RECEIVED

1:40 pm, Aug 16, 2007

Alameda County
Environmental Health

SITE INVESTIGATION WORK PLAN
SLIC CASE RO00002477
Pacific Galvanizing
715 46th Avenue
Oakland, California

August 2007

Prepared for

Pacific Galvanizing
715 46th Avenue
Oakland, California

Prepared by

WEST
Environmental Services & Technology
711 Grand Avenue, Suite 220
San Rafael, California 94901
415/460-6770 Fax 415/460-6771
main@westenvironmental.com

TABLE OF CONTENTS

SECTION **PAGE**

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

WEST
Environmental Services & Technology

SIGNATURE PAGE

All engineering information, conclusions and recommendations contained in this report have been prepared by a California Professional Engineer. All hydrogeologic and geologic information, conclusions and recommendations contained in this report have been prepared by a California Professional Geologist.

REGISTERED PROFESSIONAL ENGINEER
PETER KRASNOFF
C44031
EXP 6/30/09
CIVIL
STATE OF CALIFORNIA

Peter M. Krasnoff
California Registered Civil Engineer (44031)

Date 8/15/07

PROFESSIONAL GEOLOGIST
PETER E. MORRIS
7084
Exp. 4/30/09
STATE OF CALIFORNIA

Peter E. Morris
California Professional Geologist (7084)

Date 8/15/07

1.0 INTRODUCTION

This *Site Investigation Work Plan* ("*Work Plan*") has been prepared by West Environmental Services & Technology, Inc., (WEST) for Pacific Galvanizing located at 715 46th Avenue, Oakland, California ("the Site;" Figure 1-1). This *Work Plan* has been prepared to present the proposed scope of additional investigations at the Site and includes: a summary of previous environmental investigations; updated Conceptual Site Model (CSM); data gap analysis; and a field sampling plan (FSP).

Regulatory and technical guidance documents used in preparing this *Work Plan* included: State Water Resources Control Board (SWRCB) *Resolution 92-49 – Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304*; *Items to be Included in a Site Investigation Report* (Regional Board, 2004a); and *Items to be Included in a Site Investigation Work Plan* (Regional Board, 2004b). Based on an evaluation of the previous findings, the scope of the additional investigations has been developed and is presented in Section 5.0 of this *Work Plan*.

1.1 BACKGROUND

Pacific Galvanizing operates a "hot-dip" galvanizing facility on the northeast corner of Coliseum Way and 46th Avenue in Oakland, California. Facility operations include: receipt and handling of metal products; material preparation; galvanizing; and temporary storage of galvanized metal products for customer pickup. Incoming metal products are received and stored in the paved receiving area located west of the materials processing building, also referred to as the "Black Yard." Finished products are stored in the shipping and customer pickup yard also referred to as the "Galvanizing Yard." Adjacent properties include: Bostrom Bergen Metal Products to the south; Coliseum Way and Interstate 880 to the west; Union Pacific railroad corridor to the east; and the Spa Company and Reliance Systems to the north.

Pacific Galvanizing leases a strip of land along the north side of the facility from Alameda County. The land owned by Alameda County contains a subsurface concrete box culvert for the conveyance of surface water runoff to the Oakland Inner Harbor. The area had previously been an open drainage channel. Subsequent to the construction of the concrete box culvert, the land was paved and made available to lease.

Soil samples were collected by Earth Technology Corporation from the County land in 1996 at depths up to 1.2-meters. Laboratory analysis of the soil samples revealed the presence of lead up to 1,900 milligrams per kilogram (mg/kg) and zinc up to 45,000 mg/kg. Subsequently, additional investigations were conducted in 1998 to assess the extent of lead and zinc in soil and groundwater. Thirteen soil samples and one groundwater sample were collected from the County land in 1998. Laboratory analysis of the soil samples revealed lead up to 5,300 mg/kg and zinc up to 130,000 mg/kg. The groundwater sample contained less than 0.050 milligrams per liter (mg/l) of dissolved lead, and 0.68 mg/l of dissolved zinc.

In March 2000, following their review of the 1998 findings, the Alameda County Health Care Services Agency (ACHCSA) requested the installation of a groundwater monitoring well near the storm drain. The monitoring well was installed in March 2000 and following development was sampled in April and June of 2000. The preliminary results were forwarded to the ACHCSA. In May 2007, the ACHCSA requested submittal of the report of the monitoring well installation and a work plan that: addresses the potential for metals to be transported offsite by surface water runoff; and presents a scope of work to define the extent of metals in soil and groundwater. This *Work Plan* outlines the scope-of-work to conduct investigations to complete the characterization of metals at the Site.

1.2 WORK PLAN ORGANIZATION

The *Work Plan* has been organized as follows:

- Site Description (Section 2.0);

- Summary of Investigations (Section 3.0);
- Data Evaluation (Section 4.0); and
- Field Sampling Plan (Section 5.0).

2.0 SITE DESCRIPTION

The approximately 7,000-square meter facility is located on the northeast corner of Coliseum Way and 46th Avenue in Oakland, California, northeast of Interstate 880 (Figure 2-1). In addition, Pacific Galvanizing leases approximately 1,000 square-meters of land on the north side of the facility from Alameda County. The Site is nearly flat, with the topography sloping gently to the southwest with a gradient of approximately 0.5 percent. The Site is bounded by the Southern Pacific railroad to the northeast, Coliseum Way to the southwest, 45th Avenue to the northwest and 46th Avenue to the southeast.

2.1 FACILITY OPERATIONS

Pacific Galvanizing conducts "hot-dip" galvanizing. The operations include: receipt and handling of products; material preparation; galvanizing; and temporary storage for customer pickup. Incoming metal products are received and stored before processing in the paved receiving area located west of the materials processing building, i.e., the Black Yard. Finished products are stored in the shipping and customer pickup yard, i.e., the Galvanizing Yard.

The material preparation process includes: dipping metal products in acid, i.e., pickling tanks to remove surface residues prior to galvanizing. After pickling, the metal product is dipped in molten zinc. Ammonium chloride is used as a fluxing agent. The metal to be galvanized passes through the fluxing agent as it is immersed in the molten zinc. Aluminum is added to the zinc to enhance the appearance of the galvanized surface finish. After removal from the molten zinc, the metal is placed in a water bath to cool the finished product.

The galvanizing kettle is fired by natural gas and is maintained at a temperature of approximately 450 degrees Celsius. Other operations conducted at the Site include limited welding and equipment maintenance. An air compressor is also maintained at the Site to power pneumatic equipment. Vapor emissions from the galvanizing operation are directed to bag houses for removal of suspended particulates. Locations of the facility operations are shown on Figure 2-1.

2.2 REGIONAL GEOLOGIC AND HYDROGEOLOGIC SETTING

The Site is located within the East Bay Plain Groundwater Basin within the Coast Ranges Geomorphic province. The regional geology is composed of Holocene alluvial and fluvial deposits containing unconsolidated and interbedded clays, silts, sands and gravels underlain by Jurassic, Cretaceous and Tertiary-age bedrock units of the Franciscan Complex and Great Valley Sequence (Regional Board, 1999).

The Site is located within the Oakland Sub-Area of the San Francisco Basin portion of the East Bay Plain (Regional Board, 1999). Water supply wells in the Oakland Sub-Area groundwater basin have been constructed within the alluvial and fluvial deposits at depths of approximately 60-meters below ground surface. Groundwater generally flows along the topographic slope to the west toward the San Francisco Bay.

2.3 SITE GEOLOGY

The geology observed in borings drilled at the Site is composed of: clayey-gravel; and discontinuous interbedded fine-grained silty-sand and clayey-silt, to a depth of approximately 5-meters below ground surface. Clayey-gravels are present between the ground surface and approximately 1.2-meters below ground surface. A fine-grained layer, primarily silty-sand to clayey-silt, is present between approximately 1.2-meters and 4.5-meters below ground surface.

2.4 SITE HYDROGEOLOGY

Groundwater was encountered in borings advanced at the Site at approximately 2.3-meters below ground surface. Groundwater flow direction near the Site is inferred to the west toward San Francisco Bay. The Oakland Inner Harbor is located approximately 600-meters to the west.

2.5 STORM DRAIN SYSTEM

The Site is bermed and storm water is contained onsite by pumping to aboveground storage tanks (ASTs) for onsite reuse or disposal in accordance with applicable permits. An Alameda County storm drain, consisting of two parallel box culverts, conveys storm water runoff from upstream of the Site to the Oakland Inner Harbor. The storm drain box culverts were constructed along the alignment of a former creek that flowed through the Site. Subsequent to the construction of the concrete box culverts, Alameda County leased the land above the box culverts to Pacific Galvanizing.

3.0 SUMMARY OF INVESTIGATIONS

Soil and groundwater investigations have been conducted at the Site since 1996. The investigations included soil and groundwater sampling near the storm drain culvert alignment; and installation and sampling of a groundwater monitoring well. A summary of the investigations is presented below.

3.1 SOIL SAMPLING

Soil samples were collected by Earth Technology Corporation (Earth Tech) from along the storm drain alignment on the County land on March 15, 1996. The soil samples were collected from depths ranging from 0.3-meters to 1.2-meters below ground surface. Laboratory analyses of the soil samples revealed lead up to 1,900 mg/kg and zinc up to 45,000 mg/kg.

Based on the 1996 analytical results, thirteen soil borings (SB-1 through SB-13) were advanced at the Site on April 2, 1998 (WEST, 1999). The soil borings were advanced using hand augering equipment to a depth of approximately 1.5-meters below ground surface (Figure 3-1). Soil samples were collected from the borings between 1.2-meters and 1.5-meters below ground surface and submitted for chemical analysis. The soil samples were submitted to Sequoia Analytical for analysis lead and zinc using United States Environmental Protection Agency (USEPA) Method 6010 and for pH using USEPA Method 150.1.

Laboratory analyses of the soil samples revealed lead between 22 mg/kg and 5,300 mg/kg and zinc between 490 mg/kg to 130,000 mg/kg (Figure 3-1). The pH of the soil samples ranged from 5.5 Standard Units (S.U.) to 8.5 S.U. A summary of the soil sample analytical results is presented in Table 3-1.

The 95 percent upper confidence level (95 percent UCL) of the mean concentrations for lead and zinc in soil were calculated to be approximately 1,900 mg/kg and 43,000 mg/kg, respectively (Appendix C).

3.2 Groundwater Sampling

A groundwater sample was collected from soil boring SB-4 by WEST on April 2, 1998. The groundwater sample was submitted to Sequoia Analytical for chemical analysis. The groundwater sample was filtered by the analytical laboratory and analyzed for dissolved lead and zinc using USEPA Method 6010/7000 series and for pH using USEPA Method 150.1.

The laboratory analyses did not reveal dissolved lead above the laboratory-reporting limit of 0.05 mg/l. Laboratory analyses of the grab groundwater sample revealed zinc at 0.68 mg/l. The pH of the groundwater sample was reported at 7.5 S.U. (Table 3-2).

3.3 Groundwater Monitoring Well Installation

A boring was advanced at the Site on March 16, 2000 in the western portion of the Site (Figure 3-2). Following the advancement of soil boring, a groundwater-monitoring well (MW-1) was constructed within the annulus of the soil boring. Groundwater samples were collected from the monitoring well in April and June 2000.

3.3.1 Utility Locating and Permitting

Pursuant to Senate Bill 32, an underground services alert (USA) ticket was obtained regarding buried utilities at the Site. A private locating service was also used to locate utilities on the property near the proposed soil boring. A groundwater-monitoring well permit was obtained from the Alameda County Public Works Agency (ACPWA), Water Resources Section, on March 13, 2000.

3.3.2 Soil Boring Installation

Soil boring (MW-1) was advanced at the Site near the storm drain box culvert on March 16, 2000 (Figure 3-2). The soil boring was advanced using direct push equipment to a depth of approximately 4.5-meters below ground surface. Soil core samples were collected continuously and described using the Unified Soil Classification System. The soil boring was advanced approximately 1.5-meters below the first encountered groundwater. A soil boring log for MW-1 is included in Appendix A.

3.3.3 Groundwater-Monitoring Well Construction

Following advancement of the soil boring, the borehole was reamed using 0.2-meter outside diameter hollow-stem augers to a depth of approximately 4.5-meters below ground surface for installation of the groundwater-monitoring well. The groundwater-monitoring well was constructed using 3-meter long 5-centimeter diameter Schedule 40 polyvinyl chloride (PVC) slotted screen pipe. The well screen consisted of 0.025-centimeter factory machined slots. The upper 1.5-meters of the monitoring well consists of a 1.5-meter long 5-centimeter diameter Schedule 40 PVC blank well casing. The top of the well was outfitted with a flush mounted steel traffic rated well protection box and locking well cap.

A sand filter pack consisting of #2/16 grain size sand was placed within the annulus of the soil boring and well casing between the depths of 1.2-meters and 4.5-meters below ground surface. A bentonite seal was placed above the sand filter pack between the depths of 0.9-meters and 1.2-meters below ground surface. A sanitary seal consisting of Portland type II neat cement was placed above the bentonite seal to the ground surface. Details of the well construction are presented on the soil boring log in Appendix A.

3.3.4 Well Development

Following the well installation, the sand filter pack was developed by using a surge block and bailer to flush and remove fine-grained material within the sand filter pack. Groundwater quality parameters were collected during well development including temperature, pH and conductivity. Well development was discontinued following removal of approximately five well volumes and stabilization of the water quality parameters within 10 percent over the last three recorded measurements.

3.3.5 Groundwater Sampling

Groundwater samples were collected from monitoring well MW-1 on April 26, 2000 and June 8, 2000. The monitoring well was sampled using low-flow purge and sample collection techniques (USEPA, 1996). Groundwater parameter data, including temperature, pH, electrical conductivity, and turbidity, were monitored and recorded every three minutes during well purging for a minimum of 15 minutes. Purge flow rate and depth to water measurement data were also recorded. Groundwater samples were collected following stabilization of groundwater parameters over the last three readings during the purging activities.

Groundwater samples were collected using the peristaltic pump following stabilization of groundwater quality parameters. The groundwater samples were collected using laboratory-supplied sample containers, labeled, and placed in a cooler with ice for transportation to a California State-certified analytical laboratory for chemical analyses. The groundwater samples were submitted to Chromalab of Pleasanton, California under USEPA chain-of-custody protocols.

The groundwater samples were submitted for chemical analysis for dissolved metals including lead and zinc using USEPA Method 6010 and for pH using USEPA Method 9040B. The groundwater samples were filtered and preserved by the analytical laboratory upon receipt of the samples.

3.3.6 Groundwater Sampling Analytical Results

The laboratory analyses did not reveal dissolved lead above the laboratory-reporting limit of 0.005 mg/l. The laboratory analyses of groundwater samples collected on April 26, 2000 revealed dissolved zinc at 280 mg/l. The pH of the groundwater sample collected was reported at 6.9 S.U.

The laboratory analyses did not reveal dissolved lead above the laboratory-reporting limit of 0.005 mg/l. The laboratory analyses of groundwater samples collected on June 8, 2000 revealed dissolved zinc at 210 mg/l. The pH of the groundwater sample collected was reported at 7.0 S.U.

A summary of groundwater analytical results is presented in Table 3-2 and depicted on Figure 3-2. Copies of laboratory data certificates and chain-of-custody forms are included in Appendix B.

4.0 APPLICABLE SCREENING CRITERIA

Investigations at the Site have revealed the presence of lead and zinc in soil and groundwater. The assessment of the potential risks to human health and the environment associated with the presence of lead and zinc in the subsurface at the Site requires the development of a conceptual site model (CSM) and comparison with appropriate evaluation criteria.

The CSM presents a narrative and graphical description of Site characteristics to provide a foundation for understanding the Site. The CSM identifies the general physical conditions at the Site that influenced contaminant transport. The CSM incorporates: the geology and hydrogeology; properties of the chemicals; chemical usage; identified sources; and transport mechanisms to explain the distribution of chemicals found at and near the Site (Figure 4-1). The CSM is also used in identifying potential receptors to allow for selection of appropriate evaluation criteria. Through a comparison of Site data to applicable criteria, the CSM is used to assess the adequacy of the Site characterization and identify whether more information is required to make decisions regarding the conditions at the Site, i.e., data gaps. The CSM and an evaluation of the data are presented below.

4.1 CONCEPTUAL SITE MODEL

Pursuant to SWRCB guidelines (Executive Order D-5-99 and Senate Bill 989), a CSM has been developed for the Site. The decision-making framework for Site investigations centers on the development and continual modification of the CSM. The CSM was developed based on: known historical operations at the Site; subsurface geology and hydrogeology; Site investigation data; chemical properties; suspected chemical release and transport mechanisms; and potential exposure scenarios, to identify the general physical conditions that influence contaminant transport. The CSM representing the environmental conditions at the Site is depicted on Figure 4-1.

The CSM describes the presence of lead and zinc in soil and groundwater near the storm drain as having originated from historical spills associated with drag-out of galvanized material when the creek channel was exposed. Subsequent to the placement of the concrete box culverts and pavement, the potential for incidental spills to impact soil and/or groundwater has been addressed.

The lead and zinc are relatively immobile in soil and groundwater. Sampling data has confirmed the absence of lead above the laboratory-reporting limit in groundwater. While groundwater data indicate the presence of zinc in groundwater, given its soil/water partition coefficient, it is anticipated to have limited extent in soil and groundwater.

Zinc is not mobilized from the Site in storm water runoff, as storm water is contained onsite within the bermed area. Extensive storm water monitoring has confirmed the efficacy of the storm water containment system. Copies of the Storm Water Pollution Prevention Plan (SWPPP) and Annual Comprehensive Site Compliance Evaluations (ACSCEs) have been filed with the Regional Board.

Based on the CSM, a screening level assessment has been performed that includes a comparison of chemical data at the Site to potentially applicable human health and environmental protection criteria.

4.2 SCREENING LEVEL ASSESSMENT

A screening level assessment was performed to assist in assessing the adequacy of the existing data. The screening level assessment consisted of three components: (1) identification of potential exposure pathways; (2) identification of appropriate screening levels for each media; and (3) a comparative analysis. The screening level assessment has been used to evaluate conditions of potential concern and identify areas for additional investigations, i.e., data gaps.

The screening levels are not necessarily cleanup goals, but have been selected to evaluate Site conditions and identify the necessity for additional characterization. The screening levels are conservatively calculated threshold values below which particular chemicals are believed to "be below thresholds of concern for risks to human health." The presence of a chemical at concentrations in excess of a screening level does not indicate that adverse impacts to human health are occurring or will occur but suggests that further evaluation of potential human health concerns is warranted.

Based on the identified exposure pathways, screening levels were identified for chemicals in soil and groundwater. Chemical-specific screening levels were developed from: concentrations based on published environmental screening criteria. The screening levels that were considered include the California Regional Water Quality Control Board – San Francisco Bay Region (Regional Board) Environmental Screening Levels (ESLs); and numerical water quality objectives identified in the *Water Quality Control Plan for the San Francisco Bay Basin* or Basin Plan (Regional Board, 2006).

4.2.1 Exposure Pathways Evaluation

Exposure pathways for lead and zinc at the Site have been evaluated to assess the potential impacts to human health and environment. Based on the analysis presented in the CSM, it has been concluded that potential human exposure to lead and zinc in soil is limited due to the presence of the pavement over soil. In addition, while direct exposure to lead and zinc in soil was not identified as a likely complete exposure pathway under current Site use, the zinc has the potential to leach and impact groundwater. While direct exposure to zinc in groundwater is unlikely due to prohibitions on use of shallow groundwater, it was identified as a complete exposure pathway due to the designation of the groundwater at the Site as a potential drinking water source. A summary of the potential exposure pathways is presented on Figure 4-2.

Exposure pathways to inorganic elements at the Site have been evaluated to assess the potential impacts to human health and environment. Potential human exposure to inorganic elements at the Site is limited to soil near the alley and storm drain box culvert. The remainder of the Site is paved storage area.

4.2.2 Identification of Screening Criteria

Based on the identified exposure pathways, screening levels have been selected for chemicals in soil and groundwater. The selected screening levels have been selected based on a review of published screening levels including: California Environmental Protection Agency (CalEPA) California Human Health Screening Levels (CHHSLs); Regional Board Basin Plan numerical water quality objectives; California Department of Health Services (DHS) maximum contaminant levels (MCLs); and the Office of Environmental Health Hazard Assessment (OEHHA) Public Health Goals (PHGs).

4.2.2.1 CALIFORNIA HUMAN HEALTH SCREENING LEVELS

The California Human Health Screening Levels (CHHSLs or "Chisels") are concentrations of hazardous chemicals in soil or soil gas that the CalEPA considers to be below thresholds of concern for risks to human health (CalEPA, 2005). CHHSLs combine standard exposure assumptions and chemical toxicity values published by the USEPA and CalEPA, to estimate soil, soil gas and indoor air concentrations considered to be below thresholds of concern for risks to human health (CalEPA, 2005). The presence of a chemical at concentrations in excess of a CHHSL does not indicate that adverse impacts to human health are occurring or will occur but suggests that further evaluation of potential human health concerns is warranted. The applicable CHHSLs for protection of human health include: lead at 3,500 mg/kg and zinc at 100,000 mg/kg.

4.2.2.2 STATE WATER RESOURCES CONTROL BOARD RESOLUTION 92-49

Pursuant to SWRCB Resolution No. 92-49, groundwater containing concentrations above applicable numerical water quality objectives must obtain the requisite level of water quality within a reasonable timeframe. In general, target cleanup levels for groundwater are based on the numerical water quality objectives as designated in the Basin Plan (Regional Board, 2006). The Basin Plan also includes narrative water quality objectives that require that waters "shall not contain taste- or odor-producing substances in concentrations that…adversely affect beneficial uses."

The groundwater near the Site has been designated to have the potential beneficial use of municipal and domestic water supply (MUN). The Basin Plan identifies the drinking water MCLs as numerical water quality objectives for the MUN beneficial use. The California DHS has not set MCLs for zinc.

Zinc is a normal constituent of the human body. Its presence in drinking water in concentrations up to 40 mg/l appears to have no health significance, but it does impart an astringent taste to water, and it will precipitate as $Zn(OH)_2$ or $ZnCO_3$ in alkaline waters to produce a milky turbidity (Camp and Meserve, 1974). The recommended limit of 5 mg/l is to avoid the taste produced by zinc.

4.2.2.3 REGIONAL BOARD ENVIRONMENTAL SCREENING LEVELS

The Regional Board has identified Tier 1 ESLs for chemicals in soil and groundwater (Regional Board, 2005). The Regional Board ESLs "are considered to be very conservative [and] the presence of a chemical at concentrations below the corresponding ESL can be assumed to not pose a significant threat to human health and the environment." While a chemical may be measured at concentrations above the Regional Board ESL, it "does not necessarily indicate that adverse impact to human health or the environment are occurring, [it] simply indicates that potential for adverse impacts may exist and that additional evaluation is warranted."

In developing the ESLs, the Regional Board has considered exposure pathways to humans, including dermal contact, inhalation, migration of soil leachate to groundwater, ingestion and urban area eco-toxicity criteria. The Regional Board uses a depth of 3 meters to delineate between surface soil and subsurface soil. The Regional Board ESLs for surface soil in commercial/industrial land use areas protective of human health and where groundwater is a potential drinking water resource have been used to evaluate the chemicals at the Site (Regional Board, 2005).

4.2.2.3.1 ESL for Protection of Human Health

The Regional Board ESL for the protection of human health from lead in soil under a commercial exposure scenario is 750 mg/kg based on the USEPA's Region IX Preliminary Remediation Goal (PRG). The Regional Board ESL for lead in groundwater is 0.015 mg/l based on the California DHS MCL at the tap.

The Regional Board ESL for the protection of human health under a commercial exposure scenario based on a Hazard Index of 1.0 for zinc is 1,306,600 mg/kg, i.e., greater than 100 percent (Table 3-2). The Regional Board drinking water ESL is 10.9 mg/l, based on the USEPA's Region IX tap water PRG.

4.2.2.4 SOIL LEACHING TO GROUNDWATER

An evaluation was conducted to identify the concentration of zinc in soil that is protective of groundwater quality below its taste and odor threshold secondary MCL of 5.0 mg/l. An evaluation of the concentration of lead protective of groundwater was not conducted, as lead has not been detected in groundwater at the Site above its laboratory-reporting limit.

The Regional Board's ESLs identify a value of 610 mg/kg for zinc based on urban area ecotoxicity. However, the urban ecotoxicity value was developed for the protection of surface water runoff, where the numerical water quality objective is 0.081 mg/l. Since the surface water exposure pathway has been addressed, through site paving and containment of all surface water, a screening level for this exposure pathway is not appropriate for evaluating soil to groundwater leaching.

4.2.2.4.1 Designated Level Methodology

A review of Regional Board's ESL Table G reveals that a soil screening level for the protection of groundwater was not developed. However, given the detection of zinc in groundwater at the Site, we have prepared an analysis to estimate the concentration of zinc in soil that is protective of the groundwater quality pursuant to the *Designated Level Methodology for Waste Classification and Cleanup Level Determination* (Regional Board, 1989). The evaluation was performed to simulate the one-dimensional transport of water and zinc through the soil column. The evaluation uses a soil/water partition equation to estimate concentrations of chemicals in infiltrated water. The soil/water partition equation relates concentrations of chemicals adsorbed to soil to soil-leachate concentrations. The equation allows for the calculation of the soil concentration that corresponds to the target soil-leachate concentration. Default leachability factors and dilution attenuation factors (DAFs) were used to estimate the soil screening level for protection of groundwater using the following equation:

$$DL = WQG \times DAF \times LF$$

Where:

DL = the concentration that does not pose a threat to groundwater (mg/kg) or parts per million (ppm)
WQG = water quality goal (mg/l) or parts per million (ppm)
DAF = Dilution Attenuation Factor (unitless)
LF = Leachability Factor (unitless) or partitioning coefficient K_d

A discussion of the applicable input parameters to the cited equation is presented below.

As noted above, the water quality goal (WQG) is 5.0 mg/l based on the secondary MCL. The selection of environmental attenuation factors plays a great role in the development of allowable leachate concentrations. The degree of expected attenuation under reasonable worst-case conditions is approximated with a DAF; the greater the degree of expected attenuation, the larger the factor. The DAF is used to transform water quality goals into site-specific Designated

Levels, i.e., concentration of constituents in soil that do not have the potential to degrade water quality. The DAF accounts for diffusion, dispersion, adsorption, natural attenuation, decay and advection. In selecting an environmental attenuation factor for protection of groundwater from zinc in soil, the State of California recommends 1000-fold attenuation factor, based on studies by Battelle Laboratories and the USEPA (Regional Board, 1989).

In addition, only a fraction of the total constituent concentration is available for leaching. The remainder of the constituent concentration is immobile due to reactions with ligands in water and with surface sites on the solid materials with which the water is in contact. Reactions in which the metal is bound to the solid matrix are referred to as sorption reactions and metal that is bound to the solid is said to be sorbed. The metal partition coefficient (Kd; also known as the sorption distribution coefficient) is the ratio of sorbed metal concentration (expressed in milligrams metal per kilogram soil material) to the dissolved metal concentration (expressed in milligrams metal per liter of solution) at equilibrium. Using the chemical-specific K_d for zinc of 62 liters per kilogram (L/kg), results in a zinc soil screening level for protection of groundwater of 310,000 mg/kg (USEPA, 1996).

4.3 Exposure Point Concentrations

The comparative analysis was performed using an estimated reasonable maximum exposure (RME) point concentration. The RME concentration for chemicals of concern is defined as the highest exposure concentration that could reasonably be expected to occur at a site. Where sample data were limited, the maximum-detected concentrations of lead and zinc were used to estimate the RME point concentration for comparison with screening levels used to compare with the screening levels pursuant to the CalEPA and the USEPA guidance (CalEPA, 1996). Where an adequate number of data points are available, the use of statistical methods to estimate more site-specific exposure point concentrations is recommended.

The RME for the chemicals at the Site were developed by calculating the 95 percent UCL of the arithmetic mean of the reported chemical concentrations. For screening purposes, analytical results reported below the analytical level of detection were set at one-half the detection level. A summary of the sample concentration statistical analyses is presented in Appendix C.

4.4 COMPARATIVE ANALYSIS

The concentrations of lead and zinc have been compared to the identified screening criteria to assist in identifying potential risks or conditions of concern, i.e., areas needing additional evaluation.

4.4.1 Soil Conditions

Lead and zinc were detected in soil samples up to 5,300 mg/kg and 130,000 mg/kg, respectively. The statistical evaluation of the soil sample analytical results revealed a mean concentration for lead of 1,100 mg/kg and 95 percent UCL of 1,900 mg/kg. Both the mean and the 95 percent UCL concentration for lead are below the applicable human-health protective CHHSL of 3,500 mg/kg.

For zinc, the mean concentration is 24,000 mg/kg and the 95 percent UCL is 43,000 mg/kg. Both the mean and the 95 percent UCL concentrations for zinc are below the human-health protective CHHSL of 100,000 mg/kg and groundwater protection criteria of 310,000 mg/kg.

Statistical analysis of the results revealed a mean concentration of pH of 6.1 S.U. and a 95 percent of 6.5 S.U. The pH of the soil samples is within the normal range for soil.

4.4.2 Groundwater Conditions

Zinc was detected in groundwater samples collected from SB-4 and MW-1 at concentrations above laboratory-reporting limits. The groundwater sample collected from boring SB-4 revealed dissolved zinc at 0.68 mg/l. Dissolved lead was not detected above the laboratory detection limit of 0.05 mg/l in the grab groundwater sample.

Dissolved lead was not detected above the laboratory-reporting limit of 0.005 mg/l in either sample collected from MW-1. Analytical results for the groundwater samples collected in March 2000 and June 2000 from MW-1 revealed concentrations of dissolved zinc in groundwater up to 280 mg/l, above the taste and odor threshold of 5 mg/l.

4.5 DATA GAP ANALYSIS

The screening level assessment revealed that the CSM generally describes the distribution of metals at the Site. The assessment also has identified areas where additional information is required to address data gaps. While, the CSM appears to describe the distribution of metals in soil, the lateral extent of zinc in groundwater above the taste and odor threshold has not been determined, i.e., spatial data gap.

4.5.1 Summary of Data Gaps

Based on the data evaluation, the following data gaps were identified:

- Lateral distribution of zinc in groundwater at the Site as well as groundwater flow direction and gradient.

Based on a review of potentially applicable screening criteria, zinc is present in groundwater at concentrations above the taste and odor criterion of 5.0 mg/l. Additional groundwater samples should be collected to address data gaps of the lateral distribution of dissolved zinc in groundwater, as well as confirm the inferred groundwater flow direction and gradient.

5.0 FIELD SAMPLING PLAN

A scope-of work has been developed to generate data to address the identified data gaps. Based on the goals of the *Work Plan*, WEST has identified the following tasks:

- Task 1: Permitting, Health and Safety, Utility Clearance
- Task 2: Groundwater Monitoring Well Construction
- Task 3: Depth to Groundwater Measurements
- Task 4: Groundwater Sampling
- Task 5: Elevation Survey
- Task 6: Waste Management
- Task 7: Reporting

A detailed description of the tasks is presented below.

5.1 TASK 1: PERMITTING, HEALTH AND SAFETY, UTILITY CLEARANCE

Prior to subsurface investigations, boring and monitoring well permits will be obtained from the ACPWA. In addition, encroachment permits will be applied for from the California Department of Transportation (CalTrans) to conduct investigation activities in the public right-of-way.

A Site-specific *Health and Safety Plan* ("HASP") will be prepared to address worker health and safety during investigation activities. The HASP will be prepared in accordance with the California Occupational Health and Safety Administration (CalOSHA) Title 8 §5192 Hazardous Waste Operations and Emergency Response and United States OSHA 29 CFR 1910.120, Hazardous Waste Operations and Emergency Responses. The HASP will be approved by the Project Manager, a Quality Assurance Reviewer and the onsite Safety Officer. The HASP will be read and signed by all onsite workers and Site visitors prior to entering the work area.

Pursuant to California Assembly Bill AB 73, Underground Services Alert (USA) will be contacted to locate and clear work areas for underground utilities at the Site. The work areas will also be cleared for underground utilities using a private underground utility locating contractor.

5.2 TASK 2: GROUNDWATER MONITORING WELL CONSTRUCTION

Borings will be advanced to the first encountered groundwater using hydraulic direct-push equipment (Figure 5-1). The borings will be advanced to a depth of approximately 5-meters below ground surface. Groundwater samples will be collected from the borings using pre-pack temporary well points installed within the borings. The base of the temporary well points will be constructed using a 1.5-meter long 2-centimeter diameter Schedule 40 PVC pre-pack slotted (0.025-centimeter) screen. Between the top of the pre-pack slotted screen and ground surface, the well points will be outfitted with 2-centimeter diameter schedule 40 PVC blank casing.

5.3 TASK 3: DEPTH TO GROUNDWATER MEASUREMENTS

Prior to sampling, depth to groundwater will be measured at the temporary wells using an electronic sounding device from the top of the well casing to the nearest 0.005-meter. Groundwater elevations will be calculated using the top of casing elevations surveyed to the nearest 0.005-meter above Mean Sea Level (NAVD, 1988).

5.4 TASK 4: GROUNDWATER SAMPLING

The groundwater samples will be collected from the temporary monitoring wells using low-flow purge and sample collection techniques (USEPA, 1996). Prior to sampling, water from the well casing will be purged for a minimum of 15 minutes at a flow rate of approximately 400 milliliters per minute. Groundwater parameter data, including temperature, pH, electrical conductivity, dissolved oxygen (DO), turbidity and depth to groundwater, will be measured during well purging to monitor stability of parameters. Once groundwater parameters have stabilized to within 10 percent of previous measurements, groundwater samples will be collected into laboratory supplied and prepared containers.

The groundwater sample containers will be labeled and placed in a chilled cooler for transportation to a California DHS Environmental Laboratory Accreditation Program (ELAP) certified laboratory following ASTM D 4840 chain-of-custody protocols. The groundwater samples will be analyzed for the suite of chemicals identified in Table 5-1.

Groundwater generated during purging will be placed in United States Department of Transportation (USDOT) approved 17H steel drums. The 55-gallon drums will be labeled and temporarily stored at the Site pending analytical review of the groundwater laboratory analytical data.

5.5 TASK 5: ELEVATION SURVEY

Following temporary groundwater-monitoring well construction, the horizontal and vertical locations of the top of the well casings will be surveyed by a California state licensed land surveyor to the nearest 0.005-meters above Mean Sea Level (NAVD, 1988). The well elevation survey will be used to calculate the groundwater elevation at each monitoring well location for determination of groundwater flow direction and gradient.

5.6 TASK 6: WASTE MANAGEMENT

Investigation-derived wastes (IDWs), those materials generated during the process of sampling and investigation at the Site will be managed in accordance with applicable regulatory requirements. IDWs are anticipated to include soil, decontamination fluids, personal protective equipment (PPE) and disposable sampling equipment.

Management of IDW must comply with applicable regulations. Potential applicable regulations include the Resource Conservation and Recovery Act (RCRA), Clean Air Act (CAA), Clean Water Act (CWA), Safe Drinking Water Act (SDWA) and legally enforceable state regulations.

5.7 TASK 7: REPORTING

The results of the investigation will be summarized in a report that will include the findings of the sampling and hydrogeological data collected during field investigations. A tabularized summary of analytical data, measurements of depth to groundwater and calculations of groundwater gradient will also be included. Groundwater elevations and conditions will be depicted on separate figures. An updated CSM will reflect the known soil and groundwater conditions relative to the identified and potential sources as well as potential receptors. The report will also present appropriate conclusions and recommendations for additional work, as necessary. The report will be prepared under the supervision of a California Professional Engineer and California Professional Geologist.

Appendices to the report will include lithologic logs with well details including locations of screen intervals. The appendices will also include a copy of the sampling field data forms with a description of the groundwater parameter stabilization, e.g., tables showing pH, electrical conductivity, DO, temperature, turbidity, development and sampling methodologies and the volume of groundwater purged from the wells.

5.7.1 Electronic Submittal – AB2886

The sampling and survey data will be submitted electronically as required by Assembly Bill 2886 (Water Code Sections 13195-13198) for the SWRCB Geotracker database. As outlined in the requirements by the SWRCB (Article 12, Chapter 16, Division 3, Title 23 of the California Code of Regulations), data generated from this investigation will be submitted in both hard copy and electronic format.

6.0 REFERENCES

ASTM, *Standard Guide for Environmental Site Assessments: Phase II Environmental Site Assessment Process E 1903-97* (ASTM E 1903).

ASTM, *Standard Guide for Sample Chain-of-Custody Procedures D 4840-99* (ASTM D 4840).

California Code of Regulations, *Title 23, Division 3, Chapter 16, Section 2724 and 2725, Underground Storage Tank Regulations* (CCR, 2001).

California Environmental Protection Agency (CalEPA), *Advisory – Active Soil Gas Investigations,* January 28, 2003 (CalEPA, 2003).

CalEPA, *Guidance, Chapter 2, Use of Soil Concentration Data in Exposure Assessments,* August 1996 (CalEPA, 1996).

CalEPA, *Use of Human Health Screening Levels (CHHSLs) in Evaluation of Contaminated Properties,* January 2005 (CalEPA, 2005).

California Office of Environmental Health Hazard Assessment, Public Health Goals, December 2006 (OEHHA, 2006).

California Regional Water Quality Control Board – Central Valley Region, *The Designated Level Methodology for Waste Classification and Cleanup Level Determination,* October 1986, Updated June 1989 (Regional Board, 1989).

California Regional Water Quality Control Board – Central Valley Region, *Items to be Included in a Site Investigation Report,* February 13, 2004 (Regional Board, 2004a).

California Regional Water Quality Control Board – Central Valley Region, *Items to be Included in a Site Investigation Work Plan,* September 2, 2004 (Regional Board, 2004b).

California Regional Water Quality Control Board – San Francisco Bay Region, *Application of Environmental Screening Levels and Decision Making to Sites with Impacted Soil and Groundwater*, Interim Final, July 2005 (Regional Board, 2005).

California Regional Water Quality Control Board – San Francisco Bay Region, *East Bay Plain Groundwater Basin, Beneficial Use Evaluation Report, Alameda and Contra Costa Counties,* June 1999 (Regional Board, 1999).

California Regional Water Quality Control Board – San Francisco Bay Region, *Water Quality Control Plan for the San Francisco Bay Basin,* 2006 (Regional Board, 2006).

California State Water Resources Control Board, Resolution 92-49, *Policies and Procedures for Investigations and Cleanup and Abatement of Discharges Under Water Code Section 13304,* Amended October 2, 1996 (SWRCB, 1996).

Camp, T.R., and Meserve, R. L., *Water and Its Impurities*, Dowden, Hutchinson, & Ross, Inc., 1974 (Camp and Meserve, 1974).

United States Environmental Protection Agency (USEPA), *Guidance for the Data Quality Objectives Process*, (EPA QA/G4), EPA/600/R-96/055, Office of Research and Development, 1994 (USEPA, 1994).

USEPA, *Low-Flow (Minimal Drawdown) Ground-water Sampling Procedures,* EPA/540/S-95/504, Office of Research and Development, Washington D.C., April 1996 (USEPA, 1996).

USEPA, *Soil Screening Guidance: User's Guide*, EPA/540/R-96/018, Office of Emergency and Remedial Response, Washington, D.C., 1996 (USEPA, 1996).

USEPA, *Test Methods for Evaluating Solid Waste*, SW-846, Third Edition, May 1995 (USEPA, 1995).

West Environmental Services & Technology, Inc. (WEST), *Site Investigation Report, Pacific Galvanizing, 715 46th Avenue, Oakland, California,* October 1999 (WEST, 1999).

WEST, *Work Plan for Supplemental Investigation, Pacific Galvanizing, 715 46th Avenue, Oakland, California,* February 7, 2000 (WEST, 2000).

7.0 DISTRIBUTION LIST

Mr. Jerry Wickham, P.G. (electronic only)
Alameda County Health Services Agency
1131 Harbor Bay Parkway, 2nd Floor
Alameda, California 94502

Mr. Jack Shultz
Pacific Galvanizing
715 46th Avenue
Oakland, California 94601

TABLE 3-1
SUMMARY OF SOIL ANALYTICAL RESULTS
715 46th Street
Oakland, California

Sample ID	Date	Depth (ft)	Lead (mg/kg)	Zinc (mg/kg)	pH (S.U.)
SB-1	4/2/98	4	22	2,700	5.5
SB-2	4/2/98	5	92	2,200	6.2
SB-3	4/2/98	5	570	5,800	6.4
SB-4	4/2/98	5	360	2,800	6.3
SB-5	4/2/98	4	140	1,800	6.4
SB-6	4/2/98	4	360	9,800	6.1
SB-7	4/2/98	5	150	5,200	8.5
SB-8	4/2/98	5	110	6,300	6.9
SB-9	4/2/98	5	24	490	6.8
SB-10	4/2/98	5	1,100	11,000	6.0
SB-11	4/2/98	5	3,500	72,000	6.2
SB-12	4/2/98	5	2,500	58,000	6.5
SB-13	4/2/98	5	5,300	130,000	5.6
CHHSLs - Commercial			3,500	100,000	--
Groundwater Protection Screening Level			--	310,000	--

Notes:

ft: feet
mg/kg: milligrams per kilogram
S.U.: Standard Unit
--: not applicable

TABLE 3-2
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS
715 46th Avenue
Oakland, California

Sample ID	Date	Lead	Zinc	pH
		Dissolved	Dissolved	
		mg/l	mg/l	(S.U.)
SB-4-W	4/2/98	<0.050	0.68	7.5
MW-1	4/26/00	<0.005	280	6.9
	6/8/00	<0.005	210	7.0
Numerical Water Quality Objective		0.015	5.0	6.5 to 8.5

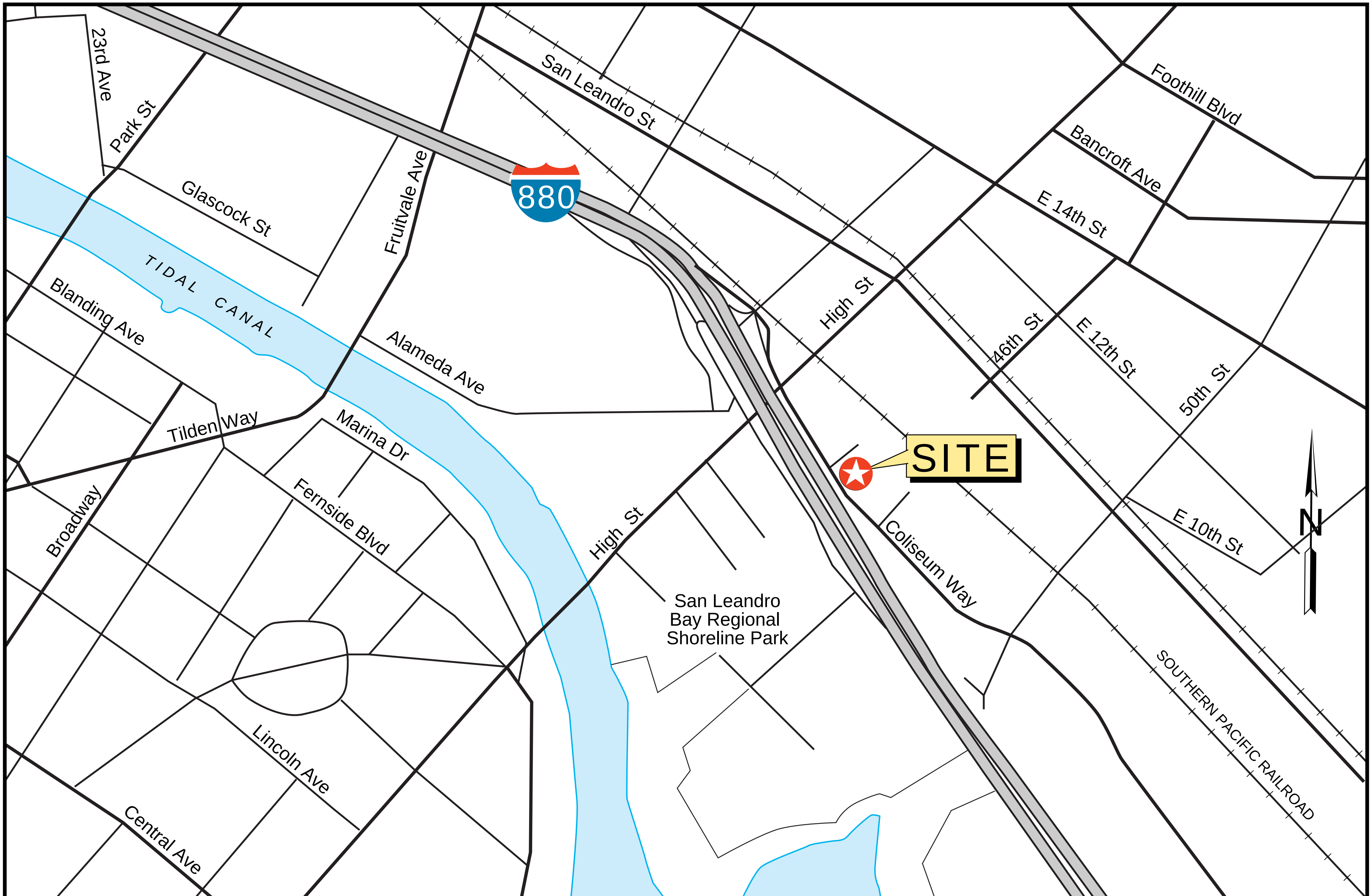
Notes:

mg/l: milligrams per liter
S.U.: Standard Units
--: not applicable

TABLE 5-1
PROPOSED LABORATORY ANALYSES
715 46th Avenue
Oakland, California

Sample ID	Sample Media	Depth (ft. bgs)	Lead/Zinc USEPA 6000	pH USEPA 150.1	Hold
W-1	Soil	5	--	--	X
		10	--	--	X
		15	--	--	X
	Groundwater	15	X	X	--
W-2	Soil	5	--	--	X
		10	--	--	X
		15	--	--	X
	Groundwater	15	X	X	--

Notes:
ft. bgs: feet below ground surface



0 FEET 1000

Approximate Scale

Figure 1-1	SITE LOCATION MAP
August 2007	715 46th Street, Oakland, California

WEST
Environmental Services & Technology

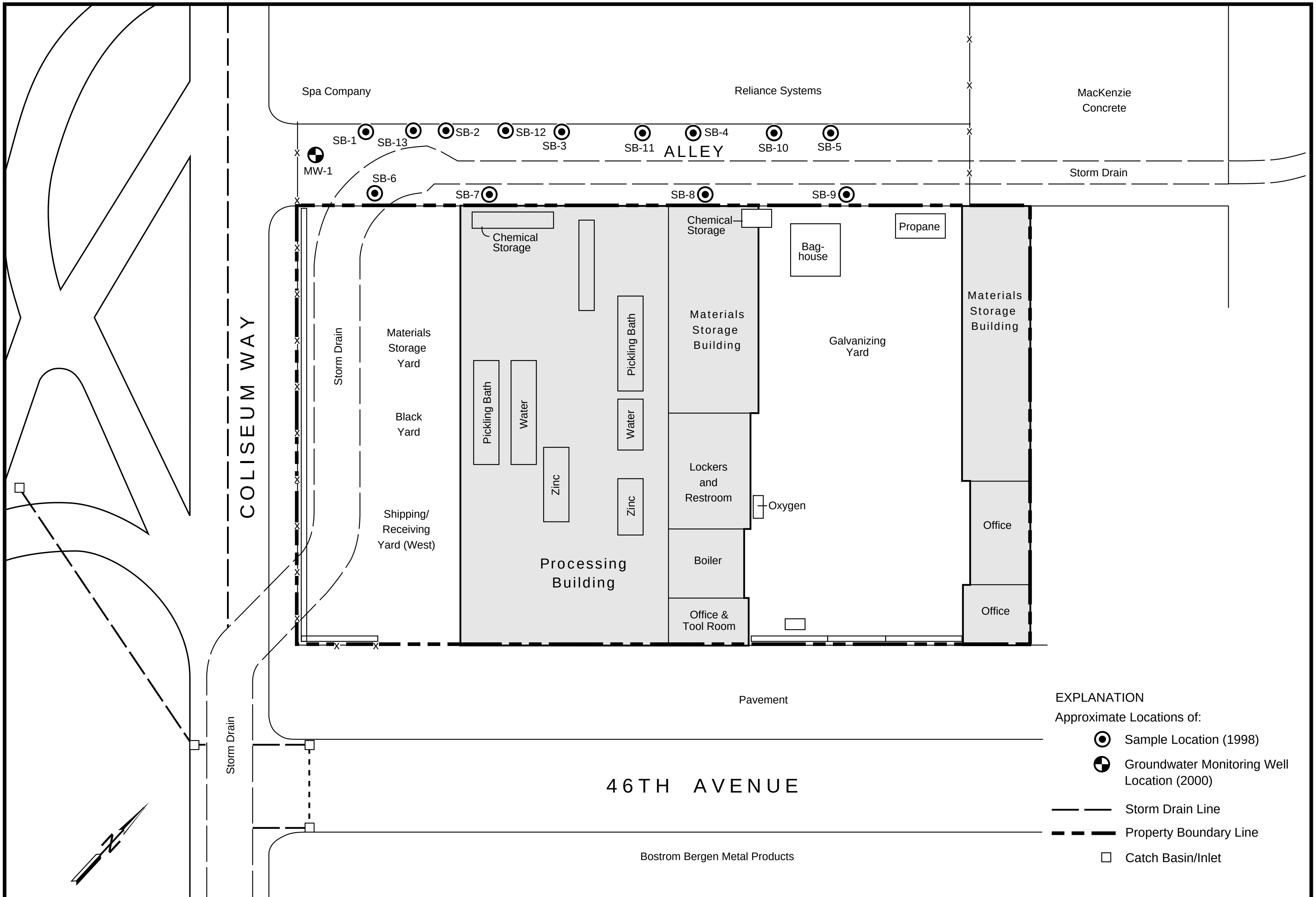


Figure 2-1	SITE PLAN	WEST Environmental Services & Technology
August 2007	715 46th Street, Oakland, California	

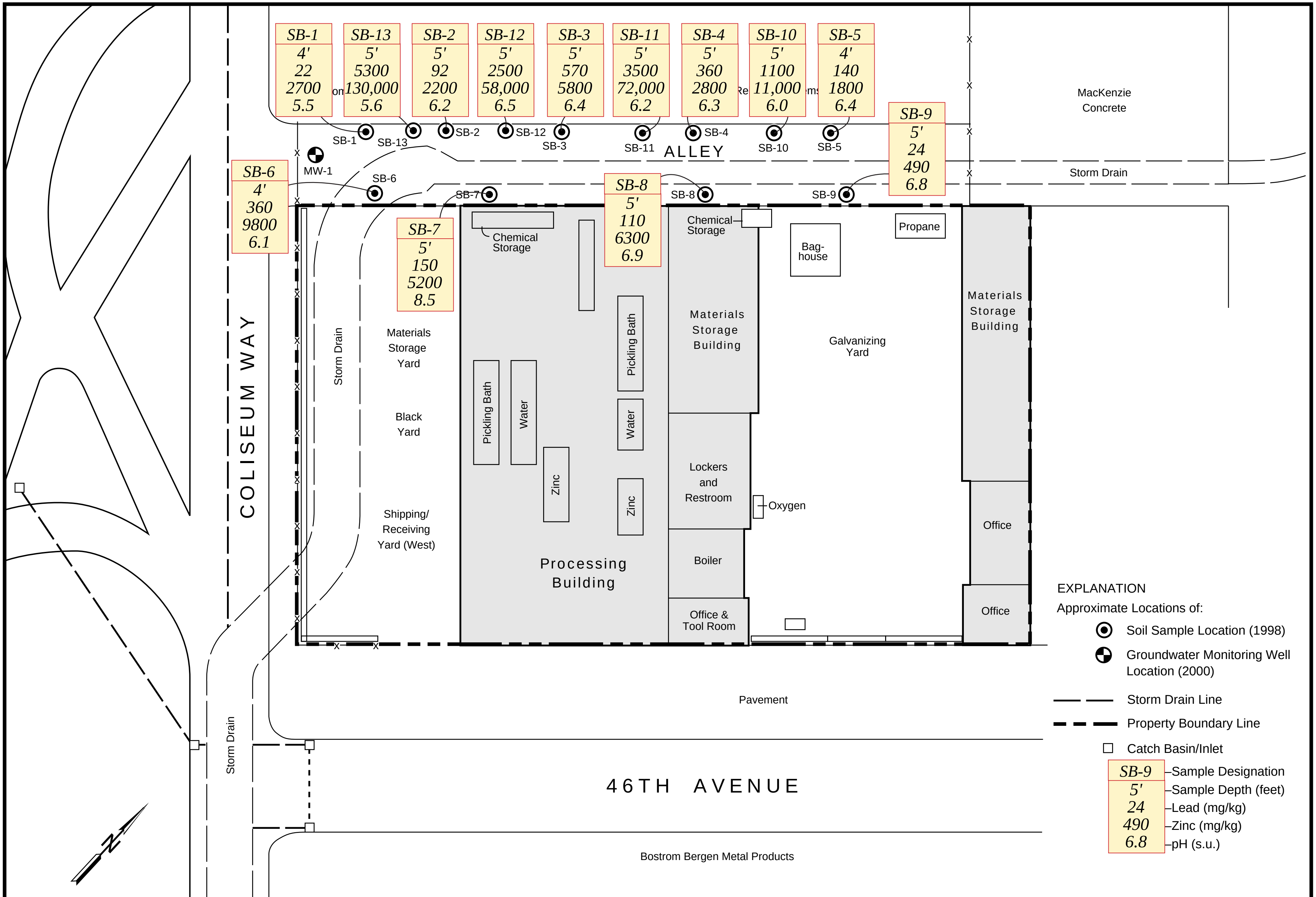


Figure 3-1 | SOIL ANALYTICAL RESULTS

August 2007 | 715 46th Street, Oakland, California

WEST Environmental Services & Technology

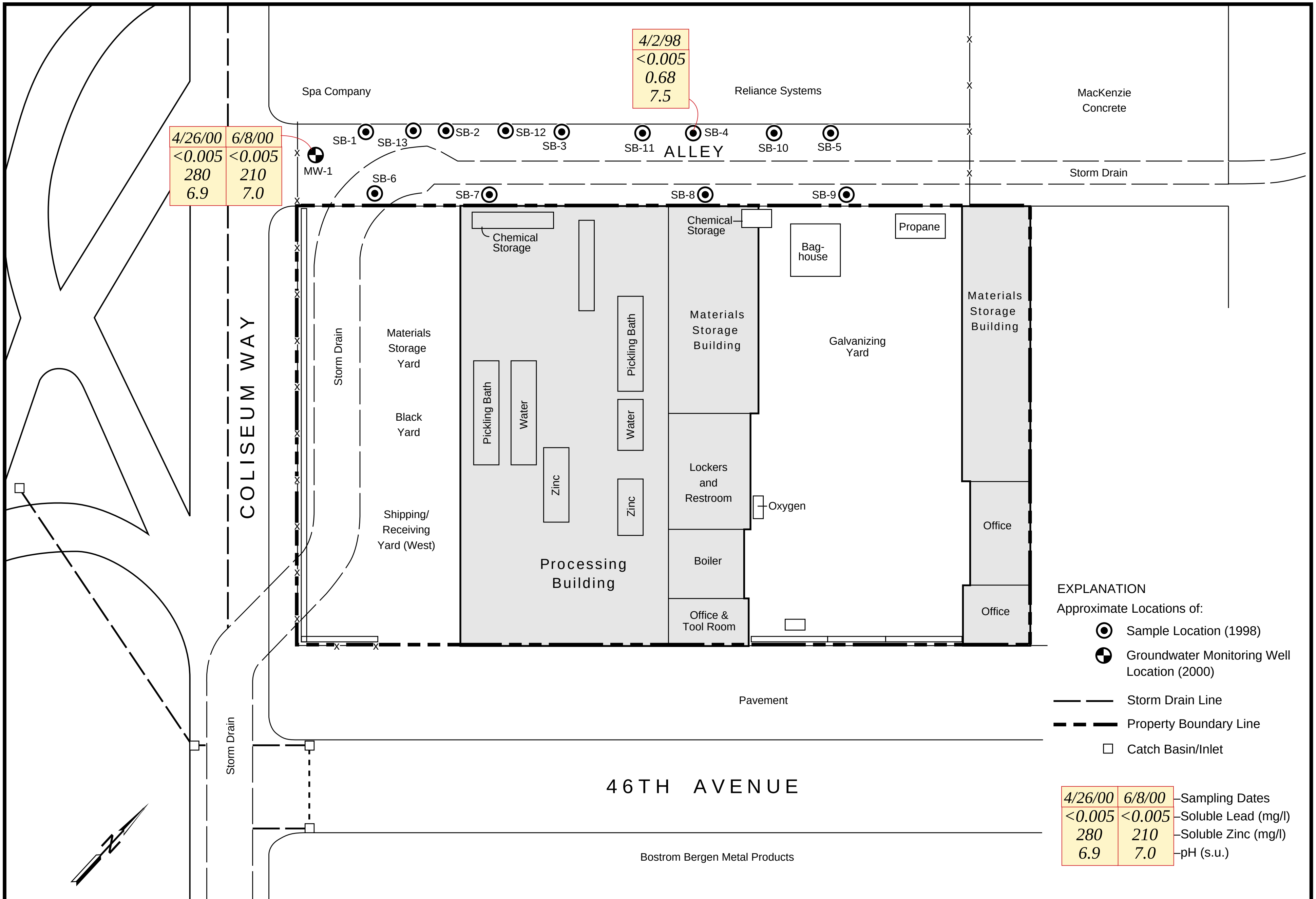
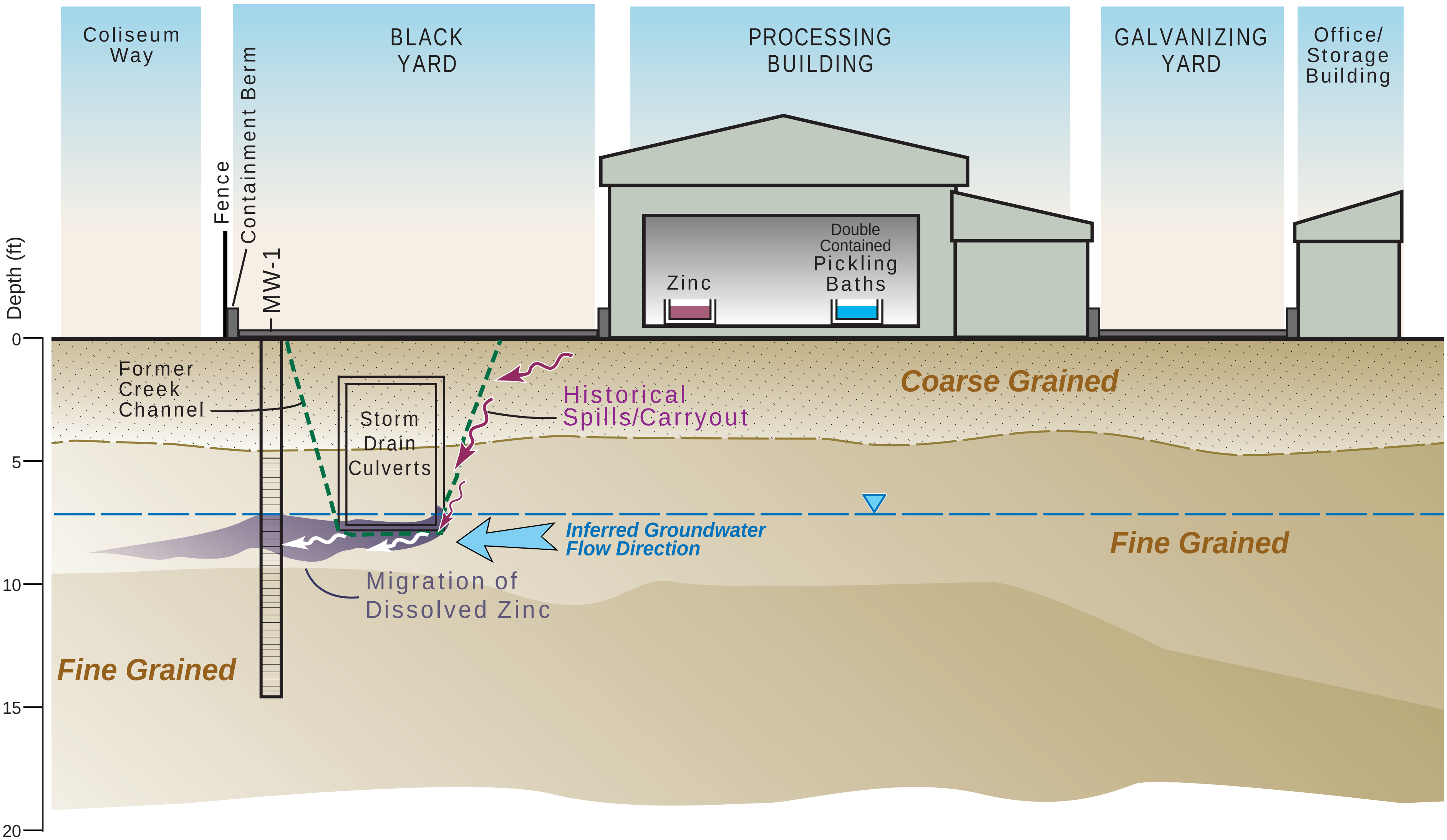
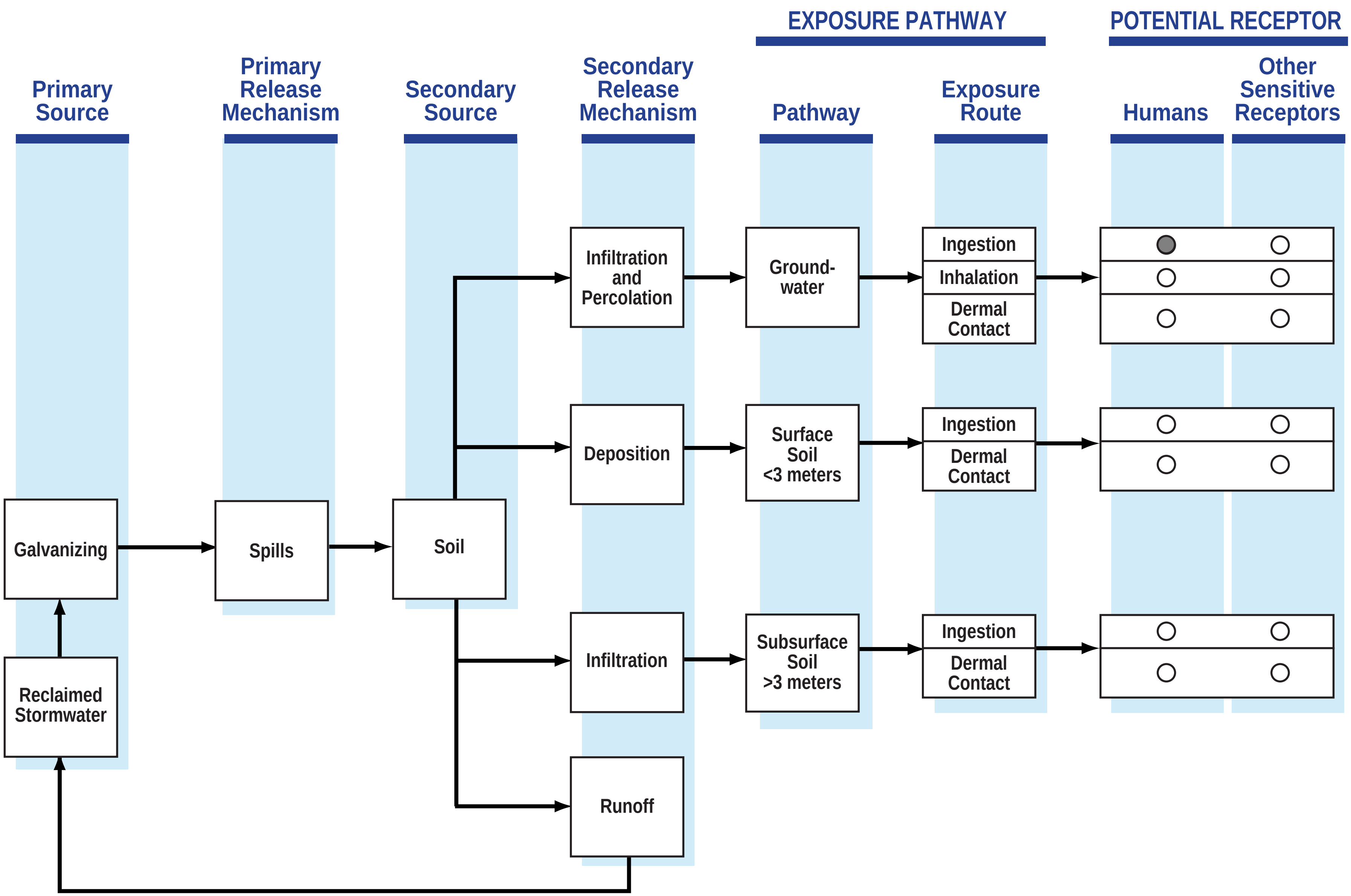


Figure 3-2	GROUNDWATER ANALYTICAL RESULTS	WEST Environmental Services & Technology
August 2007	715 46th Street, Oakland, California	



Drawing not to scale

Figure 4-1	CONCEPTUAL SITE MODEL	WEST Environmental Services & Technology
August 2007	715 46th Street, Oakland, California	



○ Incomplete exposure pathway

● Complete exposure pathway

Figure 4-2	EXPOSURE PATHWAY CHART
August 2007	715 46th Street, Oakland, California

WEST Environmental Services & Technology

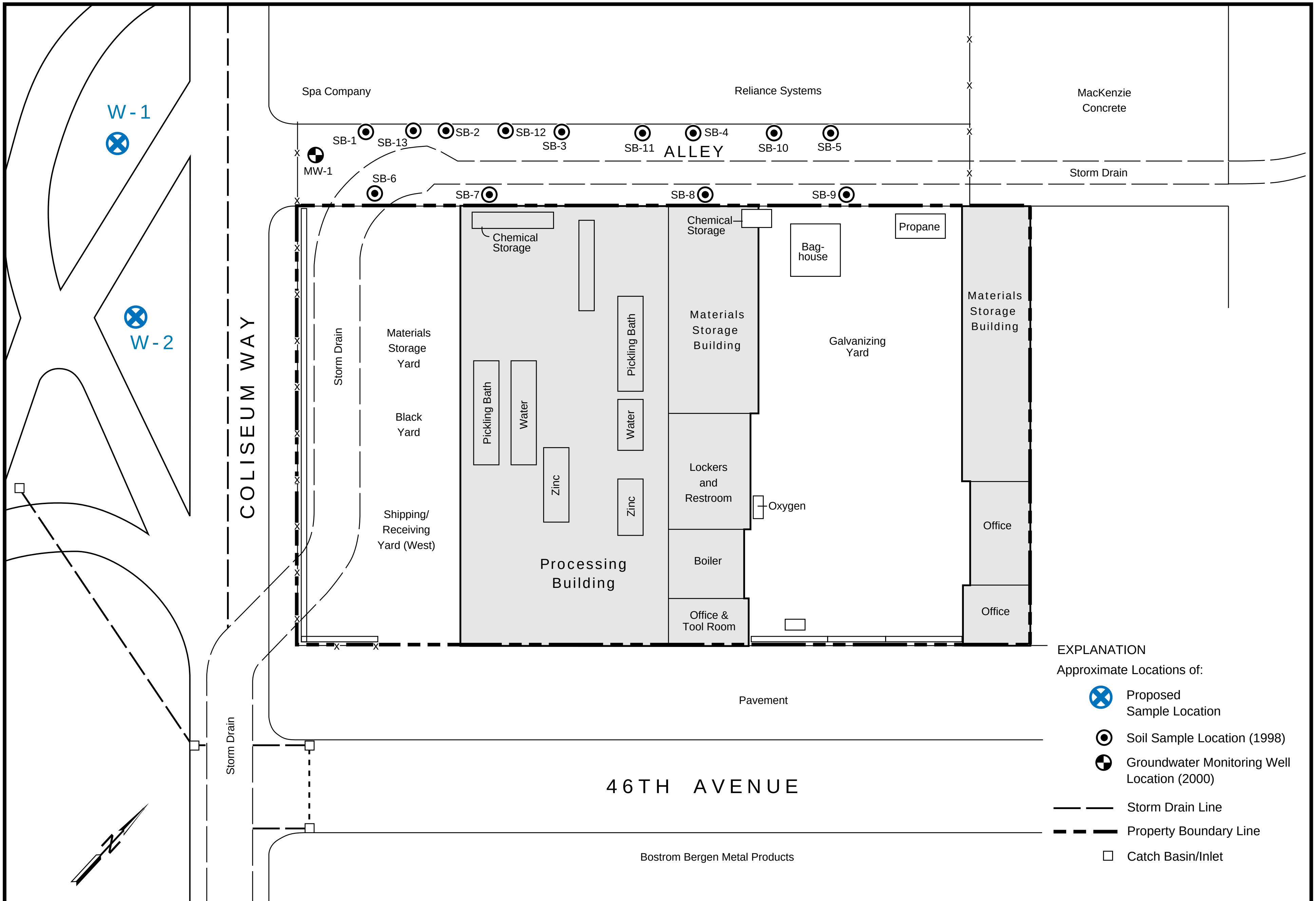
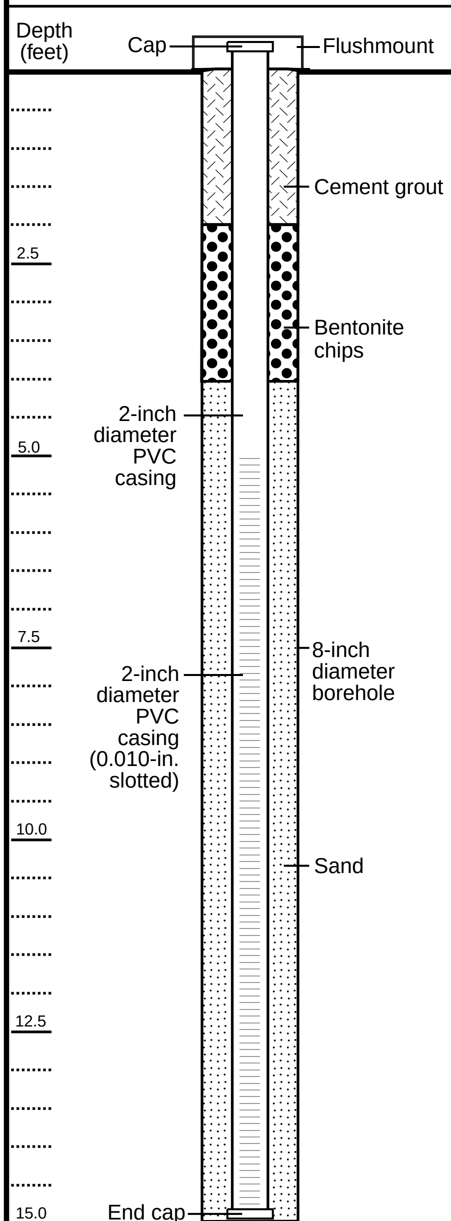


Figure 5-1	PROPOSED SAMPLING LOCATIONS
August 2007	715 46th Street, Oakland, California

APPENDIX A

SOIL BORING LOG

WELL CONSTRUCTION	LITHOLOGY	SAMPLE



Graphic Log	Description	Sample Interval
	CLAYEY GRAVEL, brown to light brown, gravels to 1-inch diameter, low to moderate plasticity, damp.	0-4
	SILTY CLAY, grayish brown, moderate to low plasticity, stiff.	
	SILTY SAND, brown, fine-grained, low plasticity, moist to very moist.	4-8
	CLAYEY SILT, dusky yellowish brown to black, moderate to high plasticity, very moist, soft.	
	SANDY GRAVELLY CLAY, light grayish brown, moderate plasticity, gravels to 1/2-inch diameter, medium- to coarse-grained sand, moist.	8-12
	—Grades to SILTY CLAY with SAND, coarse-grained sand, moist, moderate plasticity.	12-15
	BOTTOM OF HOLE AT 15 FEET.	

SAND | SILT | CLAY | GRAVEL

Drilling method: HSA
Sampling method: MacroCore
Drilling date: March 2000
Geologist: PEM

Groundwater level
At time of drilling

Soil Sample Recovery Interval

WEST Environmental Services & Technology

March 16, 2000

Pacific Galvanizing

Well Construction and Lithology for Boring No. MW-1

APPENDIX B

LABORATORY DATA CERTIFICATES

AND CHAIN-OF-CUSTODY FORMS

West World Environmental
828 Mission Street, 2nd Floor
San Rafael, CA 94901

Attn.: Mr. Peter Krasnoff

Dear Peter,

Attached is our report for your samples received on Friday June 9, 2000
This report has been reviewed and approved for release. Reproduction of this report is permitted only in its entirety.

Please note that any unused portion of the samples will be discarded after July 9, 2000 unless you have requested otherwise. We appreciate the opportunity to be of service to you.
If you have any questions, please call me at (925) 484-1919. You can also contact me via email.
My email address is: gcook@chromalab.com

Sincerely,

Gary Cook

pH

West World Environmental

828 Mission Street, 2nd Floor
San Rafael, CA 94901

Attn: Peter Krasnoff

Phone: (415) 460-6770 Fax: (415) 485-6062

Project #:

Project:

Samples Reported

Sample ID	Matrix	Date Sampled	Lab #
MW-1	Water	06/08/2000 13:15	1

CHROMALAB, INC.

Environmental Services (SDB)

Submission #: 2000-06-0200

To: **West World Environmental**
Attn.: Peter Krasnoff

Test Method: 9040B
Prep Method: 9040B

pH

Sample ID:	**MW-1**	Lab Sample ID:	**2000-06-0200-001**
Project:		Received:	06/09/2000 18:30
		Extracted:	06/12/2000
Sampled:	06/08/2000 13:15	QC-Batch:	2000/06/12-01.22
Matrix:	Water		

Compound	Result	Rep.Limit	Units	Dilution	Analyzed	Flag
pH	7.0	0.0	SU	1.00	06/12/2000	

CHROMALAB, INC.

Environmental Services (SDB)

Submission #: 2000-06-0200

To: **West World Environmental**
Attn.: Peter Krasnoff

Test Method: 9040B
Prep Method: 9040B

Batch QC Report

pH

Method Blank **Water** **QC Batch # 2000/06/12-01.22**

MB: 2000/06/12-01.22-001 Date Extracted: 06/12/2000

Compound	Result	Rep.Limit	Units	Analyzed	Flag
pH	7.00		SU	06/12/2000	

Soluble Metals

West World Environmental

Attn: Peter Krasnoff

828 Mission Street, 2nd Floor
San Rafael, CA 94901
Phone: (415) 460-6770 Fax: (415) 485-6062

Project #:

Project:

Samples Reported

Sample ID	Matrix	Date Sampled	Lab #
MW-1	Water	06/08/2000 13:15	1

CHROMALAB, INC.

Environmental Services (SDB)

To: **West World Environmental**
Attn.: Peter Krasnoff

Test Method: 6010B
Prep Method: 3005A

Soluble Metals

Sample ID:	**MW-1**	Lab Sample ID:	**2000-06-0200-001**
Project:		Received:	06/09/2000 18:30
		Extracted:	06/14/2000 12:07
Sampled:	06/08/2000 13:15	QC-Batch:	2000/06/14-04.15
Matrix:	Water		

Compound	Result	Rep.Limit	Units	Dilution	Analyzed	Flag
Lead	ND	0.0050	mg/L	1.00	06/16/2000 18:06	
Zinc	210	0.10	mg/L	10.00	06/19/2000 15:55	

To: **West World Environmental**
Attn.: Peter Krasnoff

Test Method: 6010B
Prep Method: 3005A

Batch QC Report
Soluble Metals

Method Blank **Water** **QC Batch # 2000/06/14-04.15**

MB: 2000/06/14-04.15-031 Date Extracted: 06/14/2000 12:07

Compound	Result	Rep.Limit	Units	Analyzed	Flag
Lead	ND	0.0050	mg/L	06/16/2000 17:13	
Zinc	ND	0.010	mg/L	06/16/2000 17:13	

CHROMALAB, INC.

Environmental Services (SDB)

To: **West World Environmental** Test Method: 6010B

Attn: Peter Krasnoff Prep Method: 3005A

Batch QC Report

Soluble Metals

Laboratory Control Spike (LCS/LCSD) **Water** **QC Batch # 2000/06/14-04.15**

LCS: 2000/06/14-04.15-032 Extracted: 06/14/2000 12:07 Analyzed 06/16/2000 17:16

LCSD: 2000/06/14-04.15-033 Extracted: 06/14/2000 12:07 Analyzed 06/16/2000 17:20

Compound	Conc. [mg/L]		Exp.Conc. [mg/L]		Recovery [%]		RPD	Ctrl. Limits [%]		Flags	
	LCS	LCSD	LCS	LCSD	LCS	LCSD	[%]	Recovery	RPD	LCS	LCSD
Lead	0.472	0.466	0.500	0.500	94.4	93.2	1.3	80-120	20		
Zinc	0.475	0.465	0.500	0.500	95.0	93.0	2.1	80-120	20		

1220 Quarry Lane * Pleasanton, CA 94566-4756
Telephone: (925) 484-1919 * Facsimile: (925) 484-1096

APPENDIX C

SOIL STATISTICAL CALCULATIONS

TABLE C-1
SUMMARY OF SOIL SAMPLING RESULT STATISTICS -
95 PERCENT UPPER CONFIDENCE LEVEL
715 46th Street
Oakland, California

Sample ID	Lead	Zinc
	mg/kg	mg/kg
SB-1-4'	22	2,700
SB-2-5'	92	2,200
SB-3-5'	570	5,800
SB-4-5'	360	2,800
SB-5-5'	140	1,800
SB-6-5'	360	9,800
SB-7-5'	150	5,200
SB-8-5'	110	6,300
SB-9-5'	24	490
SB-10-5'	1,100	11,000
SB-11-5'	3,500	72,000
SB-12-5'	2,500	58,000
SB-13-5'	5,300	130,000
Sample Mean	1,100	24,000

Variance of Sample	2,739,652	1,540,613,674
Standard Deviation of Sample	1,655	39,251
Standard Error	459	10,886
Degrees of Freedom	12.0	12.0
Tabulated "t" value	1.782	1.782

Sample Mean	1,100	24,000
plus/minus	818	19,399
Upper Limit of Confidence Interval*	1,900	43,000

* 95 percent confidence level concentration