Revised

Remedial Design Characterization Report for the Former Sanitary Landfill Lockheed Martin Corporation, Beaumont Site 1 Beaumont, California



Volume 1

Prepared for:







Volume 2 - Appendices







Volume 3 - Appendices





Volume 4 - Appendices







Volume 5 - Appendices





Lockheed Martin Corporation, Shared Services Energy, Environment, Safety and Health 2950 North Hollywood Way, Suite 125 Burbank, CA 91505 Telephone 818-847-0197 Facsimile 818-447-0256



July 8, 2009

Mr. Daniel Zogaib Southern California Cleanup Operations Department of Toxic Substances Control 5796 Corporate Avenue Cypress, CA 90630

Subject:

Submittal of Revised Characterization Report for the Former Sanitary Landfill, Lockheed Martin Corporation, Beaumont Site 1, Beaumont, California

Per the agreement to provide change pages, the following are enclosed:

- hard copy of the entire report body and Appendices B and D;
- a replacement notebook cover and spine;
- and a signed replacement page for SDG 08G195 in Appendix F.

In addition, please find a CD of the entire deliverable with all changes incorporated.

These changes are in compliance with responses to DTSC comments submitted to DTSC on May 21, 2009 and approved by email to Mr. Villeneuve on June 27, 2009.

If you have any questions regarding this submittal or the status of site activities, please contact me at 408.756.9595 or denise.kato@lmco.com.

Sincerely,

Denise Kato

Remediation Analyst Senior Staff

Enclosure

Copy with Enc:

Gene Matsushita, LMC (hard copy & electronic copy)
Tom Villeneuve, Tetra Tech, Inc. (hard copy & electronic copy)

Bur 142 Beau1 Landfill Characterization Report Submittal

DRAFT

RESPONSE TO DTSC COMMENTS ON THE CHARACTERIZATION REPORT FOR THE FORMER SANITARY LANDFILL LOCKHEED MARTIN CORPORATION, BEAUMONT SITE 1, BEAUMONT, CALIFORNIA TETRA TECH, INC MAY 2009

General Comments					
Comment	Response	Proposed Action			
1. Appendix F: All laboratory reports should be finalized and signed by the laboratory manager. See first reports of volumes 3 and 4, as examples.	Tetra Tech concurs with this comment.	Electronic copies of the laboratory reports with signatures will be provided on CD.			
2. A Recommendations section should be included in this report.	The results of this investigation will be incorporated as part of the larger data collection and evaluation into the upcoming dynamic investigation report. If recommendations are necessary they will be included as part of the dynamic report.				

Specific Comments					
Comment	Response	Proposed Action			
1. Figure 1-6: Attempted groundwater monitoring well locations at H49-HSAS6 and H49-HSAS8 should be identified on the figure.	Tetra Tech concurs with this comment.	The figures will be modified to reflect this comment.			
2. Section 1.2.3 Groundwater Investigations: "Therefore, impacts to groundwater do not appear to be a concern at the landfill at this time." The phrase, "at this time" should be clarified. Additionally, a shallow groundwater monitoring well should be proposed closer to the creek or a rationale provided why the installation was abandoned	During the 2007 investigation, a groundwater monitoring well was attempted at the landfill but not installed due to the drilling method limitations. The investigation used the HSA drilling method. Based on the investigation, impacts to groundwater did not appear to be a concern at the landfill. Future groundwater	Text will be added to address this comment.			

DRAFT

RESPONSE TO DTSC COMMENTS ON THE CHARACTERIZATION REPORT FOR THE FORMER SANITARY LANDFILL LOCKHEED MARTIN CORPORATION, BEAUMONT SITE 1, BEAUMONT, CALIFORNIA TETRA TECH, INC MAY 2009

Specific Comments					
Comment	Response	Proposed Action			
	investigations of this area were to be completed as part of the Dynamic Site Investigation which would utilize a more robust drilling method to investigate potential impacts to groundwater.				
	It should be noted that during the dynamic site investigation, four groundwater monitoring wells were installed at this feature to evaluate potential impacts to groundwater. However, since this investigation was completed subsequent to the landfill characterization investigation, the results and evaluation shall be discussed in the dynamic investigation report.				
3. Appendix B: All waste designations in the legend should be modified to match the figure. The symbol representing waste is white, whereas the waste is illustrated with lithology type in color in all cases. Attempted groundwater monitoring well locations at H49-HSAS6 and H49-HSAS8 should be identified on the figure.	The intent was to superimpose the waste symbol with the soil type designation since waste was mixed with various soil types.	Where applicable, the legend will be clarified by adding the statement "superimposed within specific lithology" next to the waste symbol.			



WILLIAM MUIR July 2009 TC 20305-01

Prepared for Lockheed Martin Corporation Burbank, California

Prepared by Tetra Tech, Inc

Christie Espinoza

Project Engineer

William Muir, PG California 6762

Deputy Project Manager

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1.0 INTRODUCTION

This Characterization Report (Report) for the Former Beaumont Site 1 Sanitary Landfill (herein referred to as the "Sanitary Landfill") was prepared by Tetra Tech, Inc. (Tetra Tech), on behalf of Lockheed Martin Corporation (LMC). A Clean Closure Preparation Plan (Work Plan), dated October 2007, outlined the conceptual plan and approach for the potential clean closure of the Sanitary Landfill (Tetra Tech, 2007a) and was approved in a letter dated 20 September 2007 from the California Department of Toxic Substances Control (DTSC). There is a continuing risk at the Sanitary Landfill of leaching of contaminants from disposed materials and a potential explosive hazard from the unspent propellant in the practice ammunition in the landfill. The purposes of this Report are to document the characterization activities associated with the evaluation of four areas (drainage, T-depression, soil mound and buried spent casings encircle) within the Sanitary Landfill to help further identify potential risks, and possible mitigation measures.

The objectives of this Report are to:

- Summarize the results of the previous investigations;
- Describe the technical approach implemented during the characterization activities;
- Provide an interpretation of the surface and subsurface geology and sampling activities conducted;
- Assess the impact to soil adjacent to the waste cells; and
- Present data gaps and conclusions.

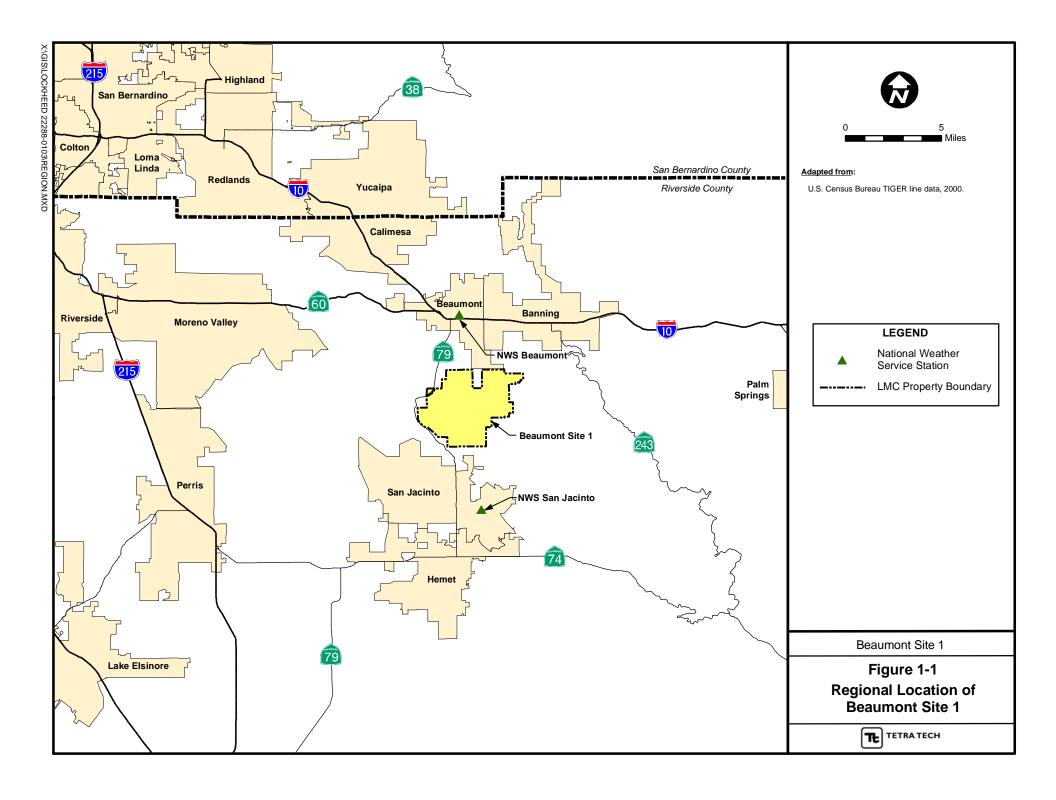
This section of the Report provides an overview of the document, and a brief summary of historical operations and the previous environmental investigations conducted at the Sanitary. The remainder of this Report is organized as follows.

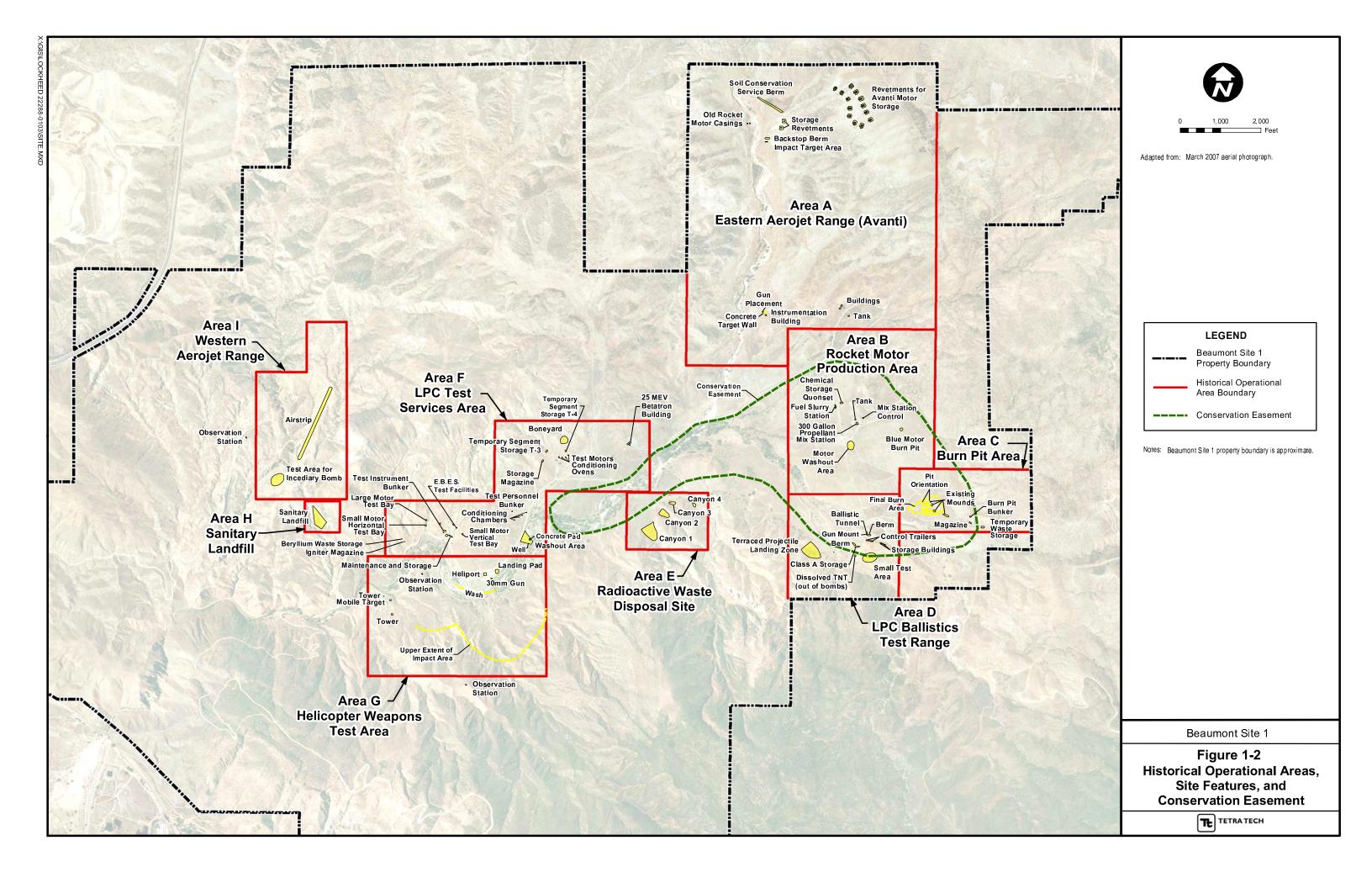
- <u>Section 2 Technical Approach</u>: This section provides a description of the activities conducted as part of the characterization investigation including site preparation, field approach and deviations from the work plans (if applicable).
- <u>Section 3 Results of Characterization</u>: This section provides a description of the field observations, laboratory analytical results and extent of impacts.
- <u>Section 4 Summary and Conclusions</u>: This section summarizes the results of the site investigation and conclusions.

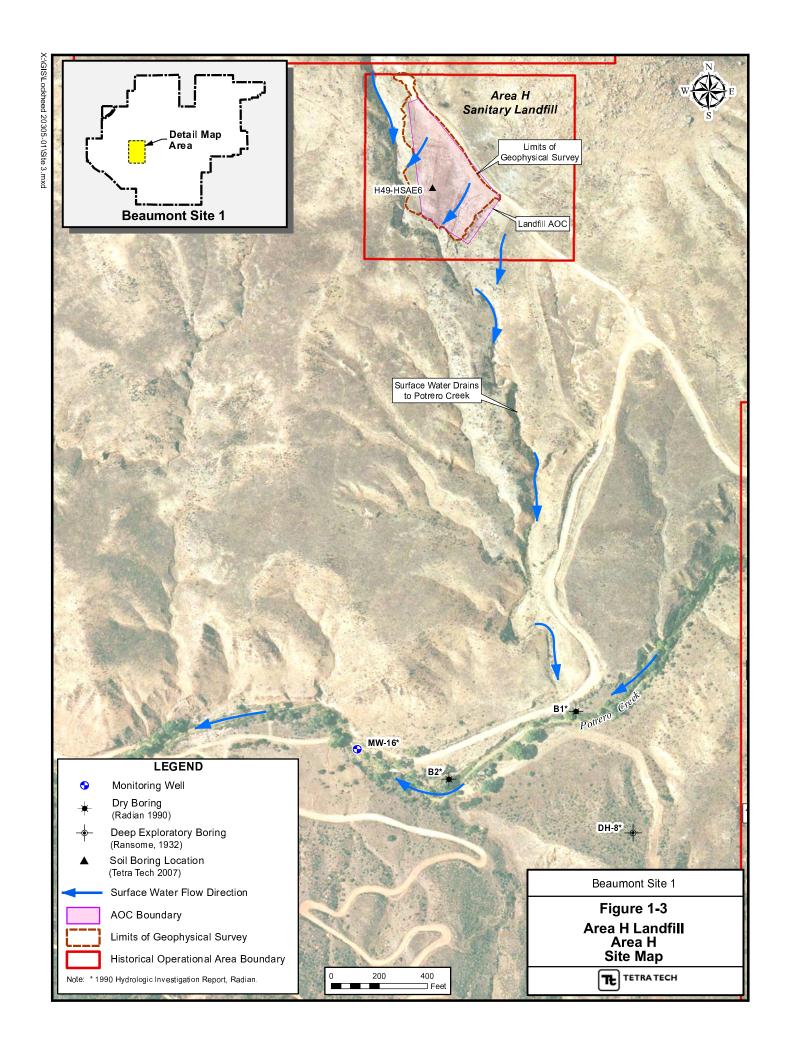
1.1 SITE BACKGROUND

The former Lockheed Beaumont Site 1 (herein referred to as the "Site") is a 9,117-acre parcel located south of Beaumont, California (Figure 1-1). The Site was primarily used for ranching prior to 1960. From 1960 to 1974, the Site was used by Lockheed Propulsion Company (LPC) for solid rocket motor and ballistics testing (Tetra Tech, 2003a). Activities at the Site also included burning of process chemicals and waste rocket propellants in an area commonly referred to as the burn pit area (BPA). Nine (9) primary historical operational areas have been identified at the Site. A Site historical operational areas and features map is presented as Figure 1-2. Each historical operational area was utilized for various activities associated with rocket motor assembly, testing, and propellant incineration.

Of the nine operational areas, the Sanitary Landfill is located in the western portion of the Site in Operational Area H. The Sanitary Landfill is positioned on the eastern flank of a ravine that drains to Massacre Canyon and is located approximately 2,000 feet up slope of the canyon (Figure 1-3). The surface of the landfill slopes gently (5 to 20 %) away from the road located on the eastern side of the landfill and then falls sharply away into a deep ravine. The relatively flat portion of the area was used as the sanitary landfill during the period the LMC facility was in operation. The Sanitary Landfill covers an irregular area approximately 3.0 acres in size. Based on previous investigations, the waste cells occupy approximately 16.6% or a 0.5 acre of the total landfill area. According to the Historical Report (Radian 1986a), the landfill was operated under an annually approved permit from the California Department of Forestry. The landfilled materials consisted mainly of paper, scrap metal, concrete and wood. Visible debris was exposed on the ground surface along with several empty 55-gallon drums. The trenches excavated for landfilled materials disposal were later covered and leveled. The Historical Report indicates that company policy strictly dictated that hazardous materials were not to be disposed of in the landfill; however, anecdotal information collected from a former LPC employee during the 2005 Munitions and Explosives of Concern (MEC) evaluation indicates that small amounts of 30 and 40 millimeter practice ammunition were occasionally disposed of in the Sanitary Landfill (Tetra Tech, 2005b).







1.2 PREVIOUS INVESTIGATIONS AT THE SANITARY LANDFILL

This section briefly describes the previous investigations conducted and information collected on the Sanitary Landfill from 1986 to 2007.

1.2.1 Landfilled Material Investigations

The Sanitary Landfill was operated under an annually renewed permit obtained from the Beaumont station of the California Department of Forestry during the late 1960s and early 1970s. The permit allowed LPC to dispose of landfilled materials generated at the Site in excavated trenches. The landfilled materials consisted of paper, scrap metal, concrete, and wood generated during daily operations, (Radian 1986a).

A geophysical investigation was conducted at the Sanitary Landfill by Norcal. Using a Schonstedt model GA-52B magnetic locator to determine the lateral extent of buried metal debris, locations of magnetic anomalies were established with measuring tapes laid out along transect lines. About 1,300 linear feet of transects were scanned at the Beaumont Site 1 landfill. Anomalies were found indicating buried landfilled materials. The endpoints of the transects were referenced on a large scale map but the endpoints were not located by a land survey. (Radian 1986b).

A 1990 Investigation Report detailed the findings from the subsurface investigation of various locations at the Site including the Sanitary Landfill. Twenty-three trenches were dug using a tracked excavator at the landfill. Landfilled materials were located in eleven of these locations at depths between 4 to 10 feet below the surrounding land surface. The landfilled materials were categorized into two types: general (consisting of paper, wood debris, plastic bags and sheeting, and rubber scrap) and scrap metal (consisting of empty drums, wire, welding rods and spent rocket casings). Composite samples were collected from four locations selected to represent different types of landfilled materials found in the trenches. Samples were analyzed for volatile organic compounds (VOCs) by Method 8240, semi-volatile organic compounds by Method 8270, priority pollutant metals by Method 6010, and nitrates by Method 353.2. Five soil vapor samples were collected around the perimeter of the landfill. VOCs were detected in one sample and tentatively detected in two additional samples. (Radian 1990).

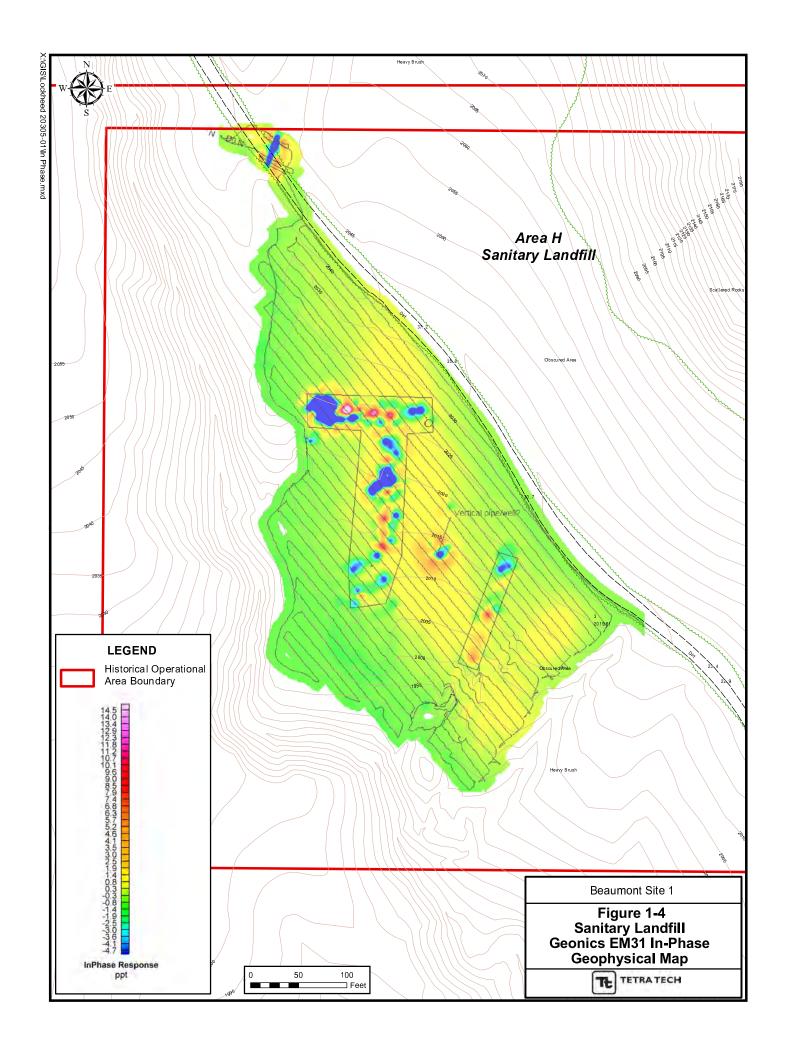
The trenching investigation showed that the landfilled materials were consistent with materials generated from the general operations at the facility and did not exhibit toxic or hazardous properties. Analysis of soil samples taken below the landfilled materials did not show significant concentrations of any priority pollutants. No compounds were detected at concentrations of concern in the groundwater 3,000 feet downgradient of the landfill in Massacre Canyon (following the course of drainages to MW-16). The

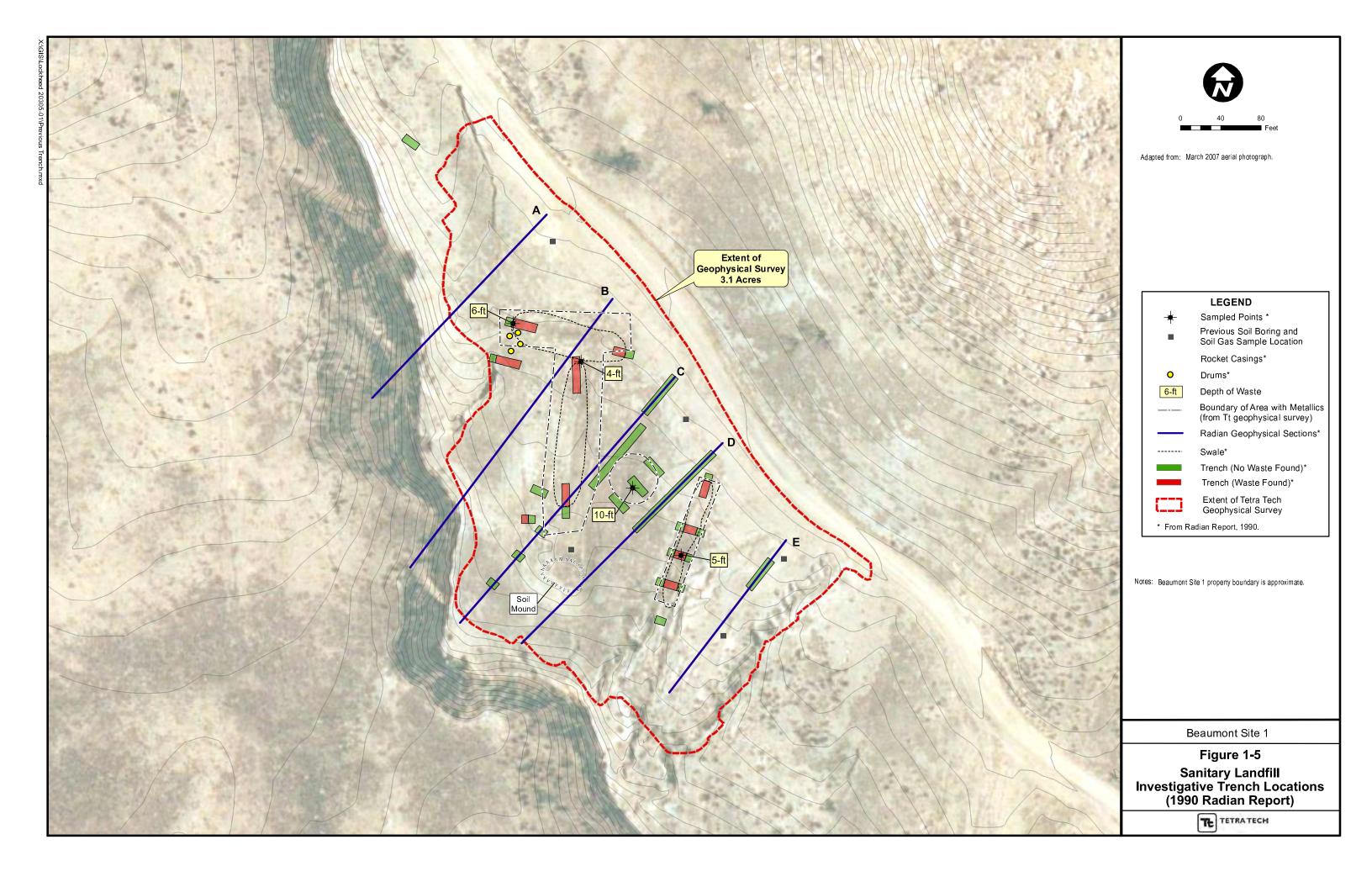
Treatability Study report (Radian 1992) stated that the results from the subsurface investigation at the landfill were consistent with Lockheed's policy of prohibiting the disposal of hazardous materials in the landfill and no further action was recommended for the landfill.

During the summer of 2005 a geophysical investigation using an EM 31 MKI and a Schonstedt magnetic locator was conducted by Tetra Tech, see Figure 1-4, (Tetra Tech, 2006). The survey area was generally triangular in shape, bounded by a canyon along the western edge; the road along the northeastern edge; and a side drainage along the southeastern edge. The survey transect lines were spaced 10 feet apart roughly parallel to the roadway bounding the northeast edge of the landfill; this orientation was also approximately perpendicular to the steep side drainages in the southern portion of the survey area. The location of this series of drainages is evident in the irregular track data in that part of the survey area. The main channel in the side drainage was too steep and deep to safely negotiate with the EM31 MKI. The side walls of this drainage were examined for the presence of protruding debris. None was observed. In addition, the area opposite of the main drainage (towards the SE) was screened with the Schonstedt magnetic locator and no anomalous areas were identified. The results from the survey generally confirm the previous geophysical and trenching results and spatially fixed the location of the waste cells (Figure 1-5).

The majority of the landfilled materials appear to be located within four trenches that occupy a combined surface area of approximately 0.5 acre (Figure 1-5). The first of these locations trends east-west and is approximately 140 feet in length; the second extends southward from the first. The second trends north-south and is approximately 180 feet in length. Each of the abovementioned anomalous areas is approximately 60 feet in width. The third likely disposal cell is located towards the south end of the survey area as shown by a series of anomalies that trends north-northeast/south-southwest. The length of this area is approximately 120 feet in length with a width of approximately 20 feet, which is considerably narrower than the previously mentioned areas. The southerly end of this area approaches the drainage channels; one large piece of exposed steel material was noted at the edge of one of these drainages. Finally, a discrete anomaly located in the center of the survey area is evident in the in-phase response map. This location corresponds to a location noted in the 1990 Investigation Report as an area containing buried spent rocket casings.

During a Phase II MEC Evaluation (Tetra Tech 2005b), the landfill area was evaluated by performing a surface sweep to identify any debris on or immediately below the ground surface that might be MEC related. No intrusive evaluation was conducted. No MEC or related items were found in this operational area. However, an interview with a former Lockheed Propulsion Company employee indicated that practice ammunition was disposed of in the landfill.



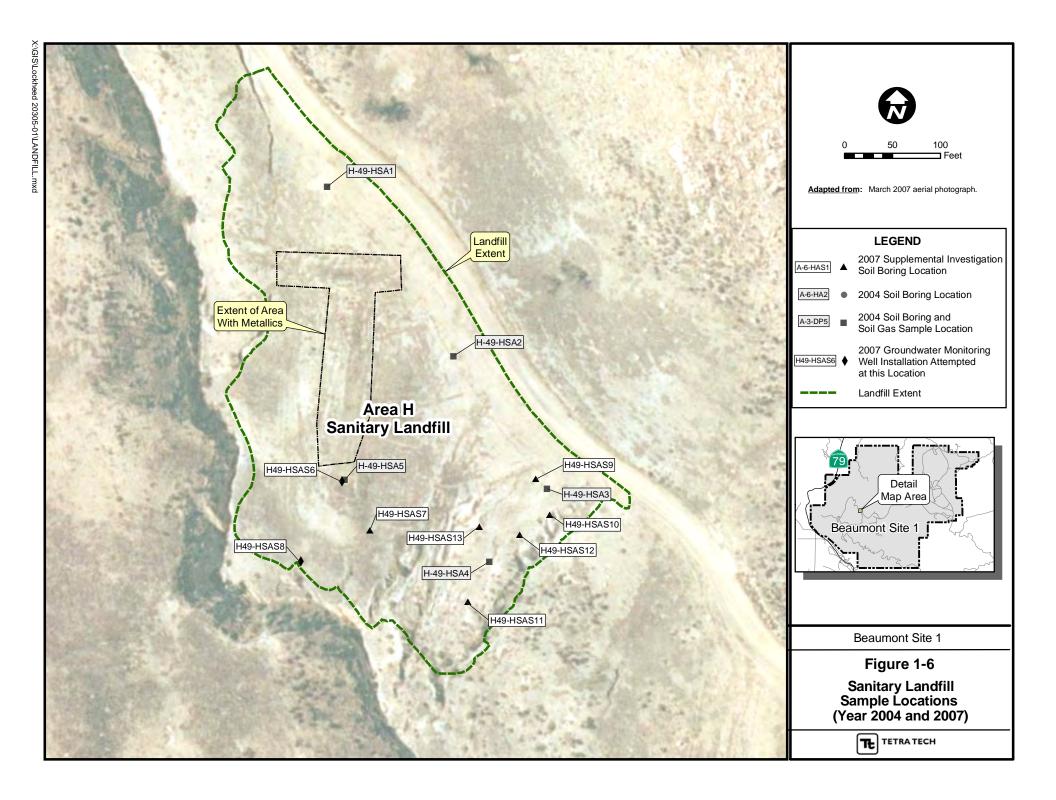


1.2.2 Soil and Soil Gas Investigations

In 2004, ten borings were drilled to depths up to 40 feet bgs (below ground surface), see Figure 1-6. Soil samples were analyzed for (VOCs), total petroleum hydrocarbons (TPH), semi-volatile organic compounds (SVOCs), perchlorate, 1,4-dioxane, polyaromatic hydrocarbons (PAHs), dioxins/furans, polychlorinated biphenyls (PCBs), and Title 22 metals. SVOCs, 1,4-dioxane, and PAHs were not detected above their respective reporting limits. Diesel range TPH was detected at concentrations ranging from 6.8 to 10 milligrams per kilogram (mg/kg). Perchlorate was detected at concentrations ranging from 42.1 to 1,520 micrograms per kilogram (μg/kg). VOCs (acetone, benzene, p-isopropyltoluene, and toluene) were detected at concentrations ranging from 0.97 to 72 μg/kg. Detected concentrations of acetone were possibly associated with laboratory cross-contamination. One PCB (i.e., Aroclor-1248) was detected at concentrations of 86, 210, and 910 μg/kg. Detected dioxin/furan concentrations were converted to their 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) values using toxicity equivalent factors. Toxicity Equivalency Factor (TEF) values ranged from 0.131 to 0.474 picograms per gram (pg/g). Metals were detected with arsenic detected at concentrations up to 1.90 mg/kg. (Tetra Tech, 2005b).

In 2007, a total of eight soil borings were drilled to depths between 26.5 and 71.5 feet bgs to further define soil impacts at the Sanitary Landfill during this investigation, see Figure 1-6. A minimum of three soil samples were collected from each boring and analyzed for perchlorate or PCBs. The proposed depth of 60 feet bgs could not be reached in H49-HSAS8 and H49-HSAS7 because of refusal in the Mt. Eden Formation. Decaying organic material was encountered in H49-HSAS13 at 26.5 feet bgs and was not believed to be related to landfill operations because of the undisturbed nature of the overlying soils. (Tetra Tech, 2008a).

Concentrations of PCBs were not detected above MDLs (method detection limit) in any of the samples tested. Perchlorate was detected in soil samples from two borings (H49-HSAS6 and H49-HSAS7) ranging from 40.1 to 4,910 µg/kg with an average detected concentration of 976 µg/kg. Perchlorate concentrations appear to increase in depth at H49-HSAS6 down to 40 feet bgs and then decrease an order of magnitude at 50 feet bgs. Perchlorate concentrations in H49-HSAS6 were relatively the same at the 5 and 15-foot samples and were reported as non-detect in the 30 and 45 feet bgs samples. Based on the concentration contours, the highest concentrations were detected between 30 and 40 feet bgs in the southwestern portion of the Sanitary Landfill near the former landfill trenches; these trenches may be the source of the perchlorate contamination. Based on the concentration contours, perchlorate is generally delineated to the southwest but is not defined to the north and east. (Tetra Tech, 2008a).



1.2.3 Groundwater Investigations

The Radian 1990 Investigation Report states that an attempt was made to install a monitoring well (MW-16) at the landfill. However, based on a field inspection of the proposed location and discussions with the California Department of Health Services (CDHS) and the Regional Water Quality Control Board RWQCB), the monitoring well was relocated downgradient of the landfill. It was determined that MW-16 be relocated because the landfill is on a steep slope (approximately 9%) and the hardness of the underlying bedrock formation (indurated sandstone of the Mt. Eden Formation) limits recharge. Therefore, water runoff from the landfill surface and near surface would flow downhill quickly and recharge the alluvial aquifer further downslope. Two additional borings, B1 and B2, were drilled near the landfill, but were terminated (B1 at 28 feet bgs and B2 at 20 feet bgs) 5 feet into the Mt Eden Formation due to lack of water. In 1932, Ransome conducted a deep exploration boring (DH-8) that was drilled downslope of the landfill. The depth to the first occurrence of groundwater was estimated to be at 215 bgs. Figure 1-3 illustrates the locations of monitoring well MW-16, soil borings B1 and B2, and the exploratory Ransome boring DH-8. (Radian, 1990).

In Spring 2007, Tetra Tech attempted to install a groundwater monitoring well at H49-HSAS8; however, the installation was terminated due to refusal at approximately 45 feet bgs (Figure 1-6). A second attempt to install a groundwater monitoring well in boring H49-HSAS6 was performed. Due to the lack of groundwater and the difficulty in drilling in the underlying Mt. Eden bedrock formation, the drilling was terminated at approximately 70 feet bgs. The monitoring well at this location was not installed. The landfill is resting on the surface of the weathered sandstone and there does not appear to be groundwater within at least 71 feet of the ground surface beneath the landfill (Tetra Tech, 2008a).

As stated above, a monitoring well at boring H49-HSAS6 was not installed due to the drilling method limitations during the investigation. Based on this investigation, impacts to groundwater do not appear to be a concern at the landfill at this time. However, if other investigations at the landfill indicate there has been significant vertical migration of contaminants from the landfill, the issue of impacts to groundwater can be further explored. Future investigation of the affected soil and potential groundwater impacts of this area were to be completed as part of the Dynamic Site Investigation. The investigation would utilize a more robust drilling method to investigate potential impacts to groundwater.

2.0 TECHNICAL APPROACH

This section discusses the objectives and technical approach implemented prior to and during characterization activities.

2.1.1 Rule 1150 Excavation Management Permit

An Excavation Management Plan (Plan) for the Sanitary Landfill (Tetra Tech, 2007) was prepared by Tetra Tech, on behalf of LMC as part of the permit application process for Rule 1150 "Excavation of Landfill Sites" (AQMD, 2007). Tetra Tech was issued Rule 1150 Excavation Permit A/N 474476 on May 30, 2008 (see Appendix A). Pursuant to the AQMD Permit, Condition No. 3, Tetra Tech notified the South Coast Air Quality Management District (AQMD) in writing of the commencement and completion of field work activities (see Appendix A).

2.1.2 Site Preparation Activities

The presence of the endangered Stephen's Kangaroo Rat (SKR) in the proposed test locations required the use of mitigation and monitoring methods approved by the United States Fish and Wildlife Service (USFWS). Prior to the field work, a permitted biologist identified active/inactive burrows in the Sanitary Landfill. An approved Section 10A permitted biologist supervised all potential disturbances and observed and directed the measures taken to limit the effects of the disturbance during the investigative activities. All trench locations could be accessed with a backhoe by using avoidance measures.

2.1.3 Lithologic Logging

Soil cuttings from the pothole trenching activities were observed by a Tetra Tech geologist, and the description recorded on a boring log utilizing the Unified Soil Classification System (USCS, 1986). Soil generated during the characterization activities were monitored for signs of contamination including location, odor, discoloration, color changes, and field instrument (photoionization detector [PID] and landfill gas meter) readings. The soil grain size, gradation, grain angularity/roundness, percentage of soil fractions (i.e., clay, silt, sand, gravel, cobbles) and moisture content were evaluated and recorded on the boring logs. All observations and readings were recorded on boring log forms for all trench locations (Appendix A). Additional information recorded includes the depth of the waste/soil interface, waste thickness, total depth of test pit, sample interval, and surface contour observed.

2.1.4 Field Instrumentation

Total organic vapor concentrations were monitored using a MiniRae 2000 PID meter at the workface and to screen each sample for VOCs. Methane and other chemicals that are not readily identified by the PID

were monitored with a landfill gas instrument. The equipment readings during the characterization activities were recorded on monitoring logs (see Table 1 in Appendix B).

2.1.5 Excavation and Sampling

Test pits were excavated adjacent to the waste cells using a backhoe with an 18-inch bucket in four main areas throughout the Sanitary Landfill. No trenching was performed through the waste cells due to concerns about MEC. Prior to excavation a surface sample was collected in each test pit location. Each test pit proceeded with the removal of several inches of soil followed by a visual clearance of the excavation by trained unexploded ordnance (UXO) personnel. The test pits were excavated to a depth that exposed the waste/soil interface for soil sample collection within or below the waste zone. Upon encountering waste, the excavation continued to 1 to 2 feet below the waste layer for sample collection in the native soil. Excavation generally continued to approximately 1 to 2 feet below the waste/soil interface (if waste was encountered) where the last soil sample was collected. Samples were collected from material excavated from the center most portion of the bucket prior to discharge.

Material excavated from each location was placed on 4-foot by 8-foot plywood sheet covered with plastic to manage any leachate. The excavated material was placed adjacent to the test pit and used as backfill once the test pit was logged and samples collected. Prior to backfilling, the backfill material (excavation material) was moistened using potable water from a 2,000-gallon water truck to enhance compaction. The backfill material was compacted using the bucket on the backhoe and tire rolled to surrounding grade.

Efforts were made to excavate and backfill any potholes during the day so that no holes were left open during non-working hours. Soil disturbance was limited to the proposed excavation areas where previous investigations identified the interface of the soil and waste. Waste exposure was limited by excavating and backfilling each location one at a time. The backhoe of the bucket was brushed off and decontaminated between each location.

2.1.6 Work Plan Deviations

Deviations from the Work Plan include:

- 1. The relocation of test pit T5, approximately 15 feet west, to limit the amount of waste exposure; and
- 2. The relocation of test pit T8, approximately 15 feet south and 5-feet east, to limit the amount of waste exposure

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3. The relocation of test pit T12, approximately 5 feet south, to limit the amount of waste exposure; and

- 4. The relocation of test pit T13, approximately 60 feet south, to limit the SKR effects of the disturbance during the investigative activities per the onsite biologist.
- 5. The addition of test pit T17 to determine if the soil at the southern end of the drainage channel (prior to entering the washout) has been impacted due to potential leachate and/or surface water runoff.

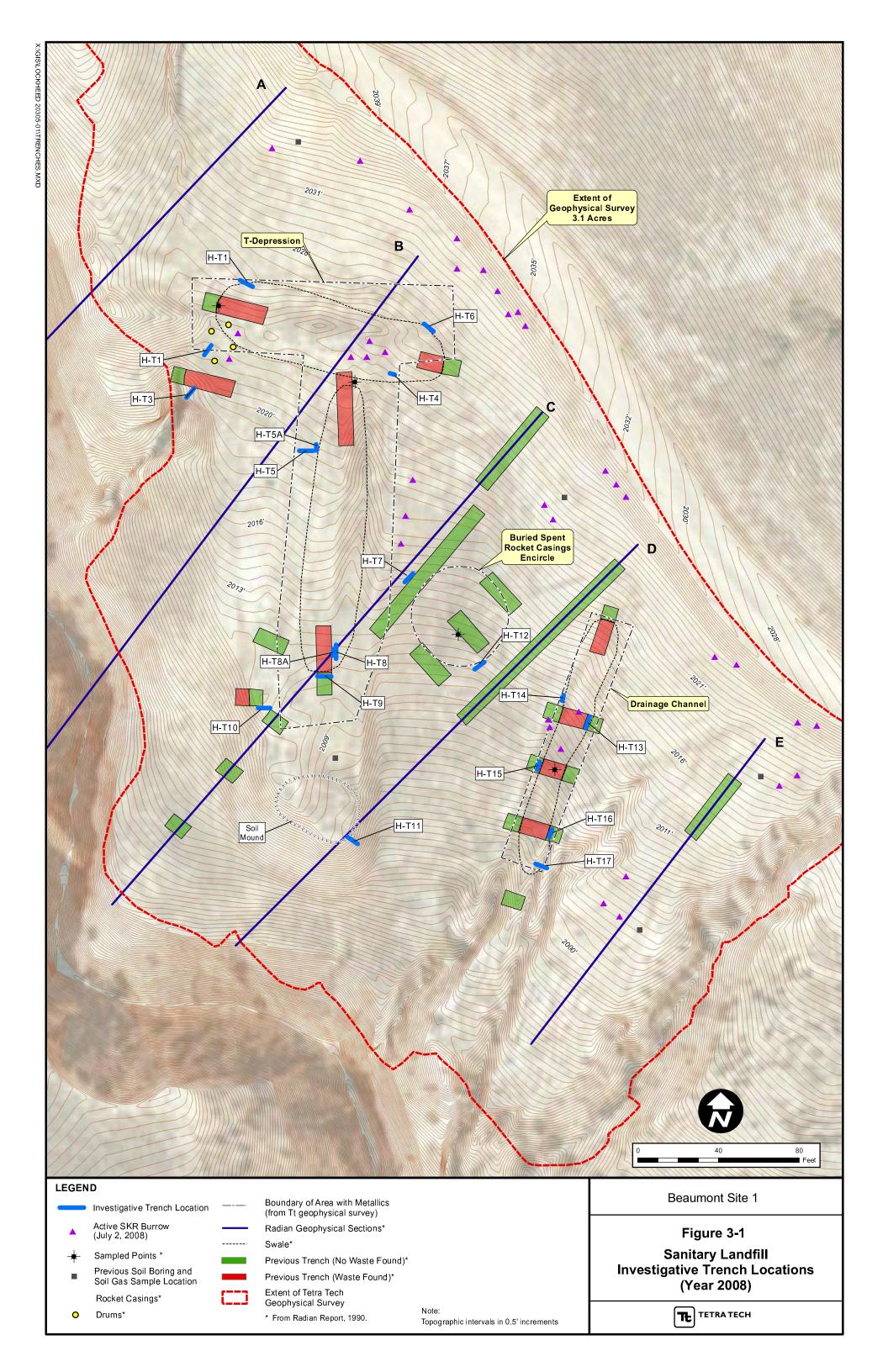
3.0 RESULTS OF CHARACTERIZATION

This section presents the results of the characterization activities completed, describes the surface and subsurface geology, and presents the characterization results. Tetra Tech completed 19 test pits for characterization purposes at the Sanitary Landfill from July 14 through July 18, 2008 (Figure 3-1). Investigative trenching was performed in four areas of the Sanitary Landfill (Drainage Channel, Soil Mound, Buried Spent Rocket Casings encircle, and the T-depression) to gather information on the horizontal and vertical extent of affected soil in the Sanitary Landfill. This information will be used to determine the remedial strategy for the Sanitary Landfill if deemed necessary.

3.1 SANITARY LANDFILL ASSESSMENT

The locations for investigative trenching were selected based on the 2005 geophysical investigation that was implemented to confirm the previous geophysical and trenching results and location of the waste cells. Based on previous investigations, the Sanitary Landfill is comprised of scattered trash, including wood debris, concrete, metal scrap, paper, etc. (Radian, 1986a). The geophysical investigation indicated that the majority of landfilled materials appear to be located within the four trenches that occupy a combined surface area of approximately 0.5 acre. Based on this information, the trenching focused on locating the waste/soil interface along the T-depression, at the base of the Soil Mound, along the circumference of the Buried Spent Rocket Casings encircle, and along the Drainage Channel..

Further investigation to assess the extent of perchlorate, VOC and PCB impacts at the Sanitary Landfill is being addressed through implementation of the Dynamic Site Investigation to (Tetra Tech, 2008b). The investigation of the Sanitary Landfill will encompass the evaluation of potential impacts to groundwater and further evaluate the two localized areas of PCB impacts to soil. The maximum depth at which waste was observed during this investigation was 8 feet bgs. Based on this information, only the upper 15 to 20 feet that encompasses the waste zone was addressed during this assessment.



3.1.1 Investigative Trenching

A total of 19 trenches were completed as part of the characterization investigation to define the lateral and vertical extent of impacted soil. Of the 19 test pits, soil samples were collected from 18 test pits for evaluation. The trench IDs denoted with an "A, B or C" (e.g., H-T12A, H-T12B) were initial trenches used to determine the location of the waste/soil interface. The final locations used for sampling were generally immediately adjacent to the initial locations to minimize waste exposure (e.g., H-T12) to maintain compliance with the AQMD 1150 Excavation Permit. Following excavation, each trench was logged and information recorded as further discussed in the next section.

Debris. consisting of wires, plastics, metal remains, etc., was observed sporadically throughout the surface materials of the landfill Debris observed in the subsurface included wires, household-like waste, plastics, small to large pieces of metal, etc. The maximum depth of trash observed was 8 feet bgs. The nature and extent of the debris encountered during the investigation is consistent with previous investigations. As per the South Coast AQMD, each test area was monitored for organic vapors. No VOCs were measured during the investigation. The range of methane measured was 0 to 2 parts per million. A summary of the air monitoring measurements recorded are provided in Table 1 in Appendix B.

3.1.2 Lithology

Trench logs were completed for each location for lithological interpretation. In addition, the depth to the top and bottom of waste encountered along the waste/soil interface was recorded. A summary of the lithology is provided in Table 1 and illustrated in Figures 1 through 19 in Appendix B.

Based on the soil trenched during this phase of the Sanitary Landfill investigation, sediments at the Site were consistent with the previous investigations. The recent soil test pits showed a stratigraphic sequence consisting (from top to bottom) of topsoil/fill, followed by waste, and Quaternary alluvium/colluvium that overlies the Mt. Eden Formation. Based upon the test pit logs, the soil encountered generally consists of light olive gray to olive, grayish brown to very dark gray, very fine to very coarse-grained clayey and silty sands and sandy clays, poorly graded, with waste not exceeding 10 feet bgs. The Mt. Eden Formation was not encountered in any of the test pits; however, colluvium consisting of olive gray, very fine to coarse-grained poorly graded sand from the Mt. Eden Formation was encountered in one test pit (H-T11), and was highly weathered, friable, and poorly indurated. Clay layers did not appear to be continuous across the Sanitary Landfill. The clay layers appeared to be fill material mixed with waste. A summary

of the waste limits observed and soil types encountered is presented Table 1 and illustrated in Figures 1 through 19 in Appendix B. Photographic documentation of the investigation is provided in Appendix E.

3.1.3 Subsurface Observations

T-depression Observations

Trenches H-T1 through H-T6 and trenches H-T8 though H-T10 as shown on Figures 1 through 11 (Appendix B) are locations that were used to characterize the T-depression. The soil cover thickness ranged from 0.5 feet to 2.5 feet in thickness. The waste observed was found to extend from the surface and up to a maximum depth of 8 feet below grade throughout this area. A substantial amount of waste was identified in trenches H-T5A, H-T5B, and H-T8A. To minimize waste exposure, the trenches were relocated immediately adjacent to these initial trenches for observations and sampling (trench H-T5 and trench H-T8). A similar occurrence occurred at location trench H-T4; however, this trench could not be relocated due to the density of SKR burrows. The soil within the T-depression generally consists of silty sand, clayey sand, poorly graded sand with clay and sandy clay.

Ash-like material that was gray in color was noted in trenches H-T1 (2 feet bgs) and H-T5 (3 feet bgs). This material appeared mixed in with waste and was present in trench H-T1 from 0.5 feet bgs to 6.5 feet bgs and in trench H-T5 from 2.5 feet bgs to 4 feet bgs. The material appeared to be fine-grained and gray in color. A thin layer of potentially burned material that was black in color was observed in trench H-T5A at 2 feet bgs.

Soil Mound Observations

Trench H-T11, as shown on Figure 12 (Appendix B), was used to characterize the soil mound. The trench was approximately 6 feet in length and 10 feet deep. The waste observed was found to extend from the surface to 3 feet below grade in this area. A minimal amount of waste was observed; however, the waste was thicker immediately within the soil mound and thinned out at the base of the soil mound. The soil generally consists of silty sand, organic silt clay, sandy clay and poorly graded sand.

Buried Spent Rocket Casings Encircle Observations

Trenches H-T7 and H-T12, as shown on Figures 13 and 14 (Appendix B), are locations that were used to characterize the buried spent rocket casings encircle. The soil cover thickness ranged from the surface to 1.5 feet bgs mainly in trench H-T12. The waste observed was found to extend from 1.5 feet to 3 feet below grade in H-T12A. No waste was encountered in trench H-T7. A substantial amount of waste was identified in trench H-T12A; hence trench H-T12 was relocated approximately two feet away from trench H-T12A to limit waste exposure. The soil within the buried spent rocket casings encircle generally

consists of silty sand, sandy clay, clayey sand and sandy clay. No evidence of rocket casings in this area was observed during the investigation.

Drainage Channel Observations

Trenches H-T13 through H-T17, as shown on Figures 15 through 19 (Appendix B), are locations that were used to characterize the drainage channel. Trenches H-T13 through H-T16 extended from the southwest to northeast and trench H-T17 extends from northwest to southeast. Trench H-T17 was positioned at the southern end of the drainage channel (prior to entering the washout) to determine if the soil has been impacted due to potential leachate and/or surface water runoff. The soil cover thickness in the drainage channel ranged from the surface up to four feet. The waste observed was found to extend from the surface down to 4.5 feet below grade, with the waste thickness generally increasing from trench H-T13 to trench H-T17. This area generally consists of silty sand, clayey sand, poorly graded sand with clay and sandy clay.

3.2 CHARACTERIZATION SAMPLING

Characterization was completed through sample collection and chemical analyses to determine the horizontal and lateral extent of affected soil in the four areas of the Sanitary Landfill: Drainage Channel, Soil Mound, Buried Spent Rocket Casings encircle, and the T-depression. Previous investigations indicate that perchlorate, PCBs, metals, and dioxins and furans in soil have been detected at the Sanitary Landfill. However, the data obtained from the 2004 and 2007 soil investigation is limited and further characterization was warranted to define the extent of chemicals in soil for closure of the Sanitary Landfill. The analytical results from the 2004 Soil Investigation (Tetra tech, 2005) and the 2007 Supplemental Soil Investigation (Tetra Tech, 2008) for perchlorate, PCBs and dioxins and furans have been included in this evaluation for characterization purposes.

The strategic sampling approach implemented to confirm the absence (or presence) and magnitude of chemicals detected in soil entailed the collection of samples immediately below ground surface (0.5 feet bgs), adjacent to or below the waste layer, and to a maximum depth of up to 12 feet bgs. Based on the analytical results from previous investigations, soil samples were analyzed for the following chemicals:

- Perchlorate by EPA Method SW314.0;
- SVOCs by EPA Method SW8270;
- CAM 17 metals by EPA Method SW6010B/7470; and
- PCBs by EPA Method SW8082.

Select samples were collected and analyzed for dioxins and furans by Method SW8290 if exposed material appeared to be burned and/or ash. The Work Plan states that if VOCs were detected above 10 parts per million in the airspace above the excavated material, discrete soil samples will be collected and analyzed by EPA Method 5035A. No VOCs were detected during the characterization activities, so no VOC sampling of soils was conducted during this investigation.

3.2.1 Investigation Screening Levels

The soil analytical results were compared to the Total Threshold Limit Concentration (TTLC) and the Soluble Threshold Limit Concentration (STLC) to determine if the concentration of constituents in soil should be classified as hazardous waste according to the California Code of Regulations Chapter 11 Identification and Listing of Hazardous Waste, Article 3 Characteristic of Hazardous Waste herein referred to as Title 22 (DTSC, 2008). A TTLC and STLC is only available for PCBs, metals, and 2,3,7,8-tetrachlorodibezo-p-dioxin (2,3,7,8-TCDD). The soil analytical results were also compared to the California Human Health Screening Levels (CHHSLs) and Regional Screening Levels (RSLs) for residential land use and industrial land use (EPA, 2008 and CalEPA, 2005). The CHHSLs and the RSLs were utilized since the background screening levels for metals are currently being established for the Site. A summary of the screening levels used for comparison are listed in Table 3-1.

Polychlorinated dibenzo-dioxins (PCDDs) and polychlorinated dibenzo-furans (PCDFs) and dioxin-like PCB compounds occur in the environment as complex mixtures of a large number of different congeners (210 possible congeners). To calculate the potency of the mixture, the concentrations of the individual PCDD and PCDF congeners were converted to Toxicity Equivalency Quotient (TEQ) concentrations using TEF. The summation of the PCDD and PCDF TEQs is equivalent to the 2,3,7,8-TCDD TEQ (Office of Environmental Health Hazard Assessment [OEHHA], 2003). The 2,3,7,8-TCDD TEQ is used for comparison to the TTLC, STLC, CHHSL and RSL. For consistency, the dioxin and furan data from the 2004 soil investigation were re-evaluated using the currently accepted TEF and TEQ methodology (OEHHA, 2003).

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Table 3-1 Screening Levels Summary

		CHHSL		RSL		TTLC	STLC
Constituent	Units	Residential	Industrial	Residentia	Industrial		
Perchlorate	ug/kg	-	-	55,000	720,000	-	-
Polychlorinated Bi-phenyls							
Aroclor-1016	ug/kg	89	300	3,900	21,000	-	-
Aroclor-1221	ug/kg	89	300	170	620	-	-
Aroclor-1232	ug/kg	89	300	170	620	-	-
Aroclor-1242	ug/kg	89	300	220	740	-	-
Aroclor-1248	ug/kg	89	300	220	740	-	-
Aroclor-1254	ug/kg	89	300	220	740	-	-
Aroclor-1260	ug/kg	89	300	220	740	-	-
Aroclor Total ^a	ug/kg	89	300	170	620	50,000	5,000
Metals							
Arsenic	mg/kg	0.07	0.24	0.39	1.6	500	5.0
Antimony	mg/kg	30	380	31	410	500	15.0
Barium	mg/kg	5,200	63,000	15,000	190,000	10,000	100.0
Beryllium	mg/kg	150	1,700	160	2,000	75	0.8
Cadmium	mg/kg	1.7	7.5	70	810	100	1.0
Cobalt	mg/kg	660	3,200	-	-	8,000	80.0
Chromium	mg/kg	100,000	100,000	120,000	1,500,000	500	5.0
Copper	mg/kg	3,000	38,000	3,100	41,000	2,500	25.0
Lead	mg/kg	150	3,500	400	-	1,000	5.0
Mercury	mg/kg	18	180	6.7	28	20	0.2
Molybdenum	mg/kg	380	4,800	390	5,100	3,500	350.0
Nickel	mg/kg	1,600	16,000	1,600	20,000	2,000	20.0
Silver	mg/kg	380	4,800	390	5,100	500	5.0
Selenium	mg/kg	380	4,800	390	5,100	100	1.0
Thallium	mg/kg	5.0	63	5.1	66	700	7.0
Vanadium	mg/kg	530	6,700	390	5,200	2,400	24.0
Zinc	mg/kg	23,000	100,000	23,000	310,000	5,000	250.0
Semi-Volatile Organic Compounds							
Butyl benzyl phthalate	ug/kg	-	-	-	-	-	-
Dioxins and Furans							
TEQ (2,3,7,8-TCDD)	ng/kg	4.6	19	4.5	18	10,000	1,000

Notes:

CHHSL - California Human Health Screening Levels [Cal EPA 2005]

RSL - Regional Screeing Level [USEPA, 2008]

TTLC - Total Threshold Limit Concentration, California Code of Regulations, DTSC 2008.

STLC - Soluble Threshold Limit Concentration, California Code of Regulations, DTSC 2008.

^aThe Aroclor Total considers the summation of the PCB mixture.

(-) Screening level not available.

3.2.2 Data Quality Review

The environmental samples reviewed are associated with the Sanitary Landfill project as described in the Clean Closure Preparation Plan (Tetra Tech, October 2007). All environmental samples were soil samples. The data for the soil sampling activities were contained in five analytical data packages (08G131, 08G146, 08G177, 08G188, and 08G195). The results for the soil samples collected for analytical testing were reviewed using the latest versions of the National Functional Guidelines for Organic and Inorganic Data Review documents from the EPA (EPA, 1999 and 2004).

Holding times, field blanks, laboratory control samples, method blanks, duplicate environmental samples, spiked samples, and surrogate and spike recovery data were reviewed. Within each environmental sample the sample specific quality control spike recoveries were examined. These data examinations include comparing statistically calculated control limits to percent recoveries of all spiked analytes and duplicate spiked analytes. The results are compared to Relative Percent Difference control limits. Surrogate recoveries were examined for all organic compound analyses and compared to their control limits. Environmental samples were analyzed by the following methods: Method E314.0 for perchlorate, Method SW6010B for CAM 17 metals, Methods SW7470A and SW7471A for mercury, Method SW8082 for PCBs, Method SW8270C for SVOCs, and SW8290 for dioxins (PCDDs) and furans (PCDFs). Unless discussed below, all data results met required criteria, are of known precision and accuracy, did not require any qualification, and may be used as reported.

Dioxins and furans were detected in the field and/or laboratory blanks collected and analyzed for this sampling event. Qualified data results (5.1 percent) are denoted with a "B" flag. The validity of "B" qualified data is suspect because the results are considered to have not originated from the native sample. These results are considered to be due to cross-contamination from field and/or laboratory operations. The levels of contaminants detected in the field or method blanks will qualify similar levels of the same detected analytes in environmental samples. Data so qualified are denoted with a "B" flag, are generally considered not usable data.

The dioxins and furans data (8.2 percent) were qualified as estimated values denoted with a "J" flag. Duplicate sample errors, laboratory control sample errors, and results above the calibration range caused the data to be "J" flagged. Data qualified with a "J" flag are still usable for the intended purpose.

Matrix spike recovery errors caused 0.4 percent of the SW6010B data to be qualified with a "J" flag. Matrix spike/matrix spike duplicate errors caused 0.1 percent of the SW8270C data to be qualified with a "J" flag. These data qualified with a "J" flag are still usable for the intended purpose.

3.2.3 Sampling Results

This section presents the sampling results for the T-depression, Soil Mound, Drainage Channel, and, the Buried Spent Rocket Casings encircle located within the Sanitary Landfill boundary. This section also identifies number of soil samples collected from each area, chemical concentrations exceeding the screening levels listed in Table 3-1, discusses the extent of affected soil, and provides tables summarizing the chemicals detected above method detection levels. A comprehensive set of data including chemicals not detected above the MDL, and any dioxins and furans conversions is provided in Appendix D. The laboratory data packages and validated data summary tables are provided in Appendices F and G.

T-Depression Sample Results

Soil samples were collected at 0.5 feet bgs, at multiple depths adjacent to and below the waste layer, and down to 12 feet bgs in trenches located within and surrounding the T-depression. A total of 28 samples were collected from nine (9) trenches to determine the extent of affected soil within the T-depression. A summary of the chemicals detected in this area is discussed below and summarized in Table 3-2.

Perchlorate was detected in 12 of 28 samples at concentrations ranging from 21.7 ug/kg to 1,230 ug/kg (Figure 3-2 and Figure 3-3). The majority of the samples containing perchlorate within this area were collected from trenches H-T5 and H-T10 and a few samples collected from trenches H-T1 and H-T8. The highest perchlorate concentrations were detected from 6 to 15 feet bgs, approximately 8 to 9 feet below the waste zone, with the exception of H-T5 (adjacent to the waste) (Figure 3-3). The maximum concentration of perchlorate detected is in the southern portion of the T-depression in trench H-T10 (sample ID H-T10-10.0). The extent of perchlorate affected soil is generally limited to the T-depression boundary identified in the geophysical investigation. Perchlorate concentrations did not exceed the residential and industrial RSL.

PCBs (Arochlor 1254 and/or Arochlor 1260), were detected in one general location within this area, trench T5 and T5A, at concentrations ranging from 44 ug/kg to 1,400 ug/kg, Figure 3-4. The highest concentration of PCBs detected in soil was in a sample collected from trench H-T5 at 2.5 feet bgs which exceeded the residential and industrial CHHSL and RSL. The extent of PCBs detected in soil is limited to the surface from 0.5 feet to 2.5 feet bgs in this location. One SVOC, butyl benzyl phthalate, was detected in one sample collected from trench H-T4. No screening level is available for butyl benzyl phthalate.

Metals, with the exception of antimony, were generally detected throughout this area. The highest concentrations of metals including arsenic, beryllium, cadmium, cobalt, chromium, copper, lead, mercury, molybdenum, silver, selenium, thallium, vanadium and zinc were detected in the T-depression. Metal

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concentrations did not exceed the TTLC or STLC. However, arsenic (found in 18 of 28 samples) were detected at concentrations exceeding the residential CHHSL and RSL, the industrial CHHSL. Thirteen (13) of the 28 samples had concentrations of arsenic that exceeded the industrial RSL. Cadmium was also detected (found in 1 of 28 samples) at concentrations exceeding the residential CHHSL and RSL. Detectable concentrations of arsenic ranged from 1.36 mg/kg to 5.67 mg/kg while detectable concentrations of cadmium ranged from 0.84 to 4.26 mg/kg.

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Table 3-2 Summary of Validated Chemicals Detected in T-Depression

	PCBS	DIOXINS AND FURANS	ORGANICS	INORGANICS																
Sample ID -	1 020	TEQ	Butyl benzyl																	
Depth	Aroclor Total ^a	2,3,7,8-TCDD	phthalate	Perchlorate	Arsenic	Barium	Beryllium	Cadmium	Cobalt	Chromium	Copper	Lead	Mercury	Molybdenum	Nickel	Silver	Selenium	Thallium	Vanadium	Zinc
Units	ug/kg	ng/kg	ug/kg	ug/kg								n	ng/kg							
H-T1-0.5	<20	NA	<170	39.5	2.08	119	0.398 Jq	<0.506	5.66	10.8	0.813 Jq	6.69	<0.0334	<0.506	7.67	<0.506	<0.506	0.704 Jq	28.7	57.9
H-T1-2.0	NA	0.0000919	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
H-T1-7.0	<22	NA	<180	<10.9	2.23	144	0.288 Jq	<0.543	5.47	9.86	5.42	4.11	<0.0359	<0.543	7.85	<0.543	<0.543	<0.543	26	40.2
H-T1-11	<22	NA	<190	<11.1	3.43	177 Jc	0.479 Jq	<0.556	7.16	13.4	7.7	5.29	<0.0367	<0.556	9.19	<0.556	0.763 Jq	1.06 Jq	36.3	61.7
H-T2-0.5	<20	NA	<170	<10.2	2.11	135	0.363 Jq	<0.509	6.21	11.7	1.57 Jq	7.06	<0.0336	<0.509	8.13	<0.509	<0.509	0.998 Jq	33.3	60.3
H-T2-2.5	<22	NA	<180	<10.8	2.23	281	0.247 Jq	<0.539	5.61	7.19	3.67	2.8	<0.0356	< 0.539	5.83	<0.539	< 0.539	1.33	27.2	39.2
H-T2-10	<25	NA	<210	<12.3	5.67	448	0.833 Jq	<0.614	16.1	28.6	14.1	11.2	<0.0405	<0.614	21	<0.614	1.1 Jq	0.845 Jq	76.8	116
H-T3-0.5	<20	NA	<170	<10.1	1.64	104	0.254 Jq	< 0.505	4.14	7.66	2.21	4.63	<0.0333	< 0.505	5.52	<0.505	< 0.505	<0.505	21.8	45.3
H-T3-5.0	<22	NA	<180	<10.9	3.56	213	0.373 Jq	<0.544	7.39	13.1	7.58	5.72	< 0.0359	<0.544	8.99	<0.544	<0.544	0.613 Jq	37.8	55
H-T3-10.0	<23	NA	<200	<11.7	2.51	188	0.495 Jq	<0.584	11	16.1	3.6	5.48	<0.0386	<0.584	10.6	<0.584	<0.584	<0.584	40.3	76.7
H-T4-0.5	<20	NA	<170	<10.1	1.42	104	0.315 Jq	<0.506	4.52	9.07	1.72 Jq	7.28	0.137	<0.506	5.86	<0.506	< 0.506	0.623 Jq	19.7	52.2
H-T4-2.0	<20	NA	<170	<10.2	1.67	87.3	0.265 Jq	1.38	5.02	13.4	5.32	19	0.351	1.48 Jq	11.3	0.697 Jq	< 0.509	0.672 Jq	18.1	67.4
H-T5-0.5	44 Jq	NA	<170	44.2	1.81	194	0.399 Jq	<0.52	7.22	13.7	14.8	8.35	0.0357 Jq	<0.52	11	<0.52	<0.52	1.35	34.8	72.9
H-T5-2.5	1400	NA	<180	117	1.87	167	0.377 Jq	<0.546	6.99	23.9	13.3	52.7	<0.036	1.44 Jq	10.6	1.15 Jq	< 0.546	1.43	33.3	98.5
H-T5-3.0	NA	13.53	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
H-T5-6.0	<24	NA	<200	195	3.76	282	0.618 Jq	<0.588	14.3	28	36.1	10.7	<0.0388	<0.588	21.4	<0.588	<0.588	1.98	68.2	101
H-T5-12.0	<23	NA	<190	110	2.04	187	0.404 Jq	< 0.579	8.8	15	16.1	6.19	<0.0382	<0.579	10.9	<0.579	< 0.579	1.18	38.5	66.3
H-T5A-0.5	109	NA	<170	613	<0.409	186	0.423 Jq	1	7.6	14.4	20.3	13.1	0.101 Jq	<0.511	10.9	5	0.697 Jq	1.39	34.8	100
H-T5A-2.0	NA	2.08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
H-T6-0.5	<20	NA	<170	<10.1	1.36	90.4	0.287 Jq	<0.507	4.54	7.96	1.35 Jq	7.96	< 0.0335	<0.507	5.41	<0.507	< 0.507	0.744 Jq	18.3	47.8
H-T6-5.0	<25	NA	<210	<12.4	0.964 Jq	73.9	<0.247	<0.618	3.71	8.25	<0.618	2.84	<0.0408	<0.618	4.54	<0.618	<0.618	<0.618	19.9	37.6
H-T6-10	<23	NA	<190	<11.3	1.75	235	0.493 Jq	<0.566	9.58	15.9	12.4	7.35	<0.0373	<0.566	15	<0.566	< 0.566	1.2	45.6	59
H-T8-0.5	<20	NA	<170	<10.2	<0.407	189	0.438 Jq	0.906 Jq	7.2	14.4	15.1	6.83	< 0.0336	<0.509	10	<0.509	0.585 Jq	1.35	37.1	63.6
H-T8-2.5	<21	NA	<180	<10.5	<0.422	143	0.402 Jq	0.846 Jq	6.65	12.6	12.4	5.13	<0.0348	<0.527	9.4	<0.527	<0.527	1.19	30.6	61.7
H-T8-11	<23	NA	<190	31.5	<0.458	181	0.426 Jq	0.873 Jq	8.03	15.2	16	6.46	<0.0378	<0.573	9.45	<0.573	0.621 Jq	1.05 Jq	42.8	60.6
H-T9-0.5	<25	NA	<210	21.7 Jq	<0.501	212	0.45 Jq	0.956 Jq	8.32	16	17.3	7.58	<0.0414	<0.627	11.4	<0.627	<0.627	1.74	40.4	67.4
H-T9-5.0	<21	NA	<180	<10.6	<0.423	147	0.225 Jq	<0.529	4.75	8.03	10.6	5.53	<0.0349	<0.529	6.93	<0.529	<0.529	1.03 Jq	22.5	34.2
H-T9-11	<24	NA	<200	22.1 Jq	<0.485	330	0.778 Jq	1.52	14.9	25.9	30.5	10.8	<0.04	<0.606	18.5	<0.606	0.71 Jq	2.28	63.9	119
H-T10-0.5	<21	NA	<170	245	<0.417	209	0.38 Jq	4.26	8.5	14.1	14.6	6.92	0.0375 Jq	<0.521	10.3	<0.521	<0.521	1.54	36.9	61.1
H-T10-2.5	<25	NA	<210	52.6	<0.506	206	0.349 Jq	0.779 Jq	7.18	12.6	13	5.27	<0.0417	<0.632	9.71	< 0.632	< 0.632	1.64	35.7	54.4
H-T10-10.0	<23	NA	<200	1230	<0.469	174	0.457 Jq	1.12 Jq	8.92	16.6	15.1	6.75	<0.0387	<0.586	10.7	<0.586	<0.586	1.77	45.7	77.2
CHHSL - Res	89	4.6	-	-	0.07	5,200	150	1.7	660	100,000	3,000	150	18	380	1,600	380	380	5.0	530	23,000
CHHSL - Ind	300	19	-	-	0.24	63,000	1,700	7.5	3,200	100,000	38,000	3,500	180	4,800	16,000	4,800	4,800	63	6,700	100,000
RSL - Res	170	4.5	-	55,000	0.39	15,000	160	70	-	120,000	3100	400	6.7	390	1,600	390	390	5.1	390	23,000
RSL - Ind	620	18.0	-	720,000	1.6	190,000	2,000	810	-	1,500,000	41,000	-	28	5,100	20,000	5,100	5,100	66	5,200	310,000
TTLC	50,000	-	-	-	500	10,000	75	100	8,000	500	2,500	1,000	20	3,500	2,000	500	100	700	2,400	5,000
STLC	5,000	-	-	-	5.0	100.0	0.8	1.0	80.0	5.0	25.0	5.0	0.2	350.0	20.0	5.0	1.0	7.0	24.0	250.0
Notes:	. · · · · · · · · · · · · · · · · · · ·		•	•	OTLO Cal	I.		centration D	TCC 2000										·	

Notes

^a Summation of PCBs in Aroclor mixture.

TEQ - Toxicity Equivalency Quotient

TCDD - Tetrachlorodibenzo-p-Dioxin

CHHSL - California Human Health Screening Level, DTSC 2005.

RSL - Regional Screening Level, USEPA 2008.

TTLC - Total Threshold Limit Concentration, DTSC 2008.

STLC - Soluble Threshold Limit Concentration, DTSC 2008.

Res - Residential Land Use.

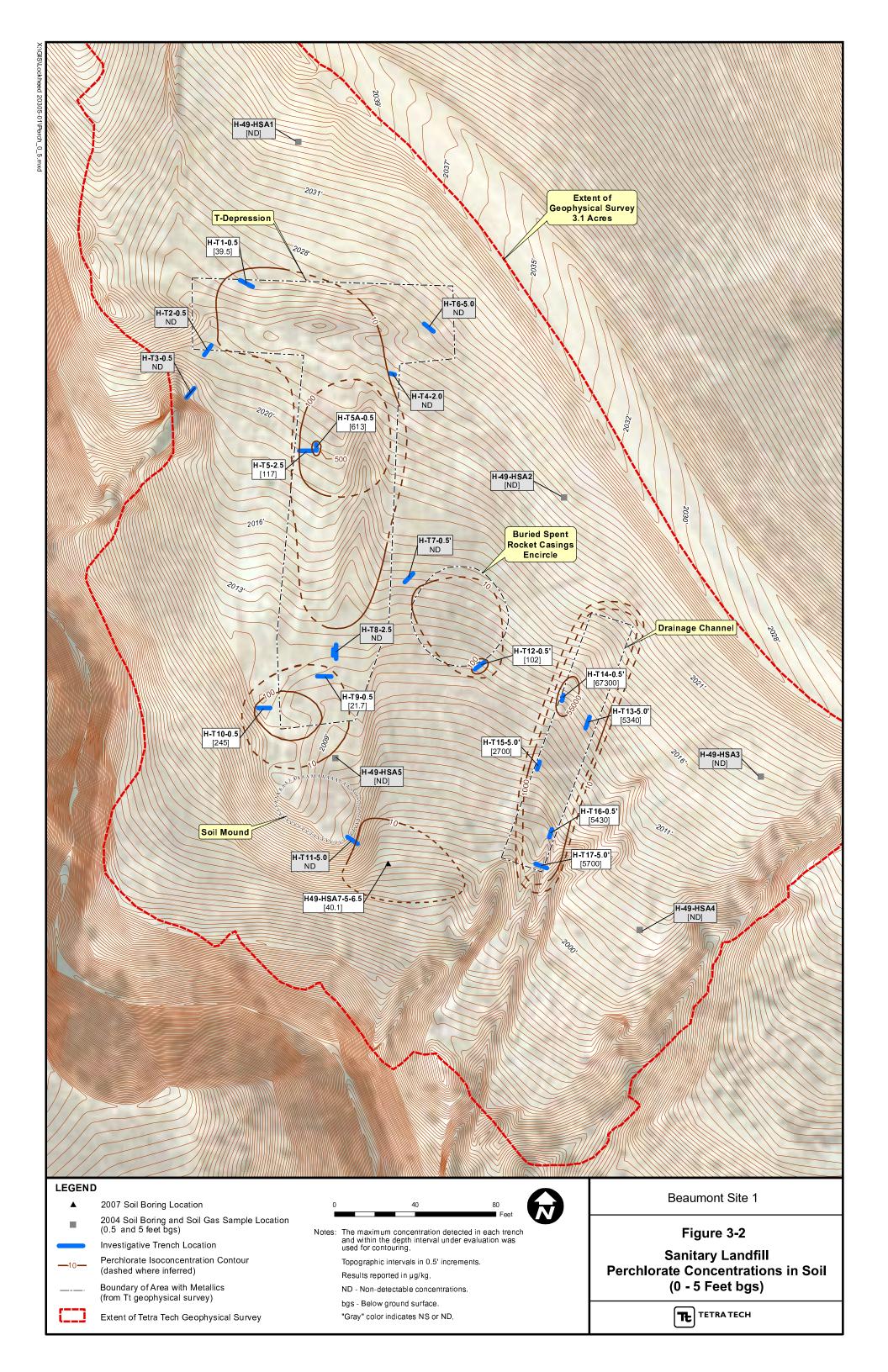
Ind - Industrial Land Use.

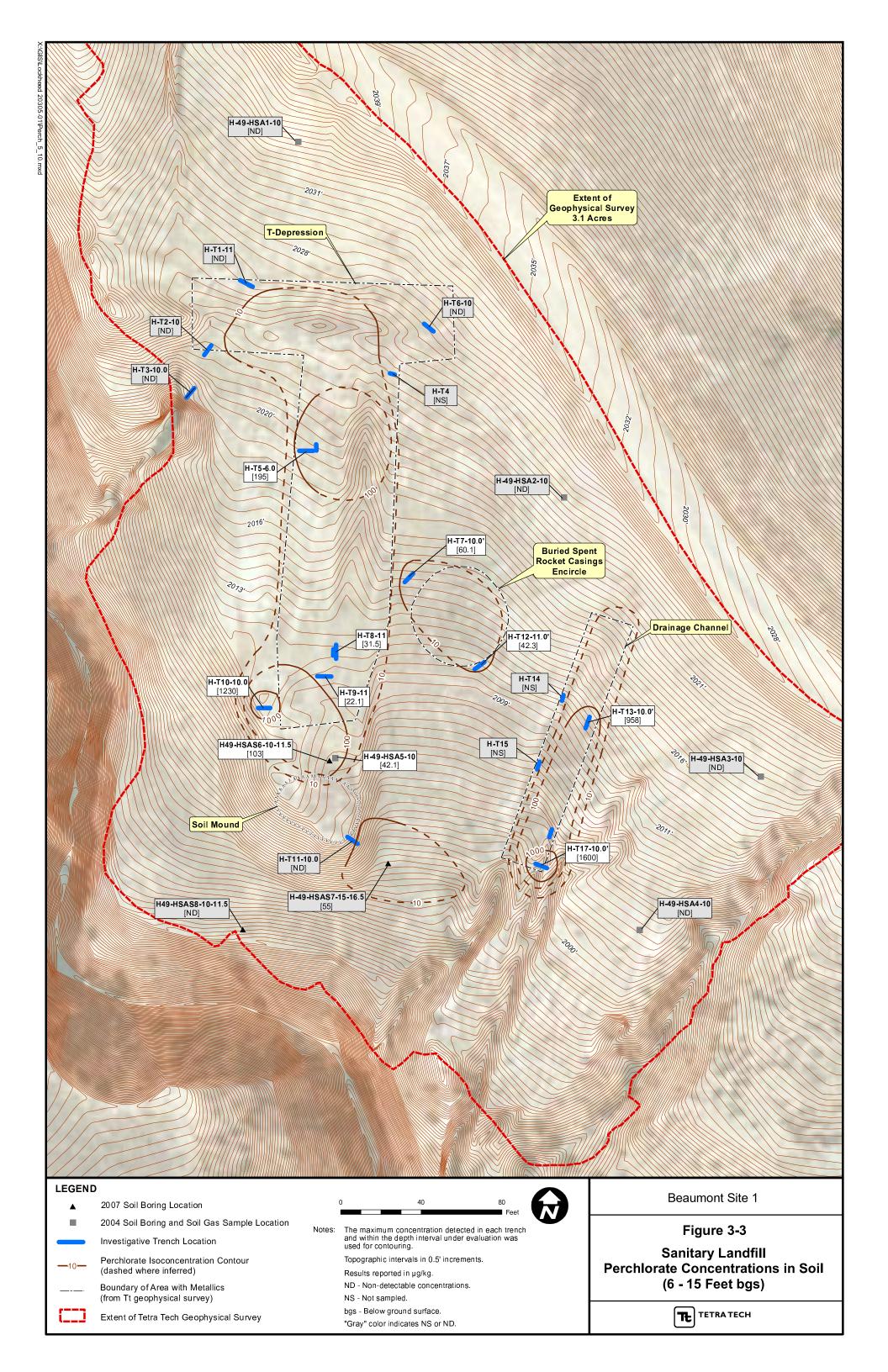
NA - Not analyzed.

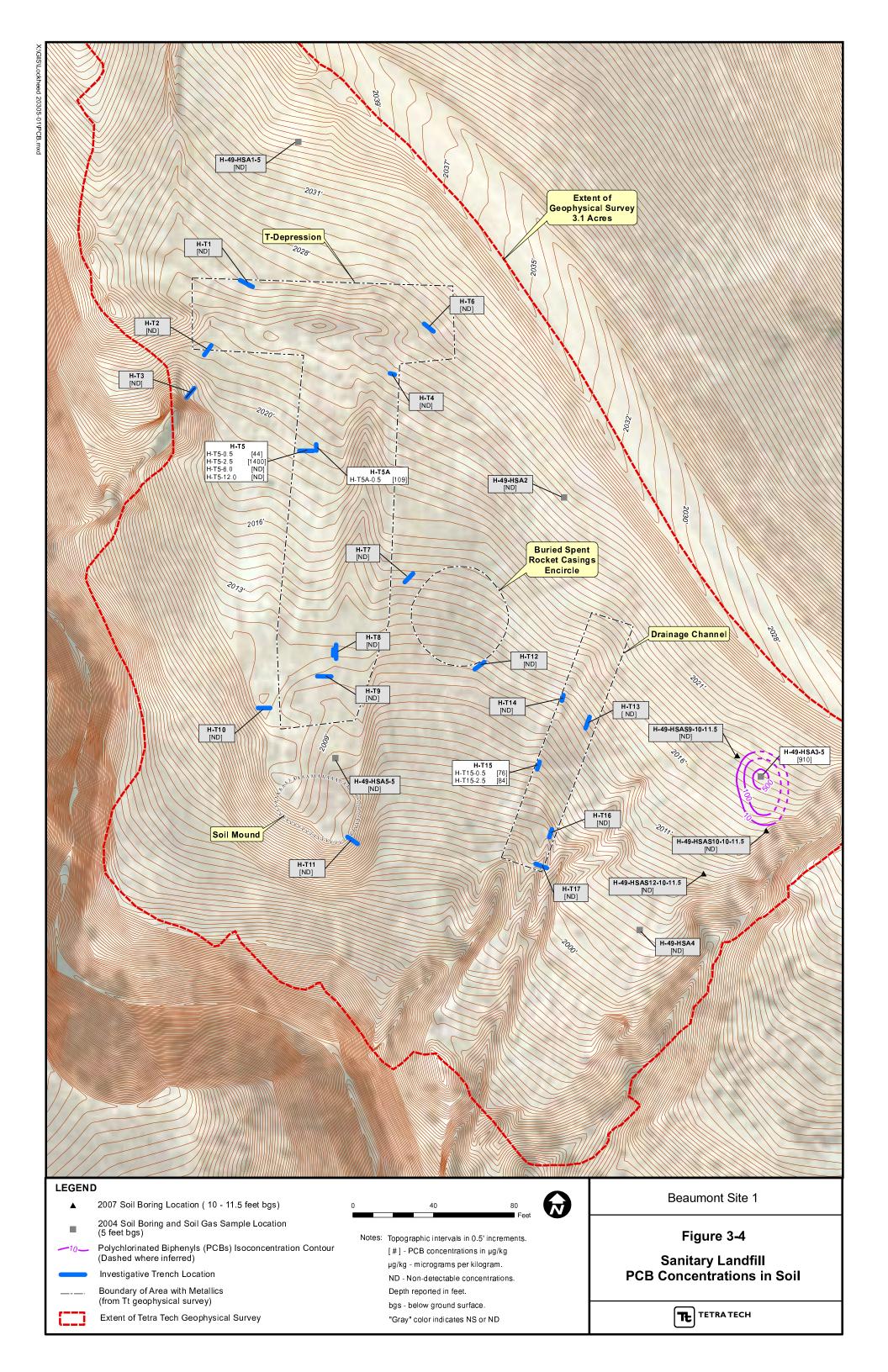
(-) Screening level not available.

"Bold" indicates concentrations detected above the MDL.

"Yellow" indicates concentrations detected above the CHHSL and/or RSL.



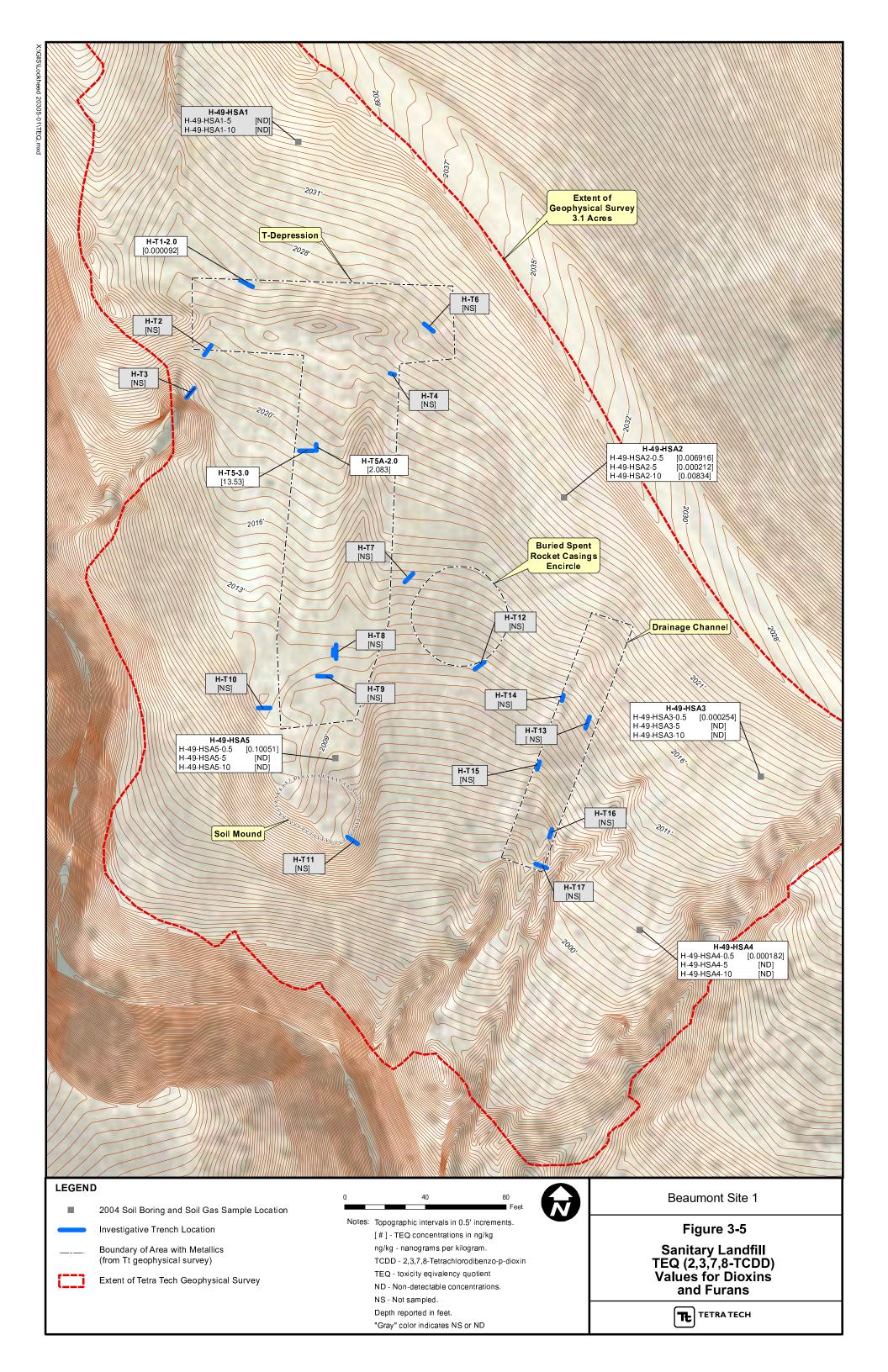




Samples were collected from trenches H-T5 (3 feet bgs) and H-T1 (2 feet bgs) from fine material that was gray in color. indicating that the material could potentially be ash. An additional sample was collected from trench H-T5A (immediately adjacent to trench H-T5) at 2 feet bgs from a thin layer of material that was black in color and appeared burned. The three (3) samples collected were tested for dioxins and furans. The results were converted to the 2,3,7,8-TCDD TEQ for each trench location for further evaluation (see Figure 3-5). The TEQ values ranged from 0.000092 nanograms per kilogram (ng/kg) to 13.53 ng/kg. The TEQ value for the sample collected from trench H-T5 did not exceed the TTLC or STLC; however, the TEQ is above the residential CHHSL and RSL.

Soil Mound Sample Results

A total of three (3) samples were collected from trench H-T11. Soil samples were collected at 0.5 feet bgs, 5.0 feet bgs (below the waste) and 10 feet bgs. Perchlorate, SVOCs, and PCBs were not detected at concentrations above the method detection limit. Eleven of the seventeen metals including arsenic, barium, beryllium, cadmium, cobalt, chromium, copper, lead, nickel, thallium, vanadium and zinc were detected in this area. Metal concentrations did not exceed the TTLC or STLC; however, arsenic was detected at concentrations exceeding the residential and industrial CHHSL and RSL. A summary of the analytical results is provided in Table 3-3.



Drainage Channel Sample Results

A total of 14 soil samples were collected from five (5) trenches along the drainage channel. Soil samples were collected at 0.5, 2.0 or 2.5 (adjacent to the waste), 4.0 or 5.0 (below the waste) and 10 feet bgs (trench H-T13 and H-T17). Perchlorate was detected in all samples collected from this area at concentrations ranging from 227 ug/kg to 67,300 ug/kg (detected in trench H-T14 at 0.5 feet bgs). The extent of perchlorate affected soil is generally limited to the drainage channel boundary identified in the geophysical investigation (Figures 3-2 and 3-3). The perchlorate concentration detected in sample H-T14-0.5 (67,300 ug/kg) exceeded the residential RSL but did not exceed the industrial RSL.

PCBs were detected in one location within this area, trench H-T15, at concentrations ranging from 76 ug/kg (Arochlor 1254) to 84 ug/kg (Arochlor 1260). The extent of PCBs detected in soil is limited to the surface from 0.5 feet to 2.5 feet bgs in trench H-T15 (Figure 3-4). The concentrations of PCBs detected in soil did not exceed the TTLC, STLC, CHHSL or RSL. SVOCs were not detected at concentrations above the method detection limit.

Thirteen of the seventeen metals including arsenic, barium, beryllium, cadmium, cobalt, chromium, copper, lead, nickel, selenium, thallium, vanadium, and zinc were detected in this area. Metal concentrations did not exceed the TTLC or STLC; however, arsenic was detected at concentrations exceeding the residential and industrial CHHSL and residential RSL. Arsenic in 7 of the 8 was detected at concentrations exceeding the industrial RSL.

Buried Spent Rocket Casings Encircle Sample Results

A total of six (6) soil samples were collected from two (2) trenches in the Buried Spent Rocket Casings Encircle. Soil samples were collected at 0.5, 2.5 (below the waste in trench T12), 5.0, 10 and 11 feet bgs. SVOCs and PCBs were not detected at concentrations above the method detection limit. Perchlorate was detected at concentrations ranging from non-detectable concentrations to 102 ug/kg (Figure 3-2). Twelve of the seventeen metals including arsenic, barium, beryllium, cobalt, chromium, copper, lead, nickel, selenium, thallium, vanadium and zinc were detected in this area. No chemical concentrations were detected above screening levels.

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Table 3-3 Summary of Validated Chemicals Detected in Soil Mound, Drainage Channel and Buried Spent Rocket Casings Encircle

		PCBS		INORGANICS															
	Sample ID -																		
Area	Depth	Aroclor Total ^a	Perchlorate	Arsenic	Barium	Beryllium	Cadmium	Cobalt	Chromium	Copper	Lead	Mercury	Molybdenum	Nickel	Silver	Selenium	Thallium	Vanadium	Zinc
	Units	ug/kg	ug/kg			_					1	ng/kg							
Soil Mound	H-T11-0.5	<21	<10.5	5.97	271	0.581 Jq	<0.524	9.5	17.4	20.3	10.8	<0.0346	<0.524	14.1	<0.524	<0.524	<0.524	45	75.1
	H-T11-5.0	<23	<11.5	1.86	467	0.497 Jq	<0.573	9.02	23.5	23.2	7.89	<0.0378	<0.573	13.3	<0.573	<0.573	1.58	60.9	78.7
	H-T11-10.0	<21	<10.7	2.56	115	0.246 Jq	<0.535	3.4	6.04	3.95	2.63	<0.0353	<0.535	3.25	<0.535	< 0.535	0.627 Jq	22.2	48.5
	H-T13-0.5'	<20	227	<0.402	64.2	<0.201	<0.502	3.43	4.81	3.33	2.85	<0.0331	<0.502	3.66	<0.502	<0.502	0.688 Jq	13.4	25.2
	H-T13-5.0'	<22	5340	<0.433	149	0.353 Jq	0.563 Jq	4.41	9.77	5.51	3.46	<0.0357	<0.541	4.85	<0.541	<0.541	1.09	25.7	46.3
	H-T13-10.0'	<22	958	<0.433	149	0.274 Jq	<0.542	3.55	5.93	2.33	2.89	<0.0358	<0.542	2.68	<0.542	<0.542	0.601 Jq	18.9	40.9
	H-T14-0.5'	<21	67300	2.58	82.6	0.355 Jq	<0.518	5.63	9.41	<0.518	4.23	<0.0342	<0.518	6.04	<0.518	<0.518	1.56	23.8	49
	H-T14-4.0	<22	5240	1.44	95.1	0.251 Jq	<0.548	4.07	6.38	<0.548	2.75	<0.0362	<0.548	4.19	<0.548	<0.548	1.15	18.6	33.7
	H-T15-0.5'	76	539	1.93	109	0.318 Jq	<0.509	4.47	9.86	3.14	4.85	<0.0336	< 0.509	5.71	<0.509	<0.509	1.28	21.9	54.3
Drainage	H-T15-2.5'	84	261	2.06	99.4	0.304 Jq	<0.529	4.92	9.05	2.6	5.71	< 0.0349	<0.529	5.84	<0.529	<0.529	1.32	20.6	54.4
Channel	H-T15-5.0'	<21	2700	2.53	460	0.312 Jq	<0.535	5.09	8.81	< 0.535	4.4	< 0.0353	< 0.535	5.77	<0.535	<0.535	1.48	26.8	48.2
	H-T16-0.5'	<21	5430	1.98	81.8	0.323 Jq	<0.514	4.92	8.08	2.45	3.81	<0.034	<0.514	5.65	<0.514	<0.514	1.37	18.8	41.1
	H-T16-2.5'	<21	2450	1.9	84	0.309 Jq	<0.531	5.06	8.38	1.82 Jq	3.56	< 0.035	<0.531	6.59	<0.531	<0.531	1.16	18.7	36.8
	H-T16-5.0'	<21	4120	2.68	182	0.358 Jq	<0.536	5.84	12.3	3.84	5.06	< 0.0354	< 0.536	7.9	<0.536	<0.536	1.35	33.8	48.5
	H-T17-0.5'	<20	305	<0.406	79.1	0.269 Jq	<0.507	3.98	8.19	7.53	4.95	<0.0335	< 0.507	7.81	<0.507	<0.507	0.762 Jq	16.6	49.8
	H-T17-5.0'	<26	5700	<0.521	149	0.398 Jq	0.76 Jq	6.82	13.7	13.2	6.2	<0.043	< 0.651	9.81	<0.651	<0.651	1.31	31.6	70
	H-T17-10.0'	<24	1600	<0.478	209	0.469 Jq	1.05 Jq	9.51	16.5	15.8	7.16	< 0.0395	<0.598	11.2	<0.598	0.706 Jq	1.69	48.6	91.9
	H-T7-0.5'	<20	<10.2	<0.408	92.2	0.267 Jq	<0.51	3.75	7.45	6.31	5.24	<0.0337	<0.51	4.78	<0.51	<0.51	0.763 Jq	18.2	42.1
Duried Chent	H-T7-5.5'	<22	75.1	<0.44	132	0.373 Jq	0.727 Jq	4.8	10.9	9.84	4.71	<0.0363	<0.55	6.69	<0.55	0.595 Jq	0.974 Jq	26.6	53.8
Buried Spent Rocket Casings	H-T7-10.0'	<22	60.1	<0.443	169	0.452 Jq	0.895 Jq	7.03	14.6	14.9	5.46	<0.0365	<0.554	9.14	<0.554	0.62 Jq	1.26	43.2	63.4
Encircle	H-T12-0.5'	<21	102	<0.425	102	0.271 Jq	<0.531	3.97	7.27	6.42	4.71	< 0.035	<0.531	4.68	<0.531	<0.531	0.773 Jq	18.1	41.2
211011010	H-T12-2.5'	<26	<13.2	<0.53	132	0.404 Jq	0.784 Jq	8.3	10.9	9.52	4.4	<0.0437	< 0.662	9.18	<0.662	0.755 Jq	1.46	33.3	54.2
	H-T12-11.0'	<24	42.3	<0.47	208	0.61 Jq	1.35	12.5	23.2	25	9.24	<0.0388	<0.588	16.3	<0.588	0.874 Jq	1.57	58.1	98
	CHHSL - Res	89	-	0.07	5,200	150	1.7	660	100,000	3,000	150	18	380	1,600	380	380	5.0	530	23,000
	CHHSL - Ind	300	-	0.24	63,000	1,700	7.5	3,200	100,000	38,000	3,500	180	4,800	16,000	4,800	4,800	63	6,700	100,000
	RSL - Res	170	55000	0.39	15,000	160	70	-	120,000	3100	400	6.7	390	1,600	390	390	5.1	390	23,000
	RSL - Ind	620	720,000	1.6	190,000	2,000	810	-	1,500,000	41,000	-	28	5,100	20,000	5,100	5,100	66	5,200	310,000
	TTLC	50,000	-	500	10,000	75	100	8,000	500	2,500	1,000	20	3,500	2,000	500	100	700	2,400	5,000
	STLC	5,000		5.0	100.0	0.8	1.0	80.0	5.0	25.0	5.0	0.2	350.0	20.0	5.0	1.0	7.0	24.0	250.0

Notes:

CHHSL - California Human Health Screening Level, DTSC 2005.

RSL - Regional Screening Level, USEPA 2008.

TTLC - Total Threshold Limit Concentration, DTSC 2008.

STLC - Soluble Threshold Limit Concentration, DTSC 2008.

Res - Residential Land Use.

Ind - Industrial Land Use.

NA - Not analyzed.

(-) Screening level not available.

"Bold" indicates concentrations detected above the MDL.

"Yellow" indicates concentrations detected above the CHHSL and/or RSL.

^a Summation of PCBs in Aroclor mixture.

4.0 SUMMARY AND CONCLUSIONS

The objective of the characterization was to perform additional sampling adjacent to the waste cells in the Sanitary Landfill to further evaluate remedial alternatives. Prior to this investigation, there was limited data to confirm the absence (or presence) of chemicals in soil adjacent to the waste cells. Results of this investigation generally confirmed the locations, depths and types of wastes present in the landfill as previously reported. In addition to the waste delineation results, this investigation provided a more thorough characterization of the chemical impacts associated with the former landfill activities and wastes still present at the landfill. The results of the characterization activities, including trench observations, characterization sampling results, and screening level comparisons were used to determine: 1) if the soil affected by the buried materials should be considered hazardous waste; 2) the lateral and vertical extent of affected soil; and 3) whether types and levels of wastes present in the landfill and affected soils may pose a risk to human health.

The focus of the characterization efforts in the Sanitary Landfill were the drainage channel, T-depression, soil mound and buried spent rocket casings encircle. The sampling locations within these four areas were selected by reviewing previous environmental investigations performed along with the results of the geophysical investigation implemented to confirm the waste cell locations. During the investigation, the maximum depth at which waste was observed was at 8 feet bgs. The maximum extent of waste was not confirmed due to equipment limitations and observation limitations attributed to trenching outside the waste cell. However, the maximum depth of waste based on previous investigations ranged from 4 - 10 feet bgs.

A total of 19 trenches were completed and samples were collected immediately below ground surface (0.5 feet bgs) and adjacent to or below the waste layer. A total of 51 samples were collected and tested for perchlorate, PCBs, SVOCs, and metals and three (3) samples were collected from material that appeared burned or contained ash and were tested for dioxins and furans. The sampling results confirmed the presence of perchlorate, PCBs, metals and dioxins and furans in soil adjacent to the waste cell. Based on the 2004, 2007 and 2008 sampling results, the extent of affected soil is generally limited to the foot prints of the waste cells.

The extent of perchlorate appears to be generally limited to the geophysical boundary area containing metallics. The highest concentration of perchlorate was identified in a surface sample collected from the Drainage Channel. Concentrations of perchlorate exceeded the RSL for residential standards in one location within the Drainage Channel. The full extent of perchlorate impacts to soil and groundwater at

the Sanitary Landfill are under investigation through implementation of the Dynamic Investigation Work Plan at the Sanitary Landfill (Tetra Tech, 2008b).

The extent of PCBs identified in soil are limited to one location within the T-depression and drainage channel and are limited to the upper 2.5 feet of the ground surface (trench H-T5). PCBs are not present in concentrations exceeding hazardous waste critera in the T-depression; however, the concentrations of PCBs in one location exceeded the CHHSL and RSL for residential standards. Further characterization of PCBs east of the drainage channel based on the results from the 2004 soil investigation (Tetra Tech, 2005a) is being addressed in the 2008 Dynamic Site Investigation (Tetra Tech, 2008b). The presence of SVOCs detected in one sample is limited to trench H-T4 and does not pose a hazardous waste condition. Further, the concentrations of SVOCs did not exceed CHHSLs and the RSL for residential standards.

All metals with the exception of antimony were detected throughout the Sanitary Landfill. The concentrations were compared to CHHSLs, RSLs for residential standards, the TTLC and STLC (Table 3-1) since the background levels are currently being established for the Site. The highest concentration of metals was in samples collected from the T-depression. Arsenic and one instance of cadmium were at concentrations exceeding the residential CHHSL and RSL. Concentrations of arsenic exceeding CHHSL and RSLs for residential standards are likely due to naturally occurring high concentrations of arsenic in the soils parent material.

A limited number of samples (a total of three samples) were collected for dioxins and furans based on field observations; however, several samples (a total of 29 samples) were collected during the 2004 soil investigation. All dioxins and furans detected in soil at the Sanitary Landfill were converted to the 2,3,7,8-TCDD TEQ for comparisons to screening levels. Data from the previous investigation suggest that 2,3,7,8-TCDD is generally confined to the top layer of soil with minimal detections (one out of five locations) in soil at 20 and 30 feet bgs outside of the waste cells. Dioxin and furans were not identified in soil at 40 feet bgs (in all five locations) outside of the waste cells. Based on the TEQ values for all data, dioxins and furans do not pose a hazardous waste condition, but the TEQ values exceeded the CHHSL and RSL for residential standards in one location in the T-Depression (trench H-T5 at 3 feet bgs).

The results from this investigation will be incorporated as part of the overall data collection and evaluation into the Dynamic Investigation Report. If recommendations are necessary for this area based on the findings and/or comprehensive data evaluation, they will be included in the Dynamic Investigation Report.

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6.0 ACRONYMS AND ABBREVIATIONS

AQMD (South Coast) Air Quality Management District

BPA Burn Pit Area

bgs below ground surface

CalEPA California Environmental Protection Agency

CDHS California Department of Health Services

CHHSL California Human Health Screening Level

cy cubic yards

DTSC California Department of Toxic Substances Control

EPA United States Environmental Protection Agency

LMC Lockheed Martin Corporation

LPC Lockheed Propulsion Company

MDLs method detection limits

MEC Munitions and Explosives of Concern

mg/kg milligrams per kilogram

μg/kg micrograms per kilogram

ng/kg nanograms per kilogram

OEHHA Office of Environmental Health Hazard Assessment

PAH polyaromatic hydrocarbons

PCB polychlorinated bi-phenyl

PCDD polychlorinated dibenzo-dioxin

PCDF polychlorinated dibenzo-furan

pg/g picograms per gram

PID photoionization detector

RWQCB Regional Water Quality Control Board

RSL Regional Screening Level

SKR Steven's Kangaroo Rat

STLC Soluble Threshold Concentration Limit

SVOC semi-volatile organic compound

TCDD Tetrachlorodibenzo-p-dioxin

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TEF Toxicity Equivalency Factor

TEQ Toxicity Equivalency Quotient

TPH Total Petroleum Hydrocarbons

TTLC Total Threshold Concentration Limit

USCS Universal Soil Classification System

USFWS United State Fish and Wildlife Service

UXO unexploded ordnance

VOC volatile organic compound