APPENDIX C2
REMEDIAL ACTION PLAN SAMPLE

TABLE OF CONTENTS

Page

PREFACE TO THE REMEDIAL ACTION PLAN SAMPLE

This version of the Remedial Action Plan (RAP) Sample is the result of efforts of the Voluntary Cleanup Program (VCP) and Proven Technologies and Remedies (PT&R) teams. In preparing this RAP Sample, the VCP team had a broader perspective than the PT&R team which focused on the cleanup of metals in soil (for the *PT&R Guidance -- Remediation of Metals in Soil*). As of February 2008, the RAP Sample was the same for both the VCP and PT&R team purposes, although some sections of the document are not applicable to sites applying the PT&R approach (indicated by gray shading). The RAP Sample is expected to change in the future as the VCP team continues its efforts to streamline a final version of the document. The VCP team will maintain the master version of the RAP Sample.

When applying the PT&R approach, please contact DTSC staff for the most current version of the master RAP Sample. However, as discussed above, the user must recognize that not all aspects of the master RAP Sample are applicable to sites applying the PT&R approach (i.e., sections flagged with gray shading).

In general, the outline of the RAP should look similar to the outline presented in this Sample. However, the RAP Sample is intended to provide sufficient flexibility to accommodate different types of sites. Although the language in this Sample is primarily focused on the soil matrix, it can easily be modified to address other media.

This document is for guidance only, and is applicable on a case-by-case basis. Some elements of this guidance may apply to your site, and others may not. Additional elements than are addressed by this Sample may also be needed.

Instructions for suggested content (denoted by boxed text) are included under most major headings. Some sections provide example text that could be applied to any site. The example text intended for general application is shown as normal text with brackets and underline to indicate locations for inserting site-specific information. Other sections provide example descriptions for specific remedial alternatives (i.e., excavation/off-site disposal and in situ injection to address a groundwater VOC plume). These example descriptions (indicated by italics) are not intended for broad application; some specificity has intentionally been removed from the example descriptions (e.g., design elements, sampling frequencies, other site-specific factors), as indicated by bracketing and underlining.

BACKGROUND

The RAP is one of two remedy selection documents that may be prepared for a hazardous substance release site pursuant to California Health and Safety Code section 25356.1. It is appropriate for response actions whose capital costs of implementation are projected to cost $1,000,000 or more.

The RAP is a public document that should be written in a clear and concise manner (avoid using technical language if possible). It presents the DTSC/RWQCB preliminary decisions and/or the Project Proponent's or Responsible Party's (RP's)) preliminary recommendations for a site. As such, it should not make definitive findings or statements concerning the alternatives that would later be difficult to revise after public comments or additional data are received. The RAP will also make reference to specific documents where more detailed information is available. Ideally, the RAP text should be between 10 to 20 pages in length, with the majority of the supporting information in tables, figures and appendices. However, the length of the text depends on the number and complexity of issues at the site.

A RAP must clearly and concisely reflect the remedial action decision reached by: identifying the preferred alternative for a remedial action and explaining the reasons for the preference; describing the other remedial alternatives considered; and soliciting public review and comments on all the alternatives described. The public is encouraged to submit comments and participate in the remedy selection process.

The RAP contains a brief summary of the Remedial Investigation/Feasibility Study (RI/FS) findings and presents the key components of the conceptual plan for site remediation. When the *PT&R Guidance – Remediation of Metals in Soil* is used to identify potential cleanup alternatives, a separate feasibility study (FS) document is not required if the FS evaluation is contained in a combined FS/RAP document. The decision to prepare a combined FS/RAP document should be made by the project team.

RAPs must clearly set out specific remedial action objectives, including cleanup levels and timeframes for completion of the remedial actions. They do not typically contain the specific engineering design details of the proposed remedial actions. However, for some sites, it may also be possible to combine the FS/RAP and the design document. This decision must be made by the project team.

RAPs (both Draft and Final) may be prepared by DTSC or its contractors, by the State Water Resources Control Board/Regional Water Quality Control Boards (SWRCB/RWQCBs), or by RPs or project proponents (with DTSC/RWQCB oversight). Only DTSC or RWQCBs may approve RAPs.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLES

Instructions: Include all tables referred to in the narrative of the RAP. The tables should appear in the order that they are mentioned in the RAP. They should be clearly labeled and prepared with an appropriate font size so that they are easily legible and understandable.

FIGURES

Instructions: Include appropriate maps, cross sections, and other figures. They should appear in the order that they are mentioned in the RAP. All maps should include standard map information, including a north arrow, scale, and map legend. Similarly, cross sections should include vertical and horizontal scale bars and legends. All figures should be shown at an appropriate scale such that text, labels, and patterns are clearly legible. Ideally, maps should be superimposed on the site layout map.

APPENDICES

Instructions: The user has the choice to include the detailed attachments for the following as appendices. Adjust the table of contents as needed.

ARARs
Statement of Reasons
Administrative Record List
CEQA Documents
Sampling and Analysis Plan/Quality Assurance Project Plan
Responsiveness Summary

ACRONYMS AND ABBREVIATIONS

Instructions: Define the acronyms and abbreviations used in the RAP.

EXECUTIVE SUMMARY

Instructions: The executive summary presents an overview of the entire RAP. The executive summary should be clear and concise, yet contain enough information to give the reviewer a basic understanding of the site, the nature and extent of contamination, potential receptors, and the proposed remedial action. Generally, no more than 4-5 pages are recommended. However, the length of the executive summary depends on the number and complexity of issues at the site. The executive summary should briefly summarize the following:

- *Purpose of the RAP;*
- *Site name and location;*
- *Site description (the physical features, buildings, brief site history of ownership and site operations);*
- *Description of the scope and role of the remediation or operable unit;*
- *Contaminants and chemicals involved within each environmental medium (soil, groundwater, surface water, and air);*
- *Proposed alternative, and the reasons for proposing that alternative;*
- *If applicable, indicate that the PT&R approach is being applied;*
- *Other remedial alternatives that were considered in the RI/FS Report and the reasons for rejecting them; and*
- *Information on how the public can be involved in the remedy selection process.*

This report presents the draft Remedial Action Plan (RAP) for the [site name], located at [site location]. This RAP report was prepared by [consultant] on behalf of [who the RAP was prepared for, if applicable] in compliance with the Site [agreement/order] Docket No. [Docket Number] and California Health and Safety Code section 25356.1. It presents an evaluation of remedial alternatives in accordance with the United States Environmental Protection Agency's (US EPA's) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Remedial Investigation/ Feasibility Study (RI/FS) guidance (EPA, 1988). This RAP describes the selected remedy and includes a conceptual design.

The [site name] operated as [type of operations] from [dates of operations]. The site is [current description of site, e.g. vacant lot, structures] occupies approximately [acreage or square footage of property] of real property within a [type of zoning e.g., residential/commercial/industrial] area in the City of [site location]. The site is bordered by [description of surrounding area] to the south, by [description of surrounding area] to the east, [description of surrounding area] to the north, and [description of surrounding area] to the west. [Describe past uses that may have contributed to the contamination found at the Site.]

During the past [years or time period of previous investigation(s)], several [type(s) of investigation(s) e.g., soil and/or groundwater] investigations have been completed at the site. [Type of media impacted, e.g., soil] at the site are impacted with [contaminant(s) of concern (COCs)] from former [source(s) of contamination]. In shallow soil [definition of shallow soil, e.g., 0-10 feet bgs], concentrations of [COCs] were the highest [COCs] in the vicinity of [location of where contamination was found]. [Describe deeper soil contamination, if found.]

Groundwater at the site occurs [description of water-bearing units] at approximately [depth of water-bearing unit(s)]. Groundwater flow in the water-bearing unit ranges from [direction of groundwater flow]. [If applicable, describe the groundwater plumes.]

The risk assessment results indicated that the site represents elevated risks to human health and the environment due to the presence of [COCs] in [identify media, e.g., soil]. To address these risks, the following remedial action objectives (RAOs) were developed for the [name of site]:

- [List RAOs.]

[COCs] were identified in the risk assessment as the chemicals posing the greatest risk to the human health. Therefore, soil screening levels were developed for these chemicals based upon [indicate basis for screening levels, e.g., standard U.S. Environmental Protection Agency (U.S. EPA) and California Environmental Protection Agency (Cal/EPA) risk assessment guidance]. The cleanup goal for [COC] is based upon its background concentration in soil and is set at [#] mg/kg. The cleanup goal for [COC] is based upon the potential for [pathway, e.g., direct contact with soil] under a [residential, commercial/industrial or other land use scenario] and is set at [type of concentration, e.g., average] concentration of [#] mg/kg. The cleanup goal for [COC] is set at [#] mg/kg for protection of groundwater resources and is based upon the Water Board's Environmental Screening Level.

The groundwater underlying the Site is designated as a [designation, e.g., potential municipal supply]. Therefore, the cleanup goals for groundwater are based upon [basis for cleanup goal, e.g., drinking water standards] and are set at [#] micrograms per liter (µg/L) for [COC], [#] µg/L for [COC] and [#] µg/L for [COC].
.
The following remedial alternatives were developed for the Site:

- [List the remedial alternatives evaluated.]

Based on the CERCLA nine-criteria analysis, Alternative [# and description] was selected as the preferred remedial alternative. The preferred remedial alternative consists of the following components: [List components.]

The following is an example description of a preferred remedial alternative.

Soil excavation involves the removal of the top [#] feet of soil across the entire site to minimize the potential for direct exposure to [COCs] in soils. The excavation will use sloped sidewalls at a slope ratio of [#], which will protect structures in the vicinity of the site. The total in-place volume of impacted soil for excavation is estimated to be about [#] cubic yards ([#] tons). The excavation will include removal of [features]. The *excavation could remove soils locally in some hot spot areas to deeper than [#] feet bgs if warranted (e.g., if heavy staining is observed under former structures or cleanup goals are not achieved in the confirmation samples).*

The excavated soils are proposed to be hauled to a permitted facility for soil treatment and/or disposal. Some of the soils have high [COC] concentrations. Therefore, a significant portion of the excavated soil would likely be classified as [waste type, e.g., Resource Conservation and Recovery Act (RCRA) hazardous waste]. Portions of the site known to have high [COC] concentrations based on prior sampling will be [describe how soil will be managed, e.g., directly excavated and loaded onto trucks for offsite disposal]. For other soils, [describe how these soils will be managed, e.g., attempts will be made during excavation and staging of materials to segregate the most impacted, hazardous soils using X-ray fluorescence instrumentation]. [Describe any stockpiling or segregation activities, e.g., Stockpiling and segregation activities on site will be limited by space constraints and excavation timeframes]. [Describe features to be protected during excavation, e.g., Existing onsite groundwater wells will need to be protected during excavation.] [Describe site backfill, grading, and restoration activities.]

[Material] will be injected into groundwater to decrease [COC] contaminant mass in the groundwater source area and to place vertical barriers to limit migration in the downgradient direction. A total of [#] injection wells are proposed with typical screen intervals of {depth range] feet bgs which includes [#] proposed on-site and [#] proposed off-site injection wells. A field injection pilot test will be conducted to determine the appropriate well spacing and injection flow rates. [Material] will be first injected into the source area perimeter wells to act as a containment barrier for the interior source area injections. Later, [material] will be injected into the downgradient wells to set up long-term barriers to [COC] migration. A minimum of two rounds of injection in groundwater are assumed in the first two years. After the injection rounds are completed, long-term groundwater monitoring for at least two years would be required to ensure that the source area has been adequately remediated and that the downgradient barriers are effectively reducing the remaining contamination that is migrating through groundwater. A Waste Discharge Requirements (WDR) permit is required from the RWQCB for injecting [material] into the subsurface and the application has been submitted. The field injection pilot test will be addressed under a separate Work Plan and performed after the RAP is finalized and the RWQCB has approved the WDR permit application. This RAP presents a conceptual design of the remediation system. The design will be finalized after the field pilot test is completed and will be presented in the Remedial Design and Implementation Plan report.

A land use covenant (LUC) that runs-with-the-land will be executed with the property owner and recorded to ensure that information about a property containing residual contamination is available to local governments, the public, prospective purchasers and tenants. The LUC would limit the use of the property to exclude sensitive uses such as residences, schools, hospitals, day care centers, and other uses such as an underground parking garage that could involve excavation into soil containing residual chemicals in soil without DTSC's prior approval. The LUC would also restrict future use *of groundwater underlying the Site until Site cleanup goals are achieved; and require non-interference with the groundwater monitoring system.*

An Operation and Maintenance Agreement will be executed and financial assurance required for monitoring of the groundwater and the LUC.

A tentative implementation schedule and a list of required permits for implementation of the preferred remedial alternative are presented in the report.

1.0 INTRODUCTION

Instructions: Provide a general overview of the site including location, purpose of the RAP, and contamination identified at the site.

This report provides the draft Remedial Action Plan (RAP) for the [site name], located at [address, city]. The site location is shown on Figure [#]. This RAP report was prepared by [consultant] in accordance with the Site [order or agreement], Docket No. [#], California Health and Safety Code section 25356.1 and DTSC RAP guidance. The purpose of this RAP is to summarize the environmental conditions at the site and use technical data to justify the selection of the remedial action to address the environmental impacts. The RAP defines the contamination, sets up remedial action objectives, and then describes the remedial action response to satisfy these remedial objectives. The soil and groundwater at the site is impacted with [contaminant(s) of concern (COCs)] from [type of site operations]. [Describe impacts to other media if applicable.]

1.1 SITE DESCRIPTION

Instructions: Because the RAP is intended to be a stand-alone document, provide basic information about the site and its owners/operators. Provide the site name and describe the site location. Also, present information about the physical setting of the site. Support the discussion with appropriate figures.

The site is located at [address] in [city], California. The property consists of [#] parcels with [County] Assessor's Parcel Number(s) [APN Number(s)]. See Figure [#] for a site location map. The site occupies approximately [#] acres ([lot dimensions]) of real property. [Describe onsite structures and features, if the site is occupied or vacant, paved or unpaved, and whether there are access controls.] Figure [#] depicts the site plan.

The subject property lies at an elevation of [#] feet above Mean Sea Level (msl). The ground surface in the vicinity is generally [describe the ground surface, e.g., flat]. The slope in the site vicinity is generally directed [direction, describe any controlling features]. [Identify any waterways or bodies near the site], which is the nearest surface water body, is located approximately [distance] to the [direction] of the site. The site is in a [identify type of zoning where site is located]. [Describe surrounding land use, e.g., There are commercial buildings to the east and north, offices to the west, and a four-lane highway to the south. The subject site is zoned [describe zoning]. Figure [#] depicts the regional site plan.

The Site is currently owned by [site owner]. [Discuss cultural resources, sensitive habitat, if present.]

1.2 SITE HISTORY

Instructions: Describe the site's industrial or commercial history. This section may include detailed information regarding the following:

- *A list of the previous owners and ownership dates;*
- *Any alternative or historical facility names;*
- *A discussion of the historical use of the site, previous business operations, and periods of operation;*
- *Possible contaminant sources;*
- *Information regarding historical non-hazardous wastes generated, received, disposed of, or managed at the site;*
- *Types, quantities, management practices, and rates of hazardous wastes historically generated, received, disposed of, or managed at the site;*
- *Historical aerial photographs;*
- *Processing or storage locations; and*
- *A chronology and description of known or suspected environmental incidents, spills, or releases of hazardous substances or pollutants.*

The following is an example description of the site history.

The Site operated as a [type of site operations] from [timeframe that site operated]. Operations included [list specific operations at the site]. The following chemical types were used at the site (approximate quantities used/generated are noted in parentheses): [List of chemical types and quantities used]. The site was leased to [Company X] in [year] and to [Company Y] in [year] for [purpose of leases]. It is unclear whether these two companies exercised their respective leases. The structures at the site were damaged by a fire in [year] and were subsequently razed in [year]. The subsurface structures were covered with fill soil, brought up to grade level and paved with asphalt in [year]. The site is currently a vacant lot.

1.3 SITE CHARACTERIZATION

Instructions: Provide an overview of the activities conducted to characterize the Site. Subsections can be used to describe each investigation, a group of investigations, or a summary of all of the investigation activities. If a separate report was not developed for the last sampling event, a separate section should be used to describe the activities in more detail.

During the past [#] years, several site investigations have been completed at the site. Sampling efforts have primarily been focused on [identify site features investigated e.g., former locations of an earthen containment trench to the north, the drainage sump to the northeast, three concrete-lined containment trenches to the northwest, the plating department to the west, and a closed clarifier to the east side of the site]. Soil samples were collected from [#] locations across the Site at depths ranging from the ground surface to [#] feet bgs. Soil gas samples were collected from [#] locations at [#] feet bgs. Between [year] and [year], [#] groundwater monitoring wells were installed. Groundwater samples were collected from [year] to [year]. Surface water samples were collected in [year] and [year]. Sediment samples were collected in [year].

[Soil, soil gas, groundwater, surface water, sediment] samples were collected and analyzed for [analytical parameters]. The results of these sampling events are described in the following documents: [list documents or reference a table containing these documents]. Figure [#] is a site map depicting soil boring, monitoring well and soil vapor probe locations.

1.4 PREVIOUS REMOVAL ACTIONS TAKEN [add this section, if appropriate]

Instructions: Provide information about previous removal actions taken to address contamination at the Site. These actions can include removal of underground storage tanks, spill responses, implementation of interim groundwater or soil vapor extraction and treatment systems, etc.

1.5 SITE GEOLOGY AND HYDROGEOLOGY

Instructions: Describe the site-specific geology and hydrogeology in a detail sufficient to support the proposed site cleanup. Include information on the regional geology and hydrogeology as necessary to provide context to the site-specific descriptions. Group the information into appropriate subsections and provide supporting figures to illustrate the discussion (e.g., geologic cross-sections, maps).

Describe the soil types, lithology, and geologic formations present. Identify the location and thickness of fill areas. Discuss structural features that might affect contaminant migration (e.g., preferential pathways, features that may impede the movement of contaminants). Address geologic heterogeneity and complex stratigraphy.

Identify the water-bearing units beneath the site, the position and thickness of the units, the depth to groundwater, and the groundwater flow rate and direction in each unit. For sites with numerous water-bearing units, it may be appropriate to include this information in a table. Describe the locations of springs/seeps, perched aquifers, and nearby extraction/production wells.

Describe the location of nearby water bodies, wetlands, floodplains, and other hydrologic features. If appropriate, describe surface water flow, flood frequency, drainage direction, and topography.

The following is an example description of site geology and hydrogeology.

1.5.1 Regional Geology

The Site is located in the central portion of the Coastal Plain of Los Angeles County. The Coastal Plain makes up the northwest end of the Peninsular Ranges Geomorphic Province. The Coastal Plain is bounded by the Santa Monica Mountains to the north, the Puente Hills to the east-northeast, and the Pacific Ocean to the south. The Santa Monica Mountains are approximately six miles north of the site.

The stratigraphic units present at the site include Recent Alluvium, the Lakewood Formation of upper Pleistocene age, and the San Pedro Formation of lower Pleistocene age. The Recent Alluvium consists of stream channel and flood plain units deposited by the Los Angeles River. The Recent Alluvium extends from below fill material or ground surface to a maximum depth of approximately 50 feet bgs. The Lakewood Formation of upper Pleistocene age underlies the Recent Alluvium and includes all upper Pleistocene deposits. Sediments consist of fine-grained alluvial deposits in the upper portion with basal deposits of coarse-grained sands and gravels. The San Pedro Formation of lower Pleistocene age underlies the Lakewood Formation and includes all lower Pleistocene deposits. The San Pedro Formation is composed of stratified sand with some beds of fine gravel, silty sand, and silt.

The site is located within the tectonically active Coastal Plain of Southern California that has several major active faults. The Newport-Inglewood Fault Zone is located approximately 4.5 miles west of the site and trends northwest to southeast towards Huntington Beach. Parallel fault zones west of the Newport-Inglewood Fault Zone include the Palos Verdes Hills Fault Zone and San Pedro Bay Fault Zone. The Hollywood fault is located approximately eight miles northwest of the site and trends southwest to northeast along the base of the Santa Monica Mountains.

Recent Alluvium and the Lakewood Formation are generally flat lying with a general dip towards the south in the Coastal Plain. Folding from tectonic activity has been observed in sediments of the San Pedro Formation within the Paramount Syncline south of the site. The axis of the Paramount Syncline lies approximately 0.5 miles south of the site. Folding in the San Pedro Formation north of the Paramount Syncline may have reversed the southerly dip direction of the overlying Lakewood Formation and Recent Alluvium [Source, Date].

1.5.2 Regional Hydrogeology

The site is located in the northern portion of the Central Groundwater Basin. The California Department of Water Resources has mapped nine aquifers and associated aquitards in the site area. The aquifers, from shallowest to deepest are Semi-perched, Gaspur, Exposition, Gage/Gardena, Hollydale, Jefferson, Lynwood, Silverado, and Sunnyside. Low permeability units (aquitards) that act as barriers to infiltration of groundwater separate the aquifers. Table [#] summarizes the regional hydrogeologic units in the vicinity of the site.

Table [#]. Summary of Regional Hydrogeologic Units Found Beneath the Site (listed in order of increasing depth)

UNIT	LOCATION	LITHOLOGY	THICKNESS AND/OR DEPTH	NOTABLE CHARACTERISTIC
Semi-perched aquifer	*On or near the surface of much of the Coastal Plain of Los Angeles County*	*Coarse sands and gravels of both Recent and late Pleistocene age*	*0 to 60 feet thick*	*May contain significant amounts of unconfined water where more than 20 feet thick*
Bellflower aquiclude	*Directly beneath the Semi-perched aquifer.*	*All fine-grained sediments extending from ground surface, or from base of Semi-perched aquifer, to Gaspur aquifer.*	*~40 feet thick with a base lying at a depth of ~68 feet bgs beneath the site.*	*Restricts vertical movement of groundwater*
Gaspur aquifer	*Present, but may be merged with the Exposition aquifer in the immediate vicinity of the site*	*Basal coarse facies of Recent series. Continental stream deposits. Ranges in size from boulder gravel to silt/clay*	*Base of the Gaspur aquifer is at a depth of ~109 feet bgs beneath the site.*	
Exposition aquifer	*Occurs in the Lakewood Formation below the Bellflower aquiclude and Gaspur aquifer*	*Consists of one to four discontinuous coarse members. Materials range in size from coarse gravels to clay, with fine deposits separating the lenticular sandy and gravelly beds.*	*Occurs from depths of ~100 to 125 feet bgs beneath the site.*	
Gage aquifer	*Most extensive Lakewood Formation aquifer underlying the region around the site*	*Comprised primarily of sand with gravel and interbedded silts and clays.*	*Extrapolated to be ~20 feet thick with the base at a depth of ~200 feet bgs beneath the site.*	
Lynwood aquifer	*Extends throughout the region*	*Continental deposits of red brown and yellow gravels, sands, silts and clays. Marine deposits of sand and gravels and blue to black clays and silts.*	*Extrapolated to be ~50 feet thick beneath the site with the base at ~470 feet bgs.*	
Silverado aquifer		*Continental deposits of yellow to brown fine sand and gravel interbedded with yellow to brown silt. Marine deposits of blue to gray sand, gravel, silt, and clay.*	*~125 feet thick beneath the area of the site. Lies at a depth of ~750 feet bgs*	*Important aquifer for groundwater production wells in the Coastal Plain region*
Sunnyside aquifer		*Marine deposits of blue, coarse-grained sands/ gravels interbedded with fine-grained blue sandy clay and clay*	*~650 feet thick with the base of the aquifer at approximately 1,200 feet bgs*	

Notes: The Gardena, Hollydale, and Jefferson aquifers are not located beneath the site and therefore are not described in this table.
[Source, Date].

1.5.3 Site-Specific Geology

The Site is underlain by fill material to a maximum depth of approximately 6 feet bgs. The fill consisted of dark brown or dark reddish brown very fine- to fine-grained sand with a trace of silt and construction debris.

Interbedded clays, silts, and sands associated with the Recent Alluvium unit extend from below fill material or ground surface to a maximum depth of approximately 50 feet bgs. The Lakewood Formation of upper Pleistocene age underlies the Recent Alluvium and includes all upper Pleistocene deposits. Sediments consist of fine-grained alluvial deposits in the upper portion with basal deposits of coarse-grained sands and gravel.

The San Pedro Formation of lower Pleistocene age underlies the Lakewood Formation and includes all lower Pleistocene deposits. The San Pedro Formation is composed of stratified sand with some beds of fine gravel, silty sand, and silt. Abundant gravel occurs at a depth from 343 feet bgs to a total depth of 425 feet bgs [Source, Date].

1.5.4 Site-Specific Hydrogeology

The Semi-perched aquifer, if present in the Recent Alluvium, is dry beneath the Site. Gravels and sand of the Gaspur aquifer occur at a depth of 47 to 88 feet bgs. The Gaspur aquifer is dry in the Site vicinity. Gravels of the Exposition aquifer occur at a depth of 100 feet bgs to 120 feet bgs. The Exposition aquifer is dry in the Site vicinity.

Fine- to medium-grained sands and clays beginning at a depth of 130 feet bgs underlie the gravels of the Exposition aquifer. Beds of fine- to medium-grained sands within this interbedded sequence of sands and clays are typically 1 to 4 feet thick. The confined sand beds are dry to moist to a depth of approximately 160 feet bgs and saturated and under higher confined pressure below a depth of 175 feet bgs. Groundwater encountered in these sand beds is considered the "uppermost water-bearing" unit [Source, Date].

Groundwater at the site occurs in two water-bearing units: an upper water-bearing unit at approximately 150 to 160 feet bgs and a deeper water-bearing unit at approximately 355 feet bgs. Groundwater in the upper water-bearing unit flows toward the north to northwest under a gradient of 0.02 feet/foot. Groundwater was observed in soils collected from well [#] at an approximate depth of 154 feet bgs. Groundwater was measured in well [#] at a depth of 151.73 feet bgs.

1.6 BACKGROUND CONCENTRATIONS

Metals occur naturally in soils. EPA (1989) and DTSC (1997) guidance indicates that risk evaluations for metals are only necessary when the levels exceed naturally occurring background concentrations. To distinguish between site-related contamination and naturally-occurring or ambient contaminant levels, a study was conducted to identify background levels of metals.

Metals in soils at the site that are elevated above naturally occurring background concentrations were identified using [method, e.g., statistical analyses]. The [method] compared metal concentrations in soil at the site to [reference concentrations, e.g., background soil data set]. Background data for [#] metals, including [metals], were obtained from soils sampled at [location]. Based on the results of the [method], [#] metals exceeded their background levels. These metals include [metals].

2.0 NATURE AND EXTENT OF CONTAMINATION

Instructions: Describe the conceptual site model (CSM), including the fate and transport of contaminants and the full nature and extent of contamination in each of the environmental media (air, surface water and sediments, soils and vadose zone, groundwater) at the site. It is important to describe the horizontal and vertical extent of contaminants in all media, both at the site and migrating from the site. To the extent possible, describe how the contamination relates to specific source areas identified during the investigation. The lateral and vertical extent of groundwater contamination should generally be defined to Basin Plan standards. Soil contamination should generally be defined to the residential soil screening levels.

The conceptual site model (CSM) is a summary and evaluation of the site information that will help make decisions regarding the path moving forward. Using all available information, the CSM distills what is already known about the nature and extent of contamination, the media of concern, and the potential receptors/exposure routes. The CSM is used to identify the information needed to achieve project goals. A project's CSM will evolve and mature as project work progresses. The maturity of the CSM reflects both the level of site understanding and the amount of information and complexity of analysis required to support the decisions that need to be made.

The project team should agree upon the components of a project-specific CSM during the scoping meeting. At a minimum, a project-specific CSM should consist of:

- *Plot Plans and Cross Sections: Include figures with: isoconcentration contours showing the type, concentration and extent of contamination in all affected media; lines/shading showing locations (plan views) and depths (cross-sections) where contaminants exceed site-specific screening levels for human health and, if applicable, screening levels for water quality protection.*
- *Proposed Redevelopment Drawings and/or Engineering Plans: Conceptual and technical drawings showing the exact location and dimensions of the proposed buildings and a detailed explanation of the proposed uses.*

- *Data Summary Tables: Tables presenting the analytical methods, detection limits, maximum and minimum concentrations, and frequency of detection for each contaminant, and which contaminants exceed the site-specific screening levels for human health and water quality protection.*
- *Pathway Identification/Evaluation and Screening Levels: An exposure pathway flow chart should be developed and agreed upon by the project team. The project team should also agree upon the site-specific screening levels, including the use of Preliminary Remediation Goals (PRGs), California Human Health Screening Levels (CHHSLs), and Ecological Screening Levels (ESLs).*

The soil sample collection locations referred to in the following discussion are shown in Figure [#] and the sample results are shown in Table [#]. [Summarize findings of the site investigation.] The groundwater collection locations referred to in the following discussion are shown in Figure [#] and the sample results are shown in Table [#]. [Summarize findings of the site investigation.]

2.1 CONCEPTUAL SITE MODEL

A conceptual site model (CSM) has been developed to address: (1) the distribution of chemicals; (2) potential sources of chemicals; and (3) affected media. Based on the results of previous investigations and an understanding of the site history, activities associated with past operations at the site by [name] between [year] and [year] most likely resulted in the release of chemicals to the subsurface [Reference Information Source: Consultant, Report, Date of Report]. Material and waste handling procedures employed by [operator] may have resulted in [leaks, spills, and/or releases of hazardous substances from potential sources, e.g., the former waste management units or hazardous materials storage areas] [Reference Information Source: Consultant, Report, Date of Report]. As indicated in Section [#], [describe source areas, e.g., the former waste management units were used primarily for waste containment and some treatment] are shown along with other site features on Figure [#]. An updated CSM is presented in the [Reference Information Source: Consultant, Report, Date of Report].

On the basis of our current understanding of the site, the CSM is graphically presented on Figure [#]. [Discuss key elements of the CSM,].

The following is an example description of a CSM.

As described in Section [#], and graphically depicted on Figure [#], the nature of the Site's subsurface lithology (e.g., the presence of the clay and alluvium materials) has influenced the transport of chemicals from the source areas into the subsurface. Releases of hazardous materials and/or waste from aboveground areas (e.g., drainage ditches, drum storage areas) as well as the underground sump areas are suspected to have migrated through the upper [#]-foot fill layer of predominantly silty sand/gravel mixtures, into the [#]-foot laterally continuous low-permeability clay layer, and into the Upper aquifer. As indicated by the soil sample laboratory analytical data from previous *investigations at the site, the main distribution of chemicals in the vadose zone appears to be predominantly within the clay layer at areas of the site coinciding with previous use or storage of chemicals.*

2.2 SOIL CONTAMINATION

[COC(s)] are the COCs for soil. Based on the results of investigations conducted at the site, the extent of soils with [COC(s)] concentrations in excess of the site-specific soil screening levels has been adequately estimated for remedial planning purposes and is graphically presented on Figure [#].

[COC] has been detected at concentrations up to [#] mg/kg. As shown in Figures [#], the contamination extends to a depth of [#] feet bgs, with the highest concentrations detected above [#] feet bgs. [COC] was detected at [site feature] at concentrations up to [#] mg/kg, with the highest concentrations detected at a depth of [#] feet bgs. Figure [#] shows the lateral extent of [contaminant] in shallow soil. A vertical profile to illustrate the general occurrence of chemicals identified within the soil is presented on Figure [#]. A summary of historical chemical data for [contaminant] in soil is included in Table [#].

2.3 GROUNDWATER CONTAMINATION

Groundwater underlying the Site [has/has not] been impacted by COCs detected in soil. Groundwater sampling was initiated in [year] after detection of elevated concentrations of [COC] in soil. [#] groundwater wells monitor the upper water-bearing unit and [#] groundwater wells monitor the deeper water-bearing unit. [Describe findings, e.g., [COCs] have only been detected in the upper water-bearing unit.]

The [contaminant(s) of concern] groundwater plume is presented on Figure [#]. As shown in the figure, the highest concentration [COC] contours [#] mg/L, [#] mg/L) cover [describe area]. The plume [does/does not] extend offsite. [If the plume extends offsite, describe the extent, e.g., The plume is generally narrow in width and elongated downgradient. It is estimated to be [#] feet long and [#] feet wide based on the [#] mg/L contour.] The contours were estimated using data obtained by [Consultant] during the most recent sampling event ([month, year]).

3.0 REMEDIAL ACTION OBJECTIVES

Instructions: RAOs are statements that define qualitative goals and quantitative levels of cleanup that you intend to achieve for each of the contaminants identified at the site. Your selection of RAOs will be based on the intended land use for the site and groundwater use in the area of the site. This section should also summarize the rationale for deciding which contaminants will be remediated and their respective cleanup goal. The RAOs should be specific for the following:

- *Chemicals of concern;*
- *Exposure pathways;*
- *Potential receptors that will be addressed;*
- *Cleanup goals;*
- *Location(s) or point of compliance at which the cleanup goals will be achieved; and*
- *Timeframe for which remedial actions will be completed.*

This section should also identify and discuss the ARARs applicable to the Site. This information can be presented in a table or appendix.

Site characterization has revealed the presence of chemicals of potential concern in [soil, groundwater, surface water, soil gas, air] at the site. Remedial Action Objectives (RAOs) have been developed based upon the current environmental conditions and the current and reasonably anticipated future uses of the site. Based on the RAOs, cleanup goals were developed that establish specific concentrations of chemicals in environmental media that are protective of both human health and the environment.

In addition, a review of pertinent laws, regulations, and other criteria was performed to identify applicable or relevant and appropriate requirements (ARARs) and other criteria to be considered (TBC) for remediating the site. A summary of the potentially applicable ARARs and TBCs is presented in [Table # or Appendix #].

A discussion of regulatory requirements, human health risks, and the remedial goals developed for the site is presented below.

3.1 SUMMARY OF RISK ASSESSMENT

Instructions: Describe the risk screening/assessment conducted to evaluate potential risks and hazards associated with the chemicals of concern at the site. Identify the chemicals of concern for each environmental media. Identify background concentrations and how they were developed if necessary to help identify chemicals of concern. Discuss the most likely receptors and pathways.

The baseline human health risk assessment (HRA) [Source, Date] evaluated the potential for human health impacts from chemicals released due to past activities at the [site name] Site. The results of the baseline HRA provide a basis for decisions regarding further action at the Site. The baseline HRA addressed the potential human health risks associated with current and future exposures to environmental media at the Site.

For risk assessment purposes, chemicals in soil were grouped according to depth below ground surface (bgs): surface soil ([define depth range, e.g., 0 to 1 feet bgs]), subsurface soil ([define depth range, e.g., 1 to 10 feet bgs]), and deeper soils ([define depth, e.g., greater than 10 feet bgs]). Under certain exposure scenarios, it was assumed that human receptors might come into direct contact with chemicals in the surface and subsurface soils up to a depth of [#, e.g., 10 feet bgs]. Chemicals detected in deeper soils were not evaluated for direct human exposure. However, they were evaluated for indirect exposure from the inhalation of VOCs emitted from subsurface sources.

USEPA (1989) and DTSC (1997) guidance indicate that risk evaluations for metals are only necessary when the levels exceed naturally occurring background concentrations. Metals in soils at the site that are elevated above naturally occurring background concentrations were identified using statistical analyses. The statistical analyses compared metal concentrations in soil at the site to metal concentrations in similar local soils. Background data for [#] metals including [list metals], were obtained from soils sampled at [location]. Based on the results of the statistical testing, the following metals were identified as chemicals of potential concern (COPCs) at the site: [List metals identified as COPCs].

There are no water production wells located within three miles of the site that are screened through the first water-bearing unit encountered at a depth of approximately [#] feet bgs. In accordance with the Basin Plan, the first water-bearing unit is classified as [classification (e.g., potential drinking water source (MUN)] [Consultant, Date of Report(s)]. Therefore, all of the detected organic compounds were identified as chemicals of potential concern (COPC) in groundwater. The primary inorganic compound identified as a COPC in groundwater was [COPC].

At the site, the most likely receptors for exposure to soil were assumed to be [receptors, e.g., industrial workers, construction workers]. Also, to assess unrestricted site use, future onsite residents were assumed to be exposed to the COPCs in soil. These receptors could be exposed to COPCs is via [list exposure scenarios and associated exposure pathways].

The overall risk estimate for construction workers exposed to the top 10 feet of soil is approximately [#], which exceeds the US EPA target risk range of 10^{-6} and 10^{-4}. The majority of this risk is due to [COPC(s)]. The overall risk for hypothetical future onsite residents is predominantly due to [COPC(s)] in soil. Overall, the calculated risks indicate that assumed exposure to COCs in soils contribute to risk estimates that exceed the point of departure of 1×10^{-6} for future receptors. Exposures to COPCs in soils also contribute to Hazard Indices [that exceed/do not exceed] the noncarcinogenic threshold of 1.

3.2 REMEDIAL ACTION OBJECTIVES

Instructions: Identify the site-specific RAOs.

The following RAOs have been developed for the [site name] Site:

- Minimize or eliminate potential exposure of humans [receptor, e.g., industrial/commercial workers, hypothetical future residents] to [COC(s)] in surface or shallow soil through [pathway, e.g., inhalation, dermal absorption, and ingestion];

- Reduce the human health-based risks associated with onsite [COCs] contamination in soil to a level that is acceptable for [land use] land use;
- Prevent or control potential exposures to contaminants in deeper soil and groundwater;
- Minimize the potential for COCs in soil to impact groundwater; and
- Prevent or control further [COC(s)] groundwater plume migration horizontally or vertically to deeper aquifers and thus eliminate the potential migration of contaminant to drinking water wells.

3.3 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Instructions: If not addressed in a separate Feasibility Study Report, identify and discuss the ARARs applicable to the Site. A table may be used to summarize this information.

Investigations of the Site indicate the presence of the COCs in [media] exceeding the site RAOs. The most effective remedial action has been determined to be removal consisting of [remedy]. The applicable or relevant and appropriate requirements (ARARs) for the Site are summarized in Table [#].

3.4 CLEANUP GOALS

Instructions: Identify and discuss the cleanup goal established for each COC in each impacted environmental medium at the Site.

Risk-based cleanup goals were selected for the Site based upon [basis for goals,e.g., the California Human Health Screening Levels (CHHSLs) and background concentrations]. The cleanup goal for [COC] is a [maximum concentration/average concentration/ background concentration] of [#] mg/kg.

3.5 AREAS EXCEEDING CLEANUP GOALS

Instructions: Identify the area where a response action is required to address environmental media containing COCs above site cleanup goals.

Soil remedial measures will generally be required to depths ranging from approximately [#] to [#] feet bgs to meet the soil cleanup-level goals. In select areas, deeper soil remediation may be required to the depth of the top of the first encountered groundwater. As shown on Figure [#], the areal extent of soil with [COC] concentrations exceeding the soil cleanup-level goal is approximately [#] square feet (ft^2) located [describe area]. As such, the total in-place volume of affected soil requiring remediation is estimated to range from approximately [#] cubic yards (cy; approximately equivalent to [#] tons) to [#] cy (approximately equivalent to [#] tons). The actual volume of affected soil will depend on the distribution of target contaminants in soil based on existing chemical data, confirmation sample laboratory analytical results, and limitations of the remedial measure implemented.

Groundwater remedial measures will be required to address [COC(s)] in the upper water-bearing unit. As shown in Figure [#], the groundwater plume is estimated to be [#] feet long and [#] feet wide based on the [#] mg/L contour.

4.0 SUMMARY OF FEASIBILITY STUDY

Instructions: Describe the process of identifying and screening remedial technologies to develop remedial alternatives. Identify the remedial action alternatives. Summarize the individual analysis of each alternative against the nine federal criteria. Present a comparative analysis of the alternatives. Identify the recommended remedial alternative.

If the project team determines that the PT&R process is appropriate to address COCs in soil, the Feasibility Study evaluation may be incorporated into the RAP document. The PT&R process presents three commonly evaluated alternatives to address metals in shallow soil.

Site-specific contaminants and media of concern will dictate the need for evaluation of additional and/or different alternatives. Any alternative being considered for the site should follow the analysis process outlined in this section.

A draft Feasibility Study Report [Date] for the [Site Name] site was submitted to the DTSC. The report discussed applicable remedial technologies for the impacted soils and groundwater at the site followed by an evaluation of remedial alternatives in accordance with the *Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Remedial Investigation/Feasibility Study (RI/FS) guidance* (EPA, 1988). The remedial alternatives were evaluated separately for the impacted soil zone and the impacted groundwater zone.

4.1 TECHNOLOGY SCREENING

Instructions: Describe the process used to screen technologies or discuss the application of the PT&R Process.

During the screening of technologies, a wide range of technology types from in-situ to ex-situ and containment to active removal were evaluated. The technologies were evaluated for their implementability, effectiveness, and cost. The technology types and process options that were considered to be technically implementable were evaluated using the criteria of effectiveness, implementability and relative cost. Those technologies that had poor implementability, effectiveness, cost, or a combination thereof were not retained for further evaluation. In cases where there were multiple variations of the same technology that were retained, a representative technology was selected for that technology type.

4.2 IDENTIFICATION OF ALTERNATIVES FOR SOIL

Instructions: Identify and describe the remedial alternatives for soil.

After the initial screening of technologies, [#] remedial alternatives were retained for in-depth evaluation to address COCs in soil.

4.2.1 Alternative 1 – No Further Action

As required by the DTSC, the No Further Action alternative has been included to provide a baseline for comparisons among other removal alternatives. The No Further Action alternative would not require implementing any measures at the site, and no costs would be incurred. This action includes no institutional controls, no treatment of soil, and no monitoring.

4.2.2 Alternative 2 – Soil Containment/Capping-in-Place

This alternative would consist of capping the surface of the impacted areas with [describe cap (e.g., a two-foot engineered soil cover, asphalt or asphalt/concrete pavement]. The cap would be used to minimize the potential to come into contact with the contaminated soil. To achieve the RAOs, it has been determined that soil at [locations] requires capping (see Figure [#]). If capping is selected, a total of [#] acres of affected soil will need to be covered.

A land use restriction will be executed between DTSC and the property owner and recorded to ensure that the cap is operated and maintained and that future uses of the property are consistent with the operation and maintenance (O&M) of the cap. An O&M plan will be submitted and approved by DTSC. An O&M Agreement signed with DTSC specifying the O&M requirements and providing financial assurance for future O&M of the cap.

4.2.3 Alternative 3 – Soil Excavation/Off-site Disposal

The excavation/off-site disposal alternative would consist of removing and transporting impacted soil to an appropriate, permitted off-site facility for disposal. Excavation includes using loaders, backhoes, and/or other appropriate equipment. Excavation operations will generate dust emissions. Suppressant, water spray, and other forms of dust control may be required during excavation, and workers may be required to use personal protective equipment to reduce exposure to COCs. Sloping excavation sidewalls may result in increased volume of soil requiring excavation. Confirmation soil sampling and analysis would be conducted to verify that cleanup criteria were met at the excavation bottom and perimeter. Excavation will require soil stockpiling, prior to [treatment, disposal]. To achieve the RAOs, soil at [location(s)] within the site requires removal to depths ranging up to [#] feet (see Figure [#]. The volume of soil removed is projected to be between [range] cubic yards ([range] tons).

[If cleanup to unrestricted land use standards is not achieved by this alternative, a land use covenant must be proposed as part of the alternative and the specific restrictions described. For example, to ensure that the property is not developed for sensitive land uses such as residential, schools, day care centers, hospitals, parks. Also need to consider whether an O&M plan and an O&M agreement are required. If they are necessary, this should be discussed in the description of the alternative.]

4.3 IDENTIFICATION OF ALTERNATIVES FOR GROUNDWATER

Instructions: Identify and describe the remedial alternatives for groundwater.

For the groundwater, the remedial alternatives evaluated were: [list remedial alternatives].

4.4 EVALUATION OF ALTERNATIVES

Instructions: Identify and describe the criteria used to evaluate the remedial alternatives. Reference a table or appendix presenting the evaluation.

The listed remedial alternatives were evaluated using the EPA CERCLA nine-criteria analysis described in the RI/FS guidance.

- Overall Protection of Human Health and the Environment - Describes how the alternative as a whole would achieve and maintain protection of human health and the environment. Evaluates protection of human health in terms of the potential risks that remain after cleanup objectives have been met;

- Compliance with ARARs - Describes how the alternatives comply with Applicable or Relevant and Appropriate Requirements;

- Long-Term Effectiveness - Evaluates the long-term effectiveness of each alternative in maintaining protection of human health and the environment after the remedial goals have been met.

- Reduction of Toxicity, Mobility, and Volume through Treatment - Evaluates the anticipated performance of each alternative with respect to the following factors:
    - The treatment process to be used and the materials to be treated;
    - The amount of hazardous substances that will be treated or destroyed;

  - The degree of expected toxicity, mobility, and volume reduction as compared to conditions prior to the remedial action;
  - The degree to which total destruction is achieved;
  - The type and quantity of residual chemical compounds; and
  - The degree to which the alternative addresses the principal risk.

- Short-Term Effectiveness – Evaluates the effects of each alternative during construction, implementation, and operation are assessed. Factors considered include protection of the community and workers during remedial operations, the time required to implement the alternative and to achieve the remedial goals, and the potential adverse environmental impacts that may result.

- Implementability – Evaluates the technical and institutional feasibility of implementing a particular alternative. Technical feasibility includes the availability of treatment, storage, and disposal services, and the availability of necessary equipment and skilled workers to implement the particular process. Institutional feasibility includes obtaining the necessary permits or regulatory concurrence.

- Cost – Estimates the amount of capital and operation and maintenance (O&M) costs to implement each alternative. The focus should be to make comparative estimates for alternatives with relative accuracy so that cost decisions among alternatives will be sustained. The capital cost estimates developed for this evaluation include equipment, construction, engineering, and permitting and construction management. The O&M cost estimates developed for this evaluation include those costs necessary to operate and maintain the remedy.

- Regulatory Agency Acceptance – Evaluates the anticipated administrative and technical issues that state or other agencies may have concerning the alternative. Actual assessment of regulatory agency acceptance is dependent on comments received during the public comment period.

- Community Acceptance – Evaluates each alternative in terms of currently available public input and the anticipated public reaction to the alternative. However, actual assessment of community acceptance is dependent on comments received during public comment period.

See Table [#] for this evaluation.

4.5 COMPARATIVE ANALYSIS

Instructions: For each evaluation criterion, describe the advantages and disadvantages of each remedial alternative and how the alternatives compare with each other. Conclude the discussion with a clear statement of the best ranked alternative for each media. If preferred, much of this discussion could be presented in tabular format.

4.6 DESCRIPTION OF RECOMMENDED REMEDIAL ALTERNATIVE

Instructions: Describe the recommended remedial alternative for each impacted media. Indicate whether the remedy includes any land use restrictions. If applicable, specify and list the land use restrictions and indicate whether a O&M plan and/or agreement (including financial assurance) is part of the remedy.

4.6.1 Recommended Remedial Alternative for Soil

Alternative [#] is the recommended alternative for soil. To remediate soils, [identify remedy]. Long-term monitoring and land use controls [are/are not] required as part of this remedy.

The recommended alternative assumes excavation of the soils impacted with [COCs] to prevent the potential for direct exposure. As a conservative measure, this alternative assumes the entire site ([#] feet by [#] feet) is excavated down to [#] feet bgs (Figure [#]). The excavation will require sloping of the sidewalls to protect structures located in the vicinity of the site. It is estimated that the total in-place volume of impacted soil for excavation is about [#] cubic yards. This alternative will include removal of any subsurface structures prior to completing the excavation. It is assumed that excavated soils will be hauled to a permitted facility for soil treatment and/or disposal. Given that some of the soils are impacted with high concentrations of [COCs], a significant portion of these soils would likely be classified as [waste type, e.g., RCRA hazardous waste].

Clean fill will be imported to backfill the excavation. The backfill will be compacted appropriately to meet geotechnical requirements amenable for typical future site uses.

[Include a paragraph indicating whether land use restrictions are required. List restrictions, as applicable. If applicable, specify what land use restrictions would be imposed. Indicate whether an O&M Plan and Agreement, including financial assurance are part of the final remedy.]

The following is an example paragraph pertaining to the land use restrictions, the O&M plan, and financial assurance.

A land use covenant is required to place some use restrictions on the Site because [COCs] will remain in soil above unrestricted use standards at the Site.

4.6.2 Recommended Remedial Alternative for Groundwater

Alternative [#] is the recommended alternative for groundwater. To remediate the groundwater, [identify remedy]. Long-term monitoring and land use controls [are/are not] required as part of this remedy.

The groundwater remediation will consist of the [describe remedy] to remediate the groundwater source area. [Describe the groundwater remedy.]

The following is an example description of a groundwater remedy.

Based upon [basis, e.g., pilot study conducted at the Site], [#] [unit, e.g., gallons, pounds] of [material] will be injected into a total of [#] injection wells (Figure [#]) installed throughout the groundwater source area. Injection wells will be installed on [#] foot centers, assuming a radius of influence of about [#] feet. A Waste Discharge Permit (WDR) would be required from the RWQCB for this activity. [#] groundwater monitoring wells will be placed within and downgradient of the treatment area to monitor treatment progress. [#] injection rounds are assumed [injection schedule, e.g., quarterly, once a year]. After the first round of injection, [frequency, e.g., monthly] sampling of groundwater monitoring wells will be conducted for [time period, e.g., the first three months, followed by quarterly sampling for the next two years]. Groundwater monitoring will continue until site RAOs are achieved. However, the sampling frequency may be reassessed after [timeframe, e.g., the first two years of sampling].

[Include a paragraph indicating whether land use restrictions are required. List restrictions, as applicable. If applicable, specify what land use restrictions would be imposed. Indicate whether an O&M Plan and Agreement, including financial assurance are part of the final remedy.]

The following is an example paragraph pertaining to the land use restrictions, the O&M plan, and financial assurance.

A land use covenant is required to place some use restrictions on the Site because contaminants remain in groundwater above unrestricted use standards at the Site. Institutional controls will be required to restrict future groundwater use at the site. Land use restrictions will be required to retain groundwater monitoring wells and injection wells onsite. An Operation and Maintenance Plan and financial assurances would also be required to ensure that appropriate long term monitoring of the groundwater and land use restrictions are conducted.

4.7 JUSTIFICATION OF SELECTED REMEDY

Instructions: For each impacted media, provide the justification for the selected remedy.

4.7.1 Justification for Selected Soil Remedy

The following is an example justification for selecting a soil remedy.

The preferred remedy removes soil containing COCs above Site cleanup goals to eliminate direct exposure and enable redevelopment of the Site. The primary factors which supported the selection of Alternative [#] (soil excavation and off-site disposal) are: (1) this alternative is protective of human health and the environment, is cost *effective, and is technically feasible; (2) the shorter duration of remedial action will reduce the impact to active site operations; and (3) it will help minimize the potential for contaminants to migrate to groundwater.*

Alternative [#] for soil was rated moderate to good for the threshold criteria (overall protection of human and environment and compliance with ARARs). It was rated moderate to good for the balancing criteria such as long term effectiveness, reduction of toxicity, mobility and volume, short term effectiveness, and implementability. Furthermore, it was moderate in cost and hence the most cost effective of the remedial alternatives that meets the threshold criteria requirements.

4.7.2 Justification for Selected Groundwater Remedy

The following is an example justification for selecting a groundwater remedy.

For groundwater, the remedy proposes to inject [material] to decrease [COCs] contaminant mass in the source area to achieve the RAOs.

The primary factors which supported the selection of Alternative [#] (in situ treatment) are that (1) this alternative is protective of human health and the environment, is cost effective, and is technically feasible; and (2) the timeframe to achieve the RAOs is reasonable and will not interfere with active site operations.

Alternative [#] for groundwater was rated moderate to good for the threshold criteria (overall protection of human and environment and compliance with ARARs). It was rated moderate for the balancing criteria such as long term effectiveness, reduction of toxicity, mobility and volume, short term effectiveness, and implementability. Furthermore, it was moderate to good in cost and hence the most cost effective of the remedial alternatives that meets the threshold criteria requirements.

5.0 PRELIMINARY REMEDIAL DESIGN FOR SOIL REMEDY

Instructions: Identify the steps in the remedial action and describe the key elements for each step. The following example language is biased toward the excavation/off-site disposal alternative. Analogous sections and content should be included for other alternatives or other components of alternatives that are proposed. If the design is relatively simple and the project team agrees, it may be possible to include the design within this section, rather than as part of a subsequent separate submittal.

This section presents a preliminary remedial design for the various phases of the soil remedy. [Indicate whether additional details will be presented in the Remedial Design and Implementation Plan to be completed later.]

Implementation of the recommended remedial action consists of a series of separate tasks. The following sections discuss each task and the activities of which they consist:

selecting excavation locations (Section 5.1); permits, notifications and site preparation (Section 5.2); excavation methodology (Section 5.3); control measures (Section 5.4); air monitoring during excavation (Section 5.5); and field variances (Section 5.6).

5.1 PERMITTING

Instructions: Discuss the applicable agencies and notification and/or permits that will need to be made or obtained, respectively, prior to the initiation of any field activities.

It is expected that the following permits may be required for excavation operations:

- A grading permit from the City of [city name].
- Building department permits from the City of [city name] Building and Safety Department.
- Well abandonment permits will be needed from the [county name] County Department of Health Services (DHS).
- An Air District permit [will/will not] be required due to the concentrations of [COCs] in the soil.
- [Name] will obtain a U.S. EPA Identification number as the generator of the waste.
- [List other permits that may be required, such as a stormwater pollution prevention permit (SWPPP), air district permit or notification, Waste Discharge Requirements permit, well replacement permits].

The excavation and soil handling will be conducted by a qualified, HAZWOPER-trained, contractor using conventional earthwork equipment. The contractor will prepare a Site Specific Health and Safety Plan (HASP), which will address identification of hazards, hazard mitigation, safe work practices and emergency response procedures for the project. The site-specific HASP will be prepared to comply with 29 CFR 1910.120 and 8 CCR GIS0 5192.

5.2 UTILITY CLEARANCE

Instructions: Indicate how utilities will be cleared. If available, provide a figure showing locations.

Prior to commencing with excavation activities, Underground Service Alert (USA) will be contacted at least 48 hours in advance to identify the location of utilities that enter the property. All proposed excavation areas will be clearly marked with white paint or surveyors flagging as required by USA. USA will contact all utility owners of record within the Site vicinity and notify them of the intent to excavate. All utility owners of record will be expected to clearly mark the position of their utilities on the ground surface throughout the designated area.

[Describe other applicable utility clearance measures.]

5.3 SITE PREPARATION

Instructions: Discuss site preparation activities, such as clearing and grubbing, pavement removal, demolition activities, access control, installation of storm water best management practices (BMPs), set up of decontamination areas, etc.

The following is an example description of site preparation methods.

Conventional construction equipment, such as a front-end loader equipped with a backhoe, will be used to remove the asphalt cover and any remaining concrete footings, concrete foundations, buried utility piping, and a concrete clarifier that reportedly remains on-site. Stained or corroded asphalt, concrete, and/or piping will be segregated and disposed as hazardous waste. The remaining material will be disposed as construction debris.

5.4 EXCAVATION EXTENT AND METHODS

Instructions: Discuss the excavation locations and depth intervals. Provide tables and figures summarizing the excavation locations and depths and the COC(s) driving the excavation. Describe how the excavation will proceed, including pit dimensions, shoring, timing of excavation floor and sidewall sampling, and decision criteria for stopping or continuing the excavation. Describe how soil will be managed on-site and profiled. Describe backfill activities. Describe timeframe for work activities (e.g., weekdays, hours of operation).

The following is an example description of excavation extent and methods.

The upper [#] feet of soil from across the entire Site will be removed to minimize the potential for direct exposure to [COC(s)] in soils. Due to engineering constraints, the vertical extent of excavation will be limited to [#] feet bgs around the entire site as shown on (Figure [#]). Excavation areas will be sloped or benched at a minimum slope of [#] to provide appropriate slope stability protection in accordance with Cal-OSHA regulations. If needed, a ramp leading into the excavation will be sloped at a minimum of [#] to allow for safe backhoe/excavator access. It is estimated that the total in-place volume of impacted soil for excavation is about [#] cubic yards. The excavation could remove soils locally in some hot spot areas to deeper than [#] feet bgs if warranted, for example, if heavy staining is observed or if confirmation sampling results indicate that site cleanup goals have not been attained.

Soil excavation activities are expected to take approximately [#] weeks to complete. Work would be conducted between [#] a.m. and [#] p.m., Monday through Saturday.

The soil will be removed using standard earthmoving equipment (e.g., backhoe, front end loader). Manual excavation methods will be used in the immediate vicinity of the monitoring wells that will remain in place (Figure [#]). Excavated soil will be segregated based on previous sampling data and other evidence, such as soil discoloration and odors, and field screening with an organic vapor meter or immuno-assay testing into three separate stockpiles: (1) potentially reusable fill stockpile; (2) soil potentially requiring disposal as a RCRA-hazardous waste; and (3) soil potentially requiring disposal as a California-hazardous waste. Stockpiling and segregation activities on Site will be limited by space constraints and excavation timeframes.

If not directly loaded into trucks, the excavated soil will either be stockpiled or placed in covered soil bins until characterization and disposal arrangements are completed. Stockpiled soil will be placed on plastic sheeting and covered with plastic sheeting when not actively being worked on and at the end of each workday. Sandbags, or other weights, will be used to keep the plastic cover in place. Soil stockpile locations will be determined prior to initiation of remedial actions through coordination with the property owners and operating businesses on-site. At this time, it is anticipated that the stockpiled soil will be placed [location]. Soil samples will be collected and submitted for chemical analyses to evaluate on-site reuse and disposal alternatives at a frequency of at least one discrete sample analyzed per [#] cubic yards. Off-site disposal of the affected soil that is unsuitable for reuse on-site will be conducted based on the soil stockpile analytical results under appropriate documentation and in accordance with applicable federal, state, and local regulations. The following table summarizes the projected soil volumes and number of trucks for each soil type.

Soil Classification	*In Place Volume (cubic yards)*	*Ex situ Weight (tons)*	*No. of Trucks*
RCRA Hazardous			
California- hazardous Soil			
Non-hazardous			

A geotechnical field technician will provide observation and testing services during backfill operations. The clean backfill material will be moisturized as needed by hose or water truck prior to placement, or else mixed as the fill material is being placed. Fill will typically be placed in [#]-inch lifts and compacted. In situ density tests will be performed to determine when a minimum relative compaction rate of [#] percent has been achieved relative to the maximum dry density obtained from ASTM [#]. The backfilling process will continue until the desired site grade is reached. A compaction report will be submitted to the City of [city name] Department of Building and Safety in accordance with the grading permit.

The source of the clean backfill material, certification that the fill is clean, and supporting analytical data will be obtained from the excavation subcontractor and submitted to DTSC approximately five working days before beginning excavation activities at the site.

The clean backfill material shall not contain chemicals above [specify levels, e.g., residential CHHSLs, US EPA PRGs]. The source of the fill material cannot be included at this time because the excavation subcontractor and the specific fill material source have not been identified.

5.5 CONTROL MEASURES

Instructions: Describe site control measures, e.g., dust control, fencing, erosion, stormwater, traffic.

The following is an example description of control measures to be applied during soil excavation.

During excavation activities, depending on soil conditions, there is potential to generate airborne dust. Dust control measures will comply with the local Air District feasible control measures to protect on-site and off-site receptors from chemicals in soil and nuisance dust.

Dust suppression will be performed by [method, e.g., lightly spraying or misting the work areas (such as the excavation, soil handling areas and haul roads) with water, BioSolve®, or a similar surfactant if water is not sufficient to reduce the potential for dust generation]. Misting may also be used on soil placed in the transport trucks. Efforts will be made to minimize the soil drop height from the excavator's bucket onto the soil pile or into the transport trucks. The excavator will be positioned so as to load or stockpile soil from the leeward side. After the soil is loaded into the transport trucks, the soil will be covered to prevent soil from spilling out of the truck during transport to the disposal facility. Additionally, soil stockpiles and truck beds containing soil will be covered to minimize the potential for dust generation.

The site currently has permanent fencing installed; however, part of this fencing, especially along the southern boundary, will need to be removed to allow heavy equipment access to the site. These areas will be secured at night using temporary fencing to reduce the potential for unauthorized personnel to enter the excavation area. Low-visibility with low-permeability windscreen will be attached to the temporary and permanent fencing prior to commencement of on-site activities.

If precipitation is anticipated, engineering controls will be implemented to minimize the collection of rainwater in the excavation. While on the property, all vehicles will maintain slow speeds (e.g., less than 5 miles per hour) for safety purposes and for dust control measures. Before exiting the job site, the vehicle's tires will be inspected and brushed, if necessary, to ensure that impacted soil remains on-site. This cleanup/ decontamination area will be established as close to the excavation and/or loading areas as possible to minimize spreading the impacted soil.

5.6 PERIMETER AIR MONITORING DURING EXCAVATION

Instructions: Describe the site air monitoring strategy, e.g., volatile constituents, fugitive dust, perimeter monitoring.

The following is an example description of perimeter air monitoring during excavation.

Air monitoring activities will be conducted in the work zone and in the immediate perimeter by the Site Safety Officer during excavation. This section describes the perimeter air monitoring program that will be implemented at the Site. Work zone air monitoring is addressed in the HASP [consultant, date].

Airborne particulate monitoring will be conducted to verify and document the effectiveness of dust suppression measures in conformance with [air management district requirement]. To mitigate offsite dust migration impacts to neighboring properties, watering of the active excavation areas will be conducted throughout the removal action. Factors considered in providing fugitive dust control measures will include wind direction, wind speed, and available dust control and dust suppression methods.

Air monitoring for particulates will be performed during the excavation activities at the perimeter of the property using an upwind/downwind sampling approach. The limit on dust concentrations at the property boundaries will be determined based on the airborne [PRG type] PRG of [#] micrograms per cubic meter (µg/m^3) and an average shallow soil [COC] concentration of [#] mg/kg.

Periodic real time particulate measurements will be taken in the working zone in accordance with the HASP. These measurements will also be taken near and around the property boundary at breathing height level using a portable hand held dust monitor. The target total particulate action level in the working zone is [#] milligrams per cubic meter (mg/m^3) of respirable particulate and [#] mg/m^3 of total particulates.

VOCs are not expected to be encountered during excavation activities based on low VOC concentrations in the site soil. Air monitoring, however, will be conducted as a safety precaution using a direct reading photo-ionization detector (PID) during excavation and soil handling activities as specified in the HASP.

5.7 FIELD VARIANCES

Instructions: Describe how field variances will be addressed.

Variances from the work plan will be discussed with DTSC prior to any action being taken except for emergencies (when an immediate response is required). The DTSC will be notified if an emergency response is implemented. The field variances will be documented in the Completion Report prepared for the project.

5.8 CONFIRMATION SAMPLING AND ANALYSIS PLAN

Instructions: Discuss the approach to confirmation sampling, analytical methods, QA/QC, general criteria for determining excavations complete, and general criteria for classifying excavated soil and determining appropriate disposal options.

Soil samples from the sides and bottom of the completed soil excavation will be collected to assess the [COCs] concentrations. The exact confirmation sample locations will be verified in the field in consultation with the DTSC. Sample locations and the number of samples collected may be adjusted in the field if necessary. After the impacted area has been excavated to the appropriate depth, bottom samples from the excavation base will be collected on a [#]-foot grid. Samples will be collected primarily using the [method]. Excavation bottom verification soil samples will be collected unless: [list exceptions]. One sidewall soil sample will be collected for every [#] linear feet of sidewall at depth intervals corresponding to areas exhibiting field indications of potential contamination and/or at depths where previous samples indicated contaminants were present. Sidewall samples will be collected using the [method]. Field quality control (QC) samples, which include [list, e.g., calibration check standards, blanks, and field duplicates] will be checked and/or collected for [#] percent of the soil samples.

[Describe any on-site screening to be conducted. If using on-site screening, describe the number of QA/QC samples to be sent to the off-site laboratory. For off-site analyses, describe sample handling, shipping, analytical parameters, analytical methods, and analytical laboratory. Describe the timing of confirmation sampling relative to excavation/backfill activities and waste characterization.]

[Describe constraints on soil excavation (e.g., existing structures, water table).]

5.9 TRANSPORTATION PLAN

Instructions: Include this section if excavated soil is to be transported. Describe the transportation plan for the remedial action. For the excavation/off-site disposal option, describe the anticipated waste classification for the soil, the potential disposal facilities, the transportation type, transportation routes, site traffic control, and associated record keeping.

Elevated levels of [COCs], up to [#] mg/kg of total [COC] and [#] mg/L of soluble [COC], were detected in the Site soil. The Total Threshold Limit Concentration (TTLC) for hazardous waste classification is [#] mg/kg for [COC]. The Soluble Threshold Limit Concentration (STLC) for hazardous waste classification is [#] mg/L for soluble [COC]. The Toxicity Characteristic Leaching Procedure (TCLP) limit for classifying [COC]-impacted soil as a hazardous waste under the Resource Conservation and Recovery Act (RCRA) of 1976 (and as amended) is [#] mg/L. As a result, any mixture of [COC]-impacted soils removed from the Site is expected to be handled as a [RCRA/non-RCRA] hazardous waste.

As a hazardous waste generator, [name] will secure an EPA Identification Number from DTSC for proper management of the hazardous waste. Compliance with the DTSC requirements of hazardous waste generation, temporary onsite storage, transportation and disposal is required. Any container used for onsite storage will be properly labeled with a hazardous waste label. Within 90 days after its generation, the hazardous waste will be transported offsite for disposal. Any shipment of hazardous wastes in California will be transported by a registered hazardous waste hauler under a uniform hazardous waste manifest. Land disposal restrictions will also be followed, as necessary. Any shipment of non-hazardous waste in California will be transported under a non-hazardous waste manifest or bill-of-lading.

Soils classified as [type] waste will probably be transported to [location] or to [location] for disposal. These disposal facilities are licensed [type] landfills and are located at the following addresses:

[Facility Name and EPA ID Number]
[Address]
[City, State, Zip code]
[Phone]
[Contact Person]

[Facility Name and EPA ID Number]
[Address]
[City, State, Zip code]
[Phone]
[Contact Person]

Soils classified as [type] will probably be transported to the following facility:

[Facility Name and EPA ID Number]
[Address]
[City, State, Zip code]
[Phone]
[Contact Person]

[Continue, as needed for each waste anticipated.]

5.9.1 Truck Transportation

Approximately [#] tons of soil will be removed from the Site. Assuming each truck carries [#] tons, up to [#] trucks will be needed to transport the impacted soil. All permitted disposal facilities operate a certified weight station at their facility. As such, each truck will be weighed before offloading its payload. Weight tickets or bills of lading will be provided to the removal action subcontractor after all the soil has been shipped off-site. Below is a summary of the truck route from the site to the disposal facilities listed above:

[Facility Name 1]
This truck route is illustrated in Figure [#]. [Describe truck route.]

[Facility Name 2]
This truck route is illustrated in Figure [#]. [Describe truck route.]

[Indicate whether alternate routes are an option and how an alternate route would be chosen. Discuss truck transportation days and hours.]

Before leaving the site, each truck driver will be instructed to notify the site manager. Each truck driver will be provided with a Uniform Hazardous Waste Manifest, Non-Hazardous Waste Manifest, or bill-of-lading and the cellular phone number for the site manager. It will be the responsibility of the site manager to notify DTSC and [entity] of any unforeseen incidences. Each truck driver will be instructed to use the freeway Call Box System (if available), a cellular telephone, and/or their radio dispatch system to call for roadside assistance and report roadside emergencies.

5.9.2 Site Traffic Control

During soil transport activities, trucks will enter the Site through [location] located on [street name]. A flag person will be located at the site to assist the truck drivers to safely drive onto the site. Transportation will be coordinated in such a manner that at any given time, on-site trucks will be in communication with the site trucking coordinator. In addition, all vehicles will be required to maintain slow speeds (e.g., less than 5 mph) for safety and for dust control purposes.

Prior to exiting the Site, the vehicle will be swept to remove any extra soil from areas not covered or protected. This cleanup/decontamination area will be set up as close to the loading area as possible so as to minimize spreading the impacted soil. Prior to the off-site transport, the site manager will be responsible for inspecting each truck to ensure that the payloads are adequately covered, the trucks are cleaned of excess soil and properly placarded, and that the truck's manifest has been completed and signed by the generator (or its agent) and the transporter. As the trucks leave the site, the flag person will assist the truck drivers so that they can safely merge with traffic on [street name].

5.10 RECORD KEEPING

The remedial action contractor will be responsible for maintaining a field logbook, which will serve to document observations, personnel on site, equipment arrival and departure times, and other important project information. Logbook entries will be complete and accurate enough to permit reconstruction of field activities. Logbooks will be bound, with consecutively numbered pages and each page will indicate the date and time of the entry. All entries will be legible, written in black or blue ink, and signed by the author. Language will be factual and objective. If an error is made, corrections will be made by crossing a line through the error and entering the correct information. Corrections will be dated and initialed.

Because some portion of the excavated soil likely will be profiled as hazardous waste under California or EPA regulations, the Uniform Hazardous Waste Manifest (hazardous waste manifest) form will be used to track the movement of soil from the point of generation to the point of ultimate disposition. The hazardous waste manifests will include the following information:

- Name and address of the generator, transporter, and the destination facility
- United States Department of Transportation description of the waste being transported and any associated hazards
- Waste quantity
- Name and phone number of a contact in case of an emergency
- EPA Hazardous Waste Generator Number
- Other information required either by the EPA and/or the DTSC.

Any soil that is profiled as non-hazardous and sent off site for disposal will be documented using a Non-Hazardous Waste Manifest or Bill-of-Lading form. At a minimum, this form will include the following information:

- Generator name and address
- Transportation company
- Accepting facility name and address
- Waste shipping name and description
- Quantity shipped.

Prior to transporting the excavated soil off site, an authorized representative of [entity] will sign each hazardous and/or non-hazardous waste manifest. The removal action site manager will maintain one copy of all hazardous and/or non-hazardous waste manifests on site.

6.0 PRELIMINARY REMEDIAL DESIGN FOR GROUNDWATER REMEDY

Instructions: Identify the components of the groundwater remedial action and describe the key aspects of each component.

The following is an example description of the preliminary remedial design for a groundwater remedy.

6.1 INJECTION INTO GROUNDWATER

The final remedial action component is [material] injection into groundwater to decrease [COC] contaminant mass in the groundwater source area. Figure [#] depicts [#] proposed injection wells and [#] proposed monitoring wells. The [material] will be injected into the source area perimeter injection wells to act as a containment barrier for the interior source area injections. Then, [material] will be injected into the source area interior to treat the higher [COC] concentrations located there. A typical onsite injection well construction with corresponding site lithology variation is shown in Figure [#]. A minimum of [#] rounds of [#] injection are assumed in the [timeframe]. After each injection round is completed, long-term groundwater monitoring for at least [timeframe] would be required to ensure that the source area has been adequately remediated.

6.1.1 Injection Permits

The following permits will be needed for the groundwater chemical injection program:

- *WDR permit from the RWQCB. This permit will take approximately [#] months to obtain.*
- *Well permits from the [name] County Department of Health Services.*
- *A building permit from the City of [name] Department of Building and Safety for the piping manifold and above-ground piping used to connect the wells to the manifold.*

6.1.2 Injection System Design

To effectively remediate the groundwater area identified above, a total of [#] injection wells will be installed with [#]-inch diameter, [casing material], and screen intervals from approximately [#] to [#] feet bgs. The injection wells will be connected together by above-ground #-inch [casing material], connected to a common manifold with control valves, a pressure gauge, and a flow meter. Chemical and water injection into the wells will be made directly through the manifold or headers.

The injection wells will be spaced about [#] feet apart around the perimeter of the source area assuming a radius of influence of about [#] feet (Figure #). [Material] will be injected into these wells first to act as a containment barrier for subsequent injection into the interior source area wells. [#] wells will be installed into the interior of the source area. [COCs] that migrate laterally away from these wells as a result of the fluid injection will be forced into the containment barriers set up by the perimeter wells.

6.1.3 Injection Procedure

[Material] solution ([#]%) will be delivered to the injection manifold at a constant rate directly from a tanker truck or from an on-Site aboveground storage tank through a flexible hose connected to a [#]-inch drop pipe in the injection well that will extend approximately [#] feet below the water table. Either the discharge pump on the truck will be used to feed the solution into the wells, or the solution will be gravity fed from the storage tank. The flow rate will be measured with an electronic stainless-steel turbine flow meter with a range of at least [#] to [#] gallons per minute (gpm).

The average injection rate is estimated to be about [#] or [#] gpm. The optimum injection rate will be limited by the local hydraulic conductivity, fluid viscosity, well efficiency, flow impedance through the injection system, tanker truck pump capacity, and the height of the fluid column in the well or the injection pressure. Plugging of the well screen and viscosity effects are likely to reduce the specific injection capacity of the injection wells and may require a reduction in the injection rate during injection. Approximately [#] to [#] minutes will be required to inject the estimated [#] gallons of concentrated [#]% solution needed to achieve the appropriate reductive environment in the saturated zone at each injection point. Multiple injections of smaller batches may also be used to reduce potential clogging issues, if necessary.

6.1.4 Injection Volume into Groundwater

Approximately [#] gallons of [material] will be used per injection point based on an injection radius of [#] feet, an average [Contaminant(s) of Concern] concentration of [#] mg/L, an average soil porosity of [#], and a saturated zone thickness of [#] feet. An estimated [#] gallons of [material] solution will be injected into each of the injection points. As the estimated treatment zone around each of injection points contains approximately [#] gallons of groundwater, the injected volume for each point represents less than [#]% of the total groundwater volume, so the dilution impact on groundwater concentrations will be minimal.

6.1.5 Confirmatory Groundwater Sampling Events

After the first injection round, [frequency] monitoring of [#] wells will be conducted for the [timeframe] followed by [frequency] monitoring for [timeframe]. In general, wells that are dedicated for monitoring will be utilized for confirmatory groundwater sampling. This proposed field sampling program will provide sufficient short-term data to assess the effectiveness of the first injection round, plus identify the areas that might need additional [material] applications. Groundwater samples will be analyzed for [COCs].

6.1.6 Performance Criteria

Performance of the groundwater remediation with respect to RAOs will be demonstrated through long-term monitoring as described in Section [#]. A trend analysis will be used *to assess the rate of [COC] concentration changes based on reductions in mass flux due to source area and downgradient remediation, and to demonstrate reductions in concentrations towards regulatory objectives.*

7.0 INSTITUTIONAL CONTROLS

Instructions: One way to minimize the potential for human exposure to contamination and/or protect the integrity of a remedy is through the use of land use restrictions. Land use covenants are legal or administrative measures that limit land or resource use. They are typically used when the chosen remedial action involves leaving the contaminants in place or when implementing long-term cleanup actions. Often, institutional controls are used in combination with engineering controls or long-term groundwater cleanup actions. This section should be used to describe the institutional controls, if applicable, that will be utilized at the site.

Institutional controls (ICs) are required for sites that contain residual contamination to prevent inappropriate uses, which would pose a threat under certain exposure scenarios. ICs in the form of a land use covenant (LUC) guarantee that information about a property containing residual contamination is available to local governments, the public, prospective purchasers and tenants. A LUC is also used to ensure O&M of long-term mitigation and monitoring measures.

A LUC will place use restrictions on the Site because [COCs] will continue to exist [describe location] above levels acceptable for unrestricted use of the property. These controls would allow a wide range of future uses for the Site, but would limit sensitive uses (e.g., residences, schools, day care centers) and other uses that could involve excavation of impacted soil (e.g., such as an underground parking garage) if DTSC has not approved provisions for addressing the potentially-contaminated soils. Generally, the LUC is deemed to be effective with respective to controlling exposures because it runs-with-the-land and the use restrictions are recorded on the property deed. Also, environmental databases are being developed that include all properties with such use restrictions such as DTSC's EnviroStor database. Such registries of properties with residual contamination will provide information to future property buyers or owners and minimize the potential for exposure to residual contamination.

The LUC will also be required to restrict future groundwater use at the Site until cleanup goals for groundwater are achieved. [List possible engineering controls, if applicable] would be needed for any future building constructed at this Site due to the presence of residual [COCs] in groundwater. The LUC would also require non-interference with the groundwater monitoring system.

Periodic monitoring of compliance with the LUC restrictions at the Site will be required.

8.0 MONITORING AND REPORTING

Monitoring consists of periodic measurement of physical and/or chemical parameters to evaluate the progress of the remedial action in achieving the RAOs defined for the site. Performance monitoring can also be used to verify or adjust estimates of remediation timeframes or determine whether advances in remediation technologies or approaches could improve the ability to achieve the RAOs. At sites where engineering controls and ICs are used, performance monitoring may be necessary to demonstrate that on-going contamination of the groundwater is prevented, groundwater contamination is not spreading to uncontaminated areas, and potential receptors are being protected.

In this section you should discuss a monitoring plan that includes a description of the RAOs, locations, frequency, type and quality of samples, techniques, and measurements that will be used to assess the performance of the remedial action. The monitoring plan should include sampling and analysis and quality assurance procedures. In addition, a schedule for submittal of periodic monitoring reports should be included in the plan. The plan should also include an O&M plan for the monitoring system. Finally, the plan should discuss the proposed remediation timeframe during which performance monitoring activities will be conducted.

8.1 MONITORING

The following is an example description of monitoring activities.

Monitoring related to the soil excavation, such as air monitoring, was discussed in Section [#]. Other monitoring activities primarily relate to performance monitoring for groundwater injection. This would involve short term monitoring after [material] injection at a frequency of about [frequency] for [timeframe] followed by [frequency] monitoring for [timeframe]. One additional round of [material] injection is assumed after [timeframe]. Long term groundwater monitoring will also be required until Site [remedial action objectives/site cleanup goals] are achieved. This long term monitoring may start of at a [frequency] frequency and later decrease to [frequency] frequency once the plume has shown stability post-remediation.

Performance monitoring and/or long-term monitoring reports should be submitted to DTSC on a periodic basis after approval of the RAP. These reports should include the following:

- *Analytical results*
- *QA/QC results*
- *Chain of custody records*
- *Groundwater sampling and field data sheets*
- *Data tables containing groundwater elevations and well data*

8.2 REPORTING

The following is an example description of reporting.

After completion of the soil excavation, an implementation report will be submitted to DTSC summarizing the excavation procedures, documenting observations, and presenting the confirmation sampling results. After the groundwater injection is completed, an implementation report will be prepared to document the implementation.

[Frequency] performance monitoring reports will be prepared summarizing the groundwater conditions post-injection. After the second round of injection, long term groundwater monitoring reports will be prepared quarterly. The reporting frequency may be reevaluated and reduced upon DTSC approval if conditions warrant.

8.3 FIVE-YEAR REVIEW

If contamination remains onsite above unrestricted use standards, the final remedy shall be evaluated after a period of five years from the completion of construction and/or startup of the final remedy and every five years thereafter. The review and reevaluation shall be conducted to determine if human health and the environment are being adequately protected by the remedial alternative(s) implemented. A five-year review workplan will be submitted to DTSC for review and approval at least [#]-days prior to the completion of this five-year period. Within [#] days of DTSC's approval of the workplan, A report will be submitted containing the results of the five-year review. The report shall describe the results of all sampling analyses, tests and other data generated or received by Proponent and evaluate the adequacy of the implemented remedy in protecting human health and the environment.

9.0 IMPLEMENTATION SCHEDULE

Instructions: Provide the proposed schedule of remedial activities. The schedule should be in tabular format and contain a brief description of the activity, date of initiation, date of completion, and other relevant information.

If the intent is to move forward with remedial action implementation at a fairly fast pace, there are several things that should be considered. First, DTSC should be notified before the planning stage of the remedial action. Second, the schedule should allow time for a 30-day public comment period and response to comments. As regulatory issues can have an impact on the timing and overall construction schedule, you should identify concurrent tasks and get DTSC involved early in the planning stage of these tasks.

A tentative implementation schedule is shown in [reference to figure or location of schedule]. The schedule shows tasks such as [description of tasks to be accomplished in the RAP].

10.0 HEALTH AND SAFETY PLAN

Instructions: The purpose of the health and safety plan is to assign responsibilities, establish personal protection standards and mandatory safety procedures, and provide for contingencies that may arise while operations are being conducted at the site. It will describe controls and procedures that shall be implemented to minimize injury, accidents, and risks. All work at the site will be performed in accordance with applicable State and Federal occupational and health safety standards as set forth in 29 CFR §1910 and 1926, California Health and Safety Regulations as set forth in Title 8, California Code of Regulations, and guidance established by the DTSC.

All contractors will be responsible for operating in accordance with the most current requirements of State and Federal Standards for Hazardous Waste Operations and Emergency Response (Cal. Code Regs., tit. 8, section 5192; 29 CFR 1910.120). Onsite personnel are responsible for operating in accordance with all applicable regulations of the Occupational Safety and Health Administration (OSHA) outlined in the State General Industry and Construction Safety Orders (Cal. Code Regs., tit. 8) and Federal Construction Industry Standards (29 CFR 1910 and 29 CFR 1926), as well as other applicable federal, state and local laws and regulations. All personnel shall operate in compliance with all California OSHA requirements.

In addition, California OSHA's Construction Safety Orders (especially Cal. Code Regs., tit. 8, sections 1539 and 1541) will be followed as appropriate. Specific requirements are identified below:

- [list all appropriate or applicable requirements.]

A site-specific HASP will be prepared for the Site or the existing health and safety plan (HASP) will be updated in accordance with current health and safety standards as specified by the federal and California OSHAs and submitted to DTSC prior to initiation of field work.

The provisions of the HASP are mandatory for all personnel of the RP/PP and its contractors who are at the Site. The RP's/PP's contractor and its subcontractors doing fieldwork in association with this RAP will either adopt and abide by the HASP, or shall develop their own safety plans which, at a minimum, meet the requirements of the HASP. All onsite personnel shall read the HASP and sign the "Plan Acceptance Form" (Attachment [#] of the HASP) before starting Site activities.

11.0 CEQA INITIAL STUDY

Instructions: Describe the DTSC's CEQA role, e.g., Lead Agency or Responsible Agency. Describe the documents that were prepared or reviewed to ensure CEQA compliance, and the status of the documents, e.g., approved and final, under review concurrent with the RAP, etc.. Attach copies of CEQA documents and/or approval notices, if applicable, as an Appendix to the RAP.

The California Environmental Quality Act (CEQA), modeled after the National Environmental Policy Act (NEPA) of 1969, was enacted in 1970 as a system of checks and balances for land-use development and management decisions in California. It is an administrative procedure to ensure comprehensive environmental review of cumulative impacts prior to project approval. It has no agency enforcement tool, but allows challenge in courts.

A CEQA project is a project that has a potential for resulting in a direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment. CEQA applies to all discretionary projects proposed to be carried out or approved by California public agencies, unless an exemption applies

In accordance with CEQA, the DTSC has prepared [or reviewed, if DTSC has Responsible Agency status] an [Insert CEQA document title and Lead Agency name, if prepared by another Agency] to ensure that CEQA requirements have been satisfied.

12.0 PUBLIC PARTICIPATION

Instructions: Identify the public participation requirements for the RAP process. Discuss the status of the process and the remaining steps of the process. Generally, the RAP process includes conducting a baseline community survey, developing a Public Participation Plan, publishing a public notice of the public comment period (minimum 30-days) in a local newspaper of general circulation, distributing of a fact sheet describing the proposed remedy selection and the availability of the draft RAP for public comment, conducting a community meeting during the public comment period and publishing a responsiveness summary responding to the comments received during the public comment period. The public is directed to the DTSC office, EnviroStor, and other repositories to conduct their review. All comments received during the public comment period will be responded to in writing and distributed to everyone who submits a comment.

All of the applicable activities described in the preceding paragraph should be summarized in this section.

The public participation requirements for the RAP process include the following [insert other activities, as appropriate]:

Public Participation Requirement	Compliance
1) Development of a Public Participation Plan	1) DTSC approved the Plan on [Date]
2) Holding a minimum 30-day public comment period.	2) Public comment period to be held from [Date] to [Date]
3) Publishing a public notice of the availability of the draft RAP for public review and comment in a local newspaper of general circulation	3) Public notice to run on [Date] in [newspaper]
4) Posting a notice of the availability of the draft RAP for public review and comment at the Site.	4) Copy of the public notice was posted at the Site on [Date] [Discuss translation, if necessary.]
5) Distributing a fact sheet to the site mailing list describing the proposed remedy and the availability of the draft RAP for public comment;	5) Fact Sheet to be distributed out to the mailing list on [Date]. [Discuss translation, if necessary.]
6) Making the draft RAP and other supporting documents available at DTSC's office and in the local information repository(ies).	6) RAP and CEQA-documents were placed in the [local information repository] on [Date]. RAP and CEQA-documents were placed in DTSC's File Room and on its EnviroStor database on [Date].
7) Conducting a public meeting during the public comment period for the draft RAP	7) Community Meeting is scheduled for [Date]
8) Responding to public comments received on the RAP and CEQA documents.	8) Following the close of the public comment period, DTSC will respond to the public comments received in a Responsiveness Summary. The Responsiveness Summary will be mailed to commenters and made a part of the Final RAP.

Once the public comment period is completed, DTSC will review and respond to the comments received. The RAP will be revised, as necessary, to address the comments received. If significant changes to the RAP are required, the RAP will be revised and be resubmitted for public review and comment. If significant changes are not required to the RAP, the RAP will be modified and DTSC will approve the modified RAP for implementation.

13.0 REFERENCES

Instructions: Provide complete citations for all site-related documents and references cited in the RAP.