Report

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

Volume VI – RFI Site Reports Appendix K

Southeast Drum Storage Yard

Prepared for:

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DRAFT IN PROGRESS

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Acronyms and Abbreviations

AI	Atomics International
AOC	Area of Concern
AST	aboveground storage tank
Boeing	The Boeing Company
bgs	below ground surface
BMP	best management practice
BTEX	benzene, toluene, ethylbenzene, and xylenes
Cal-EPA	California Environmental Protection Agency
CCR	Current Conditions Report
CF	Chatsworth Formation
CFOU	Chatsworth Formation Operable Unit
CMS	Corrective Measures Study
COC	chemical of concern
COEC	chemical of ecological concern
COPC	chemical of potential concern
CPEC	chemical of potential ecological concern
CSM	conceptual site model
CTE	central tendency exposure
CUA	Chemical Use Area
DCA	dichloroethane
DCE	dichloroethene
DOE	United States Department of Energy
DQO	data quality objective
DTSC	Department of Toxic Substances Control
ECL	Engineering Chemistry Laboratory
EEL	Environmental Effects Laboratory
ELCR	estimated lifetime cancer risk
EPC	exposure point concentration
ERA	ecological risk assessment
ESL	ecological screening level

ETEC	Energy Technology Engineering Center
GRC	Groundwater Resource Consultants, Inc.
H&A	Haley & Aldrich, Inc.
HAR	Hydrogeologic Assessment Report
HI	hazard index
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
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
msl	mean sea level
MWH	Montgomery Watson Harza
NA	not applicable
ND	not detected
NDMA	n-nitrosodimethylamine
NFA	no further action
NPDES	National Pollutant Discharge Elimination System
NSGW	near-surface groundwater
Ogden	Ogden Environmental and Energy Services Company, Inc.
OU	operable unit
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
pCi/g	picocuries per gram
PDU	Coal Gasification Process Development Unit
pg/g	picograms per gram
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
QAPP	Quality Assurance Project Plan
QC	quality control
RA	risk assessment
RBSL	risk-based screening level
RCRA	Resource Conservation and Recovery Act
RIHL	Rockwell International Hot Laboratory
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RME	reasonable maximum exposure
Rocketdyne	Rocketdyne Propulsion and Power
RWQCB	Los Angeles Regional Water Quality Control Board
SAIC	Science Applications International Corporation
SE Drum Yard	Southeast Drum Storage Yard
SMOU	Surficial Media Operable Unit
SNAP	Systems for Nuclear Auxiliary Power
SOP	standard operating procedure
SRAM	Standardized Risk Assessment Methodology
SSFL	Santa Susana Field Laboratory
STL-IV	Systems Test Laboratory IV
STP-3	Area 3 Sewage Treatment Plant
SVOC	semivolatile organic compound
SWMU	solid waste management unit
3-D	three dimensional
TCDD-TEQ	2,3,7,8-tetrachlorodibenzodioxin toxicity equivalency quotient
TDS	total dissolved solids
TEQ	toxicity equivalency quotient
TIC	tentatively identified compound
TCE	trichloroethene
TPH	total petroleum hydrocarbons
TRV	toxicity reference value
UCL	upper confidence limit
USEPA	United States Environmental Protection Agency

UST	underground storage tank
µg/dl	micrograms per deciliter
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
µg/Lv	micrograms per liter vapor
µs/cm	micro siemens per centimeter
VOC	volatile organic compound
WPA	RFI Work Plan Addendum
WPAA	RFI Work Plan Addendum Amendments

Appendix K

K.1 Introduction

This appendix to the Group 5 Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Report presents findings and recommendations based on the results of the investigation conducted at the Southeast Drum Storage Yard (SE Drum Yard) Site of the Santa Susana Field Laboratory (SSFL). The SE Drum Yard Site contains one Area of Concern (AOC), SE Drum Yard Site. The SE Drum Yard Site is located within Area IV of the SSFL and was used in support of The Boeing Company (Boeing) operations. The RCRA Corrective Action Program at the SSFL is being conducted under the oversight of the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC).

The SE Drum Yard Site is 1 of 17 RFI sites included in the Group 5 RFI Report. An RFI Site is an area that includes at least one solid waste management unit (SWMU), and/or an AOC, and some adjacent land for the purpose of characterization. The location of the SE Drum Yard Site within the SSFL and Group 5 Reporting Area is shown in Figure K.1-1. The other 16 Group 5 RFI Sites are:

- Boeing Area IV Leach Field (AOC)
- Compound A Facility (SWMU 6.4)
- Engineering Chemistry Laboratory (ECL) (SWMUs 6.1, 6.2, 6.3, and AOC)
- Environmental Effects Laboratory (EEL) (SWMU 6.9)
- Pond Dredge Area (AOC)
- Coal Gasification Process Development Unit (PDU) (SWMU 7.10)
- Area 3 Sewage Treatment Plant (STP-3) (AOC)
- Systems Test Laboratory IV (STL-IV) (SWMUs 6.5, 6.6, and 6.7)
- Building 65 Metals Laboratory Clarifier (Building 65) (AOC)
- Building 100 Trench (SWMU 7.5)
- Department of Energy Leach Field 1 (DOE LF1) (AOC)
- Department of Energy Leach Field 2 (DOE LF2) (AOC)
- Department of Energy Leach Field 3 (DOE LF3) (AOC)
- Hazardous Material Storage Area (HMSA) (AOC)
- Rockwell International Hot Laboratory (RIHL) (SWMU 7.7)
- Systems for Nuclear Auxiliary Power Facility (SNAP) (AOC)

The SE Drum Yard Site is located in the northeastern portion of the Group 5 Reporting Area, north of the ECL Site, south of the DOE LF1 Site, west of the Group 7 Reporting Area, and east of undeveloped Group 5 property (Figure K.1-1).

The SSFL RFI was conducted to (1) characterize the presence of SSFL-operation-related chemicals in environmental media, (2) estimate risks to human health and the environment (that is, the ecosystem), and (3) gather data for the next phase of RCRA Corrective Action to

support the recommendations included in this RFI Report regarding areas recommended for no further action (NFA), corrective measures study (CMS) areas, and interim stabilization.

The SSFL has been divided into two operable units (OUs): the Surficial Media Operable Unit (SMOU) and the Chatsworth Formation Operable Unit (CFOU). The SE Drum Yard Site characterization presented in this appendix includes data for the SMOU and summaries of the CFOU data. The SMOU includes soil, sediment, surface water, air, biota, and near-surface groundwater (NSGW) at the SSFL. NSGW is defined as groundwater occurring within alluvium or weathered bedrock of the Chatsworth Formation. The CFOU includes Chatsworth Formation bedrock and deeper groundwater that occurs within the unweathered bedrock of the Chatsworth Formation.

K.1.1 Report Organization

This SE Drum Yard Site Report provides detailed sampling data and evaluation pertaining to the SE Drum Yard Site, including a summary of the site history, a summary of the RFI sampling and analyses, risk assessment results, and site recommendations. This information is presented in sections organized as follows:

- **Section K.2 – Site History, Chemical Use, and Current Conditions.** Presents the site history and chemical use, and the current conditions including geology and groundwater conditions. Changes in site conditions and soil disturbance areas are also described.
- **Section K.3 – Nature and Extent of Chemical Impacts.** Presents a summary of SMOU and CFOU characterization information for the SE Drum Yard Site.
- **Section K.4 – Risk Assessment Findings Summary**. Presents the results of the human health risk assessment (HRA) and ecological risk assessment (ERA) for the SE Drum Yard Site; the complete risk assessment is included in Appendix A of the Group 5 RFI Report.
- **Section K.5 – SE Drum Yard Site Action Recommendations**. Presents a summary of the SE Drum Yard Site areas recommended for either (1) NFA or (2) further evaluation in the CMS. CMS Areas recommended for interim measures to prevent contaminant migration are also identified, if any.
- **Section K.6 – References.** Includes a list of cited references.

Site-specific additional information is provided in the following attachments.

- **Attachment K-1**: Site-specific regulatory agency documents and correspondence.
- **Attachment K-2**: Subsurface information (soil boring, trench, piezometer, and well logs).
- **Attachment K-3**: Data quality, validation, and laboratory reports.

There are no buildings at the SE Drum Yard Site; therefore, no building surveys were performed such as were conducted for other RFI Sites with buildings. Information regarding characterization for the SE Drum Yard Site is provided in the following figures and tables.

- Figure K.1-1: Presents the location of the SE Drum Yard Site within the SSFL and the Group 5 Reporting Area.
- Figure K.2-1: Presents a plan view of SE Drum Yard Site, showing known and potential Chemical Use Areas. Table K.2-1 presents a summary of the site features at the SE Drum Yard Site.
- Figure K.2-2: Presents a plan view of the SE Drum Yard Site, showing soil and soil vapor sampling locations, and locations of nearby monitoring wells.
- Figures K.2-3A and K.2-3B: Present a geologic cross-section across the SE Drum Yard Site.
- Figures K.3-1 through K.3-7: Summarize soil and soil vapor sampling performed at the SE Drum Yard Site. Soil and soil vapor sampling results are shown on these maps and are listed in Tables K.3-2A and K.3-2B.

Information regarding Group 5 area-wide conditions, transport and fate of chemicals between RFI sites, and other evaluations of area-wide issues are contained in the Group 5 RFI Report (Volume I) and appendices. Appendices pertinent to this Group 5 RFI Report are:

- **Appendix A:** Presents risk assessment information, including risk calculations, result tables, transport-and-fate modeling (except groundwater), and a description of methodology variances, if any, from the Standardized Risk Assessment Methodology (SRAM) Work Plan.
- **Appendix B:** Presents information regarding groundwater conditions in the Group 5 Reporting Area, including the SE Drum Yard Site. 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.

K.1.2 Historical Reference Documents

A searchable, historical document database for the Group 5 Reporting Area is being submitted to DTSC along with this Group 5 RFI Report (Boeing, 2008). Included are facility records, maps and drawings, correspondence, and reports relevant to the RFI for each of the Group 5 RFI sites. Documents pertaining to the entire SSFL are also included if they are relevant to Group 5. The Group 5 document database includes documents relevant to the SE Drum Yard Site. It is worth noting that information presented in this SE Drum Yard Site report is supplemented by background documents that contain information about site and facility background, SMOU Program background, and methodologies/procedures. Key historical SSFL documents are listed below with brief descriptions:

- RCRA Facility Assessment (RFA) (Science Applications International Corporation [SAIC], 1994). This report contains:
  - A brief description of the SSFL facility, including an operational history, physical setting information, and regulatory programs and oversight during the late 1980s and early 1990s.

  - Visual inspection records performed at facility operations.
  - Definition and description of SWMUs and AOCs identified during the assessment.

- Current Conditions Report (CCR) (ICF Kaiser Engineers [ICF], 1993). This report contains:
  - A general description of the SSFL facility, including an operational history, physical setting information, and regulatory programs and oversight during the late 1980s and early 1990s.
  - Description of SWMUs and AOCs, including presentation of results from environmental sampling performed to assess current conditions.
  - A draft work plan for further investigation during the RFI for selected SWMUs and AOCs.

- RFI Work Plan Addendum (WPA) (Ogden Environmental and Energy Services Company, Inc. [Ogden], 1996), RFI Work Plan Addendum Amendments (WPAA) (Ogden, 2000a and 2000b). These reports contain:
  - Sampling procedures and rationale.
  - RFI site descriptions and operational history.
  - Shallow groundwater characterization sampling and analysis plan for the SSFL.

- RFI Program Report (Montgomery Watson Harza [MWH], 2004). This report contains:
  - A general description of the SSFL facility, including an operational history, physical setting information, and regulatory programs and oversight.
  - A summary of the RCRA Corrective Action Program being conducted at the SSFL and a description of the OUs.
  - A comprehensive description of the SMOU field sampling program, including work plans followed, overall sampling scope performed, sampling methods and subcontractors used, and protocol followed.
  - Details of the analytical program for the SMOU RFI, including laboratories used, data validation findings, and Data Quality Assessment findings.
  - Programmatic key decision points or significant issues that influenced sampling, laboratory procedures, methodologies, or step-out requirements.

- Standardized Risk Assessment Methodology (SRAM) Work Plan, Revision 2 (MWH, 2005). This report contains:
  - Procedures for completing HRAs and ERAs.
  - Background soil concentrations and groundwater comparison concentrations.
  - A biological conditions report for the SSFL.

- Near-Surface Groundwater Characterization Report (MWH, 2003). This report contains:
  - Nature and extent of near-surface groundwater at the SSFL.

  - Distribution, transport, and fate of trichloroethene (TCE) and other chemicals of concern, and the relationship of NSGW to CFOU groundwater.

- CFOU Characterization Reports (Montgomery Watson, 2000; MWH, 2002 and 2003). These reports contain:
  - Geologic framework at the SSFL and hydrogeologic conditions of both NSGW and CFOU groundwater.
  - Transport and fate of TCE, and the occurrence and transport of other chemicals of concern in the CFOU.
- Annual and quarterly groundwater monitoring reports, including:
  - Second Quarter 2007 Groundwater Monitoring Report (Haley & Aldrich, Inc. [H&A], 2007a).
  - Third Quarter 2007 Groundwater Monitoring Report (H&A, 2007b).
  - Fourth Quarter 2007 Groundwater Monitoring Report (H&A, 2008a).
  - Annual Groundwater Monitoring Report (H&A, 2008b).
  - First Quarter 2008 Groundwater Monitoring Report (H&A, 2008c).
- Historical Site Assessment (Sapere, 2005). This report contains:
  - Facility descriptions and historical operational information for buildings used for radiological research and development in Area IV.
  - Information regarding radiological demolition activities, surveys, releases, and removal actions conducted for radiological areas within Area IV.
- Debris Area Survey and Sampling Methodology (CH2M HILL, in progress). This standard operating procedure (SOP) provides general guidelines for performing the following activities:
  - Visual inspections of the SSFL for surficial evidence of solid waste disposal (referred to herein as debris areas).
  - Sampling for chemical analytes at debris areas.
- Quality Assurance Project Plan (QAPP) (MECx, 2008). This QAPP provides general guidelines, which include:
  - Quality assurance/quality control (QA/QC) procedures to ensure that field and laboratory data quality and project work meet the data quality objectives (DQO).
  - Ensuring that the project work performed is in accordance with professional standards and regulatory guidelines.
- Building Feature Evaluation and Sampling (MWH, 2008). This SOP presents the procedures for evaluating environmental conditions associated with existing buildings, concrete pads, and supporting infrastructure under the following scenarios:
  - Environmental assessment prior to building demolition.
  - Environmental assessment during/after building demolition.
  - Environmental assessment for buildings not planned for demolition.

K.2 Site History, Chemical Use, and Current Conditions

The SE Drum Yard Site is approximately 2.2 acres and is located at the eastern boundary of Area IV at the SSFL. The site location within the SSFL is shown in Figure K.1-1, which also shows the Group 5 Reporting Area boundary. The site layout and the locations of Chemical Use Areas are shown in Figure K.2-1. The sampling locations across the site are shown in Figure K.2-2.

During the RFA, various SWMUs and AOCs within the SSFL were identified. The SE Drum Yard Site was identified as an AOC in the RFA (SAIC, 1994). No other SWMUs or AOCs were identified in the RFA within the boundary of the SE Drum Yard Site as it is defined in this report (Figure K.1-1).

Based on site inspections, reviews of historical aerial photographs, drawings and facility maps, and on interviews of site personnel conducted during the RFI, the SE Drum Yard Site boundary was defined to include operations associated with the SE Drum Yard Site. The identified Chemical Use Area at the SE Drum Yard Site is shown in Figure K.2-1 and described in Table K.2-1.

The following sections describe the site history and operations, chemical uses, and current conditions at the SE Drum Yard Site.

K.2.1 SE Drum Yard Site History

A summary of the site chronology, including descriptions of site operations and investigation activities for the SE Drum Yard Site, is presented below. Facility correspondence, investigation reports, waste disposal records, facility maps, drawings, photographs, and personnel interview records were reviewed and evaluated to compile the site history information presented below. Primary sources of information are summarized Section K.1.2.

K.2.1.1 Site Chronology

A summary of key historic investigation and remediation activities is presented in Table K.2-2. A more detailed description of the SE Drum Yard Site is presented below.

K.2.1.1.1 Late 1950s/Early 1960s through 1968

The SE Drum Yard Site was used to store approximately 50 to 100 drums with unknown contents in the early 1960s. The drums were used in forklift exercises. All of the drums have been removed from this area. An area of disturbed ground existed in 1965 in the southeastern portion of the site, as shown in Figure K.2-1.

K.2.1.1.2 1988

A soil sampling investigation was conducted at the SE Drum Yard Site to assess chemicals of potential concern (COPCs).

K.2.1.1.3 1999

A soil vapor sampling investigation was conducted at the SE Drum Yard Site to assess COPCs in soil vapor.

K.2.2 SE Drum Yard Site Chemical Use Areas

Chemical Use Areas are locations where chemicals were documented to have been (or potentially may have been) used, stored, spilled, discharged and/or disposed of. Based on the review of historical documents, one Chemical Use Area was identified within the SE Drum Yard Site boundary. Chemicals that were potentially used or stored in this Chemical Use Area are unknown. Some debris (a paint can) was identified during the Group 5 debris survey, and an area with disturbed soil was identified on the 1965 aerial photo. The Chemical Use Area at the SE Drum Yard Site is shown in Figure K.2-1 and listed in Table K.2-3.

K.2.3 Site Conditions

This section provides summaries of site conditions near the SE Drum Yard Site, including topography, geology, soil, groundwater, surface water, and biology.

K.2.3.1 General Conditions and Topography

The SE Drum Yard Site is located within the northeast portion of Area IV. The site is currently inactive, with no structures. Topography in the central portion of the site slopes to the south. Current surface elevations at the SE Drum Yard Site range from a low of approximately 1794 feet above mean sea level (msl) in the southwestern portion of the site to a high of approximately 1820 feet msl in the northern portions of the site. A summary site conceptual model is presented in Table K.2-4. Figure K.2-3B presents a cross-section developed for the SE Drum Yard Site (Surficial Cross Section T-T'), detailing surface topography, locations and depths of alluvium, and weathered and unweathered Chatsworth Formation, and the most recent available groundwater elevations. The location of the cross-section is shown in Figure K.2-3A.

K.2.3.2 Geology

The SE Drum Yard Site is located north of the Coca Fault, in proximity to the Lower Burro Flats Members of the Upper Chatsworth Formation (Dibblee, 1992; MWH, 2002 and 2007C).

Beds of the Lower Burro Flats Member generally strike N70°E and dip 25°NW. The Lower Burro Flats Member is predominantly composed of medium- to fine-grained sandstone with significant interbeds of siltstone and shale. Figure 2-5 of the Group 5 RFI Report (Volume I) shows the geologic units represented within the RFI site. The location of the Coca Fault is shown in Plate B-1 in Appendix B of the Group 5 RFI Report. Additional geologic information is presented in Appendix B of the Group 5 RFI Report.

K.2.3.3 Soil

Throughout most of the SE Drum Yard Site, soil is generally thin, typically ranging in thickness from less than 4 feet to greater than 10 feet. A map depicting the distribution of alluvial soil within the Group 5 Reporting Area is provided in Figure 2-4 of the Group 5 RFI Report (Volume I). Soil in the undisturbed areas of the site consists of weathered

Chatsworth Formation materials, which are primarily fine-grained silty sands, clayey sand, and silt. Soil boring logs are included as Attachment K-2 to this appendix.

K.2.3.4 Groundwater

The groundwater system and monitoring network in RFI Group 5 is discussed in detail in Appendix B of the Group 5 RFI Report. In that appendix, Figure B-4 shows wells and piezometers that are used to monitor groundwater at and near the SE Drum Yard Site. Figure K.2-2 shows well and piezometer locations in and around the SE Drum Yard Site.

One piezometer (PZ-112) approximately 200 feet to the northwest of the site and one shallow well (RS-24) at the SE Drum Yard Site were installed to monitor groundwater conditions in alluvium and weathered bedrock (that is, in NSGW), while one well (RD-16) was installed to monitor groundwater conditions in the unweathered bedrock (that is, in CFOU groundwater). Construction details for these wells and piezometers are provided in Tables B-2 and B-3 of Appendix B, and the locations of the wells and piezometers are shown in Figure K.2-2.

NSGW has not been observed in locally in alluvium or weathered bedrock in monitoring well RS-24; therefore, groundwater elevations have not been reported in quarterly monitoring reports for the most recent four quarterly monitoring events as of March 2008. Figure B-7 in Appendix B of the Group 5 RFI Report shows that regionally NSGW is encountered at elevations ranging from 1790 ft msl to 1810 ft msl in the vicinity of the SE Drum Yard Site. NSGW at the SE Drum Yard Site flows to the south-southeast at a hydraulic gradient of approximately 0.07 ft/ft. A general cross-sectional diagram of NSGW and CFOU Groundwater occurrence is shown in Figure B-6 in Appendix B of the Group 5 RFI Report.

CFOU Groundwater at the SE Drum Yard Site is encountered at depths ranging from 47 feet below ground surface (bgs) (1767 feet msl) to 50 feet bgs (1759 feet msl) in well RD-16. CFOU Groundwater at the SE Drum Yard Site flows to the southeast at a hydraulic gradient of approximately 0.05 ft/ft.

These physical features and their influence on groundwater occurrence are discussed further in Appendix B of the Group 5 RFI Report.

K.2.3.5 Surface Water

Surface water flow at the SE Drum Yard Site is shown in Figure 2-7b of the Group 5 RFI Report (Volume I). Surface water may exist intermittently at the SE Drum Yard Site as the result of seasonal precipitation events. While there are no perennial surface water bodies at the site, rain water flows generally south from the site.

Surface water runoff at the site is regularly monitored as part of the National Pollutant Discharge Elimination System (NPDES) monitoring program under the oversight of the Los Angeles Regional Water Quality Control Board (RWQCB). One downgradient monitoring location, Outfall 018, is located at the discharge point of the R-2 Ponds (Figure 2-7 of the Group 5 RFI Report [Volume I]). This discharge point is the ultimate discharge point for a large portion of the western half of SSFL.

K.2.3.6 Biology

In April 2008, a reconnaissance-level biological survey was conducted at the Group 5 RFI Sites. Biological conditions at the SE Drum Yard Site, including habitat/vegetation types, are shown on Figure 2-10 of the Group 5 RFI Report (Volume I). The results of the biological survey and a qualitative plant evaluation are presented in Appendix A, Attachment A18.

K.3 Nature and Extent of Chemical Impacts

This section describes the data used to define the nature and extent of chemical impacts to environmental media at the SE Drum Yard Site. The presentation of data includes sampling objectives, scope, key decision points related to characterization activities, and findings.

Transport and fate evaluations are discussed in the following sections of the report:

- Group 5 RFI Report (Volume I), Section 5, Contaminant Transport and Fate – Potential migration via surface water flow.
- Group 5 RFI Report (Volume II), Appendix A, Risk Assessment - Potential volatile organic compound (VOC) migration from groundwater and subsurface soil to soil vapor, and from soil vapor to indoor and ambient air.
- Group 5 RFI Report (Volume III), Appendix B, Groundwater Characterization – Potential migration from soil to groundwater, and migration in groundwater.

K.3.1 Sampling Objectives

Several soil, soil vapor, and groundwater samples were collected as part of the previous RFA and preliminary RFI sample collection events (GRC, 1989; Ogden, 1996). Based on the historical document review summarized in Section K.1.2, additional soil and soil vapor samples were collected to further characterize the site based on the RFI data quality objectives. The process of selecting sampling locations, depths, and analytical methods considered objectives established in the Group 5 DQOs as summarized in the Group 5 RFI Report, Section 4.0 (Volume I).

To achieve these objectives, recent soil and soil vapor sampling was conducted as described in Tables K.3-1A and K.3-1B, with consideration of the following:

- Additional information regarding site use and observed site conditions
- Site sampling results and data trends
- Knowledge of chemical properties (such as mobility, volatility, and association with other chemicals)
- SSFL SRAM-based screening concentrations for human health and ecological receptors
- Risk assessment results and knowledge of areas recommended to require further evaluation during the CMS

Groundwater has been sampled to meet site-wide routine monitoring requirements and additional characterization objectives according to regulatory agency-approved work plans (see Section K.3.2). Based on detected RFI site chemicals, chemical distribution, and site conditions, additional groundwater sampling and analysis was also conducted to complete characterization of individual RFI sites and provide data sufficient for risk assessment. Groundwater sampling was conducted as described in the Sampling Analysis Plans (GRC, 1995a and 1995b) and the Shallow Zone Groundwater Investigation Work Plan (Ogden, 2000b).

K.3.2 Sampling Scope

A total of 15 soil matrix samples and 4 soil vapor samples was collected to assess potential impacts associated with the Chemical Use Area at the SE Drum Yard Site. Out of those samples, nine soil matrix and four soil vapor samples were collected between March 2008 and April 2008. Sampling locations and analytical suites were based on sampling results from previous investigations, additional facility information obtained from historical records, site inspections and/or personnel interviews, and historical and/or aerial photographs. Sampling schedules are presented in Tables K.3-1A and K.3-1B. Sample locations are shown in Figure K.2-2.

Both CFOU Groundwater and NSGW have been sampled and analyzed according to agency-approved work plans (GRC, 1995a and 1995b; Ogden, 2000b). At the SE Drum Yard Site, one piezometer (PZ-112), which is 200 feet northwest of the site, was used to characterize NSGW, and one CFOU Groundwater well (RD-16) was used to characterize CFOU groundwater specifically at the SE Drum Yard Site. Groundwater characterization data for the SE Drum Yard Site are presented with the entire Group 5 groundwater data set in Appendix B.

In 2008, soil samples collected were submitted to two California-certified environmental laboratories: GEL Engineering Laboratories in Atlanta, Georgia, and Test America Inc. in Arvada, Colorado. As an ongoing, additional QA measure, the field sampling effort included collection of blind duplicates and split samples at a frequency of approximately 5 percent of primary samples. Blind duplicates were submitted along with the primary samples to the two prime environmental laboratories. Split samples were submitted for analyses to Lancaster Laboratories in Lancaster, Pennsylvania, a California-certified environmental laboratory previously designated for analyzing split samples only. The highest usable concentrations reported for the data from the primary, duplicate, and split samples were used to evaluate contamination at the site.

Based on a QA review conducted on soil and soil vapor sampling results, data have been deemed usable and in compliance with RFI program requirements as defined by QAPPs in Appendix V of the RFI Report. The RFI QA program included individual sample data validation, assessment of each laboratory's performance, and a qualitative review of the precision, accuracy, representativeness, reliability, and completeness parameters for the data sets collected for this RFI. A summary of the data quality evaluation is presented in Attachment K-3 of this report. The data quality evaluation for the historical samples (collected in 1996 prior to the beginning of the RFI) is described in the RFI Program Report (MWH, 2004). Site-specific data quality summaries for the SE Drum Yard Site are described by media in the sections below.

This report presents results of media sampling, if the media exists at the RFI site, conducted during the RFI and previous investigations at the SE Drum Yard Site, including results for the following media:

- Soil vapor
- Soil matrix
- Groundwater
- Surface water

K.3.3 Key Decision Points

Site assessment was been performed to address revised, DTSC-approved requirements for risk assessment and evaluate new potential Chemical Use Areas. Sampling of new Chemical Use Areas and step-out sampling procedures followed the DTSC-approved work plan protocol for the RFI (MWH, 2005).

Site-specific characterization decision points are described in Table K.3-2A. These decision points represent either assumptions upon which sampling was based, or decisions made during step-out sampling or data evaluation. Programmatic decision points (those common to all RFI sites) are described and included in the RFI Program Report (MWH, 2004).

K.3.4 Soil Matrix and Soil Vapor Findings

Soil and soil vapor sampling results and characterization findings are summarized in Table K.3-2A. The goals of the table are to:

1. Present summaries of sampling results, including nature and extent of impacts.
2. Evaluate the soil and soil vapor characterization and assess whether further sampling is warranted.
3. Indicate that soil and soil vapor volumes for areas recommended for CMS can be estimated within a factor of 10 for comparison of remedial alternatives.

Goals 2 and 3 are achieved through an iterative evaluation process that takes into account the risk assessment results and CMS recommendations, as well as the soil and soil vapor analytical data. For example, if detected concentrations are sufficiently high to indicate that further evaluation in the CMS will be necessary, the data are considered to be adequate for the purpose of risk assessment. Similarly, the risk assessment results can be used along with the soil and soil vapor analytical results to delineate CMS areas and estimate soil and soil vapor volumes within an order of magnitude (Goal 3). Other criteria used to evaluate characterization completeness include the sampling results compared to screening levels, the presence and magnitude of concentration gradients, the types of historical site operations and chemical uses, and analytical detection limits.

The screening and statistical summary of site characterization data for the SE Drum Storage Yard Site is provided in Tables K.3-3A and K.3-3B.

K.3.4.1 Soil and Soil Vapor Data Presentation

The soil data results organized by chemical group are summarized in Figures K.3-1 through K.3-8. Relevant site information, sampling rationale, analytical results, and evaluation of results are presented in Table K.3-2A. This table discusses the sampling approach for each chemical use area and a brief summary of the sampling results by chemical group, including:

- Column 1 –Chemical Use Area number.
- Column 2 – Chemical Use Area name.
- Column 3 – Chemical group sampled in a particular chemical use area.

- Column 4 – Sampling scope and rationale for each chemical group in a particular chemical use area.
- Column 5 – Abbreviated summary of sampling results for soil and soil vapor each chemical group in a particular chemical use area. (A more detailed site-wide summary is presented in Section K.3.4.2 below.) As appropriate, sample results are compared to established SSFL background concentrations (metals and dioxins only) and/or SSFL risk-based screening levels (RBSLs).[1] The screening levels are also displayed in Tables K.3-3A and K.3-3B.
- Column 6 – Assessment of whether characterization is sufficient such that the risk assessment reflects the approximate maximum analyte concentration or a concentration sufficiently high to result in risk requiring a recommendation for evaluation during CMS.
- Column 7 – Assessment of whether the nature and extent of chemicals is defined sufficiently to estimate soil volumes (within a factor of 10) for areas that require further consideration in the CMS (if needed).

K.3.4.2 Soil and Soil Vapor Data Summary

As detailed in Table K.3-2A, one chemical use area was investigated at the SE Drum Yard Site. A summary of the chemicals detected above screening criteria is provided below by chemical analytical group. Concentrations denoted with a "J" flag indicate the results are estimated below the method reporting limits.

K.3.4.2.1 Volatile Organic Compounds

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.

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.

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

Further characterization of VOCs is not recommended at the SE Drum Yard Site.

K.3.4.2.2 Semivolatile Organic Compounds

A total of 14 soil samples was collected at seven locations and analyzed for semivolatile organic compounds (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.

[1] The use of the SRAM-based screening levels for comparison purposes does not serve as a risk assessment. These screening levels are not used to determine the significance of detected chemical concentrations or if a Chemical Use Area will be recommended for further consideration in the CMS, but only to provide the reader another tool to evaluate the characterization data. The SRAM-based screening levels represent conservative concentrations that pose a low level of risk. See Appendix A of the Group 5 RFI Report.

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

Further characterization of SVOCs is not recommended at the SE Drum Yard Site.

K.3.4.2.3 Total Petroleum Hydrocarbons

A total of 14 soil samples was collected at seven locations and analyzed for total petroleum hydrocarbons (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.

- Kerosene-range hydrocarbon (C12-C14) and lubricating-oil-range hydrocarbons (C21-C30) were detected at concentrations that did not exceed the Residential RBSL of 1,400 mg/kg.

Further characterization of TPH is not recommended at the SE Drum Yard Site.

K.3.4.2.4 Polychlorinated Biphenyl

Polychlorinated biphenyls (PCBs) were not identified as having been previously used at the SE Drum Yard Site during the review of historical documents. Consequently, PCBs were not included for analysis at any sampling locations.

K.3.4.2.5 Metals/Inorganic Compounds

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.

- Aluminum and barium concentrations were detected above their respective background concentrations and Ecological RBSLs and/or Residential RBSLs.
  - Aluminum (background concentration of 20,000 milligrams per kilogram [mg/kg], Ecological RBSL of 12 mg/kg) was detected in three samples collected from SEBS1000 at 5 to 6 feet bgs (20,050 mg/kg), SEBS1001 at 0 to 1 foot bgs (22,000 mg/kg), and SEBS1002 at 0 to 1 foot bgs (22,000 mg/kg). The elevated concentrations of aluminum may be consistent with naturally occurring concentrations in the soil derived from the Santa Susana Formation.
  - Barium (background concentration of 140 mg/kg, Ecological RBSL of 15 mg/kg) was detected above its background concentration and Ecological RBSL in a sample collected from SEBS1001 at 0 to 1 foot bgs (150 mg/kg). The elevated concentrations of barium may be consistent with naturally occurring concentrations in the soil derived from the Santa Susana Formation.
- Metals detected above background concentrations (but below their respective RBSLs) include beryllium and sodium. Background concentrations for metals are included in Table K.3-3A. Sodium was detected at concentrations ranging from 198 mg/kg to 660 mg/kg. RBSLs for sodium have not been established.

- Perchlorate was not identified as having been previously used at the SE Drum Yard Site during the historical document review. Consequently, perchlorate was not included for analysis at any sampling locations.

K.3.4.2.6 Dioxins

Dioxins were not identified as having been previously used at the SE Drum Yard Site during the historical document review. Consequently, dioxins were not included for analysis at any sampling locations.

K.3.4.2.7 Energetics

A total of six soil samples was collected at three locations and analyzed for energetics. None of the samples had detectable levels of energetics and results are shown in Figure K.3-5. Further characterization of energetics in soil is not recommended at the SE Drum Yard Site.

K.3.5 Groundwater Findings

Groundwater occurrence and impacts at the SE Drum Yard Site are described below.

K.3.5.1 Groundwater Data Presentation

Groundwater sampling results and characterization findings are summarized in Table K.3-2B of this appendix and in Appendix B of the Group 5 RFI Report. The purpose of Table K.3-2B is to:

- Summarize soil impacts as they potentially relate to groundwater impacts
- Summarize groundwater sampling results
- Demonstrate that groundwater characterization is sufficient for the purposes of risk assessment, including:
  - That groundwater characterization is adequate for detected site-related chemical constituents
  - That site soil characterization is adequate for detected groundwater chemical constituents

Similar to Table K.3-2A, Table K.3-2B provides an evaluation of groundwater data by chemical group (such as metals, VOCs, and SVOCs). Table K.3-2B is organized as follows:

- Column 1 – Analytical group
- Column 2 – Summary of site soil impacts
- Column 3 – Confirmation that chemicals detected in site soil are monitored in groundwater and identification of wells and groundwater zones monitored
- Column 4 – Summary of chemicals detected in groundwater
- Column 5 – Discussion of whether chemicals are site related
- Column 6 – Assessment of whether groundwater characterization is adequate to support risk assessment

A detailed compilation of groundwater data is provided in Appendix B of Group 5 RFI Report (Volume III). Appendix B contains a description of hydrogeologic conditions (such as groundwater occurrence, water levels, recharge, and yield), groundwater quality, and transport and fate. These data include the following:

- Laboratory analytical results
- Hydrographs
- Time-series plots
- Cumulative distribution plots

A separate site-wide report on SSFL groundwater will be prepared in the future as part of the RFI Program. This report will comprehensively address across the site the same characterization and transport-and-fate issues addressed in Appendix B of the Group 5 RFI Report.

K.3.5.2 Groundwater Data Summary

Groundwater conditions at the SE Drum Yard Site are characterized by one NSGW piezometer located upgradient of the site (PZ-112) and one CFOU Groundwater well located on site (RD-16). Groundwater findings for this well are presented in Table K.3-2B and Appendix B of the Group 5 RFI Report.

K.3.5.2.1 NSGW Data Summary

The NSGW piezometer north (and upgradient) of the site (PZ-112) was sampled on one occasion (in April 2002). The sample was analyzed for VOCs.

- Acetone and methylene chloride were detected at concentrations that did not exceed screening levels. No other VOCs were detected.

K.3.5.2.2 CFOU Groundwater Data Summary

The CFOU Groundwater monitoring well at the site (RD-16) has been regularly sampled since September 1989, and the groundwater samples have been analyzed for VOCs, SVOCs, metals, inorganics, and energetics.

- TCE, 1,3-dichlorobenzene, 1,4-dichlorobenzene, ethylbenzene, toluene, cis-1,2-dichloroethene, chloromethane, and acetone were detected in samples collected; however, detectable concentrations of these VOCs did not exceed their respective screening levels.
- Bis(2-ethylhexyl) phthalate was detected in groundwater samples from well RD-16 at a concentration of 20 µg/L, which exceeded it's groundwater screening level of 4 µg/L.
- Concentrations for the dissolved metals detected (potassium, magnesium, calcium, sodium, silica, strontium, manganese, and zinc) in groundwater samples from well RD-16 were all below screening levels.
- Concentrations for inorganic compounds detected (fluoride, bicarbonate, chloride, sulfate, and nitrate) in groundwater samples from well RD-16 were all below their respective screening levels.

- Energetics were not detected in any of the groundwater samples collected from well RD-16.

Past operations at the SE Drum Yard Site are not expected to be the source of the low levels of VOCs, SVOCs, metals, and inorganic compounds detected in CFOU groundwater at RD-16. CFOU Groundwater will be discussed further in Appendix B and in the CFOU RFI Report.

K.3.6 Surface Water Findings

Near-surface soil within the SE Drum Yard Site contains concentrations of select metals (naturally occurring). It is possible that these metals could have been mobilized during storm events and subsequently deposited at downstream sites, including the ECL Site.

K.4 Risk Assessment Findings Summary

The objective of this risk assessment (RA) is to determine whether the SE Drum Yard Site could pose unacceptable risks that may require remedial action, or if it is eligible for an NFA designation.

The following sections summarize the findings of the HRA and ERA performed for the SE Drum Yard Site. Details regarding how the HRA and ERA were conducted are presented in the SRAM (MWH, 2005) and in Appendix A of the Group 5 RFI Report. Details regarding the site-specific HRA and ERA are presented in Appendix A, Attachment A8, of the Group 5 RFI Report.

K.4.1 Key Decision Points

Site-specific key decision points for the HRA and ERA are listed below and are described more fully in Appendix A and Attachment A8 of the Group 5 RFI Report. These decisions were made for the risk assessments based on site-specific conditions, chemical characteristics, and assessment findings. Programmatic decision points are described and included in the RFI Program Report (MWH, 2004). Site-specific key decision points include the following:

1. Both direct (drinking water) and indirect (soil vapor) exposures to groundwater COPCs were evaluated in the risk assessment (Appendix A of the Group 5 RFI Report).
2. Exposure point concentration (EPC) calculations were based on collected characterization data, as follows:
    - All CFOU Groundwater EPCs were based on maximum levels detected in a single highest-concentration well within Group 5, HAR-18, for both indirect and direct exposure. All NSGW EPCs were based on the maximum levels detected in all NSGW wells within the SE Drum Site for both indirect and direct exposure.
    - A review of time-series plots for chemical constituents, groundwater gradients, and source areas indicates maximum concentrations detected during the last consecutive 3 years conservatively represent potential future conditions for the purpose of estimating future risks.
    - Soil EPCs were calculated using ProUCL 4.0 following methods specified in the SRAM (MWH, 2005). Two EPCs were used—the central tendency exposure (CTE) and the reasonable maximum exposure (RME). The CTE was the arithmetic mean of the data and the RME was the 95 percent upper confidence limit (95UCL) as calculated by ProUCL 4.0. In cases where the 95UCL exceeded the maximum detected concentration, the RME defaulted to the maximum detected concentration. In some cases, the CTE exceeded either the RME or the maximum detected concentration due to differences in assumptions regarding distribution (the arithmetic mean assumes a normal distribution, whereas the method for calculating the 95UCL is based on data distribution) and handling of nondetected values in ProUCL 4.0. In these cases, the value selected as the RME EPC was also used for the CTE EPC.

3. Large home-range receptors were assumed to live only in source areas within the SE Drum Yard Site. Risks for these receptors using home-range adjusted exposures were calculated for the purpose of evaluating RFI-site-related risks. Large home-range receptor cumulative risk across the SSFL will be presented later in a site-wide summary report of the large home-range receptor risk assessment.

K.4.2 Summary of Human Health Risk Assessment Findings

Potential risks were estimated for future urban residents (child and adult) and future recreational users (child and adult) of the SE Drum Yard Site. A conceptual site model diagram for human health risk assessment is presented in Figure K.4-1 and a summary of COPCs and risk estimates for human health are presented in Tables K.4-1 and K.4-2 respectively. Results of the risk characterization indicated the following:

- Soil – No chemicals of concern (COCs) were identified for direct contact with soil or for plant consumption by future residents, or for direct contact with soil by future recreators.
- Soil Vapor – No COCs were identified for inhalation of ambient or indoor air by future residents or recreators.
- NSGW – No COCs were identified for domestic use of shallow groundwater by future residents.
- CFOU Groundwater – COCs will be identified and addressed as part of the CFOU.

The uncertainties associated with the Group 5 RFI Sites in general were discussed in Appendix A of the Group 5 RFI Report. Uncertainties specific to the SE Drum Yard Site are summarized in Table K.4-3.

K.4.3 Summary of Ecological Risk Assessment Findings

Potential risks were estimated for terrestrial invertebrates, birds, and mammals. A conceptual site model diagram for ecological risk assessment is presented in Figure K.4-2. Results of the risk characterization indicated the following:

- Soil – No chemicals of ecological concern (COECs). Aluminum, barium, chromium, and vanadium exceeded toxicity reference values (TRVs) for selected representative species, but weight-of-evidence evaluation indicated that these analytes were unlikely to cause potential risk to representative species using the SE Drum Yard site. Aluminum was not considered a potential risk due to pH levels in the range at which aluminum is not toxic to plants or animals. Barium, cadmium, and vanadium were present at concentrations similar to background.
- Soil Vapor – No COECs. No analytes exceeded TRVs.

A summary of COECs and ecological risk estimates is presented in Table K.4-4. The general uncertainties associated with the Group 5 RFI Sites are discussed in Appendix A of the Group 5 RFI Report. The uncertainties associated specifically with the SE Drum Yard Site are presented in Table K.4-5.

K.4.4 Conclusions for SE Drum Yard Site Risk Assessment

This section presents the overall conclusions for the SE Drum Yard Site according to this RA. The risk assessment provides a quantitative and qualitative appraisal of the actual or potential effects of contaminants on human health or terrestrial wildlife.

The potential sources of contamination at the SE Drum Yard Site consist of drums previously stored at the site and a 1-gallon can with unknown original contents.

Potential risks associated with direct contamination of soil and soil vapor were assessed in this RA. Soil and soil vapor samples were collected and analyzed for VOCs, SVOCs, TPH, metals/inorganics, dioxins, and energetics. Data were considered adequate to evaluate potential risks. No COCs were identified in soil and soil vapor for human health. No COECs were identified in soil and soil vapor for ecological receptors.

No COCs were identified in NSGW. CFOU Groundwater will be addressed as part of the CFOU RFI Report.

No further action is warranted with respect to human health or ecological risks.

K.5 SE Drum Yard Site Action Recommendations

This section presents a summary of RFI reporting requirements as applicable to the SE Drum Yard Site. Section K.5.1 describes the RFI reporting requirements, particularly with respect to the identification of areas recommended for additional work, or "site action" recommendations. The process and criteria used for making site action recommendations are described in Section K.5.2. Site action recommendations for the SE Drum Yard Site are summarized in Sections K.5.3, K.5.4, and K.5.5.

K.5.1 RFI Reporting Requirements

As described in regulatory guidance documents for the SSFL RCRA Corrective Action Program (see Section 1.2.3 in Volume I of the Group 5 RFI Report), 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 present findings regarding the above information, describe completeness of the investigation, and indicate if additional work is needed.

The SE Drum Yard Site Report accomplishes these requirements by:

1. Presenting detailed characterization findings, source area identification, and investigation completeness determinations by media and by chemical class for all Chemical Use Areas (and associated down-drainage locations) (Tables K.3-2A and K.3-2B). Section K.3 summarizes the overall characterization of contamination nature and extent, potential source areas, and an assessment of investigation completeness.
2. Evaluating groundwater migration pathways in Appendix B of the Group 5 RFI Site Report and other potential transport pathways in Appendix A of the Group 5 RFI Site Report.
3. Identifying potential receptors and estimating potential risks at the SE Drum Yard Site (Section K.4 and Appendix A of the Group 5 RFI Report).
4. Identifying SE Drum Yard Site areas requiring further work (this section).

K.5.2 Basis for Site Action Recommendations

In summary, site action recommendations included in the SE Drum Yard Site Report identify areas for the following:

- Further evaluation in the CMS (CMS Areas)
- No further action (NFA Areas)
- Interim corrective measures to stabilize source areas and control contaminant migration (Stabilization Areas)

Site action recommendations are based on the 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, estimate human health and ecological risks based on specified land use scenarios, and identify chemicals that drive or contribute to those risks.

The site action recommendations listed above result from two evaluations 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. Each process is described in more detail below.

K.5.2.1 CMS and NFA Site Action Evaluation Process

CMS or NFA site action recommendations are based on a four-step process. This process, which is presented in detail in Section 7.1 of the Group 5 RFI Report, is summarized as follows:

- **Site Action Evaluation Step 1.** Risk assessment results for human and ecological receptors are compared to "acceptable" levels published by the United States Environmental Protection Agency (USEPA) or DTSC as guidance for site managers (DTSC, 1992; USEPA, 1992). The low end of the risk range (that is, 1×10^{-6}, or 1 in 1,000,000, or HI = 1.0) is used to conservatively estimate the areal extent that is recommended for site action.
- **Site Action Evaluation Step 2.** When estimated RFI site risks are greater than 1×10^{-6} (cancer risks) or HI values are greater than 1 (noncancer and ecological risks), the RFI site risks are reviewed on a chemical-by-chemical basis to identify risk drivers and significant risk contributors to the cumulative, total risk for each potential receptor.
- **Site Action Evaluation Step 3.** Characterization findings from the entire RFI site are evaluated to 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 appropriate potential receptors or land use scenarios.
- **Site Action Evaluation Step 4.** The fourth step identifies any uncertainties in the RFI site characterization and risk assessments that could affect the findings. 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. Since this assumption is often highly conservative, its use as a basis for CMS recommendations could be further evaluated in the CMS.

Site action recommendations are tabulated by Chemical Use Area, and chemical risk drivers/contributors are identified for each appropriate receptor in Table F.K-1. CMS Areas are depicted graphically in Figure K-1 to illustrate locations and approximate areal extents, and are summarized in Table K-2.

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 (for example, mule deer and hawk). The second is a groundwater evaluation that will be reported in the Site-wide Groundwater Report. Updates to this report will be prepared as needed.

K.5.2.2 Source Area Stabilization Site Action Evaluation Process

Chemical data collected during the RFI are evaluated to determine the potential for contaminant migration. Resulting site action recommendations focus on stabilization measures related to sediment transport via the surface water pathway.

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

- Presence of chemical concentrations above background or RBSLs in surficial (not deeper) soil
- Proximity of surficial impacts to an active surface water drainage pathway
- Moderate to steep topography
- Absence of containment features (such as surface coatings and dams)
- Concentration gradients that indicate prior transport away from the source of surficial impacts

Each criterion is considered important, and a weight-of-evidence evaluation is used to make a recommendation for source area stabilization measures. Source area stabilization measures, which include the use of best management practices (BMPs), are used to prevent migration to surface water. BMPs might include the installation of straw bales, fiber rolls, and silt fencing, and/or covering of areas with plastic tarps. Erosion control measures have been applied to many surficial soil source areas at the SSFL to prevent contaminant migration. These are described in the SSFL Storm Water Pollution and Prevention Plan (MWH, 2006a).

K.5.3 CMS Site Action Recommendations

Based on the findings presented in this RFI report, the SE Drum Yard Site is recommended for no further action. Corrective measures studies are not recommended for this site.

K.5.4 NFA Site Action Recommendations

Based on a detailed review of all available historical documents, an evaluation of sample data collected at the site during previous investigations and the current RFI, and the results of human health and ecological risk assessments performed for the site, the entire SE Drum Yard Site is appropriate for an NFA designation. The sections below summarize the historical uses, the sampling data collected, and the results of the HRA and ERA for the site.

K.5.4.1 Historical Uses

CH2M HILL performed a detailed review of all available historical documents, conducted site inspections, interviewed current and previous SSFL employees, and prepared comprehensive maps and tabulations of all information related to chemicals used, stored or released at the SE Drum Yard Site. There are no records available to indicate that chemicals were used, stored or released at locations outside the Chemical Use Area identified during the review of historical records. The Chemical Use Area was subject to site investigation,

and sample collection and analysis. Consequently, all suspect areas of the SE Drum Yard Site were investigated, and the findings are presented and considered herein.

The area recommended for NFA includes the entire SE Drum Yard Site, including the following Chemical Use Area:

- Chemical Use Area 1 – SE Drum Storage Yard (forklift exercises)

Available historical documentation indicates that operations at the Chemical Use Area identified above might have involved the use of chemicals. However, the sampling data collected at and around this Chemical Use Area demonstrate that historical activities have not resulted in significant impacts to the site. These sampling data are summarized in the following section.

K.5.4.2 Sampling and Analysis Results

As presented in Section K.3, the former drum storage area, area with disturbed ground, and the debris area were investigated during this RFI. Soil and soil vapor samples were collected and analyzed for VOCs. Soil samples were collected and analyzed for SVOCs, petroleum hydrocarbons, metals, inorganics, and energetics. Of these, two metals (aluminum and barium) were detected at concentrations that exceed both background concentrations and their respective Ecological RBSLs. As shown in Figure K.3-7, the aluminum and barium exceedances are within 10 percent of their respective background concentrations, and, as such, are not indicative of a contamination release. These metals have not been detected in groundwater samples collected from the nearest CFOU Groundwater monitoring well, indicating that groundwater has not been impacted by past activities at the SE Drum Yard Site.

None of the other compounds analyzed in soil or soil vapor samples collected from the SE Drum Yard Site were detected above their respective screening levels. Therefore, although there is documentation of chemicals being used and/or stored at the SE Drum Yard Site, there are no indications of significant impacts from previous site activities.

K.5.4.3 Risk Assessment

Finally, as presented in Section K.4, the maximum cumulative risk for the site is 2×10^{-7} for a hypothetical future recreational exposure and 6×10^{-7} for a hypothetical future residential exposure. These cumulative human health risks are less than the low end of the risk management range for cancer risks (1×10^{-6}). Human health hazard indices (for noncancer and ecological risks) are below 1, indicating that the site does not pose a significant threat to future human receptors.

Although the ERA identified hazard quotients greater than 1 for aluminum, barium, chromium, and vanadium in soil, the weight-of-evidence evaluation performed during the ERA indicated that these analytes were unlikely to cause potential risk to representative species at the SE Drum Yard Site. Aluminum was not considered a potential risk due to pH levels and barium, chromium, and vanadium was present at concentrations similar to background.

Based on the risk assessment findings, an NFA designation is appropriate for the entire SE Drum Yard Site.

K.5.5 Source Area Stabilization Site Action Recommendations

No source area stabilization is required for the SE Drum Yard Site because cumulative risks for the site are below 10^{-6} and the site is recommended for NFA.

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Tables

Table K.2-1
Inventory of Other Site Features
SE Drum Yard Site

Feature ID	Location	Use Period	Use Status	Process/Chemical Use	Chemical Use Area Number	Comments	Reference
SE Drum Storage Yard	Located in Area IV, SE of G Street, close to the border with Area III.	late 1950s/early 1960s through 1968	Not in Use	Approximately 50 to 100 drums with unknown contents were stored in this area in the early 1960s. The drums were used in forklift exercises. All of the drums have been removed from this area. The drums may have been associated with the Apollo Program (based on comments made by Rockwell during 1990 site visit with EPA). Drum storage and/or forklift exercises may have also been performed in the area of disturbed ground shown on a 1965 aerial photo. The disturbed ground area is immediately southeast of the RFI site boundary for the SE Drum Storage Yard (Figure ES-1).	1		ICF Kaiser, 1993; Lockheed Environmental Systems, 1997.
Debris Location 3012	Located south of the former drum storage area on the north side of drainage.	Unknown	Unknown	An empty 5 gallon container was found with residue on the inside. It appears to have likely contained paint. The can was rusted but not holes were found in the bottom of the container.	1		CH2M HILL and MWH, 2008.

Table K.2-2
Site History - Investigations
SE Drum Yard RFI Site

Chemical Use Area Number	Chemical Use Area Name	Date	Purpose	COPCs Analyzed*	COPCs Reported*	Comments	Reference
1	SE Drum Storage Yard	8/24/1988	Soil: 2 samples collected from each of 3 borings (total of 6 samples). Sample depths ranged from 1 to 4 feet bgs.	VOCs, SVOCs, pH, TPH.	Only pH was detected.	Based on the results of this investigation, the CCR recommended the site for no further action.	IFC Kaiser, 1993.
1	SE Drum Storage Yard	9/30/1999	Soil Vapor Sampling	VOCs	VOCs were not detected.		Unknown, 2000.

* COPCs - Chemicals of potential concern by chemical group - VOCs, SVOCs, etc.

Table K.2-3
Chemical Use Summary
SE Drum Yard RFI Site

			Chemical Use Area Types and Typical Target Analytical Suites														
Chemical Use Area Number	Chemical Use Area Name	Potential Chemicals Used/Stored	Solvent VOCs	Petroleum Fuels TPH	 SVOCs	Hydrazine-Related Compounds VOCs, SVOCs (Hydrazines, Formaldehyde, NDMA, UDMH, and MMH)	Oil-Related Materials SVOCs, TPH, PCBs, Metals	Metal Wastes (exclusive of debris areas) Metals	Debris Areas/ Fill TPH, Metals	Energetic Constituents Energetics	Transformers PCBs	Leach Field	Non-metal Inorganic Compounds Fluoride, Chloride, Nitrate, Sulfate, Bromide	Non-metal Inorganic Compounds Perchlorate	Dioxins, Furans	Acids/ Bases pH	Asbestos
1	SE Drum Storage Yard	Unknown	X	X	X	X		X		X							

Table K.2-4
Conceptual Site Model
SE Drum Yard RFI Site

Chemical Use Area Name (or Site if appropriate)	Ground Surface Elevation (Feet MSL)	Alluvium Thickness (Feet)	Elevation of Unweathered Chatsworth Formation (Feet MSL)	Approximate Depth to Near-Surface Groundwater (Feet)	Near-Surface Groundwater Horizontal Gradient/Flow Direction (foot/foot)	Approximate Depth to Chatsworth Formation Groundwater (Feet)	Chatsworth Formation Groundwater Horizontal Gradient/Flow Direction (foot/foot)	Surface Water Present? (Yes/No)	Surface Water Flow Information	Other Information?	Reference
SE Drum Yard	1794 to 1820	less than 4 to greater than 10	1770 to 1785	greater than 8	0.07/south-southeast	47 to 50	0.05 / southeast	No	While there are no perennial surface water bodies at the site, rain water flows south from the site.	Near-surface groundwater has not been observed in alluvium or weathered bedrock, but has been observed approximately 200 feet northwest of the site (PZ-112). The site is located in the Lower Burro Flats Member, which consists of medium-grained sandstone with siltstone/shale interbeds. Contaminant migration from the site may be impacted by the finer grained geologic member SPA southeast of the site. The SPA member consists of interbedded fine-grained sandstone, siltstone, and shale.	ICF Kaiser, 1993; GWRC, 1989; MWH, 2004.

N/A - Not Applicable
MSL - above mean sea level

Table K.3-1A
Sampling Summary for Soil
SE Drum Yard RFI Site

Sample Location	Location Type	Sample Name	Collection Date	Top Depth (feet bgs)	Base Depth (feet bgs)	Sample Type	Remediation Status	Consultant	Matrix	Energetics	Hydrocarbons	Inorganics	Propellants	Metals	SVOC	VOC
SB_SE_DRUM-1	Soil Boring	SB_SE_DRUM-1_1.0-1.5	8/24/1988	1	1.5	Primary Sample	In Place	Groundwater Resources Consultants, Inc.	Soil	X	X	X	X		X	X
SB_SE_DRUM-1	Soil Boring	SB_SE_DRUM-1_3.5-4.0	8/24/1988	3	4	Primary Sample	In Place	Groundwater Resources Consultants, Inc.	Soil	X	X	X	X		X	X
SB_SE_DRUM-2	Soil Boring	SB_SE_DRUM-2_1.0-1.5	8/24/1988	1	1.5	Primary Sample	In Place	Groundwater Resources Consultants, Inc.	Soil	X	X	X	X		X	X
SB_SE_DRUM-2	Soil Boring	SB_SE_DRUM-2_3.5-4.0	8/24/1988	3	4	Primary Sample	In Place	Groundwater Resources Consultants, Inc.	Soil	X	X	X	X		X	X
SB_SE_DRUM-3	Soil Boring	SB_SE_DRUM-3_2.0-2.5	8/24/1988	2	2.5	Primary Sample	In Place	Groundwater Resources Consultants, Inc.	Soil	X	X	X	X		X	X
SB_SE_DRUM-3	Soil Boring	SB_SE_DRUM-3_3.5-4.0	8/24/1988	3	4	Primary Sample	In Place	Groundwater Resources Consultants, Inc.	Soil	X	X	X	X		X	X
SEBS1000	Soil Boring	SEBS1000D01	4/22/2008	0	1	MULTIPLE SAMPLE TYPES	In Place	CH2M HILL	Soil		X	X		X	X	X
SEBS1000	Soil Boring	SEBS1000X02	4/22/2008	5	6	MULTIPLE SAMPLE TYPES	In Place	CH2M HILL	Soil		X	X		X	X	X
SEBS1001	Soil Boring	SEBS1001S01	4/22/2008	0	1	Primary Sample	In Place	CH2M HILL	Soil		X	X		X	X	X
SEBS1001	Soil Boring	SEBS1001S02	4/22/2008	3	4	Primary Sample	In Place	CH2M HILL	Soil		X	X		X	X	X
SEBS1002	Soil Boring	SEBS1002S01	4/22/2008	0	1	Primary Sample	In Place	CH2M HILL	Soil		X	X		X	X	X
SEBS1002	Soil Boring	SEBS1002S02	4/22/2008	5	6	Primary Sample	In Place	CH2M HILL	Soil		X	X		X	X	X
SEBS1002	Soil Boring	SEBS1002S03	4/22/2008	9	10	Primary Sample	In Place	CH2M HILL	Soil			X				X
SEBS1500	Soil Boring	SEBS1500S01	5/1/2008	0	1	MULTIPLE SAMPLE TYPES	In Place	CH2M HILL	Soil		X			X	X	X
SEBS1500	Soil Boring	SEBS1500S02	5/1/2008	5	6	Primary Sample	In Place	CH2M HILL	Soil		X	X		X	X	X
SEBS1500	Soil Boring	SEBS1500X01	5/1/2008	0	1	MULTIPLE SAMPLE TYPES	In Place	CH2M HILL	Soil		X	X		X	X	X

Table K.3-1B
Sampling Summary for Soil Vapor
SE Drum Yard RFI Site

Sample Location	Location Type	Sample Name	Collection Date	Top Depth (feet bgs)	Base Depth (feet bgs)	Sample Type	Remediation Status	Consultant	Matrix	VOC
SESV01	Soil Gas Probe	RV740	9/30/1999	4	4	Primary Sample	In Place	OGDEN Environmental and Energy Services	Soil Vapor	X
SESV02	Soil Gas Probe	RV739	9/30/1999	4	4	Primary Sample	In Place	OGDEN Environmental and Energy Services	Soil Vapor	X
SESV1000	Soil Vapor Sample	SESV1000S01	4/17/2008	4	5	Primary Sample	In Place	CH2M HILL	Soil Vapor	X
SESV1500	Soil Vapor Sample	SESV1500D01	5/16/2008	4	5	MULTIPLE SAMPLE TYPES	In Place	CH2M HILL	Soil Vapor	X
SESV1500	Soil Vapor Sample	SESV1500S01	5/16/2008	4	5	MULTIPLE SAMPLE TYPES	In Place	CH2M HILL	Soil Vapor	X

Table K.3-2A
Evaluation of Soil and Soil Vapor Sampling Results
SE Drum Yard RFI Site

Chemical Use Area Number	**Chemical Use Area Name** (see Section 2 texts and tables for Site History)	**Potential Chemicals Used/Stored**	**Sampling Scope and Rationale** (see Figure K.2-2 for sampling locations)	**Sampling Results** Chemical Concentrations detected greater than background and/or risk screening levels?	**Characterization is sufficient for risk assessment?**	**Is delineation sufficient to estimate soil volume in CMS?** (see Figure K.5-1 for CMS area)
1	SE Drum Yard and 3012 Debris Location	VOCs	Screen for VOCs in areas that have not been previously investigated to evaluate potential presence. Soil Vapor: Samples collected at four (4) locations. Soil Matrix: Samples collected at seven (7) locations.	Soil Vapor: No VOCs were detected in any representative sample. Soil Matrix: VOCs were detected but did not exceed any RBSLs. Discussion of results is presented in K.3.4.2.1 and Figures K.3-1A, K.3-1B, and K.3-6.	**Yes.** The extent of VOC impacts is adequately defined by representative sampling locations. CUA is sufficiently evaluated for risk assessment.	**N/A**
		SVOCs	Screen for SVOCs in areas that have not been previously investigated to evaluate potential presence. Soil samples were collected at seven (7) locations.	SVOCs were detected but did not exceed any RBSLs. Discussion of results is presented in K.3.4.2.2 and Figures K.3-2 and K.3-6.	**Yes.** The extent of SVOC impacts is adequately defined by representative sampling locations. CUA is sufficiently evaluated for risk assessment.	**N/A**
		TPH	Screen for TPH in areas that have not been previously investigated to evaluate potential presence. Soil samples were collected at seven (7) locations.	TPH was detected but did not exceed any RBSLs. Discussion of results is presented in K.3.4.2.3 and Figures K.3-3 and K.3-6.	**Yes.** The extent of TPH impacts is adequately defined by representative sampling locations. CUA is sufficiently evaluated for risk assessment.	**N/A**
		Metals	Metals have not been previously investigated at the site. Screen for metals to evaluate potential presence. Soil samples were collected at four (4) locations.	Metals were detected above background and Eco RBSLs in 3 soil samples. SEBS1000 at 5-6 ft (Aluminum) SEBS1001 at 0-1 ft (Aluminum and Barium) SEBS1002 at 0-1 ft (Aluminum) Discussion of results is presented in K.3.4.2.5 and Figure K.3-4 and K.3-7.	**Yes.** The extent of metals impacts is adequately defined by representative sampling locations. CUA is sufficiently evaluated for risk assessment.	**N/A**
		Energetics	Energetics have been previously investigated at the site. Samples were collected at three (3) locations.	No energetics were detected in any of the soil samples collected.	**Yes.** The extent of energetics impacts is adequately defined by representative sampling locations. CUA is sufficiently evaluated for risk assessment.	**N/A**

Table K.3-2B
Evaluation of Groundwater Sampling Results
SE Drum Yard RFI Site

Analytical Group	Site Soil Impacts (Summary of relevant impacts)	Monitored in Groundwater?	Constituent detected in groundwater? (Above screening criteria?)	Site related?	Groundwater characterized sufficiently for risk assessment?
VOCs	VOCs were detected at low levels in soils, but were not detected in soil vapor matrix samples.	**Yes.** Monitored at RD-16 in CFOU Groundwater and PZ-112 in NSGW.	**Yes.** Low level detections.	**No.** Low level concentrations of VOC compounds in soil do not match the profile in groundwater and the low levels detected are not likely to have migrated to CFOU Groundwater.	**NSGW - Yes** **CFOU Groundwater [1]**
SVOCs	SVOCs were detected at low levels in soil samples.	**Yes.** Monitored at RD-16 in CFOU Groundwater. Not monitored in NSGW.	**Yes.** Bis (2-ethylhexyl) phthalate in CFOU Groundwater have been reported above groundwater screening levels.	**No.** SVOCs detected in CFOU Groundwater do not match the SVOCs detected in soil.	**NSGW - Yes [2]** **CFOU Groundwater [1]**
TPH	TPH was detected below screening levels in 2 samples from 2 representative locations.	**No.**	**N/A**	**No.**	**NSGW - Yes [2]** **CFOU Groundwater [1]**
Metals	A variety of metals were detected above their background concentrations in soil samples. See Section K.3.2.5 for further information.	**Yes.** Monitored at RD-16 in CFOU Groundwater. Not monitored in NSGW.	**Yes.** Metals were detected, but below groundwater screening levels in CFOU Groundwater.	**Possibly.** Metals in soil may migrate into NSGW and CFOU Groundwater but are more likely to be bound to soil. Additionally, metals detected in groundwater do not match metals detected above background concentrations in soil.	**NSGW - Yes [2]** **CFOU Groundwater [1]**
Energetics	No energetics were detected in any of the soil samples collected.	**Yes.** Monitored at RD-16 in CFOU Groundwater. Not monitored in NSGW.	**No.** Energetics were not detected in any groundwater samples collected.	**N/A**	**NSGW - Yes [2]** **CFOU Groundwater [1]**

Notes:

1. Chatsworth Formation Groundwater (CFOU Groundwater) is discussed further in Appendix B and will be evaluated for risk assessment purposes in the CFOU RFI Report.

2. Although SVOCs, TPH, metals, and energetics have not been monitored in NSGW at the SE Drum Yard Site, NSGW is not expected to have been impacted by these chemical groups due to the low concentrations of these chemical groups detected in soil at the site.

3. NSGW - Near Surface Groundwater

Table K.3-3A
Data Screening and Statistical Summary for Soil
SE Drum Yard RFI Site

		Screening Levels			Detect Data Summary						
Constituent	Units	Residential RBSL	Ecological RBSL	Background	Number of Samples	Number of Detects	Minimum Detected Value	Maximum Detected Value	Number of Detects > Residential RBSL	Number of Detects > Ecological RBSL	Number of Detects > Background SL
Energetics											
2,4-Dinitrotoluene	mg/kg		0.43		6						
2,6-Dinitrotoluene	mg/kg		1.71		6						
Nitrobenzene	mg/kg	29	2		6						
Hydrocarbons											
Kerosene Range Hydrocarbons (C12-C14)	mg/kg	1400			8	1	1.1	1.1			
Diesel Range Hydrocarbons(C15-C20)	mg/kg	1400			8						
Lubricating Oil Range Hydrocarbons (C21-C30)	mg/kg	1400			8	1	1.24	1.24			
Gasoline Range Hydrocarbons (C8-C11)	mg/kg	1.1			4						
Hydrocarbons	mg/kg				6						
Inorganics											
% Solids	%				2	2	91.2	95.4			
Moisture	%				3	3	4.84	8.8			
pH	pH Units				9	9	6.53	7.9			
Total Solids	%				7	7	86.5	95			
Metals											
Aluminum	mg/kg	75000	12	20000	8	8	8500	22000		8	3
Antimony	mg/kg	30	0.095	8.7	8						
Arsenic	mg/kg	0.095	1.9	15	8	8	1.2	8	8	7	
Barium	mg/kg	15000	15	140	8	8	42	150		8	1
Beryllium	mg/kg	150	5	1.1	8	8	0.38	1.4			2
Boron	mg/kg	15000	6.76	9.7	8	4	1.2	1.7			
Cadmium	mg/kg	39	4.50E-03	1	8	8	0.013	0.31		8	
Chromium	mg/kg	3400	930	36.8	8	8	18	29			
Cobalt	mg/kg	1500	8.9	21	8	8	2.6	6.9			
Copper	mg/kg	3000	1.1	29	8	8	4.2	11.2		8	
Lead	mg/kg	150	0.013	34	8	8	2.7	11		8	
Lithium	mg/kg	1521.66		37	8	8	10	24.55			
Mercury	mg/kg	23	0.1	0.09	8	4	5.00E-03	0.017			
Molybdenum	mg/kg	380	0.11	5.3	8	7	0.13	0.59		6	
Nickel	mg/kg	1500	0.1	29	8	8	6.7	14		8	
Potassium	mg/kg			6400	8	8	820	3360			
Selenium	mg/kg	380	0.17	0.66	8	6	0.23	0.54		6	
Silver	mg/kg	380	0.54	0.79	8	7	0.03	0.22			
Sodium	mg/kg			110	8	3	198	830			3
Thallium	mg/kg	6.1	2.9	0.46	8	8	0.15	0.29			
Vanadium	mg/kg	76	1.5	62	8	8	25	56		8	
Zinc	mg/kg	23000	21	110	8	8	29	54.45		8	
Zirconium	mg/kg			8.6	8	8	1.3	3.84			
SVOC											
1-Methyl naphthalene	mg/kg	230			8						
2,4,6-Trichlorophenol	mg/kg	10	10		6						
2,4-Dichlorophenol	mg/kg	170	1.3		6						
2,4-Dimethylphenol	mg/kg	1100	110		6						
2,4-Dinitrophenol	mg/kg	110	0.59		6						
2-Chloronaphthalene	mg/kg		530		6						
2-Chlorophenol	mg/kg	290	21		6						
2-Methylnaphthalene	mg/kg	230	210		8						
2-Nitrophenol	mg/kg		11		6						
3,3'-Dichlorobenzidine	mg/kg		1.3		6						
4,6-Dinitro-o-cresol	mg/kg	5.7	11		6						
4-Bromophenyl phenyl ether	mg/kg		4.3		6						
4-Chlorophenylphenyl ether	mg/kg		1.3		6						
4-Nitrophenol	mg/kg		7		6						
Acenaphthene	mg/kg	3400	2.46		14	2	4.80E-04	3.20E-03			

Table K.3-3A
Data Screening and Statistical Summary for Soil
SE Drum Yard RFI Site

		Screening Levels			Detect Data Summary						
Constituent	Units	Residential RBSL	Ecological RBSL	Background	Number of Samples	Number of Detects	Minimum Detected Value	Maximum Detected Value	Number of Detects > Residential RBSL	Number of Detects > Ecological RBSL	Number of Detects > Background SL
Acenaphthylene	mg/kg	1700	370		14						
Anthracene	mg/kg	17000	2.4		14	2	1.80E-03	8.20E-03			
Benzidine	mg/kg		2.3		6						
Benzo(a)anthracene	mg/kg	0.6	5.6		14	3	2.10E-04	0.024			
Benzo(a)pyrene	mg/kg	0.06	5.6		14	3	2.00E-04	0.021			
Benzo(b)fluoranthene	mg/kg	0.6	5.6		14	3	3.10E-04	0.03			
Benzo(ghi)perylene	mg/kg		6.4		14	2	3.10E-03	0.012			
Benzo(k)fluoranthene	mg/kg	0.6	5.8		12	1	9.20E-04	9.20E-04			
bis(2-Chloroethoxy)methane	mg/kg		150		6						
bis(2-Chloroethyl) ether	mg/kg	0.29	150		6						
bis(2-Chloroisopropyl) ether	mg/kg	2300	150		6						
bis(2-Ethylhexyl) phthalate	mg/kg	250	4.9		9						
Butyl benzyl phthalate	mg/kg	11000	340		9						
Chrysene	mg/kg	6	2.4		14	1	0.027	0.027			
Dibenzo(a,h)anthracene	mg/kg	0.17	5.6		14	2	1.10E-03	5.90E-03			
Diethyl phthalate	mg/kg	46000	6940		9						
Dimethyl phthalate	mg/kg	570000	4.4		14						
Di-n-butyl phthalate	mg/kg	5700	0.49		9						
Di-n-octyl phthalate	mg/kg	2300	39		13	2	7.40E-03	0.018			
Fluoranthene	mg/kg	2300	38		14	3	3.90E-04	0.044			
Fluorene	mg/kg	2300	1.6		14						
Hexachlorobenzene	mg/kg	0.4	0.34		6						
Hexachlorocyclopentadiene	mg/kg	340	13		6						
Hexachloroethane	mg/kg	18	2.1		6						
Indeno(1,2,3-cd)pyrene	mg/kg	0.6	5.8		14	2	3.50E-03	0.014			
Isophorone	mg/kg	750	320		6						
Naphthalene	mg/kg	6	210		14						
n-Nitrosodimethylamine	mg/kg	0.045	20		14						
n-Nitrosodi-n-propylamine	mg/kg	0.1	28		6						
n-Nitrosodiphenylamine	mg/kg	80	20		6						
p-Chloro-m-cresol	mg/kg		21		6						
Pentachlorophenol	mg/kg	8.8	6		6						
Phenanthrene	mg/kg	1700	1.3		14	2	6.00E-03	0.025			
Phenol	mg/kg	18000	5		6						
Pyrene	mg/kg	1700	18		14	3	3.00E-04	0.036			
VOC											
1,1,1,2-Tetrachloroethane	mg/kg	2.50E-04	76		9						
1,1,1-Trichloroethane	mg/kg	0.49	4300		15						
1,1,2,2-Tetrachloroethane	mg/kg	1.40E-03	6		15						
1,1,2-Trichloro-1,2,2-trifluoroethane	mg/kg	16	583		9						
1,1,2-Trichloroethane	mg/kg	1.20E-03	8.3		15						
1,1-Dichloroethane	mg/kg	1.60E-03	210		15						
1,1-Dichloroethene	mg/kg	0.023	10.7		15						
1,1-Dichloropropene	mg/kg		22		9						
1,2,3-Trichlorobenzene	mg/kg	0.12	20		9						
1,2,3-Trichloropropane	mg/kg	5.10E-05	12		9						
1,2,4-Trichlorobenzene	mg/kg	0.12	20		15						
1,2,4-Trimethylbenzene	mg/kg	0.035	64		9						
1,2-Dibromo-3-chloropropane	mg/kg	0.029	22		9						
1,2-Dibromoethane	mg/kg		25		9						
1,2-Dichlorobenzene	mg/kg	1.8	370		15						
1,2-Dichloroethane	mg/kg	5.00E-04	76		15						
1,2-Dichloropropane	mg/kg		250		15						
1,3,5-Trimethylbenzene	mg/kg	0.036	64		9						
1,3-Dichlorobenzene	mg/kg	1.7	160		15						

Table K.3-3A
Data Screening and Statistical Summary for Soil
SE Drum Yard RFI Site

		Screening Levels			Detect Data Summary						
Constituent	Units	Residential RBSL	Ecological RBSL	Background	Number of Samples	Number of Detects	Minimum Detected Value	Maximum Detected Value	Number of Detects > Residential RBSL	Number of Detects > Ecological RBSL	Number of Detects > Background SL
1,3-Dichloropropane	mg/kg		22		9						
1,3-Dichloropropene	mg/kg		22		6						
1,4-Dichlorobenzene	mg/kg	0.01	20		15						
2-Chloro-1,1,1-trifluoroethane	mg/kg				8						
2-Chloroethylvinyl ether	mg/kg	9.57E-06	0.73		15						
2-Hexanone	mg/kg		1220		9						
Acetone	mg/kg	51	43		4						
Benzene	mg/kg	1.30E-04	110		15						
Bromobenzene	mg/kg		110		9						
Bromochloromethane	mg/kg		25		9						
Bromodichloromethane	mg/kg	3.10E-04	15		15						
Bromoform	mg/kg		38		15						
Bromomethane	mg/kg		25		15						
Carbon Tetrachloride	mg/kg	4.20E-05	1.5		15						
Chlorobenzene	mg/kg	0.097	40		15						
Chloroethane	mg/kg		190		15						
Chloroform	mg/kg	7.70E-04	11		15						
Chloromethane	mg/kg		25		15						
Chlorotrifluoroethylene	mg/kg		10.7		8						
cis-1,2-Dichloroethene	mg/kg	0.014	68		9						
cis-1,3-Dichloropropene	mg/kg		22		9						
Cumene	mg/kg	0.38	210		9						
Dibromochloromethane	mg/kg		46		15						
Dibromomethane	mg/kg		25		9						
Dichlorodifluoromethane	mg/kg	0.015	64		9						
Ethylbenzene	mg/kg	1.2	210		15	1	2.62E-04	2.62E-04			
Hexachlorobutadiene	mg/kg	9.2	0.85		15						
Methyl ethyl ketone	mg/kg	62	2540		9						
Methyl isobutyl ketone (MIBK)	mg/kg	19.64	2540		9						
Methyl tert-butyl ether	mg/kg		120		9						
Methylene chloride	mg/kg	0.004	25		10						
m-Xylene & p-Xylene	mg/kg	0.15	64		9	2	5.14E-04	5.49E-04			
n-Butylbenzene	mg/kg		210		9						
n-Propylbenzene	mg/kg	0.20	210		9						
o-Chlorotoluene	mg/kg	1.22E+03	160		9						
o-Xylene	mg/kg	0.19	64		9						
p-Chlorotoluene	mg/kg	1222.10	160		9						
p-Cymene	mg/kg		64		9						
sec-Butylbenzene	mg/kg	7.68E+01	210		9						
sec-Dichloropropane	mg/kg		22		9						
Styrene	mg/kg	7.2	427		9	2	2.13E-04	2.71E-04			
tert-Butylbenzene	mg/kg		210		9						
Tetrachloroethene	mg/kg	4.30E-04	6		15						
Toluene	mg/kg	0.3	3.4		15						
trans-1,2-Dichloroethene	mg/kg	0.016	970		15						
trans-1,3-Dichloropropene	mg/kg		4.4		9						
Trichloroethene	mg/kg	2.20E-03	3		15						
Trichlorofluoromethane	mg/kg	0.11	300		9						
Vinyl chloride	mg/kg	9.60E-06	0.73		15						
Xylenes, Total	mg/kg	0.15	64		9	2	5.14E-04	5.49E-04			

Table K.3-3B
Data Screening and Statistical Summary for Soil Vapor
SE Drum Yard RFI Site

		Screening Levels		Detect Data Summary					
Constituent	**Units**	**Residential RBSL**	**Ecological RBSL**	**Number of Samples**	**Number of Detects**	**Minimum Detected Value**	**Maximum Detected Value**	**Number of Detects > Residential RBSL**	**Number of Detects > Ecological RBSL**
VOC									
1,1,1,2-Tetrachloroethane	ug/L	0.048		4					
1,1,1-Trichloroethane	ug/L	640	38	4					
1,1,2,2-Tetrachloroethane	ug/L	0.048		4					
1,1,2-Trichloro-1,2,2-trifluoroethane	ug/L	8800	91	4					
1,1,2-Trichloroethane	ug/L	0.17	0.057	4					
1,1-Dichloroethane	ug/L	1.7	36	4					
1,1-Dichloroethene	ug/L	58	0.6	4					
1,2-Dichloroethane	ug/L	0.13	42	4					
Benzene	ug/L	0.095	0.57	4					
Carbon Tetrachloride	ug/L	0.063	0.63	4					
Chloroethane	ug/L		992	4					
Chloroform	ug/L	0.5	0.24	4					
cis-1,2-Dichloroethene	ug/L	10	1.9	4					
Dichlorodifluoromethane	ug/L	58	91	4					
Ethylbenzene	ug/L	290	23	4					
Methylene chloride	ug/L	2.7	0.87	4					
m-Xylene & p-Xylene	ug/L		16	4					
o-Xylene	ug/L	29	16	4					
Tetrachloroethene	ug/L	0.45232	24	4					
Toluene	ug/L	110	0.084	4					
trans-1,2-Dichloroethene	ug/L	20	1.9	4					
Trichloroethene	ug/L	1.4	6.4	4					
Trichlorofluoromethane	ug/L	200	90.9	4					
Vinyl chloride	ug/L	0.035	0.56	4					
Xylenes, Total	ug/L		16	4					

Table K.4-1
Chemicals of Potential Concern for Human Health
SE Drum Yard RFI Site

Medium	Depth (ft.)	Chemical	Exceeds Background? (Y/N)	Selected as COPC?	Reason for Exclusion
Soil	0-2	Acenaphthene		Y	
Soil	0-2	Aluminum	Y	Y	
Soil	0-2	Anthracene		Y	
Soil	0-2	Arsenic	N	N	Below Background
Soil	0-2	Barium	Y	Y	
Soil	0-2	Benzo(a)anthracene		Y	
Soil	0-2	Benzo(a)pyrene		Y	
Soil	0-2	Benzo(b)fluoranthene		Y	
Soil	0-2	Benzo(ghi)perylene		Y	
Soil	0-2	Beryllium	Y	Y	
Soil	0-2	Boron	N	N	Below Background
Soil	0-2	Cadmium	N	N	Below Background
Soil	0-2	Chromium	Y	Y	
Soil	0-2	Chrysene		Y	
Soil	0-2	Cobalt	N	N	Below Background
Soil	0-2	Copper	N	N	Below Background
Soil	0-2	Dibenzo(a,h)anthracene		Y	
Soil	0-2	Diesel Range Organics (C21-C30)		N	See BTEX, PAHs
Soil	0-2	Di-n-octyl phthalate		Y	
Soil	0-2	Ethylbenzene		Y	
Soil	0-2	Fluoranthene		Y	
Soil	0-2	Indeno(1,2,3-cd)pyrene		Y	
Soil	0-2	Lead	N	N	Below Background
Soil	0-2	Lithium	N	N	Below Background
Soil	0-2	Mercury	N	N	Below Background
Soil	0-2	Molybdenum	N	N	Below Background
Soil	0-2	m-Xylene & p-Xylene		Y	
Soil	0-2	Nickel	N	N	Below Background
Soil	0-2	Phenanthrene		Y	
Soil	0-2	Pyrene		Y	
Soil	0-2	Selenium	N	N	Below Background
Soil	0-2	Silver	N	N	Below Background
Soil	0-2	Styrene		Y	
Soil	0-2	Thallium	N	N	Below Background
Soil	0-2	Vanadium	Y	Y	
Soil	0-2	Xylenes, Total		Y	
Soil	0-2	Zinc	N	N	Below Background
Soil	0-2	Zirconium	N	N	Below Background
Soil	0-10	Acenaphthene		Y	
Soil	0-10	Aluminum	Y	Y	
Soil	0-10	Anthracene		Y	
Soil	0-10	Arsenic	N	N	Below Background
Soil	0-10	Barium	Y	Y	
Soil	0-10	Benzo(a)anthracene		Y	
Soil	0-10	Benzo(a)pyrene		Y	
Soil	0-10	Benzo(b)fluoranthene		Y	
Soil	0-10	Benzo(ghi)perylene		Y	
Soil	0-10	Benzo(k)fluoranthene		Y	
Soil	0-10	Beryllium	Y	Y	
Soil	0-10	Boron	N	N	Below Background
Soil	0-10	Cadmium	N	N	Below Background
Soil	0-10	Chromium	Y	Y	
Soil	0-10	Chrysene		Y	
Soil	0-10	Cobalt	N	N	Below Background
Soil	0-10	Copper	N	N	Below Background

Table K.4-1
Chemicals of Potential Concern for Human Health
SE Drum Yard RFI Site

Medium	Depth (ft.)	Chemical	Exceeds Background? (Y/N)	Selected as COPC?	Reason for Exclusion
Soil	0-10	Dibenzo(a,h)anthracene		Y	
Soil	0-10	Diesel Range Organics (C12-C14)		N	See BTEX, PAHs
Soil	0-10	Diesel Range Organics (C21-C30)		N	See BTEX, PAHs
Soil	0-10	Di-n-octyl phthalate		Y	
Soil	0-10	Ethylbenzene		Y	
Soil	0-10	Fluoranthene		Y	
Soil	0-10	Indeno(1,2,3-cd)pyrene		Y	
Soil	0-10	Lead	N	N	Below Background
Soil	0-10	Lithium	N	N	Below Background
Soil	0-10	Mercury	N	N	Below Background
Soil	0-10	Molybdenum	N	N	Below Background
Soil	0-10	m-Xylene & p-Xylene		Y	
Soil	0-10	Nickel	N	N	Below Background
Soil	0-10	Phenanthrene		Y	
Soil	0-10	Pyrene		Y	
Soil	0-10	Selenium	N	N	Below Background
Soil	0-10	Silver	N	N	Below Background
Soil	0-10	Styrene		Y	
Soil	0-10	Thallium	N	N	Below Background
Soil	0-10	Vanadium	Y	Y	
Soil	0-10	Xylenes, Total		Y	
Soil	0-10	Zinc	N	N	Below Background
Soil	0-10	Zirconium	N	N	Below Background
Groundwater	-	Acetone		Y	
Groundwater	-	Methylene chloride		Y	

Table K.4-2
Human Health Risk Estimates[1]
SE Drum Yard RFI Site

Receptor	Soil Media[2]					Groundwater[3]				Total for Site Media[4]			
	HI Range	CD[5]	Risk Range	CD		HI Range	CD	Risk Range	CD	HI Range	CD	Risk Range	CD
Future Adult Recreator	0.00000005 - 0.0000005		2E-09 - 2E-07			NA - NA		NA - NA		<0.01 - <0.01		2E-09 - 2E-07	
Future Child Recreator	0.000002 - 0.000004		3E-08 - 1E-07			NA - NA		NA - NA		<0.01 - <0.01		3E-08 - 1E-07	
Future Adult Resident	0.02 - 0.05		3E-08 - 2E-07			0.0005 - 0.0008		5E-08 - 2E-07		0.02 - 0.05		8E-08 - 4E-07	
Future Child Resident	0.2 - 0.5		2E-07 - 5E-07			0.002 - 0.003		1E-07 - 2E-07		0.2 - 0.5		3E-07 - 6E-07	

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.

CD = Chemical risk driver
COPC = Chemical of potential concern
HI = Hazard index
NA = Not Applicable

Table K.4-3
Human Health Risk Assessment Uncertainty Analysis
SE Drum Yard RFI Site

Assessment Element	Uncertainty	Magnitude of Impact	Direction of Impact
COPC Selection	Several inorganics were selected as COPCs since it could not be demonstrated that they are consistent with background concentrations through the Wilcoxon Rank Sum test. The site data set was small, introducing uncertainty into the comparisons.	Moderate	Conservative
	Acetone and styrene were selected as soil vapor COPCs because they were detected in soil or groundwater but not analyzed for in soil vapor.	Moderate	Conservative
	Diesel range organics were not selected as COPCs since TPH-related constituents (BTEX and PAHs) were analyzed for.	Low	Realistic
Exposure Pathways	Risks associated with drinking of groundwater are not realistic because the groundwater beneath the SSFL is not currently used as a drinking water source and the presence 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	EPCs are based on some data that are over 20 years old. In these cases available analytical data may not 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 concentration for acetone are estimated using soil to soil vapor partitioning extrapolations introducing some degree of uncertainty.	Moderate	Conservative
	Several inorganics were selected as COPCs since it could not be demonstrated that they are consistent with background concentrations through the Wilcoxon Rank Sum test. The site data set was small, introducing uncertainty into the comparisons.	Moderate	Conservative
	The maximum detected concentration of each COPC detected in groundwater was used as the EPC.	Moderate	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

Table K.4-3
Human Health Risk Assessment Uncertainty Analysis
SE Drum Yard RFI Site

Assessment Element	Uncertainty	Magnitude of Impact	Direction of Impact
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 that corresponding factors derived by USEPA (e.g. arsenic, PCBs)	Moderate	Conservative
	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 sorption/adsorption coefficient
OEHHA - Office of Environmental Health Hazard Assessment
PAH - polycyclic aromatic hydrocarbon
PCB - polychlorinated biphenyl
TPH - total petroleum hydrocarbons
UCL - upper confidence limit

Table K.4-4
Chemicals of Ecological Concern and Risk Estimates - Soil
SE Drum Yard RFI Site

	Range of HQs - RME (Refined Screen)						Range of Incremental HQs- RME (Refined Screen)						Identification of COECs	
Preferred Analyte Name	**Soil Invertebrate**	**Hermit Thrush**	**Red-Tailed Hawk**	**Deer Mouse**	**Bobcat**	**Mule Deer**	**Soil Invertebrates**	**Hermit Thrush**	**Red-Tailed Hawk**	**Deer Mouse**	**Bobcat**	**Mule Deer**	**COEC**	**Rationale**
Aluminum	**8.80**	No TRV -- **21.1**	No TRV -- 0.02	**142.9** -- **1428.9**	0.01 -- 0.08	0.36 -- **3.64**	**3.7**	No TRV -- **7.0**	No TRV -- <1	**51.4** -- **514.4**	<1 -- <1	<1 -- 1.2	No	-USEPA guidance indicates no risk from aluminum when pH is greater than 5.5. -site pH ranged from 6.53 to 7.
Barium	0.44	**1.31** -- **2.6**	0.001 -- 0.002	**1.9** -- **7.3**	0.0001 -- 0.0006	0.00 -- 0.01	<1	<1 -- **1.2**	<1 -- <1	<1 -- **3.1**	<1 -- <1	<1 -- <1	No	-Estimated risk to mouse and thrush only -Maximum site detect (150 mg/kg) is close to maximum background (140 mg/kg). -Risk in excess of background is >1 only for deer mouse and thrush at the Low TRV.
Chromium	0.45	**5.63** -- **28.1**	0.001 -- 0.003	No TRV -- 0.03	No TRV -- 0.0000	No TRV -- 0.00	<1	<1 -- **4.7**	<1 -- <1	No TRV -- <1	No TRV -- <1	No TRV -- <1	No	-Estimated risk to thrush only -Maximum site detect (29 mg/kg) is less than maximum background (36.8 mg/kg). -Risk in excess of background is >1 for single receptor (thrush) at the Low TRV.
Vanadium	0.43	No TRV -- 0.5	No TRV -- 0.001	**2.9** -- **29.1**	0.0003 -- 0.0026	0.01 -- 0.08	<1	No TRV -- <1	No TRV -- <1	<1 -- **6.4**	<1 -- <1	<1 -- <1	No	-Estimated risk to deer mouse only -Maximum site detect (56 mg/kg) is less than maximum background (62 mg/kg). -Risk in excess of background is >1 for single receptor (mouse) at the Low TRV.

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 K.4-5
Ecological Risk Assessment Uncertainty Analysis
SE Drum Yard RFI Site

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 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
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	Soil vapor concentrations extrapolated from soil concentrations were used to calculate soil vapor EPC.	Moderate	Over- or under-estimation of exposure/risk

Table K.4-5
Ecological Risk Assessment Uncertainty Analysis
SE Drum Yard RFI Site

Assessment Element	Uncertainty	Magnitude of Impact	Direction of Impact
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
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
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

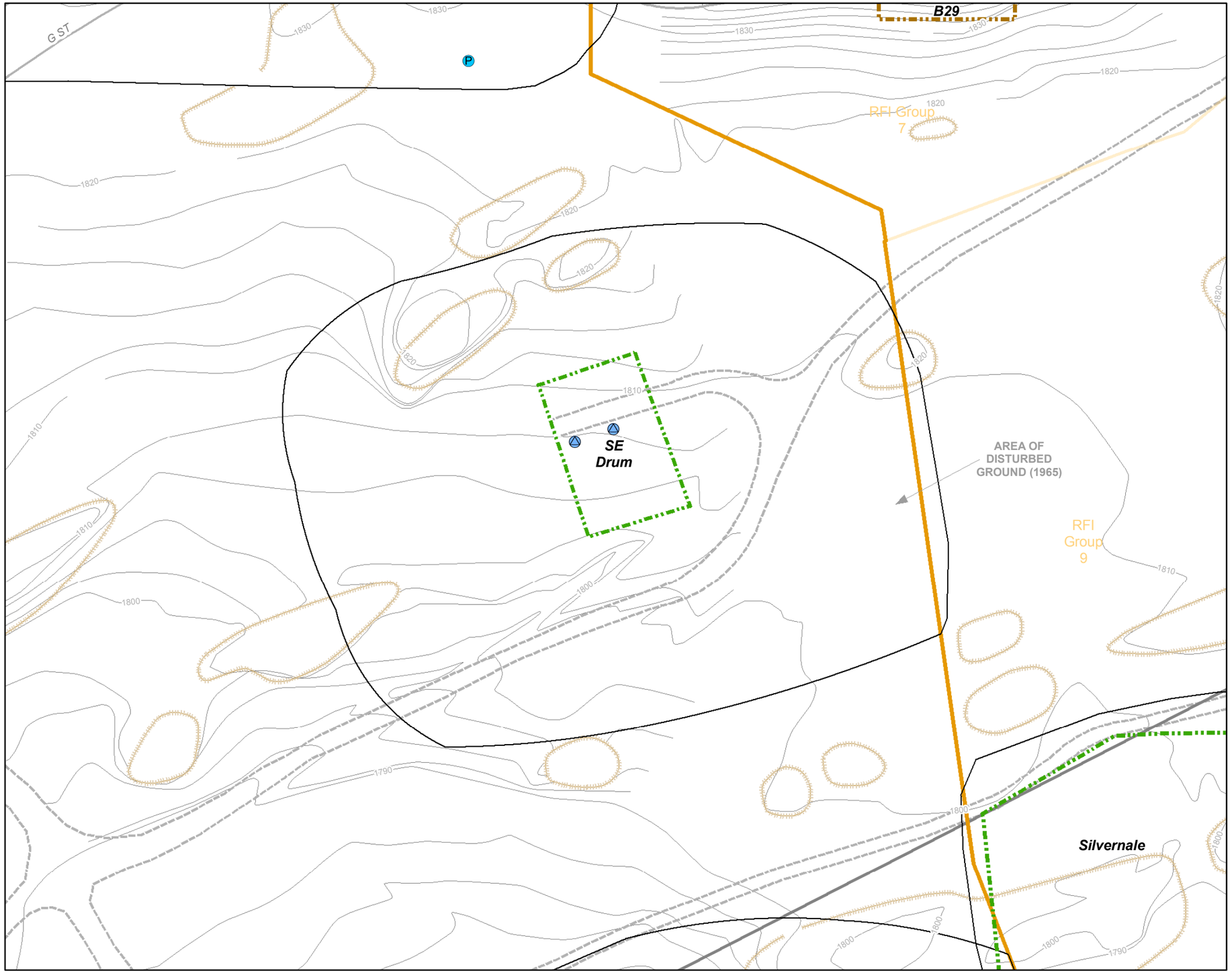
Table K.5-1
Suficial Media Site Action Recommendations
SE Drum Yard RFI Site

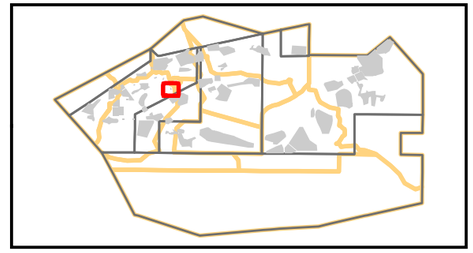
Area	Chemical Use Area Name	CMS Area (1)	Recommended for further consideration in CMS based on:				
			Residential Receptor (2)	Recreational Receptor (2)	Ecological Receptor (2)		
1	SE Drum Storage Yard	NFA	No HRA COCs identified	No HRA COCs identified	***Soil Results***		
					Any HQ>1	COEC	Rationale
					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-3

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 No chemicals of potential ecological concern exceeded Low or High TRVs under either the CTE or RME scenarios.

Figures





Basemap Legend

- Transformer Poles
- Tank - UST
- Tank - AST
- Tank - Not Yet Determined
- Pipe
- Surface Drainage Divide
- Leachfield
- Pond
- Groundwater Monitoring Well
- Piezometer
- Groundwater Extraction Well
- Building - Existing
- Building - Removed
- Building - Not Yet Determined
- Transformer - Existing
- Transformer - Removed
- Transformer - Not Yet Determined
- Road - Asphalt
- Roads - Dirt
- RFI Site - Boeing
- RFI Site - DOE
- RFI Site - NASA
- Investigation Boundary
- RFI Group Boundary
- Administrative Area
- Property Boundary
- Rocks
- Streams

Site Location
SE Drum Yard RFI Site

Date: September 18, 2008 **WORKING DRAFT**

\\..MapFiles\RFI_05\RFI_Report\RFISites_SiteLoc_BL_PLTS.mxd

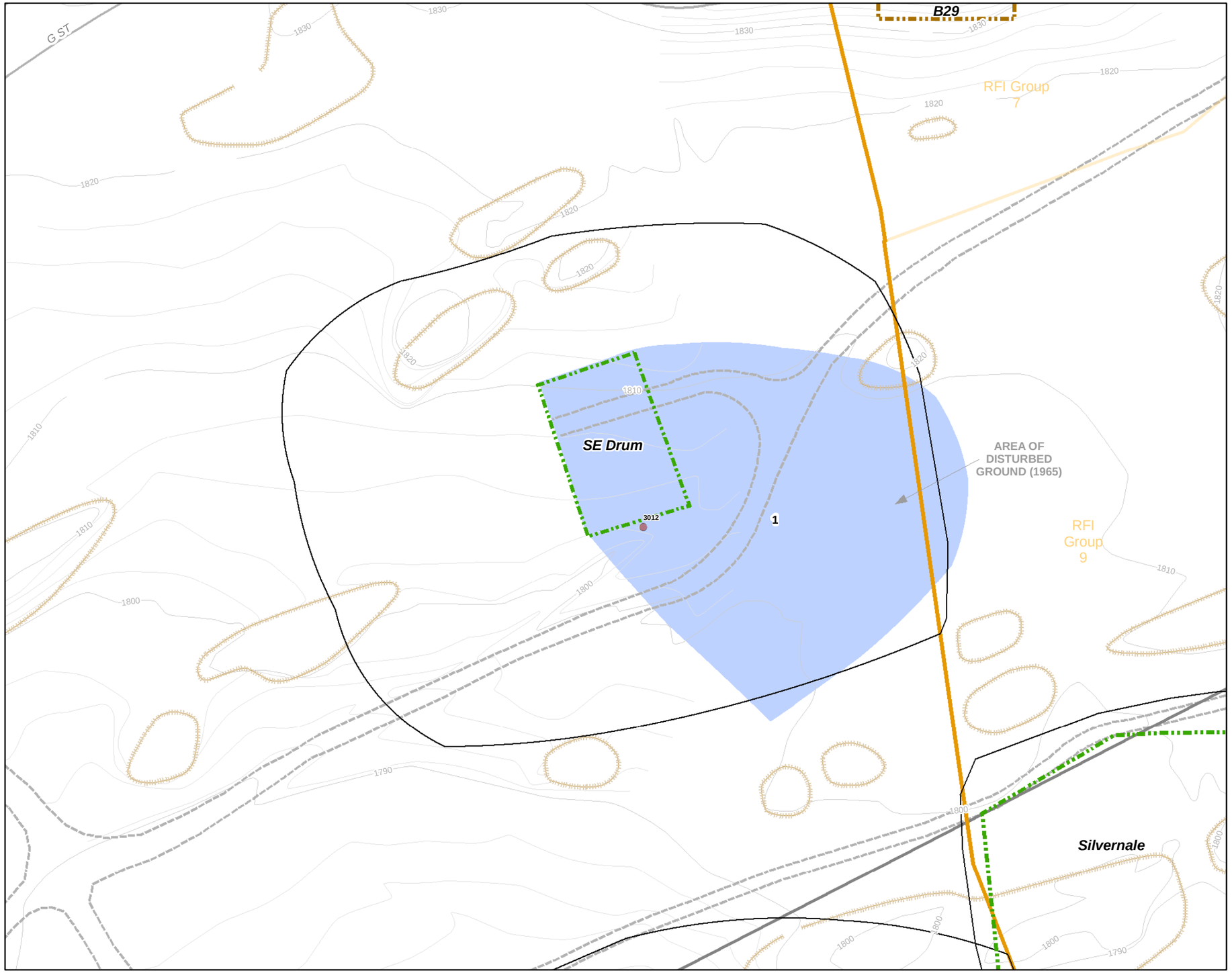
1 inch equals 60 feet

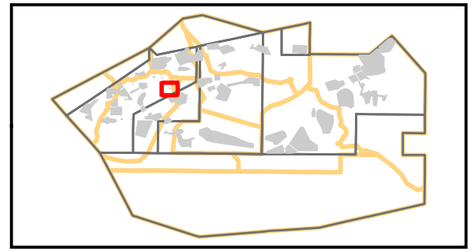
0 60 120 Feet

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure K.1-1





Chemical Use

- Debris
- Multiple Use
- Solvent
- Petroleum
- Oil/PCBs
- Metals
- Energetic Constituents
- Propellants
- Leach Field
- Non-metal Inorganic Constituents
- Screening for Potential Impacts

Multiple Use Key

ACB - Acids and Bases
ASB - Asbestos
DEB - Debris
DIOX - Dioxins and Furans
ENC - Energetic Constituents
FRM - Formaldehyde
LCF - Leach Field
MET - Metals
NMIC - Non-metal Inorganic Constituents
OPCB - Oil/PCBs
PET - Petroleum
PRP - Propellants
SLV - Solvents
SVOC - SVOCs

Basemap Legend

- Transformer Poles
- Tank - UST
- Tank - AST
- Tank - Not Yet Determined
- Excavation
- Trench
- Leachfield
- Pipe
- RFI Site - Boeing
- RFI Site - DOE
- RFI Site - NASA
- RFI Site Buffer
- RFI Group Boundary
- Administrative Area
- Property Boundary
- Building - Existing
- Building - Removed
- Building - Not Yet Determined
- Transformer - Existing
- Transformer - Removed
- Transformer - Not Yet Determined
- Surface Drainage Divide
- Road - Asphalt
- Roads - Dirt
- Rocks
- Streams
- Pond
- Waste Debris Area

Chemical Use Areas
SE Drum Yard RFI Site

Date: June 24, 2008

WORKING DRAFT

\\..RFI_05\RFISites\RFI_Report\RFIGrp5_ChemUA_BL_PLTS.mxd

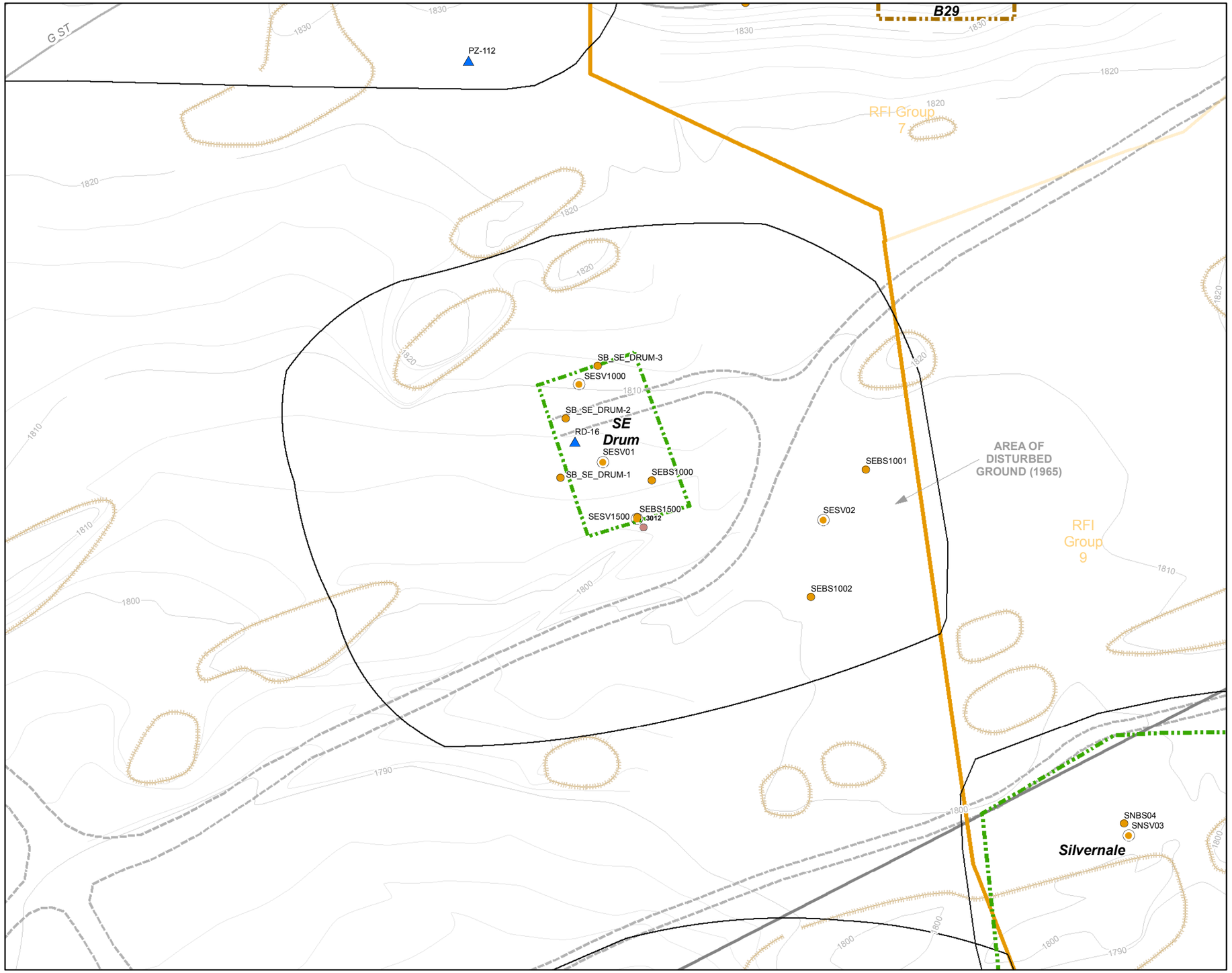
1 inch equals 60 feet

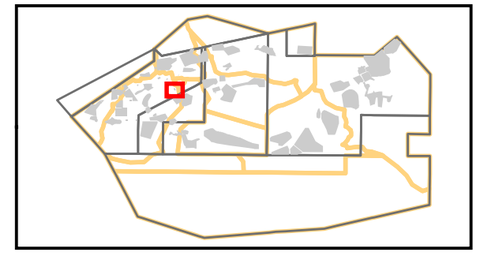
0 60 120 Feet

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure K.2-1





Sample Type

- Soil
- Soil - Composite
- Soil - Sediment
- Soil - Surface
- Air - Soil Vapor
- Air
- Groundwater
- Groundwater - Lysimeter
- Groundwater - Spring
- Water - Artificial
- Water - Discharge
- Water - Surface
- Water - Surface (Seep)
- Biological
- Other
- Sump

Basemap Legend

- Transformer Poles
- Tank - UST
- Tank - AST
- Tank - Not Yet Determined
- Excavation
- Trench
- Leachfield
- Pipe
- Surface Drainage Divide
- 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 Group Boundary
- Administrative Area
- Property Boundary

Sample Locations
SE Drum Yard RFI Site

Date: October 30, 2008 WORKING DRAFT

\\..MapFiles\RFI_05\RFI_Report\RFISites_SampleLocs_BL_PLTS.mxd

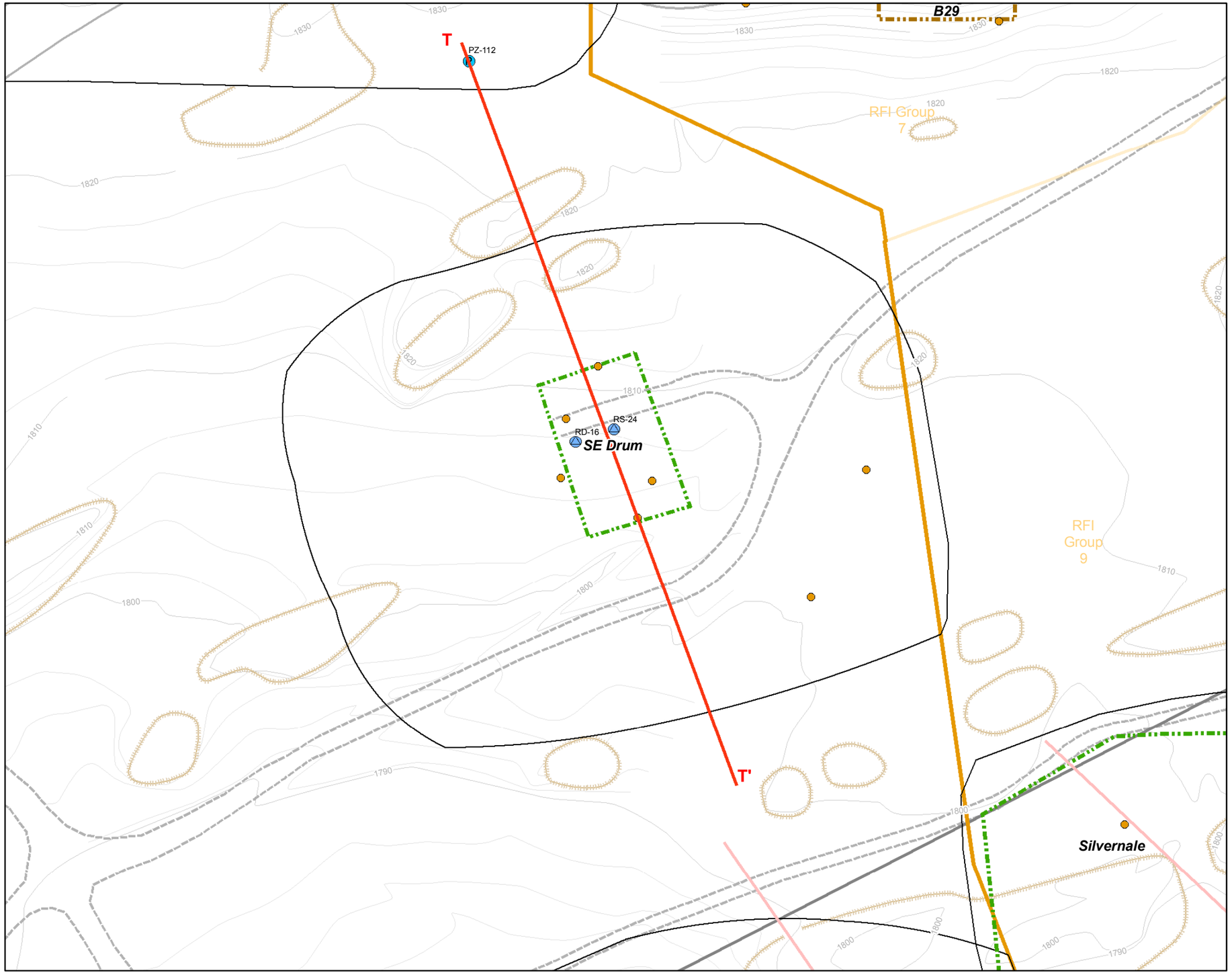
1 inch equals 60 feet

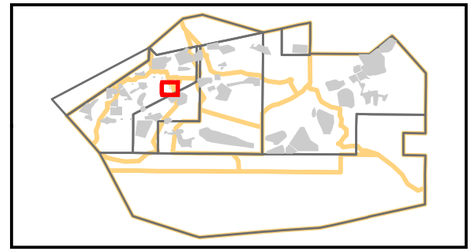
0 60 120 Feet

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure K.2-2





Cross-section Line

Basemap Legend

- Soil Boring
- Confirmation Sample
- Groundwater Monitoring Well
- Piezometer
- Groundwater Extraction Well
- Abandoned Groundwater Monitoring Well
- Leachfield
- Pipe
- 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 Group Boundary
- Administrative Area
- Property Boundary

SE Drum Yard Cross Section Location

T-T'

Date: September 11, 2008 **WORKING DRAFT**

\\..Mapfiles\RFI_05\RFI_Report\XSctns\Grp5RFIReport_CrossSct_BL_PLTS.mxd

1 inch equals 60 feet

0 60 120 Feet

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure K.2-3A

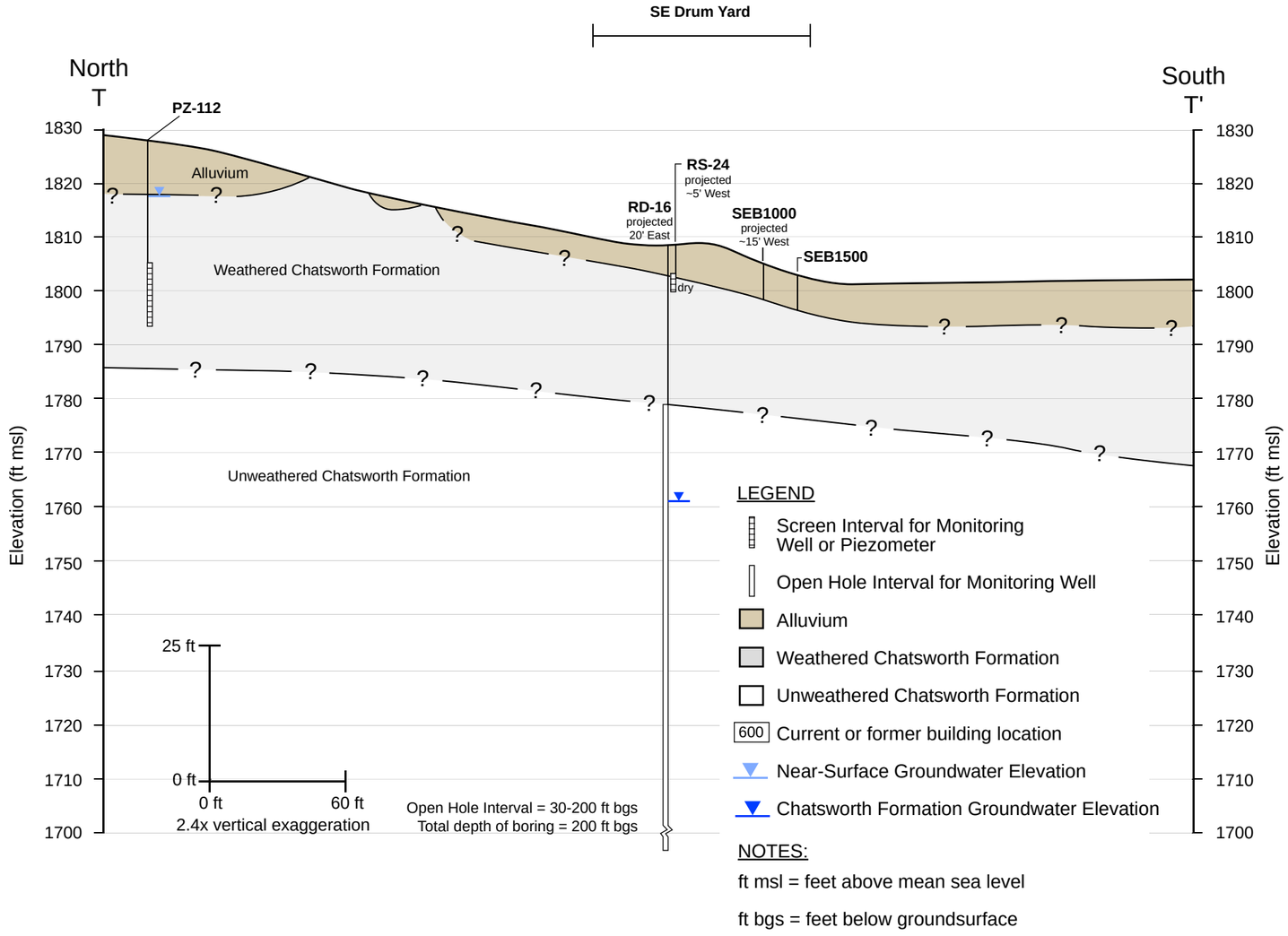
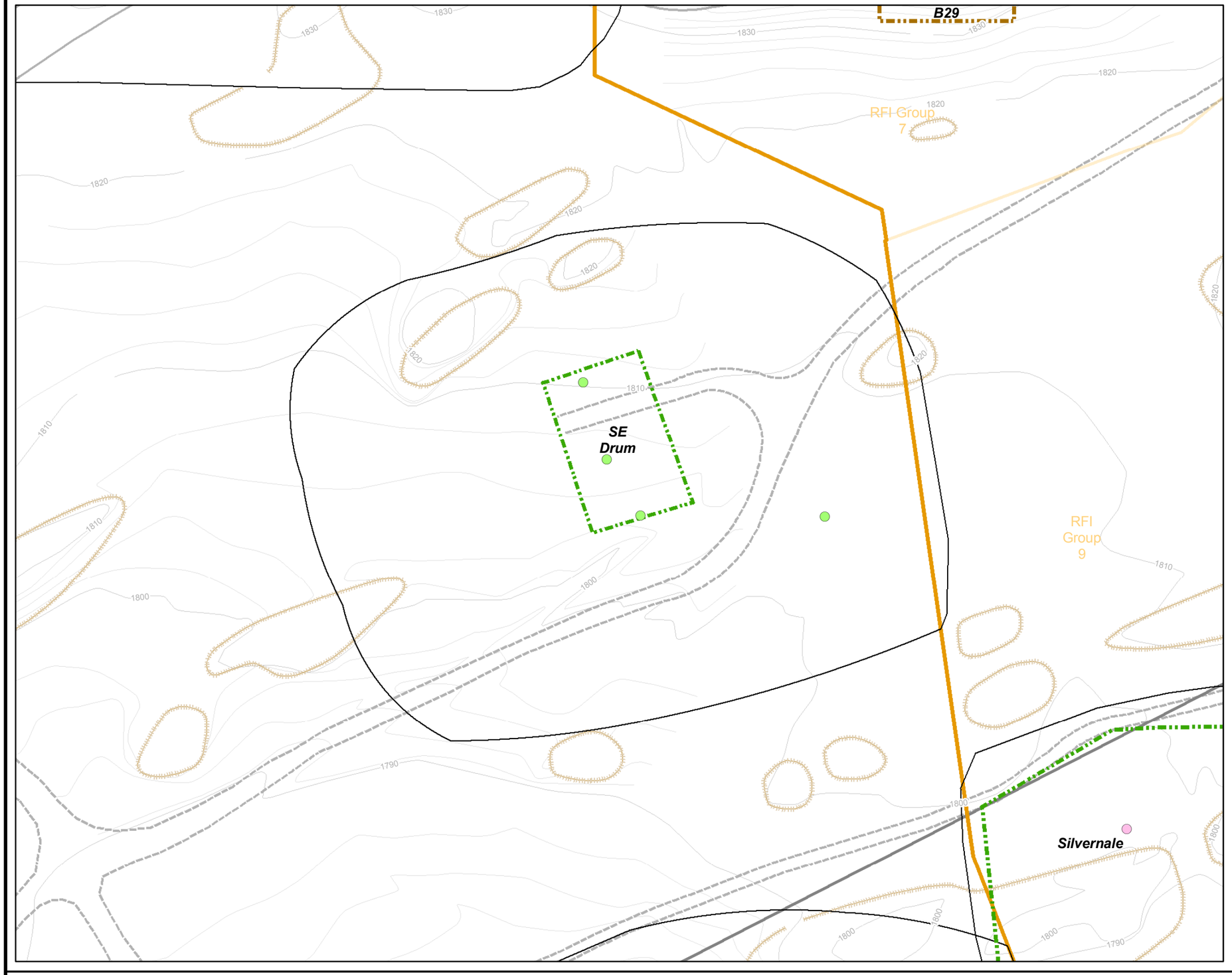
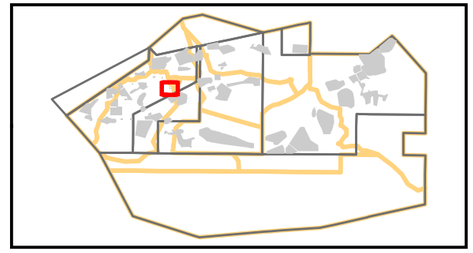


FIGURE K.2-3B
Surficial Cross Section T-T'
SE Drum Yard
Santa Susana Field Laboratory

CH2MHILL

ES072007017SCO362070.FP.5A.05.BO CrossSect_TT.ai 9/08





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

Basemap Legend

- Transformer Poles
- Tank - UST
- Tank - AST
- Tank - Not Yet Determined
- Excavation
- Leachfield
- Pipe
- Trench
- 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 Group Boundary
- Administrative Area
- Property Boundary

VOCs in Soil Vapor
SE Drum Yard RFI Site

Date: September 15, 2008 **WORKING DRAFT**

\\..RFI_05\RFI_Report\CDot_BL_PLTSL\RFIGrp5_CDotVOCsSVpr_BL_PLTS.mxd

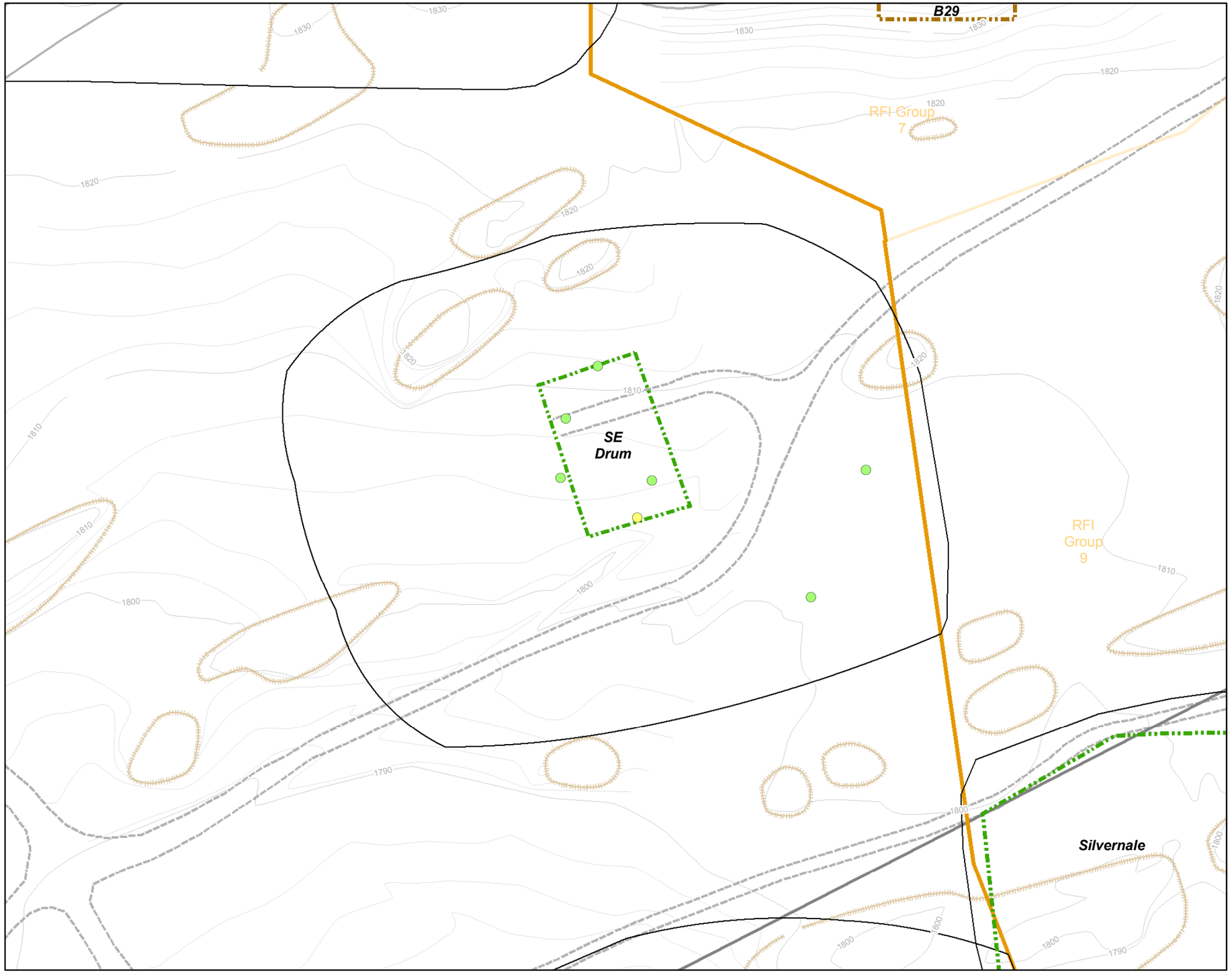
1 inch equals 60 feet

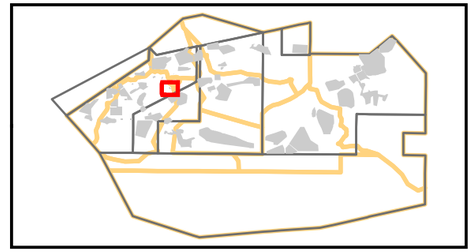
0 60 120 Feet

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure K.3-1A





VOCs in Soil

- Exceeds Residential RBSL + Eco RBSL
- Exceeds Residential RBSL
- Detect, Below All Screening Levels
- Non-detect

Basemap Legend

- Transformer Poles
- Tank - UST
- Tank - AST
- Tank - Not Yet Determined
- Excavation
- Leachfield
- Pipe
- 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 Group Boundary
- Administrative Area
- Property Boundary
- Drainage
- Road - Asphalt
- Roads - Dirt
- Rocks
- Streams
- Pond

VOCs in Soil
SE Drum Yard RFI Site

Date: September 15, 2008 WORKING DRAFT

\\..RFI_05\RFI_Report\CDot_BL_PLTS\RFIGrp5_CDotVOCsSoil_BL_PLTS.mxd

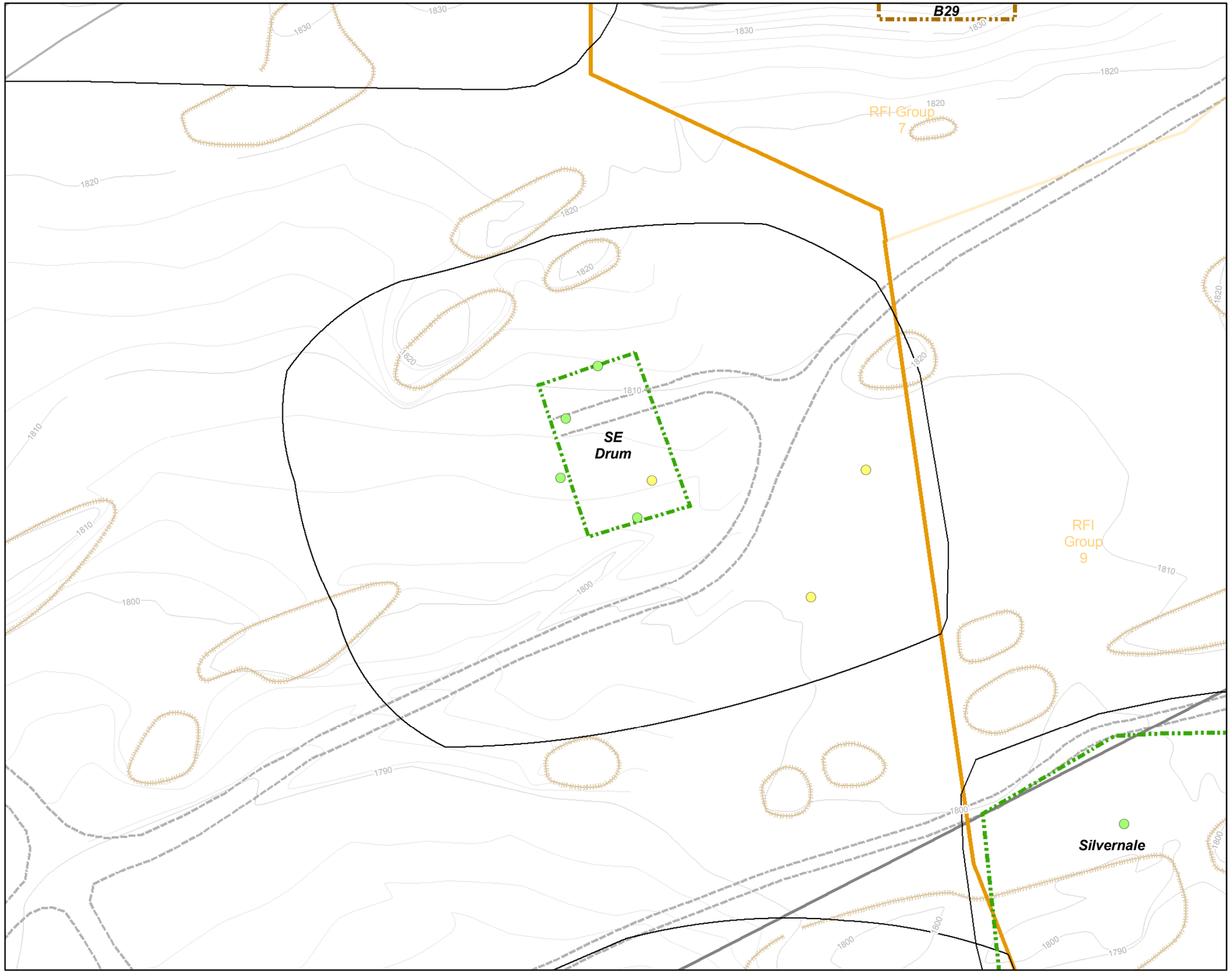
1 inch equals 60 feet

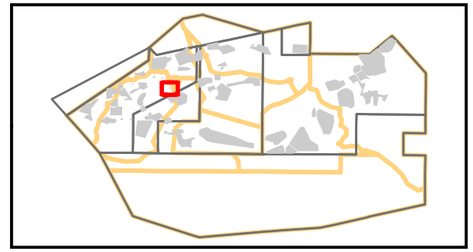
0 60 120 Feet

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure K.3-1B





SVOCs in Soil

- Exceeds Residential RBSL + Eco RBSL
- Exceeds Eco RBSL
- Exceeds Residential RBSL
- Detect, Below All Screening Levels
- Non-detect

Basemap Legend

- Transformer Poles
- Tank - UST
- Tank - AST
- Tank - Not Yet Determined
- Excavation
- Leachfield
- Pipe
- 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 Group Boundary
- Administrative Area
- Property Boundary
- Drainage
- Road - Asphalt
- Roads - Dirt
- Rocks
- Streams
- Pond

SVOCs in Soil
SE Drum Yard RFI Site

Date: September 15, 2008 WORKING DRAFT

\\..RFI_05\RFI_Report\CDot_BL_PLTS\RFIGrp5_CDotSVCsSoil_BL_PLTS.mxd

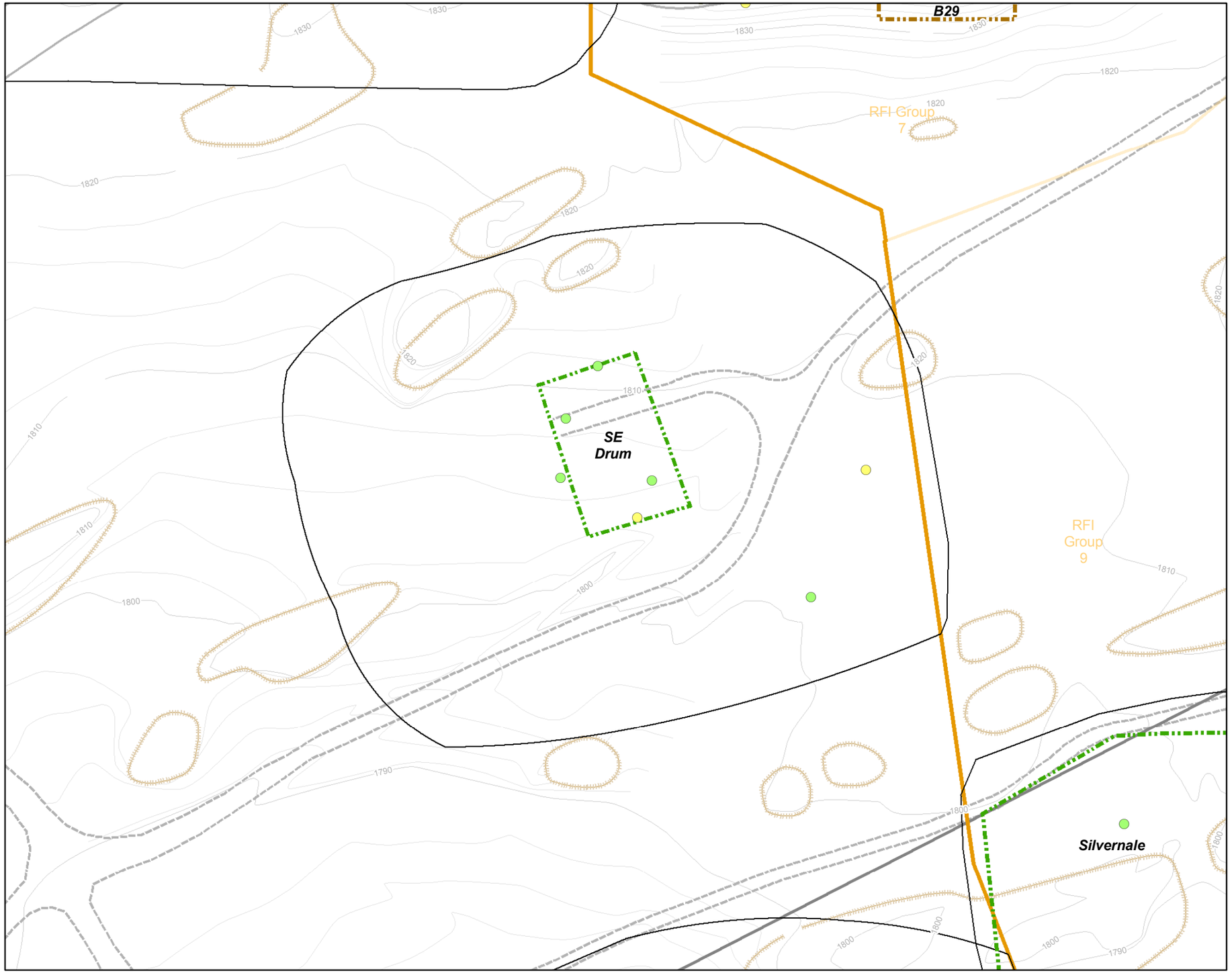
1 inch equals 60 feet

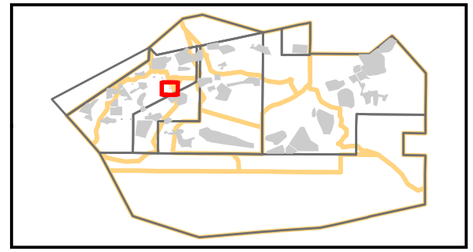
0 60 120 Feet

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure K.3-2





TPH in Soil

- Exceeds Residential RBSL
- Detect, Below Residential RBSL
- Non-detect

Basemap Legend

- Transformer Poles
- Tank - UST
- Tank - AST
- Tank - Not Yet Determined
- Excavation
- Leachfield
- Pipe
- 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 Group Boundary
- Administrative Area
- Property Boundary
- Drainage
- Road - Asphalt
- Roads - Dirt
- Rocks
- Streams
- Pond

TPH in Soil
SE Drum Yard RFI Site

Date: September 15, 2008 WORKING DRAFT

\\..RFI_05\RFI_Report\CDot_BL_PLTS\RFIGrp5_CDotTPHSoil_BL_PLTS.mxd

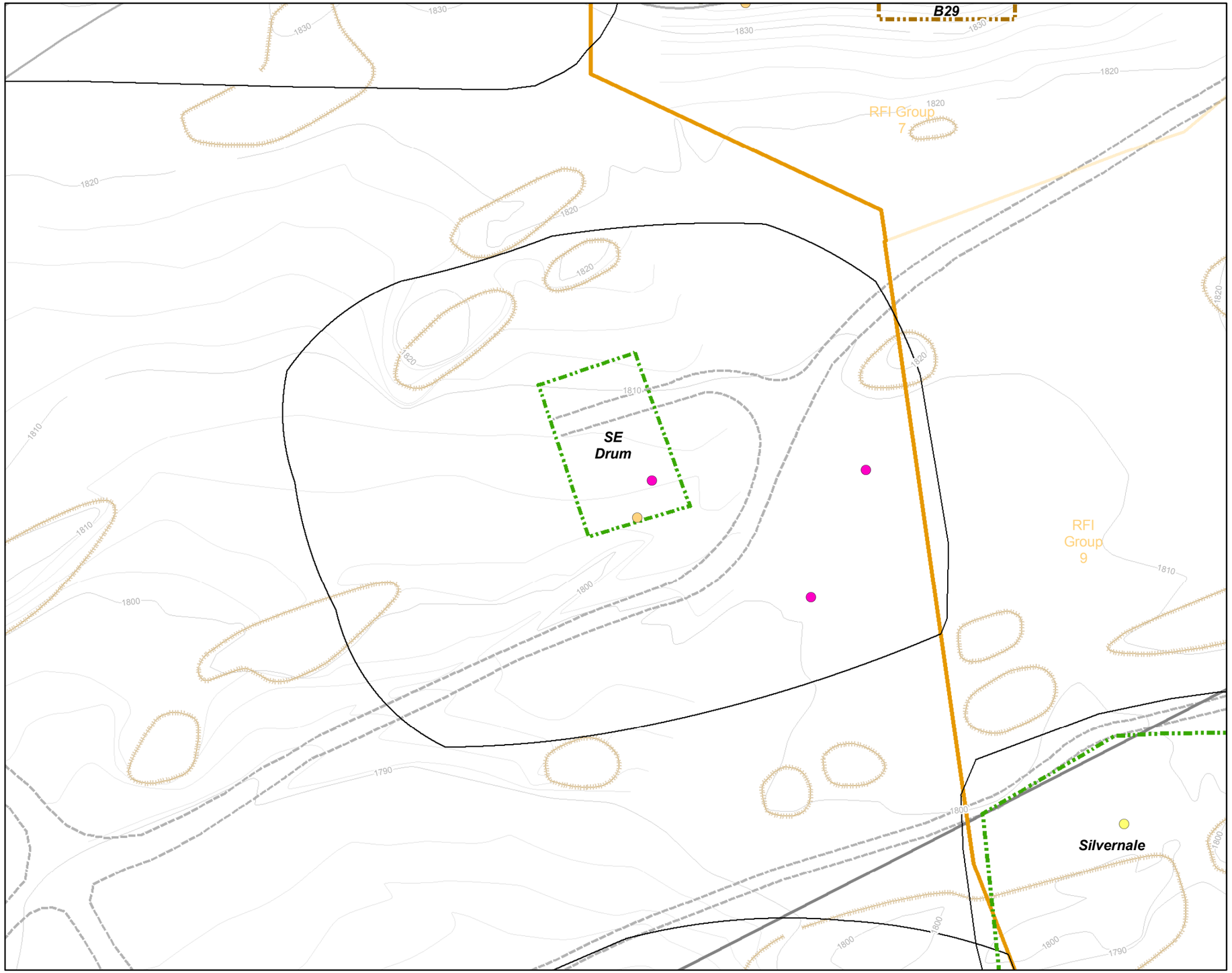
1 inch equals 60 feet

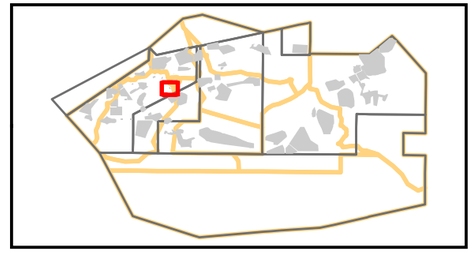
0 60 120 Feet

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure K.3-3





Metals in Soil

- Exceeds Background + Residential RBSL+ Eco RBSL
- Exceeds Background + Eco RBSL
- Exceeds Background
- Dectect, Below Background Concentration
- Non-detect

Basemap Legend

- Transformer Poles
- Tank - UST
- Tank - AST
- Tank - Not Yet Determined
- Excavation
- Leachfield
- Pipe
- 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 Group Boundary
- Administrative Area
- Property Boundary
- Drainage
- Road - Asphalt
- Roads - Dirt
- Rocks
- Streams
- Pond

Metals in Soil
SE Drum Yard RFI Site

Date: September 15, 2008 **WORKING DRAFT**

\\..RFI_05\RFI_Report\CDot_BL_PLTS\RFIGrp5_CDotMtlsSoil_BL_PLTS.mxd

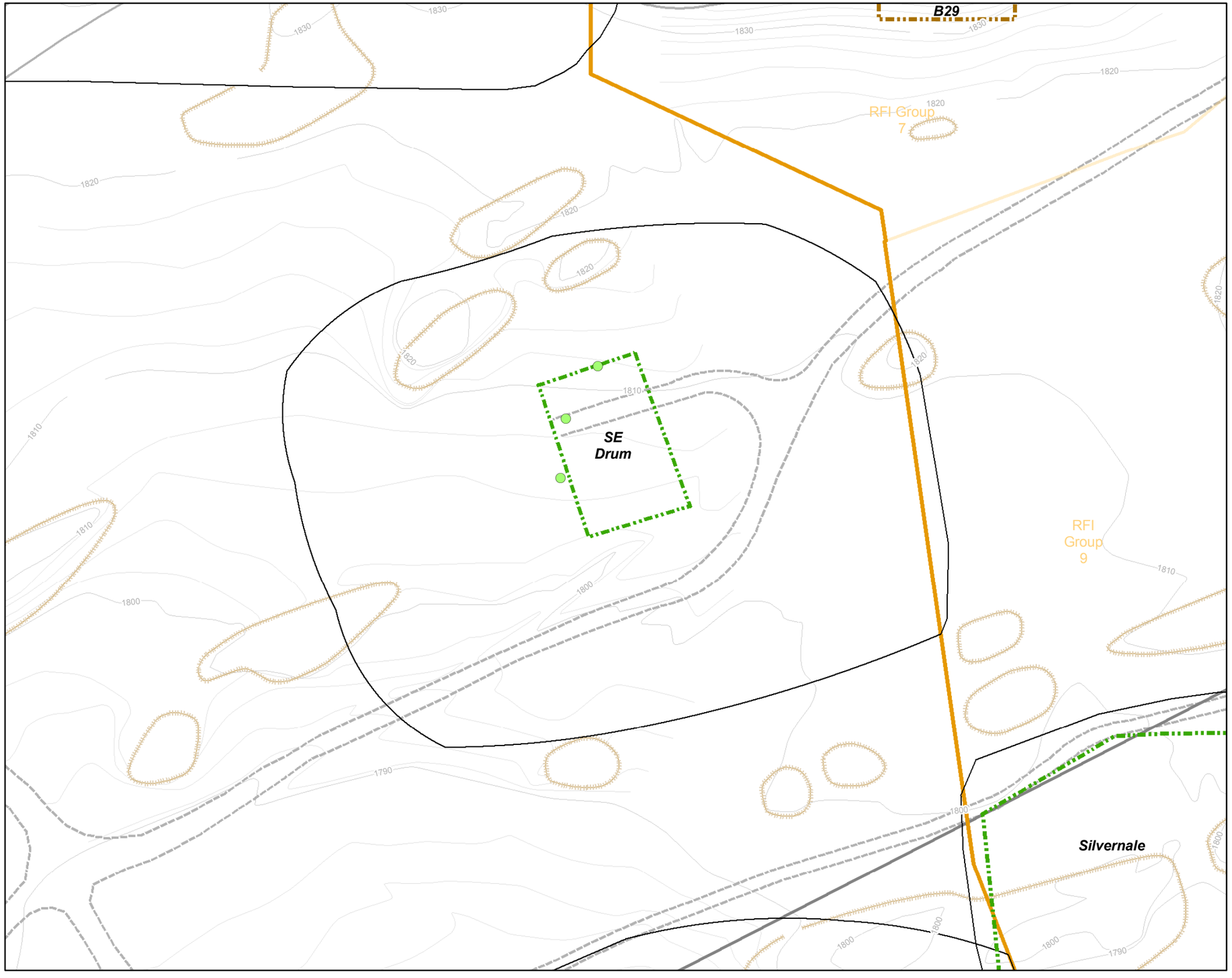
1 inch equals 60 feet

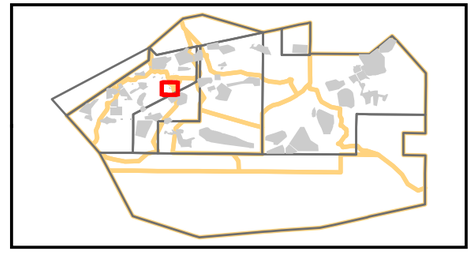
0 60 120 Feet

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure K.3-4





Energetics in Soil

- Detect, Below All Screening Levels
- Non-detect

Basemap Legend

- Transformer Poles
- Tank - UST
- Tank - AST
- Tank - Not Yet Determined
- Excavation
- Leachfield
- Pipe
- 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 Group Boundary
- Administrative Area
- Property Boundary
- Drainage
- Road - Asphalt
- Roads - Dirt
- Rocks
- Streams
- Pond

Energetics in Soil
SE Drum Yard RFI Site

Date: September 15, 2008 **WORKING DRAFT**

\\..RFI_05\RFI_Report\CDot_BL_PLTS\RFIGrp5_CDotEngtSoil_BL_PLTS.mxd

1 inch equals 60 feet

0 60 120 Feet

SANTA SUSANA FIELD LABORATORY

CH2MHILL

Figure K.3-5

Soil Sample Locations

- Soil Sample Location With Detected Organics
- Soil Sample Location Not Analyzed for Organics
- Soil Sample Location With No Detected Organics

Data Box Information

Sample Location ID: **B9BS01**

- 1.00 — Depth in Feet
- Primary — Sample Type
- B9BS01S01 — Unique Sample Identifier
- 7/10/2005 — Date

12.05	Detect with sample concentration shown
< 0.05	Non-Detect with lab detection limit shown
J	Analyte positively identified; Associated numerical value is considered estimated
NA and [-]	Analysis not conducted
[#]	If more than one result per sample depth, the maximum is presented, with number of results in backets.

Note: "12.05" and "<0.06" are for reference only and may not represent actual sample results.

Detect	Non-Detect	
12.05	<0.06	Exceeds Background (Metals + Dioxins Only)
12.05	<0.06	Exceeds Res RBSL or Exceeds Background + Res RBSL (Metals +Dioxins Only)
12.05	<0.06	Exceeds Eco RBSL or Exceeds Background + Eco RBSL (Metals + Dioxins Only)
12.05	<0.06	Exceeds Res RBSL + Eco RBSL or Exceeds Background + Res RBSL + Eco RBSL (Metals + Dioxins Only)

= 2008 Data

= Pre-2008 Data

Basemap Legend

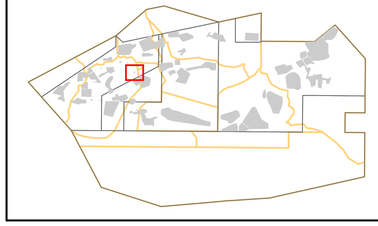
- Building - Existing
- Building - Removed
- Building - Not Yet Determined
- Road - Asphalt
- Roads - Dirt
- Rocks
- RFI Site - Boeing
- RFI Site - DOE
- RFI Site - NASA
- Investigation Boundary
- RFI Group Boundary
- Administrative Area
- Property Boundary
- Debris
- Multiple Use
- Solvent
- Petroleum
- Oil/PCBs
- Metals
- Energetic Constituents
- Propellants
- Leach Field
- Non-metal Inorganic Constituents
- Screening for Potential Impacts

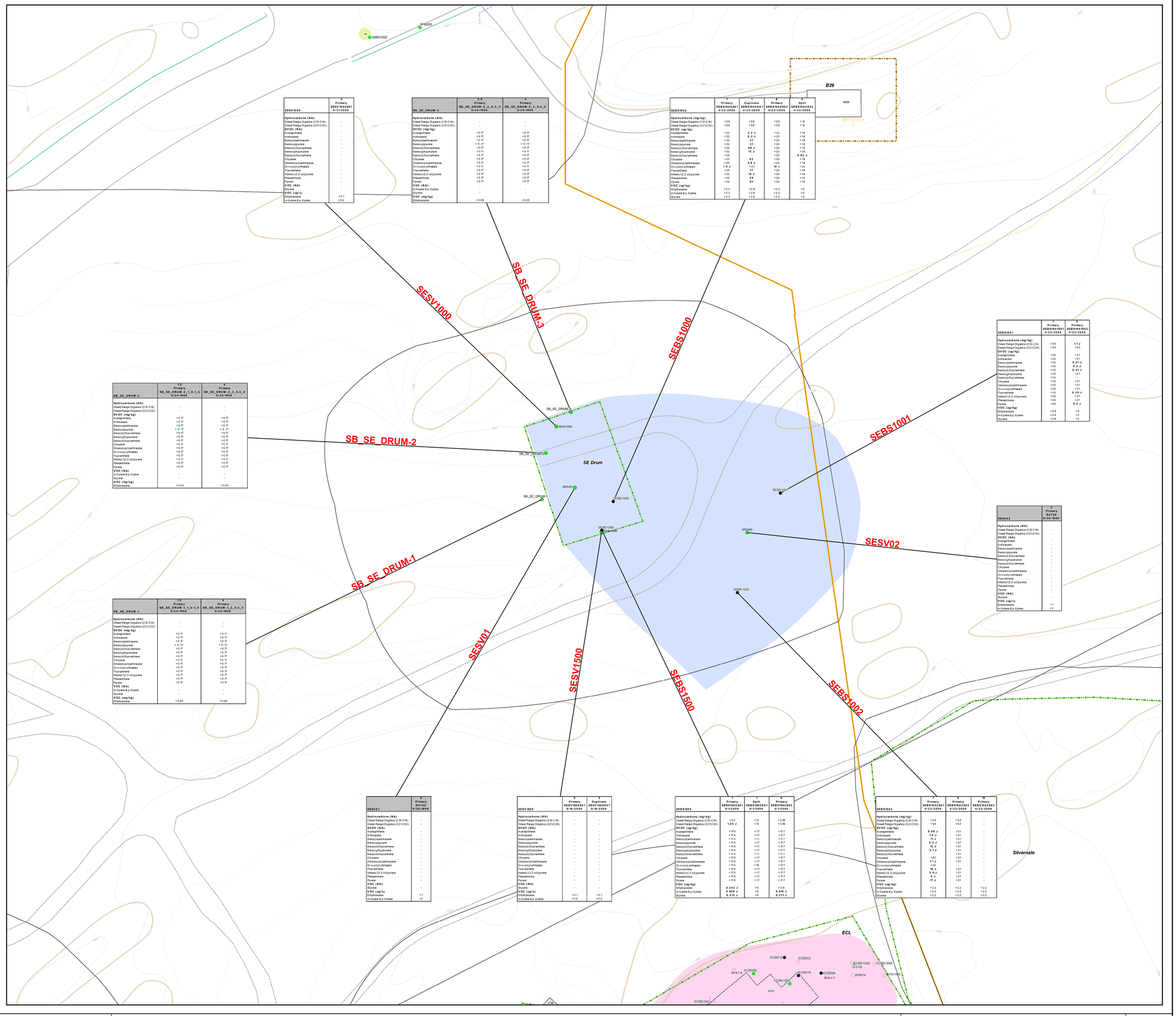
\\MapFiles\RFI_05\RFI_Report\SpiderDiagram\RFIGrp5_SpiderDiagram_EL.mxd

1 inch equals 25 feet

0 25 50

Feet





SESV1000	3 Primary SESV1000S01 4/17/2009
Hydrocarbons (NA)	
Diesel Range Organics (C12-C14)	-
Diesel Range Organics (C21-C30)	-
SVOC (NA)	
Acenaphthene	-
Anthracene	-
Benzo(a)anthracene	-
Benzo(a)pyrene	-
Benzo(b)fluoranthene	-
Benzo(ghi)perylene	-
Benzo(k)fluoranthene	-
Chrysene	-
Dibenzo(a,h)anthracene	-
Di-n-octyl phthalate	-
Fluoranthene	-
Indeno(1,2,3-cd)pyrene	-
Pyrene	-
VOC (NA)	
Styrene	-
VOC (ug/L)	
Ethylbenzene	<0.1
m,p-Xylene	<0.2

SB_SE_DRUM-3	2.5 Primary SB_SE_DRUM-3_2_0-2_5 8/24/1988	4 Primary SB_SE_DRUM-3_3_5-4_0 8/24/1988
Hydrocarbons (NA)		
Diesel Range Organics (C12-C14)	-	-
Diesel Range Organics (C21-C30)	-	-
SVOC (mg/kg)		
Acenaphthene	<0.17	<0.17
Anthracene	<0.17	<0.17
Benzo(a)anthracene	<0.17	<0.17
Benzo(a)pyrene	**< 0.17**	**< 0.17**
Benzo(b)fluoranthene	<0.17	<0.17
Benzo(ghi)perylene	<0.1/	<0.1/
Benzo(k)fluoranthene	<0.17	<0.17
Chrysene	<0.1/	<0.1/
Dibenzo(a,h)anthracene	<0.17	<0.17
Di-n-octyl phthalate	<0.1/	<0.1/
Fluoranthene	<0.17	<0.17
Indeno(1,2,3-cd)pyrene	<0.1/	<0.1/
Pyrene	<0.17	<0.17
VOC (NA)		
m,p-Xylene	-	-
Styrene	-	-
VOC (mg/kg)		
Ethylbenzene	<0.05	<0.05

SEBS1000	1 Primary SEBS1000S01 4/22/2008	1 Duplicate SEBS1000D01 4/22/2008	4 Primary SEBS1000S02 4/22/2008	5 Split SEBS1000X02 4/22/2008
Hydrocarbons (mg/kg)				
Diesel Range Organics (C12-C14)	<5.6	<5.6	<5.5	<13
Diesel Range Organics (C21-C30)	<56	<56	<55	<13
SVOC (ug/kg)				
Acenaphthene	<22	**2.2 J**	<22	<18
Anthracene	<22	**8.2 J**	<22	<18
Benzo(a)anthracene	<22	**37**	<22	<18
Benzo(a)pyrene	<22	**31**	<22	<18
Benzo(b)fluoranthene	<22	**49 J**	<22	<18
Benzo(ghi)perylene	<22	**12 J**	<22	<18
Benzo(k)fluoranthene	<22	-	<22	**0.92 J**
Chrysene	<22	**43**	<22	<18
Dibenzo(a,h)anthracene	<22	**6.9 J**	<22	<18
Di-n-octyl phthalate	**7.4 J**	<23	**18 J**	<20
Fluoranthene	<22	**77**	<22	<18
Indeno(1,2,3-cd)pyrene	<22	**14 J**	<22	<18
Phenanthrene	<22	**39**	<22	<18
Pyrene	<22	**61**	<22	<18
VOC (ug/kg)				
Ethylbenzene	<2.3	<2.8	<2.3	<5
m,p-Xylene	<2.3	<2.8	<2.3	<5
Styrene	<2.3	<2.8	<2.3	<5

SB_SE_DRUM-2	1.5 Primary SB_SE_DRUM-2_1_0-1_5 8/24/1988	4 Primary SB_SE_DRUM-2_3_5-4_0 8/24/1988
Hydrocarbons (NA)		
Diesel Range Organics (C12-C14)	-	-
Diesel Range Organics (C21-C30)	-	-
SVOC (mg/kg)		
Acenaphthene	<0.17	<0.17
Anthracene	<0.17	<0.17
Benzo(a)anthracene	<0.17	<0.17
Benzo(a)pyrene	**< 0.17**	**< 0.17**
Benzo(b)fluoranthene	<0.17	<0.17
Benzo(ghi)perylene	<0.17	<0.17
Benzo(k)fluoranthene	<0.17	<0.17
Chrysene	<0.1/	<0.1/
Dibenzo(a,h)anthracene	<0.17	<0.17
Di-n-octyl phthalate	<0.17	<0.17
Fluoranthene	<0.17	<0.17
Indeno(1,2,3-cd)pyrene	<0.1/	<0.1/
Phenanthrene	<0.17	<0.17
Pyrene	<0.17	<0.17
VOC (NA)		
m,p-Xylene	-	-
Styrene	-	-
VOC (mg/kg)		
Ethylbenzene	<0.05	<0.05

SB_SE_DRUM-1	1.5 Primary SB_SE_DRUM-1_1_0-1_5 8/24/1988	4 Primary SB_SE_DRUM-1_3_5-4_0 8/24/1988
Hydrocarbons (NA)		
Diesel Range Organics (C12-C14)	-	-
Diesel Range Organics (C21-C30)	-	-
SVOC (mg/kg)		
Acenaphthene	<0.1/	<0.1/
Anthracene	<0.17	<0.17
Benzo(a)anthracene	<0.17	<0.17
Benzo(a)pyrene	**< 0.17**	**< 0.17**
Benzo(b)fluoranthene	<0.17	<0.17
Benzo(ghi)perylene	<0.17	<0.17
Benzo(k)fluoranthene	<0.17	<0.17
Chrysene	<0.1/	<0.1/
Dibenzo(a,h)anthracene	<0.17	<0.17
Di-n-octyl phthalate	<0.17	<0.17
Fluoranthene	<0.17	<0.17
Indeno(1,2,3-cd)pyrene	<0.1/	<0.1/
Phenanthrene	<0.17	<0.17
Pyrene	<0.17	<0.17
VOC (NA)		
m,p-Xylene	-	-
Styrene	-	-
VOC (mg/kg)		
Ethylbenzene	<0.05	<0.05

SESV01	4 Primary RV740 9/30/1999
Hydrocarbons (NA)	
Diesel Range Organics (C12-C14)	-
Diesel Range Organics (C21-C30)	-
SVOC (NA)	
Acenaphthene	-
Anthracene	-
Benzo(a)anthracene	-
Benzo(a)pyrene	-
Benzo(b)fluoranthene	-
Benzo(ghi)perylene	-
Benzo(k)fluoranthene	-
Chrysene	-
Dibenzo(a,h)anthracene	-
Di-n-octyl phthalate	-
Fluoranthene	-
Indeno(1,2,3-cd)pyrene	-
Phenanthrene	-
Pyrene	-
VOC (NA)	
Styrene	-
VOC (ug/L)	
Ethylbenzene	<1
m,p-Xylene	<2

SESV1500	1 Primary SESV1500S01 5/16/2008	4 Duplicate SESV1500D01 5/16/2008
Hydrocarbons (NA)		
Diesel Range Organics (C12-C14)	-	-
Diesel Range Organics (C21-C30)	-	-
SVOC (NA)		
Acenaphthene	-	-
Anthracene	-	-
Benzo(a)anthracene	-	-
Benzo(a)pyrene	-	-
Benzo(b)fluoranthene	-	-
Benzo(ghi)perylene	-	-
Benzo(k)fluoranthene	-	-
Chrysene	-	-
Dibenzo(a,h)anthracene	-	-
Di-n-octyl phthalate	-	-
Fluoranthene	-	-
Indeno(1,2,3-cd)pyrene	-	-
Phenanthrene	-	-
Pyrene	-	-
VOC (NA)		
Styrene	-	-
VOC (ug/L)		
Ethylbenzene	<0.1	<0.1
m,p-Xylene	<0.2	<0.2

SEBS1500	1 Primary SEBS1500S01 5/12/2008	3 Split SEBS1500X01 5/12/2008	4 Primary SEBS1500S02 5/12/2008
Hydrocarbons (mg/kg)			
Diesel Range Organics (C12-C14)	<3.6	<15	<3.96
Diesel Range Organics (C21-C30)	**1.24 J**	<15	<3.96
SVOC (ug/kg)			
Acenaphthene	<17.5	<17	<17.7
Anthracene	<17.5	<17	<17.7
Benzo(a)anthracene	<17.5	<17	<17.7
Benzo(a)pyrene	<17.5	<17	<17.7
Benzo(b)fluoranthene	<17.5	<17	<17.7
Benzo(ghi)perylene	<17.5	<17	<17.7
Benzo(k)fluoranthene	<17.5	<17	<17.7
Chrysene	<17.5	<17	<17.7
Dibenzo(a,h)anthracene	<17.5	<17	<17.7
Di-n-octyl phthalate	<17.5	<16	<17.7
Fluoranthene	<17.5	<17	<17.7
Indeno(1,2,3-cd)pyrene	<17.5	<17	<17.7
Phenanthrene	<17.5	<17	<17.7
Pyrene	<17.5	<17	<17.7
VOC (ug/kg)			
Ethylbenzene	**0.262 J**	<6	<1.9
m,p-Xylene	**0.549 J**	<6	**0.514 J**
Styrene	**0.210 J**	<6	**0.271 J**

SEBS1001	1 Primary SEBS1001S01 4/22/2008	4 Primary SEBS1001S02 4/22/2008
Hydrocarbons (mg/kg)		
Diesel Range Organics (C12-C14)	<5.4	**1.1 J**
Diesel Range Organics (C21-C30)	<5.4	<5.3
SVOC (ug/kg)		
Acenaphthene	<22	<21
Anthracene	<22	<21
Benzo(a)anthracene	<22	**0.31 J**
Benzo(a)pyrene	<22	**0.2 J**
Benzo(b)fluoranthene	<22	**0.31 J**
Benzo(ghi)perylene	<22	<21
Benzo(k)fluoranthene	<22	-
Chrysene	<22	<21
Dibenzo(a,h)anthracene	<22	<21
Di-n-octyl phthalate	<22	<21
Fluoranthene	<22	**0.39 J**
Indeno(1,2,3-cd)pyrene	<22	<21
Phenanthrene	<22	<21
Pyrene	<22	**0.3 J**
VOC (ug/kg)		
Ethylbenzene	<2.6	<2
m,p-Xylene	<2.6	<2
Styrene	<2.6	<2

SESV02	4 Primary RV739 9/30/1999
Hydrocarbons (NA)	
Diesel Range Organics (C12-C14)	-
Diesel Range Organics (C21-C30)	-
SVOC (NA)	
Acenaphthene	-
Anthracene	-
Benzo(a)anthracene	-
Benzo(a)pyrene	-
Benzo(b)fluoranthene	-
Benzo(ghi)perylene	-
Benzo(k)fluoranthene	-
Chrysene	-
Dibenzo(a,h)anthracene	-
Di-n-octyl phthalate	-
Fluoranthene	-
Indeno(1,2,3-cd)pyrene	-
Phenanthrene	-
Pyrene	-
VOC (NA)	
Styrene	-
VOC (ug/L)	
Ethylbenzene	<1
m,p-Xylene	<2

SEBS1002	1 Primary SEBS1002S01 4/22/2008	4 Primary SEBS1002S02 4/22/2008	5 Primary SEBS1002S03 4/22/2008
Hydrocarbons (mg/kg)			
Diesel Range Organics (C12-C14)	<54	<53	-
Diesel Range Organics (C21-C30)	<54	<53	-
SVOC (ug/kg)			
Acenaphthene	**0.48 J**	<21	-
Anthracene	**1.8 J**	<21	-
Benzo(a)anthracene	**11 J**	<21	-
Benzo(a)pyrene	**8.3 J**	<21	-
Benzo(b)fluoranthene	**12 J**	<21	-
Benzo(ghi)perylene	**3.1 J**	<21	-
Benzo(k)fluoranthene	-	<21	-
Chrysene	<22	<21	-
Dibenzo(a,h)anthracene	**1.1 J**	<21	-
Di-n-octyl phthalate	<22	<21	-
Fluoranthene	**16 J**	<21	-
Indeno(1,2,3-cd)pyrene	**3.8 J**	<21	-
Phenanthrene	**6 J**	<21	-
Pyrene	**17 J**	<21	-
VOC (ug/kg)			
Ethylbenzene	<2.2	<2.2	<2.2
m,p-Xylene	<2.2	<2.2	<2.2
Styrene	<2.2	<2.2	<2.2

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Organics Data Results
SE Drum Yard RFI Site

FIGURE K.3-6

Soil Sample Locations

- Soil Sample Location With Detected Metals and Inorganics Data
- Soil Sample Location Not Analyzed for Metals and Inorganics Data
- Soil Sample Location With No Detected Metals and Inorganics Data

Data Box Information

Sample Location ID — B9BS01; 1.00 — Depth in Feet; Primary — Sample Type; B9BS01S01 — Unique Sample Identifier; 7/10/2005 — Date

12.05 — Detect with sample concentration shown
< 0.06 — Non-Detect with lab detection limit shown
J — Analyte positively identified; Associated numerical value is considered estimated
NA and [-] — Analysis not conducted
[#] — If more than one result per sample depth, the maximum is presented, with number of results in backets.

Note: "12.05" and "<0.06" are for reference only and may not represent actual sample results.

Detect	Non-Detect	
12.05	<0.06	Exceeds Background (Metals + Dioxins Only)
12.05	<0.06	Exceeds Res RBSL or Exceeds Background + Res RBSL (Metals +Dioxins Only)
12.05	<0.06	Exceeds Eco RBSL or Exceeds Background + Eco RBSL (Metals + Dioxins Only)
12.05	<0.06	Exceeds Res RBSL + Eco RBSL or Exceeds Background + Res RBSL + Eco RBSL (Metals + Dioxins Only)

= 2008 Data

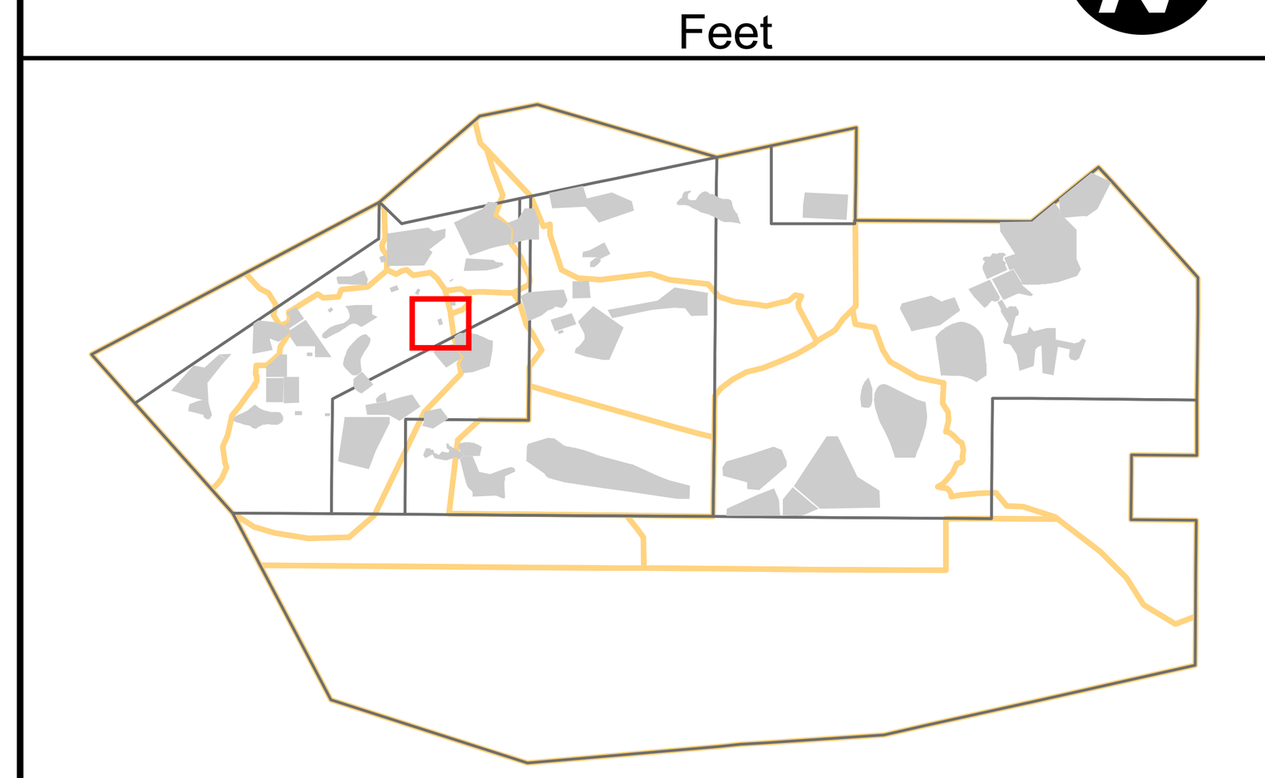
= Pre-2008 Data

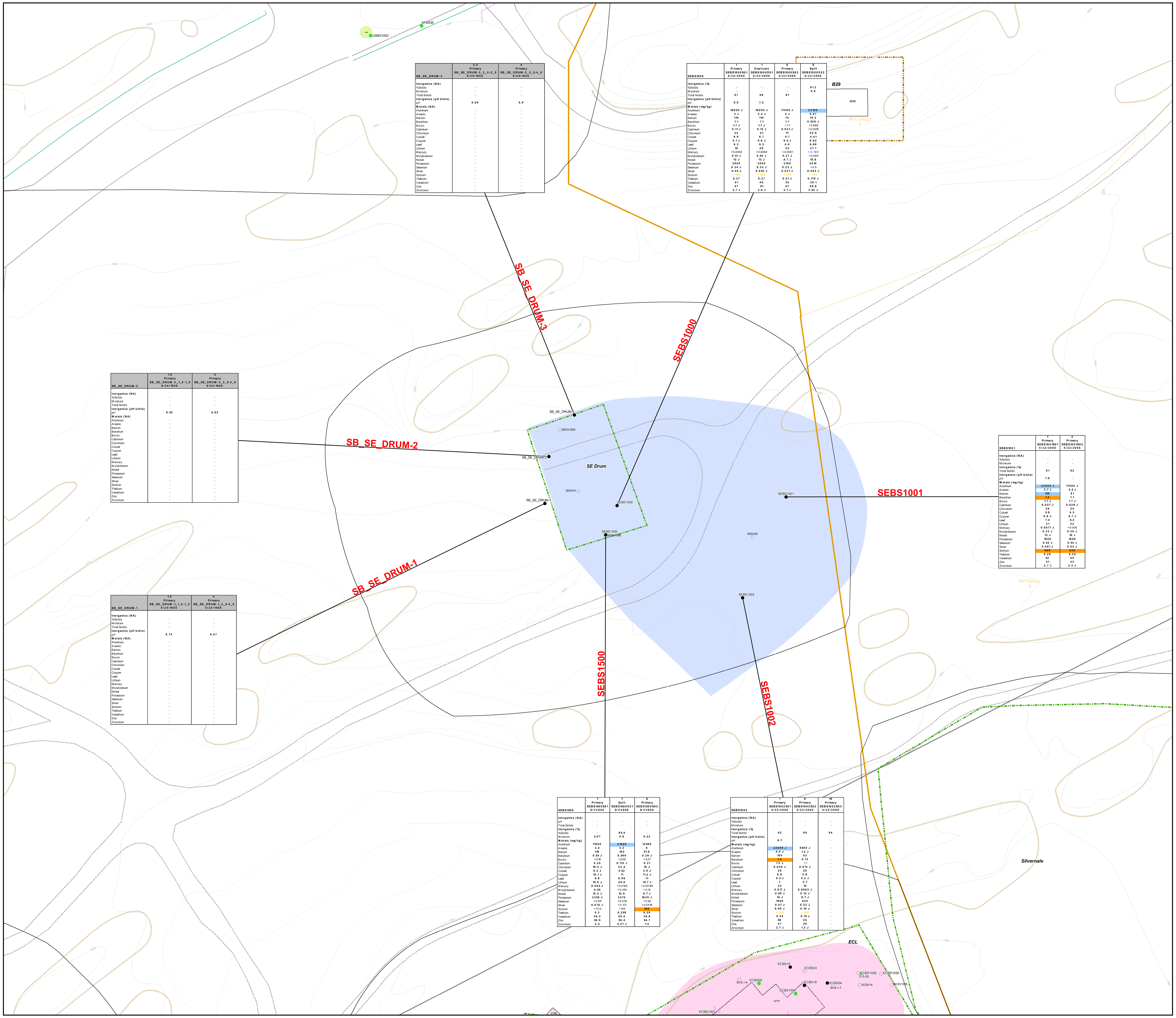
Basemap Legend

- Building - Existing
- Building - Removed
- Building - Not Yet Determined
- Road - Asphalt
- Roads - Dirt
- Rocks
- RFI Site - Boeing
- RFI Site - DOE
- RFI Site - NASA
- Investigation Boundary
- RFI Group Boundary
- Administrative Area
- Property Boundary
- Debris
- Multiple Use
- Solvent
- Petroleum
- Oil/PCBs
- Metals
- Energetic Constituents
- Propellants
- Leach Field
- Non-metal Inorganic Constituents
- Screening for Potential Impacts

\\MapFiles\RFI_05\RFI_Report\SpiderDiagram\RFIGrp5_SpiderDiagram_EL.mxd

1 inch equals 25 feet — 0 25 50 Feet





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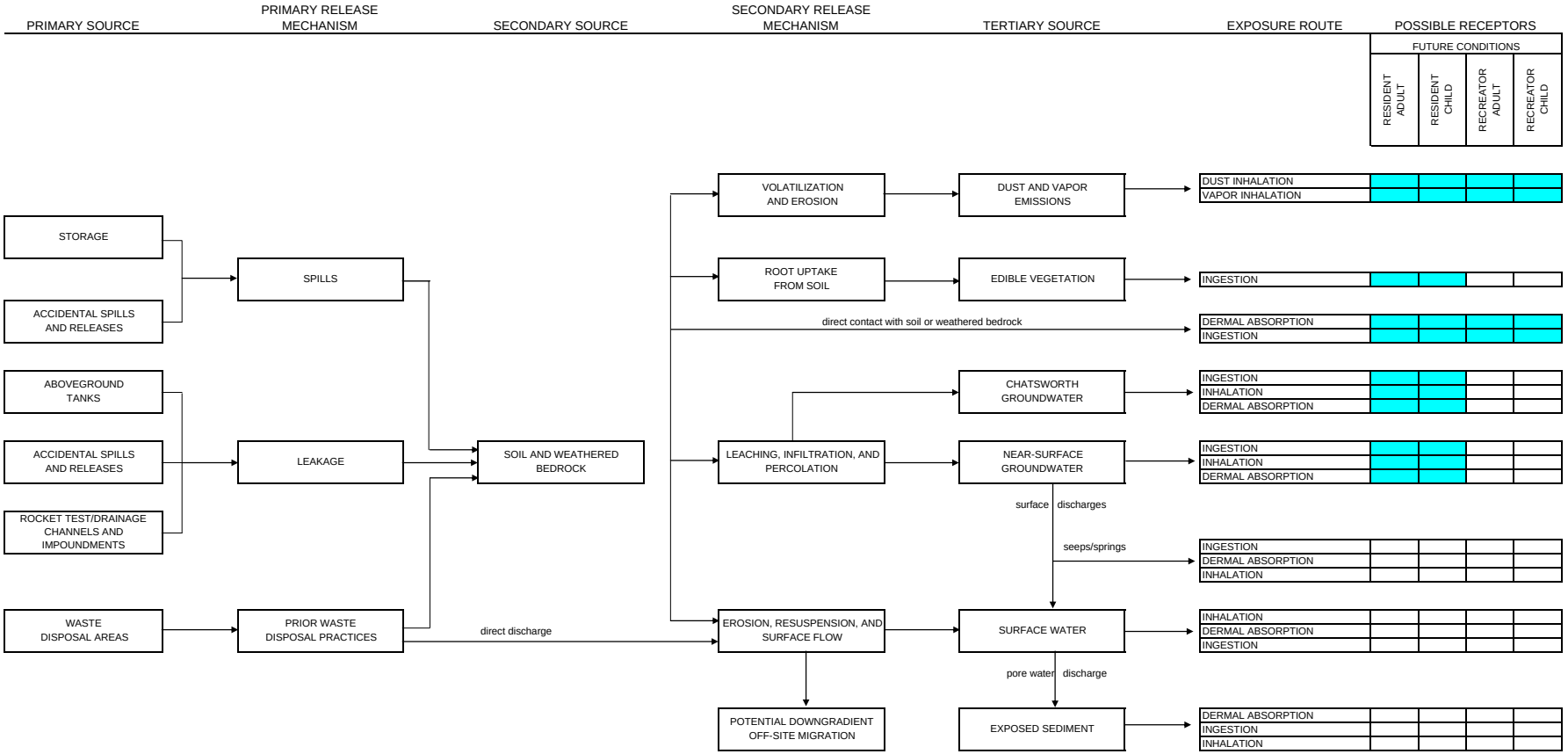
Metals and Inorganics Data Results
SE Drum Yard RFI Site

FIGURE K.3-7

Figure K.4-1

Human Health Risk Assessment Conceptual Site Model

Southeast Drum Storage Yard RFI Site

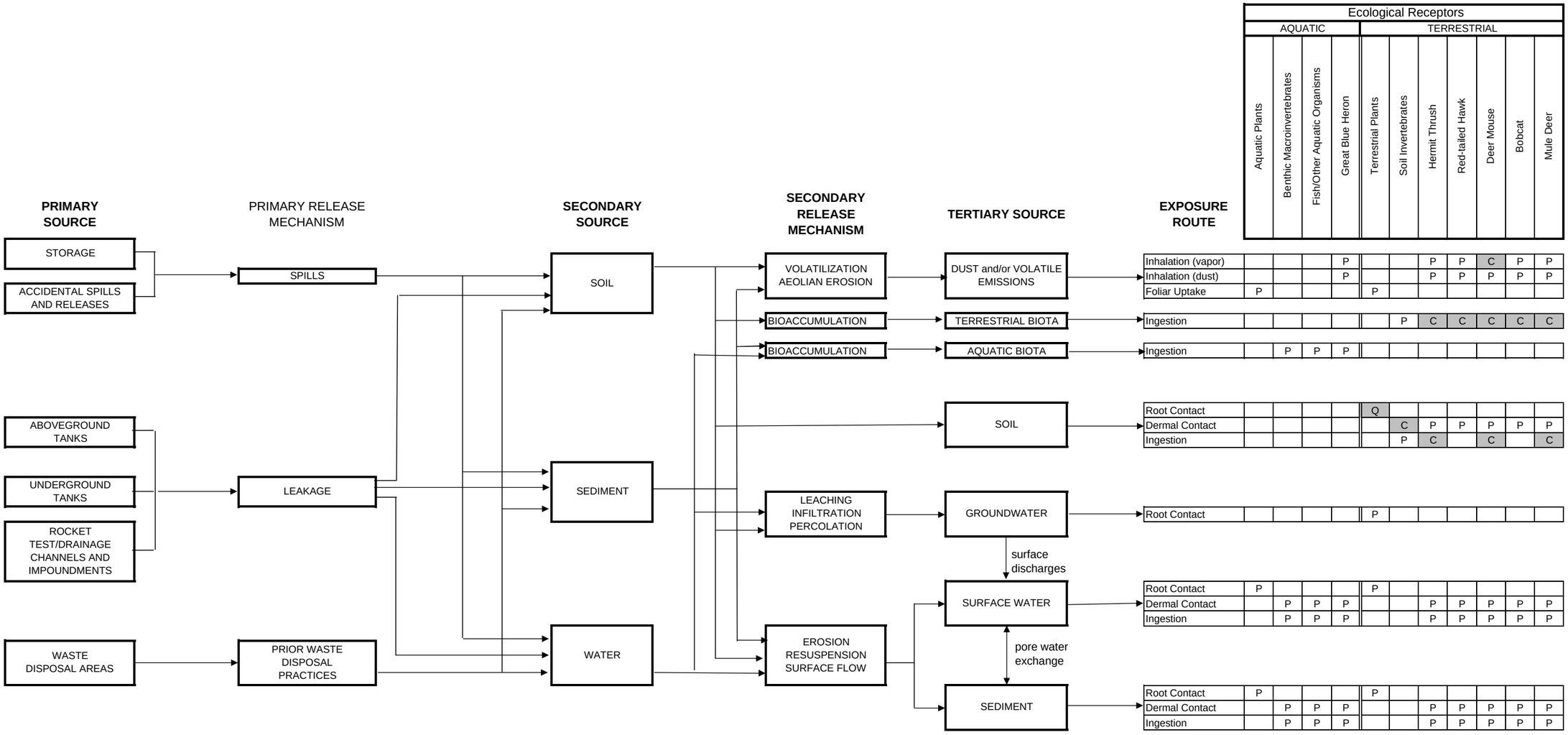


NOTES:

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 K.4-2
Ecological Conceptual Site Model
Group 5 RFI Report, Southeast Drum Storage Yard
Santa Susana Field Laboratory

Attachments