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Draft Investigation and Risk Assessment Work Plan for the Cross Alameda Trail

City of Alameda Department of Public Works Alameda, California

June 2015

Site Address:
Adjacent to and South of Ralf Appezzato Memorial Parkway between Webster Street and Main Street, Alameda, CA.

Perjury Statement:

"I declare, under penalty of perjury, that the information and/or recommendations contained in the attached document or report is true and correct to the best of my knowledge."

Signed,

REGISTERED GEOLOGIST
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No. 2204
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

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Draft

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City of Alameda
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Alameda, California

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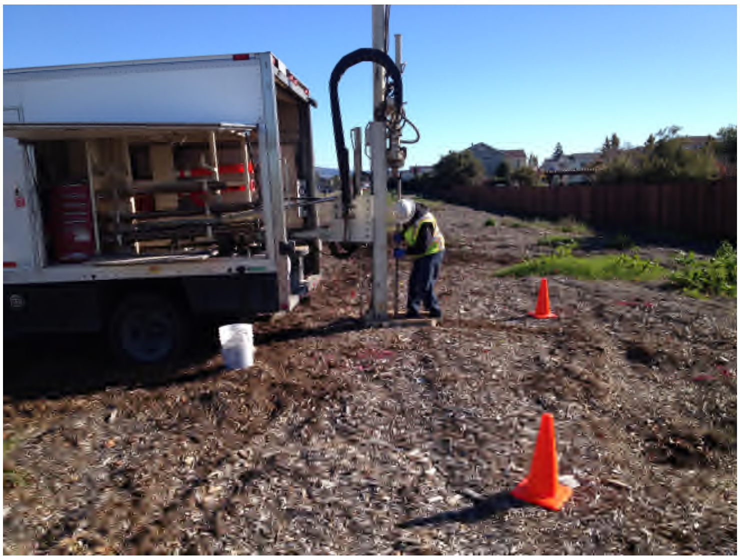

Prepared for:
City of Alameda
Department of Public Works
Alameda, California

Prepared by:
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Alameda, California

PREPARED FOR:

City of Alameda
Department of Public Works
Alameda, California

REVIEW AND APPROVAL

REGISTERED GEOLOGIST
VICTOR EARLY
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STATE OF CALIFORNIA

Project Manager: ______________________ Date: June 2015
Victor Early, CEG, Tetra Tech

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ACRONYMS AND ABBREVIATIONS

ACEH	Alameda County Department of Environmental Health
bgs	Below ground surface
CFR	Code of Federal Regulations
CHHSL	California Human Health Screening Level
COPC	Chemical of potential concern
CSM	Conceptual site model
DTSC	Department of Toxic Substances Control
EDD	Electronic data deliverable
EPA	U.S. Environmental Protection Agency
EPC	Exposure point concentration
ESA	Environmental Site Assessment
HERO	Office of Human and Ecological Risk Assessment
HI	Hazard index
HQ	Hazard quotient
IDW	Investigation-derived waste
mg/kg	Milligrams per kilogram
OEHHA	Office of Environmental Health Hazard Assessment
PAH	Polycyclic aromatic hydrocarbons
PEF	Particulate emission factor
PRG	Preliminary remediation goal
QA	Quality assurance
QC	Quality control
RCRA	Resource Conservation and Recovery Act
REC	Recognized Environmental Condition
RSL	Regional screening level
SLHHRA	Screening Level Human Health Risk Assessment
Tetra Tech	Tetra Tech, Inc.
TPH	Total petroleum hydrocarbons
TEPH	Total extractable petroleum hydrocarbons
TPPH	Total purgeable petroleum hydrocarbons
VOC	Volatile organic compound

1.0 INTRODUCTION

Under contract to the City of Alameda, Department of Public Works (Alameda), Tetra Tech has prepared this subsurface investigation and risk assessment work plan to evaluate whether there is unacceptable chemical contamination of the former railroad corridor property located between Webster Street and Main Street, along the south side of Ralph Appezzato Memorial Parkway (hereinafter referred to as the site), in Alameda, California (Figure 1). The property is owned by the City of Alameda and includes Assessor's Parcel Numbers [APN] 74-905-20-3 and 74-905-20-2. The site occupies approximately 13 acres of former railroad right-of-way and is approximately 4,200 feet in length (Figure 2) (Blackie, 2010).

The environmental investigation and risk assessment described in this work plan is related to a planned project at the site called the Cross Alameda Trail. Construction of the Cross Alameda Trail, a typical rail-to-trail project, will add to the San Francisco Bay Trail. The proposed path is approximately 0.8-mile long and will include separate walking and bike paths, bike lockers, trees, and a bioswale for stormwater runoff control. Upon completion, the Cross Alameda Trail will be open for recreational land use.

1.1 PURPOSE, BACKGROUND, AND SCOPE

The purpose of this investigation is to continue the characterization of subsurface contamination, for COPCs established by Tetra Tech in the *Phase II Environmental Site Assessment Report for the Cross Alameda Trail* (Phase II ESA) dated February 3, 2015 (Tetra Tech, 2015). As a part of the investigation described in this work plan, Tetra Tech will generate soil and groundwater data to further evaluate the extent of contamination previously identified at the site, and perform a screening level human health risk assessment (SLHHRA) based on the levels of contamination identified.

1.2.1 Site History and Previous Investigations

Evidence of railroad tracks are visible in a 1939 aerial photograph but the railroad was also likely present as early as the mid- to late-1910s. The railroad tracks were removed from the parcels in the mid- to late-1950s (Blackie, 2010). Based on observations made on December 29 and 30, 2014 during Tetra Tech's Phase II ESA field work, the site is primarily undeveloped and covered with low vegetation, mulch, and some pavement. The westernmost portion of the site is partially covered by a parking lot for an adjacent business (Tetra Tech, 2015).

The Phase II ESA was done to address recognized environmental conditions (RECs) identified in a Phase I ESA conducted by Belinda P. Blackie, dated March 8, 2010. The Phase I ESA was done for the Alameda Belt Line Parcels (nine non-contiguous parcels comprising 38.81 acres of land including the site), which at the time of the ESA were mostly undeveloped (Blackie, 2010).

The Phase I ESA identified the following RECs for the site:

- Historical railroad tracks;
- Fill, imported soil, and;
- Marsh crust (Blackie, 2010).

Tetra Tech based the initial selection of COPCs for the Phase II ESA on the RECs identified for the site in the Phase I ESA (Blackie, 2010). Chlorinated herbicides were selected because products containing these chemicals are known to have been used for weed control along railroad tracks; arsenic and lead were selected because fill material and imported fill is likely present at the site and similar materials in Alameda are known to contain these chemicals (Blackie, 2010); and petroleum hydrocarbons and polycyclic aromatic hydrocarbons (PAH) were selected because the material known as the Marsh Crust is known to contain these chemicals. The site is possibly within the limit of filling where marsh crust material was disposed, and the original shoreline was approximately within the site or near the southern border of the site with the upland occurring to the south. The marsh crust material was disposed on tidal marshland between 1900 and 1940 to extend dry land from the existing shoreline (City of Alameda, 2015).

A total of 20 soil samples (and one duplicate) were collected from boreholes CAT-B-1 through CAT-B-10. The soil samples were collected from depths ranging from 1 to 8 feet below ground surface (bgs). The borehole locations were selected to be in approximate alignment with the former railroad tracks, as identified on a USGS topographic map from 1959 (Blackie, 2010). The results of the chemical analyses for the soil samples collected during the Phase II ESA are summarized in Tables 1 and 2, and the boreholes are shown on Figure 2. Based on the results of the Phase II ESA chlorinated herbicides and polycyclic aromatic hydrocarbons (PAHs) were excluded as COPCs, and it was determined that further investigation of the extent of lead, arsenic, and petroleum hydrocarbons was warranted (Tetra Tech, 2015).

1.1.1 Objectives

The primary objectives of this work plan are described below:

- Establish procedures applicable for soil borehole installation, water level measurement, the collection of soil and groundwater samples, and the installation of temporary groundwater wells;
- Generate descriptions of lithology to further evaluate the subsurface at the site;
- Further evaluate extent and magnitude of COPCs identified during the Phase II ESA, (excluding chlorinated herbicides and PAHs);
- Describe the procedural steps for completing a SLHHRA that considers unrestricted land use and planned recreational use; and
- Determine whether a significant chemical source exists onsite and if concentrations of chemicals in soil or groundwater (if any) at the site pose an unacceptable risk to human health and the environment.

1.1.2 Scope

To meet the project objectives, the following activities are planned at the site:

- Perform utility clearance and obtain Alameda County Department of Environmental Health (ACEH) permit;
- Prepare site specific Health and Safety plan;
- Install soil boreholes and temporary groundwater wells at select locations based on the soil data generated during the Phase II ESA (Figure 2);
- Measure water levels, collect soil samples from boreholes, and groundwater samples from temporary wells;
- Evaluate extent and magnitude of COPCs using soil and groundwater sample data;
- Log and describe soil cores generated during the investigation;
- Decommission soil boreholes and temporary wells with oversight by ACEH, and dispose of investigation derived waste (IDW); and
- Evaluate soil and groundwater data according to a SLHHRA for the site.

1.2 WORK PLAN ORGANIZATION

This work plan is organized as follows:

- Section 1.0 provides an introduction, the purpose and objectives for the project, the work plan organization, site descriptions, and previous investigations.
- Section 2.0 includes a summary of the field program.
- Section 3.0 presents the approach for the SLHHRA for the site.
- Section 4.0 presents the proposed schedule for the work plan tasks.
- Section 5.0 provides a list of references used in compiling this work plan.

The figures and tables follow the text of this report.

Table 1 and 2 summarizes the results of the chemical analyses for the soil samples collected during the Phase II ESA. Table 3 presents exposure assumptions for the SLHHRA. Figure 1 shows the site location, and Figure 2 shows the Phase II ESA borehole locations and the general vicinity where additional soil investigation is proposed with step-out soil borings. Proposed locations for temporary groundwater wells and the COPCs to be investigated in soil and groundwater are also indicated on Figure 2.

2.0 DATA GENERATION AND ACQUISITION

The following is a brief summary of the field methods for the investigation at the site.

2.1 INVESTIGATION METHODS

This section describes the methods that will be implemented during the investigation field activities.

2.1.1 Site Access

The site is accessible and Tetra Tech plans to drive to each borehole location.

2.1.2 Utility Clearance

Tetra Tech will mark proposed drilling locations at the site in white paint and notify Underground Service Alert (USA) at least 2 working days (48 hours) before any intrusive activities. USA will alert utility operators that have utilities in the vicinity of the site and each utility company with potential onsite buried lines will clear the proposed drill locations. In addition, Tetra Tech will hire a private utility clearance subcontractor for an independent survey to clear each drill location for discernible subsurface utilities using non-intrusive techniques. The location of each identifiable buried utility will be marked either by the utility owner or by the private clearance subcontractor. Certain utilities, such as clay pipes and PVC irrigation lines cannot be readily detected using the geophysical techniques available to utility clearance subcontractors. The City of Alameda should supply Tetra Tech all available utility plans on their property to minimize the possibility of damage to buried utilities that are difficult to detect.

2.1.3 Step-out Boreholes and Soil Sampling

Tetra Tech proposes to install step-out boreholes using direct push drilling technology in the vicinity of Phase II ESA boreholes where COPCs were detected at levels warranting further investigation. Four step-out boreholes are proposed in the vicinity of each of the following Phase II ESA boreholes: CAT-B-1, CAT-B-2, CAT-B-6, CAT-B-7, and CAT-B-10. One step-out borehole will be placed within 3 feet of the initial Phase II ESA borehole to confirm the presence of the COCPs at the borehole, and the remaining three step-out boreholes will be installed approximately 10 feet away from the initial Phase II ESA borehole spaced approximately 120 degrees apart, to surround the borehole. The purpose of the step-out boreholes is to (1) confirm the presence of COPCs identified during the Phase II ESA, and (2) further define the extent of any laterally continuous COPCs in soil at the site. The COPCs being evaluated at each step-out soil investigation location are shown on Figure 2.

Soil cores will be collected in driller-supplied acetate liners at approximately 4-foot depth intervals for lithologic description and retention for possible laboratory analysis. Soil cores will be logged for lithology, including the preparation of borehole logs under the supervision of a professional geologist licensed in the State of California.

Discrete soil samples will be collected using laboratory-provided glass jars; labeled with date, sample identification, and time, entered into a chain-of-custody form, and placed on ice in a cooler for shipment to the laboratory. Samples will be delivered via FedEx to an accredited laboratory under chain-of-custody.

2.1.4 Temporary Wells and Groundwater Sampling

Two temporary groundwater wells will be installed in the vicinity of Phase II ESA boreholes CAT-B-1 and CAT-B-10 to determine whether petroleum hydrocarbons are dissolved in groundwater. Tetra Tech will use direct push drilling technology to collect groundwater samples from each temporary well. Tetra Tech anticipates that groundwater will be encountered at a depth of less than 15 feet bgs. The well casing and screen will be made of 1.5-inch diameter rigid polyvinyl chloride (PVC) casing. A 5-foot screened interval (0.02-inch slot) will span the bottom 5 feet of the temporary well to facilitate groundwater sample collection. Groundwater samples will be analyzed for VOCs, total purgeable petroleum hydrocarbons (TPPH) as gasoline, and total extractable petroleum hydrocarbons (TEPH) as motor oil and diesel.

Before groundwater samples are collected, the static groundwater levels and, if present, free-phase petroleum product thicknesses, will be measured to the nearest 0.01 foot using an oil-water interface probe and electronic water level sounder. The wells will be purged and sampled using the California EPA, Department of Toxic Substances Control (DTSC) guidelines in their Representative Sampling of Groundwater for Hazardous Substances, Guidance Manual for Groundwater Investigations (Cal EPA 2008). A peristaltic pump will be used to purge each well using low-flow purging techniques. During purging of the wells, the water quality parameters temperature, pH, electrical conductivity, oxidation-reduction potential, dissolved oxygen, and turbidity will be measured using a water quality meter. Before sampling, the water quality parameters will be measured until stabilization (See Table for Stabilization Criteria). If the water quality parameters do not stabilize after 20 liters are purged, or the well is purged dry then the groundwater samples will be collected even if the stabilization criteria are not met. The groundwater collected will be placed into appropriate sample containers, labeled with a unique identification number, date, and time and placed into an ice-chilled cooler for transportation to the analytical laboratory under chain of custody documentation.

Parameter	**Stabilization Criteria**
Temperature	± 3% of reading (minimum of ± 0.2° C)
pH	± 0.1
Specific electrical conductivity	± 3%
Oxidation-reduction potential (ORP)	± 10 millivolts
Dissolved oxygen (DO)	± 0.3 milligrams per liter
Turbidity	Relatively clear and free of sediment or <100 Nephelometric Turbidity Unit (NTU)

2.1.5 Decommissioning Soil Boreholes and Temporary Groundwater Wells

Tetra Tech proposes to decommission the soil boreholes and temporary wells via tremie with Type I/II cement-bentonite grout (maximum of 6 gallons of water per 94 pounds of cement, up to 5 percent bentonite) from the bottom of the borehole to the ground surface. Borehole decommissioning will be done according to the requirements of the ACEH. Tetra Tech will schedule accordingly with the ACEH for grout inspections.

2.1.6 Investigation Derived Waste (Waste Management Plan)

All solid and liquid waste generated from this project will be transported and disposed of off-site at the appropriate disposal, treatment, or recycling facility in accordance with federal, state, and local regulations. Between boreholes and after all field work has been completed, subcontracted drillers will decontaminate drill rigs, and equipment will be decontaminated and then demobilized from the site. Tetra Tech will perform a thorough site inspection at the end of the project field work to ensure all trash and investigation materials have been removed from the site. Investigation-derived waste (IDW) that may be generated during the field work includes:

- Decontamination water
- Disposable sampling equipment and personal protective equipment
- Soil and groundwater waste

Any IDW generated will be classified, labeled, managed, and disposed of in accordance with EPA guidance and applicable state and federal regulations. All soil, groundwater, and decontamination water generated from drilling will be drummed on site.

Waste codes applicable to each hazardous waste stream will be identified based on the requirements in 40 Code of Federal Regulations (CFR) 261 or any applicable state or local law or regulation. All applicable treatment standards in 40 CFR 268 and state land disposal restrictions will be identified and a determination will be made as to whether the waste meets or exceeds the standards.

The soil and decontamination water is anticipated to be shipped as Resource Conservation and Recovery Act (RCRA) hazardous waste, non-RCRA hazardous waste, or as nonhazardous waste. The waste will be tracked using hazardous waste and nonhazardous waste manifests, as appropriate. This waste classification will be made by Tetra Tech after the soil has been characterized using the sample data generated during the investigation. A waste disposal subcontractor will profile the waste for disposal. Waste profiles, analyses, classification, and treatment standards will be according to the requirements of the receiving facility. Waste manifests will be signed by an Alameda representative. The IDW will be transported by a subcontracted transporter to the disposal facility within 90 days of generation.

2.2 SAMPLING DESIGN

This section discusses the sampling approach and rationale for the site. Tetra Tech plans to collect soil samples from 5 step-out investigation locations at the site (a total 20 shallow soil boreholes to a maximum depth of 8 feet bgs), as described in Section 2.1.3. Additionally, Tetra Tech plans to collect groundwater samples from two temporary wells, as described in Section 2.1.4. The number of samples per COPC, sample type, and location in relation the Phase II ESA borehole locations is tabulated in the following table.

COPC	Rationale for Further Investigation	Phase II ESA Borehole (Step-out Investigation/Temporary Well)	Number of Boreholes/Samples
TEPH as diesel and motor oil	Table 1 (TEPH results indicate possible petroleum release and extent of contamination is undefined)	CAT-B-1, CAT-B-2, and CAT-B-10 (three step-out soil investigation locations)	12 step-out boreholes and up to 24 soil samples
TPPH as gasoline	Table 1 (possible petroleum release to groundwater based on TEPH data)	CAT-B-1 and CAT-B-10 (two temporary groundwater well locations)	Up to 2 groundwater samples
VOCs	Table 1 (possible petroleum release to groundwater based on TEPH data)	CAT-B-1 and CAT-B-10 (two temporary groundwater well locations)	Up to 2 groundwater samples
Lead	Table 2 (exceeds regulatory screening levels)	CAT-B-6, CAT-B-7, and CAT-B-10 (three step-out soil investigation locations)	12 step-out boreholes and up to 12 soil samples
Arsenic	Table 2 (exceeds background level)[1]	CAT-B-1 and CAT-B-2 (two step-out soil investigation locations)	8 step-out boreholes and up to 16 soil samples

[1] The regional background level for arsenic is 11 mg/kg (Duverge, 2011). Step-out soil investigation is being proposed at Phase II ESA borehole locations where arsenic concentrations exceeded 11 mg/kg, even though concentrations less than background exceed applicable regulatory screening levels.

The rationale for soil and groundwater sampling is described below based on the results of the Phase II ESA soil sample data presented in Tables 1 and 2.

(1) PAHs in soil are not being further investigated because the concentrations of benzo(a)pyrene that exceeded the regulatory screening levels provided in Table 1 appear to be ubiquitous at the site, and are likely widespread in the marsh crust material on adjacent land,

(2) Petroleum hydrocarbons in soil and groundwater are being investigated to better understand the nature and extend of petroleum contamination in certain areas of the site (see Table 1),

(3) Petroleum hydrocarbons and VOCs in groundwater are included to determine if groundwater has been contaminated with petroleum constituents,

(4) Lead in soil is being further investigated to better understand the extent of lead in soil exceeding regulatory screening levels (see Table 2), and

(5) Arsenic is being investigated in areas of the site where concentrations of arsenic exceed the regional background level for arsenic (see Table 2).

2.3 ANALYTICAL METHODS

Analytical methods were selected to obtain the chemical information needed for making decisions at the site. The soil and groundwater samples will be analyzed by a certified State of California, Environmental Laboratory Accreditation Program (ELAP) laboratory. The soil and groundwater samples will be analyzed using the following United States Environmental Protection Agency (USEPA) methods covering the COPCs for the site:

- TEPH in soil by USEPA Method 8015M;
- PAH in soil by USEPA Method 8270C;
- Lead and arsenic in soil by USEPA Method 6020;
- Volatile organic compounds (VOCs) in groundwater by EPA Method 8260B; and
- TPPH as gasoline in groundwater by EPA Method 8260B.

The subcontracted laboratory will provide electronic data deliverables (EDD) for all analytical results.

2.4 DATA ASSESSMENT AND USE

The data will be fully assessed to confirm the overall data quality. The analytical laboratory will conduct analyses for establishing quality assurance/ quality control (QA/QC) for the sample analyses. These will include analysis of blanks, spikes of surrogate compounds, laboratory control samples, and matrix spike/matrix spike duplicates. Tetra Tech will review the laboratory reports for conformance with the requested analyses and established protocols for the referenced methods. Based on the laboratory QA/QC data, Tetra Tech will determine if the sample data is considered valid for use in the SLHHRA described below.

Relative percent difference (RPD) values for duplicate sample analytical results will be calculated to evaluate the precision of the analyses of groundwater samples (one duplicate sample will be collected). The RPD goal, which will only applied to constituents with concentrations greater than 10 times their respective laboratory method detection limits, is 30 percent or less for field duplicates. Based on the results of the RPD evaluation which provides an indication of precision of the sampling and/or analytical methods, Tetra Tech will make a determination about the validity of the data.

3.0 RISK ASSESSMENT APPROACHES

The following section presents the approach for the SLHHRA for the site.

3.1 SCREENING LEVEL HUMAN HEALTH RISK ASSESSMENT METHODOLOGY

The investigation will include a SLHHRA. This section describes the methodology that will be used to complete the SLHHRA. The SLHHRA process involves using conservative screening levels to estimate cumulative cancer risks and noncancer hazards. If the cumulative risk and hazard index (HI) estimates are acceptable using conservative screening assumptions, then site-specific conditions can be expected to result in acceptable risks and hazards. The results of a SLHHRA indicate whether a quantitative baseline risk assessment or further site investigation is warranted.

The methods used to conduct the SLHHRA are based on the risk assessment framework developed by EPA. The framework is set forth in *Risk Assessment Guidance for Superfund (RAGS), Volume I, Human Health Evaluation Manual (Part A)* (EPA 1989) and "Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities" (DTSC 1992). The SLHHRA will consist of the following seven components, described in the sections below.

- Conceptual Site Model (CSM) (Section 3.1.1)
- Data Evaluation for Chemicals of Potential Concern (COPC) (Section 3.1.2)
- Exposure Assessment (Section 3.1.3)
- Toxicity Assessment (Section 3.1.4)
- Risk Characterization and Results (Section 3.1.5)
- Uncertainty Analysis (Section 3.1.6)
- Exit Criteria for the SLHHRA (Section 3.1.7)

3.1.1 Conceptual Site Model

The CSM summarizes information about sources of chemicals at the sites, affected environmental media, chemical release and transport mechanisms that may occur at the site, potential exposed receptors, and potential exposure pathways for each receptor. The CSM for the site will be refined as the data from the investigation described in this work plan is collected and evaluated. The components of the CSM that will be included in the SLHHRA are briefly discussed below.

3.1.1.1 Sources of Site Chemicals

The Phase I and Phase II ESA for the site were used to establish petroleum hydrocarbons, VOCs, and lead and arsenic as COPCs for the site. The chemical identified at the site in the Phase II ESA are hypothesized to have originated from historical uses identified in the Phase I ESA for the site. Historical uses of the site include import fill and marsh crust materials disposal, and the operation of railroad tracks are summarized in Section 1.2.1 of this work plan. COPCs have been identified at levels warranting further investigation in soil from 1 foot bgs to 5 feet bgs throughout the site (Tables 1 and 2, Figure 2).

3.1.1.2 Affected Environmental Media

Historical use of the site likely resulted in chemical releases to soil, which may have been transported to groundwater. VOCs in soil gas may potentially migrate into overlying residential or industrial/commercial buildings constructed at the sites in the future, as well as into ambient (outdoor) air.

3.1.1.3 Potentially Exposed Human Receptors

The site is currently vacant, unused land owned by the City of Alameda. Future recreational use of the site as the Cross Alameda Trail is proposed, and is the reason for the proposed SLHHRA.

It is expected that risks will be quantified for the following receptors: (1) residential users representing an unrestricted use scenario, and (2) site-specific recreational users. While a construction worker may be present at the site in the future, the scenario is not part of the SLHHRA because of the lack of generic risk-based screening levels (RBSL). If the SLHHRA cumulative risk and HI estimates for cancer risks and noncancer hazards are unacceptable for residential and recreational receptors then the site-specific construction worker scenario may need to be evaluated.

3.1.1.4 Potentially Complete Exposure Pathways

According to guidance from EPA (1989), a complete exposure pathway consists of four elements:

- A source and mechanism of chemical release
- A retention or transport medium (or media, in cases involving transfer of chemicals)
- A point of potential human contact with the contaminated medium (referred to as the exposure point)
- An exposure route (such as ingestion) at the exposure point

The CSM identifies whether exposure pathways are potentially complete or are considered incomplete. Only potentially complete exposure pathways will be considered in the SLHHRA. As discussed below in Section 3.1.5, receptor-specific risks and hazards are calculated by comparing medium-specific chemical concentrations to medium-specific RBSLs. The RBSLs in turn have been calculated based on a series of default exposure pathways. For the purpose of the SLHHRA, residential and recreational user RBSLs will be considered.

3.1.1.4.1 Soil

Three potentially complete exposure pathways from surface and subsurface soil were identified for the receptors that will be evaluated in the SLHHRA:

- Incidental ingestion of soil
- Dermal contact with soil
- Inhalation of chemicals released to outdoor air from wind erosion and volatilization

These three soil pathways will be evaluated for surface and subsurface soil and incorporated into development of soil RBSLs to be used in the SLHHRA for residential and recreational users. Soil RBSLs for the residential and recreational users will be based on EPA's soil regional screening levels (RSL) (EPA 2015); however, if a more conservative (that is, lower) "Cal-modified 2004 EPA Region 9 preliminary remediation goal (PRG)" (DTSC 2012) or Office of Environmental Health Hazard Assessment (OEHHA) California Human Health Screening Level (CHHSL) has been established (OEHHA, 2010), then this will be used instead of the EPA RSL. For the recreational user, generic RBSLs are not available; thus, site-specific RBSLs will be developed using EPA-derived exposure algorithms (EPA 2015). The DTSC, Office of Human and Ecological Risk (HERO), Note Number 3 will be used to help incorporate the EPA RSLs with the HERO human health risk assessment process. TPH data will be evaluated using the San Francisco Bay Regional Water Quality Control, Environmental Screening Levels (ESLs) (RWQCB, 2013).

3.1.1.4.2 Groundwater

Three potentially complete exposure pathways for groundwater used for household domestic uses were identified for future residents that will be evaluated in the SLHHRA:

- Ingestion of groundwater as a source of drinking water
- Dermal contact with groundwater during domestic use
- Inhalation of vapors released from groundwater to indoor air during domestic use

The three pathways evaluated for groundwater are incorporated into the residential tap water RBSLs that will be used in the SLHHRA, which are based on EPA tap water RSLs (EPA 2015). For the recreational user, generic RBSLs are not available; thus, site-specific RBSLs will be developed using EPA-derived exposure algorithms (EPA 2015). The DTSC, Office of Human and Ecological Risk (HERO), Note Number 3 will be used to help incorporate the EPA RSLs with the HERO human health risk assessment process. TPH data will be evaluated using the San Francisco Bay Regional Water Quality Control, Environmental Screening Levels (ESLs) (RWQCB, 2013).

3.1.2 Data Evaluation and Selection of Chemicals of Potential Concern

Only analytical data derived from soil and groundwater samples will be considered in the SLHHRA. Field screening data (for example, waste characterization data) will not be considered in the SLHHRA because this data does not meet data quality criteria for risk assessment.

3.1.2.1 Data Evaluation

All analytical data obtained during the investigation will undergo cursory validation using EPA Contract laboratory Program National functional Guidelines for Inorganic and Organic Data Review (EPA 2008, 2010a) and the associated analytical methods. Approximately, 20 percent of the data will undergo full validation to verify the data meet EPA data quality criteria for use in risk assessment (EPA 1992).

All data without qualifiers and all data qualified as estimated (J) and not detected (U or UJ) will be used in the SLHHRA. Any analytes not detected in any medium-specific samples will be excluded from consideration for that medium.

Duplicate samples for groundwater will be collected to assess laboratory precision. The highest detected concentration for each detected chemical in the normal and duplicate sample will be used as the concentration for that sample location for sample location where a normal and duplicate sample are collected.

3.1.2.2 Data Reduction

No data reduction processes additional to those described above in the data evaluation section will be implemented in the SLHHRA.

3.1.2.3 Data Grouping

Surface and subsurface soil data will be evaluated to determine soil exposure to a future resident or recreational user at the site as described below:

- **Surface soil** is represented by samples collected from 0 to 0.5 feet bgs, where 0.5 feet represents the deepest end-depth interval. This data set will be used to evaluate potential current/future exposures associated with the current site configuration, assuming little or no redevelopment and minimal disturbance of deeper (subsurface) soils.

- **Subsurface soil** that could become surface soil in the future is represented by soil samples collected from 0 to 10 feet bgs, where 10 feet represents the deepest end-depth. This data set will be used to evaluate potential future exposures associated with possible intrusive development, whereby future regrading or excavation may redistribute subsurface soils to the surface.

- **Groundwater** will be evaluated for evaluation of future residential and recreational exposure to groundwater through domestic use.

3.1.2.4 Selection of COPCs

COPCs are chemicals carried through the quantitative exposure assessment and risk characterization. The COPCs previously identified through Phase I and II ESAs may be refined as the SLHHRA is prepared. COPCs for soil and groundwater will be identified separately for each data grouping. All chemicals detected in at least one sample, except essential human nutrients (calcium, magnesium, potassium, and sodium), will be initially identified as COPCs. Data for specific TPH indicator chemicals (for example, benzene, toluene, ethylbenzene, and xylenes) will be used to assess potential human health risk from TPH contamination in groundwater.

3.1.3 Exposure Assessment

An exposure assessment identifies potential human receptors that could be exposed to site-related chemicals, as well as the exposure routes, magnitudes, frequencies, and durations of the potential exposures. Potential exposure scenarios and pathways will be documented in the CSM. The final step of the exposure assessment, quantification of COPC intake by exposure pathway, is not used in the SLHHRA because the SLHHRA applies standard RBSLs and a ratiometric approach (see Section 3.1.5) to estimate risks and hazards. The remainder of this section describes the process used to estimate exposure point concentrations (EPC) for COPCs for each exposure scenario.

The EPC is the concentration of a COPC in an exposure medium (for example, surface soil) to which a receptor may be exposed. The maximum detected concentrations will be used as the EPC for each COPC in soil, and groundwater. COPCs in soil and groundwater may be transferred to outdoor air from wind erosion or volatilization and to indoor air from volatilization. Samples of outdoor and indoor air will not be collected at the site. Transport models are incorporated into the RBSLs to account for transfer mechanisms from these media in the absence of direct measurements of chemical concentrations in air. The RBSLs will then be used to calculate risk to a receptor. Section 3.1.5 discusses the methods used to calculate risks and hazards at the sites.

3.1.3.1 Outdoor Air – Particulate Chemicals Released from Soil

To derive EPCs for airborne particulates, EPA uses a model that calculates a particulate emission factor (PEF) relative to the contaminant concentration in soil and the concentration of respirable particulates in the air due to fugitive dust (erosion from wind) emissions from contaminated soils. The soil EPC is multiplied by the reciprocal of the PEF, which is a non-chemical-specific value that relates chemical concentrations in soil to airborne concentrations that may be inhaled. The EPA (2012) default PEF of 1.36E+09 cubic meters per kilogram is used to develop the RBSL.

3.1.3.2 Outdoor Air – Volatile Chemicals Released from Soil

EPCs for volatile compounds released from soil to outdoor air will be estimated using the soil EPCs as the source term along with an EPA methodology on the derivation of RSLs (EPA 2012). To derive these outdoor air EPCs, the soil EPC is multiplied by the reciprocal of a chemical-specific volatilization factor, which is a chemical-specific value that relates chemical concentrations in soil to airborne concentrations that may be inhaled.

3.1.4 Toxicity Assessment

The medium-specific RBSLs already incorporate the most current, accepted chemical- and medium-specific toxicity factors (EPA 2015).

As necessary, the SLHHRA will incorporate chemical surrogates for any COPCs for which toxicity criteria and corresponding generic RBSLs have not been established.

Risks from lead in soil will be characterized by comparing the EPC with the OEHHA industrial and residential CHHSLs (320 and 80 milligrams per kilogram [mg/kg], respectively) (OEHHA, 2010).

3.1.5 Risk Characterization and Results

Risk characterization involves combining EPCs, daily intakes, and toxicity criteria to calculate the potential for health risks associated with exposure to COPCs. Cancer risks and noncancer health hazards are characterized separately. Health risks for the sites will be estimated using a "risk-ratiometric" approach. In this approach, the ratio of EPCs (maximum detected site concentration) to RBSLs will be multiplied by the target cancer risk (1×10^{-6}) or target HI (1) to estimate health risks. The resulting risk estimates are numerically equivalent to the estimates obtained using the EPA (1989) "forward calculation methodology."

For each exposure scenario, RBSLs for carcinogenic COPCs are based on a target cancer risk of 1×10^{-6}, and for noncarcinogenic COPCs are based on a target noncancer HI of 1. Both cancer-based and noncancer-based RSLs were considered for COPCs associated with both cancer and noncancer effects. The RBSL equations are presented in EPA (2015).

3.1.6 Uncertainty Analysis

Varying degrees of uncertainty are introduced at each stage of the SLHHRA process. These uncertainties arise from assumptions made in the risk assessment and from limitations of the data used to calculate risks and hazards. The general and most significant sources of uncertainties will be identified and the direction and magnitude of the likely impact of each uncertainty on the risks and hazards presented in the SLHHRA will be discussed.

3.1.7 Exit Criteria for the SLHHRA

Three decision criteria control the outcome of the SLHHRA: existence of a complete exposure pathway from the chemical to the receptor, chemicals detected at concentrations exceeding background, and chemical concentrations that exceed the RBSLs.

If these three criterion are absent then no further action would be recommended with regards to the COPCs evaluated in this investigation.

If any of the three criterion are part of the outcome then further investigation, additional risk characterization, or site remediation may be necessary.

4.0 PROPOSED SCHEDULE

Task	**Estimated Start Date**	**Estimated Completion Date**
Draft Work Plan		19-June 2015
Agency Review	22-June-2015	20-July 2015
Final Workplan	21-July 2015	24-July 2105
Field Work, Sampling	27-July 2015	7-August 2015
Laboratory Analysis	7-August 2015	4-September 2015
Draft Report	7-September 2015	25-September 2105
Agency Review of Draft Report	25-September 2015	16-October 2015
Final Report	19-October 2015	23-October 2015

5.0 REFERENCES

Blackie, 2010. Belinda P. Blackie, Phase I Environmental Site Assessment, ABL Parcels, Alameda, California. March 8, 2010.

Brown et al, 2010. Attenuation of Naturally Occurring Arsenic at Petroleum Hydrocarbon-Impacted Sites, Seventh International Conference on Remediation of Chlorinated and Recalcitrant Compounds (Monterey, California. May 2010.

California Environmental Protection Agency (Cal EPA) 2008. California Environmental Protection Agency, Department of Toxic Substances Control. Representative Sampling of Groundwater for Hazardous Substances, Guidance Manual for Groundwater Investigations. July 1995, Revised February 2008.

Code of Federal Regulations (CFR). “Title 40- Protection of Environment, Chapter 1 Environmental Protection Agency, Subchapter 1 Solid Wastes, Part 261- Identification and Listing of Hazardous Waste.”

CFR. “Title 40 Protection of Environment, Chapter 1 Environmental Protection Agency, Subchapter 1 Solid Wastes, Part 268- Land Disposal Restrictions.”

City of Alameda, 2015. March Crust. http://alamedaca.gov/community-development/building/marsh-crust. Website accessed on January 27, 2015.

DTSC. 1992. “Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities.” Office of the Science Advisor. July.DTSC. 2014. “DTSC Recommended Methodology for Use of U.S. EPA Regional Screening Levels (RSLs) in Human Health Risk Assessment (HHRA) Risk Assessment Process at Hazardous Waste Sites and Permitted Facilities.” Office of Human and Ecological Risk (HERO). HERO HHRA Note Number 3. July 2014. Available on-line at: < http://www.dtsc.ca.gov/AssessingRisk/upload/HHRA-Note-3-2.pdf >.

Duverge, 2011. Establishing Background Arsenic in Soil of the Urbanized San Francisco Bay Region, by Dylan Jacques Duverge, San Francisco State University. December 2011.

EPA. 1989. *Risk Assessment Guidance for Superfund (RAGS), Volume I, Human Health Evaluation Manual (Part A)*. Interim Final. Office of Emergency and Remedial Response (OERR). EPA/540/1-89/002. December. Available on-line at: <http://www.epa.gov/oswer/riskassessment/ragsa/>

EPA. 1992. “Guidance for Data Usability in Risk Assessment (Part A).” Publication 9285.7-09A. OERR. Washington, D.C. PB-92-963356. April.

EPA. 1997. “Health Effects Assessment Summary Tables.” Office of Research and Development.

EPA. 1999. “Compendium of Methods for Determination of Toxic Organic Compounds in Ambient Air – Second Edition.” Center for Environmental Research Information. EPA/625/R-96/010b. January.

EPA. 2000a. “Data Quality Objectives Process for Hazardous Waste Site Investigations (EPA QA/ G-4HW).” Office of Environmental Information. Washington, DC. EPA/600/R-00/007. January.

EPA. 2000b. “Guidance for the Data Quality Objectives Process, EPA QA/G-4.” Office of Environmental Information. Washington, DC. EPA/600/R-96/055. August.

EPA. 2008a. “Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), Update IV.” Promulgated revisions through 1998. Office of Solid Waste and Emergency Response. Washington, DC. January.

EPA. 2008b. “USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review.” June. Available on-line at: <http://www.epa.gov/superfund/programs/clp/download/somnfg.pdf>

EPA. 2010a. “USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review.” January. Available on-line at: <http://www.epa.gov/superfund/programs/clp/download/ism/ism1nfg.pdf>

EPA. 2015. Regional Screening Levels for Chemical Contaminants at Superfund Sites. May. Available on-line at: <http://www.epa.gov/region9/superfund/prg/index.html>

Office of Environmental Health Hazard Assessment (OEHHA), 2010. California Human Health Screening Levels (CHHSLs), Table 1 Soil and Soil-Gas Screening Numbers (mg/kg) for Nonvolatile Chemicals Based on Total Exposure to Contaminated Soil: Inhalation, Ingestion and Dermal Absorption. September 23, 2010.

San Francisco Bay Regional Water Quality Control Board (RWQCB), 2013. Environmental Screening Levels for Specific Concerns. December 2013.

Tetra Tech, 2015. Phase II Environmental Site Assessment on the Cross Alameda Trail Project, Alameda, California. February 3, 2015.

FIGURES

Figure 1

Figure 2

TABLES

Table 1

Table 2

Table 3