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National Park Service
Sequoia and Kings Canyon National Parks
Three Rivers, California

Engineering Evaluation/Cost Analysis Report

Lower Kaweah Dump Area (SWMU #11)
Sequoia and Kings Canyon National Parks
Tulare County, California

November 5, 2014

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TABLE OF CONTENTS

Page

FIGURES

EMBEDDED TABLES

ATTACHMENTS

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ACRONYMS AND ABBREVIATIONS

amsl	above mean sea level
ARAR	Applicable or Relevant and Appropriate Requirement
AUF	Area Use Factor
bgs	below ground surface
CAMU	Corrective Action Management Unit
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
COC	contaminant of concern
COPC	constituent of potential concern
CSM	conceptual site model
cy	cubic yard
DDE	dichlorodiphenyldichloro-ethylene
DDT	dichlorodiphenyltrichloroethane
DTSC	Department of Toxic Substances Control
DRO	Diesel range organics
DU	decision unit
ECM	Environmental Cost Management, Inc.
ED	exposure dose
EE/CA	Engineering Evaluation/Cost Analysis
EPA	United States Environmental Protection Agency
EPC	exposure point concentration
°F	Degrees Fahrenheit
GPS	global positioning system
HERA	Human Health and Ecological Risk Evaluation
HI	Hazard Index
HQ	Hazard Quotient
IC	Institutional Control
ISM	Incremental Sampling Methodology
kg	kilogram
MCL	maximum contaminant levels
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MI	multi-increment
NCP	National Oil and Hazardous Substance Pollution Contingency Plan
NPS	National Park Service
NTCRA	non-time critical removal action
OM&M	operation, maintenance, and monitoring

PA	Preliminary Assessment
PCB	Polychlorinated Biphenyl
pg/g	picograms per gram
PRG	Preliminary Remediation Goal
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RAO	Removal Action Objectives
RCRA	Resource Conservation and Recovery Act
RSL	Regional Screening Level
RSV	risk screening value
RWQCB	Regional Water Quality Control Board
SA	site assessment
SEKI	Sequoia and Kings Canyon National Parks
SI	site investigation
sq ft	square feet
SRE	streamlined risk evaluation
SSSL	site specific screening level
STLC	soluble threshold limits concentrations
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TCLP	toxicity characteristic leaching procedure
TRV	Toxicity Reference Value
TTLC	Total Threshold Limit Concentrations
UCL	upper confidence limit
U.S.C.	United States Code
VOC	volatile organic compound

EXECUTIVE SUMMARY

The Department of Interior, National Park Service (NPS) retained Environmental Cost Management, Inc. (ECM) to prepare an Engineering Evaluation/Cost Analysis (EE/CA) Report for the Lower Kaweah Dump Area, Solid Waste Management Unit (SWMU) #11 at Sequoia and Kings Canyon National Parks (SEKI) in Tulare County, California (**Figure 1.1**). NPS is engaging in a non-time critical removal action (NTCRA) process at SEKI, using their authority under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

NPS identified an old dumpsite during inspections of the Lower Kaweah area within the Giant Forest at Sequoia National Park. In 1998[1] and 2001[2], two site investigations reported that materials present on the surface of the dump pile consisted of wood, concrete, asphalt fragments, and other debris. The contents of the dump fill consisted mostly of burn materials. Some of the observed fill materials consisted of ash, metal, glass, sheet metal, porcelain, aluminum pans and pitchers, wire, pipes, metal paint cans, wood chips and roots. No water was observed atop the bedrock surface below the dump fill material.

A Human Health and Ecological Risk Evaluation[3] (HERA) for the Site concluded that no unacceptable human or ecological effects from site contaminants were expected to occur. In the HERA it is reported that the Site is covered with a clean soil/gravel cover material, 1 to 2 feet thick. Documentation for the design and dates of placement of this cover material do not exist, but correspondence between NPS and Department of Toxic Substances Control (DTSC) indicate that this cover was placed during the year 2000 or 2001 with apparent DTSC approval.

The 1998 and 2001, Site Investigation (SI) and expanded Site Assessment (SA), respectively, indicated that CERCLA hazardous substances were present at elevated concentrations in materials and soils in the dump area. Because the exact locations of samples collected during both investigations are not clearly identified, and composite samples were collected mixing suspected clean soil with impacted soil, the extent of contamination was not clearly defined. This represents a gap in the Site characterization. Although the HERA concluded no human or ecological exposure risk exits, NPS reviewed all available Site information and concluded that the SI and expanded SA did not completely characterize the nature and extent of contamination

[1] Kleinfelder, 1998.
[2] Kleinfelder, 2002.
[3] U.S. Army Corps of Engineers, 2005.

for purposes of conducting a NTCRA. To address these gaps in the characterization of contamination, NPS directed ECM to prepare and perform a Work Plan[4] to address the remaining data needs for a complete Site characterization and the preparation of this EE/CA Report.

Using the additional collected data, ECM completed a streamlined risk evaluation (**Section 2.6**) for human and ecological receptors that indicates hazard indices above one, for both ecological and human receptors, which indicate that leaving the impacted soil and waste materials associated with the Lower Kaweah Dump Area in its present condition, could pose an unacceptable risk to human health and the environment.

The scope of removal action evaluated in this EE/CA Report focuses on the following removal action objectives (RAO):

- Prevent or reduce the potential for human and ecological exposure (through inhalation, ingestion, and dermal contact) to contaminants of concern (COCs) in soil.
- Prevent or reduce potential migration of impacts via surface runoff, erosion, and wind dispersion.

Four removal action technologies were reviewed (**Section 4**) to develop the following four removal action alternatives:

- Alternative 1 – No Action
- Alternative 2 – Capping, Re-vegetation and Institutional Controls
- Alternative 3 – Capping, Phytoremediation and Institutional Controls
- Alternative 4 – Excavation and Off-Site Disposal

The four removal action alternatives were evaluated based on the following overall criteria:

1) Effectiveness
    a) Protectiveness
    b) Level of treatment and/or containment
    c) Reduction or elimination of contaminants of concern

[4] Environmental Cost Management, Inc. (ECM), 2014. *Work Plan for Additional Soil Assessment, Sequoia and Kings Canyon National Parks, Three Rivers*, CA. March 6.

2) Implementability
   a) Technical feasibility
   b) Administrative and legal feasibility
   c) Ease of Implementation
3) Cost
   a) Capital cost
   b) Post removal site controls cost
   c) Present worth value / present cost
   d) Long-term operation, maintenance and monitoring (OM&M) costs

Effectiveness and implementability have been evaluated in detail in subsections presented for each alternative in **Section 5**.

Based on the information presented in this EE/CA Report and previous investigations, it is recommended to implement Alternative 4, consisting of Excavation and Off-Site Disposal. Alternative 4 is the most protective of human health and ecological resources and it will eliminate the potential for environmental impacts, in the short- and long-term, immediately after completion, meeting all the evaluation criteria. There are no post-removal OM&M activities associated with the implementation of Alternative 4.

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1.0 INTRODUCTION

On behalf of the Department of the Interior, National Park Service (NPS), Environmental Cost Management, Inc. (ECM) prepared this Engineering Evaluation/Cost Analysis (EE/CA) Report for the Sequoia and Kings Canyon National Parks (SEKI) in Three Rivers, California **(Figure 1.1).** This EE/CA Report addresses the Lower Kaweah Dump Area, referred herein as “the Site”, because of elevated concentrations of contaminants found in soil during previous and recent investigations.

1.1 AUTHORITY

This EE/CA Report has been prepared in accordance with the criteria established under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as well as sections of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) as applicable to removal actions (40 Code of Federal Regulations [CFR] §300.415 [b][4][I]). NPS has been delegated CERCLA lead agency authority by the President of the United States and the Secretary of the Interior, and is exercising this authority at the Site. This EE/CA is consistent with the United States Environmental Protection Agency (EPA) Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA, EPA/540-R-93-057, Publication 9360.0.32, PB93-963402, August 1993.

1.2 PURPOSE AND OBJECTIVES

This EE/CA provides an engineering evaluation to support the selection of a Non-Time-Critical Removal Action (NTCRA) for the Site. Environmental investigations at the Site have identified conditions that correspond to factors in Section 300.415(b)(2) of NCP (40 C.F.R. 300.415). These conditions indicate that an NTCRA may be necessary to abate, prevent, minimize, stabilize, mitigate, or eliminate threats to human health and the environment.

National Oil and Hazardous Substance Pollution Contingency Plan (NCP) discusses three types of removal actions: emergency, time critical, and non-time-critical. These designations are based on the urgency with which cleanup must be initiated to respond to a threat to human health and the environment posed by a release or potential release of hazardous substances. Emergency and time-critical removal actions are initiated to respond to a release or potential release where less than six months are available for planning the response. An NTCRA may be implemented at SEKI Lower Kaweah Dump Site, because the *Site Investigation*[5], *Site Assessment*[6] and *Risk Assessment*[7] indicated that no immediate threat to human health or the environment exists at the Site, therefore NPS determined that more than six months are available for planning a response for the identified source of contaminants.

An Approval Memorandum (**Attachment A**) authorized the preparation of this EE/CA Report. The Approval Memorandum is the first step in NTCRA process. Section 300.415(b)(4)(I) of NCP requires the development of an EE/CA Report with a public comment period, prior to the signing of the Action Memorandum to initiate the selected alternative for NTCRA.

The EE/CA Report identifies removal action objectives for protection of human health and the environment, identifies removal action alternatives, and assesses the effectiveness, implementability, and cost of the alternatives that satisfy the removal action objectives.

The EE/CA Report considers the nature of the contamination, any potential risks to human health and the environment, and how the alternatives fit into the strategy for Site remediation.

The goals of the EE/CA Report include:

- Conduct a Streamlined Risk Evaluation (SRE) to determine the potential threats posed by contamination originating from the Site;
- Prepare a list of remedial technologies, screen the remedial for Site specific goals assemble selected technologies into proposed removal action alternatives and propose a removal action alternative to address contamination;
- Provide a framework for the evaluation and selection of potential response actions and applicable technologies consistent with the NCP and EPA Guidance.

1.3 BACKGROUND/SITE HISTORY

NPS identified an old dumpsite during inspections of the Lower Kaweah area within the Giant Forest at Sequoia National Park. The specific contents of the suspected dumpsite were undocumented and unknown, but thought to include burn ash from the former Lower Kaweah incinerator. In 1998[8] and 2001[9], two site investigations indicated that materials present on the

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5 Kleinfelder, Inc. *Site Investigation Report, Giant Forest – Lower Kaweah Dump Area.* Sequoia National Park, California. November 25, 1998.

6 Kleinfelder, Inc. *Lower Kaweah Dump Area, Expanded Site Assessment.* Sequoia National Park, California. January 11, 2002.

7 US Army Corps of Engineers. Sacramento District, Environmental Design Section, *Human Health and Ecological Risk Evaluation Lower Kaweah Dump Area*, Sequoia National Park, California, Draft, August 2005.

8 Kleinfelder, 1998.

9 Kleinfelder, 2002.

surface of the dump pile consisted of wood, concrete, asphalt fragments, and other debris. The contents of the dump fill consisted mostly of burn materials. Some of the observed fill materials consisted of ash, metal, glass, sheet metal, porcelain, aluminum pans and pitchers, wire, pipes, metal paint cans, wood chips and roots. No water was observed atop the bedrock surface below the dump fill material.

A Human Health and Ecological Risk Evaluation[10] (HERA) for the Site concluded that no unacceptable human or ecological effects from site contaminants were expected to occur. In the HERA it is reported that the Site is covered with a clean soil/gravel cover material, 1 to 2 feet thick. Documentation for the design and dates of placement of this cover material do not exist, but correspondence between NPS and DTSC indicate that this cover was placed during the year 2000 or 2001 with apparent DTSC approval. According the HERA report, as a result of this cover material, direct exposure to the contaminated soil/debris is not likely to occur. In the HERA report it is assumed that potential receptors could come in direct contact with the contaminated soil and debris, as if no cover was present at any portion of the dump area, theoretically overestimating the risk for actual receptors. However, the HERA used data from the existing *Site Investigation*[11] and *Site Assessment*[12], which may not have captured representative concentrations due to composite soil sampling mixing from suspected clean areas with impacted areas. Finally, background concentrations had not been established for the Site.

After reviewing the entire presented Site information, NPS concluded that the *Site Investigation* and *Site Assessment* performed did not completely characterize the nature and extent of contamination at the Site and that the conclusions and recommendation in the HERA report could not be applied. ECM reviewed the data from these reports and performed additional site assessment activities to facilitate the completion of this EE/CA Report.

[10] U.S. Army Corps of Engineers, 2005.
[11] Kleinfelder, 1998.
[12] Kleinfelder, 2002.

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2.0 SITE CHARACTERIZATION

This section gives a general site description and an overview of site investigations that have been completed to characterize the nature and extent of impacts to soil at the Site.

2.1 SITE DESCRIPTION

The Site is located near a maintenance yard, at approximately 1,350 feet northwest of the Giant Forest Museum, located at the intersection of Generals Highway and Crescent Meadow Road in the Lower Kaweah area of the Giant Forest in SEKI (**Figure 2.1**). The Site covers an approximate 11,500-square-foot area of non-symmetrical shape (approximately an oval shape) at an elevation of approximately 6,400 feet above mean sea level (amsl). The dump area is mainly level and gently slopes (approximately 0.13 ft/ft) to the southwest. The thickness of the dump fill material ranges from 2 to 9 feet, with an estimated average thickness of 5 feet. A mixed-conifer forest surrounds the area with topography sloping gently to the southwest (approximately 0.17 ft/ft). Numerous large downed pine trees cross portions of the Site and the general vicinity. A large granite slab (bedrock) exists on the north side of the adjacent trail road, and slopes towards the dump (**Figure 2.2**).

2.1.1 Geology and Geohydrology

The Site is located in an area of near-surface granitic bedrock, which is characteristic of the upper elevations of the Sierra Nevada Mountains. Soil accumulations are generally granular in nature and relatively thin. Groundwater in this environment is usually present in localized fractures in the bedrock or not at all. No surface water or shallow groundwater was encountered above the bedrock in the area of the Site during previous explorations. However, during periods of heavy rain or snowmelt in the spring, the ground may become saturated in localized areas.

Geology/Geologic History[13]

SEKI is the home of prominent and renowned geological features and resources. The parks contain a significant portion of America's longest mountain range, the Sierra Nevada. Included in the Parks' mountainous landscape is the tallest mountain in the contiguous United States, Mt. Whitney, which rises to 14,491 feet above sea level. Eleven additional peaks taller than 14,000 feet are also found along the parks' eastern boundaries at the crest of the Sierra Nevada.

[13] National Parks Service. Sequoia and Kings Canyon, Geology Overview. http://www.nps.gov/seki/naturescience/geology_overview.htm.

In Kings Canyon National Park, prominent ridges extend westward from the crest creating the Goddard and Monarch divides with mountains taller than 13,000 feet. In Sequoia National Park, a second prominent ridge of mountains, The Great Western Divide, parallels the Sierran crest. These mountains of the Great Western Divide are visible in Mineral King and from Moro Rock and the Giant Forest area. Peaks in the Great Western Divide climb to more than 12,000 feet.

Between these mountains lie deep, spectacular canyons. The most significant is Kings Canyon. In the parks, Kings Canyon is a wide glacial valley featuring tall cliffs, a meandering river, meadows, and waterfalls. A few miles outside the parks, Kings Canyon deepens and steepens becoming arguably the deepest canyon in North America for short distance. The confluence of the South Fork and Middle forks of the Kings River lies at 2,260 feet, while towering above the rivers on the north side of the canyon is Spanish Peak, which is 10,051 feet tall. The south side of this canyon above the confluence is significantly lower. Dozens of other canyons include Tokopah Valley above Lodgepole, Deep Canyon on the Marble Fork of the Kaweah River, and, deep in the parks' remote backcountry, Kern Canyon, which is more than 5,000 feet deep for 30 miles. The parks are headwaters for the Kaweah River, the Kern River, two forks of the Kings River and small areas of the San Joaquin and Tule river watersheds.

Most of the mountains and canyons in the Sierra Nevada are formed in granitic rocks. These rocks, such as granite, diorite and monzonite, formed when molten rock cooled far beneath the surface of the earth. The molten rock was a by-product of a geologic process known as subduction. Plate tectonics forced the landmass under the waters of the Pacific Ocean beneath and below an advancing North American Continent. Super-hot water driven from the subjecting ocean floor migrated upward and melted rock as it went. This process took place during the Cretaceous Period 100 million years ago. Granitic rocks have speckled salt and pepper appearance because they contain various minerals including quartz, feldspars and micas.

While geologists debate the details, it is clear that the Sierra Nevada is a young mountain range, probably not more than 10 million years old. Incredible forces in the earth, probably associated with the development of the Great Basin, forced the mountains upwards. During the 10 million years, at least four periods of glacial advance have coated the mountains in a thick mantle of ice. Glaciers form and develop during long periods of cool and wet weather. Today, a few small glaciers remain in the parks. They are the southern-most glaciers in North America. Glaciers move through the mountains like slow-motion rivers carving deep valleys and craggy peaks. The extensive history of glaciation within the range and the erosion resistant nature of the granitic rocks that make up most of the Sierra Nevada have together created a landscape of hanging valleys, towering waterfalls, craggy peaks, alpine lakes and large glacial canyons.

The Sierra Nevada is still growing today. In fits and leaps the mountains gain height during earthquakes on the east side of the range near Bishop and Lone Pine. Rain and winter snows combined with a steep landscape induce massive movements of sediment and rapid erosion. The mountains are being removed by erosion almost as quickly as they grow. This erosion has created and deposited sediments thousands of feet thick on the floor of the San Joaquin and Sacramento Valleys.

Small sections of the park contain areas of metamorphic rocks. These rocks are the remnants of volcanic islands that were added to North America before the Sierra Nevada uplift. They include metamorphosed volcanic rocks, schist, quartzite, phyllite, and marble.

Hydrology[14]

SEKI contains some 3,200 lakes and ponds and approximately 2,600 miles of rivers and streams. Three major rivers originate in these parks --Kings, Kaweah and Kern. These rivers provide valuable irrigation water to agricultural lands in Fresno, Kern and Tulare counties as well as water for recreation and industrial activities outside the parks. The monitoring and maintenance of watershed health is clearly of interest not only to park managers but also to water users throughout this region.

Winter snowpack in the Sierra Nevada is a natural storage system for the precipitation that accumulates during winter months. The amount of water stored as snowpack increases through mid-April at higher elevations. Melt off typically begins in April and continues through May or June. October is the month in which the least water runoff occurs from park watersheds. Snowfields, forests, lakes and streams collect, store, and release the water supplied from winter storms, so it is available throughout the dry summers for agriculture, recreation, electrical power generation and other uses. The amount of snowpack is also important to park vegetation and wildlife. In years of low snowpack accumulation, less water is available for plant growth (for example, many trees will produce a small annual ring in years of drought). During these drought years, reduced plant growth and fruit and seed production result in altered food production for wildlife.

Water determines the distribution and abundance of many plants and animals throughout the Sierra Nevada by shaping and providing habitat. Lakes and streams support rich communities of native organisms both in the water and in adjoining riparian areas. Water is also a powerful attractant to human visitors to these parks, as is evident from the popularity of rivers, streams and lakes as destinations for picnickers, hikers, campers and anglers. Introduced (non-native) animals, human use of rivers and lakes, runoff and effluent from park developed areas and ecosystem-level, human-caused changes have had negative impacts on SEKI water resources. Park research, inventory and monitoring are critical in identifying changes in water quality and quantity and declines in native plant and animal populations that can result from human-caused impacts to aquatic systems.

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[14] National Parks Service. Sequoia and Kings Canyon, Water Resources Overview. http://www.nps.gov/seki/naturescience/water.htm.

2.1.2 Climate, Vegetation and Wildlife

Climate

At middle elevations (approximately 4,000 to 7,000 feet amsl) in this forested area of the parks, summer offers warm days and cool evenings. These elevations receive an average of 40 to 45 inches of precipitation annually. Much of this falls during the winter, resulting in a deep blanket of snow from December to May. Temperatures below zero degrees Fahrenheit (°F), however, are rare. In the summer, occasional afternoon thundershowers may occur. Temperatures in mid-summer may reach 90 °F.

Vegetation

Extreme topographic differences and a striking elevation gradient (ranging from 1,360 feet in the foothills to 14,494 feet along the Sierran crest) create a variety of environments, from the hot, dry lowlands along the western boundary to the stark and snow-covered alpine high country. Topographic diversity supports over 1,200 species (and more than 1,550 taxa, including subspecies and varieties) of vascular plants, which make up dozens of unique plant communities. These include not only the renowned groves of massive giant sequoia, but also vast tracts of montane forests, alpine habitats, and oak woodlands and chaparral. The Sierran flora mirrors that of the state as a whole; over 20 percent of Californian plant species can be found within SEKI[15].

Unlike many of the cone-bearing, evergreen forests of the world, which are dominated by a single species of tree, the mixed-conifer forests that cloak the lower and middle slopes of the Sierra Nevada are remarkably diverse. Here ponderosa pine, incense cedar, white fir, sugar pine, and scattered groves of giant sequoia intermix and coexist. These trees, many of which reach tremendous heights, form some of the most extensive stands of old-growth coniferous forest that remain in the world.

In the upper montane, pure stands of red fir and lodgepole pine are predominant. Characterized by deep snow accumulation during the winter months and a dense canopy that limits the amount of sunlight that reaches the forest floor, the red fir forests lack a diverse herbaceous component. Only the most shade tolerant herbs thrive beneath the towering trees. Lodgepole pines have an unusual distribution, growing in both moist lowlands and in drier sites

[15] National Park Service, "Sequoia and Kings Canyon Nature and Science", retrieved on 12/17/2013 from http://www.nps.gov/seki/naturescience/index.htm.

on benches and ridges. In wetter sites, these forests can support a rich amalgam of herbs and wildflowers in their understory[16].

Wildlife

SEKI supports a wide diversity of animal species, reflecting their range in elevation, climate, and habitat variety. Over 260 native vertebrate species are in the parks; numerous additional species may be present but have not been confirmed. Of the native vertebrates, five species are extirpated (extinct at the parks), and over 150 are rare or uncommon.

There have been some studies of invertebrates, but not enough information is available to know how many species occur in the parks. Many of the parks' caves contain invertebrates, some of which occur only in one cave and are known nowhere else in the world.

Year-round and seasonal residents include the mammals and a variety of birds. Reptiles are not as common, but the mountain king snake, rubber boa, western fence lizard, and alligator lizard are occasionally seen[17].

Mammals

A total of 77 mammal species are known to occur in SEKI. An additional 13 species, such as the wolverine, Sierra Nevada red fox, and black-tailed hare, may also be present but exist in such low densities that their status is unconfirmed. Commonly observed species include yellow-bellied marmots, mule deer, pika, and several species of squirrels. Examples include ringtails, spotted skunks, short-tailed weasels, and mountain lions.

A diversity of habitat types is present in the parks. Two orders of mammals are particularly diverse—Rodentia (rodents) and Chiroptera (bats). There are 26 species of rodents, ranging in size from the tiny montane vole up to the beaver, which can be 4 feet long and weigh over 60 pounds. There are 17 species of bats, including several species of concern such as the Townsend's big-eared bat, pallid bat, spotted bat, Western mastiff bat, and Western red bat.

Threatened mammal species within SEKI include Sierra Nevada bighorn sheep, which were granted protection under the Endangered Species Act in 1999. This species is still threatened by the risk of disease from domestic sheep, predation by mountain lions, forest succession, genetic diversity, severe weather, climate change, and reduced geographic distribution.

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[16] *Ibid*.
[17] National Park Service, "Sequoia and Kings Canyon Nature and Science", retrieved on 12/17/2013 from http://www.nps.gov/seki/naturescience/index.htm.

The Pacific fisher, a secretive forest-dwelling carnivore, is another species with special status. It is a candidate for listing under the Endangered Species Act and considered a Species of Special Concern by the state of California. Because fishers appear to require habitats that are prone to catastrophic wildfires (e.g., dense canopies, abundant woody debris), ongoing research throughout the region is assessing the impacts of fuel reduction treatments on fishers[18].

Birds

SEKI's 863,741 acres provide habitat for over 200 species of birds, including many neotropical migrants. Park biologists monitor birds to obtain more information about individual species. As known indicator species, avian monitoring also provides evidence of local and regional change for the larger ecosystem. A variety of migratory and resident birds exist at SEKI including the western tanager, violet-green swallow, white-throated swift, Wilson's warbler, olive-sided flycatcher, hermit thrush, western bluebird, and pileated woodpecker.

Amphibian, Fish and Reptile

Amphibians, reptiles, and fish are found at all elevations within SEKI, and certain species may be found at all times of the year. Their occurrence ranges from common (e.g., western fence lizards) to extirpated (locally extinct) (e.g., foothill yellow-legged frogs). The parks also have numerous species of exotics such as the bullfrog and many species of fish, which were brought into naturally fishless lakes to make the area more attractive to anglers.

The introduction of fish has had many unintended effects, the most dramatic being the resulting decline in the mountain yellow-legged frog populations which are under consideration for listing as federally endangered, due to predation. Scientists have investigated the role of other causative factors in their decline, such as acid deposition, UVB radiation, and disease, but predation is clearly the main problem. When fish are present, they eat frogs, force frogs into marginal habitat, and fragment the population, the latter of which hinders colonization. Wildlife management staff plans to remove exotic fish from some naturally fishless lakes to help restore the native frog population[19].

[18] *Ibid*.
[19] National Park Service, *"Sequoia and Kings Canyon Nature and Science"*, retrieved on 12/17/2013 from http://www.nps.gov/seki/naturescience/index.htm.

2.1.3 Land Uses

SEKI hosted 1,697,617 visitors in 2012, with an average of 1,620,445 visitors annually from 2009 to 2012[20]. Recreational activities vary with each season and include day hiking, backpacking, horseback riding, stock use, rock climbing, snow sports, snow play, and auto touring[21]. Approximately 96.85 percent of SEKI is designated and managed as wilderness (838,000 acres).

2.2 SITE HISTORY

Sequoia National Park was established on September 25, 1890. The park spans 404,063 acres. Kings Canyon National Park was established on March 4, 1940, and covers 461,901 acres. It incorporated General Grant National Park, established in October 1, 1890, to protect the General Grant Grove of giant sequoias. Sequoia National Park is south of and contiguous with Kings Canyon National Park; since 1943 the two parks have been administered together by NPS.

2.2.1 Dump Area Operational History

The history and contents of the dump area were reportedly unknown to the current Park staff, except that the park concessionaires used to burn and dispose of common trash in the area.

The former Lower Kaweah Incinerator (also known as Lodgepole Incinerator) operated from 1931 until 1965 to burn domestic waste. In 1965, the parks began to dispose of the waste off-site. The incinerator was dismantled in around 1975[22] and demolished in the 1990's[23].

The dump site was capped in place by NPS in direct consultation with, and with the apparent approval from, DTSC in or around 2000 or 2001[24].

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[20] National Park Service, "Sequoia and Kings Canyon – Fact Sheet 2013". August 23, 2013.
[21] National Park Service, "Sequoia and Kings Canyon – Things To Do", last updated 05/26/2013, accessed 05/29/2013, http://www.nps.gov/seki/planyourvisit/things2do.htm
[22] California Department of Toxic Substances Control. *RCRA Facility Assessment, U.S. Department of Interior, National Park Service, Sequoia and Kings Canyon National Parks*. August 1997.
[23] California Department of Toxic Substances Control. Resource Conservation and Recovery Act (*RCRA), Facility Assessment of Sequoia and Kings Canyon National Parks.* June 3, 2010.
[24] National Park Service. *Memorandum Subject: Lower Kaweah Incinerator site*. January 26, 2000.

2.3 SUMMARY OF PREVIOUS INVESTIGATIONS

In August 1998, Kleinfelder, Inc. (Kleinfelder) performed a site investigation[25] (SI) at an area of the dumpsite composed mostly of burned materials and ash. Five test pits were excavated through the dump fill material, and five composite soil samples were collected from the sidewalls of the test pits. Four of the five samples collected were analyzed for cadmium, chromium, lead, zinc, nickel, and dioxins. Laboratory analytical results indicated concentrations of the five metals analyzed and dioxins below their Total Threshold Limited Concentration (TTLC) as listed in the California Code of Regulations (CCR), Title 22 and therefore would not be classified as hazardous waste, if the dump fill material were removed for off-site disposal. Initially total lead and zinc concentrations were high enough (744 milligrams per kilogram [mg/kg] and 4,760 mg/kg, respectively) that testing for leaching potential was conducted. The results of citric solubility testing indicated that lead was present at 22.4 milligrams per liter (mg/L) in leachate, which is above its Solubility Threshold Limit Concentration (STLC) of 5.0 mg/l, and therefore would be classified as a California hazardous waste if removed from the site. A toxicity characteristic leaching procedure (TCLP) test was not performed on the sample, so it was unknown if the waste would be classified as a Resource Conservation and Recovery Act (RCRA) hazardous waste if removed from the Site.

In December 2001, Kleinfelder performed an expanded SA[26] and excavated eight exploratory trenches in the dumpsite to further define its volume and characterize the fill material. Six exploratory backhoe test pits were excavated near the topographically inferred perimeter of the dumpsite. The test pits were located in a radial pattern around the perimeter of the dump area at distances ranging from approximately 15 to 26 feet, averaging approximately 20 feet from one another. Soil samples were collected from the outer perimeter of each test pit to characterize the outer boundary of the dump.

Additionally, two exploratory 13 foot-long test pits were excavated in the central area of the dump. The two interior test pits were excavated to depths of 5 feet and 9 feet, where underlying bedrock and native material were encountered. Four soil samples were collected from the two interior test pits, two from each test pit. One sample was analyzed to further characterize the dump material and the other sample was used to characterize the native soil laying underneath the dump material above the underlying bedrock. Dioxins were present in the discrete soil

[25] Kleinfelder, Inc. *Site Investigation Report, Giant Forest – Lower Kaweah Dump Area, Sequoia National Park*. November 25, 1998.

[26] Kleinfelder, Inc. *Lower Kaweah Dump Area Expanded Site Assessment, Sequoia National Park, California*. January 11, 2002.

samples, with 2,3,7,8-TCDD reported in concentrations up to 5.4 picograms per gram (pg/g). The maximum concentration was detected in the sample collected at 4 feet bgs from test pit TP-8, excavated in the interior of the dump area. This concentration is lower than the concentration reported from the composite sample collected in September 1998. Of the organochlorine pesticides, only 4,4-DDT and 4,4-DDE were detected, but at concentrations not exceeding their respective TTLC; therefore, solubility testing for 4,4-DDT and 4,4-DDE was not performed. Of the metals detected, lead and chromium had elevated concentrations and therefore solubility tests were performed on seven soil samples. Solubility testing of lead and chromium indicated lead exceeded its CCR, Title 22, STLC of 5 mg/l; thus, the dump material would be classified as a hazardous waste if removed. TCLP solubility testing for lead did not detect concentrations exceeding the Title 22 value of 5 mg/l, and therefore the dump fill material would not be considered a RCRA hazardous waste if removed.

In 2005, the U.S. Army Corps of Engineers conducted a HERA[27] utilizing data collected during Kleinfelder's investigations. The HERA concluded that no unacceptable human or ecological effects from site contaminants are expected to occur. The HERA assumed that potential receptors would come in direct contact with the contaminated soil and debris, as if no cover was present at any portion of the dump area, theoretically overestimating the risk for actual receptors. No site-specific background concentrations for metals were established in the HERA. The HERA identified the primary constituents of potential concern (COPCs) for ecological receptors to be dioxins/furans, dichlorodiphenyltrichloroethane (DDT), dichlorodiphenyldichloro-ethylene (DDE), and metals. For human receptors, COPCs are dioxins/furans and arsenic. The HERA concluded that no further investigation or further action is required.

2.4 2014 EE/CA FIELD INVESTIGATIONS

As summarized above, the 1998 and 2001 SI and expanded SAs indicated that CERCLA hazardous substances were present at elevated concentrations in materials and soils in the dump area. Because the exact locations of samples collected during both investigations were not clearly identified, and composite samples were collected mixing suspected native, potentially clean soil with impacted soil, the extent of contamination was not clearly defined, which represents a gap in the Site characterization. Although the HERA concluded no human or ecological exposure risk exits, NPS reviewed all available Site information and concluded that

[27] U.S. Army Corps of Engineers, Sacramento District, Environmental Design Section, *Human Health and Ecological Risk Evaluation Lower Kaweah Dump Area, Sequoia National Park, California, Draft, August 2005.*

the SI and expanded SA did not completely characterize the nature and extent of contamination for purposes of conducting a non-time-critical removal action (NTCRA) and identified the following assessment gaps:

- Quantity (area and depth) of dump fill material and impacted soil exceeding cleanup goals;
- Extent and concentration of impacts above background; and
- Waste classification of the dump fill material and impacted soil for potential off-site disposal.

In order to address these gaps in the characterization of contamination, NPS directed ECM to prepare and perform a Work Plan[28], including a Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan[29] (QAPP), to address the remaining data needs for a complete Site characterization.

ECM conducted an initial field visit on November 11, 2013, to support Work Plan development. ECM observed the Lower Kaweah dumpsite and collected global positioning system (GPS) locations around the perimeter of the visible waste material and inferred dumpsite. The southern slope of the dumpsite was exposed, revealing ash and debris. Many young cedar trees were growing within the waste area. Small erosion rills were observed across the level portion of the dump material and remaining thin cap. ECM identified locations for equipment staging and confirmed these locations with NPS staff.

In May 2014, ECM collected additional site data to characterize the nature and extent of potential contamination in soil at and near the Lower Kaweah dumpsite during the execution of the Work Plan. In accordance to the Work Plan, ECM separated fieldwork activities into three tasks:

1. Dump area delineation;
2. Background soil characterization; and,
3. Dumpsite fill material and impacted soil characterization.

[28] Environmental Cost Management, Inc. (ECM), 2014. *Work Plan for Additional Soil Assessment, Sequoia and Kings Canyon National Parks, Three Rivers*, CA. March 6.

[29] ECM, 2014. *Sampling and Analysis Plan / Quality Assurance Project Plan for Site Characterization at Lower Kaweah Area Dumpsite, Sequoia and Kings Canyon National Parks*, Three Rivers, California. January 31.

Surface water in the vicinity of the Site is ephemeral and only occurs for hours or days following rainfall or snowmelt. No surface water was present during site assessment activities; therefore no surface water samples were collected.

Dumpsite Area Delineation

ECM defined the perimeter and depth of the dump area in order to estimate its total volume by digging four trenches using a small backhoe. Additionally, the thickness of the soil cover, areas without soil cover, areas with underlying bedrock, and thickness of soil between bedrock and fill material in the excavate trenches was defined by direct observation. ECM carefully mapped all trenches using a GPS device and indicated the boundaries of the dump area on **Figure 2.3**. **Attachment E** includes photographs of field activities.

Background Characterization

ECM implemented incremental sampling methodology[30] (ISM) to characterize background concentrations of COPCs, listed below, excluding dioxins and furans, within the Site vicinity. ISM is a technique designed to statistically reduce or limit variability associated with discrete sampling. ISM provides a representative and reproducible estimate of the mean concentration of analytes in a specific area of interest, known as a *decision unit* (DU).

ECM collected ISM background samples from one DU. The DU had an area of approximately 60 feet by 50 feet, divided into a grid of thirty, 10-foot by 10-foot, sections (**Figure 2.4**). ECM collected four background samples using ISM within the DU, consisting of 30 multi-increment (MI) portions, each MI subsample weighed approximately 50 grams (g). The sampling methodology was such that the total amount of soil collected was approximately 1.5 kilograms (kg) of soil for each of the four samples.

Laboratory analysis results from samples collected from the DU provided information regarding background concentrations near the Site for an approximate soil volume of 3,000 cubic feet. Results for background sampling are presented in **Attachment B**, **Table B-1**.

Dump Fill Material and Adjacent Soil Characterization

ECM dug four perimeter trenches and two interior trenches to characterize potentially impacted waste and native soils in contact with waste material. **Figure 2.3** shows the observed perimeter of dump fill material and the trenching locations. ECM collected discrete soil samples

30 ITRC, Technical and Regulatory Guidance, *Incremental Sampling Methodology*, February 2012.

representative of fill material and adjacent native soil at the immediate interface where waste material contacted native soil at the edge of the dump pile.

Samples were analyzed for the following COPCs:

- CAM 17 Metals by EPA method 6010B;
- Mercury by EPA method 7471A;
- Dioxins and Furans by EPA method 8290;
- Diesel Range Organics by EPA method 8015B;
- Semi-Volatile Organic Compounds by EPA method 8270C;
- Herbicides by EPA method 8151A;
- Organochlorine Pesticides by EPA method 8081A; and,
- Polychlorinated Biphenyls (PCBs) by EPA method 8082.

Additionally, ECM submitted two soil samples, SEKI1 and SEKI2, for phytoremediation/ agricultural parameters, specifically:

- Soil salinity,
- Soil texture, and
- Percent water saturation.

Laboratory reports for samples collected in May 2014 are presented in **Attachment B** and results are summarized in **Table B-1** through **Table B-6**. **Table B-7** presents a comparison of 95 percent upper confidence limit (95% UCL) estimated values for background, waste stream and adjacent native soil analytical sample results.

Arsenic, barium, cadmium, copper, chromium, lead and zinc were detected at concentrations greater than 10 times their STLC and/or greater than 20 times their TCLP in some samples collected at the waste stream area (**Table B-2**). STLC tests were not performed because sample SEKI-T03-05-3 had a reported lead concentration of 1,200 mg/kg that exceeds the TTLC for lead of 1,000 mg/kg and samples SEKI-T05-09-7 and SEKI-T06-10-5 had reported zinc concentrations of 9,800 mg/kg and 11,000 mg/kg, respectively. These values exceed the TTLC for zinc of 2,500 mg/kg. Therefore the soil from the dump site area is considered non-RCRA California hazardous waste if disposed off-site. If the waste is transported and disposed off-site, TCLP analyses will be required for complete characterization.

No semivolatile organic compounds (SVOCs) (**Table B-3**) were detected in any of the samples. In addition, diesel range organics (DRO) (**Table B-3**) analyses were all below recommended USEPA Region 9 residential action levels of 250 mg/kg and also below estimated background concentrations of 94.24 mg/kg in all samples.

Results of ECM's additional site assessment indicate that dioxins (**Table B-4**) were detected in the discrete soil samples up to a 2,3,7,8-TCDD equivalent concentration of 115.5 picograms per gram (pg/g) in waste material in sample SEKI-TO3-05-3 and 78.195 pg/g at the adjacent native soil. The TTLC for dioxin (2,3,7,8-TCDD) is 10,000 pg/g. Solubility testing for dioxins and furans was not performed.

Of the organochlorine pesticides, DDE and DDT (**Table B-5**) were detected in the soil samples collected from the test pits at the waste stream and adjacent native soil areas. In both cases, concentrations did not exceed their TTLC of 1.0 mg/kg, with the exception of toxaphene, which was reported at a concentration of 1.8 mg/kg in sample SEKI-TO4-08-2. Solubility testing for DDE and DDT was not performed. Analytical results for samples SEKI1 and SEKI2, for phytoremediation/ agricultural parameters, are presented in **Table B-6**.

The 95% UCL calculation comparison for analytical results for metals presented in **Table B-7** shows elevated concentrations of metals in the waste stream sample results, compared to the background samples. Specifically for copper, lead and zinc, which are 85.5, 48.8 and 128.3 times higher than the estimated 95% UCL for background concentrations, respectively. The estimated 95% UCL estimate for metals in soil adjacent to the waste stream is similar to the results obtain for metals in background samples, with the exception of copper, lead and zinc, which are 9.3, 8.6 and 7.7 times higher than the estimated 95% UCL for background concentrations, respectively. Higher concentrations of metals can be observed in adjacent native soil samples SEKI-T03-06-2 and SEKI-TO4-08-2, both collected in downgradient zones of the dumpsite area, possibly indicating a small migration of some chemical compounds in this direction.

2.4.1 Site-Specific Background Data

Under CERCLA[31], concentrations of contaminants of concern below the naturally occurring background levels are not generally subject to removal action. Site Specific Background concentrations for metals, DRO and organochlorine pesticides in vicinity surface soils, determined within the 95% UCL using a Student's distribution curve, were estimated from laboratory results of four MI samples collected at DU in May 2014 and are included in **Attachment C, Table C-2**.

2.5 NATURE AND EXTENT OF CONTAMINATION

NPS indicated that the Site was used for disposal of burn ash from the former Lower Kaweah incinerator and domestic wastes from park visitors and workers. Some of the observed fill materials in the dumpsite consisted of ash, metal, glass, concrete, asphalt fragments, sheet

[31] EPA, Role of Background in the CERCLA Cleanup Program, OSWER 9285.6-07P, April 26, 2002.

metal, porcelain, aluminum pans and pitchers, wire, pipes, metal paint cans, wood chips and roots.

The Site consists of an oval shaped area measuring approximately 150 feet in length by 100 feet in width, covering an area measuring approximately 11,780 square feet or 0.27 acres. The thickness of the dump fill material ranges from 2 to 9 feet (**Figure 2.5** through **Figure 2.10**), with an estimated average thickness of 5 feet. Based on these approximate measurements, the volume of the dumpsite is estimated at approximately 59,000 cubic feet or 2,180 cubic yards.

2.5.1 Constituents of Potential Concern

Metals (arsenic, barium, cadmium, copper, chromium, lead and zinc) and organochlorine pesticides (DDE and DDT) were detected above background concentrations at the Site and are considered constituents of potential concern (COPC) related to this investigation (**Table B-1** and **Table B-2**). Total petroleum hydrocarbons reported as diesel range organics (DRO) were reported at a maximum concentration of 78 mg/kg at sample SEKI-T06-10-5, this concentration is below the background concentration of 94.2 mg/Kg and the residential RSL value of 250 mg/kg and are not considered COPC related to this investigation (**Table B-1** and **Table B-3**). Dioxins and Furans (2,3,7,8-TCDD) were detected above regional screening levels (RSLs) at the Site (**Table B-4**) and are considered COPC related to this investigation. SVOCs, PCBs and Herbicides were reported as non-detected above laboratory reporting limits (RLs) and are not considered COPC related to this investigation (**Table B-3**, **Table B-4** and **Table B-5**, respectively). Some of the RLs for SVOCs were above RSLs, however the HERA did not include SVOCs as COPC.

Compounds that exceeded the site-specific background concentration and recommended action levels (EPA RSLs or CHHSLs) were considered COPCs and used for the preparation of the Streamlined Risk Evaluation (SRE) in **Section 2.6**.

2.6 STREAMLINED RISK EVALUATION

As described in EE/CA Guidance[32], a SRE is intermediate in scope between the limited risk assessment conducted for emergency removal actions and the conventional baseline assessment conducted for remedial actions. The purpose of a SRE is to justify a removal action. Consistent with EE/CA Guidance, SRE will identify the potential for risk, if no removal action is taken within the removal action boundary.

[32] EPA, 1993. *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA*. EPA/540-F-93-048. September 1993

The SRE approach identifies and addresses exposure pathways by evaluating potential ecological and human health risks. The assessment focuses on the human health and ecological risks associated with elevated COPC concentrations and focuses on the media that the removal action is intended to address, which is the total volume of the former dumpsite at Lower Kaweah former dumpsite.

2.6.1 Preliminary Exposure Pathways

The SRE is designed to identify risk from potential exposure pathways if no action is taken. An exposure pathway is considered complete if a chemical can travel from a source to a human or ecological receptor and is available to the receptor via one or more exposure routes[33]. **Figure 2.11** and **Figure 2.12** depict the various exposure pathways in the form of a Human Exposure Conceptual Site Model (CSM) and an Ecological Exposure CSM, respectively. The CSMs graphically summarize site conditions based on available data. They illustrate the understanding of contaminant distribution, release mechanisms, exposure pathways, migration routes and potentially exposed receptors. The CSM indicates that the pathway may be complete from surface and subsurface soils to human receptors via inhalation, ingestion or direct contact. Exposed populations are SEKI visitors and workers, including NPS staff and subcontractors. Ecological populations may be exposed to chemicals in surface soils via inhalation, ingestion, direct contact and ingestion of plants, which have absorbed chemicals from soils.

2.6.2 Human Risk Screening Criteria

The preliminary COPC identification process was integrated with SRE for a protective, risk-based approach, which compares contaminant concentrations to regulatory screening criteria that are considered protective of human health. The CSM is used to evaluate the possible exposure pathways and receptors for the impacted soil via relevant transport mechanisms.

As shown in the presented Human Exposure CSM (**Figure 2.11**), NPS eliminated the following mediums and receptors from consideration:

- Groundwater,
- Surface water,
- Air for chemicals volatilization, and
- Residents.

[33] EPA, 1989. *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual*. EPA/540/1-89/002. December 1989.

Based on field observations, no water is present at the surface or immediately beneath the waste material near the dump site. Groundwater is typically found within fractures in bedrock. Although the COPC exceed soil-to-groundwater screening thresholds (**Table C-3**), COPC will not likely impact site groundwater, due to depth to groundwater and lack of presence of water at the site. Also, background concentrations of COPC are above soil-to-groundwater screening thresholds. Nearest downgradient surface water to the Site is the Marble Fork of the Kaweah River, approximately 4,900 feet downslope. The drainage pathway from the site to surface water is heavily vegetated, and no waste material was observed to be migrating more than a few feet from the dumpsite area. COPC are not expected to impact surface water. Results for volatile compounds in soil taken with field instruments (photoionization detector) indicated that no volatile organic compounds (VOCs) are emanating from the Site. No residents live at or near the location of the dumpsite at SEKI.

Sediment is naturally occurring material that is broken down by processes of weathering and erosion, and is subsequently transported by the action of wind, water, or ice, and/or by the force of gravity acting on particles. Waste material was observed to be migrating only two to five feet downslope to the south from the dumpsite area. No sediment samples were collected during EE/CA field investigation, as there is no sediment material in the vicinity of the Site. The CSM indicates that the sediment exposure pathway is possible, but it is not confirmed due to limited sediment material near the Site.

All human health screening levels considered in the SRE are presented in **Attachment C, Table C-3**. Minimum human health risk screening values for each COPC are presented in **Table C-4** after being selected as these are the lowest levels that apply for the Site human health risk CSM[34].

2.6.3 Ecological Risk Screening Criteria

The preliminary COPC identification process was integrated with SRE for a protective, risk-based approach, which compares contaminant concentrations to regulatory screening criteria that are considered protective of ecological receptors. A CSM is used to evaluate the possible COPC exposure pathways and receptors for the impacted soil via relevant transport mechanisms.

[34] EPA Region 9 Screening Levels for Soil – May 2014

Based on **Figure 2.12**, NPS eliminated the following receptor from consideration in the CSM:

- Aquatic organisms

Aquatic organisms screening levels were removed because the exposure pathway is not complete based on the location of nearest surface body of water, Marble Fork Kaweah River, located 0.7 miles west of the dumpsite, as there is no confirmed transport pathway from the source that could reach the stream.

All ecological screening levels considered in the SRE are presented in **Attachment C, Table C-3**. Minimum ecological receptor risk screening values for each COPC are presented in **Table C-4** after being selected as these are the lowest levels that apply for the Site ecological CSM[35].

2.6.4 Site Specific Screening Level

A Site Specific Screening Level (SSSL) value for each COPC was determined by evaluating all published screening levels for soil for human health and ecological receptors potentially present. These values were adjusted based on the area use factor (AUF) for the avian and mammalian species[36] with the smallest home range (most conservative), as presented in **Attachment C, Table C-1,** to estimate their site specific Toxicity Reference Value (TRV). For a Site estimated area of approximately 0.27 acres, the AUF for the American Robin was estimated at approximately 0.14 and the AUF for the California Deer mouse was estimated at approximately **0.68** (**Attachment C, Table C-6**).

By dividing the published COPC screening levels by the AUF, we obtain an estimated TRV value for each COPC for avian and mammalian receptors, as presented in **Attachment C, Table C-4**. The smallest value TRV or background for each COPC was selected as the SSSL for that COPC.

2.6.5 Contaminants of Concern for Removal Action

Exposure point concentrations of COPCs, estimated as the Student's t-distribution 95% UCL, were compared to the human health and ecological SSSL to establish if a COPC should be a contaminant of concern (COC). As shown in **Table C-5** of **Attachment C**, sample concentrations for most metals exceeded the SSSL for soil. Only beryllium was below the

[35] Risk Assessment Information System ecological benchmark tool at http://rais.ornl.gov/tools/eco_search.php
[36] California Department of Fish and Wild Life - CWHR Life History Accounts and Range Maps at http://www.dfg.ca.gov/biogeodata/cwhr/cawildlife.aspx

SSSL and therefore not considered a COC. Additionally, 2,3,7,8-TCDD and 4,4'-DDT exceeded SSSL concentrations in at least one sample and are considered COCs. The following is a list of COCs:

- Antimony
- Arsenic
- Barium
- Cadmium
- Chromium
- Cobalt
- Copper
- Lead
- Mercury
- Molybdenum
- Nickel
- Selenium
- Silver
- Thallium
- Vanadium
- Zinc
- 2,3,7,8-TCDD
- 4,4'-DDT

2.6.6 Risk Summary

Section 2.6 explains that this EE/CA must evaluate whether there is potential risk to human health or to the environment, if no action were to occur. These risks are estimated by the following:

- Hazard quotient – human health
- Hazard quotient – ecological receptors
- Hazard index – human health
- Hazard index – ecological receptors
- Total Cancer Risk

Hazard quotients estimate COC-specific non-cancer hazards by dividing each COC's exposure point concentration (EPC) by its respective SSSL for non-cancer evaluation, for both human health and ecological receptors. Cancer risk for COCs which are carcinogenic are handled separately as described below. Arsenic and 2-3-7-8-TCDD are the only COCs whose SSSLs are based on a cancer endpoint.

The exposure point concentration can be either the maximum detection, or if the sample size is large, the 95% upper confidence limit (UCL) of all samples for that COC. The exposure point concentrations for the COCs were estimated using the 95% UCL using a Student's *t* distribution curve and are presented in **Table C-5** of **Attachment C**. A hazard quotient of 1 or less generally means that a particular COC does not pose a significant risk to human health or ecological receptors.

The total hazard index is the cumulative non-cancer hazard of all detected compounds based on non-carcinogenic effects. This accounts for all metal COCs except arsenic. It is calculated by summing the hazard quotients, for human health and ecological receptors, separately. A hazard index of 1 or less is generally considered "safe" with regard to the cumulative effects of all COCs together.

The total cancer risk is the cumulative cancer risk of all COCs with SSSLs based on carcinogenic effects. The total cancer risk was calculated by dividing the exposure point concentration for arsenic (94 mg/kg) and 2-3-7-8-TCDD (6.14 mg/kg) by their respective SSSLs for cancer evaluation (0.24 mg/kg and 19 mg/kg, respectively), adding the two resulting values (392 and 10.4) and multiplying the result (402.4) by 10^{-6} to obtain the excess lifetime cancer risk per person.

Arsenic and 2-3-7-8-TCDD pose an excess lifetime cancer risk of 4.02×10^{-4}, or 4.02 in ten thousand. This risk should generally fall between 1×10^{-4} (one in 10,000) and 1×10^{-6} (one in a million) to be considered within an acceptable range. In remote, seldom-accessed areas, like the Site, 4.02×10^{-4} may be acceptable, while the more stringent benchmark of 1×10^{-6} would be required for a densely populated city. At SEKI, the overall cancer risk, estimated at 4.02×10^{-4}, is within a reasonable range based on the expected low human exposure to the Site.

Of all the COCs with non-cancer endpoints, cadmium (HQ = 2.62), chromium (HQ = 2.77), copper (HQ = 1.80), lead (HQ = 18.21) and zinc (HQ = 3.04) have human-health hazard quotients exceeding 1. All remaining COCs have lower HQs. Additionally, the hazard index (HI) is estimated at 33.18, indicating that these COPCs collectively could pose a significant risk to human health.

For the ecological receptors, zinc poses the greatest risk ranging from 23.11 to 1,146.94 for avian and invertebrates, respectively. Beryllium is the only COC that didn't exceed a value of one for any ecological receptor. Collectively, the hazard index is estimated at 45.4 for avian, 242.6 for mammalian, 1,423.9 for invertebrates and 344.0 for plants, indicating that these COCs collectively pose a significant risk to ecological receptors.

Hazard indices above one, for both ecological and human receptors, indicate that leaving the waste material associated with the lower Kaweah dumpsite in its present condition, could pose an unacceptable risk to human health and the environment.

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3.0 REMOVAL ACTION OBJECTIVES & APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

3.1 REMOVAL ACTION OBJECTIVES

Removal action objectives (RAOs) have been developed based on analysis of the sources of contamination, the nature and extent of contamination, results of the human health and ecological risk evaluations, and the ARARs that have been identified. The RAOs have been developed to control the contamination sources and eliminate the potential for exposure of human and ecological receptors to Site contamination.

The RAOs for the Site are:

- Prevent or reduce the potential for human and ecological exposure (through inhalation, ingestion, and dermal contact) to COCs in soil.
- Prevent or reduce potential migration of impacts via surface runoff, erosion, and wind dispersion.

3.2 REMOVAL ACTION JUSTIFICATION

According to 40 CFR 300.415(b), a removal action is justified, if there is a threat to human health or the environment based on one or a combination of any of the eight factors listed below:

Table 3.1: Removal Action Justification

Factor	Site Condition	Justified
(1) Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances, pollutants, or contaminants.	Public access to soil containing concentrations of COCs exists. Animal populations have access to the soil. The Hazard Index for exposure to COCs for human health is greater than one (1) and greater than one (1) for ecological receptors at the Site (**Section 2.6.6**).	Yes
(2) Actual or potential contamination of drinking water supplies or sensitive ecosystems.	There are no population centers near the Site. Drinking water aquifers do not appear impacted by Site contaminants. (**Section 2.6.2**).	No
(3) Hazardous substances, pollutants, or contaminants in drums, barrels, tanks, or other bulk storage containers that may pose a threat of release.	No drums, barrels, tanks, or bulk storage containers have been found on the Site.	No
(4) High levels of hazardous substances, pollutants, or contaminants in soils largely at, or near, the surface, that may migrate.	Concentrations of metals in soil at or near the surface subject to erosion and migration.	Yes

Factor	Site Condition	Justified
(5) Weather conditions that may cause hazardous substances, pollutants, or contaminants to migrate or be released.	Surface soil subject to erosion during wind, high flows, rain events, and snowmelt could cause waste material migration.	Yes
(6) Threat of fire or explosion.	No flammable materials or explosives have been found on the Site.	No
(7) The availability of other appropriate federal or state response mechanisms to respond to the release.	The site is on NPS-administered land and is being addressed under NPS CERCLA authority.	Yes
(8) Other situations or factors that may pose threats to public health or the environment.	None.	No

3.3 IDENTIFICATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The NPS is responsible for the identification of potential Applicable or Relevant and Appropriate Requirements (ARARs) that pertain to any CERCLA removal action proposed for the Site. Section 121(d) of CERCLA requires that on-site remedial actions attain or waive Federal environmental ARARs, or more stringent State environmental ARARs, upon completion of the remedial action. The NCP also requires compliance with ARARs during remedial actions and during removal actions to the extent practicable. ARARs are identified on a site-by-site basis for all on-site response actions where CERCLA authority is the basis for cleanup.

ARARs are presented in three general categories in the following sections:

1. Chemical-specific: ARARs that pertain to handling or control of certain chemicals based on health concerns or risks.
2. Location-specific: ARARs that control activities based on the location such as wetlands, historic sites, or sensitive ecosystems
3. Action-specific: ARARs that govern discrete actions which may include the use of certain technologies for remedial actions or use of certain types of equipment during remedial actions.

The ARARs are ranked as either: 1) Applicable 2) Relevant and Appropriate 3) To Be Considered, or 4) Not an ARAR. Substantive portions of an ARAR may be Applicable or Relevant and Appropriate.

1. Applicable requirements are cleanup standards, standards of control, and other substantive requirements, criteria or limitations that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstances found at a CERCLA site.

2. Relevant and Appropriate requirements are cleanup standards, standards of control, and other substantive requirements, criteria, or limitations that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location or other circumstances at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site and are well-suited to the particular site.
3. To Be Considered (TBC) are non-promulgated advisories or guidances regarding: 1) health effects information with a high degree of credibility; 2) technical information on how to perform or evaluate site investigations or response actions; or 3) policy.

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3.3.1 Chemical-Specific ARARs

Table 3.2: Chemical-Specific ARARs

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR
CHEMICAL-SPECIFIC : FEDERAL			
EPA Ecological Soil Screening Levels (Eco-SSL)	www.epa.gov/ecotox/ecossl	Ecological Soil Screening Levels (Eco-SSLs) represent the collaborative effort of a workgroup consisting of federal, state, consulting, industry and academic participants led by the EPA.	**Applicable**
EPA Region 9 Screening Levels (Formerly PRGs) - "Industrial Soil Supporting"	EPA Region 9 Screening Levels (Formerly 2004 PRGs) (November 2010) www.epa.gov/region9/ superfund/prg/	Combine current EPA toxicity values with standard exposure factors to estimate acceptable contaminant concentrations in different environmental media (soil, air, and water) that are protective of human health."	**Applicable**
Clean Water Act Water Quality Standards	33 U.S.C. 1251-1387, Section 303(c)(2)(B) 40 CFR Section 440.40-440.45 40 CFR Part 131, Quality Criteria for Water 1976, 1980, 1986	Chapter 26, Water Pollution Prevention and Control, sets criteria for water quality based on toxicity to aquatic organisms and human health.	**Applicable**
Safe Drinking Water Act National Primary Drinking Water Regulations Maximum Contamination Levels (MCLs) National Secondary Drinking Water Regulations	40 U.S.C. 300 40 CFR Part 141, Subpart B, pursuant to 42 U.S.C. 300(g)(1) and 300(j)(9) 40 CFR Part 141, Subpart F, pursuant to 42 U.S.C. 300(g)(1) 40 CFR Part 143, Subpart B pursuant to 42 U.S.C. 300(g)(1) and 300(j)(9)	Establishes health-based standards for public water systems (maximum contaminant levels) and sets goals for contaminants.	**Applicable**
EPA Ambient Water Quality Criteria (AWQC)	water.epa.gov/scitech/swguidance/standards/current/ index.cfm Human Health Criteria Table Aquatic Life Criteria Table	EPA's compilation of national recommended water quality criteria for the protection of aquatic life and human health in surface water for approximately 150 pollutants.	**Applicable**

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR
EPA Region 3 Biological Technical Assistance Group (BTAG) Freshwater Screening Benchmarks and Freshwater Sediment Screening Benchmarks	EPA Region 3, Oak Ridge National Laboratory (ORNL) Toxicological Benchmarks for Screening Contaminants of Potential Concern (ORNL, 1997)	The Region III BTAG Screening Benchmarks are values to be used for the evaluation of sampling data at Superfund sites. These values facilitate consistency in screening level ecological risk assessments.	**Relevant and Appropriate**
CHEMICAL-SPECIFIC : STATE/LOCAL			
California Categories of Hazardous Waste	Title 22 California Code of Regulations (CCR), Div 4.5, Ch 11, Sections: 66261.2, 66261.3 66261.2	Criteria for identifying a waste as hazardous.	**Applicable**
CalTOX	www.dtsc.ca.gov/AssessingRisk/caltox.cfm	A spreadsheet risk assessment model for multimedia exposure.	**To Be Considered**
Department of Toxic Substance Control (DTSC) Preliminary Endangerment Assessment Guidance Manual, June 1999	www.dtsc.ca.gov/SiteCleanup/Brownfields/upload/SMP_REP_PEA_CH1.pdf	The human health screening evaluation process discussed in the manual can be used to assess risk associated with existing conditions or calculate health based cleanup levels for unrestricted land use.	**Applicable**
California Human Health Screening Levels (CHHSLs)	http://oehha.ca.gov/risk/chhsltable.html	Used in evaluation of contaminated properties to calculate health based cleanup levels.	**Applicable**
California Safe Drinking Water Act	Title 22 CCR Sections 64431 and 64449(a)	Primary and secondary MCLs for public drinking water under the California SDWA of 1976.	**Applicable**
Porter-Cologne Water Quality Act	California Water Code, Division 7: Water Quality, Water Code Sections 13000-13002 - Policy	Mandates that the quality of all the waters of the state shall be protected for use and enjoyment by the people of the state. Also mandates each Regional Board to formulate and adopt basin plans.	**Applicable**
California Water Plan	Water Code §10004(a)	Provides for the orderly and coordinated control, protection, conservation, development, and utilization of the water resources of the state.	**To be Considered**

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR
RWQCB (CR) - *Water Quality Control (Basin) Plan*	California Regional Water Quality Control Board - State Water Resources Control Board, *Water Quality Control Plan*, Colorado River Basin, Region 7; Includes Amendments Adopted by the Regional Board through June 2006.	The Basin Plan established location-specific beneficial uses and water quality objectives for surface water and groundwater of the region.	**To be Considered**
State of California Water Resources Control Board Statement of Policy with Respect to Maintaining High Quality Waters in California	State Water Resources Control Board Resolution 68-18	Resolution 68-16 establishes the policy that high quality waters of the state "shall be maintained to the maximum extent possible" consistent with the "maximum benefit to the people of the state."	**To be Considered**
State of California Water Resources Control Board Policies and Procedures for Investigation and Cleanup and Abatement of Discharges under California Water Code Section 13304	State Water Resources Control Board Resolution 92-49	Section III.G requires attainment of background water quality, or if background cannot be restored, the best water quality that is reasonable.	**To be Considered**
RWQCB (SFB) - Screening levels for groundwater and surface water; Soil screening levels; Industrial/Commercial.	California Regional Water Control Board, San Francisco Bay Region, 2007. *Screening for Environmental Concerns at Sites with Contaminated Soil & Groundwater.* November. November. Updated May 2008.	Guidance for the application of risk-based screening levels and decision making to sites with impacted soil and groundwater	**To Be Considered**
RWQCB (SFB) - Screening levels for groundwater and surface water; Soil screening levels; Residential/Parkland/ Agricultural	California Regional Water Control Board, San Francisco Bay Region, 2007. *Screening for Environmental Concerns at Sites with Contaminated Soil & Groundwater.* November. Updated May 2008.	Guidance for the application of risk-based screening levels and decision making to sites with impacted soil and groundwater	**To Be Considered**

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR
State of California Drinking Water Policy	State Water Resources Control Board No. 88-63 www.swrcb.ca.gov/board_decisions/adopted_orders/resolutions/2006/rs2006_0008_rev_rs88_63.pdf	Provides direction indicating that surface water and groundwater is considered a potential drinking water source if the TDS levels are below 3,000 mg/L and the yield is more than 200 gallons per day.	**To Be Considered**
Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities	www.dtsc.ca.gov/AssessingRisk/Supplemental_Guidance.cfm	Provides California methods and default parameters for conducting risk assessment.	**To Be Considered**

3.3.2 Location-Specific ARARs

Table 3.3: Location-Specific ARARs

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR
LOCATION-SPECIFIC : FEDERAL			
Endangered Species Act	316 USC § 1531 (h) through 1543 40 CFR Part 6.302 50 CFR Part 402	Act to protect habitat of endangered and threatened species. Activities may not jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify a critical habitat.	Substantive requirements are **Applicable**
Fish and Wildlife Coordination Act	16 USC 1251 661 et seq.; 40 CFR 6.302(g)	Requires consultation when Federal agency proposes or authorizes any modification of any stream or other water body to assure adequate protection of fish and wildlife resources.	**Relevant and Appropriate**

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR
Historic Sites, Buildings, and Antiquities Act and Executive Order 11593	16 USC 461 et seq. 40 CFR Part 6.301	EPA is subject to the requirements of the Historic Sites Act of 1935, 16 U.S.C. 461 et seq., the National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470 et seq., the Archaeological and Historic Preservation Act of 1974, 16 U.S.C. 469 et seq., and Executive Order 11593, entitled Protection and Enhancement of the Cultural Environment.	Substantive requirements are **Applicable**
National Environmental Policy Act	7 CFR 799 (1969) http://www.epa.gov/region9/nepa/	Section (102)(2) of NEPA requires all Federal agencies to give appropriate consideration to the environmental effects of their proposed actions. The Council on Environmental Quality regulations at 40 CFR 1507.3(b) identify those items which must be addressed in agency procedures.	Substantive requirements are **Applicable**
The Historic and Archeological Data Preservation Act of 1974	16 USC 469 40 CFR 6.301	Establishes procedures to provide for preservation of historical and archeological data that might be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program.	Substantive requirements are **Applicable**
Migratory Bird Treaty Act	16 USC §§ 703 et seq.	Establishes federal responsibility for the protection of the international migratory bird resource and requires continued consultation with the US Fish and Wildlife Service during remedial design and remedial construction to ensure that the cleanup of the site does not unnecessarily impact migratory birds.	**Applicable**
National Park Service Wilderness Resource Management General Policy - Minimum Tool Concept	Reference Manual RM 41: Wilderness Preservation and Management. Washington, D.C.: National Park Service. 1999. Section 6.3.6.1	This policy requires that any scientific activity determined to be necessary to accomplish an essential task must make use of the least intrusive tool, equipment, device, force, regulation, or practice to achieve the wilderness management objective.	**To be considered**

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR
National Park Service – Management Policies 2006	Management Policies – 9 Park Facilities, 9.1.7 Energy Management	This policy requires that all facilities, vehicles, and equipment will be operated and managed to minimize the consumption of energy, water, and nonrenewable fuels.	**Applicable**
Protection of Wetlands Order, Executive Order 11990	40 CFR Part 6	Requires minimizing and avoiding adverse impacts to wetlands	**Relevant and Appropriate**
Native American Graves Protection and Repatriation Act	25 USC § 3001	Establishes the ownership of cultural items excavated or discovered on federal or tribal land.	**Applicable**
Floodplain Management	40 CFR §6.302(b) and 40 CFR Part 6, Appendix A §6(a)(1), (a)(3), and (a)(5)	Federal agencies are required to evaluate the potential effects of actions they may take in a floodplain to avoid, to the extent possible, adverse effects associated with direct and indirect development of a floodplain.	**Relevant and Appropriate**
Consultation and Coordination With Indian Tribal Governments	Executive Order 13175	Agencies shall respect Indian tribal self-government and sovereignty, honor tribal treaty and other rights, and strive to meet the responsibilities that arise from the unique legal relationship between the Federal Government and Indian tribal governments.	To Be Considered
Protection of Indian Sacred Sites	Executive Order 13007	Each executive branch agency with statutory or administrative responsibility for the management of Federal lands shall, as appropriate, promptly implement procedures for the purposes of carrying out the provisions of section 1 of this order, including, where practicable and appropriate, procedures to ensure reasonable notice is provided of proposed actions or land management policies that may restrict future access to or ceremonial use of, or adversely affect the physical integrity of, sacred sites. In all actions pursuant to this section, agencies shall comply with the Executive memorandum of April 29, 1994, "Government-to-Government Relations with Native American Tribal Governments."	To Be Considered

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR
LOCATION-SPECIFIC : STATE/LOCAL			
California Cultural and Paleontological Resources	Document 33.4	State-level cultural resource protection is regulated through the provisions of Appendix K of the California Environmental Quality Act (CEQA). Paleontological resource protection is regulated through 1906 Antiquities Act.	**Applicable**
California Endangered Species Act (CESA)	Title 14 CCR Section 783 et seq Fish and Game Code - Section 2080;	The CESA Act parallels the main provisions of the Federal ESA. The 'take' of any species the commission has determined to be an endangered or threatened species is prohibited. However, CESA allows incidental take for lawful development projects.	**Applicable**
California Preservation Laws	Administrative Code, Title 14, Section 4307	No person shall remove, injure, deface or destroy any object of paleontological, archaeological, or historical interest or value.	**Applicable**
California Wildlife Conservation Act	Fish and Game Code Section 2050-2068, Section 2080, Section 3005, and Section 5650.	California Department of Fish and Game Habitat Conservation Planning Branch	**Applicable**

3.3.3 Action-Specific ARARs

Table 3.4: Action-Specific ARARs

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR
ACTION-SPECIFIC : FEDERAL			
Clean Air Act National Primary and Secondary Ambient Air Quality Standards National Emission Standards for Hazardous Air Pollutants	42 U.S.C. 7409 40 CFR Part 50 40 CFR Part 61, Subparts N, O, P, pursuant to 42 U.S.C. 7412	Establish air quality levels that protect public health, sets standards for air emissions Regulates emissions of hazardous chemicals to the atmosphere	**Applicable**

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR
Closure Criteria for Municipal Solid Waste Landfills	40 CFR Part 258.60 (a)(1-3)	Establishes design for caps.	**Relevant or Appropriate**
Criteria For Municipal Solid Waste Landfills	40 CFR part 258, at 40 CFR 258.60 and 258.61.	The purpose of this part is to establish minimum national criteria under RCRA, as amended, for all municipal solid waste landfill units and under the Clean Water Act, as amended, for municipal solid waste landfills that are used to dispose of sewage sludge. These minimum national criteria ensure the protection of human health and the environment.	**Applicable**
Comprehensive Environmental Response, Compensation, and Liability Act	CERCLA Section 121	Requires all remedial actions which result in any hazardous substance, pollutants, or contaminants remaining on the site be subject to Five-Year Review to evaluate the performance of the remedy.	**Applicable**
Hazardous Materials Transportation Act: Standards Applicable to Transport of Hazardous Materials	49 U.S.C. § 1801-1813 49 CFR Parts 10, 171-173 and 177	Requires placing, packaging, documentation for the movement of hazardous materials on public roadways.	**Applicable**
Clean Water Act National Pollutant Discharge Elimination System Effluent Limitations	33 USC 1342 Section 404 40 CFR Parts 122, 125 33 USC 131140 CFR Part 440	Requires permits for the discharge of pollutants from any point source into waters of the United States. Sets standards for discharge of treated effluent to waters of the United States	Substantive requirements are **Applicable**
Resource Conservation and Recovery Act	40 CFR Part 261, Subpart D	Defines wastes which are subject to regulation as hazardous wastes under 40 CFR Parts 262-265 and Parts 124, 270, and 271	**Applicable**
Special Provisions for Cleanup - Corrective Action Management Units	40 CFR Part 264, Subpart S, § 264.552 CAMU	Defines the applicability of Corrective Action Management Units (CAMU)	**Applicable**

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR
National Park Resource Protection, Public Use and Recreation	36 CFR Part 2	Provides general park use regulations.	**Relevant or Appropriate**
Solid Waste Disposal In Units of the National Park System	36 CFR Part 6	Regulates the disposal of solid waste within the National Park System.	**Applicable**
Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act Standards Applicable to Transporters of Hazardous Waste	42 U.S.C. 6901, et seq. 40 CFR Part 263, pursuant to 42 U.S.C. 6923 40 CFR Part 264, pursuant to 42 U.S.C. 6924, 6925	Establishes standards for persons transporting hazardous waste within the US if the transportation requires a manifest under 40 CFR Part 262 Defines acceptable management standards for owners and operators of facilities that treat, store, or dispose of hazardous waste	**Applicable**
Wilderness Act	16 USC 1131-1136, et seq.	Provides legal definition of wilderness, provides protection for wilderness, restrains human influences so that ecosystems can change over time in their own way, prohibits permanent roads and commercial enterprises, except commercial services that may provide for recreational or other purposes of the Wilderness Act. Wilderness areas generally do not allow motorized equipment, motor vehicles, mechanical transport, temporary roads, permanent structures or installations.	?
ACTION-SPECIFIC : STATE/LOCAL			
California Air Quality Control Act	California Air Resources Board www.arb.ca.gov	Regulates air particulates and general air quality; Administers, controls, and maintains the Statewide Best Available Control Technology (BACT) database for air quality.	**Applicable**

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR
California Hazardous Waste Disposal and Transportation Program	Title 26 CCR, Division 4 - Cal/OSHA, Division 21.5 - Health and Welfare (Prop 65); Title 26 CCR, Division 22 - Department of Health Services; 49 CFR - Parts 100-177 and 350-399 - Department of Transportation.	Regulates transportation and disposal of hazardous waste.	**Applicable**
California Solid Waste Management Regulations	Title 27. Environmental Protection, Division 2. Solid Waste, Subdivision 1. Consolidated Regulations for Treatment, Storage, Processing or Disposal of Solid Waste	Applies to all disposal sites meaning active, inactive closed or abandoned, as defined in §40122 of the Public Resources Code including facilities or equipment used at the disposal sites	**Applicable**
State Water Resources Control Board General Permits for Industrial/ Construction Storm Water Discharges Requirements	www.waterboards.ca.gov/water_issues /programs/stormwater/ industrial.shtml	The regulations require that stormwater associated with industrial/construction activity that discharges either directly to surface waters or indirectly through municipal separate storm sewers must be regulated by a NPDES permit.	**To be Considered**
The California Global Warming Solutions Act of 2006	Assembly Bill 32 (AB 32) - Assembly Speaker Fabian Nunez (D-Los Angeles), Statutes of 2006, Chapter 488	Determined the statewide 1990 greenhouse gas emissions level as a statewide aggregate emissions limit to be achieved by 2020.	**Applicable**
California Hazardous Waste Control Act	California Health and Safety Code, Division 20, Chapter 6.5 CCR Title 22 Social Security, Division 4.5, Environmental Health Standards for the Management of Hazardous Waste.	California's Hazardous Waste Control Act (HWCA 1973) regulates generators, transporters and facilities that handle, treat, store or dispose of hazardous waste. Facilities with a permit to handle, transport, treat, store, or dispose of hazardous materials/waste are subject to regulatory oversight by DTSC. They are periodically inspected to ensure compliance.	**Applicable**

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR
San Joaquin Valley Unified Air Pollution Control District - San Joaquin Valley Air Basin Program Mulford-Carrell Air Resources Act	Regulation II - Permits Regulation IV - Prohibitions Regulation VI - Air Pollution Emergency Contingency Plan Regulation VII - Toxic Air Pollutants Regulation VIII - Fugitive PM10 Prohibition Regulation IX - Mobile and Indirect Sources	Rules and regulations enacted to achieve and maintain local, state, and federal ambient air quality standards for San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare, and Kern counties.	**Applicable**
Environmental Ordinances of the County of Tulare, California.	Tulare County, California, Code Of Ordinances, Part 4 Health, Safety, and Sanitation, Chapter 3 Management of Solid Waste and Chapter 27 Storm Water Quality and Regulation	Regulates Management of Soil Waste and Storm Water Quality and Regulation.	**Applicable**

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4.0 IDENTIFICATION AND SCREENING OF REMOVAL ACTION ALTERNATIVES

This section identifies and evaluates diverse, individual *technologies* that can help achieve RAOs at the Site. Typically, no single technology will achieve most or all RAOs. Therefore, complimentary technologies are assembled into groups to create *alternatives* for a more complete evaluation based on effectiveness, implementability, and cost.

4.1 IDENTIFICATION OF REMOVAL ACTION TECHNOLOGIES

The table below identifies technology types and process options within the technologies generally capable of meeting RAOs to be considered for removal action alternatives.

Table 4.1: Removal Action Technologies

Removal Action Technology	Description
1. No Action	This action leaves contaminated materials in their current condition and assumes no further intervention will occur. No response activities or monitoring are associated with this technology. All evaluations of technologies must include “No Action” as a baseline for comparison to the other technologies.
2. Institutional Controls	Institutional controls restrict access to or control the use of a site. They include construction of barriers, installation of fences and gates, moats, warning signs, hostile vegetation, and designation of the lands in public records as a repository with use restrictions. Enforcement of such controls would require periodic inspections and patrols, as wells as legal action against violators. Institutional controls do not reduce the volume or toxicity of the hazardous material.
Zoning	*Zoning would be implemented to control present and future land uses on or around waste and source areas consistent with the potential hazards present, the nature of removal action implemented, and future land-use patterns. The objective of zoning would be to prevent public or private misuse of waste and source areas that could jeopardize the effectiveness of removal action or pose an unacceptable potential for human exposure to the contaminants present in the waste and source areas.*
Deed Restrictions	*Deed restrictions would prevent the transfer of property without notification of limitations on the use of the property or requirements related to preservation and protection of the effectiveness of the implemented removal action alternative.*
Environmental Control Easements	*This is an enforceable easement mechanism for imposing restrictions on the use of a site and requiring performance of operations and maintenance activities that may help protect public health, safety, and welfare, and the environment.*
Access Restrictions	*Access restrictions typically include physical barriers, such as fencing, that could prevent both human and wildlife access to preclude exposure to waste contamination or structures; and to protect the integrity of the action. Fencing can be installed around the perimeter of waste and source areas to prevent human and animal access to the areas. Posted warnings would identify the potential hazards present at the waste and source areas to deter trespass and misuse.*

Removal Action Technology	Description
3. Engineering Controls	Engineering controls are used primarily to reduce the mobility of, and exposure to, contaminants. These goals are accomplished by creating a barrier that prevents direct exposure and transport of waste from the contaminated source to the surrounding media. Engineering controls do not reduce the volume or toxicity of the hazardous material. Typical engineering controls for solid media include surface controls, containment, and on-site and off-site disposal.
Engineering Controls – *Surface Controls*	*This technology involves grading, re-vegetation, erosion controls, or soil binding to reduce the mobility of, and exposure to, contaminants.*
Grading	*Grading is the general term for techniques used to reshape the ground surface to reduce slopes, manage surface water infiltration and runoff, restore eroded areas, and aid in erosion control. The spreading and compaction steps used in grading are routine construction practices.*
Re-vegetation	*Re-vegetation means fostering native plant growth to reduce surface erosion. It involves adding soil amendments to the waste surface to provide nutrients, organic material, and neutralizing agents, and to improve the water storage capacity of the contaminated media, as necessary. Re-vegetation can provide an erosion-resistant cover that protects the ground surface from surface water and wind erosion and reduces net infiltration through the contaminated medium and can also reduce the potential for direct contact.*
Erosion Controls	*Erosion control and protection includes using erosion-resistant materials, such as mulch, natural or synthetic fabric mats, gabions, velocity breaks, drainage channels, ditches, trenches, and riprap to reduce the erosion potential at the surface of the contaminated medium. The erosion-resistant materials are placed in areas susceptible to wind or surface water erosion (concentrated flow or overland flow). Surface water diversion controls or stormwater management structures are designed to prevent surface water from contacting contaminated materials and to appropriately manage any water that contacts those materials despite controls.*
Soil Binder	*Application of a chemical soil binder involves adding proprietary soil amendments to the waste surface to bond the individual soil particles together and form a flexible "crust" that strengthens the surface of the soil resulting in enhanced stability to reduce dust and to prevent further erosion. This is normally a temporary measure.*
Engineering Controls – *Surface Containment*	*This technology involves covering the waste material (or consolidated waste material) to limit the potential for human and ecological exposure to the contaminants, and limit the potential for off-site migration via erosion or leaching. The capping configuration would be graded so that drainage would follow the natural contours of the area. Capping would also limit stormwater flow and infiltration and promote runoff away from the contaminated areas, thereby preventing the transport of contaminated sediments to surface water bodies.*
Engineering Controls – *On-Site Disposal (CAMU)*	*This technology involves excavation, relocation, and placement of the waste materials in an on-site consolidation waste pile, cell or repository to minimize its footprint and concentrate its mass in a single, manageable area designated as a Corrective Action Management Unit (CAMU). It is normally implemented in conjunction with other containment technologies. The CAMU would be specifically designed and constructed to contain the waste materials.*

Removal Action Technology	Description
Engineering Controls – *Off-site Disposal*	*This action involves relocation and placement of contaminated materials in an off-site commercial landfill facility in open cells in a manner determined by the facility operator. The facility would be responsible for compliance with all applicable regulations governing solid waste disposal.*
4. Ex-Situ Removal and Treatment	This technology involves removal of contaminated soil and waste and subsequent treatment through processes that chemically, physically, or thermally reduces contaminant toxicity and/or volume. Excavated areas are backfilled with clean soil, returned to original grade, if necessary, and re-vegetated or otherwise stabilized to prevent erosion. In the case of excavating waste piles, backfilling may not be necessary, but restoration should occur.
Chemical Soil Washing	*Chemical soil washing applies an acidic solution to the contaminated medium in a heap, vat, or agitated vessel. Depending on temperature, pressure, and acid concentration, varying quantities of the metal constituents present in the contaminated medium would solubilize. This is similar to the heap leaching process used by mills to extract metals from processed ore. It requires the construction of a double-lined impoundment with leachate collection and removal systems.*
Chemical Solidification/ Stabilization	*Ex-situ chemical solidification involves removing the soil (via excavation or vacuum methods) and mix it with a binding agent. Common solidification binding agents include cement, asphalt, fly ash, and clay. Water is added to the mixture for binding to occur; then the mixture is allowed to dry and harden to form a solid block. For ex-situ chemical stabilization the binding agents cause a chemical reaction with contaminants to make them less likely to be released into the environment. For example, when soil contaminated with metals is mixed with water and lime (a white powder produced from limestone) a reaction changes the metals into a form that will not dissolve in water.*
Thermal Treatment	*This technology involves removing the soil (via excavation or vacuum methods) and applying heat to volatilize and oxidize metals and render them amenable to additional processing. Potentially applicable moderate-temperature thermal processes, which volatilize metals and form metallic oxide particulates, include the fluidized bed reactor, the rotary kiln, and the multi-hearth kiln.*
5. *In-Situ* Treatment	Stabilization and fixation of the contamination in-place reduces the mobility of contaminants in soil. The treatment seeks to permanently trap or immobilize the contamination within the soil using non-hazardous chemical binders to prevent erosion.
Phytoremediation	*Phytoremediation would help to meet the RAOs when employed in conjunction with other removal action technologies. The phytoremediation process uses plants to contain, uptake, degrade, or eliminate contaminants. The most significant challenge in phytoremediation of contaminated soils is achieving contact between specific plants and contaminants to achieve uptake allowing the contaminants to be removed from the soil and into the plant matrix.*

Removal Action Technology	Description
Chemical Solidification/ Stabilization	*In-situ chemical solidification involves injecting a solidifying agent, which is a substance that makes loose materials stick together, into contaminated materials. Common binding agents include cement, asphalt, fly ash, and clay. Water must be added to most mixtures for binding to occur; then the mixture is allowed to dry and harden to form a solid block. For in-situ chemical stabilization the binding agents cause a chemical reaction with contaminants to make them less likely to be released into the environment. For example, when soil contaminated with metals is mixed with water and lime (a white powder produced from limestone) a reaction changes the metals into a form that will not dissolve in water.*
Thermal Treatment	*In-situ vitrification is a process used to melt contaminated solid media in-situ to immobilize metals into a glass-like, inert, non-leachable solid matrix.*

4.2 SCREENING OF REMOVAL ACTION TECHNOLOGIES

An evaluation of each response technology was performed to determine whether it would meet RAOs and ARARs. A summary of selected technologies is presented in Table 4.2 showing the selection factors identified during the screening process.

Table 4.2: Removal Action Technology Screening

Removal Action Technology	Site Specific Screening Evaluation
1. No Action	Although No Action will not meet the RAOs or ARARs, it is used as a baseline against other alternatives measured. For this reason, and because a No Action is required according to EPA guidance, it is retained for further evaluation as a Removal Action Alternative.
2. Institutional Controls	Land use restrictions would be necessary to prevent future activities that are inconsistent with the streamlined human health risk evaluation's exposure pathway assumptions. Due to the remoteness of the Site, enforcement of ICs could be difficult, but not impossible. Additional fencing would prevent human trespassers but not ecological exposure or off-site migration of the contamination. Therefore, ICs would likely need to accompany another technology to adequately meet RAOs and ARARs. ICs can augment technologies such as capping and storm water controls to ensure that future construction projects do not disrupt or disturb them.
3. Capping	Capping of contaminated materials (in place) would meet RAOs and ARARs when employed in conjunction with other removal action technologies to address areas where capping would not be technologically feasible or otherwise cost-effective **(Figure 4.1)**. This approach may require access for medium size vehicles and semi-heavy equipment to the Site.

Removal Action Technology	Site Specific Screening Evaluation
4. Engineering Controls – Re-vegetation	Re-vegetation means fostering native plant growth to reduce surface erosion. It involves adding soil amendments to the waste surface to provide nutrients, organic material, and neutralizing agents, and to improve the water storage capacity of the contaminated media, as necessary. Re-vegetation can provide an erosion-resistant cover that protects the ground surface from surface water and wind erosion and reduces net infiltration through the contaminated medium and can also reduce the potential for direct contact.
5. Phytoremediation	Phytoremediation would help to meet the RAOs when employed in conjunction with other removal action technologies. The phytoremediation process uses plants to contain, uptake, degrade, or eliminate contaminants. The most significant challenge in phytoremediation of contaminated soils is achieving contact between specific plants and contaminants to achieve uptake allowing the contaminants to be removed from the soil and into the plant matrix.
6. Excavation	Excavation would meet RAOs and ARARs when applied with other technologies to address the end use/disposal of the excavated contaminated materials. This approach may require access for medium size vehicles and semi-heavy equipment to the Site.
7. Off-site Disposal	Transportation of contaminated materials to an off-site disposal facility would meet RAOs and ARARs. This approach is often costly and transfers the problem to another location. It may require multiple truckloads transported over a long distance without a significant carbon footprint based on diesel emissions. This approach may require Site access to accommodate mid-size dump trucks.

4.3 ASSEMBLY OF REMOVAL ACTION ALTERNATIVES

The removal action technologies described in the preceding section were assembled into four Removal Action Alternatives, which have been analyzed with respect to the evaluation criteria (RAOs and ARARs). These alternatives have been developed based on the known nature and extent of soil contamination and results of the risk evaluation.

- Alternative 1 – No Action
- Alternative 2 – Capping, Re-vegetation and Institutional Controls
- Alternative 3 – Capping, Phytoremediation and Institutional Controls
- Alternative 4 – Excavation and Off-Site Disposal

Section 5.0 presents an evaluation of these alternatives.

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5.0 EVALUATION OF REMOVAL ACTION ALTERNATIVES

According to the EPA's *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA* (EPA 1993a), the efficacy of a removal action should be evaluated based on:

I. Effectiveness:
   1. Protective of Public Health and the Community (Protectiveness)
   2. Protective of Workers During Implementation
   3. Protective of the Environment
   4. Compliance with ARARs
   5. Achievement of RAOs
   6. Level of Containment Expected
   7. Reduction or Elimination of Residual Concerns

II. Implementability:
   1. Technical Feasibility
      a. Availability of Equipment
      b. Availability of Services
      c. Site Accessibility
      d. Availability of Laboratory Testing Capacity
      e. Can be Implemented in One Year
   2. Administrative and Legal Feasibility
      a. Acquisition of Permits Required for Off-site Work
      b. Acquisition of Permits Required for On-site Work
      c. Acquisition of Easement or Rights-of-Way Required
      d. Impact on Adjoining Property
      e. Ability to Impose Institutional Controls
   3. Ease of Implementation
      a. Regulatory Acceptance
      b. Community Acceptance

III. Cost:
   1. Capital Cost
   2. Post Removal Site Control Cost
   3. Long-Term Maintenance and Monitoring (O&M) Costs
   4. Present Worth Cost/Present Value

In accordance with EPA guidance (EPA 1993a, 2000), engineering costs are estimates within plus 50 to minus 30 percent of the actual estimated expected project costs (based on year 2014 dollars). Cost estimates were prepared in accordance with EPA guidelines (EPA 2000) using engineer's estimates, historical costs for similar projects, and vendor budgetary quotes (**Attachment D, Table D-1**). Changes in the cost elements are likely as new information and data collected during the removal action design becomes available. The present worth cost of each removal action alternative provides the basis for the cost comparison. The present worth cost represents the amount of money that, if invested in the initial year of the removal action at a given interest rate (this EE/CA Report uses a 3 percent discount rate, that is the historical average rate for a 30-year T-bill), would provide the funds required to make future payments to cover all costs associated with the removal action over its planned life. Inflation and depreciation were not considered in preparing the present worth costs. **Table D-2** through **Table D-4**, in **Attachment D,** present detailed cost estimate tables for each alternative.

Estimated costs relied on several assumptions regarding site conditions and are based on conceptual design only. The estimated costs are intended for alternative comparison only and are not suitable for construction bidding purposes in the absence of an approved design. Assumptions made in preparing the cost estimate include:

- Prior to removal action planning, an archeological survey of the site may be required and completed by NPS.
- Site access road reconstruction or improvement will not be needed.
- Existing data may be sufficient for characterization and profiling wastes for landfill disposal, with minimal additional analyses required.
- All the removed materials from the dumpsite will require stabilization at the landfill previous to final disposal. Additional dumpsite characterization that could be used to discriminate waste areas with less stringent disposal requirements are not included.
- A temporary heavy equipment staging area can be established near the Site.
- No borrow pits will be established within the site. All additional cap material will be imported from outside the park to meet best management practices.
- An archeological resource specialist will be present during site excavation for off-site disposal; however, no limitations to excavation, such as artifact removal, have been assumed.
- Post-removal action O&M monitoring of the site will be required to monitor the removal action effectiveness and compliance with the ARARs.

The following sections present an evaluation of each of the Removal Action Alternatives. A comparative analysis of alternatives is presented in **Section 5.5** and summarized in Table 5.1.

5.1 ALTERNATIVE 1: NO ACTION

The No Action Alternative leaves contaminated materials at the Site in their current condition and assumes no further intervention will occur. Under the No Action Alternative, no response activities or monitoring would occur at the Site as a baseline for comparison to the other alternatives.

5.1.1 Effectiveness of Alternative 1

The following subsections evaluate the effectiveness of a proposed No Action Alternative, as demonstrated by environmental conditions that would exist, if a removal action was not implemented.

Protectiveness

The No Action Alternative would not protect human health or the environment because it would not address metals contamination which presents an environmental risk. Conditions would not change at the Site, and human health, ecology, and wildlife would remain at risk.

Compliance with ARARs

The No Action Alternative would not enforce complete compliance with ARARs because it does not address a number of human health, ecological, historical, and archaeological requirements from the ARARs listed on **Table 3.2** through **Table 3.4**.

Ability to Achieve RAOs

The No Action Alternative would not achieve the RAOs, since it would not prevent or reduce human or ecological exposure to metals in soil. Human health and ecological risks would persist. Storm water drainage flows over the exposed soil in the form of run-on or sheet flow. Under this alternative, these flows will continue to erode the surface soil and will transport metal-laden materials through aeolian processes[37] and through run-off flow[38].

Level of Treatment/Containment Expected

The No Action Alternative provides no containment or treatment options.

Reduction or Elimination of Residual Concerns

The No Action Alternative does not reduce the risk to human health or ecological receptors through absorption, ingestion, inhalation, and dermal contact pathways. The toxicity, mobility and volume of contaminants would not be reduced under this alternative.

5.1.2 Implementability of Alternative 1

Technical Feasibility

The No Action Alternative is technically implementable. This alternative requires no on-site equipment, on-site personnel or services, nor does it require laboratory testing.

[37] Particles transported by wind through suspension, saltation (bouncing), and creep.

[38] Erosion from source area and deposition in new location, such as a normally dry wash as sediment.

Administrative and Legal Feasibility

The No Action Alternative is administratively feasible, and the availability of resources would not be an issue. Alternative 1 requires no acquisition of permits for off-site work, requires no acquisition of easements or rights-of-way, and requires no institutional controls.

Ease of Implementation

There is no implementation process associated with the No Action Alternative.

Regulatory acceptance is unlikely because this alternative does not achieve RAOs and ARARs. Community acceptance is unknown, but it is unlikely the community would accept this alternative.

5.1.3 Cost of Alternative 1

There are no capital costs or operation and maintenance costs associated with the No Action Alternative. However, there may be significant long-term costs associated with future impacts or releases. There may also be non-monetary costs associated with ecological impacts to ecological receptors.

5.2 ALTERNATIVE 2: CAPPING, RE-VEGETATION AND INSTITUTIONAL CONTROLS

Alternative 2 consists of capping and institutional controls. Excavation and consolidation would not be necessary since the burned and waste materials are already consolidated in one place. The components for Alternative 2 are discussed in more detail below.

Documentation

This alternative would require minor engineering designs, construction management, health and safety plans. Contacts with appropriate agencies and tribes regarding historical and cultural resources and potential cultural items, remains, and funerary objects could be required.

A biological and botanical resource inventory report concluding that the project would not impact sensitive species would be required before design and construction. In addition, a historical and cultural resources survey report concluding that the project would not impact these resources would be required before design and construction.

Capping and Re-vegetation

The existing cap at the dumpsite will be inspected and repaired in order to construct a consistent 18-inch thick layer of imported clean cobble and gravel fill (to discourage burrowing animals) covered with a 6-inch clean soil layer. The cap should be slightly compacted, graded and thickly re-vegetated with native species as soon as practicable to reduce erosion. A Storm Water Pollution Prevention Plan (SWPPP) should be prepared containing measures such as drainage swales, sediment ponds, or silt fencing and be incorporated into the project to minimize the potential for adverse impacts to water quality during cap construction activities. Post removal action site controls (operations and maintenance) would consist of cap inspections and repairs, re-vegetation of clear areas and minor erosion repairs to the natural channels surrounding the dumpsite. **Figure 4.1** is a conceptual schematic cap design.

Institutional Controls

Workers would be instructed to avoid contact with surface water at the dumpsite, when present. Periodic site visits would be conducted to monitor the integrity of the cap and to perform repairs and maintenance activities as necessary. Park planning and engineering records would require update and a planning process should be implemented to ensure that no future ground disturbance occurs at the dumpsite and that the land is not used for residential purposes. A fence with appropriate signage would surround the cap and restrict access.

5.2.1 Effectiveness of Alternative 2

The following subsections evaluate the effectiveness of Alternative 2 based on the environmental conditions that would exist, if such actions and/or controls were implemented.

Protectiveness

Alternative 2 would limit infiltration of precipitation and surface water and reduce human and environmental exposure to contaminated soil. This alternative would reduce potential human and ecological exposure to soils contaminated with metals by reducing erosion and transport of contaminated soils down a wash, and preventing wind erosion of the contaminated material.

Access restrictions would deter public access to the site and reduce exposure to waste materials. Periodic inspections would be necessary to ensure the dumpsite cover, surface controls (vegetation), access restrictions, and warning signs remain intact over the long term.

This alternative would not reduce the toxicity of metals or volume of contaminated soil. However, risk associated with ingestion, dermal adsorption, and inhalation of metals in soil or soil particles would be reduced primarily through the improved capping and re-vegetation of the area. Although the presence of metals-contaminated material would remain unchanged, future activities at near the site would be generally unencumbered except in the dumpsite area. Protection of ecological receptors would also occur through the installation of a bio-intrusion protective layer, made of well-graded cobble and gravel, to discourage burrowing animals.

Potential water quality impacts would be reduced by limiting water contact with contaminated soil and waste materials reducing residual material migration to on- and off-site washes. Surface water at the Site is ephemeral and groundwater is not used, so no water quality impacts are expected to occur.

Compliance with ARARs

Alternative 2 would comply with chemical and location ARARs and will comply with action specific ARARs related to 36 CFR condition that must be met for solid waste disposal site closure and post-closure to be in compliance with the requirements prescribed by 40 CFR part 258, Criteria For Municipal Solid Waste Landfills at 40 CFR 258.60 and 258.61. Although metal-contaminated material would remain on-site at concentrations not protective of surface water and groundwater quality, the source area is consolidated, and will be stabilized within the roots and biomass system and exposure to and mobility of materials would be minimized.

Use of the smallest equipment practicable would address NPS stewardship concept for cultural and natural resource protection ethic of employing the most effective concepts, techniques, equipment, and technology to prevent, avoid, or mitigate unacceptable impacts.

Ability to Achieve RAOs

Alternative 2 meets all RAOs, with explanations and minor exceptions noted:

- Minimize human and ecological exposure (through inhalation, ingestion, and dermal contact) to soil contaminated with metals;

  Alternative 2 meets this ARAR by reducing exposure and/or eliminating exposure in the areas by blocking exposure to human receptors and reducing exposure to ecological receptors. The potential for ecological exposure is not eliminated due to the ability for burrowing animals to enter the consolidation areas. A special precaution was addressed by placing an 18-inch thick layer of cobble and gravel to deter burrowing animals.

- Prevent or reduce potential migration of surface soil impacted with metals via surface runoff, erosion, and wind dispersion.

  This RAO is achieved through large reduction in migration potential.

Level of Treatment/Containment Expected

No treatment is proposed with this alternative. Containment occurs by capping and re-vegetation and the majority of the metals of concern will be stabilized within the surface soil via the roots and biomass system. A high level of containment, with the use of institutional controls can be expected with proper maintenance.

Reduction or Elimination of Residual Concerns

Since the site is a former dumpsite area, residual concerns are decreased considerably since most of the material has already been burned and consolidated reducing the areal size of the waste material.

5.2.2 Implementability of Alternative 2

The following sections provide an evaluation of the feasibility and implementability of Alternative 2.

Technical Feasibility

The required grading of the dumpsite will not require the use of heavy equipment. Controlling fugitive dust emissions and stormwater discharges (if generated) during grading and construction would not be required because the dumpsite is already partially capped and vegetated and the proposed grading will be part of the cap repair activities. Long-term monitoring and maintenance would be required, especially inspection and repair of the dumpsite cap, including keeping a thick vegetation covering.

Design methods, construction practices, and engineering requirements for installation of the components for dumpsites closure are well documented and understood. The availability of equipment, personnel and services, and obtaining a laboratory would not present any foreseeable obstacle to the technical feasibility of this alternative.

Administrative and Legal Feasibility

Alternative 2 is both legally and administratively feasible. It requires no acquisition of permits for off-site work (other than traffic control), no acquisition of easements or rights-of-way since all operations will be conducted on NPS SEKI property, and offers implementable institutional controls. Only native plant species shall be selected for re-vegetation. NPS would prepare a historical and cultural resources survey for each site to identify all resources, to identify resources that cannot be disturbed or that must be restored after construction, and to identify features that are not a resource requiring protection or mitigation. Additionally, NPS must comply with requirements in CFR 40 Part 258 Criteria for Municipal Solid Waste Landfills, Section §258.60 Closure Criteria, which may require upgradient and downgradient monitoring wells.

Ease of Implementation

Alternative 2 is more difficult to implement than alternative 1 presented herein, due to the requirement of small or medium size machinery and site disturbance required to complete the task.

Regulatory acceptance is likely with Alternative 2 because it achieves RAOs and ARARs. Community acceptance is unknown at this time but will be determined during the EE/CA Report public comment period.

5.2.3 Cost of Alternative 2

The costs for Alternative 2 have been evaluated in detail based on the evaluation criteria listed in **Section 5.0**. A complete break-out of costs is for Alternative 2 is provided in **Attachment D, Table D-2**.

Summary of Alternative 2 associated costs:

- Capital Cost: $ 136,962
- Long-Term Maintenance and Monitoring Costs: Approximately $ 10,500 per year
- Present Worth Cost/Present Value: Approximately $ 342,766

The capital costs are estimated based on the following general elements:

- Design, including pre- and post-construction submittals, excluding ecological resource inventory and cultural resources survey

- Cap construction
- Re-vegetation

The post-removal maintenance and monitoring costs are calculated based on annual site monitoring and maintenance for 30 years. Present Worth/Present Value cost is calculated based on the total of the capital costs and long-term maintenance/monitoring costs.

5.3 ALTERNATIVE 3: CAPPING, PHYTOREMEDIATION AND INSTITUTIONAL CONTROLS

Alternative 3 will consist of the following components.

Documentation

This alternative would require engineering designs, soil characterization/feasibility analysis, a treatability study to evaluate plant uptake/degradation, a pilot-study, construction management, and a health and safety plan. Contacts with appropriate agencies and tribes regarding historical and cultural resources and potential cultural items, remains, and funerary objects could be required.

A biological and botanical resource inventory report prepared by NPS concluding that the project would not impact sensitive species would be required before implementation. In addition, a historical and cultural resources survey report prepared by NPS concluding that the project would not impact these resources would be required before implementation.

Capping and Phytoremediation

The existing cap at the dumpsite will be inspected and repaired in order to construct a consistent 18-inch thick layer of imported clean cobble and gravel fill covered with a 6-inch clean soil layer slightly compacted, graded and thickly re-vegetated for phytoremediation purposes as soon as practicable to reduce erosion of the cover and to discourage burrowing animals (**Figure 4.1**). A Storm Water Pollution Prevention Plan (SWPPP) should be prepared containing measures such as drainage swales, sediment ponds, or silt fencing and be incorporated into the project to minimize the potential for adverse impacts to water quality during cap construction activities. Post removal action site controls (operations and maintenance) would consist of cap inspections and repairs, phytoremediation maintenance and minor erosion repairs to the natural channels surrounding the dumpsite.

Phytoremediation at the site would conceptually consist of reducing metals contamination in soil by containing, degrading, and transferring them into the roots and biomass system over time. Plants would be harvested on a scheduled basis and replaced with new plants to further the process. Other scheduled maintenance would include checking for proper drainage, plant fertility, weeds and pests, and maintaining an irrigation system, if necessary.

Engineering Controls

Engineering controls may be required to re-grade uphill of the phytoremediation area. Generally, normal runoff and precipitation conditions are required to allow the plants to maintain an adequate water supply. Should an adequate water supply not be able to be achieved, additional engineering controls, such as an irrigation system, would be required.

Institutional Controls

Workers would be instructed to avoid contact with surface water at the dumpsite, when present. Periodic site visits would be conducted to monitor the integrity of the cap, the plant matrix involved in the phytoremediation process, and to perform general repairs and maintenance activities as necessary. Park planning and engineering records would require updating and a planning process should be implemented to ensure that no future ground disturbance occurs at the dumpsite and that the land is not used for residential purposes. A fence with appropriate signage would surround the cap and restrict access.

5.3.1 Effectiveness of Alternative 3

The following subsections evaluate the effectiveness of Alternative 3 based on the environmental conditions that would exist, if such actions and/or controls were implemented.

Protectiveness

Alternative 3 would limit infiltration of precipitation and surface water and reduce human and environmental exposure to contaminated soil, contain, degrade, and remove the metals contamination over time. This alternative would reduce potential human and ecological exposure to contaminated material by stabilizing the majority of the source area via the roots and biomass system, reducing erosion and transport of contaminated material down a wash, and preventing wind erosion of the contaminated material.

Access restrictions would deter public access to the site and reduce exposure to waste materials. Periodic inspections would be necessary to ensure the dumpsite cover, surface controls (vegetation), access restrictions, and warning signs remain intact over the remediation period.

Alternative 3 protects downstream washes and reduces water quality impacts over the long term because contaminated material would be stabilized via the roots and biomass system. Surface water is ephemeral and groundwater is not used at the Site, so no change in exposure would occur.

Compliance with ARARs

Alternative 3 would comply with chemical and location ARARs and will comply with action specific ARARs related to 36 CFR condition that must be met for solid waste disposal site closure and post-closure to be in compliance with the requirements prescribed by 40 CFR part 258, Criteria For Municipal Solid Waste Landfills at 40 CFR 258.60 and 258.61. Although metal-contaminated material would remain on-site at concentrations not protective of surface water and groundwater quality, the source area is consolidated, and will be stabilized within the roots and biomass system and exposure to and mobility of materials would be minimized.

Use of the smallest equipment practicable would address NPS stewardship concept for cultural and natural resource protection ethic of employing the most effective concepts, techniques, equipment, and technology to prevent, avoid, or mitigate unacceptable impacts.

Ability to Achieve RAOs

Alternative 3 meets all RAOs, with explanations and minor exceptions noted:

- Minimize human and ecological exposure (through inhalation, ingestion, and dermal contact) to soil contaminated with metals;

  Alternative 3 meets this ARAR by reducing exposure and/or eliminating exposure in the areas by blocking exposure to human receptors and reducing exposure to ecological receptors. The potential for ecological exposure is not eliminated due to the ability for burrowing animals to enter the root and biomass system. A special precaution was addressed by placing an 18-inch thick layer of cobble and gravel to deter burrowing animals.

- Prevent or reduce potential migration of surface soil impacted with metals via surface runoff, erosion, and wind dispersion.

  This RAO is achieved through large reduction in migration potential.

Level of Treatment/Containment Expected

The majority of the metals of concern will be stabilized within the surface soil via the roots and biomass system and will be partially removed through plant uptake processes. Based on the high concentrations for lead and zinc in samples collected at more than 2 feet below the dump pile surface, the expected removal efficiency is very low, incapable of achieving SSSLs in less than 30 years. A high level of containment, with the use of institutional controls, can be expected with proper maintenance.

Reduction or Elimination of Residual Concerns

Since the site is a former dumpsite area, residual concerns are decreased considerably since most of the material has already been burned and consolidated reducing the areal size of the waste material. Additionally, residual concerns are reduced by utilizing phytoremediation to partially mitigate the contaminated material.

5.3.2 Implementability of Alternative 3

The following sections provide an evaluation of the feasibility and implementability of Alternative 3.

Technical Feasibility

The required grading of the dumpsite will not require the use of heavy equipment. Controlling fugitive dust emissions and stormwater discharges (if generated) during grading and construction would not be required because the dumpsite is already partially capped and vegetated and the proposed grading will be part of the cap repair activities. Long-term monitoring and maintenance would be required, especially inspection and repair of the dumpsite cap, including keeping a thick vegetation covering and phytoremediation maintenance activities.

Although case studies exist for the removal of metals contamination at various sites using phytoremediation, additional work would be required to determine its site specific technical feasibility, including:

- Soil Characterization/Feasibility Analysis;
- Greenhouse/growth chamber treatability study to evaluate plant uptake/degradation; and
- Pilot-scale field test plot.

Design methods, construction practices, and engineering requirements for installation of the components for dumpsites closure are well documented and understood. The availability of equipment, personnel and services, and obtaining a laboratory would not present any foreseeable obstacle to the technical feasibility of this alternative. Elevated COCs concentrations and the thickness of the dump site could render phytoremediation technically unfeasible by not providing any additional soil treatment when compared to Alternative 2.

Administrative and Legal Feasibility

Alternative 3 is both legally and administratively feasible. It requires no acquisition of permits for off-site work (other than traffic control), no acquisition of easements or rights-of-way since all operations will be conducted on NPS SEKI property, and offers implementable institutional controls. Only native plant species or non-invasive foreign plant species shall be selected for phytoremediation at the Site. All non-invasive foreign plants shall be completely removed from the Site after treatment completion. NPS would prepare a historical and cultural resources survey for each site to identify all resources, to identify resources that cannot be disturbed or that must be restored after construction, and to identify features that are not a resource requiring protection or mitigation. Additionally, NPS must comply with requirements in CFR 40 Part 258 Criteria for Municipal Solid Waste Landfills, Section §258.60 Closure Criteria.

Ease of Implementation

Alternative 3 is more difficult to implement than alternative 1 presented herein, due to the requirement of small or medium size machinery and site disturbance required to complete the task. Alternative 3 is more difficult to implement than alternative 2 presented herein, due to the addition of phytoremediation treatment. Phytoremediation treatment will require additional feasibility studies, plant selection, pilot testing, replanting and maintenance of the plant system.

Regulatory acceptance is likely with Alternative 3 because it achieves RAOs and ARARs. Community acceptance is unknown at this time but will be determined during the EE/CA Report public comment period. It is likely the community would accept this alternative as protective.

5.3.3 Cost of Alternative 3

The costs for Alternative 3 have been evaluated in detail based on the evaluation criteria listed in **Section 5.0**. A complete break-out of costs for Alternative 3 is provided in **Attachment D, Table D-3**.

Summary of Alternative 3 associated costs:

- Capital Cost: $ 247,722
- Long-Term Maintenance and Monitoring Costs: Approximately $ 22,500 per year
- Present Worth Cost/Present Value: Approximately $ 688,732

The capital costs are estimated based on the following general elements:

- Design, including pre- and post-construction submittals, excluding ecological resource inventory and cultural resources survey
- Cap construction
- Phytoremediation feasibility analysis/soil study
- Phytoremediation treatability analysis/plant uptake study
- Phytoremediation pilot study
- Field implementation (phytoremediation and phytoextraction)

The post-removal maintenance and monitoring costs are calculated based on annual site monitoring and maintenance for 30 years. Present Worth/Present Value cost is calculated based on the total of the capital costs and long-term maintenance/monitoring costs.

5.4 ALTERNATIVE 4: EXCAVATION AND OFF-SITE DISPOSAL

Alternative 4 will consist of the following components.

Documentation

This alternative would require engineering designs, construction management, and a health and safety plan. Contacts with appropriate agencies and tribes regarding historical and cultural resources and potential cultural items, remains, and funerary objects could be required.

A biological and botanical resource inventory report prepared by NPS concluding that the project would not impact sensitive species would be required before implementation. In addition, a historical and cultural resources survey report prepared by NPS concluding that the project would not impact these resources would be required before implementation.

Excavation

Alternative 4 would involve removing the waste materials from the dumpsite area to match the pre-existing natural grade. No additional imported soil will be required, as no depression will be created by the removal activities since the waste materials were deposited on top of the pre-existing surface, which doesn’t need to be excavated. A Storm Water Pollution Prevention Plan

(SWPPP) should be prepared containing measures such as drainage swales, sediment ponds, or silt fencing and be incorporated into the project to minimize the potential for adverse impacts to water quality during excavation activities. Fugitive dust emissions will be minimized by laying down water spray during excavation and soil loading operations, and will conform to the applicable EPA regulations for earth-moving activities in contaminated areas.

Off Site Disposal

Department of Transportation (DOT) waste management regulations apply to all disposal sites, including facilities or equipment used at the disposal sites. This is an applicable ARAR which must be addressed if any solid waste is transported away from the Site.

If excavated, the soil would constitute a waste for off-site disposal. The exposure point concentration of zinc (5,089 mg/kg) exceeds the California Total Threshold Limit Concentration (TTLC) of 5,000 mg/kg, so if disposed in California, an authorized hazardous waste landfill could only accept the waste as a non-RCRA hazardous waste solid. Other metals (arsenic, cadmium, chromium, copper, and lead) could potentially contain leachable concentrations exceeding California's Soluble Threshold Limit Concentration (STLC). The exposure point concentration for lead is 632.38 mg/kg, which can potentially contain leachable concentrations exceeding the RCRA D008 limit. If so, then the waste would require chemical stabilization prior to landfill disposal.

Chemical Stabilization

For soils with STLC metals concentration values that would deem the removed impacted soil as a RCRA Hazardous Waste for off-site disposal purposes, chemical stabilization would be performed at the landfill. Chemical stabilization uses reagents added to the contaminated soils to form less soluble compounds while controlling pH in a range of minimum solubility.

Confirmation Sampling

Following the removal of the contaminated material from the site, confirmation sampling would verify that contamination was fully removed to the extent practicable. Confirmation samples would be collected for metals analysis. Once confirmation sampling shows that metal concentrations meet the removal action objectives designated for the project, restoration activities would be completed.

Restoration Activities

If a depression is left at the dumpsite area, it must be re-graded to match the pre-existing natural grade in order to direct surface water into natural channels and drainages. All disturbed areas would be re-graded for positive drainage, and then vegetated with native species, to the extent practicable and as soon as practicable to minimize construction-related sediment transport.

5.4.1 Effectiveness of Alternative 4

The following subsections evaluate the effectiveness of Alternative 4 as demonstrated by environmental conditions that would exist, if such actions were implemented.

Protectiveness

This alternative provides the highest possible level of environmental protection at the Site. The complete removal of soil impacted with metals and other waste materials from the currently partially exposed, uncontrolled environment to a permitted facility eliminates the on-site potential for human and/or ecological exposure through inhalation, ingestion, and dermal contact.

The hauling operations would not be confined to NPS property, and the hauling distance to the landfill poses a limited potential exposure to the public. Special care would be taken to assure trucks are decontaminated before leaving the Site and that truck covers prevent wind-blown dust.

The off-site commercial landfill alternative has a high level of long-term effectiveness, as the landfill would have a post-closure monitoring and maintenance period of 30 years or longer and will have site security, environmental monitoring, maintenance requirements, and other systems required of a commercial facility.

At the global sustainability level, this alternative involves the use of dump trucks for transporting contaminated material to an off-site landfill. It will create a moderate amount of greenhouse gas (GHG) emissions.

Compliance with ARARs

Alternative 4 addresses all ARARs, except the introduction of a moderate amount of GHG emissions due to transportation.

Ability to Achieve RAOs

Alternative 4 would meet all site RAOs, as follows:

- Minimize human and ecological exposure (through inhalation, ingestion, and dermal contact) to lead in impacted soils.
- Prevention of potential migration of metals in impacted soil via surface runoff, erosion, and wind dispersion.

Level of Treatment/Containment Expected

Alternative 4 would provide nearly 100% containment of the dumpsite contaminated soil and waste materials through excavation and off-site disposal. An extremely high level of containment can be expected at the off-site disposal facility.

Reduction or Elimination of Residual Concerns

This alternative is considered permanent, and is thus effective in both the short-term and long-term. This alternative will almost completely eliminate residual concerns at the site.

5.4.2 Implementability of Alternative 4

The following sections provide an evaluation of the feasibility and implementability of Alternative 4.

Technical Feasibility

Excavation and loading could require the use of heavy equipment in order to reduce costs. Controlling fugitive dust emissions and stormwater discharge (if generated) during grading and construction would be required.

The necessary equipment, personnel, and laboratory services for excavating and transporting the waste are available to support implementation of this removal action.

Administrative and Legal Feasibility

Alternative 4 is both legally and administratively feasible. Off-site permits could be required for truck hauling outside the park or for traffic control during transport and disposal.

Waste profiling documentation would be required and disposal manifests or bills of landing would accompany waste during transportation.

NPS would conduct a historical and cultural resources survey to identify resources that cannot be disturbed or that must be restored after excavation, and features that are not a resource requiring protection or mitigation.

Ease of Implementation

A low level of operational requirements, including excavation, grading, and the transportation of waste, would be incurred with Alternative 4. No major difficulties should be experienced in carrying out this alternative.

Regulatory acceptance is likely with Alternative 4 because it meets RAOs. Community acceptance is unknown at this time but will be determined during the EE/CA Report public comment period. The community would probably accept this alternative as protective, but they may object to highway congestion by waste haulers.

5.4.3 Cost of Alternative 4

The costs for Alternative 4 have been evaluated in detail based on the evaluation criteria listed in **Section 5.0**. Due to uncertainty of the final classification of the excavated materials for disposal at an off-site landfill and the potential need for chemical stabilization, two cost estimates were prepared for the implementation of Alternative 4. The lower cost option (Alternative 4a) assumes that all excavated waste materials could be disposed as non-RCRA California hazardous waste and the higher cost option (Alternative 4b) assumes that all excavated waste materials shall be disposed as RCRA hazardous waste requiring chemical stabilization at the landfill. A complete break-out of costs for Alternative 4 is provided in **Attachment D, Table D-4a and Table D-4b**.

Summary of Alternative 4 associated costs:

- Capital Cost: $ 1,026,356 (Alternative 4a) or $ 1,591,082 (Alternative 4b)
- Long-Term Maintenance and Monitoring Costs: $ 0
- Present Worth Cost/Present Value: Approximately $ 1,026,356 (Alternative 4a) or $ 1,591,082 (Alternative 4b)

The capital costs are estimated based on the following general elements:

- Design, including pre- and post-excavation submittals, excluding ecological resource inventory and cultural resources survey
- Mobilization
- Excavation (Removal)
- Alternative 4a: Transportation and off-site disposal of non-RCRA, California-hazardous waste direct to landfill, assuming no stabilization required
- Alternative 4b: Transportation and off-site disposal of RCRA hazardous waste requiring chemical stabilization at the landfill
- Management

There are no post-removal maintenance and monitoring costs associated with Alternative 4. Therefore, Present Worth Value/Present Cost is the same as the capital cost.

5.5 COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES

Table 5.1 summarizes the removal action alternatives and ranks the alternatives from most likely to least likely to achieve all of the RAOs and ARARs.

Table 5.1: Comparative Analysis of Removal Action Alternatives

EVALUATION CRITERIA	ALTERNATIVE 1 No Action	ALTERNATIVE 2 Capping, Re-vegetation and Institutional Controls	ALTERNATIVE 3 Capping, Phyto-remediation and Institutional Controls	ALTERNATIVE 4 Excavation and Off-Site Disposal
EFFECTIVENESS	Does not achieve ARARs or RAOs	Achieves ARARs and RAOs	Achieves ARARs and RAOs	Achieves ARARs and RAOs
Protective of Public Health and Community	No	Yes	Yes	Yes
Protective of Workers During Implementation	Not Applicable	Yes, with proper health and safety plan implemented	Yes, with proper health and safety plan implemented	Yes, with proper health and safety plan implemented

EVALUATION CRITERIA	ALTERNATIVE 1 No Action	ALTERNATIVE 2 Capping, Re-vegetation and Institutional Controls	ALTERNATIVE 3 Capping, Phyto-remediation and Institutional Controls	ALTERNATIVE 4 Excavation and Off-Site Disposal
Protective of the Environment	No	Yes, with continued maintenance of cap and vegetation	Yes, with continued maintenance of cap and plant system	Yes
Complies with All ARARs	No	Yes	Yes	Yes
Achieves All RAOs	No	Yes	Yes	Yes
Level of Containment Expected	Low; Actual cap doesn't cover wastes completely	High; Requires proper maintenance	High: Requires proper monitoring and maintenance	High; Maintenance only at landfill
Reduction or Elimination of Residual Concerns	Low	Low; Residual concerns remain on-site	Low; Residual concerns remain on-site	High; No residual concerns remain on-site
IMPLEMENTABILITY	Low; Easy to implement. Not administratively feasible	Medium; Moderate to implement; Feasible	Low; Low to implement; Not feasible	High; Moderate to implement; Feasible
Equipment Availability	High; None required	High; Available	High; Available	High; Available
Services Availability	High; None required	High; Available	High; Available	High; Available
Site Accessibility	High; None required	High; Accessible	High; Accessible	High; Accessible
Availability of Laboratory Testing Capacity	High; None required	High; Available	High; Available	High; Available
Off-site Treatment and Disposal Capacity	High; None required	None Required	None Required	Available

EVALUATION CRITERIA	ALTERNATIVE 1 No Action	ALTERNATIVE 2 Capping, Re-vegetation and Institutional Controls	ALTERNATIVE 3 Capping, Phyto-remediation and Institutional Controls	ALTERNATIVE 4 Excavation and Off-Site Disposal
Can Be Implemented in One Year	High	Medium; Barring any significant consultation periods for NPS or other ARAR-related administration	Medium; Barring any significant consultation periods for NPS or other ARAR-related administration	Medium; Barring any significant consultation periods for NPS or other ARAR-related administration
Administrative and Legal Feasibility: Acquisition of Permits for Off-site Work	High; None required	High; None required	High; None required	High; Commercial landfill disposal profile required, transportation manifests
Administrative and Legal Feasibility: Acquisition of Permits for Site Work	High; None required	Medium; Permits not required but substantive ecological; requirements are applicable	Medium; Permits not required but substantive ecological; requirements are applicable	High; None required
Administrative and Legal Feasibility: Acquisition of Easement or Rights-of-Way	High; No easements or rights-of-way permits required	High; No easements or rights-of-way permits required	High; No easements or rights-of-way permits required	High; No easements or rights-of-way permits required
Administrative and Legal Feasibility: Impact on Adjoining Property	High; No impacts to adjoining property	High; No impacts to adjoining property	High; No impacts to adjoining property	High; No impacts to adjoining property
Administrative and Legal Feasibility: Ability to Impose Institutional Controls	High; None required	High; Recommended ICs are implementable	High; Recommended ICs are implementable	High, No ICS recommended

EVALUATION CRITERIA	ALTERNATIVE 1 No Action	ALTERNATIVE 2 Capping, Re-vegetation and Institutional Controls	ALTERNATIVE 3 Capping, Phyto-remediation and Institutional Controls	ALTERNATIVE 4 Excavation and Off-Site Disposal
Ease of Implementation: Regulatory Acceptance	Low; Unlikely	Medium; Impacted soil and wastes to remain at the Site	Medium; Impacted soil and wastes to remain at the Site. Phytoremediation is not a common technology	High; Common technology
Ease of Implementation: Community Acceptance	Medium; Unknown until public comment period	Medium; Unknown until public comment period	Medium; Unknown until public comment period	High; Creates small truck traffic disturbance
COST	No Capital, Monitoring, or Post-Removal Costs	Range below includes Capital, Monitoring, & Post-Removal Costs	Range below includes Capital, Monitoring, & Post-Removal Costs	Range below includes Capital. No Post Removal Costs Required
Site Total Present Worth Cost / Present Value				
Cost Estimate	$0	$342,766	$688,732	$1,026,356 or $1,591,082*
Low End Cost Estimate (- 30%)	$0	$239,937	$482,112	$718,449 or $1,113,758*
High End Cost Estimate (+ 50%)	$0	$514,150	$1,033,098	$1,539,534 or $2,386,623*

Notes:

ARAR – Applicable or Relevant and Appropriate Requirement
IC – Institutional Control (i.e.: fencing, signage, deed restriction)
RAO – Removal action objective
Green – Effective, implementable
Red – Ineffective, difficult to implement
Yellow – Effective, difficult to implement
* Additional cost estimate due to potential disposal fees as RCRA hazardous waste needing stabilization

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6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 RECOMMENDED REMOVAL ACTION ALTERNATIVE

Alternative 2 is the least costly and sufficiently protective for the environment. However, even though it will not leave the contaminants exposed to the elements and to people or animals, it would leave the impacted soil and waste materials untreated and requiring ongoing operation, maintenance and monitoring (OM&M) to remain effective. Alternative 3 is significantly more costly than Alternative 2 but provides additional treatment to the impacted soil via phytoremediation, with the potential to reduce long-term concerns, if phytoremediation is deemed feasible after the performance of the necessary field studies. The phytoremediation component of Alternative 3 would require OM&M and it is unknown when or if will be capable to achieve remedial cleanup levels. Special attention shall be placed while selecting the vegetation to be used for phytoremediation purposes to avoid including non-native invasive plant species that could propagate in the park.

Alternative 4 is the most protective of human health and ecological resources and it will eliminate potential environmental impacts, in the short- and long-term, immediately after completion, meeting all of the evaluation criteria. There are no post-removal OM&M activities associated with the implementation of Alternative 4. Implementation of Alternative 4 would be more costly than the other alternatives and it could create an increased level of disturbance at the Site, with the potential for exposure to contaminants by workers and ecological receptors during implementation, if protective measures are not sufficient or properly implemented.

Based on the information presented in this EE/CA Report and previous investigations, Alternative 4 – Excavation and Off-Site Disposal is the recommended NTCRA for the former Lower Kaweah dump site, SWMU #11.

6.2 REMOVAL SCHEDULE

NPS has determined that a non-time-critical removal action is appropriate at the Site. After completion of the EE/CA Report, NPS must complete an Action Memorandum. Following issuance of the Action Memorandum, NPS must secure congressional funding for the removal action. After receipt of funding, NPS will need to prepare a removal design and may need to contract the design implementation separately. A more detailed schedule can be developed once congressional funding has been secured.

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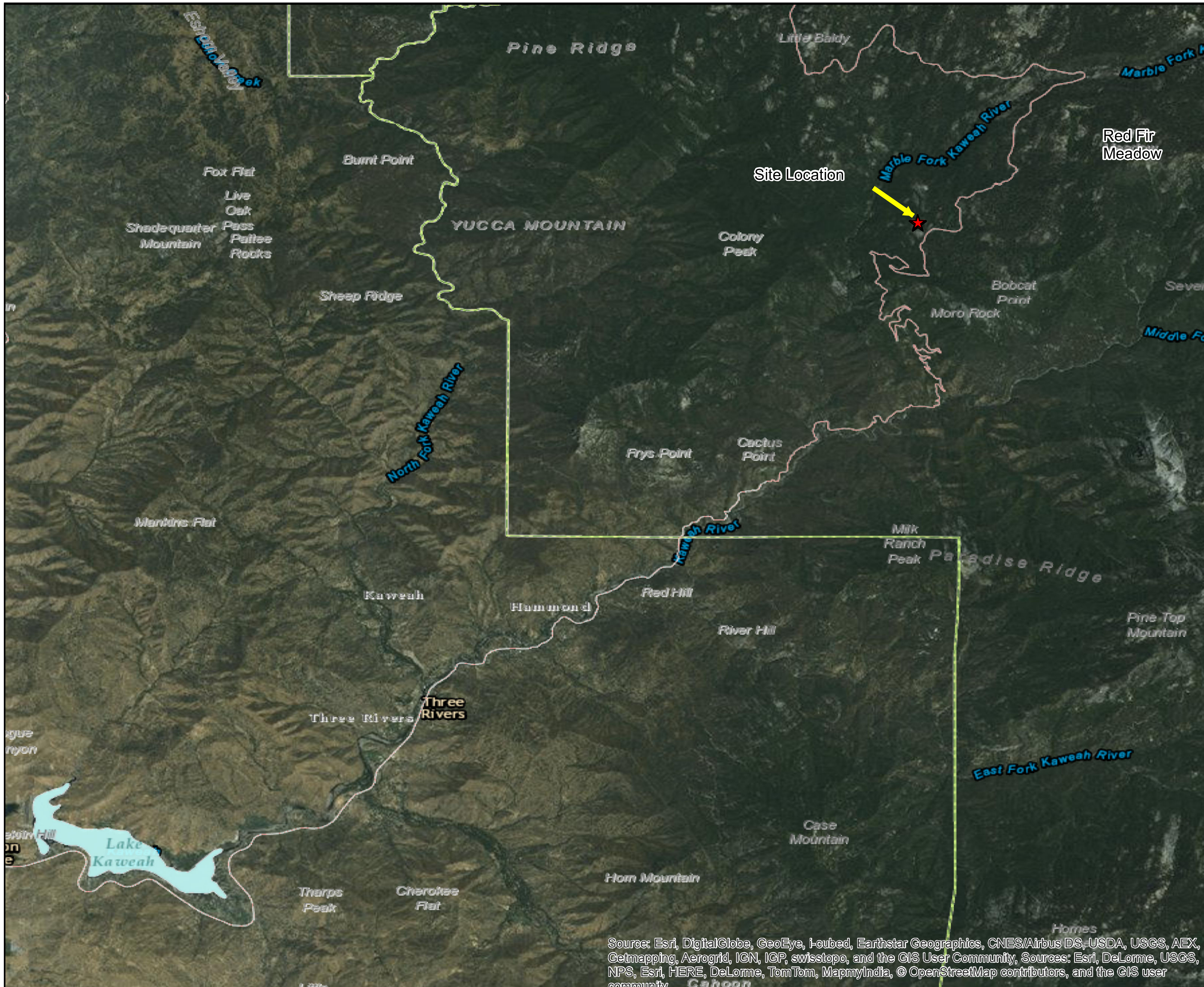
FIGURES



Legend

★ Site Location

0 1.75 3.5 7 Miles

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National Park Service
Sequoia and Kings Canyon National Parks,
Tulare County, California

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Managing Cost and Liability
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Tel: (714) 662-2759 ● Fax: (714) 662-2758

Site Location Map
Engineering Evaluation/Cost Analysis Report
Lower Kaweah Dump Area

Figure 1.1

U.S. Department of Interior
National Park Service
Sequoia and Kings Canyon National Parks,
Tulare County, California

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Site Features
Engineering Evaluation/Cost Analysis Report
Lower Kaweah Dump Area

Figure 2.1

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Site Layout Map
Engineering Evaluation/Cost Analysis Report
Lower Kaweah Dump Area

Figure 2.2

N

Legend

Sample Location

Trench Locations

Former Dumpsite Boundary

Note

Soil Samples were collected on May 12 through May 14, 2014
Sample depths ranged between 1 and 7 feet below ground surface

0 15 30 60 90 Feet

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Trench and Sample Locations
Engineering Evaluation/Cost Analysis Report
Lower Kaweah Dump Area

Figure 2.3

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Tulare County, California

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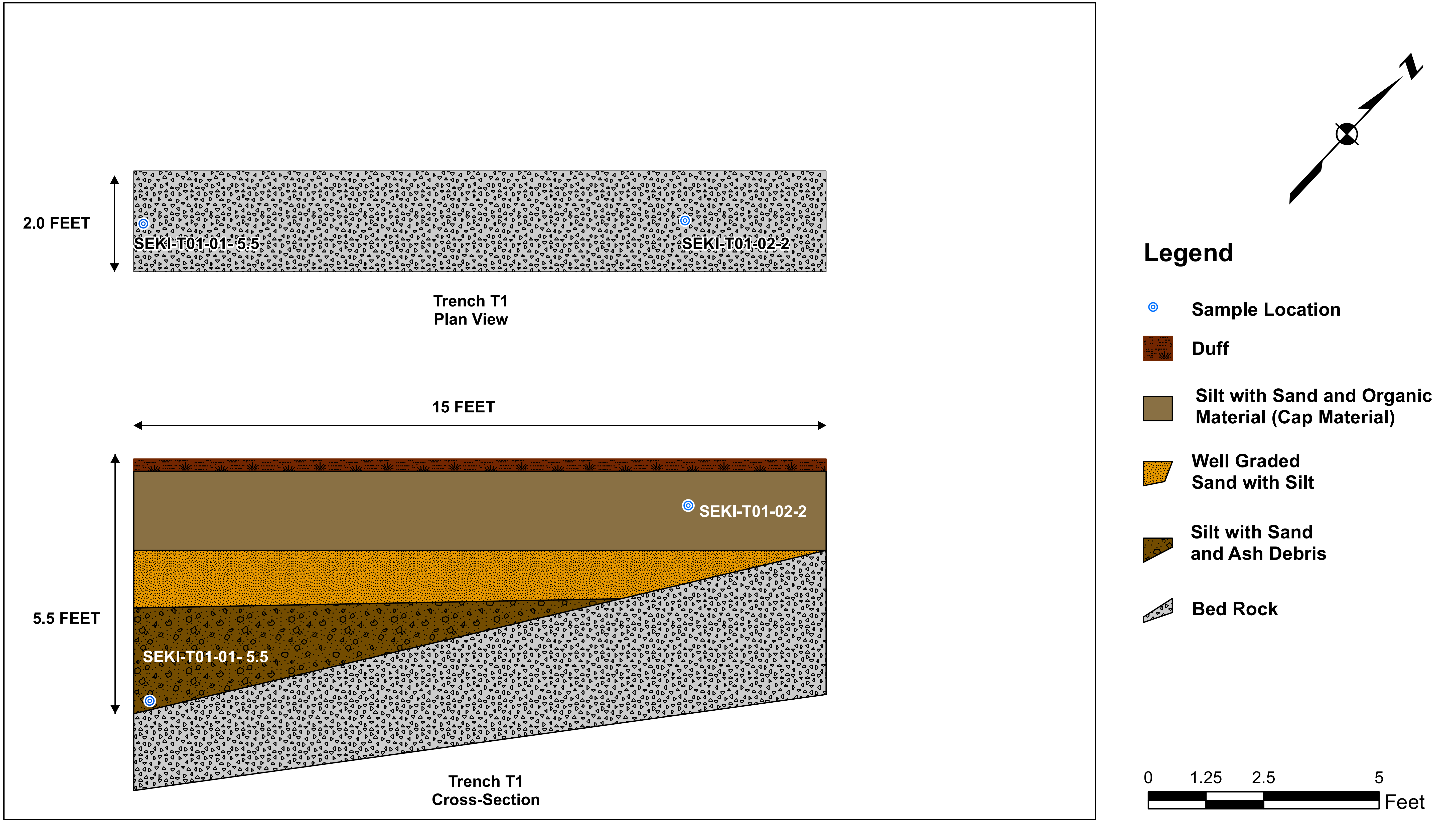
ISM Sample Locations
Engineering Evaluation/Cost Analysis Report
Lower Kaweah Dump Area

Figure
2.4



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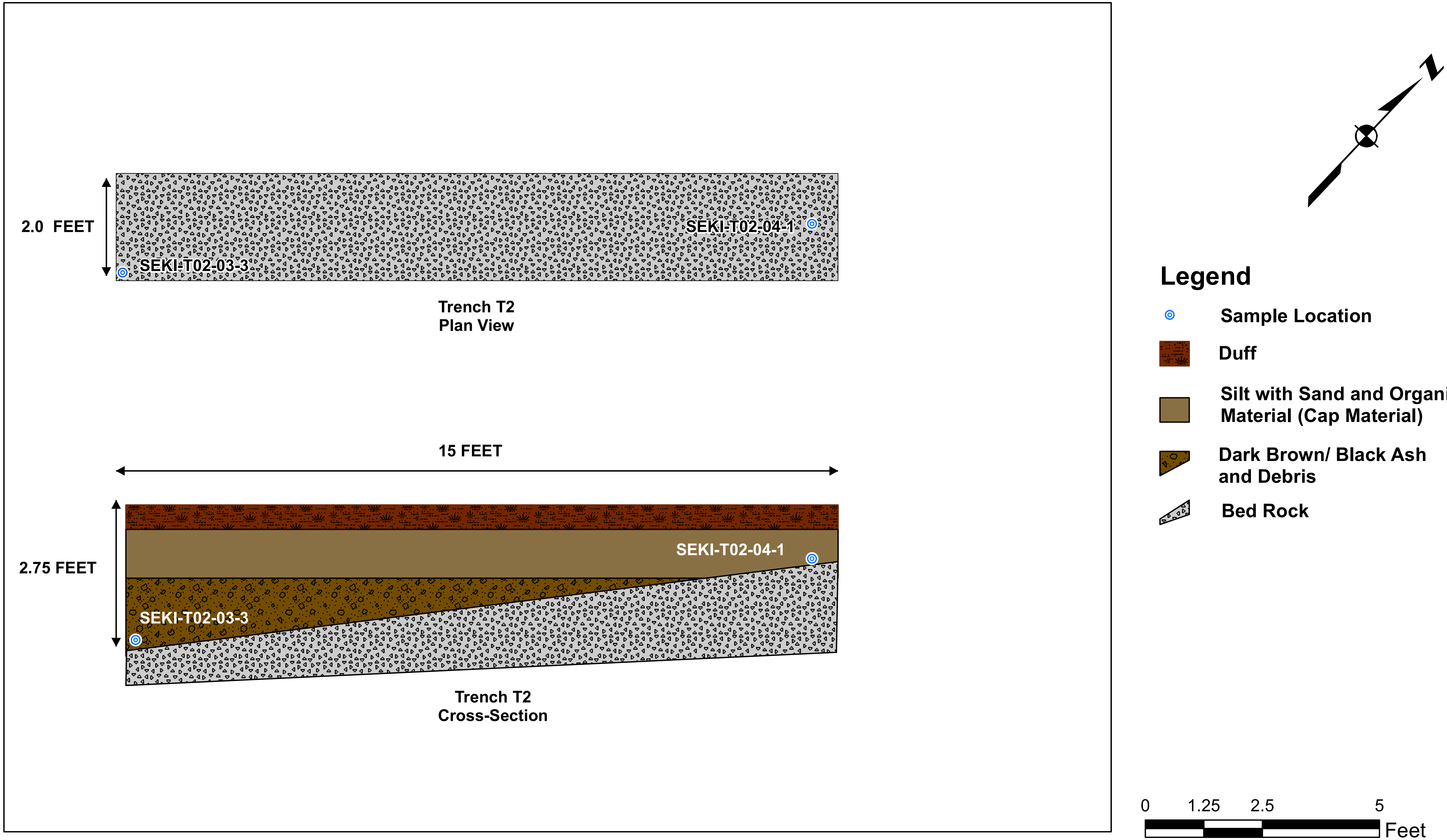
Trench T1
Cross-Section and Plan View
Engineering Evaluation/Cost Analysis Report
Lower Kaweah Dump Area

Figure 2.5



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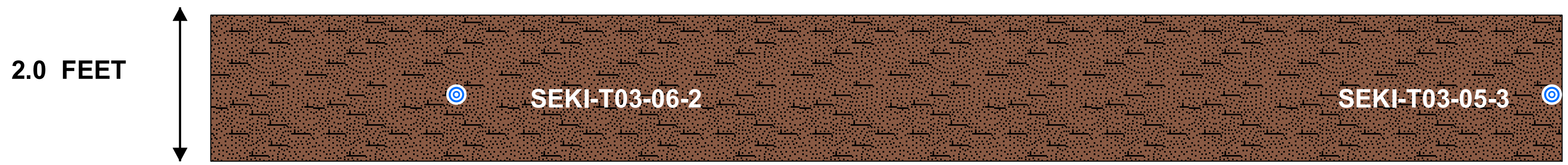
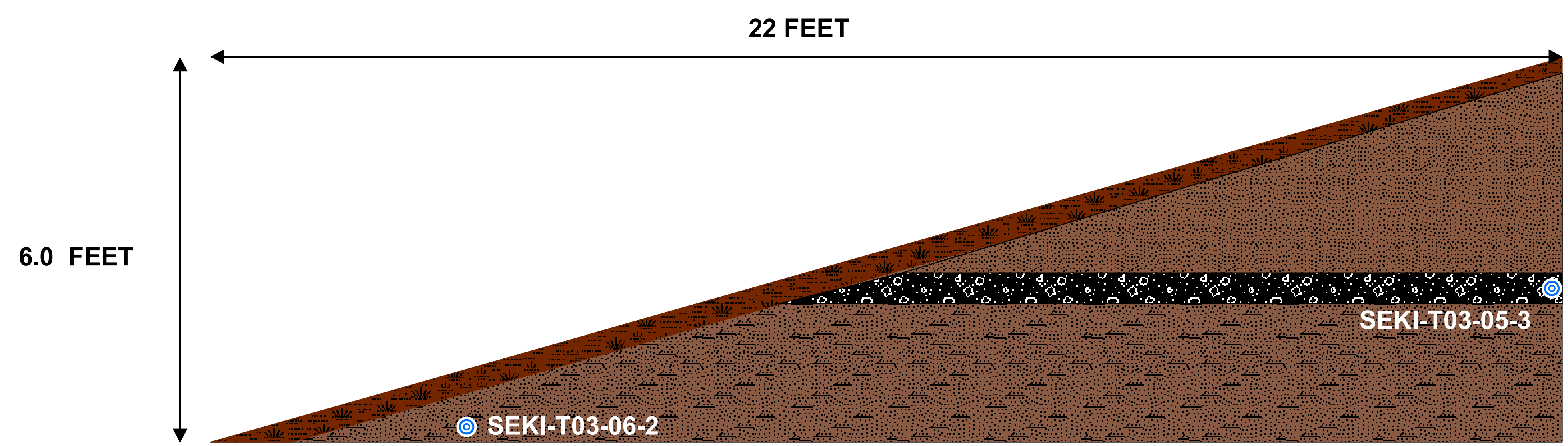
Trench T2
Cross-Section and Plan View
Engineering Evaluation/Cost Analysis Report
Lower Kaweah Area

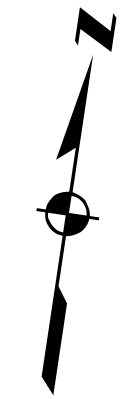
Figure 2.6



Trench T3
Plan View

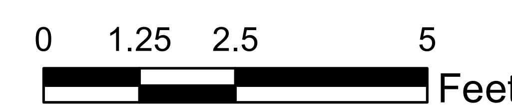


Trench T3
Cross-Section



Legend

- Sample Location
- Duff
- Dark Brown Silty Sand Organic Material, Brick and Debris
- Black Ash and Debris
- Dark Brown Silt With Sand (Native Soil)



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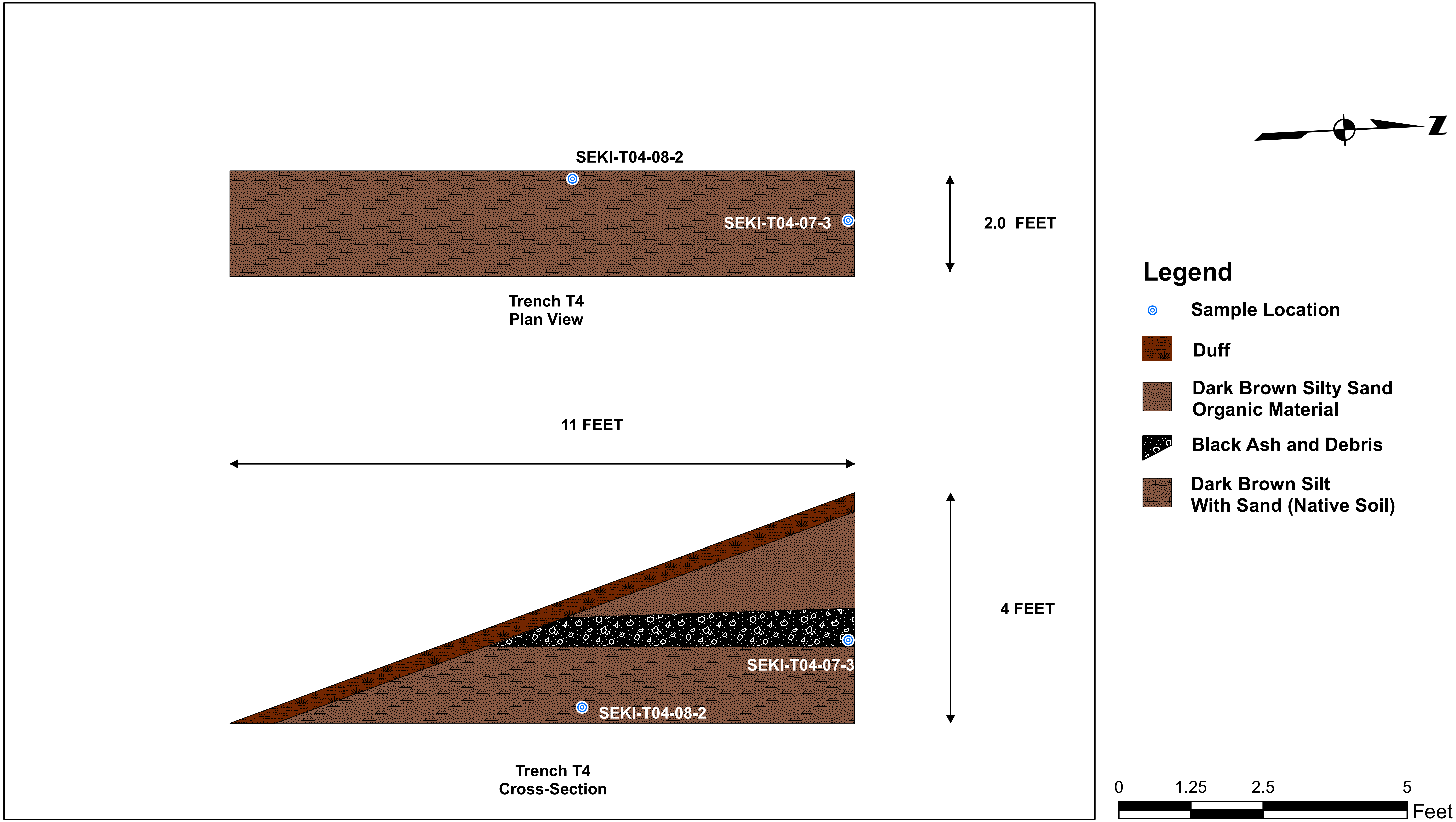
Trench T3
Cross-Section and Plan View
Engineering Evaluation/Cost Analysis Report
Lower Kaweah Dump Area

Figure
2.7



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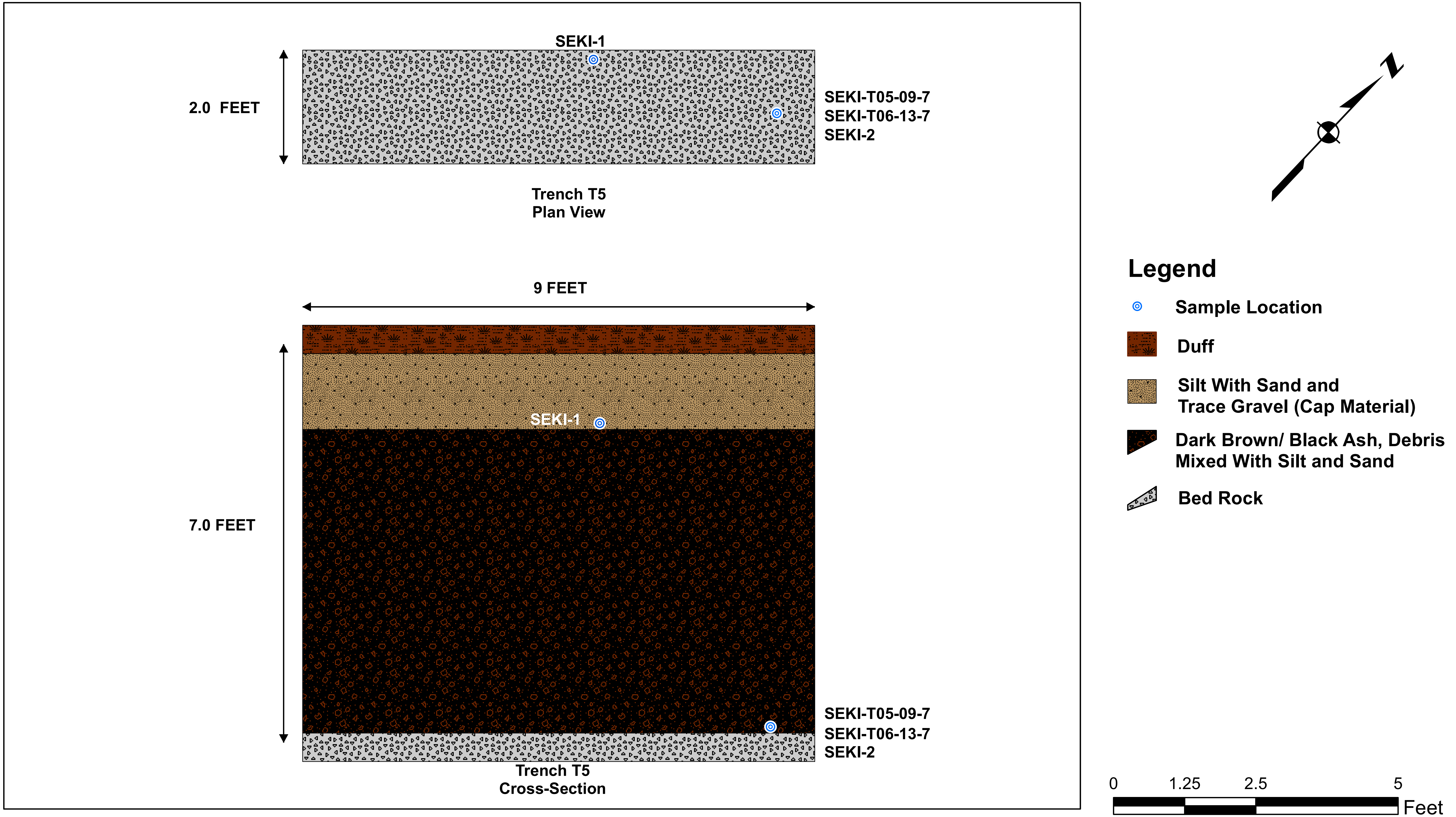
Trench T4
Cross-Section and Plan View
Engineering Evaluation/Cost Analysis Report
Lower Kaweah Dump Area

Figure
2.8



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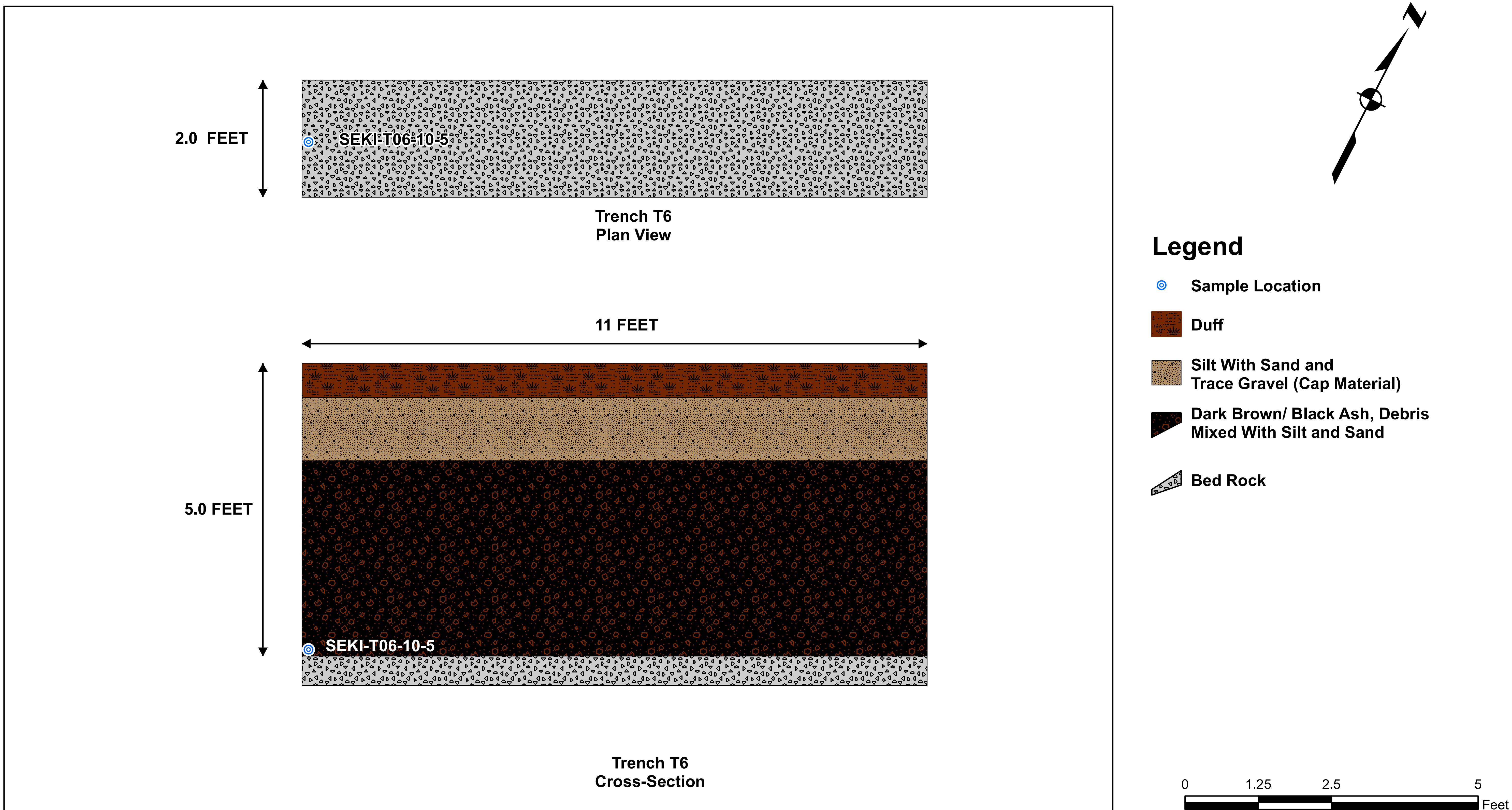
Trench T5
Cross-Section and Plan View
Engineering Evaluation/Cost Analysis Report
Lower Kaweah Dump Area

Figure 2.9



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Trench T6
Cross-Section and Plan View
Engineering Evaluation/Cost Analysis Report
Lower Kaweah Dump Area

Figure
2.10

Figure 2.11
Human Exposure Conseptual Site Model
Engineering Evaluation/Cost Analysis Report
Sequoia and Kings Canyon National Parks

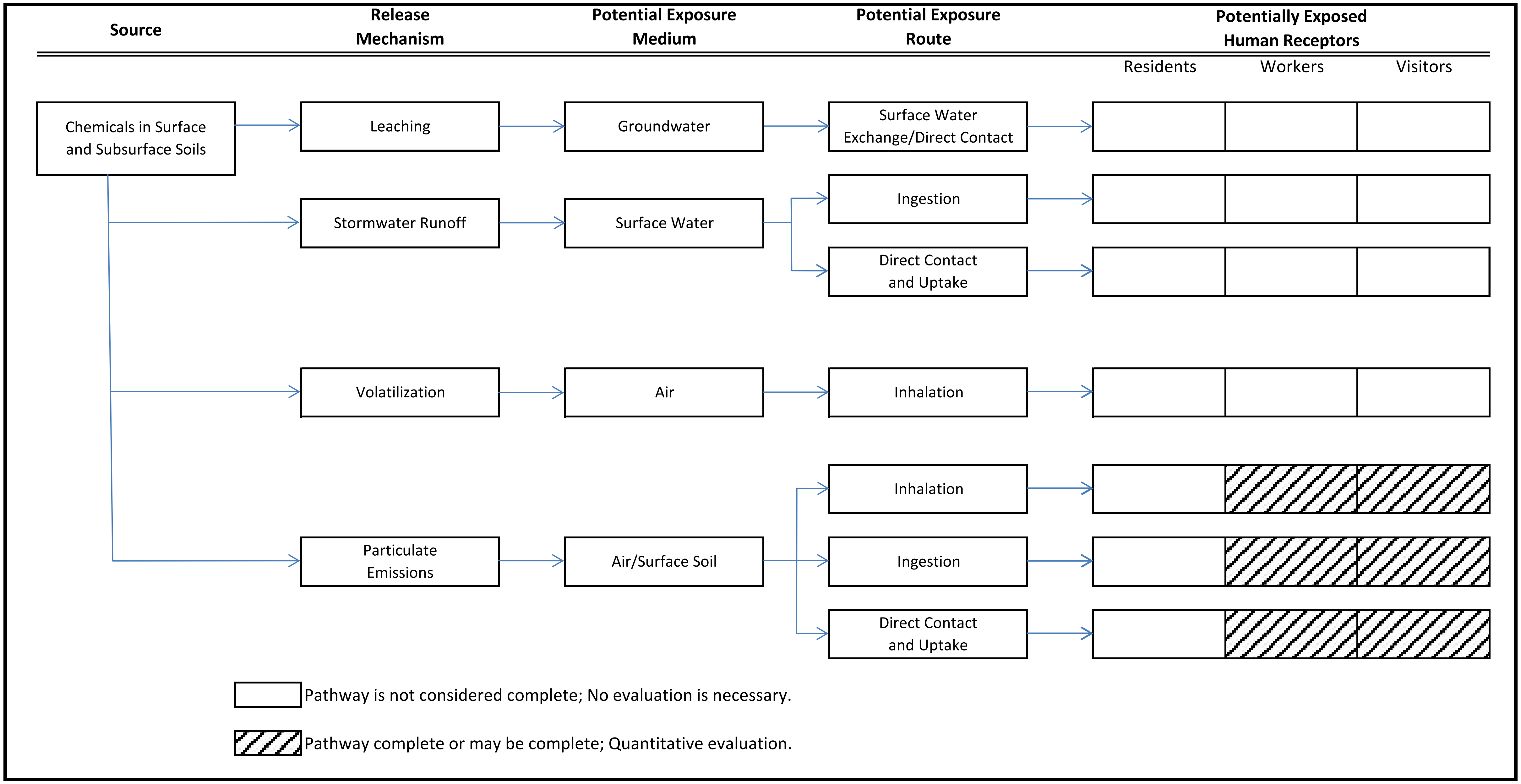
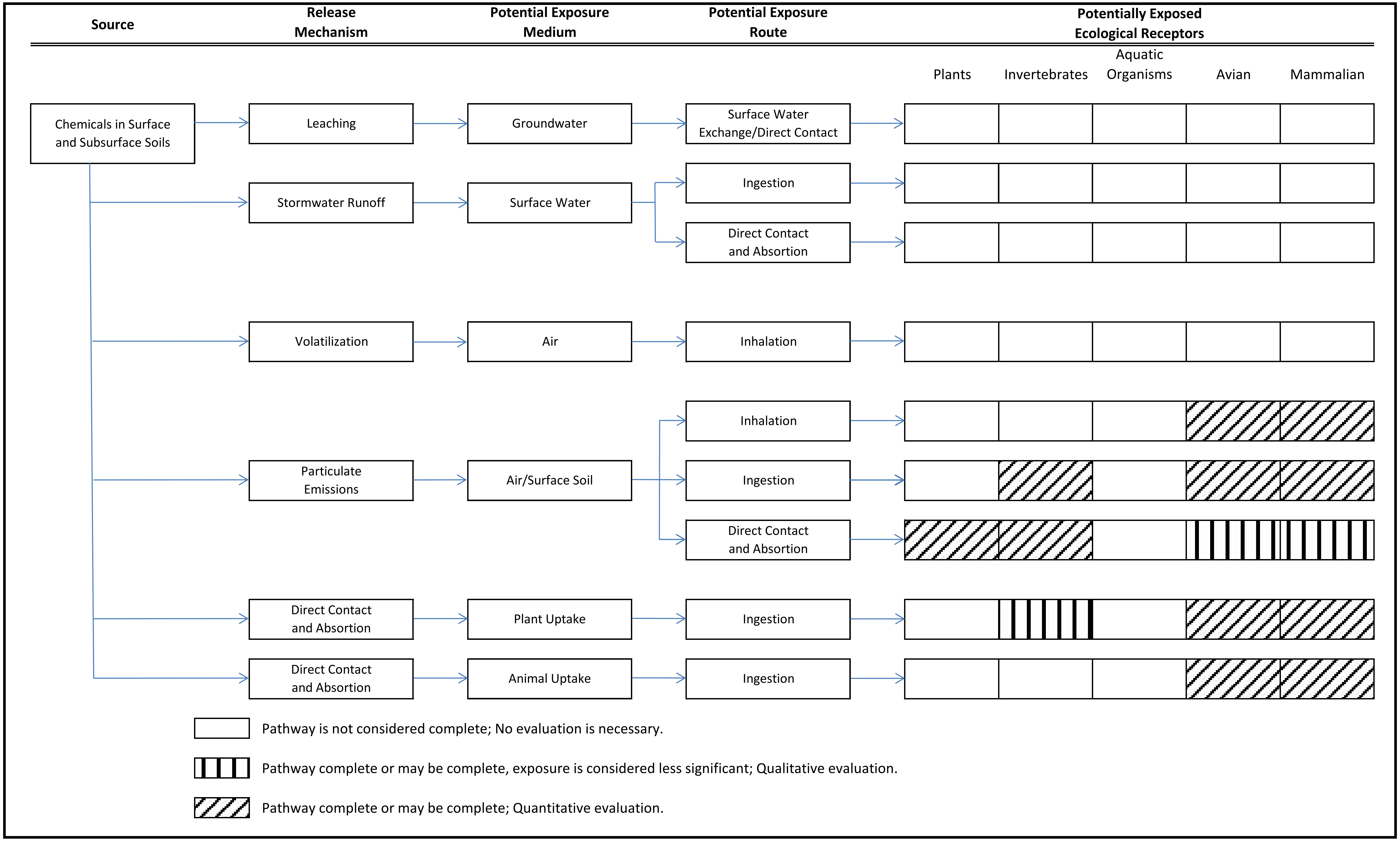
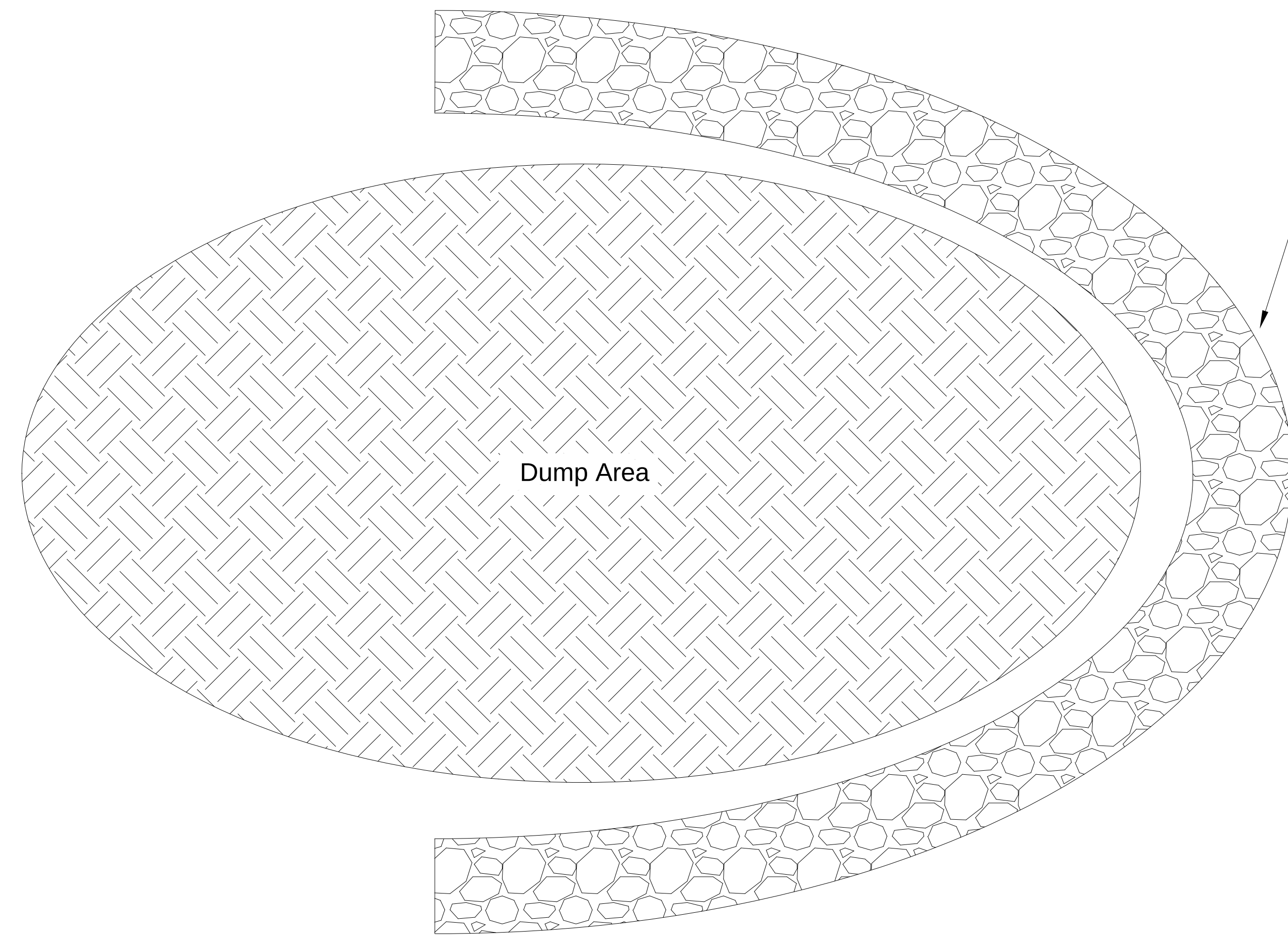
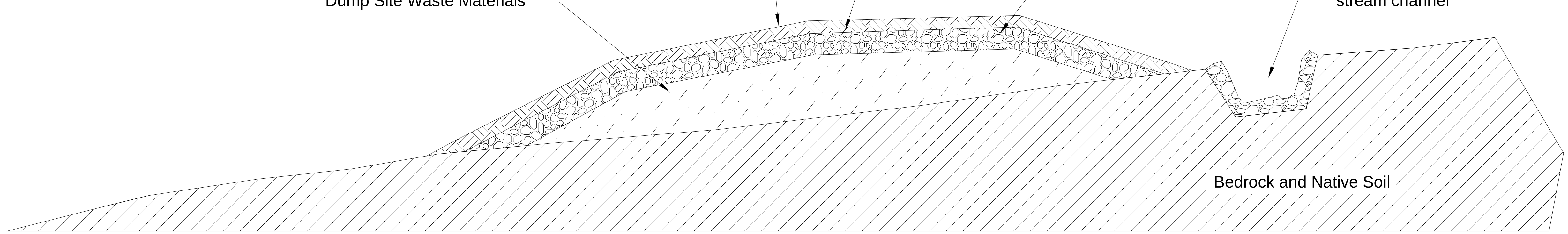


Figure 2.12
Ecological Exposure Conseptual Site Model
Engineering Evaluation/Cost Analysis Report
Sequoia and Kings Canyon National Parks





Top View



Side View

"Not to scale"

U.S. Department of Interior National Park Service Sequoia and Kings Canyon National Parks, Tulare County, California	**ENVIRONMENTAL COST MANAGEMENT, INC.** *Managing Cost and Liability* 3525 Hyland Avenue, Suite 200 ● Costa Mesa, CA 92626 Tel: (714) 662-2759 ● Fax: (714) 662-2758	Schematic Cap Design Engineering Evaluation/Cost Analysis Report Lower Kaweah Dump Area	Figure 4.1

File Path: A:\NPS\SEKI\Deliverables\Reports\EECA\Figures
Drafter: JWP
Chkd by: R. Macedo
Date drafted: 10/02/2014
Proj. Manager: H. Trejo
Project: NPS SEKI

ATTACHMENT A

APPROVAL MEMORANDUM

November 7, 2013~~October 30, 2013~~

To: Regional Director, Pacific West Region

From: Superintendent, Sequoia and Kings Canyon National Park W8mew 11.7.13

Through: Steve J. Mitchell, PE, NPS/PWR/FM, Operations/Environmental Program Lead

Subject: Engineering Evaluation & Cost Analysis Approval Memorandum
Lower Kaweah Dump Area at Sequoia and Kings Canyon National Park

PURPOSE

This memorandum recommends and documents the decision of the National Park Service (NPS) to conduct an Engineering Evaluation/Cost Analysis (EE/CA) pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. §§ 9601 *et seq.*, for the impacted area near the lower Kaweah dump area (Site) at Sequoia and Kings Canyon National Park (SEKI), California. NPS is the CERCLA lead agency with authority to respond to the release or threatened release of hazardous substances at or from the Site. This Memorandum was prepared in accordance with CERCLA, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. Part 300, and the U.S. Environmental Protection Agency's (EPA) *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA*, OSWER Publication 9360.0-32 (August 1993).

BACKGROUND

The Site is located across from an un-named street (south) from an old incinerator and maintenance yard located approximately 1,900 feet west of the Generals Highway in the Lower Kaweah area of the Giant Forest in SEKI and appears to be an old dump site. The site area is at an elevation of approximately 6,400 feet. The history or contents of the dump are unknown. However, due to its proximity to the old incinerator, it was assumed (Kleinfelder, 1998) that burn waste may be present. The fill area is relatively flat and has a gentle slope to the southwest and a dimension of approximately 80 feet by 100 feet.

In August 1998, a focused Site Assessment (SA) (Kleinfelder, 1998) addressed an area of the dump site that was composed mostly of burn materials and ash. Five test pits were excavated through the dump material, and five soil samples were collected from the excavation sidewalls. Four of the five samples collected were composited and analyzed for metals (cadmium, chromium, lead, zinc and nickel) and dioxins. The initial laboratory results indicated that concentrations of metals and dioxins analyzed were all below the Total Threshold Limited Concentration (TTLC) listed in the California Code of Regulations (CCR), Title 22 and therefore should not be classified as hazardous waste if the dump material was moved off-site for disposal. However, concentrations of dioxins and lead are above the Regional Screening Levels (RSLs) for residential soils (U.S. EPA Region 9), indicating that dump material may be hazardous to human health. Initially total lead and zinc concentrations were high enough that testing for leaching potential for these two metals was conducted. Solubility testing indicated that lead was present above its Solubility Threshold Limit Concentration (STLC), so disposed material should be classified as a California hazardous waste if removed from the Site.

In December 2001, an expanded SA (Kleinfelder, 2002) further defined the volume and characterized the material present in the dump. Eight test pits were excavated to a depth below the base of the dump material, or into underlying bedrock. Confirmation soil samples were collected from the dump's outer boundary. Two soil samples were collected from two interior test pits: one to further characterize the dump material and one to characterize the non-dump material. Laboratory results indicate that dioxins (2,3,7,8-TCDD) were present up to a concentration of 5.4 picograms per gram (pg/g, or parts per trillion). This was less than the composite sample taken initially in September 1998, but still exceeds the RSL for residential soil. Of the organochlorine pesticides, only DDT and DDE were detected in the soil samples collected from the test pits and their concentrations did not exceed TTLC. STLC testing for DDE and DDT was not performed. Of the metals detected, lead and chromium were somewhat elevated such that STLC testing was performed on seven samples. STLC testing of lead and chromium indicated lead exceeds the CCR, Title 22 STLC level of 5 mg/l; thus, the material should be classified as a California hazardous waste if removed from the Site. TCLP testing for lead did not indicate concentrations exceeding the Title 22 level of 5.0 mg/l. Therefore, disposed material should not be classified as a RCRA waste if removed from the Site.

USE OF REMOVAL ACTION AUTHORITY

Pursuant to Sections 104(a)(1) and (b)(1) of CERCLA, 42 U.S.C. §§ 9604(a)(1) and (b)(1), whenever there is a release or substantial threat of a release of a hazardous substance into the environment, the President is authorized to act, consistent with the NCP, to remove or arrange for the removal of such hazardous substance or take any other response action, including appropriate investigations, deemed necessary to protect public health or welfare or the environment. Section 104(a) and (b) response authority (including the authority to perform an NTCRA, including the EE/CA that is the subject of this Memorandum) has been delegated to the Secretary of the Department of the Interior (DOI) pursuant to Executive Order 12580, 52 Fed. Reg. 2923 (1987), and further delegated to NPS by DOI Departmental Manual Part 207, Chapter 7, with respect to property under the jurisdiction, custody; or control of NPS.

Section 300.415(b)(2) of the NCP establishes the criteria for determining the appropriateness of a removal action. The following are applicable criteria that support the determination to consider a removal action at the Site:

i. Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants;

ii. Actual or potential contamination of drinking water supplies or sensitive ecosystems;

iii. High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate; and

iv. Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released.

As summarized above, the 1998 and 2001 assessments indicated lead, a CERCLA hazardous substance, was present at elevated concentrations in shallow soils at the Site area (criterion iii). Because the locations of the samples collected are unknown, the extent of contamination is unknown, which represents a gap in the characterization.

Units of the National Park System are considered sensitive ecosystems. See, *e.g.*, National Park Service Organic Act, 16 U.S.C. § 1 (National Park System units shall be managed "to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.").

Based on SA, shallow groundwater is not present at the Site and surface water targets are not within sufficient distance of the Site for there to be a migratory pathway to these resources. Restrictive air flow due to the forested terrain between the source and potential targets make it unlikely that an airborne pathway exists. However, if soils were to be excavated in the future, the quantity of hazardous substances should be estimated.

Based upon these considerations, NPS has determined that the use of removal action authority at SEKI to investigate, abate, prevent, minimize, stabilize, mitigate, and/or eliminate the release or threat of release of hazardous substances at or from the Site is appropriate. Additionally, NPS has determined that a planning period of at least six months exists before on-site activities must be initiated. Therefore, NPS is authorized to conduct an EE/CA (or its equivalent) pursuant to and in accordance with Section 300.415(b)(4) of the NCP. An EE/CA is performed to determine the nature and extent of contamination, assess potential risks posed to human and ecological receptors from exposure to such contamination, identify and evaluate removal action alternatives to address unacceptable risk, and identify a recommended removal action alternative that best meets the evaluation criteria.

EE/CA IMPLEMENTATION AND FUNDING

NPS has received funding from the DOI Central Hazardous Materials Fund (CHF) to implement the Site EE/CA. Upon approval of the recommendation, the Site EE/CA will be implemented.

APPROVAL

Based upon the information and analysis presented in this memorandum, please indicate your concurrence on non-concurrence with the recommendation to perform an EE/CA as part of a NTCRA at the lead contaminated site identified herein and located within SEKI. If you have any questions, please contact Steve Mitchell at (415) 623-2286.

I Concur

Patricia L. Neubacher Date: 4/3/14

AW Christine S. Lehnertz, Regional Director
National Park Service, Pacific West Region

I Do Not Concur

____________________ Date: __________

ATTACHMENT B

LABORATORY ANALYTICAL RESULT TABLES, REPORTS AND CHAIN-OF-CUSTODY DOCUMENTATION

Attachment B
Table B-1
Decision Unit Sample Results
and Estimated Background Concentrations
Sequoia and Kings Canyon National Parks

Sequoia & Kings Canyon National Parks Lower Kaweah Dump Site	Reporting Units	Background Samples				
		SEKI-DU1-01	SEKI-DU1-02	SEKI-DU1-03	SEKI-DU1-04	95% UCL
Date		05/13/14	05/13/14	05/13/14	05/13/14	
Depth (Feet bgs)						
Metals						
Antimony	mg/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Arsenic	mg/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Barium	mg/kg	140	130	140	140	143.4
Beryllium	mg/kg	0.65	0.55	0.55	0.57	0.6
Cadmium	mg/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Chromium	mg/kg	6.7	6.1	6.4	6.3	6.7
Cobalt	mg/kg	5.9	4.8	5.3	5.5	5.9
Copper	mg/kg	5.4	5	5.4	5.1	5.5
Lead	mg/kg	12	11	20	9.1	18.7
Mercury	mg/kg	0.032	0.036	0.038	0.034	0.0
Molybdenum	mg/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Nickel	mg/kg	4.6	4.3	4.5	4.4	4.6
Selenium	mg/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Silver	mg/kg	1.3 U	1.2 U	1.2 U	1.2 U	1.3 U
Thallium	mg/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Vanadium	mg/kg	37	32	34	35	36.9
Zinc	mg/kg	59	53	57	56	59.2
Total Petroleum Hydrocarbons						
Diesel Range Organics (DRO)	mg/kg	65	84	93	80	94.2
Polychlorinated Biphenyls						
Aroclor 1016	µg/kg	32 U	33 U	33 U	33 U	33.3 U
Aroclor 1221	µg/kg	32 U	33 U	33 U	33 U	33.3 U
Aroclor 1232	µg/kg	32 U	33 U	33 U	33 U	33.3 U
Aroclor 1242	µg/kg	32 U	33 U	33 U	33 U	33.3 U
Aroclor 1248	µg/kg	32 U	33 U	33 U	33 U	33.3 U
Aroclor 1254	µg/kg	32 U	33 U	33 U	33 U	33.3 U
Aroclor 1260	µg/kg	32 U	33 U	33 U	33 U	33.3 U
Organochlorine Pesticides						
4,4'-DDD	µg/kg	8.3 U	8.5 U	8.5 U	1.7 U	10.7 U
4,4'-DDE	µg/kg	7.2 J	11	8.3 J	8	10.6 J
4,4'-DDT	µg/kg	6.8 J	13	12	28	25.7 J
Aldrin	µg/kg	8.3 U	8.5 U	8.5 U	0.27 Jp	11.2 UJ
alpha-BHC	µg/kg	1.8 J	8.5 U	8.5 U	1.7 U	9.7 UJ
alpha-Chlordane	µg/kg	8.3 U	8.5 U	8.5 U	0.31 Jp	11.2 UJp
beta-BHC	µg/kg	8.3 U	8.5 U	8.5 U	0.5 J	11.1 UJ
delta-BHC	µg/kg	8.3 U	8.5 U	8.5 U	1.7 U	10.7 U
Dieldrin	µg/kg	8.3 U	0.46 Jp	1.1 J	0.24 Jp	7.1 UJp
Endosulfan I	µg/kg	0.55 J	1.3 J	1.1 J	0.32 J	1.4 J
Endosulfan II	µg/kg	0.54 J	8.5 U	8.5 U	1.7 U	9.9 UJ
Endosulfan sulfate	µg/kg	11	26	47	9	43.9
Endrin	µg/kg	8.3 U	8.5 U	8.5 U	0.12 J	11.2 UJ
Endrin aldehyde	µg/kg	8.3 U	1.2 Jp	8.5 U	0.19 Jp	9.8 UJp
Endrin ketone	µg/kg	2.2 Jp	4.3 J	7.6 J	1.7 U	7.1 Ujp
gamma-BHC (Lindane)	µg/kg	8.3 U	8.5 U	8.5 U	1.7 U	10.7 U

Attachment B
Table B-1
Decision Unit Sample Results
and Estimated Background Concentrations
Sequoia and Kings Canyon National Parks

Sequoia & Kings Canyon National Parks Lower Kaweah Dump Site	Reporting Units	Background Samples				
		SEKI-DU1-01	SEKI-DU1-02	SEKI-DU1-03	SEKI-DU1-04	95% UCL
Date		05/13/14	05/13/14	05/13/14	05/13/14	
Depth (Feet bgs)						
gamma-Chlordane	µg/kg	0.51 JB	0.29 JpB	6 JB	0.48 JpB	5.1 JpB
Heptachlor	µg/kg	8.3 U	1.1 J	1.9 J	0.45 J	7.2 J
Heptachlor epoxide	µg/kg	8.3 U	1.1 J	1.1 J	5.3	8.1 J
Methoxychlor	µg/kg	23	46	79	16	74.4
Toxaphene	µg/kg	330 U	340 U	330 U	68 U	423.2 U
Herbicides						
2,4,5-T	µg/kg	100 U	99 U	100 U	20 U	126.62 U
2,4-D	µg/kg	400 U	400 U	400 U	79 U	508.61 U
2,4-DB	µg/kg	79 Jp	400 U	400 U	79 U	457.57 UJ
Dalapon	µg/kg	200 U	200 U	200 U	40 U	254.13 U
Dicamba	µg/kg	200 U	200 U	200 U	40 U	254.13 U
Dichlorprop	µg/kg	400 U	400 U	400 U	79 U	508.61 U
MCPA	µg/kg	40000 U	40000 U	40000 U	7900 U	50861 U
MCPP	µg/kg	40000 U	40000 U	40000 U	7900 U	50861 U
Silvex (2,4,5-TP)	µg/kg	100 U	99 U	< 100 U	20 U	150.38 U
Semi-Volatile Compounds						
1,2,4-Trichlorobenzene	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
1,2-Dichlorobenzene	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
1,3-Dichlorobenzene	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
1,4-Dichlorobenzene	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
2,4,5-Trichlorophenol	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
2,4,6-Trichlorophenol	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
2,4-Dichlorophenol	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
2,4-Dimethylphenol	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
2,4-Dinitrophenol	µg/kg	8000 U	8100 U	8000 U	7800 U	8123.1 U
2,4-Dinitrotoluene	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
2,6-Dinitrotoluene	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
2-Chloronaphthalene	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
2-Chlorophenol	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
2-Methylnaphthalene	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
2-Methylphenol	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
2-Nitroaniline	µg/kg	8000 U	8100 U	8000 U	7800 U	8123.1 U
2-Nitrophenol	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
3,3-Dichlorobenzidine	µg/kg	8000 U	8100 U	8000 U	7800 U	8123.1 U
3-Methylphenol & 4-Methylphenol	µg/kg	3300 U	3300 U	3300 U	3200 U	3333.8 U
3-Nitroaniline	µg/kg	8000 U	8100 U	8000 U	7800 U	8123.1 U
4,6-Dinitro-2-methylphenol	µg/kg	8000 U	8100 U	8000 U	7800 U	8123.1 U
4-Bromophenyl phenyl ether	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
4-Chloro-3-methylphenol	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
4-Chloroaniline	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
4-Chlorophenyl phenyl ether	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
4-Nitroaniline	µg/kg	8000 U	8100 U	8000 U	7800 U	8123.1 U
4-Nitrophenol	µg/kg	8000 U	8100 U	8000 U	7800 U	8123.1 U
Acenaphthene	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Acenaphthylene	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U

Attachment B
Table B-1
Decision Unit Sample Results
and Estimated Background Concentrations
Sequoia and Kings Canyon National Parks

Sequoia & Kings Canyon National Parks Lower Kaweah Dump Site	Reporting Units	Background Samples				
		SEKI-DU1-01	SEKI-DU1-02	SEKI-DU1-03	SEKI-DU1-04	95% UCL
Date		05/13/14	05/13/14	05/13/14	05/13/14	
Depth (Feet bgs)						
Anthracene	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Benzo[a]anthracene	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Benzo[a]pyrene	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Benzo[b]fluoranthene	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Benzo[g,h,i]perylene	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Benzo[k]fluoranthene	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Bis (2-chloroisopropyl) ether	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Bis(2-chloroethoxy)methane	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Bis(2-chloroethyl)ether	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Bis(2-ethylhexyl) phthalate	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Butyl benzyl phthalate	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Chrysene	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Dibenz(a,h)anthracene	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Dibenzofuran	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Diethyl phthalate	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Dimethyl phthalate	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Di-n-butyl phthalate	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Di-n-octyl phthalate	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Fluoranthene	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Fluorene	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Hexachlorobenzene	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Hexachlorobutadiene	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Hexachlorocyclopentadiene	µg/kg	1600 U	8100 U	8000 U	7800 U	10124 U
Hexachloroethane	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Indeno[1,2,3-cd]pyrene	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Isophorone	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Naphthalene	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Nitrobenzene	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
N-Nitrosodi-n-propylamine	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
N-Nitrosodiphenylamine	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Pentachlorophenol	µg/kg	8000 U	8100 U	8000 U	7800 U	8123.1 U
Phenanthrene	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Phenol	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U
Pyrene	µg/kg	1600 U	1700 U	1600 U	1600 U	1683.8 U

Laboratory Qualifiers:

U - Non-detected above the indicated laboratory reporting limit

B - Compound was found in the blank and sample.

J - Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

p - The %RPD between the primary and confirmation column/detector is >40%. The lower value has been reported.

Attachment B
Table B-2
Laboratory Analytical Results
Metals
Sequoia and Kings Canyon National Park

Sequoia & Kings Canyon National Parks Lower Kaweah Dump Site	EPA RSLs (Residential)	EPA RSLs (Industrial)	CHHSLs (Residential)	CHHSLs (Industrial)	Reporting Units	Waste Stream Samples								Adjacent Native Soil Samples				
						SEKI-T01-01-5	SEKI-T02-03-3	SEKI-T03-05-3	SEKI-T04-07-3	SEKI-T05-09-7	SEKI-T06-10-5	SEKI-T06-13*	95% UCL	SEKI-T01-02-2	SEKI-T02-04-1	SEKI-T03-06-2	SEKI-T04-08-2	95% UCL
Date						05/12/14	05/12/14	05/13/14	05/13/14	05/14/14	05/14/14	05/14/14		05/12/14	05/12/14	05/13/14	05/13/14	
Depth (Feet bgs)						5	3	3	3	7	5	7		2	1	2	2	
Metals																		
Antimony	3.1	47	30	380	mg/kg	1.9 J	22	15	1.4 J	26	44	17	29.0 J	1.9 J	2.1 U	1.1 J	1.4 J	2.2 UJ
Arsenic	0.67	3	0.07	0.24	mg/kg	3	27	28	2.4	130	57	130	94.4	2 J	1.5 J	2.7	4.4	4.1 J
Barium	1,500	22,000	5,200	63,000	mg/kg	430	640	1200	140	320	420	270	746	180	42	130	190	215
Beryllium	16	230	150	1,700	mg/kg	0.041 J	0.091 J	0.24 J	0.42	0.14 J	0.79 U	0.21 J	0.47 UJ	0.13 J	0.25	0.31	0.61	0.57 J
Cadmium	7	98	1.7	7.5	mg/kg	2.3	6.8	10	0.8	16	35	6.6	19.65	0.49	0.26	0.41	1.3	1.16
Chromium	12,000	180,000	17	37	mg/kg	14	110	90	10	76	130	52	102.6	3.6	2.4	6	21	18.4
Cobalt	2.3	35	660	3,200	mg/kg	5.7	39	27	3.9	34	24	22	32.0	6.8	1.6	6.5	5.6	8.0
Copper	310	4,700	660	3,200	mg/kg	58 B	670 B	400 B	18 B	370 B	310 B	170 B	451 B	10 B	2.2 B	3.6 B	59 B	51 B
Lead	400	800	150	3,500	mg/kg	260	400	1200	100	940	240	980	911	3	7.4	6.2	190	160
Mercury	0.94	4	18	180	mg/kg	0.084	0.15	0.35	0.019 J	0.54	0.049 J	0.34	0.362 J	0.01 J	0.044 U	0.028 J	0.2	0.173 UJ
Molybdenum	39	580	380	4,800	mg/kg	1.7 J	5.6	6.5 J	2.2 U	14	32	10	18.0 J	1.3 J	2.1 U	2.4 U	1.2 J	2.4 UJ
Nickel	84	1,200	1,600	16,000	mg/kg	7.2	140	72	4.7	130	160	88	131.8	1.9	1.4	3.7	6.5	6.1
Selenium	39	580	380	4,800	mg/kg	2.7 U	4.2 U	7.4 U	2.2 U	5.4 U	7.9 U	5.2 U	6.6 U	2.3 U	2.1 U	2.4 U	2.7 U	2.7 U
Silver	39	580	380	4,800	mg/kg	0.26 J	2.1	4.8	0.55 U	3.7	1.5 J	2.5	3.40 UJ	0.58 U	0.52 U	0.6 U	0.2 J	0.69 UJ
Thallium	0.078	1.2	5	63	mg/kg	2.7 U	4.2 U	7.4 U	2.2 U	5.4 U	7.9 U	5.2 U	6.6 U	2.5	1.1 J	1.7 J	1.6 J	2.4 J
Vanadium	39	580	530	6,700	mg/kg	33	8.8	36	25	13	22	11	29	53	15	44	40	57
Zinc	2,300	35,000	23,000	100,000	mg/kg	1600	2200	3100	420	9800	11000	3700	7593	66	28	100	530	457

Notes:

Screening level criteria based upon the most conservative values for comparison purposes. Only the most conservative values are shown on the table.

CHHSLs - California Human Health Screening Level

EPA RSLs - United States Environmental Protection Agency Region 9 Regional Screening Levels

95% UCL - 95 percent conficende limit based on the Student's *t-statistic*

* Duplicate sample for SEKI-T05-09-7

Laboratory Qualifiers:

U - Non-detected above the indicated laboratory reporting limit

B - Compound was found in the blank and sample.

J - Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Attachment B
Table B-3
Laboratory Analytical Results
Total Petroleum Hydrocarbons and Semi-Volatile Compounds
Engineering Evaluation and Cost Analysis Report
Sequoia and Kings Canyon National Park

Sequoia & Kings Canyon National Parks Lower Kaweah Dump Site	EPA RSLs (Residential)	EPA RSLs (Industrial)	CHHSLs (Residential)	CHHSLs (Industrial)	Reporting Units	**Waste Stream Samples** SEKI-T01-01-5	SEKI-T02-03-3	SEKI-T03-05-3	SEKI-T04-07-3	SEKI-T05-09-7	SEKI-T06-10-5	SEKI-T06-13*	95% UCL	**Adjacent Native Soil Samples** SEKI-T01-02-2	SEKI-T02-04-1	SEKI-T03-06-2	SEKI-T04-08-2	95% UCL
Date						05/12/14	05/12/14	05/13/14	05/13/14	05/14/14	05/14/14	05/14/14		05/12/14	05/12/14	05/13/14	05/13/14	
Depth (Feet bgs)						5	3	3	3	7	5	7		2	1	2	2	
Total Petroleum Hydrocarbons																		
Diesel Range Organics (DRO)	250	3,300			mg/kg	46	25	71	13	23	78	26	58.96	1.8	5.3	6.5	40	34.40
Semi-Volatile Compounds																		
1,2,4-Trichlorobenzene	5,800	26,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
1,2-Dichlorobenzene	180,000	930,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
1,3-Dichlorobenzene					µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
1,4-Dichlorobenzene	2,600	11,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
2,4,5-Trichlorophenol	620,000	8,200,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
2,4,6-Trichlorophenol	6,200	82,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
2,4-Dichlorophenol	18,000	250,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
2,4-Dimethylphenol	120,000	1,600,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
2,4-Dinitrophenol	12,000	160,000			µg/kg	1800 J	3700 U	29000 U	9300 U	11000 U	16000 U	11000 U	18299 U	1900 U	1700 U	1900 U	22000 U	18740 U
2,4-Dinitrotoluene	1,700	7,400			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
2,6-Dinitrotoluene	360	1,500			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
2-Chloronaphthalene	630,000	9,300,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
2-Chlorophenol	39,000	580,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
2-Methylnaphthalene	23,000	300,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
2-Methylphenol					µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
2-Nitroaniline	61,000	800,000			µg/kg	10000 J	3700 U	29000 U	9300 U	11000 U	16000 U	11000 U	18718 U	1900 U	1700 U	1900 U	22000 U	18740 U
2-Nitrophenol					µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
3,3-Dichlorobenzidine	1,200	5,100			µg/kg	10000 U	3700 U	29000 U	9300 U	11000 U	16000 U	11000 U	18718 U	1900 U	1700 U	1900 U	22000 U	18740 U
3-Methylphenol & 4-Methylphenol					µg/kg	4300 U	1500 U	12000 U	3800 U	4600 U	6700 U	4400 U	7761 U	770 U	690 U	770 U	9000 U	7665 U
3-Nitroaniline					µg/kg	10000 U	3700 U	29000 U	9300 U	11000 U	16000 U	11000 U	18718 U	1900 U	1700 U	1900 U	22000 U	18740 U
4,6-Dinitro-2-methylphenol	150,000				µg/kg	2600 J	3700 U	29000 U	9300 U	11000 U	16000 U	11000 U	18309 U	1900 U	1700 U	1900 U	22000 U	18740 U
4-Bromophenyl phenyl ether					µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
4-Chloro-3-methylphenol					µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
4-Chloroaniline	2,700	12,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
4-Chlorophenyl phenyl ether					µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
4-Nitroaniline	25,000	120,000			µg/kg	10000 U	3700 U	29000 U	9300 U	11000 U	16000 U	11000 U	18718 U	1900 U	1700 U	1900 U	22000 U	18740 U
4-Nitrophenol					µg/kg	10000 U	3700 U	29000 U	9300 U	11000 U	16000 U	11000 U	18718 U	1900 U	1700 U	1900 U	22000 U	18740 U
Acenaphthene	350,000	4,500,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Acenaphthylene					µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Anthracene	1,700,000	23,000,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Benzo[a]anthracene	150	2,900			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Benzo[a]pyrene	15	290			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Benzo[b]fluoranthene	150	2,900			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Benzo[g,h,i]perylene					µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Benzo[k]fluoranthene	150	2,900			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Bis (2-chloroisopropyl) ether	4,900	22,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Bis(2-chloroethoxy)methane	18,000	250,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Bis(2-chloroethyl)ether	230	1,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Bis(2-ethylhexyl) phthalate	38,000	160,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Butyl benzyl phthalate	260,000				µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Chrysene	15,000	290,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Dibenz(a,h)anthracene	15	290			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Dibenzofuran	7,200	100,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Diethyl phthalate	4,900,000	66,000,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U

Attachment B
Table B-4
Laboratory Analytical Results
Polychlorinated Biphenyls, Dioxins and Furans
Sequoia and Kings Canyon National Park

Sequoia & Kings Canyon National Parks Lower Kaweah Dump Site	EPA RSLs (Residential)	EPA RSLs (Industrial)	CHHSLs (Residential)	CHHSLs (Industrial)	Reporting Units	Waste Stream Samples: SEKI-T01-01-5	SEKI-T02-03-3	SEKI-T03-05-3	SEKI-T04-07-3	SEKI-T05-09-7	SEKI-T06-10-5	SEKI-T06-13*	95% UCL	Adjacent Native Soil Samples: SEKI-T01-02-2	SEKI-T02-04-1	SEKI-T03-06-2	SEKI-T04-08-2	95% UCL
Date						05/12/14	05/12/14	05/13/14	05/13/14	05/14/14	05/14/14	05/14/14		05/12/14	05/12/14	05/13/14	05/13/14	
Depth (Feet bgs)						5	3	3	3	7	5	7		2	1	2	2	
Polychlorinated Biphenyls																		
Aroclor 1016	400	5,200			µg/kg	43 U	74 U	59 U	38 U	44 U	67 U	43 U	63 U	37 U	35 U	39 U	44 U	43 U
Aroclor 1221	150	660			µg/kg	43 U	74 U	59 U	38 U	44 U	67 U	43 U	63 U	37 U	35 U	39 U	44 U	43 U
Aroclor 1232	150	660			µg/kg	43 U	74 U	59 U	38 U	44 U	67 U	43 U	63 U	37 U	35 U	39 U	44 U	43 U
Aroclor 1242	240	1,000			µg/kg	43 U	74 U	59 U	38 U	44 U	67 U	43 U	63 U	37 U	35 U	39 U	44 U	43 U
Aroclor 1248	240	1,000			µg/kg	43 U	74 U	59 U	38 U	44 U	67 U	43 U	63 U	37 U	35 U	39 U	44 U	43 U
Aroclor 1254	110	1,000			µg/kg	43 U	74 U	59 U	38 U	44 U	67 U	43 U	63 U	37 U	35 U	39 U	44 U	43 U
Aroclor 1260	240	1,000			µg/kg	43 U	74 U	12 J	38 U	44 U	67 U	43 U	61 UJ	37 U	35 U	39 U	44 U	43 U
Dioxins and Furans																		
1,2,3,4,6,7,8-HpCDD					pg/g	180 B	62 B	1800 B	36 B	460 B	12 B	390 B	885 B	3.7 JB	730 B	1.3 JB	780 B	891 JB
1,2,3,4,6,7,8-HpCDF					pg/g	100 B	34 B	380 B	10 B	92 B	12 B	80 B	195.51 B	1.2 JB	340 B	0.92 JBq	300 B	378.05 JBq
1,2,3,4,7,8,9-HpCDF					pg/g	1.8 J	3.1 J	15	5.7 U	5.3 J	1.6 J	5.3 J	8.8 UJ	5.6 U	9.8	5.7 U	17	15.8 U
1,2,3,4,7,8-HxCDD					pg/g	0.81 J	1.5 J	26	0.91 Jq	10	0.65 Jq	8.1	13.67 Jq	5.6 U	1.8 J	5.7 U	17	15.26 UJ
1,2,3,4,7,8-HxCDF					pg/g	2.8 JB	6.4 JB	29 B	2 JB	7.4 B	1.7 JB	4.8 JB	14.8 JB	5.6 U	5 JB	5.7 U	12 B	11.0 UJB
1,2,3,6,7,8-HxCDD					pg/g	5.7 J	5.7 J	99	2.1 J	27	2 Jq	22	48.9 Jq	0.12 Jq	17	5.7 U	37	34.1 Jq
1,2,3,6,7,8-HxCDF					pg/g	1.9 JB	7.9 JB	35 B	0.77 JBq	6.4 JB	3.4 JB	5.8 JB	17.45 JBq	5.6 U	3.8 JB	5.7 U	9.4 B	8.89 JBq
1,2,3,7,8,9-HxCDD					pg/g	2.6 J	5.4 J	82	2.1 J	22	1.3 J	24	41.2 J	5.6 U	3.6 Jq	5.7 U	24	21.0 Ujq
1,2,3,7,8,9-HxCDF					pg/g	0.38 Jq	11 U	9 U	5.7 U	6.8 U	9.9 U	6.6 U	9.64 UJq	5.6 U	5.4 U	5.7 U	6.8 U	6.62 U
1,2,3,7,8-PeCDD					pg/g	0.55 J	1.6 Jq	36	5.7 U	7.7 q	9.9 U	7.9	18.72 UJq	5.6 U	0.7 Jq	5.7 U	18	16.18 UJ
1,2,3,7,8-PeCDF					pg/g	1 J	6 J	23	5.7 U	4.6 Jq	9.9 U	4.7 J	13.1 UJq	5.6 U	5.4 U	5.7 U	5.1 Jq	5.8 UJq
2,3,4,6,7,8-HxCDF					pg/g	2.3 J	9.7 J	44	1.2 Jq	4.5 J	4.3 J	3.5 Jq	21.1 UJq	0.074 J	3.3 J	5.7 U	9	9.0 J
2,3,4,7,8-PeCDF					pg/g	1.1 J	6.3 J	35	0.83 J	7.1	1.4 Jq	5.9 J	17.1 Jq	5.6 U	0.51 J	5.7 U	8	8.7 UJ
2,3,7,8-TCDD	4.9	22	4.6	19	pg/g	0.25 Jq	1 J	12	1.1 U	3.1	2 U	2.9	6.14 UJq	1.1 U	1.1 U	1.1 U	35	29.52 U
OCDD					pg/g	1400 B	220 B	7300 EB	190 B	2100 B	1.8 J	1900 B	3740.7 EB	0.18 Jq	0.21 J	1.1 U	5500 EB	4611.0 BUJq
OCDF					pg/g	680 B	32 B	1700 B	34 B	310 B	59 B	310 B	887 B	12 B	6000 EB	16 B	950 B	5123 EB
Total HpCDD					pg/g	300 B	110 B	3300 B	66 B	820 B	12 JB	700 B	1613.4 B	4.9 JB	1900 B	1.6 JBq	1400 B	1970.9 JBq
Total HpCDF					pg/g	270 B	58 Bq	900 B	22 B	240 B	22 B	210 B	471.4 Bq	5.8 B	1100 B	2.4 JB	810 B	1140.4 JB
Total HxCDD					pg/g	27	46	880	19 q	260	34 B	200	437.6 Bq	2.9 JB	1600 B	2.1 JBq	450 q	1401.3 JBq
Total HxCDF					pg/g	52 Bq	75 Bq	660 Bq	13 Bq	90 Bq	15 q	67 Bq	309 Bq	0.47 Jq	66 q	5.7 U	240 Bq	210 BUJq
Total PeCDD					pg/g	5.2 Bq	18 q	300	0.83 Jq	79 q	94 Bq	56 q	155.37 Bq	0.43 JBq	240 B	0.55 JBq	150 q	236.78 JBq
Total PeCDF					pg/g	17 q	74	510	14 q	92 q	9.9 U	73 q	243.8 q	5.6 U	3.6 Jq	5.7 U	130 q	109.8 UJq
Total TCDD					pg/g	3.4 q	15 Bq	190 B	0.85 JBq	45 Bq	58 q	39 B	98.17 JBq	0.17 Jq	11 q	5.7 U	71 Bq	60.78 BUJq
Total TCDF					pg/g	14 q	92	500	11 q	120 q	2 U	110	249.31 q	1.1 U	0.72 JBq	1.1 U	120	100.76 BUJq
2,3,7,8-TCDF					pg/g	0.92 q	6.1	35	1 J	9.6	11 q	8.5	18.82 Jq	0.26 Jq	1.9 q	1.1 U	10	8.62 UJq
Dioxins and Furans Total Toxicity Equivalence																		

Sequoia & Kings Canyon National Parks Lower Kaweah Dump Site	TEF	Waste Stream Soil Toxicity Equivalence: SEKI-T01-01-5	SEKI-T02-03-3	SEKI-T03-05-3	SEKI-T04-07-3	SEKI-T05-09-7	SEKI-T06-10-5	SEKI-T06-13*	Adjacent Native Soil Toxicity Equivalence: SEKI-T01-02-2	SEKI-T02-04-1	SEKI-T03-06-2	SEKI-T04-08-2
Date												
Depth (Feet bgs)												
Polychlorinated Biphenyls												
Aroclor 1016												
Aroclor 1221												
Aroclor 1232												
Aroclor 1242												
Aroclor 1248												
Aroclor 1254												
Aroclor 1260												
Dioxins and Furans												
1,2,3,4,6,7,8-HpCDD	0.01	1.8 B	0.62 B	18 B	0.36 B	4.6 B	0.12 B	3.9 B	0.037 B	7.3 B	0.013 B	7.8 B
1,2,3,4,6,7,8-HpCDF	0.01	1 B	0.34 B	3.8 B	0.1 B	0.92 B	0.12 B	0.8 B	0.012 B	3.4 B	0.0092 B	3 B
1,2,3,4,7,8,9-HpCDF	0.01	0.018 J	0.031 J	0.15	0.057 U	0.053 J	0.016 J	0.053 J	0.056 U	0.098 J	0.057 J	0.17 J
1,2,3,4,7,8-HxCDD	0.1	0.081 J	0.15 J	2.6	0.091 Jq	1	0.065 Jq	0.81	0.56 Jq	0.18	0.57 Jq	1.7
1,2,3,4,7,8-HxCDF	0.1	0.28 JB	0.64 JB	2.9 B	0.2 JB	0.74 B	0.17 JB	0.48 JB	0.56 JB	0.5 B	0.57 JB	1.2 JB
1,2,3,6,7,8-HxCDD	0.1	0.57 J	0.57 J	9.9	0.21 J	2.7	0.2 Jq	2.2	0.012 J	1.7	0.57 Jq	3.7
1,2,3,6,7,8-HxCDF	0.1	0.19 JB	0.79 JB	3.5 B	0.077 JBq	0.64 JB	0.34 JB	0.58 JB	0.56 JBq	0.38 JB	0.57 JB	0.94 JB
1,2,3,7,8,9-HxCDD	0.1	0.26 J	0.54 J	8.2	0.21 J	2.2	0.13 J	2.4	0.56 J	0.36	0.57 J	2.4
1,2,3,7,8,9-HxCDF	0.1	0.038 Jq	1.1 U	0.9 U	0.57 U	0.68 U	0.99 U	0.66 U	0.56 U	0.54 U	0.57 U	0.68 U
1,2,3,7,8-PeCDD	0.5	0.275 J	0.8 Jq	18	2.85 U	3.85 q	4.95 U	3.95	2.8 U	0.35 q	2.85 U	9
1,2,3,7,8-PeCDF	0.05	0.05 J	0.3 J	1.15	0.285 U	0.23 Jq	0.495 U	0.235 J	0.28 U	0.27 Jq	0.285 U	0.255 J
2,3,4,6,7,8-HxCDF	0.1	0.23 J	0.97 J	4.4	0.12 Jq	0.45 J	0.43 J	0.35 Jq	0.0074 Jq	0.33 J	0.57 J	0.9 Jq
2,3,4,7,8-PeCDF	0.5	0.55 J	3.15 J	17.5	0.415 J	3.55	0.7 Jq	2.95 J	2.8 J	0.255	2.85 Jq	4 J
2,3,7,8-TCDD	1	0.25 Jq	1 J	12	1.1 U	3.1	2 U	2.9	1.1 U	1.1	1.1 U	35
OCDD	0.001	1.4 B	0.22 B	7.3 EB	0.19 B	2.1 B	0.002 J	1.9 B	0.00018 B	0.00021 B	0.0011 J	5.5 B
OCDF	0.001	0.68 B	0.032 B	1.7 B	0.034 B	0.31 B	0.059 B	0.31 B	0.012 B	6 B	0.016 B	0.95 B
Total HpCDD	0	0 B	0 B	0 B	0 B	0 B	0 JB	0 B	0 B	0 B	0 JB	0 B
Total HpCDF	0	0 B	0 Bq	0 B	0 B	0 B	0 B	0 B	0 B	0 B	0 B	0 B
Total HxCDD	0	0	0	0	0 q	0	0 B	0	0 q	0	0 B	0
Total HxCDF	0	0 Bq	0 Bq	0 Bq	0 Bq	0 Bq	0 q	0 Bq	0 Bq	0 Bq	0 q	0 Bq
Total PeCDD	0	0 Bq	0 q	0	0 Jq	0 q	0 Bq	0 q	0 Jq	0 q	0 Bq	0 q
Total PeCDF	0	0 q	0	0	0 q	0 q	0 U	0 q	0 q	0 q	0 U	0 q
Total TCDD	0	0 q	0 Bq	0 B	0 JBq	0 Bq	0 q	0 B	0 JBq	0 Bq	0 q	0 B
Total TCDF	0	0 q	0	0	0 q	0 q	0 U	0	0 q	0 q	0 U	0
2,3,7,8-TCDF	0.1	0.092 q	0.61	3.5	0.1 J	0.96	1.1 q	0.85	0.026 J	0.19	0.11 q	1
Dioxins and Furans Total Toxicity Equivalence		7.764	11.86	115.5	6.969	28.08	11.89	25.33	9.94258	22.9532	11.2813	78.195

Notes:

Screening level criteria based upon the most conservative values for comparison purposes. Only the most conservative values are shown on the table.

CHHSLs - California Human Health Screening Level

EPA RSLs - United States Environmental Protection Agency Region 9 Regional Screening Levels

95% UCL - 95 percent conficende limit based on the Student's *t-statistic*

* Duplicate sample for SEKI-T05-09-7

TEF = Toxicity equivalence factor

Laboratory Qualifiers:

U - Non-detected above the indicated laboratory reporting limit

B - Compound was found in the blank and sample.

J - Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

p - The %RPD between the primary and confirmation column/detector is >40%. The lower value has been reported.

q - The result is the estimated maximum possible concentration, quantitated using the theoretical ion ratio. The measured ion ratio does not meet qualitative identification criteria and indicates a possible interference.

Attachment B
Table B-3
Laboratory Analytical Results
Total Petroleum Hydrocarbons and Semi-Volatile Compounds
Engineering Evaluation and Cost Analysis Report
Sequoia and Kings Canyon National Park

Sequoia & Kings Canyon National Parks Lower Kaweah Dump Site	EPA RSLs (Residential)	EPA RSLs (Industrial)	CHHSLs (Residential)	CHHSLs (Industrial)	Reporting Units	**Waste Stream Samples** SEKI-T01-01-5	SEKI-T02-03-3	SEKI-T03-05-3	SEKI-T04-07-3	SEKI-T05-09-7	SEKI-T06-10-5	SEKI-T06-13*	95% UCL	**Adjacent Native Soil Samples** SEKI-T01-02-2	SEKI-T02-04-1	SEKI-T03-06-2	SEKI-T04-08-2	95% UCL
Date						05/12/14	05/12/14	05/13/14	05/13/14	05/14/14	05/14/14	05/14/14		05/12/14	05/12/14	05/13/14	05/13/14	
Depth (Feet bgs)						5	3	3	3	7	5	7		2	1	2	2	
Dimethyl phthalate	780,000	12,000,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Di-n-butyl phthalate	620,000	8,200,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	740 J	3730 UJ	380 U	350 U	380 U	4500 U	3832 U
Di-n-octyl phthalate	62,000	820,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Fluoranthene	230,000	3,000,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Fluorene	230,000	3,000,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Hexachlorobenzene	330	1,400			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Hexachlorobutadiene	6,200	30,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Hexachlorocyclopentadiene	37,000	490,000			µg/kg	2100 U	3700 U	29000 U	9300 U	11000 U	16000 U	11000 U	18302 U	1900 U	1700 U	1900 U	22000 U	18740 U
Hexachloroethane	4,300	58,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Indeno[1,2,3-cd]pyrene	150	2,900			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Isophorone	510,000				µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Naphthalene	3,800	17,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Nitrobenzene	5,100	22,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
N-Nitrosodi-n-propylamine	76	330			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
N-Nitrosodiphenylamine	110,000	470,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Pentachlorophenol	990	4,000			µg/kg	1400 J	3700 U	29000 U	9300 U	11000 U	16000 U	11000 U	18297 U	1900 U	1700 U	1900 U	22000 U	18740 U
Phenanthrene					µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Phenol	1,800,000	25,000,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U
Pyrene	170,000	2,300,000			µg/kg	2100 U	760 U	5900 U	1900 U	2300 U	3300 U	2200 U	3827 U	380 U	350 U	380 U	4500 U	3832 U

Notes:

Screening level criteria based upon the most conservative values for comparison purposes. Only the most conservative values are shown on the table.

CHHSLs - California Human Health Screening Level

EPA RSLs - United States Environmental Protection Agency Region 9 Regional Screening Levels

95% UCL - 95 percent conficende limit based on the Student's *t-statistic*

* Duplicate sample for SEKI-T05-09-7

Laboratory Qualifiers:

U - Non-detected above the indicated laboratory reporting limit

J - Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Attachment B
Table B-4
Laboratory Analytical Results
Polychlorinated Biphenyls, Dioxins and Furans
Sequoia and Kings Canyon National Park

						Waste Stream Samples								Adjacent Native Soil Samples						Waste Stream Soil Toxicity Equivalence							Adjacent Native Soil Toxicity Equivalence			
Sequoia & Kings Canyon National Parks Lower Kaweah Dump Site	EPA RSLs (Residential)	EPA RSLs (Industrial)	CHHSLs (Residential)	CHHSLs (Industrial)	Reporting Units	SEKI-T01-01-5	SEKI-T02-03-3	SEKI-T03-05-3	SEKI-T04-07-3	SEKI-T05-09-7	SEKI-T06-10-5	SEKI-T06-13*	95% UCL	SEKI-T01-02-2	SEKI-T02-04-1	SEKI-T03-06-2	SEKI-T04-08-2	95% UCL	TEF	SEKI-T01-01-5	SEKI-T02-03-3	SEKI-T03-05-3	SEKI-T04-07-3	SEKI-T05-09-7	SEKI-T06-10-5	SEKI-T06-13*	SEKI-T01-02-2	SEKI-T02-04-1	SEKI-T03-06-2	SEKI-T04-08-2
Date						05/12/14	05/12/14	05/13/14	05/13/14	05/14/14	05/14/14	05/14/14		05/12/14	05/12/14	05/13/14	05/13/14													
Depth (Feet bgs)						5	3	3	3	7	5	7		2	1	2	2													
Polychlorinated Biphenyls																														
Aroclor 1016	400	5,200			µg/kg	43 U	74 U	59 U	38 U	44 U	67 U	43 U	63 U	37 U	35 U	39 U	44 U	43 U												
Aroclor 1221	150	660			µg/kg	43 U	74 U	59 U	38 U	44 U	67 U	43 U	63 U	37 U	35 U	39 U	44 U	43 U												
Aroclor 1232	150	660			µg/kg	43 U	74 U	59 U	38 U	44 U	67 U	43 U	63 U	37 U	35 U	39 U	44 U	43 U												
Aroclor 1242	240	1,000			µg/kg	43 U	74 U	59 U	38 U	44 U	67 U	43 U	63 U	37 U	35 U	39 U	44 U	43 U												
Aroclor 1248	240	1,000			µg/kg	43 U	74 U	59 U	38 U	44 U	67 U	43 U	63 U	37 U	35 U	39 U	44 U	43 U												
Aroclor 1254	110	1,000			µg/kg	43 U	74 U	59 U	38 U	44 U	67 U	43 U	63 U	37 U	35 U	39 U	44 U	43 U												
Aroclor 1260	240	1,000			µg/kg	43 U	74 U	12 J	38 U	44 U	67 U	43 U	61 UJ	37 U	35 U	39 U	44 U	43 U												
Dioxins and Furans																														
1,2,3,4,6,7,8-HpCDD					pg/g	180 B	62 B	1800 B	36 B	460 B	12 B	390 B	885 B	3.7 JB	730 B	1.3 JB	780 B	891 JB	0.01	1.8 B	0.62 B	18 B	0.36 B	4.6 B	0.12 B	3.9 B	0.037 B	7.3 B	0.013 B	7.8 B
1,2,3,4,6,7,8-HpCDF					pg/g	100 B	34 B	380 B	10 B	92 B	12 B	80 B	195.51 B	1.2 JB	340 B	0.92 JBq	300 B	378.05 JBq	0.01	1 B	0.34 B	3.8 B	0.1 B	0.92 B	0.12 B	0.8 B	0.012 B	3.4 B	0.0092 B	3 B
1,2,3,4,7,8,9-HpCDF					pg/g	1.8 J	3.1 J	15	5.7 U	5.3 J	1.6 J	5.3 J	8.8 UJ	5.6 U	9.8	5.7 U	17	15.8 U	0.01	0.018 J	0.031 J	0.15	0.057 U	0.053 J	0.016 J	0.053 J	0.056 U	0.098 J	0.057 J	0.17 J
1,2,3,4,7,8-HxCDD					pg/g	0.81 J	1.5 J	26	0.91 Jq	10	0.65 Jq	8.1	13.67 Jq	5.6 U	1.8 J	5.7 U	17	15.26 UJ	0.1	0.081 J	0.15 J	2.6	0.091 Jq	1	0.065 Jq	0.81	0.56 Jq	0.18	0.57 Jq	1.7
1,2,3,4,7,8-HxCDF					pg/g	2.8 JB	6.4 JB	29 B	2 JB	7.4 B	1.7 JB	4.8 JB	14.8 JB	5.6 U	5 JB	5.7 U	12 B	11.0 UJB	0.1	0.28 JB	0.64 JB	2.9 B	0.2 JB	0.74 B	0.17 JB	0.48 JB	0.56 JB	0.5 B	0.57 JB	1.2 JB
1,2,3,6,7,8-HxCDD					pg/g	5.7 J	5.7 J	99	2.1 J	27	2 Jq	22	48.9 Jq	0.12 Jq	17	5.7 U	37	34.1 Jq	0.1	0.57 J	0.57 J	9.9	0.21 J	2.7	0.2 Jq	2.2	0.012 J	1.7	0.57 Jq	3.7
1,2,3,6,7,8-HxCDF					pg/g	1.9 JB	7.9 JB	35 B	0.77 JBq	6.4 JB	3.4 JB	5.8 JB	17.45 JBq	5.6 U	3.8 JB	5.7 U	9.4 B	8.89 JBq	0.1	0.19 JB	0.79 JB	3.5 B	0.077 JBq	0.64 JB	0.34 JB	0.58 JB	0.56 JBq	0.38 JB	0.57 JB	0.94 JB
1,2,3,7,8,9-HxCDD					pg/g	2.6 J	5.4 J	82	2.1 J	22	1.3 J	24	41.2 J	5.6 U	3.6 Jq	5.7 U	24	21.0 Ujq	0.1	0.26 J	0.54 J	8.2	0.21 J	2.2	0.13 J	2.4	0.56 J	0.36	0.57 J	2.4
1,2,3,7,8,9-HxCDF					pg/g	0.38 Jq	11 U	9 U	5.7 U	6.8 U	9.9 U	6.6 U	9.64 UJq	5.6 U	5.4 U	5.7 U	6.8 U	6.62 U	0.1	0.038 Jq	1.1 U	0.9 U	0.57 U	0.68 U	0.99 U	0.66 U	0.56 U	0.54 U	0.57 U	0.68 U
1,2,3,7,8-PeCDD					pg/g	0.55 J	1.6 Jq	36	5.7 U	7.7 q	9.9 U	7.9	18.72 UJq	5.6 U	0.7 Jq	5.7 U	18	16.18 UJ	0.5	0.275 J	0.8 Jq	18	2.85 U	3.85 q	4.95 U	3.95	2.8 U	0.35 q	2.85 U	9
1,2,3,7,8-PeCDF					pg/g	1 J	6 J	23	5.7 U	4.6 Jq	9.9 U	4.7 J	13.1 UJq	5.6 U	5.4 U	5.7 U	5.1 Jq	5.8 UJq	0.05	0.05 J	0.3 J	1.15	0.285 U	0.23 Jq	0.495 U	0.235 J	0.28 U	0.27 Jq	0.285 U	0.255 J
2,3,4,6,7,8-HxCDF					pg/g	2.3 J	9.7 J	44	1.2 Jq	4.5 J	4.3 J	3.5 Jq	21.1 UJq	0.074 J	3.3 J	5.7 U	9	9.0 J	0.1	0.23 J	0.97 J	4.4	0.12 Jq	0.45 J	0.43 J	0.35 Jq	0.0074 Jq	0.33 J	0.57 J	0.9 Jq
2,3,4,7,8-PeCDF					pg/g	1.1 J	6.3 J	35	0.83 J	7.1	1.4 Jq	5.9 J	17.1 Jq	5.6 U	0.51 J	5.7 U	8	8.7 UJ	0.5	0.55 J	3.15 J	17.5	0.415 J	3.55	0.7 Jq	2.95 J	2.8 J	0.255	2.85 Jq	4 J
2,3,7,8-TCDD	4.9	22	4.6	19	pg/g	0.25 Jq	1 J	12	1.1 U	3.1	2 U	2.9	6.14 UJq	1.1 U	1.1 U	1.1 U	35	29.52 U	1	0.25 Jq	1 J	12	1.1 U	3.1	2 U	2.9	1.1 U	1.1	1.1 U	35
OCDD					pg/g	1400 B	220 B	7300 EB	190 B	2100 B	1.8 J	1900 B	3740.7 EB	0.18 Jq	0.21 J	1.1 U	5500 EB	4611.0 BUJq	0.001	1.4 B	0.22 B	7.3 EB	0.19 B	2.1 B	0.002 J	1.9 B	0.00018 B	0.00021 B	0.0011 J	5.5 B
OCDF					pg/g	680 B	32 B	1700 B	34 B	310 B	59 B	310 B	887 B	12 B	6000 EB	16 B	950 B	5123 EB	0.001	0.68 B	0.032 B	1.7 B	0.034 B	0.31 B	0.059 B	0.31 B	0.012 B	6 B	0.016 B	0.95 B
Total HpCDD					pg/g	300 B	110 B	3300 B	66 B	820 B	12 JB	700 B	1613.4 B	4.9 JB	1900 B	1.6 JBq	1400 B	1970.9 JBq	0	0 B	0 B	0 B	0 B	0 B	0 JB	0 B	0 B	0 B	0 JB	0 B
Total HpCDF					pg/g	270 B	58 Bq	900 B	22 B	240 B	22 B	210 B	471.4 Bq	5.8 B	1100 B	2.4 JB	810 B	1140.4 JB	0	0 B	0 Bq	0 B	0 B	0 B	0 B	0 B	0 B	0 B	0 B	0 B
Total HxCDD					pg/g	27	46	880	19 q	260	34 B	200	437.6 Bq	2.9 JB	1600 B	2.1 JBq	450 q	1401.3 JBq	0	0	0	0	0 q	0	0 B	0	0 q	0	0 B	0
Total HxCDF					pg/g	52 Bq	75 Bq	660 Bq	13 Bq	90 Bq	15 q	67 Bq	309 Bq	0.47 Jq	66 q	5.7 U	240 Bq	210 BUJq	0	0 Bq	0 Bq	0 Bq	0 Bq	0 Bq	0 q	0 Bq	0 Bq	0 Bq	0 q	0 Bq
Total PeCDD					pg/g	5.2 Bq	18 q	300	0.83 Jq	79 q	94 Bq	56 q	155.37 Bq	0.43 JBq	240 B	0.55 JBq	150 q	236.78 JBq	0	0 Bq	0 q	0	0 Jq	0 q	0 Bq	0 q	0 Jq	0 q	0 Bq	0 q
Total PeCDF					pg/g	17 q	74	510	14 q	92 q	9.9 U	73 q	243.8 q	5.6 U	3.6 Jq	5.7 U	130 q	109.8 UJq	0	0 q	0	0	0 q	0 q	0 U	0 q	0 q	0 q	0 U	0 q
Total TCDD					pg/g	3.4 q	15 Bq	190 B	0.85 JBq	45 Bq	58 q	39 B	98.17 JBq	0.17 Jq	11 q	5.7 U	71 Bq	60.78 BUJq	0	0 q	0 Bq	0 B	0 JBq	0 Bq	0 q	0 B	0 JBq	0 Bq	0 q	0 B
Total TCDF					pg/g	14 q	92	500	11 q	120 q	2 U	110	249.31 q	1.1 U	0.72 JBq	1.1 U	120	100.76 BUJq	0	0 q	0	0	0 q	0 q	0 U	0	0 q	0 q	0 U	0
2,3,7,8-TCDF					pg/g	0.92 q	6.1	35	1 J	9.6	11 q	8.5	18.82 Jq	0.26 Jq	1.9 q	1.1 U	10	8.62 UJq	0.1	0.092 q	0.61	3.5	0.1 J	0.96	1.1 q	0.85	0.026 J	0.19	0.11 q	1
Dioxins and Furans Total Toxicity Equivalence																				7.764	11.86	115.5	6.969	28.08	11.89	25.33	9.94258	22.9532	11.2813	78.195

Notes:

Screening level criteria based upon the most conservative values for comparison purposes. Only the most conservative values are shown on the table.
CHHSLs - California Human Health Screening Level
EPA RSLs - United States Environmental Protection Agency Region 9 Regional Screening Levels
95% UCL - 95 percent conficende limit based on the Student's *t-statistic*
* Duplicate sample for SEKI-T05-09-7
TEF = Toxicity equivalence factor

Laboratory Qualifiers:

U - Non-detected above the indicated laboratory reporting limit
B - Compound was found in the blank and sample.
J - Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
p - The %RPD between the primary and confirmation column/detector is >40%. The lower value has been reported.
q - The result is the estimated maximum possible concentration, quantitated using the theoretical ion ratio. The measured ion ratio does not meet qualitative identification criteria and indicates a possible interference.

Attachment B
Table B-5
Laboratory Analytical Results
Organochlorine Pesticides and Herbicides
Sequoia and Kings Canyon National Park

Sequoia & Kings Canyon National Parks Lower Kaweah Dump Site	EPA RSLs (Residential)	EPA RSLs (Industrial)	CHHSLs (Residential)	CHHSLs (Industrial)	Reporting Units	Waste Stream Samples								Adjacent Native Soil Samples				
						SEKI-T01-01-5	SEKI-T02-03-3	SEKI-T03-05-3	SEKI-T04-07-3	SEKI-T05-09-7	SEKI-T06-10-5	SEKI-T06-13*	95% UCL	SEKI-T01-02-2	SEKI-T02-04-1	SEKI-T03-06-2	SEKI-T04-08-2	95% UCL
Date						05/12/14	05/12/14	05/13/14	05/13/14	05/14/14	05/14/14	05/14/14		05/12/14	05/12/14	05/13/14	05/13/14	
Depth (Feet bgs)						5	3	3	3	7	5	7		2	1	2	2	
Organochlorine Pesticides																		
4,4'-DDD	2,200	9,600			µg/kg	11 U	3.8 U	17 p	0.45 J	1.4 Jp	3.4 U	3.4 p	10.19 Ujp	1.9 U	1.8 U	2 U	19 J	16.24 Ujp
4,4'-DDE	1,600	6,800			µg/kg	11 U	3.8 U	63	4.9	7.6	3.4 U	12	30.81 U	1.9 U	0.48 J	2 U	95	79.88 UJ
4,4'-DDT	1,900	8,600			µg/kg	2.8 J	3.8 U	180	6.9	15	3.4 U	31	82.3 UJ	1.9 U	1.8 U	2 U	470	394.3 UJ
Aldrin	31	140			µg/kg	11 U	0.5 Jp	15 U	2 U	2.3 U	3.4 U	2.2 U	9.3 Ujp	1.9 U	1.8 U	2 U	46 U	38.9 Ujp
alpha-BHC	85	370			µg/kg	11 U	3.8 U	67	2 U	2.3 U	3.4 U	2.2 U	30.7 U	1.9 U	1.8 U	2 U	46 U	38.9 U
alpha-Chlordane	1,800	8,000			µg/kg	11 U	3.8 U	15 U	2 U	2.3 U	3.4 U	2.2 U	9.5 U	1.9 U	1.8 U	2 U	46 U	38.9 U
beta-BHC	300	1,300			µg/kg	11 U	0.55 J	21	2 U	2.3 U	3.4 U	2.2 U	11.52 U	1.9 U	1.8 U	2 U	46 U	38.87 U
delta-BHC	520				µg/kg	3.3 J	3.8 U	15 U	2 U	0.14 Jp	0.4 Jp	2.2 U	7.58 UJp	1.9 U	1.8 U	2 U	46 U	38.87 UJp
Dieldrin	33	140			µg/kg	11 U	3.8 U	15 U	0.71 Jp	2.3 U	3.4 U	0.18 Jp	9.3 UJp	1.9 U	1.8 U	2 U	46 U	38.9 UJp
Endosulfan I					µg/kg	11 U	3.8 U	0.99 J	2 U	2.3 U	3.4 U	2.2 U	6.14 UJ	1.9 U	1.8 U	2 U	46 U	38.87 UJ
Endosulfan II					µg/kg	1.5 J	3.8 U	0.92 J	2 U	0.49 Jp	3.4 U	2.2 U	2.94 UJp	1.9 U	1.8 U	2 U	46 U	38.87 UJp
Endosulfan sulfate	37,000	490,000			µg/kg	11 U	3.8 U	2.2 J	2 U	2.3 U	0.4 Jp	2.2 U	6.0 UJp	1.9 U	1.8 U	2 U	46 U	38.9 UJp
Endrin	1,800	25,000			µg/kg	11 U	3.8 U	15 U	2 U	2.3 U	0.61 Jp	2.2 U	9.30 UJp	1.9 U	1.8 U	2 U	46 U	38.87 UJp
Endrin aldehyde	18,000				µg/kg	11 U	3.8 U	2.6 Jp	0.28 Jp	1.1 JBp	3.4 U	2.2 U	6.08 UJBp	1.9 U	1.8 U	0.37 Jp	46 U	38.80 UJBp
Endrin ketone	18,000				µg/kg	11 U	3.8 U	15 U	2 U	0.97 J	3.4 U	2.2 U	9.41 UJ	1.9 U	1.8 U	2 U	46 U	38.87 UJ
gamma-BHC (Lindane)	560	2,500			µg/kg	11 U	0.64 J	15 U	2 U	0.87 J	2.6 JBp	0.98 JBp	8.99 UJBp	1.9 U	0.29 JBp	2 U	46 U	38.81 UJBp
gamma-Chlordane					µg/kg	11 U	3.8 U	6.6 JB	0.48 JBp	4.5 U	3.4 U	2.2 U	7.07 UJBp	0.34 JB	1.8 U	2 U	46 U	38.80 UJBp
Heptachlor	120	510			µg/kg	11 U	150 U	15 U	2 U	90 U	3.4 U	4.4 U	81.9 U	1.9 U	1.8 U	2 U	46 U	38.9 U
Heptachlor epoxide	59	250			µg/kg	11 U	1.4 Jp	6.5 J	2 U	0.37 Jp	6.9 U	87 U	39.47 UJp	1.9 U	3.6 U	4 U	46 U	39.10 UJp
Methoxychlor	31,000	410,000			µg/kg	24	0.21 Jp	30 U	3.9 U	0.77 Jp	140 U	1.7 Jp	65.80 UJp	3.8 U	71 U	78 U	91 U	106.8 UJp
Toxaphene	480	2,100			µg/kg	430 U	0.42 Jp	600 U	77 U	0.33 Jp	0.28 Jp	0.46 Jp	342.04 UJp	75 U	0.26 Jp	0.48 JBp	1800 U	1514 UJBp
Herbicides																		
2,4,5-T	62,000	820,000	550		µg/kg	130 U	44 U	35 U	22 U	26 U	40 U	26 U	74 U	22 U	22 U	23 U	27 U	26 U
2,4-D	69,000	970,000	690		µg/kg	530 U	180 U	140 U	89 U	110 U	160 U	100 U	301 U	90 U	89 U	92 U	110 U	107 U
2,4-DB	49,000	660,000			µg/kg	530 U	180 U	140 U	89 U	110 U	160 U	100 U	301 U	90 U	86 U	92 U	110 U	107 U
Dalapon	180,000	2,500,000			µg/kg	260 U	89 U	71 U	44 U	53 U	80 U	52 U	148 U	45 U	43 U	46 U	53 U	52 U
Dicamba	180,000	2,500,000			µg/kg	260 U	89 U	71 U	44 U	53 U	80 U	52 U	148 U	45 U	43 U	46 U	53 U	52 U
Dichlorprop					µg/kg	530 U	180 U	140 U	89 U	110 U	160 U	100 U	301 U	90 U	86 U	92 U	110 U	107 U
MCPA	3,100	41,000			µg/kg	53000 U	18000 U	14000 U	8900 U	11000 U	16000 U	10000 U	30068 U	9000 U	8600 U	9200 U	11000 U	10701 U
MCPP	6,200	82,000			µg/kg	53000 U	18000 U	14000 U	8900 U	11000 U	16000 U	10000 U	30068 U	9000 U	8600 U	9200 U	11000 U	10701 U
Silvex (2,4,5-TP)					µg/kg	130 U	44 U	35 U	22 U	26 U	40 U	26 U	74 U	22 U	22 U	23 U	27 U	26 U

Attachment B
Table B-5
Laboratory Analytical Results
Organochlorine Pesticides and Herbicides
Sequoia and Kings Canyon National Park

Sequoia & Kings Canyon National Parks Lower Kaweah Dump Site	EPA RSLs (Residential)	EPA RSLs (Industrial)	CHHSLs (Residential)	CHHSLs (Industrial)	Reporting Units	Waste Stream Samples								Adjacent Native Soil Samples				
						SEKI-T01-01-5	SEKI-T02-03-3	SEKI-T03-05-3	SEKI-T04-07-3	SEKI-T05-09-7	SEKI-T06-10-5	SEKI-T06-13*	95% UCL	SEKI-T01-02-2	SEKI-T02-04-1	SEKI-T03-06-2	SEKI-T04-08-2	95% UCL
Date						05/12/14	05/12/14	05/13/14	05/13/14	05/14/14	05/14/14	05/14/14		05/12/14	05/12/14	05/13/14	05/13/14	
Depth (Feet bgs)						5	3	3	3	7	5	7		2	1	2	2	

Notes:

Screening level criteria based upon the most conservative values for comparison purposes. Only the most conservative values are shown on the table.

CHHSLs - California Human Health Screening Level

EPA RSLs - United States Environmental Protection Agency Region 9 Regional Screening Levels

95% UCL - 95 percent conficende limit based on the Student's *t-statistic*

* Duplicate sample for SEKI-T05-09-7

Laboratory Qualifiers:

U - Non-detected above the indicated laboratory reporting limit

B - Compound was found in the blank and sample.

J - Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

p - The %RPD between the primary and confirmation column/detector is >40%. The lower value has been reported.

q - The result is the estimated maximum possible concentration, quantitated using the theoretical ion ratio. The measured ion ratio does not meet qualitative identification criteria and indicates a possible interference.

Attachment B
Table B-6
Laboratory Analytical Results
Phytoremediation / Agricultural Parameters
Sequoia and Kings Canyon National Park

Sequoia & Kings Canyon National Parks Lower Kaweah Dump Site	Reporting Units	SEKI1	SEKI2
Date		05/12/14	05/12/14
Depth (Feet bgs)		5	2
Soil Salinity			
SAR		0.3	0.2
ESP		0.1 U	0.1 U
Na	meq/L	0.1	0.3
Ca	meq/L	0.3	4.2
Mg	meq/L	0.1	0.4
pH		5.2	7.1
CO_3	meq/L	0.0	0.0
HCO_3	meq/L	1.0	2.3
E.C.	dS/m	0.1	0.5
Cl	meq/L	0.3	0.6
B	ppm	0.0	0.1
Saturation	%	77.7	66.4
Physical Characteristics			
Sand	%	74	78
Silt	%	12	11
Clay	%	15	11
Texture		Sandy	Sandy
Analysis Report			
Organic Matter - % Rating	%	19.9 VH	14.4 VH
Organic Matter - ENR	lbs/A	427	317
Phosphorus - P1	ppm	40 VH	9
Phosphorus - $NaHCO_3$-P	ppm	14	14 H
Potassium - K	ppm	68 M	117 M
Magnesium - Mg	ppm	39 VL	45 VL
Calcium - Ca	ppm	935 L	2251 VH
Sodium - Na	ppm	6 VL	11 VL
pH - Soil pH		5.2	7.1
pH - Buffer Index		6.7	
Hydrogen - H	meq/100g	2.7	0.0
Cation Exchange Capacity - C.E.C.	meq/100g	7.9	11.9
Percent Cation Saturation - K	%	2.2	2.5
Percent Cation Saturation - Mg	%	4.0	3.1
Percent Cation Saturation - Ca	%	58.9	94.0
Percent Cation Saturation - H	%	34.5	0.0
Percent Cation Saturation - Na	%	0.4	0.4
Nitrogen - NO_3-N	ppm	2 VL	1 VL
Sulfur - SO_4-S	ppm	22 M	85 VH
Zinc - Zn	ppm	165 VH	131 VH
Manganese - Mn	ppm	1 VL	1 VL
Iron - Fe	ppm	3 VL	1 VL
Copper - Cu	ppm	18.5 VH	4.9 VH
Boron - B	ppm	0.2 VL	0.5 VL
Excess Lime Rating		L	M
Soluble Salts	mmhos/cm	0.1 VL	0.5 L

Laboratory Qualifiers:
U - Non-detected above the indicated laboratory reporting limit
VL - Very low
L - Low
M - Medium
H - High
VH - Very high

Attachment B
Table B-7
Laboratory Analytical Results
Background, Waste Stream and Adjacent Native Soils 95% UCL Comparison
Sequoia and Kings Canyon National Park

Sequoia & Kings Canyon National Parks Lower Kaweah Dump Site	EPA RSLs (Residential)	EPA RSLs (Industrial)	CHHSLs (Residential)	CHHSLs (Industrial)	Reporting Units	Background 95% UCL	Waste Stream 95% UCL	Adjacent Native Soils 95% UCL
Metals								
Antimony	3.1	47	30	380	mg/kg	5.0 U	29.0 J	2.2 UJ
Arsenic	0.67	3	0.07	0.24	mg/kg	5.0 U	94.4	4.1 J
Barium	1,500	22,000	5,200	63,000	mg/kg	143.4	746	215
Beryllium	16	230	150	1,700	mg/kg	0.6	0.47 UJ	0.57 J
Cadmium	7	98	1.7	7.5	mg/kg	5.0 U	19.65	1.16
Chromium	12,000	180,000	17	37	mg/kg	6.7	102.6	18.4
Cobalt	2.3	35	660	3,200	mg/kg	5.9	32.0	8.0
Copper	310	4,700	660	3,200	mg/kg	5.5	451 B	51 B
Lead	400	800	150	3,500	mg/kg	18.7	911	160
Mercury	0.94	4	18	180	mg/kg	0.0	0.362 J	0.173 UJ
Molybdenum	39	580	380	4,800	mg/kg	5.0 U	18.0 J	2.4 UJ
Nickel	84	1,200	1,600	16,000	mg/kg	4.6	131.8	6.1
Selenium	39	580	380	4,800	mg/kg	5.0 U	6.6 U	2.7 U
Silver	39	580	380	4,800	mg/kg	1.3 U	3.40 UJ	0.69 UJ
Thallium	0.078	1.2	5	63	mg/kg	5.0 U	6.6 U	2.4 J
Vanadium	39	580	530	6,700	mg/kg	36.9	29	57
Zinc	2,300	35,000	23,000	100,000	mg/kg	59.2	7593	457
Total Petroleum Hydrocarbons								
Diesel Range Organics (DRO)	250	3,300			mg/kg	94.2	58.96	34.40
Polychlorinated Biphenyls								
Aroclor 1016	400	5,200			µg/kg	33.3 U	63 U	43 U
Aroclor 1221	150	660			µg/kg	33.3 U	63 U	43 U
Aroclor 1232	150	660			µg/kg	33.3 U	63 U	43 U
Aroclor 1242	240	1,000			µg/kg	33.3 U	63 U	43 U
Aroclor 1248	240	1,000			µg/kg	33.3 U	63 U	43 U
Aroclor 1254	110	1,000			µg/kg	33.3 U	63 U	43 U
Aroclor 1260	240	1,000			µg/kg	33.3 U	61 UJ	43 U
Dioxins and Furans								
1,2,3,4,6,7,8-HpCDD					pg/g	--	885 B	891 JB
1,2,3,4,6,7,8-HpCDF					pg/g	--	195.51 B	378.05 JBq
1,2,3,4,7,8,9-HpCDF					pg/g	--	8.8 UJ	15.8 U
1,2,3,4,7,8-HxCDD					pg/g	--	13.67 Jq	15.26 UJ
1,2,3,4,7,8-HxCDF					pg/g	--	14.8 JB	11.0 UJB
1,2,3,6,7,8-HxCDD					pg/g	--	48.9 Jq	34.1 Jq
1,2,3,6,7,8-HxCDF					pg/g	--	17.45 JBq	8.89 JBq
1,2,3,7,8,9-HxCDD					pg/g	--	41.2 J	21.0 Ujq
1,2,3,7,8,9-HxCDF					pg/g	--	9.64 UJq	6.62 U
1,2,3,7,8-PeCDD					pg/g	--	18.72 UJq	16.18 UJ
1,2,3,7,8-PeCDF					pg/g	--	13.1 UJq	5.8 UJq
2,3,4,6,7,8-HxCDF					pg/g	--	21.1 UJq	9.0 J
2,3,4,7,8-PeCDF					pg/g	--	17.1 Jq	8.7 UJ
2,3,7,8-TCDD	4.9	22	4.6	19	pg/g	--	6.14 UJq	29.52 U
OCDD					pg/g	--	3740.7 EB	4611.0 BUJq
OCDF					pg/g	--	887 B	5123 EB
Total HpCDD					pg/g	--	1613.4 B	1970.9 JBq
Total HpCDF					pg/g	--	471.4 Bq	1140.4 JB
Total HxCDD					pg/g	--	437.6 Bq	1401.3 JBq

Attachment B
Table B-7
Laboratory Analytical Results
Background, Waste Stream and Adjacent Native Soils 95% UCL Comparison
Sequoia and Kings Canyon National Park

Sequoia & Kings Canyon National Parks Lower Kaweah Dump Site	EPA RSLs (Residential)	EPA RSLs (Industrial)	CHHSLs (Residential)	CHHSLs (Industrial)	Reporting Units	Background 95% UCL	Waste Stream 95% UCL	Adjacent Native Soils 95% UCL
Total HxCDF					pg/g	--	309 Bq	210 BUJq
Total PeCDD					pg/g	--	155.37 Bq	236.78 JBq
Total PeCDF					pg/g	--	243.8 q	109.8 UJq
Total TCDD					pg/g	--	98.17 JBq	60.78 BUJq
Total TCDF					pg/g	--	249.31 q	100.76 BUJq
2,3,7,8-TCDF					pg/g	--	18.82 Jq	8.62 UJq
Organochlorine Pesticides								
4,4'-DDD	2,200	9,600			µg/kg	10.7 U	10.19 Ujp	16.24 Ujp
4,4'-DDE	1,600	6,800			µg/kg	10.6 J	30.81 U	79.88 UJ
4,4'-DDT	1,900	8,600			µg/kg	25.7 J	82.3 UJ	394.3 UJ
Aldrin	31	140			µg/kg	11.2 UJ	9.3 Ujp	38.9 Ujp
alpha-BHC	85	370			µg/kg	9.7 UJ	30.7 U	38.9 U
alpha-Chlordane	1,800	8,000			µg/kg	11.2 UJp	9.5 U	38.9 U
beta-BHC	300	1,300			µg/kg	11.1 UJ	11.52 U	38.87 U
delta-BHC	520				µg/kg	10.7 U	7.58 UJp	38.87 UJp
Dieldrin	33	140			µg/kg	7.1 UJp	9.3 UJp	38.9 UJp
Endosulfan I					µg/kg	1.4 J	6.14 UJ	38.87 UJ
Endosulfan II					µg/kg	9.9 UJ	2.94 UJp	38.87 UJp
Endosulfan sulfate	37,000	490,000			µg/kg	43.9	6.0 UJp	38.9 UJp
Endrin	1,800	25,000			µg/kg	11.2 UJ	9.30 UJp	38.87 UJp
Endrin aldehyde	18,000				µg/kg	9.8 UJp	6.08 UJBp	38.80 UJBp
Endrin ketone	18,000				µg/kg	7.1 Ujp	9.41 UJ	38.87 UJ
gamma-BHC (Lindane)	560	2,500			µg/kg	10.7 U	8.99 UJBp	38.81 UJBp
gamma-Chlordane					µg/kg	5.1 JpB	7.07 UJBp	38.80 UJBp
Heptachlor	120	510			µg/kg	7.2 J	81.9 U	38.9 U
Heptachlor epoxide	59	250			µg/kg	8.1 J	39.47 UJp	39.10 UJp
Methoxychlor	31,000	410,000			µg/kg	74.4	65.80 UJp	106.8 UJp
Toxaphene	480	2,100			µg/kg	423.2 U	342.04 UJp	1514 UJBp
Herbicides								
2,4,5-T	62,000	820,000	550		µg/kg	126.62 U	74 U	26 U
2,4-D	69,000	970,000	690		µg/kg	508.61 U	301 U	107 U
2,4-DB	49,000	660,000			µg/kg	457.57 UJ	301 U	107 U
Dalapon	180,000	2,500,000			µg/kg	254.13 U	148 U	52 U
Dicamba	180,000	2,500,000			µg/kg	254.13 U	148 U	52 U
Dichlorprop					µg/kg	508.61 U	301 U	107 U
MCPA	3,100	41,000			µg/kg	50861 U	30068 U	10701 U
MCPP	6,200	82,000			µg/kg	50861 U	30068 U	10701 U
Silvex (2,4,5-TP)					µg/kg	150.38 U	74 U	26 U
Semi-Volatile Compounds								
1,2,4-Trichlorobenzene	5,800	26,000			µg/kg	1683.8 U	3827 U	3832 U
1,2-Dichlorobenzene	180,000	930,000			µg/kg	1683.8 U	3827 U	3832 U
1,3-Dichlorobenzene					µg/kg	1683.8 U	3827 U	3832 U
1,4-Dichlorobenzene	2,600	11,000			µg/kg	1683.8 U	3827 U	3832 U
2,4,5-Trichlorophenol	620,000	8,200,000			µg/kg	1683.8 U	3827 U	3832 U
2,4,6-Trichlorophenol	6,200	82,000			µg/kg	1683.8 U	3827 U	3832 U
2,4-Dichlorophenol	18,000	250,000			µg/kg	1683.8 U	3827 U	3832 U
2,4-Dimethylphenol	120,000	1,600,000			µg/kg	1683.8 U	3827 U	3832 U
2,4-Dinitrophenol	12,000	160,000			µg/kg	8123.1 U	18299 U	18740 U

Attachment B
Table B-7
Laboratory Analytical Results
Background, Waste Stream and Adjacent Native Soils 95% UCL Comparison
Sequoia and Kings Canyon National Park

Sequoia & Kings Canyon National Parks Lower Kaweah Dump Site	EPA RSLs (Residential)	EPA RSLs (Industrial)	CHHSLs (Residential)	CHHSLs (Industrial)	Reporting Units	Background 95% UCL	Waste Stream 95% UCL	Adjacent Native Soils 95% UCL
2,4-Dinitrotoluene	1,700	7,400			µg/kg	1683.8 U	3827 U	3832 U
2,6-Dinitrotoluene	360	1,500			µg/kg	1683.8 U	3827 U	3832 U
2-Chloronaphthalene	630,000	9,300,000			µg/kg	1683.8 U	3827 U	3832 U
2-Chlorophenol	39,000	580,000			µg/kg	1683.8 U	3827 U	3832 U
2-Methylnaphthalene	23,000	300,000			µg/kg	1683.8 U	3827 U	3832 U
2-Methylphenol					µg/kg	1683.8 U	3827 U	3832 U
2-Nitroaniline	61,000	800,000			µg/kg	8123.1 U	18718 U	18740 U
2-Nitrophenol					µg/kg	1683.8 U	3827 U	3832 U
3,3-Dichlorobenzidine	1,200	5,100			µg/kg	8123.1 U	18718 U	18740 U
3-Methylphenol & 4-Methylphenol					µg/kg	3333.8 U	7761 U	7665 U
3-Nitroaniline					µg/kg	8123.1 U	18718 U	18740 U
4,6-Dinitro-2-methylphenol	150,000				µg/kg	8123.1 U	18309 U	18740 U
4-Bromophenyl phenyl ether					µg/kg	1683.8 U	3827 U	3832 U
4-Chloro-3-methylphenol					µg/kg	1683.8 U	3827 U	3832 U
4-Chloroaniline	2,700	12,000			µg/kg	1683.8 U	3827 U	3832 U
4-Chlorophenyl phenyl ether					µg/kg	1683.8 U	3827 U	3832 U
4-Nitroaniline	25,000	120,000			µg/kg	8123.1 U	18718 U	18740 U
4-Nitrophenol					µg/kg	8123.1 U	18718 U	18740 U
Acenaphthene	350,000	4,500,000			µg/kg	1683.8 U	3827 U	3832 U
Acenaphthylene					µg/kg	1683.8 U	3827 U	3832 U
Anthracene	1,700,000	23,000,000			µg/kg	1683.8 U	3827 U	3832 U
Benzo[a]anthracene	150	2,900			µg/kg	1683.8 U	3827 U	3832 U
Benzo[a]pyrene	15	290			µg/kg	1683.8 U	3827 U	3832 U
Benzo[b]fluoranthene	150	2,900			µg/kg	1683.8 U	3827 U	3832 U
Benzo[g,h,i]perylene					µg/kg	1683.8 U	3827 U	3832 U
Benzo[k]fluoranthene	150	2,900			µg/kg	1683.8 U	3827 U	3832 U
Bis (2-chloroisopropyl) ether	4,900	22,000			µg/kg	1683.8 U	3827 U	3832 U
Bis(2-chloroethoxy)methane	18,000	250,000			µg/kg	1683.8 U	3827 U	3832 U
Bis(2-chloroethyl)ether	230	1,000			µg/kg	1683.8 U	3827 U	3832 U
Bis(2-ethylhexyl) phthalate	38,000	160,000			µg/kg	1683.8 U	3827 U	3832 U
Butyl benzyl phthalate	260,000				µg/kg	1683.8 U	3827 U	3832 U
Chrysene	15,000	290,000			µg/kg	1683.8 U	3827 U	3832 U
Dibenz(a,h)anthracene	15	290			µg/kg	1683.8 U	3827 U	3832 U
Dibenzofuran	7,200	100,000			µg/kg	1683.8 U	3827 U	3832 U
Diethyl phthalate	4,900,000	66,000,000			µg/kg	1683.8 U	3827 U	3832 U
Dimethyl phthalate	780,000	12,000,000			µg/kg	1683.8 U	3827 U	3832 U
Di-n-butyl phthalate	620,000	8,200,000			µg/kg	1683.8 U	3730 UJ	3832 U
Di-n-octyl phthalate	62,000	820,000			µg/kg	1683.8 U	3827 U	3832 U
Fluoranthene	230,000	3,000,000			µg/kg	1683.8 U	3827 U	3832 U
Fluorene	230,000	3,000,000			µg/kg	1683.8 U	3827 U	3832 U
Hexachlorobenzene	330	1,400			µg/kg	1683.8 U	3827 U	3832 U
Hexachlorobutadiene	6,200	30,000			µg/kg	1683.8 U	3827 U	3832 U
Hexachlorocyclopentadiene	37,000	490,000			µg/kg	10124 U	18302 U	18740 U
Hexachloroethane	4,300	58,000			µg/kg	1683.8 U	3827 U	3832 U
Indeno[1,2,3-cd]pyrene	150	2,900			µg/kg	1683.8 U	3827 U	3832 U
Isophorone	510,000				µg/kg	1683.8 U	3827 U	3832 U
Naphthalene	3,800	17,000			µg/kg	1683.8 U	3827 U	3832 U
Nitrobenzene	5,100	22,000			µg/kg	1683.8 U	3827 U	3832 U

Attachment B
Table B-7
Laboratory Analytical Results
Background, Waste Stream and Adjacent Native Soils 95% UCL Comparison
Sequoia and Kings Canyon National Park

Sequoia & Kings Canyon National Parks Lower Kaweah Dump Site	EPA RSLs (Residential)	EPA RSLs (Industrial)	CHHSLs (Residential)	CHHSLs (Industrial)	Reporting Units	Background 95% UCL	Waste Stream 95% UCL	Adjacent Native Soils 95% UCL
N-Nitrosodi-n-propylamine	76	330			µg/kg	1683.8 U	3827 U	3832 U
N-Nitrosodiphenylamine	110,000	470,000			µg/kg	1683.8 U	3827 U	3832 U
Pentachlorophenol	990	4,000			µg/kg	8123.1 U	18297 U	18740 U
Phenanthrene					µg/kg	1683.8 U	3827 U	3832 U
Phenol	1,800,000	25,000,000			µg/kg	1683.8 U	3827 U	3832 U
Pyrene	170,000	2,300,000			µg/kg	1683.8 U	3827 U	3832 U

Notes:

Screening level criteria based upon the most conservative values for comparison purposes. Only the most conservative values are shown on the table.

CHHSLs - California Human Health Screening Level

EPA RSLs - United States Environmental Protection Agency Region 9 Regional Screening Levels

95% UCL - 95 percent conficende limit based on the Student's *t-statistic*

* Duplicate sample for SEKI-T05-09-7

Laboratory Qualifiers:

U - Non-detected above the indicated laboratory reporting limit

B - Compound was found in the blank and sample.

J - Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

p - The %RPD between the primary and confirmation column/detector is >40%. The lower value has been reported.

q - The result is the estimated maximum possible concentration, quantitated using the theoretical ion ratio. The measured ion ratio does not meet qualitative identification criteria and indicates a possible interference.

ATTACHMENT C

SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT CALCULATION TABLES

Table C-1: Habitat Type and Species Inventory

Table C-2: ISM Calculator for 1-sided UCL for the Mean

Table C-3: ARAR Soil Screening Levels

Table C-4: Site Specific Screen Level Calculation

Table C-5: Hazard Quotient Calculation

Table C-6: Area Use Factor Calculations

Attachment C
Table C-1
Habitat Type and Species Inventory
Engineering Evaluation/Cost Analysis Report
Sequoia and Kings Canyon National Parks

Avian Species						
Common Name	**Scientific Name**	**Subgroup**	**Home Range/Territory Description***	**Area****	**Units**	**Area in acres**
American Robin	*Turdus migratorius*	Insectivore	Home range in Massachusetts averaged about 400 m (1320 ft) around the nest (Hirth et al. 1969). In nonbreeding season, often flies long distances from nightly roost to forage. Gaines (1974a) reported 7-13 males per 40 ha (100 ac) in Central Valley riparian habitat. Haldeman et al. (1973) reported 20 pairs per 40 ha (100 ac) in a ponderosa pine forest, and 2 pairs per 40 ha (100 ac) in a fir-pine-aspen forest in Arizona.	2	ac	2.0
Red-Tailed Hawk	*Buteo jamaicensis*	Carnivorous	The red-tailed hawk preferred habitat is mixed forest and field, with high bluffs or trees that may be used as perch sites. It occupies a wide range of habitats and altitudes, including deserts, grasslands, coastal regions, mountains, foothills, coniferous and deciduous woodlands, tropical rainforests, agricultural fields and urban areas. It is second only to the Peregrine Falcon in the use of diverse habitats in North America. It lives throughout the North American continent, except in areas of unbroken forest or the high Arctic.	272	ac	272.0
Mountain Chickadee	*Poecile gambeli*	Insectivore	No information found. Bock and Lynch (1970) found breeding density averaged 15.6 pairs per 40 ha (100 ac) in unburned stands, and 5.2 pairs per 40 ha (100 ac) in burned stands, in a pine-fir forest in the Sierra Nevada. Dahlston and Copper (1979), in Modoc and Lassen cos., reported a highest density of 38 pairs per 40 ha (100 ac) in white-fir forests with supplementary nest boxes, and a mean density of 24.4 pairs per 40 ha (100 ac).	?		
Western Tanager	*Piranga ludoviciana*	Insectivore	No information found. Breeding density per 40 ha (100 ac) reported as: 25-30 pairs in Idaho Douglas-fir forests (Johnston 1949), 5-18 individuals in Wyoming coniferous forests (Salt 1957), 21-46 individuals in an Oregon coniferous forest (Wiens and Nussbaum 1975), and 4-30 individuals in coniferous forests in the Sierra Nevada (Beedy 1982).	?		
Steller's Jay	*Cyanocitta stelleri*	Omnivore	No information found. Density in a live oak-eucalyptus picnic area in Alameda Co. was 19 pairs per 40 ha (100 ac) (Brown 1964).	?		
Common raven	*Corvus corax*	Omnivore	In Wyoming, home range averaged 938 ha (2317 ac), varying from 680-1080 ha (1680-2668 ac) (Craighead and Craighead 1956). In Great Britain, breeding density reported as 1 pair per 17-46 km² (6.6 to 17.6 mi²) (Ratcliffe 1962). In Virginia, 1 pair per 29 km² (11 mi²) reported by Hooper et al. (1975)	1,680	ac	1680.0
Red Breasted Nuthatch	*Sitta canadensis*	Insectivore	No information found. Apparently territorial all year. In Arizona, Carothers et al. (1973) found 6.7 breeding pairs per 40 ha (100 ac) in spruce-fir forest. In Idaho, Johnston (1949) found 20-45 breeders per 40 ha (100 ac) in Douglas-fir forest.	?		
Dark Eyed Junco	*Junco hyemalis*	Insectivore	Winter foraging range of "slate-colored" junco in Kansas was 5.8 ha (14 ac) or females, and 10.5 ha (26 ac) for males (Fitch 1958). Individuals probably travelled much farther to roosting cover. In Oregon, Gashwiler (1977) reported 14-20 pairs per 40 ha (100 ac) in lodgepole pine, 3-17 pairs per 40 ha (100 ac) in juniper, and 3 pairs per 40 ha (100 ac) in ponderosa pine stands. In northwestern California, Hagar (1960) found 42-54 pairs per 40 ha (100 ac) in recently logged Douglas-fir.	20	ac	20
Golden Crowned Kinglet	*Regulus satrapa*	Insectivore	No information found. In Arizona spruce-fir forests, Carothers et al. (1973) reported 17 pairs per 40 ha (100 ac).	?		
White-Headed Woodpecker	*Picoides albolarvatus*	Insectivore	Home ranges of white-headed woodpeckers appear to require larger areas to reproduce in a managed forest landscape than in relatively contiguous old growth. In fragmented habitat, home ranges averaged 321 ha (793 ac) and 342 ha (845 ac) for central and south-central Oregon, respectively, but were much smaller in continuous old growth (104 ha [257 ac] and 212 ha [524 ac]) (Dixon 1995a, b).	819	ac	819
American Robin	*Turdus migratorius*	Insectivore	Home range in Massachusetts averaged about 400 m (1320 ft) around the nest (Hirth et al. 1969). In nonbreeding season, often flies long distances from nightly roost to forage. Gaines (1974a) reported 7-13 males per 40 ha (100	1,368,478	ft^2	31.4
Blue Grouse	*Dendragapus obscurus*	Omnivore	Minimum habitat area is defined as the minimum amount of contiguous habitat required before a species will occupy an area. Specific information on minimum areas required for blue grouse throughout the year was not found in the literature. This model assumes two home ranges is the minimum area required to support a blue grouse population during the breeding season.	126	ac	126
Red- Tailed Hawk	*Buteo jamaicensis*	Carnivore	Home range sizes range from 1.3 to 5.2 square kilometers. The size of red-tailed hawk home ranges varies with the quality of habitat, the sex of the individual, and the season. (Preston and Beane, 1993)	3.25	km^2	803.1
Sharp-Shinned Hawk	*Accipiter striatus*	Carnivore	Their home range is usually between 0.9 and 2.8 square km. (Bildstein and Meyer, 2000)	1.85	km^2	457.1
Western Screech Owl	*Otus kennicottli*	Carnivore	Adults tend to remain near their breeding areas year-round while juveniles disperse in the autumn. Small territories around nest sites are vigorously defended by males. In desert riparian areas of the southwest, where these Owls can be quite numerous, territories may be only 50 meters apart. Home ranges are much larger, and range from 3 to 60 hectares, but these are not defended and there is much overlap between pairs.	31.5	ha	78

Attachment C
Table C-1
Habitat Type and Species Inventory
Engineering Evaluation/Cost Analysis Report
Sequoia and Kings Canyon National Parks

Common Name	Scientific Name	Subgroup	Home Range/Territory Description*	Area**	Units	Area in acres
Northern Goshawk	*Accipiter gentilis*	Carnivore	Extremely defensive of nest area. Vociferous; will strike intruders, including humans. Territory estimated to be 1.6 to 39 km^2 (0.6 to 15 mi^2) (Brown and Amadon 1968). Averaged 2.1 km^2 (0.8 mi^2) in Wyoming (Craighead and Craighead 1956). Distances of 2.9 to 5.6 km (1.8 to 3.5 mi) have been reported between nesting pairs.	20.3	km^2	5,016
California Spotted Owl	*Strix occidentalis*	Carnivore	Spotted Owl home ranges are generally large, but sizes are variable. The average home range size of Northern Spotted Owl pairs varies from 1,030 acres (417 ha) in coniferous forests of Oregon to 14,169 acres (5,734 ha) on Washington's Olympic Peninsula. In riparian hardwood forests of the Sierra National Forest, California Spotted Owl had comparatively small home ranges, varying from 661 to 985 acres (267–399 ha), while those in mixed pine, white fir, and California red fir forests of the Lassen National Forest had home ranges varying from 7,061 to 12,473 acres (2,857–5,048 ha).	5,295	ac	5,295
					Avian Smallest Average Home Range	**2.00**

Mammalian Species						
Common Name	**Scientific Name**	**Subgroup**	**Home Range/Territory Description***	**Area****	**Units**	**Area in acres**
Lodgepole Chipmunk	*Neotamias speciosus*	Herbivore	Home ranges of 1.0-2.0 ha (2.5-5.0 ac) were reported by (Roberts 1962).	3.75	ac	3.75
Northern Flying Squirrel	*Glaucomys sabrinus*	Omnivorous	Depending on the habitat, the home range of northern flying squirrels ranges from 0.8 hectares to 31 hectares. Female northern flying squirrels are territorial, but males are not. The population density can be as high as 10 squirrels per hectare in favorable conditions.	15.9	ha	39
Deer mouse	Peromyscus maniculatus	Omnivorous	*Peromyscus maniculatus* are found in places including Alaska, Canada, and parts of South America. The majority of deer mice nest is up high in large hollow trees. The deer mouse nests alone for the most part but will sometimes nest with a deer mouse of the opposite sex. They are populous in the western mountains and live in wooded areas and areas that were previously wooded. The deer mouse is generally a nocturnal creature. Deer mice can be found active on top of snow or beneath logs during the winter seasons.	0.4	ac	0.4
Douglas Squirrel	*Tamiasciurus douglasii*	Omnivorous	Home range and territory coincide (Smith 1968). Good habitat supports densities approaching 2/ha (2.5 ac).	2.5	ac	2.5
Mule Deer	Odocoileus hemionus	Herbivore	Typical home ranges of small doe and fawn groups were 1-3 km^2 (0.4- 1.1 mi^2), but varied from 0.5 to 5.0 km^2 (0.2 to 1.9 mi^2) in Lake Co. (Taber and Dasmann 1958). Bucks usually have larger home ranges, and travel longer distances than doe and fawn groups (Brown 1961). Statewide densities of 7-23 deer/km^2 (18-60/mi^2) are typical, varying from 2-40/km^2 (5-104/mi^2) (Longhurst et al. 1952). Home ranges usually are less than 1.6 km (1 mi) in diameter. Dasmann and Taber (1956) and Miller (1970) reported that the home range consists of many small areas from which the deer obtains its life requisites. Individual deer may use parts of the home range only seasonally	2.8	km^2	680
American (Pine) Marten	*Martes americana*	Carnivorous	In Montana, home ranges of males averaged 238 ha (589 ac), and varied from 88-262 ha (218-646 ac). Home ranges of females averaged 70 ha (173 ac), and varied from 8-52 ha (19-128 ac) (Hawley and Newby 1957). Home ranges often coincide with topographical or vegetation features, such as timber stands, ridges, streams, meadows, or burns.	432.0	ac	432
Black Bear	*Ursus americanus*	Carnivorous	In northwestern California in summer, home ranges of adult males averaged 10.6 km^2 (4.1 mi^2), and varied from 2.6 to 19.7 km^2 (1.0 to 7.6 mi^2). Those of adult females averaged 3.6 km^2 (1.4 mi^2), and varied from 1.8 to 4.4 km^2 (0.7 to 1.7 mi^2) (Kelleyhouse 1975). In the San Bernardino Mts., home ranges of males varied from 7.4 to 53.6 km^2 (2.8 to 20.6 mi^2), and averaged 22.4 km (8.6 mi^2) (Novick 1979). In western Washington, home ranges of adult and yearling males averaged 51.5 km2 (19.9 mi2); those of adult and yearling females averaged 5.3 km^2 (2.0 mi^2), and varied from 3.4 to 87 km^2 (1.3 to 33.6 mi^2) (Poelker and Hartwell 1973).	11.2	km^2	2,755
Mountain Lion	*Puma concolor*	Carnivorous	Home range sizes of pumas vary considerably across their geographic distribution, and the smallest ranges tend to occur in areas where prey densities are high and prey are not migratory (Sunquist and Sunquist 2002). In North America, home range sizes ranged from 32-1,031 km^2 (Lindzey et al. 1987).	531.5	km^2	131,336
Bobcat	*Lynx rufus*	Carnivorous	The sizes of bobcats' home ranges vary significantly; a World Conservation Union (IUCN) summary of research suggests ranges from 0.02 to 126 sq mi (0.052 to 326.339 km^2).	163.2	km^2	40,326
Ringtail	*Bassariscus astutus*	Carnivorous	Reports on home range include 5.0 to 13.8 ha for four individuals (Lacy, 1983), 43.4 ha (35 and 51.7 ha) for two males and 20.3 ha (15.7 to 27.7 ha) for three females (Toweill and Teer, 1980) and 136 ha (49 to 233) for nine individuals. Ringtails are nocturnal carnivores with some crepuscular activity and are solitary, except for the breeding season (Toweill and Toweill, 1978; Poglayen-Neuwall and Toweill, 1988). They breed at the end of February and give birth in May (Poglayen-Neuwall and Poglayen-Neuwall, 1980). They eat rodents, insects, birds and a good amount of fruit (Trapp, 1978; Aranda, 2000).	24.4	ha	60

Attachment C
Table C-1
Habitat Type and Species Inventory
Engineering Evaluation/Cost Analysis Report
Sequoia and Kings Canyon National Parks

Common Name	Scientific Name	Subgroup	Home Range/Territory Description*	Area**	Units	Area in acres
Fisher	*Martes pennanti*	Omnivorous	A fisher's hunting range varies from 6.6 km2 (3 sq mi) in the summer to 14.1 km2 (5 sq mi) in the winter. Ranges of up to 20.0 km2 (8 sq mi) in the winter are possible depending on the quality of the habitat. Male and female fishers have overlapping territories. This behavior is imposed on females by males due to dominance in size and a male desire to increase mating success.	10.35	mi^2	6,624
Long-Tailed Vole	*Microtus longicaudus*	Omnivorous	Home range averages from 0.2-0.4 ha (0.3-1.0 ac) (Jenkins 1948) (Conley 1976) reported a peak density of 120/ha (491 ac). Populations probably do not fluctuate as much as those of M. montanus (Randall and Johnson 1979).	0.7	ac	0.7
Townsend Shrew	*Sorex trowbridgii*	Herbivore	This species is found in coastal southwestern British Columbia south of Burrard Inlet, south through western Washington and Oregon to northwestern California, south through coast ranges to Santa Barbara County, east to Warner Mountains (northeastern California), south through Sierra Nevada to Kern County, California in the United States (George 1989). It occurs from sea level up to 1,820 m asl.			
Long-Eared Myotis	*Myotis evotis*	Carnivorous	No data found. The long-eared myotis is widespread in California, but generally is believed to be uncommon in most of its range. It avoids the arid Central Valley and hot deserts, occurring along the entire coast and in the Sierra Nevada, Cascades, and Great Basin from the Oregon border south through the Tehachapi Mts. to the Coast Ranges. This species has been found in nearly all brush, woodland, and forest habitats, from sea level to at least 2700 m (9000 ft), but coniferous woodlands and forests seem to be preferred.	?		
Big Brown Bat	*Eptesicus fuscus*	Carnivorous	The big brown bat is found in virtually every American habitat ranging from timberline meadows to lowland deserts, though it is most abundant in deciduous forest areas. It is often abundant in suburban areas of mixed agricultural use. This species ranges from extreme northern Canada, throughout the United States and south to the extreme southern tip of Mexico. Traditionally, these bats have formed maternity colonies beneath loose bark and in small cavities of pine, oak, beech, bald cypress and other trees. Common maternity roosts today can be found in buildings, barns, bridges, and even bat houses.	?		
					Mammalia Smallest Average Home Range	**0.40**

Plant Species

Common Name	Scientific Name	Subgroup	Home Range/Territory Description*
White Fir	*Abies concolor*		Abies concolor, commonly known as the white fir, is a fir native to the mountains of western North America, occurring at elevations of 900–3,400 m (2,952–11,154 ft). It is a medium to large evergreen coniferous tree growing to 25–60 m (80–197 ft) tall and with a trunk diameter of up to 2 m (6.5 ft). It is popular as an ornamental landscaping tree and as a Christmas tree. It is sometimes known as concolor fir.
Incense Cedar	*Calocedrus decurrens*		Calocedrus decurrens (California incense cedar; syn. Libocedrus decurrens Torr.) is a species of conifer native to western North America, with the bulk of the range in the United States, from central western Oregon through most of California and the extreme west of Nevada, and also a short distance into northwest Mexico in northern Baja California. It grows at altitudes of 50–2900 m. It is the most widely known species in the genus, and is often simply called 'incense cedar' without the regional qualifier.
Jeffrey Pine	*Pinus jeffreyi*		Jeffrey pine occurs from southwest Oregon south through much of California (mainly in the Sierra Nevada), to northern Baja California in Mexico. It is a high-altitude species; in the north of its range, it grows widely at 1,500 to 2,100 m (4,900 to 6,900 ft) altitude, and at 1,800 to 2,900 m (5,900 to 9,500 ft) in the south of its range.
Scattered Gooseberry	*Ribes roezlii*		It is native to many of the mountain ranges of California, its distribution extending just into Nevada and north into Oregon. Its habitat includes chaparral, woodlands, and forested areas.
Blackcap Raspberry	*Rubus leucodermis*		Rubus leucodermis (blackcap raspberry, black raspberry, whitebark raspberry, or blue raspberry (commonly used name in candy & drinks), is a species of Rubus native to western North America, from British Columbia, Canada south to California, New Mexico and Mexico. It is closely related to the eastern black raspberry Rubus occidentalis.
Greenleaf Manzanita	*Arctostaphylos patula*		Arctostaphylos patula is a species of manzanita known by the common name greenleaf manzanita. This manzanita is native to western North America where it grows inconiferous forests at moderate to high elevations.

Notes:

* Data from CWHR Life History Accounts and Range Maps at http://www.dfg.ca.gov/biogeodata/cwhr/cawildlife.aspx

** Home Range Area is the reported average or an estimated average unsing the smalles and largest reported home range.

Attachment C
Table C-2
ISM Calculator for 1-sided UCL for the Mean
Engineering Evaluation/Cost Analysis Report
Sequoia and Kings Canyon National Parks

Note on Selecting a UCL Method. This worksheet can be used to calculate a 95 UCL from ISM data using both the Chebyshev and Student's-t methods. If you have discrete data or other knowledge that indicates the variability in contaminant concentrations within the DU is low, use the Student's t method. If discrete data or other knowledge suggests that the variability may be high or the variability is unknown, use the Chebyshev method. Because the Chebyshev method tends to yield higher UCL values for the same data set, it's statistical performance is desirable - it achieves the desired 95% coverage of the mean under conditions when the variability of concentrations throughout the DU are moderate or high (See Table 4-4). One drawback of this performance is that the Chebyshev will tend to more severely overestimate the true mean than Student's t. Nevertheless, if no discrete data are available to estimate this variability, then Chebyshev is generally preferred over Student's. Do not mistake the standard deviation (SD) of replicates as a measure of this variability. The SD of replicates is a measure of consistency in estimates of the mean - this is considered a reliable indicator of the laboratory processing steps, but not an indicator of the degree of variability in the

Background Concentrations

Replicate Number	Replicate Results													Explanation
	Barium	Beryllium	Chromium	Cobalt	Copper	Lead	Mercury	Nickel	Vanadium	Zinc	DRO	4-4'-DDE	4-4'-DDT	
Rep 1	140	0.65	6.7	5.9	5.4	12	0.032	4.6	37	59	65	7.2	6.8	
Rep 2	130	0.55	6.1	4.8	5	11	0.036	4.3	32	53	84	11	13	
Rep 3	140	0.55	6.4	5.3	5.4	20	0.038	4.5	34	57	93	8.3	12	
Rep 4	140	0.57	6.3	5.5	5.1	9.1	0.034	4.4	35	56	80	8	28	
arithmetic mean	137.5	0.6	6.4	5.4	5.2	13.0	0.0	4.5	34.5	56.3	80.5	8.6	15.0	Sample mean of replicate results
standard deviation	5.0	0.0	0.3	0.5	0.2	4.8	0.0	0.1	2.1	2.5	11.7	1.7	9.1	Sample standard deviation of replicate results
CV = SD / mean	0.04	0.08	0.04	0.09	0.04	0.37	0.07	0.03	0.06	0.04	0.15	0.19	0.61	CV gives a measure of spread of the replicates, which is different from CV of underlying distribution
count (r)	4	4	4	4	4	4	4	4	4	4	4	4	4	For ISM, the sample size in the UCL calculation is the number of replicates, not the number of increments.
alpha (95% = 0.05)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	Standard choice is alpha = 0.05
$t_{(\alpha, r-1)}$	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	From Student's t distribution
Student's t UCL	**143.38**	**0.64**	**6.67**	**5.91**	**5.47**	**18.68**	**0.038**	**4.60**	**36.95**	**59.19**	**94.24**	**10.57**	**25.68**	Note that the UCL for these relatively small sample sizes will typically exceed the maximum.
Chebyshev UCL	148.40	0.68	6.92	6.37	5.67	23.49	0.041	4.73	39.04	61.70	105.95	12.22	34.81	The calculated UCL should be used (do not use the maximum).

Notes:
4-4'-DDE – dichloro diphenyl dichloroethylene
4-4'-DDT – dichloro diphenyl trichloroethane
CV – coefficient of variation
DRO – diesel range organics
ISM – incremental sampling methodology
r-1 – degrees of freedom equal to count (r) minus one
SD – standard deviation
t(α, df=r-1): $(1-\alpha)^{th}$ quantile of the Student's t distribution

Attachment C
Table C-3
ARAR Soil Screening Levels
Engineering Evaluation/Cost Analysis Report
Sequoia and Kings Canyon National Parks

ARAR	RECEPTOR	Antimony (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Molybdenum (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Thallium (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)	DRO (mg/kg)	2,3,7,8-TCDD (pg/g)	4-4'-DDE (µg/kg)	4-4'-DDT (µg/kg)
Site Specific Background; 95% Student's UCL for DU (Background)		*5.0*	*5.0*	*143.38*	*0.64*	*5.0*	*6.67*	*5.91*	*5.47*	*18.68*	*0.04*	*5.0*	*4.60*	*5.0*	*5.0*	*5.0*	*36.95*	*59.19*	*94.24*	*NA*	*10.57*	*25.68*
Eco-SSL Benchmark	Avian	NE	43	NE	NE	0.77	26	120	28	11	NE	NE	210	12	4.2	NE	7.8	46	NE	NE	NE	93
	Mammals	0.27	46	2,000	21	0.36	34	230	49	56	NE	NE	13.6	0.63	14	NE	280	79	NE	NE	NE	21
	Invertebrates	78	60	330	40	20	0.4	NE	50	500	0.1	NE	200	4.1	NE	NE	NE	6.62	NE	NE	NE	NE
	Plants	5	18	500	10	4	1	13	70	50	0.3	2	30	0.52	2	1	2	50	NE	NE	NE	NE
USEPA Region 9 Screening Levels for Soil - November 2011	Residential	31	0.39	1,500	16	70	12,000	2.3	310	400	0.94	390.00	84	3,900	390	78	39	2,300	250	4.9	1,600	1,900
	Industrial	410	1.6	22,000	230	800	180,000	35	4,700	800	4	5,100	1,200	5,100	5,100	10	580	35,000	2,300	22	6,800	8,600
USEPA Region 9 Screening Levels for Soil to Groundwater - May 2014	Risk Based	0.035	0.002	16	1.9	0.069	NE	0.027	2.8	NE	NE	0.2	NE	0.052	0.08	NE	8.6	37	NE	0.0000003	0.054	0.077
California Values for Inorganic Persistent and Bioaccumulative Toxic Substances	Total Threshold Limit Concentration (TTLC)	500	500	10,000	75	100	2,500	8,000	2,500	1,000	20	3,500	2,000	100	500	700	2,400	5,000	NE	10,000	1,000	1,000
	Soluble Threshold Limit Concentration (STLC) x 10 (mg/L)	150	50	1,000	8	10	50	800	250	50	2	3,500	200	10	50	70	240	2,500	NE	10,000	1,000	1,000
RCRA Land Disposal	Toxicity Characteristic Threshold x 20 (mg/L)	NE	100	2,000	NE	20	100	NE	NE	100	4	NE	NE	20	100	NE	NE	NE	NE	NE	NE	NE
California Human Health Screening Levels for Soils	Residential	30	0.07	5,200	150	2	17	660	660	150	18	380	1,600	380	380	5	530	23,000	NE	4.6	1,600	1,600
	Industrial	380	0.24	63,000	1,700	8	37	3,200	3,200	3,500	180	4,800	16,000	4,800	4,800	63	6,700	100,000	NE	19	6,300	6,300
U.S. DOE, OEM, Oak Ridge National Laboratory (ORNL) Toxicological Benchmarks	Invertebrates	NE	60	NE	NE	20	0	NE	50	500	0	NE	200	70	NE	NE	NE	100	NE	NE	NE	NE
	Microbes	NE	100	3,000	NE	20	10	1,000	100	900	30	200	90	100	50	NE	20	100	NE	NE	NE	NE
	Plants	5	10	500	10	4	1	20	100	50	0.3	2.0	30	1	2	1	2	50	NE	NE	NE	NE

Notes:
2,3,7,8-TCDD – 2,3,7,8-Tetrachlorodibenzodioxin
4-4'-DDE – dichloro diphenyl dichloroethylene
4-4'-DDT – dichloro diphenyl trichloroethane
DRO – diesel range organics
EcoSSL – EPA Ecological soil screening level retrived from The Risk Assessment Information System ecological benchmark tool at http://rais.ornl.gov/tools/eco_search.php
EPA – Environmental Protection Agency
µg/kg – micrograms per kilogram
mg/kg – milligrams per kilogram
NE – Not Established
pg/g – picograms per gram
UCL – Upper Confidence Limit
USEPA – United States Environmental Protection Agency (Federal)

Attachment C
Table C-4
Site Specific Screen Level Calculation
Engineering Evaluation/Cost Analysis Report
Sequoia and Kings Canyon National Parks

Risk Screening Values	**Antimony** (mg/kg)	**Arsenic** (mg/kg)	**Barium** (mg/kg)	**Beryllium** (mg/kg)	**Cadmium** (mg/kg)	**Chromium** (mg/kg)	**Cobalt** (mg/kg)	**Copper** (mg/kg)	**Lead** (mg/kg)	**Mercury** (mg/kg)	**Molybdenum** (mg/kg)	**Nickel** (mg/kg)	**Selenium** (mg/kg)	**Silver** (mg/kg)	**Thallium** (mg/kg)	**Vanadium** (mg/kg)	**Zinc** (mg/kg)	**DRO** (mg/kg)	**2,3,7,8-TCDD** (pg/g)	**4-4'-DDE** (µg/kg)	**4-4'-DDT** (µg/kg)
Human Health Risk Screening Value (Industrial)	150	0.24	1,000	8	7.5	37	35	250	50	2	3,500	200	10	50	10	240	2,500	2,300	19	1,000	1,000
Ecological Soil Screening Benchmark (EcoSSL - Avian)	NE	43	NE	NE	0.77	26	120	28	11	NE	NE	210	12	4.2	NE	7.8	46	NE	NE	NE	93
Ecological Soil Screening Benchmark (EcoSSL - Mammalian)	0.27	46.0	2,000.00	21	0.36	34	230	49	56	NE	NE	13.6	0.6	14.00	NE	280	79	NE	NE	NE	21
Ecological Soil Screening Benchmark (EcoSSL - Invertebrates)	78	60	330	40	20	0.4	NE	50	500	0.1	NE	200	4.1	NE	NE	NE	6.62	NE	NE	NE	NE
Ecological Soil Screening Benchmark (EcoSSL - Plants)	5	18	500	10	4	1	13	70	50	0.3	2	30	0.52	2	1	2	50	NE	NE	NE	NE
Area Use Factor (AUF) (Avian)	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Area Use Factor (AUF) (Mammalian)	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	NA	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68
Toxicity Reference Value (TRV) (Human Health - Industrial)	150	**0.24**	1,000	8	7.5	37	35	250	50	2	3,500	200	10	50	10	240	2,500	**2,300**	**19**	**1,000**	1,000
Toxicity Reference Value (TRV) (Ecological - Avian)	NA	307.14	NA	NA	6	26	857	200	78.6	NA	NA	1,500	86	30	NA	56	328.57	NA	NA	NA	664
Toxicity Reference Value (TRV) (Ecological - Mammalian)	**0.397**	67.65	2,941	30.88	**0.53**	50	338.2	72.1	82.4	NA	NA	**20**	0.93	20.6	NA	411.8	79	NA	NA	NA	**30.9**
Toxicity Reference Value (TRV) (Ecological - Invertebrates)	78	60	**330**	40	20	**0.4**	NA	**50**	500	**0.1**	NA	200	4.1	NA	NA	NA	**6.62**	NA	NA	NA	NA
Toxicity Reference Value (TRV) (Ecological - Plants)	5	18	500	**10**	4	**1**	**13**	70	**50**	0.3	**2**	30	**0.52**	**2**	**1**	**2**	**50**	NA	NA	NA	NA
Site Specific Screening Level (Lowest Estimated TRV or Background)	**0.397**	**0.24**	**330**	**8**	**0.53**	**6.67**	**13**	**50**	**50**	**0.1**	**2**	**20**	**0.52**	**2**	**1**	**36.9**	**59.2**	**2,300**	**19**	**1,000**	**30.9**
	Mammalian	Human	Invertebrates	Plants	Mammalian	Background	Plants	Invertebrates	Plants	Invertebrates	Plants	Mammalian	Plants	Plants	Plants	Background	Background	Human	Human	Human	Mammalian

Notes:
2,3,7,8-TCDD – 2,3,7,8-Tetrachlorodibenzodioxin
4-4'-DDE – dichloro diphenyl dichloroethylene
4-4'-DDT – dichloro diphenyl trichloroethane
DRO – diesel range organics
EcoSSL – Ecological soil screening level from The Risk Assessment Information System ecological benchmark tool at http://rais.ornl.gov/tools/eco_search.php
µg/kg – micrograms per kilogram
mg/kg – milligrams per kilogram
pg/g – picograms per gram

Attachment C
Table C-5
Hazard Quotient Calculation
Engineering Evaluation/Cost Analysis Report
Sequoia and Kings Canyon National Parks

Sample Name	Antimony (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Molybdenum (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Thallium (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)	DRO (mg/kg)	2,3,7,8-TCDD (pg/g)	4-4'-DDE (µg/kg)	4-4'-DDT (µg/kg)
SEKI-T01-01-5	1.9	3	430	0.041	2.3	14	5.7	58	260	0.084	1.7	7.2	2.7	0.26	2.7	33	1600	46	0.25	11	2.8
SEKI-T02-03-3	22	27	640	0.091	6.8	110	39	670	400	0.15	5.6	140	4.2	2.1	4.2	8.8	2200	25	1	3.8	3.8
SEKI-T03-05-3	15	28	1200	0.24	10	90	27	400	1200	0.35	6.5	72	7.4	4.8	7.4	36	3100	71	12	63	180
SEKI-T04-07-3	1.4	2.4	140	0.42	0.8	10	3.9	18	100	0.019	2.2	4.7	2.2	0.55	2.2	25	420	13	1.1	4.9	6.9
SEKI-T05-09-7	26	130	320	0.14	16	76	34	370	940	0.54	14	130	5.4	3.7	5.4	13	9800	23	3.1	7.6	15
SEKI-T06-10-5	44	57	420	0.79	35	130	24	310	240	0.049	32	160	7.9	1.5	7.9	22	11000	78	2	3.4	3.4
SEKI-T06-13*	17	130	270	0.21	6.6	52	22	170	980	0.34	10	88	5.2	2.5	5.2	11	3700	26	2.9	12	31
Toxicity Reference Value (TRV) (HHRSV - Industrial)	150	0.24	1,000	8	8	37	35.0	250	50	2	3,500	200	10	50	10	240	2,500	2,300	19.0	1,000	1,000
Toxicity Reference Value (TRV) (Ecological - Avian)	NA	307.1	NA	NA	5.5	26	857.1	200	78.6	NA	NA	1,500	85.714	30.0	NA	55.7	329	NA	NA	NA	664
Toxicity Reference Value (TRV) (Ecological - Mammalian)	0.397	67.6	2,941	30.9	0.529	50	338.2	72.1	82.4	NA	NA	20	0.926	20.6	NA	411.8	79	NA	NA	NA	30.9
Area Use Factor (AUF) (Ecological - Avian)	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Area Use Factor (AUF) (Ecological - Mammalian)	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	NA	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68
Toxicity Reference Value (TRV) (Ecological - Invertebrates)	78	60	330	40	20	0.4	NA	50	500	0.1	NA	200	4	NA	NA	NA	7	NA	NA	NA	NA
Toxicity Reference Value (TRV) (Ecological - Plants)	5	18	500	10	4	1	13	70	50	0.3	2	30	1	2	1	2	50	NA	NA	NA	NA
Minimum Concentration	1.4	2.4	140	0.041	0.80	10.0	3.9	18.0	100	0.02	1.7	4.7	2.2	0.3	2.2	8.8	420	13.0	0.25	3.40	2.8
Maximum Concentration	44	130	1200	0.79	35	130	39	670	1200	0.54	32	160	7.9	4.8	7.9	36	11000	78	12	63	180
Average Concentration	18.2	53.9	489	0.276	11.07	68.9	22.2	285.1	589	0.22	10.3	86.0	5.0	2.2	5.0	21.3	4546	40.3	3.19	15.10	34.7
Standard Deviation	14.7	55.1	350.0	0.26	11.7	46.0	13.3	225.6	438.6	0.19	10.5	62.4	2.2	1.6	2.2	10.8	4149	25.4	4.0	21.4	64.9
Number of Detections	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Exposure Point Concentration**	29	94	746	0.47	19.65	102.63	31.97	450.83	910.71	0.36	17.99	131.80	6.59	3.40	6.59	29.18	7593	58.96	6.14	30.81	82.33
Exposure Dose*** (Avian)	4	13	104	0.07	2.75	14.37	4.48	63.12	127.50	0.05	2.52	18.45	0.92	0.48	0.92	4.09	1063	8.25	0.86	4.31	11.53
Exposure Dose*** (Mammalian)	20	64	507	0.32	13.36	69.79	21.74	306.56	619.28	NA	12.24	89.62	4.48	2.31	4.48	19.84	5163	40.09	4.18	20.95	55.99
HQ - Human Health	0.19	**393**	0.75	0.06	**2.62**	**2.77**	0.91	**1.80**	**18.21**	0.18	0.005	0.66	0.66	0.068	0.66	0.12	**3.04**	0.03	0.32	0.03	0.08
HQ - Avian	NA	0.31	NA	NA	**4**	**3.95**	0.04	**2.25**	**11.59**	NA	NA	0.09	0.08	0.11	NA	0.52	**23.11**	NA	NA	NA	0.12
HQ - Mammalian	**73.03**	**1.40**	0.25	0.02	**37**	**2.05**	0.09	**6.26**	**11.06**	NA	NA	**6.59**	**7.11**	0.17	NA	0.07	**96.11**	NA	NA	NA	**2.67**
HQ - Invertebrates	0.37	**1.57**	**2.26**	0.01	0.98	**256.57**	NA	**9.02**	**1.82**	**3.62**	NA	0.66	**1.61**	NA	NA	NA	**1,146.94**	NA	NA	NA	NA
HQ - Plants	**5.80**	**5.24**	**1.49**	0.05	**4.91**	**102.63**	**2.46**	**6.44**	**18.21**	1.21	**9.00**	**4.39**	**12.67**	**1.70**	**6.59**	**14.59**	**151.86**	NA	NA	NA	NA

Notes:
2,3,7,8-TCDD – 2,3,7,8-Tetrachlorodibenzodioxin
4-4'-DDE – dichloro diphenyl dichloroethylene
4-4'-DDT – dichloro diphenyl trichloroethane
DRO – diesel range organics
EcoSSL – ecological soil screening level
HHRSV – human health risk screening value
HQ – hazard quotient
µg/kg – micrograms per kilogram
mg/kg – milligrams per kilogram
pg/g – picograms per gram
* SEKI=T06-13 is a duplicate sample of SEKI-T05-09-7
** Exposure Point Concentration is the 95% Student's t UCL concentration.
*** Considers area use factor for most sensitive (smallest home range) species.
= Exceeds the Site Specific Screening Level (SSSL)
= Exceeds Total Threshold Limit Concentration (TTLC)

Attachment C
Table C-6
Area Use Factor Calculations
Engineering Evaluation/Cost Analysis Report
Sequoia and Kings Canyon National Parks

Lenght (ft)	**Width** (ft)	**Area*** (ft^2)	**Area** (ac)	**Average Height** (ft)	**Volume** (ft^3)	**Volume** (yd^3)	**Avian**		**Mammalian**	
							Home Range (ac)	**AUF**	**Home Range** (ac)	**AUF**
150	100	11,781	0.27	5	58,905	2,182	2.00	0.14	0.40	0.68

Notes:
ac – acre
AUF – area use factor
ft – feet
ft^2 – square feet
ft^3 – cubic feet
yd^3 – cubic yard
* for the area calculation and oval shape was used

ATTACHMENT D

COST ESTIMATES

Table D-1: Design Alternatives Cost Comparison Summary

Table D-2: Alternative 2 - Capping, Re-vegetation and Institutional Controls

Table D-3: Alternative 3 - Capping, Phytoremediation and Institutional Controls

Table D-4: Alternative 4 - Excavation, Transportation and Off-site Disposal

Sequoia and Kings Canyon National Parks
Location: Tulare County, CA
Phase: EE/CA (-30% / +50%)
Base Year: 2014
CAPITAL COSTS:

Design Alternatives Cost Comparison Summary												
Alt 1	**Alt 2**			**Alt 3**			**Alt 4a**			**Alt 4b**		
Cost	**Cost**		**Table**	**Cost**		**Table**	**Cost**		**Table**	**Cost**		**Table**
$0	-30%	$239,937	**D-2**	-30%	$482,112	**D-3**	-30%	$718,449	**D-4a**	-30%	$1,113,758	**D-4b**
		$342,766			$688,732			$1,026,356			$1,591,082	
	+50%	$514,150		+50%	$1,033,098		+50%	$1,539,534		+50%	$2,386,623	

Alt 1: Alternative 1 - No Action
Alt 2: Alternative 2 - Capping, Re-vegetation and Institutional Controls
Alt 3: Alternative 3 - Capping, Phytoremediation and Institutional Controls
Alt 4a: Alternative 4 - Excavation, Transportation and Off-site Disposal as non-RCRA California Hazardous Waste
Alt 4b: Alternative 4 - Excavation, Transportation and Off-site Disposal as RCRA Hazardous Waste

Notes:
Rough cost estimate and minus 30% and plus 50% range.
Estimated costs include capital costs and annual recurring costs.

Alternative 2 consists of in cap, re-vegetation and institutional controls.

Sequoia and Kings Canyon National Parks - Lower Kaweah Dump Area

	Quantity	Unit	Rate	Cost	Subtotal	Total Task
Direct Cost						**$ 23,350.00**
Site Preparation					$ 23,350.00	
Health and Safety Plan	1	lump sum	$ 6,500.00	$ 6,500.00		
Work Plan	1	lump sum	$ 15,000.00	$ 15,000.00		
Site Visit	1	lump sum	$ 1,500.00	$ 1,500.00		
Storm Monitoring Pollution Prevention Plan	0	lump sum	$ 8,000.00	$ -		
Project Design	0	lump sum	$ 15,000.00	$ -		
Regulatory Compliance (Permits)	1	lump sum	$ 350.00	$ 350.00		
Capping and Re-vegetation						**$ 77,752.00**
Field Labor					$ 15,000.00	
Consultant Oversight	10	day	$ 1,500.00	$ 15,000.00		
Cap Construction and Plants					$ 60,000.00	
Import Fill for Cap (Cobble and Gravel)	850	cubic yard	$ 50	$ 42,500		
Native Plants	500	each	$ 5	$ 2,500		
Subcontractor	10	day	$ 1,500	$ 15,000		
Laboratory/Compaction testing	0	each	$ 500	$ -		
Compaction Test Report	0	lump sum	$ 2,000	$ -		
Monitoring Well Installation	0	each	$ 4,500	$ -		
Analytical - Confirmation Samples					$ -	
Metals Analysis by CAM 17 ICPMS 6020 plus mercury by EPA 7471A	0	each	$ 95.00	$ -		
STLC Analysis	0	each	$ 74.00	$ -		
Materials and Equipment					$ 1,000.00	
Consultant Support Truck	2	week	$ 500.00	$ 1,000.00		
Per Diem					$ 1,752.00	
Logging	12	day	$ 85.00	$ 1,020.00		
Meals	12	day	$ 61.00	$ 732.00		
Institutional Controls					$ 1,000.00	**$ 1,000.00**
Construct perimeter fence barrier	0	linear feet	$ 45.00	$ -		
Install Signage	10	each	$ 100.00	$ 1,000.00		
Site Restoration					$ 2,700.00	**$ 2,700.00**
Regrade for drainage	0.27	acre	$ 10,000.00	$ 2,700.00		
Deliverables						**$ 15,000.00**
Cap Completion Summary Report	1	lump sum	$ 15,000.00	$ 15,000.00	$ 15,000.00	
					Total Direct Cost	**$ 96,452.00**
Indirect Cost						
Project Management (20% Direct Cost)	1	lump sum	$ 19,290.40	$ 19,290.40		
Prime Contractor Overhead (10% Direct Cost)	1	lump sum	$ 9,645.20	$ 9,645.20		
Profit (10% Direct Cost)	1	lump sum	$ 9,645.20	$ 9,645.20		
Bonding (2% Direct Cost)	1	lump sum	$ 1,929.04	$ 1,929.04	$ 40,509.84	**$ 40,509.84**
					Total Indirect Cost	**$ 40,509.84**
					Total Direct and Indirect Cost	**$ 136,961.84**
Annual Recurring Cost						
OM&M and Reporting	1	year	$ 10,000	$ 10,000		
Incidental Repairs	1	year	$ 500	$ 500	$ 10,500	**$ 10,500.00**
					Total Annual Recurring Cost	**$ 10,500.00**
Present Value Analysis						
	Year	**Total Cost**	**3% Interest Rate**	**Present Value**		
Direct and Indirect Cost	0	$ 136,962	0.03	$ 136,962		
Annual Recurring Cost	30	$ 10,500	0.03	$ 205,804.63	$ 342,766.47	**$ 342,766.47**
					Total Present Value	**$ 342,766.47**

	Current Value	- 30% Value	+ 50% Value
EE/CA (-30% / +50%) Value	$ 342,766.47	$ 239,936.53	$ 514,149.71

Alternative 3 consists of cap, phytoremediation and institutional controls.

Sequoia and Kings Canyon National Parks - Lower Kaweah Dump Area

	Quantity	Unit	Rate	Cost	Subtotal	Total Task
Direct Cost						**$ 23,350.00**
Site Preparation					$ 23,350.00	
Health and Safety Plan	1	lump sum	$ 6,500.00	$ 6,500.00		
Workplan	1	lump sum	$ 15,000.00	$ 15,000.00		
Site Visit	1	lump sum	$ 1,500.00	$ 1,500.00		
Storm Monitoring Pollution Prevention Plan	0	lump sum	$ 8,000.00	$ -		
Project Design	0	lump sum	$ 15,000.00	$ -		
Regulatory Compliance (Permits)	1	lump sum	$ 350.00	$ 350.00		
Capping and Phytoremediation						
Field Labor					$ 15,000.00	
Consultant Oversight	10	day	$ 1,500.00	$ 15,000.00		
Cap Construction					$ 42,500.00	
Import Fill for Cap (Cobble and Gravel)	850	cubic yard	$ 50	$ 42,500		
Laboratory/Compaction testing	0	each	$ 500	$ -		
Compaction Test Report	0	lump sum	$ 2,000	$ -		
Monitoring Well Installation	0	each	$ 4,500	$ -		
Phytoremediation Subcontractor					$ 96,500.00	
Feasibility Analysis/Soil Study	1	lump sum	$ 7,500.00	$ 7,500.00		
Treatability Study/Plant Uptake Study	1	lump sum	$ 15,000.00	$ 15,000.00		
Pilot Study	1	lump sum	$ 20,000.00	$ 20,000.00		
Phytoremediation Field Implementation	12000	square feet (event)	$ 2.50	$ 30,000.00		
Phytoextracton Field Implementation	12000	square feet (event)	$ 2.00	$ 24,000.00		
Analytical - Confirmation Samples					$ -	
Metals Analysis by CAM 17 ICPMS 6020 plus mercury by EPA 7471A	0	each	$ 95.00	$ -		
STLC Analysis	0	each	$ 74.00	$ -		
Materials and Equipment					$ 1,000.00	
Consultant Support Truck	2	week	$ 500.00	$ 1,000.00		
Per Diem					$ 1,752.00	**$ 156,752.00**
Logging	12	day	$ 85.00	$ 1,020.00		
Meals	12	day	$ 61.00	$ 732.00		
Site Restoration					$ 2,700.00	**$ 2,700.00**
Regrade for drainage	0.27	acre	$ 10,000.00	$ 2,700.00		
Deliverables					$ 15,000.00	**$ 15,000.00**
Phytoremediation Summary Report	1	lump sum	$ 15,000.00	$ 15,000.00		
					Total Direct Cost	**$ 174,452.00**
Indirect Cost						
Project Management (20% Direct Cost)	1	lump sum	$ 34,890.40	$ 34,890.40		
Prime Contractor Overhead (10% Direct Cost)	1	lump sum	$ 17,445.20	$ 17,445.20		
Profit (10% Direct Cost)	1	lump sum	$ 17,445.20	$ 17,445.20		
Bonding (2% Direct Cost)	1	lump sum	$ 3,489.04	$ 3,489.04	$ 73,269.84	**$ 73,269.84**
					Total Indirect Cost	**$ 73,269.84**
					Total Direct and Indirect Cost	**$ 247,721.84**
Annual Recurring Cost						
OM&M	1	year	$ 15,000	$ 15,000		
Reporting	1	year	$ 7,500	$ 7,500	$ 22,500	**$ 22,500.00**
					Total Annual Recurring Cost	**$ 22,500.00**

Present Value Analysis

	Year	Total Cost	3% Interest Rate	Present Value		
Direct and Indirect Cost	0	$ 247,722	0.03	$ 247,722		
Annual Recurring Cost	30	$ 22,500	0.03	$ 441,009.93	$ 688,731.77	**$ 688,731.77**
					Total Present Value	**$ 688,731.77**

	Current Value	- 30% Value	+ 50% Value
EE/CA (-30%/+50%) Value	$ 688,731.77	$ 482,112.24	$ 1,033,097.66

Alternative 4 consists of excavation of waste material, transportation, and non-RCRA California Hazardous disposal of all waste at an off-site landfill

Sequoia and Kings Canyon National Parks - Lower Kaweah Dump Area

	Quantity	Unit	Rate	Cost	Subtotal	Total Task
Direct Cost						
Site Preparation					$ 31,350.00	**$ 31,350.00**
Health and Safety Plan	1	lump sum	$ 6,500.00	$ 6,500.00		
Work Plan	1	lump sum	$ 15,000.00	$ 15,000.00		
Site Visit	1	lump sum	$ 1,500.00	$ 1,500.00		
Storm Water Pollution Prevention Plan	1	lump sum	$ 8,000.00	$ 8,000.00		
Regulatory Compliance (Permits)	1	lump sum	$ 350.00	$ 350.00		
Soil Removal and Offsite Disposal						**$ 702,086.14**
Field Labor					$ 75,900.00	
Consultant Oversight	33	day	$ 1,500.00	$ 49,500.00		
Archeological Resource Specialist	33	day	$ 800.00	$ 26,400.00		
Soil Removal Subcontractor					$ 613,767.14	
Mob/Demob/Load/Dust Control/Per Diem	1	lump sum	$ 51,000.00	$ 51,000.00		
Delivery of roll-off bins with liners	27	each	$ 952.12	$ 25,707.24		
Transportation	3,139	ton	$ 87.50	$ 274,650.74		
Dispose of as non-hazwaste	0	ton	$ 48.00	$ -		
Dispose of as non-RCRA CA hazwaste	3,139	ton	$ 83.60	$ 262,409.16		
Dispose of as RCRA hazwaste (Direct Landfill)	0	ton	$ 158.50	$ -		
Dispose of as RCRA hazwaste (Stabilization)	0	ton	$ 210.30	$ -		
Analytical - Soil Characterization Samples					$ 2,057.00	
Metals Analysis by CAM 17 ICPMS 6020 plus mercury by EPA 7471A	11	each	$ 95.00	$ 1,045.00		
STLC/TCLP Analysis	11	each	$ 92.00	$ 1,012.00		
Materials and Equipment					$ 3,500.00	
Consultant Support Truck	7	week	$ 500.00	$ 3,500.00		
Per Diem					$ 6,862.00	
Logging	47	day	$ 85.00	$ 3,995.00		
Meals	47	day	$ 61.00	$ 2,867.00		
Site Restoration					$ 5,700.00	**$ 5,700.00**
Backfill	100	cubic yard	$ 30.00	$ 3,000.00		
Regrade for drainage	0.27	acre	$ 10,000.00	$ 2,700.00		
Deliverables					$ 15,000.00	**$ 15,000.00**
Soil Removal Summary Report	1	lump sum	$ 15,000.00	$ 15,000.00		
					Total Direct Cost	**$ 722,786.14**
Indirect Cost						
Project Management (20% Direct Cost)	1	lump sum	$ 144,557.23	$ 144,557.23		
Prime Contractor Overhead (10% Direct Cost)	1	lump sum	$ 72,278.61	$ 72,278.61		
Profit (10% Direct Cost)	1	lump sum	$ 72,278.61	$ 72,278.61		
Bonding (2% Direct Cost)	1	lump sum	$ 14,455.72	$ 14,455.72	$ 303,570.18	**$ 303,570.18**
					Total Indirect Cost	**$ 303,570.18**
					Total Direct and Indirect Cost	**$ 1,026,356.32**
Present Value Analysis						
	Year	**Total Cost**	**3% Interest Rate**	**Present Value**		
Direct and Indirect Cost	0	$ 1,026,356	0.03	$ 1,026,356		
Annual Recurring Cost	0	$ -	0.03	$ -	$ 1,026,356.32	**$ 1,026,356.32**
					Total Present Value	**$ 1,026,356.32**
	Current Value	**- 30% Value**	**+ 50% Value**			
EE/CA (-30% / +50%) Value	$ 1,026,356.32	$ 718,449.42	$ 1,539,534.48			

Alternative 4 consists of excavation of waste material, transportation, and assuming RCRA Hazardous disposal of all waste at an off-site landfill

Sequoia and Kings Canyon National Parks - Lower Kaweah Dump Area

	Quantity	Unit	Rate	Cost	Subtotal	Total Task
Direct Cost						
Site Preparation					$ 31,350.00	**$ 31,350.00**
Health and Safety Plan	1	lump sum	$ 6,500.00	$ 6,500.00		
Work Plan	1	lump sum	$ 15,000.00	$ 15,000.00		
Site Visit	1	lump sum	$ 1,500.00	$ 1,500.00		
Storm Water Pollution Prevention Plan	1	lump sum	$ 8,000.00	$ 8,000.00		
Regulatory Compliance (Permits)	1	lump sum	$ 350.00	$ 350.00		
Soil Removal and Offsite Disposal						**$ 1,099,780.41**
Field Labor					$ 75,900.00	
Consultant Oversight	33	day	$ 1,500.00	$ 49,500.00		
Archeological Resource Specialist	33	day	$ 800.00	$ 26,400.00		
Soil Removal Subcontractor					$ 1,011,461.41	
Mob/Demob/Load/Dust Control/Per Diem	1	lump sum	$ 51,000.00	$ 51,000.00		
Delivery of roll-off bins with liners	27	each	$ 952.12	$ 25,707.24		
Transportation	3,139	ton	$ 87.50	$ 274,650.74		
Dispose of as non-hazwaste	0	ton	$ 48.00	$ -		
Dispose of as non-RCRA CA hazwaste	0	ton	$ 83.60	$ -		
Dispose of as RCRA hazwaste (Direct Landfill)	0	ton	$ 158.50	$ -		
Dispose of as RCRA hazwaste (Stabilization)	3,139	ton	$ 210.30	$ 660,103.43		
Analytical - Soil Characterization Samples					$ 2,057.00	
Metals Analysis by CAM 17 ICPMS 6020 plus mercury by EPA 7471A	11	each	$ 95.00	$ 1,045.00		
STLC/TCLP Analysis	11	each	$ 92.00	$ 1,012.00		
Materials and Equipment					$ 3,500.00	
Consultant Support Truck	7	week	$ 500.00	$ 3,500.00		
Per Diem					$ 6,862.00	
Logging	47	day	$ 85.00	$ 3,995.00		
Meals	47	day	$ 61.00	$ 2,867.00		
Site Restoration					$ 5,700.00	**$ 5,700.00**
Backfill	100	cubic yard	$ 30.00	$ 3,000.00		
Regrade for drainage	0.27	acre	$ 10,000.00	$ 2,700.00		
Deliverables					$ 15,000.00	**$ 15,000.00**
Soil Removal Summary Report	1	lump sum	$ 15,000.00	$ 15,000.00		
					Total Direct Cost	**$ 1,120,480.41**
Indirect Cost						
Project Management (20% Direct Cost)	1	lump sum	$ 224,096.08	$ 224,096.08		
Prime Contractor Overhead (10% Direct Cost)	1	lump sum	$ 112,048.04	$ 112,048.04		
Profit (10% Direct Cost)	1	lump sum	$ 112,048.04	$ 112,048.04		
Bonding (2% Direct Cost)	1	lump sum	$ 22,409.61	$ 22,409.61	$ 470,601.77	**$ 470,601.77**
					Total Indirect Cost	**$ 470,601.77**
					Total Direct and Indirect Cost	**$ 1,591,082.18**

Present Value Analysis	**Year**	**Total Cost**	**3% Interest Rate**	**Present Value**		
Direct and Indirect Cost	0	$ 1,591,082	0.03	$ 1,591,082		
Annual Recurring Cost	0	$ -	0.03	$ -	$ 1,591,082.18	**$ 1,591,082.18**
					Total Present Value	**$ 1,591,082.18**

	Current Value	- 30% Value	+ 50% Value
EE/CA (-30% / +50%) Value	$ 1,591,082.18	$ 1,113,757.53	$ 2,386,623.27

ATTACHMENT E

PHOTO LOG

Photo 1: View of background sample area

Photo 2: Trench T6 showing debris

Photo 3: Trench T5 showing debris in situ

Photo 4: Trench T3 indicating burn ash within waste stream

Photo 5: Cross-sectional view of Trench T3, showing ash and debris

Photo 6: Trench T1 being dug