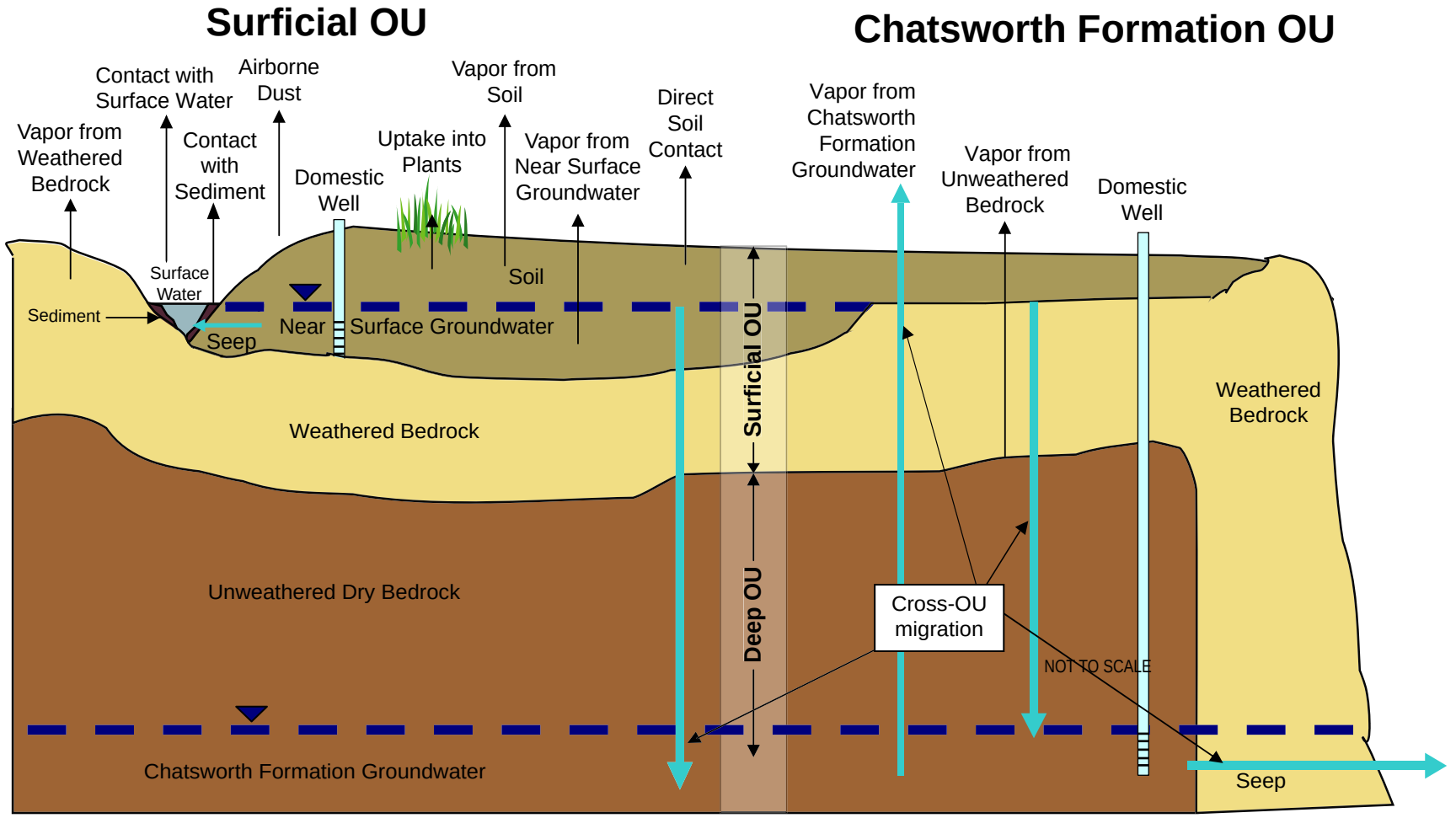
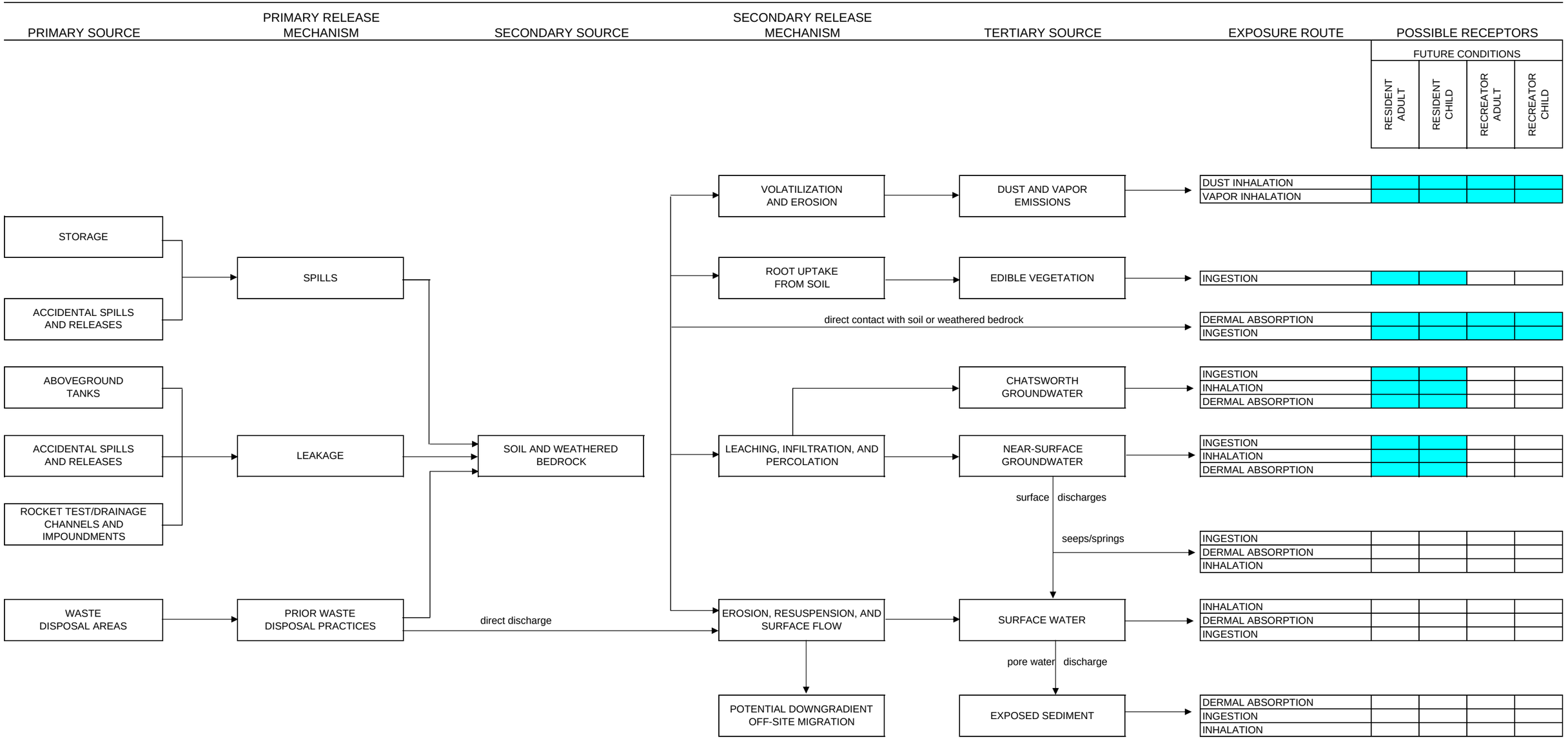


FIGURE 5-1
Illustrated Conceptual Site Model of Human Health and Ecological Exposures
Santa Susana Field Laboratory
Ventura County, California

Figure 6-1

Generalized Human Health Risk Assessment Conceptual Site Model

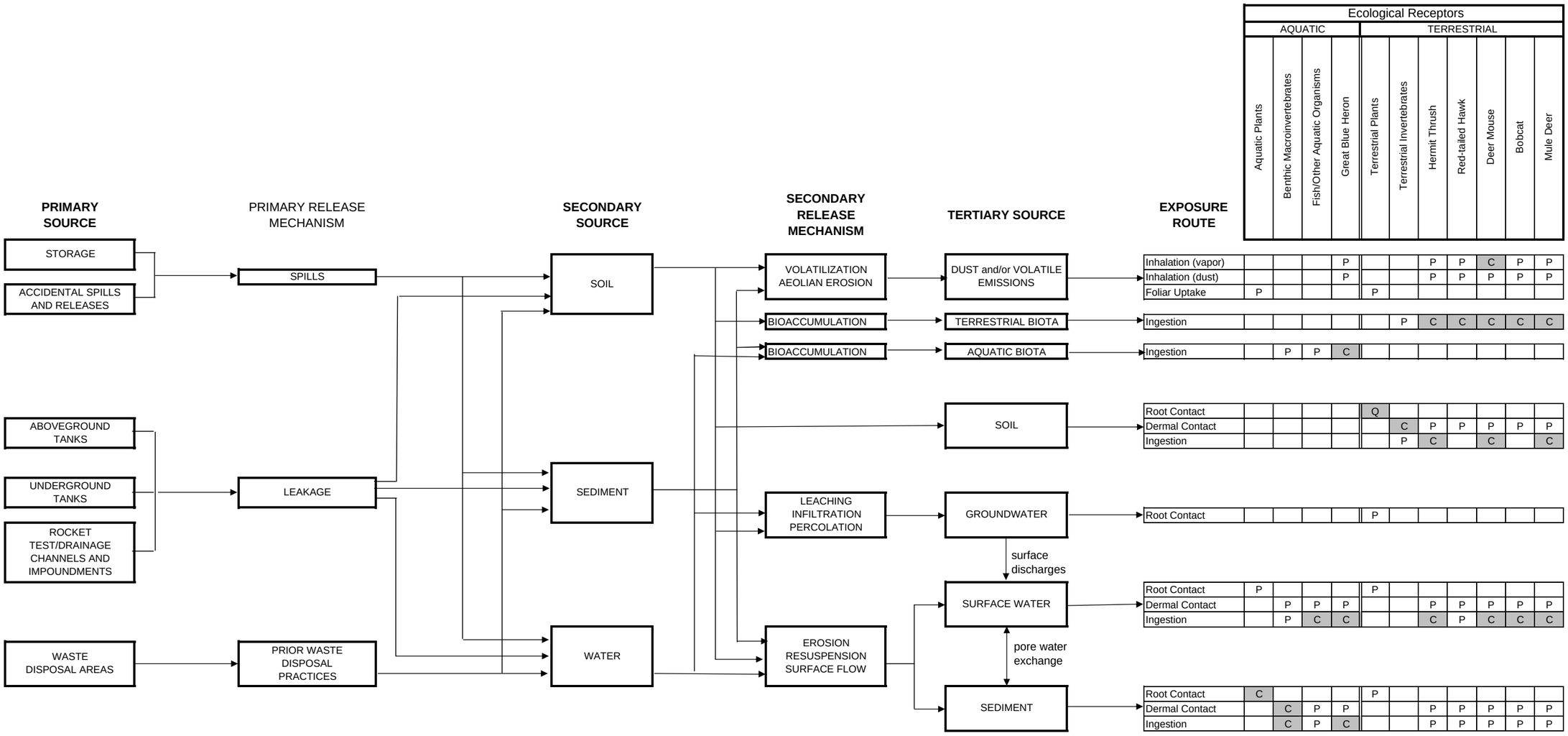
Group 5 RFI Report



NOTES:
As described in the SRAM (MWH 2005), note that risk estimates for the potential future recreational user (recreator) are used as surrogate risk estimates for the trespasser.

- complete and potentially complete exposure pathways evaluated in this risk assessment

- incomplete exposure pathways not evaluated in this risk assessment



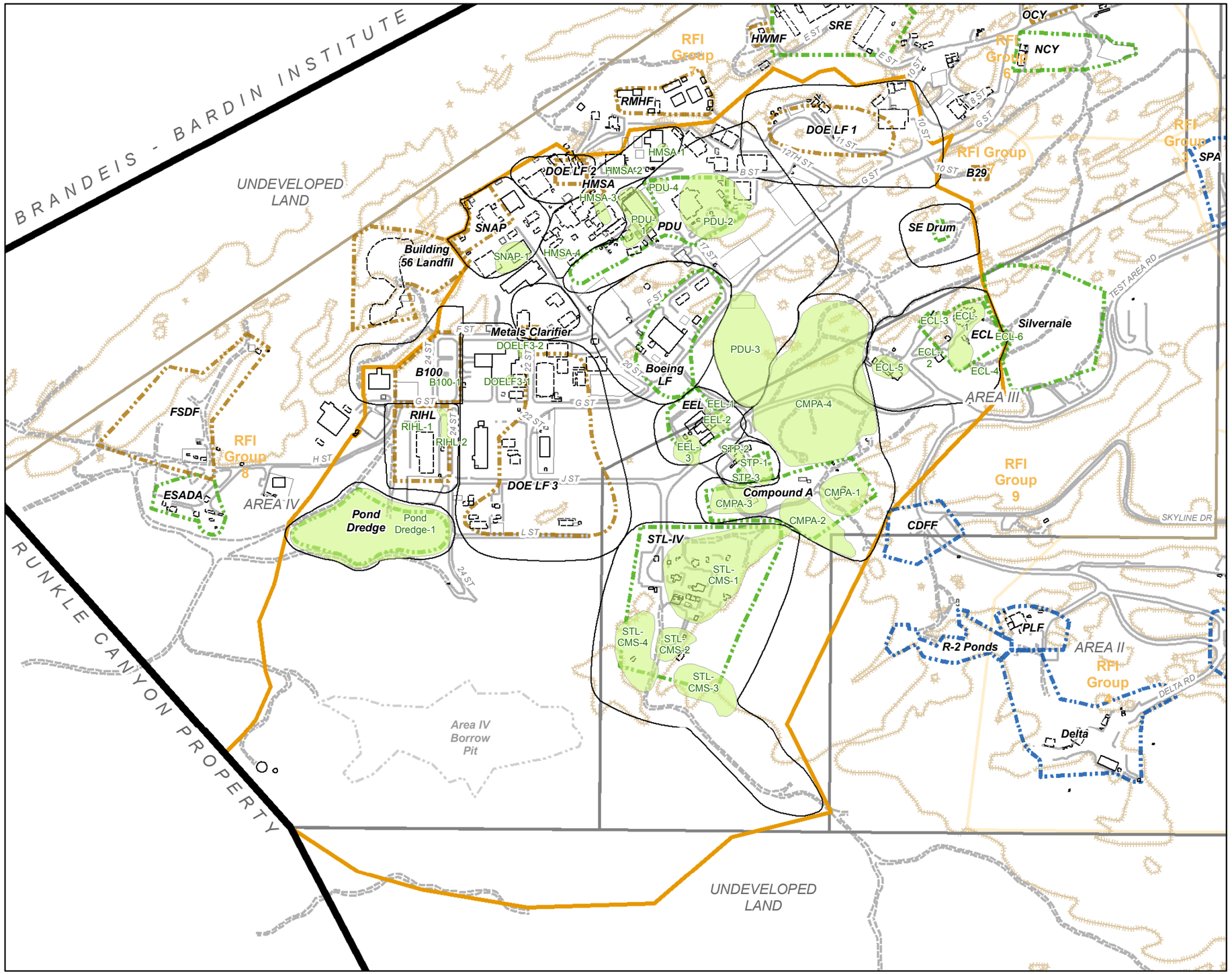
C - Pathway considered complete for purposes of ecological risk assessment

P - Pathway considered potentially complete

Q - Pathway evaluated qualitatively unless site conditions indicate need for quantitative evaluation

Pathways evaluated qualitatively or quantitatively in ecological risk assessment

Figure 6-2
General Ecological Conceptual Site Model
Group 5 RFI Report
Santa Susana Field Laboratory



CMS Area

Basemap Legend

- Building - Existing
- Building - Removed
- Building - Not Yet Determined
- Transformer - Existing
- Transformer - Removed
- Transformer - Not Yet Determined
- RFI Site - Boeing
- RFI Site - DOE
- RFI Site - NASA
- Investigation Boundary
- RFI 5 Group Boundary
- RFI Group Boundary
- Administrative Area
- Property Boundary
- Road - Asphalt
- Roads - Dirt
- Rocks
- Streams
- Pond

Surficial Media Site Action Recommendations

Date: October 30, 2008

WORKING DRAFT

1 inch equals 500 feet

0 500 1,000 Feet

Document: \\..MapFiles\RFI_05\RFI_Report\RFIGrp5_CMS_7-1_BL.mxd

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure 7-1

Appendices