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Document Transmittal

To: Mr. Brian Oliva, REHS
Alameda County Environmental Health Department
Division of Environmental Protection

From: John R. Sutton

CC: Mr. Mike Cortez,
Oro Loma Sanitary District (w/ 2 copies of Work Plan)

Date: October 23, 1997

Re: **Work Plan for Supplemental Site Evaluation, Gasoline Tank Area,**
Oro Loma Sanitary District Service Center,
2600 Grant Avenue, San Lorenzo, CA **State ID 1996**
Sutton Project No: 3022.8

Dear Brian:

At the request of Oro Loma Sanitary District, The Sutton Group submits this Work Plan for the Department's review. The work plan was requested in the Department's letter to the District dated September 15, 1997.

The work plan was prepared by me, and by personnel working under my direction. It has been reviewed by personnel of the Oro Loma Sanitary District.

Please provide comments to the District with copies to me.

Attachment: Work Plan

October 23, 1997
SG Project No. 3022.8

WORK PLAN
for
SUPPLEMENTAL SITE EVALUATION
in the vicinity of the former site of the
1,000 Gallon Gasoline Tank at the
Oro Loma Sanitary District Service Center
San Lorenzo, California

PREPARED FOR

Mr. Mike Cortez
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PREPARED BY

THE SUTTON GROUP

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1.0 INTRODUCTION

1.1 Statement of Scope of Work

This work plan describes supplemental work that the Oro Loma Sanitary District (The District) proposes to perform in response to an Alameda County Environmental Health Services Department's Environmental Protection Division, (ACEH) request for additional evaluation of ground conditions in the vicinity of a former 1,000 gallon underground fuel storage tank. The work described in this work plan would supplement the District's previous investigations, including subsurface soil and ground water sample collection and evaluation of the site vicinity subsequent to initial discovery of the leak in 1993. The schedule for submittal of this work plan was included in ACEH's letter to the District dated September 15, 1997.

This work plan includes the results of an ASTM-RBCA Tier-1 evaluation of risk to human health and the environment. The RBCA risk evaluation has been prepared in general accordance with ASTM E1739-95 "Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites."

This work plan has been prepared under the direction of a California-registered Civil Engineer in accordance with local and State of California laws and regulations. The risk assessment has been prepared by a risk assessment professional, experienced in performing RBCA assessments under the guidelines of ASTM, ACEH and RWQCB Region 2 staff.

1.2 Site Location

The subject 1,000 gallon, underground gasoline storage tank was located in the parking lot of the District's Service Center at 2600 Grant Avenue, San Lorenzo, in unincorporated Alameda County. The tank location was to the west of the Engineering Building and south of the Maintenance Building. The site vicinity is shown on Figure 1, and the site location more specifically in relation to the District facilities on Figure 2.

1.3 Background / Site History

The 1,000 gallon tank installed by the District in 1978, was used to store leaded gasoline until 1985. At that time it was converted to unleaded gasoline and its use continued until 1994. No leakage had been noted with this tank. The tank was removed in 1995 as part of the District's program to eliminate excess infrastructure. This tank replaced a pre-existent 1,000 gallon, leaded gasoline tank in the same location, which was part of the original construction of the District's Maintenance Facility in 1961. The original tank was replaced in 1978 because it was known to have leaked. The amount of leakage was not documented.

A subsurface investigation of the tank area, was commenced by Levine Fricke in August, 1993. That program comprised drilling six hollow stem auger borings, collection of soil samples, and grab ground water samples from selected borings. Sample analysis revealed soil contamination by gasoline to as much as 4,300 mg/kg (ppm) and ground water contamination to 1,600 mg/l. Ground water was recorded at 6 feet depth in all 6 borings and no free product was reported. The project was terminated due to interference with seismic retrofit work on the adjacent maintenance building. Test results for this investigation are summarized on Table 1.

The Sutton Group was engaged by the District to complete the investigation and to manage removal of the tank and subsequent remediation. The supplementary investigation comprised the excavation of seven shallow (6± foot depth) test trenches in the parking lot. Trenches were sited in the probable down-gradient fan from the previous borings. The results of this investigation were documented in a report titled "Stage II Tank Removal Investigation, 1,000 Gallon Gasoline Tank Site..." dated November 23, 1994, on file with ACEH. In summary the investigation showed concentrations of degraded gasoline in a plume emanating from the tank via granular fill soils and Bay Mud at depths shallower than the observed groundwater. Degraded gasoline was present at up to 1,600 mg/kg in the soils. Water samples were not collected since caving of trench walls necessitated immediate back-filling. Test results from this investigation are summarized on Table 2.

Following a public bidding process, the District contracted the tank removal with "VCI of California". VCI removed the tank on May 3, 1995 under permit issued by, and under observation of ACEH/LOP and the San Lorenzo Fire Marshal. The contractor excavated a 17 feet long by 11 feet wide pit to remove the 1,000 gallon tank. Some of the soil overlying the tank was stained in the vicinity of the fill pipe and also near the short service pump line, suggesting overfill spillage, and fuel line leakage. The bottom of the 4 foot diameter tank was at 7 feet depth. The tank was founded in pea gravel, and water was initially noted to be seeping at 7.5 feet depth in the pit. Little gasoline odor was noted in the shallow fill soil, including the vicinity of the service piping. No free product was observed. Excavation of the pea gravel to expose "native" soils revealed similar soil conditions to those exposed in the 1994 trench investigation. Excavation walls were relatively stable and the contractor did not mobilize shoring. Water was later noted to be seeping from the pit end walls at approximately 6 feet depth, which was in the zone of

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bayland soils. Soil samples were collected from each end of the tank pit and from beneath the supply line elbow in the fuel island as required by Tri-Regional Guidelines (RWQCB, 1990). The seepage inflow rate was insufficient to provide a water sample. We also collected an additional sample from native soils beneath the bottom of the tank as an indicator of plume depth. Test results are summarized on Table 3.

On the basis of these findings, The Sutton Group performed a Feasibility Study and concluded that the best solution for tank site closure, based on then-current guidelines from RWQCB, was removal of significantly contaminated soil. This soil was located within a zone extending generally south from the tank through the parking lot to about the south end of the Engineering Building. To provide data for contractor's use in design of shoring for protection of the Engineering Building, a geotechnical investigation was performed in July, 1995. This investigation comprised two borings alongside the engineering building which were extended to depths of 51 and 36 feet. The borings were logged during drilling by a Geotechnical Engineer and selected samples were tested in the geotechnical laboratory. Locations of geotechnical borings GB-1 and GB-2 are shown on Figure 4.

In May 1996, The Sutton Group concluded a soil and ground water investigation of the site vicinity. This investigation comprised drilling seven soil borings with a 'hydro-push' rig Soil samples were recovered at selected depths and ground water samples were collected from temporarily installed well screen in each borehole. The study identified a pervious, relatively continuous, thin, sand layer immediately beneath the fill/Bay Mud interface. Based on field organic vapor readings and petroleum odor, this layer appeared to be the significant conduit for ground water-borne contaminant transport emanating from the source area. The presence of such a saturated layer of clean fine sand at this depth is retrospectively considered reasonable cause for the trench caving that limited the excavation depth in the November 1994 investigation.

2.0 SITE DESCRIPTION

2.1 Site Conditions

The site vicinity of the District sewage treatment plant facility and adjacent Service Center is generally level. The grade ranges from elevations 6 to 9 feet above mean sea level (msl). The area was at one time bayland, at an approximate elevation 3 feet above msl.. Man-made fill was placed to raise the site above the unstable Bay Mud. The gasoline tank site is located approximately 1,000 feet inland from the current shoreline. The subject tank site is within a paved parking lot at approximate elevations 8 to 9 feet msl. The District's Maintenance Building and the Engineering Building, a part of the District's Service Center complex, lie to the north and to the east of the former tank location, as shown on Figure 4. To the west of the District's Service Center is Grant Avenue, the entire 100 foot width of which is paved for industrial traffic density.

2.2 Regional and Local Geology and Hydrology

The facility lies on the San Francisco Bay margin of the East Bay Plain. The East Bay Plain is a three to five miles wide, gently sloping alluvial plain which falls from the foot of the Oakland Hills, south westward to the San Francisco Bay shore. The local topography comprises a typical filled bay setting with bayland deposits covered with manmade fill material to provide stability for structures sited in the area. Prior to filling, the land was tidal wetlands and mudflats of the East Bay. The bay land, clays known regionally as Bay Mud are about 20 feet thick at the site. Clays and sands extend to significant depth. Bedrock is many hundreds of feet deep beneath the site.

Local hydrogeology consists of saline groundwater caused by intrusion of bay waters into the shallow brackish aquifers. These aquifers extend down to various levels. Underlying these brackish aquifers at depths of from 50 to 500 feet is a groundwater aquifer currently not being used by the community. Figure 3 depicts the local geology and hydrogeology.

2.3 Subsurface Conditions

2.3.1 Soil Conditions

The site subsurface profile comprises man-made fill placed over bayland deposits. Borings and test trenches excavated in the parking lot for the three previous investigations show the asphalt surfacing is about 2½ inches thick over ¾ inch sized crushed rock aggregate base, and 1½ inch sized quarry stone sub base which extends to from 2 to 4.5 feet depth. The sub base is typically a very gravely sand or sandy gravel with some clayey phases, and is brown to tan to blue colored. The thickness of the fill increased from a minimum near Grant Avenue to a maximum nearer the maintenance building. This well-compacted fill material is underlain at from 2.5 to 4 feet depth by a "bridging fill" which appears to be one half to one foot thick. The bridging fill includes broken concrete and general construction debris in a (typically crusted) Bay Mud matrix. This zone was not observed in all locations.

The bayland soils immediately underlying the fill soils were often seen to have a peat layer or crusted clay surface, which was typically brown to black, about one foot thick, and with a noticeable organic odor.

A layer of fine, gray to black sand, which was clean to silty or clayey, and varying in thickness from one to three feet, was noted in five of the seven borings. The top of this sand layer was at from three to six feet depth where found, which is at the approximate native soil interface. This layer was typically wet, and often had a pronounced petroleum odor. The layer was bounded on its underside by characteristic green to black, moderately to highly plastic, Bay Mud clays. The Bay Mud is underlain by gray-green clays and

clayey sands, with brown clays at approximately 25 feet depth. Locations of the borings and test trenches are presented on Figure 4.

2.3.2 Ground Water Conditions

Ground water depth was typically identified from the appearance of recovered soil samples. Additionally, depth to ground water was measured the day following drilling, prior to collection of the water samples in the 1996 investigation. Ground water depth ranged from five to seven feet in those borings.

2.4 Extent of Known Soil and Ground Water Contamination

Analytical results in the May 1996 investigation report concurred with the earlier findings which limited the depth of gasoline contamination. The vertical extent of significant contamination, previously adjudged to "extend to less than 10 feet depth", was essentially confirmed to be contained within a shallow sand zone that immediately underlies the clay/peat (former) surficial cap of the Bay Mud deposits. This clay cap, which lies at from 4 to 6 feet below site grade, appeared to be an effective barrier confining the gasoline to that depth. Deeper clays may well be confining the gasoline contamination from downward vertical transport.

The May 1996 study also showed that the gasoline contamination plume extends, via ground water transport, beneath the west wall of the Engineering Building. The concentration of gasoline contamination in ground water in boring EP-2, located on the northwest (parking lot) side of the Engineering Building, and boring EP-5, at the entrance to the Engineering Building parking lot, on the Grant Avenue boundary, exceeded threshold levels that, prior to RBCA, would have triggered further study. Borings sited on the remote side of the Engineering Building were essentially free of ground water contamination. Likewise, the ground water sample collected from EP-3 near the wall of the Maintenance Building showed a relatively insignificant level of gasoline contamination. The 1994 study showed the westward extent of the plume in the parking lot is limited, as seen in results from test trenches TT-1, TT-2, TT-4, TT-5, and TT-8. The absence of contamination in water samples from borings EP-4 and EP-7 delimit the lateral plume extent to the east.

The significant direction of ground water movement was shown to be normal to the alignment of Grant Avenue, i.e. to the south east and south. It is also concluded that gasoline tainted ground water flowing toward Grant Avenue would be intercepted by The District's sewer lines and large-diameter, gravity trunk sewers which parallel the Grant Avenue centerline within the street easement. These pipes are understood to be bedded in pervious gravel. Figure 4 shows the locations of these lines beneath Grant Avenue. The cross section on Figure 4 depicts the postulated flow path from the former gasoline tank location, until the flow contacts the first sewer trench.

2.5 Migration Control/Interim Remediation

To mitigate the migration of the contamination, soils with the highest contaminant concentrations in the immediate area of the tank, were excavated and removed when the tank and associated piping were removed in 1995.

3.0 RBCA TIER 1 RISK ASSESSMENT

3.1 Introduction

This section presents the Tier I risk-based screening conducted for the site. It was prepared following ASTM Standard Guide E1739-95, "Risk-Based Corrective Action Applied at Petroleum Release Sites." The objective of the screening was to identify those chemicals and exposure pathways that have a potential to cause adverse effects. This analysis found that volatilization of benzene and toluene into enclosed spaces and volatilization of benzene into outdoor air are the only chemical/exposure pathway combinations that have the potential to cause an unacceptable health impact. Due to the conservative approach used in this screening, this chemical/exposure pathway combination may not pose an actual hazard. The chemical/exposure pathway combinations that were found not to pose a potential risk are very unlikely to pose an actual unacceptable hazard since the screening exaggerates potential exposures and risks.

The screening conducted for the site involved three tasks that are summarized in the following subsections.

> Section 3.2: Conceptual Site Model - This subsection identifies the chemicals of potential concern for this site. It also identifies both the potential current and future receptors, based on land- and ground water uses at the site and surrounding area, and the potentially complete exposure pathways for each receptor.
>
> Section 3.3: Exposure Point Concentrations - Based on the potential receptors at the site, the Site was divided into two exposure areas and exposure point concentrations for chemicals in soil and water were calculated based on the existing analytical results.
>
> Section 3.4: Screening Risk Characterization - This section compares the exposure point concentrations to Tier 1 Risk-Based Screening Levels (RBSLs) to determine which chemical/exposure pathway combinations may pose a risk to site receptors.

3.2 Conceptual Site Model

A conceptual site model describes:

- the potential sources of chemicals in the environment;

- the mechanisms by which these substances are transported through the environment;
- the potential receptors of concern; and
- the mechanisms by which receptors may come into contact with (or be exposed to) the substances.

It is based on the distributions of chemicals, the physical properties of the environment, the fate and transport characteristics of the chemicals, and land and ground water use of the site and surrounding area. This section provides the conceptual site model for the Oro Loma Sanitary District gasoline tank site.

Chemicals in the environment at the site are the result of a leak or spill or gasoline from a tank that has been removed. Thus the primary source of chemicals is removed and subsurface soil and ground water are the secondary sources of substances at this site. The investigations of the site have focused on the most mobile and toxic organic chemicals in gasoline: benzene, toluene, ethylbenzene, total xylenes, and methyl tert-butyl ether (MTBE). These chemicals are volatile, thus they may be transported through soil gas to ambient air and into buildings. In addition, these chemicals have moderate to high water solubility, thus they may migrate via ground water dispersion and diffusion. All of these chemicals have been identified as chemicals of potential concern (COPCs) for the site, however screening has been completed for only the first four. The ASTM (1995) Standard Guide does not provide Tier 1 RBSLs for MTBE, nor have California regulatory agencies issued RBSLs for MTBE. Thus, MTBE may need to be examined within a Tier 2 RBCA analysis and has not been addressed in this analysis.

In addition to the organic constituents of gasoline, 15 soil samples were analyzed for total lead content (Sutton Group 1996). Except for a single sample, the concentrations of lead in soil were less than 200 mg/kg, the soil action level established by the U.S.EPA and U.S. Department of Housing and Urban Development (HUD) under the Childhood Lead Poisoning Prevention Program (HUD 1995). The lead-in-soil results ranged from <5 to 57 mg/kg. One sample from the tank excavation pit contained 260 mg/kg lead. Due to the limited subsurface environmental mobility of lead this result is not representative of subsurface concentrations of lead at this site. Lead has thus not been designated as a COPC for this site.

The site is located in an unincorporated portion of Alameda County and land-use in this area is regulated by the Alameda County Planning Department. The site is zoned for light and heavy industrial activities (Alameda County Planning Department, personal communication, 1997). In addition, the General Plans for jurisdictions at and surrounding the site do not indicate that any change in land use is under consideration, thus it is anticipated that the site will remain as an industrial facility for the foreseeable future (Alameda County Planning Department, personal communication, 1997). Based on this use land use, both the potential current and future receptors at the site are adult workers. In addition to workers at the site, construction workers may be exposed to COPCs if they conduct subsurface excavations at this site and thus these workers are considered potential receptors for the site.

As part of identifying potentially complete exposure pathways and conducting RBSL comparisons, the site was divided into an office exposure area, comprising the area of and immediately surrounding the Engineering Building, and an outdoor exposure area, comprising the remainder of the site, including the parking lot and the adjacent Grant Avenue. The locker room in the Maintenance Building was also considered as a potential exposure area, however, contaminant levels are low in samples from this vicinity, and the District's workers occupy this room for only a small fraction of the day. The combination of these two factors results in insignificant exposure, potential, and thus was not studied in detail. The infrastructure and operations in the two selected exposure areas are sufficiently dissimilar to result in different exposure potentials.

The only potentially complete exposure pathways in the office exposure area are:

- inhalation of COPCs volatilizing into enclosed spaces from soil, and
- inhalation of COPCs volatilizing into enclosed spaces from ground water.

The building structure, especially its floor system, and the parking lot's paved surface prevents the office workers from routinely contacting soil and ground water beneath the building, thus inhalation of soil particulates and both ingestion and dermal contact with soil and ground water are incomplete exposure pathways. Ground water is not extracted to supply drinking water in either this exposure area or in the outdoor exposure area. Installation of a potable water well into the first aquifer at the site is not probable in the future, nor feasible due to the documented poor water quality and the poor aquifer characteristics of the site vicinity (RWQCB 1992). Thus ingestion of ground water is an incomplete exposure pathway for workers in the office exposure area and all other receptors.

Due to its design, the Maintenance Building is open to the ambient air and does not act as an enclosed space. Thus, the only potentially complete exposure pathway in this exposure area for routine conditions is:

- inhalation of COPCs volatilizing into outdoor air.

Due to the subsurface primary and secondary sources of COPCs, surface soils are not impacted; thus direct soil exposure pathways are not complete under routine conditions. However, construction workers may need to install trenches and excavations in the outdoor exposure area, thus there are three potentially complete exposure pathways for these workers:

- dermal contact with subsurface soil,
- ingestion of subsurface soil, and
- inhalation of soil particulates.

Potential off-site receptors were identified on the basis of land uses and environmental fate and transport processes. The land uses surrounding the facility are primarily commercial/industrial, there are no residential areas in the immediate vicinity of the site. Thus, the off-site receptors are also adult workers located to the east and south of the site.

Considering ground water transport of COPCs, the only potentially complete exposure pathway is:

- inhalation of COPCs volatilizing into enclosed spaces from ground water.

why not soil?

In addition to human receptors, the potential for off-site ecological receptors was considered. There is a wetland approximately 400 feet south of the site. However, this wetland and its associated flora and fauna are not potential receptors. There is a series of large utility trenches along Grant Avenue, south of the former tank site. These trenches intercept any potentially impacted ground water and divert it away from the wetland and the ecological receptors.

3.3 Exposure Point Concentrations

The soil and ground water results for the site were divided into three groups based on the exposure areas. The soil and ground water samples taken nearest to the Engineering Building were used represent the Office Exposure Area. Neither soil or ground water samples have been collected from the off-site areas. Consequently, ground water results from EP-6 and EP-7 were used to represent the off-site exposure area since these samples were taken closest to the eastern boundary of the site. The remainder of the results were used to represent the Outdoor Exposure Area. Tables A-1 and A-2 document which soil and ground water samples have been selected to represent each exposure area.

Results for ground water samples taken earlier than 1995 have not been used to characterize the exposure point concentrations (EPCs). Fate and transport processes, particularly biodegradation and volatilization, impact ground water concentrations of volatile organic chemicals over time. Thus, these older ground water results were not considered as representative of existing and potential future exposures.

No soil result was excluded on the basis of collection date since biodegradation and volatilizaton in soil are slower than in ground water. However, the soil results for the tank excavation pit wall samples were not considered in calculating the EPCs since those samples are representative of the primary tank source that has been removed.

soil was removed?

Both the maximum measured concentration and a measure of the central tendency have been used as EPCs in the Tier 1 screening. The central tendency was characterized using either the arithmetic mean or the 95% upper confidence limit on the mean (95% UCL). For both of these statistics, it was assumed that the sample results were normally distributed. The mean was calculated by:

you cannot assume,

$$\text{mean} = n^{-1} * \sum (x_i)$$

where:

n	=	number of samples, and
x_i	=	result for sample i.

The 95% UCL was calculated by (Gilbert 1987):

$$95\%\ UCL = mean + t*s*(\sqrt{n})$$

where:

t	=	Student's t statistic, and
s	=	standard deviation.

Tables A-1 and A-2 in Appendix A provide the representative EPCs for each exposure area.

3.4 Screening Risk Characterization

RBSLs were identified from the ASTM RBCA Guide. Table A-3 compares the applicable Tier 1 default values for exposure parameters, building characteristics, soil characteristics and ground water characteristics. This comparison suggests that the ASTM Tier 1 RBSLs are very conservative measures of potential risk for receptors at the site. In particular, the ASTM RBSLs are based on a homogeneous sandy subsurface soil. The site is underlain by clay and peat soils which are generally more resistant to soil gas flow than a sandy soil. In addition, the Engineering (office) Building at the site has a crawl space beneath the floor, and a two inch thick concrete ground slab placed over a waterproof membrane shield the building floor, as distinct from having soil gas transport directly into the enclosed crawl space as is assumed in the ASTM model. The crawl space results in greater dispersion of soil gases and lower concentrations of COPCs potentially infiltrating into the enclosed space than considered in the ASTM exposure model. This is due in part to the ground slab.

Table A-4 compares site EPCs to RBSLs. These comparisons were made using a Hazard Quotient (HQ) approach as follows:

$$HQ = EPC / RBSL$$

A hazard quotient less than or equal to unity indicates that no adverse health effects are expected to occur. A hazard quotient greater than unity indicates only that further evaluation, i.e. a Tier 2 or Tier 3 analysis is warranted; it does not mean that adverse health effects will occur.

The site maximum and central tendency EPCs for the off-site exposure area are all substantially below the applicable RBSLs (Table A-4). Thus, COPCs at the site are unlikely to pose an unacceptable health threat to off-site receptors.

Within the outdoor exposure area, the only chemical/exposure pathway combinations that have hazard quotients greater than 1 are:

- inhalation of benzene volatilizing from soil, and

- inhalation of benzene volatilizing from ground water.

All hazard quotients associated with subsurface soil excavation in the outdoor exposure area are less than unity.

In the office exposure area the only chemical/exposure pathway combinations that have hazard quotients greater than 1 are:

- inhalation of benzene volatilizing from soil,
- inhalation of toluene volatilizing from soil, and
- inhalation of benzene volatilizing from ground water.

Site-specific data for the buildings and subsurface environment may show that even these pathways do not pose unacceptable risks to on-site receptors. If warranted as a result of planned investigations, i.e. the proposed investigations do not resolve the issues, then a Tier 2 RBCA analysis should be conducted to evaluate the inhalation exposure pathways using site-specific exposure parameters for the soil and buildings.

4.0 PROPOSED INVESTIGATIONS

4.1 Sampling Plan

The purpose of this investigation is to provide data which can be input to a RBCA Tier 2 Assessment and used to support site closure. The two proposed areas of investigation are the ground water flow path, referred to as the "offsite area," and the Engineering Building area, referred to as the "office area".

For the "offsite" area, subsurface data will be collected to supplement existing data to illustrate the postulated path of gasoline impacted ground water flow away from the immediate tank site area. It is postulated that the gasoline impacted ground water in the shallow zone emanating from the former tank area travels south to southeast beneath the parking lot. Flow is essentially within a thin sand layer at approximately six feet depth within the impervious Bay Mud. This flow layer is shown on the site cross section on Figure 4, and the postulated zone of impact is depicted on the Benzene In Ground Water Iso-Concentration Map, Figure 6. Upon exiting the parking lot area at the Grant Avenue property line, this flow path is immediately intercepted by a gravel-backfilled sewer trench. The impacted ground water then flows west through this pervious trench backfill, and into the bacterially fertile soils underlying the District's adjacent POTW.

It is similarly reasonable to postulate that the onsite sewer service branch which traverses the parking lot from the Maintenance Building to manhole P-6 on the aforementioned sewer line in Grant Avenue is also similarly encased in a gravel envelope. District engineering plans show the depth of the gravel envelope on this branch line to be approximately four feet at the Maintenance Building and six feet depth at manhole P-6 on

Grant Avenue. Thus it is similarly reasonable to conclude that this gravel acts as lateral barrier to gasoline contaminant migration northward. This barrier effect is illustrated by the test results on Figure 5 and also on the Benzene In Ground Water Iso-Concentration Map, Figure 6.

4.1.1 Soil And Ground Water Investigations

Five new borings are proposed. Soil samples will be collected as each hole is advanced. Selected soil samples will be tested for chemical and/or physical properties. Grab ground water samples will be collected from temporary well casing installed in the borings. The new borings will be numbered EP-8 through EP-12.

Boring EP-8, will be located close to the southwest corner of the Engineering Building. The purpose of this boring is twofold. Samples from this boring will be tested for physical properties and a suite of chemical constituents. These properties will available for use in the Tier 2 RBCA Risk Analysis.

Two of the borings, EP-9 and EP-10 will be located on the north sidewalk of Grant Avenue, on the alignment of the abandoned 10 inch sanitary sewer line. The purpose of borings EP-9 and EP-10 is to show that the gravel backfill in the sewer trench is pervious, and is the active conduit for transporting gasoline impacted ground water to the POTW site.

The final two borings, EP-11 and EP-12 will be within in Grant Avenue, between the alignment of the abandoned 10 inch sanitary sewer and the 66-inch sewer main. The purpose of borings EP-11 and EP-12 is to show that the gravel backfill in the sewer trench is an effective ground water collection system and that gasoline impacted ground water exiting the parking lot does not travel further south across Grant Avenue.

Soil samples will be collected using a continuous sampling tube. Samples for physical testing will be collected to represent each soil type found. Selected soil samples will be scheduled for chemical analysis. Based on our experience, ground water will be at approximately five to seven feet depth in this area. The borings will be extended to about 12 feet depth and slotted well screen will be installed to facilitate collection of a ground water sample at each boring location. The locations of these proposed new soil borings are shown on Figure 7.

4.1.2 Ground Water Sampling

Temporary well casings will be installed in each of the borings and grab samples collected with bailers.

4.1.3 Indoor Air Sampling

To provide definitive information about the potential for harmful petroleum vapors to rise from the postulated ground water plume beneath the Engineering Building, permeate the plastic water proofing membrane, and the two inch thick 'rat proofing' slab, disperse in

the ventilated crawl space, permeate the suspended floor system, and enter into the work space, two samples of air will be collected. One air sample, CSA-1, will be collected from the crawl space at a location near the northwest corner of the building, near boring EP-1 . The second sample, CSA-2, will also be collected from the crawl space but at a location in the vicinity of boring EP-2.

4.2 Sampling Procedures

4.2.1 Soil Sampling

Soil core drilling and ground water well screen installation will subcontracted to Precision Sampling, Inc. (PSI), a soil and ground water sampling specialty company located in San Rafael, California. PSI uses portable, hydraulically driven soil coring systems to obtain soil and ground water samples for lithologic and chemical, and limited geotechnical (physical) analysis. PSI holds California Well Drilling Contractor's (C57) license No. 636387. The Sutton Group will assist PSI in obtaining a drilling permit for the work from Alameda County Department of Public Works.

Boring locations will be marked on the ground or staked based on measurements from the site boundaries or other landmarks. The boring sites will be surveyed by Underground Service Alert (USA) in advance of rig mobilization. Borings will not be relocated without the approval of the engineer-of-record.

The soil borings will be logged by an appropriately qualified engineer or geologist from The Sutton Group. Soil samples will be classified in the field using the Unified Soil Classification System. All soil samples will be screened on-site using a portable photo-ionization detector (PID). Samples will be labeled with the project number, boring number, sample depth interval and date of collection. The soil samples will be appropriately packed, refrigerated and transported to the chemical analytical laboratory for testing.

A chain-of-custody form will be initiated by the sampler and accompany the soil samples to the laboratory. All samples collected for chemical analysis will be delivered under chain-of custody to the District's chemical analysis contractor.

Soil samples selected for physical analysis will be field screened for volatile organics to assure there is no potential adverse hazard to the shipper or receiver prior to dispatch to the appropriate laboratory.

4.2.2 Ground Water Sampling

Ground water sampling will entail recovery of water from temporary wells. The temporary well construction and ground water sampling protocols are described in Appendix B. Wells will be installed in each boring at the completion of soil sample collection. . Based on past experience at the site, recovery will be slow, thus wells will be allowed to draw until the following day, at which time, water samples will be collected. Removal of the well casing string and grouting of the hole will follow.

4.2.3 Indoor Air Sampling Indoor air samples will be collected over an 8-hour period in accordance with EPA Method TO-14. SUMMA canisters will be prepared for the sampling period by the laboratory. The canisters will be set beneath the floor. The canisters will be equipped with calibrated mass flow control valves pre-set for the sampling period, checked and certified prior to shipment. A log of ambient temperature range will be recorded over the duration of the test.

4.3 Laboratory Testing

4.3.1 Physical Properties of Soils
Testing of physical properties will be performed by Cooper Testing Laboratories of Mountain View, California. Cooper is an independent geotechnical laboratory which regularly performs tests according to ASTM, Corps of Engineers and Caltrans procedures.

Selected samples will be tested for field density and moisture content by the method ASTM D-2937, and Specific Gravity by ASTM D-854.

4.3.2 Chemical Analysis of Samples
The District has contracted Sequoia Analytical Laboratory of Redwood City California for transport and chemical analysis of the soil and ground water samples. Sequoia is an independent, California EPA-certified hazardous waste testing laboratory (ELAP No. 1210), accredited to perform the analyses in accordance with the San Francisco Bay Regional Water Quality Control Board, and the Alameda County Health Department's Hazardous Materials Program's guidelines for analysis of petroleum fuels releases from underground tanks.

Soil samples will be analyzed for total petroleum hydrocarbons as gasoline, benzene, toluene, ethyl benzene and xylenes using EPA methods 5030, and 8020, in accordance with Table 2 of the "Tri-Regional Guidelines, dated August 1990. Selected samples will also be tested for Total Organic Carbon Content.

The ground water samples will be analyzed for benzene, toluene, ethyl benzene, xylenes, and methyl tert-butyl ether (MTBE) using EPA methods 5030 and 8020, in accordance of the "Tri-Regional Guidelines, (RWQCB 1990).

4.3.3 Air Sample Analysis
The air samples will be analyzed by Air Toxics Ltd. at their California EPA-certified laboratory in Folsom, California. Samples collected in SUMMA canisters will be shipped by overnight carrier to the laboratory in the canisters. Samples will be analyzed for benzene and toluene by EPA Method TO-3, Aromatic Volatile Organics in Air.

4.4 Soil Cuttings And Collected Water Management

The soil cuttings will be placed on visqueen at a designated location on the site, for eventual disposition by the District. Excess recovered ground water and l rinsate from the cleaning will be temporarily contained in 55-gallon drums at the project site and later, with District approval, discharged into the sanitary sewer system for treatment at the District's POTW.

5.0 EVALUATION AND REPORT

The Sutton Group will evaluate the data and draft a written report describing field and laboratory results for subsurface soil and ground water conditions, and indoor air conditions. The report will draw conclusions, and make recommendations for future work, including the Tier 2 risk assessment. The submittal to the District will first be in draft form to be discussed during a meeting at the District's offices. Conclusions and recommendations will be discussed and the final report will be submitted within five working days of the meeting. The District should then submit a copy of the final report to Alameda County Environmental Health Department, Hazardous Materials Division, to the attention of Mr. Brian Oliva.

6.0 REFERENCES

Alameda County Planning Department. 1997. Personal Communication with Barbara Marks on 29 September 1997.

ASTM, 1995 (American Society for Testing and Materials) Standard Guide E 1739-95: Risk-Based Corrective Action Applied at Petroleum Release Sites. ASTM, West Coshohocken, PA.

CARB, 1984 (California Air Resources Board). California Surface Wind Climatology. CARB, Sacramento, CA.

Gilbert, R.O. 1987. Statistical Methods for Environmental Pollution Monitoring. Van Nostrand Reinhold Company, New York.

HUD, 1995 U.S. Department of Housing and Urban Development) Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing. HUD, Washington, D.C. June.

Mills, W.B., et al. 1985. Water Quality Assessment: A Screening Procedure for Toxic and Conventional Pollutants in Surface and Ground Water - Part II (Revised 1985). U.S. Environmental Protection Agency, Washington, D.C. EPA/600/6-85/002b.

NOAA, 1992 (National Oceanic and Atmospheric Administration). Monthly Station Normals of Temperature, Precipitation and Heating and Cooling Degree Days 1961 - 1990, California. NOAA, Asheville, N.C.

RWQCB, 1990 Tri-Regional Staff Recommendations for Preliminary Evaluation and Investigation of Underground Tank Sites, Prepared jointly by staff of the North Coast, the San Francisco Bay, and the Central Valley Regional Water Quality Control Boards, dated 10 August 1990

RWQCB, 1992 Water Quality Control Plan, San Francisco Bay Basin Region (2), San Francisco Bay Regional Water Quality Control Board, 1986, and amended through 1992

The Sutton Group, 1994 Stage II Tank Removal Investigation, 1,000 Gallon Gasoline Tank Site at 2600 Grant Avenue, San Lorenzo, California, prepared for Oro Loma Sanitary District, San Lorenzo, California, dated November 23, 1994.

The Sutton Group, 1995 Report of Removal of 1,000 Gallon Gasoline Tank Oro Loma Sanitary District Service Center, San Lorenzo, California, dated June 7, 1995.

The Sutton Group, 1995a Report of Geotechnical Investigation for 1,000 Gallon Gasoline Tank Site Closure at 2600 Grant Avenue, San Lorenzo, California, prepared for Oro Loma Sanitary District, San Lorenzo, California, dated August 30, 1995

The Sutton Group, 1995b Remedial Investigation, Feasibility Study and Proposed Corrective Action Plan for 1,000 Gallon Gasoline Tank Site at 2600 Grant Avenue, San Lorenzo, California, prepared for Oro Loma Sanitary District, San Lorenzo, California, dated December 6, 1995.

The Sutton Group, 1996. Report of Soil and Ground Water Investigations at the Former Site of a 1,000 Gallon Gasoline Tank at the Oro Loma Sanitary District Service Center, San Lorenzo, California. Prepared for Mike Cortez, Oro Loma Sanitary District. May 15, 1996.

7.0 PERSONNEL

This Work Plan has been prepared by The Sutton Group, under the direction of John R. Sutton, PE, a California Registered Civil Engineer, No. 40324, and Geotechnical Engineer No. 812, with expiration date December 31, 1998. The risk assessment was performed by Barbara Marks, MS, CIH who prepared Section 3 and Appendix A of this document. Ms. Marks has prepared numerous risk assessments over the past 12 years, in accordance with the ASTM RBCA, California, and US EPA guidelines.

The Engineer-of-Record for the proposed supplementary investigations will be Mr. Sutton, who has over 20 years of geo-environmental engineering experience, and has been

responsible for, and directly involved in hazardous waste investigations in northern California since 1986.

The work will be performed under appropriate health and safety guidelines, by technical staff, including subcontractors who have been trained in the hazardous waste operations requirements "HAZWOPER" of 29CFR 1910.120.

8.0 LIMITATIONS

This work plan has been prepared according to generally accepted geologic, geotechnical and environmental engineering, and risk assessment practices. No other warranty, either expressed or implied is made. The analysis, conclusions and recommendations contained in this work plan are based on review of customer-provided data and other available documents relevant to the site conditions Changes in the information or data gained from any of these sources could result in the need for changes in conclusions and the recommended scope of work. If such changes do occur, we should be advised so that we can review this document and the work scope in light of these changes.

*****000*****

TABLE 1
ANALYTICAL RESULTS FOR SOILS & WATERS
GASOLINE TANK AREA
1993 INVESTIGATION
ANALYTICAL RESULTS FOR SOILS

BORING	DEPTH Ft.	TPH-GAS mg/kg	Benzene mg/kg	Toluene mg/kg	Ethyl Benzene mg/kg	Xylenes mg/kg	LEAD,Total mg/kg
SB1	5.5	2,100	23	200	55	330	NA
SB2	3.5	4,300	14	250	130	680	NA
SB4	3.5	1,100	11	51	39	210	NA
SB5	3.5	3.2	0.25	ND	0.27	0.83	NA
SB6	3.5	160	2.8	14	5.9	26	NA
SB6	5.5	2,100	14	210	80	430	NA
SB6	7.5	1,500	4.8	120	61	340	NA
MDLs*	SOIL, mg/kg	0.2	0.005	0.005	0.005	0.005	5

ANALYTICAL RESULTS FOR WATERS

		mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
SB3	GW	0.12	0.0007	ND	ND	ND	NA
SB4	GW	1,600	27	39	4.2	22	NA
SB5	GW	1,100	8	29	4.2	20	NA
MDLs*	WATER,mg/kg	0.05	0.0005	0.0005	0.0005	0.0005	NA

* Refer to Laboratory Report for complete listing of results

TABLE 2

ANALYTICAL RESULTS FOR SOILS

GASOLINE TANK AREA

1994 INVESTIGATION

TRENCH No	DEPTH Ft.	TPH-GAS mg/kg	Benzene mg/kg	Toluene mg/kg	Ethyl Benzene mg/kg	Xylenes mg/kg	LEAD,Total mg/kg	LEAD, Sol. mg/kg
TT-1	4.5-5.0	ND	ND	ND	ND	ND	**57**	**1.8**
TT-2	2.5-3.0	ND	ND	ND	ND	**0.007**	ND	--
TT-2	6.0-6.5	ND	ND	ND	ND	ND	**21**	--
TT-2	7.0-7.5	ND	**0.015**	ND	ND	**0.015**	**15**	--
TT-3	2.0-2.5	ND	ND	ND	ND	ND	ND	--
TT-3	3.5-4.0	**160**	**4.7**	**25**	**4.6**	**22**	**31**	**5.3**
TT-3	6.0-6.5	**1600**	**8.8**	**77**	**25**	**130**	**7.4**	--
TT-4	5.0-5.5	ND	ND	**0.009**	ND	**0.008**	**9.3**	--
TT-5	2.5-3.0	ND	ND	ND	ND	ND	ND	--
TT-5	5.5-6.0	ND	ND	ND	ND	ND	**37**	**0.2**
TT-8	2.0-2.5	ND	ND	ND	ND	ND	ND	--
MDLs*		1.0	0.005	0.005	0.005	0.005	5	0.1

* Refer to Laboratory Report for complete listing of results

TABLE 3

TANK REMOVAL ANALYTICAL RESULTS

GASOLINE TANK AREA

TEST RESULTS FOR SOILS

SAMPLE ID	LOCATION	DEPTH Ft	TPH-GAS mg/kg	Benzene mg/kg	Toluene mg/kg	Ethyl Benzene mg/kg	Xylenes mg/kg	LEAD,Total mg/kg	LEAD, Sol. mg/kg
S1	East End of Tank Pit	5.8	**1,900**	**7.1**	**57**	**39**	**190**	**18**	NA
S2	West End of Tank Pit	6	**3,300**	**37**	**18**	**61**	**350**	**260**	**6.4**
S3	Center of Tank Pit	11.5	**43**	**0.3**	**0.56**	**0.41**	**1.7**	ND	NA
S4	Island: beneath fuel pipe	1.5	**49**	**0.25**	**0.28**	**0.45**	**2.6**	**15**	NA
MDLs*			0.2	0.005	0.005	0.005	0.005	5	0.1

* Refer to Laboratory Report for complete listing of results

Job No. 3022, Stage 7

TABLE 4

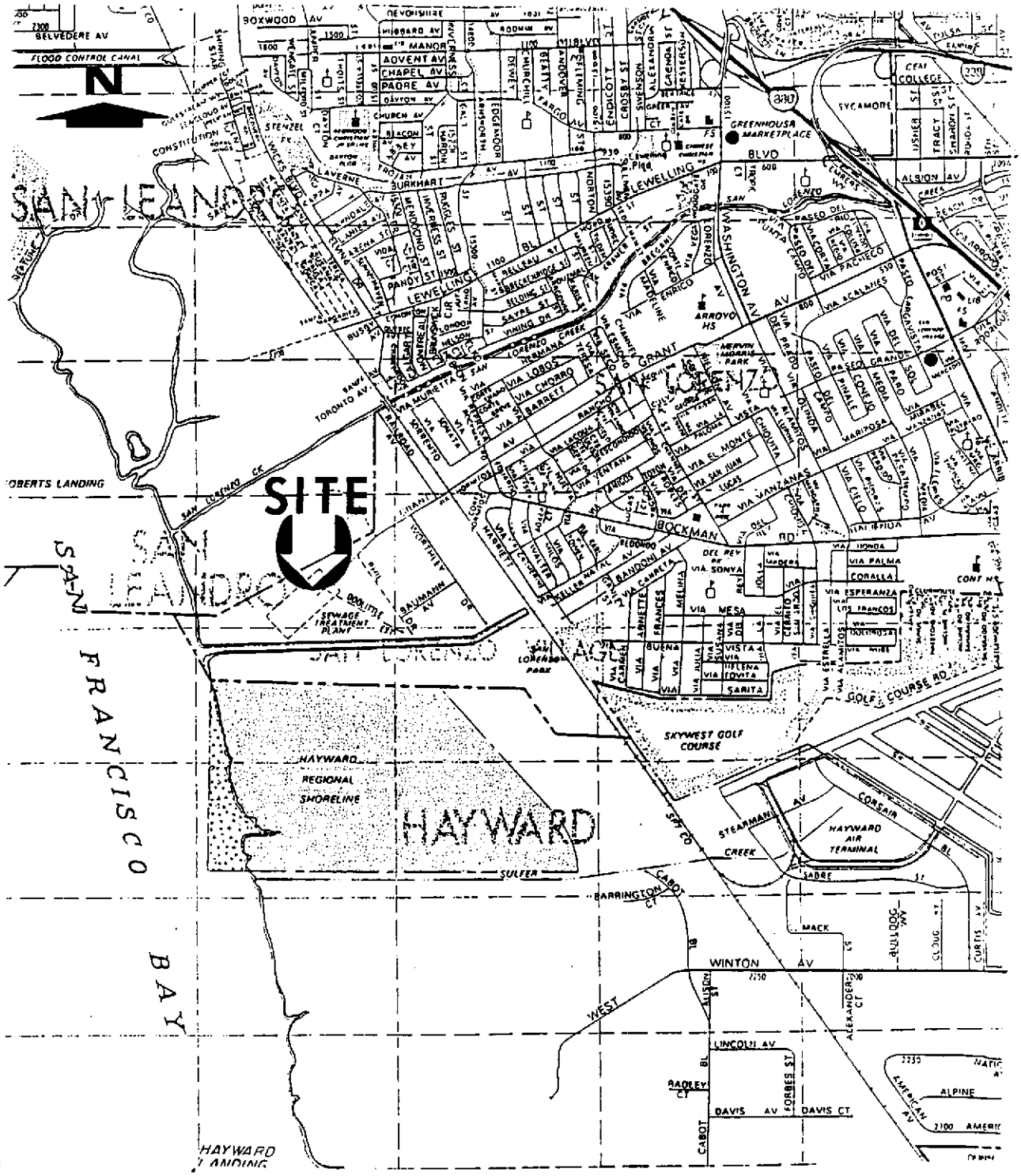
ANALYTICAL RESULTS FOR SOIL SAMPLES

GASOLINE TANK AREA

SOIL AND GROUNDWATER INVESTIGATION, 1996

BORING	Depth	TPH-GAS	Benzene	Toluene	Ethyl Benzene	Total Xylenes	MTBE	Lead
	feet	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EP-1	6.5-7	**4.5**	ND	ND	ND	**.059**	ND	**7.7**
EP-2	6.5-7	**1800**	**21**	**120**	**3.5**	**180**	ND*	**16**
EP-2B	2.5-3	ND	ND	ND	ND	ND	NA	**13**
EP-2B	3.1-3.6	ND	ND	ND	ND	ND	NA	ND
EP-3[1]	3.0-3.5	(810)	(8.7)	(47)	(14)	(72)	NA	NA
EP-3	6.5-7	**5.3**	ND	ND	ND	**.036**	ND	ND
EP-3A	1.5-2	ND	ND	ND	ND	ND	NA	NA
EP-3B	3.5-4	ND	ND	ND	ND	ND	ND	NA
EP-3B	4.5-5	**1.5**	ND	ND	ND	0.010	NA	NA
EP-5	3.5-4	**29**	**1.5**	**0.24**	**0.90**	**2.2**	NA	**49**
EP-6	3.5-4	ND	ND	ND	ND	ND	ND	**46**
MDL'S		1.0	0.0050	0.0050	0.0050	0.0050	.025-6	5.0

[1] Sample mislabeled. Result erroneous.



SOURCE: THOMAS BROS MAPS, ALAMEDA COUNTY, CALIFORNIA Scale 1" = 2500 feet

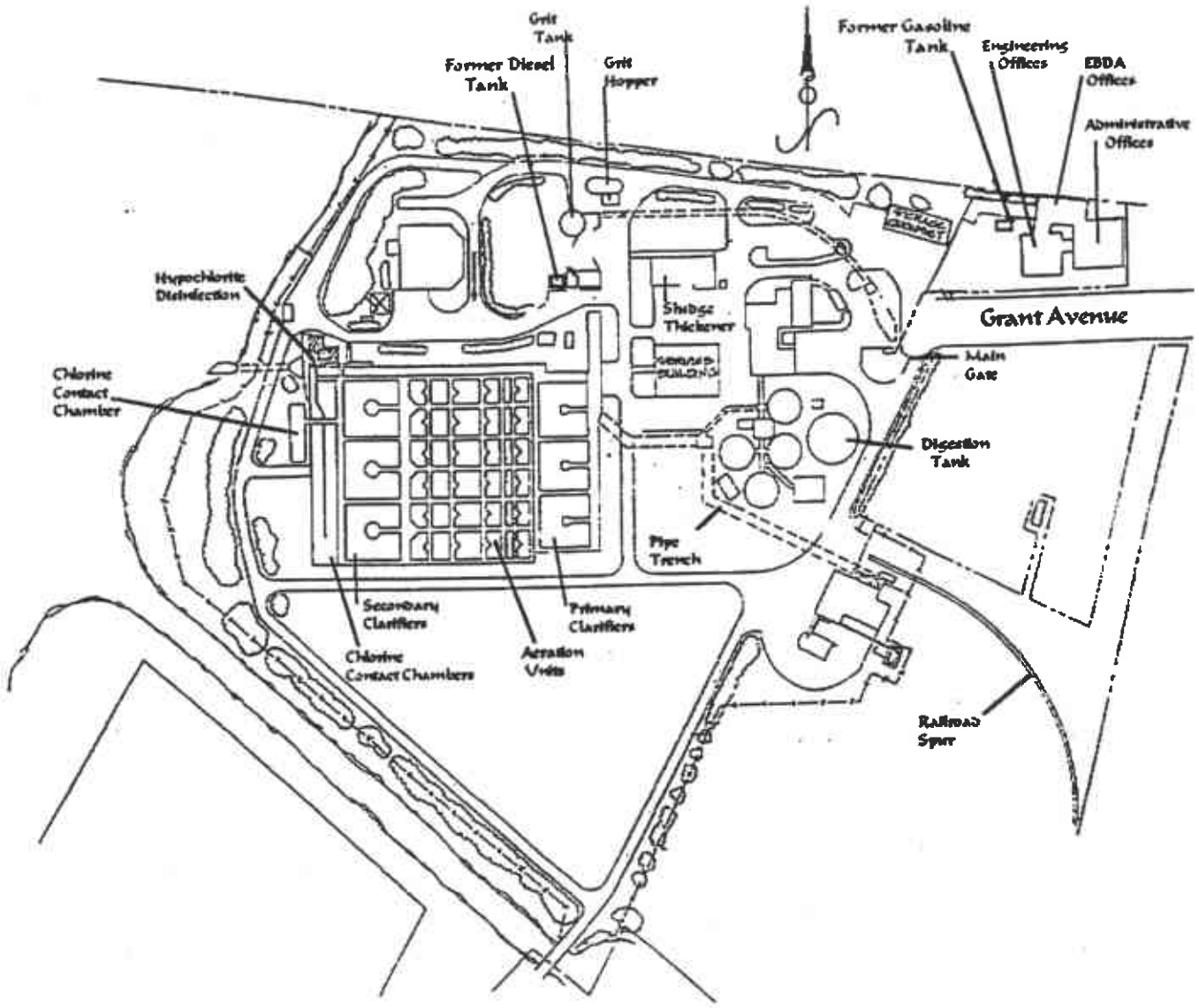
THE SUTTON GROUP
Engineering and Environmental Services
51 Shuey Drive
Moraga, California 94556-2620
phone (510) 631-1688
FAX (510) 631-1371

SITE LOCATION MAP
WORK PLAN FOR
SUPPLEMENTAL SITE EVALUATION
1,000 Gallon Gasoline Tank Site
ORO LOMA SANITARY DISTRICT
San Lorenzo, California

PROJECT No. 3022.8

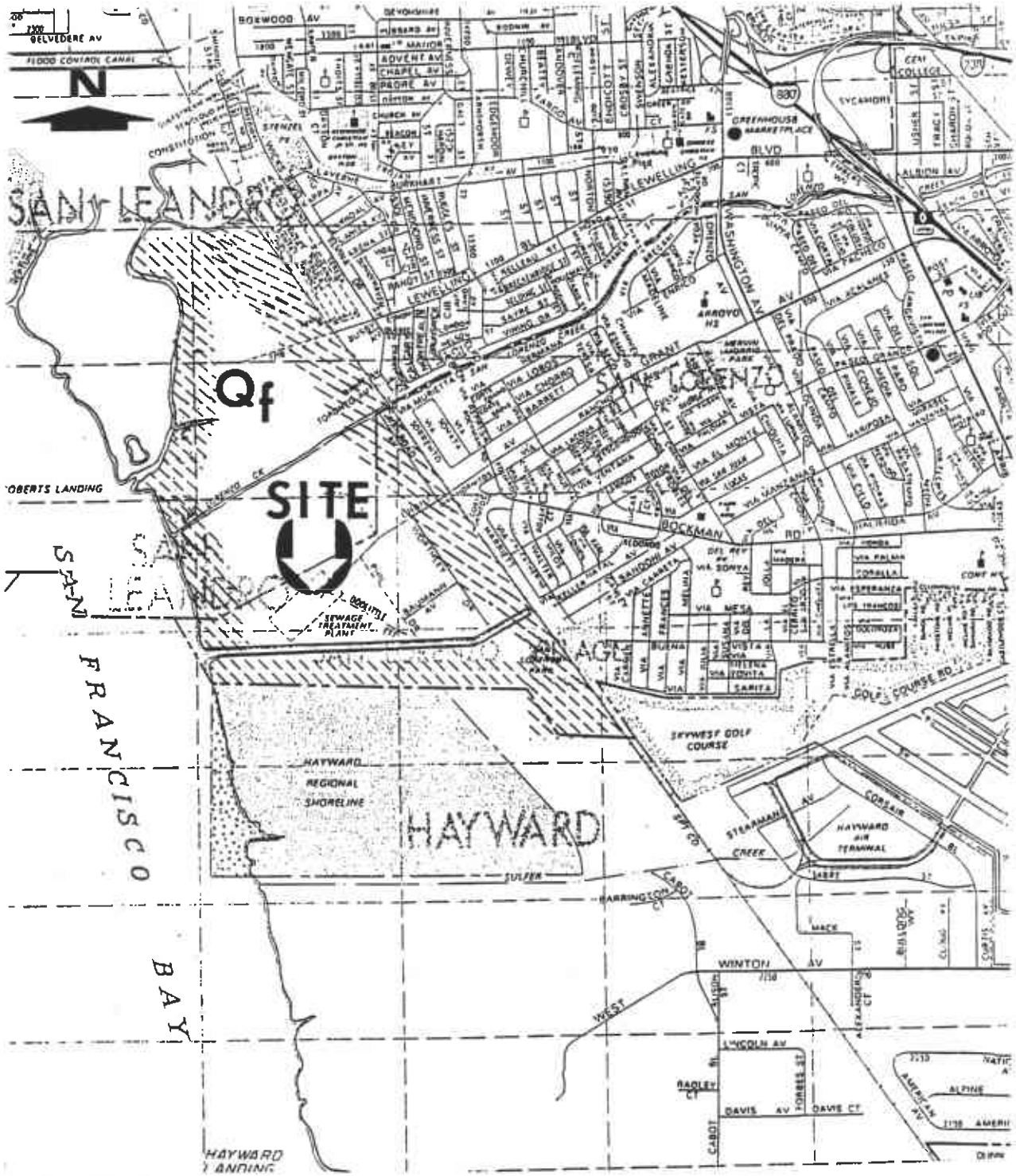
FIGURE 1

Revision a, 10/12/97



SITE PLAN

THE SUTTON GROUP *Engineering and Environmental Services* *51 Shuey Drive* *Moraga, California 94556-2620* *phone (510) 631-1688* *FAX (510) 631-1371*	**PLANT LOCATION MAP** **WORK PLAN FOR** **SUPPLEMENTAL SITE EVALUATION** **1,000 Gallon Gasoline Tank Site** **ORO LOMA SANITARY DISTRICT** **San Lorenzo, California**	PROJECT No. 3022.8 FIGURE 2 Revision o, 10/12/97



Q_f= Filled Bayland

THE SUTTON GROUP *Engineering and Environmental Services* *51 Shuey Drive* *Moraga, California 94556-2620* *phone (510) 631-1688* *FAX (510) 631-1371*	**HYDROLOGIC SETTING** **WORK PLAN FOR** **SUPPLEMENTAL SITE EVALUATION** **1,000 Gallon Gasoline Tank Site** **ORO LOMA SANITARY DISTRICT** **San Lorenzo, California**	PROJECT No. 3022.8 FIGURE 3 Revision o, 10/12/97

LARGE MAP REMOVED

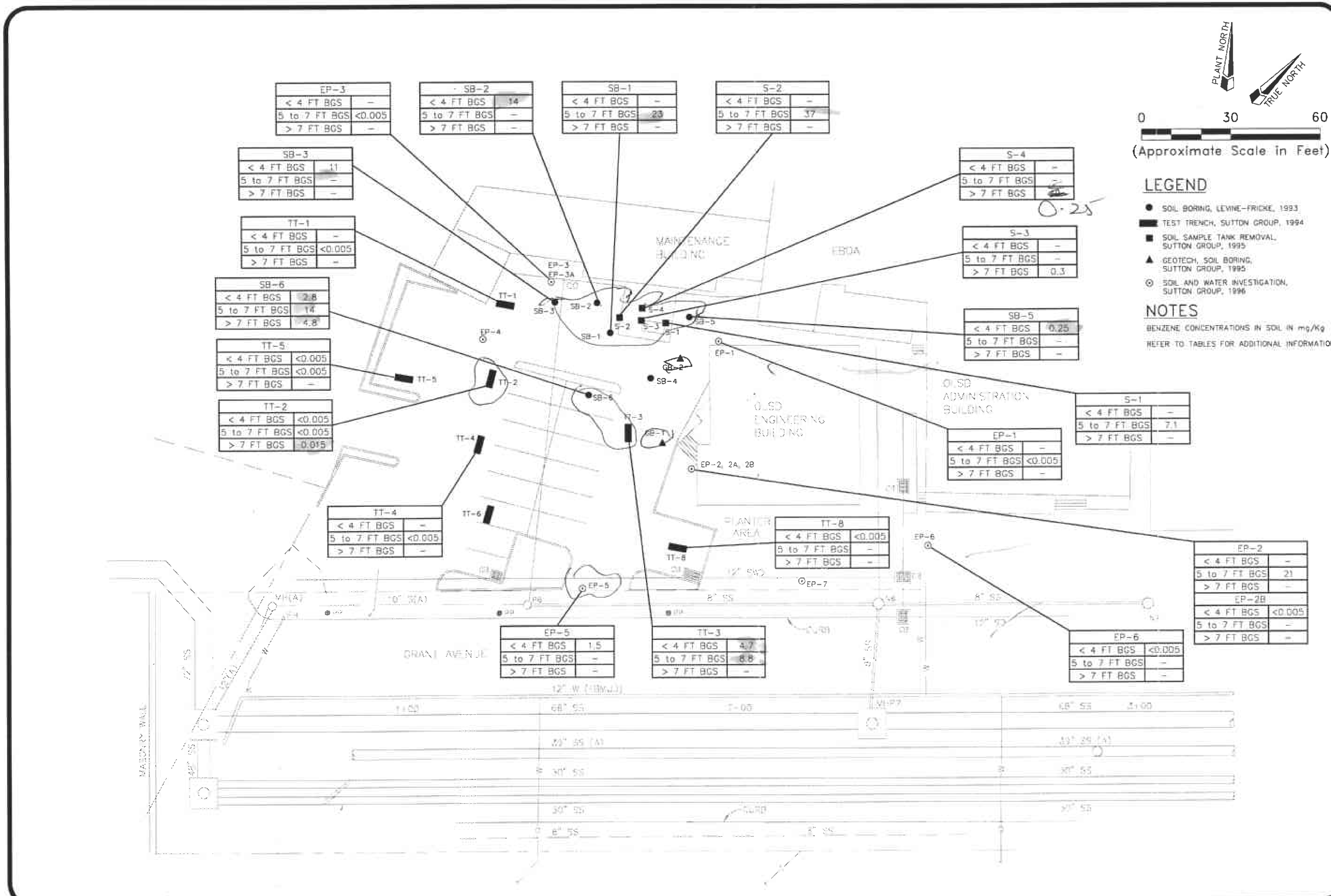


FIGURE 5

PROJECT NO. 3027.8

10/9/97

Benzene Concentrations in Soil

Gasoline Tank Area

ORO LOMA SANITARY DISTRICT
SAN LORENZO, CALIFORNIA

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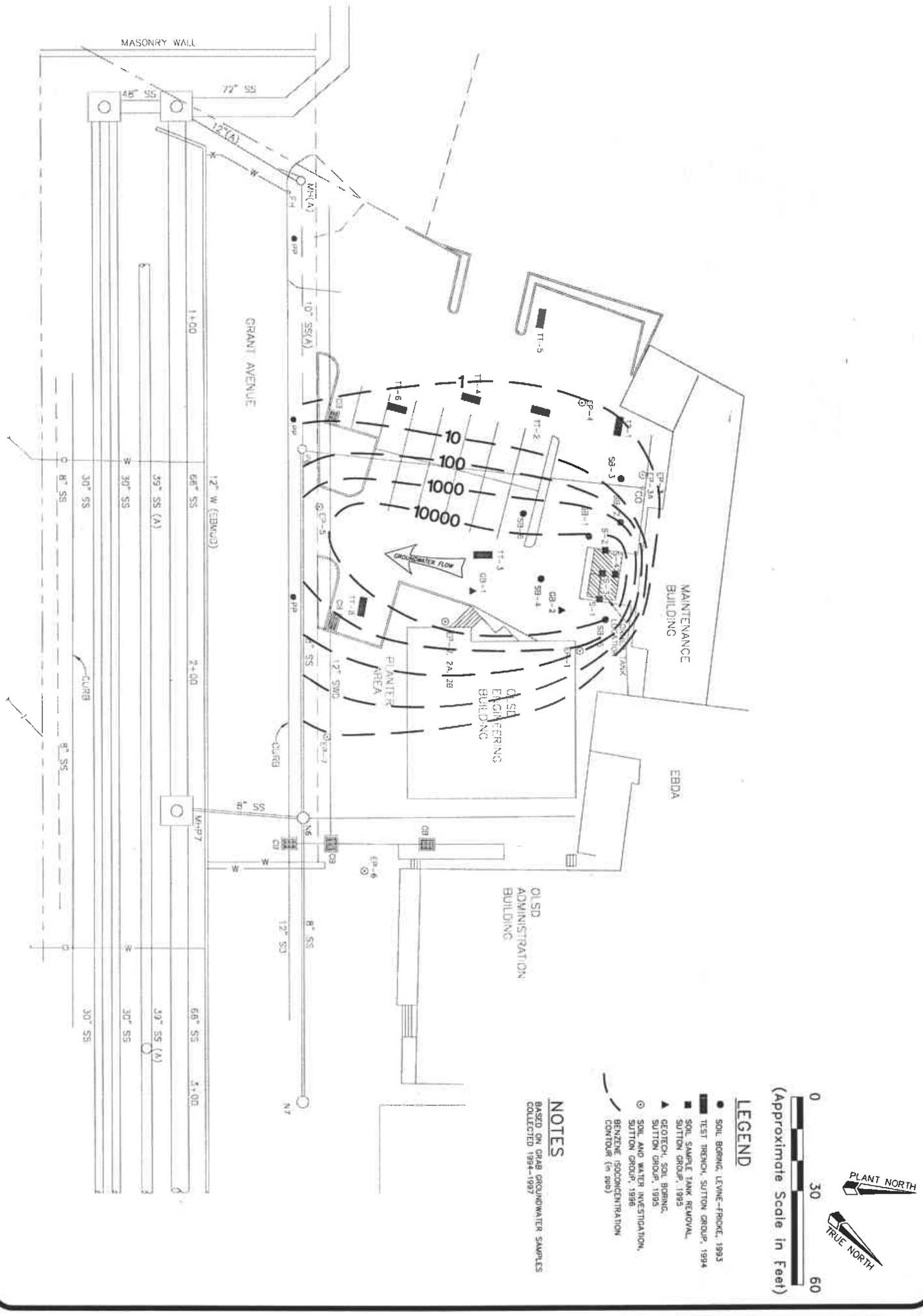

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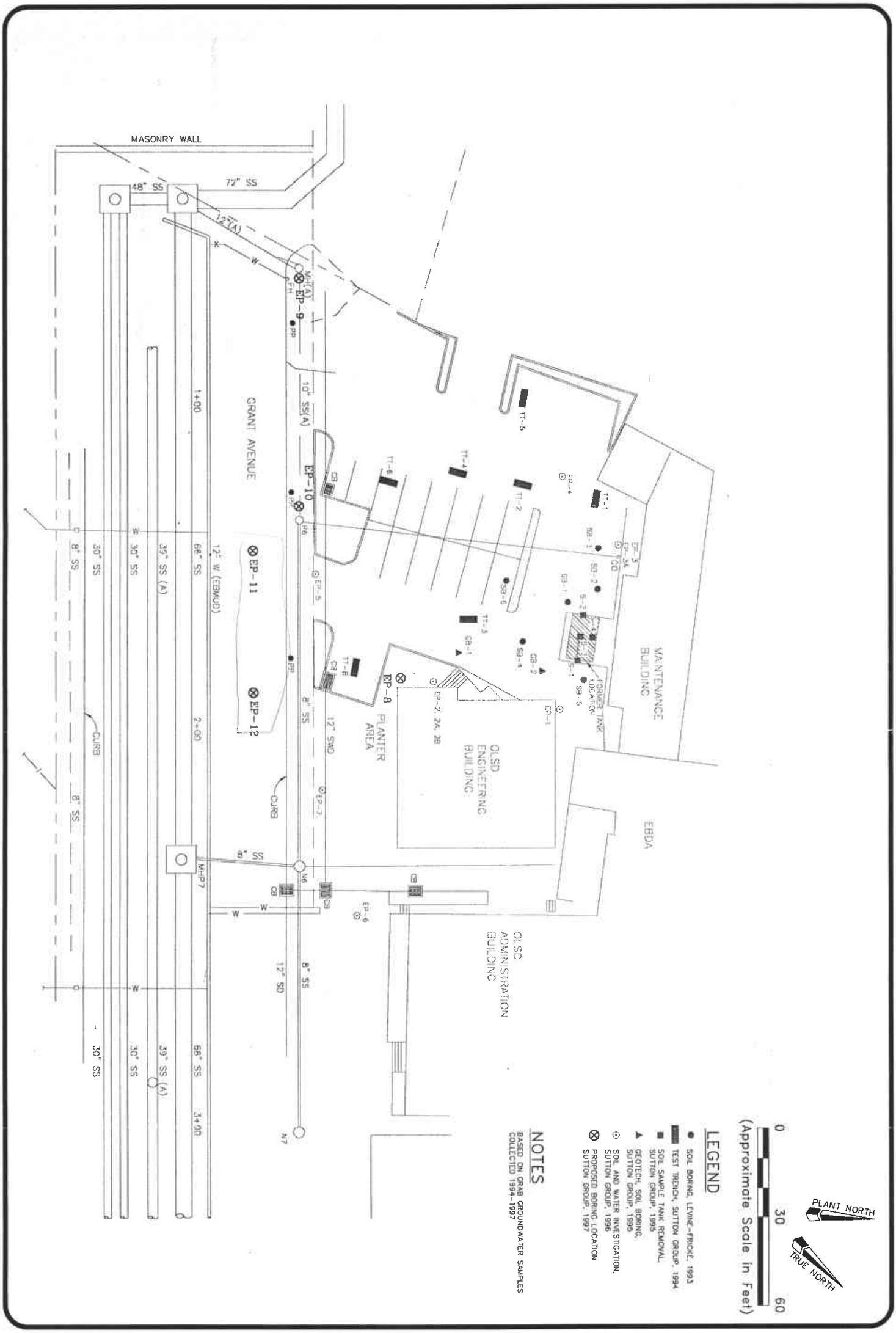
Postulated Isoconcentration Map
Benzene in Groundwater

Gasoline Tank Area
ORO LOMA SANITARY DISTRICT
SAN LORENZO, CALIFORNIA

PROJECT NO. 3027.8

FIGURE 6

10/9/97



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Proposed Additional Boring Locations

Gasoline Tank Area
ORO LOMA SANITARY DISTRICT
SAN LORENZO, CALIFORNIA

PROJECT NO. 3027.8

FIGURE 7

10/9/97

Table A-1
Groundwater Results By Exposure Area

Boring	Sample Date	Exposure Area	Results (mg/L) TPH-g	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE
EP-1	1996	Office	0.51	0.031	0.0074	0.0038	0.015	0.019
EP-2	1996	Office	230	23	47	4.3	21	3.9
SB4	1993*	Office	1600	27	39	4.2	22	N/A
		Average	115	11.5	23.5	2.2	10.5	2.0
		Maximum	230	23.0	47.0	4.3	21.0	3.9
EP-6	1996	Off-site	<0.05	<0.0005	0.00099	<0.0005	0.001	<0.0025
EP-7	1996	Off-site	<0.05	0.00053	0.0021	0.00053	0.0029	<0.0025
		Average	ND	0.00039	0.0015	0.00039	0.0020	ND
		Maximum	ND	0.00053	0.0021	0.00053	0.0029	ND
SB3	1993*	Outdoor	0.12	0.0007	<0.0005	<0.0005	<0.0005	N/A
SB5	1993*	Outdoor	1100	8	29	4.2	20	N/A
EP-5	1996	Outdoor	64	8.8	4.8	1.1	4.8	<0.0025
EP-3	1996	Outdoor	210	0.0058	0.0026	0.001	0.0031	0.0054
EP-4	1996	Outdoor	<0.05	0.0023	0.00097	<0.0005	0.00059	0.036
		Average	91.3	2.9	1.6	0.37	1.6	0.01
		Maximum	210	8.8	4.8	1.1	4.8	0.036

N/A: Sample Not Analyzed for this constituent
*: 1993 data has not been considered representative of existing and potential future concentrations based on the age of these data
Average calculated assume a concentration in a sample reported as not detected equals half the detection limit

bjm\Olsdrbcawater

Table A-2
Evalution of Soil Result By Exposure Area

Boring/Trench	Depth feet	Exposure Area	Results (mg/kg) TPH-g	Benzene	Toluene	Ethylbenzene	Xylenes
EP-1	6.5-7	Office	4.5	<0.005	<0.005	<0.005	0.059
EP-2	6.5-7	Office	1800	21	120	3.5	180
EP-2B	3.1-3.6	Office	<1.0	<0.005	<0.005	<0.005	0.0025
EP2-B	2.5-3	Office	<1.0	<0.005	<0.005	<0.005	0.0025
SB4	3.5	Office	1100	11	51	39	210
TT-3	2.0-2.5	Office	<1	<0.005	<0.005	<0.005	0.0025
TT-3	3.5-4.0	Office	160	4.7	25	4.6	22
TT-3	6.0-6.5	Office	1600	8.8	77	25	130
TT-8	2.0-2.5	Office	<1	<0.005	<0.005	<0.005	0.0025
	Average Concentration		518.5	5.1	30.3	8.0	60.2
	Standard Deviation		716.2	6.9	41.2	13.3	82.5
	t(alpha = 0.05 & n = 9)		1.86	1.86	1.86	1.86	1.86
	95% UCL on the mean		962.5	9.3	55.9	16.3	111.4
	Maximum Concentration		1800.0	21.0	120.0	39.0	210.0
EP-6	3.5-4	Off-site	<1.0	<0.005	<0.005	<0.005	<0.005
SB1	5.5	Outdoor	2100	23	200	55	330
SB2	3.5	Outdoor	4300	14	250	130	680
SB5	3.5	Outdoor	3.2	0.25	<0.005	0.27	0.83
TT-1	4.5-5.0	Outdoor	<1	<0.005	<0.005	<0.005	<0.005
EP-3	3.0-3.5	Outdoor	810	8.7	47	14	72
EP-3	6.5-7	Outdoor	5.3	<0.005	<0.005	0.0025	0.036
EP-3A	1.5-2	Outdoor	<1.0	<0.005	<0.005	0.0025	0.0025
EP-3B	3.5-4	Outdoor	<1.0	<0.005	<0.005	0.0025	0.0025
EP-3B	4.5-5	Outdoor	1.5	<0.005	<0.005	0.0025	0.01
EP-5	3.5-4	Outdoor	29	1.5	0.24	0.9	2.2
SB6	3.5	Outdoor	160	2.8	14	5.9	26
SB6	5.5	Outdoor	2100	14	210	80	430
SB6	7.5	Outdoor	1500	4.8	120	61	340
TT-2	2.5-3.0	Outdoor	<1	<0.005	<0.005	0.0025	0.007
TT-2	6.0-6.5	Outdoor	<1	<0.005	<0.005	0.0025	0.0025
TT-2	7.0-7.5	Outdoor	<1	0.015	<0.005	0.0025	0.015
TT-4	5.0-5.5	Outdoor	<1	<0.005	0.009	0.0025	0.008
TT-5	2.5-3.0	Outdoor	<1	<0.005	<0.005	0.0025	0.0025
TT-5	5.5-6.0	Outdoor	<1	<0.005	<0.005	0.0025	0.0025
	Average Concentration		579.7	3.6	44.3	18.3	99.0
	Standard Deviation		1151.3	6.6	83.7	36.5	196.0
	t(alpha = 0.05 & n = 19)		1.729	1.729	1.729	1.729	1.729
	95% UCL on the mean		1036.3	6.2	77.5	32.7	176.7
	Maximum Concentration		4300.0	23.0	250.0	130.0	680.0

Statistics Calculated Assuming All Result Reported As Below Detection Contained A Concentration Equal To Half The Detection Limit
95% Upper Confidence Limit on the Mean Assumes A Normally Distributed Sample
95% UCL Calculated as:

95% UCL = average + (t * standard Deviation)/(square root of sample size)

Table A-3
Comparison of Applicable ASTM RBCA Tier I Default Values to Site and Worker Characteristics

Symbol	Parameter	ASTM Default	Comparison to Site Conditions
d	lower depth of surficial soil zone, cm	100	ASTM Surface Soil Values Used for Trenching/Excavation Scenario; this would be the same for both default and site-specific evaluations
ER	enclosed-space air exchange rate, L/s	0.00023	ASTM air exchange rate is very conservative for an office building, i.e. less than 1 exchange per hour, site buildings are likely to have high exchange rates and would be made more site-specific in a Tier 2 analysis
h_{cap}	thickness of capillary fringe, cm	5	ASTM assumes a sand soil, the site has a clay/peat soil below the engineered fill. Due to the smaller pore diameters, the capillary fringe in these soil is likely to be higher which would slow diffusion of organic chemicals from the groundwater
h_v	thickness of vadose zone, cm	295	ASTM assumes a depth to groundwater of approximately 9 feet, site depth to groundwater is 5 to 7 feet
L_B	enclosed space volume/infiltration surface area ratio, cm	200	ASTM assumes entire area of building is beneath an impacted area, groundwater and soil results for the site suggest limited surface area below the office building is impacted
P_s	particulate emission rate, g/cm^2-s	$6.9x\ 10^{-14}$	Controls used during trenching, e.g. watering, should keep particulate emissions limited
U_{air}	wind speed above ground surface in ambient mixing zone, cm/s	225	ASTM assumes a slow wind speed, annual average wind speed in the Oakland area is 3.84 m/s (CARB 1984)
W	width of source area parallel to wind direction, cm	1500	The length of any trench or excavation is likely to be less than 1500 cm (approximately 50 feet)
$delta_{air}$	ambient air mixing zone height, cm	200	This default is based on height of an individual, approximately 6 feet, so it would be applicable to the site
nu	areal fraction of cracks in foundation/walls cm^2-cracks/cm^2-total area	0.01	This is very conservative for the site since there is a crawl space between the slab and the building floor, thus there is a dilution of the soil gas with ambient air prior to infiltration into the building working space
$theta_{acap}$	volumetric air content of the capillary fringe, cm3-air/cm3-soil	0.038	ASTM default assumes 90% saturation of the capillary fringe, this is likely to be a reasonable assumption for the site. However, total porosity is likely to be higher, so the absolute air-filled porosity is likely to be higher

bjm:\Olsdrbca Properties

Table A-3 (continued)
Comparison of Applicable ASTM RBCA Tier I Default Values to Site and Worker Characteristics

Symbol	Parameter	ASTM Default	Comparison to Site Conditions
$theta_{acrack}$	volumetric air content of the foundation/wall cracks, cm3-air/cm3-soil	0.26	No site data, so ASTM default is appropriate for site
$theta_{as}$	volumetric air content of the vadose zone soil, cm3-air/cm3 soil	0.26	ASTM default assumes a relative saturation of approximately 2/3. The site may be higher since clay/peat soils have a higher retention of soil moisture than sands.
$theta_{T}$	total soil porosity, cm3/cm3-soil	0.38	Based on literature values, a clay soil would be expected to have a higher total porosity, the range is 0.342 to 0.569 withthe mean of 0.42 (Mills, et al. 1985). The higher total porosity would tend to predict higher soil gas transport.
$theta_{wcap}$	volumetric water content of the capillary fringe, cm3-water/cm3-soil	0.342	No site data, so ASTM default is appropriate for foundation, however site soils are clay/peat rather than sands (ASTM default soil) and are likely to have a higher percent satuaration which would limit gas transport
$theta_{wcrack}$	volumetric water content of the foundation/wall cracks, cm3-water/cm3-soil	0.12	No site data, so ASTM default is appropriate for site
$theta_{ws}$	volumetric water content of the vadose zone soil, cm3-water/cm3-soil	0.12	No site data, so ASTM default is appropriate for foundation, however site soils are clay/peat rather than sands (ASTM default soil) and are likely to have a higher percent saturation which would limit gas transport
rho_{s}	soil bulk density, g-soil/cm^3-soil	1.7	The bulk density of sand is higher than clay (ranges from 1.18 to 1.72 with a mean of 1.49). This implies a higher total porosity for clay soils.
tau	averaging time for vapor flux, s	7.88×10^8	Assumes a typical 25 year exposure period for a worker
ATc	Averaging Time for carcinogens, years	70	This is appropriate for both office and construction workers
ATn	Averaging time for noncarcinogens, years	25	This is appropriate for office workers but construction workers would have a much lower exposure duration, e.g., 1 year for a trench in a single area
BW	adult body weight, kg	70	This is appropriate for both office and construction workers
ED	exposure duration, years	25	This is appropriate for office workers but construction workers would have a much lower exposure duration, e.g., 1 year for a trench in a single area

Table A-3 (continued)
Comparison of Applicable ASTM RBCA Tier I Default Values to Site and Worker Characteristics

Symbol	Parameter	ASTM Default	Comparison to Site Conditions
EF	exposure frequency, days/year	250	This is appropriate for office workers but construction workers would have a much lower exposure frequency, e.g., 5 to 10 days for a trench in a single area
IR_{soil}	soil ingestion rate, mg/day	50	typical value developed by USEPA
IR_{air}-indoo	daily indoor inhalation rate, m^3/day	20	Assumes daily tidal volume or moderate to strenuous efforts by office workers during an entire work day
IR_{air}-outdo	daily outdoor inhalation rate, m^3/day	20	Assumes a moderate to strenuous effort by workers
M	soil to skin adherence factor, mg/cm^2	0.5	typical value developed by USEPA
SA	skin area, cm^2-day	3160	assumes head, arms, and hands are all exposed to soil, this may be high for a site where workers are wearing overalls and/or personal protective equipment

Table A-4
Comparison of Site Concentrations to ASTM Tier I Risk-Based Screening Levels (RBSLs)

Constituent	Exposure Pathway	ASTM Tier I RBSL*	Adjusted RBSL**	Site Hazard Evaluation: Maximum	Hazard Quotient***	95% UCL or Average	Hazard Quotient***
			Office Worker Receptor				
Benzene	Soil Vapor Volatilization to Indoor Air	1.09E-01	3.16E-02	21	664.34673	9.3	294.21069
Benzene	Groundwater Volatilization to Indoor Air	7.39E-01	2.14E-01	23	107.32117	11.5	53.660585
Toluene	Soil Vapor Volatilization to Indoor Air	5.45E+01		120	2.2018349	56	1.0275229
Toluene	Groundwater Volatilization to Indoor Air	8.50E+01		47	0.5529412	24	0.2823529
Ethylbenzene	Soil Vapor Volatilization to Indoor Air	1.10E+03		39	0.0354545	16	0.0145455
Ethylbenzene	Groundwater Volatilization to Indoor Air	>S		4.3	N/A	2.2	N/A
Xylenes	Soil Vapor Volatilization to Indoor Air	RES		210	N/A	110	N/A
Xylenes	Groundwater Volatilization to Indoor Air	>S		21	N/A	11	N/A
			Maintenance/Outdoor Worker Receptor				
Benzene	Soil Volatilization to Outdoor Air	4.57E+00	1.33E+00	23	17.354561	6.2	4.6781861
Benzene	Groundwater Volatilization to Outdoor Air	1.84E+02	5.34E+01	8.8	0.1649175	2.9	0.0543478
Toluene	Soil Volatilization to Outdoor Air	RES		250	N/A	78	N/A
Toluene	Groundwater Volatilization to Outdoor Air	>S		4.8	N/A	1.6	N/A
Ethylbenzene	Soil Volatilization to Outdoor Air	RES		130	N/A	33	N/A
Ethylbenzene	Groundwater Volatilization to Outdoor Air	>S		1.1	N/A	0.37	N/A
Xylenes	Soil Volatilization to Outdoor Air	RES		680	N/A	180	N/A
Xylenes	Groundwater Volatilization to Outdoor Air	>S		4.8	N/A	1.6	N/A
			Off-site Worker Receptor				
Benzene	Groundwater Volatilization to Outdoor Air	1.84E+02	5.34E+01	0.00053	9.933E-06	0.00039	7.309E-06
Toluene	Groundwater Volatilization to Outdoor Air	>S		0.0021	N/A	0.0015	N/A
Ethylbenzene	Groundwater Volatilization to Outdoor Air	>S		0.00053	N/A	0.00039	N/A
Xylenes	Groundwater Volatilization to Outdoor Air	>S		0.0029	N/A	0.002	N/A

Table A-4 (continued)
Comparison of Site Concentrations to ASTM Tier I
Risk-Based Screening Levels (RBSLs)

Constituent	Exposure Pathway	ASTM Tier I RBSL*	Adjusted RBSL**	Site Hazard Evaluation Maximum	Hazard Quotient***	95% UCL or Average	Hazard Quotient***
			Construction Worker Receptor				
Benzene	Soil Ingestion, Dermal Contact, & Particulate Inhalation	1.00E+02	2.90E+01	23	0.7931034	6.2	0.2137931
Toluene	Soil Ingestion, Dermal Contact, & Particulate Inhalation	1.87E+04		250	0.013369	78	0.0041711
Ethylbenzene	Soil Ingestion, Dermal Contact, & Particulate Inhalation	1.15E+04		130	0.0113043	33	0.0028696
Xylenes	Soil Ingestion, Dermal Contact, & Particulate Inhalation	2.08E+05		680	0.0032692	180	0.0008654

*: Taken from ASTM Tier I Example Lookup Table, assuming a cancer risk of 1×1^{-05} and a hazard quotient of 1

**: Benzene adjusted to use California Environment Protection Agency's cancer slope factor for benzene 0.029 $mg/kg\text{-}day^{-1}$ for both oral and inhalation exposures. Adjusted by:

Adjusted RBSL = (ASTM RBSL)* (0.029/0.1)

where

0.1 = USEPA Cancer Slope Factors, used by ASTM

0.029 = California Environmental Protection Agency Cancer Slope Factors

Hazard Quotient = site concentration/RBSL

>S = RBSL is greater than pure product solubility of chemical

RES = RBSL is greater than the soil saturation value for the assumed soil characteristics

N/A: No analysis since the RBSL can not be reached due to physical/chemical saturation of the medium

APPENDIX B

SOIL CORING AND SAMPLING, AND GROUND WATER SAMPLING PROCEDURES

Soil cores and ground water samples will be obtained for The Sutton Group by PRECISION SAMPLING, INC. (PSI), a specialty soil and ground water sampling company. located in San Rafael, California. PSI uses portable, hydraulically driven soil coring systems to obtain soil and ground water samples for lithologic and chemical analysis. PSI holds California Well Drilling Contractor's (C-57) license No.636387. The Sutton Group will assist PSI in obtaining a drilling permit for the work from Alameda County Public Works Department.

SOIL CORING PROCEDURES

PSI's difficult access rig, the DA-1, utilizes a hydraulic hammer to drive Enviro-Core™ sampling rods into the ground to collect continuous soil cores. The larger sampling rigs, the XD-1 and MD-1, are mounted on 4-wheel-drive vehicles, and the Enviro-Core™ rods are advanced with vibrators, a hydraulic hammer, or pushed into the ground. With any rig, two nested sampling rods are driven simultaneously; small-diameter inner sampling rods are used to obtain and retrieve the soil cores; the larger diameter (2 ½" OD) outer rods serve as temporary drive casing.

As the Enviro-Core™ rods are advanced, soil is driven into a 1-7/8 inch diameter, 3-foot long, sample barrel that is attached to the end of the inner rods, Soil samples are collected in 1¾-inch diameter by 6-inch long stainless steel sleeves inside the sample barrel as both rods are advanced. After being driven 3 feet, the inner rods are removed from the borehole with a hydraulic winch The stainless sleeves containing the soil samples are removed from the inner sample barrel, and can then be preserved for chemical analyses or used for lithologic identification. After adding new stainless steel sleeves, the drive sampler and inner rods are then lowered back into the borehole to the previous depth, an additional 3-foot section of Enviro-Core™ casing is attached, and the process is repeated until the desired depth is reached.

The use of outer rods prevents sloughing of the formation while the inner rods are withdrawn from the hole. This ensures that the drive sampler will always be sampling soil from the desired interval, rather than potentially contaminated soil that has sloughed in from higher up in the hole

All drive casing, inner sample barrels, inner rods, and tools will be cleaned with a high-pressure, hot water washer between holes. Sample barrels will be washed with trisodium phosphate and double-rinsed with de-ionized water between samples collected in the same hole All rinsate from the cleaning will be temporarily contained in 55-gallon drums at the project site and later, with approval, discharged into the sanitary sewer system for treatment at OLSD's POTW.

GROUND WATER SAMPLING PROCEDURES

After the targeted water-bearing zone has been penetrated, the sample barrel and inner rods will be removed from the borehole, and the drive casing will be pulled up approximately three feet to allow groundwater to flow into the borehole. A 1-inch-diameter Schedule 40 PVC casing with a five foot section of 0.010" slotted well screen may be installed in the borehole to facilitate the collection of groundwater samples. Threaded sections of PVC are lowered into the borehole inside the drive casing. The drive casing is then pulled up to expose the slotted interval of the PVC. Groundwater samples may then be collected from within the PVC casing with a 1-inch diameter Teflon or stainless steel bailer until adequate sample volume is obtained.

BOREHOLE GROUTING

On completion of soil and water sampling, boreholes will be abandoned with a grout mixture of Type II cement with 4% pure sodium bentonite. The grout will be pumped through a 1-inch-diameter grouting tube positioned at the bottom of the boreholes, prior to withdrawing the outer rods.

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BOREHOLE LITHOLOGIC LOG

Project No. 3022.7 Boring No **EP-1**

Date Drilled	March 07, 1996	Drilling Company	Precision Sampling, Inc.
Client	Oro Loma Sanitary District	Driller	C. Fricke
Site Name	Mntce Bldg. Gasoline Tank Area	Rig Model	PSI: XD-2
City/Town	San Lorenzo, CA	Drilling Method	Enviropush continuous core
Logged By	J. Sutton	Borehole Diameter	2 ½"
Surface Elevation	9.7' msl	Sampling Method	Envirocore, 1 5/8" ID x 6" long
Grd Water Depth	5.4 on 3/8/96		liners

Depth (ft)	Graphic Symbol	USCS Symbol	Soil Description	Sample Loc'n/ Well Details			PID ppm	Remarks
0			Asphalt paving, 2" thick over Fill.					
		GP,	FILL comprises field mixture of crushed				0	
		CL	quarry stone: gray/blue to green, angular, to					
			1½" size; some with clay (brown, moist)				1	
5			No odor, soft at 3.5'	x				
				x				
		Pt.	PEAT, black, moist, organic odor @ 6'	x			1	
		CL-CH	CLAY, very sandy(fine) soft, moist,	x				
			gray/green, Bay Mud.	x				
10			@ 8.5 becomes silty, little sand.	x			1	
			slight organic odor in 10 ' sample	x				
				x			1	
			Terminated at 12'.					
15								
			1" dia temporary well with 5' slotted section.					
			Set at 12 ft depth.					
			Casing removed and hole tremie-grouted					
			after water sampling					

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BOREHOLE LITHOLOGIC LOG

Project No. 3022.7 Boring No **EP-2**

Date Drilled	March 07, 1996	Drilling Company	Precision Sampling, Inc.
Client	Oro Loma Sanitary District	Driller	C. Fricke
Site Name	Mntce Bldg. Gasoline Tank Area	Rig Model	PSI: XD-2
City/Town	San Lorenzo, CA	Drilling Method	Enviropush continuous core
Logged By	J. Sutton	Borehole Diameter	2 ½"
Surface Elevation	9.2 msl	Sampling Method	Envirocore, 1 5/8" ID x 6" long
Grd Water Depth	7.1 at time of drilling		liners

Depth (ft)	Graphic Symbol	USCS Symbol	Soil Description	Sample Loc'n/ Well Details		PID ppm	Remarks
		FILL	FILL: SAND very clayey, some gravel, dry to		*		
			moist, brown (SC) garden. @ 0-1.5'*				
			FILL: SAND, v. gravelly, slightly clayey,	x	*		
			blue/gray.(SP-SM to GP-GM) is moist @ 3.2'*	x		5	
5		Pt	PEAT, black/brown, moist, organic odor.	x		150	
			Contact @ 3.5'	x			
		SC	SAND, clayey, very moist, petroleum odor	x		250	
		CL-CH	CLAY, moderately to highly plastic, sl. sandy,	x		150	
			silty, graygreen BAY MUD	x		5000	
10				x			
				x			
			EP-2 terminated @ 12 ft.				
			1" dia temporary well with 5' slotted section.				
			Set at 12 ft depth.				
			Casing removed and hole tremie-grouted				
			after water sampling				
			EP-2A drilled 2' away on 3/7/96, re-sampled				
			4'-7', odorous @ 6-7'				
			EP-2B hand-augered 2' from EP-2 on 4/2/96,				
			sampled 2.5 -3.5' depth with hand-driver				
			* Log based on hand-auger boring EP-2B				

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BOREHOLE LITHOLOGIC LOG

Project No. 3022.7 Boring No **EP-3, 3A, 3B**

Date Drilled	March 07, 1996 (EP-3)		Drilling Company	Precision Sampling, Inc.
Client	Oro Loma Sanitary District		Driller	C. Fricke
Site Name	Mntce Bldg. Gasoline Tank Area		Rig Model	PSI: XD-2
City/Town	San Lorenzo, CA		Drilling Method	Enviropush continuous core
Logged By	J. Sutton		Borehole Diameter	2 ½"
Surface Elevation	9+/-	msl	Sampling Method	Envirocore, 1 5/8" ID x 6" long
Grd Water Depth	7.3	at time of drilling		liners

Depth (ft)	Graphic Symbol	USCS Symbol	Soil Description	Sample Loc'n/ Well Details			PID ppm	Remarks
0		FILL	GRAVEL, sandy, brown/olive/gray, dry.					
			Base-rock/quarry fill..(GP-GM)	x				
				x				
			PEAT/Organic Clay. Organic Clay, stiff, dry to	x			0	
5		Pt	moist, brown. Interface @ 4'	x			0	
		CL-CH	@5': CLAY, silty, m.plastic, soft, gray/green.	x			0	
		SM	@6.8 SAND silty, fine tr.clay, wet, gray	x			1	
				x				
				x			0	
10				x				
		CL-CH	CLAY, mod. to highly plastic, moist,	x			0	
			green/black. Softer @ 11'.	x			0	
				x			0	
			Boring terminated at 13'.					
15								
			1" dia temporary well with 5' slotted section.					
			Set at 12 ft depth.					
			Casing removed and hole tremie-grouted					
			after water sampling					
			EP-3A, 3B drilled 2' away on 4/18/96,					
			EP-3A, drilled to 4,' sampled @1.5 to 2.0'					
			EP-3B to 5' , sampled @ 3.5-4' and 4.5- 5.0'					

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BOREHOLE LITHOLOGIC LOG

Project No. 3022.7 Boring No **EP-4**

Date Drilled	March 06, 1996	Drilling Company	Precision Sampling, Inc.
Client	Oro Loma Sanitary District	Driller	C. Fricke
Site Name	Mntce Bldg. Gasoline Tank Area	Rig Model	PSI: XD-2
City/Town	San Lorenzo, CA	Drilling Method	Enviropush continuous core
Logged By	J. Sutton	Borehole Diameter	2 ½"
Surface Elevation	msl	Sampling Method	Envirocore, 1 5/8" ID x 6" long
Grd Water Depth	at time of drilling		liners

Depth (ft)	Graphic Symbol	USCS Symbol	Soil Description	Sample Loc'n/ Well Details	PID ppm	Remarks
0		FILL	Asphalt over FILL: GRAVEL, sandy, dry, olive	x		
			green/gray	x		
				x	0	
				x		
5				x	0	
		Pt	@5.8 PEAT, very clayey, moist, brown	x		
		SP,	@6.3 SAND, fine, clean to clayey and silty,	x	0	
		SM/SC	wet, gray green	x	0	
				x	0	
10			CLAY, silty, mod to highly plastic, stiff, moist,	x		
			gray/green	x	0	
				x		
				x	0	
			Boring terminated at 13'.			
15						
			1" dia temporary well with 5' slotted section.			
			Set at 12 ft depth.			
			Casing removed and hole tremie-grouted			
			after water sampling			

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BOREHOLE LITHOLOGIC LOG

Project No. 3022.7 Boring No **EP-5**

Date Drilled	March 07, 1996	Drilling Company	Precision Sampling, Inc.
Client	Oro Loma Sanitary District	Driller	C. Fricke
Site Name	Mntce Bldg. Gasoline Tank Area	Rig Model	PSI: XD-2
City/Town	San Lorenzo, CA	Drilling Method	Enviropush continuous core
Logged By	J. Sutton	Borehole Diameter	2 ½"
Surface Elevation	8.5+/- msl	Sampling Method	Envirocore, 1 5/8" ID x 6" long
Grd Water Depth	6.0 0n 3/8/96		liners

Depth (ft)	Graphic Symbol	USCS Symbol	Soil Description	Sample Loc'n/ Well Details	PID ppm	Remarks
0		FILL	Asphalt Paving approx 2" thick over FILL:			
			GRAVEL, sandy, olive green/gray. @ 3.'some	x	0	
			trash, lumber in PEAT matrix. Org. odor	x		
		CH	@3.7CLAY,v.stiff,grn/gray w/fill gravel, peat	x	0	
5		SP-SM	@ 4.8 SAND, fine, s.silty, v.moist. NO odor	x	0	
				x	0	
		ML	@ 6.8 SILT, sandy, clayey, gray	x	0	
		CL-CH	CLAY, stiff to very stiff, very moist some	x		
			roots/organics, organic odor	x	0	
10				x	0	
			Clay becomes soft to m. stiff, gray green	x	0	
				x	0	
			Boring terminated @ 12 ft.			
15						
			1" dia temporary well with 5' slotted section.			
			Set at 12 ft depth.			
			Casing removed and hole tremie-grouted			
			after water sampling			
25						

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BOREHOLE LITHOLOGIC LOG

Project No. 3022.7 Boring No **EP-6**

Date Drilled	March 07, 1996	Drilling Company	Precision Sampling, Inc.
Client	Oro Loma Sanitary District	Driller	C. Fricke
Site Name	Mntce Bldg. Gasoline Tank Area	Rig Model	PSI: XD-2
City/Town	San Lorenzo, CA	Drilling Method	Enviropush continuous core
Logged By	J. Sutton	Borehole Diameter	2 ½"
Surface Elevation	9.5+/- msl	Sampling Method	Envirocore, 1 5/8" ID x 6" long
Grd Water Depth	7.0 On 3/8/96		liners

Depth (ft)	Graphic Symbol	USCS Symbol	Soil Description	Sample Loc'n/ Well Details	PID ppm	Remarks
0		FILL	FILL, SAND and GRAVEL , brown, (garden)	x		
				x		
		CL-CH	CLAY, organics, roots, black/green moist.	x		
		SP-SM	@ 3.7SAND, fine, to medium, moist, brown to	x	0	
5			olive. NO odor	x	0	
			becomes wet at 6.5'.	x	0	
		CL-CH	CLAY, mod. to high plasticity, m.stiff, very	x	0	
			moist gray green	x	0	
				x	0	
10				x		
			Boring terminated @ 12 ft.			
15						
			1" dia temporary well with 5' slotted section.			
			Set at 12 ft depth.			
			Casing removed and hole tremie-grouted			
			after water sampling			

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BOREHOLE LITHOLOGIC LOG

Project No. 3022.7 Boring No **EP-7**

Date Drilled	March 07, 1996	Drilling Company	Precision Sampling, Inc.
Client	Oro Loma Sanitary District	Driller	C. Fricke
Site Name	Mntce Bldg. Gasoline Tank Area	Rig Model	PSI: XD-2
City/Town	San Lorenzo, CA	Drilling Method	Enviropush continuous core
Logged By	J. Sutton	Borehole Diameter	2 ½"
Surface Elevation	9.8+/- msl	Sampling Method	Envirocore, 1 5/8" ID x 6" long
Grd Water Depth	5.4 0n 3/8/96		liners

Depth (ft)	Graphic Symbol	USCS Symbol	Soil Description	Sample Loc'n/ Well Details			PID ppm	Remarks
0		FILL	SAND, clayey, gravelly Root zone in upper					
			1.5' (Garden)	x				
		CL-CH	CLAY, w/ PEAT, v.stiff, roots, green/gray	x				
			SILT, sandy, clayey, dry to moist, brown	x			0	
5				x			0	
		SP	SAND, fine, clean to very silty, moist, brown,	x			0	
			gray	x			0	
			becomes wet at 6.				0	
				x			0	
10		CL-CH	CLAY, mod. to high plasticity, soft to med.	x				
			Stiff. very moist gray green, root zone @	x			0	
			10-11', brown	x				
			Boring terminated @ 12 ft.					
15								
			1" dia temporary well with 5' slotted section.					
			Set at 12 ft depth.					
			Casing removed and hole tremie-grouted					
			after water sampling					

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BOREHOLE LITHOLOGIC LOG

Date Drilled	7/12/1995	Drilling Company	Soils Exploration Services
Client	Oro Loma Sanitary District	Driller	Morris
Site Name	1,000 gal Gas. Tank	Rig Model	CME-55
City/Town	San Lorenzo, CA	Drilling Method	Hollow Stemmed Auger
		Sampling Method	Calif, Shelby tube
Logged By	J.R.S.	Surface Elevation	
		Borehole Diameter	9"

Depth (ft)	Graphic Symbol	USCS Symbol	Soil Description	Sample Type/ BlowCounts/ N-Value			Remarks
			ASPHALT, 2" thick				
		GP/GM	FILL:Base Course Gravel, well graded, dry,brown				
		CL/CH	CLAY stiff, gravelly, moist..Bay Mud/Fill interface	C	2,3,4	7	
5							
			BAY MUD, soft to medium stiff	S			Push 7-9,
							2"/24 recovery
		CL	BAY MUD, soft, very moist, gray				
10		CH/CL	BAY MUD, soft, very moist, gray				ST,10-12',.
			DD=89.5, w=50%, , -200=95%,				24/24 recov
				S			
15		MH/CH	BAY MUD, soft, SILT/CLAY, mod.plasticity,very	C	1,1,1	2	
			moist, olive green, strong organic.decomp.odor				
			DD=78, w=42%, LL=45, PI=21				
20			easy push then sand at 21.5'				ST 20-22 lost
		CH	CLAY,high plastic, w/#8 sized cem, shell nodules	S			in hole
			lt. green/gray DD=103.9,w=20.9,LL=53.p=PI=31				due to sand
		SC	SAND Lens, Clayey, green				layer @ 21.5
25		CL	CLAY, very stiff, sandy, brown	C	3,7,9	16	
		SC	....@ 26.3 becomes SAND, clayey, brown				
			DD=111.6 pcf, w=18.7 %, -#200=81%				
30							

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Boring No. SB-1

BOREHOLE LITHOLOGIC LOG

Depth (ft)	Graphic Symbol	USCS Symbol	Soil Description	Sample Type/ BlowCounts/ N-Value			Remarks
		CL/ML	CLAY,very silty, sandy (fine) olive brown,	C	2,2,3	5	No recov.
			moist, to wet				went back,
		CL	CLAY, sandy ,silty to SAND, clayey, olive brown				pushed to 32'
35							
							thin slurry of
							gray water
							being
							returned from
40		CL	CLAY,very silty, very sandy (fine), ,				auger at > 30
			wet/flowing, brown	C	2,3,4	7	
			DD=103.9 pcf, w=23.9%, -#200=73%				
45							
50		CL/CH	CLAY, stiff, silty, moist, brown	C	3,4,6	10	
			TERMINATED @ 51.5 ft.				
			Caved to 5.8 feet in 2hrs. Redrilled,				
			shaft grouted w/ neat cement slurry, topped off.				

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Project No. 3022.6

Boring No. SB-1

Sheet 2 of 2.

BOREHOLE LITHOLOGIC LOG

Date Drilled	7/12/1995	Drilling Company	Soils Exploration Services
Client	Oro Loma Sanitary District	Driller	Morris
Site Name	1,000 gal Gas. Tank	Rig Model	CME-55
City/Town	San Lorenzo, CA	Drilling Method	Hollow Stemmed Auger
		Sampling Method	Calif. Shelby tube
Logged By	J.R.S.	Surface Elevation	
		Borehole Diameter	9"

Depth (ft)	Graphic Symbol	USCS Symbol	Soil Description	Sample Type/ BlowCounts/ N-Value			Remarks
			ASPHALT, 2" thick over roadbase:Gravelly SAND,				
			dry, blue green, odorless				
			MIXED FILL including Bay Mud and peat with				
5			sand and gravel				
			6' Black fine sand with strong odor of gasoline	C	2,3,3	6	
		CH/CL	CLAY, moderate to high plasticity, organic, soft to	S			ST 7.0-9.0,
			medium stiff, gray, green, black..LL=48, PI=23				100% recovery
10							
			CLAY, gray-green as above	C			advanced
							under rod wt.
15		CL	CLAY, silty, soft gray-green	S			ST 15.0-16.6'
			LL=39, PI=15, -#200=99.4				(20") 100% recov.
20				C	5,9,10	19	
		CL/CH	CLAY with cementation, shell (gravel size),				
			nodules, stiff, wet, light gray				
			DD=105 pcf, w=23.4%				
25							
		CL	@25.2 CLAY,silty, very stiff, moist, olive brown	C	4,7,12	19	
			DD=106pcf, w=23.0%				
30							

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Project No. 3022.6

Boring No. SB-2

BOREHOLE LITHOLOGIC LOG

Depth (ft)	Graphic Smbol	USCS Symbol	Soil Description	Sample Type/ BlowCounts/ N-Value			Remarks
		CL	CLAY, as above, less stiff, moist, olive brown	C	3,5,6	11	
			DD=101.7, w=23.8%				
35		CL	CLAY, stiff, slightly sandy, moist, olive brown				
			DD=104.8 pcf, w=22.0%	C	4,8,9	17	
			TERMINATED at 36.5 feet				
			shaft grouted w/ neat cement slurry, topped off.				
40							
			Catcher used with California samples				

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Project No. 3022.6

Boring No. SB-2

EXCAVATION LOG

based on field visual-manual procedure

TRENCH No.TT -1
Sheet 1 of 1

Project Name	OLSD Gas Tank Site	Date of Field Work	10/28/1994
Project No.	sg 3022	Equipment Supplier	OLSD
Client	Oro Loma Sanitary District	Operator	Lenny
Site Location	2600 Grant Av. San Lorenzo, CA	Excavator Model	JD 310 Extend-a-hoe
Pit Location		Bucket Width	12 in.
		Sampling Method	Driven Tube
		Surface Elevation	8±
		Datum	msl
		water level	
Logged by J R.S	Checked by	date/time	

Depth (FT)	Graphic Soil Symbol	USCS Symbol	Field Soil/ Description	Sample, Type	PID Reading	Remarks
0-0.2			ASPHALT Paving			
0.2		SP/GP	Quarry Sand FILL:SAND, VERY GRAVELLY, Trace fines to clean, much rock fragment. dry to moist, brown, tan, blue		6	Blue stained soil from 0.5 feet depth.
						Organic odor at top of Bay Mud
4.0_		CL-CH	CLAY, moderate to high plasticity, black moist, BAY MUD		0	Petroleum odor at 5.0'
			Total depth of trench: 6.5 feet			
			Backfilled with pea gravel topped with granular fill			

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FIGURE No: T-1

EXCAVATION LOG

based on field visual-manual procedure

TRENCH No. TT-2
Sheet 1 of 1

Project Name	OLSD Gas Tank Site	Date of Field Work	10/28/1994
Project No.	sg 3022	Equipment Supplier	OLSD
Client	Oro Loma Sanitary District	Operator	Lenny
Site Location	2600 Grant Av. San Lorenzo, CA	Excavator Model	JD 310 Extend-a-hoe
Pit Location		Bucket Width	12 in.
		Sampling Method	Driven Tube
		Surface Elevation	8±
		Datum	msl
		water level	
Logged by J R.S	Checked by	date/time	

Depth (FT)	Graphic Soil Symbol	USCS Symbol	Field Soil/ Description	Sample, Type		PID Reading	Remarks
0-0.2'			ASPHALT Paving				
0.2		SC/CL GC	FILL:SAND, clayey with much rock fragment.Quarry fill dry to moist, brown.				
			blue color from 0.8 to 4' appears to be native		2'	150	
					3'	20	
					4'	50	
3.8'		CL	CLAY, moderate to high plasticity, black moist, sandy zones BAY MUD. Wood fragments in top 1' (3.8-4.8').				
			Peaty/fibrous, green, sandy @ 6'.				
7.0		SM	SAND, fine, silty,wet, black/green (Bay Mud phase)		7.	2,0	sample @ 7.0-7.5'
			Total depth of trench: 7.5 feet				
			Backfilled with pea gravel topped with granular fill				

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FIGURE No: T-2

EXCAVATION LOG

based on field visual-manual procedure

TRENCH No. TT-3
Sheet 1 of 1

Project Name	**OLSD Gas Tank Site**	Date of Field Work	**10/28/1994**
Project No.	**sg 3022**	Equipment Supplier	**OLSD**
Client	**Oro Loma Sanitary District**	Operator	**Lenny**
Site Location	**2600 Grant Av. San Lorenzo, CA**	Excavator Model	**JD 310 Extend-a-hoe**
Pit Location		Bucket Width	**12 in.**
		Sampling Method	**Driven Tube**
		Surface Elevation	**8±**
		Datum	**msl**
		water level	7.0'
Logged by **J R.S**	Checked by	date/time	10/28,

Depth (FT)	Graphic Soil Symbol	USCS Symbol	Field Soil/ Description	Sample, Type		PID Reading	Remarks
0-0.2'			ASPHALT Paving				
0.2		SP/CL GP	FILL:SAND, with much rock fragment, occas. very clayey. Quarry Fill moist, brown.		2'	10	
3.0		CL_CH	CLAY, moderate to high plasticity, black, moist, BAY MUD.		3.5	20	Blue staining 2" thick, petroleum odor in sand over Bay Mud surface
		▽	6.0' Becomes wet, very soft		6.5	150	Sample 6-6.5', PID 200 ppm
			7.0' water, caving				
			Total depth of trench: 7.5 feet				
			Backfilled with pea gravel topped with granular fill				

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FIGURE No: T-3

EXCAVATION LOG

based on field visual-manual procedure

TRENCH No. TT-4
Sheet 1 of 1

Project Name	**OLSD Gas Tank Site**	Date of Field Work	**10/28/1994**
Project No.	**sg 3022**	Equipment Supplier	**OLSD**
Client	**Oro Loma Sanitary District**	Operator	**Lenny**
Site Location	**2600 Grant Av. San Lorenzo, CA**	Excavator Model	**JD 310 Extend-a-hoe**
Pit Location		Bucket Width	**12 in.**
		Sampling Method	**Driven Tube**
		Surface Elevation	**8±**
		Datum	**msl**
		water level	
Logged by **J R.S**	Checked by	date/time	

Depth (FT)	Graphic Soil Symbol	USCS Symbol	Field Soil/ Description	Sample, Type	PID Reading	Remarks
0-0.2'			ASPHALT Paving			
0.2		SC/CL GC	FILL:SAND, clayey with much rock fragment to 1½". Quarry fill dry to moist, brown.			
			blue color from 0.8 to 4' appears to be native	2'	2	No odor
3.5'		CL	CLAY, moderate to high plasticity, , sandy, silty zones	4'	6	
			black moist.BAY MUD. Wood fragments in top 1' (3.8-4.8').			
			Sample @ 5-5.5' clay, very silty	5'	5	No free water
			Total depth of trench: 5.5 feet			
7.0						
			Backfilled with pea gravel topped with granular fill			

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FIGURE No: T-4

EXCAVATION LOG

based on field visual-manual procedure

TRENCH No. TT-5
Sheet 1 of 1

Project Name	**OLSD Gas Tank Site**	Date of Field Work	**10/28/1994**
Project No.	**sg 3022**	Equipment Supplier	**OLSD**
Client	**Oro Loma Sanitary District**	Operator	**Lenny**
Site Location	**2600 Grant Av. San Lorenzo, CA**	Excavator Model	**JD 310 Extend-a-hoe**
Pit Location		Bucket Width	**12 in.**
		Sampling Method	**Driven Tube**
		Surface Elevation	**8±**
		Datum	**msl**
		water level	
Logged by **J R.S**	Checked by	date/time	

Depth (FT)	Graphic Soil Symbol	USCS Symbol	Field Soil/ Description	Sample, Type		PID Reading	Remarks
0-0.2'			ASPHALT Paving				
0.2		GP/GM	FILL:GRAVEL, very sandy, Crushed rock base course/sub base dry to moist, brown.				
			2.5-3.3 blue color, appears to be native			1	
					2	1	
					2.5	2	sample 2.5-3.0'
					3	2	
3.3'		CL-OH	CLAY, moderate to high plasticity,organic odor , stiff at surface. black moist. BAY MUD. FILL				
			Wood , gravel in top 0.6' (3.3-3.9')				No free water
			4.5-5' concrete, rubble layer in mud matrix				
		CL/ML	@ 5' mottled gray and green, very silty		5.5	1	sample 5.5-6.0'
7.0			Total depth of trench: 6.0 feet				
			Backfilled with pea gravel topped with granular fill				

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FIGURE No: T-5

EXCAVATION LOG

based on field visual-manual procedure

TRENCH No.TT -6
Sheet 1 of 1

Project Name	**OLSD Gas Tank Site**	Date of Field Work	**10/28/1994**
Project No.	**sg 3022**	Equipment Supplier	**OLSD**
Client	**Oro Loma Sanitary District**	Operator	**Lenny**
Site Location	**2600 Grant Av. San Lorenzo, CA**	Excavator Model	**JD 310 Extend-a-hoe**
Pit Location		Bucket Width	**12 in.**
		Sampling Method	**Driven Tube**
		Surface Elevation	**8±**
		Datum	**msl**
		water level	
Logged by J R.S	Checked by	date/time	

Depth (FT)	Graphic Soil Symbol	USCS Symbol	Field Soil/ Description	Sample, Type	PID Reading	Remarks
0-0.2			ASPHALT Paving			
0.2		SP/GP	FILL:GRAVEL, very sandy, Crushed rock base course/sub base dry to moist, brown, blue/gray.		0 0	No odor
2.8		CH/OH	CLAY, moderate to high plasticity, black moist, Bay Mud			
		CL	CLAY, very moist, green black, Bay Mud		0	
4.0			Total depth of trench: 4.0 feet			No Samples Collected
			Backfilled with pea gravel topped with granular fill			

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FIGURE No: T-6

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EXCAVATION LOG

based on field visual-manual procedure

TRENCH No.TT-7
Sheet 1 of 1

Project Name	**OLSD Gas Tank Site**	Date of Field Work	
Project No.	**sg 3022**	Equipment Supplier	
Client	**Oro Loma Sanitart District**	Operator	
Site Location	**2600 Grant Av. San Lorenzo, CA**	Excavator Model	
Pit Location		Bucket Width	
		Sampling Method	
		Surface Elevation	**8±**
		Datum	**msl**
		water level	
Logged by **J R.S**	Checked by	date/time	

Depth (FT)	Graphic Soil Symbol	USCS Symbol	Field Soil/ Description	Sample, Type	PID Reading	Remarks
			Trench TT-7 was not excavated			

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FIGURE No: T-7

EXCAVATION LOG

based on field visual-manual procedure

TRENCH No.TT -8
Sheet 1 of 1

Project Name	**OLSD Gas Tank Site**	Date of Field Work	**10/28/1994**
Project No.	**sg 3022**	Equipment Supplier	**OLSD**
Client	**Oro Loma Sanitary District**	Operator	**Lenny**
Site Location	**2600 Grant Av. San Lorenzo, CA**	Excavator Model	**JD 310 Extend-a-hoe**
Pit Location		Bucket Width	**12 in.**
		Sampling Method	**Driven Tube**
		Surface Elevation	**8±**
		Datum	**msl**
		water level	
Logged by **J R.S**	Checked by	date/time	

Depth (FT)	Graphic Soil Symbol	USCS Symbol	Field Soil/ Description	Sample, Type	PID Reading	Remarks
0-0.2			ASPHALT Paving			
0.2		SP/GP	Quarry Sand FILL:GRAVEL very sandy, crushed rock Trace clay fines to clean moist to wet, brown, tan, bluegray much coarse rock fragment .0.7-2.7', seepage zone over mud		80	**Sample 2.0-2.5'**
2.7		CL	CLAY, moderate plasticity,organic,black moist, BAY MUD			
4.0			Total depth of trench: 4 feet		80	organic odor...not sampled due to rock
			Backfilled with pea gravel topped with granular fill			

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FIGURE No: T-8