Denis L. Brown
January 10, 2006
Jerry Wickham
Alameda County Health Care Services Agency
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

Shell Oil Products US
HSE – Environmental Services
20945 S. Wilmington Ave.
Carson, CA 90810-1039
Tel (707) 865 0251
Fax (707) 865 2542
Email denis.l.brown@shell.com

Re: Site Conceptual Model
Shell-branded Service Station
1800 ½ Powell Street
Emeryville, California
SAP Code 135266
Incident No. 98995349

Dear Mr. Wickham:

Included for your review and comment is a *Site Conceptual Model* for the above referenced site. Upon information and belief, I declare, under penalty of perjury, that the information contained in the attached document is true and correct.

If you have any questions or concerns, please call me at (707) 865-0251.

Sincerely,

Denis L. Brown
Sr. Environmental Engineer

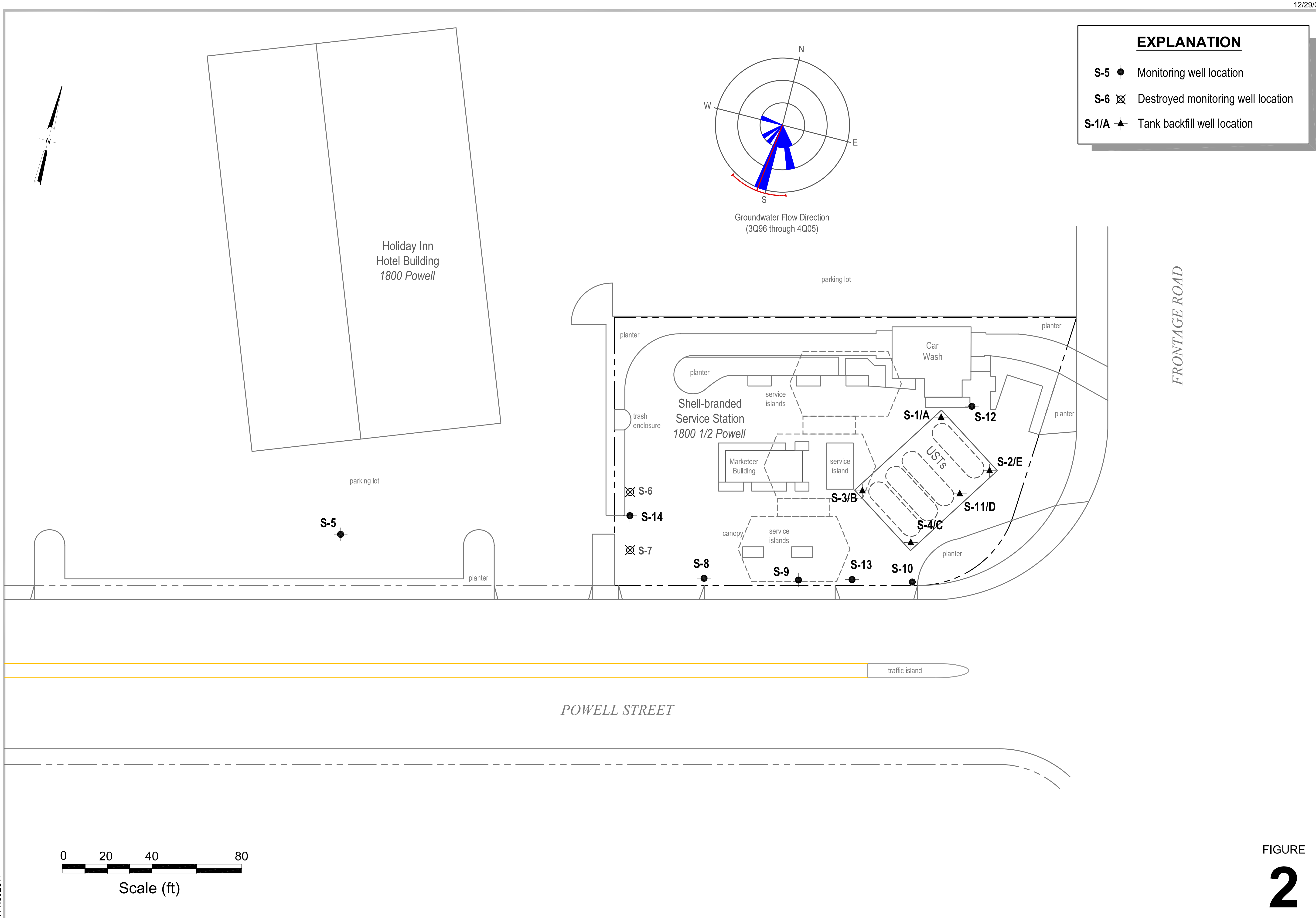


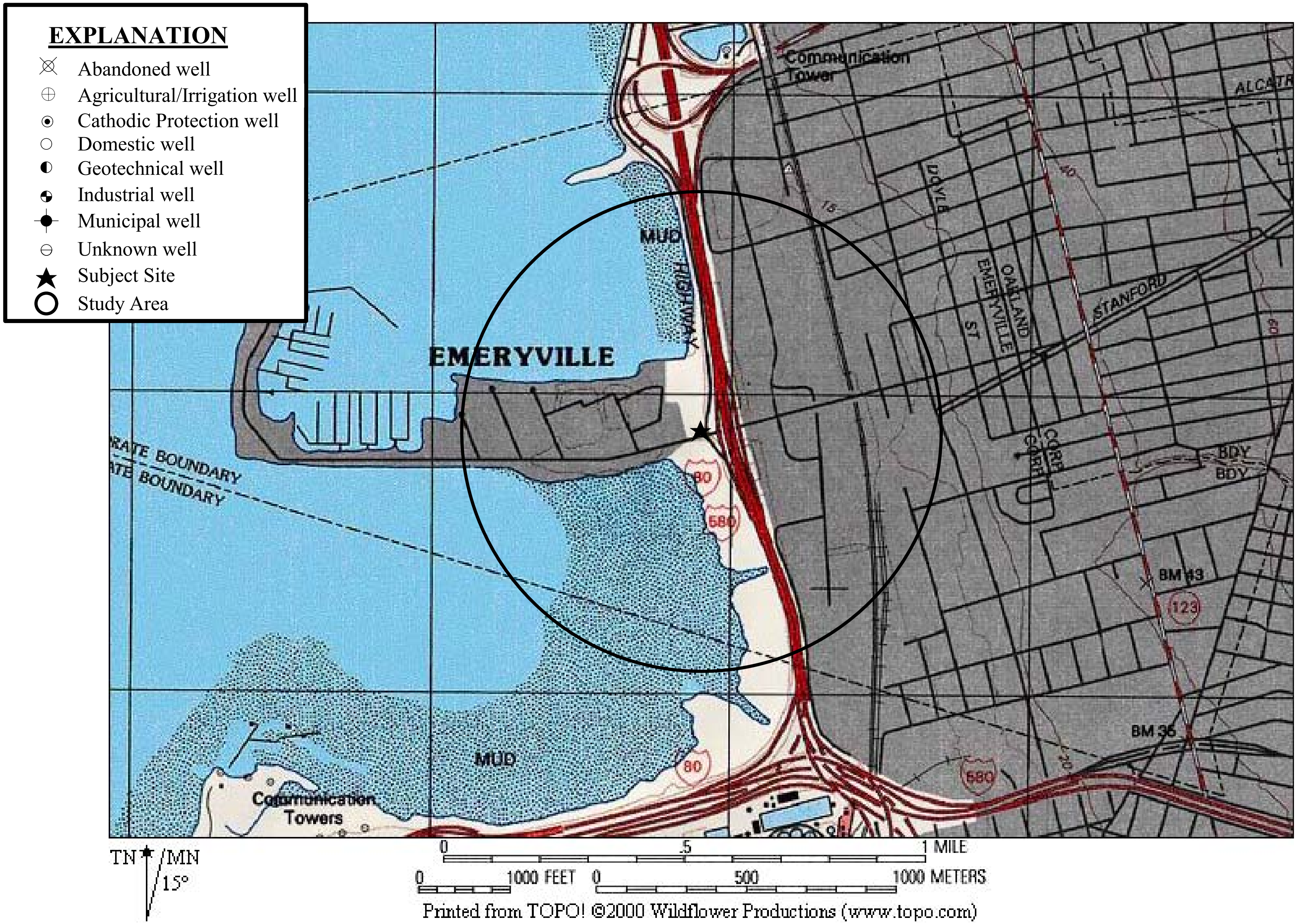
FIGURE
2

Site Plan

CAMBRIA

Shell-branded Service Station
1800 1/2 Powell Street
Emeryville, California
Incident No.98995349

24-Jun-04



FIGURE

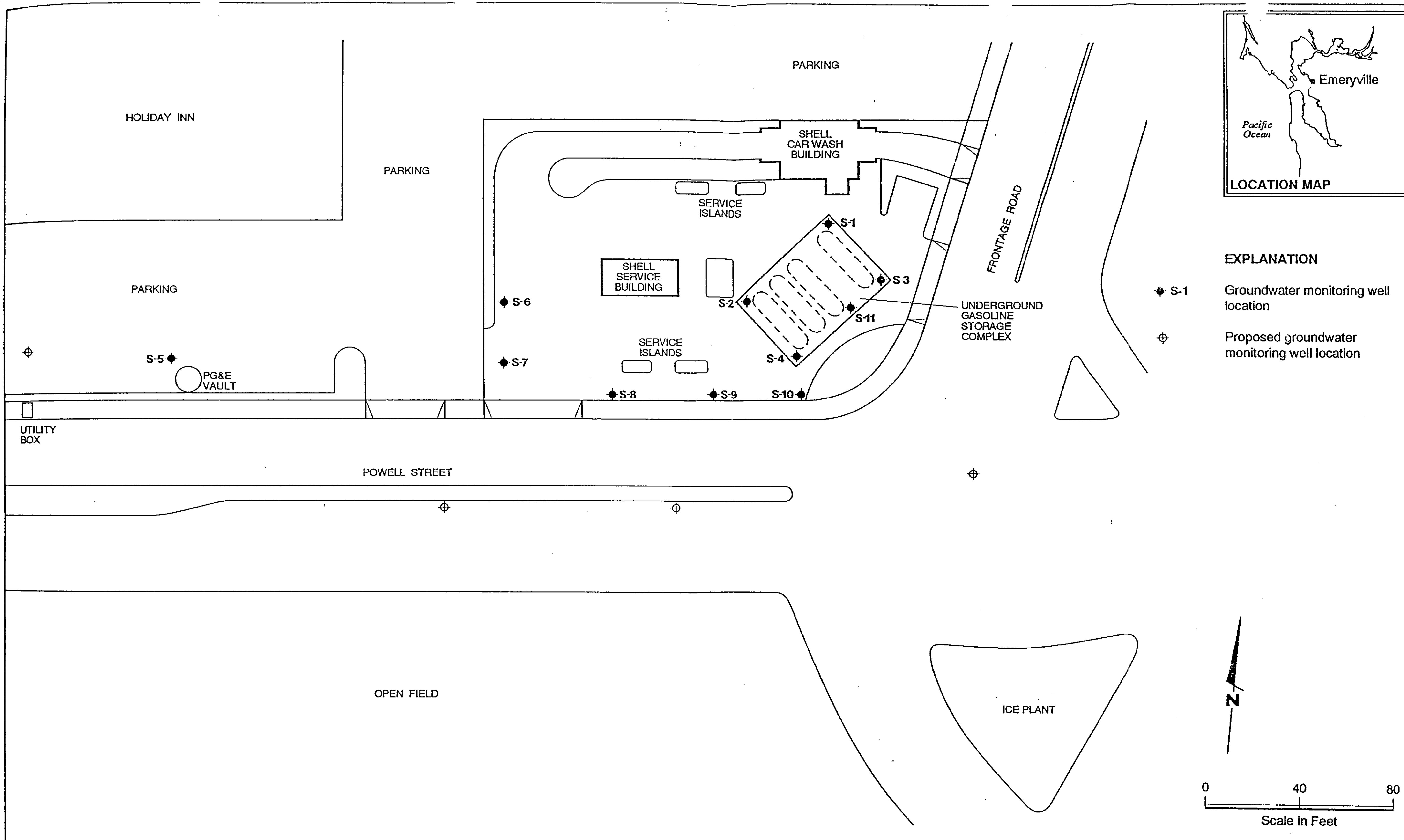
1

0894

Shell-branded Service Station
1800 Powell Street
Emeryville, California

CAMBRIA

Site Vicinity/Well Survey Map

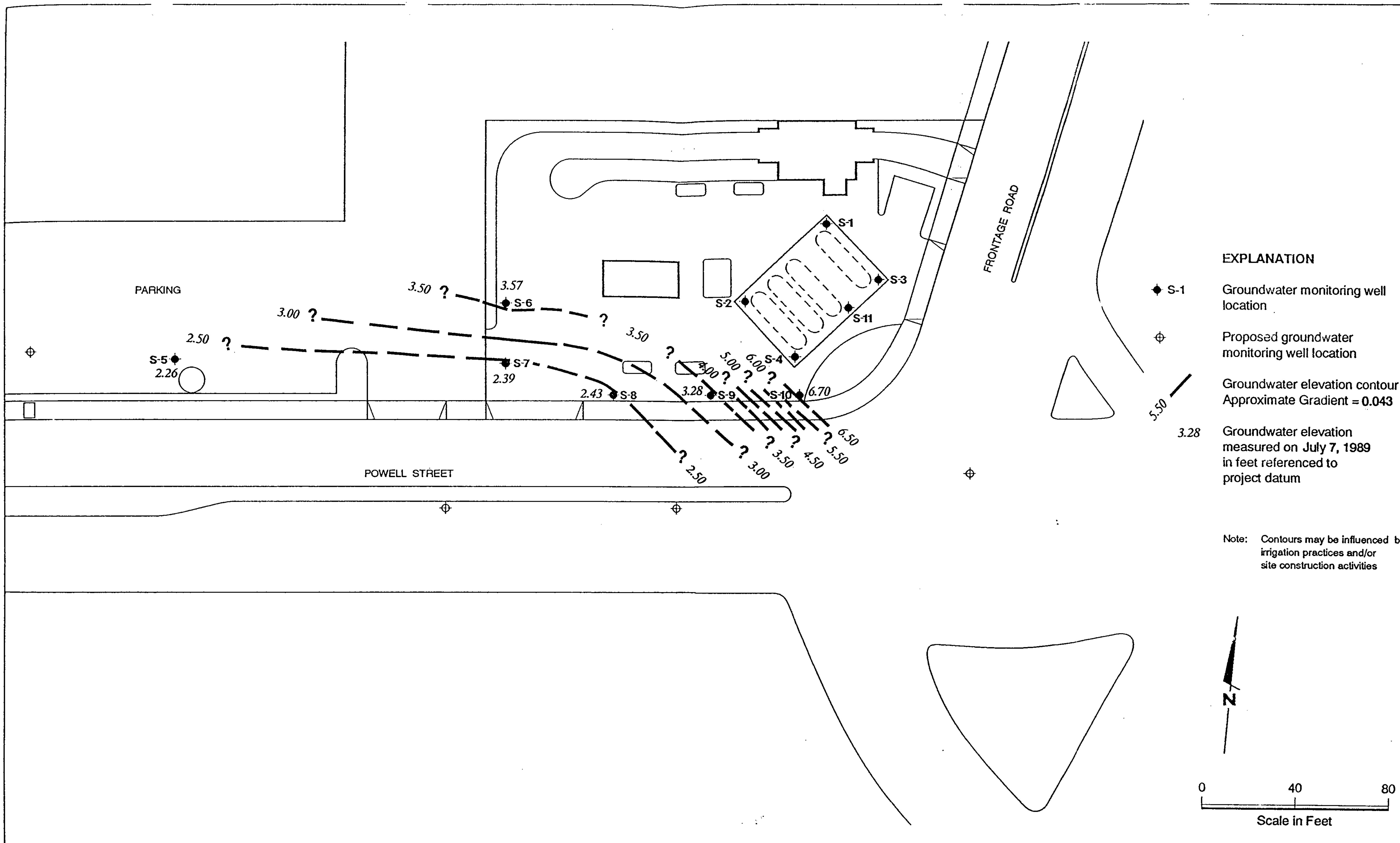


GSI GeoStrategies Inc.

Site Plan
Shell Service Station
1800 Powell Street
Emeryville, California

PLATE
1

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7605	CMP CEG 1262	8/89		

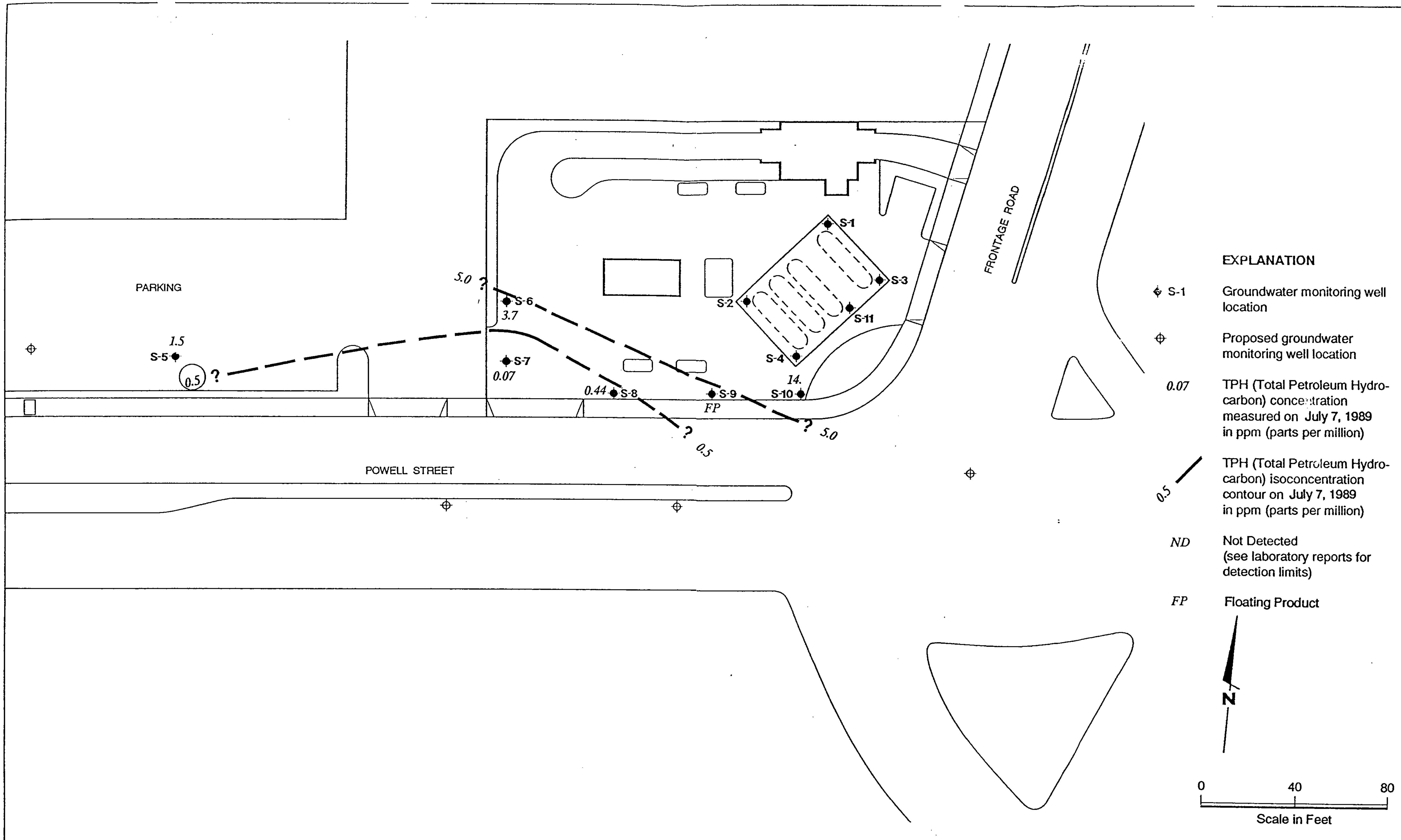


GSI GeoStrategies Inc.

Potentiometric Map
Shell Service Station
1800 Powell Street
Emeryville, California

PLATE
2

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7605	CMP CEG 1262	8/89		

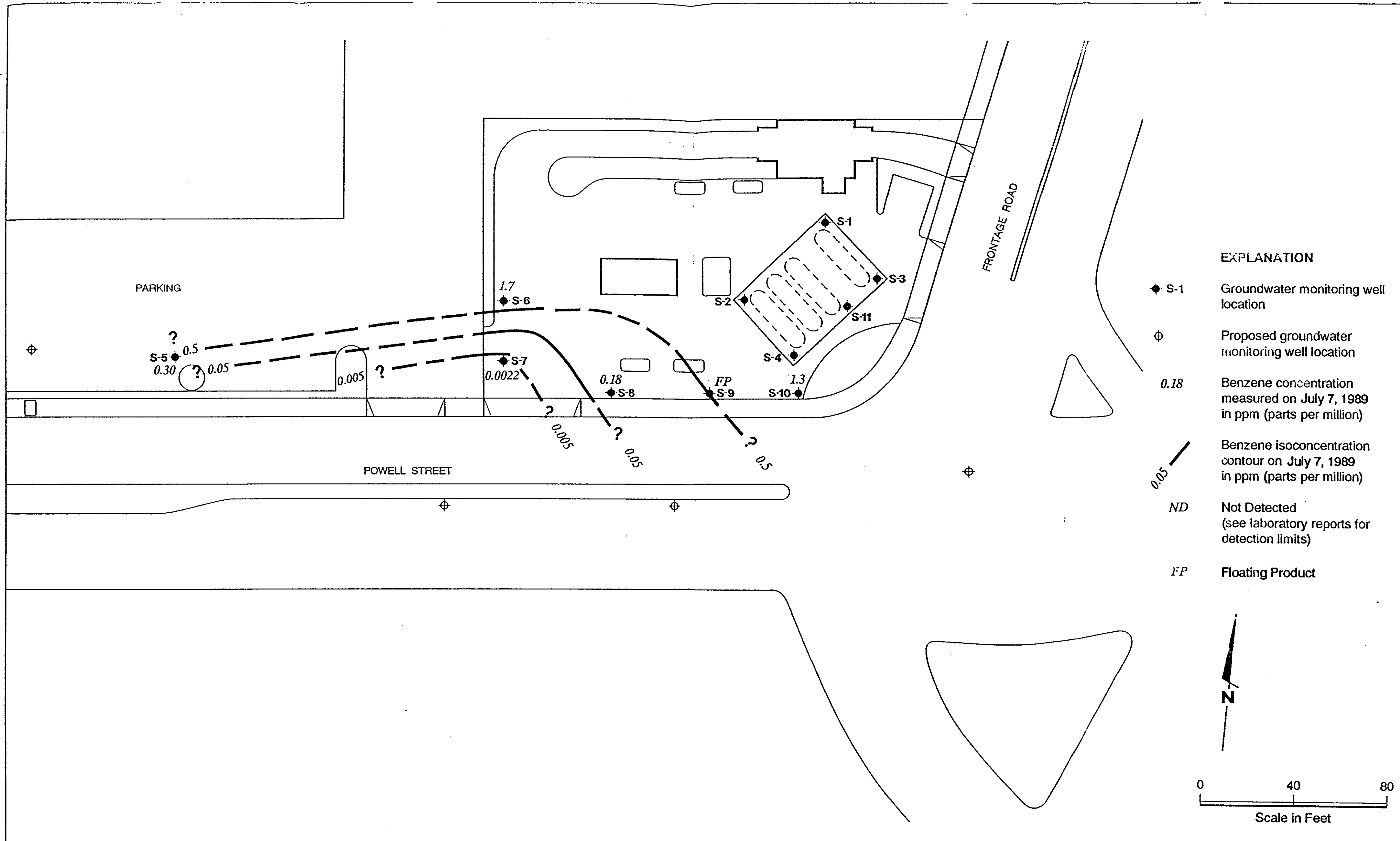


GSI GeoStrategies Inc.

TPH Isoconcentration Map
Shell Service Station
1800 Powell Street
Emeryville, California

PLATE **3**

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7605	CMP CEG 1262	8/89		



GSI GeoStrategies Inc.

Benzene Isoconcentration Map
Shell Service Station
1800 Powell Street
Emeryville, California

PLATE **4**

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7605	CMP CEG 1262	8/89		

GeoStrategies Inc.

WORK PLAN

Shell Service Station
1800 Powell Street
Emeryville, California

Report No. 7605-1

August 22, 1989

GeoStrategies Inc.
2140 WEST WINTON AVENUE
HAYWARD, CALIFORNIA 94545
(415) 352-4800

August 22, 1989

Gettler-Ryan Inc.
1992 National Avenue
Hayward, California 94545

Attn: Mr. John Werfal

Re: WORK PLAN
Shell Service Station
1800 Powell Street
Emeryville, California

Gentlemen:

This work plan has been prepared for the Shell Service Station at the above referenced location (Plate 1). The work plan addresses the need to further assess petroleum hydrocarbon migration from the underground fuel storage complex.

BACKGROUND

Prior to August 1983, five tank backfill wells (S-1 through S-4, and S-11) and six ground-water monitoring wells S-5 through S-10) were installed at the site. Boring logs and well construction details were not available for these wells.

In October 1988, the existing monitoring network outside of the tank area (Wells S-5 through S-10) was sampled for Total Petroleum Hydrocarbons (TPH); and Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX). TPH concentrations ranged from 0.05 to 700 parts per million (ppm). Benzene concentrations ranged from 0.0011 to 37.0 ppm. Well S-9 contained separate-phase petroleum hydrocarbons. Bi-weekly monitoring of well S-9 reveals a range of floating product thickness from 1.21 to 1.50 feet in measured thickness, through January 1989.

Report No. 7605-1

In February, G-R conducted groundwater sampling for the first quarter of 1989. Wells S-5 and S-6 contained sheen of floating product, and well S-9 had 1.3 feet of floating product. TPH and Benzene were detected in all wells sampled. TPH concentrations ranged from 0.05 ppm to 6.5 ppm. Benzene concentrations ranged from 0.0009 ppm to 0.74 ppm. Presented in a G-R report dated March 1989.

In April 1989, G-R conducted second quarter ground-water sampling. Well S-9 contained floating product (1.25 feet in measured thickness). TPH was detected in Wells S-5, S-6, S-8 and S-10, and ranged in concentrations from 2.7 ppm to 13 ppm. Benzene was detected in all wells sampled, and ranged from 0.0010 ppm to 1.5 ppm. Presented in a G-R report dated May 22, 1989.

In July 1989, G-R conducted sampling for the third quarter. Well S-9 contained floating hydrocarbon product (1.20 feet in measured thickness). TPH and Benzene were detected in all wells sampled. Benzene concentrations ranged from 0.0022 ppm to 1.7 ppm. Presented in a G-R report dated August 11, 1989 (see attachment).

TECHNICAL APPROACH

GSI has reviewed available field and chemical data for this site. Based on our review, we recommend that four additional monitoring wells be installed to further assess the lateral and vertical extent of the hydrocarbon contaminant plume. Four wells should be installed off-site; two wells downgradient along Powell Street, one well approximately 50 feet west of monitoring well S-5, and one cross-gradient well along the Frontage Road (Plate 2). Soil and ground-water samples from the proposed wells will be analyzed for TPH and BTEX only. The location of the four proposed wells is shown on Plate 1. Borings will be drilled to a maximum depth of 30 feet. Soil samples will be collected for lithologic description, field head-space analysis using an OVM, and for chemical analysis on selected soil samples. As a minimum, soil samples should be collected at five-foot intervals. Additional samples may be collected for lithologic description and/or chemical analysis.

In addition to the four proposed monitoring wells, we recommend that vacuum-pumping of Well S-9 be conducted to reduce ground-water and separate phase product at this location. If separate-phase and dissolved ground-water conditions remain unchanged by the next quarterly sampling, additional interim remediation measures will be proposed at that time.

Ground-water samples should be analyzed in a State-certified laboratory for Total Petroleum Hydrocarbons according to EPA Method 8015 (Modified), and Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX) according to EPA Method 8020.

The rationale for the above proposed scope of work is based on the following criteria:

- o Floating product has been identified in existing monitoring well S-9. Product thickness measurements have ranged from 1.20 feet to 1.50 feet (measurements taken from G-R historical monitoring data through August 1989). Therefore, interim remediation (vacuuming monitoring well S-9) seems appropriate to begin to remove floating product.

- o Dissolved petroleum hydrocarbons have migrated off-site (Plates 3 and 4). Since the shallow aquifer appears to be composed of primarily Bay mud deposits, relative hydraulic conductivities appear to be low which infers that subsurface geologic conditions do not favor rapid transport of hydrocarbons.

- o A cross-gradient, upgradient, and downgradient no detection (ND) boundary needs to be defined so that the hydrocarbon plume configuration can be estimated for the selection and implementation of the appropriate remedial action.

GSI recommends that the proposed monitoring wells screened intervals be installed a minimum of one-foot above the equilibrated water level to accommodate for separate-phase product (if present), and potential diurnal and seasonal groundwater fluctuations. Notwithstanding, the well screens will be emplaced so that well designs are compatible with subsurface geologic conditions. No well screens will be installed that potentially could permit cross-contamination of adjacent aquifers.

If chemical analytical results from either soil or ground-water samples exceed present DHS action levels and/or guidelines, additional work will be proposed at that time.

Attached to this work plan are the procedures, protocols, and methods that will be used to investigate this site. Additional scopes of work, if necessary, will follow the procedures described in this work plan, or shall be added as appropriate addendum.

If you have any questions, please call.

GeoStrategies Inc. by,

Jeffrey L. Peterson/cmp

Jeffrey L. Peterson
Senior Hydrogeologist
R.E.A. 1021

Christopher M. Palmer

REGISTERED GEOLOGIST
CHRISTOPHER M. PALMER
No 1262
CERTIFIED
ENGINEERING
GEOLOGIST
STATE OF CALIFORNIA

Christopher M. Palmer
Senior Geologist
C.E.G. 1262, R.E.A. 285

JLP/CMP/mg

Attachments:
- Plate 1. Site Plan
- Plate 2. Potentiometric Map
- Plate 3. TPH Isoconcentration Map
- Plate 4. Benzene Isoconcentration Map
- G-R Groundwater Sampling Report (August 11, 1989)
- Field Methods and Procedures

ATTACHMENTS

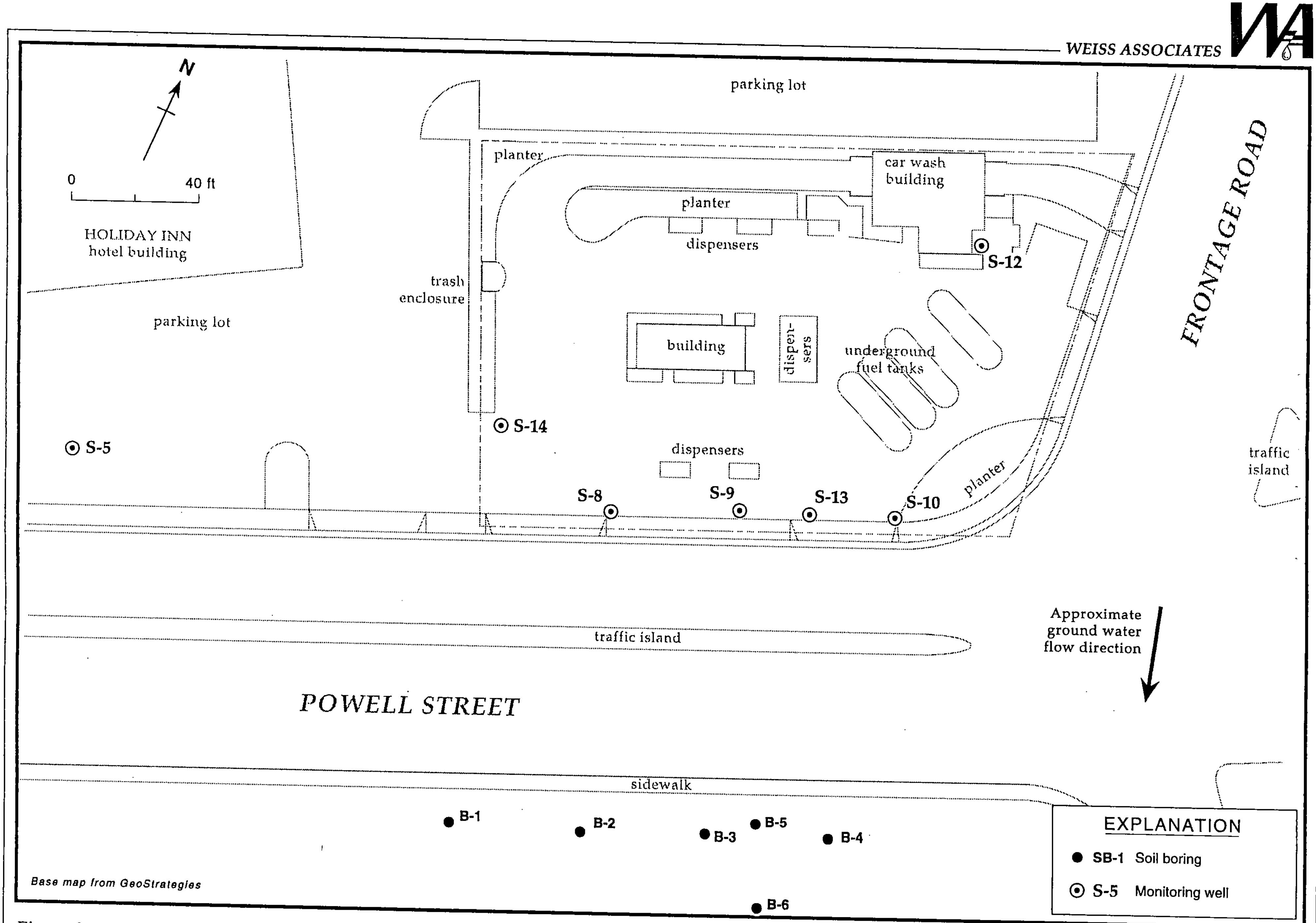


Figure 2. Soil Boring Locations - Shell Service Station - WIC# 204-2495-0107, 1800 Powell Street, Emeryville, California

S794-014.al

02/13/96

Table 1. Analytic Results for Soil and Ground Water - Shell Service Station, WIC #204-2495-0101, 1800 Powell Street, Emeryville, California

Sample ID	Date Sampled	Sample Depth (ft)	TPH-G	FF	B	T	E	X	P&P	VOCs	SVOCs	TRPH	MTBE
			←				ppm for soil, ppb for water					→	
Soil Samples: (mg/kg)													
B1-2.0	5/20/96	2.0	<1.0	---	<0.005	<0.005	<0.005	<0.005	---	---	---	---	---
B1-7.0	5/20/96	7.0	<1.0	---	<0.005	<0.005	<0.005	<0.005	ND	ND	ND[a]	---	---
B1-13.0	5/20/96	13.0	<1.0	160	<0.005	<0.005	<0.005	<0.005	---	---	---	67	---
B1-15.0	5/20/96	15.0	43	350	<0.025	<0.025	0.072	0.19	---	---	---	1,100	---
B2-2.0	5/20/96	2.0	<1.0	---	<0.005	<0.005	<0.005	<0.005	---	---	---	---	---
B2-7.5	5/20/96	7.5	<1.0	---	<0.005	<0.005	<0.005	<0.005	---	---	---	---	---
B2-11.0	5/20/96	11.0	<1.0	870	<0.005	<0.005	<0.005	<0.005	---	---	---	1,500	---
B3-6.5	5/20/96	6.5	<1.0	---	<0.005	<0.005	<0.005	<0.005	---	---	---	---	---
B3-10.5	5/20/96	10.5	<1.0	31	<0.005	<0.005	<0.005	<0.005	---	---	---	82	---
B4-6.5	5/20/96	6.5	<1.0	---	<0.005	<0.005	<0.005	<0.005	---	---	---	---	---
B5-3.0	5/20/96	3.0	<1.0	---	<0.005	<0.005	<0.005	0.0054	---	---	---	---	---
B6-3.5	5/20/96	3.5	<1.0	---	<0.005	<0.005	<0.005	<0.005	---	---	---	---	---
B6-6.5	5/20/96	6.5	<1.0	---	<0.005	<0.005	<0.005	<0.005	---	---	---	---	---
B6-11.0	5/20/96	11.0	<1.0	40	<0.005	<0.005	<0.005	<0.005	---	---	---	380	---
Grab Ground Water Samples (ug/l):													
B1-GW	5/20/96		<50	---	<0.50	<0.50	<0.50	<0.50	---	ND[b]	---	---	<2.5
B2-GW	5/20/96		<50	---	<0.50	<0.50	<0.50	<0.50	---	ND	---	---	<2.5
B6-GW	5/20/96		<50	---	<0.50	<0.50	<0.50	<0.50	---	ND	---	---	<2.5

Table 1. Analytic Results for Soil and Ground Water - Shell Service Station, WIC #204-2495-0101, 1800 Powell Street, Emeryville, California (continued)

Abbreviations:

TPH-G	=	Total petroleum hydrocarbons as gasoline by Modified EPA Method 8015
FF	=	Fuel Fingerprint between C_9 and C_{40} by Modified EPA Method 8015; (Sample results expressed as ppm of Extractable Hydrocarbons)
B	=	Benzene by EPA Method 8020
T	=	Toluene by EPA Method 8020
E	=	Ethylbenzene by EPA Method 8020
X	=	Xylenes by EPA Method 8020
P&P	=	Organochlorine Pesticides and PCBs by EPA Modified Method 8080
VOCs	=	Volatile Organics by EPA Method 8240
SVOCs	=	Semi-Volatile Organics by EPA Method 8270
TRPH	=	Total Recoverable Petroleum Hydrocarbon by Standard Method 5520
<n	=	Not detected at detection limits of n ppm or ppb
ND	=	Not detected at the detection limits for all compounds within the analysis

Note:

Analytical Laboratory: Sequoia Analytical of Redwood City, California.

a: Phenol concentration was detected at 1.9 parts per million (ppm)

b: Acetone concentration detected at 14 ppb

Geologic map and map database of the Oakland metropolitan area, Alameda, Contra Costa, and San Francisco Counties, California

By R.W. Graymer

Pamphlet to accompany
MISCELLANEOUS FIELD STUDIES MF-2342
Version 1.0

2000
U.S. Department of the Interior
U.S. Geological Survey

Contents

Geologic Explanation and Acknowledgements

Introduction

This report contains a new geologic map at 1:50,000 scale, derived from a set of geologic map databases containing information at a resolution associated with 1:24,000 scale, and a new description of geologic map units and structural relationships in the mapped area. The map database represents the integration of previously published reports and new geologic mapping and field checking by the author (see Sources of Data index map on the map sheet or the Arc-Info coverage pi-so and the textfile pi-so.txt). The descriptive text (below) contains new ideas about the Hayward fault and other faults in the East Bay fault system, as well as new ideas about the geologic units and their relations.

These new data are released in digital form in conjunction with the Federal Emergency Management Agency Project Impact in Oakland. The goal of Project Impact is to use geologic information in land-use and emergency services planning to reduce the losses occurring during earthquakes, landslides, and other hazardous geologic events. The USGS, California Division of Mines and Geology, FEMA, California Office of Emergency Services, and City of Oakland participated in the cooperative project.

The geologic data in this report were provided in pre-release form to other Project Impact scientists, and served as one of the basic data layers for the analysis of hazard related to earthquake shaking, liquifaction, earthquake induced landsliding, and rainfall induced landsliding.

The publication of these data provides an opportunity for regional planners, local, state, and federal agencies, teachers, consultants, and others outside Project Impact who are interested in geologic data to have the new data long before a traditional paper map could be published. Because the database contains information about both the bedrock and surficial deposits, it has practical applications in the study of groundwater and engineering of hillside materials, as well as the study of geologic hazards and the academic research on the geologic history and development of the region.

Stratigraphy

Mesozoic Complexes

In general, the Tertiary strata in the map area rest with angular unconformity on two highly deformed Mesozoic rock complexes. One of these, the Great Valley complex, is made up of the Coast Range ophiolite, which in the map area consists mostly of serpentinite, gabbro, diabase, basalt, and keratophyre (altered silicic volcanic rocks); and Great Valley sequence, composed of sandstone, conglomerate, and shale of Jurassic and Cretaceous age. Although the sedimentary rocks and ophiolite have been tectonically separated almost everywhere in the map area, the Great Valley sequence was originally deposited on the ophiolite. The depositional relationship is known from two contacts exposed in the map area (Berkeley Hills, Jones and Curtis, 1991, and Hayward Hills, Graymer and others, 1996), contacts exposed in Sonoma and Solano Counties in the San Francisco Bay region, and contacts elsewhere in California. This complex represents the accreted and deformed remnants of arc-related Jurassic oceanic crust and a thick sequence of turbidites.

The second Mesozoic complex is the Franciscan complex, which is composed of weakly to strongly metamorphosed graywacke, argillite, basalt, serpentinite, chert, limestone, and other rocks. The rocks of the Franciscan complex in the area were probably Jurassic oceanic crust and Jurassic to Cretaceous pelagic deposits overlain by Late Jurassic to Late Cretaceous turbidites. Although Franciscan complex rocks are dominantly little metamorphosed, high-pressure, low-temperature metamorphic minerals are common in rocks that crop out as mélange blocks within the complex (Bailey and others, 1964). High-grade metamorphic blocks in sheared but relatively unmetamorphosed argillite matrix (Blake and Jones, 1974) reflect the complicated history of the Franciscan complex. The complex was subducted beneath the Coast Range ophiolite, at least in part, during Late Cretaceous time, after the deposition of the Franciscan complex sandstone containing Campanian (Late Cretaceous) fossils that crops out in the map area (Novato Quarry terrane). Because the Franciscan complex was accreted under the Great Valley complex containing the Coast Range Ophiolite, the contact between the two Mesozoic complexes is everywhere faulted (Bailey and others, 1964), and the Franciscan complex presumably underlies the entire San Francisco Bay area east of the San Andreas fault.

Both the Franciscan and the Great Valley complexes have been further divided into a number of fault-bounded tectonostratigraphic terranes (Blake and others, 1982, 1984). When the terranes were first established, the prevailing philosophy was to identify separate terranes if any doubt existed about stratigraphic linkage between structurally seperated entities. As a result of further research, much additional data, in particular new fossil localities, are known and the distribution and nature of the original terranes have been greatly modified in this report (see below).

Description of Terranes

Great Valley complex

Del Puerto Terrane

The main body of Great Valley complex rocks that have been assigned to the Del Puerto Terrane (Blake and others, 1984) lies east of the Diablo Range, some 50 km east of the study area. There the basal part of the sequence is composed of dismembered ophiolite and a thick accumulation of silicic volcanic rocks (keratophyre and quartz keratophyre), overlain by silicic tuff and tuffaceous sandstone of the Late Jurassic Lotta Creek Formation and Late Jurassic to Early Cretaceous turbidites. These rocks are overlain by Late Cretaceous and Paleocene strata that overlap eastward onto Sierran basement.

Although the Jurassic and Early Cretaceous Great Valley complex rocks in the study area are for the most part dismembered and highly deformed, they are herein assigned to the Del Puerto Terrane based on the following criteria: 1) the presence of large bodies of keratophyre within the ophiolitic rocks, 2) the presence of a sliver of silicic tuff similar to that of the Lotta Creek Formation, and 3) the absence of much silicic volcanic detritus in the Late Jurassic and Early Cretaceous strata (which would be suggestive of Healdsburg rather than Del Puerto terrane). Although the Late Jurassic and Early Cretaceous strata in the map area are similar to those of the Elder Creek terrane, including the presence of ophiolite-clast breccia at the base of the sequence in one outcrop in the Hayward quadrangle, Elder Creek terrane is characterized by its lack of keratophyre within the basal ophiolite. Therefore all Great Valley complex rocks in the map area are assigned to the Del Puerto Terrane.

The basal ophiolitic rocks in the map area include most of the rock-types that make up the ophiolite suite, including serpentinite, pyroxenite, gabbro, diabase, and massive and pillowed basalt. However, serpentinite that is structurally interleaved with Franciscan complex mélange or that contains high-grade metamorphic blocks, has previously been mapped as part of the Franciscan complex, so it is important to point out that all serpentinite in the map area is herein considered to be part of or derived from the Coast Range ophiolite (see Blake and others, 2000, for a more complete discussion of the serpentinite).

Franciscan complex

Yolla Bolly terrane

Among the many other Franciscan complex terranes in the San Francisco Bay region, one of the most widespread and distinctive units consists of metagraywacke, metachert, and metabasalt, all containing abundant blueschist-facies minerals such as lawsonite, jadeitic pyroxene, and metamorphic aragonite. In addition, the metagraywackes are characterized by a weak to pronounced foliation (TZ-2 of Blake and others, 1967). These rocks have been correlated with the type Yolla Bolly terrane of northern California (Blake and others, 1984) based on similarities in lithology, sandstone composition, age, and metamorphic state.

No fossils are known from the Yolla Bolly rocks of the study area, but similar metacherts from the nearby Diablo Range (Sliter and others, 1993) have yielded ages that range from Early (?) to Late Jurassic, and the overlying metagraywacke is latest Jurassic (Tithonian, Crawford, 1976) presumably marking the time when the oceanic rocks entered the trench (Wentworth and others, 1998).

The outcrops of Yolla Bolly terrane rocks in the mapped area comprise a north-northwest trending thrust block of jadite-bearing metagraywacke with a pronounced foliation (TZ-2B) in the Richmond quadrangle.

Alcatraz terrane

On Alcatraz and Yerba Buena Islands, north and east of San Francisco in San Francisco Bay, and in eastern San Francisco, another graywacke-rich terrane (broken formation) crops out that lacks the metamorphic minerals and foliation seen in the Yolla Bolly terrane and instead contains metamorphic prehnite and pumpellyite. These rocks have also been observed by the authors in drill cores extracted along the San Francisco Bay Bridge Crossing east of San Francisco.

Fossils found in these rocks have been the subject of considerable controversy. In fact, the first fossil ever found in what was then called the Franciscan Formation, was in a boatload of rock from Alcatraz Island. This consisted of an *Inoceramus elliotti* of Cretaceous age (see Bailey and others, 1964, for a discussion, including the fact that the fossil was destroyed in the 1906 San Francisco earthquake). A subsequent fossil discovery on Alcatraz (Armstrong and Gallagher, 1977) was identified as *Buchia sp.* of Early Cretaceous age. More recently, additional fossils were found by personnel of the National Park Service and include an *Inoceramus sp.* of undoubted early Late Cretaceous (Cenomanian) age (oral commun., W. P. Elder, 1997).

Although the early Late Cretaceous age for the Alcatraz rocks is similar to that of the nearby Marin

Headlands terrane graywacke, pronounced differences in sandstone composition (Jayko and Blake, 1984) suggest that it is a separate terrane.

In the map area, the outcrops of Alcatraz terrane form two narrow thrust belts of unfoliated graywacke in the Richmond quadrangle.

Novato Quarry terrane

This terrane forms a relatively narrow, discontinuous, northwest- trending belt between the San Andreas and Hayward faults. It consists largely of thin-bedded turbidites with local channel deposits of massive sandstone (see Blake and others, 1984, for discussion of depositional environments as well as photographs of typical outcrops). Although the strata are in many places folded and locally disrupted (broken formation), they are nearly everywhere well bedded.

Like the Alcatraz terrane, the sandstone contains metamorphic prehnite and pumpellyite. However, the Novato Quarry terrane is younger than the Alcatraz terrane; several specimens of *Inoceramus schmidti* of Late Cretaceous (Campanian) age have been found in this terrane (Bailey and others, 1964). In addition, Alcatraz terrane sandstone lacks K-feldspar, but Novato Quarry terrane sandstone composition is arkosic with abundant K-feldspar, indicating derivation from a granitic or rhyolitic source area.

Outcrops in the map area form a 1-km-broad, fault-bounded belt of well-bedded graywacke in the Richmond and Oakland East quadrangles. South of the California College of Arts and Crafts in the Oakland East quadrangle, the graywacke is intruded by a small body of fine-grained quartz diorite (Kfgm). Although the margins of the intrusive body are pervasively sheared, the diorite was probably originally intruded into the sandstone, judging from the extensive hydrothermal alteration in many parts of the sandstone. The age of the diorite is unknown, but the extent of deformation within the intrusive body, similar to that of the surrounding sandstone, suggests that it was formed before accretion of the Novato Quarry terrane.

The age of the Novato Quarry terrane rocks constrains Franciscan complex deposition to have continued at least into Campanian time, with subsequent subduction and accretion.

Central “terrane” (Mélange)

All of the previously-described Franciscan complex terranes in the map area are tectonically enclosed in an argillite matrix mélange that has been called the Central terrane (Blake and others, 1982, 1984). Most of the matrix consists of sheared mudstone (argillite) and lithic sandstone, within which are mixed numerous blocks and slabs of greenstone, chert, metamorphic rocks, serpentinite, and other rocks. Although treated as a single terrane, the mélange is actually the result of the tectonic and/or sedimentary mixing of rocks derived from several terranes: the rocks that would form the sheared matrix from one terrane, the chert, greenstone and metamorphic rocks from other Franciscan complex terranes, and the serpentinite from the Coast Range ophiolite. In particular, most of the chert blocks that crop out in the mélange can be assigned with confidence to the Marin Headlands terrane based on similarity of radiolarian faunas (Murchey and Jones, 1984).

In a few places, such as the abandoned quarry at Greenbrae in Marin County northwest of the study area (Blake and others, 2000), it is possible to see preserved slabs of interbedded graywacke, mudstone, chert, and tuffaceous greenstone that could represent the original sedimentary accumulation that has been subsequently sheared to form the mélange matrix. Such rocks have yielded both megafossils and microfossils (radiolaria and dinoflagellates) of Late Jurassic and Early Cretaceous age (Blake and Jones, 1974; Murchey and Jones, 1984).

Despite their similar ages, the radiolarian fauna found in the Marin Headlands chert blocks in the mélange is different from that found in chert interbedded in the matrix. This difference in chert faunas has led to the concept that the mélange matrix is derived from some kind of deep-water, continental margin deposit into which the other terranes were introduced by tectonic or sedimentary processes. Deformation during accretion resulted in the interleaving of the rocks that would become mélange and the accreted terranes. Deformation during subsequent uplift has led to both the almost complete disruption of the original sedimentary character of the matrix and the inmixing of exotic blocks derived from the accreted terranes, such as the chert blocks from Marin Headlands terrane (Blake and Wentworth, 1999). Only in a few locations, like Greenbrae, are the mélange matrix strata preserved.

However, the mechanism by which the mélange blocks were originally incorporated into the matrix rock is an issue of some debate. The sedimentary model suggests that blocks (olistoliths) were transported into the depositional environment of the matrix material by gravity driven debris slides. The trench associated with the subduction zone provides an area of suitably steep slopes and the converging plates bring the displaced terranes into proximity of the continental margin mélange matrix. The resulting olistostrome then undergoes the deformation described above, disrupting the original depositional character of the matrix/block relationships. In contrast, the tectonic model suggests that blocks in mélange have been incorporated only by tectonic processes. During and after accretion, lenses of rock derived from incoming exotic terranes are interleaved by faulting with continental margin deposits. Subsequent deformation during uplift further broke up the lenses of exotic rocks, forming the mélange blocks observed today.

I prefer the tectonic model for the Franciscan mélange for the following reasons:

1. No original depositional relationship between block and matrix has been observed, although areas (like Greenbrae) of relatively undisrupted matrix are known.
2. Radiolarians in the matrix are of similar age to those in blocks. If the blocks were deposited as olistoliths, they would have to be lithified prior to redeposition. This implies they should be appreciably older than the matrix.
3. The Marin Headlands terrane and other terranes are characterized by an upper stratigraphic section composed of graywacke thought to have been derived from volcanic arc sources as the terrane approached a subduction zone. This suggests that exotic terranes were receiving sediments, not eroding to produce large blocks, as they entered the subduction zone. The sedimentary model requires that the nature of deposition changed as the terrane entered the trench, and that the entire thickness of graywacke be removed in places to allow generation of chert blocks (and the entire thickness of chert to allow generation of greenstone blocks) or that they received sediment at one subduction zone and then eroded into another subduction zone.
4. High-grade metamorphic blocks are incorporated into low-grade mélange matrix. The tectonic model provides the mechanism (fault offset) to transport material from the deeper part of the subduction zone back into the upper part, intermixing it with lower grade rock. The sedimentary model requires that blueschist metamorphism was complete before formation of olistoliths, suggesting a tectonic history of deep subduction, uplift to the surface, erosion and deposition, shallow subduction and accretion, and a second period of uplift to the surface.
5. Blueschist metamorphic blocks were metamorphosed during Late Jurassic and Early Cretaceous time (Nelson, 1991; McDowell and others, 1984), the same time that mélange matrix sediments were being deposited at the surface. If metamorphic mélange blocks were emplaced into matrix sediments by sedimentary processes, the metamorphic age of the blocks should be appreciably older to account for the time required to unroof the metamorphic rocks.

The presence of serpentinite blocks in the mélange also suggests that blocks of the Coast Range ophiolite may have been incorporated into the mélange during uplift and disruption, although the correlation of the serpentinite blocks with the Coast Range ophiolite is unproven (see Blake and others, 2000).

Tertiary Stratigraphy

The Mesozoic rocks in the study area are overlain by Paleocene and younger strata. These Tertiary rocks probably originally were deposited unconformably over the amalgamated terranes of both the Mesozoic complexes in the area, as evidenced by preserved unconformities mapped throughout the San Francisco Bay region (for example, Graymer and others, 1994, 1996; Blake and others, 2000; Wentworth and others, 1998). However, the depositional contact at the base of the Tertiary sequence is only preserved in the northeast corner of the Briones Valley quadrangle in the mapped area. Everywhere else in the map area the original contact has been disrupted by faulting.

The stratigraphic relationships in the mapped area have been used to subdivide the area into stratigraphic Assemblages. As defined in Graymer and others (1994, the concept of Assemblages was originally proposed in Jones and Curtis, 1991), an Assemblage is a fault-bounded rock body, which has a stratigraphic sequence that is significantly different from surrounding rock bodies. The map area has been divided into six Assemblages (see the Index Map of Assemblages on the map sheet, or Arc/Info coverage pi-as/). Examples of significant differences in stratigraphy between Assemblages in the area are as follows: the late Miocene section in Assemblage I contains a thick pile of volcanic rocks, but the neighboring Assemblages contain little or no late Miocene volcanics; the basal unit in Assemblage VII is middle Miocene (unconformable on Mesozoic rocks south of the map area), whereas neighboring Assemblages have Paleocene basal strata; Assemblage III contains a unique suite of rocks, including diatomite, not found in neighboring Assemblages. The differences between Assemblages is summarized in the Correlation of Map Units table (see map sheet or Arc/Info coverage pi-corr/).

The juxtaposition of these fault-bounded rock bodies with significantly different stratigraphies suggests that they originally formed in separate depositional basins or widely separated parts of a large basin and have since been juxtaposed by large offsets on the bounding faults. The East San Francisco Bay region is thought to have experienced about 180 km of Miocene or younger right-lateral offset related to the San Andreas fault system (McLaughlin and others, 1996). The juxtaposition of different Assemblages suggests that most of that offset has taken place on Assemblage-bounding faults.

Paleontology

Many different kinds of fossils have proved invaluable in understanding the geology of the map area: *Buchia* in the Franciscan and lower Great Valley complex rocks, Ammonites and *Inoceramus* in the Franciscan and upper Great Valley, radiolarians in the latest Cretaceous, Paleocene corals, Miocene mollusks, nonmarine vertebrates, and diatoms. Perhaps the most widespread and useful fossils, however, are the foraminifers. In the map area they are found in the upper Great Valley complex rocks and throughout the Tertiary rocks.

A partial list of references to paleontological reports in the map area and surrounding areas is given by White (1990) and by Freeburg (1990). Preparation of a digital database of fossil localities and associated paleontologic information is being prepared by workers at the USGS and University of California, Berkeley.

Radiometric Ages

Three different types of rock bodies in the study area have yielded radiometric ages. The volcanic rocks in the Berkeley Hills (Tmb, Tst, Tbp) have been carefully studied, the most recent report of ages is Grimsich and others (1996). Several silicic tuffs outcrop in the map area, and studies of these rocks have been published by Sarna-Wojcicki (1976) and Sarna-Wojcicki and others (1979). Finally, analysis of the keratophyre (Jsv) has been published by Curtis (1989). An overview of radiometric ages in the northern San Francisco Bay region, including the map area, is provided by Lindquist and Morganthaler (1991).

Structure

The structures in the map area can be roughly divided into four provinces, each with a distinct structural trend and style. The first is the San Francisco Bay block, west of the Hayward fault zone, which roughly corresponds with Assemblage XII. In this area there is little evidence of throughgoing Tertiary deformation, mainly because of the almost complete lack of Tertiary strata in the area. Quaternary strata sit unconformably on Franciscan complex rocks, and there is no known evidence for fault offset or folding of the Quaternary strata. However, small faulted outcrops of Miocene rocks in Marin County do suggest that this block has undergone some Miocene or younger deformation (Blake and others, 2000).

The second structural province is the Hayward fault zone as defined by Graymer and others (1995), the area between the San Francisco Bay plain and the Moraga-Miller Creek-Palomares fault. In this area, the structures are dominated by closely spaced, east-dipping, north-15°-west-trending faults. Most fold axes in this area have been disrupted by faults, but two large synclines are preserved with axial trends of about north 30° west. Structures within this zone deform and truncate the late Miocene volcanics of the Berkeley Hills and include the actively creeping strands of the Hayward fault (see below). Geodetic studies also indicate as much as 1 mm/yr of active uplift in this area (Gilmore, 1992). Therefore much of the deformation in this region is late Miocene or younger and continues at this time.

The rocks east of the Moraga-Miller Creek-Palomares fault but west of the Calaveras fault make up the third structural province. This area is characterized by broad folds and widely spaced reverse faults that trend about north 45° west. Late Miocene to early Pliocene strata are fully involved in this deformation, suggesting that most of the folding and faulting occurred in late Miocene or younger time. Unruh and Lettis (1998) suggested that much of the deformation in this area is related to geometric accomodation of right-lateral regional stress, but Jones and others (1994) suggest that there is a significant component of compression perpendicular to the observed strike-slip offset on major faults like the Hayward and Calaveras. The deformation in this area is probably due to a combination of these two stresses. Paleoseismic studies have found evidence for Quaternary offset on both the Franklin Canyon fault (Geomatrix, 1998) and the Miller Creek fault (Wakabayashi and Sawyer, 1998).

The fourth structural province is that east of the Calaveras fault. This area, only a small fraction of which lies in the map area (Las Trampas Ridge quadrangle), is dominated by the southwest-vergent overturned folds and thrust faults related to the Diablo thrust. These structures deform the Pliocene strata in the area, and studies of Pleistocene terraces suggest that uplift and deformation is still very active here.

The complex structures found in the study area result from a complicated structural history that includes late Mesozoic to early Cenozoic subduction and accretion, subsequent uplift and detachment faulting, followed by oblique strike-slip and reverse faulting that continues at the present time.

The earliest structural relationships in the map area are those that juxtapose the multiple terranes of the Franciscan complex and the Great Valley complex. Structural relationships in this area, as well as in the Diablo Range (Blake and Wentworth, 1999) and the northern Coast Ranges (Wentworth and others, 1984), suggest that the Yolla Bolly terrane is the structurally highest and innermost of Franciscan complex terranes in the area. Additionally, the age of the graywacke of the Yolla Bolly terrane, which probably reflects its approach to North America, is older than other Franciscan complex graywackes in the area. Therefore the Yolla Bolly accreted first, followed by the younger, more coherent, less metamorphosed terranes. The order of accretion of structurally lower terranes is more problematical (see Blake and others, 1999, for a discussion of the accretion of these and related terranes), but the Campanian age of graywackes in the Novato Quarry terrane requires that accretion of Franciscan complex terranes continued into Campanian or younger time.

Presumably the rocks that would become the matrix for the mélange terrane were formed between the subduction zone and North America, allowing the incoming terranes to be subducted into them. At the same time or later the terrane/mélange package was wedged under the Coast Range ophiolite (Wentworth and others, 1984).

The period of accretion and crustal thickening was followed by one or more periods of unroofing and attenuation. The previously stacked terranes were significantly thinned, and previously buried ophiolite and Franciscan complex rocks were brought to the surface. This thinning resulted in the almost complete attenuation of the Coast Range ophiolite in the map area, leaving only the dismembered fragments of the ophiolite present. Attenuation also took place between the Franciscan complex terranes, as evidenced by the "pinching out" of some terranes in the region (for example, the Novato Quarry terrane is found structurally below the Alcatraz terrane in the map area, but not in Marin County). Krueger and Jones (1989) and Harms and others (1992) showed that the first period of regional attenuation probably initiated 60-70 Ma. They suggested that extension was complete by late Oligocene time based on the age of strata that overlapped extensional faults (Page, 1970), but in some parts of the San Francisco Bay area, unroofing may have persisted into the middle Miocene, as suggested by the unconformable contact of middle Miocene strata on Franciscan complex rocks in the Diablo Range (Osuch, 1970; Graymer and others, 1996) and on Great Valley complex strata in Marin (Blake and others, 1999). Before attenuation was completed, regional uplift of buried layers to the surface had been accomplished by the early Eocene, as indicated by the presence of ophiolite and Franciscan complex detritus in sedimentary strata of that period both south and east of the mapped area (for example, the Domingene Sandstone in the Cordelia area contains detritus derived from the Coast Range ophiolite, Graymer and others, 1999). The attenuation of this period probably completely obliterated most of the original thrust faults in the mapped rocks. For example, the original subduction related thrust fault between the Franciscan complex and Coast Range ophiolite was reactivated as a detachment fault throughout most of its extent (Krueger and Jones, 1989), and many of the other rock units in the map area are also bounded by normal faults. However, the timing of offset on most of the faults is poorly constrained, so there may be some faults that remain from the initial stage of accretion and thrusting. The tectonic model of incorporation of blocks into the Franciscan complex mélange suggests that the tectonic mixing associated with mélange was accomplished during attenuation, and disruption of coherent parts of the mélange matrix in Marin County by normal faulting supports this idea (Blake and others, 1999).

By late Miocene time, the regional tectonic stress again changed to transpression associated with the development of the San Andreas fault system. Many of the terrane bounding faults were reactivated as reverse faults at this time, as evidenced by uplift associated with the Hayward fault zone (Graymer and others, 1995). Jones and others (1994) described a significant component of compression normal to the San Andreas fault system, and I suggest that the pervasive tight folding and imbricate faulting of the strata in the map area is due to this compression. It is important to note that late Miocene to early Pliocene rocks are fully involved in the compressional deformation, so the deformation must have occurred for the most part in late Miocene or younger time.

In addition to compressive deformation, there is strong evidence of large amounts of right-lateral offset in late Miocene and later time. The correlation of the volcanic rocks in the region suggest that the Hayward fault zone has undergone about 95 km of Miocene and younger right-lateral offset, and faults east of the Berkeley Hills, including the Moraga-Miller Creek-Palomares fault zone and the Calaveras fault zone, have undergone an additional 95 km (Graymer, 1999; Blake and others, 2000; see the index map of faults on the map sheet or the Arc/Info coverage pi-flt for fault names).

Active faulting in the map area is thought to be focused on the Hayward and Calaveras fault zones (Hart and Bryant, 1997). The Hayward fault zone in the map area experienced up to 2 meters of right-lateral surface fault rupture during the 1868 earthquake (Lawson, 1908), and one or more strands of the fault zone are known to be actively creeping along much of the length of the fault zone (Lienkaemper, 1992). The Calaveras fault probably generated an earthquake with a magnitude around 5.6 that was centered in San Ramon Valley (Las Trampas Ridge quadrangle) in 1861 (Ellsworth, 1990). However, evidence for Holocene offset on the Calaveras fault is not known from the northern part of the San Ramon Valley or northward, which has suggested to many workers (Working Group on California Earthquake Probabilities, 1999) that the throughgoing seismogenic deformation associated with the Calaveras fault in the southern part of the San Ramon Valley and southward diverges from the Calaveras fault in or near the mapped area. The nature of the divergence is very poorly understood, but the deformation may become distributed on other northwest-trending structures that run through the map area between the Calaveras and Moraga-Miller Creek-Palomares faults (Las Trampas Ridge and Briones Valley quadrangles).

Description of Map Units

Surficial Deposits

af **Artificial fill (Historic)**—Man-made deposit of various materials and ages. Some are compacted and quite firm, but fills made before 1965 are nearly everywhere not compacted and consist simply of dumped materials

alf **Artificial levee fill (Historic)**—Man-made deposit of various materials and ages, forming artificial levees as much as 20 feet (6.5 meters) high. Some are compacted and quite firm, but fills made before 1965 are almost everywhere not compacted and consist simply of dumped materials. The distribution of levee fill conforms to levees shown on the most recent U.S. Geological Survey 7.5 minute quadrangles

Qhasc **Artificial stream channels (Historic)**--Modified stream channels, usually where streams have been straightened and realigned, but also including those channels that are confined within artificial dikes and levees

Qhaf1 **Younger alluvial fan deposits (Holocene)**--Brown, poorly-sorted, dense, sandy or gravelly clay. Small fans at mountain fronts have a probable debris flow origin. Larger Qhaf1 fans away from mountain fronts may represent the modern loci of deposition for Qhaf

Qhaf **Alluvial fan and fluvial deposits (Holocene)**--Alluvial fan deposits are brown or tan, medium dense to dense, gravely sand or sandy gravel that generally grades upward to sandy or silty clay. Near the distal fan edges, the fluvial deposits are typically brown, never reddish, medium dense sand that fines upward to sandy or silty clay. The best developed Holocene alluvial fans are on the San Francisco Bay plain. All other alluvial fans and fluvial deposits are confined to narrow valley floors

Qhb **Basin deposits (Holocene)**--Very fine silty clay to clay deposits occupying flat-floored basins at the distal edge of alluvial fans adjacent to the bay mud (Qhbm)

Qhbs **Basin deposits, salt-affected (Holocene)**--Clay to very fine silty-clay deposits similar to the Qhb deposits except that they contain carbonate nodules and iron-stained mottles (U.S. Soil Conservation Service, 1958). These deposits may have been formed by the interaction of bicarbonate-rich upland water and saline water of the San Francisco Bay estuary. With minor exceptions, salt-affected basin deposits are in contact with bay mud deposits, Qhbm

Qhbm **Bay mud (Holocene)**--Water saturated estuarine mud, predominantly gray, green, and blue clay and silty clay underlying marshlands and tidal mud flats of San Francisco Bay. The upper surface is covered with cordgrass (*Spartina sp.*) and pickleweed (*Salicornia sp.*). The mud also contains a few lenses of well-sorted, fine sand and silt, a few shelly layers (oysters), and peat. The mud interfingers with and grades into fine-grained deposits at the distal edge of Holocene fans and was deposited during the post-Wisconsin rise in sea-level, about 12 ka to present (Imbrie and others, 1984). Estimated thickness: 0-40 m. In places it rests unconformably on bedrock

Qhbr **Beach ridge deposits (Holocene)**--Long narrow ridge of probably well-sorted sand inferred from 1939 imagery. Observed between Emeryville and Berkeley, these deposits are now beneath the Interstate 80 roadbed

Qhfp **Floodplain deposits (Holocene)**--Medium to dark gray, dense, sandy to silty clay. Lenses of coarser material (silt, sand, and pebbles) may be locally present. Floodplain deposits usually occur between levee deposits (Qhl) and basin deposits (Qhb)

Qhl **Natural levee deposits (Holocene)**--Loose, moderately-sorted to well-sorted sandy or clayey silt grading to sandy or silty clay. These deposits are porous and permeable and provide conduits for transport of ground water. Levee deposits border stream channels, usually both banks, and slope away to flatter floodplains and basins. Levee deposits are best developed along San Pablo and Wildcat Creeks on the bay plain in Richmond. Abandoned levee systems have also been mapped

Qhsc **Stream channel deposits (Holocene)**—Poorly-sorted to well-sorted sand, silt, silty sand, or sandy gravel with minor cobbles. Cobbles are more common in the mountainous valleys. Many stream channels are presently lined with concrete or riprap. Engineering works such as diversion dams, drop structures, energy dissipaters, and percolation ponds also modify the original channel. Many stream channels have been straightened, and these are labeled Qhasc. This straightening is especially prevalent in the lower reaches of streams entering the estuary. The mapped distribution of stream channel deposits is controlled by the depiction of major creeks on the most recent U.S. Geological Survey 7.5 minute quadrangles. Only those deposits related to major creeks are mapped. In some places these deposits are under shallow water for some or all of the year, as a result of reservoir release and annual variation in rainfall

Qds **Dune sand (Holocene and Pleistocene)**--Fine-grained, very well sorted, well-drained, eolian deposits. They occur mainly in large sheets, as well as many small hills, most displaying Barchan morphology. Dunes display as much as 30 m of erosional relief and are presently being buried by basin deposits (Qhb) and bay mud (Qhbm). They probably began accumulating after the last interglacial high stand of sea level began to recede about 71 ka, continued to form when sea level dropped to its Wisconsin minimum about 18 ka, and probably ceased to accumulate after sea level reached its present elevation (about 6 ka). Atwater (1982) recognized buried paleosols in the dunes, indicating periods of nondeposition

Qms **Merritt sand (Holocene and Pleistocene)**--Fine-grained, very well sorted, well-drained eolian deposits of western Alameda County. The Merritt sand outcrops in three large areas in Oakland and Alameda. Previously thought to be only of Pleistocene age, the Merrit sand is probably time-correlative with unit Qds, based on similar interfingering with Holocene bay mud (Qhbm) and presumably similar depositional environments associated with long-term sea-level fluctuations. The Merrit sand displays different morphology from unit Qds, however, forming large sheets up to 15 meters high with yardang morphology

Qls **Landslide deposits (Holocene and/or Pleistocene)**--Poorly sorted clay, silt, sand, and gravel. Only a few very large landslides have been mapped. For a more complete map of landslide deposits, see Nilsen and others (1979)

Qpaf **Alluvial fan and fluvial deposits (Pleistocene)**—Brown, dense, gravely and clayey sand or clayey gravel that fines upward to sandy clay. These deposits display various sorting and are located along most stream channels in the county. All Qpaf deposits can be related to modern stream courses. They are distinguished from younger alluvial fans and fluvial deposits by higher topographic position, greater degree of dissection, and stronger soil profile development. They are less permeable than Holocene deposits and locally contain fresh water mollusks and extinct late Pleistocene vertebrate fossils. They are overlain by Holocene deposits on lower parts of the alluvial plain and incised by channels that are partly filled with Holocene alluvium on higher parts of the alluvial plain. Maximum thickness is unknown but at least 50 m

Qpaf1 **Alluvial terrace deposits (Pleistocene)**--Deposits consist of crudely bedded, clast-supported gravels, cobbles, and boulders with a sandy matrix. Clasts as much as 35 cm intermediate diameter are present. Coarse sand lenses may be locally present. Pleistocene terrace deposits are cut into Qpaf alluvial fan deposits a few meters and lie up to several meters above Holocene deposits

Qmt **Marine terrace deposits (Pleistocene)**--Three small outcrops of marine terraces are located about 5 m above present mean sea level. Similar terraces are located north of the map area on the south shore of San Pablo Bay in the extreme northwest Contra Costa County at Lone Tree Point, Wilson Point, and an unnamed outcrop in between (Helley and Graymer, 1997b). The oyster beds at the base of those outcrops unconformably overlie the Cierbo Sandstone of Miocene Age and are in turn overlain by about 5 m of greenish-gray silty mudstone. The oysters have been dated by the Uranium-Thorium method (Helley and others, 1993) and are of last interglacial age, approximately 125 ka

Qpoaf **Older alluvial fan deposits (Pleistocene)**--Brown dense gravely and clayey sand or clayey gravel that fines upward to sandy clay. These deposits display various sorting qualities. All Qpoaf deposits can be related to modern stream courses. They are distinguished from younger alluvial fans and fluvial deposits by higher topographic position, greater degree of dissection, and stronger profile development. They are less permeable than younger deposits, and locally contain freshwater mollusks and extinct Pleistocene vertebrate fossils

QTi **Irvington Gravels of Savage (1951) (Pleistocene and Pliocene?)**--Poorly to well consolidated, distinctly bedded pebbles and cobbles, gray pebbly sand, and gray, coarse-grained, cross-bedded sand. Cobbles and pebbles are well- to sub-rounded, and as much as 25 cm in diameter, and consist of about 60 percent micaceous sandstone, 35 percent metamorphic and volcanic rocks and chert probably derived from the Franciscan complex, and 5 percent black laminated chert and cherty shale derived from the Claremont Formation. In the map area, these gravels are limited to several very small outcrops in the San Leandro quadrangle, thought to be offset from the main exposures of this unit in Fremont, south of the map area, by movement on the Hayward fault zone (Graymer, 1999). A large suite of early Pleistocene vertebrate fossils from this unit in quarries in Fremont was described by Savage (1951)

QTu **Undifferentiated continental gravels (Pleistocene and/or Pliocene)**--Semi-consolidated to unconsolidated poorly sorted gravel, sand, silt, and clay distributed in isolated patches throughout the map area. These deposits are unrelated to modern drainages and are most abundant in the Walnut Creek-Concord Valley (Briones Valley quadrangle) and in patches that appear to represent an ancestral drainage emanating from the north face of Mt. Diablo flowing northwesterly down the Clayton-Concord valley northeast of the map area. Their main distinction is not being related to modern drainage or Pleistocene drainage. Thickness varies but most outcrop areas exceed 50 m. No soil profile development is preserved at most localities due to erosion. These deposits probably reflect the late Cenozoic uplift of the Coast Ranges (Jones and others, 1994)

Assemblage I

Tbp **Bald Peak Basalt (late Miocene)**--Massive basalt flows. Ar/Ar ages of 8.37+0.2 and 8.46+0.2 Ma have been obtained from rocks of this unit (Curtis, 1989)

Tst **Siesta Formation (late Miocene)**--Nonmarine siltstone, claystone, sandstone, and minor limestone

Tmb **Moraga Formation (late Miocene)**--Basalt and andesite flows, minor rhyolite tuff. Ar/Ar ages obtained from rocks of this unit range from 9.0+0.3 to 10.2+0.5 Ma (Curtis, 1989). Includes, mapped locally:

Tms **Interflow sedimentary rocks**

Tor **Orinda Formation (late Miocene)**--Distinctly to indistinctly bedded, nonmarine, pebble to boulder conglomerate, conglomeratic sandstone, coarse- to medium-grained lithic sandstone, and green and red siltstone and mudstone. Conglomerate clasts are subangular to well rounded, and contain a high percentage of detritus derived from the Franciscan complex

Tcc **Claremont chert (late to middle Miocene)**--Laminated and bedded chert, minor brown shale, and white sandstone. Chert crops out as distinct, massive to laminated, gray or brown beds as much as 10 cm thick with thin shale partings. Distinctive black, laminated chert crops out locally in the Berkeley Hills. Lawson (1914) named rocks of this unit and coeval rocks elsewhere in and around the map area Claremont Shale, but within the area of Assemblage I, including Claremont Canyon, this unit is made up of much more chert than shale. Therefore, in this report I use the informal name Claremont chert for the rocks in Assemblage I and the formally accepted name Claremont Shale (Tcs) for coeval rocks in other assemblages where shale is the dominant lithology. The Claremont chert also includes, mapped locally:

Tccs **Interbedded sandstone**

Tss **Unnamed sandstone (Miocene(?))**

Tush **Unnamed gray mudstone (early Miocene)**

Tsm **Unnamed glauconitic mudstone (Miocene and Oligocene(?))**--Brown mudstone is interbedded with sandy mudstone containing prominent glauconite grains. Both rock types locally contain phosphate nodules up to one centimeter in diameter. The unit is bounded below and above by faults. It was mapped as Sobrante(?) Formation by Radbruch (1969). Includes:

Tsms **Interbedded sandstone**--Brown siltstone and fine-grained sandstone are locally interbedded

Tes **Unnamed mudstone (Eocene)**--Green and maroon, foraminifer-rich mudstone, locally interbedded with hard, distinctly bedded, mica-bearing, quartz sandstone. This unit is bounded above and below by faults

Ta **Unnamed glauconitic sandstone (Paleocene)**--Coarse-grained, green, glauconite-rich, lithic sandstone with well-preserved coral fossils. Locally interbedded with gray mudstone and hard, fine-grained, mica-bearing quartz sandstone. Outcrop of this unit is restricted to a small, fault-bounded area in the Oakland hills

Great Valley Complex

Kss **Unnamed lithic sandstone (Cretaceous)**

Assemblage II

Mullholland Formation of Ham (1952) (Pliocene and late Miocene)--Divided into upper and lower members:

Tmlu **Upper member**--Conglomerate, sandstone, and mudstone

Tmll **Lower member**--Sandstone and mudstone. Includes:

Tmls **Sandstone marker beds**--Mapped locally

Tus **Unnamed sedimentary and volcanic rocks (late Miocene)**--Includes conglomerate, sandstone, siltstone. Also includes, mapped locally:

Tub **Interbedded basalt**

Tul **Interbedded limestone**

Tlt **Lafayette Tuff (late Miocene)**--K/Ar age of 8.2 ± 2.0 Ma (Sarna-Wojcicki, 1976)

Tn **Neroly Sandstone (late Miocene)**--Blue, gray, and brown, volcanic-rich, shallow marine sandstone, with minor shale, siltstone, tuff, and andesitic conglomerate

Tc **Cierbo Sandstone (late Miocene)**

Tbr **Briones Sandstone (late and middle Miocene)**--Sandstone, siltstone, conglomerate and shell breccia. The Briones Sandstone in this assemblage contains a tuffaceous layer with a K/Ar age of 14.5+0.4 Ma (Lindquist and Morganthaler, 1991)

In the southern part of the assemblage, locally divided into:

Tbi **I member of Wagner (1978)**--Massive feldspathic sandstone

Tbg **G member of Wagner (1978)**--Massive sandstone, pebble conglomerate, and shell breccia. Locally subdivided into:

Tbgc **Conglomerate**

Tbgl **Limestone**

Tbf **F member of Wagner (1978)**--Fine-grained feldspathic sandstone and locally prominent brown shale.

Tbe **E member of Wagner (1978)**--Medium-grained sandstone with abundant shell breccia beds; lithologically similar to unit Tbg.

Tbd **D member of Wagner (1978)**--Massive, medium-grained sandstone with local conglomerate layers.

In the northern part of the assemblage, locally divided into:

Tbu **Upper sandstone and shale member**

Tbh **Hercules Shale Membe--**Gray shale and siltstone

Tbl **Lower sandstone and siltstone member**

Tro **Rodeo Shale, Hambre Sandstone, Tice Shale, and Oursan Sandstone, undivided (middle Miocene)**

Tr **Rodeo Shale (middle Miocene)**--Brown siliceous shale with yellow carbonate concretions

Th **Hambre Sandstone (middle Miocene)**--Massive, medium-grained sandstone, weathers brown

Tt **Tice Shale (middle Miocene)**--Brown siliceous shale

To **Oursan Sandstone (middle Miocene)—**Greenish-gray, medium-grained sandstone with calcareous concretions

Tcs **Claremont Shale (middle Miocene)**--Brown siliceous shale with yellow carbonate concretions and minor interbedded chert. Also includes:

Tccs **Sandstone interbeds**--Interbeds of light gray and white quartz sandstone and siltstone, mapped locally

Ts **Sobrante Sandstone (middle Miocene)**--Massive white, medium-grained calcareous sandstone

Tts **Tuffaceous sandstone (Miocene and/or Oligocene)**--Light-gray tuffaceous sandstone and tuff, with minor conglomerate and siltstone, marine. Clark (1918) correlated this unit with the Kirker Tuff, which crops out north of Mount Diablo, east of the map area, based on similar lithology and the presence in both units of 11 fossil species, including *Acila shumardi*. Durham (1944) indicated that *A. shumardi* is indicative of a late Oligocene age, the accepted age for the Kirker Tuff, but the underlying San Ramon Sandstone is considered to be early Miocene. This apparent contradiction has caused me to use the less restricted age indicated

Tsr **San Ramon Sandstone (Miocene and/or Oligocene)**--Massive, medium- to coarse-grained, fossiliferous, marine sandstone. The accepted age for this unit is early Miocene, based on Addicott (1970) who noted that Weaver and others (1944) had reclassified the molluscan zone of the San Ramon Sandstone fauna (*Echinophoria apta*) from late Oligocene to early Miocene. However, Kleinpell (1938) reported early Zemorrian foraminifera from this unit. Weaver and others (1944) classified the Zemorrian as early Miocene (probably based on the relationships in this unit), but more recent work on foraminiferal zonation by McDougall (1983) has shown the Zemorrian zone to be entirely Oligocene. In addition, the San Ramon Sandstone underlies tuffaceous sandstone and tuff correlated with the Kirker Tuff, which is considered to be Oligocene. The contradiction in accepted ages of the two units and the contradiction of foraminiferal and molluscan zonation has caused me to use the less restricted age indicated

Tshc **Shale and claystone (Eocene)**--Also contains minor sandstone

Great Valley Complex

Ku **Unnamed sedimentary rocks (Late Cretaceous, Turonian and Cenomanian)**--Massive to distinctly bedded, biotite-bearing, brown-weathering, coarse- to fine-grained graywacke and lithic wacke, siltstone, and mudstone. Also contains:

Kc **Conglomerate**--Lenses of pebble to boulder conglomerate, mapped locally

Assemblage III

Tcgl **Conglomerate, sandstone, siltstone (Pliocene and Miocene)**--Contains abundant clasts of Claremont chert. Includes:

Tcglt **Rhyolite tuff and tuff breccia**--Correlated with the 5.7 to 6.1 Ma Roblar tuff of Sarna-Wojcicki (1992) in Sonoma County (Sarna-Wojcicki, written commun.,1990)

Tdi **Diatomite (Miocene)**—Light-gray to white with minor brown shale

Tsa **Sandstone (Miocene)**--Massive, light-gray, fine- to medium-grained

Tmu **Mudstone, shale, and siltstone (Miocene)**

Assemblage IV

Most of the stratigraphic section of this assemblage does not crop out in the map area; see Graymer and others (1994) for a complete description of the units in this assemblage.

Tchs **Unnamed shale (Miocene)**--Light-brown mudstone and siltstone, interbedded with fine-grained brown sandstone. This unit crops out only on Castle Hill west of Alamo in the northeast part of the Las Trampas Ridge quadrangle

Tuc **Unnamed conglomerate (Miocene)**--Brown pebbly sandstone and siltstone. This unit crops out only on Castle Hill west of Alamo in the northeast part of the Las Trampas Ridge quadrangle

Ts **Sobrante Sandstone (Miocene)**--Gray to brown, fine- to medium-grained sandstone and minor conglomerate

Tsr **San Ramon Sandstone (Miocene and/or Oligocene)**--Bluish-gray to brown, medium-grained sandstone with conglomerate locally present in basal part. The accepted age for this unit is early Miocene, based on Addicott (1970) who noted that Weaver and others (1944) had reclassified the molluscan zone of the San Ramon Sandstone fauna (*Echinophoria apta*) from late Oligocene to early Miocene. However, Kleinpell (1938) reported early Zemorrian foraminifera from the San Ramon Sandstone. Weaver and others (1944) classified the Zemorrian as early Miocene (probably based on the relationships in this unit), but more recent work on foraminiferal zonation by McDougall (1983) has shown the Zemorrian zone to be entirely Oligocene. In addition, the San Ramon Sandstone in Assemblage II underlies tuffaceous sandstone and tuff correlated with the Kirker Tuff, which is considered to be Oligocene. The contradiction in accepted ages of the two units and the contradiction of foraminiferal and molluscan zonation has caused me to use the less restricted age indicated

Tes **Escobar Sandstone of Weaver (1953) (Eocene)**—Massive, medium- to coarse-grained, brown sandstone with shale in the basal part

Muir Sandstone of Weaver (1953), upper member (Eocene)--Massive, yellow-weathering arkosic sandstone. Divided into:

Tmru **Upper member—**Sandstone

Tmrl **Lower member—**Claystone with thin sandstone in the basal part

Tvh **Vine Hill Sandstone of Weaver (1953) (Paleocene)**--Glauconitic sandstone. Locally, divided into:

Tvhu **Upper member**--Sandstone and shale

Tvhl **Lower member**--Glauconitic sandstone

Great Valley Complex

Ku **Undivided Great Valley complex rocks (Cretaceous)**--Sandstone, siltstone, shale, and minor conglomerate. Locally, divided into:

Kcs **Gray, massive quartz arenite**

Ksh **Siltstone and shale**

Kus **Sandstone, siltstone, and shale**

Assemblage V

Most of the stratigraphic section of this assemblage does not crop out in the map area; see Graymer and others (1994) for a complete description of the units in this assemblage.

Tgvt **Green Valley and Tassajara Formations of Conduit (1938), undivided (Pliocene and Miocene)**--Nonmarine sandstone, siltstone, and conglomerate. South of the map area, includes a 5-meter-thick tuff marker bed. A tuff in this unit has a K/Ar age of 4.0±1.0 Ma, while tuff layers lower in the unit have been correlated with the Roblar tuff of Sarna-Wojcicki (1992) in Sonoma County, which has K/Ar ages of 5.7±0.5 Ma and 6.1±0.1 Ma, and the Pinole Tuff of Assemblage II, which has a K/Ar age of 5.2±0.1 Ma (Sarna-Wojcicki, 1976)

Tn **Neroly Sandstone (Miocene)**--Brown, massive, marine sandstone with abundant volcanic clasts

Assemblage VII

The Tertiary strata of this assemblage do not crop out in the map area; see Graymer and others (1996) for a description of the complete stratigraphic sequence in this assemblage.

Great Valley complex

Kp **Pinehurst Shale (Late Cretaceous, Campanian)**--Siliceous shale with interbedded sandstone and siltstone. This unit also includes maroon, concretionary shale at base. This formation was originally considered to be Paleocene, but it contains foraminifers and radiolarians of Campanian age in its type area and throughout its outcrop extent

Kr **Redwood Canyon Formation (Late Cretaceous, Campanian)**--Distinctly bedded, cross-bedded to massive, thick beds of fine- to coarse-grained, biotite- and quartz-rich wacke and thin interbeds of mica-rich siltstone. This formation is conformably overlain by the Pinehurst Shale. Locally, conglomerate (Kc) and siltstone (Kslt) members of this formation have been mapped

Ksc **Shephard Creek Formation (Late Cretaceous, Campanian)**--Distinctly bedded mudstone and shale, mica-rich siltstone, and thin beds of fine-grained, mica-rich wacke. This formation is conformably overlain by the Redwood Canyon Formation

Kcv **Unnamed sandstone, conglomerate, and shale of the Castro Valley area (Late Cretaceous, Turonian and younger(?))**--The lower part of the unit is composed of distinctly bedded, mica-bearing siltstone, fine-grained mica-bearing wacke, shale, and, locally, one thin pebble conglomerate layer. The middle part of the unit is composed of distinct, thick beds of medium- to coarse-grained, mica-rich wacke and pebble to cobble conglomerate. The middle part grades upward into the upper part, which is composed of distinctly to indistinctly bedded, medium- to fine-grained, mica-rich wacke and siltstone. This unit is bounded above and below by faults

Ko **Oakland Conglomerate (Late Cretaceous, Turonian and/or Cenomanian)**--Massive, medium- to coarse-grained, biotite and quartz-rich wacke and prominent interbedded lenses of pebble to cobble conglomerate. Conglomerate clasts are distinguished by a large amount of silicic volcanic detritus, including quartz porphyry rhyolite. Conglomerate composes as much as fifty percent of the unit in the Oakland hills, but it becomes a progressively smaller portion of the unit to the south. In areas of little conglomerate, this unit is distinguished from other Great Valley complex sandstones by its stratigraphic position, the presence of minor conglomerate, and its massive character. Includes, mapped locally:

Kcg **Conglomerate**

Kslt **Siltstone**

Kjm **Joaquin Miller Formation (Late Cretaceous, Cenomanian)**--Thinly bedded shale with minor sandstone. The shale grades into thinly bedded, fine-grained sandstone near the top of the formation. The contact with the overlying Oakland Sandstone is gradational

KJk **Knoxville Formation (Early Cretaceous and Late Jurassic)**--Mainly dark, greenish-gray silt or clay shale with thin sandstone interbeds. The depositional contact of Knoxville Formation on ophiolite and silicic volcanic rocks can be observed at several locations in the region, including outcrops in the Hayward quadrangle.

The Knoxville Formation is distinguished from the structurally overlying Joaquin Miller Formation by the greenish color, more poorly developed bedding, the presence of *Ammonite* and *Buchia* fossils. Locally includes:

KJkc **Conglomerate--**Thick pebble to cobble conglomerate beds in the lower part of the Knoxville Formation

KJkv **Volcanoclastic breccia--**Locally at the base, the formation contains beds of angular, volcanoclastic breccia derived from underlying ophiolite and silicic volcanic rocks

Jsv **Keratophyre and quartz keratophyre (Late Jurassic)**--Highly altered intermediate and silicic volcanic and hypabyssal rocks. Feldspars are almost all replaced by albite. In some places, closely associated with (intruded into?) basalt. This unit includes rocks previously mapped as Leona and Northbrae rhyolite, erroneously considered to be Tertiary (Dibblee, 1980b,d; Radbruch and Case, 1967; Robinson, 1956). Recent biostratigraphic and isotopic analyses have revealed the Jurassic age of these rocks (Jones and Curtis, 1991). These rocks are probably the altered remnants of a volcanic arc deposited on ophiolite during the Jurassic Period

Coast Range ophiolite (Jurassic)--Consists of:

Jpb **Pillow basalt, basalt breccia, and minor diabase**

Jb **Massive basalt and diabase**

Jgb **Gabbro**

sp **Serpentinite**--Mainly sheared serpentinite, but also includes massive serpentinized harzburgite. In places, pervasively altered to:

sc **Silica carbonate rock**

spm **Serpentinite matrix mélange**--Sheared serpentinite with large blocks (up to 10 meters or more in diameter) of high-grade metamorphic rocks such as amphibolite and actinolite schist

Assemblage XII

This assemblage is characterized by having no Tertiary or Great Valley complex rocks in the map area and only a thin section of these rocks elsewhere in the region. For the most part, including everywhere in the map area, Quaternary deposits are in angular unconformity directly on Franciscan complex rocks.

Franciscan complex

Franciscan complex rocks presumably underlie the entire area (see above for further discussion of the Franciscan complex and the terranes that it comprises).

KJf **Undivided Franciscan complex rocks (Cretaceous and Jurassic)**--More or less sheared and metamorphosed graywacke, shale, mafic volcanic rock, chert, ultramafic rock, limestone, and conglomerate. Highly sheared sandstone and shale forms the matrix of a mélange containing blocks of many rock types, including sandstone, chert, greenstone, blueschist, serpentinite, eclogite, and limestone. Locally divided into:

Kfn **Sandstone of the Novato Quarry terrane of Blake and others (1984) (Late Cretaceous)**--Distinctly bedded to massive, fine- to coarse-grained, mica-bearing, lithic wacke. Where distinctly bedded, sandstone beds are about 1 m thick, and siltstone interbeds are a few centimeters thick. Sedimentary structures are well preserved. At the type area in Marin County, fossils of Campanian age have been discovered, but none have yet been collected in Alameda County. In north Oakland, the sandstone is associated with a 1-km-diameter body of:

Kfgm **Fine-grained quartz diorite (Late Cretaceous?)**--Although the margins of the intrusive body are pervasively sheared, the diorite was probably originally intruded into the sandstone, judging from the extensive hydrothermal alteration in many parts of the sandstone outcrop area

Kfa **Sandstone of the Alcatraz terrane of Blake and others (1984) (Cretaceous)**--Coarse-grained, biotite- and shale-chip-bearing lithic wacke. Large biotite grains and shale chips up to 2 mm diameter are prominent in hand sample. In the map area the sandstone is massive, with some thin shale partings. Dark greenish-gray where fresh, weathers to yellowish-brown

KJfy **Metasandstone of the Yolla Bolly terrane of Blake and others (1982) (Cretaceous(?) and Late Jurassic)**--Strongly foliated, coarse-grained, shale-chip-bearing lithic wacke. Jadeite is visible under the hand lens, and prominent in thin-section

KJfs **Franciscan complex sandstone, undivided (Late Cretaceous to Late Jurassic)**--Graywacke and meta-graywacke not assigned to any terrane

KJfm **Franciscan complex mélange (Cretaceous and/or Late Jurassic)**--Sheared black argillite, graywacke, and minor green tuff, containing blocks and lenses of graywacke and meta-graywacke (fs), chert (fc), shale, metachert, serpentinite (sp), greenstone (fg), amphibolite, tuff, eclogite, quartz schist, greenschist, basalt, marble, conglomerate, and glaucophane schist (fm). Blocks range in size from pebbles to several hundred meters in length. Only some of the largest blocks are shown on the map

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Digital Publication and Database Description

Introduction

This publication includes, in addition to cartographic and text products, geospatial (GIS) databases and other digital files. These files are published on the Internet through the USGS Publications Group web sites. The database files are particularly useful because they can be combined with any type of other geospatial data for purposes of display and analysis. The other files include digital files that support the databases and digital plot files that can be used to display and print the cartographic and text products included in this publication.

Following is the digital publication and database description. It contains information about the content and format of the digital geospatial databases used to create this digital geologic map publication. **This information is not necessary to use or understand the geologic information in the map sheet, and preceding geologic description.** The digital map and database description contains information primarily useful for those who intend to use the geospatial databases. However, it also contains information about how to get digital plot files of the map sheet and geologic pamphlet via the Internet or on magnetic tape, as well as information about how the map sheets and pamphlets were created, and information about getting copies of the map sheets and text from the U.S. Geological Survey.

In addition, the USGS has adopted new policies regarding revision of publications, introducing the concept of version numbers similar to those used in the computer industry. The following pamphlet contains information about the version system and about how to access a revision list explaining changes from version 1.0, if any have been made.

The digital map database, compiled from previously published and unpublished data and new mapping by the author, represents the general distribution of bedrock and surficial deposits in the mapped area. Together with the accompanying pamphlet file (available as oakmf.ps, oakmf.pdf, or oakmf.txt), it provides current information on the geologic structure and stratigraphy of the area covered. The database delineates map units that are identified by general age and lithology following the stratigraphic nomenclature of the U.S. Geological Survey. The scale of the source maps limits the spatial resolution (scale) of the database to 1:24,000 or smaller. The content and character of the digital publication, as well as methods of obtaining the digital files, are described below.

For those who don't use digital geologic map databases

For those interested in the geology of the mapped area who do not use an ARC/INFO compatible Geographic Information System (GIS), we have provided two sets of plotfiles containing images of much of the information in the database. Each set contains an image of a geologic map sheet and an explanatory pamphlet. There is a set of images in PostScript format and another in Adobe Acrobat PDF format (see the sections “PostScript plot files” and “PDF plot files” below).

Those interested who have computer capability can access the plot file packages in either of the two ways described below (see the section “Obtaining the digital database and plotfile packages”). However, it should be noted the plot file packages do require gzip and tar utilities to access the plot files. Therefore additional software, available free on the Internet, may be required to use the plot files (see section “Tar files”). In addition, the map sheet is large and requires a large-format color plotter to produce a plot of the entire image, although smaller plotters can be used to plot portions of the images using the PDF plot files (see the sections “PostScript plot files” and “PDF plot files” below).

Those without computer capability can obtain plots of the map files through USGS Map-On-Demand service for digital geologic maps (see section “Obtaining plots from USGS Information Services”) or from an outside vendor (see section “Obtaining plots from an outside vendor”).

Also, USGS has adopted version numbers for publications, similar to that used in the computer industry. See the section “Revisions and version numbers” for details on this new policy.

MF2342 Digital Contents

This publication includes three digital packages. The first is the PostScript Plotfile Package, which consists of PostScript plot files of a geologic map, explanation sheet, and geologic and digital description pamphlet. The second is the PDF Plotfile Package, and contains the same plotfiles as the first package, but in Portable Document Format (PDF). The third is the Digital Database Package, and contains the geologic map database itself, and the supporting data, including base maps, map explanation, digital and geologic description, and references

Postscript plotfile package

This package contains the images described here in PostScript format (see below for more information on PostScript plot files):

oakmap.ps	A PostScript plottable file containing an image of the geologic map and base maps at a scale of 1:50,000, along with a map key, including terrane map, index maps, cross sections, and correlation chart.
oakmf.ps	A PostScript plot file of the pamphlet containing detailed unit descriptions and geological information, plus references cited, and describing the digital content of the publication (this pamphlet).

PDF plotfile package

This package contains the images described here in PDF format (see below for more information on PDF plot files):

oakmap.pdf	A PDF file containing an image of the geologic map and base maps at a scale of 1:50,000, along with a map key, including terrane map, index maps, cross sections, and correlation chart.
oakmf.pdf	A PDF plot file of the pamphlet containing detailed unit descriptions and geological information, plus references cited, and describing the digital content of the publication (this pamphlet).

Digital database package

The database package includes geologic map database files for each quadrangle in the map area. The digital maps, or coverages, along with their associated INFO directory have been converted to uncompressed ARC/INFO export files. ARC export files promote ease of data handling and are usable by some Geographic Information Systems in addition to ARC/INFO (see below for a discussion of working with export files). The ARC export files and the associated ARC/INFO coverages and directories, as well as the additional digital material included in the database, are described below:

ARC/INFO export file	Resultant Coverage	Description of Coverage
ri-geol.e00	ri-geol/	Faults, depositional contacts, and rock units in the Richmond quadrangle. This coverage includes arcs, polygons, and annotation.
ri-strc.e00	ri-strc/	Strike and dip information and fold axes in the Richmond quadrangle. This coverage includes arcs, points, and annotation. **Note:** The structure coverage may include additional point data that is not plotted in the map sheet (plotfiles oakmap.ps or oakmap.pdf) because of space constraints at map scale.
bv-geol.e00	bv-geol/	Faults, depositional contacts, and rock units in the Briones Valley quadrangle. This coverage includes arcs, polygons, and annotation.
bv-strc.e00	bv-strc/	Strike and dip information and fold axes in the Briones Valley quadrangle. This coverage includes arcs, points, and annotation. **Note:** The structure coverage may include additional point data that is not plotted in the map sheet (plotfiles oakmap.ps or oakmap.pdf) because of space constraints at map scale.

ow-geol.e00	ow-geol/	Faults, depositional contacts, and rock units in the Oakland West quadrangle. This coverage includes arcs, polygons, and annotation.
oe-geol.e00	oe-geol/	Faults, depositional contacts, and rock units in the Oakland East quadrangle. This coverage includes arcs, polygons, and annotation.
oe-strc.e00	oe-strc/	Strike and dip information and fold axes in the Oakland East quadrangle. This coverage includes arcs, points, and annotation. **Note:** The structure coverage may include additional point data that is not plotted in the map sheet (plotfiles oakmap.ps or oakmap.pdf) because of space constraints at map scale.
sl-geol.e00	sl-geol/	Faults, depositional contacts, and rock units in the San Leandro quadrangle. This coverage includes arcs, polygons, and annotation.
lt-geol.e00	lt-geol/	Faults, depositional contacts, and rock units in the Las Trampas Ridge quadrangle. This coverage includes arcs, polygons, and annotation.
lt-strc.e00	lt-strc/	Strike and dip information and fold axes in the Las Trampas Ridge quadrangle. This coverage includes arcs, points, and annotation. **Note:** The structure coverage may include additional point data that is not plotted in the map sheet (plotfiles oakmap.ps or oakmap.pdf) because of space constraints at map scale.
ha-geol.e00	ha-geol/	Faults, depositional contacts, and rock units in the Hayward quadrangle. This coverage includes arcs, polygons, and annotation.
ha-strc.e00	ha-strc/	Strike and dip information and fold axes in the Hayward quadrangle. This coverage includes arcs, points, and annotation. **Note:** The structure coverage may include additional point data that is not plotted in the map sheet (plotfiles oakmap.ps or oakmap.pdf) because of space constraints at map scale.

The database package also includes the following ARC coverages, and files:

ARC Coverages, which have been converted to uncompressed ARC/INFO export files:

ARC/INFO export file	Resultant Coverage	Description of Coverage
oak-quad.e00	oak-quad/	Polygon, line, and annotation coverage showing index map of quadrangles in the map area.
oak-corr.e00	oak-corr/	Polygon, line, and annotation coverage of the correlation table for the units in this map database. This database is not geospatial.
oak-so.e00	oak-so/	Polygon, line, and annotation coverage showing sources of data index map for this map database (see oakso.txt for sources of data list).
oak-as.e00	oak-as/	Polygon and line coverage of the index map of stratigraphic assemblages in the map area. (Assemblages are described in the publication pamphlet oakmf.ps, oakmf.pdf, or oakmf.txt)
oak-terr.e00	oak-terr/	Polygon, line, and annotation coverage of the index map of terranes in and around the study area. (Terranes are described in the publication pamphlet oakmf.ps, oakmf.pdf, or oakmf.txt)
oak-flt.e00	oak-flt/	Line and annotation coverage of the index map of faults and fault names for this map database.

oak-xsa.e00	oak-xsa/	Polygon, line, and annotation coverage of cross-section A-A'-A". This database is not geospatial.
oak-xsb.e00	oak-xsb/	Polygon, line, and annotation coverage of cross-section B-B'-B". This database is not geospatial.

ASCII text files, including explanatory text, ARC/INFO key files, PostScript plot files, and an ARC Macro Language file for conversion of ARC export files into ARC coverages:

oakmf.ps	A PostScript plot file of the pamphlet containing detailed unit descriptions and geological information, plus references cited, and describing the digital content of the publication (this pamphlet).
oakmf.pdf	A PDF version of oakmf.ps.
oakmf.txt	A text-only file containing an unformatted version of oakmf.ps.
oakso.txt	A text-only file containing a list of sources of data keyed to areas recorded in the coverage oak-so.
import.aml	ASCII text file in ARC Macro Language to convert ARC export files to ARC coverages in ARC/INFO.
mf2342d.rev	A text-only file containing the revisions list for this report.
mf2342e.met	A parsable text-only file of publication level FGDC metadata for this report.

The following supporting directory is not included in the database package, but is produced in the process of reconverting the export files into ARC coverages:

info/	INFO directory containing files supporting the databases.

Tar files

The three data packages described above are stored in tar (UNIX tape archive) files. A tar utility is required to extract the database from the tar file. This utility is included in most UNIX systems and can be obtained free of charge over the Internet from Internet Literacy's Common Internet File Formats Webpage (http://www.matisse.net/files/formats.html). The tar files have been compressed and may be uncompressed with **gzip**, which is available free of charge over the Internet via links from the USGS Public Domain Software page (http://edcwww.cr.usgs.gov/doc/edchome/ndcdb/public.html). When the tar file is uncompressed and the data is extracted from the tar file, a directory is produced that contains the data in the package as described above. The specifics of the tar files are listed below:

Name of compressed tar file	Size of compressed tar file (uncompressed)	Directory produced when extracted from tar file	Data package contained
mf2342a.tgz	6.3 MB (29 MB)	oakps	PostScript Plotfile Package
mf2342b.tgz	6.8 MB (6.8 MB)	oakpdf	PDF Plotfile Package
mf2342c.tgz	4.9 MB (15.5 MB)	oakdb	Digital Database Package

PostScript plotfiles

For those interested in the geology of the map area who don't use an ARC/INFO compatible GIS system we have included a separate data package with two PostScript plot files. One contains a color plot of the digital geologic map at 1:50,000 scale (oakmap.ps), along with an assemblage map, terrane map, cross sections, correlation chart, and map key. In addition, a second PostScript file, containing the geologic description and discussion and an appendix including a description of the digital content of the publication, is provided (oakmf.ps).

The PostScript images of the geologic maps and map explanation are 52 inches high by 34.5 inches wide, so a large plotter is required to produce paper copies at the intended scale. In addition, some plotters, such as those with continual paper feed from a roll, are oriented with the long axis in the horizontal direction, so the PostScript image will have to be rotated 90 degrees to fit entirely onto the page. Some plotters and plotter drivers, as well as many graphics software packages, can perform this rotation. The geologic description is on 8.5- by 11-inch pages.

The PostScript plotfiles for maps were produced by the ‘postscript’ command with compression set to zero in ARC/INFO version 7.1.1. The PostScript plotfiles for pamphlets were produced in Microsoft Word 6.0 using the Destination PostScript File option from the Print command.

PDF plotfiles

We have also included a second digital package containing PDF versions of the PostScript map sheet and pamphlet described above. Adobe Acrobat PDF (Portable Document Format) files are similar to PostScript plot files in that they contain all the information needed to produce a paper copy of a map or pamphlet and they are platform independent. Their principal advantage is that they require less memory to store and are therefore quicker to download from the Internet. In addition, PDF files allow for printing of portions of a map image on a printer smaller than that required to print the entire map without the purchase of expensive additional software. All PDF files in this report have been created from PostScript plot files using Adobe Acrobat Distiller. In test plots we have found that paper maps created with PDF files contain almost all the detail of maps created with PostScript plot files. We would, however, recommend that those users with the capability to print the large PostScript plot files use them in preference to the PDF files.

To use PDF files, the user must get and install a copy of Adobe Acrobat Reader. This software is available **free** from the Adobe website (http://www.adobe.com). Please follow the instructions given at the website to download and install this software. Once installed, the Acrobat Reader software contains an on-line manual and tutorial.

There are two ways to use Acrobat Reader in conjunction with the Internet. One is to use the PDF reader plug-in with your Internet browser. This allows for interactive viewing of PDF file images within your browser. This is a very handy way to quickly look at PDF files without downloading them to your hard disk. The second way is to download the PDF file to your local hard disk, and then view the file with Acrobat Reader. **We strongly recommend that large map images be handled by downloading to your hard disk**, because viewing them within an Internet browser tends to be very slow.

To print a smaller portion of a PDF map image using Acrobat Reader, it is necessary to cut out the portion desired using Acrobat Reader and the standard cut and paste tools for your platform, and then to paste the portion of the image into a file generated by another software program that can handle images. Most word processors (such as Microsoft Word) will suffice. The new file can then be printed. Image conversion in the cut and paste process, as well as changes in the scale of the map image, may result in loss of image quality. However, test plots have proven adequate. Many software packages designed to handle images (such as Adobe Illustrator or Photoshop) will open and work with PDF files and will produce plots of part or all of the large images without loss of image quality.

Obtaining the Digital Database and Plotfile Packages

The digital data can be obtained in any of two ways:

a. From the USGS Western Region Publications Web Page.
b. Sending a tape with request

To obtain tar files of database or plotfile packages from the USGS web pages:

The U.S. Geological Survey now supports a set of graphical pages on the World Wide Web. Digital publications (including this one) can be accessed via these pages. The location of the main Web page for the entire USGS is

http://www.usgs.gov

The Web server for digital publications from the Western Region is

http://geopubs.wr.usgs.gov

Go to

http://geopubs.wr.usgs.gov/map-mf/mf2342 to access this publication. Besides providing easy access to the entire digital database, the Western Region Web page also affords easy access to the PostScript plot files for those who do not use digital databases (see below).

To obtain tar files of database or plotfile packages on tape:

The digital database package, including database files, PostScript plotfiles, and related files can be obtained by sending a tape with request and return address to:

Oakland Metropolitan Area Geologic Database
c/o Database Coordinator
U.S. Geological Survey
345 Middlefield Road, M/S 975
Menlo Park, CA 94025

Do not omit any part of this address!

Copies of either the PostScript or PDF plot-file packages can also be obtained by sending a tape with request and return address to:

Oakland Metropolitan Area Geologic Map Plotfiles
c/o Database Coordinator
U.S. Geological Survey
345 Middlefield Road, M/S 975
Menlo Park, CA 94025

Do not omit any part of this address!

NOTE: Be sure to include with your request the exact names, as listed above, of the tar files you require. A report number is not sufficient.

The compressed tar file will be returned on the tape. The acceptable tape types are:

2.3 or 5.0 GB, 8 mm Exabyte tape.

Obtaining plots from a commercial vendor

Those interested in the geologic map, but who use neither a computer nor the Internet, can still obtain the information. We will provide the PostScript or PDF plot files on digital tape for use by commercial vendors who can make large-format plots. Make sure your vendor is capable of reading Exabyte tape types and PostScript or PDF plot files. Many vendors can also download the plotfiles via the Internet. Important information regarding file formats is included in the sections "Tar files," "PostScript plot files," and "PDF plot files" above, so be certain to provide a copy of this document to your vendor.

Obtaining plots from USGS

U.S. Geological Survey provides a map-on-demand service for certain map plotfiles, such as those described in this report. In order to obtain plots of the map sheet and accompanying pamphlet, contact:

USGS Information Services
Box 25286
Denver Federal Center
Denver, CO 80225-0046

(303) 202-4200

FAX: (303) 202-4695

e-mail: infoservices@usgs.gov

Revisions and version numbers

From time to time, new information and mapping, or other improvements, will be integrated into this publication. Rather than releasing an entirely new publication, the USGS has adopted a policy of using version numbers similar to that used in the computer industry. The original version of all publications will be labeled Version 1.0. Subsequent small revisions will be denoted by the increase of the numeral after the decimal, while large changes will be denoted by increasing the numeral before the decimal. Pamphlets and map products will be clearly marked with the appropriate version number. Information about the changes, if any, that have been made since the release of Version 1.0 will be listed in the publication revision file. This file will be available at the publication web site (see above) and will also be included in the digital database package. A simplified version of the revision list will be included in the publication metadata.

Digital database format

The databases in this report were compiled in ARC/INFO, a commercial Geographic Information System (Environmental Systems Research Institute, Redlands, California), with version 3.0 of the menu interface ALACARTE (Fitzgibbon and Wentworth, 1991, Fitzgibbon, 1991, Wentworth and Fitzgibbon, 1991). The files are in either GRID (ARC/INFO raster data) format or COVERAGE (ARC/INFO vector data) format. Coverages are stored in uncompressed ARC export format (ARC/INFO version 7.x). ARC/INFO export files (files with the .e00 extension) can be converted into ARC/INFO coverages in ARC/INFO (see below) and can be read by some other Geographic Information Systems, such as MapInfo via ArcLink and ESRI's ArcView (version 1.0 for Windows 3.1 to 3.11 is available for free from ESRI's web site: http://www.esri.com). The digital compilation was done in version 7.2.1 of ARC/INFO with version 3.0 of the menu interface ALACARTE (Fitzgibbon and

Wentworth, 1991, Fitzgibbon, 1991, Wentworth and Fitzgibbon, 1991).

Converting ARC export files

ARC export files are converted to ARC coverages using the ARC command IMPORT with the option COVER. To ease conversion and maintain naming conventions, we have included an ASCII text file in ARC Macro Language that will convert all of the export files in the database into coverages and create the associated INFO directory. From the ARC command line type:

```
Arc:  &run import.aml
```

ARC export files can also be read by some other Geographic Information Systems. Please consult your GIS documentation to see if you can use ARC export files and the procedure to import them.

Digital compilation

The geologic map information was digitized from stable originals of the geologic maps at 1:24,000 scale. The author manuscripts (pen on mylar) were scanned using an Altek monochrome scanner with a resolution of 800 dots per inch. The scanned images were vectorized and transformed from scanner coordinates to projection coordinates with digital tics placed by hand at quadrangle corners. The scanned lines were edited interactively by hand using ALACARTE, color boundaries were tagged as appropriate, and scanning artifacts visible at 1:24,000 were removed.

Base maps

Base Map layers were derived from published digital raster graphics (DRGs) obtained from the U.S. Geological Survey Mapping Division Website for the San Francisco Bay area (http://bard.wr.usgs.gov). Please see the website for more detailed information about the original databases. Because the base map digital files are already available at the website mentioned above, they are not included in the digital database package.

Faults and landslides

This map is intended to be of general use to engineers and land-use planners. However, its small scale does not provide sufficient detail for site development purposes. In addition, this map does not take the place of fault-rupture hazard zones designated by the California State Geologist (Hart and Bryant, 1997). Similarly, because only some of the landslides in the mapped area are shown, the database cannot be used to completely identify or delineate landslides in the region. For a more complete depiction of landslide distribution, see Nilsen and others (1979), Ellen and others (1988, 1997), Pike (1997), and Wentworth and others (1997).

Spatial resolution

Uses of this digital geologic map should not violate the spatial resolution of the data. Although the digital form of the data removes the constraint imposed by the scale of a paper map, the detail and accuracy inherent in map scale are also present in the digital data. The fact that this database was edited at a scale of 1:24,000 means that higher resolution information is not present in the dataset. Plotting at scales larger than 1:24,000 will not yield greater real detail, although it may reveal fine-scale irregularities below the intended resolution of the database. Similarly, where this database is used in combination with other data of higher resolution, the resolution of the combined output will be limited by the lower resolution of these data.

Database specifics

What follows is a brief and simple description of the databases included in this report and the data in them. For a comprehensive look at the database structure and content, please see the FGDC Metadata file, mf2342d.met, included in the database package and available separately at the publication web page.

The map databases consist of ARC coverages and supporting INFO files, which are stored in a Stateplane projection (Table 1). Digital tics define a 2.5 minute grid of latitude and longitude in the geologic coverages corresponding with quadrangle corners and internal tics.

Table 1. Map Projection File

The maps are stored in Stateplane projection. The following is an annotated projection file of the type used in Arc/Info.

```
PROJECTION STATEPLANE
UNITS METERS
ZONE 3326                    -Arc/Info code corresponding to California Coordinate System, Zone 3
SPHEROID CLARKE1866
PARAMETERS
END
```

The content of the geologic database can be described in terms of the lines, points, and areas that compose the map. Each line, point, or area in a map layer or index map database (coverage) is associated with a database entry stored in a feature attribute table. Each database entry contains both a number of items generated by Arc/Info to describe the geometry of the line, point, or area, and one or more items defined by the authors to describe the geologic information associated with that entry. Each item is defined as to the amount and type of information that can be recorded. Descriptions of the database items use the terms explained in Table 2.

Table 2. Field Definition Terms

ITEM NAME	name of the database field (item)
WIDTH	maximum number of digits or characters stored
OUTPUT	output width
TYPE	B-binary integer, F-binary floating point number, I-ASCII integer, C-ASCII character string
N. DEC.	number of decimal places maintained for floating point numbers

Because the database structure for each of the seven quadrangles included in this publication is the same, in the description of the feature attribute tables below the notation <quad> has been used to denote that the description applies to any of the quadrangle coverages. For example, <quad>-geol means that the description applies to the geologic coverage for any quadrangle. The specific notation for a single coverage can be made by replacing <quad> with the two letter code for each quadrangle (ri – Richmond, bv – Briones Valley, ow – Oakland West, oe – Oakland East, lt – Las Trampas Ridge, sl – San Leandro, ha – Hayward). For example, ri-geol denotes the geologic coverage for the Richmond quadrangle. Similarly, some descriptions apply to all coverages in the publication. In that case, the notation <coverage> has been used. For example, <coverage>-ID means that the description is the same for every coverage. The specific notation for a single coverage can be derived by replacing <coverage> with the coverage name (ie. RI-GEOL-ID for the coverage ri-geol).

Lines

The lines (arcs) are recorded as strings of vectors and are described in the arc attribute table (the format of the arc attribute table is shown in Table 3). They define the boundaries of the map units, the boundaries of open bodies of water, and the map boundaries. These distinctions, including the geologic identities of the unit boundaries, are recorded in the LTYPE field according to the line types listed in Table 4.

Table 3. Content of the Arc Attribute Tables

ITEM NAME	WIDTH	OUTPUT	TYPE	N. DEC	ITEM DESCRIPTION
FNODE#	4	5	B		starting node of arc (from node)
TNODE#	4	5	B		ending node of arc (to node)
LPOLY#	4	5	B		polygon to the left of the arc
RPOLY#	4	5	B		polygon to the right of the arc
LENGTH	4	12	F	3	length of arc in meters
<coverage>#	4	5	B		unique internal control number
<coverage>-ID	4	5	B		unique identification number
LTYPE	35	35	C		line type (see Table 4)
FAULTNAME	35	35	C		name of fault (oak-flt only)

Table 4. Line Types Recorded in the LTYPE Field

<quad>-geol, oak-terr, oak-as, oak-flt (no contacts)	<quad>-strc	oak-corr, oak-so and oak-quad
contact, approx. located	f.a., anticline, approx. located	map boundary
contact, certain	f.a., anticline, inferred	box
contact, inferred	f.a., overturned anticline, approx.	bracket
contact, inferred, queried	f.a., overturned syncline, approx.	scratch boundary
fault, approx. located	f.a., syncline, approx. located	quad
fault, certain	f.a., syncline, certain	contact, certain
fault, concealed	f.a., syncline, inferred	leader
fault, concealed, queried		
fault, inferred		
fault, inferred, queried		
leader		
map boundary		
normal fault, approx. located		
normal fault, certain		
normal fault, concealed		
reverse fault, approx. located		
reverse fault, certain		
reverse fault, concealed		
s.s. fault, r.l., approx. located		
s.s. fault, r.l., approx. located@		
s.s. fault, r.l., certain		
s.s. fault, r.l., certain@		
s.s. fault, r.l., concealed		
scratch boundary		
thrust fault, approx. located		
thrust fault, certain		
thrust fault, concealed		
thrust fault, inferred		
water boundary		

Note, not every line type listed is present in every coverage. For example, oak-terr only has some of the fault types listed.

The geologic and structural line types are ALACARTE line types that correlate with the geologic line symbols in the ALACARTE line set GEOL61.LIN according to the ALACARTE lines lookup table (GEOL61.LUT). For more information on ALACARTE and its linesets, see Wentworth and Fitzgibbon (1991).

Areas

Map units (polygons) are described in the polygon attribute table (the format of the polygon attribute table is shown in Table 5). In the geologic coverages (<quad>-geol) and the correlation coverage (oak-corr), the identities of the map units from compilation sources are recorded in the PTYPE field by map label (Table 6). Map units are described more fully in the accompanying text file. In other coverages, various areal information is recorded in the PTYPE field (data source region number, assemblage number, terrane label, quadrangle name). Note that ARC/INFO coverages cannot contain both point and polygon information, so only coverages with polygon information will have a polygon attribute table, and these coverages will not have a point attribute table.

Table 5. Content of the Polygon Attribute Tables

ITEM NAME	WIDTH	OUTPUT	TYPE	N. DEC	ITEM DESCRIPTION
AREA	4	12	F	3	area of polygon in square meters
PERIMETER	4	12	F	3	length of perimeter in meters
<coverage>#	4	5	B		unique internal control number
<coverage>-ID	4	5	B		unique identification number
PTYPE	35	35	C		unit label or other area label

Table 6. Unit labels (See oakmf.ps, oakmf.pdf, or oakmf.txt for descriptions of units)

H2O	Qhfp	Tmru
Jb	Qhl	Tms
Jgb	Qhsc	Tmu
Jpb	Qls	Tn
Jpb?	Qms	Tn?
Jsv	Qmt	To
KJf	Qpaf	To?
KJfm	Qpaf1	Tor
KJfs	Qpoaf	Tr
KJfy	Ta	Tr?
KJk	Tbd	Tro
KJkc	Tbe	Ts
KJkv	Tbf	Ts?
Kc	Tbg	Tsa
Kcg	Tbgc	Tshc
Kcs	Tbgl	Tsm
Kcv	Tbh	Tsms
Kfa	Tbi	Tsr
Kfgm	Tbl	Tss
Kfn	Tbp	Tst
Kjm	Tbr	Tt
Ko	Tbu	Tt?
Kp	Tc	Tts
Kr	Tcc	Tub
Ksc	Tccs	Tuc
Ksh	Tccs?	Tul
Kslt	Tcgl	Tus
Kss	Tcglt	Tush
Ku	Tchs	Tvh
Kus	Tcs	Tvhl
QTi	Tdi	Tvhu
QTi?	Tes	af
QTu	Tes?	alf
Qds	Tgvt	fc
Qhaf	Th	fg
Qhaf1	Th?	fm
Qhasc	Tlt	fs
Qhb	Tmb	sc
Qhbm	Tmll	sp
Qhbr	Tmls	sp?
Qhbs	Tmlu	spm

Note, not every unit label listed is present in every coverage. For example, queried units are not present in the correlation table coverage.

Points

Data gathered at a single locality (points) are described in the point attribute table (the format of the point attribute table is shown in Table 7) The identities of the points from compilation sources are recorded in the PTTYPE field by map label (Table 8). Additional information about the points is stored in additional attribute fields as described below and in Table 9. Note that ARC/INFO coverages cannot contain both point and polygon information, so only coverages with point information will have a point attribute table, and these coverages will not have a polygon attribute table.

Table 7. Content of the Point Attribute Tables

ITEM NAME	WIDTH	OUTPUT	TYPE	N. DEC	ITEM DESCRIPTION
AREA	4	12	F	3	area of polygon in square meters
PERIMETER	4	12	F	3	length of perimeter in meters
<coverage>#	4	5	B		unique internal control number
<coverage>-ID	4	5	B		unique identification number
PTTYPE	35	35	C		unit label
DIP	3	3	I		dip of bedding or foliation
STRIKE	3	3	I		strike of bedding or foliation

Table 8. Point Types Recorded in the PTTYPE Field

<quad>-strc
----

approx bedding
bedding
bedding w/tops
crumpled bedding
flat bedding
foliation
joint
ot bedding
ot bedding w/ tops
vert bedding
vert bedding w/ tops
vert foliation and bedding

The geologic point types in the structure coverage are ALACARTE point types that correlate with the geologic point symbols in the ALACARTE point set ALCGEOL.MRK according to the ALACARTE point lookup table. For more information on ALACARTE and its pointsets, see Wentworth and Fitzgibbon (1991).

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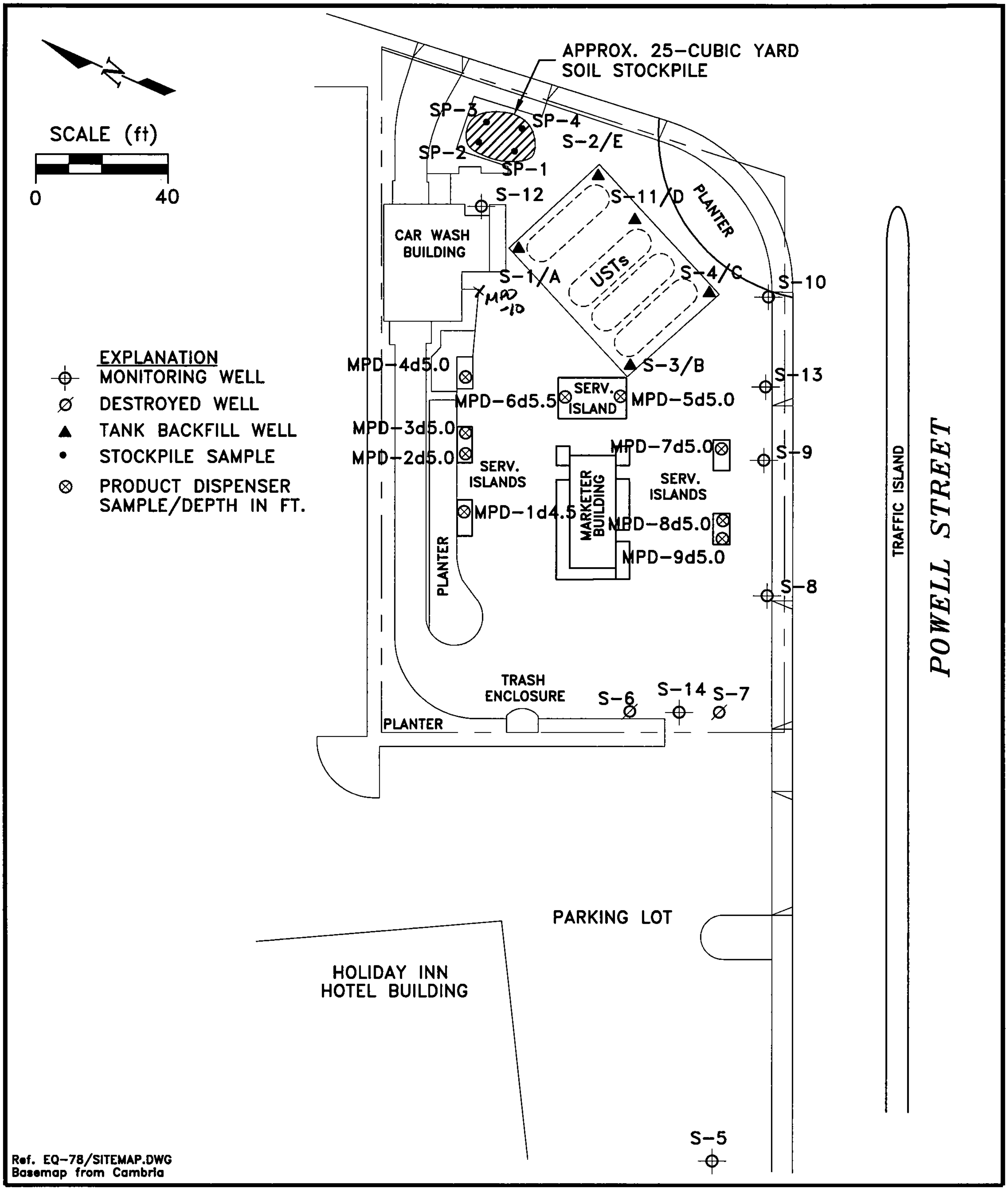

PREPARED BY TOXICHEM Management Systems, Inc. Environmental & Occupational Health Services	Shell-Branded Service Station 1800 Powell Street Emeryville, California	FIGURE: 1
	DISPENSER SOIL SAMPLE LOCATION MAP	PROJECT: EQ-78

Table 1
Soil Analytical Data
Total Petroleum Hydrocarbons, BTEX Compounds, Fuel Oxygenates, Lead Scavengers and Lead
By EPA Methods 8260B, 8015M and 6010B

Shell Branded Service Station
1800 Powell Street, Emeryville

Sample Number	Depth (feet bgs)	Date Sampled	TEPH (mg/kg)	TPPH (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethyl-benzene (mg/kg)	Xylenes (mg/kg)	MtBE (mg/kg)	TBA (mg/kg)	DIPE (mg/kg)	ETBE (mg/kg)	TAME (mg/kg)	1,2-DCA (mg/kg)	EDB (mg/kg)	Lead (mg/kg)
Soil																
MPD-1	4.5	09/22/04	**85 ldr**	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<2.5	<1.0	<0.50	<0.50	<0.50	<0.50	**150**
MPD-2	5.0	09/22/04	**33 ldr**	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<2.5	<1.0	<0.50	<0.50	<0.50	<0.50	**48**
MPD-3	5.0	09/22/04	**42 ldr**	<50	<0.50	<0.50	<0.50	<0.50	**0.64**	<2.5	<1.0	<0.50	<0.50	<0.50	<0.50	**39**
MPD-4	5.0	09/22/04	**1.5 ldr**	<1.0	<0.005	<0.005	<0.005	<0.005	<0.005	<0.010	<0.010	<0.005	<0.005	<0.005	<0.005	**16**
MPD-5	5.0	09/22/04	**12 ldr**	<1.0	**0.031**	<0.005	<0.005	<0.005	**0.0064**	**0.011**	<0.010	<0.005	<0.005	<0.005	<0.005	**15**
MPD-6	5.5	09/22/04	**3.6 ldr**	<1.0	<0.005	<0.005	<0.005	**0.013**	**0.027**	**0.032**	<0.010	<0.005	<0.005	<0.005	<0.005	**5.7**
MPD-7	5.0	09/22/04	**54 ndp**	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<2.5	<1.0	<0.50	<0.50	<0.50	<0.50	**5.4**
MPD-8	5.0	09/22/04	**3,500 edr**	**54**	<0.50	<0.50	<0.50	<0.50	<0.50	<2.5	<1.0	<0.50	<0.50	<0.50	<0.50	**8.3**
MPD-9	5.0	09/22/04	**320 edr**	**1,300**	<0.50	<0.50	**7.1**	**17**	<0.50	<2.5	<1.0	<0.50	<0.50	<0.50	<0.50	**9.5**
MPD-10	4.3	10/12/04	**970 edr**	**7,900**	<5.0	**32**	**21**	**630**	<5.0	<25	<10	<5.0	<5.0	<5.0	<5.0	**4.2**
	4.6	10/12/04	**110 edr**	**5,600**	<5.0	**53**	**26**	**530**	<5.0	<25	<10	<5.0	<5.0	<5.0	<5.0	**20**
Stockpile																
SP-1,2,3,4		09/22/04	**280 ndp**	**4.3**	<0.005	<0.005	**0.018**	**0.20**	NA	NA	NA	NA	NA	NA	NA	28

TEPH = Total extractable petroleum hydrocarbons
TPPH = Total purgeable petroleum hydrocarbons
MtBE = Methyl tert-butyl ether
TBA = Tertiary butyl alcohol, or t-butanol
DIPE = Di-isopropyl ether
ETBE = Ethyl tertiary-butyl ether
TAME = Tertiary amyl methyl ether
1,2-DCA = 1,2-Dichloroethane, or ethylene dichloride (EDC)
EDB = Ethylene dibromide
mg/kg = Milligrams per kilogram
bgs = Below ground surface

ldr = Hydrocarbon reported in late diesel range and does not match lab diesel standard.
ndp = Hydrocarbon reported in does not match lab diesel standard.
edr = Hydrocarbon reported in early diesel range and does not match lab diesel standard.

1800 Powell Street, Emeryville Initial Site Conceptual Model (2006)

	DESCRIPTION	Data Tables	Graphics	Reference	Data Gaps	Work Necessary to fill data gap	Comments
Regional Setting	**Geology/Stratigraphy** United States Geological Survey (USGS) publications and maps indicate that the site area is underlain by historic artificial fill (symbol af) (*Areal and Engineering Geology of the Oakland West Quadrangle, California,* D.H. Radbruch, USGS, *Miscellaneous Geological Investigations, Map I-239,* 1957, and *Geologic Map and Map Database of the Oakland Metropolitan Area, Alameda, Contra Costa, and San Francisco Counties, California*, USGS R.W. Graymer, 2000). Surficial deposits consist of man-made deposits of various ages and materials. Newer fill may be compacted but those imported prior to 1965 are generally un-compacted and are primarily dumped material. Beneath the fill and debris are naturally deposited organic silty clays interbedded with discontinuous intervals of sand, consistent with a near-shore depositional environment.		Geology map SF OAK.pdf	*2000 Geologic map and map database of the Oakland metropolitan area, Alameda, Contra Costa, and San Francisco Counties, California.pdf*	None identified.	Not applicable.	
	Hydrogeology According to the *East Bay Plain Groundwater Basin Beneficial Use Evaluation Report,* (California Regional Water Quality Control Board – San Francisco Bay Region, June 1999), the site is located within the Central Sub-Area of the San Francisco Basin of the East Bay Plain, which extends beneath San Francisco Bay. The boundaries of the Central Sub Area are defined by the Young Bay Mud and are well defined in some areas and less so in others. There have historically been artesian wells within the Sub Area, producing from gravel intervals that underlie the Yerba Buena Mud. These wells were abandoned due to salt water intrusion. The Merritt Sand has historically supplied water to single family residences, but salt water intrusion and contamination from septic tanks impacted these wells. Water quality in the Sub- Area is considered satisfactory for use as an irrigation source. The City of Emeryville does not have "any plans to develop local groundwater resources for drinking water purposes, because of existing or potential saltwater intrusion, contamination, or poor or limited quantity".			*East Bay Plain Beneficial Use Report.doc* Basin Plan	None identified.	Not applicable.	
	Nearby Release Sites BP/Mobil #11126 Operating 76 gas station at 1700 Powell Street, Emeryville; total petroleum hydrocarbons as gasoline (TPHg), benzene, toluene, ethylbenzene, and xylenes (BTEX), tert-butyl alcohol (TBA), oil and grease present in groundwater.	111262Q05.txt	BP11126 Site Map.pdf		None identified.	Not applicable.	

	DESCRIPTION	Data Tables	Graphics	Reference	Data Gaps	Work Necessary to fill data gap	Comments
Site Setting	**Site Geology** The site is built on fill consisting of imported clayey and sandy soil and industrial and construction waste and refuse. Filling began in 1884 when Paraffine Company bought ten acres on the Emeryville waterfront. Filling was terminated in 1969 due to environmental concerns for the Bay. Based on available log data, the fill material at the Shell Service Station site extends to an approximate depth of at least 10 feet and appears continuous across the site. The fill materials reportedly include industrial refuse, rip-rap, concrete blocks, and other material used to bring the area up to and above the existing sea level. Borings completed at the site have typically encountered fill and refuse, including tar paper, to approximately 12 and 15 feet below grade (fbg), underlain by clayey sand, clay with sand, and sand to at least 29 fbg, according to available boring logs.		Vicinity Map.pdf 1800 Powell Site Plan.pdf S-12 Boring Log.pdf S-13 Boring Log.pdf S-14 Boring Log.pdf		Boring logs for all but three of site wells unavailable; well construction details missing for all wells.	Shell and Alameda County file review.	
	Groundwater Conditions Depth to groundwater typically ranges between 5 and 12 fbg, and flows toward the south at an approximate gradient of 0.03 ft/ft.	Blaine Data Summary, Fourth Quarter, 2005.pdf	1800 Powell Site Plan.pdf		Well construction details for all site wells unavailable.	Shell and Alameda County file review.	
	Separate Phase Hydrocarbons Separate phase hydrocarbons (SPH) have been detected in monitoring wells S-9, S-10, and S-13. In November 1996, an anomalous measurement of 9 feet of SPH was noted in monitoring well S-9; a more reasonable maximum thickness of 2.79 feet was measured in February 1996. The SPH has been described as oil consisting of hydrocarbons heavier than gasoline. According to Weiss Associates' (Weiss) of Emeryville, California August 14, 1996 *Subsurface Investigation Report,* in November 1995 a sample of the SPH was submitted to Shell's Westhollow Technical Center analytical laboratory for analysis. They concluded that the substance was approximately 50% gasoline, with the remainder a hydrocarbon mixture indicative of roofing material. This is consistent with the site's use by Parrafine Company to produce industrial products that included roofing and building materials. As reported in the Toxichem Management Systems, Inc. of San Carlos, California (Toxichem) February 2, 2005 *Dispenser Sampling Report,* the substance was analyzed by Shell Global Solutions and Triton Analytics Corporation on an unknown date and contained 18% gasoline range hydrocarbons. Approximately 45% of the sample's weight lies in the vacuum gas oil range, or the carbon region above diesel (above 650°F) to the region of vacuum tower bottoms (pitch, asphalt), and approximately 35% of the material represents the heaviest fraction (1000°F+ to a max of C_{110} or boiling point 1351°F). Toxichem's report also concludes that the material present in Well S-9 can be attributable to the previous facility at the site. Due to the presence of SPH in S-9, this monitoring well has never been sampled.	Blaine Data Summary, Fourth Quarter, 2005.pdf	1800 Powell Site Plan.pdf	*August 1996 Subsurface Investigation Report.pdf* *Dispenser Sampling Report.doc*	None identified.	Not applicable.	

	DESCRIPTION	Data Tables	Graphics	Reference	Data Gaps	Work Necessary to fill data gap	Comments
	Release Source and History According to Weiss' August 14, 1997 *Subsurface Investigation Report*, products manufactured by Paraffine included: Linoleum and other hard-surfaced floor coverings, roofing and building materials, paints, varnishes, lacquers and enamels. A 1949 aerial photograph shows two above-ground storage tanks located across from Paraffine on filled tidal land. These tanks were located approximately 700 feet north of the present Shell site. Due to the nature of products manufactured and stored by Paraffine, it is believed that these tanks contained one or more of the following products: varnish, linseed oil, thinner, and/or paints. A 1957 aerial photograph shows the area of the Shell site completely filled, with dumping of various waste materials. Dumping still continued to the west of the Shell site. In a 1969 aerial photograph, all of the above-ground tanks observed in earlier photographs had been removed. The removal of tanks is related to the closure of Paraffine in the 1960s.			*August 1996 Subsurface Investigation Report.pdf*			
	According to Certified Engineering & Testing Company's August 21, 1989 *Phase II – Environmental Site Assessment* report for the Holiday Inn that currently shares the parcel at 1800 Powell Street with the Shell station, three off-site locations of concern were identified. The sites had reported or potential releases of various contaminants including one, American Bitumals and Asphalt, described as an EPA Superfund site that had reported the release of hydrocarbon compounds to soil and groundwater. The locations of these sites is not included in the report but it does state that the sites are upgradient or adjacent to the Holiday Inn site and that fill material from these sites may have been used during the infilling of the tidal marsh in the vicinity of 1800 Powell Street. The report also notes the detection of diesel in soil samples collected on the Holiday Inn property but states that the concentrations appear too low to indicate that the Shell station is the source.			*Holiday Inn Phase II Report.pdf*			
	During the installation of new dispensers at the Shell station in September 1982, a leak from damaged fiberglass piping connected to an underground storage tank at the site was reported. The release was reported as approximately 3,200 gallons of super unleaded gasoline. In response to the release, five tank backfill wells (S-1 through S-4, and S-11) and six groundwater monitoring wells (S-5 through S-10) were installed at the site sometime prior to August 1983. Boring logs and well construction details are unavailable for these wells. An Unauthorized Release Report (URR) was submitted by Shell on September 10, 1982.						
	On May 20, 1996, Weiss advanced six off-site soil borings (B-1 through B-6) to determine if soil or groundwater downgradient of the site had been impacted by petroleum or other hydrocarbons. Boring depths ranged from 7 to 16 fbg. Up to 43 parts per million (ppm) of TPHg and 1,500 ppm of total recoverable petroleum hydrocarbons (TRPH) were detected in soil from the borings. Soil from 11 fbg in boring B-2 contained 870 ppm of extractable hydrocarbons. Heavy oils were detected in soil collected just above first-encountered groundwater. Grab groundwater samples from the borings contained no detectable concentrations of TPHg or BTEX.	1996 Boring Sampling Results.pdf	1996 Boring Location Map.pdf		Missing boring logs, as discussed above.	Shell and Alameda County file review.	
	In September 2004, Toxichem conducted soil sampling during station upgrade activities at the site. Toxichem collected soil samples from beneath each of the nine former product dispensers at between 4.5 and 5.5 fbg (MPD-1 through MPD-9). In addition, due to a product line failing a line test prior to station	2004 Upgrade Sampling Results.xls	Dispenser Sample Location Map.pdf	*Dispenser Sampling Report.doc*	Lateral and vertical extent of impacted soil is unknown; very limited on-site	Additional soil sampling.	

	DESCRIPTION	Data Tables	Graphics	Reference	Data Gaps	Work Necessary to fill data gap	Comments
	re-opening, the section of piping was replaced and two soil samples were collected on October 12, 2004 (sample location MPD-10 at depths of 4.3 and 4.6 fbg). Samples MPD-8 and MPD-9 were reported to contain 3,500 ppm and 320 ppm TPHd, respectively but were noted to be in the early diesel range and did not match the laboratory diesel standard. The maximum concentrations of TPHg were associated with sample MPD-10 at 7,900 ppm (4.3 fbg) and 5,600 ppm (4.6 fbg). Due to newly installed piping, the vertical extent of impacted soil was not determined and no excavation was performed. Based on the results of the sampling, An Unauthorized Release Report (URR) was submitted by Shell to the Alameda County Health Care Services Agency on October 15, 2004.				soil data is available.		
	Dissolved plume There are currently 12 groundwater monitoring wells at this location. Wells S-1 through S-4 and S-11 have been designated tank backfill wells, renamed S-A through S-E and are no longer monitored. Wells S-4 and S-7 were abandoned in November 1989. Wells S-5, S-8, S-9, S-10, S-12, S-13, and S-14 comprise the current monitoring network. Sampling events occur annually during the fourth quarter. During the site's December 6, 2005 fourth quarter 2005 groundwater sampling event, TPHg was detected in groundwater from wells S-5, S-8, and S-10 at concentrations ranging from 476 parts per billion (ppb) to 1,630 ppb. Benzene was detected in wells S-5, S-8, S-10, and S-13 from 4.33 ppb to 102 ppb. MTBE was detected in wells S-8, S-10, S-12, S-13, and S-14 from 1.02 ppb to 93.3 ppb. As of January 1, 2003, Shell no longer included MTBE in the formulation of their gasoline. TBA was detected in wells S-8, S-12, and S-13 from 20.1 ppb to 393 ppb. TPHd has been detected in groundwater samples collected from site wells at concentrations of up to 535,000 ppb. The laboratory results are routinely flagged as not matching the laboratory's diesel standard, or determined by the laboratory to be due to the presence of a heavier petroleum hydrocarbon in the C_{18} to C_{36} range. This is consistent with the analysis of the SPH removed from well S-9 and indicates that the results reported as TPHd are likely caused by material in the subsurface attributed to prior site occupants and unrelated to the activities of the Shell station. Concentrations of all analytes exhibit a stable or decreasing trend over time in all wells, however the lateral extent of impacted groundwater has not been determined. TPHg and benzene concentrations detected during the December 2005 sampling event exceed the San Francisco Regional Water Quality Control Board's (RWQCB) Environmental Screening Levels (ESLs) for sites at which groundwater is not a drinking water source of 500 ppb and 46 ppb, respectively. Current MTBE and TBA concentrations are well below their respective ESLs of 1,800 ppb and 18,000 ppb.	Blaine Data Summary, Fourth Quarter, 2005.pdf	S-5 concentration vs. Time.pdf S-6 concentration vs. Time.pdf S-7 concentration vs. Time.pdf S-8 concentration vs. Time.pdf S-10 concentration vs. Time.pdf	*SFRWQCB ESLs.pdf*	Incomplete plume definition. No concentration trend for TBA.	Additional wells to the south across Powell Street, down-gradient of USTs, dispensers and on-site wells. Add TBA to groundwater monitoring list of quarterly analytes.	

	DESCRIPTION	Data Tables	Graphics	Reference	Data Gaps	Work Necessary to fill data gap	Comments
			S-12 concentration vs. Time.pdf S-13 concentration vs. Time.pdf S-14 concentration vs. Time.pdf TPHg Isocon.pdf Benzene Isocon.pdf MTBE Isocon.pdf				
	Remediation Archived documents mention the removal of approximately 400 gallons of product from wells following the September 1982 release of approximately 3,200 gallons of gasoline. No other details could be located. During periodic groundwater monitoring events, field personnel have removed free product from the wells using disposable bailers. No record of total amount removed has been located. In addition, GeoStrategies, Inc. recommended in an August 22, 1989 Work Plan the vacuum removal of free product and impacted groundwater from monitoring well S-9. This was reported to have occurred in November 1989 but no documentation available to support this.		1989 GSI Work Plan Figures.pdf	*1989 GSI Work Plan Text.pdf*	Unable to sample monitoring well S-9.	Determine extent of SPH substance using borings proposed in work plan included with this document. Remove substance from S-9, if possible, and begin sampling.	Reported SPH thickness precludes vacuum removal; alternatives will be discussed in report of proposed boring and well installations.
	Sensitive Receptors Well Survey - Cambria conducted a well survey in 2004 at the request of Shell. Review of the California State Department of Water Resources well logs and the California State Water Resources Control Board Geotracker system did not identify any water-producing wells within approximately a ½-mile radius of the site. Given that no water producing wells were identified during Cambria's 2004 Well Survey, the likelihood of impact to unidentified wells from chemicals originating from the site is low. Analysis - Given that the nearest surface water, San Francisco Bay, is approximately 390 feet south of the site and the nearest creek (Temescal Creek) is located approximately ¼ mile south of the site within the Emeryville Crescent, which is part of the Eastshore State Park, there is the possibility of impact to surface water from chemicals originating from the site.		1800 Powell Well Survey.pdf Exposure Eval Flowchart.xls		None identified.	Not applicable.	
	Risk Assessment No formal Risk Assessment has been performed. However, benzene would appear to be the main driver for this site. The RWQCB ESL for benzene at sites where groundwater is not a source of drinking water is 46 ppb. As discussed above, TPHg and benzene concentrations in groundwater exceed their respective ESLs.		Exposure Eval Flowchart.xls	*SFRWQCB ESLs.pdf*	None identified.	Not applicable.	
	Proposed Work Plan To further assess the extent of hydrocarbon impact to soil and groundwater and to address data gaps identified in this Site Conceptual Model, Cambia proposes to complete a file review to obtain missing boring logs and well construction details, advance 6 soil borings, and install 2 additional groundwater monitoring wells. *Monitoring Wells:* Install 2 groundwater monitoring wells (S-15 and S-16) off site,		Proposed Borings and	Soil Boring SOP.doc			

	DESCRIPTION	Data Tables	Graphics	Reference	Data Gaps	Work Necessary to fill data gap	Comments
	downgradient of the site and across Powell Street. These wells are proposed to determine the extent of impacted groundwater in this direction. A Cambria geologist will supervise the drilling, and each boring will be continuously logged to provide detailed lithologic profiles. Soil samples will be collected for laboratory analysis every 5 feet above the water table. A State-approved analytical laboratory will analyze soil samples for TPHg, BTEX, fuel oxygenates (TBA, di-isopropyl ether, ethyl tert butyl ether, tert amyl methyl ether, and MTBE) by EPA Method 8260B and TPHd by EPA Method 8015M. Well depths and screens will be determined based on field observations. The wells will be constructed using 4-inch diameter Schedule 40 PVC casing. The filter pack will be placed from the bottom of the well screen up to 2 feet above the top of the well screen followed by a 2-foot-thick bentonite seal and cement grout to grade. The wells will be secured with a locking cap under traffic-rated well boxes. Cambria will prepare boring logs for the wells and record photo-ionization detector measurements on the boring logs. Following monitoring well installation, a licensed surveyor will survey the wellhead elevation relative to mean sea level and the well's latitude and longitude. *On-site Soil Borings:* Boring SB-7 will be advanced adjacent to the location of 2004 piping sample MPD-10. The boring will be advanced adjacent to the current piping and in a step-out location to accurately characterize hydrocarbon impact to the soils. All reasonable care will be taken to ensure that the product piping is not damaged during soil boring placement. Borings SB-8 through SB-12 will be advanced to provide information on the lateral and vertical extent of impacted soil on site. The borings will be logged continuously, and soil samples will be collected for lab analysis every 3 feet to first-encountered groundwater and a sample of the first encountered groundwater will be collected from each boring. A State-approved analytical laboratory will analyze soil and groundwater samples for TPHg, BTEX, fuel oxygenates, and TPHd. Within 60 days following the receipt of analytical results from the laboratory, Cambria will prepare a written report for the well installation and soil boring advancement which will include field procedures, laboratory results, boring logs, including those found during the proposed file review, a well construction summary table, cross-sections, conclusions and recommendations.		Wells Map .pdf	Well Installation SOP.doc			

Weiss Associates Environmental and Geologic Services
SSI 8/96
5500 Shellmound Street, Emeryville, CA 94608-2411 Fax: 510-547-5043 Phone: 510-450-6000

August 14, 1996

Susan Hugo
Alameda County Department
of Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502

Re: **Subsurface Investigation Report**
Shell Service Station
WIC #204-2495-0101
1800 Powell Street
Emeryville, California
WA Job #81-0794-06

Dear Ms. Hugo:

On behalf of Shell Oil Products Company (Shell), Weiss Associates' (WA) presents the results of the subsurface investigation conducted at the Shell service station referenced above (Figure 1). As outlined in WA's March 6, 1996 workplan, the subsurface investigation objectives were to assess whether petroleum or other hydrocarbons are in soil and ground water down gradient of the Shell site. Our scope of work, site background and results for this investigation are presented below.

Scope of Work

WA's scope of work for this investigation was to:

- Locate underground utilities down grading of the site and prepare a site-specific health and safety plan;
- Obtain city encroachment permits from the Emeryville Department of Public Works and drilling permits from the Alameda County Zone 7 Water Agency;
- Drill four soil borings (Figure 2) using a Geoprobe drill rig, collect soil samples at 5-foot intervals for hydrogeologic description and possible chemical analysis;
- Analyze selected soil samples for total petroleum hydrocarbons between C_5 and C_{32}, petroleum oil and grease, metals, volatile organic compounds, and semi-volatile organic compounds;

- Collect one ground water sample from each boring for possible laboratory analysis;
- Prepare a subsurface investigation report that includes the site background, and presents the results of the investigation.

Site History

The operating Shell service station is built on fill consisting of imported clayey and sandy soil, industrial waste and construction debris. Beginning in 1884, Paraffine Company operated an industrial complex on the Emeryville waterfront and filled areas along the shoreline through 1969. Based on available boring log data, the fill at the Shell service station is at least 10 feet deep and appears continuous across the site.

Products manufactured by Paraffine included: linoleum and other hard-surfaced floor coverings, roofing and building materials, paints, varnishes, lacquers and enamels. A 1949 aerial photograph shows two above ground storage tanks located about 700 feet north of the current Shell site. The contents of the former above ground tanks are unknown.

A previously completed site assessment report described a 1957 aerial photograph that showed that the area of the Shell site was completely filled with soil and waste material. Dumping was active west of the Shell site. According to the site assessment report, a 1969 aerial photograph indicated that all of the above ground tanks observed in earlier photographs had been removed. The removal of the tanks was apparently related to the closure of the Paraffine facility in the 1960s.

By 1970, land use in the area began to convert from industrial complexes to hotels, condominiums, restaurants and office buildings. Given present and historical land use within the vicinity of the Shell service station, it does not appear that the shallow ground water is likely to be used as a potable, industrial or agricultural water source. Also, water quality data shows that over 3,000 parts per million (ppm) total dissolved solids (TDS) have been measured in ground water from the Shell wells. Therefore, based on state standards, ground water is not suitable for domestic or municipal supply.

In September 1982, an underground fuel leak was reported in the Shell service station in which the fiberglass piping connected to the underground storage tank was damaged and about 3,200 gallons of super unleaded gasoline was released.

Shell has installed seven ground water monitoring wells in the site vicinity since 1988. Quarterly monitoring and sampling of the wells began that same year. Up to 2.38 feet of separate-phase hydrocarbons (SPH) have been detected on top of ground water in well S-9 (Figure 2) since February 22, 1995. The SPH appears to be an oil consisting of hydrocarbons heavier than gasoline. Thus, it is unlikely that the SPH resulted from Shell's operations because Shell has not operated a garage or has had a waste oil tank at the site.

Ground water depth in the site vicinity ranges from 7.5 to 12 feet below ground surface (bgs) with local ground water flow towards the south. Up to 2,500 parts per billion (ppb) total petroleum hydrocarbon as diesel (TPH-D), 1,900 ppb total petroleum hydrocarbon as gasoline (TPH-G) and 470 ppb benzene were detected in the most recent quarterly monitoring event (Attachment A).

In November 1995, WA collected a SPH sample from monitoring well S-9 (Figure 2) and submitted the sample to Shell's Westhollow analytical laboratory in Houston, Texas for analysis. The analysis indicated that the SPH is about 50% gasoline and 50% of a hydrocarbon mixture with carbon range of n-C_{20} to over n-C_{50}, possibly roofing tar. This conclusion is consistent with historical land uses at this site.

May 1996 Subsurface Investigation

Permits Obtained: Encroachment permit from the City of Emeryville Department of Public Work and drilling permits from the Alameda County Zone 7 Water Agency (Permit No. 96336)

Drilling Date: May 20, 1996

Drilling Geologist: WA Geologist Elizabeth Brogna and Engineer Yi-Ran Wu under the supervision of Certified Hydrogeologist James W. Carmody

Drilling Method: On May 20, 1996, Gregg Drilling and Testing, Inc. (Gregg) of Martinez, California advanced two-inch diameter continuous-core samplers using a hydraulically powered Geoprobe. WA's standard field procedures are presented in Attachment B.

Number of Borings: Six, B-1 through B-6 (Figure 2)

Boring Depths: 7 to 16 ft bgs

Sediments Encountered: Sediments in borings B-1 through B-6 consisted of silt and clay of medium estimated permeability mixed with concrete and brick debris. The boring logs are included in Attachment C.

Depth to Ground Water: Ground water was encountered about 12' bgs. However, the depth to water during drilling does not reflect the static water level since the borehole was only open long enough to allow for the collection of a ground water sample.

Soil Sampling Method: In borings B-1 through B-6, continuous coring was conducted from the surface to about 7 to 16 ft bgs. Soil samples were collected about every five feet using clean split-spoon drive samplers lined with brass tubes for field screening and lithologic description. Soil

Water Sampling Method: Ground water samples were collected from borings B-1, B-2 and B-6 with a clean stainless steel bailer from inside a temporary PVC casing pushed into the water-bearing zone by a steel outer protective casing.

Soil and Water Analytical Methods: Selected soil samples were analyzed for total petroleum hydrocarbons as gasoline by Modified EPA Method 8015, fuel fingerprint between C_9 and C_{40} by Modified EPA Method 8015, benzene, toluene, ethylbenzene and total xylenes (BTEX) by EPA Method 8020, volatile organics (VOCs) by EPA Method 8240, semi-volatile organics (SVOCs) by EPA Method 8270, PCBs and pesticides by EPA Method 8080, petroleum oil and grease (TRPH) by Standard Method 5520, and inorganic persistent and bioaccumulative toxic substances (TTLC) by EPA Method 6010. Ground water samples were analyzed for TPH-G and TPH-D by Modified EPA Method 8015, benzene, toluene, ethylbenzene and total xylenes (BTEX) and methyl-tertiary butyl ether (MTBE) by EPA Method 8020, petroleum oil and grease by Standard Method 5520, and semi-volatile organics by EPA Method 8270. The analytic report and chain-of-custody form for the soil and ground water samples are presented in Attachment D.

Analytic Laboratory: Sequoia Analytical, Incorporated in Redwood City, California.

Soil Analytic Results: Analytic results for soil are tabulated on Table 1 and 2. Up to 43 parts per million (ppm) TPH-G and 1,500 ppm TRPH were detected in the soil borings. No benzene was detected in any of the soil borings above the detection limit. Up to 870 ppm extractable hydrocarbons were detected in sample B-2-11.0. Soil samples taken from the capillary fringe zone at borings B-1 and B-2 contained heavy oils. Up to 1.9 ppm phenol and no other VOCs or SVOCs above the detection limits were detected in the soil borings. No organochlorine pesticides or PCBs were detected in the sample taken 7 feet bgs from boring B-1.

Ground Water Analytic Results: Analytic results for ground water are tabulated on Table 1. No TPH-G, BTEX, VOCs, or MTBE and virtually no VOCs were detected above the detection limits in the grab ground water samples collected from borings B-1, B-2 and B-6.

Boring Backfill: All borings were backfilled from their total depth to ground surface with Portland Type I/II cement grout containing 3 to 5% bentonite using a tremie pipe.

Conclusions

The results of this investigation indicate that:

- TPH-G was only detected in one of 14 soil samples at 43 ppm, while up to 1,500 ppm TRPH (with longer chain hydrocarbons) were detected in every one of the analyzed samples.
- No TPH-G, BTEX, VOCs, or MTBE and virtually no VOCs were detected above the detection limits in the grab ground water samples collected from borings B-1, B-2 and B-6.
- Up to 1.9 ppm phenol and no other VOCs or SVOCs above the detection limits were detected in the soil borings. No organochlorine pesticides or PCBs were detected in the sample taken 7 feet bgs from boring B-1.

We trust that this submittal meets your needs. Please call if you have any questions or comments.

Sincerely,
Weiss Associates

REGISTERED GEOLOGIST
JAMES WILLIAM CARMODY
No HG217
CERTIFIED
HYDRO-
GEOLOGIST
STATE OF CALIFORNIA

Thomas [illegible] FOR
Yi-Ran Wu
Staff Engineer

James W. Carmody
James W. Carmody, C.H.G.
Senior Project Hydrogeologist

Attachments:	Figure 1	Site Location Map
	Figure 2	Site Plan - Soil Boring Location
	Table 1 and 2	Analytic Results

A - 1st Quarter 1996 Ground Water Monitoring Results
B - Standard Field Procedures
C - Boring Logs
D - Soil and Ground Water Analytic Report and Chain-of-Custody Form

cc: R. Jeff Granberry, Shell Oil Company, P.O. Box 4023, Concord, California 94524
Kevin Graves, Regional Water Quality Control Board - San Francisco Bay Region, 2101 Webster Street, Suite 500, Oakland, California 94612

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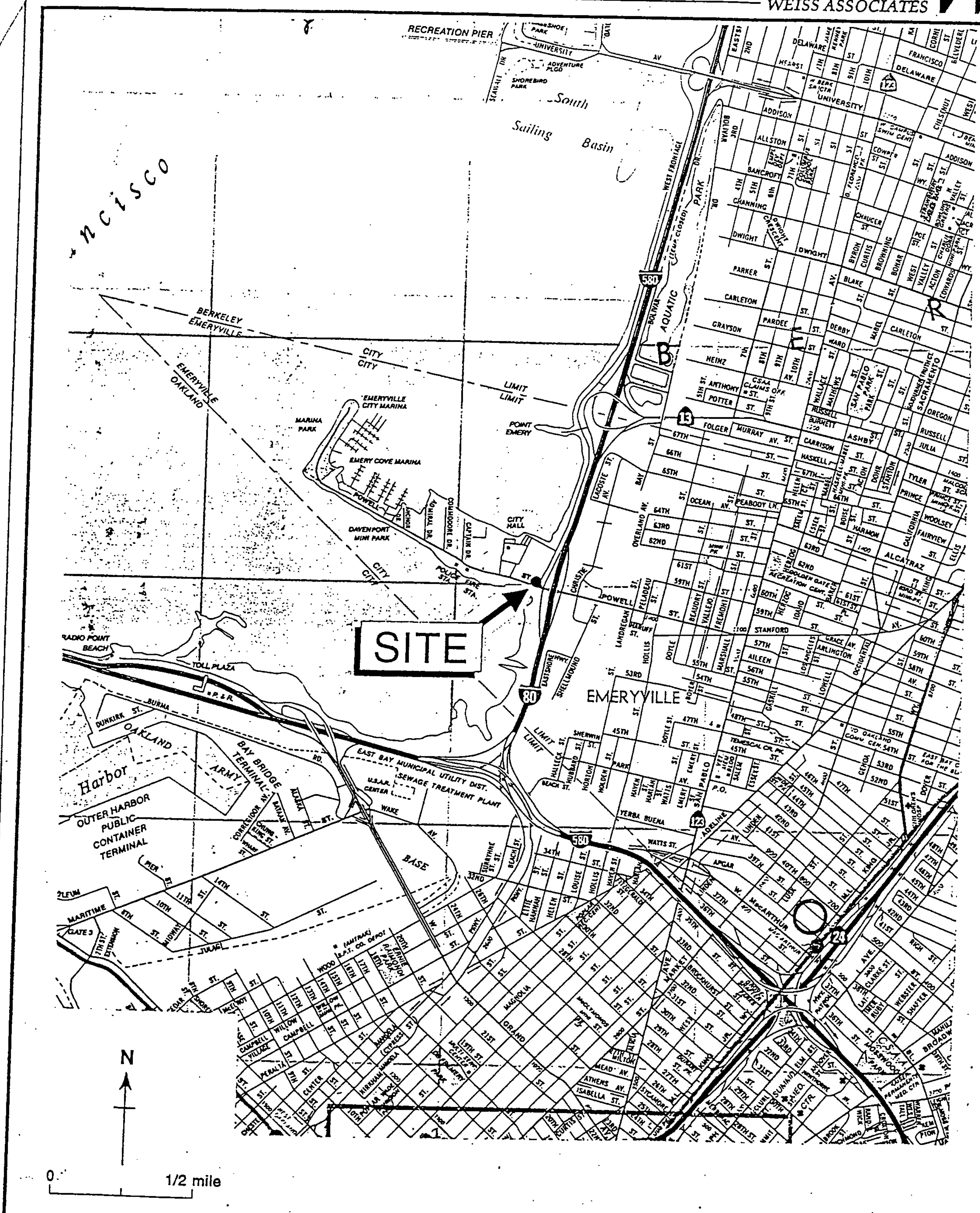

Figure 1. Site Location Map - Shell Service Station WIC# 204-2495-01, 1800 Powell Street, Emeryville, California

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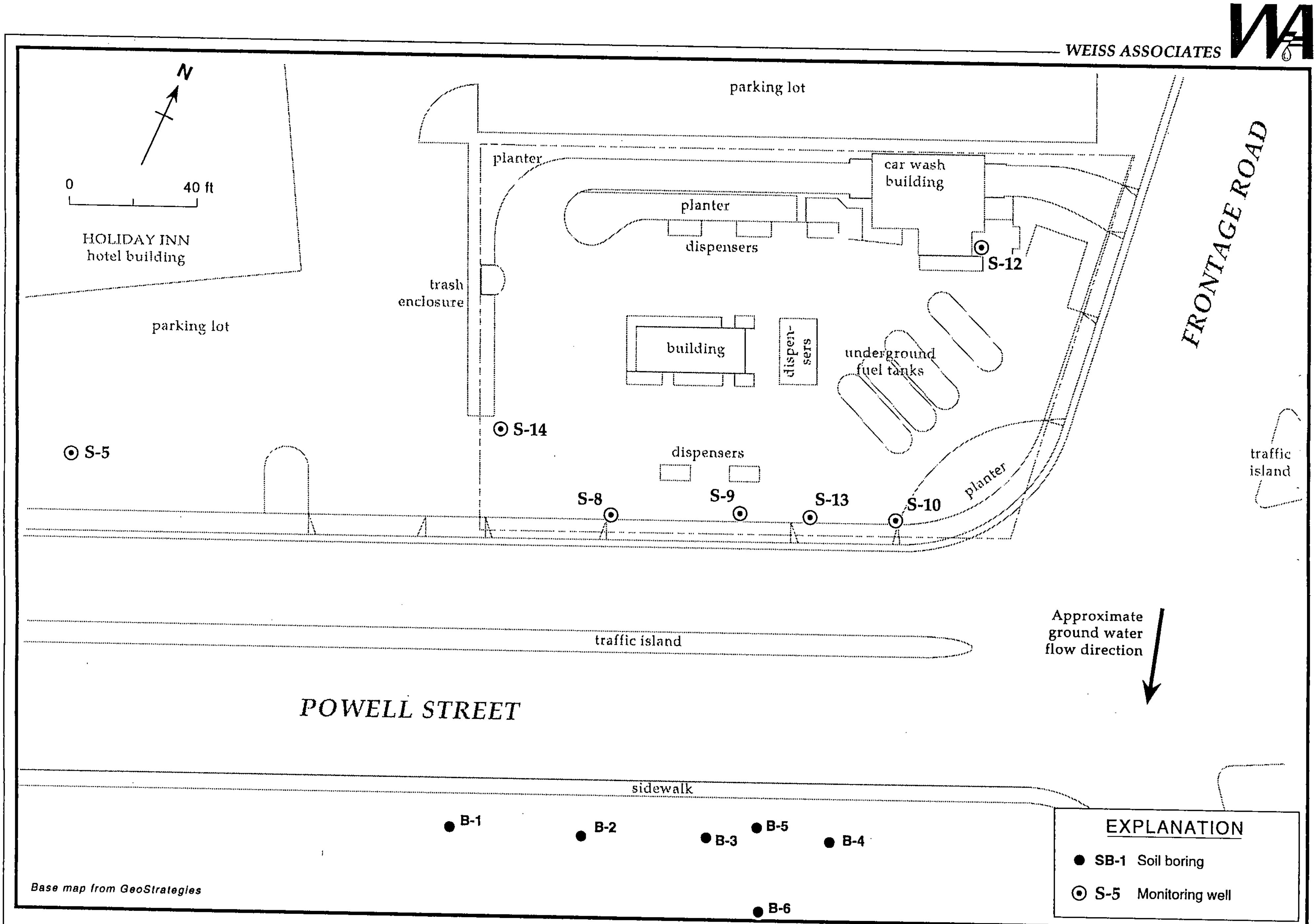

Figure 2. Soil Boring Locations - Shell Service Station - WIC# 204-2495-0107, 1800 Powell Street, Emeryville, California

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Table 1. Analytic Results for Soil and Ground Water - Shell Service Station, WIC #204-2495-0101, 1800 Powell Street, Emeryville, California

Sample ID	Date Sampled	Sample Depth (ft)	TPH-G	FF	B	T	E	X	P&P	VOCs	SVOCs	TRPH	MTBE
			← ppm for soil, ppb for water →										
Soil Samples: (mg/kg)													
B1-2.0	5/20/96	2.0	<1.0	---	<0.005	<0.005	<0.005	<0.005	---	---	---	---	---
B1-7.0	5/20/96	7.0	<1.0	---	<0.005	<0.005	<0.005	<0.005	ND	ND	ND[a]	---	---
B1-13.0	5/20/96	13.0	<1.0	160	<0.005	<0.005	<0.005	<0.005	---	---	---	67	---
B1-15.0	5/20/96	15.0	43	350	<0.025	<0.025	0.072	0.19	---	---	---	1,100	---
B2-2.0	5/20/96	2.0	<1.0	---	<0.005	<0.005	<0.005	<0.005	---	---	---	---	---
B2-7.5	5/20/96	7.5	<1.0	---	<0.005	<0.005	<0.005	<0.005	---	---	---	---	---
B2-11.0	5/20/96	11.0	<1.0	870	<0.005	<0.005	<0.005	<0.005	---	---	---	1,500	---
B3-6.5	5/20/96	6.5	<1.0	---	<0.005	<0.005	<0.005	<0.005	---	---	---	---	---
B3-10.5	5/20/96	10.5	<1.0	31	<0.005	<0.005	<0.005	<0.005	---	---	---	82	---
B4-6.5	5/20/96	6.5	<1.0	---	<0.005	<0.005	<0.005	<0.005	---	---	---	---	---
B5-3.0	5/20/96	3.0	<1.0	---	<0.005	<0.005	<0.005	0.0054	---	---	---	---	---
B6-3.5	5/20/96	3.5	<1.0	---	<0.005	<0.005	<0.005	<0.005	---	---	---	---	---
B6-6.5	5/20/96	6.5	<1.0	---	<0.005	<0.005	<0.005	<0.005	---	---	---	---	---
B6-11.0	5/20/96	11.0	<1.0	40	<0.005	<0.005	<0.005	<0.005	---	---	---	380	---
Grab Ground Water Samples (ug/l):													
B1-GW	5/20/96		<50	---	<0.50	<0.50	<0.50	<0.50	---	ND[b]	---	---	<2.5
B2-GW	5/20/96		<50	---	<0.50	<0.50	<0.50	<0.50	---	ND	---	---	<2.5
B6-GW	5/20/96		<50	---	<0.50	<0.50	<0.50	<0.50	---	ND	---	---	<2.5

Table 1. Analytic Results for Soil and Ground Water - Shell Service Station, WIC #204-2495-0101, 1800 Powell Street, Emeryville, California (continued)

Abbreviations:

TPH-G = Total petroleum hydrocarbons as gasoline by Modified EPA Method 8015
FF = Fuel Fingerprint between C_9 and C_{40} by Modified EPA Method 8015; (Sample results expressed as ppm of Extractable Hydrocarbons)
B = Benzene by EPA Method 8020
T = Toluene by EPA Method 8020
E = Ethylbenzene by EPA Method 8020
X = Xylenes by EPA Method 8020
P&P = Organochlorine Pesticides and PCBs by EPA Modified Method 8080
VOCs = Volatile Organics by EPA Method 8240
SVOCs = Semi-Volatile Organics by EPA Method 8270
TRPH = Total Recoverable Petroleum Hydrocarbon by Standard Method 5520
<n = Not detected at detection limits of **n** ppm or ppb
ND = Not detected at the detection limits for all compounds within the analysis

Note:

Analytical Laboratory: Sequoia Analytical of Redwood City, California.

a: Phenol concentration was detected at 1.9 parts per million (ppm)

b: Acetone concentration detected at 14 ppb

Table 2. Analytic Results for Soil Sample B1-7.0, Inorganic Persistent and Bioaccumulative Toxic Substances (TTLC) - Shell Service Station, WIC #204-2495-0101, 1800 Powell Street, Emeryville, California

Analyte	Max. Limit (mg/Kg)	Detection Limit (mg/Kg)	Sample Results (mg/Kg)
Antimony (Sb)	500	5.0	10
Arsenic (As)	500	5.0	ND
Barium (Ba)	10,000	5.0	180
Beryllium (Be)	75	0.50	ND
Cadmium (Cd)	100	0.50	ND
Chromium (Cr)	2,500	0.50	44
Cobalt (Co)	8,000	2.5	9.5
Copper (Cu)	2,500	0.50	44
Lead (Pb)	1,000	5.0	37
Mercury (Hg)	20	0.020	0.079
Molybdenum (Mo)	3,500	2.5	ND
Nickel (Ni)	2,000	2.5	45
Selenium (Se)	100	5.0	ND
Silver (Ag)	500	0.50	ND
Thallium (Tl)	700	5.0	12
Vanadium (V)	2,400	2.5	30
Zinc (Zn)	5,000	0.50	88

ATTACHMENT A

1ST QUARTER 1996 GROUND WATER MONITORING RESULTS

Table 1. Ground Water Elevations and Analytic Results - Shell Service Station WIC# 204-2495-0101, 1800 Powell Street, Emeryville, California

Well ID	Sampling Date	Top-of-Box Elevation (ft msl)	Depth to Water (ft)	Separate-Phase Hydrocarbon Thickness (ft)	Ground Water Elevation (ft msl)	TDS (ppm)	TPH-G	TPH-D	B	T	E	X	MTBE
							← parts per billion (µg/L) →						
S-5	10/26/84	11.72	---	---	---	---	3,000	---	660	20	20	70	---
	02/09/85		---	---	---	---	2,800	---	740	20	20	140	---
	04/27/85		---	---	---	---	4,300	---	750	10	20	<30	---
	07/06/85		---	---	---	---	1,500	---	300	8.0	7.0	9.0	---
	10/24/85		---	---	---	---	2,100	---	760	10	40	50	---
	01/03/86		---	---	---	---	1,300	---	520	9.0	8.0	10	---
	07/05/86		8.36	---	3.36	---	1,400	---	500	10	4.0	<10	---
	10/18/86		---	---	---	---	4,200	---	1,100	9.0	14	7.0	---
	01/13/87		---	---	---	---	4,500	6,100	1,100	15	30	25	---
	07/07/87		9.15	---	2.57	---	3,200	---	1,000	16	9.0	12	---
	10/10/87		9.67	---	2.05	---	1,700	---	16	5.7	5.2	8.9	---
	02/11/88		9.00	---	2.72	---	1,300	---	300	5.0	<5	<5	---
	05/10/88		8.61	---	3.11	---	1,900	---	490	<0.5	<5	<5	---
	08/31/88		9.61	---	2.11	---	6,700	---	760	26	<25	<25	---
	12/03/88		9.47	---	2.25	---	2,900	---	890	5.3	7.3	13	---
	02/16/89		8.29	---	3.43	---	1,300	---	280	3.0	3.4	9.4	---
	08/10/89		9.30	---	2.42	---	1,700	---	530	5.5	<5	5.8	---
	11/11/89		9.42	---	2.30	---	---	---	---	---	---	---	---
	02/21/94		7.95	---	3.77	---	1,000	---	250	<5	<5	<5	---
	02/21/94[dup]		7.95	---	3.77	---	1,300	---	220	<5	<5	11	---
	05/16/94		8.00	---	3.72	---	1,200	---	230	<5	<5	<5	---
	08/09/94[a]		---	---	---	---	---	---	---	---	---	---	---
	11/09/94		8.32	---	3.40	---	1,600	---	220	3.2	1.8	5.0	---
	11/09/94[dup]		8.32	---	---	---	1,600	---	250	3.3	1.9	5.9	---
	02/22/95[a]		---	---	---	---	---	---	---	---	---	---	---
	05/02/95[a]		---	---	---	---	---	---	---	---	---	---	---
	05/10/95		---	---	---	---	910	---	170	1.5	1.3	5.2	---
	08/24/95		8.78	---	2.94	---	620	---	210	<0.5	1.2	5.3	---
	12/08/95		9.78	---	1.94	---	1,600	---	510	3.3	1.5	6.6	---

Table 1. Ground Water Elevations and Analytic Results - Shell Service Station WIC# 204-2495-0101, 1800 Powell Street, Emeryville, California (continued)

Well ID	Sampling Date	Top-of-Box Elevation (ft msl)	Depth to Water (ft)	Separate-Phase Hydrocarbon Thickness (ft)	Ground Water Elevation (ft msl)	TDS (ppm)	TPH-G	TPH-D	B	T	E	X	MTBE
							← parts per billion (µg/L) →						
	12/08/95[dup]		9.78	---	1.94	---	1,600	---	530	1.8	1.1	5.4	---
	02/29/96		7.64	---	4.08	---	1,900	---	470	5.8	<5.0	<5.0	46
	02/29/96[dup]		7.64	---	4.08	---	1,700	---	440	5.4	<5.0	<5.0	40
S-6[b]	04/27/85		---	---	---	---	6,500	---	2,400	30	50	210	---
	07/06/85		---	---	---	---	3,700	---	1,700	34	55	200	---
	10/24/85		---	---	---	---	<50	---	23	<0.5	<5	10	---
S-7[b]	10/26/84		---	---	---	---	50	---	1.1	<1	<1	4	---
	02/09/85		---	---	---	---		---	0.90	<1	<1	<3	---
	04/27/85		---	---	---	---	<50	---	<1	<1	<1	<3	---
	07/06/85		---	---	---	---	70	---	2.2	<1	<1	<3	---
	10/24/85		---	---	---	---	6,200	---	2,200	130	190	660	---
S-8	10/26/84	12.76	---	---	---	---	1,000	---	610	9.0	1.0	42	---
	02/09/85		---	---	---	---	500	---	160	5.0	<2	17	---
	04/27/85		---	---	---	---	2,700	---	1500	20	10	40	---
	07/06/85		---	---	---	---	440	---	180	5.0	2.0	12	---
	10/24/85		---	---	---	---	2,000	---	1,100	17	5.0	70	---
	01/03/86		---	---	---	---	1,900	---	1,300	20	<10	70	---
	07/05/86		9.50	---	3.26	---	1,600	---	920	30	<10	60	---
	10/18/86		---	---	---	---	1,400	---	640	<10	<10	30	---
	01/13/87		---	---	---	---	670	760	190	5.8	<0.5	19	---
	04/22/87		---	---	---	---	2,400	---	740	54	5.7	59	---
	07/07/87		10.45	---	2.31	---	1,100	---	450	15	<2.5	42	---
	10/10/87		10.83	---	1.93	---	340	---	4.0	0.60	<0.5	17	---
	02/11/88		10.44	---	2.32	---	<1,000	---	260	<10	<10	11	---
	05/10/88		10.17	---	2.59	---	1,800	---	700	14	<5	46	---
	08/31/88[SPH]		10.81	---	1.95	---	---	---	---	---	---	---	---
	12/03/88		10.81	---	1.95	---	960	---	250	4.3	<2.5	14	---

Table 1. Ground Water Elevations and Analytic Results - Shell Service Station WIC# 204-2495-0101, 1800 Powell Street, Emeryville, California (continued)

Well ID	Sampling Date	Top-of-Box Elevation (ft msl)	Depth to Water (ft)	Separate-Phase Hydrocarbon Thickness (ft)	Ground Water Elevation (ft msl)	TDS (ppm)	TPH-G	TPH-D	B	T	E	X	MTBE
							← parts per billion (µg/L) →						
	02/16/89		9.65	---	3.11	---	2,700	---	800	35	10	83	---
	05/28/89		10.46	---	2.3	---	960	---	710	25	84	80	---
	08/10/89		10.59	---	2.17	---	1,300	---	630	17	<5	46	---
	11/11/89		10.29	---	2.47	---	910	---	180	8	<2.5	15	---
	02/21/94		9.52	---	3.24	2,910	3,200	---	480	52	<5	130	---
	05/16/94		9.49	---	3.27	---	1,000	---	220	7.3	<5	28	---
	05/16/94[dup]		9.49	---	3.27	---	1,000	---	280	10	<5	29	---
	08/09/94		10.37	---	2.39	4,500	400	---	27	6.6	<0.5	18	---
	11/09/94		9.58	---	3.18	4,600	650	---	170	5.3	<0.5	17	---
	02/22/95		9.02	---	3.74	---	650	---	210	10	1.2	22	---
	05/02/95		8.45	---	4.31	---	1,000	---	280	17	1.4	32	---
	08/24/95		10.02	---	2.74	---	480	---	180	11	1.0	19	---
	08/24/95[dup]		10.02	---	2.74	---	700	---	180	6.5	<0.5	17	---
	12/08/95		10.65	---	2.11	---	740	---	230	6.9	0.7	15	---
	02/29/96		**9.10**	**---**	**3.66**	**---**	**740**	**---**	**260**	**8.1**	**<5.0**	**19**	**58**
S-9	10/26/84[SPH]	12.75	---	---	---	---	---	---	---	---	---	---	---
	02/09/85[SPH]		---	1.30	---	---	---	---	---	---	---	---	---
	04/27/85[SPH]		---	1.25	---	---	---	---	---	---	---	---	---
	07/06/85[SPH]		---	1.20	---	---	---	---	---	---	---	---	---
	10/24/85[SPH]		---	---	---	---	---	---	---	---	---	---	---
	01/03/86[SPH]		---	---	---	---	---	---	---	---	---	---	---
	04/11/86[SPH]		---	---	---	---	---	---	---	---	---	---	---
	07/05/86[SPH]		9.67	---	3.08	---	---	---	---	---	---	---	---
	10/18/86[SPH]		---	---	---	---	---	---	---	---	---	---	---
	01/13/87[SPH]		---	---	---	---	---	---	---	---	---	---	---
	04/22/87[SPH]		---	---	---	---	---	---	---	---	---	---	---
	07/07/87[SPH]		---	---	---	---	---	---	---	---	---	---	---
	10/10/87[SPH]		22.30	---	-9.55	---	---	---	---	---	---	---	---
	02/24/94[SPH]		---	---	---	---	---	---	---	---	---	---	---

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Weiss Associates

Table 1. Ground Water Elevations and Analytic Results - Shell Service Station WIC# 204-2495-0101, 1800 Powell Street, Emeryville, California (continued)

Well ID	Sampling Date	Top-of-Box Elevation (ft msl)	Depth to Water (ft)	Separate-Phase Hydrocarbon Thickness (ft)	Ground Water Elevation (ft msl)	TDS (ppm)	TPH-G	TPH-D	B	T	E	X	MTBE
							← parts per billion (µg/L) →						
	05/16/94SPH		---	1.5	---	---	---	---	---	---	---	---	---
	08/09/94SPH		11.80	2.0	---	---	---	---	---	---	---	---	---
	11/09/94SPH		---	---	---	---	---	---	---	---	---	---	---
	02/22/95SPH		11.40	2.38	---	---	---	---	---	---	---	---	---
	05/02/95SPH		11.83	2.12	---	---	---	---	---	---	---	---	---
	12/08/95		11.92	1.06	---	---	---	---	---	---	---	---	---
	02/29/96		**12.10**	**2.79**	**2.88**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**
S-10	10/26/84	12.58	---	---	---	---	700,000	---	37,000	100,000	20,000	110,000	---
	02/09/85		---	---	---	---	6,500	---	480	700	100	1,800	---
	04/27/85		---	---	---	---	13,000	---	1,300	500	600	3,700	---
	07/06/85		---	---	---	---	14,000	---	1,300	310	270	2,400	---
	10/24/85		---	---	---	---	4,200	---	580	34	4	440	---
	01/03/86		---	---	---	---	1,700	---	360	10	7.8	170	---
	04/11/86SPH		---	0.01	---	---	---	---	---	---	---	---	---
	07/05/86SPH		9.16	0.01	3.42	---	---	---	---	---	---	---	---
	10/18/86SPH		---	0.03	---	---	---	---	---	---	---	---	---
	01/13/87SPH		---	0.03	---	---	---	---	---	---	---	---	---
	04/22/87SPH		---	0.01	---	---	---	---	---	---	---	---	---
	07/07/87SPH		9.41	0.03	3.17	---	---	---	---	---	---	---	---
	10/10/87SPH		7.77	---	4.81	---	---	---	---	---	---	---	---
	02/11/88		6.41	---	6.17	---	1,200	---	470	16	<5	14	---
	05/10/88		9.04	---	3.54	---	1,100	---	100	6	4	19	---
	08/31/88SPH		9.38	0.01	3.20	---	---	---	---	---	---	---	---
	12/03/88SPH		6.89	---	5.69	---	---	---	---	---	---	---	---
	02/16/89		7.34	---	5.24	---	530	---	89	8.5	1.6	4.5	---
	05/28/89		6.60	---	5.98	---	240	---	65	3.8	2.2	8.6	---
	08/10/89		9.09	---	3.49	---	250	---	23	4.1	<1	6.4	---
	11/11/89		6.58	---	6.00	---	320	---	1.6	1.3	1.4	6.2	---
	02/21/94		8.32	---	4.26	---	1,400	---	190	9.9	<2.5	19	---

Table 1. Ground Water Elevations and Analytic Results - Shell Service Station WIC# 204-2495-0101, 1800 Powell Street, Emeryville, California (continued)

Well ID	Sampling Date	Top-of-Box Elevation (ft msl)	Depth to Water (ft)	Separate-Phase Hydrocarbon Thickness (ft)	Ground Water Elevation (ft msl)	TDS (ppm)	TPH-G	TPH-D	B	T	E	X	MTBE
							← parts per billion (µg/L) →						
	05/16/94		8.35	---	4.23	---	300	---	45	8.6	6.2	19	---
	08/08/94		8.66	---	3.92	---	700	---	57	14	<0.5	9.3	---
	11/09/94		6.68	---	5.90	---	640	---	130	2.0	1.6	4.1	---
	02/22/95		9.12	---	3.46	---	500	---	65	5.9	1.0	8.2	---
	05/02/95		9.50	---	3.08	---	530	---	59	2.3	0.8	8.2	---
	08/24/95		10.06	---	2.52	---	350	---	35	4.6	<0.5	6.7	---
	12/08/95		10.08	---	2.50	---	690	---	28	4.6	0.9	8.6	---
	02/29/96		**5.32**	**---**	**7.26**	**---**	**430**	**---**	**32**	**1.8**	**0.5**	**5.8**	**16**
S-12	07/06/85	12.84	8.22	---	---	---	<250	2,200	0.71	<0.5	<0.5	<3.6	---
	11/16/85		---	---	---	---	<250	1,400	18	<2	<2	<5	---
	01/03/86		---	---	---	---	<250	---	24	2	<2	<5	---
	07/05/86		8.27	---	4.57	---	80	---	15	0.7	<0.5	2	---
	10/18/86		---	---	---	---	150	---	12	9	<0.5	3.6	---
	01/13/87		---	---	---	---	120	1,000	3.6	0.8	<0.5	2.9	---
	04/22/87		---	---	---	---	100	820	3.7	3.8	0.8	11	---
	07/07/87		9.5	---	3.34	---	70	---	2.5	0.8	<0.5	2.4	---
	10/10/87		9.9	---	2.94	---	220	2,500	2.1	0.7	<0.5	1.2	---
	02/11/88		9.43	---	3.41	---	110	2,500	0.8	<0.5	<0.5	1.3	---
	05/10/88		8.65	---	4.19	---	140	3,800[d]	0.8	0.8	<0.5	2.5	---
	08/31/88		9.86	---	2.98	---	190	2,600[d]	3	15	0.5	4.5	---
	12/03/88		9.93	---	2.91	---	180	3,900[d]	1.2	1	1	7.7	---
	02/16/89		8.08	---	4.76	---	350[e]	2,100[d]	0.6	<0.5	0.5	5.5	---
	05/28/89		9.08	---	3.76	---	290	2,200	2	1.6	4.4	6	---
	08/10/89		9.35	---	3.49	---	240	720	0.7	<0.5	<0.5	1.1	---
	11/11/89		9.28	---	3.56	---	210[e]	4,100	0.7	0.5	<0.5	3.4	---
	02/21/94		8.22	---	4.62	---	240[f]	2,200[g]	0.7	<0.5	<0.5	3.6	---
	05/16/94		8.92	---	3.92	---	96	2,200	1.5	<0.5	<0.5	2.0	---
	08/08/94		---	---	---	---	110[h]	3,500[i]	<0.5	<0.5	<0.5	<0.5	---
	11/09/94		7.56	---	5.28	---	80	5,400[i]	80	<0.5	<0.5	0.6	---

Table 1. Ground Water Elevations and Analytic Results - Shell Service Station WIC# 204-2495-0101, 1800 Powell Street, Emeryville, California (continued)

Well ID	Sampling Date	Top-of-Box Elevation (ft msl)	Depth to Water (ft)	Separate-Phase Hydrocarbon Thickness (ft)	Ground Water Elevation (ft msl)	TDS (ppm)	TPH-G	TPH-D	B	T	E	X	MTBE
							← parts per billion (µg/L) →						
	02/22/95		7.98	---	4.86	---	110	2,900[i,j]	0.7	<0.5	<0.5	3.7	---
	02/22/95[dup]		7.98	---	4.86	---	110	3,400[i,j]	4.8	7.1	<0.5	2.1	---
	05/02/95		8.44	---	4.40	---	140	2,800	2.4	1.1	0.8	4.3	---
	08/24/95		9.00	---	3.84	---	200	1,600	19	12	5.6	24	---
	12/08/95		9.62	---	3.22	---	170	2,700	2.2	0.7	0.9	3.6	---
	02/29/96		**7.64**	**---**	**5.20**	**---**	**1,700**	**2,200**	**<5.0**	**<5.0**	**<5.0**	**<5.0**	**5,600**
S-13	07/06/85	12.59	9.26	---	---	---	700	3,600	200	<5	<5	45	---
	11/16/85		---	---	---	---	1,900	2,000	700	160	70	340	---
	01/03/86		---	---	---	---	2,800	---	1,400	130	10	500	---
	07/05/86		9.47	---	3.12	---	3,100	---	1,800	60	40	270	---
	10/23/86		---	---	---	---	3,400	---	1,500	28	28	250	---
	01/13/87		---	---	---	---	1,900	900	830	15	<10	99	---
	04/22/87		---	---	---	---	2,900[e]	770[j]	1,100	20	30	140	---
	07/07/87		10.38	---	2.21	---	1,500	---	880	10	6	160	---
	10/10/87		10.78	---	1.81	---	480	2,400	830	15	<0.5	120	---
	02/11/88		10.48	---	2.11	---	1,300	1,300	510	<10	<10	86	---
	05/10/88		9.48	---	3.11	---	1,000	1,300[d]	470	<0.5	<5	50	---
	08/31/88[SPH]		10.74	---	1.85	---	---	---	---	---	---	---	---
	12/03/88		10.3	---	2.29	---	900	2,400[d]	290	4.6	<2.5	20	---
	02/16/89		7.6	---	4.99	---	840[e]	1,200[d]	310	3.5	<2.5	27	---
	05/28/89[c]		10.6	---	1.99	---	2,100	4,600	1,100	19	50	350	---
	08/10/89[c]		10.58	---	2.01	---	900	2,300	230	16	6.9	65	---
	11/11/89		9.84	---	2.75	---	2,800	2,800	200	15	8.6	58	---
	02/21/94		9.26	---	3.33	---	700	1,800[f]	200	<5	<5	45	---
	05/16/94		9.62	---	2.97	---	650	1,700	180	2.5	<2.5	21	---
	08/08/94		10.32	---	2.27	---	470	2,600[i]	12	1.5	0.5	14	---
	11/09/94[a]		---	---	---	---	---	---	---	---	---	---	---
	02/22/95		8.92	---	3.67	---	550	2,400[i,j]	190	4.0	<0.5	17	---
	05/02/95		9.52	---	3.07	---	790	2,100	250	6.9	1.2	22	---

Table 1. Ground Water Elevations and Analytic Results - Shell Service Station WIC# 204-2495-0101, 1800 Powell Street, Emeryville, California (continued)

Well ID	Sampling Date	Top-of-Box Elevation (ft msl)	Depth to Water (ft)	Separate-Phase Hydrocarbon Thickness (ft)	Ground Water Elevation (ft msl)	TDS (ppm)	TPH-G	TPH-D	B	T	E	X	MTBE
							← parts per billion (µg/L) →						
	08/24/95		10.02	---	2.57	---	330	1,500	93	<0.5	<0.5	2.0	---
	12/08/95		10.75	---	1.84	---	440	2,400	110	2.2	0.8	23	---
	02/29/96		**9.02**	**---**	**3.57**	**---**	**560**	**2,500**	**130**	**<5.0**	**<5.0**	**30**	**30**
S-14	11/16/85	12.69	---	---	---	---	<250	400	3	<2	<2	<5	---
	01/03/86		---	---	---	---	<250	---	3	2	<2	<5	---
	04/22/87		---	---	---	---	1,200	18,000	7.4	2.7	15	110	---
	07/07/87		10.32	---	2.37	---	190	---	6.5	0.6	1.9	26	---
	10/10/87		10.77	---	1.92	---	4,900	21,000	7	1.2	<0.5	25	---
	02/11/88		10.4	---	2.29	---	370	12,000[e]	4.6	<2.5	<2.5	26	---
	05/10/88		9.66	---	3.03	---	660	2,200[d]	2.9	<2.5	<2.5	24	---
	08/31/88		10.74	---	1.95	---	700	7,900	3.2	<2.5	<2.5	15	---
	12/03/88		10.69	---	2.00	---	210	11,000[d]	<0.5	<0.5	0.8	6.8	---
	02/16/89		9.69	---	3.00	---	130[e]	5,700[d]	<0.5	<0.5	<0.5	4.4	---
	05/28/89		10.42	---	2.27	---	770	5,200	<0.5	<0.5	<0.5	4.5	---
	08/10/89		10.54	---	2.15	---	920	8,800	<1	<1	1.6	17	---
	11/11/89		9.91	---	2.78	---	710	28,000	20	57	25	69	---
	02/21/94		9.3	---	3.09	---	2,800	3,600	<5	<5	<5	14	---
	02/21/94		9.30	---	3.39	---	2,300[f]	3,600[g]	<5.0	<5	<5	14	---
	05/16/94		9.54	---	3.15	---	310	6,700	<2.5	<2.5	<2.5	3.1	---
	08/08/94		10.29	---	2.4	---	480[k]	2,900	<0.5	0.6	<0.5	0.8	---
	08/08/94[dup]		10.29	---	2.4	---	590[k]	2,900	<0.5	0.6	<0.5	1.5	---
	11/09/94		9.52	---	3.07	---	170[k]	6,400[i]	0.7	<0.5	<0.5	2.7	---
	02/22/95		9.18	---	3.51	---	550	7,000[i,j]	<0.5	<0.5	<0.5	1.6	---
	05/02/95		9.49	---	3.2	---	210	2,300	1.0	0.9	1.1	6.3	---
	05/02/95[dup]		9.49	---	3.2	---	160	2,600	0.6	0.6	0.7	3.8	---
	08/24/95		9.94	---	2.75	---	180	3,700	0.5	<0.5	<0.5	1.3	---
	12/08/95		10.65	---	2.04	---	190	4,900	1.0	<0.5	0.6	4.6	---
	02/29/96		**8.90**	**---**	**3.79**	**---**	**200**	**11,000**	**<0.5**	**<0.5**	**<0.5**	**2.0**	**3.0**

Table 1. Ground Water Elevations and Analytic Results - Shell Service Station WIC# 204-2495-0101, 1800 Powell Street, Emeryville, California (continued)

Well ID	Sampling Date	Top-of-Box Elevation (ft msl)	Depth to Water (ft)	Separate-Phase Hydrocarbon Thickness * (ft)	Ground Water Elevation (ft msl)	TDS (ppm)	TPH-G	TPH-D	B	T	E	X	MTBE
							←			parts per billion (µg/L)			→
Trip Blank	02/21/94		---	---	---	---	<50	---	<0.5	<0.5	<0.5	<0.5	---
	02/24/94		---	---	---	---	<50	---	<0.5	<0.5	<0.5	<0.5	---
	05/16/94		---	---	---	---	<50	---	<0.5	<0.5	<0.5	<0.5	---
	08/08/94		---	---	---	---	<50	---	<0.5	<0.5	<0.5	<0.5	---
	11/09/94		---	---	---	---	<50	---	<0.5	<0.5	<0.5	<0.5	---
	02/22/95		---	---	---	---	<50	---	<0.5	<0.5	<0.5	<0.5	---
	05/02/95		---	---	---	---	<50	---	<0.5	0.9	<0.5	<0.5	---
	05/10/95		---	---	---	---	<50	---	<0.5	<0.5	<0.5	<0.5	---
	12/08/95		---	---	---	---	<50	---	<0.5	<0.5	<0.5	<0.5	---
DHS MCLs				---		---	NE	NE	1	100[c]	680	1,750	NE

Abbreviations:

ft msl = Feet above mean sea level
TPH-G = Total petroleum hydrocarbons as gasoline by Modified EPA Method 8015
TPH-D = Total petroleum hydrocarbons as diesel by Modified EPA Method 8015
B = Benzene by EPA Method 8020
T = Toluene by EPA Method 8020
E = Ethylbenzene by EPA Method 8020
X = Xylenes by EPA Method 8020
MTBE = Methyl tertiary butyl ether by EPA Method 8020
DHS MCLs = California Department of Health Services maximum contaminant levels for drinking water
NE = Not established
<n = Not detected at a detection limit of n ppb
dup = Duplicate sample
SPH = Separate-phase hydrocarbons present, often unable to measure thickness accurately
--- = Not analyzed/not measured

Notes:

a = Well inaccessible
b = Well abandoned on 11/09/85
c = DHS recommended action level; MCL not established
d = Compounds detected within the chromatographic range appear to be weathered diesel
e = Compounds detected within the chromatographic range of gasoline but not characteristic of the standard gasoline pattern.
f = The concentrations reported as gasoline for samples S-12 and S-14 are primarily due to the presence of a discrete peak
g = The concentrations reported as diesel for samples S-12, S-13 and S-14 are due to the presence of a combination of diesel and a heavier petroleum product of hydrocarbon range C18 - C36, possibly motor oil
h = The result for gasoline is an unknown hydrocarbon which consists of several peaks
i = The positive result appears to be a heavier hydrocarbon than diesel
j = Compounds detected within the chromatographic range of diesel appears to include gasoline compounds.
k = The positive result appears to be a heavier hydrocarbon than gasoline

ATTACHMENT B

STANDARD FIELD PROCEDURES

WA has developed standard procedures for drilling and sampling soil borings and installing, developing and sampling ground water monitoring wells. These procedures comply with Federal, State and local regulatory guidelines. Specific procedures are summarized below.

Soil Boring and Sampling

Objectives/Supervision

Soil sampling objectives include characterizing subsurface lithology, assessing whether the soils exhibit obvious hydrocarbon or other compound vapor or staining, and collecting samples for analysis at a State-certified laboratory. All borings are logged using the Unified Soil Classification System by a trained geologist working under the supervision of a California Registered Geologist (RG) or a Certified Engineering Geologist (CEG).

Soil Boring and Sampling

Deep soil borings or borings for well installation are typically drilled using hollow-stem augers. Split-barrel samplers lined with steam-cleaned brass or stainless steel tubes are driven through the hollow auger stem into undisturbed sediments at the bottom of the borehole using a 140 pound hammer dropped 30 inches. Soil samples can also be collected without using hollow-stem augers by progressively driving split-barrel soil samplers to depths of up to 30 ft.

Soil samples are collected at least every five ft to characterize the subsurface sediments and for possible chemical analysis. Near the water table and at lithologic changes, the sampling interval may be less than five ft.

Drilling and sampling equipment is steam-cleaned prior to drilling and between borings to prevent cross-contamination. Sampling equipment is washed between samples with trisodium phosphate or an equivalent EPA-approved detergent.

Sample Analysis

After noting the lithology at each end of the sampling tubes, the tube chosen for analysis is immediately trimmed of excess soil and capped with Teflon tape and plastic end caps. The sample is labeled, stored in crushed ice at or below 4°C, and transported under chain-of-custody to a State-certified analytic laboratory.

Screening

One of the remaining tubes is partially emptied leaving about one-third of the soil in the tube. The tube is capped with plastic end caps and set aside to allow hydrocarbons to volatile from the soil. After ten to fifteen minutes, a portable photoionization detector (PID) measures volatile hydrocarbon vapor concentrations in the tube headspace, extracting the vapor through a slit in the cap. PID measurements are used along with the stratigraphy and ground water depth to select soil samples for analysis.

Grouting

If the borings are not completed as wells, the borings are filled to the ground surface with cement grout poured or pumped through a tremie pipe. If wells are completed in the borings, the well installation, development and sampling procedures summarized below are followed.

ATTACHMENT C

BORING LOGS

WEISS ASSOCIATES

BOREHOLE / WELL CONSTRUCTION LOG

Project: (facility, address, city, state) Shell powell St	Borehole/Well No: B-1
	Job No: 81-0794-205
Logged By: R. Devany	Edited By:
Project Manager: T. Fojut	Drill Rig:
Drilling Contractor: (name, city, state) Greggs - Martinez CA	
Driller:	License # : C57-
Drilling Method: Geoprobe	Sample Method: Core
Well Head Completion: NA	Ground Surface Elevation:
Hammer Weight/Drop: NA	Borehole Diameter:
Started, Time: 10:30	Date: 5/20/96
Completed, Time: 11:30	Date: 5/20/96

BOREHOLE LOCATION

Approximate Scale:

Notes:

Water Depth						
Boring/Casing Depth						
Time						
Date						

Total Boring Depth:	Total Well Depth:
Screened Interval:	Well Diameter:
Sand Pack (Type and Interval):	
Well Development Method:	
Time: Date: Flow Rate:	
Geophysical Logs, Type:	
By: Date:	

Sample ID	PID / FID (ppm)	Sampler Type / depth	Blows per 6 Inches	Inches Driven	Inches Recovered	Sample Condition	Boring Diameter	Conductor Casing(s) Interval and Diameter	Sand / Grout	Well Casing / Screen	Depth In Feet	LITHOLOGIC DESCRIPTIONS
		GP 0									0	CLAYEY SILT (ML) DK. Brown (7.5YR 4/2) Med stiff, Dry to damp, 10% vf-m sand, 0-5% SA pebbles to ½ in, low est K, styrofoam.
											1	
B1-2											2	Silty to gravelly Clay (CH) Black (7.5YR 2/0) very stiff, damp, 5-20% vf-mg sand 5-25% angular to sub angular pebble to 1 inch, low to very Crack, 1"+ ϕ concrete block in stad
											3	
		GP 4		48	35	G					4	
											5	Silty Clay (CH) lt brownish gray w/ lt gray + blk mottling (2.5Y 6/2) med stiff, damp, low est K
											6	gravelly Clay (CH) as above except softer (stiff)
B1-7											7	
		GP 8		48	13						8	
											9	Sandy silt (ML) Blk (7.5YR 2/0) w/ gray green mottling, soft to med stiff, wet, 10%-20 vf-mg sand
B1-10											10	

WEISS ASSOCIATES

BOREHOLE / WELL CONSTRUCTION LOG (cont.)

Project / Job No.: 81 0794 - 205

Borehole/Well No.: SB-1

Notes:

ID	PID/FID	Sampler Type	Blows / 6 Inches	Inches Driven	Inches Recov'd	Sample Cond.	Boring Diameter	Conduct. Casing	Sand / Grout	Well Casing	Depth (ft)	Recovery	Contact	Notes
											1			
											2		∇	5/20/96 11:45
31-13											3			
											4			Silty Sand (SM) gray green to black (5Y 5/1 to 7.5YR 2/0) dense, wet, 20-30 silt, modest K (hydrocbn odor at 14 ft.)
											5			Silt (ML) to clayey silt gray green to black (5Y 5/1 to 7.5YR 2/0) soft, non plastic - mod plast, modest K (hydrocarbon odor)
31-15											6			
											7			
											8			
											9			
											0			
											1			
											2			
											3			
											4			
											5			
											6			
											7			
											8			
											9			
											0			

WEISS ASSOCIATES

BOREHOLE / WELL CONSTRUCTION LOG

BOREHOLE LOCATION

Approximate Scale:

Notes:

Project: (facility, address, city, state) Shell - Powell St	Borehole/Well No: B-2
	Job No: 81-0794-205
Logged By: R Devany	Edited By:
Project Manager: T. Fojut	Drill Rig:
Drilling Contractor: (name, city, state) Gregs	
Driller:	License # : C57-
Drilling Method: geoprobe	Sample Method:
Well Head Completion:	Ground Surface Elevation:
Hammer Weight/Drop:	Borehole Diameter:
Started, Time:	Date:
Completed, Time:	Date:

Water Depth						
Boring/Casing Depth						
Time						
Date						

Total Boring Depth:	Total Well Depth:
Screened Interval:	Well Diameter:
Sand Pack (Type and Interval):	
Well Development Method: Time: Date: Flow Rate:	
Geophysical Logs, Type: By: Date:	

Sample ID	PID / FID (ppm)	Sampler Type / depth	Blows per 6 Inches	Inches Driven	Inches Recovered	Sample Condition	Boring Diameter	Conductor Casing(s) Interval and Diameter	Sand / Grout	Well Casing / Screen	Depth in Feet	Recovery / Sample Loc.	Contact / Hyd. Conduct.	LITHOLOGIC DESCRIPTIONS
		GP 0		48	36	G								Gray Silt (ML) Dk brn (7.5YR 4/2), med stiff, dry to damp, 5-10% pebbles to ½ in bricks, debris. (Fill)
											1			
B2-2														
											2			
											3			
											4			
		GP 4		48	33	F								
											5			
											6			
											7			← 3-4 in sandy gravel layer - lt gray
B2-7.5														
											8			
		GP 8		48	32	F								
											9			
											10			

Project / Job No.: 81-0794-205
Borehole/Well No.: B-2
Notes:

Sample ID	PID/FID	Sampler Type	Blows / 6 Inches	Inches Driven	Inches Recov'd	Sample Cond.	Boring Diameter	Conduct. Casing	Sand / Grout	Well Casing	Depth (ft)	Recovery	Contact	Description
B2-11											11			Clayey Silt (MH) green-gray (5Y 5/1) soft, damp to moist, 0-5% vf-mg sand lowest K
		GP 12		6	6						12			← refusal at 12.5 ft
											3			
											4			
											5			
											6			
											7			
											8			
											9			
											0			
											1			
											2			
											3			
											4			
											5			
											6			
											7			
											8			
											9			
											0			

WEISS ASSOCIATES

BOREHOLE / WELL CONSTRUCTION LOG

BOREHOLE LOCATION	
Project: (facility, address, city, state)	
Borehole/Well No:	B-3
Job No:	81-0794-205
Logged By:	R. Devany
Edited By:	
Project Manager:	T. Fogut
Drill Rig:	
Drilling Contractor: (name, city, state)	Gregg Martinez CA
Driller:	
License # :	C57-
Drilling Method:	Geoprobe
Sample Method:	core
Well Head Completion:	NA
Ground Surface Elevation:	
Hammer Weight/Drop:	NA
Borehole Diameter:	
Started, Time:	12:45
Date:	5/20
Completed, Time:	1315
Date:	
Water Depth	
Boring/Casing Depth	
Time	
Date	
Approximate Scale:	
Notes:	
Total Boring Depth:	
Total Well Depth:	
Screened Interval:	
Well Diameter:	
Sand Pack (Type and Interval):	
Well Development Method:	
Time: / Date: / Flow Rate:	
Geophysical Logs, Type:	
By: / Date:	

Sample ID	PID / FID (ppm)	Sampler Type / depth	Blows per 6 Inches	Inches Driven	Inches Recovered	Sample Condition	Boring Diameter	Conductor Casing(s) Interval and Diameter	Sand / Grout	Well Casing / Screen	Depth in Feet	Recovery / Sample Loc.	Contact / Hyd. Conduct.	LITHOLOGIC DESCRIPTIONS
C		GP 0		48	42						0–1			Clayey Silt (ML/MH) red Brown (10YR 4/3) to very dk gray (10YR 3/1), soft to med stiff, 5-20% vf-mg sand, 5-10% pebbles to 1 in, low est K, occasional Bricks fragment
											2			
B3-3.5											3			
		GP 4		48	32						4			Sandy Gravel (GW) 2.5Y 7/0 Light grey dense? dry, 30% - 40% sand, very Fine - Medium Coarse sand angular - subangular pebbles up to Two inches, High K (concrete?)
		6									5			Clayey silt (ML) dark greyish Br. (2.5YR 4/0) med. stiff 5% V Fine sand, Low K.
											6			
B3-6.5											7			
		GP 8		30	24						8			as described in section at 4' (concrete?)
											9			
											10			

WEISS ASSOCIATES

BOREHOLE / WELL CONSTRUCTION LOG (cont.)

Project / Job No.:

Borehole/Well No.: B-3

Notes:

Sample ID	PID/FID	Sampler Type	Blows / 6 Inches	Inches Driven	Inches Recov'd	Sample Cond.	Boring Diameter	Conduct. Casing	Sand / Grout	Well Casing	Depth (ft)	Recovery	Contact	
B3-10.5														Refusal at 10.5 ft
											1			
											2			
											3			
											4			
											5			
											6			
											7			
											8			
											9			
											0			
											1			
											2			
											3			
											4			
											5			
											6			
											7			
											8			
											9			

WEISS ASSOCIATES

BOREHOLE / WELL CONSTRUCTION LOG

BOREHOLE LOCATION	
Project: (facility, address, city, state)	Borehole/Well No: B-4
	Job No: 81-0794-01
Logged By: Yi-Ran Wu	Edited By:
Project Manager: T. Fojut	Drill Rig:
Drilling Contractor: (name, city, state) Gregg Drilling	
Driller:	License # : C57-
Drilling Method: Geoprobe	Sample Method: Core
Well Head Completion: NA	Ground Surface Elevation:
Hammer Weight/Drop: NA	Borehole Diameter:
Started, Time: 13:25	Date: 5/20
Completed, Time: 13:55	Date:

Approximate Scale:

Notes:

Water Depth						
Boring/Casing Depth						
Time						
Date						

Total Boring Depth:	Total Well Depth:
Screened Interval:	Well Diameter:
Sand Pack (Type and Interval):	
Well Development Method:	
Time: Date: Flow Rate:	
Geophysical Logs, Type:	
By: Date:	

Sample ID	PID / FID (ppm)	Sampler Type / depth	Blows per 6 Inches	Inches Driven	Inches Recovered	Sample Condition	Boring Diameter	Conductor Casing(s) Interval and Diameter	Sand / Grout	Well Casing / Screen	Depth in Feet	Recovery / Sample Loc.	Contact / Hyd. Conduct.	LITHOLOGIC DESCRIPTIONS
											0			Clayey silt (ML) very dark greyish Brown – Black 7.5y 2/0 & 10yr 3/2 Subangular – angular pebbles to 1" damp, Low K
											1			
B4-4											2			
											3			
											4			
											5			
B4-6.5											6			
											7			
											8			(concrete?) Clayey silt (ML) very dark greyish Brown (10yr 3/2) TO Black (7.5yr 2/0) Low K, damp
											9			hits refusal at 9' cement in the Shoe
											10			

WEISS ASSOCIATES

BOREHOLE / WELL CONSTRUCTION LOG

BOREHOLE LOCATION	Project: (facility, address, city, state)		Borehole/Well No: B5
			Job No: 81-0794-01
	Logged By: Yi-Ran Wu		Edited By:
	Project Manager: T. Fojut		Drill Rig:
	Drilling Contractor: (name, city, state) Gregg Drilling		
	Driller:		License #.: C57-
	Drilling Method: Geoprobe		Sample Method: Core
	Well Head Completion: NA		Ground Surface Elevation:
	Hammer Weight/Drop: NA		Borehole Diameter:
	Started, Time: 14:00		Date:
	Completed, Time: 14:30		Date:
Approximate Scale:	Water Depth		
Notes:	Boring/Casing Depth		
	Time		
	Date		

Total Boring Depth:	Total Well Depth:
Screened Interval:	Well Diameter:
Sand Pack (Type and Interval):	
Well Development Method: Time: Date: Flow Rate:	
Geophysical Logs, Type: By: Date:	

Sample ID	PID / FID (ppm)	Sampler Type / depth	Blows per 6 Inches	Inches Driven	Inches Recovered	Sample Condition	Boring Diameter	Conductor Casing(s) Interval and Diameter	Sand / Grout	Well Casing / Screen	Depth in Feet	Recovery / Sample Loc.	Contact / Hyd. Conduct.	LITHOLOGIC DESCRIPTIONS
														Clayey Silt (ML) very dark grey (10YR 3/1) damp, LOW K, Subangular - angular pebbles up to 1"
														6" reddish yellow Brick lense
											1			
											2			
S B5-3														
											3			
											4			Clayey Silt (ML) Very dark grey (10R 3/1) dry to damp subangular - angular pebbles up to 2" (concrete?) on Top & Bottom of core. 10% - 30% SAND, LOW K
											5			
											6			
											7			hit refusal at 7'
											8			
											9			
											10			

WEISS ASSOCIATES

BOREHOLE / WELL CONSTRUCTION LOG

BOREHOLE LOCATION	Project: (facility, address, city, state)	Borehole/Well No: B6
		Job No: 81-0794-01
	Logged By: Yi-Ran Wu	Edited By:
	Project Manager: T. Fojut	Drill Rig:
	Drilling Contractor: (name, city, state) Gregg Drilling	
	Driller:	License # : C57-
	Drilling Method: Geoprobe	Sample Method: Core
	Well Head Completion: NA	Ground Surface Elevation:
	Hammer Weight/Drop: NA	Borehole Diameter:
	Started, Time: 14:30	Date:
	Completed, Time: 15:00	Date:
Approximate Scale:	Water Depth	
	Boring/Casing Depth	
Notes:	Time	
	Date	

Total Boring Depth:	Total Well Depth:
Screened Interval:	Well Diameter:
Sand Pack (Type and Interval):	
Well Development Method:	
Time: Date:	Flow Rate:
Geophysical Logs, Type:	
By:	Date:

Sample ID	PID / FID (ppm)	Sampler Type / depth	Blows per 6 Inches	Inches Driven	Inches Recovered	Sample Condition	Boring Diameter	Conductor Casing(s) Interval and Diameter	Sand / Grout	Well Casing / Screen	Depth in Feet	Recovery / Sample Loc.	Contact / Hyd. Conduct.	LITHOLOGIC DESCRIPTIONS
B6-3.5											0			Clayey Silt (ML) Very dark grey (10R 3/1) to Black, low k, damp
											1			
											2			
											3			
B6-6.5											4			
											5			
											6			
											7			
B6-11											8			Same as above description with a few exceptions: High moisture content, with increasing silt content
											9			
											10			

WEISS ASSOCIATES

BOREHOLE / WELL CONSTRUCTION LOG (cont.)

Project / Job No.:

Borehole/Well No.: B-6

Notes:

Sample ID	PID/FID	Sampler Type	Blows / 6 Inches	Inches Driven	Inches Recov'd	Sample Cond.	Boring Diameter	Conduct. Casing	Sand / Grout	Well Casing	Depth (ft)	Recovery	Contact
											1		
											2		
											3		
											4		
											5		
											6		
											7		
											8		
											9		
											0		
											1		
											2		
											3		
											4		
											5		
											6		
											7		
											8		
											9		

ATTACHMENT D

SOIL AND GROUND WATER ANALYTIC REPORT AND CHAIN-OF-CUSTODY FORM

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
404 N. Wiget Lane, Walnut Creek, CA 94598, (510) 988-9600, FAX (510) 988-9673
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Weiss Associates
5500 Shellmound
Emeryville, CA 94608
Attention: Yi-Ran Wu

Project: Shell 1800 Powell St.

Enclosed are the results from samples received at Sequoia Analytical on May 22, 1996. The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION		DATE COLLECTED	TEST METHOD
9605H09 -01	SOLID,	B1-2.0	05/20/96	TPHGBS Purgeable TPH/BTEX
9605H09 -02	SOLID,	B1-7.0	05/20/96	8080 Organochlorine Pest
9605H09 -02	SOLID,	B1-7.0	05/20/96	8240 Volatile Organic Co
9605H09 -02	SOLID,	B1-7.0	05/20/96	8270 SemiVolatile Organi
9605H09 -02	SOLID,	B1-7.0	05/20/96	ITTLCS Title 22: Metals, T
9605H09 -02	SOLID,	B1-7.0	05/20/96	TPHGBS Purgeable TPH/BTEX
9605H09 -03	SOLID,	B1-13.0	05/20/96	TRPH (SM 5520 E&F Mod.)
9605H09 -03	SOLID,	B1-13.0	05/20/96	TPHFFS Fuel Fingerprint
9605H09 -03	SOLID,	B1-13.0	05/20/96	TPHGBS Purgeable TPH/BTEX
9605H09 -04	SOLID,	B1-15.0	05/20/96	TRPH (SM 5520 E&F Mod.)
9605H09 -04	SOLID,	B1-15.0	05/20/96	TPHFFS Fuel Fingerprint
9605H09 -04	SOLID,	B1-15.0	05/20/96	TPHGBS Purgeable TPH/BTEX
9605H09 -05	SOLID,	B2-2.0	05/20/96	TPHGBS Purgeable TPH/BTEX

SEQUOIA ANALYTICAL

Sequoia Analytical

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SAMPLE #	SAMPLE DESCRIPTION		DATE COLLECTED	TEST METHOD
9605H09 -06	SOLID,	B2-7.5	05/20/96	TPHGBS Purgeable TPH/BTEX
9605H09 -07	SOLID,	B2-11.0	05/20/96	TRPH (SM 5520 E&F Mod.)
9605H09 -07	SOLID,	B2-11.0	05/20/96	TPHFFS Fuel Fingerprint
9605H09 -07	SOLID,	B2-11.0	05/20/96	TPHGBS Purgeable TPH/BTEX

Please contact me if you have any questions. In the meantime, thank you for the opportunity to work with you on this project.

Very truly yours,

SEQUOIA ANALYTICAL

Mike Gregory
Project Manager

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
404 N. Wiget Lane, Walnut Creek, CA 94598, (510) 988-9600, FAX (510) 988-9673
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Weiss Associates	Client Proj. ID: Shell 1800 Powell St.	Sampled: 05/20/96
5500 Shellmound	Sample Descript: B1-2.0	Received: 05/22/96
Emeryville, CA 94608	Matrix: SOLID	Extracted: 05/29/96
	Analysis Method: 8015Mod/8020	Analyzed: 05/29/96
Attention: Yi-Ran Wu	Lab Number: 9605H09-01	Reported: 06/07/96

QC Batch Number: GC052996BTEXEXA
Instrument ID: GCHP6

Total Purgeable Petroleum Hydrocarbons (TPPH) with BTEX

Analyte	Detection Limit mg/Kg	Sample Results mg/Kg
TPPH as Gas	1.0	N.D.
Benzene	0.0050	N.D.
Toluene	0.0050	N.D.
Ethyl Benzene	0.0050	N.D.
Xylenes (Total)	0.0050	N.D.
Chromatogram Pattern:		

Surrogates	Control Limits %		% Recovery
Trifluorotoluene	70	130	105

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Mike Gregory
Project Manager

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
404 N. Wiget Lane, Walnut Creek, CA 94598, (510) 988-9600, FAX (510) 988-9673
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Weiss Associates	Client Proj. ID: Shell 1800 Powell St.	Sampled: 05/20/96
5500 Shellmound	Sample Descript: B1-7.0	Received: 05/22/96
Emeryville, CA 94608	Matrix: SOLID	Extracted: 05/28/96
	Analysis Method: EPA 8080,R-1	Analyzed: 06/06/96
Attention: Yi-Ran Wu	Lab Number: 9605H09-02	Reported: 06/07/96

QC Batch Number: GC0528968080EXA
Instrument ID: GCHP10

Organochlorine Pesticides and PCBs by EPA 8080 (Modified)

Analyte	Detection Limit ug/Kg	Sample Results ug/Kg
Aldrin	5.0	N.D.
alpha-BHC	5.0	N.D.
beta-BHC	5.0	N.D.
delta-BHC	5.0	N.D.
gamma-BHC (Lindane)	5.0	N.D.
Chlordane	100	N.D.
4,4'-DDD	30	N.D.
4,4'-DDE	10	N.D.
4,4'-DDT	30	N.D.
Dieldrin	10	N.D.
Endosulfan I	10	N.D.
Endosulfan II	10	N.D.
Endosulfan sulfate	30	N.D.
Endrin	10	N.D.
Endrin aldehyde	30	N.D.
Heptachlor	5.0	N.D.
Heptachlor epoxide	5.0	N.D.
Methoxychlor	100	N.D.
Toxaphene	400	N.D.
PCB-1016	100	N.D.
PCB-1221	400	N.D.
PCB-1232	100	N.D.
PCB-1242	100	N.D.
PCB-1248	100	N.D.
PCB-1254	100	N.D.
PCB-1260	100	N.D.

Surrogates	Control Limits %		% Recovery
Dibutylchlorendate	30	150	71
Tetrachloro-m-xylene	30	150	61

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Mike Gregory
Project Manager

Sequoia Analytical

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819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Weiss Associates 5500 Shellmound Emeryville, CA 94608 Attention: Yi-Ran Wu	Client Proj. ID: Shell 1800 Powell St. Sample Descript: B1-7.0 Matrix: SOLID Analysis Method: EPA 8240 Lab Number: 9605H09-02	Sampled: 05/20/96 Received: 05/22/96 Extracted: 05/29/96 Analyzed: 05/29/96 Reported: 06/07/96

QC Batch Number: MS0529968240EXA
Instrument ID: F2

Volatile Organics (EPA 8240)

Analyte	Detection Limit ug/Kg	Sample Results ug/Kg
Acetone	500	N.D.
Benzene	100	N.D.
Bromodichloromethane	100	N.D.
Bromoform	100	N.D.
Bromomethane	100	N.D.
2-Butanone	500	N.D.
Carbon disulfide	100	N.D.
Carbon tetrachloride	100	N.D.
Chlorobenzene	100	N.D.
Chloroethane	100	N.D.
2-Chloroethyl vinyl ether	500	N.D.
Chloroform	100	N.D.
Chloromethane	100	N.D.
Dibromochloromethane	100	N.D.
1,1-Dichloroethane	100	N.D.
1,2-Dichloroethane	100	N.D.
1,1-Dichloroethene	100	N.D.
cis-1,2-Dichloroethene	100	N.D.
trans-1,2-Dichloroethene	100	N.D.
1,2-Dichloropropane	100	N.D.
cis-1,3-Dichloropropene	100	N.D.
trans-1,3-Dichloropropene	100	N.D.
Ethylbenzene	100	N.D.
2-Hexanone	500	N.D.
Methylene chloride	250	N.D.
4-Methyl-2-pentanone	500	N.D.
Styrene	100	N.D.
1,1,2,2-Tetrachloroethane	100	N.D.
Tetrachloroethene	100	N.D.
Toluene	100	N.D.
1,1,1-Trichloroethane	100	N.D.
1,1,2-Trichloroethane	100	N.D.
Trichloroethene	100	N.D.
Trichlorofluoromethane	100	N.D.
Vinyl acetate	250	N.D.
Vinyl chloride	100	N.D.

SEQUOIA ANALYTICAL

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
404 N. Wiget Lane, Walnut Creek, CA 94598, (510) 988-9600, FAX (510) 988-9673
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Weiss Associates	Client Proj. ID: Shell 1800 Powell St.	Sampled: 05/20/96
5500 Shellmound	Sample Descript: B1-7.0	Received: 05/22/96
Emeryville, CA 94608	Matrix: SOLID	Extracted: 05/29/96
	Analysis Method: EPA 8240	Analyzed: 05/29/96
Attention: Yi-Ran Wu	Lab Number: 9605H09-02	Reported: 06/07/96

QC Batch Number: MS0529968240EXA
Instrument ID: F2

Analyte	Detection Limit ug/Kg		Sample Results ug/Kg
Total Xylenes	100		N.D.
Surrogates	**Control Limits %**		**% Recovery**
1,2-Dichloroethane-d4	70	121	104
Toluene-d8	81	117	103
4-Bromofluorobenzene	74	121	105

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Mike Gregory
Project Manager

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Weiss Associates
5500 Shellmound
Emeryville, CA 94608

Attention: Yi-Ran Wu

Client Proj. ID: Shell 1800 Powell St.
Sample Descript: B1-7.0
Matrix: SOLID
Analysis Method: EPA 8270
Lab Number: 9605H09-02

Sampled: 05/20/96
Received: 05/22/96
Extracted: 05/29/96
Analyzed: 05/29/96
Reported: 06/07/96

QC Batch Number: MS0523968270EXA
Instrument ID: H5

Semivolatile Organics (EPA 8270)

Analyte	Detection Limit ug/Kg	Sample Results ug/Kg
Acenaphthene	250	N.D.
Acenaphthylene	250	N.D.
Anthracene	250	N.D.
Benzoic Acid	500	N.D.
Benzo(a)anthracene	250	N.D.
Benzo(b)fluoranthene	250	N.D.
Benzo(k)fluoranthene	250	N.D.
Benzo(g,h,i)perylene	250	N.D.
Benzo(a)pyrene	250	N.D.
Benzyl alcohol	250	N.D.
Bis(2-chloroethoxy)methane	250	N.D.
Bis(2-chloroethyl)ether	250	N.D.
Bis(2-chloroisopropyl)ether	250	N.D.
Bis(2-ethylhexyl)phthalate	500	N.D.
4-Bromophenyl phenyl ether	250	N.D.
Butyl benzyl phthalate	250	N.D.
4-Chloroaniline	500	N.D.
2-Chloronaphthalene	250	N.D.
4-Chloro-3-methylphenol	250	N.D.
2-Chlorophenol	250	N.D.
4-Chlorophenyl phenyl ether	250	N.D.
Chrysene	250	N.D.
Dibenzo(a,h)anthracene	250	N.D.
Dibenzofuran	250	N.D.
Di-n-butyl phthalate	500	N.D.
1,2-Dichlorobenzene	250	N.D.
1,3-Dichlorobenzene	250	N.D.
1,4-Dichlorobenzene	250	N.D.
3,3-Dichlorobenzidine	500	N.D.
2,4-Dichlorophenol	250	N.D.
Diethyl phthalate	250	N.D.
2,4-Dimethylphenol	250	N.D.
Dimethyl phthalate	250	N.D.
4,6-Dinitro-2-methylphenol	500	N.D.
2,4-Dinitrophenol	500	N.D.
2,4-Dinitrotoluene	250	N.D.

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Weiss Associates 5500 Shellmound Emeryville, CA 94608 Attention: Yi-Ran Wu	Client Proj. ID: Shell 1800 Powell St. Sample Descript: B1-7.0 Matrix: SOLID Analysis Method: EPA 8270 Lab Number: 9605H09-02	Sampled: 05/20/96 Received: 05/22/96 Extracted: 05/29/96 Analyzed: 05/29/96 Reported: 06/07/96

QC Batch Number: MS0523968270EXA
Instrument ID: H5

Analyte	Detection Limit ug/Kg	Sample Results ug/Kg
2,6-Dinitrotoluene	250	N.D.
Di-n-octyl phthalate	250	N.D.
Fluoranthene	250	N.D.
Fluorene	250	N.D.
Hexachlorobenzene	250	N.D.
Hexachlorobutadiene	250	N.D.
Hexachlorocyclopentadiene	500	N.D.
Hexachloroethane	250	N.D.
Indeno(1,2,3-cd)pyrene	250	N.D.
Isophorone	250	N.D.
2-Methylnaphthalene	250	N.D.
2-Methylphenol	250	N.D.
4-Methylphenol	250	N.D.
Naphthalene	250	N.D.
2-Nitroaniline	500	N.D.
3-Nitroaniline	500	N.D.
4-Nitroaniline	500	N.D.
Nitrobenzene	250	N.D.
2-Nitrophenol	250	N.D.
4-Nitrophenol	500	N.D.
N-Nitrosodiphenylamine	250	N.D.
N-Nitroso-di-n-propylamine	250	N.D.
Pentachlorophenol	500	N.D.
Phenanthrene	250	N.D.
Phenol	**250**	**1900**
Pyrene	250	N.D.
1,2,4-Trichlorobenzene	250	N.D.
2,4,5-Trichlorophenol	500	N.D.
2,4,6-Trichlorophenol	250	N.D.

Surrogates	Control Limits %		% Recovery
2-Fluorophenol	25	121	57
Phenol-d5	24	113	68
Nitrobenzene-d5	23	120	51
2-Fluorobiphenyl	30	115	62
2,4,6-Tribromophenol	19	122	49
p-Terphenyl-d14	18	137	68

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Mike Gregory
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Weiss Associates 5500 Shellmound Emeryville, CA 94608 Attention: Yi-Ran Wu	Client Proj. ID: Shell 1800 Powell St. Sample Descript: B1-7.0 Matrix: SOLID Analysis Method: Title 22 Lab Number: 9605H09-02	Sampled: 05/20/96 Received: 05/22/96 Extracted: 05/29/96 Analyzed: 05/30/96 Reported: 06/07/96

QC Batch Number: ME0529966010MDF
Instrument ID: MTJA-2

Inorganic Persistent and Bioaccumulative Toxic Substances : TTLC

Analyte	Max. Limit mg/Kg	Detection Limit mg/Kg	Sample Results mg/Kg
Antimony, Sb	**500**	**5.0**	**10**
Arsenic, As	500	5.0	N.D.
Barium, Ba	**10000**	**5.0**	**180**
Beryllium, Be	75	0.50	N.D.
Cadmium, Cd	100	0.50	N.D.
Chromium, Cr	**2500**	**0.50**	**44**
Cobalt, Co	**8000**	**2.5**	**9.5**
Copper, Cu	**2500**	**0.50**	**44**
Lead, Pb	**1000**	**5.0**	**37**
Mercury, Hg	**20**	**0.020**	**0.079**
Molybdenum, Mo	3500	2.5	N.D.
Nickel, Ni	**2000**	**2.5**	**45**
Selenium, Se	100	5.0	N.D.
Silver, Ag	500	0.50	N.D.
Thallium, Tl	**700**	**5.0**	**12**
Vanadium, V	**2400**	**2.5**	**30**
Zinc, Zn	**5000**	**0.50**	**88**

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Mike Gregory
Project Manager

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Weiss Associates 5500 Shellmound Emeryville, CA 94608 Attention: Yi-Ran Wu	Client Proj. ID: Shell 1800 Powell St. Sample Descript: B1-7.0 Matrix: SOLID Analysis Method: 8015Mod/8020 Lab Number: 9605H09-02	Sampled: 05/20/96 Received: 05/22/96 Extracted: 05/29/96 Analyzed: 05/29/96 Reported: 06/07/96

QC Batch Number: GC052996BTEXEXA
Instrument ID: GCHP6

Total Purgeable Petroleum Hydrocarbons (TPPH) with BTEX

Analyte	Detection Limit mg/Kg	Sample Results mg/Kg
TPPH as Gas	1.0	N.D.
Benzene	0.0050	N.D.
Toluene	0.0050	N.D.
Ethyl Benzene	0.0050	N.D.
Xylenes (Total)	0.0050	N.D.
Chromatogram Pattern:		

Surrogates	Control Limits %		% Recovery
Trifluorotoluene	70	130	102

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

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Weiss Associates	Client Proj. ID: Shell 1800 Powell St.	Sampled: 05/20/96
5500 Shellmound	Sample Descript: B1-13.0	Received: 05/22/96
Emeryville, CA 94608	Matrix: SOLID	Extracted: 05/28/96
	Analysis Method: EPA 8015 Mod	Analyzed: 05/29/96
Attention: Yi-Ran Wu	Lab Number: 9605H09-03	Reported: 06/07/96

QC Batch Number: GC0528960HBPEXB
Instrument ID: GCHP5A

Fuel Fingerprint

Analyte	Detection Limit mg/Kg	Sample Results mg/Kg
Extractable Hydrocarbons	**4.0**	**160**
Chromatogram Pattern:		**C9-C40**

Surrogates	Control Limits %		% Recovery
n-Pentacosane (C25)	50	150	173 Q

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

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Weiss Associates	Client Proj. ID: Shell 1800 Powell St.	Sampled: 05/20/96
5500 Shellmound	Sample Descript: B1-13.0	Received: 05/22/96
Emeryville, CA 94608	Matrix: SOLID	Extracted: 05/29/96
	Analysis Method: 8015Mod/8020	Analyzed: 05/29/96
Attention: Yi-Ran Wu	Lab Number: 9605H09-03	Reported: 06/07/96

QC Batch Number: GC052996BTEXEXA
Instrument ID: GCHP6

Total Purgeable Petroleum Hydrocarbons (TPPH) with BTEX

Analyte	Detection Limit mg/Kg	Sample Results mg/Kg
TPPH as Gas	1.0	N.D.
Benzene	0.0050	N.D.
Toluene	0.0050	N.D.
Ethyl Benzene	0.0050	N.D.
Xylenes (Total)	0.0050	N.D.
Chromatogram Pattern:		

Surrogates	Control Limits %		% Recovery
Trifluorotoluene	70	130	97

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

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Weiss Associates	Client Proj. ID: Shell 1800 Powell St.	Sampled: 05/20/96
5500 Shellmound	Sample Descript: B1-15.0	Received: 05/22/96
Emeryville, CA 94608	Matrix: SOLID	Extracted: 05/28/96
	Analysis Method: EPA 8015 Mod	Analyzed: 05/29/96
Attention: Yi-Ran Wu	Lab Number: 9605H09-04	Reported: 06/07/96

QC Batch Number: GC0528960HBPEXB
Instrument ID: GCHP5A

Fuel Fingerprint

Analyte	Detection Limit mg/Kg	Sample Results mg/Kg
Extractable Hydrocarbons	**5.0**	**350**
Chromatogram Pattern:		**C9-C40**

Surrogates	**Control Limits %**		**% Recovery**
n-Pentacosane (C25)	50	150	444 Q

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

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Weiss Associates	Client Proj. ID: Shell 1800 Powell St.	Sampled: 05/20/96
5500 Shellmound	Sample Descript: B1-15.0	Received: 05/22/96
Emeryville, CA 94608	Matrix: SOLID	Extracted: 05/29/96
	Analysis Method: 8015Mod/8020	Analyzed: 05/29/96
Attention: Yi-Ran Wu	Lab Number: 9605H09-04	Reported: 06/07/96

QC Batch Number: GC052996BTEXEXA
Instrument ID: GCHP6

Total Purgeable Petroleum Hydrocarbons (TPPH) with BTEX

Analyte	Detection Limit mg/Kg	Sample Results mg/Kg
TPPH as Gas	**5.0**	**43**
Benzene	0.025	N.D.
Toluene	0.025	N.D.
Ethyl Benzene	**0.025**	**0.072**
Xylenes (Total)	**0.025**	**0.19**
Chromatogram Pattern:		**C8-C12**

Surrogates	Control Limits %		% Recovery
Trifluorotoluene	70	130	102

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Mike Gregory
Project Manager

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Weiss Associates	Client Proj. ID: Shell 1800 Powell St.	Sampled: 05/20/96
5500 Shellmound	Sample Descript: B2-2.0	Received: 05/22/96
Emeryville, CA 94608	Matrix: SOLID	Extracted: 05/29/96
	Analysis Method: 8015Mod/8020	Analyzed: 05/29/96
Attention: Yi-Ran Wu	Lab Number: 9605H09-05	Reported: 06/07/96

QC Batch Number: GC052996BTEXEXA
Instrument ID: GCHP6

Total Purgeable Petroleum Hydrocarbons (TPPH) with BTEX

Analyte	Detection Limit mg/Kg	Sample Results mg/Kg
TPPH as Gas	1.0	N.D.
Benzene	0.0050	N.D.
Toluene	0.0050	N.D.
Ethyl Benzene	0.0050	N.D.
Xylenes (Total)	0.0050	N.D.
Chromatogram Pattern:		

Surrogates	Control Limits %		% Recovery
Trifluorotoluene	70	130	116

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Mike Gregory
Project Manager

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Weiss Associates	Client Proj. ID: Shell 1800 Powell St.	Sampled: 05/20/96
5500 Shellmound	Sample Descript: B2-7.5	Received: 05/22/96
Emeryville, CA 94608	Matrix: SOLID	Extracted: 05/29/96
	Analysis Method: 8015Mod/8020	Analyzed: 05/29/96
Attention: Yi-Ran Wu	Lab Number: 9605H09-06	Reported: 06/07/96

QC Batch Number: GC052996BTEXEXA
Instrument ID: GCHP6

Total Purgeable Petroleum Hydrocarbons (TPPH) with BTEX

Analyte	Detection Limit mg/Kg	Sample Results mg/Kg
TPPH as Gas	1.0	N.D.
Benzene	0.0050	N.D.
Toluene	0.0050	N.D.
Ethyl Benzene	0.0050	N.D.
Xylenes (Total)	0.0050	N.D.
Chromatogram Pattern:		

Surrogates	Control Limits %		% Recovery
Trifluorotoluene	70	130	95

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Mike Gregory
Project Manager

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Weiss Associates 5500 Shellmound Emeryville, CA 94608 Attention: Yi-Ran Wu	Client Proj. ID: Shell 1800 Powell St. Sample Descript: B2-11.0 Matrix: SOLID Analysis Method: EPA 8015 Mod Lab Number: 9605H09-07	Sampled: 05/20/96 Received: 05/22/96 Extracted: 05/30/96 Analyzed: 05/31/96 Reported: 06/07/96

QC Batch Number: GC0529960HBPEXA
Instrument ID: GCHP5A

Fuel Fingerprint

Analyte	Detection Limit mg/Kg		Sample Results mg/Kg
Extractable Hydrocarbons	**10**		**870**
Chromatogram Pattern:			**C9-C40**
Surrogates	**Control Limits %**		**% Recovery**
n-Pentacosane (C25)	50	150	352 Q

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Mike Gregory
Project Manager

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Weiss Associates 5500 Shellmound Emeryville, CA 94608 Attention: Yi-Ran Wu	Client Proj. ID: Shell 1800 Powell St. Sample Descript: B2-11.0 Matrix: SOLID Analysis Method: 8015Mod/8020 Lab Number: 9605H09-07	Sampled: 05/20/96 Received: 05/22/96 Extracted: 05/29/96 Analyzed: 05/29/96 Reported: 06/07/96

QC Batch Number: GC052996BTEXEXA
Instrument ID: GCHP6

Total Purgeable Petroleum Hydrocarbons (TPPH) with BTEX

Analyte	Detection Limit mg/Kg	Sample Results mg/Kg
TPPH as Gas	1.0	N.D.
Benzene	0.0050	N.D.
Toluene	0.0050	N.D.
Ethyl Benzene	0.0050	N.D.
Xylenes (Total)	0.0050	N.D.
Chromatogram Pattern:		

Surrogates	Control Limits %		% Recovery
Trifluorotoluene	70	130	92

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Mike Gregory
Project Manager

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Weiss Associates 5500 Shellmound Emeryville, CA 94608 Attention: Yi-Ran Wu	Client Proj. ID: Shell 1800 Powell St. Lab Proj. ID: 9605H09	Received: 05/22/96 Reported: 06/07/96

LABORATORY NARRATIVE

DIESEL: Sample# 3,4 and 7 contains heavy oil.
Surrogate recovery is high due to co-elution.

8080: Sample 02 run at a dilution due to matrix.

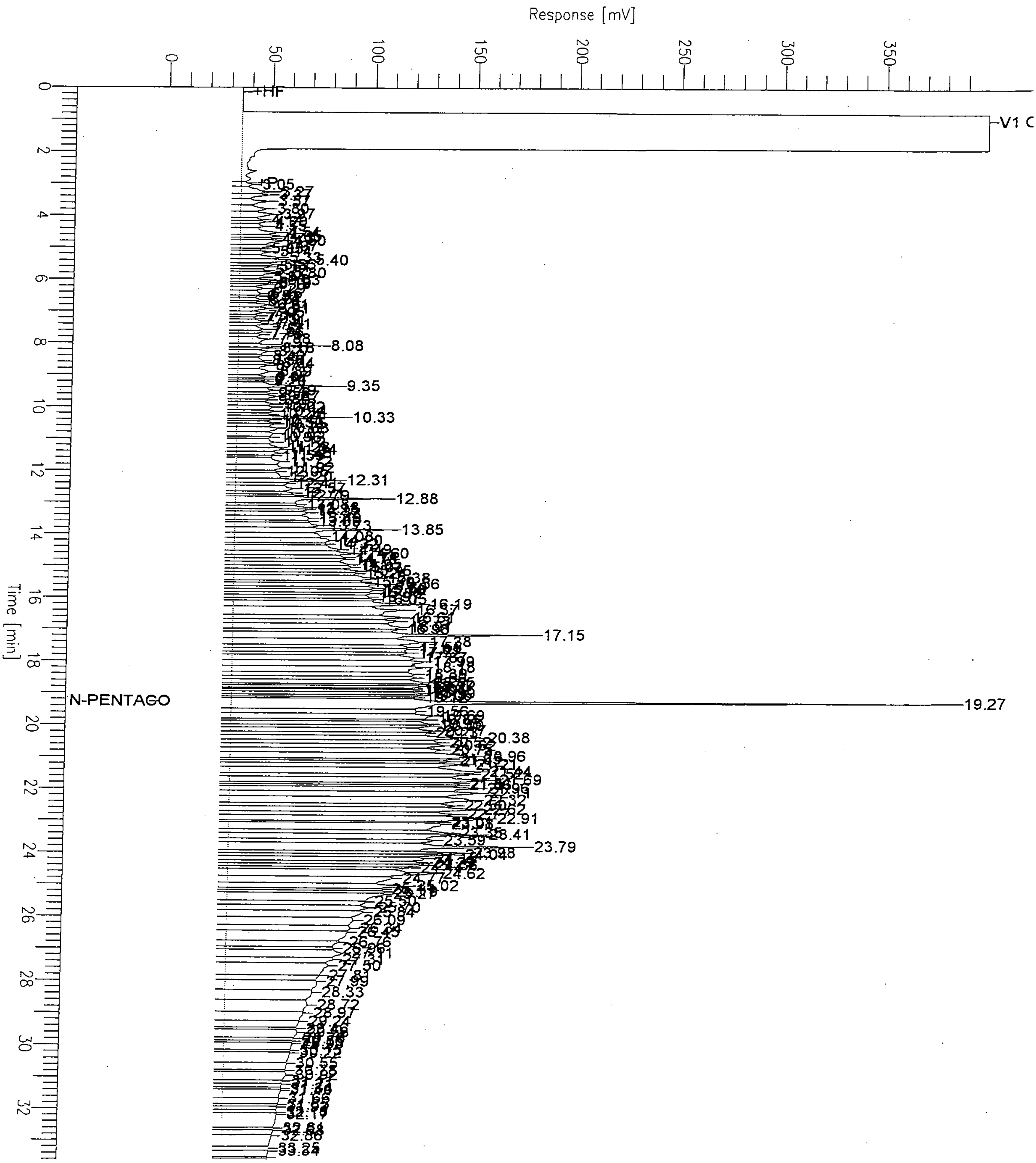
SEQUOIA ANALYTICAL

Mike Gregory
Project Manager

Chromatogram

Sample Name : DS9605H09-4 (20:1*5) RS1
FileName : S:\GHP_05\0602\528A029.raw
Method : TPH05A
Start Time : 0.00 min   End Time : 33.65 min
Scale Factor: 0.0   Plot Offset: 0 mV

Sample #: B1-15.0
Date : 6/3/96 09:09
Time of Injection: 5/29/96 12:33
Low Point : 0.00 mV   High Point : 400.00 mV
Plot Scale: 400.0 mV



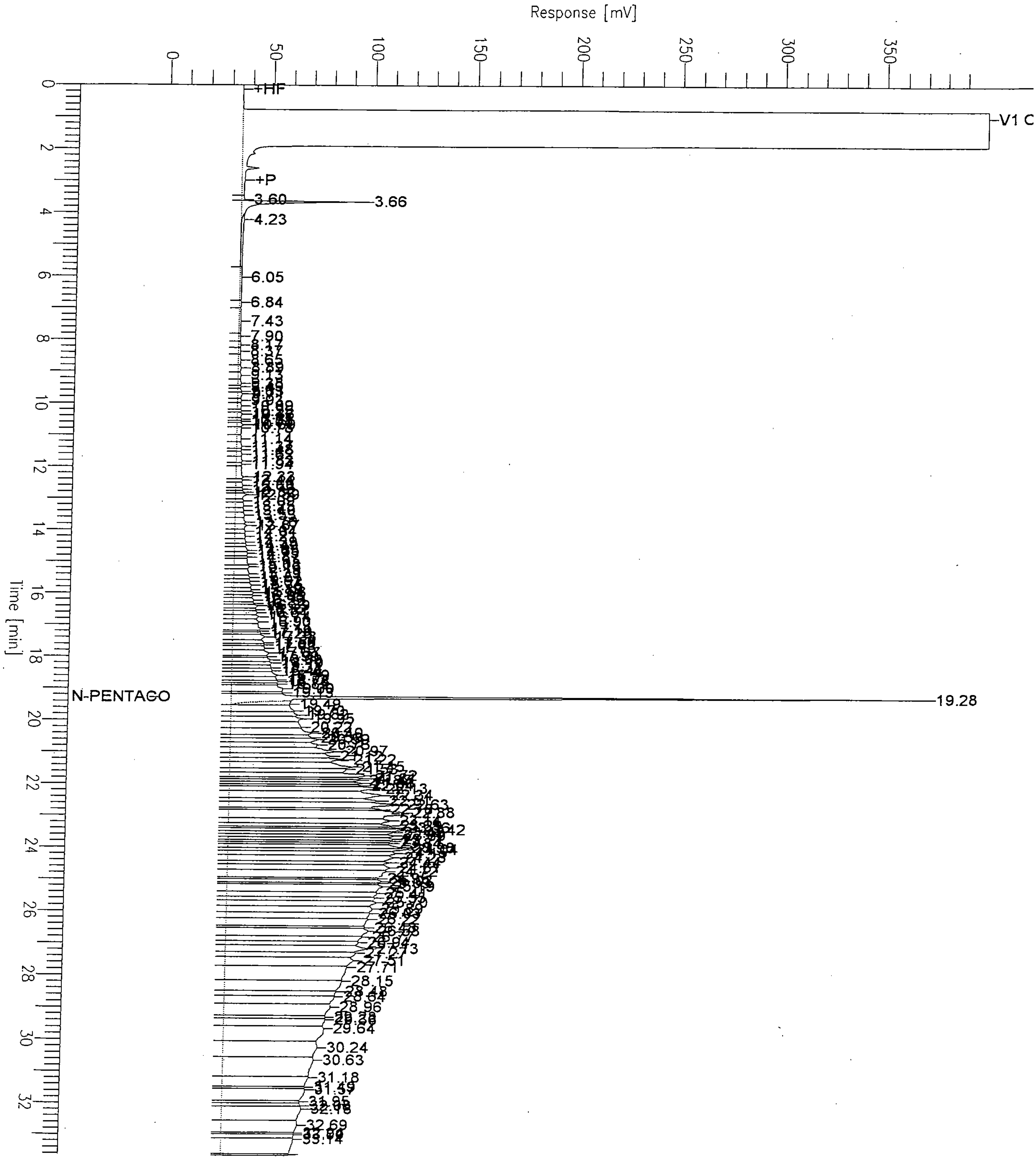
Chromatogram

Sample Name : DS9605H09-3 (20:1*4) RS1
FileName : S:\GHP_05\0602\528A028.raw
Method : TPH05A
Start Time : 0.00 min
Scale Factor: 0.0

End Time : 33.65 min
Plot Offset: 0 mV

Sample #: B1-13.0
Date : 6/3/96 09:09
Time of Injection: 5/29/96 10:53
Low Point : 0.00 mV
Plot Scale: 400.0 mV

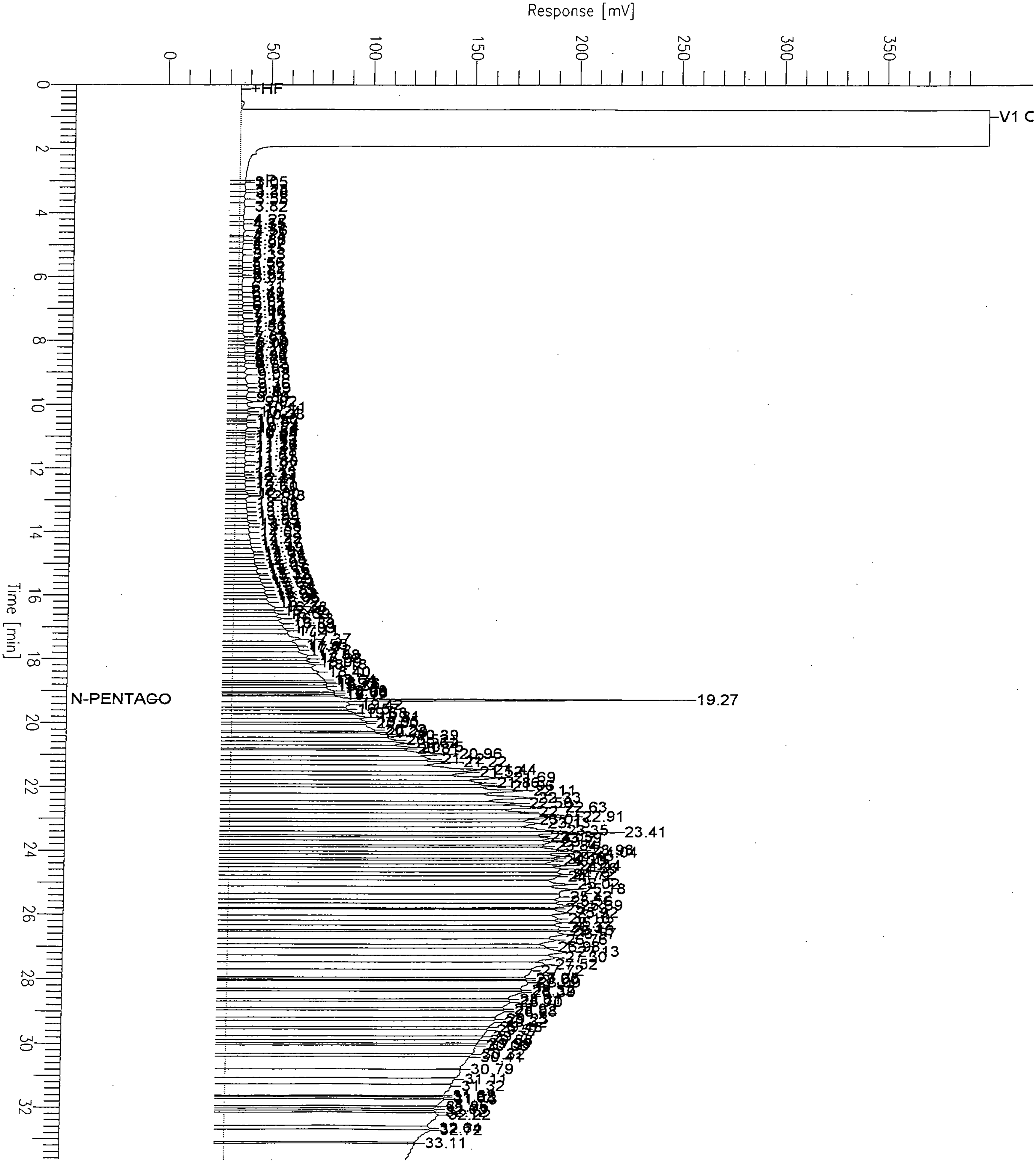
High Point : 400.00 mV



Chromatogram

Sample Name : DS9605H09-7 (20:1*10)RS1
FileName : S:\GHP_05\0602\530A043.raw
Method : TPH05A
Start Time : 0.00 min End Time : 33.65 min
Scale Factor: 0.0 Plot Offset: 0 mV

Sample #: B2-11.0
Date : 6/3/96 09:10
Time of Injection: 5/31/96 13:31
Low Point : 0.00 mV High Point : 400.00 mV
Plot Scale: 400.0 mV



Sequoia Analytical

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Weiss & Associates
5500 Shellmound
Emeryville, CA 94608
Attention: Yi-Ran Wu

Client Project ID: Shell 1800 Powell St.
Matrix: Solid
Work Order #: 9605H09 -01 - 07

Reported: Jun 21, 1996

QUALITY CONTROL DATA REPORT

Analyte:	Benzene	Toluene	Ethyl Benzene	Xylenes
QC Batch#:	GC052996BTEXEXA	GC052996BTEXEXA	GC052996BTEXEXA	GC052996BTEXEXA
Analy. Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Prep. Method:	EPA 5030	EPA 5030	EPA 5030	EPA 5030

Analyst:	E. Cunanan	E. Cunanan	E. Cunanan	E. Cunanan
MS/MSD #:	9605C38-03	9605C38-03	9605C38-03	9605C38-03
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Prepared Date:	5/29/96	5/29/96	5/29/96	5/29/96
Analyzed Date:	5/29/96	5/29/96	5/29/96	5/29/96
Instrument I.D.#:	GCHP1	GCHP1	GCHP1	GCHP1
Conc. Spiked:	0.20 mg/kg	0.20 mg/kg	0.20 mg/kg	0.60 mg/kg
Result:	0.16	0.16	0.16	0.48
MS % Recovery:	80	80	80	80
Dup. Result:	0.16	0.16	0.16	0.50
MSD % Recov.:	80	80	80	83
RPD:	0.0	0.0	0.0	4.1
RPD Limit:	0-25	0-25	0-25	0-25

LCS #:	GBLK052996BSA	GBLK052996BSA	BLK052996BSA	GBLK052996BSA
Prepared Date:	5/29/96	5/29/96	5/29/96	5/29/96
Analyzed Date:	5/29/96	5/29/96	5/29/96	5/29/96
Instrument I.D.#:	GCHP1	GCHP1	GCHP1	GCHP1
Conc. Spiked:	0.20 mg/kg	0.20 mg/kg	0.20 mg/kg	0.60 mg/kg
LCS Result:	0.19	0.19	0.19	0.56
LCS % Recov.:	95	95	95	93

MS/MSD	60-140	60-140	60-140	60-140
LCS	70-130	70-130	70-130	70-130
Control Limits				

SEQUOIA ANALYTICAL

Mike Gregory
Project Manager

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** MS=Matrix Spike, MSD=MS Duplicate, RPD=Relative % Difference

Sequoia Analytical

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Weiss & Associates
5500 Shellmound
Emeryville, CA 94608
Attention: Yi-Ran Wu

Client Project ID: Shell 1800 Powell St.
Matrix: Solid
Work Order #: 9605H09 -02
Reported: Jun 21, 1996

QUALITY CONTROL DATA REPORT

Analyte:	Heptachlor	Aldrin	Dieldrin
QC Batch#:	GC0528968080EXB	GC0528968080EXB	GC0528968080EXB
Analy. Method:	EPA 8080	EPA 8080	EPA 8080
Prep. Method:	EPA 3550	EPA 3550	EPA 3550
Analyst:	D. Nelson	D. Nelson	D. Nelson
MS/MSD #:	9605G09-01	9605G09-01	9605G09-01
Sample Conc.:	N.D.	N.D.	N.D.
Prepared Date:	5/28/96	5/28/96	5/28/96
Analyzed Date:	6/19/96	6/19/96	6/19/96
Instrument I.D.#:	GCHP10	GCHP10	GCHP10
Conc. Spiked:	3.3 ug/kg	3.3 ug/kg	13 ug/kg
Result:	-	-	-
MS % Recovery:	-	-	-
Dup. Result:	-	-	-
MSD % Recov.:	-	-	-
RPD:	-	-	-
RPD Limit:	0-50	0-50	0-50

LCS #:	BLK052896BS	BLK052896BS	BLK052896BS
Prepared Date:	5/28/96	5/28/96	5/28/96
Analyzed Date:	6/6/96	6/6/96	6/6/96
Instrument I.D.#:	GCHP10	GCHP10	GCHP10
Conc. Spiked:	3.3 ug/kg	3.3 ug/kg	13 ug/kg
LCS Result:	2.1	2.0	8.4
LCS % Recov.:	63	60	63
MS/MSD LCS Control Limits	35-145	31-170	10-176

SEQUOIA ANALYTICAL

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Weiss & Associates	Client Project ID:	Shell 1800 Powell St.	
5500 Shellmound	Matrix:	Solid	
Emeryville, CA 94608			
Attention: Yi-Ran Wu	Work Order #:	9605H09 -02	Reported: Jun 21, 1996

QUALITY CONTROL DATA REPORT

Analyte:	Phenol	2-Chlorophenol	1,4-Dichloro benzene	N-Nitroso-Di-N-propylamine
QC Batch#:	MS0523968270EXA	MS0523968270EXA	MS0523968270EXA	MS0523968270EXA
Analy. Method:	EPA 8270	EPA 8270	EPA 8270	EPA 8270
Prep. Method:	EPA 3550	EPA 3550	EPA 3550	EPA 3550
Analyst:	B. Pitamah	B. Pitamah	B. Pitamah	B. Pitamah
MS/MSD #:	9605F09-01	9605F09-01	9605F09-01	9605F09-01
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Prepared Date:	5/23/96	5/23/96	5/23/96	5/23/96
Analyzed Date:	5/24/96	5/24/96	5/24/96	5/24/96
Instrument I.D.#:	H5	H5	H5	H5
Conc. Spiked:	3300 ug/kg	3300 ug/kg	3300 ug/kg	3300 ug/kg
Result:	2800	2800	2700	3200
MS % Recovery:	85	85	82	97
Dup. Result:	2800	2800	2700	3100
MSD % Recov.:	85	85	82	94
RPD:	0.0	0.0	0.0	3.2
RPD Limit:	0-20	0-23	0-26	0-32
LCS #:	SB0523SA	SB0523SA	SB0523SA	SB0523SA
Prepared Date:	5/23/96	5/23/96	5/23/96	5/23/96
Analyzed Date:	5/24/96	5/24/96	5/24/96	5/24/96
Instrument I.D.#:	H5	H5	H5	H5
Conc. Spiked:	3300 ug/kg	3300 ug/kg	3300 ug/kg	3300 ug/kg
LCS Result:	2800	2800	2700	3200
LCS % Recov.:	85	85	82	97
MS/MSD LCS Control Limits	28-90	25-102	28-104	41-126

SEQUOIA ANALYTICAL

Mike Gregory
Project Manager

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Weiss & Associates	Client Project ID:	Shell 1800 Powell St.	
5500 Shellmound	Matrix:	Solid	
Emeryville, CA 94608			
Attention: Yi-Ran Wu	Work Order #:	9605H09 -02	Reported: Jun 21, 1996

QUALITY CONTROL DATA REPORT

Analyte:	1,2,4-Trichloro benzene	4-Chloro-3 Methylphenol	Acenaphthene	4-Nitrophenol
QC Batch#:	MS0523968270EXA	MS0523968270EXA	MS0523968270EXA	MS0523968270EXA
Analy. Method:	EPA 8270	EPA 8270	EPA 8270	EPA 8270
Prep. Method:	EPA 3550	EPA 3550	EPA 3550	EPA 3550
Analyst:	B. Pitamah	B. Pitamah	B. Pitamah	B. Pitamah
MS/MSD #:	9605F09-01	9605F09-01	9605F09-01	9605F09-01
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Prepared Date:	5/23/96	5/23/96	5/23/96	5/23/96
Analyzed Date:	5/24/96	5/24/96	5/24/96	5/24/96
Instrument I.D.#:	H5	H5	H5	H5
Conc. Spiked:	3300 ug/kg	3300 ug/kg	3300 ug/kg	3300 ug/kg
Result:	2900	2800	3100	2700
MS % Recovery:	88	85	94	82
Dup. Result:	2900	2900	3100	2600
MSD % Recov.:	88	88	94	79
RPD:	0.0	3.5	0.0	3.8
RPD Limit:	0-25	0-24	0-29	0-40
LCS #:	SB0523SA	SB0523SA	SB0523SA	SB0523SA
Prepared Date:	5/23/96	5/23/96	5/23/96	5/23/96
Analyzed Date:	5/24/96	5/24/96	5/24/96	5/24/96
Instrument I.D.#:	H5	H5	H5	H5
Conc. Spiked:	3300 ug/kg	3300 ug/kg	3300 ug/kg	3300 ug/kg
LCS Result:	2800	2800	2800	2500
LCS % Recov.:	85	85	85	76
MS/MSD LCS Control Limits	38-107	26-103	31-137	11-114

SEQUOIA ANALYTICAL

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Weiss & Associates	Client Project ID:	Shell 1800 Powell St.	
5500 Shellmound	Matrix:	Solid	
Emeryville, CA 94608			
Attention: Yi-Ran Wu	Work Order #:	9605H09 -02	Reported: Jun 21, 1996

QUALITY CONTROL DATA REPORT

Analyte:	2,4-Dinitro-toluene	Pentachloro-phenol	Pyrene
QC Batch#:	MS0523968270EXA	MS0523968270EXA	MS0523968270EXA
Analy. Method:	EPA 8270	EPA 8270	EPA 8270
Prep. Method:	EPA 3550	EPA 3550	EPA 3550
Analyst:	B. Pitamah	B. Pitamah	B. Pitamah
MS/MSD #:	9605F09-01	9605F09-01	9605F09-01
Sample Conc.:	N.D.	N.D.	N.D.
Prepared Date:	5/23/96	5/23/96	5/23/96
Analyzed Date:	5/24/96	5/24/96	5/24/96
Instrument I.D.#:	H5	H5	H5
Conc. Spiked:	3300 ug/kg	3300 ug/kg	3300 ug/kg
Result:	2800	2300	3600
MS % Recovery:	85	70	109
Dup. Result:	2700	2000	3600
MSD % Recov.:	82	61	109
RPD:	3.6	14	0.0
RPD Limit:	0-31	0-43	0-25
LCS #:	SB0523SA	SB0523SA	SB0523SA
Prepared Date:	5/23/96	5/23/96	5/23/96
Analyzed Date:	5/24/96	5/24/96	5/24/96
Instrument I.D.#:	H5	H5	H5
Conc. Spiked:	3300 ug/kg	3300 ug/kg	3300 ug/kg
LCS Result:	2700	1600	3100
LCS % Recov.:	82	48	94
MS/MSD LCS Control Limits	28-89	17-109	35-142

SEQUOIA ANALYTICAL

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Weiss & Associates
5500 Shellmound
Emeryville, CA 94608
Attention: Yi-Ran Wu

Client Project ID: Shell 1800 Powell St.
Matrix: Solid
Work Order #: 9605H09 -02

Reported: Jun 21, 1996

QUALITY CONTROL DATA REPORT

Analyte:	1,1-Dichloroethene	Trichloroethene	Benzene	Toluene	Chloro-benzene
QC Batch#:	MS0529968240EXA	MS0529968240EXA	MS0529968240EXA	MS0529968240EXA	MS0529968240EXA
Analy. Method:	EPA 8240	EPA 8240	EPA 8240	EPA 8240	EPA 8240
Prep. Method:	N.A.	N.A.	N.A.	N.A.	N.A.
Analyst:	L. Duong	L. Duong	L. Duong	L. Duong	L. Duong
MS/MSD #:	9605H09-02	9605H09-02	9605H09-02	9605H09-02	9605H09-02
Sample Conc.:	N.D.	N.D.	N.D.	N.D.	N.D.
Prepared Date:	5/29/96	5/29/96	5/29/96	5/29/96	5/29/96
Analyzed Date:	5/29/96	5/29/96	5/29/96	5/29/96	5/29/96
Instrument I.D.#:	MS-F2	MS-F2	MS-F2	MS-F2	MS-F2
Conc. Spiked:	2500 ug/kg	2500 ug/kg	2500 ug/kg	2500 ug/kg	2500 ug/kg
Result:	2300	2200	2600	2700	2600
MS % Recovery:	92	88	104	108	104
Dup. Result:	2300	2200	2400	2500	2400
MSD % Recov.:	92	88	96	100	96
RPD:	0.0	0.0	8.0	7.7	8.0
RPD Limit:	0-25	0-25	0-25	0-25	0-25

LCS #:	VB052996MS	VB052996MS	VB052996MS	VB052996MS	VB052996MS
Prepared Date:	5/29/96	5/29/96	5/29/96	5/29/96	5/29/96
Analyzed Date:	5/29/96	5/29/96	5/29/96	5/29/96	5/29/96
Instrument I.D.#:	MS-F2	MS-F2	MS-F2	MS-F2	MS-F2
Conc. Spiked:	2500 ug/kg	2500 ug/kg	2500 ug/kg	2500 ug/kg	2500 ug/kg
LCS Result:	2700	2600	2800	2700	2700
LCS % Recov.:	108	104	108	104	104

Control Limits					
MS/MSD	60-140	60-140	60-140	60-140	60-140
LCS	65-135	70-130	70-130	70-130	70-130

SEQUOIA ANALYTICAL

Mike Gregory
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Weiss & Associates
5500 Shellmound
Emeryville, CA 94608
Attention: Yi-Ran Wu

Client Project ID: Shell 1800 Powell St.
Matrix: Solid
Work Order #: 9605H09 -03, 04

Reported: Jun 21, 1996

QUALITY CONTROL DATA REPORT

Analyte: Diesel

QC Batch#: GC052896OHBPEXB
Analy. Method: EPA 8015 M
Prep. Method: EPA 3550

Analyst: J. Minkel
MS/MSD #: 9605D18-02
Sample Conc.: 1.0
Prepared Date: 5/28/96
Analyzed Date: 5/29/96
Instrument I.D.#: GCHP4A
Conc. Spiked: 25 mg/kg

Result: 28
MS % Recovery: 108

Dup. Result: 23
MSD % Recov.: 88

RPD: 20
RPD Limit: 0-50

LCS #: BLK052896C

Prepared Date: 5/28/96
Analyzed Date: 5/28/96
Instrument I.D.#: GCHP4A
Conc. Spiked: 25 mg/kg

LCS Result: 27
LCS % Recov.: 108

MS/MSD LCS Control Limits 50-150

SEQUOIA ANALYTICAL

Mike Gregory
Project Manager

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Weiss & Associates	Client Project ID:	Shell 1800 Powell St.	
5500 Shellmound	Matrix:	Solid	
Emeryville, CA 94608			
Attention: Yi-Ran Wu	Work Order #:	9605H09 -07	Reported: Jun 21, 1996

QUALITY CONTROL DATA REPORT

Analyte: Diesel

QC Batch#: GC0529960HBPEXA
Analy. Method: EPA 8015 M
Prep. Method: EPA 3550

Analyst: B. Ali
MS/MSD #: 9605H24-01
Sample Conc.: 2.1
Prepared Date: 5/29/96
Analyzed Date: 5/30/96
Instrument I.D.#: GCHP5A
Conc. Spiked: 25 mg/kg

Result: 27
MS % Recovery: 100

Dup. Result: 27
MSD % Recov.: 100

RPD: 0.0
RPD Limit: 0-50

LCS #: BLK052996S

Prepared Date: 5/29/96
Analyzed Date: 5/30/96
Instrument I.D.#: GCHP5A
Conc. Spiked: 25 mg/kg

LCS Result: 21
LCS % Recov.: 84

MS/MSD LCS Control Limits: 50-150

SEQUOIA ANALYTICAL

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Weiss & Associates	Client Project ID:	Shell 1800 Powell St.	
5500 Shellmound	Matrix:	Solid	
Emeryville, CA 94608			
Attention: Yi-Ran Wu	Work Order #:	9605H09 -03, 04	Reported: Jun 21, 1996

QUALITY CONTROL DATA REPORT

Analyte:	Total Recoverable Pet. Hydrocarbons
QC Batch#:	OP052996SM5520EXA
Analy. Method:	SM 5520 EF Mod
Prep. Method:	EPA 3550

Analyst:	C. Alcayde
MS/MSD #:	9605F45-15
Sample Conc.:	N.D.
Prepared Date:	5/29/96
Analyzed Date:	5/30/96
Instrument I.D.#:	MANUAL
Conc. Spiked:	500 mg/kg
Result:	390
MS % Recovery:	78
Dup. Result:	370
MSD % Recov.:	74
RPD:	5.4
RPD Limit:	0-50

LCS #:	BLK052996
Prepared Date:	5/29/96
Analyzed Date:	5/30/96
Instrument I.D.#:	MANUAL
Conc. Spiked:	500 mg/kg
LCS Result:	380
LCS % Recov.:	76

MS/MSD	60-140
LCS	70-110
Control Limits	

SEQUOIA ANALYTICAL

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Weiss & Associates
5500 Shellmound
Emeryville, CA 94608
Attention: Yi-Ran Wu

Client Project ID: Shell 1800 Powell St.
Matrix: Solid
Work Order #: 9605H09 -07

Reported: Jun 21, 1996

QUALITY CONTROL DATA REPORT

Analyte:	Total Recoverable Pet. Hydrocarbons
QC Batch#:	OP053096SM5520EXA
Analy. Method:	SM 5520 EF Mod
Prep. Method:	EPA 3550

Analyst:	C. Alcayde
MS/MSD #:	9605C35-01
Sample Conc.:	150
Prepared Date:	5/30/96
Analyzed Date:	5/31/96
Instrument I.D.#:	MANUAL
Conc. Spiked:	500 mg/kg
Result:	300
MS % Recovery:	30
Dup. Result:	410
MSD % Recov.:	52
RPD:	3.1
RPD Limit:	0-50

LCS #:	BLK053096
Prepared Date:	5/30/96
Analyzed Date:	5/31/96
Instrument I.D.#:	MANUAL
Conc. Spiked:	500 mg/kg
LCS Result:	370
LCS % Recov.:	74

MS/MSD	60-140
LCS	70-110
Control Limits	

SEQUOIA ANALYTICAL

Mike Gregory
Project Manager

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Emeryville, CA 94608
Attention: Yi-Ran Wu

Client Project ID: Shell 1800 Powell St.
Matrix: Solid
Work Order #: 9605H09 -02

Reported: Jun 21, 1996

QUALITY CONTROL DATA REPORT

Analyte:	Beryllium	Cadmium	Chromium	Nickel
QC Batch#:	ME0529966010MDE	ME0529966010MDE	ME0529966010MDE	ME0529966010MDE
Analy. Method:	EPA 6010	EPA 6010	EPA 6010	EPA 6010
Prep. Method:	EPA 3050	EPA 3050	EPA 3050	EPA 3050
Analyst:	C. Medefesser	C. Medefesser	C. Medefesser	C. Medefesser
MS/MSD #:	9605H24-01	9605H24-01	9605H24-01	9605H24-01
Sample Conc.:	N.D.	N.D.	27	14
Prepared Date:	5/29/96	5/29/96	5/29/96	5/29/96
Analyzed Date:	5/30/96	5/30/96	5/30/96	5/30/96
Instrument I.D.#:	MTJA2	MTJA2	MTJA2	MTJA2
Conc. Spiked:	100 mg/kg	100 mg/kg	100 mg/kg	100 mg/kg
Result:	99	100	130	110
MS % Recovery:	99	100	103	96
Dup. Result:	100	100	130	110
MSD % Recov.:	100	100	103	96
RPD:	1.0	0.0	0.0	0.0
RPD Limit:	0-20	0-20	0-20	0-20
LCS #:	BLK052996MS	BLK052996MS	BLK052996MS	BLK052996MS
Prepared Date:	5/29/96	5/29/96	5/29/96	5/29/96
Analyzed Date:	5/30/96	5/30/96	5/30/96	5/30/96
Instrument I.D.#:	MTJA2	MTJA2	MTJA2	MTJA2
Conc. Spiked:	100 mg/kg	100 mg/kg	100 mg/kg	100 mg/kg
LCS Result:	98	100	100	100
LCS % Recov.:	98	100	100	100
MS/MSD LCS Control Limits	80-120	80-120	80-120	80-120

SEQUOIA ANALYTICAL

Mike Gregory
Project Manager

Please Note:
The LCS is a control sample of known, interferent-free matrix that is analyzed using the same reagents, preparation, and analytical methods employed for the samples. The matrix spike is an aliquot of sample fortified with known quantities of specific compounds and subjected to the entire analytical procedure. If the recovery of analytes from the matrix spike does not fall within specified control limits due to matrix interference, the LCS recovery is to be used to validate the batch.

** MS=Matrix Spike, MSD=MS Duplicate, RPD=Relative % Difference

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819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Weiss & Associates	Client Project ID:	Shell 1800 Powell St.			
5500 Shellmound	Matrix:	Solid			
Emeryville, CA 94608					
Attention: Yi-Ran Wu	Work Order #:	9605H09	-02	Reported:	Jun 21, 1996

QUALITY CONTROL DATA REPORT

Analyte: Mercury

QC Batch#: ME0529967471M4A
Analy. Method: EPA 7471
Prep. Method: EPA 7471

Analyst: T. Hua
MS/MSD #: 9605H09-02A
Sample Conc.: 0.079
Prepared Date: 5/29/96
Analyzed Date: 5/30/96
Instrument I.D.#: MPE4
Conc. Spiked: 0.40 mg/kg

Result: 0.50
MS % Recovery: 105

Dup. Result: 0.48
MSD % Recov.: 100

RPD: 4.1
RPD Limit: 0-30

LCS #: BLK052996B

Prepared Date: 5/29/96
Analyzed Date: 5/29/96
Instrument I.D.#: MPE4
Conc. Spiked: 0.40 mg/kg

LCS Result: 0.35
LCS % Recov.: 88

MS/MSD	75-115
LCS	
Control Limits	

SEQUOIA ANALYTICAL

Mike Gregory
Project Manager

Please Note:
The LCS is a control sample of known, interferent-free matrix that is analyzed using the same reagents, preparation, and analytical methods employed for the samples. The matrix spike is an aliquot of sample fortified with known quantities of specific compounds and subjected to the entire analytical procedure. If the recovery of analytes from the matrix spike does not fall within specified control limits due to matrix interference, the LCS recovery is to be used to validate the batch.

** MS=Matrix Spike, MSD=MS Duplicate, RPD=Relative % Difference

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Weiss Associates
5500 Shellmound
Emeryville, CA 94608
Attention: Yi-Ran Wu

Project: Shell 1800 Powell, Emeryville

Enclosed are the results from samples received at Sequoia Analytical on May 22, 1996. The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION		DATE COLLECTED	TEST METHOD
9605E85 -01	SOLID,	B3-6.5	05/20/96	TPHGBS Purgeable TPH/BTEX
9605E85 -02	SOLID,	B3-10.5	05/20/96	TRPH (SM 5520 E&F Mod.)
9605E85 -02	SOLID,	B3-10.5	05/20/96	TPHFFS Fuel Fingerprint
9605E85 -02	SOLID,	B3-10.5	05/20/96	TPHGBS Purgeable TPH/BTEX
9605E85 -04	SOLID,	B4-6.5	05/20/96	TPHGBS Purgeable TPH/BTEX
9605E85 -05	SOLID,	B5-3	05/20/96	TPHGBS Purgeable TPH/BTEX
9605E85 -06	SOLID,	B6-3.5	05/20/96	TPHGBS Purgeable TPH/BTEX
9605E85 -07	SOLID,	B6-6.5	05/20/96	TPHGBS Purgeable TPH/BTEX
9605E85 -08	SOLID,	B6-11	05/20/96	TRPH (SM 5520 E&F Mod.)
9605E85 -08	SOLID,	B6-11	05/20/96	TPHFFS Fuel Fingerprint
9605E85 -08	SOLID,	B6-11	05/20/96	TPHGBS Purgeable TPH/BTEX

Please contact me if you have any questions. In the meantime, thank you for the opportunity to work with you on this project.

Very truly yours,

SEQUOIA ANALYTICAL

Mike Gregory
Project Manager

Sequoia Analytical

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Weiss Associates
5500 Shellmound
Emeryville, CA 94608

Attention: Yi-Ran Wu

Client Proj. ID: Shell 1800 Powell, Emeryville

Lab Proj. ID: 9605E85

Sampled: 05/20/96
Received: 05/22/96
Analyzed: see below

Reported: 06/04/96

LABORATORY ANALYSIS

Analyte	Units	Date Analyzed	Detection Limit	Sample Results
Lab No: 9605E85-02 Sample Desc : **SOLID,B3-10.5**				
TRPH (SM 5520 E&F Mod.)	**mg/Kg**	**05/30/96**	**50**	**82**
Lab No: 9605E85-08 Sample Desc : **SOLID,B6-11**				
TRPH (SM 5520 E&F Mod.)	**mg/Kg**	**05/30/96**	**50**	**380**

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Mike Gregory
Project Manager

Sequoia Analytical

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819 Striker Avenue, Suite 8 Sacramento, CA 95834 (916) 921-9600 FAX (916) 921-0100

Weiss Associates 5500 Shellmound Emeryville, CA 94608 Attention: Yi-Ran Wu	Client Proj. ID: Shell 1800 Powell, Emeryville Sample Descript: B3-6.5 Matrix: SOLID Analysis Method: 8015Mod/8020 Lab Number: 9605E85-01	Sampled: 05/20/96 Received: 05/22/96 Extracted: 05/29/96 Analyzed: 05/29/96 Reported: 06/04/96

QC Batch Number: GC052996BTEXEXA
Instrument ID: GCHP18

Total Purgeable Petroleum Hydrocarbons (TPPH) with BTEX

Analyte	Detection Limit mg/Kg	Sample Results mg/Kg
TPPH as Gas	1.0	N.D.
Benzene	0.0050	N.D.
Toluene	0.0050	N.D.
Ethyl Benzene	0.0050	N.D.
Xylenes (Total)	0.0050	N.D.
Chromatogram Pattern:		

Surrogates	Control Limits %		% Recovery
Trifluorotoluene	70	130	91

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Mike Gregory
Project Manager

Sequoia Analytical

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Weiss Associates	Client Proj. ID: Shell 1800 Powell, Emeryville	Sampled: 05/20/96
5500 Shellmound	Sample Descript: B3-10.5	Received: 05/22/96
Emeryville, CA 94608	Matrix: SOLID	Extracted: 05/29/96
	Analysis Method: EPA 8015 Mod	Analyzed: 05/30/96
Attention: Yi-Ran Wu	Lab Number: 9605E85-02	Reported: 06/04/96

QC Batch Number: GC0529960HBPEXA
Instrument ID: GCHP5A

Fuel Fingerprint

Analyte	Detection Limit mg/Kg	Sample Results mg/Kg
Extractable Hydrocarbons	1.0	31
Chromatogram Pattern:		C9-C40

Surrogates	Control Limits %		% Recovery
n-Pentacosane (C25)	50	150	109

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Mike Gregory
Project Manager

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Weiss Associates 5500 Shellmound Emeryville, CA 94608 Attention: Yi-Ran Wu	Client Proj. ID: Shell 1800 Powell, Emeryville Sample Descript: B3-10.5 Matrix: SOLID Analysis Method: 8015Mod/8020 Lab Number: 9605E85-02	Sampled: 05/20/96 Received: 05/22/96 Extracted: 05/29/96 Analyzed: 05/29/96 Reported: 06/04/96

QC Batch Number: GC052996BTEXEXA
Instrument ID: GCHP18

Total Purgeable Petroleum Hydrocarbons (TPPH) with BTEX

Analyte	Detection Limit mg/Kg	Sample Results mg/Kg
TPPH as Gas	1.0	N.D.
Benzene	0.0050	N.D.
Toluene	0.0050	N.D.
Ethyl Benzene	0.0050	N.D.
Xylenes (Total)	0.0050	N.D.
Chromatogram Pattern:		

Surrogates	Control Limits %		% Recovery
Trifluorotoluene	70	130	89

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Mike Gregory
Project Manager

Sequoia Analytical

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Weiss Associates	Client Proj. ID: Shell 1800 Powell, Emeryville	Sampled: 05/20/96
5500 Shellmound	Sample Descript: B4-6.5	Received: 05/22/96
Emeryville, CA 94608	Matrix: SOLID	Extracted: 05/29/96
	Analysis Method: 8015Mod/8020	Analyzed: 05/29/96
Attention: Yi-Ran Wu	Lab Number: 9605E85-04	Reported: 06/04/96

QC Batch Number: GC052996BTEXEXA
Instrument ID: GCHP18

Total Purgeable Petroleum Hydrocarbons (TPPH) with BTEX

Analyte	Detection Limit mg/Kg	Sample Results mg/Kg
TPPH as Gas	1.0	N.D.
Benzene	0.0050	N.D.
Toluene	0.0050	N.D.
Ethyl Benzene	0.0050	N.D.
Xylenes (Total)	0.0050	N.D.
Chromatogram Pattern:		

Surrogates	Control Limits %		% Recovery
Trifluorotoluene	70	130	93

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Mike Gregory
Project Manager

Sequoia Analytical

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Weiss Associates
5500 Shellmound
Emeryville, CA 94608

Attention: Yi-Ran Wu

Client Proj. ID: Shell 1800 Powell, Emeryville
Sample Descript: B5-3
Matrix: SOLID
Analysis Method: 8015Mod/8020
Lab Number: 9605E85-05

Sampled: 05/20/96
Received: 05/22/96
Extracted: 05/29/96
Analyzed: 05/29/96
Reported: 06/04/96

QC Batch Number: GC052996BTEXEXA
Instrument ID: GCHP18

Total Purgeable Petroleum Hydrocarbons (TPPH) with BTEX

Analyte	Detection Limit mg/Kg	Sample Results mg/Kg
TPPH as Gas	1.0	N.D.
Benzene	0.0050	N.D.
Toluene	0.0050	N.D.
Ethyl Benzene	0.0050	N.D.
Xylenes (Total)	**0.0050**	**0.0054**
Chromatogram Pattern:		

Surrogates	Control Limits %		% Recovery
Trifluorotoluene	70	130	92

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Mike Gregory
Project Manager

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Weiss Associates	Client Proj. ID: Shell 1800 Powell, Emeryville	Sampled: 05/20/96
5500 Shellmound	Sample Descript: B6-3.5	Received: 05/22/96
Emeryville, CA 94608	Matrix: SOLID	Extracted: 05/29/96
	Analysis Method: 8015Mod/8020	Analyzed: 05/29/96
Attention: Yi-Ran Wu	Lab Number: 9605E85-06	Reported: 06/04/96

QC Batch Number: GC052996BTEXEXA
Instrument ID: GCHP18

Total Purgeable Petroleum Hydrocarbons (TPPH) with BTEX

Analyte	**Detection Limit mg/Kg**	**Sample Results mg/Kg**
TPPH as Gas	1.0	N.D.
Benzene	0.0050	N.D.
Toluene	0.0050	N.D.
Ethyl Benzene	0.0050	N.D.
Xylenes (Total)	0.0050	N.D.
Chromatogram Pattern:		

Surrogates	**Control Limits %**		**% Recovery**
Trifluorotoluene	70	130	92

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Mike Gregory
Project Manager

Sequoia Analytical

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Weiss Associates	Client Proj. ID: Shell 1800 Powell, Emeryville	Sampled: 05/20/96
5500 Shellmound	Sample Descript: B6-6.5	Received: 05/22/96
Emeryville, CA 94608	Matrix: SOLID	Extracted: 05/29/96
	Analysis Method: 8015Mod/8020	Analyzed: 05/29/96
Attention: Yi-Ran Wu	Lab Number: 9605E85-07	Reported: 06/04/96

QC Batch Number: GC052996BTEXEXA
Instrument ID: GCHP18

Total Purgeable Petroleum Hydrocarbons (TPPH) with BTEX

Analyte	**Detection Limit mg/Kg**	**Sample Results mg/Kg**
TPPH as Gas	1.0	N.D.
Benzene	0.0050	N.D.
Toluene	0.0050	N.D.
Ethyl Benzene	0.0050	N.D.
Xylenes (Total)	0.0050	N.D.
Chromatogram Pattern:		

Surrogates	**Control Limits %**		**% Recovery**
Trifluorotoluene	70	130	93

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Mike Gregory
Project Manager

Sequoia Analytical

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Weiss Associates 5500 Shellmound Emeryville, CA 94608 Attention: Yi-Ran Wu	Client Proj. ID: Shell 1800 Powell, Emeryville Sample Descript: B6-11 Matrix: SOLID Analysis Method: EPA 8015 Mod Lab Number: 9605E85-08	Sampled: 05/20/96 Received: 05/22/96 Extracted: 05/29/96 Analyzed: 05/30/96 Reported: 06/04/96

QC Batch Number: GC0529960HBPEXA
Instrument ID: GCHP5A

Fuel Fingerprint

Analyte	Detection Limit mg/Kg	Sample Results mg/Kg
Extractable Hydrocarbons	1.0	40
Chromatogram Pattern:		C9-C40

Surrogates	Control Limits %		% Recovery
n-Pentacosane (C25)	50	150	101

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Mike Gregory
Project Manager

Sequoia Analytical

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Weiss Associates 5500 Shellmound Emeryville, CA 94608 Attention: Yi-Ran Wu	Client Proj. ID: Shell 1800 Powell, Emeryville Sample Descript: B6-11 Matrix: SOLID Analysis Method: 8015Mod/8020 Lab Number: 9605E85-08	Sampled: 05/20/96 Received: 05/22/96 Extracted: 05/29/96 Analyzed: 05/29/96 Reported: 06/04/96

QC Batch Number: GC052996BTEXEXA
Instrument ID: GCHP18

Total Purgeable Petroleum Hydrocarbons (TPPH) with BTEX

Analyte	**Detection Limit mg/Kg**	**Sample Results mg/Kg**
TPPH as Gas	1.0	N.D.
Benzene	0.0050	N.D.
Toluene	0.0050	N.D.
Ethyl Benzene	0.0050	N.D.
Xylenes (Total)	0.0050	N.D.
Chromatogram Pattern:		

Surrogates	**Control Limits %**		**% Recovery**
Trifluorotoluene	70	130	89

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Mike Gregory
Project Manager

Sequoia Analytical

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Weiss Associates
5500 Shellmound
Emeryville, CA 94608
Attention: Yi-Ran Wu

Client Proj. ID: Shell 1800 Powell, Emeryville
Lab Proj. ID: 9605E85

Received: 05/22/96
Reported: 06/04/96

LABORATORY NARRATIVE

DIESEL: Both samples contains heavy oil.

SEQUOIA ANALYTICAL

Mike Gregory
Project Manager

Sequoia Analytical

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Weiss & Associates	Client Project ID:	Shell 1800 Powell, Emeryville			
5500 Shellmound	Matrix:	Solid			
Emeryville, CA 94608					
Attention: Yi-Ran Wu	Work Order #:	9605E85	01, 02, 04-08	Reported:	Jun 4, 1996

QUALITY CONTROL DATA REPORT

Analyte:	Benzene	Toluene	Ethyl Benzene	Xylenes
QC Batch#:	GC052996BTEXEXA	GC052996BTEXEXA	GC052996BTEXEXA	GC052996BTEXEXA
Analy. Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Prep. Method:	EPA 5030	EPA 5030	EPA 5030	EPA 5030
Analyst:	E. Cunanan	E. Cunanan	E. Cunanan	E. Cunanan
MS/MSD #:	9605C38-03	9605C38-03	9605C38-03	9605C38-03
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Prepared Date:	5/29/96	5/29/96	5/29/96	5/29/96
Analyzed Date:	5/29/96	5/29/96	5/29/96	5/29/96
Instrument I.D.#:	GCHP1	GCHP1	GCHP1	GCHP1
Conc. Spiked:	0.20 mg/kg	0.20 mg/kg	0.20 mg/kg	0.60 mg/kg
Result:	0.16	0.16	0.16	0.48
MS % Recovery:	80	80	80	80
Dup. Result:	0.16	0.16	0.16	0.50
MSD % Recov.:	80	80	80	83
RPD:	0.0	0.0	0.0	4.1
RPD Limit:	0-25	0-25	0-25	0-25
LCS #:	GBLK052996BSA	GBLK052996BSA	BLK052996BSA	GBLK052996BSA
Prepared Date:	5/29/96	5/29/96	5/29/96	5/29/96
Analyzed Date:	5/29/96	5/29/96	5/29/96	5/29/96
Instrument I.D.#:	GCHP1	GCHP1	GCHP1	GCHP1
Conc. Spiked:	0.20 mg/kg	0.20 mg/kg	0.20 mg/kg	0.60 mg/kg
LCS Result:	0.19	0.19	0.19	0.56
LCS % Recov.:	95	95	95	93
MS/MSD	60-140	60-140	60-140	60-140
LCS	70-130	70-130	70-130	70-130
Control Limits				

SEQUOIA ANALYTICAL

Mike Gregory
Project Manager

Please Note:
The LCS is a control sample of known, interferent-free matrix that is analyzed using the same reagents, preparation, and analytical methods employed for the samples. The matrix spike is an aliquot of sample fortified with known quantities of specific compounds and subjected to the entire analytical procedure. If the recovery of analytes from the matrix spike does not fall within specified control limits due to matrix interference, the LCS recovery is to be used to validate the batch.

** MS=Matrix Spike, MSD=MS Duplicate, RPD=Relative % Difference

Sequoia Analytical

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Weiss & Associates	Client Project ID:	Shell 1800 Powell, Emeryville		
5500 Shellmound	Matrix:	Solid		
Emeryville, CA 94608				
Attention: Yi-Ran Wu	Work Order #:	9605E85 -02, 08	Reported:	Jun 4, 1996

QUALITY CONTROL DATA REPORT

Analyte:	Diesel	Total Recoverable Petroleum Hydro.
QC Batch#:	GC052996OHBPEXA	OP052996SM5520EXA
Analy. Method:	EPA 8015 M	SM 5520 EF Mod
Prep. Method:	EPA 3550	EPA 3550
Analyst:	B. Ali	C. Alcayde
MS/MSD #:	9605H24-01	9605F45-15
Sample Conc.:	2.1	N.D.
Prepared Date:	5/29/96	5/29/96
Analyzed Date:	5/30/96	5/30/96
Instrument I.D.#:	GCHP5A	MANUAL
Conc. Spiked:	25 mg/kg	500 mg/kg
Result:	27	390
MS % Recovery:	100	78
Dup. Result:	27	370
MSD % Recov.:	100	74
RPD:	0.0	5.4
RPD Limit:	0-50	0-50

LCS #:	BLK052996S	BLK052996
Prepared Date:	5/29/96	5/29/96
Analyzed Date:	5/30/96	5/30/96
Instrument I.D.#:	GCHP5A	MANUAL
Conc. Spiked:	25 mg/kg	500 mg/kg
LCS Result:	21	380
LCS % Recov.:	84	76

MS/MSD	60-140	60-140
LCS	50-150	70-110
Control Limits		

SEQUOIA ANALYTICAL

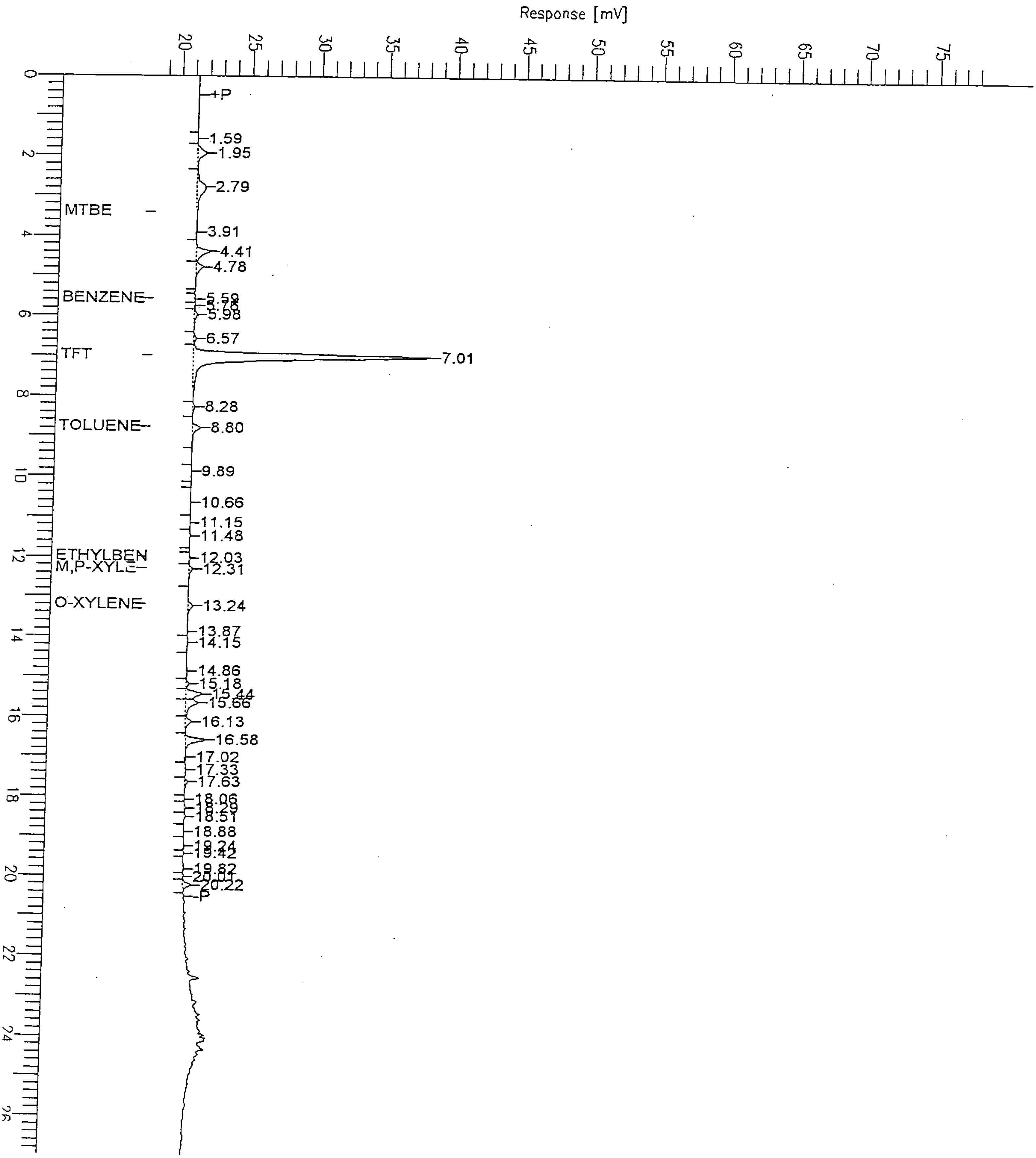
Mike Gregory
Project Manager

Please Note:
The LCS is a control sample of known, interferent-free matrix that is analyzed using the same reagents, preparation, and analytical methods employed for the samples. The matrix spike is an aliquot of sample fortified with known quantities of specific compounds and subjected to the entire analytical procedure. If the recovery of analytes from the matrix spike does not fall within specified control limits due to matrix interference, the LCS recovery is to be used to validate the batch.

** MS=Matrix Spike, MSD=MS Duplicate, RPD=Relative % Difference

Chromatogram

Sample Name : GS9605E85-01		Sample #: B3-6.5	Page 1 of 1
FileName : S:\GHP_18\0602\529B018.raw		Date : 5/29/96 21:57	
Method : TPH		Time of Injection: 5/29/96 21:29	
Start Time : 0.00 min	End Time : 26.99 min	Low Point : 18.20 mV	High Point : 78.20 mV
Scale Factor: -1.0	Plot Offset: 18 mV	Plot Scale: 60.0 mV	



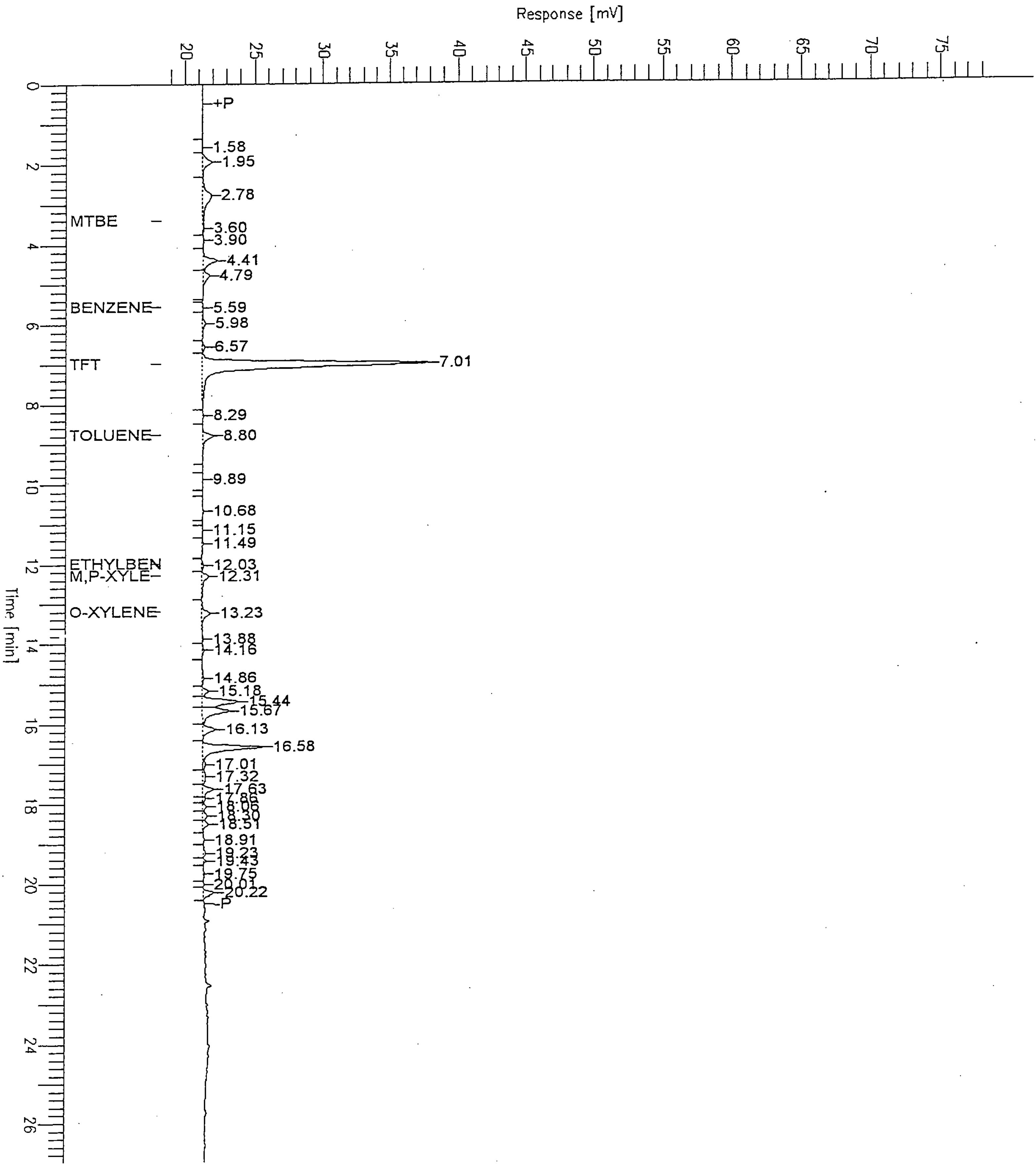
Chromatogram

:mple Name : GS9605E85-02
leName : S:\GHP_18\0602\529B019.raw
·thod : TPH
art Time : 0.00 min
:ale Factor: -1.0

End Time : 26.99 min
Plot Offset: 18 mV

Sample #: B3-10.5
Date : 5/29/96 22:32
Time of Injection: 5/29/96 22:05
Low Point : 18.23 mV
Plot Scale: 60.0 mV

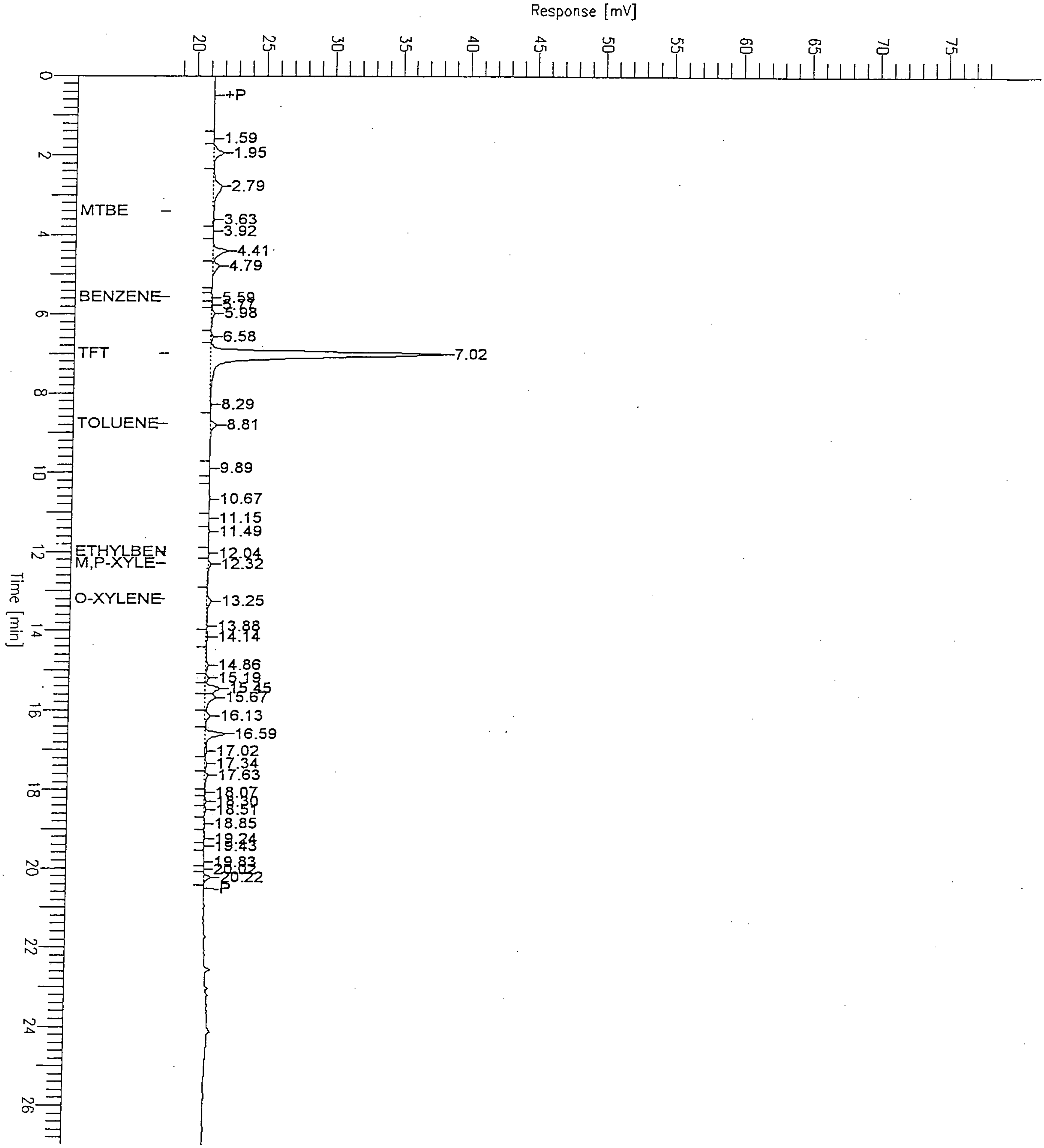
High Point : 78.23 mV



Chromatogram

Sample Name : GS9605E85-04
FileName : S:\GHP_18\0602\529B020.raw
Method : TPH
Start Time : 0.00 min
End Time : 26.99 min
Scale Factor: -1.0
Plot Offset: 18 mV

Sample #: B4-6.5
Date : 5/29/96 23:08
Time of Injection: 5/29/96 22:40
Low Point : 18.22 mV
High Point : 78.22 mV
Plot Scale: 60.0 mV



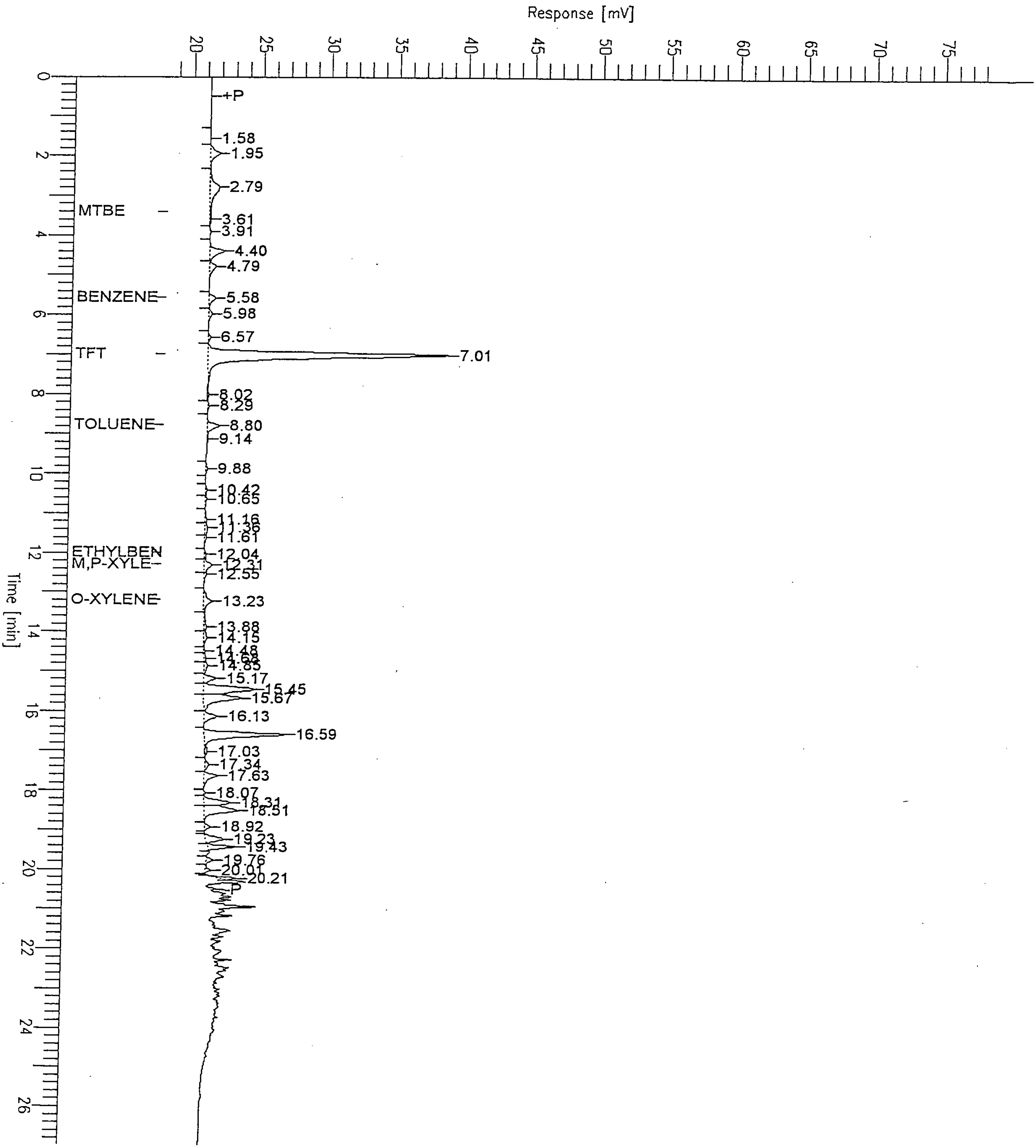
Chromatogram

Sample Name : GS9605E85-05
FileName : S:\GHP_18\0602\529B021.raw
Method : TPH
Start Time : 0.00 min
Scale Factor: -1.0

End Time : 26.99 min
Plot Offset: 18 mV

Sample #: B5-3
Date : 5/29/96 23:43
Time of Injection: 5/29/96 23:15
Low Point : 18.21 mV
Plot Scale: 60.0 mV

High Point : 78.21 mV



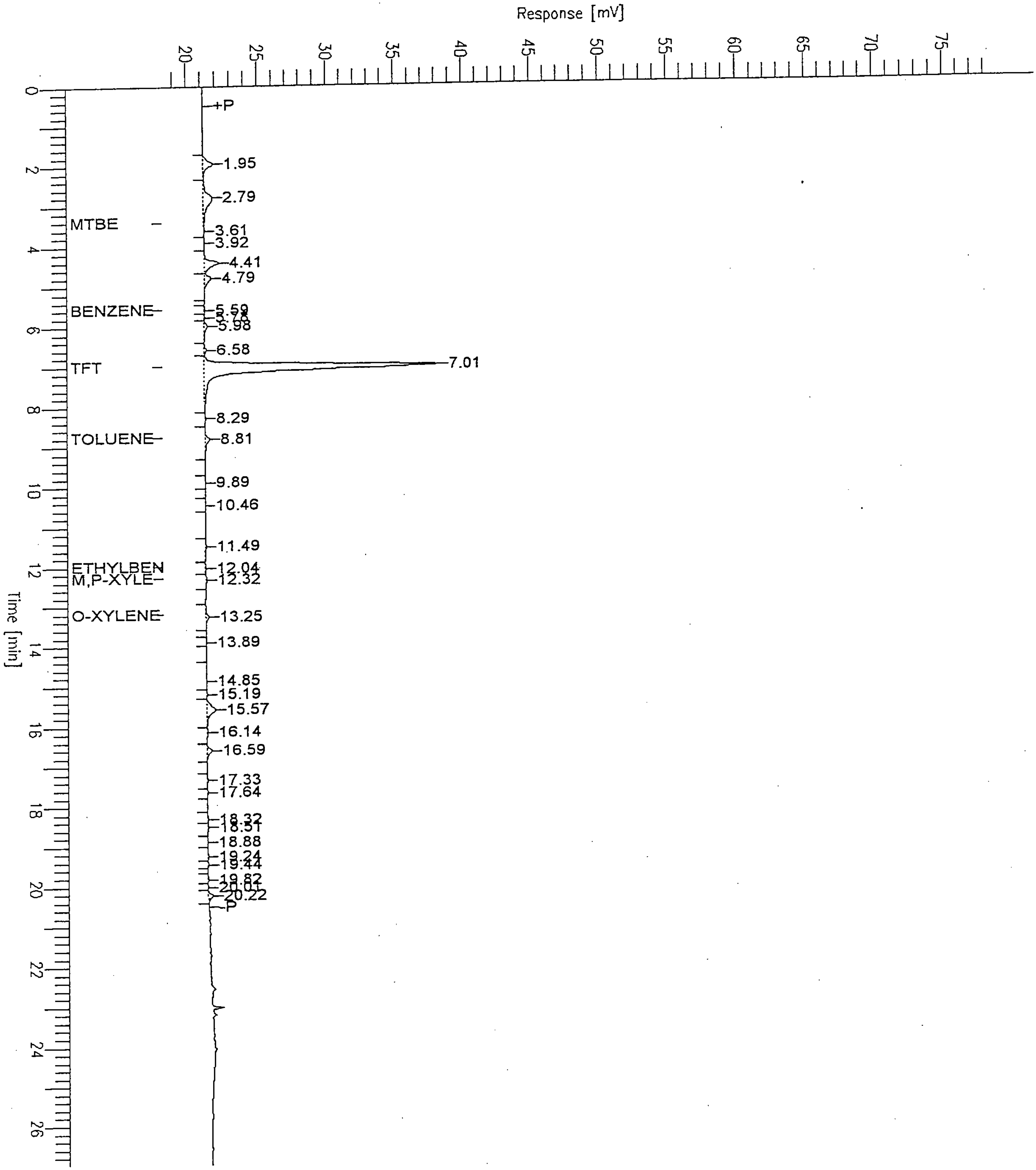
Chromatogram

ample Name : GS9605E85-06
ileName : S:\GHP_18\0602\529B022.raw
ethod : TPH
tart Time : 0.00 min
cale Factor: -1.0

End Time : 26.99 min
Plot Offset: 18 mV

Sample #: B6-3.5
Date : 5/30/96 00:19
Time of Injection: 5/29/96 23:51
Low Point : 18.21 mV
Plot Scale: 60.0 mV

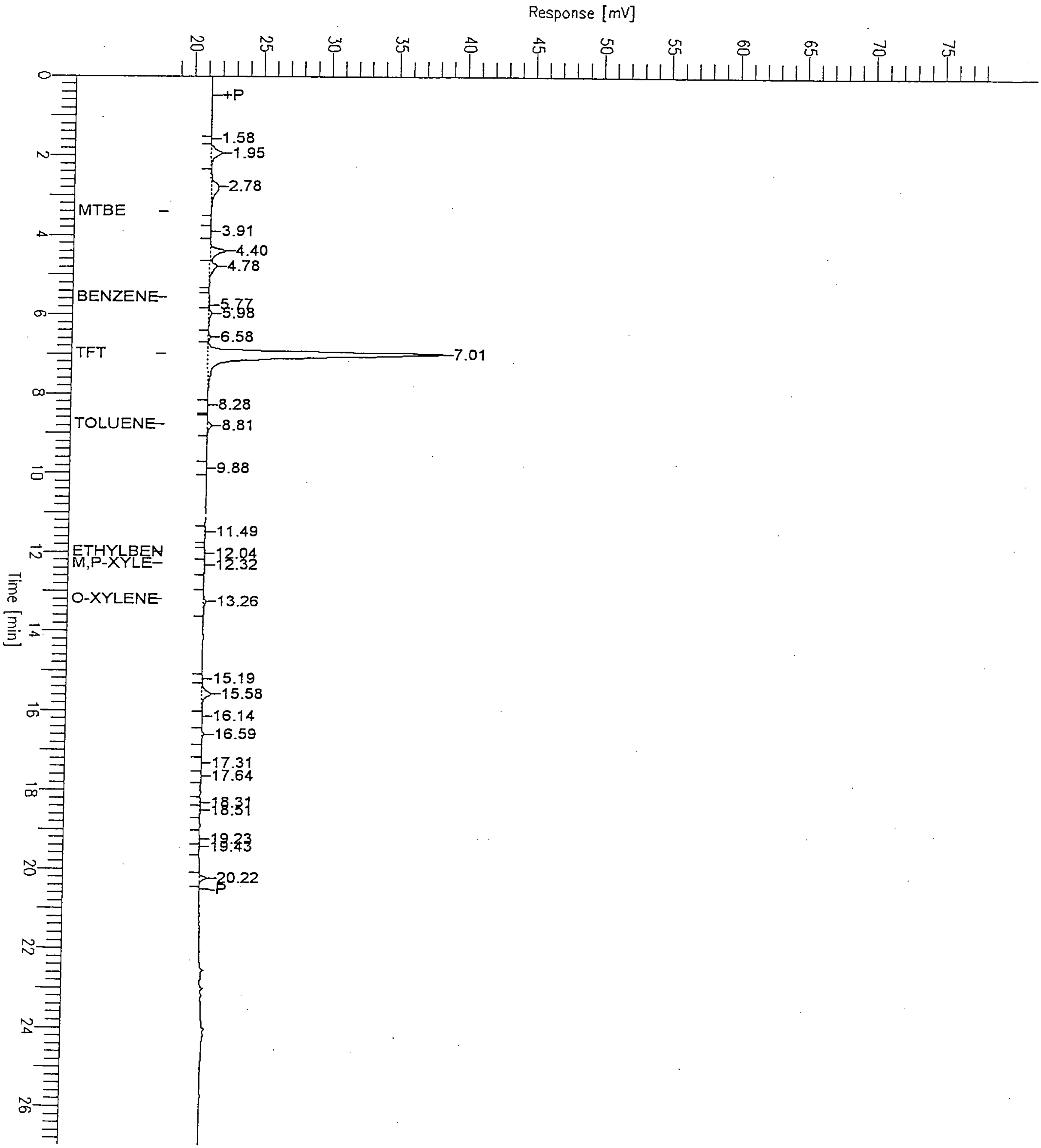
High Point : 78.21 mV



Chromatogram

Sample Name : GS9605E85-07
FileName : S:\GHP_18\0602\529B023.raw
Method : TPH
Start Time : 0.00 min
Scale Factor: -1.0
End Time : 26.99 min
Plot Offset: 18 mV
Sample #: B6-6.5
Date : 5/30/96 00:55
Time of Injection: 5/30/96 00:26
Low Point : 18.21 mV
Plot Scale: 60.0 mV

High Point : 78.21 mV



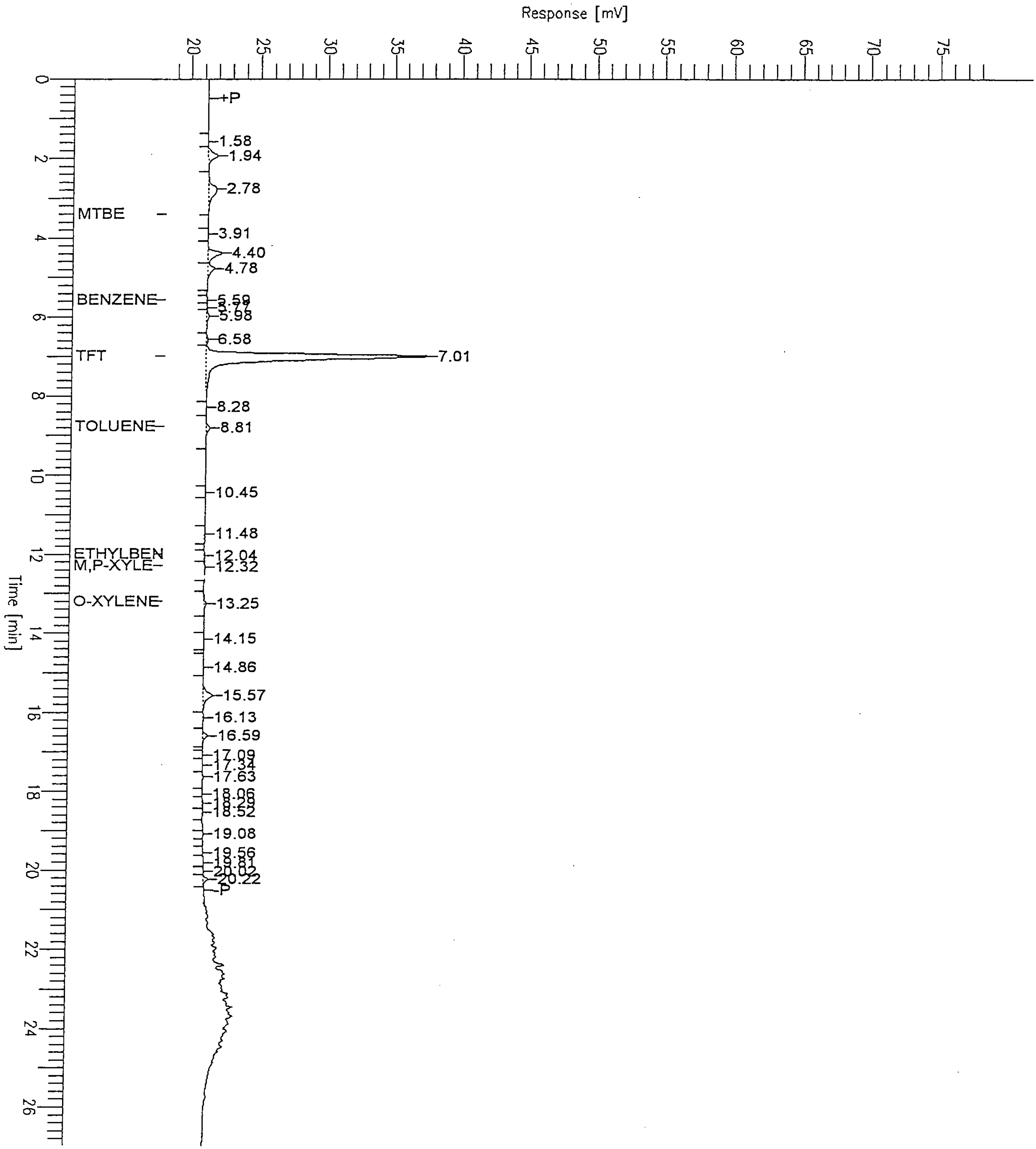
Chromatogram

Sample Name : GS9605E85-08
FileName : S:\GHP_18\0602\529B024.raw
Method : TPH
Start Time : 0.00 min
Scale Factor: -1.0

End Time : 26.99 min
Plot Offset: 18 mV

Sample #: B6-11
Date : 5/30/96 01:30
Time of Injection: 5/30/96 01:02
Low Point : 18.21 mV
Plot Scale: 60.0 mV

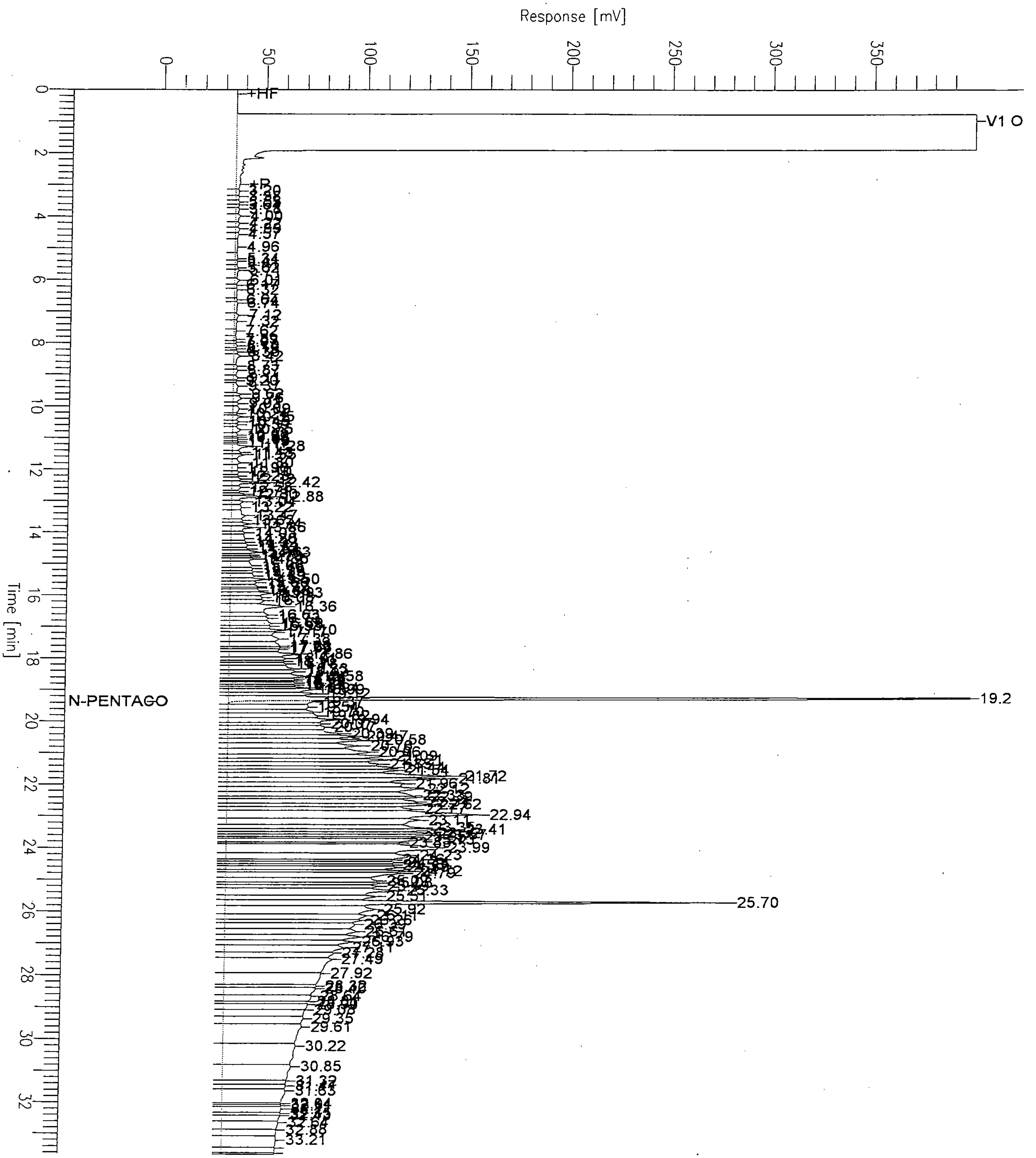
High Point : 78.21 mV



Chromatogram

Sample Name : DS9605E85-2 (20:1)
FileName : S:\GHP_05\0602\530A012.raw
Method : TPH05A
Start Time : 0.00 min   End Time : 33.65 min
Scale Factor: 0.0   Plot Offset: 0 mV

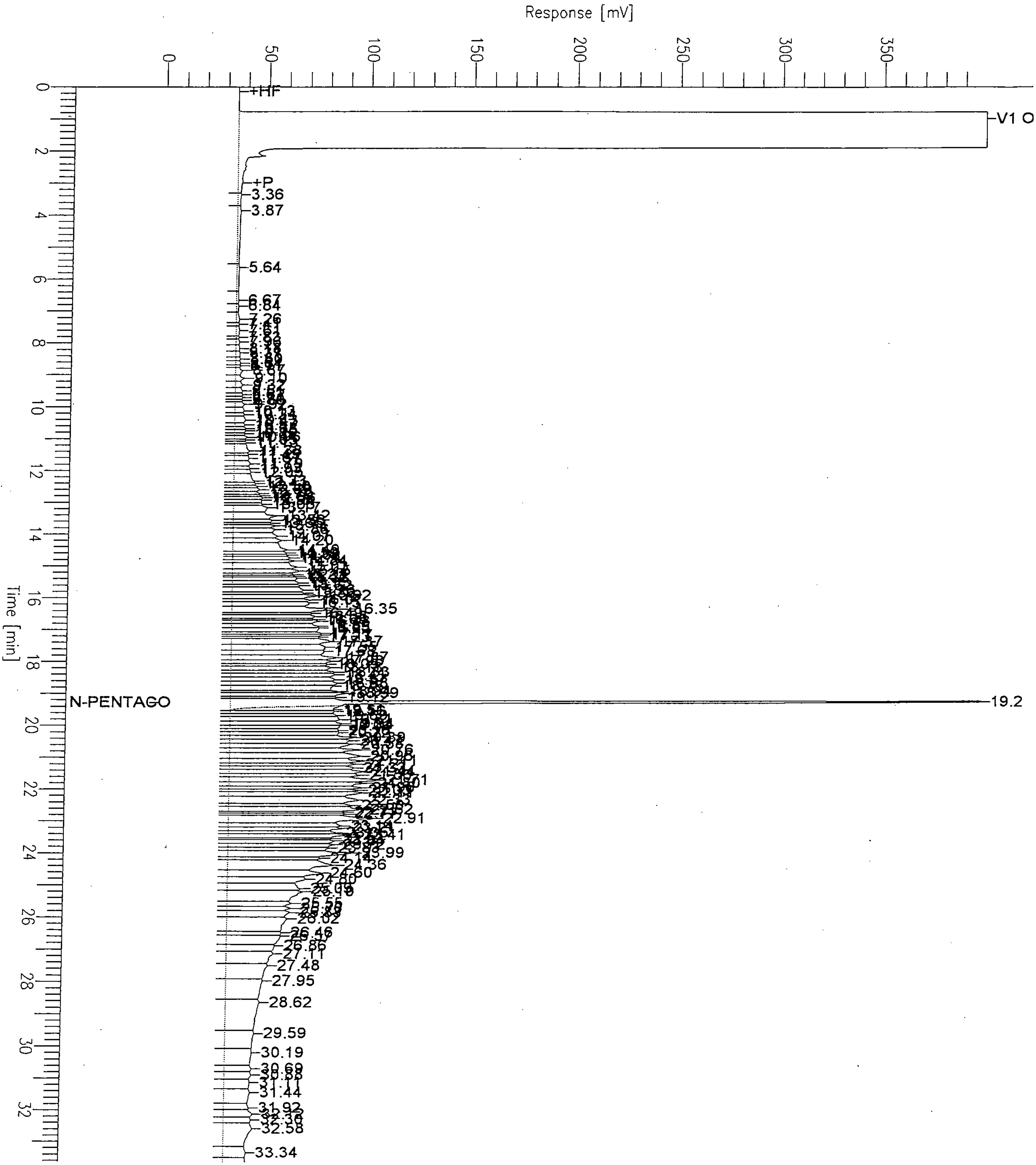
Sample #: B3-10.5
Date : 6/3/96 09:10
Time of Injection: 5/30/96 15:24
Low Point : 0.00 mV   High Point : 400.00 mV
Plot Scale: 400.0 mV



Chromatogram

Sample Name : DS9605E85-8 (20:1)
FileName : S:\GHP_05\0602\530A011.raw
Method : TPH05A
Start Time : 0.00 min End Time : 33.65 min
Scale Factor: 0.0 Plot Offset: 0 mV

Sample #: B6-11
Date : 6/3/96 09:10
Time of Injection: 5/30/96 14:42
Low Point : 0.00 mV High Point : 400.00 mV
Plot Scale: 400.0 mV



Sequoia Analytical

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Weiss Associates
5500 Shellmound
Emeryville, CA 94608

Attention: Yi-Ran Wu

Client Proj. ID: Shell 1800 Powell St.
Lab Proj. ID: 9605H09

Sampled: 05/20/96
Received: 05/22/96
Analyzed: see below
Reported: 06/07/96

LABORATORY ANALYSIS

Analyte	Units	Date Analyzed	Detection Limit	Sample Results
Lab No: 9605H09-03 Sample Desc : **SOLID,B1-13.0**				
TRPH (SM 5520 E&F Mod.)	**mg/Kg**	**05/30/96**	**50**	**67**
Lab No: 9605H09-04 Sample Desc : **SOLID,B1-15.0**				
TRPH (SM 5520 E&F Mod.)	**mg/Kg**	**05/30/96**	**50**	**1100**
Lab No: 9605H09-07 Sample Desc : **SOLID,B2-11.0**				
TRPH (SM 5520 E&F Mod.)	**mg/Kg**	**05/31/96**	**50**	**1500**

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Mike Gregory
Project Manager

Sequoia Analytical

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Weiss Associates
5500 Shellmound
Emeryville, CA 94608
Attention: Jeff Granberry

Project: Shell 81-0794-01/Everyville

Enclosed are the results from samples received at Sequoia Analytical on May 22, 1996. The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION	DATE COLLECTED	TEST METHOD
9605E72 -01	LIQUID, B1-GW	05/20/96	8240 Volatile Organic Co
9605E72 -01	LIQUID, B1-GW	05/20/96	TPGBMW Purgeable TPH/BTEX
9605E72 -02	LIQUID, B2-GW	05/20/96	8240 Volatile Organic Co
9605E72 -02	LIQUID, B2-GW	05/20/96	TPGBMW Purgeable TPH/BTEX
9605E72 -03	LIQUID, B6-GW	05/20/96	8240 Volatile Organic Co
9605E72 -03	LIQUID, B6-GW	05/20/96	TPGBMW Purgeable TPH/BTEX

Please contact me if you have any questions. In the meantime, thank you for the opportunity to work with you on this project.

Very truly yours,

SEQUOIA ANALYTICAL

Mike Gregory
Project Manager

Sequoia Analytical

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Weiss Associates
5500 Shellmound
Emeryville, CA 94608

Attention: Jeff Granberry

Client Proj. ID: Shell 81-0794-01/Everyville
Sample Descript: B1-GW
Matrix: LIQUID
Analysis Method: EPA 8240
Lab Number: 9605E72-01

Sampled: 05/20/96
Received: 05/22/96

Analyzed: 05/28/96
Reported: 05/30/96

QC Batch Number: MS0528968240F3A
Instrument ID: F3

Volatile Organics (EPA 8240)

Analyte	Detection Limit ug/L	Sample Results ug/L
Acetone	**10**	**14**
Benzene	2.0	N.D.
Bromodichloromethane	2.0	N.D.
Bromoform	2.0	N.D.
Bromomethane	2.0	N.D.
2-Butanone	10	N.D.
Carbon disulfide	2.0	N.D.
Carbon tetrachloride	2.0	N.D.
Chlorobenzene	2.0	N.D.
Chloroethane	2.0	N.D.
2-Chloroethyl vinyl ether	10	N.D.
Chloroform	2.0	N.D.
Chloromethane	2.0	N.D.
Dibromochloromethane	2.0	N.D.
1,1-Dichloroethane	2.0	N.D.
1,2-Dichloroethane	2.0	N.D.
1,1-Dichloroethene	2.0	N.D.
cis-1,2-Dichloroethene	2.0	N.D.
trans-1,2-Dichloroethene	2.0	N.D.
1,2-Dichloropropane	2.0	N.D.
cis-1,3-Dichloropropene	2.0	N.D.
trans-1,3-Dichloropropene	2.0	N.D.
Ethylbenzene	2.0	N.D.
2-Hexanone	10	N.D.
Methylene chloride	5.0	N.D.
4-Methyl-2-pentanone	10	N.D.
Styrene	2.0	N.D.
1,1,2,2-Tetrachloroethane	2.0	N.D.
Tetrachloroethene	2.0	N.D.
Toluene	2.0	N.D.
1,1,1-Trichloroethane	2.0	N.D.
1,1,2-Trichloroethane	2.0	N.D.
Trichloroethene	2.0	N.D.
Trichlorofluoromethane	2.0	N.D.
Vinyl acetate	5.0	N.D.
Vinyl chloride	2.0	N.D.

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Weiss Associates
5500 Shellmound
Emeryville, CA 94608

Attention: Jeff Granberry

Client Proj. ID: Shell 81-0794-01/Everyville
Sample Descript: B1-GW
Matrix: LIQUID
Analysis Method: EPA 8240
Lab Number: 9605E72-01

Sampled: 05/20/96
Received: 05/22/96

Analyzed: 05/28/96
Reported: 05/30/96

QC Batch Number: MS0528968240F3A
Instrument ID: F3

Analyte	Detection Limit ug/L		Sample Results ug/L
Total Xylenes	2.0		N.D.
Surrogates	**Control Limits %**		**% Recovery**
1,2-Dichloroethane-d4	76	114	101
Toluene-d8	88	110	100
4-Bromofluorobenzene	86	115	99

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Mike Gregory
Project Manager

Sequoia Analytical

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Weiss Associates	Client Proj. ID: Shell 81-0794-01/Everyville	Sampled: 05/20/96
5500 Shellmound	Sample Descript: B1-GW	Received: 05/22/96
Emeryville, CA 94608	Matrix: LIQUID	
	Analysis Method: 8015Mod/8020	Analyzed: 05/24/96
Attention: Jeff Granberry	Lab Number: 9605E72-01	Reported: 05/30/96

QC Batch Number: GC052496BTEX17B
Instrument ID: GCHP17

Total Purgeable Petroleum Hydrocarbons (TPPH) with BTEX and MTBE

Analyte	Detection Limit ug/L	Sample Results ug/L
TPPH as Gas	50	N.D.
Methyl t-Butyl Ether	2.5	N.D.
Benzene	0.50	N.D.
Toluene	0.50	N.D.
Ethyl Benzene	0.50	N.D.
Xylenes (Total)	0.50	N.D.
Chromatogram Pattern:		

Surrogates	Control Limits %		% Recovery
Trifluorotoluene	70	130	94

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Mike Gregory
Project Manager

Sequoia Analytical

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Weiss Associates 5500 Shellmound Emeryville, CA 94608 Attention: Jeff Granberry	Client Proj. ID: Shell 81-0794-01/Everyville Sample Descript: B2-GW Matrix: LIQUID Analysis Method: EPA 8240 Lab Number: 9605E72-02	Sampled: 05/20/96 Received: 05/22/96 Analyzed: 05/28/96 Reported: 05/30/96

QC Batch Number: MS0528968240F3A
Instrument ID: F3

Volatile Organics (EPA 8240)

Analyte	Detection Limit ug/L	Sample Results ug/L
Acetone	10	N.D.
Benzene	2.0	N.D.
Bromodichloromethane	2.0	N.D.
Bromoform	2.0	N.D.
Bromomethane	2.0	N.D.
2-Butanone	10	N.D.
Carbon disulfide	2.0	N.D.
Carbon tetrachloride	2.0	N.D.
Chlorobenzene	2.0	N.D.
Chloroethane	2.0	N.D.
2-Chloroethyl vinyl ether	10	N.D.
Chloroform	2.0	N.D.
Chloromethane	2.0	N.D.
Dibromochloromethane	2.0	N.D.
1,1-Dichloroethane	2.0	N.D.
1,2-Dichloroethane	2.0	N.D.
1,1-Dichloroethene	2.0	N.D.
cis-1,2-Dichloroethene	2.0	N.D.
trans-1,2-Dichloroethene	2.0	N.D.
1,2-Dichloropropane	2.0	N.D.
cis-1,3-Dichloropropene	2.0	N.D.
trans-1,3-Dichloropropene	2.0	N.D.
Ethylbenzene	2.0	N.D.
2-Hexanone	10	N.D.
Methylene chloride	5.0	N.D.
4-Methyl-2-pentanone	10	N.D.
Styrene	2.0	N.D.
1,1,2,2-Tetrachloroethane	2.0	N.D.
Tetrachloroethene	2.0	N.D.
Toluene	2.0	N.D.
1,1,1-Trichloroethane	2.0	N.D.
1,1,2-Trichloroethane	2.0	N.D.
Trichloroethene	2.0	N.D.
Trichlorofluoromethane	2.0	N.D.
Vinyl acetate	5.0	N.D.
Vinyl chloride	2.0	N.D.

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Weiss Associates 5500 Shellmound Emeryville, CA 94608 Attention: Jeff Granberry	Client Proj. ID: Shell 81-0794-01/Everyville Sample Descript: B2-GW Matrix: LIQUID Analysis Method: EPA 8240 Lab Number: 9605E72-02	Sampled: 05/20/96 Received: 05/22/96 Analyzed: 05/28/96 Reported: 05/30/96

QC Batch Number: MS0528968240F3A
Instrument ID: F3

Analyte	Detection Limit ug/L		Sample Results ug/L
Total Xylenes	2.0		N.D.
Surrogates	**Control Limits %**		**% Recovery**
1,2-Dichloroethane-d4	76	114	102
Toluene-d8	88	110	99
4-Bromofluorobenzene	86	115	103

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Mike Gregory
Project Manager

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819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Weiss Associates	Client Proj. ID: Shell 81-0794-01/Everyville	Sampled: 05/20/96
5500 Shellmound	Sample Descript: B2-GW	Received: 05/22/96
Emeryville, CA 94608	Matrix: LIQUID	
	Analysis Method: 8015Mod/8020	Analyzed: 05/24/96
Attention: Jeff Granberry	Lab Number: 9605E72-02	Reported: 05/30/96

QC Batch Number: GC052496BTEX03A
Instrument ID: GCHP3

Total Purgeable Petroleum Hydrocarbons (TPPH) with BTEX and MTBE

Analyte	Detection Limit ug/L	Sample Results ug/L
TPPH as Gas	50	N.D.
Methyl t-Butyl Ether	2.5	N.D.
Benzene	0.50	N.D.
Toluene	0.50	N.D.
Ethyl Benzene	0.50	N.D.
Xylenes (Total)	0.50	N.D.
Chromatogram Pattern:		

Surrogates	Control Limits %		% Recovery
Trifluorotoluene	70	130	99

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Mike Gregory
Project Manager

Sequoia Analytical

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819 Striker Avenue, Suite 8 Sacramento, CA 95834 (916) 921-9600 FAX (916) 921-0100

Weiss Associates
5500 Shellmound
Emeryville, CA 94608

Attention: Jeff Granberry

Client Proj. ID: Shell 81-0794-01/Everyville
Sample Descript: B6-GW
Matrix: LIQUID
Analysis Method: EPA 8240
Lab Number: 9605E72-03

Sampled: 05/20/96
Received: 05/22/96

Analyzed: 05/28/96
Reported: 05/30/96

QC Batch Number: MS0528968240F3A
Instrument ID: F3

Volatile Organics (EPA 8240)

Analyte	Detection Limit ug/L	Sample Results ug/L
Acetone	10	N.D.
Benzene	2.0	N.D.
Bromodichloromethane	2.0	N.D.
Bromoform	2.0	N.D.
Bromomethane	2.0	N.D.
2-Butanone	10	N.D.
Carbon disulfide	2.0	N.D.
Carbon tetrachloride	2.0	N.D.
Chlorobenzene	2.0	N.D.
Chloroethane	2.0	N.D.
2-Chloroethyl vinyl ether	10	N.D.
Chloroform	2.0	N.D.
Chloromethane	2.0	N.D.
Dibromochloromethane	2.0	N.D.
1,1-Dichloroethane	2.0	N.D.
1,2-Dichloroethane	2.0	N.D.
1,1-Dichloroethene	2.0	N.D.
cis-1,2-Dichloroethene	2.0	N.D.
trans-1,2-Dichloroethene	2.0	N.D.
1,2-Dichloropropane	2.0	N.D.
cis-1,3-Dichloropropene	2.0	N.D.
trans-1,3-Dichloropropene	2.0	N.D.
Ethylbenzene	2.0	N.D.
2-Hexanone	10	N.D.
Methylene chloride	5.0	N.D.
4-Methyl-2-pentanone	10	N.D.
Styrene	2.0	N.D.
1,1,2,2-Tetrachloroethane	2.0	N.D.
Tetrachloroethene	2.0	N.D.
Toluene	2.0	N.D.
1,1,1-Trichloroethane	2.0	N.D.
1,1,2-Trichloroethane	2.0	N.D.
Trichloroethene	2.0	N.D.
Trichlorofluoromethane	2.0	N.D.
Vinyl acetate	5.0	N.D.
Vinyl chloride	2.0	N.D.

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Weiss Associates 5500 Shellmound Emeryville, CA 94608 Attention: Jeff Granberry	Client Proj. ID: Shell 81-0794-01/Everyville Sample Descript: B6-GW Matrix: LIQUID Analysis Method: EPA 8240 Lab Number: 9605E72-03	Sampled: 05/20/96 Received: 05/22/96 Analyzed: 05/28/96 Reported: 05/30/96

QC Batch Number: MS0528968240F3A
Instrument ID: F3

Analyte	Detection Limit ug/L		Sample Results ug/L
Total Xylenes	2.0		N.D.
Surrogates	**Control Limits %**		**% Recovery**
1,2-Dichloroethane-d4	76	114	101
Toluene-d8	88	110	100
4-Bromofluorobenzene	86	115	101

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Mike Gregory
Project Manager

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
404 N. Wiget Lane, Walnut Creek, CA 94598, (510) 988-9600, FAX (510) 988-9673
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Weiss Associates
5500 Shellmound
Emeryville, CA 94608

Attention: Jeff Granberry

Client Proj. ID: Shell 81-0794-01/Everyville
Sample Descript: B6-GW
Matrix: LIQUID
Analysis Method: 8015Mod/8020
Lab Number: 9605E72-03

Sampled: 05/20/96
Received: 05/22/96

Analyzed: 05/24/96
Reported: 05/30/96

QC Batch Number: GC052496BTEX03A
Instrument ID: GHCP3

Total Purgeable Petroleum Hydrocarbons (TPPH) with BTEX and MTBE

Analyte	Detection Limit ug/L	Sample Results ug/L
TPPH as Gas	50	N.D.
Methyl t-Butyl Ether	2.5	N.D.
Benzene	0.50	N.D.
Toluene	0.50	N.D.
Ethyl Benzene	0.50	N.D.
Xylenes (Total)	0.50	N.D.
Chromatogram Pattern:		

Surrogates	Control Limits %		% Recovery
Trifluorotoluene	70	130	97

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Mike Gregory
Project Manager

Sequoia Analytical

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Weiss & Associates
5500 Shellmound
Emeryville, CA 94608
Attention: Jeff Granberry

Client Project ID: Shell 81-0794-01/Everyville
Matrix: Liquid

Work Order #: 9605E72 -01

Reported: May 31, 1996

QUALITY CONTROL DATA REPORT

Analyte:	Benzene	Toluene	Ethyl Benzene	Xylenes
QC Batch#:	GC052496BTEX17B	GC052496BTEX17B	GC052496BTEX17B	GC052496BTEX17B
Analy. Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Prep. Method:	EPA 5030	EPA 5030	EPA 5030	EPA 5030

Analyst:	J. Woo	J. Woo	J. Woo	J. Woo
MS/MSD #:	G9605C37-02B	G9605C37-02B	G9605C37-02B	G9605C37-02B
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Prepared Date:	5/24/96	5/24/96	5/24/96	5/24/96
Analyzed Date:	5/24/96	5/24/96	5/24/96	5/24/96
Instrument I.D.#:	GCHP17	GCHP17	GCHP17	GCHP17
Conc. Spiked:	10 ug/L	10 ug/L	10 ug/L	30 ug/L
Result:	10	10	10	31
MS % Recovery:	100	100	100	103
Dup. Result:	10	10	10	31
MSD % Recov.:	100	100	100	103
RPD:	0.0	0.0	0.0	0.0
RPD Limit:	0-25	0-25	0-25	0-25

LCS #:	GBLK052496B	GBLK052496B	GBLK052496B	GBLK052496B
Prepared Date:	5/24/96	5/24/96	5/24/96	5/24/96
Analyzed Date:	5/24/96	5/24/96	5/24/96	5/24/96
Instrument I.D.#:	GCHP17	GCHP17	GCHP17	GCHP17
Conc. Spiked:	10 ug/L	10 ug/L	10 ug/L	30 ug/L
LCS Result:	10	10	10	31
LCS % Recov.:	100	100	100	103

Control Limits				
MS/MSD	60-140	60-140	60-140	60-140
LCS	70-130	70-130	70-130	70-130

SEQUOIA ANALYTICAL

Mike Gregory
Project Manager

Please Note:
The LCS is a control sample of known, interferent-free matrix that is analyzed using the same reagents, preparation, and analytical methods employed for the samples. The matrix spike is an aliquot of sample fortified with known quantities of specific compounds and subjected to the entire analytical procedure. If the recovery of analytes from the matrix spike does not fall within specified control limits due to matrix interference, the LCS recovery is to be used to validate the batch.

** MS=Matrix Spike, MSD=MS Duplicate, RPD=Relative % Difference

Sequoia Analytical

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819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Weiss & Associates
5500 Shellmound
Emeryville, CA 94608
Attention: Jeff Granberry

Client Project ID: Shell 81-0794-01/Everyville
Matrix: Liquid
Work Order #: 9605E72 -02 -03
Reported: May 31, 1996

QUALITY CONTROL DATA REPORT

Analyte:	Benzene	Toluene	Ethyl Benzene	Xylenes
QC Batch#:	GC052496BTEX03A	GC052496BTEX03A	GC052496BTEX03A	GC052496BTEX03A
Analy. Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Prep. Method:	EPA 5030	EPA 5030	EPA 5030	EPA 5030

Analyst:	J. Woo	J. Woo	J. Woo	J. Woo
MS/MSD #:	G9605978-02G	G9605978-02G	G9605978-02G	G9605978-02G
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Prepared Date:	5/24/96	5/24/96	5/24/96	5/24/96
Analyzed Date:	5/24/96	5/24/96	5/24/96	5/24/96
Instrument I.D.#:	GCHP3	GCHP3	GCHP3	GCHP3
Conc. Spiked:	10 ug/L	10 ug/L	10 ug/L	30 ug/L
Result:	9.7	9.6	9.5	28
MS % Recovery:	97	96	95	93
Dup. Result:	9.9	9.9	9.8	29
MSD % Recov.:	99	99	98	97
RPD:	2.0	3.1	3.1	3.5
RPD Limit:	0-25	0-25	0-25	0-25

LCS #:	GBLK052496A	GBLK052496A	GBLK052496A	GBLK052496A
Prepared Date:	5/24/96	5/24/96	5/24/96	5/24/96
Analyzed Date:	5/24/96	5/24/96	5/24/96	5/24/96
Instrument I.D.#:	GCHP3	GCHP3	GCHP3	GCHP3
Conc. Spiked:	10 ug/L	10 ug/L	10 ug/L	30 ug/L
LCS Result:	10	9.9	9.8	30
LCS % Recov.:	100	99	98	100

Control Limits				
MS/MSD	60-140	60-140	60-140	60-140
LCS	70-130	70-130	70-130	70-130

SEQUOIA ANALYTICAL

Mike Gregory
Project Manager

Please Note:
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** MS = Matrix Spike, MSD = MS Duplicate, RPD = Relative % Difference

Sequoia Analytical

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Weiss & Associates
5500 Shellmound
Emeryville, CA 94608
Attention: Jeff Granberry

Client Project ID: Shell 81-0794-01/Everyville
Matrix: Liquid
Work Order #: 9605E72 -01 -03

Reported: May 31, 1996

QUALITY CONTROL DATA REPORT

Analyte:	1,1-Dichloroethene	Trichloroethene	Benzene	Toluene	Chloro-benzene
QC Batch#:	MS0528968240F3A	MS0528968240F3A	MS0528968240F3A	MS0528968240F3A	MS0528968240F3A
Analy. Method:	EPA 8240	EPA 8240	EPA 8240	EPA 8240	EPA 8240
Prep. Method:	N.A.	N.A.	N.A.	N.A.	N.A.
Analyst:	L.Duong	L.Duong	L.Duong	L.Duong	L.Duong
MS/MSD #:	9605E72-01	9605E72-01	9605E72-01	9605E72-01	9605E72-01
Sample Conc.:	N.D.	N.D.	N.D.	N.D.	N.D.
Prepared Date:	5/28/96	5/28/96	5/28/96	5/28/96	5/28/96
Analyzed Date:	5/28/96	5/28/96	5/28/96	5/28/96	5/28/96
Instrument I.D.#:	F3	F3	F3	F3	F3
Conc. Spiked:	50 ug/L	50 ug/L	50 ug/L	50 ug/L	50 ug/L
Result:	48	51	52	51	50
MS % Recovery:	96	102	104	102	100
Dup. Result:	49	50	53	50	51
MSD % Recov.:	98	100	106	100	102
RPD:	2.1	2.0	2.0	2.0	2.0
RPD Limit:	0-25	0-25	0-25	0-25	0-25

LCS #:	BB052896MS	BB052896MS	BB052896MS	BB052896MS	BB052896MS
Prepared Date:	5/28/96	5/28/96	5/28/96	5/28/96	5/28/96
Analyzed Date:	5/28/96	5/28/96	5/28/96	5/28/96	5/28/96
Instrument I.D.#:	F3	F3	F3	F3	F3
Conc. Spiked:	50 ug/L	50 ug/L	50 ug/L	50 ug/L	50 ug/L
LCS Result:	48	49	50	49	50
LCS % Recov.:	96	98	100	98	100

MS/MSD	60-140	60-140	60-140	60-140	60-140
LCS	65-135	70-130	70-130	70-130	70-130
Control Limits					

SEQUOIA ANALYTICAL

Mike Gregory
Project Manager

Please Note:
The LCS is a control sample of known, interferent-free matrix that is analyzed using the same reagents, preparation, and analytical methods employed for the samples. The matrix spike is an aliquot of sample fortified with known quantities of specific compounds and subjected to the entire analytical procedure. If the recovery of analytes from the matrix spike does not fall within specified control limits due to matrix interference, the LCS recovery is to be used to validate the batch.

** MS=Matrix Spike, MSD=MS Duplicate, RPD=Relative % Difference

SHELL OIL COMPANY
RETAIL ENVIRONMENTAL ENGINEERING - WEST

CHAIN OF CUSTODY RECORD
Serial No: 9605H09

Date: 5/20/96
Page 1 of 1

Site Address: 1800 Powell St, Emeryville CA

WIC#: 204-2495-0101

Shell Engineer: Jeff Granberry
Phone No.: (510) 675-6168
Fax #: 675-6172

Consultant Name & Address: WEISS ASSOCIATES 5500 SHELLMOUND ST EMERYVILLE CA 94608

Consultant Contact: WA JOB #81-0794-01
Phone No.: (510) 450-6000
Fax #: 547-5043

Comments:

Sampled by: Yi-Ran Wu

Printed Name: Yi-Ran Wu

LAB: Sequoia

CHECK ONE (1) BOX ONLY	CT/DT	
G.W. Monitoring	☐	4461
Site Investigation	☒	4441
Soil Classify/Disposal	☐	4442
Water Classify/Disposal	☐	4443
Soil/Air Rem. or Sys. O & M	☐	4452
Water Rem. or Sys. O & M	☐	4453
Other	☐	

TURN AROUND TIME
- 24 hours ☐
- 48 hours ☐
- 15 days ☒ (Normal)
- Other ☐ ______

NOTE: Notify Lab as soon as Possible of 24/48 hrs. TAT.

UST AGENCY: ALAMEDA CO DEPT OF ENV HEALTH

Analysis Required

	Sample ID	Date	Sludge	Soil	Water	Air	No. of conts.	TPH (EPA 8015 ~~Mod. Gas~~) TPH-C_6-C_{12} GAS	TPH (~~EPA 8015 Mod. Diesel~~) FUEL FINGERPRINT (C_9-C_{40})	BTEX (EPA 8020/602)	Volatile Organics (EPA 8240)	~~Test for Disposal~~ PCBs & PESTICIDES (8080)	Combination TPH 8015 & BTEX 8020	PETROLEUM OIL & GREASE (5520)	SEMI-VOCs (8270)	~~Asbestos~~ CAM 17 METALS	Container Size	Preparation Used	Composite Y/N	MATERIAL DESCRIPTION	SAMPLE CONDITION/ COMMENTS
1	B1-2.0	5/20		X			1	X		X							N/A	N	N	SOIL-GAS	GOOD
2	B1-7.0							X		X	X	X			X	X					
	B1-10.0																				Hold per Yi-Ran Wu 5/23/96 MG
3	B1-13.0							X	X	X				X							
4	B1-15.0							X	X DISREGARD	X	per Yi-Ran MG			X							
5	B2-2.0							X		X											
6	B2-7.5							X		X											
7	~~B2-11.0~~							x	x	x				x							
	B3-3.5																				Hold per Yi-Ran Wu

Relinquished By (signature):	Printed Name:	Date/Time	Received (signature):	Printed Name:	Date/Time
[signature]	Anni Kreml	Date: 5/22/96 Time: 1125	[signature]	Neil Van Slambrook	Date: 5/22/96 Time: 1123
[signature]	Neil Van Slambrook	Date: 5-22-96 Time: 1306	Received (signature):	Printed Name:	Date: Time:
	Printed Name:	Date: Time:	[signature]	M. Biederman	Date: 5-22-96 Time: 1306

THE LABORATORY MUST PROVIDE A COPY OF THIS CHAIN-OF-CUSTODY WITH INVOICE AND RESULTS

Rev. 1/13/93

Shell Oil Chain of Custody

SHELL OIL COMPANY
RETAIL ENVIRONMENTAL ENGINEERING - WEST

CHAIN OF CUSTODY RECORD

Serial No:

Date: 5/20/96

Page 1 of 1

Site Address: 1800 Powell St Emeryville, CA

WIC#: 1-204-2495-0101

Shell Engineer: Jeff Granberry

Phone No.: (510)675-6168
Fax #: 675-6172

Consultant Name & Address: WEISS ASSOCIATES 5500 SHELLMOUND ST EMERYVILLE CA 94608

Consultant Contact: WA JOB # 81-0794-01

Phone No.: (510) 450-6000
Fax #: 547-5043

Comments:

Sampled by: Yi-Ran Wu

Printed Name: Yi-Ran Wu

LAB: Sequoia

Analysis Required: 9605E85

CHECK ONE (1) BOX ONLY	CT/DT
G.W. Monitoring ☐	4461
Site Investigation ☒	4441
Soil Classify/Disposal ☐	4442
Water Classify/Disposal ☐	4443
Soil/Air Rem. or Sys. O & M ☐	4452
Water Rem. or Sys. O & M ☐	4453
Other ☐	

TURN AROUND TIME: 24 hours ☐ 48 hours ☐ 15 days ☒ (Normal) Other ☐

NOTE: Notify Lab as soon as Possible of 24/48 hrs. TAT.

UST AGENCY: ALAMEDA CO DEPT OF ENV HEALTH

	Sample ID	Date	Sludge	Soil	Water	Air	No. of conts.	TPH (EPA 8015 Mod. Gas)	TPH (EPA 8015 ~~Mod. Diesel~~) FUEL FINGERPRINT (C_9-C_{40})	BTEX (EPA 8020/602)	Volatile Organics (EPA 8240)	Test for Disposal	Combination TPH 8015 & BTEX 8020	PETROLEUM OIL & GREASE (5520)		Asbestos	Container Size	Preparation Used	Composite Y/N	MATERIAL DESCRIPTION	SAMPLE CONDITION/ COMMENTS
01	B3-6.5	5/20		X			1	X		X							N/A	N	N	SOIL-GAS	GOOD
02	B3-10.5	↓		↓			↓	X	X	X				X			↓	↓	↓	↓	↓
03	B4-4																			9605E85	Hold per Yi-Ran Wu 5/23/96 mG
04	B4-6.5							X		X											
05	B5-3							X		X											
06	B6-3.5							X		X											
07	B6-6.5							X		X											
08	B6-11							X	X	X				X							

Relinquished By (signature):	Printed Name:	Date/Time	Received (signature):	Printed Name:	Date/Time
[signature]	ANNI KREML	Date: 5/22/96 Time: 1125	[signature]	NEIL VAN SLAMBROOK	Date: 5/22/96 Time: 1125
[signature]	NEIL VAN SLAMBROOK	Date: 5/22/96 Time: 1300		Printed Name:	Date: Time:
Relinquished By (signature):	Printed Name:	Date: Time:	[signature]	M. Biederman	Date: 5-22-96 Time: 1300

THE LABORATORY MUST PROVIDE A COPY OF THIS CHAIN-OF-CUSTODY WITH INVOICE AND RESULTS

Rev. 1/12/93

Shell Oil Chn. of Custody

SHELL OIL COMPANY
RETAIL ENVIRONMENTAL ENGINEERING - WEST

CHAIN OF CUSTODY RECORD
Serial No: ____

Date: 5/20/96
Page 1 of 1

Site Address: 1800 Powell St, Emeryville, CA

WIC#: 204-2495-0101

Shell Engineer: Jeff Granberry
Phone No.:
Fax #:

Consultant Name & Address: WEISS ASSOCIATES 5500 SHELLMOUND ST EMERYVILLE CA 94608

Consultant Contact: WA JOB # 81-0794-01
Phone No.: (510) 450-6000
Fax #: 547-5043

Comments:

Sampled by: Yi-Ran Wu

Printed Name: Yi-Ran Wu

LAB: SEQUOIA

Analysis Required

CHECK ONE (1) BOX ONLY	CT/DT	TURN AROUND TIME
G.W. Monitoring ☐	4461	24 hours ☐
Site Investigation ☒	4441	48 hours ☐
Soil Classify/Disposal ☐	4442	15 days ☒ (Normal)
Water Classify/Disposal ☐	4443	Other ☐
Soil/Air Rem. or Sys. O & M ☐	4452	NOTE: Notify Lab as soon as Possible of 24/48 hrs. TAT.
Water Rem. or Sys. O & M ☐	4453	
Other ☐		

UST AGENCY: ALAMEDA CO OF ENV HEALTH

Sample ID	Date	Sludge	Soil	Water	Air	No. of conts.	~~TPH (EPA 8015 Mod. Gas)~~	TPH (EPA 8015 Mod. Diesel)	BTEX (EPA 8020/602)	Volatile Organics (EPA 8240)	Test for Disposal	Combination TPH 8015 & BTEX 8020 + MTBE	PETROLEUM OIL & GREASE (5520)	SEMI - VOCs	Asbestos	Container Size	Preparation Used	Composite Y/N	MATERIAL DESCRIPTION	SAMPLE CONDITION/ COMMENTS
B1-GW	5/20	01		1		3				X		X				N/A	N	N	WATER-GAS	GOOD
B2-GW	↓	02		↓		↓				↓		↓				↓	↓	↓	↓	↓
B6-GW	↓	03		↓		↓				↓		↓				↓	↓	↓	↓	↓

9605E72

Relinquished By (signature):	Printed Name:	Date/Time	Received (signature):	Printed Name:	Date/Time
[signature]	ANNI KREML	Date: 5/22/96 Time: 1125	[signature]	Neil VanHlambrook	Date: 5/22/96 Time: 1125
[signature]	Neil VAN SLAMBROOK	Date: 5/22/96 Time: 1800			Date: Time:
		Date: Time:	[signature]	M. Biederman	Date: 5-22-96 Time: 1300

THE LABORATORY MUST PROVIDE A COPY OF THIS CHAIN-OF-CUSTODY WITH INVOICE AND RESULTS

Rev. 1/12/93

Shell Oil Chn. of Custody

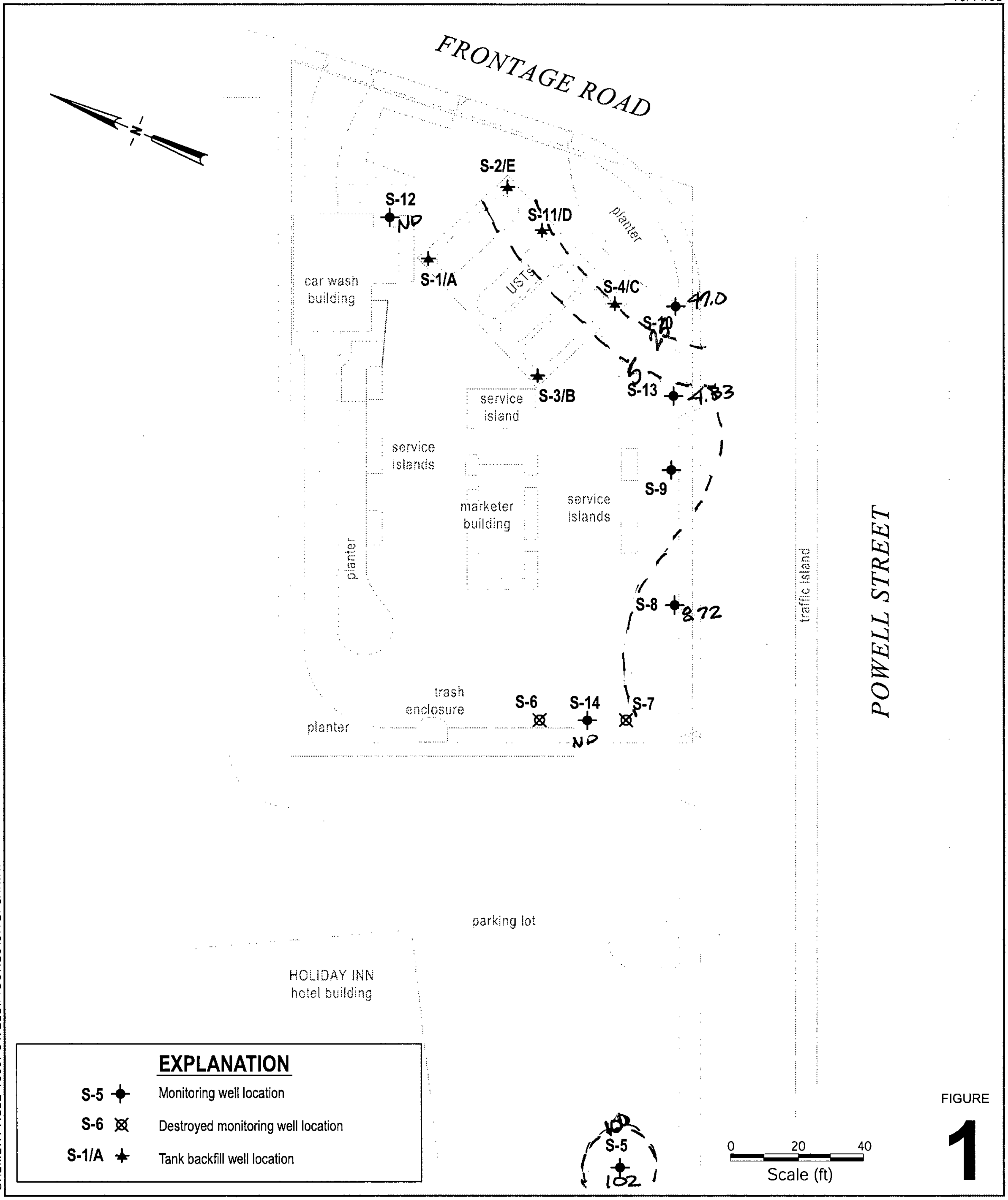

FIGURE
1

Shell-branded Service Station
1800 Powell Street
Emeryville, California
Incident #98995349

CAMBRIA

Benzene Isocon (ppb) **Site Plan**
November 2005

BLAINE
TECH SERVICES INC.

GROUNDWATER SAMPLING SPECIALISTS
SINCE 1985

December 23, 2005

Denis Brown
Shell Oil Products US
20945 South Wilmington Avenue
Carson, CA 90810

Fourth Quarter 2005 Groundwater Monitoring at
Shell-branded Service Station
1800 Powell Street
Emeryville, CA

Monitoring performed on November 23, 2005

Groundwater Monitoring Report **051123-PC-2**

This report covers the routine monitoring of groundwater wells at this Shell-branded facility. In accordance with standard procedures that conform to Regional Water Quality Control Board requirements, routine field data collection includes depth to water, total well depth, thickness of any separate immiscible layer, water column volume, calculated purge volume (if applicable), elapsed evacuation time (if applicable), total volume of water removed (if applicable), and standard water parameter instrument readings. Sample material is collected, contained, stored, and transported to the laboratory in conformance with EPA standards. Purgewater (if applicable) is, likewise, collected and transported to the Shell Martinez Manufacturing Complex.

Basic field information is presented alongside analytical values excerpted from the laboratory report in the cumulative table of **WELL CONCENTRATIONS**. The full analytical report for the most recent samples and the field data sheets are attached to this report.

At a minimum, Blaine Tech Services, Inc. field personnel are certified on completion of a forty-hour Hazardous Materials and Emergency Response training course per 29 CFR 1910.120. Field personnel are also enrolled in annual eight-hour refresher courses.

Blaine Tech Services, Inc. conducts sampling and documentation assignments of this type as an independent third party. Our activities at this site consisted of objective data and sample collection only. No interpretation of analytical results, defining of hydrological conditions or formulation of recommendations was performed.

Please call if you have any questions.

Yours truly,

Mike Ninokata
Project Coordinator

MN/ks

attachments: Cumulative Table of WELL CONCENTRATIONS
Certified Analytical Report
Field Data Sheet

cc: Anni Kreml
Cambria Environmental Technology, Inc.
5900 Hollis St., Suite A
Emeryville, CA 94608

WELL CONCENTRATIONS
Shell-Branded Service Station
1800 Powell Street
Emeryville, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	DIPE (ug/L)	ETBE (ug/L)	TAME (ug/L)	TBA (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-5	10/26/1984	3,000	NA	660	20	20	70	NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	02/09/1985	2,800	NA	740	20	20	140	NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	04/27/1985	4,300	NA	750	10	20	<30	NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	07/06/1985	1,500	NA	300	8	7	9	NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	10/24/1985	2,100	NA	760	10	40	50	NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	01/03/1986	1,300	NA	520	9	8	10	NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	07/05/1986	1,400	NA	500	10	4	<10	NA	NA	NA	NA	NA	NA	11.72	8.36	3.36	NA
S-5	10/18/1986	4,200	NA	1,100	9	14	7	NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	01/13/1987	4,500	6,100	1,100	15	30	25	NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	07/07/1987	3,200	NA	1,000	16	9	12	NA	NA	NA	NA	NA	NA	11.72	9.15	2.57	NA
S-5	10/10/1987	1,700	NA	16	5.7	5.2	8.9	NA	NA	NA	NA	NA	NA	11.72	9.67	2.05	NA
S-5	02/11/1988	1,300	NA	300	5	<5	<5	NA	NA	NA	NA	NA	NA	11.72	9.00	2.72	NA
S-5	05/10/1988	1,900	NA	490	<0.5	<5	<5	NA	NA	NA	NA	NA	NA	11.72	8.61	3.11	NA
S-5	08/31/1988	6,700	NA	760	26	<25	<25	NA	NA	NA	NA	NA	NA	11.72	9.61	2.11	NA
S-5	12/03/1988	2,900	NA	890	5.3	7.3	13	NA	NA	NA	NA	NA	NA	11.72	9.47	2.25	NA
S-5	02/16/1989	1,300	NA	280	3	3.4	9.4	NA	NA	NA	NA	NA	NA	11.72	8.29	3.43	NA
S-5	08/10/1989	1,700	NA	530	5.5	<5	5.8	NA	NA	NA	NA	NA	NA	11.72	9.30	2.42	NA
S-5	11/11/1989	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11.72	9.42	2.30	NA
S-5	02/21/1994	1,000	NA	250	<5	<5	<5	NA	NA	NA	NA	NA	NA	11.72	7.95	3.77	NA
S-5 (D)	02/21/1994	1,300	NA	220	<5	<5	11	NA	NA	NA	NA	NA	NA	11.72	7.95	3.77	NA
S-5	05/16/1994	1,200	NA	230	<5	<5	<5	NA	NA	NA	NA	NA	NA	11.72	8.00	3.72	NA
S-5	08/09/1994	Well inaccessible		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	11/09/1994	1,600	NA	220	3.2	1.8	5	NA	NA	NA	NA	NA	NA	11.72	8.32	3.40	NA
S-5 (D)	11/09/1994	1,600	NA	250	3.3	1.9	5.9	NA	NA	NA	NA	NA	NA	11.72	8.32	NA	NA
S-5	02/22/1995	Well inaccessible		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	05/02/1995	Well inaccessible		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	05/10/1995	910	NA	170	1.5	1.3	5.2	NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	08/24/1995	620	NA	210	<0.5	1.2	5.3	NA	NA	NA	NA	NA	NA	11.72	8.78	2.94	NA
S-5	12/08/1995	1,600	NA	510	3.3	1.5	6.6	NA	NA	NA	NA	NA	NA	11.72	9.78	1.94	NA
S-5 (D)	12/08/1995	1,600	NA	530	1.8	1.1	5.4	NA	NA	NA	NA	NA	NA	11.72	9.78	1.94	NA

WELL CONCENTRATIONS
Shell-Branded Service Station
1800 Powell Street
Emeryville, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	DIPE (ug/L)	ETBE (ug/L)	TAME (ug/L)	TBA (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-5	02/29/1996	1,900	NA	470	5.8	<5.0	<5.0	46	NA	NA	NA	NA	NA	11.72	7.64	4.08	NA
S-5 (D)	02/29/1996	1,700	NA	440	5.4	<5.0	<5.0	40	NA	NA	NA	NA	NA	11.72	7.64	4.08	NA
S-5	05/22/1996	1,200	NA	490	<10	<10	<10	<50	NA	NA	NA	NA	NA	11.72	8.60	3.12	NA
S-5	07/30/1996	1,100	NA	400	<5.0	<5.0	6.9	<25	NA	NA	NA	NA	NA	11.72	9.40	2.32	NA
S-5	11/11/1996	Well inaccessible		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	11/03/1997	Well inaccessible		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	11/06/1998	620	NA	91	<0.50	0.64	4.0	<2.5	NA	NA	NA	NA	NA	11.72	8.25	3.47	NA
S-5	12/07/1999	Well inaccessible		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	11/02/2000	1,120	NA	191	2.78	<2.50	3.56	<12.5	NA	NA	NA	NA	NA	11.72	8.55	3.17	NA
S-5	12/27/2001	760	NA	110	2.4	<0.50	5.8	NA	<5.0	NA	NA	NA	NA	11.72	7.64	4.08	NA
S-5	11/26/2002	Well inaccessible		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.07	NA	NA	NA
S-5	12/06/2002	860	NA	130	2.3	<0.50	6.0	NA	<5.0	NA	NA	NA	NA	14.07	8.62	5.45	NA
S-5	11/25/2003	920	NA	180	3.0	<1.0	6.2	NA	<1.0	NA	NA	NA	NA	14.07	9.32	4.75	NA
S-5	11/10/2004	530	NA	2.4	0.68	<0.50	6.3	NA	<0.50	NA	NA	NA	NA	14.07	9.35	4.72	NA
S-5	**11/23/2005**	**1,630**	**NA**	**102**	**2.42**	**0.540**	**5.71**	**NA**	**<0.500**	**<0.500**	**<0.500**	**<0.500**	**<10.0**	**14.07**	**9.62**	**4.45**	**NA**
S-6	04/27/1985	6,500	NA	2,400	30	50	210	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-6	07/06/1985	3,700	NA	1,700	34	55	200	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-6	10/24/1985	23	<0.5	<5	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<50	NA
S-6	11/08/1985	Well abandoned		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-7	10/26/1984	50	NA	1.1	<1	<1	4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-7	02/09/1985	NA	NA	0.9	<1	<1	<3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-7	04/27/1985	<50	NA	<1	<1	<1	<3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-7	07/06/1985	70	NA	2.2	<1	<1	<3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-7	10/24/1985	6,200	NA	2,200	130	190	660	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-7	11/09/1985	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-8	10/26/1984	1,000	NA	610	9	1	42	NA	NA	NA	NA	NA	NA	12.76	NA	NA	NA
S-8	02/09/1985	500	NA	160	5	<2	17	NA	NA	NA	NA	NA	NA	12.76	NA	NA	NA

WELL CONCENTRATIONS
Shell-Branded Service Station
1800 Powell Street
Emeryville, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	DIPE (ug/L)	ETBE (ug/L)	TAME (ug/L)	TBA (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-8	04/27/1985	2,700	NA	1,500	20	10	40	NA	NA	NA	NA	NA	NA	12.76	NA	NA	NA
S-8	07/06/1985	440	NA	180	5	2	12	NA	NA	NA	NA	NA	NA	12.76	NA	NA	NA
S-8	10/24/1985	2,000	NA	1,100	17	5	70	NA	NA	NA	NA	NA	NA	12.76	NA	NA	NA
S-8	01/03/1986	1,900	NA	1,300	20	<10	70	NA	NA	NA	NA	NA	NA	12.76	NA	NA	NA
S-8	07/05/1986	1,600	NA	920	30	<10	60	NA	NA	NA	NA	NA	NA	12.76	9.50	3.26	NA
S-8	10/18/1986	1,400	NA	640	<10	<10	30	NA	NA	NA	NA	NA	NA	12.76	NA	NA	NA
S-8	01/13/1987	670	760	190	5.8	<0.5	19	NA	NA	NA	NA	NA	NA	12.76	NA	NA	NA
S-8	04/22/1987	2,400	NA	740	54	5.7	59	NA	NA	NA	NA	NA	NA	12.76	NA	NA	NA
S-8	07/07/1987	1,100	NA	450	15	<2.5	42	NA	NA	NA	NA	NA	NA	12.76	10.45	2.31	NA
S-8	10/10/1987	340	NA	4	0.6	<0.5	17	NA	NA	NA	NA	NA	NA	12.76	10.83	1.93	NA
S-8	02/11/1988	<1,000	NA	260	<10	<10	11	NA	NA	NA	NA	NA	NA	12.76	10.44	2.32	NA
S-8	05/10/1988	1,800	NA	700	14	<5	46	NA	NA	NA	NA	NA	NA	12.76	10.17	2.59	NA
S-8	08/31/1988	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.76	10.81	1.95	SPH
S-8	12/03/1988	960	NA	250	4.3	<2.5	14	NA	NA	NA	NA	NA	NA	12.76	10.81	1.95	NA
S-8	02/16/1989	2,700	NA	800	35	10	83	NA	NA	NA	NA	NA	NA	12.76	9.65	3.11	NA
S-8	05/28/1989	960	NA	710	25	84	80	NA	NA	NA	NA	NA	NA	12.76	10.46	2.30	NA
S-8	08/10/1989	1,300	NA	630	17	<5	46	NA	NA	NA	NA	NA	NA	12.76	10.59	2.17	NA
S-8	11/11/1989	910	NA	180	8	<2.5	15	NA	NA	NA	NA	NA	NA	12.76	10.29	2.47	NA
S-8	02/21/1994	3,200	NA	480	52	<5	130	NA	NA	NA	NA	NA	NA	12.76	9.52	3.24	NA
S-8	05/16/1994	1,000	NA	220	7.3	<5	28	NA	NA	NA	NA	NA	NA	12.76	9.49	3.27	NA
S-8 (D)	05/16/1994	1,000	NA	280	10	<5	29	NA	NA	NA	NA	NA	NA	12.76	9.49	3.27	NA
S-8	08/09/1994	400	NA	27	6.6	<0.5	18	NA	NA	NA	NA	NA	NA	12.76	10.37	2.39	NA
S-8	11/09/1994	650	NA	170	5.3	<0.5	17	NA	NA	NA	NA	NA	NA	12.76	9.58	3.18	NA
S-8	02/22/1995	650	NA	210	10	1.2	22	NA	NA	NA	NA	NA	NA	12.76	9.02	3.74	NA
S-8	05/02/1995	1,000	NA	280	17	1.4	32	NA	NA	NA	NA	NA	NA	12.76	8.45	4.31	NA
S-8	08/24/1995	480	NA	180	11	1	19	NA	NA	NA	NA	NA	NA	12.76	10.02	2.74	NA
S-8 (D)	08/24/1995	700	NA	180	6.5	<0.5	17	NA	NA	NA	NA	NA	NA	12.76	10.02	2.74	NA
S-8	12/08/1995	740	NA	230	6.9	0.7	15	NA	NA	NA	NA	NA	NA	12.76	10.65	2.11	NA
S-8	02/29/1996	740	NA	260	8.1	<5.0	19	58	NA	NA	NA	NA	NA	12.76	9.10	3.66	NA
S-8	05/22/1996	1,200	NA	350	10	<5.0	23	74	NA	NA	NA	NA	NA	12.76	10.14	2.62	NA

WELL CONCENTRATIONS
Shell-Branded Service Station
1800 Powell Street
Emeryville, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	DIPE (ug/L)	ETBE (ug/L)	TAME (ug/L)	TBA (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-8	07/30/1996	530	NA	220	20	6.3	36	69	NA	NA	NA	NA	NA	12.76	10.51	2.25	NA
S-8	11/11/1996	540	NA	140	3.7	<2.0	17	42	NA	NA	NA	NA	NA	12.76	10.23	2.53	NA
S-8	11/03/1997	480	NA	54	3.5	<0.50	12	40	NA	NA	NA	NA	NA	12.76	9.40	3.36	NA
S-8	11/06/1998	740	NA	110	10	2.8	26	31	NA	NA	NA	NA	NA	12.76	9.78	2.98	NA
S-8	12/07/1999	770	NA	270	16	<2.0	33	75	NA	NA	NA	NA	NA	12.76	10.14	2.62	NA
S-8	11/02/2000	436	NA	75.8	6.18	0.549	14.9	81.5	NA	NA	NA	NA	NA	12.76	9.45	3.31	NA
S-8	12/27/2001	1,300	NA	62	11	1.8	31	NA	86	NA	NA	NA	NA	12.76	9.19	3.57	NA
S-8	11/26/2002	970	NA	58	3.8	0.51	15	NA	35	NA	NA	NA	NA	15.00	10.10	4.90	NA
S-8	11/25/2003	400	NA	19	4.4	<0.50	15	NA	34	NA	NA	NA	NA	15.00	10.49	4.51	NA
S-8	11/10/2004	430	NA	28	3.4	<0.50	11	NA	25	NA	NA	NA	NA	15.00	10.45	4.55	NA
S-8	**11/23/2005**	**476**	**NA**	**8.72**	**3.15**	**1.03**	**12.6**	**NA**	**35.2**	**<0.500**	**<0.500**	**<0.500**	**20.1**	**15.00**	**10.46**	**4.54**	**NA**
S-9	10/26/1984	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	02/09/1985	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	1.30
S-9	04/27/1985	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	1.25
S-9	07/06/1985	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	1.20
S-9	10/24/1985	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	01/03/1986	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	04/11/1986	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	07/05/1986	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	9.67	3.08	SPH
S-9	10/18/1986	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	01/13/1987	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	04/22/1987	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	07/07/1987	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	10/10/1987	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	22.30	-9.55	SPH
S-9	02/24/1994	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	05/16/1994	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	1.50
S-9	08/09/1994	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	11.80	NA	2.00
S-9	11/09/1994	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	02/22/1995	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	11.40	NA	2.38

WELL CONCENTRATIONS
Shell-Branded Service Station
1800 Powell Street
Emeryville, CA

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S-9	05/02/1995	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	11.83	NA	2.12
S-9	12/08/1995	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	11.92	NA	1.06
S-9	02/29/1996 a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	12.10	2.88	2.79
S-9	05/22/1996 a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	11.71	2.44	1.75
S-9	07/30/1996 a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	11/11/1996 a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	9.00
S-9	11/03/1997 a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	11/06/1998 a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	12/07/1999 a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	NA
S-9	11/02/2000 a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	NA
S-9	12/27/2001 a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	NA
S-9	11/26/2002 a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.83	NA	NA	NA
S-9	11/25/2003 a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.83	NA	NA	NA
S-9	11/25/2003 a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.98 n	NA	NA	NA
S-9	**11/23/2005 a**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**14.98**	**NA**	**NA**	**NA**
S-10	10/26/1984	700,000	NA	37,000	100,000	20,000	110,000	NA	NA	NA	NA	NA	NA	12.58	NA	NA	NA
S-10	02/09/1985	6,500	NA	480	700	100	1,800	NA	NA	NA	NA	NA	NA	12.58	NA	NA	NA
S-10	04/27/1985	13,000	NA	1,300	500	600	3,700	NA	NA	NA	NA	NA	NA	12.58	NA	NA	NA
S-10	07/06/1985	14,000	NA	1,300	310	270	2,400	NA	NA	NA	NA	NA	NA	12.58	NA	NA	NA
S-10	10/24/1985	4,200	NA	580	34	4	440	NA	NA	NA	NA	NA	NA	12.58	NA	NA	NA
S-10	01/03/1986	1,700	NA	360	10	7.8	170	NA	NA	NA	NA	NA	NA	12.58	NA	NA	NA
S-10	04/11/1986	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.58	NA	NA	0.01
S-10	07/05/1986	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.58	9.16	3.42	0.01
S-10	10/18/1986	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.58	NA	NA	0.03
S-10	01/13/1987	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.58	NA	NA	0.03
S-10	04/22/1987	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.58	NA	NA	0.01
S-10	07/07/1987	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.58	9.41	3.17	0.03
S-10	10/10/1987	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.58	7.77	4.81	SPH
S-10	02/11/1988	1,200	NA	470	16	<5	14	NA	NA	NA	NA	NA	NA	12.58	6.41	6.17	NA

WELL CONCENTRATIONS
Shell-Branded Service Station
1800 Powell Street
Emeryville, CA

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S-10	05/10/1988	1,100	NA	100	6	4	19	NA	NA	NA	NA	NA	NA	12.58	9.04	3.54	NA
S-10	08/31/1988	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.58	9.38	3.20	0.01
S-10	12/03/1988	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.58	6.89	5.69	SPH
S-10	02/16/1989	530	NA	89	8.5	1.6	4.5	NA	NA	NA	NA	NA	NA	12.58	7.34	5.24	NA
S-10	05/28/1989	240	NA	65	3.8	2.2	8.6	NA	NA	NA	NA	NA	NA	12.58	6.60	5.98	NA
S-10	08/10/1989	250	NA	23	4.1	<1	6.4	NA	NA	NA	NA	NA	NA	12.58	9.09	3.49	NA
S-10	11/11/1989	320	NA	1.6	1.3	1.4	6.2	NA	NA	NA	NA	NA	NA	12.58	6.58	6.00	NA
S-10	02/21/1994	1,400	NA	190	9.9	<2.5	19	NA	NA	NA	NA	NA	NA	12.58	8.32	4.26	NA
S-10	05/16/1994	300	NA	45	8.6	6.2	19	NA	NA	NA	NA	NA	NA	12.58	8.35	4.23	NA
S-10	08/08/1994	700	NA	57	14	<0.5	9.3	NA	NA	NA	NA	NA	NA	12.58	8.66	3.92	NA
S-10	11/09/1994	640	NA	130	2	1.6	4.1	NA	NA	NA	NA	NA	NA	12.58	6.68	5.90	NA
S-10	02/22/1995	500	NA	65	5.9	1	8.2	NA	NA	NA	NA	NA	NA	12.58	9.12	3.46	NA
S-10	05/02/1995	530	NA	59	2.3	0.8	8.2	NA	NA	NA	NA	NA	NA	12.58	9.50	3.08	NA
S-10	08/24/1995	350	NA	35	4.6	<0.5	6.7	NA	NA	NA	NA	NA	NA	12.58	10.06	2.52	NA
S-10	12/08/1995	690	NA	28	4.6	0.9	8.6	NA	NA	NA	NA	NA	NA	12.58	10.08	2.50	NA
S-10	02/29/1996	430	NA	32	1.8	0.5	5.8	16	NA	NA	NA	NA	NA	12.58	5.32	7.26	NA
S-10	05/22/1996	100	1,200	19	0.63	<0.5	1.4	5.3	NA	NA	NA	NA	NA	12.58	6.04	6.54	NA
S-10	07/30/1996	240	13,000	17	<1.2	<1.2	7.8	11	NA	NA	NA	NA	NA	12.58	10.48	2.10	NA
S-10	11/11/1996	370	4,800	16	1.1	<0.5	7	94	NA	NA	NA	NA	NA	12.58	10.31	2.27	NA
S-10	11/03/1997	340	1,100	6.7	2.1	<0.50	3.3	19	NA	NA	NA	NA	NA	12.58	9.53	3.05	NA
S-10 (D)	11/03/1997	310	1,100	7.8	1.3	<0.50	3.1	19	NA	NA	NA	NA	NA	12.58	9.53	3.05	NA
S-10	11/06/1998	<250	2,000	<2.5	<2.5	<2.5	6.5	900	NA	NA	NA	NA	NA	12.58	5.12	7.46	NA
S-10	12/07/1999	400	2,230	47	33	10	29	90	NA	NA	NA	NA	NA	12.58	7.95	4.63	NA
S-10	11/02/2000	536	14,500	32.0	3.08	<0.500	2.98	42.3	NA	NA	NA	NA	NA	12.58	7.05	5.53	NA
S-10	12/27/2001	870	6,600	61	4.9	2.5	15	NA	26	NA	NA	NA	NA	12.58	7.43	5.15	NA
S-10	11/26/2002	720	9,800	56	3.5	<0.50	8.4	NA	52	NA	NA	NA	NA	15.11	9.75	5.36	NA
S-10	11/25/2003	550	530 m	29	2.7	<0.50	8.4	NA	49	NA	NA	NA	NA	15.11	9.00	6.11	NA
S-10	11/10/2004	660	1,500 m	64	5.0	0.61	14	NA	54	NA	NA	NA	NA	14.93 o	9.50	5.43	NA
S-10	**11/23/2005**	**866**	**NA**	**47.0**	**3.44**	**0.600**	**12.6**	**NA**	**61.9**	**<0.500**	**<0.500**	**<0.500**	**<10.0**	**14.93**	**10.23**	**4.70**	**NA**

WELL CONCENTRATIONS
Shell-Branded Service Station
1800 Powell Street
Emeryville, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	DIPE (ug/L)	ETBE (ug/L)	TAME (ug/L)	TBA (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-12	07/06/1985	<250	2,200	0.71	<0.5	<0.5	<3.6	NA	NA	NA	NA	NA	NA	12.84	8.22	NA	NA
S-12	11/16/1985	<250	1,400	18	<2	<2	<5	NA	NA	NA	NA	NA	NA	12.84	NA	NA	NA
S-12	01/03/1986	<250	NA	24	2	<2	<5	NA	NA	NA	NA	NA	NA	12.84	NA	NA	NA
S-12	07/05/1986	80	NA	15	0.7	<0.5	2	NA	NA	NA	NA	NA	NA	12.84	8.27	4.57	NA
S-12	10/18/1986	150	NA	12	9	<0.5	3.6	NA	NA	NA	NA	NA	NA	12.84	NA	NA	NA
S-12	01/13/1987	120	1,000	3.6	0.8	<0.5	2.9	NA	NA	NA	NA	NA	NA	12.84	NA	NA	NA
S-12	04/22/1987	100	820	3.7	3.8	0.8	11	NA	NA	NA	NA	NA	NA	12.84	NA	NA	NA
S-12	07/07/1987	70	NA	2.5	0.8	<0.5	2.4	NA	NA	NA	NA	NA	NA	12.84	9.50	3.34	NA
S-12	10/10/1987	220	2,500	2.1	0.7	<0.5	1.2	NA	NA	NA	NA	NA	NA	12.84	9.90	2.94	NA
S-12	02/11/1988	110	2,500	0.8	<0.5	<0.5	1.3	NA	NA	NA	NA	NA	NA	12.84	9.43	3.41	NA
S-12	05/10/1988	140	3,800 b	0.8	0.8	<0.5	2.5	NA	NA	NA	NA	NA	NA	12.84	8.65	4.19	NA
S-12	08/31/1988	190	2,600 b	3	15	0.5	4.5	NA	NA	NA	NA	NA	NA	12.84	9.86	2.98	NA
S-12	12/03/1988	180	3,900 b	1.2	1	1	7.7	NA	NA	NA	NA	NA	NA	12.84	9.93	2.91	NA
S-12	02/16/1989	350c	2,100 b	0.6	<0.5	0.5	5.5	NA	NA	NA	NA	NA	NA	12.84	8.08	4.76	NA
S-12	05/28/1989	290	2,200	2	1.6	4.4	6	NA	NA	NA	NA	NA	NA	12.84	9.08	3.76	NA
S-12	08/10/1989	240	720	0.7	<0.5	<0.5	1.1	NA	NA	NA	NA	NA	NA	12.84	9.35	3.49	NA
S-12	11/11/1989	210c	4,100	0.7	0.5	<0.5	3.4	NA	NA	NA	NA	NA	NA	12.84	9.28	3.56	NA
S-12	02/21/1994	240d	2,200 e	0.7	<0.5	<0.5	3.6	NA	NA	NA	NA	NA	NA	12.84	8.22	4.62	NA
S-12	05/16/1994	96	2,200	1.5	<0.5	<0.5	2	NA	NA	NA	NA	NA	NA	12.84	8.92	3.92	NA
S-12	08/08/1994	110f	3,500 g	<0.5	<0.5	<0.5	<0.5	NA	NA	NA	NA	NA	NA	12.84	NA	0.00	NA
S-12	11/09/1994	80	5,400 g	80	<0.5	<0.5	0.6	NA	NA	NA	NA	NA	NA	12.84	7.56	5.28	NA
S-12	02/22/1995	110	2,900 g,h	0.7	<0.5	<0.5	3.7	NA	NA	NA	NA	NA	NA	12.84	7.98	4.86	NA
S-12 (D)	02/22/1995	110	3,400 g,h	4.8	7.1	<0.5	2.1	NA	NA	NA	NA	NA	NA	12.84	7.98	4.86	NA
S-12	05/02/1995	140	2,800	2.4	1.1	0.8	4.3	NA	NA	NA	NA	NA	NA	12.84	8.44	4.40	NA
S-12	08/24/1995	200	1,600	19	12	5.6	24	NA	NA	NA	NA	NA	NA	12.84	9.00	3.84	NA
S-12	12/08/1995	170	2,700	2.2	0.7	0.9	3.6	NA	NA	NA	NA	NA	NA	12.84	9.62	3.22	NA
S-12	02/29/1996	1,700	2,200	<5.0	<5.0	<5.0	<5.0	5,600	NA	NA	NA	NA	NA	12.84	7.64	5.20	NA
S-12	05/22/1996	<1,000	5,700	<10	<10	<10	<10	2,400	NA	NA	NA	NA	NA	12.84	8.94	3.90	NA
S-12	07/30/1996	<500	3,200	<5.0	<5.0	<5.0	<5.0	1,500	NA	NA	NA	NA	NA	12.84	9.71	3.13	NA
S-12 (D)	07/30/1996	<500	2,900	<5.0	<5.0	<5.0	<5.0	NA	2,000	NA	NA	NA	NA	12.84	9.71	3.13	NA

WELL CONCENTRATIONS
Shell-Branded Service Station
1800 Powell Street
Emeryville, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	DIPE (ug/L)	ETBE (ug/L)	TAME (ug/L)	TBA (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-12	11/11/1996	<500	6,900	<5.0	<5.0	<5.0	<5.0	1,400	NA	NA	NA	NA	NA	12.84	9.65	3.19	NA
S-12	11/03/1997	110	2,800	2.1	<0.50	<0.50	1.3	NA	NA	NA	NA	NA	NA	12.84	8.73	4.11	NA
S-12	11/06/1998	<500	2,900	<5.0	<5.0	<5.0	<5.0	2,700	NA	NA	NA	NA	NA	12.84	8.85	3.99	NA
S-12	12/07/1999	<500	2,800	<5.0	<5.0	<5.0	<5.0	1,900	NA	NA	NA	NA	NA	12.84	8.32	4.52	NA
S-12	11/02/2000	132	4,000	0.642	<0.500	<0.500	1.07	1,900	2,230 k	NA	NA	NA	NA	12.84	7.50	5.34	NA
S-12	12/27/2001	230	2,700	<2.0	<2.0	<2.0	<2.0	NA	760	NA	NA	NA	NA	12.84	7.00	5.84	NA
S-12	11/26/2002	180	540	<1.0	<1.0	<1.0	1.7	NA	390	NA	NA	NA	NA	14.87	8.35	6.52	NA
S-12	11/25/2003	<250	2,600 m	<2.5	<2.5	<2.5	<5.0	NA	310	NA	NA	NA	NA	14.87	6.04	8.83	NA
S-12	11/10/2004	290	1,000 m	<1.0	1.2	<1.0	5.0	NA	140	NA	NA	NA	NA	14.87	7.80	7.07	NA
S-12	**11/23/2005**	**<50.0**	**NA**	**<0.500**	**<0.500**	**<0.500**	**2.63**	**NA**	**93.3**	**<0.500**	**<0.500**	**<0.500**	**398**	**14.87**	**7.22**	**7.65**	**NA**
S-13	07/06/1985	700	3,600	200	<5	<5	45	NA	NA	NA	NA	NA	NA	12.59	9.26	NA	NA
S-13	11/16/1985	1,900	2,000	700	160	70	340	NA	NA	NA	NA	NA	NA	12.59	NA	NA	NA
S-13	01/03/1986	2,800	NA	1,400	130	10	500	NA	NA	NA	NA	NA	NA	12.59	NA	NA	NA
S-13	07/05/1986	3,100	NA	1,800	60	40	270	NA	NA	NA	NA	NA	NA	12.59	9.47	3.12	NA
S-13	10/23/1986	3,400	NA	1,500	28	28	250	NA	NA	NA	NA	NA	NA	12.59	NA	NA	NA
S-13	01/13/1987	1,900	900	830	15	<10	99	NA	NA	NA	NA	NA	NA	12.59	NA	NA	NA
S-13	04/22/1987	2,900 c	770 h	1,100	20	30	140	NA	NA	NA	NA	NA	NA	12.59	NA	NA	NA
S-13	07/07/1987	1,500	NA	880	10	6	160	NA	NA	NA	NA	NA	NA	12.59	10.38	2.21	NA
S-13	10/10/1987	480	2,400	830	15	<0.5	120	NA	NA	NA	NA	NA	NA	12.59	10.78	1.81	NA
S-13	02/11/1988	1,300	1,300	510	<10	<10	86	NA	NA	NA	NA	NA	NA	12.59	10.48	2.11	NA
S-13	05/10/1988	1,000	1,300 b	470	<0.5	<5	50	NA	NA	NA	NA	NA	NA	12.59	9.48	3.11	NA
S-13	08/31/1988	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.59	10.74	1.85	SPH
S-13	12/03/1988	900	2,400 b	290	4.6	<2.5	20	NA	NA	NA	NA	NA	NA	12.59	10.30	2.29	NA
S-13	02/16/1989	840 c	1,200 b	310	3.5	<2.5	27	NA	NA	NA	NA	NA	NA	12.59	7.60	4.99	NA
S-13	05/28/1989	2,100	4,600	1,100	19	50	350	NA	NA	NA	NA	NA	NA	12.59	10.60	1.99	NA
S-13	08/10/1989	900	2,300	230	16	6.9	65	NA	NA	NA	NA	NA	NA	12.59	10.58	2.01	NA
S-13	11/11/1989	2,800	2,800	200	15	8.6	58	NA	NA	NA	NA	NA	NA	12.59	9.84	2.75	NA
S-13	02/21/1994	700	1,800 d	200	<5	<5	45	NA	NA	NA	NA	NA	NA	12.59	9.26	3.33	NA
S-13	05/16/1994	650	1,700	180	2.5	<2.5	21	NA	NA	NA	NA	NA	NA	12.59	9.62	2.97	NA

WELL CONCENTRATIONS
Shell-Branded Service Station
1800 Powell Street
Emeryville, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	DIPE (ug/L)	ETBE (ug/L)	TAME (ug/L)	TBA (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-13	08/08/1994	470	2,600 g	12	1.5	0.5	14	NA	NA	NA	NA	NA	NA	12.59	10.32	2.27	NA
S-13	11/09/1994	Well inaccessible		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.59	NA	NA	NA
S-13	02/22/1995	550	2,400 g,h	190	4	<0.5	17	NA	NA	NA	NA	NA	NA	12.59	8.92	3.67	NA
S-13	05/02/1995	790	2,100	250	6.9	1.2	22	NA	NA	NA	NA	NA	NA	12.59	9.52	3.07	NA
S-13	08/24/1995	330	1,500	93	<0.5	<0.5	2	NA	NA	NA	NA	NA	NA	12.59	10.02	2.57	NA
S-13	12/08/1995	440	2,400	110	2.2	0.8	23	NA	NA	NA	NA	NA	NA	12.59	10.75	1.84	NA
S-13	02/29/1996	560	2,500	130	<5.0	<5.0	30	30	NA	NA	NA	NA	NA	12.59	9.02	3.57	NA
S-13	05/22/1996	430	3,700	55	1.6	310	27	<5.0	NA	NA	NA	NA	NA	12.59	10.20	2.39	NA
S-13	07/30/1996	230	1,600	30	2	1.4	17	15	NA	NA	NA	NA	NA	12.59	10.42	2.17	NA
S-13	11/11/1996	320	2,700	19	1.1	<0.5	14	3.5	NA	NA	NA	NA	NA	12.59	10.28	2.31	NA
S-13 (D)	11/11/1996	360	2,400	24	1.3	<0.5	15	4.5	NA	NA	NA	NA	NA	12.59	10.28	2.31	NA
S-13	11/03/1997	300	1,900	25	1.4	0.63	12	5.0	NA	NA	NA	NA	NA	12.59	9.36	3.23	NA
S-13	11/06/1998	390	1,300	53	2.9	1.1	13	17	NA	NA	NA	NA	NA	12.59	9.85	2.74	NA
S-13	12/07/1999	420	1,430	15	6.2	2.6	15	42	NA	NA	NA	NA	NA	12.59	9.72	2.87	NA
S-13	11/02/2000	257	4,240	4.89	1.92	<0.500	5.17	45.1	NA	NA	NA	NA	NA	12.59	7.15	5.44	NA
S-13	12/27/2001	300	6,400	7.2	0.84	<0.50	6.0	NA	34	NA	NA	NA	NA	12.59	9.35	3.24	NA
S-13	11/26/2002	160	850	<0.50	<0.50	<0.50	2.6	NA	23	NA	NA	NA	NA	14.47	9.80	4.67	NA
S-13	11/25/2003	180	5,100 m	0.57	0.55	<0.50	3.0	NA	26	NA	NA	NA	NA	14.47	9.94	4.53	NA
S-13	11/10/2004	220	1,900 m	<0.50	0.71	<0.50	2.8	NA	26	NA	NA	NA	NA	14.47	10.05	4.42	NA
S-13	**11/23/2005**	**<50.0**	**NA**	**4.33**	**1.24**	**0.700**	**5.40**	**NA**	**27.2**	**<0.500**	**<0.500**	**<0.500**	**30.3**	**14.47**	**10.02**	**4.45**	**NA**
S-14	11/16/1985	<250	400	3	<2	<2	<5	NA	NA	NA	NA	NA	NA	12.69	NA	NA	NA
S-14	01/03/1986	<250	NA	3	2	<2	<5	NA	NA	NA	NA	NA	NA	12.69	NA	NA	NA
S-14	04/22/1987	1,200	18,000	7.4	2.7	15	110	NA	NA	NA	NA	NA	NA	12.69	NA	NA	NA
S-14	07/07/1987	190	NA	6.5	0.6	1.9	26	NA	NA	NA	NA	NA	NA	12.69	10.32	2.37	NA
S-14	10/10/1987	4,900	21,000	7	1.2	<0.5	25	NA	NA	NA	NA	NA	NA	12.69	10.77	1.92	NA
S-14	02/11/1988	370	12,000 c	4.6	<2.5	<2.5	26	NA	NA	NA	NA	NA	NA	12.69	10.40	2.29	NA
S-14	05/10/1988	660	2,200 b	2.9	<2.5	<2.5	24	NA	NA	NA	NA	NA	NA	12.69	9.66	3.03	NA
S-14	08/31/1988	700	7,900	3.2	<2.5	<2.5	15	NA	NA	NA	NA	NA	NA	12.69	10.74	1.95	NA
S-14	12/03/1988	210	11,000 b	<0.5	<0.5	0.8	6.8	NA	NA	NA	NA	NA	NA	12.69	10.69	2.00	NA

WELL CONCENTRATIONS
Shell-Branded Service Station
1800 Powell Street
Emeryville, CA

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S-14	02/16/1989	130 c	5,700 b	<0.5	<0.5	<0.5	4.4	NA	NA	NA	NA	NA	NA	12.69	9.69	3.00	NA
S-14	05/28/1989	770	5,200	<0.5	<0.5	<0.5	4.5	NA	NA	NA	NA	NA	NA	12.69	10.42	2.27	NA
S-14	08/10/1989	920	8,800	<1	<1	1.6	17	NA	NA	NA	NA	NA	NA	12.69	10.54	2.15	NA
S-14	11/11/1989	710	28,000	20	57	25	69	NA	NA	NA	NA	NA	NA	12.69	9.91	2.78	NA
S-14	02/21/1994	2,800	3,600	<5	<5	<5	14	NA	NA	NA	NA	NA	NA	12.69	9.30	3.09	NA
S-14	02/21/1994	2,300 d	3,600 e	<5.0	<5	<5	14	NA	NA	NA	NA	NA	NA	12.69	9.30	3.39	NA
S-14	05/16/1994	310	6,700	<2.5	<2.5	<2.5	3.1	NA	NA	NA	NA	NA	NA	12.69	9.54	3.15	NA
S-14	08/08/1994	480l	2,900	<0.5	0.6	<0.5	0.8	NA	NA	NA	NA	NA	NA	12.69	10.29	2.40	NA
S-14 (D)	08/08/1994	590l	2,900	<0.5	0.6	<0.5	1.5	NA	NA	NA	NA	NA	NA	12.69	10.29	2.40	NA
S-14	11/09/1994	170 i	6,400 g	0.7	<0.5	<0.5	2.7	NA	NA	NA	NA	NA	NA	12.69	9.52	3.07	NA
S-14	02/22/1995	550	7,000 g,h	<0.5	<0.5	<0.5	1.6	NA	NA	NA	NA	NA	NA	12.69	9.18	3.51	NA
S-14	05/02/1995	210	2,300	1	0.9	1.1	6.3	NA	NA	NA	NA	NA	NA	12.69	9.49	3.20	NA
S-14 (D)	05/02/1995	160	2,600	0.6	0.6	0.7	3.8	NA	NA	NA	NA	NA	NA	12.69	9.49	3.20	NA
S-14	08/24/1995	180	3,700	0.5	<0.5	<0.5	1.3	NA	NA	NA	NA	NA	NA	12.69	9.94	2.75	NA
S-14	12/08/1995	190	4,900	1	<0.5	0.6	4.6	NA	NA	NA	NA	NA	NA	12.69	10.65	2.04	NA
S-14	02/29/1996	200	11,000	<0.5	<0.5	<0.5	2	3	NA	NA	NA	NA	NA	12.69	8.90	3.79	NA
S-14	05/22/1996	93	3,800	<0.5	<0.5	<0.5	1.6	<2.5	NA	NA	NA	NA	NA	12.69	10.10	2.59	NA
S-14 (D)	05/22/1996	150	3,900	<0.5	<0.5	<0.5	1.8	<2.5	NA	NA	NA	NA	NA	12.69	10.10	2.59	NA
S-14	07/30/1996	<50	2,500	<0.5	<0.5	<0.5	0.89	<2.5	NA	NA	NA	NA	NA	12.69	10.37	2.32	NA
S-14	11/11/1996	2,600	27,000	<2.5	<2.5	<2.5	3.9	<12	NA	NA	NA	NA	NA	12.69	10.29	2.40	NA
S-14	11/03/1997	430	1,800	<0.50	<0.50	<0.50	1.7	<2.5	NA	NA	NA	NA	NA	12.69	9.52	3.17	NA
S-14	11/06/1998	Well inaccessible		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.69	NA	NA	NA
S-14	12/07/1999	970	5,920	1.0	1.1	0.59	3.5	2.6	NA	NA	NA	NA	NA	12.69	9.73	2.96	NA
S-14	11/02/2000	273	535,000	<0.500	<0.500	<0.500	1.59	<2.50	NA	NA	NA	NA	NA	12.69	9.98	2.71	NA
S-14	12/27/2001	68	20,000	<0.50	<0.50	<0.50	1.3	NA	<5.0	NA	NA	NA	NA	12.69	9.33	3.36	NA
S-14	11/26/2002	<50	2,400	<0.50	<0.50	<0.50	0.91	NA	<5.0	NA	NA	NA	NA	14.51	9.70	4.81	NA
S-14	11/25/2003	78 m	4,400 m	<0.50	<0.50	<0.50	1.2	NA	1.6	NA	NA	NA	NA	14.51	9.99	4.52	NA
S-14	11/10/2004	74 p	2,500 m	<0.50	<0.50	<0.50	<1.0	NA	1.9	NA	NA	NA	NA	14.51	10.05	4.46	NA
S-14	**11/23/2005**	**<50.0**	**NA**	**<0.500**	**<0.500**	**<0.500**	**<0.500**	**NA**	**1.02**	**<0.500**	**<0.500**	**<0.500**	**<10.0**	**14.51**	**9.92**	**4.59**	**NA**

WELL CONCENTRATIONS
Shell-Branded Service Station
1800 Powell Street
Emeryville, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	DIPE (ug/L)	ETBE (ug/L)	TAME (ug/L)	TBA (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)

Abbreviations:

TPPH = Total petroleum hydrocarbons as gasoline by EPA Method 8260B, prior to December 27, 2001, by EPA Method 8015.

TEPH = Total petroleum hydrocarbons as diesel by modified EPA Method 8015.

BTEX = Benzene, toluene, ethylbenzene, xylenes by EPA Method 8260B; prior to December 27, 2001, by EPA Method 8020.

MTBE = Methyl tertiary butyl ether

TOB = Top of Wellbox Elevation

TOC = Top of Casing Elevation

SPH = Separate-Phase Hydrocarbons

GW = Groundwater

ug/L = parts per billion

MSL = Mean sea level

ft. = Feet

<n = Below detection limit

(D) = Duplicate sample

NA = Not applicable

WELL CONCENTRATIONS
Shell-Branded Service Station
1800 Powell Street
Emeryville, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	DIPE (ug/L)	ETBE (ug/L)	TAME (ug/L)	TBA (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)

Notes:

a = Tar-like substance in well, probably from previous landfill activities; not gasoline.

b = Compounds detected within the chromatographic range appear to be weathered diesel.

c = Compounds detected within the chromatographic range of gasoline but not characteristic of the standard gasoline pattern.

d = The concentrations reported as gasoline for samples S-12 and S-14 are primarily due to the presence of a discrete peak.

e = The concentrations reported as diesel for samples S-12, S-13, and S-14 are due to the presence of a combination of diesel and a heavier petroleum product of hydrocarbon range C18 - C36, possibly motor oil.

f = The result for gasoline is an unknown hydrocarbon which consists of several peaks.

g = The positive result appears to be a heavier hydrocarbon than diesel.

h = Compounds detected within the chromatographic range of diesel appears to include gasoline compounds.

i = The positive result appears to be a heavier hydrocarbon than gasoline.

j = No MTBE could be determined due to co-elution with early eluting compounds.

k = This sample analyzed outside of EPA recommended holding time.

m = Hydrocarbon does not match pattern of laboratory's standard.

n = Top of casing altered +0.15 feet on August 2, 2004 due to wellhead maintenance.

o = Top of casing altered -0.18 feet on August 2, 2004 due to wellhead maintenance.

p = Quantity of unknown hydrocarbon(s) in sample based on gasoline.

Beginning November 26, 2002, depth to water referenced to Top of Casing Elevation.

Active wells surveyed February 12, 2002 by Virgil Chavez Land Surveying of Vallejo, CA.

WELL CONCENTRATIONS
Shell-Branded Service Station
1800 Powell Street
Emeryville, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-5	10/26/1984	3,000	NA	660	20	20	70	NA	NA	11.72	NA	NA	NA
S-5	2/9/1985	2,800	NA	740	20	20	140	NA	NA	11.72	NA	NA	NA
S-5	4/27/1985	4,300	NA	750	10	20	<30	NA	NA	11.72	NA	NA	NA
S-5	7/6/1985	1,500	NA	300	8	7	9	NA	NA	11.72	NA	NA	NA
S-5	10/24/1985	2,100	NA	760	10	40	50	NA	NA	11.72	NA	NA	NA
S-5	1/3/1986	1,300	NA	520	9	8	10	NA	NA	11.72	NA	NA	NA
S-5	7/5/1986	1,400	NA	500	10	4	<10	NA	NA	11.72	8.36	3.36	NA
S-5	10/18/1986	4,200	NA	1,100	9	14	7	NA	NA	11.72	NA	NA	NA
S-5	1/13/1987	4,500	6,100	1,100	15	30	25	NA	NA	11.72	NA	NA	NA
S-5	7/7/1987	3,200	NA	1,000	16	9	12	NA	NA	11.72	9.15	2.57	NA
S-5	10/10/1987	1,700	NA	16	5.7	5.2	8.9	NA	NA	11.72	9.67	2.05	NA
S-5	2/11/1988	1,300	NA	300	5	<5	<5	NA	NA	11.72	9.00	2.72	NA
S-5	5/10/1988	1,900	NA	490	<0.5	<5	<5	NA	NA	11.72	8.61	3.11	NA
S-5	8/31/1988	6,700	NA	760	26	<25	<25	NA	NA	11.72	9.61	2.11	NA
S-5	12/3/1988	2,900	NA	890	5.3	7.3	13	NA	NA	11.72	9.47	2.25	NA
S-5	2/16/1989	1,300	NA	280	3	3.4	9.4	NA	NA	11.72	8.29	3.43	NA
S-5	8/10/1989	1,700	NA	530	5.5	<5	5.8	NA	NA	11.72	9.30	2.42	NA
S-5	11/11/1989	NA	NA	NA	NA	NA	NA	NA	NA	11.72	9.42	2.30	NA
S-5	2/21/1994	1,000	NA	250	<5	<5	<5	NA	NA	11.72	7.95	3.77	NA
S-5 (D)	2/21/1994	1,300	NA	220	<5	<5	11	NA	NA	11.72	7.95	3.77	NA
S-5	5/16/1994	1,200	NA	230	<5	<5	<5	NA	NA	11.72	8.00	3.72	NA
S-5	8/9/1994	Well inaccessible		NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	11/9/1994	1,600	NA	220	3.2	1.8	5	NA	NA	11.72	8.32	3.40	NA
S-5 (D)	11/9/1994	1,600	NA	250	3.3	1.9	5.9	NA	NA	11.72	8.32	NA	NA
S-5	2/22/1995	Well inaccessible		NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	5/2/1995	Well inaccessible		NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	5/10/1995	910	NA	170	1.5	1.3	5.2	NA	NA	11.72	NA	NA	NA
S-5	8/24/1995	620	NA	210	<0.5	1.2	5.3	NA	NA	11.72	8.78	2.94	NA

WELL CONCENTRATIONS
Shell-Branded Service Station
1800 Powell Street
Emeryville, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-5	12/8/1995	1,600	NA	510	3.3	1.5	6.6	NA	NA	11.72	9.78	1.94	NA
S-5 (D)	12/8/1995	1,600	NA	530	1.8	1.1	5.4	NA	NA	11.72	9.78	1.94	NA
S-5	2/29/1996	1,900	NA	470	5.8	<5.0	<5.0	46	NA	11.72	7.64	4.08	NA
S-5 (D)	2/29/1996	1,700	NA	440	5.4	<5.0	<5.0	40	NA	11.72	7.64	4.08	NA
S-5	5/22/1996	1,200	NA	490	<10	<10	<10	<50	NA	11.72	8.60	3.12	NA
S-5	7/30/1996	1,100	NA	400	<5.0	<5.0	6.9	<25	NA	11.72	9.40	2.32	NA
S-5	11/11/1996	Well inaccessible		NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	11/3/1997	Well inaccessible		NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	11/6/1998	620	NA	91	<0.50	0.64	4.0	<2.5	NA	11.72	8.25	3.47	NA
S-5	12/7/1999	Well inaccessible		NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	11/2/2000	1,120	NA	191	2.78	<2.50	3.56	<12.5	NA	11.72	8.55	3.17	NA
S-5	12/27/2001	760	NA	110	2.4	<0.50	5.8	NA	<5.0	11.72	7.64	4.08	NA
S-5	11/26/2002	Well inaccessible		NA	NA	NA	NA	NA	NA	14.07	NA	NA	NA
S-5	12/6/2002	860	NA	130	2.3	<0.50	6.0	NA	<5.0	14.07	8.62	5.45	NA
S-5	11/25/2003	920	NA	180	3.0	<1.0	6.2	NA	<1.0	14.07	9.32	4.75	NA
S-5	**11/10/2004**	**530**	**NA**	**2.4**	**0.68**	**<0.50**	**6.3**	**NA**	**<0.50**	**14.07**	**9.35**	**4.72**	**NA**
S-6	4/27/1985	6,500	NA	2,400	30	50	210	NA	NA	NA	NA	NA	NA
S-6	7/6/1985	3,700	NA	1,700	34	55	200	NA	NA	NA	NA	NA	NA
S-6	10/24/1985	23	<0.5	<5	10	NA	NA	NA	NA	NA	NA	<50	NA
S-6	11/8/1985	Well abandoned		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-7	10/26/1984	50	NA	1.1	<1	<1	4	NA	NA	NA	NA	NA	NA
S-7	2/9/1985	NA	NA	0.9	<1	<1	<3	NA	NA	NA	NA	NA	NA
S-7	4/27/1985	<50	NA	<1	<1	<1	<3	NA	NA	NA	NA	NA	NA
S-7	7/6/1985	70	NA	2.2	<1	<1	<3	NA	NA	NA	NA	NA	NA
S-7	10/24/1985	6,200	NA	2,200	130	190	660	NA	NA	NA	NA	NA	NA
S-7	11/9/1985	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

WELL CONCENTRATIONS
Shell-Branded Service Station
1800 Powell Street
Emeryville, CA

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S-8	10/26/1984	1,000	NA	610	9	1	42	NA	NA	12.76	NA	NA	NA
S-8	2/9/1985	500	NA	160	5	<2	17	NA	NA	12.76	NA	NA	NA
S-8	4/27/1985	2,700	NA	1500	20	10	40	NA	NA	12.76	NA	NA	NA
S-8	7/6/1985	440	NA	180	5	2	12	NA	NA	12.76	NA	NA	NA
S-8	10/24/1985	2,000	NA	1,100	17	5	70	NA	NA	12.76	NA	NA	NA
S-8	1/3/1986	1,900	NA	1,300	20	<10	70	NA	NA	12.76	NA	NA	NA
S-8	7/5/1986	1,600	NA	920	30	<10	60	NA	NA	12.76	9.50	3.26	NA
S-8	10/18/1986	1,400	NA	640	<10	<10	30	NA	NA	12.76	NA	NA	NA
S-8	1/13/1987	670	760	190	5.8	<0.5	19	NA	NA	12.76	NA	NA	NA
S-8	4/22/1987	2,400	NA	740	54	5.7	59	NA	NA	12.76	NA	NA	NA
S-8	7/7/1987	1,100	NA	450	15	<2.5	42	NA	NA	12.76	10.45	2.31	NA
S-8	10/10/1987	340	NA	4	0.6	<0.5	17	NA	NA	12.76	10.83	1.93	NA
S-8	2/11/1988	<1,000	NA	260	<10	<10	11	NA	NA	12.76	10.44	2.32	NA
S-8	5/10/1988	1,800	NA	700	14	<5	46	NA	NA	12.76	10.17	2.59	NA
S-8	8/31/1988	NA	NA	NA	NA	NA	NA	NA	NA	12.76	10.81	1.95	SPH
S-8	12/3/1988	960	NA	250	4.3	<2.5	14	NA	NA	12.76	10.81	1.95	NA
S-8	2/16/1989	2,700	NA	800	35	10	83	NA	NA	12.76	9.65	3.11	NA
S-8	5/28/1989	960	NA	710	25	84	80	NA	NA	12.76	10.46	2.30	NA
S-8	8/10/1989	1,300	NA	630	17	<5	46	NA	NA	12.76	10.59	2.17	NA
S-8	11/11/1989	910	NA	180	8	<2.5	15	NA	NA	12.76	10.29	2.47	NA
S-8	2/21/1994	3,200	NA	480	52	<5	130	NA	NA	12.76	9.52	3.24	NA
S-8	5/16/1994	1,000	NA	220	7.3	<5	28	NA	NA	12.76	9.49	3.27	NA
S-8 (D)	5/16/1994	1,000	NA	280	10	<5	29	NA	NA	12.76	9.49	3.27	NA
S-8	8/9/1994	400	NA	27	6.6	<0.5	18	NA	NA	12.76	10.37	2.39	NA
S-8	11/9/1994	650	NA	170	5.3	<0.5	17	NA	NA	12.76	9.58	3.18	NA
S-8	2/22/1995	650	NA	210	10	1.2	22	NA	NA	12.76	9.02	3.74	NA
S-8	5/2/1995	1,000	NA	280	17	1.4	32	NA	NA	12.76	8.45	4.31	NA

WELL CONCENTRATIONS
Shell-Branded Service Station
1800 Powell Street
Emeryville, CA

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S-8	8/24/1995	480	NA	180	11	1	19	NA	NA	12.76	10.02	2.74	NA
S-8 (D)	8/24/1995	700	NA	180	6.5	<0.5	17	NA	NA	12.76	10.02	2.74	NA
S-8	12/8/1995	740	NA	230	6.9	0.7	15	NA	NA	12.76	10.65	2.11	NA
S-8	2/29/1996	740	NA	260	8.1	<5.0	19	58	NA	12.76	9.10	3.66	NA
S-8	5/22/1996	1,200	NA	350	10	<5.0	23	74	NA	12.76	10.14	2.62	NA
S-8	7/30/1996	530	NA	220	20	6.3	36	69	NA	12.76	10.51	2.25	NA
S-8	11/11/1996	540	NA	140	3.7	<2.0	17	42	NA	12.76	10.23	2.53	NA
S-8	11/3/1997	480	NA	54	3.5	<0.50	12	40	NA	12.76	9.40	3.36	NA
S-8	11/6/1998	740	NA	110	10	2.8	26	31	NA	12.76	9.78	2.98	NA
S-8	12/7/1999	770	NA	270	16	<2.0	33	75	NA	12.76	10.14	2.62	NA
S-8	11/2/2000	436	NA	75.8	6.18	0.549	14.9	81.5	NA	12.76	9.45	3.31	NA
S-8	12/27/2001	1,300	NA	62	11	1.8	31	NA	86	12.76	9.19	3.57	NA
S-8	11/26/2002	970	NA	58	3.8	0.51	15	NA	35	15.00	10.10	4.90	NA
S-8	11/25/2003	400	NA	19	4.4	<0.50	15	NA	34	15.00	10.49	4.51	NA
S-8	**11/10/2004**	**430**	**NA**	**28**	**3.4**	**<0.50**	**11**	**NA**	**25**	**15.00**	**10.45**	**4.55**	**NA**
S-9	10/26/1984	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	2/9/1985	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	1.30
S-9	4/27/1985	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	1.25
S-9	7/6/1985	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	1.20
S-9	10/24/1985	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	1/3/1986	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	4/11/1986	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	7/5/1986	NA	NA	NA	NA	NA	NA	NA	NA	12.75	9.67	3.08	SPH
S-9	10/18/1986	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	1/13/1987	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	4/22/1987	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	7/7/1987	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH

WELL CONCENTRATIONS
Shell-Branded Service Station
1800 Powell Street
Emeryville, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-9	10/10/1987	NA	NA	NA	NA	NA	NA	NA	NA	12.75	22.30	-9.55	SPH
S-9	2/24/1994	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	5/16/1994	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	1.50
S-9	8/9/1994	NA	NA	NA	NA	NA	NA	NA	NA	12.75	11.80	NA	2.00
S-9	11/9/1994	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	2/22/1995	NA	NA	NA	NA	NA	NA	NA	NA	12.75	11.40	NA	2.38
S-9	5/2/1995	NA	NA	NA	NA	NA	NA	NA	NA	12.75	11.83	NA	2.12
S-9	12/8/1995	NA	NA	NA	NA	NA	NA	NA	NA	12.75	11.92	NA	1.06
S-9	02/29/1996 a	NA	NA	NA	NA	NA	NA	NA	NA	12.75	12.10	2.88	2.79
S-9	05/22/1996 a	NA	NA	NA	NA	NA	NA	NA	NA	12.75	11.71	2.44	1.75
S-9	07/30/1996 a	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	11/11/1996 a	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	9.00
S-9	11/03/1997 a	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	11/06/1998 a	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	12/07/1999 a	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	NA
S-9	11/02/2000 a	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	NA
S-9	12/27/2001 a	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	NA
S-9	11/26/2002 a	NA	NA	NA	NA	NA	NA	NA	NA	14.83	NA	NA	NA
S-9	11/25/2003 a	NA	NA	NA	NA	NA	NA	NA	NA	14.83	NA	NA	NA
S-9	**11/25/2003 a**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**14.98 n**	**NA**	**NA**	**NA**
S-10	10/26/1984	700,000	NA	37,000	100,000	20,000	110,000	NA	NA	12.58	NA	NA	NA
S-10	2/9/1985	6,500	NA	480	700	100	1,800	NA	NA	12.58	NA	NA	NA
S-10	4/27/1985	13,000	NA	1,300	500	600	3,700	NA	NA	12.58	NA	NA	NA
S-10	7/6/1985	14,000	NA	1,300	310	270	2,400	NA	NA	12.58	NA	NA	NA
S-10	10/24/1985	4,200	NA	580	34	4	440	NA	NA	12.58	NA	NA	NA
S-10	1/3/1986	1,700	NA	360	10	7.8	170	NA	NA	12.58	NA	NA	NA
S-10	4/11/1986	NA	NA	NA	NA	NA	NA	NA	NA	12.58	NA	NA	0.01

WELL CONCENTRATIONS
Shell-Branded Service Station
1800 Powell Street
Emeryville, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-10	7/5/1986	NA	NA	NA	NA	NA	NA	NA	NA	12.58	9.16	3.42	0.01
S-10	10/18/1986	NA	NA	NA	NA	NA	NA	NA	NA	12.58	NA	NA	0.03
S-10	1/13/1987	NA	NA	NA	NA	NA	NA	NA	NA	12.58	NA	NA	0.03
S-10	4/22/1987	NA	NA	NA	NA	NA	NA	NA	NA	12.58	NA	NA	0.01
S-10	7/7/1987	NA	NA	NA	NA	NA	NA	NA	NA	12.58	9.41	3.17	0.03
S-10	10/10/1987	NA	NA	NA	NA	NA	NA	NA	NA	12.58	7.77	4.81	SPH
S-10	2/11/1988	1,200	NA	470	16	<5	14	NA	NA	12.58	6.41	6.17	NA
S-10	5/10/1988	1,100	NA	100	6	4	19	NA	NA	12.58	9.04	3.54	NA
S-10	8/31/1988	NA	NA	NA	NA	NA	NA	NA	NA	12.58	9.38	3.20	0.01
S-10	12/3/1988	NA	NA	NA	NA	NA	NA	NA	NA	12.58	6.89	5.69	SPH
S-10	2/16/1989	530	NA	89	8.5	1.6	4.5	NA	NA	12.58	7.34	5.24	NA
S-10	5/28/1989	240	NA	65	3.8	2.2	8.6	NA	NA	12.58	6.60	5.98	NA
S-10	8/10/1989	250	NA	23	4.1	<1	6.4	NA	NA	12.58	9.09	3.49	NA
S-10	11/11/1989	320	NA	1.6	1.3	1.4	6.2	NA	NA	12.58	6.58	6.00	NA
S-10	2/21/1994	1,400	NA	190	9.9	<2.5	19	NA	NA	12.58	8.32	4.26	NA
S-10	5/16/1994	300	NA	45	8.6	6.2	19	NA	NA	12.58	8.35	4.23	NA
S-10	8/8/1994	700	NA	57	14	<0.5	9.3	NA	NA	12.58	8.66	3.92	NA
S-10	11/9/1994	640	NA	130	2	1.6	4.1	NA	NA	12.58	6.68	5.90	NA
S-10	2/22/1995	500	NA	65	5.9	1	8.2	NA	NA	12.58	9.12	3.46	NA
S-10	5/2/1995	530	NA	59	2.3	0.8	8.2	NA	NA	12.58	9.50	3.08	NA
S-10	8/24/1995	350	NA	35	4.6	<0.5	6.7	NA	NA	12.58	10.06	2.52	NA
S-10	12/8/1995	690	NA	28	4.6	0.9	8.6	NA	NA	12.58	10.08	2.50	NA
S-10	2/29/1996	430	NA	32	1.8	0.5	5.8	16	NA	12.58	5.32	7.26	NA
S-10	5/22/1996	100	1,200	19	0.63	<0.5	1.4	5.3	NA	12.58	6.04	6.54	NA
S-10	7/30/1996	240	13,000	17	<1.2	<1.2	7.8	11	NA	12.58	10.48	2.10	NA
S-10	11/11/1996	370	4,800	16	1.1	<0.5	7	94	NA	12.58	10.31	2.27	NA
S-10	11/3/1997	340	1,100	6.7	2.1	<0.50	3.3	19	NA	12.58	9.53	3.05	NA
S-10 (D)	11/3/1997	310	1,100	7.8	1.3	<0.50	3.1	19	NA	12.58	9.53	3.05	NA

WELL CONCENTRATIONS
Shell-Branded Service Station
1800 Powell Street
Emeryville, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-10	11/6/1998	<250	2,000	<2.5	<2.5	<2.5	6.5	900	NA	12.58	5.12	7.46	NA
S-10	12/7/1999	400	2,230	47	33	10	29	90	NA	12.58	7.95	4.63	NA
S-10	11/2/2000	536	14,500	32.0	3.08	<0.500	2.98	42.3	NA	12.58	7.05	5.53	NA
S-10	12/27/2001	870	6,600	61	4.9	2.5	15	NA	26	12.58	7.43	5.15	NA
S-10	11/26/2002	720	9,800	56	3.5	<0.50	8.4	NA	52	15.11	9.75	5.36	NA
S-10	11/25/2003	550	530 m	29	2.7	<0.50	8.4	NA	49	15.11	9.00	6.11	NA
S-10	**11/10/2004**	**660**	**1,500 m**	**64**	**5.0**	**0.61**	**14**	**NA**	**54**	**14.93 o**	**9.50**	**5.43**	**NA**
S-12	7/6/1985	<250	2,200	0.71	<0.5	<0.5	<3.6	NA	NA	12.84	8.22	NA	NA
S-12	11/16/1985	<250	1,400	18	<2	<2	<5	NA	NA	12.84	NA	NA	NA
S-12	1/3/1986	<250	NA	24	2	<2	<5	NA	NA	12.84	NA	NA	NA
S-12	7/5/1986	80	NA	15	0.7	<0.5	2	NA	NA	12.84	8.27	4.57	NA
S-12	10/18/1986	150	NA	12	9	<0.5	3.6	NA	NA	12.84	NA	NA	NA
S-12	1/13/1987	120	1,000	3.6	0.8	<0.5	2.9	NA	NA	12.84	NA	NA	NA
S-12	4/22/1987	100	820	3.7	3.8	0.8	11	NA	NA	12.84	NA	NA	NA
S-12	7/7/1987	70	NA	2.5	0.8	<0.5	2.4	NA	NA	12.84	9.50	3.34	NA
S-12	10/10/1987	220	2,500	2.1	0.7	<0.5	1.2	NA	NA	12.84	9.90	2.94	NA
S-12	2/11/1988	110	2,500	0.8	<0.5	<0.5	1.3	NA	NA	12.84	9.43	3.41	NA
S-12	5/10/1988	140	3,800b	0.8	0.8	<0.5	2.5	NA	NA	12.84	8.65	4.19	NA
S-12	8/31/1988	190	2,600b	3	15	0.5	4.5	NA	NA	12.84	9.86	2.98	NA
S-12	12/3/1988	180	3,900b	1.2	1	1	7.7	NA	NA	12.84	9.93	2.91	NA
S-12	2/16/1989	350c	2,100b	0.6	<0.5	0.5	5.5	NA	NA	12.84	8.08	4.76	NA
S-12	5/28/1989	290	2,200	2	1.6	4.4	6	NA	NA	12.84	9.08	3.76	NA
S-12	8/10/1989	240	720	0.7	<0.5	<0.5	1.1	NA	NA	12.84	9.35	3.49	NA
S-12	11/11/1989	210c	4,100	0.7	0.5	<0.5	3.4	NA	NA	12.84	9.28	3.56	NA
S-12	2/21/1994	240d	2,200e	0.7	<0.5	<0.5	3.6	NA	NA	12.84	8.22	4.62	NA
S-12	5/16/1994	96	2,200	1.5	<0.5	<0.5	2	NA	NA	12.84	8.92	3.92	NA
S-12	8/8/1994	110f	3,500g	<0.5	<0.5	<0.5	<0.5	NA	NA	12.84	NA	0.00	NA

WELL CONCENTRATIONS
Shell-Branded Service Station
1800 Powell Street
Emeryville, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-12	11/9/1994	80	5,400g	80	<0.5	<0.5	0.6	NA	NA	12.84	7.56	5.28	NA
S-12	2/22/1995	110	2,900g,h	0.7	<0.5	<0.5	3.7	NA	NA	12.84	7.98	4.86	NA
S-12 (D)	2/22/1995	110	3,400g,h	4.8	7.1	<0.5	2.1	NA	NA	12.84	7.98	4.86	NA
S-12	5/2/1995	140	2,800	2.4	1.1	0.8	4.3	NA	NA	12.84	8.44	4.40	NA
S-12	8/24/1995	200	1,600	19	12	5.6	24	NA	NA	12.84	9.00	3.84	NA
S-12	12/8/1995	170	2,700	2.2	0.7	0.9	3.6	NA	NA	12.84	9.62	3.22	NA
S-12	2/29/1996	1,700	2,200	<5.0	<5.0	<5.0	<5.0	5,600	NA	12.84	7.64	5.20	NA
S-12	5/22/1996	<1,000	5,700	<10	<10	<10	<10	2,400	NA	12.84	8.94	3.90	NA
S-12	7/30/1996	<500	3,200	<5.0	<5.0	<5.0	<5.0	1,500	NA	12.84	9.71	3.13	NA
S-12 (D)	7/30/1996	<500	2,900	<5.0	<5.0	<5.0	<5.0	NA	2,000	12.84	9.71	3.13	NA
S-12	11/11/1996	<500	6,900	<5.0	<5.0	<5.0	<5.0	1,400	NA	12.84	9.65	3.19	NA
S-12	11/3/1997	110	2,800	2.1	<0.50	<0.50	1.3	NA	NA	12.84	8.73	4.11	NA
S-12	11/6/1998	<500	2,900	<5.0	<5.0	<5.0	<5.0	2,700	NA	12.84	8.85	3.99	NA
S-12	12/7/1999	<500	2,800	<5.0	<5.0	<5.0	<5.0	1,900	NA	12.84	8.32	4.52	NA
S-12	11/2/2000	132	4,000	0.642	<0.500	<0.500	1.07	1,900	2,230 k	12.84	7.50	5.34	NA
S-12	12/27/2001	230	2,700	<2.0	<2.0	<2.0	<2.0	NA	760	12.84	7.00	5.84	NA
S-12	11/26/2002	180	540	<1.0	<1.0	<1.0	1.7	NA	390	14.87	8.35	6.52	NA
S-12	11/25/2003	<250	2,600 m	<2.5	<2.5	<2.5	<5.0	NA	310	14.87	6.04	8.83	NA
S-12	**11/10/2004**	**290**	**1,000 m**	**<1.0**	**1.2**	**<1.0**	**5.0**	**NA**	**140**	**14.87**	**7.80**	**7.07**	**NA**
S-13	7/6/1985	700	3,600	200	<5	<5	45	NA	NA	12.59	9.26	NA	NA
S-13	11/16/1985	1,900	2,000	700	160	70	340	NA	NA	12.59	NA	NA	NA
S-13	1/3/1986	2,800	NA	1,400	130	10	500	NA	NA	12.59	NA	NA	NA
S-13	7/5/1986	3,100	NA	1,800	60	40	270	NA	NA	12.59	9.47	3.12	NA
S-13	10/23/1986	3,400	NA	1,500	28	28	250	NA	NA	12.59	NA	NA	NA
S-13	1/13/1987	1,900	900	830	15	<10	99	NA	NA	12.59	NA	NA	NA
S-13	4/22/1987	2,900c	770h	1,100	20	30	140	NA	NA	12.59	NA	NA	NA
S-13	7/7/1987	1,500	NA	880	10	6	160	NA	NA	12.59	10.38	2.21	NA

WELL CONCENTRATIONS
Shell-Branded Service Station
1800 Powell Street
Emeryville, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-13	10/10/1987	480	2,400	830	15	<0.5	120	NA	NA	12.59	10.78	1.81	NA
S-13	2/11/1988	1,300	1,300	510	<10	<10	86	NA	NA	12.59	10.48	2.11	NA
S-13	5/10/1988	1,000	1,300b	470	<0.5	<5	50	NA	NA	12.59	9.48	3.11	NA
S-13	8/31/1988	NA	NA	NA	NA	NA	NA	NA	NA	12.59	10.74	1.85	SPH
S-13	12/3/1988	900	2,400b	290	4.6	<2.5	20	NA	NA	12.59	10.30	2.29	NA
S-13	2/16/1989	840c	1,200b	310	3.5	<2.5	27	NA	NA	12.59	7.60	4.99	NA
S-13	5/28/1989	2,100	4,600	1,100	19	50	350	NA	NA	12.59	10.60	1.99	NA
S-13	8/10/1989	900	2,300	230	16	6.9	65	NA	NA	12.59	10.58	2.01	NA
S-13	11/11/1989	2,800	2,800	200	15	8.6	58	NA	NA	12.59	9.84	2.75	NA
S-13	2/21/1994	700	1,800d	200	<5	<5	45	NA	NA	12.59	9.26	3.33	NA
S-13	5/16/1994	650	1,700	180	2.5	<2.5	21	NA	NA	12.59	9.62	2.97	NA
S-13	8/8/1994	470	2,600g	12	1.5	0.5	14	NA	NA	12.59	10.32	2.27	NA
S-13	11/9/1994	Well inaccessible		NA	NA	NA	NA	NA	NA	12.59	NA	NA	NA
S-13	2/22/1995	550	2,400g,h	190	4	<0.5	17	NA	NA	12.59	8.92	3.67	NA
S-13	5/2/1995	790	2,100	250	6.9	1.2	22	NA	NA	12.59	9.52	3.07	NA
S-13	8/24/1995	330	1,500	93	<0.5	<0.5	2	NA	NA	12.59	10.02	2.57	NA
S-13	12/8/1995	440	2,400	110	2.2	0.8	23	NA	NA	12.59	10.75	1.84	NA
S-13	2/29/1996	560	2,500	130	<5.0	<5.0	30	30	NA	12.59	9.02	3.57	NA
S-13	5/22/1996	430	3,700	55	1.6	310	27	<5.0	NA	12.59	10.20	2.39	NA
S-13	7/30/1996	230	1,600	30	2	1.4	17	15	NA	12.59	10.42	2.17	NA
S-13	11/11/1996	320	2,700	19	1.1	<0.5	14	3.5	NA	12.59	10.28	2.31	NA
S-13 (D)	11/11/1996	360	2,400	24	1.3	<0.5	15	4.5	NA	12.59	10.28	2.31	NA
S-13	11/3/1997	300	1,900	25	1.4	0.63	12	5.0	NA	12.59	9.36	3.23	NA
S-13	11/6/1998	390	1,300	53	2.9	1.1	13	17	NA	12.59	9.85	2.74	NA
S-13	12/7/1999	420	1,430	15	6.2	2.6	15	42	NA	12.59	9.72	2.87	NA
S-13	11/2/2000	257	4,240	4.89	1.92	<0.500	5.17	45.1	NA	12.59	7.15	5.44	NA
S-13	12/27/2001	300	6,400	7.2	0.84	<0.50	6.0	NA	34	12.59	9.35	3.24	NA
S-13	11/26/2002	160	850	<0.50	<0.50	<0.50	2.6	NA	23	14.47	9.80	4.67	NA

WELL CONCENTRATIONS
Shell-Branded Service Station
1800 Powell Street
Emeryville, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-13	11/25/2003	180	5,100 m	0.57	0.55	<0.50	3.0	NA	26	14.47	9.94	4.53	NA
S-13	**11/10/2004**	**220**	**1,900 m**	**<0.50**	**0.71**	**<0.50**	**2.8**	**NA**	**26**	**14.47**	**10.05**	**4.42**	**NA**
S-14	11/16/1985	<250	400	3	<2	<2	<5	NA	NA	12.69	NA	NA	NA
S-14	1/3/1986	<250	NA	3	2	<2	<5	NA	NA	12.69	NA	NA	NA
S-14	4/22/1987	1,200	18,000	7.4	2.7	15	110	NA	NA	12.69	NA	NA	NA
S-14	7/7/1987	190	NA	6.5	0.6	1.9	26	NA	NA	12.69	10.32	2.37	NA
S-14	10/10/1987	4,900	21,000	7	1.2	<0.5	25	NA	NA	12.69	10.77	1.92	NA
S-14	2/11/1988	370	12,000c	4.6	<2.5	<2.5	26	NA	NA	12.69	10.40	2.29	NA
S-14	5/10/1988	660	2,200b	2.9	<2.5	<2.5	24	NA	NA	12.69	9.66	3.03	NA
S-14	8/31/1988	700	7,900	3.2	<2.5	<2.5	15	NA	NA	12.69	10.74	1.95	NA
S-14	12/3/1988	210	11,000b	<0.5	<0.5	0.8	6.8	NA	NA	12.69	10.69	2.00	NA
S-14	2/16/1989	130c	5,700b	<0.5	<0.5	<0.5	4.4	NA	NA	12.69	9.69	3.00	NA
S-14	5/28/1989	770	5,200	<0.5	<0.5	<0.5	4.5	NA	NA	12.69	10.42	2.27	NA
S-14	8/10/1989	920	8,800	<1	<1	1.6	17	NA	NA	12.69	10.54	2.15	NA
S-14	11/11/1989	710	28,000	20	57	25	69	NA	NA	12.69	9.91	2.78	NA
S-14	2/21/1994	2,800	3,600	<5	<5	<5	14	NA	NA	12.69	9.30	3.09	NA
S-14	2/21/1994	2,300d	3,600e	<5.0	<5	<5	14	NA	NA	12.69	9.30	3.39	NA
S-14	5/16/1994	310	6,700	<2.5	<2.5	<2.5	3.1	NA	NA	12.69	9.54	3.15	NA
S-14	8/8/1994	480I	2,900	<0.5	0.6	<0.5	0.8	NA	NA	12.69	10.29	2.40	NA
S-14 (D)	8/8/1994	590I	2,900	<0.5	0.6	<0.5	1.5	NA	NA	12.69	10.29	2.40	NA
S-14	11/9/1994	170i	6,400g	0.7	<0.5	<0.5	2.7	NA	NA	12.69	9.52	3.07	NA
S-14	2/22/1995	550	7,000g,h	<0.5	<0.5	<0.5	1.6	NA	NA	12.69	9.18	3.51	NA
S-14	5/2/1995	210	2,300	1	0.9	1.1	6.3	NA	NA	12.69	9.49	3.20	NA
S-14 (D)	5/2/1995	160	2,600	0.6	0.6	0.7	3.8	NA	NA	12.69	9.49	3.20	NA
S-14	8/24/1995	180	3,700	0.5	<0.5	<0.5	1.3	NA	NA	12.69	9.94	2.75	NA
S-14	12/8/1995	190	4,900	1	<0.5	0.6	4.6	NA	NA	12.69	10.65	2.04	NA
S-14	2/29/1996	200	11,000	<0.5	<0.5	<0.5	2	3	NA	12.69	8.90	3.79	NA

WELL CONCENTRATIONS
Shell-Branded Service Station
1800 Powell Street
Emeryville, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-14	5/22/1996	93	3,800	<0.5	<0.5	<0.5	1.6	<2.5	NA	12.69	10.10	2.59	NA
S-14 (D)	5/22/1996	150	3,900	<0.5	<0.5	<0.5	1.8	<2.5	NA	12.69	10.10	2.59	NA
S-14	7/30/1996	<50	2,500	<0.5	<0.5	<0.5	0.89	<2.5	NA	12.69	10.37	2.32	NA
S-14	11/11/1996	2,600	27,000	<2.5	<2.5	<2.5	3.9	<12	NA	12.69	10.29	2.40	NA
S-14	11/3/1997	430	1,800	<0.50	<0.50	<0.50	1.7	<2.5	NA	12.69	9.52	3.17	NA
S-14	11/6/1998	Well inaccessible		NA	NA	NA	NA	NA	NA	12.69	NA	NA	NA
S-14	12/7/1999	970	5,920	1.0	1.1	0.59	3.5	2.6	NA	12.69	9.73	2.96	NA
S-14	11/2/2000	273	535,000	<0.500	<0.500	<0.500	1.59	<2.50	NA	12.69	9.98	2.71	NA
S-14	12/27/2001	68	20,000	<0.50	<0.50	<0.50	1.3	NA	<5.0	12.69	9.33	3.36	NA
S-14	11/26/2002	<50	2,400	<0.50	<0.50	<0.50	0.91	NA	<5.0	14.51	9.70	4.81	NA
S-14	11/25/2003	78 m	4,400 m	<0.50	<0.50	<0.50	1.2	NA	1.6	14.51	9.99	4.52	NA
S-14	**11/10/2004**	**74 p**	**2,500 m**	**<0.50**	**<0.50**	**<0.50**	**<1.0**	**NA**	**1.9**	**14.51**	**10.05**	**4.46**	**NA**

Abbreviations:

TPPH = Total petroleum hydrocarbons as gasoline by EPA Method 8260B, prior to December 27, 2001, by EPA Method 8015.

TEPH = Total petroleum hydrocarbons as diesel by modified EPA Method 8015.

BTEX = Benzene, toluene, ethylbenzene, xylenes by EPA Method 8260B; prior to December 27, 2001, by EPA Method 8020.

MTBE = Methyl tertiary butyl ether

TOB = Top of Wellbox Elevation

TOC = Top of Casing Elevation

SPH = Separate-Phase Hydrocarbons

GW = Groundwater

ug/L = parts per billion

MSL = Mean sea level

ft. = Feet

<n = Below detection limit

(D) = Duplicate sample

NA = Not applicable

WELL CONCENTRATIONS
Shell-Branded Service Station
1800 Powell Street
Emeryville, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)

Notes:

a = Tar-like substance in well, probably from previous landfill activities; not gasoline.

b = Compounds detected within the chromatographic range appear to be weathered diesel.

c = Compounds detected within the chromatographic range of gasoline but not characteristic of the standard gasoline pattern.

d = The concentrations reported as gasoline for samples S-12 and S-14 are primarily due to the presence of a discrete peak.

e = The concentrations reported as diesel for samples S-12, S-13, and S-14 are due to the presence of a combination of diesel and a heavier petroleum product of hydrocarbon range C18 - C36, possibly motor oil.

f = The result for gasoline is an unknown hydrocarbon which consists of several peaks.

g = The positive result appears to be a heavier hydrocarbon than diesel.

h = Compounds detected within the chromatographic range of diesel appears to include gasoline compounds.

i = The positive result appears to be a heavier hydrocarbon than gasoline.

j = No MTBE could be determined due to co-elution with early eluting compounds.

k = This sample analyzed outside of EPA recommended holding time.

m = Hydrocarbon does not match pattern of laboratory's standard.

n = Top of casing altered +0.15 feet on August 2, 2004 due to wellhead maintenance.

o = Top of casing altered -0.18 feet on August 2, 2004 due to wellhead maintenance.

p = Quantity of unknown hydrocarbon(s) in sample based on gasoline.

Beginning November 26, 2002, depth to water referenced to Top of Casing Elevation.

Active wells surveyed February 12, 2002 by Virgil Chavez Land Surveying of Vallejo, CA.

GLOBAL_ID	LOCID	LOGDATE	ANADATE	MATRIX	LABLOTCTL	SAMPID	QCCODE	ANMCODE	PARLABEL	PARVQ	PARVAL	UNITS	REPDL	UNITS	RLNOTE
T0600100208	MW-1	4/25/2005	5/5/2005	W	5E04001	MW-1	CS	8260FA	BENZENE	=	140	UG/L	2.5	UG/L	
T0600100208	MW-1	4/25/2005	5/5/2005	W	5E04001	MW-1	CS	8260FA	TOLUENE	=	3.6	UG/L	2.5	UG/L	
T0600100208	MW-1	4/25/2005	5/5/2005	W	5E04001	MW-1	CS	8260FA	1,2-DICHLOROETHANE	ND	0	UG/L	2.5	UG/L	
T0600100208	MW-1	4/25/2005	5/5/2005	W	5E04001	MW-1	CS	8260FA	1,2-DICHLOROETHANE-D4	SU	96	%	0	%	
T0600100208	MW-1	4/25/2005	5/5/2005	W	5E04001	MW-1	CS	8260FA	DI-ISOPROPYL ETHER (DIPE)	ND	0	UG/L	2.5	UG/L	
T0600100208	MW-1	4/25/2005	5/5/2005	W	5E04001	MW-1	CS	8260FA	ETHYLBENZENE	=	5.3	UG/L	2.5	UG/L	
T0600100208	MW-1	4/25/2005	5/5/2005	W	5E04001	MW-1	CS	8260FA	1,2-DIBROMOETHANE	ND	0	UG/L	2.5	UG/L	
T0600100208	MW-1	4/25/2005	5/5/2005	W	5E04001	MW-1	CS	8260FA	ETHYL TERT-BUTYL ETHER (ETBE)	ND	0	UG/L	2.5	UG/L	
T0600100208	MW-1	4/25/2005	5/5/2005	W	5E04001	MW-1	CS	8260FA	ETHANOL (ETOH)	ND	0	UG/L	500	UG/L	
T0600100208	MW-1	4/25/2005	5/5/2005	W	5E04001	MW-1	CS	8260FA	GASOLINE RANGE ORGANICS (C4-C12)	=	930	UG/L	250	UG/L	
T0600100208	MW-1	4/25/2005	5/5/2005	W	5E04001	MW-1	CS	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	=	200	UG/L	2.5	UG/L	
T0600100208	MW-1	4/25/2005	5/5/2005	W	5E04001	MW-1	CS	8260FA	TERT-AMYL METHYL ETHER (TAME)	ND	0	UG/L	2.5	UG/L	
T0600100208	MW-1	4/25/2005	5/5/2005	W	5E04001	MW-1	CS	8260FA	TERT-BUTYL ALCOHOL (TBA)	=	5000	UG/L	100	UG/L	
T0600100208	MW-1	4/25/2005	5/5/2005	W	5E04001	MW-1	CS	8260FA	XYLENES	=	11	UG/L	2.5	UG/L	
T0600100208	MW-10	4/25/2005	5/6/2005	W	5E05002	MW-10	CS	8260FA	BENZENE	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-10	4/25/2005	5/6/2005	W	5E05002	MW-10	CS	8260FA	TOLUENE	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-10	4/25/2005	5/6/2005	W	5E05002	MW-10	CS	8260FA	1,2-DICHLOROETHANE	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-10	4/25/2005	5/6/2005	W	5E05002	MW-10	CS	8260FA	1,2-DICHLOROETHANE-D4	SU	101	%	0	%	
T0600100208	MW-10	4/25/2005	5/6/2005	W	5E05002	MW-10	CS	8260FA	DI-ISOPROPYL ETHER (DIPE)	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-10	4/25/2005	5/6/2005	W	5E05002	MW-10	CS	8260FA	ETHYLBENZENE	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-10	4/25/2005	5/6/2005	W	5E05002	MW-10	CS	8260FA	1,2-DIBROMOETHANE	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-10	4/25/2005	5/6/2005	W	5E05002	MW-10	CS	8260FA	ETHYL TERT-BUTYL ETHER (ETBE)	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-10	4/25/2005	5/6/2005	W	5E05002	MW-10	CS	8260FA	ETHANOL (ETOH)	ND	0	UG/L	100	UG/L	IC
T0600100208	MW-10	4/25/2005	5/6/2005	W	5E05002	MW-10	CS	8260FA	GASOLINE RANGE ORGANICS (C4-C12)	ND	0	UG/L	50	UG/L	
T0600100208	MW-10	4/25/2005	5/6/2005	W	5E05002	MW-10	CS	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	=	1.5	UG/L	0.5	UG/L	
T0600100208	MW-10	4/25/2005	5/6/2005	W	5E05002	MW-10	CS	8260FA	TERT-AMYL METHYL ETHER (TAME)	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-10	4/25/2005	5/6/2005	W	5E05002	MW-10	CS	8260FA	TERT-BUTYL ALCOHOL (TBA)	ND	0	UG/L	20	UG/L	
T0600100208	MW-10	4/25/2005	5/6/2005	W	5E05002	MW-10	CS	8260FA	XYLENES	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-11	4/25/2005	5/6/2005	W	5E06007	MW-11	CS	8260FA	BENZENE	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-11	4/25/2005	5/6/2005	W	5E06007	MW-11	CS	8260FA	TOLUENE	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-11	4/25/2005	5/6/2005	W	5E06007	MW-11	CS	8260FA	1,2-DICHLOROETHANE	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-11	4/25/2005	5/6/2005	W	5E06007	MW-11	CS	8260FA	1,2-DICHLOROETHANE-D4	SU	101	%	0	%	
T0600100208	MW-11	4/25/2005	5/6/2005	W	5E06007	MW-11	CS	8260FA	DI-ISOPROPYL ETHER (DIPE)	ND	0	UG/L	0.5	UG/L	

GLOBAL_ID	LOCID	LOGDATE	ANADATE	MATRIX	LABLOTCTL	SAMPID	QCCODE	ANMCODE	PARLABEL	PARVQ	PARVAL	UNITS	REPDL	UNITS	RLNOTE
T0600100208	MW-11	4/25/2005	5/6/2005	W	5E06007	MW-11	CS	8260FA	ETHYLBENZENE	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-11	4/25/2005	5/6/2005	W	5E06007	MW-11	CS	8260FA	1,2-DIBROMOETHANE	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-11	4/25/2005	5/6/2005	W	5E06007	MW-11	CS	8260FA	ETHYL TERT-BUTYL ETHER (ETBE)	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-11	4/25/2005	5/6/2005	W	5E06007	MW-11	CS	8260FA	ETHANOL (ETOH)	ND	0	UG/L	100	UG/L	
T0600100208	MW-11	4/25/2005	5/6/2005	W	5E06007	MW-11	CS	8260FA	GASOLINE RANGE ORGANICS (C4-C12)	ND	0	UG/L	50	UG/L	
T0600100208	MW-11	4/25/2005	5/6/2005	W	5E06007	MW-11	CS	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-11	4/25/2005	5/6/2005	W	5E06007	MW-11	CS	8260FA	TERT-AMYL METHYL ETHER (TAME)	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-11	4/25/2005	5/6/2005	W	5E06007	MW-11	CS	8260FA	TERT-BUTYL ALCOHOL (TBA)	ND	0	UG/L	20	UG/L	
T0600100208	MW-11	4/25/2005	5/6/2005	W	5E06007	MW-11	CS	8260FA	XYLENES	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-2	4/25/2005	5/5/2005	W	5E04001	MW-2	CS	8260FA	BENZENE	=	6700	UG/L	50	UG/L	
T0600100208	MW-2	4/25/2005	5/5/2005	W	5E04001	MW-2	CS	8260FA	TOLUENE	=	4900	UG/L	50	UG/L	
T0600100208	MW-2	4/25/2005	5/5/2005	W	5E04001	MW-2	CS	8260FA	1,2-DICHLOROETHANE	ND	0	UG/L	50	UG/L	
T0600100208	MW-2	4/25/2005	5/5/2005	W	5E04001	MW-2	CS	8260FA	1,2-DICHLOROETHANE-D4	SU	103	%	0	%	
T0600100208	MW-2	4/25/2005	5/5/2005	W	5E04001	MW-2	CS	8260FA	DI-ISOPROPYL ETHER (DIPE)	ND	0	UG/L	50	UG/L	
T0600100208	MW-2	4/25/2005	5/5/2005	W	5E04001	MW-2	CS	8260FA	ETHYLBENZENE	=	4400	UG/L	50	UG/L	
T0600100208	MW-2	4/25/2005	5/5/2005	W	5E04001	MW-2	CS	8260FA	1,2-DIBROMOETHANE	ND	0	UG/L	50	UG/L	
T0600100208	MW-2	4/25/2005	5/5/2005	W	5E04001	MW-2	CS	8260FA	ETHYL TERT-BUTYL ETHER (ETBE)	ND	0	UG/L	50	UG/L	
T0600100208	MW-2	4/25/2005	5/5/2005	W	5E04001	MW-2	CS	8260FA	ETHANOL (ETOH)	ND	0	UG/L	10000	UG/L	
T0600100208	MW-2	4/25/2005	5/5/2005	W	5E04001	MW-2	CS	8260FA	GASOLINE RANGE ORGANICS (C4-C12)	=	80000	UG/L	5000	UG/L	
T0600100208	MW-2	4/25/2005	5/5/2005	W	5E04001	MW-2	CS	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	=	8200	UG/L	50	UG/L	
T0600100208	MW-2	4/25/2005	5/5/2005	W	5E04001	MW-2	CS	8260FA	TERT-AMYL METHYL ETHER (TAME)	=	220	UG/L	50	UG/L	
T0600100208	MW-2	4/25/2005	5/5/2005	W	5E04001	MW-2	CS	8260FA	TERT-BUTYL ALCOHOL (TBA)	=	3700	UG/L	2000	UG/L	
T0600100208	MW-2	4/25/2005	5/5/2005	W	5E04001	MW-2	CS	8260FA	XYLENES	=	17000	UG/L	50	UG/L	
T0600100208	MW-3	4/25/2005	4/28/2005	W	5D27018	MW-3	CS	SW8015B	OCTACOSANE	SU	107	%	0	%	SG
T0600100208	MW-3	4/25/2005	5/5/2005	W	5E05002	MW-3	CS	8260FA	BENZENE	ND	0	UG/L	2.5	UG/L	
T0600100208	MW-3	4/25/2005	5/5/2005	W	5E05002	MW-3	CS	8260FA	TOLUENE	ND	0	UG/L	2.5	UG/L	
T0600100208	MW-3	4/25/2005	5/5/2005	W	5E05002	MW-3	CS	8260FA	1,2-DICHLOROETHANE	ND	0	UG/L	2.5	UG/L	
T0600100208	MW-3	4/25/2005	5/5/2005	W	5E05002	MW-3	CS	8260FA	1,2-DICHLOROETHANE-D4	SU	96	%	0	%	
T0600100208	MW-3	4/25/2005	5/5/2005	W	5E05002	MW-3	CS	8260FA	DI-ISOPROPYL ETHER (DIPE)	ND	0	UG/L	2.5	UG/L	
T0600100208	MW-3	4/25/2005	4/28/2005	W	5D27018	MW-3	CS	SW8015B	DIESEL RANGE ORGANICS (C10-C36)	=	520	UG/L	50	UG/L	SG,PT
T0600100208	MW-3	4/25/2005	5/5/2005	W	5E05002	MW-3	CS	8260FA	ETHYLBENZENE	ND	0	UG/L	2.5	UG/L	
T0600100208	MW-3	4/25/2005	5/5/2005	W	5E05002	MW-3	CS	8260FA	1,2-DIBROMOETHANE	ND	0	UG/L	2.5	UG/L	
T0600100208	MW-3	4/25/2005	5/5/2005	W	5E05002	MW-3	CS	8260FA	ETHYL TERT-BUTYL ETHER (ETBE)	ND	0	UG/L	2.5	UG/L	

GLOBAL_ID	LOCID	LOGDATE	ANADATE	MATRIX	LABLOTCTL	SAMPID	QCCODE	ANMCODE	PARLABEL	PARVQ	PARVAL	UNITS	REPDL	UNITS	RLNOTE
T0600100208	MW-3	4/25/2005	5/5/2005	W	5E05002	MW-3	CS	8260FA	ETHANOL (ETOH)	ND	0	UG/L	500	UG/L	IC
T0600100208	MW-3	4/25/2005	5/5/2005	W	5E05002	MW-3	CS	8260FA	GASOLINE RANGE ORGANICS (C4-C12)	ND	0	UG/L	250	UG/L	
T0600100208	MW-3	4/25/2005	5/5/2005	W	5E05002	MW-3	CS	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	=	220	UG/L	2.5	UG/L	
T0600100208	MW-3	4/25/2005	5/3/2005	W	5E03017	MW-3	CS	E1664A	OIL AND GREASE	=	6300	UG/L	5400	UG/L	
T0600100208	MW-3	4/25/2005	5/5/2005	W	5E05002	MW-3	CS	8260FA	TERT-AMYL METHYL ETHER (TAME)	=	10	UG/L	2.5	UG/L	
T0600100208	MW-3	4/25/2005	5/5/2005	W	5E05002	MW-3	CS	8260FA	TERT-BUTYL ALCOHOL (TBA)	=	160	UG/L	100	UG/L	
T0600100208	MW-3	4/25/2005	5/5/2005	W	5E05002	MW-3	CS	8260FA	XYLENES	ND	0	UG/L	2.5	UG/L	
T0600100208	MW-4	4/25/2005	5/5/2005	W	5E04001	MW-4	CS	8260FA	BENZENE	=	8	UG/L	5	UG/L	
T0600100208	MW-4	4/25/2005	5/5/2005	W	5E04001	MW-4	CS	8260FA	TOLUENE	=	5.3	UG/L	5	UG/L	
T0600100208	MW-4	4/25/2005	5/5/2005	W	5E04001	MW-4	CS	8260FA	1,2-DICHLOROETHANE	ND	0	UG/L	5	UG/L	
T0600100208	MW-4	4/25/2005	5/5/2005	W	5E04001	MW-4	CS	8260FA	1,2-DICHLOROETHANE-D4	SU	100	%	0	%	
T0600100208	MW-4	4/25/2005	5/5/2005	W	5E04001	MW-4	CS	8260FA	DI-ISOPROPYL ETHER (DIPE)	ND	0	UG/L	5	UG/L	
T0600100208	MW-4	4/25/2005	5/5/2005	W	5E04001	MW-4	CS	8260FA	ETHYLBENZENE	ND	0	UG/L	5	UG/L	
T0600100208	MW-4	4/25/2005	5/5/2005	W	5E04001	MW-4	CS	8260FA	1,2-DIBROMOETHANE	ND	0	UG/L	5	UG/L	
T0600100208	MW-4	4/25/2005	5/5/2005	W	5E04001	MW-4	CS	8260FA	ETHYL TERT-BUTYL ETHER (ETBE)	ND	0	UG/L	5	UG/L	
T0600100208	MW-4	4/25/2005	5/5/2005	W	5E04001	MW-4	CS	8260FA	ETHANOL (ETOH)	ND	0	UG/L	1000	UG/L	
T0600100208	MW-4	4/25/2005	5/5/2005	W	5E04001	MW-4	CS	8260FA	GASOLINE RANGE ORGANICS (C4-C12)	=	720	UG/L	500	UG/L	
T0600100208	MW-4	4/25/2005	5/5/2005	W	5E04001	MW-4	CS	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	=	170	UG/L	5	UG/L	
T0600100208	MW-4	4/25/2005	5/5/2005	W	5E04001	MW-4	CS	8260FA	TERT-AMYL METHYL ETHER (TAME)	ND	0	UG/L	5	UG/L	
T0600100208	MW-4	4/25/2005	5/5/2005	W	5E04001	MW-4	CS	8260FA	TERT-BUTYL ALCOHOL (TBA)	=	18000	UG/L	200	UG/L	
T0600100208	MW-4	4/25/2005	5/5/2005	W	5E04001	MW-4	CS	8260FA	XYLENES	=	16	UG/L	5	UG/L	
T0600100208	MW-5	4/25/2005	5/6/2005	W	5E06007	MW-5	CS	8260FA	BENZENE	=	7.6	UG/L	2.5	UG/L	
T0600100208	MW-5	4/25/2005	5/6/2005	W	5E06007	MW-5	CS	8260FA	TOLUENE	=	4	UG/L	2.5	UG/L	
T0600100208	MW-5	4/25/2005	5/6/2005	W	5E06007	MW-5	CS	8260FA	1,2-DICHLOROETHANE	ND	0	UG/L	2.5	UG/L	
T0600100208	MW-5	4/25/2005	5/6/2005	W	5E06007	MW-5	CS	8260FA	1,2-DICHLOROETHANE-D4	SU	96	%	0	%	
T0600100208	MW-5	4/25/2005	5/6/2005	W	5E06007	MW-5	CS	8260FA	DI-ISOPROPYL ETHER (DIPE)	ND	0	UG/L	2.5	UG/L	
T0600100208	MW-5	4/25/2005	5/6/2005	W	5E06007	MW-5	CS	8260FA	ETHYLBENZENE	=	4.3	UG/L	2.5	UG/L	
T0600100208	MW-5	4/25/2005	5/6/2005	W	5E06007	MW-5	CS	8260FA	1,2-DIBROMOETHANE	ND	0	UG/L	2.5	UG/L	
T0600100208	MW-5	4/25/2005	5/6/2005	W	5E06007	MW-5	CS	8260FA	ETHYL TERT-BUTYL ETHER (ETBE)	ND	0	UG/L	2.5	UG/L	
T0600100208	MW-5	4/25/2005	5/6/2005	W	5E06007	MW-5	CS	8260FA	ETHANOL (ETOH)	ND	0	UG/L	500	UG/L	
T0600100208	MW-5	4/25/2005	5/6/2005	W	5E06007	MW-5	CS	8260FA	GASOLINE RANGE ORGANICS (C4-C12)	=	5200	UG/L	250	UG/L	
T0600100208	MW-5	4/25/2005	5/6/2005	W	5E06007	MW-5	CS	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	=	12	UG/L	2.5	UG/L	
T0600100208	MW-5	4/25/2005	5/6/2005	W	5E06007	MW-5	CS	8260FA	TERT-AMYL METHYL ETHER (TAME)	ND	0	UG/L	2.5	UG/L	

GLOBAL_ID	LOCID	LOGDATE	ANADATE	MATRIX	LABLOTCTL	SAMPID	QCCODE	ANMCODE	PARLABEL	PARVQ	PARVAL	UNITS	REPDL	UNITS	RLNOTE
T0600100208	MW-5	4/25/2005	5/6/2005	W	5E06007	MW-5	CS	8260FA	TERT-BUTYL ALCOHOL (TBA)	ND	0	UG/L	100	UG/L	
T0600100208	MW-5	4/25/2005	5/6/2005	W	5E06007	MW-5	CS	8260FA	XYLENES	=	9.9	UG/L	2.5	UG/L	
T0600100208	MW-6	4/25/2005	5/6/2005	W	5E05002	MW-6	CS	8260FA	BENZENE	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-6	4/25/2005	5/6/2005	W	5E05002	MW-6	CS	8260FA	TOLUENE	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-6	4/25/2005	5/6/2005	W	5E05002	MW-6	CS	8260FA	1,2-DICHLOROETHANE	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-6	4/25/2005	5/6/2005	W	5E05002	MW-6	CS	8260FA	1,2-DICHLOROETHANE-D4	SU	102	%	0	%	
T0600100208	MW-6	4/25/2005	5/6/2005	W	5E05002	MW-6	CS	8260FA	DI-ISOPROPYL ETHER (DIPE)	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-6	4/25/2005	5/6/2005	W	5E05002	MW-6	CS	8260FA	ETHYLBENZENE	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-6	4/25/2005	5/6/2005	W	5E05002	MW-6	CS	8260FA	1,2-DIBROMOETHANE	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-6	4/25/2005	5/6/2005	W	5E05002	MW-6	CS	8260FA	ETHYL TERT-BUTYL ETHER (ETBE)	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-6	4/25/2005	5/6/2005	W	5E05002	MW-6	CS	8260FA	ETHANOL (ETOH)	ND	0	UG/L	100	UG/L	IC
T0600100208	MW-6	4/25/2005	5/6/2005	W	5E05002	MW-6	CS	8260FA	GASOLINE RANGE ORGANICS (C4-C12)	=	64	UG/L	50	UG/L	
T0600100208	MW-6	4/25/2005	5/6/2005	W	5E05002	MW-6	CS	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	=	50	UG/L	0.5	UG/L	
T0600100208	MW-6	4/25/2005	5/6/2005	W	5E05002	MW-6	CS	8260FA	TERT-AMYL METHYL ETHER (TAME)	=	6	UG/L	0.5	UG/L	
T0600100208	MW-6	4/25/2005	5/6/2005	W	5E05002	MW-6	CS	8260FA	TERT-BUTYL ALCOHOL (TBA)	=	45	UG/L	20	UG/L	
T0600100208	MW-6	4/25/2005	5/6/2005	W	5E05002	MW-6	CS	8260FA	XYLENES	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-7	4/25/2005	5/6/2005	W	5E05002	MW-7	CS	8260FA	BENZENE	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-7	4/25/2005	5/6/2005	W	5E05002	MW-7	CS	8260FA	TOLUENE	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-7	4/25/2005	5/6/2005	W	5E05002	MW-7	CS	8260FA	1,2-DICHLOROETHANE	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-7	4/25/2005	5/6/2005	W	5E05002	MW-7	CS	8260FA	1,2-DICHLOROETHANE-D4	SU	96	%	0	%	
T0600100208	MW-7	4/25/2005	5/6/2005	W	5E05002	MW-7	CS	8260FA	DI-ISOPROPYL ETHER (DIPE)	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-7	4/25/2005	5/6/2005	W	5E05002	MW-7	CS	8260FA	ETHYLBENZENE	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-7	4/25/2005	5/6/2005	W	5E05002	MW-7	CS	8260FA	1,2-DIBROMOETHANE	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-7	4/25/2005	5/6/2005	W	5E05002	MW-7	CS	8260FA	ETHYL TERT-BUTYL ETHER (ETBE)	ND	0	UG/L	0.5	UG/L	
T0600100208	MW-7	4/25/2005	5/6/2005	W	5E05002	MW-7	CS	8260FA	ETHANOL (ETOH)	ND	0	UG/L	100	UG/L	IC
T0600100208	MW-7	4/25/2005	5/6/2005	W	5E05002	MW-7	CS	8260FA	GASOLINE RANGE ORGANICS (C4-C12)	=	67	UG/L	50	UG/L	
T0600100208	MW-7	4/25/2005	5/6/2005	W	5E05002	MW-7	CS	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	=	41	UG/L	0.5	UG/L	
T0600100208	MW-7	4/25/2005	5/6/2005	W	5E05002	MW-7	CS	8260FA	TERT-AMYL METHYL ETHER (TAME)	=	2.1	UG/L	0.5	UG/L	
T0600100208	MW-7	4/25/2005	5/6/2005	W	5E05002	MW-7	CS	8260FA	TERT-BUTYL ALCOHOL (TBA)	=	520	UG/L	20	UG/L	
T0600100208	MW-7	4/25/2005	5/6/2005	W	5E05002	MW-7	CS	8260FA	XYLENES	=	0.64	UG/L	0.5	UG/L	
T0600100208	MW-8	4/25/2005	5/6/2005	W	5E06007	MW-8	CS	8260FA	BENZENE	ND	0	UG/L	12	UG/L	
T0600100208	MW-8	4/25/2005	5/6/2005	W	5E06007	MW-8	CS	8260FA	TOLUENE	ND	0	UG/L	12	UG/L	
T0600100208	MW-8	4/25/2005	5/6/2005	W	5E06007	MW-8	CS	8260FA	1,2-DICHLOROETHANE	ND	0	UG/L	12	UG/L	

GLOBAL_ID	LOCID	LOGDATE	ANADATE	MATRIX	LABLOTCTL	SAMPID	QCCODE	ANMCODE	PARLABEL	PARVQ	PARVAL	UNITS	REPDL	UNITS	RLNOTE
T0600100208	MW-8	4/25/2005	5/6/2005	W	5E06007	MW-8	CS	8260FA	1,2-DICHLOROETHANE-D4	SU	102	%	0	%	
T0600100208	MW-8	4/25/2005	5/6/2005	W	5E06007	MW-8	CS	8260FA	DI-ISOPROPYL ETHER (DIPE)	ND	0	UG/L	12	UG/L	
T0600100208	MW-8	4/25/2005	5/6/2005	W	5E06007	MW-8	CS	8260FA	ETHYLBENZENE	ND	0	UG/L	12	UG/L	
T0600100208	MW-8	4/25/2005	5/6/2005	W	5E06007	MW-8	CS	8260FA	1,2-DIBROMOETHANE	ND	0	UG/L	12	UG/L	
T0600100208	MW-8	4/25/2005	5/6/2005	W	5E06007	MW-8	CS	8260FA	ETHYL TERT-BUTYL ETHER (ETBE)	ND	0	UG/L	12	UG/L	
T0600100208	MW-8	4/25/2005	5/6/2005	W	5E06007	MW-8	CS	8260FA	ETHANOL (ETOH)	ND	0	UG/L	2500	UG/L	
T0600100208	MW-8	4/25/2005	5/6/2005	W	5E06007	MW-8	CS	8260FA	GASOLINE RANGE ORGANICS (C4-C12)	=	1400	UG/L	1200	UG/L	
T0600100208	MW-8	4/25/2005	5/6/2005	W	5E06007	MW-8	CS	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	=	32	UG/L	12	UG/L	
T0600100208	MW-8	4/25/2005	5/6/2005	W	5E06007	MW-8	CS	8260FA	TERT-AMYL METHYL ETHER (TAME)	ND	0	UG/L	12	UG/L	
T0600100208	MW-8	4/25/2005	5/6/2005	W	5E06007	MW-8	CS	8260FA	TERT-BUTYL ALCOHOL (TBA)	=	45000	UG/L	500	UG/L	
T0600100208	MW-8	4/25/2005	5/6/2005	W	5E06007	MW-8	CS	8260FA	XYLENES	ND	0	UG/L	12	UG/L	
T0600100208	MW-9	4/25/2005	5/6/2005	W	5E05002	MW-9	CS	8260FA	BENZENE	=	190	UG/L	5	UG/L	
T0600100208	MW-9	4/25/2005	5/6/2005	W	5E05002	MW-9	CS	8260FA	TOLUENE	ND	0	UG/L	5	UG/L	
T0600100208	MW-9	4/25/2005	5/6/2005	W	5E05002	MW-9	CS	8260FA	1,2-DICHLOROETHANE	ND	0	UG/L	5	UG/L	
T0600100208	MW-9	4/25/2005	5/6/2005	W	5E05002	MW-9	CS	8260FA	1,2-DICHLOROETHANE-D4	SU	97	%	0	%	
T0600100208	MW-9	4/25/2005	5/6/2005	W	5E05002	MW-9	CS	8260FA	DI-ISOPROPYL ETHER (DIPE)	ND	0	UG/L	5	UG/L	
T0600100208	MW-9	4/25/2005	5/6/2005	W	5E05002	MW-9	CS	8260FA	ETHYLBENZENE	=	120	UG/L	5	UG/L	
T0600100208	MW-9	4/25/2005	5/6/2005	W	5E05002	MW-9	CS	8260FA	1,2-DIBROMOETHANE	ND	0	UG/L	5	UG/L	
T0600100208	MW-9	4/25/2005	5/6/2005	W	5E05002	MW-9	CS	8260FA	ETHYL TERT-BUTYL ETHER (ETBE)	ND	0	UG/L	5	UG/L	
T0600100208	MW-9	4/25/2005	5/6/2005	W	5E05002	MW-9	CS	8260FA	ETHANOL (ETOH)	ND	0	UG/L	1000	UG/L	IC
T0600100208	MW-9	4/25/2005	5/6/2005	W	5E05002	MW-9	CS	8260FA	GASOLINE RANGE ORGANICS (C4-C12)	=	5900	UG/L	500	UG/L	
T0600100208	MW-9	4/25/2005	5/6/2005	W	5E05002	MW-9	CS	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	=	540	UG/L	5	UG/L	
T0600100208	MW-9	4/25/2005	5/6/2005	W	5E05002	MW-9	CS	8260FA	TERT-AMYL METHYL ETHER (TAME)	=	14	UG/L	5	UG/L	
T0600100208	MW-9	4/25/2005	5/6/2005	W	5E05002	MW-9	CS	8260FA	TERT-BUTYL ALCOHOL (TBA)	=	1400	UG/L	200	UG/L	
T0600100208	MW-9	4/25/2005	5/6/2005	W	5E05002	MW-9	CS	8260FA	XYLENES	=	77	UG/L	5	UG/L	
T0600100208			4/28/2005	WQ	5D27018		LB1	SW8015B	OCTACOSANE	SU	61	%	0	%	SG
T0600100208			4/28/2005	WQ	5D27018		BS1	SW8015B	OCTACOSANE	SU	71	%	0	%	SG
T0600100208			4/28/2005	WQ	5D27018		BD1	SW8015B	OCTACOSANE	SU	81	%	0	%	SG
T0600100208			5/4/2005	WQ	5E04001		BS2	8260FA	BENZENE	=	5.01	UG/L	0.5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		LB1	8260FA	BENZENE	ND	0	UG/L	0.5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BS2	8260FA	BENZENE	=	5.08	UG/L	0.5	UG/L	
T0600100208			5/6/2005	W	5E06007		SD1	8260FA	BENZENE	=	88.6	UG/L	5	UG/L	
T0600100208			5/6/2005	W	5E06007		MS1	8260FA	BENZENE	=	89	UG/L	5	UG/L	

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T0600100208			5/6/2005	WQ	5E06007		BD1	8260FA	BENZENE	=	9.84	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BS2	8260FA	BENZENE	=	4.72	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BS1	8260FA	BENZENE	=	9.85	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		LB1	8260FA	BENZENE	ND	0	UG/L	0.5	UG/L	
T0600100208			5/5/2005	W	5E05002		SD1	8260FA	BENZENE	=	241	UG/L	5	UG/L	
T0600100208			5/5/2005	W	5E05002		MS1	8260FA	BENZENE	=	249	UG/L	5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BD1	8260FA	BENZENE	=	9.82	UG/L	0.5	UG/L	
T0600100208			5/6/2005	W	5E06007		NC	8260FA	BENZENE	=	38	UG/L	5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BS1	8260FA	BENZENE	=	8.64	UG/L	0.5	UG/L	
T0600100208			5/4/2005	W	5E04001		SD1	8260FA	BENZENE	=	324	UG/L	25	UG/L	
T0600100208			5/4/2005	WQ	5E04001		BS1	8260FA	BENZENE	=	9.21	UG/L	0.5	UG/L	
T0600100208			5/4/2005	W	5E04001		NC	8260FA	BENZENE	=	88	UG/L	25	UG/L	
T0600100208			5/4/2005	W	5E04001		MS1	8260FA	BENZENE	=	337	UG/L	25	UG/L	
T0600100208			5/4/2005	WQ	5E04001		BD1	8260FA	BENZENE	=	9.56	UG/L	0.5	UG/L	
T0600100208			5/4/2005	WQ	5E04001		LB1	8260FA	BENZENE	ND	0	UG/L	0.5	UG/L	
T0600100208			5/4/2005	WQ	5E04001		BS2	8260FA	TOLUENE	=	31.5	UG/L	0.5	UG/L	
T0600100208			5/5/2005	W	5E05002		SD1	8260FA	TOLUENE	=	312	UG/L	5	UG/L	
T0600100208			5/5/2005	W	5E05002		MS1	8260FA	TOLUENE	=	317	UG/L	5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BD1	8260FA	TOLUENE	=	9.67	UG/L	0.5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BS2	8260FA	TOLUENE	=	32	UG/L	0.5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BS1	8260FA	TOLUENE	=	8.71	UG/L	0.5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		LB1	8260FA	TOLUENE	ND	0	UG/L	0.5	UG/L	
T0600100208			5/4/2005	W	5E04001		SD1	8260FA	TOLUENE	=	1870	UG/L	25	UG/L	
T0600100208			5/4/2005	W	5E04001		MS1	8260FA	TOLUENE	=	1880	UG/L	25	UG/L	
T0600100208			5/4/2005	WQ	5E04001		BD1	8260FA	TOLUENE	=	10.1	UG/L	0.5	UG/L	
T0600100208			5/4/2005	W	5E04001		NC	8260FA	TOLUENE	=	220	UG/L	25	UG/L	
T0600100208			5/6/2005	W	5E06007		NC	8260FA	TOLUENE	=	90	UG/L	5	UG/L	
T0600100208			5/6/2005	W	5E06007		SD1	8260FA	TOLUENE	=	415	UG/L	5	UG/L	
T0600100208			5/6/2005	W	5E06007		MS1	8260FA	TOLUENE	=	419	UG/L	5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BD1	8260FA	TOLUENE	=	9.8	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BS2	8260FA	TOLUENE	=	32.8	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BS1	8260FA	TOLUENE	=	10.1	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		LB1	8260FA	TOLUENE	ND	0	UG/L	0.5	UG/L	

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T0600100208			5/4/2005	WQ	5E04001		BS1	8260FA	TOLUENE	=	9.55	UG/L	0.5	UG/L	
T0600100208			5/4/2005	WQ	5E04001		LB1	8260FA	TOLUENE	ND	0	UG/L	0.5	UG/L	
T0600100208			5/4/2005	WQ	5E04001		LB1	8260FA	1,2-DICHLOROETHANE	ND	0	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BD1	8260FA	1,2-DICHLOROETHANE	=	11	UG/L	0.5	UG/L	
T0600100208			5/4/2005	WQ	5E04001		BS1	8260FA	1,2-DICHLOROETHANE	=	10.6	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BS1	8260FA	1,2-DICHLOROETHANE	=	11.4	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		LB1	8260FA	1,2-DICHLOROETHANE	ND	0	UG/L	0.5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BD1	8260FA	1,2-DICHLOROETHANE	=	11.4	UG/L	0.5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BS1	8260FA	1,2-DICHLOROETHANE	=	10	UG/L	0.5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		LB1	8260FA	1,2-DICHLOROETHANE	ND	0	UG/L	0.5	UG/L	
T0600100208			5/4/2005	WQ	5E04001		BD1	8260FA	1,2-DICHLOROETHANE	=	11.2	UG/L	0.5	UG/L	
T0600100208			5/4/2005	WQ	5E04001		BS2	8260FA	1,2-DICHLOROETHANE-D4	SU	105	%	0	%	
T0600100208			5/6/2005	W	5E06007		MS1	8260FA	1,2-DICHLOROETHANE-D4	SU	89	%	0	%	
T0600100208			5/6/2005	WQ	5E06007		BD1	8260FA	1,2-DICHLOROETHANE-D4	SU	101	%	0	%	
T0600100208			5/6/2005	WQ	5E06007		BS2	8260FA	1,2-DICHLOROETHANE-D4	SU	98	%	0	%	
T0600100208			5/6/2005	WQ	5E06007		BS1	8260FA	1,2-DICHLOROETHANE-D4	SU	102	%	0	%	
T0600100208			5/6/2005	WQ	5E06007		LB1	8260FA	1,2-DICHLOROETHANE-D4	SU	93	%	0	%	
T0600100208			5/5/2005	W	5E05002		SD1	8260FA	1,2-DICHLOROETHANE-D4	SU	105	%	0	%	
T0600100208			5/5/2005	W	5E05002		MS1	8260FA	1,2-DICHLOROETHANE-D4	SU	105	%	0	%	
T0600100208			5/5/2005	WQ	5E05002		BS2	8260FA	1,2-DICHLOROETHANE-D4	SU	105	%	0	%	
T0600100208			5/5/2005	WQ	5E05002		BS1	8260FA	1,2-DICHLOROETHANE-D4	SU	97	%	0	%	
T0600100208			5/5/2005	WQ	5E05002		LB1	8260FA	1,2-DICHLOROETHANE-D4	SU	102	%	0	%	
T0600100208			5/4/2005	W	5E04001		SD1	8260FA	1,2-DICHLOROETHANE-D4	SU	85	%	0	%	
T0600100208			5/4/2005	W	5E04001		MS1	8260FA	1,2-DICHLOROETHANE-D4	SU	104	%	0	%	
T0600100208			5/4/2005	W	5E04001		NC	8260FA	1,2-DICHLOROETHANE-D4	SU	100	%	0	%	
T0600100208			5/4/2005	WQ	5E04001		LB1	8260FA	1,2-DICHLOROETHANE-D4	SU	103	%	0	%	
T0600100208			5/4/2005	WQ	5E04001		BS1	8260FA	1,2-DICHLOROETHANE-D4	SU	104	%	0	%	
T0600100208			5/6/2005	W	5E06007		NC	8260FA	1,2-DICHLOROETHANE-D4	SU	100	%	0	%	
T0600100208			5/6/2005	W	5E06007		SD1	8260FA	1,2-DICHLOROETHANE-D4	SU	106	%	0	%	
T0600100208			5/5/2005	WQ	5E05002		BD1	8260FA	1,2-DICHLOROETHANE-D4	SU	103	%	0	%	
T0600100208			5/4/2005	WQ	5E04001		BD1	8260FA	1,2-DICHLOROETHANE-D4	SU	104	%	0	%	
T0600100208			5/4/2005	WQ	5E04001		LB1	8260FA	DI-ISOPROPYL ETHER (DIPE)	ND	0	UG/L	0.5	UG/L	
T0600100208			5/4/2005	WQ	5E04001		BS1	8260FA	DI-ISOPROPYL ETHER (DIPE)	=	10.8	UG/L	0.5	UG/L	

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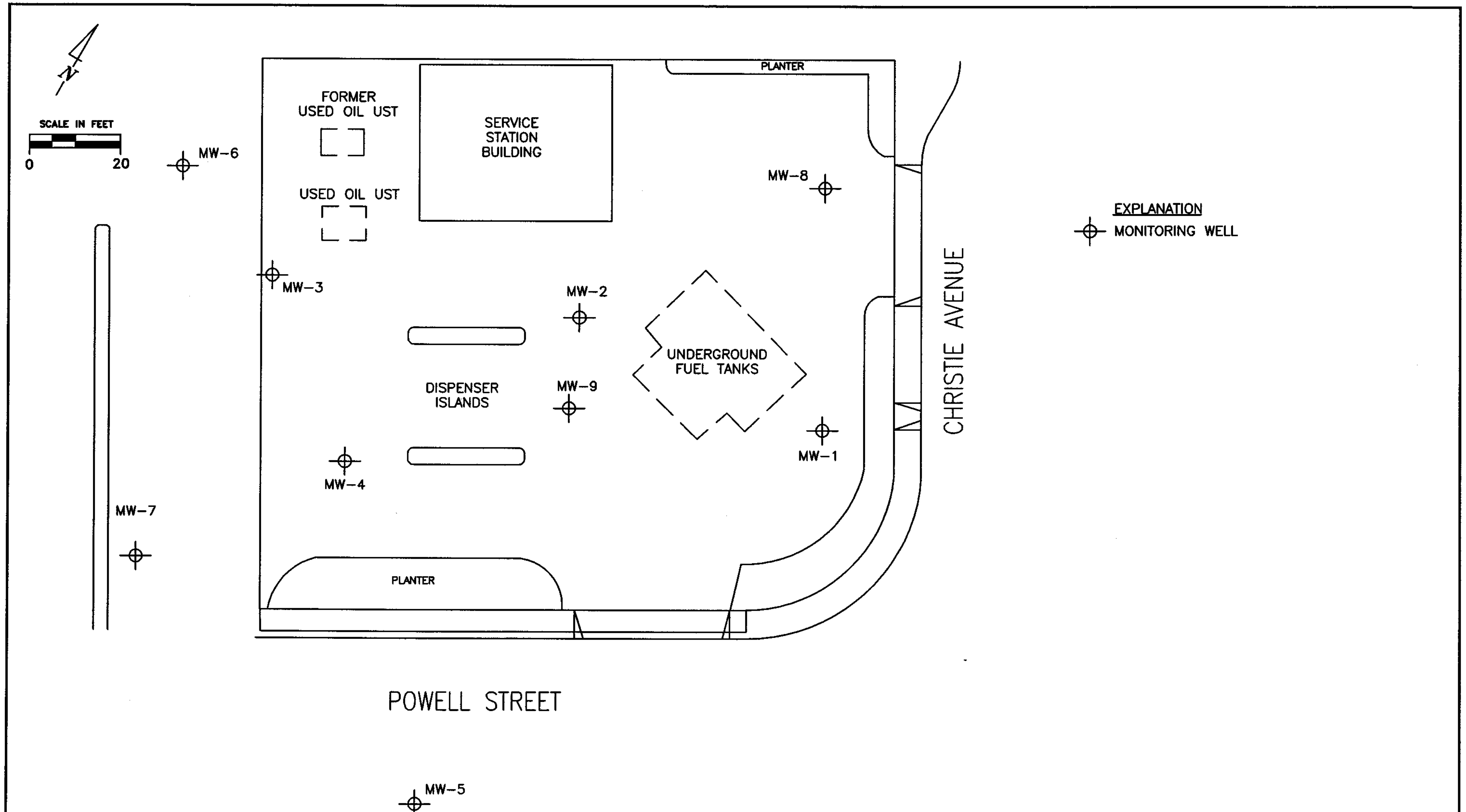
T0600100208			5/5/2005	WQ	5E05002		LB1	8260FA	DI-ISOPROPYL ETHER (DIPE)	ND	0	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BS1	8260FA	DI-ISOPROPYL ETHER (DIPE)	=	11.5	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BD1	8260FA	DI-ISOPROPYL ETHER (DIPE)	=	11.2	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		LB1	8260FA	DI-ISOPROPYL ETHER (DIPE)	ND	0	UG/L	0.5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BD1	8260FA	DI-ISOPROPYL ETHER (DIPE)	=	11.4	UG/L	0.5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BS1	8260FA	DI-ISOPROPYL ETHER (DIPE)	=	10	UG/L	0.5	UG/L	
T0600100208			5/4/2005	WQ	5E04001		BD1	8260FA	DI-ISOPROPYL ETHER (DIPE)	=	11.4	UG/L	0.5	UG/L	
T0600100208			4/28/2005	WQ	5D27018		LB1	SW8015B	DIESEL RANGE ORGANICS (C10-C36)	ND	0	UG/L	50	UG/L	SG
T0600100208			4/28/2005	WQ	5D27018		BD1	SW8015B	DIESEL RANGE ORGANICS (C10-C36)	=	324	UG/L	50	UG/L	SG
T0600100208			4/28/2005	WQ	5D27018		BS1	SW8015B	DIESEL RANGE ORGANICS (C10-C36)	=	276	UG/L	50	UG/L	SG
T0600100208			5/4/2005	WQ	5E04001		BS2	8260FA	ETHYLBENZENE	=	7.51	UG/L	0.5	UG/L	
T0600100208			5/4/2005	WQ	5E04001		LB1	8260FA	ETHYLBENZENE	ND	0	UG/L	0.5	UG/L	
T0600100208			5/4/2005	WQ	5E04001		BS1	8260FA	ETHYLBENZENE	=	9.68	UG/L	0.5	UG/L	
T0600100208			5/4/2005	WQ	5E04001		BD1	8260FA	ETHYLBENZENE	=	10.2	UG/L	0.5	UG/L	
T0600100208			5/4/2005	W	5E04001		MS1	8260FA	ETHYLBENZENE	=	2060	UG/L	25	UG/L	
T0600100208			5/4/2005	W	5E04001		SD1	8260FA	ETHYLBENZENE	=	2020	UG/L	25	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BS1	8260FA	ETHYLBENZENE	=	9.22	UG/L	0.5	UG/L	
T0600100208			5/6/2005	W	5E06007		NC	8260FA	ETHYLBENZENE	=	9.5	UG/L	5	UG/L	
T0600100208			5/6/2005	W	5E06007		SD1	8260FA	ETHYLBENZENE	=	83.5	UG/L	5	UG/L	
T0600100208			5/6/2005	W	5E06007		MS1	8260FA	ETHYLBENZENE	=	85.2	UG/L	5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BD1	8260FA	ETHYLBENZENE	=	9.98	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BS2	8260FA	ETHYLBENZENE	=	8	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BS1	8260FA	ETHYLBENZENE	=	10.2	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		LB1	8260FA	ETHYLBENZENE	ND	0	UG/L	0.5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		LB1	8260FA	ETHYLBENZENE	ND	0	UG/L	0.5	UG/L	
T0600100208			5/5/2005	W	5E05002		SD1	8260FA	ETHYLBENZENE	=	198	UG/L	5	UG/L	
T0600100208			5/5/2005	W	5E05002		MS1	8260FA	ETHYLBENZENE	=	202	UG/L	5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BD1	8260FA	ETHYLBENZENE	=	9.92	UG/L	0.5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BS2	8260FA	ETHYLBENZENE	=	7.72	UG/L	0.5	UG/L	
T0600100208			5/4/2005	W	5E04001		NC	8260FA	ETHYLBENZENE	=	1700	UG/L	25	UG/L	
T0600100208			5/4/2005	WQ	5E04001		LB1	8260FA	1,2-DIBROMOETHANE	ND	0	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BD1	8260FA	1,2-DIBROMOETHANE	=	9.36	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BS1	8260FA	1,2-DIBROMOETHANE	=	10.2	UG/L	0.5	UG/L	

GLOBAL_ID	LOCID	LOGDATE	ANADATE	MATRIX	LABLOTCTL	SAMPID	QCCODE	ANMCODE	PARLABEL	PARVQ	PARVAL	UNITS	REPDL	UNITS	RLNOTE
T0600100208			5/4/2005	WQ	5E04001		BS1	8260FA	1,2-DIBROMOETHANE	=	9.6	UG/L	0.5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BD1	8260FA	1,2-DIBROMOETHANE	=	9.26	UG/L	0.5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		LB1	8260FA	1,2-DIBROMOETHANE	ND	0	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		LB1	8260FA	1,2-DIBROMOETHANE	ND	0	UG/L	0.5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BS1	8260FA	1,2-DIBROMOETHANE	=	8.74	UG/L	0.5	UG/L	
T0600100208			5/4/2005	WQ	5E04001		BD1	8260FA	1,2-DIBROMOETHANE	=	9.89	UG/L	0.5	UG/L	
T0600100208			5/4/2005	WQ	5E04001		LB1	8260FA	ETHYL TERT-BUTYL ETHER (ETBE)	ND	0	UG/L	0.5	UG/L	
T0600100208			5/4/2005	WQ	5E04001		BS1	8260FA	ETHYL TERT-BUTYL ETHER (ETBE)	=	10.8	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BD1	8260FA	ETHYL TERT-BUTYL ETHER (ETBE)	=	11.2	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BS1	8260FA	ETHYL TERT-BUTYL ETHER (ETBE)	=	11.4	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		LB1	8260FA	ETHYL TERT-BUTYL ETHER (ETBE)	ND	0	UG/L	0.5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BD1	8260FA	ETHYL TERT-BUTYL ETHER (ETBE)	=	11.2	UG/L	0.5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BS1	8260FA	ETHYL TERT-BUTYL ETHER (ETBE)	=	9.96	UG/L	0.5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		LB1	8260FA	ETHYL TERT-BUTYL ETHER (ETBE)	ND	0	UG/L	0.5	UG/L	
T0600100208			5/4/2005	WQ	5E04001		BD1	8260FA	ETHYL TERT-BUTYL ETHER (ETBE)	=	11.3	UG/L	0.5	UG/L	
T0600100208			5/4/2005	WQ	5E04001		BS1	8260FA	ETHANOL (ETOH)	=	209	UG/L	100	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BD1	8260FA	ETHANOL (ETOH)	=	181	UG/L	100	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BS1	8260FA	ETHANOL (ETOH)	=	195	UG/L	100	UG/L	
T0600100208			5/6/2005	WQ	5E06007		LB1	8260FA	ETHANOL (ETOH)	ND	0	UG/L	100	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BD1	8260FA	ETHANOL (ETOH)	=	170	UG/L	100	UG/L	IC
T0600100208			5/5/2005	WQ	5E05002		BS1	8260FA	ETHANOL (ETOH)	=	185	UG/L	100	UG/L	
T0600100208			5/5/2005	WQ	5E05002		LB1	8260FA	ETHANOL (ETOH)	ND	0	UG/L	100	UG/L	
T0600100208			5/4/2005	WQ	5E04001		BD1	8260FA	ETHANOL (ETOH)	=	188	UG/L	100	UG/L	
T0600100208			5/4/2005	WQ	5E04001		LB1	8260FA	ETHANOL (ETOH)	ND	0	UG/L	100	UG/L	
T0600100208			5/4/2005	WQ	5E04001		BS2	8260FA	GASOLINE RANGE ORGANICS (C4-C12)	=	410	UG/L	50	UG/L	
T0600100208			5/6/2005	W	5E06007		NC	8260FA	GASOLINE RANGE ORGANICS (C4-C12)	ND	440	UG/L	500	UG/L	
T0600100208			5/6/2005	W	5E06007		SD1	8260FA	GASOLINE RANGE ORGANICS (C4-C12)	=	4490	UG/L	500	UG/L	
T0600100208			5/6/2005	W	5E06007		MS1	8260FA	GASOLINE RANGE ORGANICS (C4-C12)	=	4420	UG/L	500	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BS2	8260FA	GASOLINE RANGE ORGANICS (C4-C12)	=	418	UG/L	50	UG/L	
T0600100208			5/6/2005	WQ	5E06007		LB1	8260FA	GASOLINE RANGE ORGANICS (C4-C12)	ND	0	UG/L	50	UG/L	
T0600100208			5/5/2005	WQ	5E05002		LB1	8260FA	GASOLINE RANGE ORGANICS (C4-C12)	ND	0	UG/L	50	UG/L	
T0600100208			5/5/2005	W	5E05002		SD1	8260FA	GASOLINE RANGE ORGANICS (C4-C12)	=	9180	UG/L	500	UG/L	
T0600100208			5/5/2005	W	5E05002		MS1	8260FA	GASOLINE RANGE ORGANICS (C4-C12)	=	9790	UG/L	500	UG/L	

GLOBAL_ID	LOCID	LOGDATE	ANADATE	MATRIX	LABLOTCTL	SAMPID	QCCODE	ANMCODE	PARLABEL	PARVQ	PARVAL	UNITS	REPDL	UNITS	RLNOTE
T0600100208			5/5/2005	WQ	5E05002		BS2	8260FA	GASOLINE RANGE ORGANICS (C4-C12)	=	423	UG/L	50	UG/L	
T0600100208			5/4/2005	W	5E04001		MS1	8260FA	GASOLINE RANGE ORGANICS (C4-C12)	=	32600	UG/L	2500	UG/L	
T0600100208			5/4/2005	W	5E04001		SD1	8260FA	GASOLINE RANGE ORGANICS (C4-C12)	=	30800	UG/L	2500	UG/L	
T0600100208			5/4/2005	WQ	5E04001		LB1	8260FA	GASOLINE RANGE ORGANICS (C4-C12)	ND	0	UG/L	50	UG/L	
T0600100208			5/4/2005	W	5E04001		NC	8260FA	GASOLINE RANGE ORGANICS (C4-C12)	=	9800	UG/L	2500	UG/L	
T0600100208			5/4/2005	WQ	5E04001		BS2	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	=	9.41	UG/L	0.5	UG/L	
T0600100208			5/4/2005	WQ	5E04001		BD1	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	=	11.1	UG/L	0.5	UG/L	
T0600100208			5/4/2005	W	5E04001		NC	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	ND	0	UG/L	25	UG/L	
T0600100208			5/4/2005	WQ	5E04001		LB1	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	ND	0	UG/L	0.5	UG/L	
T0600100208			5/6/2005	W	5E06007		NC	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	ND	0	UG/L	5	UG/L	
T0600100208			5/6/2005	W	5E06007		SD1	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	=	99.1	UG/L	5	UG/L	
T0600100208			5/6/2005	W	5E06007		MS1	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	=	90.8	UG/L	5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BD1	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	=	11	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BS2	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	=	8.63	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BS1	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	=	11.6	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		LB1	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	ND	0	UG/L	0.5	UG/L	
T0600100208			5/5/2005	W	5E05002		SD1	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	=	632	UG/L	5	UG/L	
T0600100208			5/5/2005	W	5E05002		MS1	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	=	628	UG/L	5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BD1	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	=	11.2	UG/L	0.5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BS2	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	=	9.38	UG/L	0.5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BS1	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	=	10.1	UG/L	0.5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		LB1	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	ND	0	UG/L	0.5	UG/L	
T0600100208			5/4/2005	W	5E04001		SD1	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	=	436	UG/L	25	UG/L	
T0600100208			5/4/2005	W	5E04001		MS1	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	=	480	UG/L	25	UG/L	
T0600100208			5/4/2005	WQ	5E04001		BS1	8260FA	METHYL-TERT-BUTYL ETHER (MTBE)	=	10.7	UG/L	0.5	UG/L	
T0600100208			5/3/2005	WQ	5E03017		LB1	E1664A	OIL AND GREASE	ND	0	UG/L	5000	UG/L	
T0600100208			5/3/2005	WQ	5E03017		BS1	E1664A	OIL AND GREASE	=	16800	UG/L	5000	UG/L	
T0600100208			5/3/2005	WQ	5E03017		BD1	E1664A	OIL AND GREASE	=	16500	UG/L	5000	UG/L	
T0600100208			5/4/2005	WQ	5E04001		BD1	8260FA	TERT-AMYL METHYL ETHER (TAME)	=	10.7	UG/L	0.5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BS1	8260FA	TERT-AMYL METHYL ETHER (TAME)	=	9.58	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		LB1	8260FA	TERT-AMYL METHYL ETHER (TAME)	ND	0	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BD1	8260FA	TERT-AMYL METHYL ETHER (TAME)	=	10.2	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BS1	8260FA	TERT-AMYL METHYL ETHER (TAME)	=	11	UG/L	0.5	UG/L	

GLOBAL_ID	LOCID	LOGDATE	ANADATE	MATRIX	LABLOTCTL	SAMPID	QCCODE	ANMCODE	PARLABEL	PARVQ	PARVAL	UNITS	REPDL	UNITS	RLNOTE
T0600100208			5/5/2005	WQ	5E05002		LB1	8260FA	TERT-AMYL METHYL ETHER (TAME)	ND	0	UG/L	0.5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BD1	8260FA	TERT-AMYL METHYL ETHER (TAME)	=	10.4	UG/L	0.5	UG/L	
T0600100208			5/4/2005	WQ	5E04001		LB1	8260FA	TERT-AMYL METHYL ETHER (TAME)	ND	0	UG/L	0.5	UG/L	
T0600100208			5/4/2005	WQ	5E04001		BS1	8260FA	TERT-AMYL METHYL ETHER (TAME)	=	10.2	UG/L	0.5	UG/L	
T0600100208			5/4/2005	WQ	5E04001		BD1	8260FA	TERT-BUTYL ALCOHOL (TBA)	=	51.7	UG/L	20	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BD1	8260FA	TERT-BUTYL ALCOHOL (TBA)	=	52.9	UG/L	5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BS1	8260FA	TERT-BUTYL ALCOHOL (TBA)	=	54	UG/L	5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		LB1	8260FA	TERT-BUTYL ALCOHOL (TBA)	ND	0	UG/L	5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BD1	8260FA	TERT-BUTYL ALCOHOL (TBA)	=	53	UG/L	20	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BS1	8260FA	TERT-BUTYL ALCOHOL (TBA)	=	49.1	UG/L	20	UG/L	
T0600100208			5/5/2005	WQ	5E05002		LB1	8260FA	TERT-BUTYL ALCOHOL (TBA)	ND	0	UG/L	20	UG/L	
T0600100208			5/4/2005	WQ	5E04001		LB1	8260FA	TERT-BUTYL ALCOHOL (TBA)	ND	0	UG/L	20	UG/L	
T0600100208			5/4/2005	WQ	5E04001		BS1	8260FA	TERT-BUTYL ALCOHOL (TBA)	=	51.6	UG/L	20	UG/L	
T0600100208			5/4/2005	WQ	5E04001		BS2	8260FA	XYLENES	=	38.2	UG/L	0.5	UG/L	
T0600100208			5/4/2005	WQ	5E04001		BD1	8260FA	XYLENES	=	31	UG/L	0.5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BD1	8260FA	XYLENES	=	30.1	UG/L	0.5	UG/L	
T0600100208			5/6/2005	W	5E06007		NC	8260FA	XYLENES	=	60	UG/L	5	UG/L	
T0600100208			5/6/2005	W	5E06007		SD1	8260FA	XYLENES	=	440	UG/L	5	UG/L	
T0600100208			5/6/2005	W	5E06007		MS1	8260FA	XYLENES	=	460	UG/L	5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BD1	8260FA	XYLENES	=	30.2	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BS2	8260FA	XYLENES	=	41.4	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		BS1	8260FA	XYLENES	=	30.7	UG/L	0.5	UG/L	
T0600100208			5/6/2005	WQ	5E06007		LB1	8260FA	XYLENES	ND	0	UG/L	0.5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		LB1	8260FA	XYLENES	ND	0	UG/L	0.5	UG/L	
T0600100208			5/5/2005	W	5E05002		SD1	8260FA	XYLENES	=	468	UG/L	5	UG/L	
T0600100208			5/5/2005	W	5E05002		MS1	8260FA	XYLENES	=	477	UG/L	5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BS2	8260FA	XYLENES	=	39.3	UG/L	0.5	UG/L	
T0600100208			5/5/2005	WQ	5E05002		BS1	8260FA	XYLENES	=	27.6	UG/L	0.5	UG/L	
T0600100208			5/4/2005	W	5E04001		SD1	8260FA	XYLENES	=	2870	UG/L	25	UG/L	
T0600100208			5/4/2005	W	5E04001		MS1	8260FA	XYLENES	=	2890	UG/L	25	UG/L	
T0600100208			5/4/2005	W	5E04001		NC	8260FA	XYLENES	=	930	UG/L	25	UG/L	
T0600100208			5/4/2005	WQ	5E04001		BS1	8260FA	XYLENES	=	29.2	UG/L	0.5	UG/L	
T0600100208			5/4/2005	WQ	5E04001		LB1	8260FA	XYLENES	ND	0	UG/L	0.5	UG/L	



PREPARED BY

RRM

engineering contracting firm

BP Oil Service Station No. 11126
1700 Powell Street
Emeryville, California

FIGURE:

PROJECT: DAC04

Ref. 11126qm
Basemap from Alisto Engineering Group

Historical Soil Analytical Data - Shell-branded Service Station - 1800 Powell Street, Emeryville, California - Incident # 98995349

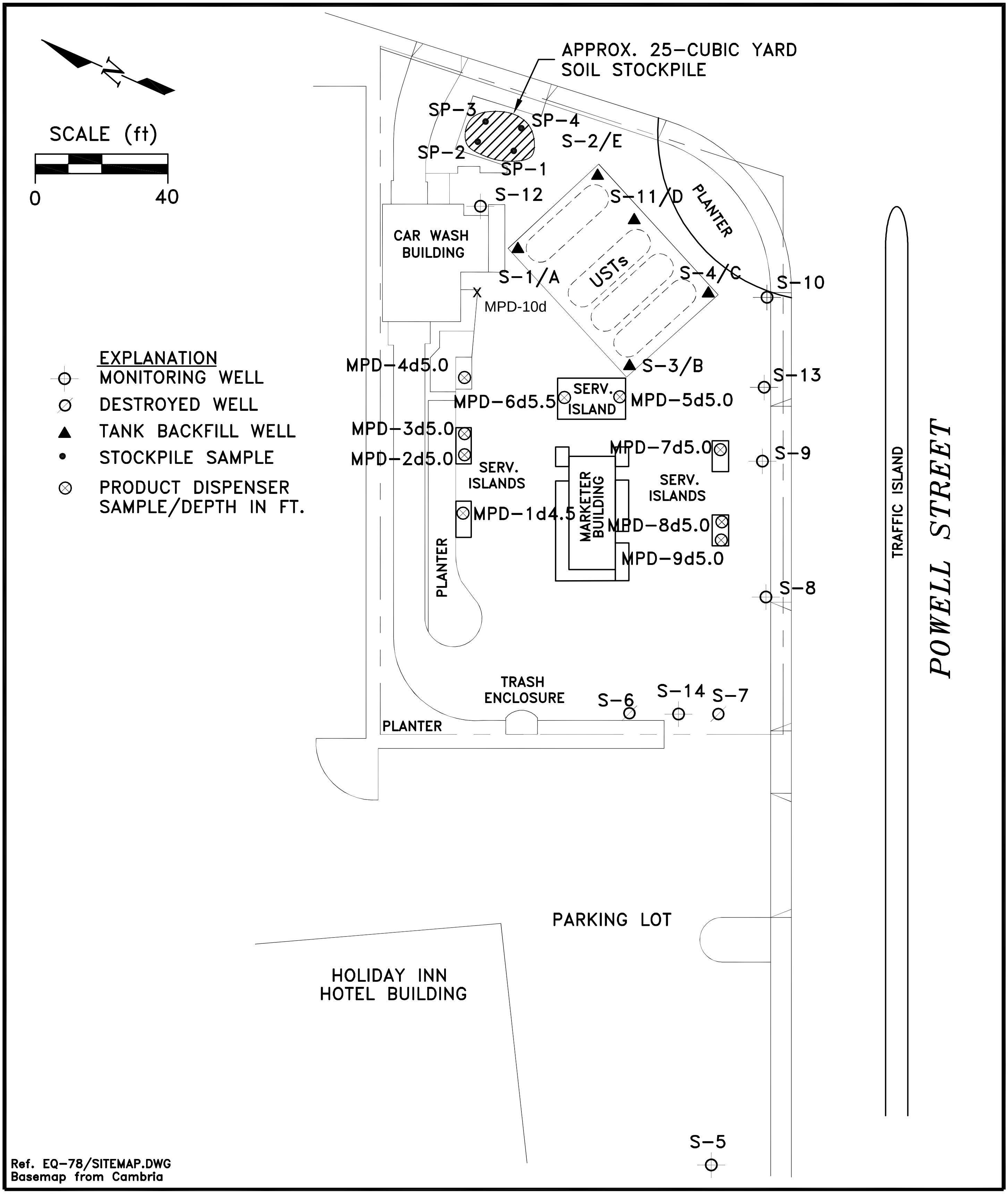
(Concentrations in ppm)

Sample Number	Depth (feet bgs)	Date Sampled	TPHg	TPHd	Benzene	Toluene	Ethyl-benzene	Xylenes	MtBE	TBA	DIPE	ETBE	TAME	1,2-DCA	EDB	Lead	Pesticides and PCBs	VOCs	SVOCs	TRPH
B1-2.0	2.0	05/20/96	<1.0	--	<0.005	<0.005	<0.005	<0.005	--	--	--	--	--	--	--	--	--	--	--	--
B1-7.0	7.0	05/20/96	<1.0	--	<0.005	<0.005	<0.005	<0.005	--	--	--	--	--	--	--	--	ND	ND	ND	--
B1-13.0	13.0	05/20/96	<1.0	**160a**	<0.005	<0.005	<0.005	<0.005	--	--	--	--	--	--	--	--	--	--	--	**67**
B1-15.0	15.0	05/20/96	**43**	**350a**	<0.005	<0.025	**0.072**	**0.19**	--	--	--	--	--	--	--	--	--	--	--	**1,100**
B2-2.0	2.0	05/20/96	<1.0	--	<0.005	<0.005	<0.005	<0.005	--	--	--	--	--	--	--	--	--	--	--	--
B2-7.5	7.5	05/20/96	<1.0	--	<0.005	<0.005	<0.005	<0.005	--	--	--	--	--	--	--	--	--	--	--	--
B2-11.0	11.0	05/20/96	<1.0	**870a**	<0.005	<0.005	<0.005	<0.005	--	--	--	--	--	--	--	--	--	--	--	**1,500**
B3-6.5	6.5	05/20/96	<1.0	--	<0.005	<0.005	<0.005	<0.005	--	--	--	--	--	--	--	--	--	--	--	--
B3-10.5	10.5	05/20/96	<1.0	**31a**	<0.005	<0.005	<0.005	<0.005	--	--	--	--	--	--	--	--	--	--	--	**82**
B4-6.5	6.5	05/20/96	<1.0	--	<0.005	<0.005	<0.005	<0.005	--	--	--	--	--	--	--	--	--	--	--	--
B5-3.0	3.0	05/20/96	<1.0	--	<0.005	<0.005	<0.005	**0.0054**	--	--	--	--	--	--	--	--	--	--	--	--
B6-3.5	3.5	05/20/96	<1.0	--	<0.005	<0.005	<0.005	<0.005	--	--	--	--	--	--	--	--	--	--	--	--
B6-6.5	6.5	05/20/96	<1.0	--	<0.005	<0.005	<0.005	<0.005	--	--	--	--	--	--	--	--	--	--	--	--
B6-11.0	11.0	05/20/96	<1.0	**40a**	<0.005	<0.005	<0.005	<0.005	--	--	--	--	--	--	--	--	--	--	--	**380**
D-7	2.0	03/19/98	**32**	**220**	**0.25**	**0.061**	**0.53**	**3.5**	**0.13**	--	--	--	--	--	--	--	--	--	--	--
D-9	3.5	03/19/98	**260**	**250**	**0.26**	**1.0**	**2.6**	**14**	<0.62	--	--	--	--	--	--	--	--	--	--	--
MPD-1	4.5	09/22/04	**85**	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<2.5	<1.0	<0.50	<0.50	<0.50	<0.50	**150**	--	--	--	--
MPD-2	5.0	09/22/04	**33**	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<2.5	<1.0	<0.50	<0.50	<0.50	<0.50	**48**	--	--	--	--
MPD-3	5.0	09/22/04	**42**	<50	<0.50	<0.50	<0.50	<0.50	**0.64**	<2.5	<1.0	<0.50	<0.50	<0.50	<0.50	**39**	--	--	--	--
MPD-4	5.0	09/22/04	**1.5**	<1.0	<0.005	<0.005	<0.005	<0.005	<0.005	<0.010	<0.010	<0.005	<0.005	<0.005	<0.005	**16**	--	--	--	--
MPD-5	5.0	09/22/04	**12**	<1.0	**0.031**	<0.005	<0.005	<0.005	**0.0064**	**0.011**	<0.010	<0.005	<0.005	<0.005	<0.005	**15**	--	--	--	--

Historical Soil Analytical Data - Shell-branded Service Station - 1800 Powell Street, Emeryville, California - Incident # 98995349

Sample Number	Depth (feet bgs)	Date Sampled	TPHg	TPHd	Benzene	Toluene	Ethyl-benzene	Xylenes	MtBE	TBA	DIPE	ETBE	TAME	1,2-DCA	EDB	Lead	Pesticides and PCBs	VOCs	SVOCs	TRPH
			(Concentrations in ppm)																	
MPD-6	5.5	09/22/04	**3.6**	<1.0	<0.005	<0.005	<0.005	**0.013**	**0.027**	**0.032**	<0.010	<0.005	<0.005	<0.005	<0.005	**5.7**	--	--	--	--
MPD-7	5.0	09/22/04	**54**	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<2.5	<1.0	<0.50	<0.50	<0.50	<0.50	**5.4**	--	--	--	--
MPD-8	5.0	09/22/04	**3,500**	**54**	<0.50	<0.50	<0.50	<0.50	<0.50	<2.5	<1.0	<0.50	<0.50	<0.50	<0.50	**8.3**	--	--	--	--
MPD-9	5.0	09/22/04	**320**	**1,300**	<0.50	<0.50	**7.1**	**17**	<0.50	<2.5	<1.0	<0.50	<0.50	<0.50	<0.50	**9.5**	--	--	--	--
MPD-10	4.3	10/12/04	**970**	**7,900**	<5.0	**32**	**21**	**630**	<5.0	<25	<10	<5.0	<5.0	<5.0	<5.0	**4.2**	--	--	--	--
	4.6	10/12/04	**110**	**5,600**	<5.0	**53**	**26**	**530**	<5.0	<25	<10	<5.0	<5.0	<5.0	<5.0	**20**	--	--	--	--

TPHg = Total petroleum hydrocarbons as gasoline
TPHd = Total petroleum hydrocarbons as diesel
MTBE = Methyl tert-butyl ether
TBA = tert-Butly alcohol
DIPE = Di-isopropyl ether
ETBE = Ethyl tertiary-butyl ether
TAME Tertiary amyl methyl ether
1,2-DCA = 1,2-Dichloroethane, or ethylene dichloride (EDC)
TAME = Tert-Amyl methyl ether



PREPARED BY

TOXICHEM Management Systems, Inc.
Environmental & Occupational Health Services

Shell-Branded Service Station
1800 Powell Street
Emeryville, California

DISPENSER SOIL SAMPLE LOCATION MAP

FIGURE: 1

PROJECT: EQ-78

February 2, 2005 ***REPORTS***
Project EQ-78.1A

Mr. Robert Weston
Alameda County Health Agency
Department of Environmental Health
1131 Harbor Bay Parkway
Alameda, California 94502

Re: **Product Dispenser Sampling Report**
Shell-Branded Service Station
1800 Powell Street, Emeryville, California
Incident #98995349, SAP Number 135266

Dear Mr. Weston:

On behalf of Equilon Enterprises LLC dba Shell Oil Products US (Shell), this report prepared by Toxichem Management Systems, Inc. (TOXICHEM) transmits the results of sampling conducted during station upgrade activities at the site referenced above. Included in this report is a brief discussion of the site description, scope of work, findings, and conclusions.

SITE DESCRIPTION

The Shell-Branded service station is located on Powell Street immediately adjacent and to the west of Interstate I-80 in Emeryville at the base of the Emeryville Peninsula (Emeryville Marina). Across Powell Street to the south, the East Shore State Park is located within the Emeryville Crescent (a horseshoe shaped tidal marsh with mudflat areas bounding San Francisco Bay). The Bay is located approximately 390 feet south of the site and the nearest creek (Temescal Creek) is located approximately ¼ mile south of the site within the Emeryville Crescent.

The local land use is predominantly a mixture of retail and commercial land uses. Multi-story (hotel and office) buildings bound the site to the west and north, respectively. Interstate 80 and off-ramp are present to the east of the site, and the Eastshore State Park and San Francisco Bay are to the south of the site.

A well survey was performed by Cambria (2004) through the Department of Water Resources. No active water supply wells were found within ½ mile radius of the site. Additionally, groundwater is not used in the study area and is designated as part of the Zone B: Emeryville Brownfields Groundwater Management Zone.

A total of seven groundwater monitoring wells are monitored on an annual basis. During the most recent groundwater monitoring event (November 10, 2004), static groundwater occurred within the on-site wells between 9.35 and 10.45 feet below ground surface (bgs) with flow to the south-southwest. The maximum concentration of total purgeable petroleum hydrocarbons

(TPPH) and benzene was present in Well S-10 at 660 micrograms per liter (µg/L) and 64 µg/L, respectively. The maximum concentration of methyl tertiary butyl ether (MtBE) was present in Well S-12 at 140 µg/L located upgradient of the UST complex.

Thick, separate-phase liquid/tar has been present in Well S-9 at thicknesses up to 2.8 feet (with an outlier thickness measurement of 9 feet), therefore the well is not gauged, nor sampled during the monitoring event. The liquid has been analyzed by Shell Global Solutions and Triton Analytics Corporation. They concluded that:

- About 18% is gasoline range hydrocarbons.
- There was little material from the chromatographic region of about carbon number C_{13} to C_{18} or boiling points from about 455 to 600°F.
- Approximately 45% of the sample's weight lies in the vacuum gas oil range, or the carbon region above diesel (above 650°F) to the region of vacuum tower bottoms (pitch, asphalt).
- Approximately 35% of the material represents the heaviest fraction (1000°F+ to a max of C_{110} or boiling point 1351°F).
- There are many types of roofing materials that would have a significant amount of hydrocarbons in the Vacuum Gas Oil (VGO) range as well the Vacuum Residue range (Pitch) (1000°F). Some roofing materials that are applied as a semi-liquid from a 5 gal bucket contain solvent that evaporates after application but then remained quite flexible due to the mixture of vacuum gas oils in addition to the pitch and other fillers. The roofing materials (hot melt) contain less of the VGOs and are therefore more rigid and not sticky after application.

In summary, the material present in Well S-9 can be attributable to the previous facility at the site: Beginning in 1884, the Paraffine Company operated an industrial complex on the Emeryville waterfront and filled areas along the shoreline through 1969. Based on boring log data, the fill at the Shell service station is at least 10 feet deep and appears continuous across the site. The fill consists of imported clayey, silty and sandy soil, industrial material and construction debris (concrete, bricks, tar paper and wood fragments). Products manufactured by Paraffine included: linoleum, roofing and building materials, paints, varnishes, lacquers and enamels.

SCOPE OF WORK

The scope of this investigation included the following activities:

- Collect soil samples from beneath the product dispensers and one location beneath product piping at the direction of the Alameda County Health Agency, Department of Environmental Health (ACDEH).
- Collect samples of residual materials generated during excavation activities and profile for disposal.

FINDINGS

Product Dispenser Sampling

Prior to TOXICHEM's arrival on September 22, 2004, Gettler Ryan, Inc. had removed the nine product dispensers to facilitate environmental sampling (Figure 1). At the direction of the ACDEH, TOXICHEM collected soil samples beneath each of the nine former product dispensers at between 4.5 and 5.5 feet bgs. Sample locations are shown on Figure 1. Soil analytical data is presented in Table 1. Field procedures are presented as Attachment A.

Product Line Replacement Sampling

Due to a product line failing a line test prior to station re-opening, the section of piping was replaced and soil samples were collected on October 12, 2004. Two soil samples were collected by TOXICHEM at the direction of the ACDEH at depths of 4.3 and 4.6 feet bgs (at sample location MPD-10, Figure 1). Deeper sampling and overexcavation were not feasible due to the newly installed product piping. An Unauthorized Release Report (URR) was submitted by Shell to the ACDEH via email on October 15, 2004 (a copy is included as Attachment A).

Soil Analytical Data

Soil analytical data are summarized below and are presented on Table 1. At the request of the ACDEH, all soil samples (including soil stockpile samples) were analyzed for total extractable petroleum hydrocarbons (TEPH) by EPA Method 8015M; TPPH, benzene, toluene, ethylbenzene and xylene (BTEX) compounds, MtBE, di-isopropyl ether (DIPE), ethyl tert-butyl ether (ETBE), tert-amyl methyl ether (TAME), tert-Butyl alcohol (TBA), 1,2-DCA and EDB by EPA Method 8260B; and for total lead by EPA Method 6010B. The certified analytical reports and chain-of-custody documentation for the soil samples are presented as Attachment B.

- During the dispenser sampling performed on September 22, 2004 all nine soil samples contained detectable concentrations reported as TEPH. However, the laboratory noted that the low concentrations (1.5 to 85 mg/kg) reported in Samples MPD-1 through MPD-7 did not match their diesel standard and were mainly constituents in the late diesel range. The seven samples also did not contain detected concentrations of TPPH.
- Samples MPD-8 and MPD-9 were reported to contain 3,500 mg/kg and 320 mg/kg TEPH, respectively but were noted to be in the early diesel range and did not match the laboratory diesel standard. Interestingly, Sample MPD-8 which reported the maximum concentration as TEPH (3,500 mg/kg, though in the early diesel range and not indicative of diesel) did not contain any other detectable constituent analyzed with the exception of minor TPPH (54 mg/kg) and lead at 5.4 mg/kg.
- Similarly, the concentrations reported as TEPH beneath the replaced product lines were not indicative of diesel and were reported as being in the early diesel range (Samples MPD-10 at 4.3 and 4.6 feet bgs). The maximum concentrations of TPPH were associated with Sample MPD-10 at these two sample depths at 7,900 and 5,600 mg/kg, respectively. Additionally, the maximum site concentrations of toluene, ethylbenzene and xylenes were detected in Sample MPD-10 at 53 mg/kg (at 4.6 feet bgs), 26 mg/kg (at 4.6 feet bgs) and 630 mg/kg (at 4.3 feet bgs), respectively.

- Benzene was only reported above the detection limit in one of the eleven samples collected (MPD-5 at 0.031 mg/kg).
- MtBE was detected in three of the eleven samples collected at a maximum concentration of 0.64 mg/kg in Sample MPD-3. TBA was detected in two of the eleven samples collected at a maximum concentration of 0.032 mg/kg in Sample MPD-6. No additional oxygenates or lead scavengers were detected in the dispenser samples collected.
- Lead was detected in every soil sample analyzed at concentrations ranging from 4.2 mg/kg (MPD-10 at 4.3 feet bgs) to 150 mg/kg (MPD-1 at 4.5 feet bgs).

Residual Sampling and Disposal Documentation

During site upgrade activities, soil generated was stockpiled on visqueen, sampled and profiled for disposal. On October 5, 2004, approximately 30.5 tons of soil was hauled by Manley and Sons Trucking to Forward Landfill in Manteca, California. Disposal documentation is included in Attachment C.

To facilitate tank top upgrade activities, minor dewatering was required. A vacuum truck from Onyx Industrial was utilized to extract approximately 3,779 gallons of groundwater from the UST pit on September 15, 2004. The groundwater was hauled under Bill of Lading to the Shell Martinez Refinery for recycling and treatment (Attachment C).

All removed piping, sumps and miscellaneous equipment was contained within a storage bin and transported to ECI under hazardous waste manifest for disposal. Hazardous waste manifests are included in Attachment C.

CONCLUSIONS

Based on the results of this investigation, TOXICHEM concludes that:

- The concentrations reported as TEPH in the soil samples collected is not indicative of diesel fuel.
- The samples collected beneath the replaced piping (MPD-10 at 4.3 and 4.6 feet bgs) reported the maximum concentrations of TPPH (7,900 mg/kg and 5,600 mg/kg, respectively), however benzene was not detected in the samples.
- Benzene was only reported above the detection limit in one of the eleven samples collected (MPD-5 at 0.031 mg/kg).
- MtBE was detected in three of the eleven samples collected at a maximum concentration of 0.64 mg/kg in Sample MPD-3. TBA was detected in two of the eleven samples collected at a maximum concentration of 0.032 mg/kg in Sample MPD-6. No additional oxygenates or lead scavengers were detected in the dispenser samples collected.
- A total of approximately 3,779 gallons of groundwater was removed from the UST area.
- An Unauthorized Release Report (URR) was submitted by Shell to the ACDEH via email on October 15, 2004 (a copy is included as Attachment A).

If you have any questions regarding this report, please contact me at (650) 551-0112.

Sincerely,

Toxichem Management Systems, Inc.

Ross Tinline, RG.
Senior Geologist

Attachments: Table 1 - Soil Analytical Data
Figure 1 - Dispenser Soil Sample Location Map
Attachment A - Field Procedures and Unauthorized Release Report
Attachment B - Certified Analytical Reports and Chain-of-Custody Documentation
Attachment C - Soil, Groundwater and Piping Disposal Documentation

cc: Jim Martin, Shell Oil Products US, 418 Regal Lily Lane, San Ramon, California, 94583 (Without Attachment B)
Karen Petryna, Shell Oil Products US, 20945 S. Wilmington, Carson, California 90810

ATTACHMENT A

FIELD PROCEDURES AND UNAUTHORIZED RELEASE REPORT

ATTACHMENT B

CERTIFIED ANALYTICAL REPORT AND CHAIN-OF-CUSTODY DOCUMENTATION

ATTACHMENT C

SOIL, GROUNDWATER AND EQUIPMENT DISPOSAL DOCUMENTATION

FIELD PROCEDURES

Soil Sampling Procedures

Soil samples were collected by advancing a hand driven stainless-steel sampling sleeve and brass ring into undisturbed soil, or alternatively by driving a brass sleeve into native soil excavated by the backhoe. Soil samples were retained in brass rings, capped with Teflon squares and plastic end caps, labeled, and immediately stored in an iced chest. The soil samples, along with a completed chain of custody were submitted to a certified laboratory.

Stockpile Sampling Procedures

The soil stockpile was sampled by driving brass sleeves into freshly exposed material and composited in the laboratory to represent the material in the stockpile. The brass sleeves were then capped with Teflon squares, affixed with plastic end caps, labeled, placed in an iced cooler and transported to the laboratory.

San Francisco Bay Regional Water Quality Control Board
Groundwater Committee

EAST BAY PLAIN GROUNDWATER BASIN BENEFICIAL USE EVALUATION REPORT

Final Report

March 30, 2010

Contributors

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Acknowledgements

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EXECUTIVE SUMMARY

All regulatory agencies rely on the groundwater beneficial use designations for establishing soil and groundwater cleanup levels at individual contaminated sites. The San Francisco Bay Basin Water Quality Control Plan (Basin Plan), adopted through a public hearing process in 1992, includes alternatives for improving beneficial use designations. Since 1992, The San Francisco Bay Regional Water Quality Control Board's (Regional Board) Groundwater Committee (Committee) has undertaken regional groundwater basin projects to better understand and improve beneficial use designations. This report presents a comprehensive evaluation of the beneficial uses of groundwater in the East Bay Plain Groundwater Basin (East Bay Plain). The purpose of this project is to better define current and future East Bay Plain beneficial uses. This project, when combined with a California Environmental Quality Act (CEQA) analysis, will be the technical basis for a future amendment to the Basin Plan. For agencies, consultants, businesses, and the public, the project provides a broader context in which to evaluate site-specific cleanup issues within the East Bay Plain.

STUDY AREA and PROJECT DESIGN

Located on the eastern shore of San Francisco Bay, the Basin is long (25 miles), narrow (2 to 7 miles) and includes all or portions of the cities of Richmond, San Pablo, El Cerrito, Albany, Berkeley, Emeryville, Piedmont, Alameda, Oakland, San Leandro, San Lorenzo and Hayward. Over 900,000 people live in the East Bay Plain. There are approximately 1300 leaking underground fuel sites and 130 non-fuel sites with identified pollution. While most of this pollution is limited in extent, there are 13 groundwater pollution plumes over 1,000 feet long.

The East Bay Plain project was conducted by the Committee, which was originally established by the Board's Executive Officer in 1990. For this project, its membership was expanded to include staff from the Alameda County Flood Control and Water Conservation District (ACFCWCD), East Bay Municipal Utility District (EBMUD), the Port of Oakland, the U.S. Navy and the cities of Oakland and San Leandro. The Committee initiated the study in 1996 to answer the following six key questions:

1. What are the current and planned future groundwater beneficial uses of the East Bay Plain?
2. Can the East Bay Plain be subdivided into Sub-Areas based on hydrogeology?
3. Where is the use of the East Bay Plain limited?
4. Can the shallow and deeper zones have different designations?
5. Should any current beneficial use designations change?
6. Are there areas requiring special protection programs?

Current, published reports were not detailed enough to answer the key questions. This is due, in part, to the population's reliance on surface water. However, pre-1930's data was available. At that time, groundwater supplied a significant portion of the water demand. In recognition of this, the Committee sought out a comprehensive review of historical groundwater use. The Friends of the San Francisco Estuary, in cooperation with the Regional Board, retained a consultant to complete a report on the historic groundwater use and current hydrogeologic framework of the East

Bay Plain (Figuers, 1998). Building upon this report, Committee members have compiled the best available information on beneficial uses, analyzed the information, developed a conceptual groundwater framework, and recommended revisions for beneficial use designations.

FINDINGS

Based on the key questions posed, the following findings were made:

1. Approximately 3,400 acre-feet of groundwater is extracted annually, based on 1995 estimates. Although safe yield estimates are somewhat crude, this volume is about 40% of the available yield. With a current demand of over 162,000 acre-feet/year, groundwater supplies about 2% of the total water used within the East Bay Plain.

2. There are approximately 4,700 existing wells in the East Bay Plain used for agricultural, industrial and municipal use, based on the records of ACFCWCD and EBMUD. Many of these wells are inactive. Well permit applications for Alameda County indicate that nearly all of the wells are used for "backyard" or commercial irrigation (91%) with less utilization for industrial process water (8.6%) and municipal drinking water supply (0.4%). Current uses of groundwater, by beneficial use designation category are:

   - Municipal and Domestic Water Supply: There are 6 permitted small water system wells that serve, collectively, over 200 individual users, primarily for backyard irrigation. Hayward also has 5 stand-by wells planned in the event of an emergency. Individual domestic drinking water wells are more difficult to account for due to gaps in databases in the permitting agencies. However, it is believed that there are very few wells used for domestic drinking water. Of the 1422 wells permitted since July 17, 1973 by ACFCWCD, 1417 (99.6%) are for non-drinking water purposes, primarily backyard irrigation. While these backyard irrigation wells are primarily intended for landscape and garden irrigation, incidental ingestion can occur. Therefore, backyard wells are considered a Municipal and Domestic Supply Beneficial Use.
   - Industrial/Process Water Supply: There are 10 active permitted industrial wells that service food processing and product manufacturing operations.
   - Agricultural Water Supply: Groundwater is used at two golf courses, three cemeteries and by several high schools, colleges, parks, and nurseries.

3. In addition to these designated categories, there are over 60 groundwater extraction systems at contaminated sites that collectively are pumping about 800 acre-feet per year.

4. Water service in the East Bay Plain is provided by the City of Hayward and EBMUD in the remaining area (San Lorenzo north to Richmond). Future potential beneficial uses include the use of the Basin's aquifers for storage of imported surface water by EBMUD. This storage is intended for use during a drought or an earthquake. Additional potential uses by EBMUD include municipal extraction wells and non-potable irrigation wells. Based on the Committee's review of general plans for the cities and at a workshop attended by most cities, no groundwater wells are planned for future emergency use other than by Hayward and EBMUD.

5. The East Bay Plain can be subdivided into seven Sub-Areas based on previously defined boundaries and geologic factors. Distinct characteristics are the potential for vertical contaminant migration and the potential for water supply development.

6. Groundwater use is limited in the East Bay Plain by several factors, including a) readily available high quality imported surface water, b) existing high salts in shallow bay margin groundwater, c) the potential for saltwater intrusion, and d) contamination in shallow aquifers. In particular, shallow groundwater use is limited in artificial fill and shallow bay-margin deposits in Richmond and Oakland because these units are largely saturated by brackish Bay water. In San Leandro, shallow groundwater use is limited by extensive shallow groundwater pollution by industrial solvents.

7. At this time, it does not appear prudent to change designations for most of the shallow water bearing units. The geologic relationships between deeper, potentially productive aquifers and shallow water bearing units are not defined well enough to change subregional designations. Furthermore, there were over 15,000 historical groundwater wells that were never appropriately decommissioned. These wells are potential pathways of shallow pollution to deeper aquifers. It is estimated that 8% of these wells are deeper than 200 feet. However, localized changes in some designations are feasible.

RECOMMENDATIONS

As a result of the findings of the regional analysis, the Committee has made specific recommendations to direct better decision-making at polluted sites. Also, the need for groundwater protection and monitoring measures to prevent further pollution is recommended. Some of the recommendations call for specific actions by the Regional Board or its staff, while others require the cooperation of other agencies.

Recommendations requiring action by the Regional Board or its staff:

- The Regional Board should amend the Basin Plan to include the East Bay Plain Basin Sub-Areas.

- The East Bay Plain should be subdivided into three management zones to prioritize groundwater remediation and dedesignate beneficial uses (see Figure 19). Subdivisions were developed by utilizing information on water quality, historic, existing and probable-future beneficial uses, and hydrogeology. The subdivisions are:

  Zone A - Significant drinking water resource. - Groundwater in these areas is an existing or probable drinking water resource. The basin is deep, with depths ranging from 500 to over 1000 feet. Well yields are generally sufficient for municipal supply. Cleanup strategies should be focused on actively maintaining or restoring groundwater quality to drinking water standards. Cleanup, spill prevention and education efforts within the source water protection zones of existing municipal wells should be the top priority of local and state programs.

Also areas with a high density of potential conduit wells and/or shallow backyard wells may need to receive higher priority and be subject to more detailed investigations than other areas.

Zone B - Groundwater that is unlikely to be used as a drinking water resource. In this area the basin is shallow, with depths generally less than 300 feet. Well yields are generally not sufficient for municipal supply. There are no current or planned uses of groundwater as a drinking water source. However, groundwater in these areas is used for backyard irrigation, industrial supply and commercial irrigation. Therefore, dedesignating beneficial uses in this area is not recommended. Remedial strategies should reflect the low probability that groundwater in this zone will be used as a public water supply in the foreseeable future. However, other beneficial uses/exposure pathways exist and should be actively protected. These include domestic irrigation, industrial process supply, human health, and ecological receptors. The potential for exposure via incidental ingestion from back yard wells should be evaluated.

Zone C - Shallow, nonpotable groundwater proposed for dedesignation of the Municipal Supply Beneficial Use. The Regional Board should locally dedesignate the municipal beneficial use for brackish, shallow groundwater in Bay-front artificial fill, young bay mud and the San Antonio Formation/Merritt Sand. This groundwater meets the exemption criteria of the State Water Resources Control Board's (SWRCB's) Sources of Drinking Water Policy because the groundwater could not reasonably be expected to serve a public water supply and exceeds the 3000 mg/L total dissolved solids criteria. Cleanup should be protective of ecological receptors and human health. Pursuant to SWRCB Resolution 92-49, pollution sites will continue to be required to demonstrate 1) that reasonably adequate source removal has occurred, 2) the plume has been reasonably defined both laterally and vertically and 3) a long-term monitoring program is established to verify that the plume is stable and will not impact ecological receptors or human health

- Within the East Bay Plain, there are groundwater pollution plumes that may warrant less aggressive remediation on a case-by-case basis. In certain cases, aggressive cleanup may not be warranted when the plume is shallow, concentrations are declining and no beneficial uses are threatened. The requirement for aggressive cleanup can pose a serious obstacle to redevelopment of blighted urban areas in the East Bay. This report outlines “basin specific” situations where less aggressive remediation may be warranted. Ultimately, the remedial options that would be part of a less aggressive strategy depend on site specific conditions. However, likely options would include restricting groundwater remediation to the source area only, allowing monitored natural attenuation, or implementing pump-and-treat solely to limit plume migration.

- Regional Board staff should encourage the use of aquifers in the East Bay Plain for groundwater storage. If groundwater from existing sources or surface water is stored in these aquifers (either from surface water sources in wet years or from treated wastewater), demand on limited surface water resources can be reduced.
- The methods required for conducting a Vertical Conduit Study and Well Search in the East Bay Plain should be formalized by Regional Board staff.
- Regional Board staff should encourage the establishment of a basin-wide groundwater management program.
- The GIS coverages displayed in this report should be updated regularly and placed on the Internet.

Recommendations requiring follow-up in cooperation with other agencies:

- The five agencies that maintain well databases within the East Bay Plain should make the data accessible to the public at a single agency.
- The existing ACFCWCD regional groundwater monitoring network should be expanded to include more wells, sampled more frequently, and monitored for a larger list of chemicals of concern. A similar network is also needed in the Contra Costa County portion of the East Bay Plain.
- Regulatory agencies should request that both ACFCWCD and EBMUD well databases are searched for current well locations as part of groundwater pollution site investigations.
- Well abandonment programs should be undertaken by appropriate Alameda and Contra Costa agencies in areas where groundwater resources are at risk.
- Together with ACFCWCD and EBMUD, the Regional Board staff should encourage the establishment of a basin-wide groundwater management program.

EAST BAY PLAIN GROUNDWATER BASIN
BENEFICIAL USE EVALUATION REPORT

LIST OF TABLES

LIST OF FIGURES

APPENDICES

AVAILABLE UPON REQUEST

1.0 INTRODUCTION

The in-house Groundwater Committee (Committee) for the San Francisco Bay Regional Water Quality Control Board (Regional Board), and other State and local agencies completed the *San Francisco and Northern San Mateo County Pilot Beneficial Use Designation Project* in April 1996. The 1996 project evaluated alternatives to the current framework of groundwater beneficial use designation. As a result of this project, the Regional Board staff recommended that the preferred alternative, the Hydrogeologic Framework, should be tested in other groundwater basins. The East Bay Plain Groundwater Basin (East Bay Plain) was highlighted as a good test candidate. The goal of this project is to better define groundwater beneficial uses in the East Bay Plain. Located between San Francisco Bay and the East Bay Hills, the East Bay Plain is a highly urbanized groundwater basin (Figure 1).

1.1 About This Report

This report leads the reader through the steps that were followed to complete the beneficial use project. Sections 1-5 provide the background and context of the project. Sections 6-13 cover the physical and chemical characteristics of the East Bay Plain. Historic and current groundwater beneficial uses are analyzed in sections 12-13. Section 14 highlights local redevelopment and regulatory initiatives in Oakland, Berkeley, Emeryville and Richmond. The key findings and recommendations are presented in Sections 15-17. The proposed revisions and an accompanying CEQA analysis will be brought before the Regional Board for consideration of a Water Quality Control Plan (Basin Plan) Amendment.

1.2 Background

The urbanized East Bay Plain includes 12 cities, the five largest being Oakland, Berkeley, Hayward, Richmond and San Leandro. The total population within the Plain is over 900,000. From the 1860's to the 1930's, all water supplies to the East Bay Plain area were provided by groundwater, springs, and local reservoirs (Figures 2 and 3). As a result of the development of various Sierra Nevada water supplies in the 1920's and 1930's, all local East Bay Plain municipal water supplies were abandoned. Since then, the East Bay Plain has not been a regional source of water. However, the East Bay Plain is used locally for irrigation, industrial and emergency water supply purposes and as a limited drinking water supply.

There are areas of the East Bay Plain where beneficial use is limited due to brackish water quality, low sustainable yields, or the presence of pollution. This project seeks to balance the need to protect existing and potential future groundwater resources with the need to develop realistic cleanup goals for polluted groundwater in areas of limited beneficial use. To achieve this balance we framed the following key questions:

- What are the current and planned future groundwater beneficial uses of the East Bay Plain?
- Can the East Bay Plain be subdivided into Sub-Areas based on hydrogeology?
- Where is the use of the East Bay Plain limited?
- Can the shallow and deeper zones have different designations?

FIGURE 1. LOCATION MAP

FIGURE 2. HISTORIC WELLS

FIGURE 3. HISTORIC WELL FIELDS

- Should any current beneficial use designations change?
- Are there areas requiring special protection programs?

1.3 Selection of East Bay Plain as Study Area

The Plain offers an excellent opportunity to conduct a groundwater beneficial use evaluation as a follow up to the Regional Board’s San Francisco/ Northern San Mateo County Project (Regional Board, 1996). Information is available on current beneficial uses of groundwater, and largely forgotten historical information has been brought to light. The East Bay Plain includes areas that currently provide drinking water and areas that are unlikely to. U.S. EPA’s Brownfields Programs are being studied for Emeryville, Oakland and Richmond, which could potentially benefit from this project. Simultaneously, the East Bay Municipal Utility District (EBMUD) is studying the feasibility of using the East Bay Plain for conjunctive use. EBMUD’s study of using Aquifer Storage Recovery technology to inject imported surface water into the East Bay Plain raises important questions about its future beneficial uses (see Section 13.5).

Lastly, given the large number of groundwater pollution sites, a better definition of beneficial uses could focus expenditure of public and private resources on groundwater remediation on areas that are either existing or probable future drinking water sources. Correspondingly, in areas where no groundwater use exists and its future use is unlikely, remediation could be driven by human health and environmental risks associated with non-potable users.

1.4 Groundwater Committee

The Committee recommends policy on groundwater issues, conveys and shares new information and events related to groundwater pollution cleanup, and fosters internal consistency on groundwater policy implementation. The Committee normally consists of Regional Board line staff, supervisors, and managers from all five staff divisions.

The Committee's first major project was the groundwater Basin Plan Amendment adopted by the Board in 1992. Significant portions of this amendment have been used by the State and other regional boards in their Basin Plan updates. It highlights the Board's experience with groundwater cleanup since the early 1980’s and includes a recommendation to evaluate the Board's existing approach to managing site cleanups. This includes a review of the beneficial use designations for each of the Region's groundwater basins.

In 1994, the Committee conducted a survey among its members and other interested Board staff to identify the primary unresolved issues in dealing with groundwater pollution cleanup within the Region. The results of the survey identified inconsistencies in applying the State Board's “Sources of Drinking Water” Policy (Sources Policy) to groundwater pollution cleanup and the corresponding need for refinement of beneficial use designations. This was similar to the Basin Plan's recommendation to streamline Board programs by developing “cleanup levels and policies for individual groundwater basins or Sub-Areas based on designated beneficial uses.”

The Committee then embarked on its first pilot beneficial use project, which was San

Francisco and Northern San Mateo County. Between 1994 and 1996, the Committee designed and completed a comprehensive evaluation of hydrogeology, future groundwater uses, and alternatives for revised beneficial use designations. At the April 16, 1996, Regional Board meeting, staff presented the project summary report titled, "The San Francisco and Northern San Mateo County Pilot Beneficial Use Designation Project." The draft staff report provided the following recommendations:

- Three different methods for defining beneficial uses were evaluated. For groundwater basins in the study area, the Hydrogeologic Framework is the preferred alternative.
- Portions of the seven groundwater basins within the study area should retain their existing designations.
- Beneficial uses should be changed for the Downtown San Francisco Basin and portions of other basins composed of Franciscan Bedrock, artificial fill or bay mud.
- Corrective action strategies should match revised beneficial use designations. These strategies include aggressive cleanup to drinking water standards, passive cleanup with drinking water standards achieved as a long-term goal, and cleanup and management to goals defined by risk analysis.

After this pilot project was completed, the Committee decided to test the Hydrogeologic Framework in other basins. In late 1996, a second pilot project was initiated in the East Bay Plain.

2.0 STAKEHOLDER PARTICIPATION

On January 29, 1997, the Committee held a workshop for all potential agency stakeholders in the East Bay Plain Region. Included were municipal and county elected officials, water agencies, flood control districts, planning agencies, health and regulatory agencies, and city managers, as well as the East Bay Regional Park District, the Port of Oakland, U.S. Geological Survey, U.S. EPA, U.S. Navy; dischargers, and state agencies: Department of Water Resources, CALTRANS, Department of Toxic Substances Control, State Water Resources Control Board, and Department of Health Services. Stakeholders were invited to participate in the pilot project to update the beneficial use designation of groundwater in the East Bay Plain. Fifty-six individuals representing thirty-one agencies attended this workshop. The attendees are listed in Appendix C.

Participants were asked to give their input in the initial planning phases of the project and to share any information regarding their current or planned use of groundwater in the project area. The Committee also asked to review any evaluations of groundwater supplies that stakeholders might have. Input was also requested about how best to clean up and manage polluted groundwater.

The Committee felt that it was very important to include all of the agency stakeholders in the preliminary stage of this pilot project. After the initial workshops, agency representatives from EBMUD, Port of Oakland, DTSC, US Navy, the Alameda County Flood Control and Water Conservation District, the City of Oakland, and the City of San Leandro became active participants with Regional Board staff on the Committee.

3.0 METHODS

The methods used for this Pilot Project (Figure 4) were similar to those used in the San Francisco/San Mateo Beneficial Use Study (Regional Board, 1996). First, the best information available was compiled on beneficial uses and existing water quality. This information was compiled and analyzed on an ArcView GIS database. Second, a conceptual groundwater framework was developed that identified major aquifers and aquicludes, recharge areas, discharge areas, storage, potential for vertical migration, groundwater flow direction, etc. Third, findings were made regarding the overall condition of the East Bay Plain and its ability to meet all of the beneficial uses documented in the Basin Plan (RWQCB, 1995).

3.1 Investigation by Norfleet Consultants

One of the key resources that the Committee used for the beneficial use analysis was a comprehensive study on the area prepared by Sandy Figuers, Ph.D. (1998). This study provides a geologic, hydrologic and historical framework of the East Bay Plain.

The report, titled "Groundwater Study and Water Supply History of the East Bay Plain, Alameda and Contra Costa Counties, CA.," built upon the previous work by Dr. Figuers (Rogers and Figuers, 1991). Figuers' work included an in-depth search for and review of documents held in 12 libraries that yielded over 250 contemporary and historical references. In addition, he evaluated the subsurface geology, created the first basin-wide subsurface bedrock map, delineated areas of historical groundwater use, and proposed subdividing the basin into Sub-Areas.

Figuers' work expands on the efforts by previous workers including notably Muir (1993, 1996, 1997), Maslonkowski (1988) and the California Department of Water Resources (1963, 1994) to create the principal reference on East Bay Plain geology, hydrogeology and groundwater history.

3.2 Geographic Information System (GIS) Analysis

The GIS analysis in this report was performed by the staff of EBMUD and the Regional Board using Arc/INFO 7.2.1 and ArcView 3.0a software. Coverages were collected and compiled from a variety of sources and agencies, including the Regional Board, EBMUD, U.S. Geological Survey, U.S. Navy, Association of Bay Area Governments, Division of Toxic Substances Control, Norfleet Consultants and the County of Alameda. Where necessary, coverages were modified in consultation with one-meter resolution digital orthophotographs to enable proper overlay and display. SLIC and LUST data were geocoded by the Regional Board based on 1993 TIGER street data. The minimum coverage scale is 1:100000.

The proximity analysis of the well and toxic site data was performed at distances of 660 feet (approximately 1/8 mile), 1000 feet and 2000 feet. The lowest number was assumed to be the minimum possible distance for which accurate results could be obtained as the wells in the Alameda County Well Database are referenced by Township-Range quartersection coordinate, whose diagonal distance is 660 feet. Since the 660-foot distance is also approximately the same length as the average city block, it is assumed that the distance also provides sufficient flexibility to account

FIGURE 4. METHODS OVERVIEW

for most variation in accuracy.

4.0 CURRENT STATE WATER RESOURCES CONTROL BOARD POLICIES FOR GROUNDWATER

4.1 Resolution 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California"

Adopted in 1968, the Policy requires that where water quality objectives are set by Basin Plans or the Porter Cologne Act, existing water quality must be maintained. The resolution says:

> "1. Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies.
>
> 2. Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the state will be maintained.
>
> 3. In implementing this policy, the Secretary of the Interior will be kept advised and will be provided with such information as he will need to discharge his responsibilities under the Federal Water Pollution Control Act."

This implies cleanup must be made to non-detect or background levels. Background is the lowest concentration limit required for groundwater protection. Chemical specific objectives for bacteria, organic and inorganic constituents, radioactivity, and taste and odor define the upper limit that is protective of beneficial uses. These objectives are based on Federal and State published standards and guidelines. Other site-specific limits are risk-based. The Policy does provide conditions under which a change in water quality is allowable. A change must:

- Be consistent with maximum benefit to the people of the state;
- Not unreasonably affect present and anticipated beneficial uses of water; and
- Not result in water quality less than that prescribed in the water quality policies.

4.2 Resolution 88-63, Sources of Drinking Water Policy (Sources Policy)

The Sources Policy was adopted by the State Board in 1988, following the passage of Proposition 65, which required public notification when specific cancer-causing chemicals were discharged into "sources of drinking water." The Sources Policy was incorporated into the Basin Plan in 1989 (Regional Board Order No. 89-39). The Sources Policy assigns municipal and domestic supply designations to all waters of the state with certain exceptions. The Sources Policy specifies that "any body of water that is not currently designated as MUN (municipal and domestic supply) but, in the opinion of the Regional Board, is presently or potentially suitable for MUN and domestic water, the Regional Board shall include MUN in the beneficial use designation." The Sources Policy allows for exceptions if the Regional Board has previously assigned specific designations or if specific exemption criteria are met. These exemption criteria are as follows:

- The total dissolved solids (TDS) exceed 3,000 mg/l (5,000 uS/cm, electrical conductivity) and it is not reasonably expected by the Regional Board that the groundwater could supply a public water system; *or*,

- There is contamination, either by natural processes or by human activity (unrelated to a specific pollution incident), that cannot reasonably be treated for domestic use using either Best Management Practices or best economically achievable treatment practices; *or*,

- The water source does not provide sufficient water to supply a single well capable of producing an average, sustained yield of 200 gallons per day; *or*,

- The aquifer is regulated as a geothermal energy producing source or has been exempted administratively pursuant to 40 CFR Section 146.4 for the purpose of underground injection of fluids associated with the production of hydrocarbon or geothermal energy, provided that these fluids do not constitute a hazardous waste under 40 CFR Section 261.3.

Basin Plan Table 2-9 (Appendix A), applies the beneficial use designations to groundwaters. In this table, each of the Region's groundwater basins is identified, and their existing and potential beneficial uses are designated. Identification of the groundwater basins is based on the Department of Water Resources (DWR) Bulletin 118-80. In addition to these designations, the Basin Plan further states that all subsurface waters are considered suitable, or potentially suitable, for municipal or domestic supply. Therefore, groundwater that falls outside of the identified basins was included within this designation.

4.3 Resolution 92-49, Policies and Procedures for Investigation and Cleanup and Abatement of Discharges under Water Code, Section 13304.

This Resolution was enacted in June 1992, amended in April 1994 and again in October 1996. Resolution 92-49 establishes policies and procedures for the oversight of investigations and cleanup and abatement activities resulting from discharges of hazardous substances. It requires regional boards to meet the highest levels reasonably attainable where, at a minimum, water quality objectives, established in the Basin Plans, must be met. If it is not reasonable to restore water quality to background levels, case by case cleanup levels may be specified, depending on the water quality provisions of a regional board's Basin Plan, beneficial uses of the waters, and maximum benefit to the people of the state.

4.4 Resolution 96-79, Adoption of Containment Zone Policy

Adopted October 2, 1996, Resolution 96-79 amends Resolution No. 92-49 to include the Containment Zone Policy. In recent years, the State Board and the regional boards have found that, in some circumstances, compliance with water quality objectives for groundwater as part of cleanup actions cannot be reasonably achieved. Since there were no procedures to address the inability of meeting Basin Plan objectives, Resolution 92-49 was further amended to include the Containment Zone Policy. This Policy establishes conditions under which a regional board may establish containment zones. That is, specific portions of groundwater-bearing units where water quality objectives cannot be reasonably achieved. The amendment therefore recognizes that some pollutants will remain within the containment zone for a period of time.

Since there is a potential for the migration of polluted water into uncontaminated waters, the amendment requires the discharger to contain pollutants within the area of the containment zone. The containment zone designation will be revoked if chemicals migrate outside of that area.

The amendment also includes an environmental document, the Functional Equivalent Document (FED). The FED is intended to be "functionally equivalent" to the CEQA process, therefore fulfilling the requirement for preparing Environmental Impact Reports, Negative Declarations, and Initial Studies.

5.0 GROUNDWATER REGULATORY AGENCIES

5.1 Federal

5.1.1 U.S. Environmental Protection Agency (EPA)

EPA has the regulatory lead for the National Priorities List (NPL) Superfund sites. They also provide grant funding for other regulatory programs.

5.1.2 U.S. EPA's Groundwater Classification Guidelines

Under State Water Board Resolution 88-63 (see Section 4.2), all state waters are considered to be potential drinking water unless either the total dissolved solids (TDS) exceeds 3000 mg/l and the Regional Water Board makes a determination that the water is not reasonably expected to supply a public water system, or the yield is less than 200 gal/day. However, EPA's Groundwater Classification Guidelines use a stricter standard of 10,000 mg/l TDS or less and a yield of 150 gal/day to define a potential drinking water source. The National Contingency Plan (NCP) Preamble directs EPA to use the Guidelines when determining the appropriate remediation for contaminated groundwater at CERCLA (Superfund) sites and EPA's OSWER Directive #9283.1-09 directs EPA to defer to the NCP Preamble and the Guidelines when a state does not have an EPA endorsed Comprehensive State Groundwater Protection Program (CSGWPP). EPA's definition is based on the importance of maintaining broad protections of potential drinking water sources in light of the growing demands on drinking water supplies. Since California does not have a CSGWPP, the federal definition of potential drinking water (10,000 ppm TDS or less and a yield of 150 gal/day) has recently been required by USEPA at CERCLA sites. Of the 1430 groundwater contamination sites in the East Bay Plain, CERCLA sites accounted for 3% by number and roughly 10% by area. These CERCLA sites consist primarily of closing Navy bases that are undergoing investigation and remediation as part of base reuse.

5.2 State of California

The major California laws regulating cleanup of pollution sites are contained in the Health and Safety Code and the Water Code. The nature of these chemicals and their effects on human health and the environment has long involved multi-agency oversight for the cleanup of these sites. In addition to the state agencies, several county and city agencies participate in regulatory activities. The state agencies usually have the lead in overseeing the cleanup of these sites.

5.2.1 Regional Water Quality Control Board (Regional Board)

The mission of the Regional Board is to protect the beneficial uses of the Region's surface and groundwater. Beneficial uses are the resources, services, and qualities of aquatic ecosystems that are the ultimate goals of protecting and achieving water quality. The Board works with local public entities and industry to ensure that they comply with the policies and objectives of the Water Quality Control Plan (Basin Plan) which is intended to guide local officials. The Regional Board will consider any proposed alternative actions that are consistent with the Basin Plan. The Regional Board oversees many programs with and without local program participation.

5.2.1.1 The "Spills, Leaks, Investigation and Cleanup" (SLIC) Program

SLIC is the program term used by the State Water Resources Control Board and Regional Boards to define those sites with groundwater polluted by chemicals other than total petroleum hydrocarbon (TPHs) that are used as fuels. These chemicals include, but are not limited to, polyaromatic hydrocarbons (PAHs), volatile organic chemicals (VOCs), PCBs, metals and pesticides. Most of the 32 SLIC sites in the study area are located on the western side in old industrial areas.

Because of the nature of these chemicals and their effects on human health and the environment, a group of agencies has long been involved in overseeing the cleanup of these sites. In addition to state agencies, several county and city agencies have had a significant role in the process. Usually, a state agency has the lead for overseeing the cleanup of SLIC and other toxic sites, but because of local agencies participating actively in determining cleanup levels and time frames, the role of the lead agency becomes less distinct. One reason is that SLIC sites do not have a Local Oversight Program like the leaking underground storage tank sites (LUSTs) program (see below).

5.2.1.2 Non-SLIC Regional Board-lead groundwater cleanup sites

This class of sites includes the Unocal Oil Terminal in Richmond and the PG&E facility in Oakland that use aboveground tanks for storing petroleum hydrocarbons; and the groundwater cleanup under the Chevron refinery in Richmond (the only refinery located on the Plain). Although the Regional Board is the lead agency for these sites, the corresponding County Health Departments are consulted on soil cleanup issues.

Although the Regional Board has the authority to protect groundwater quality, the non-distinguishable relationships between human health, the environment, land-use, and economic considerations have complicated the regulatory roles of all agencies involved in site cleanup. Occasional inconsistencies in cleanup requirements, and the lack of coordination and information sharing between these agencies, have resulted in regulatory oversight that is not as efficient as it could be. Table 1 provides a breakdown of the number and types of cases each agency regulates. This “multi-agency” approach to regulating groundwater pollution presents both advantages and disadvantages. The advantage is that it allows each agency to use the unique skills and legal tools that it possesses and it makes the best use of limited resources to provide oversight of the thousands of sites in the East Bay Plain. The main disadvantage is the lack of a coordinated “watershed” approach to prioritizing sites, compiling data, and sharing information. For example, in San Leandro four agencies need to be contacted to get information on groundwater pollution sites. The East Bay Plain is essentially a large unmanaged basin with pollution sites regulated by any of eight different environmental agencies.

Table 1. Summary of Groundwater Cleanup Regulatory Agencies in the East Bay Plain

Agency	Types of Groundwater Pollution Cases Regulated	Number of active cases in East Bay Plain except where noted otherwise [1]	Comments
U.S. EPA	Superfund Sites, DoD Sites/Emergency Response	52 Fuel Sites 19 VOC Sites	Oversight of cleanup at closing military bases and DC Metals
CA Department of Toxic Substances Control	VOCs, metals, RCRA, state lead for DoD Sites	90	From Calsites Database
CA Regional Water Quality Control Board	VOCs, Metals, coordinates LUFT Program, Landfills, Refineries, consults on DoD Sites	Active LUFT: 1310 [2] Nonfuel/SLIC: 32 Landfills: (1 active and 10 closed)	
Alameda County Environmental Health Services	Local Oversight Program for Fuels, also active in SLIC Sites	1235	
Contra Costa County Department of Environ. Health	Non-Local Oversight Program for Fuels	686 within entire county	RWQCB is lead for all sites.
City of Berkeley, Planning and Development Department, Toxics Management Division	Non-Local Oversight Program for Fuels	194	
San Leandro Fire Department	Non-Local Oversight Program for Fuels	121	
Hayward Fire Department	Non-Local Oversight Program for Fuels	256	

1Total number of sites as of January 1998.
2 LUFT total includes fuel sites regulated by other agencies.

5.2.2 Department of Toxic Substances Control (DTSC) protects public health and the environment from the effects of hazardous substances as required by Chapter 6.8 of the California Health and Safety Code. They are required to ensure that contaminated sites are cleaned up in accordance with state and federal laws and they regulate the generation, storage, treatment, transportation, handling, and disposal of hazardous wastes. DTSC is organized into two separate programs, Site Mitigation and Hazardous Waste Management Program (Figure 5).

5.2.2.1 Site Mitigation Program oversees the investigation and remediation of hazardous substance release sites, including military facilities as well as private party sites. According to the

FIGURE 5. GROUNDWATER POLLUTION SITES REGULATED BY THE REGIONAL BOARD UNDER THE SPILLS, LEAKS, INVESTIGATIONS AND CLEANUP PROGRAM (SLIC) AND BY DTSC UNDER THE SITE MITIGATION UNIT.

"CALSITES LIST" database, DTSC currently oversees the investigation and cleanup of 90 sites in the East Bay Plain. Responsibility includes the oversight of remediation of both soil and groundwater contamination. Larger projects include the DWA Plume (San Leandro), Barbary Coast (Emeryville), Cypress Freeway Reconstruction Projects (Oakland), and the Liquid Gold Site (Richmond).

5.2.2.2 Hazardous Waste Management Program is responsible for permitting corrective action, and enforcement for sites that handle hazardous wastes. This includes generators, transporters, as well as those who accept offsite waste for treatment or disposal.

5.2.3 Landfills

Landfills are regulated by the Regional Board in coordination with the California Integrated Waste Management Board and the Local Oversight Agency (Alameda County and Contra Costa County Health Departments). Of the eleven regulated landfills in the East Bay Plain, only one (West Contra Costa Landfill) is still open and accepting waste. See Section 9.4 and Table 3B for more information on landfills.

5.2.4 Department of Health Services

The Drinking Water Source Assessment and Protection (DWSAP) Program was prepared in response to 1996 amendments to the federal Safe Drinking Water Act (SDWA). These amendments included requirements for states to develop a program to assess sources of drinking water and encourage states to establish drinking water protection programs. The Department of Health Services (DHS) Division of Drinking Water and Environmental Management is the lead agency for development and implementation of the DWSAP Program.

The drinking water source assessment is the first step in developing a complete drinking water source protection program. The assessments enable determinations to be made as to whether a drinking water source may be vulnerable to contamination. Assessments are to be completed between November 1999 and May 2003.

California's DWSAP Program addresses both groundwater and surface water sources, and draws upon EPA guidance, DHS' experience from related programs and advice from advisory committees and the public. The groundwater portion of the DWSAP will serve as the State's wellhead protection program. The surface water components of the DWSAP will be developed using DHS' experience with other activities such as watershed sanitary surveys.

Although DHS is responsible for performing the assessments, some public water systems may wish to perform their own. In such cases, the assessments must be conducted in conformance with DHS procedures.

A copy of the DWSAP can be found on the internet at http://www.dhs.cahwnet.gov.

5.3 Local Agencies (Counties, Cities and Special Districts)

Local oversight differs from county to county and city to city:

(a) Contra Costa County and Cities - sites within the Study Area are overseen by the Regional Board or DTSC, with some assistance from the County Health Services Department.

(b) Alameda County and Cities - involvement varies from city to city.

San Leandro - DTSC, the Alameda County Health Services Department (ACHSD), the Regional Board and the City of San Leandro all assume lead roles for various sites in San Leandro.

Hayward - the Regional Board is usually the lead agency with ACHSD taking the lead on some pesticide-polluted sites. The City of Hayward is the lead agency for most fuel sites in Hayward.

Emeryville and Oakland - the lead is usually a joint effort between the Regional Board and ACHSD, with DTSC taking the lead in several large pollution sites, such as the Cypress Freeway Project.

Berkeley - the City of Berkeley, Planning and Development Department, Toxics Management Division (TMD), oversees the cleanup of pollution sites; the Regional Board provides technical and regulatory support for the agency.

5.3.1 Local Oversight Program (LOP) for Leaking Underground Fuel Tank Sites

The Local Oversight Program (LOP) and the Local Implementing Agencies (LIAs, see below) were formed to oversee the closing of Leaking Underground Fuel Tanks (LUFTs) in the State. As of January 1998, the Regional Board had 1310 sites (see Table 1 and Figure 6). Developed in the late 1980's as a pilot program the LOP was codified in 1990 in Section 25297.1 of Chapter 6.7 of the Health and Safety Code. Under Section 25283 of this Code ("Underground Storage of Hazardous Substances"), counties or local agencies are required to implement the conditions of the chapter as they relate to permitting, inspection, and monitoring of Underground Storage Tanks (USTs). Under the LOP program, the State Water Resources Control Board (SWRCB) contracted with local agencies, including Alameda County, that agreed to oversee the remediation of unauthorized releases of fuels from USTs. The agreement focuses only on fuel USTs, specifically exempting solvent cases, because of Federal and State funding restrictions. The primary source of funding for the program comes from the Federal LUST Grant and the State's UST Cleanup Fund (USTCF). Most costs to a responsible party are reimbursable by the UST Cleanup Fund if the responsible party remains in compliance. USTCF is funded by a 1.2-cent tax per gallon of gasoline sold.

The LOP provides a framework to implement the cleanup of LUFTs and requires that work

FIGURE 6. LEAKING UNDERGROUND FUEL TANKS SITES

performed under the agreement be consistent with cleanup standards specified by the State and Regional Boards. The Local Agency is encouraged to do its own enforcement. Appeals arising from disputes between the LOP agency and the responsible party are heard by petition at the SWRCB, although some technical disputes may be handled informally by Regional Board staff. Unless a case has been assigned to the Regional Board, the LOP agencies oversee day to day cleanup activities and prepare final closure packages for Regional Board review and concurrence.

Alameda County Environmental Health Services is the only LOP within the East Bay Plain and has jurisdiction over all of Alameda County, except for the areas covered by the three non-LOP agencies described below. In January 1998, the County had 1235 sites.

5.3.2 LIA Programs – Cities of San Leandro, Berkeley, Hayward, and Contra Costa County

Some local agencies chose not to participate in the LOP program and elected instead to implement cleanup oversight authority themselves. These agencies are known as Local Implementing Agencies (LIAs). There are four LIAs in the East Bay Plain: the Cities of Berkeley, Hayward and San Leandro, and Contra Costa County. These agencies do not have enforcement authority, rather the agency or County District Attorney refers cases to the Regional Board. The agency submits its recommendation for closure to the Regional Board (the only agency that can officially close a case) along with a summary checklist. Regional Board staff provides technical guidance, general support, and enforcement, as required. Staff maintains case files, reviews closure recommendations and prepares the final closure letter and transmittal packages.

Berkeley (Toxics Division) currently has 194 cases. Funding sources include hourly fee schedules, permit fees, and work plan review fees.

Hayward (Hayward Fire Department) covers the incorporated part of Hayward and has 256 cases. Alameda County handles cases located in unincorporated areas. Funding sources are the annual permit fees for hazardous materials storage and cost recovery.

San Leandro (Hazardous Materials Division) has 121 cases and is the lead agency for all but one. The Regional Board is the lead agency for the other case. The funding source is reimbursement for direct oversight.

Contra Costa County (Department of Health Services) has 686 LUST cases, which are under the lead of the Regional Board. The funding source is UST Permit Fees and cost recovery in special cases.

5.3.3 Alameda County Flood Control and Water Conservation District (ACFCWCD) was formed in 1949 to address the flood control and water supply problems of the rapidly developing southern and eastern portions of the County. Within its boundaries, ACFCWCD has monitored and protected groundwater since 1955. This includes a continuous program of well measurements and water quality sampling. These boundaries are exclusive of the Alameda County Water District, which is a separate agency.

ACFCWCD collects information on water levels and water quality from 50 private wells in the Alameda County portion of the East Bay Plain (30 for water levels, 20 for quality). Water levels are measured semi-annually, quality biannually, and half of the wells are sampled every other year. The Department of Water Resources (DWR) analyzes the samples for inorganic compounds. The monitoring program does not analyze for synthetic organic chemicals such as solvents or fuel compounds.

The present network (Figure 7) was established by DWR in the 1950's and 1960's to study saltwater intrusion. The data is kept on file with ACFCWCD in both hard copy and computerized form.

On July 17,1973, Alameda County enacted a groundwater protection ordinance, No. 73-68, to regulate the construction of water wells. Permits for well construction or destruction are obtained from the county at no cost. The purpose of the ordinance was to protect the quality of the groundwater from contamination either from surface pollutants or from groundwater sources of lesser quality. The ordinance is administered and enforced by ACFCWCD in the unincorporated areas of the County and in the Cities of Alameda, Albany, Hayward, Oakland, Piedmont, Emeryville, and San Leandro. ACFCWCD has information on over 10,000 wells. These "driller logs" are filed by State well numbers, which are stored on a computer data base (dBASE) linked to a mapping software (MapInfo).

6.0 GEOLOGIC SETTING

The study area has a Mediterranean climate. Most rainfall occurs between November and March. The average annual rainfall across the entire area is 23 inches. The upland watershed area for the East Bay Plain is over 100 square miles along the western slope of the Coast Ranges. The major drainages in the watershed are San Pablo Creek, Wildcat Creek, San Leandro Creek, and San Lorenzo Creek (see Figure 8). In addition, there are thirteen minor creeks within the watershed. This study does not include groundwater in the upland watersheds.

This section describes the geologic setting including structural features and stratigraphic units within the East Bay Plain.

6.1 Previous Investigations

Several reports and investigations exist detailing the stratigraphy and structure of the East Bay Plain. They are the product of extensive field investigations, including geotechnical borings, well borings, and field mapping. Recently other authors have compiled, summarized, and synthesized previous investigations. Muir (1993, 1997) and Figuers (1998) were the primary reports used in the compilation of this section.

6.2 Structural Geology

The East Bay Plain overlies a flank of a broad Franciscan bedrock depression, the core of which is roughly centered under San Francisco Bay (Figuers, 1998). The Hayward Fault and the

FIGURE 7. MONITORING WELL NETWORK

FIGURE 8. SURFACE WATER FEATURES

San Andreas Fault form the eastern and western boundaries of the depression. The Hayward Fault is the dominant structural feature in the Plain, trending parallel to the long axis of the East Bay Plain in a northwest direction.

Within the East Bay Plain, Figuers (1998) finds that there are two, separate basins based on the presence of two structural depressions (Figure 10). The San Francisco Basin extends north from the Dumbarton Bridge to the shoreline south of Richmond. There is a well-defined bedrock ridge separating the San Francisco Basin from the San Pablo Basin. The San Pablo Basin extends from Richmond north to the Petaluma area. The Hayward-Rogers Creek fault system crosses the basin, but it is unknown how this fault system has affected the sediments or groundwater flow patterns within the Basin. Figure 11 illustrates the structural contours for the bedrock, and clearly indicates the two basins.

6.3 Major Stratigraphic Units

The geologic units can be divided into two groups: 1) consolidated bedrock of Jurassic, Cretaceous, and Tertiary age and 2) unconsolidated sediments of Pleistocene and Holocene age (Muir, 1993). Recently, the U.S. Geological Survey compiled a surficial geological map of Alameda and Contra Costa Counties (USGS, 1999) (See Figure 9).

Bedrock forms the bottom and eastern boundary of the Basin. The bedrock is structurally complex and includes the Franciscan Complex (melanges, serpentines, and ultramafic rocks) and the Great Valley Sequence (shale, sandstone, and conglomerate). The unconsolidated sediments have a variable thickness, but are up to 1000 feet thick in their deepest areas. The nomenclature applied to the unconsolidated sediments has varied over time. For the purposes of this report, we use the nomenclature from Figuers (1998). From oldest to youngest, the unconsolidated sediments are 1) Santa Clara Formation 2) the Alameda Formation (including Yerba Buena Mud, San Antonio, Merritt, and Young Bay Mud Members 3) Temescal and 4) Artificial Fill (Figure 12).

For discussion purposes, shallow groundwater-bearing units are defined as the units above the Yerba Buena Mud (Artificial Fill, San Antonio/Merritt/Posey Member, and Temescal Formation). Deeper groundwater-bearing units are defined as the units below the Yerba Buena Mud (Unnamed member of the Alameda Formation and Santa Clara Formation).

6.3.1 Santa Clara Formation

This formation name has not been consistently applied to the deep units north of the Santa Clara Valley. This early Pleistocene formation is continental in origin and includes alluvial fans deposits interfingered with lake, swamp, river channel, and flood plain deposits. The formation is between 300 to 600 feet thick. Overall, this formation is very poorly understood. Figuers (1998) reports that this section has only been sampled within the past year or so by Caltrans borings along the San Mateo and Bay Bridges. Historically, municipal well fields were completed in this formation. Its thickness is up to 600 feet. This formation is of interest to EBMUD for their aquifer storage program, so additional stratigraphic information may be forthcoming.

FIGURE 9. SURFICIAL GEOLOGY MAP

FIGURE 10. OUTLINE OF MAIN BASINS

FIGURE 11. DEPTH TO BEDROCK

FIGURE 12. STRATIGRAPHIC COLUMN

6.3.2 Alameda Formation

This formation is differentiated from the underlying Santa Clara Formation by nature of its estuarine origins. The members of this formation include:

Yerba Buena Mud Member: This member, originally named Old Bay Mud, has subsequently been renamed. The black, organic clay averages 25 to 50 feet thick with a gravel/sand/shell layer commonly in the middle of the unit.

San Antonio/Merritt/Posey Member: This 0 to 120 foot thick member contains a sequence of alluvial fan deposits between the Young Bay Mud and the Yerba Buena Mud. Given a discontinuous nature and the wide array of materials found in this member (sands, gravels, and silts) the units are difficult to correlate. A distinctive facies within this member is the Merritt Sand. Found on Alameda Island and western Oakland, this facies is fine grained, well sorted, aeolian sand. It ranges between 0 to 60 feet thick. Figuers (1998) reports that it was deposited at the same time as the upper San Antonio/Posey.

Young Bay Mud: Ranging in thickness from less than 1 foot to 75 feet, this member is a black, organic-rich clay being deposited today in the San Francisco Bay. It contains occasional gravel and sand layer, shell fragments/layers, peat, and organic debris.

6.3.3 Temescal Formation

The Temescal is an early Holocene alluvial deposit that varies from 1 to 50 feet thick, thinning toward the bay. It consists primarily of silts and clays, but near Alameda, the base of the unit is a layer of gravel with cobbles up to 8 inches thick.

6.3.4 Artificial Fill

The fill varies from 1 to 50 feet in thickness and generally thickens toward the Bay. Most of the fill was placed in the bay front and wetland areas. Much of the Oakland and Alameda fill is derived from sediment dredged during the completion of Oakland Inner Harbor. Other common sources of artificial fill include rock from the Leona Heights Quarry, construction and demolition debris, and municipal waste.

7.0 HYDROGEOLOGY

This section describes what is known about the East Bay Plain's hydrogeology including the storage, recharge, and yield amounts.

7.1 East Bay Plain Boundaries

The East Bay Plain is an elongated, northwest trending flat alluvial plain encompassing about 115 square miles (Figure 9). The East Bay Plain, as defined by DWR (1980), is bounded on the west by San Francisco Bay, by San Pablo Bay to the north, and by the Hayward Fault to the east.

The southern boundary is defined as the northern boundary of the Alameda County Water District. Figuers (1998) suggests that the eastern boundary is better defined by the contact with the Franciscan bedrock. He also suggests that the basin extends under San Francisco Bay (Figure 10).

7.2 East Bay Plain Depth

The base of the East Bay Plain is defined at the contact between unconsolidated materials and bedrock. As illustrated on Figure 11 (Depth to Bedrock), this surface is variable across the study area. As described above, Figuers (1998) identifies two main basins, the San Pablo and the San Francisco (Figure 10). There is not as much geologic information to define the depth of San Pablo Basin. Water well depths suggest that the basin is 600 feet or more below ground surface. Moving southerly from Richmond into the San Francisco Basin, the unconsolidated materials thicken to greater than 1,000 feet. The deepest sections of the East Bay Plain are underneath San Francisco Bay. To the east, the East Bay Plain thins out rapidly.

7.3 Sub-Area Hydrogeology

The East Bay Plain is regionally subdivided into two major basins, the San Pablo and the San Francisco Basins. Further subdivisions have been previously reported by Muir (1993). Refinements were recently made by Figuers (1998). Figure 13 illustrates the seven Sub-Areas. Because of the East Bay's reliance of surface water supplies, little data is available to characterize the hydrogeologic characteristics of the Sub-Areas. In recognition of this, the Committee commissioned a comprehensive review of historical groundwater use. The results of this review are reported in Figuers (1998). Sub-Areas have been defined based on geologic, geomorphic and geographic factors. The hydrogeologic characteristics of each Sub-Area can be summarized below.

7.3.1 Richmond Sub-Area is located at the southern end of the San Pablo Basin. It is estimated to contain at least 600 feet of unconsolidated deposits. The deposits are primarily alluvial materials, but there is evidence of estuarine clays between 60 to 125 feet below sea level. These clays and the younger bay muds may be limited in extent. Given what appears to be a lack of widespread clay layers, regionally the shallow and deep water bearing layers can be considered to be interconnected. Historically, there were well fields in this Sub-Area that likely tapped significant gravel deposits that occur 100 to 150 feet below ground surface. The historical wells were only operated for 12 to 16 years before they were shut down due to saltwater intrusion.

7.3.2 Berkeley Sub-Area contains a series of alluvial fans deposited on a west sloping bedrock surface. The alluvial deposits range from 10 to 300 feet deep, averaging 100 to 200 feet deep. There is no historical evidence that groundwater supplies are sufficient for municipal use, primarily due to low recharge rates.

There are no reported clay units that function as major aquitards. However, in the Berkeley Sub-Area the first encountered groundwater is frequently semi-confined, particularly in West Berkeley.

7.3.3 Oakland Sub-Area is similar to the Berkeley Sub-Area in that it contains a sequence of alluvial fans. However, the basement is deeper and the alluvial fill is thicker (300 to

FIGURE 13. SUB AREAS

700 feet). There are no well-defined aquitards such as the estuarine muds. The largest and deepest wells in this Sub-Area historically pumped 1 to 2 million gallons per day at a depth greater than 200 feet. Upland areas historically had shown little groundwater potential beyond single family use. Overall, sustainable yields are low due to low recharge potential. The Merritt Sand outcrop in west Oakland was an important part of the early water supply for Oakland. It is shallow (up to 60 feet) and before the turn of the century, septic systems contaminated the water supply wells. Other high production wells were located from the southwestern side of Alameda to the Oakland Coliseum. The wells tapped gravels below the Yerba Buena Mud. EBMUD has drilled a test well near San Leandro Bay in the Oakland Sub-Area to explore the potential for aquifer storage of injected surface water.

7.3.4 San Lorenzo and San Leandro Sub-Areas are very similar in hydrogeologic characteristics, but can be separated based the surface trace of the junction between the San Leandro and San Lorenzo alluvial fans. The Sub-Areas are primarily filled with alluvial fans, but unlike the Sub-Areas to the north, the Yerba Buena Mud extends west into the San Lorenzo and San Leandro Sub-Areas. It has been proposed that a clay layer forms an extensive east-west aquitard across this basin. Historically there were municipal supply wells in these Sub-Areas that produced from upper Alameda gravels. These Sub-Areas were distinct from the Niles Cone basin to the south, in that the alluvial fans are finer-grained and produce less groundwater. The City of Hayward has emergency supply wells in the San Lorenzo Sub-Area. Also, EBMUD has drilled test wells in the San Lorenzo Sub-Area to explore the potential for aquifer storage of injected surface water.

7.3.5 Central Sub-Area extends beneath San Francisco Bay. The boundaries of the Sub-Area are based on the Young Bay Mud. The Young Bay Mud has a sharp "edge" in some areas, and in other areas, the boundary is less well-defined. Alameda and Bay Farm Islands are located along the northeastern edge of the Sub-Area. Historically there were artesian wells in the Sub-Area that produced from gravels below the Yerba Buena Mud, but saltwater intrusion shut down these wells. Single family residences historically relied on the Merritt Sand for water supply. However, contamination from septic systems and some saltwater intrusion resulted in localized contamination. More recently, deep wells (700 to 1000 feet deep) were drilled at the Alameda City Golf Course. Production rates were lower than expected but this is believed due to drilling problems. Water quality was satisfactory for irrigation.

7.4 Groundwater Flow Direction

Throughout most of the Alameda County portion of the East Bay Plain, Hayward north to Albany, water level contours show that the direction of groundwater flow is east to west, or from the Hayward Fault to San Francisco Bay. Groundwater flow direction generally correlates to topography. Flow direction and velocity are also influenced by buried stream channels that typically are oriented in an east-west direction. In the very southern end of the study area, in the San Lorenzo Sub-Area, the direction of flow may not be this simple. The small set of water level measurements available seem to show that the groundwater in the upper aquifers may be flowing south, with the deeper aquifers, the Alameda Formation, moving north (Muir, 1996).

In the northern portion of the Richmond Sub-Area, investigations showed flow in the San Antonio Aquifer to be toward San Pablo Bay. In the southern portion of the Richmond Basin, groundwater flows south between both the Hayward and San Pablo Faults to San Francisco Bay (EBMUD, 1986). In the Richmond Sub-Area, the EBMUD report used an average field measured transmissivity value at Richmond UC Field Station wells of about 4000 gallons per day per foot, and a hydraulic gradient of 0.003 to calculate a volume flow rate south to San Francisco Bay on the order of 135 acre-feet per year.

7.5 Groundwater Storage

DWR (1994) examined over 350 wells in Alameda County to evaluate the storage capacity in the Alameda County portion of the East Bay Plain. The study area consisted of the area north of Hayward, (about 114 square miles). DWR estimates: 1) total groundwater storage capacity of the East Bay Plain, 2) amount of storage in the East Bay Plain, and 3) usable storage in the East Bay Plain. Potential storage beneath San Francisco Bay was not considered.

DWR examined the thickness and equivalent specific yield of the various sediment types within 50-foot horizontal sections of the study area to approximate the three above properties. The estimated storage capacity of the study area is approximately 2,670,000 acre-feet. Of this amount, roughly 2,560,000 acre-feet of groundwater is currently stored. This is the total current storage in the Plain, as not all of the aquifers are 100 % saturated.

The storage for the Richmond sub-basin has not been quantitatively evaluated, but is assumed to be much lower than the storage for Alameda County, given the much smaller area and thinner section of unconsolidated sediments (EBMUD, 1986).

7.6 Recharge and Discharge Estimates

Muir (1993) summarized the different types and overall amounts of recharge for the Alameda County portion of the East Bay Plain. The study area comprised approximately 114 square miles between Albany and Hayward, and the Bay and the Hayward Fault. Sources of recharge were: rainfall infiltration, stream seepage, pipe leakage, agriculture return water, and subsurface inflow. Rainfall infiltration was defined as the rainfall left over after surface runoff and evapotranspiration that percolates through the soil strata and recharges the groundwater reservoir. The report evaluated the recharge potential of various sub-basins, rainfall data, and evapotranspiration data to determine the amount of rainfall that recharges groundwater. It looked at the unlined length of streams, the streambed recharge potential, stream gradients, and stream area to determine the potential seepage rates for each stream in cubic feet per day. These rates were multiplied by the average time per year in which there would be flow and summed to total the amount of stream seepage. Muir then analyzed EBMUD's water meter readings to determine the annual water loss from water supply lines in the area. For loss from sewer pipes, he used discharge records of four sewer treatment plants that serve the East Bay, and the records of potable water usage for the same study area. Agricultural return runoff and subsurface inflow were assumed to be small.

Based on the above considerations, Muir broke down recharge accordingly:

Table 2. Groundwater Recharge in the East Bay Plain
(Alameda County Portion Only)

Recharge Sources	Recharge (Acre-feet per Year)
Rainfall Infiltration	3,700
Stream Seepage	6,200
Sewer Pipe Leakage	4,500
Water Pipe Leakage	5,400
Agriculture Return Water	200
Subsurface Inflow	200
Total	20,200

The Richmond Sub-Area recharge was assumed to be much lower than the above figure, due to dense urbanization in Richmond and San Pablo (EBMUD, 1986).

In another Muir study, "Groundwater Discharge in the East Bay Plain Area, Alameda County" (July, 1996), he approximated the outflow, or discharge, in the study area. This was the same area used to calculate recharge. Muir identified evapotranspiration and subsurface discharge as the two natural forms of discharge and pumpage as the means of artificial discharge. The report determined evapotranspiration by using long term climatic data from the East Bay Plain and correlating this data with evapotranspiration studies made in comparable areas of California and calculated a total of 25,780 acre-feet for 1995. This is equivalent to about 8 inches a year, or about 38 percent of the annual rainfall of the area. Evapotranspiration, although an important discharge element in the overall hydrologic budget, does not remove groundwater from aquifer storage. In other words, this is rainfall that evapotranspires before it enters the subsurface aquifer. The report next assumed that most of the subsurface discharge occurred at the Bay margins. To determine subsurface discharge, Muir examined the thickness of unconsolidated deposits at the Bay margins for various sub basins, the width of the sub basins, and the amount of saturation. Muir concluded a subsurface discharge of 13,500 acre-feet for 1995. Finally, the report determined groundwater pumpage for agricultural, domestic and industrial uses. The total for 1995 was approximately 3,350 acre-feet per year.

7.7 Groundwater Basin Yield

The yield of the East Bay Plain is the rate at which water can be withdrawn annually, without decreasing groundwater in storage to the point where the intrusion of saltwater from San Francisco Bay would occur. It is related to the groundwater storage of the East Bay Plain. Storage can be depleted by pumping until water levels near the Bay are drawn down to near sea level. When this occurs, the average annual pumpage should not exceed a quantity equal to the long-term average inflow to the reservoir minus the quantity of subsurface discharge that must flow to the Bay annually to maintain a barrier against saltwater intrusion. This would be the groundwater yield of the East Bay Plain Area (Muir, 1993). Muir (1996) estimated that the groundwater safe yield for the Alameda County portion of the East Bay Plain at 10,000 acre-feet/year based on 1965 to 1995 data for rainfall from Niles and Berkeley, hydrographs of selected wells, and the historical water use..

8.0 GROUNDWATER QUALITY

This Section summarizes the findings presented in the Alameda County Flood Control and Water Conservation District report titled “Groundwater Quality of the East Bay Plain, Alameda County California” authored by Kenneth Muir in December 1997, and presents a survey of Total Dissolved Solids (TDS) concentration data collected from 15 sites along the East Bay Plain shoreline.

The Committee recognizes that a complete groundwater quality assessment of the East Bay Plain would identify and evaluate the past and present groundwater chemistry facies specific to each groundwater aquifer. From a regulatory perspective, the single most important groundwater quality parameter directly influencing a beneficial use determination is the TDS concentration. Resolution 89-39, Sources of Drinking Water, exempts the Municipal and Domestic Supply Beneficial Use designation for groundwaters with TDS concentrations greater than 3,000 mg/l and are not reasonably expected by the Regional Board to supply a public water system (note that USEPA uses the 10,000 mg/l TDS value in determining potential drinking water sources). This section includes a review of the available inorganic data and an evaluation of TDS groundwater values along the East Bay shoreline.

8.1 East Bay Plain Inorganic Groundwater Quality

Muir (1997) prepared a study of inorganic groundwater quality of the East Bay Plain. His study area extents from Albany in the north to Hayward in the south and is bounded by the Hayward Fault in the east and the bay shoreline in the west. He identified seven Sub-Areas within the East Bay Plain but limited his study to five Sub-Areas: the Berkeley Alluvial Plain, the Merritt Sand Outcrop, the Oakland Upland and alluvial Plain, the San Leandro Cone, and the San Lorenzo Cone. He divided the aquifer system into two depth zones: Shallow Zone aquifers (0 to 200 feet) and Deep Zone aquifers (200 to 1,000 feet). The inorganic water quality data was collected from 16 shallow zone wells and 13 deep zone wells.

The Shallow Zone groundwater is generally a calcium-bicarbonate type of water. TDS concentrations in the 16 wells assessed by Muir ranged from 364 to 1,020 mg/l. Along the Oakland Inner Harbor and adjacent to the Bay, Shallow Zone deposits appear to be in contact with saltwater, as indicated by the magnesium-sodium-chloride type waters found in these areas.

The Deep Zone groundwater is generally a sodium-bicarbonate type water. TDS concentrations in 13 Deep Zone wells ranged from 313 to 1,420 mg/l. Water from two Deep Zone wells in the Oakland alluvial plain were classified as sodium-chloride type water. Water in the northern part of the San Leandro Cone was the only water in those areas studied with a calcium-chloride type water. Water from this area also had the highest TDS, with values exceeding 1,300 mg/l in the three wells studied. TDS concentrations exceeded the secondary Maximum Contaminant Level (MCL) of 500 mg/l in 15 of the 29 wells.

Based on historic data (1940-1970), nitrate concentrations have exceeded the MCL of 45 mg/l in many Shallow Zone wells, though few currently exceed the standard. Nitrate concentrations in deep wells historically have been low.

Historically, saltwater intrusion has occurred in portions of deeper aquifers as a result of large scale historic pumping prior to 1930 (Figuers, 1998). Saltwater intrusion occurred at the High Street Well Field in Alameda, San Pablo Well Fields No. 1 and No. 2 in Richmond and the Fitchburg Well Field in Oakland.

8.2 East Bay Plain Shoreline Total Dissolved Solids Concentrations

The Committee surveyed 15 facilities along the East Bay Plain shoreline for shallow groundwater chemistry data. Appendix E provides a groundwater chemistry data summary table for each site surveyed. A total of 399 data points are reported, where the concentrations of TDS ranged from 24 to 55,333 mg/l. TDS values were both measured analytically and calculated from conductivity measurements. All groundwater data was collected from groundwater monitoring wells screened in the shallow units, primarily from 10 to 60 feet below ground surface.

Several other studies have been performed to determine tidal influence. Work at Oakland Army Base (Draft Base-wide Hydrogeologic Study, 1998) showed that the effects of San Francisco Bay on facility groundwater were seen up to 600 feet from the Bay margins. The study focused on the artificial fill and Merritt Sand aquifers. Hydrogeologic studies at Alameda Point indicate that tidal influence is up to 1500 feet inland and that saltwater intrusion has occurred up to 250 feet inland within the artificial fill and 1500 feet inland within the unconfined Merritt Sand. In their groundwater storage feasibility study in the Roberts Landing area of Hayward, EBMUD observed a pressure variation in their wells due to tidal influence. This included wells screened in the deeper Alameda Formation.

The landward extent of saltwater intrusion in shallow aquifers along the East Bay Plain appears related to the anthropogenic deposition of the overlying sediment, the connectivity of an aquifer to the San Francisco Bay, the amount of fresh water recharge, the hydraulic isolation of the aquifer, and any active landward pumping of groundwater. Existing saltwater intrusion is limited and correlates with shallow aquifers contained in artificial fill and hydraulically isolated aquifers (e.g., Merritt Sand) in direct contact with the Bay. In the north, the deeper fresh water aquifer systems (e.g., Alameda Formation) appear to be hydraulically isolated from the shallow aquifer systems along the East Bay Plain margin by the Yerba Buena Mud. However, in the southern portion, the water quality values in the San Leandro and San Lorenzo Sub-Areas indicate probable vertical migration from the Shallow Zone to the Deep Zone aquifer (Muir, 1997).

9.0 GROUNDWATER CONTAMINATION

9.1 Fuels and Solvents

Some shallow groundwater has been impacted by historical and current releases of fuels and solvents. A review of case files from the Regional Board, Department of Toxic Substances Control, Alameda County, City of Berkeley, and City of San Leandro reveal that, as of January 1998, there were a total of 1310 active leaking underground fuel tanks and 130 non-fuel cases (typically solvents) in the East Bay Plain. These totals do not include the numerous groundwater pollution sites at former DoD facilities in the East Bay Plain.

A map showing the location of groundwater plumes longer than 1000 feet is shown on Figure 14 and the following table summarizes information about each plume.

Table 3A. Major Areas of Existing Groundwater Pollution in the East Bay Plain

Site Name	Location	Chemicals	Boundary	Date	Lead Agency
Thermofustion	Hayward	VOCs	10 ppb	6/6/97	RWQCB
CHEMCentral	Hayward	VOCs	100 ppb	12/19/96	RWQCB
DWA Plume	San Leandro	VOCs	Above MCL's	Dec-95	DTSC
Caterpillar Facility	San Leandro	PCE/TCE	5 ppb	Feb-97	DTSC
Kaiser Aerotech	San Leandro	1,2-DCE	100 ppb	Nov-96	San Leandro
1964 Williams St.	San Leandro	TCE	10 ppb	11/7/96	RWQCB
Site 4, Alameda Point Navy Base	City of Alameda	TCE	1 ppb	1998	DTSC
Site 5, Alameda Point Navy Base	City of Alameda	TCE	1 ppb	1998	DTSC
Lawrence Berkeley	Berkeley	Diesel, Tritium	Detection Limit	1997	DTSC
WRE/ColorTech	Berkeley	Chromium	Detection Limit	1998	TMD
GE site	Oakland	TCE	10 ppb	1998	DTSC
Santa Fe Railway	Richmond	Petroleum Hydrocarbons	Detection Limit	1993	RWQCB
Chevron Refinery	Richmond	Petroleum Hydrocarbons	Detection Limit	1997	RWQCB

Ambient monitoring data on common organic pollutants within the deeper groundwater (i.e., deeper than about 100 feet) is very limited. Based on this limited data, the overall water quality of the deeper in the East Bay Plain is good. Much more data is available on the water quality of shallow groundwater (i.e., less than about 100 feet). Some shallow groundwater has been impacted by historical and current releases of fuels and solvents.

Groundwater pollution in the East Bay Plain appears to generally be restricted to portions of the shallow aquifers. Typically, site investigations require that groundwater plumes be defined in both the lateral and vertical dimension. In almost all cases, groundwater pollution appears limited to less than 50 feet below the ground surface.

However, recently one of EBMUD’s aquifer storage test wells detected contamination at a depth of over 200 feet below ground surface. Volatile organic compounds were detected in a test well located west of Interstate 880 about one mile north of the Oakland Coliseum. TCE was detected in the test well at 50-70 ppb that was screened between 260 and 350 feet below ground surface. Prior to this detection, no pollution had ever been detected above trace levels at depths greater than 140 feet. The source and migration pathway for the TCE contamination is currently under investigation by DTSC.

Although the source of the deep groundwater contamination has not been defined, it may illustrate the potential for connection between the shallow deposits and deeper aquifers. Moreover, given that there are very few existing wells pumping from the deeper aquifer, and the numerous historical wells in the East Bay Plain that could be vertical conduits, if the number of wells pumping from the deeper aquifer increases, there is a potential that shallow pollution could be drawn down into the deeper aquifers.

Water quality testing data for common organic pollutants in the East Bay Plain is very limited. In October 1997, eight water supply wells were sampled and tested for volatile organic compounds, metals and inorganic parameters in a joint project between ACFCWCD, EBMUD and the Regional Board. Two of the wells showed trace levels of carbon tetrachloride, chloroform, methylene chloride, naphthalene, and trichloroethene. However, the results are considered suspect because these two wells were not fully functional when the water samples were taken. Confirmation sampling is recommended when these wells are repaired. The contaminants may be related to residual chemicals used to lubricate the pumps in the wells. No volatile organic compounds were detected in the other six wells (see Appendix E).

Nearly all of the 32 active Regional Board SLIC Sites have volatile organic compounds (VOCs) in groundwater. Generally, VOC groundwater pollution has been regulated less aggressively in the East Bay Plain because the basin is not used as a current municipal source of drinking water. At a minimum, source control, plume delineation and long-term monitoring is typically required. A number of sites have also implemented soil vapor extraction and groundwater pump-and-treat systems.

9.2 Fuel Pipelines

Potential impacts to groundwater resources from leaking or ruptured fuel pipelines are recognized as significant areas of concern, especially in the seismically active East Bay Plain. Development of a GIS pipeline database is being performed by the State Fire Marshal's Office. This information, when completed, should be made available to stakeholders in the East Bay Plain.

FIGURE 14. AREAS OF GROUNDWATER POLLUTION

9.3 Vertical Conduits

Improperly abandoned wells (vertical conduits) are included in this section on Groundwater Pollution Sources. While vertical conduits are not "pollution sources" in the conventional sense, they can provide a potential pathway for contamination to migrate from shallow to deeper aquifers.

In the East Bay Plain, it is likely that numerous historical wells drilled prior to the importing of Sierra water are potential vertical conduits. J.H. Dockweiler (1912) provided a detailed snapshot of water supply and usage in the East Bay area in the fall of 1911 and identified a total of 3,573 wells. Of these wells, only 1,930 had data on well depth. In the study area overall, about 8% of the wells with depth data had a total depth of 200 feet or deeper. About 30% of the wells with depth data were 100 feet deep or more (see Section 12.1 for additional discussion)

The Yerba Buena Mud forms a major aquitard between the shallow and deep aquifers throughout much of the southwest portion of the East Bay Plain. However, the integrity of the aquitard may be locally compromised due to the drilling of wells in the 1890-1930 time frame. In Oakland, it is estimated that there are over 200 wells that penetrated the Yerba Buena Mud. It is surmised that virtually none of these wells was properly destroyed. In the remaining portions of the East Bay Plain, the Yerba Buena Mud is not present and no other major aquitards separate the shallow and deep aquifers.

One exception is the area along the extreme western East Bay Plain shoreline, south of the Bay Bridge, where artificial fill was placed after 1930. In this area, the Yerba Buena Mud is considered continuous and should form a natural barrier to minimize the downward spread of pollution.

9.4 Landfills

A total of about 1150 acres of bay-front wetlands were used for municipal waste disposal (see Figure 14). The landfills were constructed using earthen levees and filling the interiors with waste. Fill elevations range from approximately 20 to 150 feet above sea level. Most of the landfills are unlined and were built directly over Young Bay Mud. Typically, groundwater gradients are upward into the waste fill due to the weight of the overlying waste pile. The most significant water quality issue at these landfills is seepage of leachate from the base of the fill directly into San Francisco Bay. Minor low level VOC groundwater pollution is present at most of the landfills. Nearly all of the landfills are closed and capped and several have leachate extraction systems in place. The following table summarizes landfill data in the East Bay Plain.

Table 3B. Summary of Regulated Landfills
in the East Bay Plain Groundwater Basin

Landfill Name and Regional Board Order No.	City	Years Operated	Acres	Water Quality Issues
Alameda Naval Air Station Landfill No. 93-129	Alameda	30-40 years until 4/93	Two landfills (12 and 110 acres respectively)	Primarily surface water issues.
Alameda City Doolittle Landfill No. 95-189	Alameda	1953-1985	40	No leachate detected below or off-site.
Albany Landfill	Albany	1963-83	75	Primarily surface water issue.
Berkeley Landfill No. 86-041	Berkeley	Approx. 1900-1985	90	Low levels of metals in groundwater and leachate within landfill footprint.
Oyster Bay/Davis Street Landfill	San Leandro	1942-1980	247	Shallow groundwater pollution. Leachate extraction planned to contain seeps.
Galbraith Landfill No. 94-187	Oakland	1930's-1960's	110	Fuels in shallow groundwater. Perimeter slurry wall installed. Currently used for dredged sediment disposal by Port of Oakland.
Oakland Scavenger Construction Debris Landfill, North Field, Oakland Airport	Oakland	1957-1960	21	
Tony Lema No. 95-129	San Leandro	1958-1977		Landfill gas found in groundwater wells in 1993.
West Contra Costa Landfill No. 96-079	Richmond	1953 – 1999	188	Fuels and VOCs in shallow groundwater. Slurry wall and leachate extraction system in place.
Winton Avenue Landfill	Hayward		approx. 200	Primarily surface water issues.
West Winton Landfill No. 95-088	Hayward	1938-1974	57	Seepage to surface water controlled by leachate extraction.

In addition to the regulated landfills discussed above, about 17,000 acres (26 sq. mi.) of bay-front wetlands and mudflats along the western edge of the East Bay Plain were filled with dredged material, construction debris, rock from various quarries, and other unknown sources. These fills were not previously regulated, but are now becoming an issue for regulatory review as the land use changes (e.g., Alameda Naval Air Station, the East Bay Shoreline State Park, and the Port of Oakland).

9.5 Department of Defense Sites

This subsection provides a summary of activities and releases to groundwater at four DoD facilities in the East Bay Plain: Naval Fuel Depot Point Molate, Fleet Industrial Supply Center Oakland (FISCO), Alameda Annex, and Alameda Point.

9.5.1 Naval Fuel Depot Point Molate

Naval Fuel Depot (NFD) Point Molate is located in the Potrero Hills along the northeastern shore of San Francisco Bay on the San Pablo Peninsula. Bulk fuel storage was provided at NFD Point Molate from 1943 until fuel transfer and storage ceased in May 1995. Several different fuels and wastewater have been stored in the 24 fuel tanks at the facility including Navy special fuel oil, marine diesel fuel, jet propellant (JP)-5, motor gasoline, mixed fuels, oil reclamation, lube and turbine oil, JP-8, ballast, wastewater, and sludge. Currently, four active Investigation Remediation (IR) sites are located at NFD Point Molate with three sites releasing contaminants to groundwater. Releases to groundwater include (1) oil, fuel, and sludge from leaking tanks, pipelines, and valve boxes, and (2) contaminated fuels, tank bottom sludges, and Bunker fuel from a former sump pond. Total petroleum hydrocarbons (primarily JP-5), PAHs, BTEX, and VOCs were the most commonly detected contaminants in groundwater. Five fuel-related and three chlorinated VOC-related plumes exist at NFD Point Molate. The fuel-related plumes range from approximately 50 feet in width by 75 feet in length up to 440 feet in width by 1750 feet in length and extend to the bottom of the artificial fill, approximately 22 feet below ground surface. The chlorinated VOC-related plumes range from approximately 50 feet by 50 feet up to 50 feet in width by 125 feet in length and also extend to the bottom of the artificial fill.

The Navy will be investigating the soil and groundwater around the large Underground Storage Tanks (USTs) and underground fuel pipelines in future investigations. There is the potential that other fuel plumes occur in the hillsides or near the shoreline due to previous spills from the USTs and fuel pipelines. The Navy is investigating approximately 20 two-million gallon USTs and approximately 20 miles of underground fuel pipeline, analyzing the soil and groundwater for TPH, VOCs, and SVOCs. Groundwater flow in the vicinity of NFD Point Molate is west to southwest, generally toward San Francisco Bay. The majority of the shallow groundwater at NFD Point Molate contains concentrations of total dissolved solids (TDS) below 3,000 mg/l. (Draft Final Evaluation of Beneficial Uses for Groundwater for NFD Point Molate, June 26, 1998, Table 1) The only portion of the facility that has shallow groundwater with a high TDS (up to 27,000 mg/l) is a portion of the shoreline. While the shallow aquifers are generally capable of maintaining a sustained yield of 200 gallons per day near the bay margin, pumping induced intrusion of saltwater would further degrade water quality. An extraction trench has been installed along the shoreline to capture floating fuel and remove contaminated groundwater for treatment.

9.5.2 Fleet Industrial Supply Center Oakland

Fleet Industrial Supply Center Oakland (FISCO) is located in Oakland just south of the San Francisco-Oakland Bay Bridge, and within the Port of Oakland. FISCO was commissioned in 1941 as the principal supply facility supporting DoD activities in the Pacific Basin and was the Navy's largest west coast supply point. Currently, ten active Investigation Remediation sites are located at FISCO with eight sites releasing contaminants to groundwater. Releases to groundwater include (1) leaking fluids from a scrapyard and storage area, (2) disposal of waste materials (lubricants, solvents, paints), (3) leaking sumps and waste oil USTs, (4) spills from redrumming and overpacking operations, (5) discharges from a wash rack, and (6) spills due to poor drum handling and slow leaks from older drums. Chlorinated VOCs, BTEX, SVOCs, and TPH were the most commonly detected contaminants in groundwater. No fuel-related plumes exist at FISCO. One chlorinated VOC-related plume exists at FISCO and is approximately 350 feet long and 260 feet wide and extends to 12 feet bgs. The VOC contaminant plume is located within the artificial fill hydrostratigraphic unit. Groundwater flow in the vicinity of FISCO is west to southwest, generally toward San Francisco Bay. The groundwater typically contains moderate to high concentrations of total dissolved solids (405 to 36,000 mg/l) as a result of saltwater intrusion from San Francisco Bay. Lenses of fresh water exist near the ground surface as a result of leaking water supply distribution pipes and rainwater infiltration. While the shallow aquifers are generally capable of maintaining a sustained yield of 200 gallons per day near the bay margin, pumping induced intrusion of saltwater would further degrade water quality.

Regional Board staff have recently reviewed and commented on the Navy's groundwater beneficial use evaluation at FISCO (see Appendix G). As part of the review, staff found that the brackish quality of the shallow groundwater beneath FISCO is such that the water is not a potential source of drinking water pursuant to SWRCB Resolution 88-63 (Sources of Drinking Water Policy).

9.5.3 Alameda Annex

The Fleet and Industrial Supply Center, Oakland, Alameda Facility/Alameda Annex (hereafter referred to as the Annex) is located along the southern shore of the Oakland Inner Harbor in Alameda, California. It is situated about 1 mile southeast of the FISCO main base and less than ½ mile east of Alameda Point. Currently, seven active Investigation Remediation sites are located at the Annex with four sites releasing contaminants to groundwater. Releases to groundwater include (1) leaking fluids from a screening lot and scrapyard, (2) a diesel fuel spill, and (3) paint and solvent spills at a paint spray booth. Chlorinated VOCs, SVOCs, and TPH were the most commonly detected contaminants in groundwater. Five fuel-related plumes also exist at the Annex. The fuel-related plumes range from approximately 400 feet to 2000 feet long by 300 to 1000 feet wide and extend to the bottom of the artificial fill, approximately 10 to 12 feet bgs. All contaminant plumes are located within the artificial fill hydrostratigraphic units. Groundwater flow in the vicinity of the Annex is north to northwest toward the Oakland Inner Harbor. The groundwater typically contains moderate to high concentrations of total dissolved solids (500 to 36,000 mg/l) as a result of saltwater intrusion from the San Francisco Bay. Small lenses of fresh water exist near the ground surface as a result of leaking water supply distribution pipes and rainwater infiltration. While the shallow aquifers are generally capable of maintaining a sustained yield of 200 gallons per day near the bay margin, pumping induced intrusion of saltwater would further degrade water quality.

9.5.4 Alameda Point

Alameda Point (formerly Naval Air Station Alameda) is located on the western end of Alameda Island. Alameda Point was a major active naval base between 1936 and 1997. The installation and its tenants supported several activities that generated wastes including, but not limited to, industrial solvents, acids, paint strippers, degreasers, caustic cleaners, metal plating wastes, used oil, fuel, and asbestos. Other installation activities that generated hazardous wastes in the past include (1) repair of aircraft components for transient and tenant aircraft which may have produced contamination from fuel products and cleaning solvents; (2) air operations related fuel spills and fuel dumps; (3) waste oils stored in underground tanks from automotive service stations; (4) wastes related to receiving, issuing, storing, and shipping ammunition, ammunition components, and explosives; and (5) fueling support service activities.

Currently, twenty-five active Investigation Remediation sites are located at Alameda Point with seventeen sites releasing contaminants to groundwater. Releases to groundwater include (1) leachate from a 12 acre and a 110 acre landfill, (2) jet fuel from a former fuel storage area, solvents and heavy metals from paint stripping and plating operations, (3) solvents from parts cleaning, operations and equipment washing, (4) spills or leaks associated with underground storage tanks, fuel pipelines, and fuel pump islands, (5) spills and releases of petroleum products related to the former refinery, and (6) spills or leaks from hazardous waste container storage area. Chlorinated VOCs, BTEX, SVOCs, TPH, PAH, and heavy metals were the most commonly detected contaminants in groundwater. At least seventeen fuel-related and fourteen chlorinated VOC-related plumes exist at Alameda Point. The fuel-related plumes range from approximately 125 to 1,100 feet long by 125 to 600 feet wide and extend up to at least 27 feet bgs. The chlorinated VOC-related plumes range from approximately 125 to 1,800 feet long by 190 to 1,800 feet wide and extend up to at least 27 feet bgs. All contaminant plumes are located within the artificial fill and Merritt Sand hydrostratigraphic units, which comprise the first and second water bearing zones at Alameda Point. Generally, groundwater flow in the vicinity of Alameda Point is radial from the center of the facility toward the San Francisco Bay, Oakland Inner Harbor, and the Seaplane Lagoon. The first water bearing zone (fill aquifer) along the shoreline contains concentrations of total dissolved solids greater than 3000 mg/l, as a result of saltwater intrusion. However, the first water bearing zone in the central and southeastern portions of Alameda Point is primarily fresh water (<3000 mg/l TDS) and is recharged by rainwater infiltration and leaking water supply distribution pipes. The second water bearing zone (Merritt Sand) contains total dissolved solids greater than 3000 mg/l, except in the southeastern portion of Alameda Point. The southeastern portion of Alameda Point is distinctive due to the absence of a bay mud aquitard. The single water bearing zone (fill + Merritt Sand) contains mainly fresh (<3000 mg/l TDS) that is recharged by rainwater infiltration and groundwater flowing from eastern, upgradient portions of the Merritt Sand aquifer.

The size of fresh groundwater lenses may change during future property development at Alameda Point. On the one hand, the size of the fresh groundwater lenses may increase when the paved surfaces are removed. On the other hand, the size of the fresh groundwater lenses may decrease because redevelopment will include replacement of the leaking water supply and sanitary sewer pipelines, which currently are believed to provide the majority of fresh water recharge. The current safe yields for aquifer development exceed 200 gallons per day in the western, central and southeastern areas of Alameda Point. In the southeastern portion of Alameda Point, the current safe yield exceeds 8,000 gallons per day.

9.5.5 Oakland Army Base

Oakland Army Base (OARB) is a former active U.S. Army installation located in an industrialized area of Oakland. The installation was constructed on fill in a shallow tideland water area on the eastern shore of San Francisco Bay. OARB sits adjacent to the toll plaza of the San Francisco-Oakland Bay Bridge, and is surrounded by the Fleet Industrial Supply Center Oakland, the Port of Oakland, and the Southern Pacific Rail Terminal. It was constructed and began performing its duties as a military transportation port and distribution terminal in the early 1940s. Most of the site is approximately 10 feet above sea level. Seven operable units for investigation and remediation have been identified at OARB. They are all currently being investigated. These operable units include a railroad roundhouse site, a chlorinated solvent release site, and a housing area containing some petroleum tank sites. Chlorinated VOCs, SVOCs, and TPH were the most commonly detected contaminants in groundwater. The contamination has affected the artificial aquifer, and additional work is being conducted to investigate the potential that shallow contamination has migrated into the deeper Merritt Sand aquifer.

The natural groundwater gradient for the artificial fill is west toward San Francisco Bay. The total dissolved solids (TDS) of the artificial fill groundwater is high (up to 25,000 mg/l) in background borings that are in paved areas. The TDS of the shallow aquifer is below 3,000 mg/l in much of the unpaved, grassy areas of OARB. However, geochemical studies conducted by the Army have pointed to the source of the relatively fresh water as lawn watering, and leaking pipes at the base. The shallow artificial fill aquifer generally can sustain pumping rates of at least 200 gallons per day. Deeper groundwater studies and the potential for shallow groundwater contamination to migrate vertically to the Merritt Sand are being investigated, on a site-by-site basis, in the seven designated operable units.

9.6 Davis-Washington-Alvarado (DWA) Plume

The largest groundwater plume in the East Bay Plain is the Davis-Washington-Alvarado (DWA) Plume in San Leandro (Figure 14). The VOC plume (primarily TCE and PCE) is 2 miles long and over 1 mile wide. Since 1993, DTSC has been conducting soil and groundwater investigations to determine the extent of the plume and possible sources. DTSC has determined that the groundwater pollution could not be attributable to any one site but is coming from multiple sources. The extent of the groundwater plume has been defined and soil remediation has been conducted at several sites.

Many San Leandro residents use private wells in the vicinity of the plume for landscape and garden irrigation. DTSC has conducted a risk assessment and determined that shallow groundwater in the plume can be safely used for irrigation and other outside uses, but should not be used in the home for domestic purposes such as drinking, cooking, showering or bathing. An intensive public education campaign was conducted in the early 1990’s to warn residents of the risks associated with drinking the shallow groundwater and to encourage and facilitate residents that were using shallow wells for domestic purposes to connect to the EBMUD water system. Currently, DTSC is investigating eight potential sources of pollution within the DWA plume and developing a coordinated plan for long-term management of the plume.

9.7 Chevron Richmond Refinery

The Chevron Richmond Refinery is located on the peninsula of the Potrero-San Pablo Ridge in northwestern Richmond. It consists of a large refining complex and appurtenant tank fields and manufactures and stores approximately 12 primary refined petroleum products including propane, gasoline, jet fuel, fuel oils, diesel, lube oil, solvents and other byproducts.

The refinery was built at the turn of the century. There are four geologic zones: Alluvial, Flats (marsh covered by fill), Ridge (deformed Franciscan Complex), and Transition Zone (between Flats and Ridge) on more than 2,900 acres. The City of Richmond lies south and east of the facility, where there are industrial, residential, commercial and agricultural land use operations. It is classified as an integrated refinery as defined by the U.S. Environmental Protection Agency in 40 CFR 419.50. Remediation of the site is regulated by the Regional Board under Order No. 93-109. Groundwater pollution at the refinery is prevented from migrating off site by a four-mile long slurry wall/groundwater interceptor trench. Within the refinery property, groundwater and soil contaminated sites are being remediated. However, restoration of groundwater beneath the entire refinery is not a requirement due to the infeasibility of remediating significant pollution related to nearly 100 years of operation and the absence of any historical, existing or planned municipal beneficial use.

9.8 Port of Oakland

The Port of Oakland is a semi-autonomous department of the City of Oakland that is responsible for the management of the Marine Terminals, Oakland International Airport, and commercial real estate. The Port has jurisdiction over the Port Area, defined as extending immediately south of the Bay Bridge to the City of San Leandro northern boundary and including approximately 23 miles of shoreline. Geographically the Port is situated at the boundary between the East Bay Plain and San Francisco Bay.

Prior to the arrival, in the mid-1800's, of the transcontinental railroad, the Oakland shoreline was relatively unaltered. Subsequently, deep water shipping channels were dredged and the intertidal and shallow near-shore Bay waters were filled with dredged materials, some refuse materials, and imported soils. The new land was mostly utilized for both marine and heavy industrial activities. Typical industrial usages included railyards, shipbuilding, gas and electric generation, lumber yards, grain milling and storage, petroleum tank farms, and a number of smaller industries. With the arrival of World War II, the US military filled additional Port Baylands to create large installations to support the war effort. Beginning in the 1960's, the conversion of the ocean-going shipping industry from break-bulk to containerization resulted in wholesale changes in the Marine Terminals landscape. Timber wharves and finger piers, transit sheds, and near shore industries were replaced by marginal concrete wharves, container cranes, and large paved container storage yards.

The industrial legacy has left a mark upon the soils and shallow groundwater under the Port Area. Past industrial releases have typically and locally impacted some sites with petroleum hydrocarbons, i.e. gasoline and diesel fuels derived from underground and above ground storage tanks, and atypically, polynuclear aromatic hydrocarbons associated with residues from gas and power generation plants. The most significant sites at the Port include a former wood treatment plant at Embarcadero Cove (State Superfund Site), fuel pollution at Berth 24, and a former Coal Gasification Plant. There are 12 leaking underground storage tank sites at the Port; six have been remediated and are closed, five are on quarterly monitoring and one site is undergoing active remediation.

The Port recently conducted a hydrogeologic investigation of the Marine Terminals area. The purpose of the study was to assess the potential for saltwater intrusion from San Francisco Bay as a result of a proposed deepening of the shipping channels. The study concluded that the proposed deepening would have minimal impact on the Alameda Formation aquifer. However, the study demonstrated that shallower water-bearing units, the Merritt Sand and saturated fill soils, have already been invaded by salty Bay water.

9.9 Oakland Central District Redevelopment Area

The Oakland Central District Redevelopment Area, often referred to as the Uptown Theater District, encompasses Oakland's historic downtown. This area, which is anchored by the historic Fox Theater, was almost completely abandoned by business over the last three decades. Significant groundwater contamination has been identified in large portions of the area and must be addressed prior to redevelopment.

9.10 Bacteriological Contamination

Leaking sewer pipes are estimated to account for 20% of the groundwater recharge in the East Bay Plain. Shallow groundwater frequently contains elevated levels of fecal coliform. Both of these findings are typical for highly urbanized areas. California State Well Standards require a minimum 50-foot deep well seal for drinking water wells to guard against exposure to such contamination.

10.0 ECOLOGICAL IMPACTS

In the East Bay Plain, groundwater may discharge directly to the Bay or to freshwater features such as lakes, creeks, or manmade culverts or channels, which in turn discharge to the Bay. Over the last hundred or more years, a great deal of industrial activity has occurred along the Bay margin, and has resulted in many instances of groundwater contamination. This section looks at sites where groundwater contamination exists near a surface water body where there is the potential for impacts to aquatic receptors. To summarize the findings of the section, there are a number of sites where concentrations of chemicals in groundwater exceed numerical water quality objectives for individual constituents or levels of mixtures shown to have impacts in aquatic receptor tests. At the present time, while the potential for impact exists, studies to establish a link between these sites and impacts to aquatic receptors have not been completed or performed.

10.1 Ecological Impacts from Petroleum Hydrocarbons

In the East Bay Plain, most documented releases of contaminants to the subsurface that have resulted or could result in degradation of groundwater quality are associated with underground fuel storage tanks. A preliminary assessment of the potential for such sites to reach surface water was conducted using the information presented in Figure 6. To make this assessment, the number of sites located within about 250 feet of a surface water body was estimated. Surface water bodies included the Bay, surface water drainages shown on Figure 6, and wetlands (the latter primarily in the most southerly and northerly portions of the East Bay Plain). The distance of 250 feet was selected for fuel sites based on the Lawrence Livermore National Laboratory (LLNL) finding that 90% of groundwater plumes at fuel sites stabilize within about 250 feet of the source of the release. Thus, the class of sites more than 250 feet from surface water bodies are judged to have a small potential for impacts to ecological receptors via a groundwater pathway. About 40 sites were identified within 250 feet of the Bay or wetlands adjacent to the Bay. About 60 sites were identified within 250 feet of surface water drainages.

An example of a site where discharge of petroleum hydrocarbons to surface water has been documented is located at 1138 Glascock Street on the Oakland side of the Oakland-Alameda estuary. A 20,000-gallon diesel tank and a 4,000-gallon diesel tank were removed from the property in 1993. Samples collected in the last 12 months from a well located adjacent to the estuary have shown concentrations of TPH-diesel and TPH-motor oil ranging from 1 to 10 mg/l and 1 to 8 mg/l, respectively.

The Chevron refinery in Richmond is another facility in the East Bay Plain where petroleum hydrocarbons in groundwater have discharged to the surface waters of San Francisco Bay. An assessment of ecological impacts associated with releases from the refinery and associated activities to surface water and sediment of the Bay is in the planning stages.

At sites where groundwater containing petroleum hydrocarbons is discharging to surface water, the potential for impacts to aquatic receptors exists. While the nature and degree of any such impacts is not well characterized at this time, studies conducted at other Bay margin sites indicate that water with TPH concentrations in the range of 100-1,000 ug/L can result in significant effects on test organisms.

10.2 Ecological Impacts from Chlorinated Solvent Plumes

There are an estimated 90 sites in the East Bay Plain where chlorinated solvents have been identified in groundwater. Of these sites, about 19 are located within 1000 feet of the Bay or a surface water feature. Major plumes in the East Bay Plain are shown on Figure 14. In general, the major solvent plumes do not extend to the Bay or discharge to surface water. The potential for impacts to ecological receptors from chlorinated solvents would appear to be limited.

10.3 Ecological Impacts from Pesticides

There appears to be little evidence of discharge of pesticides to surface water via a groundwater pathway. As an example, at the United Heckathorn site on the Lauritzen Canal, Richmond, crystalline DDT (100% DDT) was observed in shallow soils while concentrations in sediments ranged to 633 mg/kg. Groundwater investigations revealed little in the way of dissolved pesticides. This observation is consistent with the generally strong sorption characteristics of many pesticides. Direct discharge or transport of pesticides with suspended sediment in surface water appears to be much more significant migration pathways to aquatic ecological receptors than migration as a dissolved phase in groundwater.

10.4 Ecological Impacts from Metals

This section illustrates the potential impact to aquatic receptors via elevated metals concentrations in groundwater through brief discussions of two sites: the Volvo-GM site in Oakland and the Zeneca Ag Products site in Richmond.

The Volvo-GM site is located at 5050, 5051, and 5200 Coliseum Way, Oakland. The site was formerly a paint manufacturing facility. Several metals including arsenic, cadmium, cobalt, copper, lead, nickel, and zinc are contaminants of concern. The site is bordered on the west by subsurface culverts and a stormwater drainage channel. Groundwater elevation contours and contaminant distribution maps indicate groundwater discharges to the culverts or channel. The channel discharges to San Leandro Bay. Groundwater contaminant concentrations of zinc have exceeded Basin Plan water quality objectives by factors of up to 20,000. Concentrations of cadmium, copper, and nickel have exceeded objectives by factors of 100 to 1,000. Storm sewer samples have shown elevated nickel and zinc concentrations. An ecological risk assessment is planned at this site.

The Stege Marsh site (owned by Zeneca Ag Products) is located at 1415 South 47th Street, Richmond. The site occupies about 75 acres and is bordered to the south by a tidal basin connected to San Francisco Bay. A variety of chemicals has been manufactured at the facility. Chemicals associated with plant activities have been identified in Quaternary Alluvium to depths up to 20 feet below Mean Sea Level, and include arsenic, cadmium, copper, lead, zinc, and several chlorinated volatile organics. Maximum measured metals concentrations in wells adjacent to the tidal basin exceed Basin Plan water quality objectives by factors of up to about 500. An ecological risk assessment is planned for this site, although groundwater discharge is not considered to be the most important route of exposure to aquatic receptors.

11.0 REGULATORY ISSUES

11.1 Lawrence Livermore National Laboratory LUFT Report

In October 1995, Lawrence Livermore National Laboratory (LLNL), under contract to and at the request of the State Board, submitted written recommendations to the State Board for improving the cleanup process for California's leaking underground fuel storage tanks (LUFTs) for fuels without MTBE or other oxygenates. The recommendations were the result of an 18-month review of the regulatory framework and cleanup procedures currently applied to LUFTs. Under current regulation, the minimum cleanup standards for cases affecting groundwater are the maximum contaminant levels (MCLs) for drinking water. Numeric cleanup standards are not established for residual fuel hydrocarbons (FHC) in soil.

The main findings of the LLNL study were: 1) if an FHC source is removed, passive bioremediation processes act to naturally reduce the mass of dissolved constituents in groundwater, and to eventually complete the FHC cleanup, 2) dissolved benzene plumes in groundwater tend to stabilize at relatively short distances from the FHC release site, 3) in 90% of the cases, benzene concentrations greater than 10 ppb extended no more than about 250 feet from release sites, and 4) a review of the state's database of over 28,000 cases showed that 136 sites (0.5%) reportedly have affected drinking water wells.

The LLNL study also found that remediation alternatives that use pump and treat technologies were ineffective at reaching MCL groundwater cleanup standards for FHC constituents in many geologic settings. Although contaminated groundwater can be removed, contaminants sorbed to soil particles act as a continuing source to groundwater, making it difficult to reach MCLs. The LUFT historical case study conducted by LLNL, as well as other historical case studies, found that once an FHC source is removed, the time for passive bioremediation to reduce a dissolved FHC plume by a factor of 10 is about 1 to 3 years. LLNL recommended that passive bioremediation be used as a remediation alternative for LUFTs whenever possible; pump and treat remediation should not be used unless its effectiveness can be demonstrated.

From a regulatory perspective, the LLNL study concluded that the current LUFT decision-making process does not result in cost-effective site closures. As an alternative, a Risk-Based Corrective Action (RBCA) approach to LUFT cleanups was recommended to provide guidance to reasonably manage risks to human health, ecosystems, and groundwater beneficial uses, while considering technical and economic feasibility.

The RBCA approach is tiered. Lower tiers use conservative assumptions and historical or screening level data to make decisions. Tier 1 evaluations rely on a generic approach and are applicable to most LUFT cases and sites. Higher tier evaluations require more intensive, site-specific data as a trade-off for the conservative Tier 1 assumptions. By using a modified American Society of Testing and Materials (ASTM) RBCA approach, LUFT cases can be evaluated on the basis of exposure pathways, (e.g., proximity of drinking water wells and depth to groundwater). A modified Tier 1 approach could encompass a majority of California's LUFT cases, and encourage the use of passive remediation. LLNL recommends that a modified ASTM RBCA framework be applied to cases where FHCs have affected soil but do not threaten groundwater, and that SWRCB policies be modified to allow the consideration of risk-based cleanup goals higher than MCLs. The Regional Board concurs with the submitted recommendations, and implements them for LUFT cases on a case-by-case basis.

11.2 Methyl-tert-butyl-ether (MTBE)

Methyl-tert-butyl-ether (MTBE) is an oxygenate additive to gasoline intended to reduce combustion emissions. MTBE is more soluble, less volatile, less well adsorbed, and apparently significantly less biodegradable than gasoline mixtures or benzene. As a consequence, releases of gasoline to the subsurface have resulted in MTBE migration in groundwater that is much more extensive than the migration of the gasoline or other constituents of concern in gasoline. In addition, MTBE imparts an unpleasant taste and odor to water at very low concentrations. Given its migration characteristics and its low taste and odor threshold, the potential for impacts to water supply wells is higher for MTBE than for gasoline or BTEX constituents. The concern would be greatest for wells completed in shallow aquifers, as is the case for some domestic wells included in the ACFCWCD or EBMUD well database.

The Department of Health Services has proposed a taste and odor secondary MCL of 5 ppb for MTBE. The Office of Environmental Health Hazards Assessment proposed a Public Health Goal of 14 ppb in August 1998. The primary MCL for MTBE must be adopted by DHS by July 1, 1999, and could be as low as 14 ppb.

The use of MTBE in reformulated gasoline to satisfy the federal Clean Air Act has sparked considerable controversy in California and elsewhere. On November 12, in conformance with SB 521, the University of California (UC) issued a report to the Governor, “Health and Environmental Assessment of Methyl Tertiary-Butyl Ether (MTBE)”, which found that the air quality benefits of reformulated gasoline containing MTBE were not significant on exhaust emissions from advanced technology vehicles. However UC did find that there are significant risks and costs associated with water contamination due to the use of MTBE. The UC report recommends a gradual phase out of MTBE over several years as well as other strategies to minimize the risks associated with MTBE. On March 25, 1999, after peer review and public hearings, in accordance with SB 521, the Governor issued Executive Order D-5-99 that mandated the California Air Resources Board develop a timetable by July 1, 1999 for the removal of MTBE from reformulated gasoline at the earliest possible date, but no later than December 31, 2002.

12.0 HISTORICAL GROUNDWATER BENEFICIAL USES

Groundwater was a major part of the water supply for the East Bay during the period from 1860 to 1930, before Sierra water was imported to the area. Groundwater may have supplied up to 15,000,000 gallons of water per day for short periods, and was the sole supply for months on end during times of drought. Approximately half of the groundwater was pumped from the study area (Figuers, 1998). Most of this was produced from a band of well fields stretching from the southeastern end of Alameda Island to 98th Street in Oakland. Groundwater was used widely for municipal supply. It is estimated that 15,000 wells were drilled in the Basin between 1860 and 1950 (Figuers, 1998). Most of these wells were less than 50 feet deep, but many were 200 to 500 feet deep, with some extending as deep as 1000 feet below ground surface (see Figures 2 and 3).

While the development of local groundwater supplies was instrumental in the early development of the East Bay Plain, by the late 1920's the supply was too small to meet the growing population. In addition, wells often became contaminated by seepage or saltwater intrusion. Thus faced with an increasingly degraded and insufficient water supply, East Bay civic leaders turned to imported supplies to meet the growing demand for water. Early alternatives for such a supply included a joint effort in developing the Hetch Hetchy Reservoir with the City of San Francisco, pumping surface water from the Sacramento Delta and developing its own Sierran supply. Ultimately the decision was made to develop a Sierran supply by building Pardee Reservoir. For a detailed and colorful account of the East Bay Plain water supply history, see Figuers (1998).

In addition to using the East Bay Plain for a source of drinking water, it was used for agricultural and industrial supply. An estimated 15,000 acres of land were in agricultural production in 1963 (Muir, 1994). If all of this acreage was irrigated with an average of 3 acre-feet/year, agricultural usage would have been an estimated 45,000 acre-feet in 1963. It is not known what portion of historical agricultural usage may have been supplied by groundwater. Groundwater has also been used for industrial processes, though no estimates of historical usage were obtained for this report.

12.1 Dockweiler Report

J.H. Dockweiler (1912) provided a detailed snapshot of water supply and usage in the East Bay area in the fall of 1911. During the period August to October 1911, Dockweiler hired a corps of canvassers to identify all wells in the territory between Richmond and Hayward. Canvassers went house to house and recorded the address, use and number of people served, depth to water and depth of water in the well. Dockweiler estimates that 80% of the wells were recorded, the remainder being small wells with hand pumps.

Excluding those in Castro Valley, a total of 3,573 wells were identified (see Figures 2 and 3). Of these wells, only 1,930 had data on depth to water or height of water in well. It is assumed that the depth to water in the well plus the height of water in the well would be equal to the total depth of the well. The data was put into a spreadsheet to examine statistics on the number of deep wells in each city area. Table 4 summarizes the results of this analysis. In the study area overall, about 8% of the wells with depth data had a total depth of 200 feet or deeper. About 30% of the wells with depth data were 100 feet deep or more.

Looking at each city area individually and estimating the area of the city canvassed, an approximate deep well density for 1911 can be calculated. This calculation shows the highest density of wells 200 feet deep or more to be in the areas of Alameda and Oakland, with densities of 6 to 10 deep wells per square mile. These cities were fairly densely developed, so these numbers may accurately reflect the density of the time. In Alameda, there are reports of saltwater intrusion of the shallow groundwater, so the density of deeper wells may be due to pursuit of clean, deeper aquifers. Other developed areas were Berkeley and Emeryville, where the deep well density was fairly low, around 1 deep well per square mile. This low density reflects the shallow bedrock in this area. Any deep wells were likely installed close to the Bay shore.

Richmond was partially developed and the San Leandro/San Lorenzo and Hayward areas were rural (undeveloped) in 1911. These areas had low deep well densities (zero deep wells in the hamlet of Hayward and about 1 deep well per 2 square miles in Richmond and San Leandro/San Lorenzo). The low deep well density in Richmond even with the partial development at the time may reflect the successful service of the water companies there and their wellfields in Richmond and San Pablo. The deep well densities in all those areas are likely to have increased due to development between 1911 and the early 1930s when EBMUD began supplying imported surface water to the region.

Table 4. Summary of Well Data Recorded in the Dockweiler Report

Area	Total Wells Reported	Wells deeper than 199 ft	Wells deeper than 99 ft	Approximate Area Canvassed (sq. mi.)	Ratio Wells > 199 ft Deep wells per Sq. Mile
Alameda	362	16%	55%	6	10.2
Berkeley	642	1%	9%	12	0.6
Emeryville	77	3%	5%	2	1.2
Hayward	55	0%	2%	1	0.0
Oakland	1762	12%	36%	35	6.0
Richmond	238	5%	51%	26	0.5
San Leandro/ San Lorenzo	437	2%	13%	16	0.5
Overall	3573	8%	30%		

Note: Well canvassing took place in 1911. Canvassers recorded depth to water and height of water in well for 1,930 of the 3,573 wells recorded (percentage of wells are based on these 1,930 records). "Depth to water" and "feet of water in well" were added to calculate the well depth and this data was analyzed for wells depth statistics. The approximate area canvassed was measured roughly off the map on page 141 from the Dockweiler report.

13.0 CURRENT GROUNDWATER BENEFICIAL USES

13.1 Industrial Use

Using a variety of sources, Muir (1996) compiled information on groundwater use in the Alameda County portions of the basin, including the amount of groundwater pumped by industrial concerns and remediation projects. EBMUD, DTSC, the Environmental Compliance Department of the San Leandro Water Pollution Control District, and the Hayward Sewage Treatment Plant supplied data that were critical to determine this pumpage. He also used a county list of industrial wells and contacted individual industrial concerns to determine if they used groundwater.

Muir found that only ten industrial concerns used groundwater. They pumped a total of 1015 acre-feet in 1995, which came from wells deeper than 200 feet. This was used mainly in food processing and product manufacturing. He estimated that there were about 60 remediation projects in operation in the East Bay Plain in any one year, pumping about 800 acre-feet, generally from wells less than 100 feet deep. Thus, estimated total industrial use in 1995 was 1815 acre-feet.

13.2 Agricultural Use

Muir (1996) compiled information on agricultural groundwater use in the Alameda County portion of the East Bay Plain as follows:

In 1995, five elements were considered: golf courses, cemeteries, schools and colleges, parks, and crops. Data from DWR Bulletins No. 113-3 (DWR, 1975) and No. 113-4 (DWR, 1986) and Sunset (1961) were used to estimate agricultural pumpage.

Golf Courses – Only two golf courses used wells for irrigation; all others used either reclaimed sewage water or water stored in lakes from captured rainfall runoff. It was estimated that the two golf courses pumped 390 acre-feet of groundwater.

Cemeteries – Three cemeteries used approximately 450 acre-feet of well water for irrigation.

Schools and Colleges – Several high schools and colleges use well water to irrigate athletic fields. Their total pumpage for 1995 was estimated to be only 20 acre-feet.

Parks – A number of parks in the East Bay Plain have wells for irrigation purposes, but a total of only 25 acre-feet were used.

Crops – There were only 14 acres of row crops and several hot houses in the area; their estimated pumpage totaled 25 acre-feet.

Table 5. Groundwater Pumpage for Agricultural Use in the East Bay Plain, 1995

Use	Acre-Feet
Golf Courses	390
Cemeteries	450
Schools and Colleges	20
Parks	25
Crops	25
Total Agricultural Usage	910

13.3 Domestic Use

13.3.1 EBMUD Survey

EBMUD staff conducted an agency survey to identify small drinking water systems (2 or more connections) in the East Bay Plain (excluding Castro Valley):

- Alameda County Department of Environmental Health oversees water systems of 2 to 14 connections (Personal communication, Ron Torres).
- California DHS Division of Drinking Water and Environmental Management oversees water systems of 15 and higher connections in Alameda County (John Andrew at 510-540-3227).

- Contra Costa County DEH oversees water systems of 2 to 199 connections (William Alejandro at 925-646-5225 x212).

Although other systems may exist, agency files only indicate several small drinking water systems in Alameda County that rely on groundwater. There are no known small water systems in Contra Costa County. The water systems are grouped below by oversight agency.

Alameda County DEH records indicate two small water systems that rely on groundwater for drinking water:

- The Venice Court Housing Group, located on Venice Court off Dutton in the northern part of San Leandro. One well serves 7 houses. Well depth is unknown.

- 24180 Saklan, off Winton Avenue on the outskirts of Hayward. One well serves 4 or 5 units. The well was deepened in 1989, although well construction details are not known.

DHS ODW records indicate several groundwater-based water systems with 15 or more connections (see Figure 15):

- 2399 East 14th Street, San Leandro. The Trailer Haven trailer park has a 290-foot deep well. Although the site is located near the source of the DWA Plume, solvents have not been detected in water from the well (per Karen Toth, DTSC).

- 28111 Harvey Street in Hayward. One well serves 6 units. Well construction details are not known.

- 6901 Sobrante Road, Oakland, off Skyline. One well serves 4 homes and is pumped at 40 gpm. The well is 275 feet deep. This system is not in the East Bay Plain.

- The Mohrland Mutual Water Company in Mt. Eden, an unincorporated area near Hayward. It serves about 180 connections with one well that is approximately 800 feet deep.

The City of Hayward has installed 4 emergency supply water wells with one more planned. The 5 wells are expected to supply 10,000 gpm for use over 7 days should an earthquake damage the San Francisco Water Department's Hetch Hetchy aqueduct, which is the main drinking water source for the city. The wells range in depth from 464 to 600 feet.

In addition, there may be households with a single well connection using groundwater for drinking water. The following agencies were contacted to identify single connection domestic-use wells:

- Alameda County Flood Control and Water Conservation District (ACFCWCD) issues well permits for much of Alameda County except Berkeley and the areas covered by Zone 7 and the

FIGURE 15. DHS LISTED WATER SUPPLY SYSTEMS

Alameda County Water District (contact: Andreas Godfrey at 510-670-5575).

- City of Berkeley Department of Public Works Permit Service Center 510-883-6555 and City of Berkeley Planning Department Toxics Division (contact: Nabil Al-Hadithy at 510-705-8155).

- Contra Costa County DEH issues well permits for Contra Costa County (contact: William Alejandro at 925-646-5225 x212).

- EBMUD maintains a database of well owners for their Backflow Prevention Program.

EBMUD obtained a copy of ACFCWCD's well database as of January 1, 1997. This compilation of wells is incomplete and may include wells abandoned or destroyed. The well database includes wells permitted by the agency and installed in the Alameda County portion of the Plain (excluding Berkeley) starting in July 17, 1973, with sporadic records of wells installed prior to that. For wells destroyed or abandoned, it is difficult to cross-check installation with destruction records.

As part of the evaluation of beneficial uses in the East Bay Plain, the ACFCWCD data for all wells coded as Domestic, Municipal, Irrigation, and Industrial was analyzed (see Figures 16 and 17). ACFCWCD codes wells as Domestic, Irrigation, Municipal, and Industrial. Of the 1421 wells permitted since July 17, 1973 by ACFCWCD, 1417 (99.6%) are for non-drinking water purposes. A summary of the number of wells in each category is shown below:

Table 6. Number of Permitted ACFCWCD Wells Classified as Domestic, Irrigation, Municipal or Industrial

Use Code and Description	**Total Number of wells <100 ft. deep**	**Total Number of wells >100 ft. deep**	**Sub Total**
Domestic – Small scale irrigation well (e.g. private backyard irrigation well)	331	61	392
[1] Municipal – Large scale drinking water well	2	11	13
Irrigation – Large scale irrigation well	730	169	899
Industrial – Industrial process supply well	38	79	117
TOTAL	1101	320	1421

[1] Of these 13 wells, only 7 are known to be for drinking water supply. These 7 wells consist of 3 owned by the Mohrland Mutual Water Company in Hayward (one of which is active), 2 owned by EBMUD, and 2 owned by the City of Hayward. The remaining 6 wells are not believed to be used for drinking water purposes.

For the following cities, the number of wells indicated as "domestic use" (defined as small scale irrigation wells, e.g. private backyard irrigation wells) or "municipal use" (defined as large scale drinking water wells) are as follows:

- Alameda: 2 wells, 60 and 325 feet deep
- Albany: 0 wells
- Berkeley (although ACFCWCD does not issue permits for Berkeley): 2 wells, 180 and 204 feet deep
- Emeryville: 0 wells

FIGURE 16. EXISTING WELLS FROM ACFCWCD DATABASE (WELLS <100 FEET DEEP)

FIGURE 17. EXISTING WELLS FROM ACFCWCD DATABASE (WELLS >100 FEET DEEP)

- Hayward: 357 wells, depths range from 18 to 763 feet
- Oakland: 32 wells, depths range from 33 to 533 feet
- Piedmont: 24 wells, depths range from 83 to 300 feet
- San Leandro: 76 wells, depths range from 12 to 596 feet
- San Lorenzo: 14 wells, depths range from 30 to 834 feet.

Note that the total wells listed above are greater than shown in Table 6. This is because some wells located in the above cities are outside (i.e., east) of the East Bay Plain basin boundary.

The City of Berkeley issues permits for monitoring wells through its Toxics Division but does not maintain a publicly accessible well database. It is possible that several units near San Pablo Ave. in Berkeley use groundwater for drinking water (per Nabil Al-Hadithy, City of Berkeley). Before approximately 1993, the City of Emeryville issued well permits; now they are issued by ACFCWCD.

Contra Costa County DEH has recorded permitted wells in their database since 1992. However, at the time that this report was prepared, Contra Costa County DEH was not able to provide information from their well database.

EBMUD has a database of well owners in its area for their Backflow Prevention Program. In about 1990, EBMUD used mailings with utility bills to ask customers with wells to contact EBMUD. Backflow devices are installed at houses with a well, regardless of whether the well is in use or tied into the customer's water system. Although no data are collected on the well, customer type is known. The table below shows numbers of wells in the backflow database for each city for several customer classifications.

A map of the location of well owners with backflow prevention devices is shown on Figure 18.

Table 7. EBMUD Customers with Backflow Prevention Devices

City	Single Family	Multi-Family	Other
Alameda	374	20	7
Albany	11	0	1
Berkeley	43	4	1
El Cerrito	28	0	1
Emeryville	1	1	0
Hayward	229	40	5
Oakland	272	27	19
Piedmont	1	0	0
Richmond	317	4	14
San Leandro	1973	43	30
San Lorenzo	768	9	8
San Pablo	291	0	10
Total	4308	148	96

Note: Data in this table is from EBMUD well Backflow Prevention Database. Most of Hayward is not within EBMUD Service Area and is not in EBMUD's BPS database.

FIGURE 18. EBMUD CUSTOMERS WITH BACKFLOW PREVENTION DEVICES

13.3.2 City of San Leandro

In 1994, the City set out to determine if any properties in San Leandro were being serviced by domestic wells. First, the City used existing sources, such as DTSC, to identify all known domestic wells. The City also asked EBMUD to identify all lots in San Leandro that were not being billed. Each of these lots was checked to verify that it was being supplied by EBMUD. Most of the lots were industrial double lots or were an entry error.

After several weeks of investigation, the City was satisfied that all existing residences with no domestic water service other than groundwater had been identified. A total of ten residences were identified. All were offered City assistance to obtain an EBMUD hookup, including homes outside of the known plume areas. By 1995, all but four of the homes were hooked up to EBMUD or had been demolished. In 1998, one of the four homes was additionally connected to EBMUD using private party funds.

The only three potential remaining domestic wells in San Leandro are all outside of the known plume areas.

13.3.3 City of Hayward

ACFCWCD records show there are several “islands” of unincorporated land within the City of Hayward. Over the years, the size and quantity of these “islands” has decreased. As land is incorporated into the City of Hayward, infrastructure is added, including imported water supplied by Hayward. These remaining “islands” represent areas where groundwater is currently being used (i.e. Mohrland Mutual Water Company) or areas with a high probability of use.

13.4 Municipal Use

13.4.1 Hayward emergency wells

The City of Hayward depends on the San Francisco Water Department’s Hetch Hetchy aqueduct for its municipal water supply. Since a major earthquake could disrupt this supply for periods of days, Hayward has installed an emergency water supply well system. To date, 4 wells have been installed of a planned 5-well, 10,000-gpm system. In the event of an earthquake, the wells are expected to be in use for no more than 7 days.

Hayward overlies the San Lorenzo Cone, which contains an upper and a lower aquifer. The emergency water supply well screens are generally perforated across several intervals in the Lower Hayward Aquifer, between 350 and 550 feet below grade. The wells are 18 inches in diameter and were installed using reverse rotary drilling equipment. Although manganese concentrations are above the secondary maximum concentration level (MCL), DHS has given the City approval to use the wells in an emergency. Well water is chlorinated at each wellhead with sodium hypochlorite.

Hayward selected well sites that were generally on City property and adjacent to water transmission pipelines of 12-inch diameter or larger. The City historically operated a wellfield near

Hesperian and Industrial Boulevards; it was phased out of service starting in 1962, when Hetch Hetchy water became available. Only Well No. 9 remains operable (but inactive). Two of the four emergency wells installed to date (Wells B and C) are located near this former wellfield. The fifth well will replace Well No. 9.

13.4.2 East Bay Municipal Utility District (EBMUD)

Background: EBMUD was created in 1923 to provide a public water supply to East Bay communities. By 1929, EBMUD was providing imported water to the East Bay from Pardee Reservoir on the Mokelumne River in the Sierra Nevada Mountains. The reservoir provided a high-quality, reliable supply that soon eliminated the need for local groundwater wells. The District has expanded its boundaries as development has occurred, with demands increasing as agricultural areas with wells were converted into residential communities relying upon EBMUD for water.

EBMUD currently provides water to approximately 1.2 million customers in Alameda and Contra Costa Counties, including all of the East Bay Plain, except for portions of the City of Hayward, which receive water from the City of San Francisco's Hetch Hetchy Project. Average District-wide water consumption is approximately 200 million gallons per day (MGD). Of this, approximately 70-75% is delivered to customers in areas tributary to the East Bay Plain.

Pardee Reservoir provides 95% of EBMUD's water supply, with a small amount of water also contributed by local runoff collected in Briones, San Pablo, and Upper San Leandro Reservoirs in the East Bay hills. Lafayette and Chabot Reservoirs are available for emergency use only.

Normalized current EBMUD demand is expected to rebound to 220 MGD. Gross demand of 277 MGD is projected for the year 2020, much of which will be offset by aggressive conservation and reclamation programs. Supply from Pardee Reservoir is projected as 228 MGD in 2020.

Previous Investigations: For nearly seventy years, EBMUD has benefited from a reliable, high-quality water supply. Therefore, the District did not actively pursue local groundwater as a supplemental supply. In recent years, however, as more demands have been placed on Pardee Reservoir by senior water rights holders and environmental needs, it has become apparent that EBMUD must develop storage to meet customer demands during drought periods. The East Bay Plain Groundwater Basin is currently being considered by EBMUD as a water storage alternative.

In 1986 and again in 1993, the District performed reconnaissance level studies of groundwater resources within its East Bay service area. The study results indicated that at the time, other, higher quality resources might be available. The 1986 study compiled existing water quality information and aquifer characteristics and concluded that the southern part of the East Bay Plain and the San Ramon Valley were most promising for municipal use. In 1993, the District developed a Water Supply Management Program, which included a brief evaluation of local groundwater resources. The study concluded that total yield from local groundwater resources was not likely to meet the District's need for drought water supplies.

In 1997, based on improvements in dual purpose injection/extraction well technology, the District decided to evaluate whether the East Bay Plain could serve as storage for at least a part of the District's dry year supply.

Aquifer Storage and Recovery Pilot Project/Potential Future Beneficial Use: In 1997, EBMUD started a pilot project to evaluate the use of dual-purpose injection/extraction wells in the East Bay Plain. The technology, also known as aquifer storage recovery (ASR), may enable the District to store excess high-quality Sierra water supply underground for future use during a drought or earthquake. By using the same well for both injection and extraction, the District plans to extract virtually the same high quality water supply as was injected.

Exploratory borings were installed at the first project site in western San Lorenzo in the Fall of 1997. The borings indicated the presence of a significant aquifer zone at a depth of 550 to 660 feet below the ground surface. The borings were converted into monitoring wells, which were used to perform preliminary aquifer tests and water quality analyses. The results of these tests indicate that the aquifer appears to be suitable for ASR. Therefore, a more detailed pilot project is being undertaken with a larger well. The well will be tested by alternating cycles of injection and extraction to determine whether ASR may be feasible for EBMUD. In addition, a second pilot test is being initiated at EBMUD's Oakport property across Highway 880 from the Oakland Coliseum. The pilot project reports will be complete in the Spring of 1999 and will present an assessment of the feasibility of using ASR wells in the Plain for emergency water supply purposes.

The results of the pilot projects, along with an assessment of local groundwater resources, will be used to determine EBMUD's future plans for beneficial use of the Plain. Potential beneficial uses by EBMUD include ASR wells, municipal extraction wells, and non-potable irrigation wells. The actual locations of these facilities are not known, but may include any part of the East Bay Plain within the EBMUD service area where high potential for extraction or storage is available.

13.5 East Bay Plain City General Plans for Groundwater Use

In 1996, Regional Board Staff reviewed the General Plans for the East Bay Plain Cities of Alameda, Albany, El Cerrito, Berkeley, Emeryville, Hayward, Oakland, Piedmont, Richmond, and San Leandro, along with the Alameda County Resource Conservation District, the ACFCWCD, the North Richmond Shoreline, and Alameda County (see Appendix F). None of these cities had any plans to develop local groundwater resources for drinking water purposes, because of existing or potential saltwater intrusion, contamination, or poor or limited quantity. Only the City of Hayward is currently developing groundwater as an emergency drinking water supply. General plans for Richmond and El Cerrito acknowledge the potential for groundwater use in an emergency. However, both plans lack any specific details on such use.

However, the lack of interest by East Bay cities to install emergency groundwater wells may actually reflect confidence in EBMUD's role as water supplier rather than general disinterest.

13.6 Freshwater Replenishment

The ultimate points of discharge of groundwater in the East Bay Plain are surface water bodies including streams, lakes and San Francisco Bay. Freshwater bodies and the Bay support a range of aquatic life. Groundwater in the East Bay Plain retains the beneficial use of freshwater replenishment because groundwater discharge helps maintain surface water quantity and quality.

14.0 LOCAL REGULATORY INITIATIVES

14.1 City of Oakland Urban Land Redevelopment (ULR) Program

The ULR is a program designed to facilitate the cleanup and redevelopment of contaminated properties by clarifying investigation requirements, standardizing the regulatory process and establishing pre-approved cleanup standards for qualifying sites based on physical and chemical characteristics, land and water use, and potential for contaminant migration. The program is based on the premise that contaminated properties in Oakland pose not only a public health threat, but also affect the social and economic health of communities. Frequently, contaminated sites remain vacant, unremediated, and undeveloped because remediation and redevelopment efforts are stunted by liability issues, a confusing regulatory framework, and uncertainty surrounding cleanup costs.

Members of the ULR Oversight Committee include representatives from: EPA Region 9, State Board, Regional Board, DTSC, Alameda County EHD, and the City of Oakland. In addition, volunteers from consulting firms participate as non-voting members.

The ULR Program employs a tiered decision-making approach for evaluating sites that contain, or are suspected to contain, soil or groundwater contamination. The first tier consists of comparing site concentrations of chemicals of concern with a Tier 1 look-up table containing cleanup levels applicable at all Oakland sites. The second tier involves characterizing site geology and consists of comparing site concentrations of chemicals of concern with one of three Tier 2 look-up tables that contain cleanup levels based on geological setting. The Tier 2 process takes into account potential for contaminant retardation and migration in three different Oakland soil types: Merritt Sands, sandy silts and clayey silts. The Tier 3 process involves an extensive, site-specific analysis.

In Tiers 1 and 2, the property owner/developer has three options:

1. Clean up to the concentrations in the applicable look-up table.
2. Implement engineering controls that eliminate or sufficiently reduce exposure via pathways of concern
3. Undertake more site-specific analysis in a higher tier.

Cleanup levels for contaminated groundwater are partially dependent on the potential beneficial uses of the groundwater basin. Most groundwater in Oakland is currently designated as a potential source of drinking water, requiring the highest levels of protection. This has a direct impact on the determination of groundwater cleanup levels and, therefore, on development costs and the prospects for economic revitalization in the Downtown and other commercial/industrial areas of the city.

In developing the ULR Program, a Community Review Panel was formed consisting of individuals who constituted a representative cross-section of the Oakland community. The ULR Program Community Review Panel Report indicates that Oakland's shallow groundwater is not currently, nor is it expected to be, utilized as a source of drinking water in Oakland. Further, it acknowledges that, due to historic contamination and alternative sources, groundwater in much of Oakland is neither a healthy nor a cost-effective source of drinking water. With this in mind, the Community Review Panel supports the Regional Board's study and a possible redesignation of the beneficial uses of some portions of Oakland's groundwater on the condition that the following recommendations are implemented:

- Ensure that the redesignation is based on sound hydrogeologic data;
- Show that it will have a positive impact;
- Demonstrate that it will have an equitable impact on the various socio-economic and ethnic groups within Oakland;
- Ensure that a viable plan exists for providing drinking water to Oakland residents in the case of any foreseeable emergency;
- Demonstrate an openness to innovative technologies for providing clean, fresh water;
- Undertake a public education campaign to inform Oakland residents of the potential health hazards associated with the use of groundwater from private wells;
- Increase the minimum well sanitary seal depth required to obtain a well construction permit;
- Ensure that standards for future polluting activities will not be relaxed based on the redesignation of the beneficial uses.

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14.2 Berkeley City Council Actions

In March, 1996, the Berkeley City Council responded to what they perceived as a weakening of the State Board Resolution 92-49 in State Board's Executive Officer Walt Pettit's proposed amendment to the resolution and in the recommendations found in the LLNL Report. Berkeley took the position that Resolution 92-49 gave Regional Boards authority to suspend remediation requirements on a case-by-case basis and suggested that any further loosening of these requirements not be adopted. Berkeley felt that "the initial intent of a containment zone policy was to provide a process for the closure of sites that had undergone remediation but for technological and financial considerations were unable to achieve drinking water standards but would still protect human health and the environment. The containment zone policy as currently proposed does not reflect this goal. Therefore, the City of Berkeley will not adopt these policies, as currently proposed."

Existing Toxics Management Division (TMD) policy is to preserve the water resource, where technologically and financially feasible, and this is consistent with existing State policy and with Berkeley policy set by Council in 1996. In the City's position (discussed in Council in 1996), the resource is identified first and if found to not be of quality, then a lower level of clean up is required. Berkeley's policy has several significant benefits, it reduces dependence on EBMUD water, less water is diverted from Sierra and Delta regions and provides an emergency resource if needed in the future. TMD proposes taking it further by actually correctly identifying and encouraging the use of groundwater for irrigation or industry, where possible. This indicates a commitment of maintaining high environmental and health standards.

14.3 U.S. EPA Brownfields Projects

A "brownfield" is a property, or portion thereof, that has actual or perceived contamination and an active potential for redevelopment or reuse. EPA's Brownfields Economic Redevelopment Initiative is designed to allow states, communities and other stakeholders in economic redevelopment to work together in a timely manner to prevent, assess, safely clean up, and sustainably reuse brownfields. Between 1995 and 1996, EPA funded 76 National and Regional Brownfields Assessment Pilots, at up to $200,000 each, to support creative two-year explorations and demonstrations of brownfields solutions. The pilots are intended to provide EPA, States, Tribes, municipalities, and communities with useful information and strategies as they continue to seek new methods to promote a unified approach to site assessment, environmental cleanup, and redevelopment. EPA has designated three municipalities within the Plain (Emeryville, Oakland and Richmond) as pilot project cities.

14.3.1 Emeryville

Background

Historically, heavy industry was the predominant land use in Emeryville, but the majority of these companies left the area in the 1970s. Currently, 234 acres are vacant or under-used, and 213 acres are known to have soil and groundwater contamination. Nearly half of the City's citizens are low-income, and more than half are minorities. Most of the City's poor live in neighborhoods bordered by brownfields. Although there is demand for residential and commercial development, the cost and risk associated with brownfields have impeded their redevelopment. The result for the City over the past five years has been a loss of $13.3 million in tax revenues and about 450 jobs.

Objectives

The aim of Emeryville's Brownfields effort is to encourage residential and commercial development by building stakeholder confidence in a risk management-based model for brownfields redevelopment. The model will incorporate an emerging State of California regulatory policy based on using an area-wide rather than a parcel-by-parcel approach to environmental cleanups.

Accomplishments and Activities

The Emeryville Pilot has:

- Selected ten brownfields sites for potential redevelopment. Collectively, these sites cover approximately 180 acres;
- Compiled hydrogeologic, soil, and groundwater information from available sources to develop geographical information system (GIS) and developed a Conceptual Groundwater Model (Geomatrix, 1998);
- Achieved a 50% completion milestone in development of a GIS model that incorporates environmental, economic, land use, and zoning information
- Convened a broad-based Community Task Force to serve as a forum for community participation in decision making related to brownfields redevelopment;
- Drafted a regulatory framework for a Mitigation and Risk Management Plan to incorporate a City-wide approach to groundwater cleanup.

Experience with the Emeryville Pilot has been a catalyst for related activities including the following:

- The Chiron Corporation, the second largest biotechnology firm in the country, will redevelop an unused research facility. Chiron will construct 12 new buildings over the span of 20 years to house their biotech firm, creating more than 3,000 jobs during this time.
- Catellus Development Corporation will construct 200 units of mixed income housing on a four-acre Brownfields site, considerably decreasing the City's housing shortage.

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14.3.2 Oakland

Background

Oakland selected two catalyst sites for redevelopment projects in its commercial and industrial centers: the 2-acre Central District Redevelopment Area and a 17-acre portion of the Coliseum Redevelopment Area of East Oakland.

The Central District Redevelopment Area, often referred to as the Uptown Theater District, encompasses Oakland's historic downtown. This area, which is anchored by the historic Fox Theater, was almost completely abandoned by business over the last three decades. Significant groundwater contamination has been identified in large portions of the area and must be addressed prior to redevelopment.

During the past two decades over 20,000 manufacturing jobs have been lost in the Coliseum Area due to plant closure and relocation. Over 600 acres in the Coliseum Area were vacated or are under-used, and over 700 sites were identified as having known or suspected hazardous or toxic contamination. Most of the Coliseum Area is within a federally-designated Enhanced Enterprise Community.

In April 1997, an additional $100,000 was added to the Pilot grant, and is being used to encourage Brownfields redevelopment of the Fruitvale Bay Area Rapid Transit (BART) area's Transit Village project. This large-scale redevelopment project is designed to revitalize the neighborhood with shops, offices, and housing in a pedestrian-oriented setting. This is a local, community-driven project for which EPA is working in partnership with the Department of Housing and Urban Development (HUD), the Department of Health and Human Services (HHS), and the Department of Transportation (DOT) and private entities.

Objectives

The Oakland Pilot is seeking to revitalize the contaminated properties in the Central District and Coliseum Redevelopment Areas as well as the Fruitvale BART Station area. The major focus of the Pilot will be on completing Phase II site assessments and remediation planning. This information will assist Oakland's Redevelopment Agency in developing a strategy for redevelopment of the sites.

Accomplishments and Activities

The Oakland Pilot is:

- Reviewing existing data on two sites and completing site assessments;
- Completing health and safety plans, site surveys, and risk assessments, and preparing summary reports of the findings and recommendations; and
- Developing remedial plans and cost estimates.

Contacts:
Jeffrey Chew, Oakland Office of Economic Development and Employment, (510) 238-3629
Wally Woo, U.S. EPA – Region 9, (415) 744-1207

14.3.3 Richmond

Background

The project area is the 900-acre North Richmond Shoreline, which contains a variety of brownfields in a relatively compact area. Aging heavy industry, low-income housing, idle and vacant properties, and waste disposal facilities are concentrated in an area that borders a distressed neighborhood and an estuarine ecosystem known to support two endangered species. At least 36 properties (90 percent of the City's developable area) are contaminated with volatile organic compounds, polychlorinated biphenyls, and metals. The sector has a mix of thriving large businesses and struggling smaller ones. The presence of hazardous materials on the latter's property, combined with their shaky financial condition, has stymied growth in that sector.

Objectives

The focus of Richmond's brownfields effort is to stimulate economic growth and improve public health and the environmental quality of the Bay. To do this, the project is building on the intensive planning and cooperative partnerships that have evolved over the last five years. Richmond included a green component in its planning that will provide public recreation, open the shoreline for public use, and establish zoning standards to limit industrial activities that may endanger human health and the environment. Richmond is working to increase public awareness of contaminated sites and involve the community in remedial planning and redevelopment activities.

Accomplishments and Activities

Completed Activities:

- Created a computerized inventory of all properties within the project area. The listing includes assessor parcel number, site names, jurisdiction, address, property owner, and other site related information. A site inventory was distributed to interested parties;
- Developed site selection criteria and identified potential sites for matching funds from among the inventoried sites; and
- Held meetings with the North Richmond Industrial and Agricultural Association, the Municipal Advisory Committee, neighborhood councils, the League of Women Voters, and West County Toxics.

Current Activities:

- Completing preliminary site assessments of two to five sites within the North Richmond Shoreline;
- Developing financing mechanisms specifically to promote the City's brownfields process;
- Working to clarify jurisdictional authorities to promote coordination among the City, County, and State;
- Streamlining the regulatory process through cooperative partnerships with State and Federal authorities; and implementing community education and outreach programs to promote full stakeholder participation.

Related Activities:

- Several property owners, representing a number of large properties in the Pilot Project Area, are working together to explore issues of mutual concern such as regulatory cleanup processes and site assessments.
- The Pilot is working with Contra Costa College's Center for Science Excellence to develop information on the environmental status of each property in the inventory.

Contacts:
Nancy Kaufman, Planning Department, City of Richmond, (510) 620-6706
Wally Woo, U.S. EPA – Region 9, (415) 744-1207

14.3.4 Base Reuse Authority

There are a number of closing military facilities in the East Bay Plain. These include the Oakland Army Base, Alameda Naval Air Station, Fleet Industrial Supply Center Oakland, Oak Knoll Naval Hospital, and the Navy's Point Molate Fuel Depot. The facilities will be or have been taken out of military service and are intended for beneficial reuse. As part of the process leading to reuse, the facilities are being investigated and remediated to reduce impacts to human health and the environment to acceptable levels.

15.0 FINDINGS

This section summarizes the six key findings of the report.

15.1 Portions of the East Bay Plain currently support all of the groundwater beneficial uses listed in the Basin Plan.

Until the 1930s, the East Bay Plain Groundwater Basin historically was extensively used for drinking water, industrial, and agricultural supply. However, because of the lack of an adequate and dependable supply for a growing population, the East Bay now relies on imported surface water to satisfy nearly all drinking water and industrial demands. By far the most frequent current use of groundwater is for irrigation from "backyard" private shallow wells. It is estimated that East Bay Plain groundwater is used by over 4000 homeowners for irrigation. Groundwater is also still used by 10 businesses for industrial purposes and by several users to irrigate a few parks, golf courses, cemeteries and schools.

Groundwater is still used as source of drinking water by several small systems in the cities of Hayward, San Leandro and Oakland. A total of five permitted water systems (three in Hayward and two in San Leandro) are known to serve between 4 and 180 households each. The only known permitted system in Oakland is located in the Oakland Hills above the East Bay Plain Groundwater Basin. There are no permitted water supply systems north of Oakland.

In addition, according to Alameda County Flood Control & Water Conservation District's (ACFCWCD's) records, there are 507 wells that are classified as municipal or domestic wells. Nearly all of these wells are believed to be used for residential irrigation. However, there are still some individual private wells being used for drinking water.

The following table shows the existing and potential beneficial uses as determined by this evaluation for the Sub-Areas proposed by Figuers (1998).

Table 8. Existing and Potential Beneficial Uses in Sub-Areas of the East Bay Plain

Sub-Area	MUN – Municipal And Domestic Water Supply	AGR – Agricultural Water Supply	IND –Industrial Service Water Supply and PROC Industrial Process Supply
Richmond	E[1]	E	E
Berkeley	E[1]	E	E
Oakland	E[1]	E	E
San Leandro	E	E	E
San Lorenzo	E	E	E
Central	E[1,2]	E	E

P-Potential E-Existing

[1] No known existing drinking water wells, existing MUN designation based on backyard irrigation use.

[2] EBMUD has installed a pilot aquifer storage well in the Central Sub-Area, which, if successful, would result in an existing beneficial use.

15.2 A review of historical groundwater beneficial uses provides insight into future probable uses.

All water supplies in the East Bay were derived from wells and local runoff until the import of Sierra water into the area in 1930. Figuers (1998) searched for historical private and municipal wells as part of a comprehensive evaluation of groundwater conditions in the East Bay Plain for the Regional Board. In addition to municipal well fields, thousands of private wells supplied water to homes and businesses. In 1911, there was an extensive survey of all private and public wells in the East Bay area, locating and mapping more than 3400 active wells serving a population of about 232,150 (1910 census). Norfleet estimates that in the range of 15,000 wells were drilled in the East Bay Plain between 1860 and 1950. The majority of the wells were less than 50 feet deep, but many were 200 to 500 feet deep, with the deepest reaching 1000 feet below the ground surface. A few are still in use today, but most were abandoned and forgotten. Virtually none of these wells was properly destroyed.

Table 9. Summary of East Bay Plain Groundwater Basin Sub-Areas

Sub-Area	Approximate Basin Depth	**Historic Municipal Groundwater** Well Fields (circa 1890-1930)	Are Significant Aquitards Present?
Richmond	>600 ft.	Yes, San Pablo and Richmond Well Fields	No
Central	>1000 ft	Yes, High Street Well Field	Yes
Berkeley	< 300 ft.	No, but suitable for limited single family/industrial users. No historical evidence that groundwater supplies are sufficient for municipal use	No
Oakland	< 700 ft.	Yes, Fitchburg Well Field	Yes, along western portion
San Leandro	700-1100 ft.	No, however, area was primarily rural prior to 1930.	Yes, along western portion
San Lorenzo	700-1100 ft.	Yes, Roberts Well Field	Yes, along western portion

15.3 Shallow groundwater has been degraded locally in much of the East Bay Plain and regionally in the Cities of Emeryville and San Leandro. Deeper groundwater supplies are at risk given the number of abandoned wells.

Ambient monitoring data on common organic pollutants within the deeper groundwater (i.e., deeper than about 100 feet) is very limited. Based on this limited data, the overall water quality of deep groundwater in the East Bay Plain is good. Much more data is available on the water quality of shallow groundwater (i.e., less than about 100 feet). Some shallow groundwater has been impacted by historical and current releases of fuels and solvents. See Section 8.0 and 9.0 for a more detailed discussion on water quality.

Groundwater pollution in the East Bay Plain appears to generally be restricted to portions of the shallow aquifers. Typically, site investigations require that groundwater plumes be defined in both the lateral and vertical dimension. In almost all cases, groundwater pollution appears limited to less than 50 feet below the ground surface.

However, recently one of EBMUD's aquifer storage test wells detected contamination at a depth of over 200 feet below ground surface. Volatile organic compounds were detected in a test well located west of Interstate 880 about one mile north of the Oakland Coliseum. TCE was detected in the test well at 50-70 ppb that was screened between 260 and 350 feet below ground surface. Prior to this detection, no pollution had ever been detected above trace levels at depths greater than 140 feet. The source and migration pathway for the TCE contamination is currently under investigation by DTSC.

Although the source of the above deep groundwater contamination has not been defined, it may illustrate the potential for connection between the shallow deposits and deeper aquifers. Moreover, given that there are very few existing wells pumping from the deeper aquifer, and the numerous historical wells in the East Bay Plain that could be vertical conduits, if the number of wells pumping from the deeper aquifer increases, there is a potential that shallow pollution could be drawn down into the deeper aquifers.

15.4 Innovative remedial approaches are being developed to manage East Bay land that often contains soil and groundwater pollution.

Several significant land development and redevelopment initiatives may be affected by the regulatory recommendations resulting from this beneficial use evaluation. The initiatives are as follows:

- Closing Military Bases and Conversion to Civilian Uses;
- City of Oakland Urban Land Redevelopment Program; and
- US EPA's Brownfields Economic Redevelopment Initiative for Emeryville, Oakland, and Richmond.

These initiatives have a common interest in remediating and redeveloping East Bay land that often contains soil and groundwater pollution.

A legacy of intense urban and industrial development has contaminated some soil and portions of the shallow East Bay Plain aquifers. In general, addressing soil contamination issues is relatively straightforward compared to groundwater. For soil cleanup, most projects utilize a risk-based approach to establish cleanup levels. Then, based upon redevelopment, technical, and economic factors, the soil is either excavated to remove chemicals above a prescribed level or remediated in-situ. Groundwater cleanup, on the other hand, poses a much more difficult dilemma. First, groundwater contamination is usually much larger in areal extent than soil contamination and may underlie many other properties besides the source property. Second, since all groundwater is essentially currently designated with a municipal beneficial use, the groundwater cleanup objectives are set no greater than drinking water standards. Given the technical difficulty of restoring contaminated aquifers, most groundwater cleanup involves significant expenditures in the range of $100,000 - $1,000,000+, and time frames measured in decades (for VOCs). Compared to soil cleanups, costs for groundwater cleanups are much more difficult to forecast. The staggering costs and potential liability associated with cleaning up this contamination severely impacts local redevelopment efforts.

The uncertainty in projecting cost and cleanup time has resulted in financial institutions being unwilling or very risk-adverse when considering whether to invest in groundwater contaminated areas of the East Bay Plain. In addition, the uncertainty breeds delays in converting closing military bases to civilian uses including expanding the Port of Oakland's maritime facilities. Moreover, most groundwater contamination is located in shallow groundwater zones that are unlikely to ever be used as a source of drinking water and are often isolated from deeper or regional aquifers. The viewpoint of many of the parties involved in groundwater remediation is that society is essentially spending enormous amounts of money to remediate contaminated shallow groundwater even though it will take decades to restore, is unlikely to be used, is usually isolated from deeper and regional aquifers, and if used, will likely still need treatment to meet use requirements.

Additionally, several other essentially local programs and initiatives may have an impact upon groundwater cleanup: US EPA's Underground Injection Control program, wellhead protection programs, and source water protection programs under the amended Safe Drinking Water Act. At this time, none of these programs have been developed enough to indicate their impacts on redesignating beneficial uses.

15.5 East Bay Municipal Utilities District is considering using portions of the East Bay Plain for conjunctive use.

In 1997, EBMUD started a pilot project to evaluate the use of dual-purpose injection/extraction wells in the East Bay Plain. The technology, also known as aquifer storage recovery (ASR) may enable the District to store excess high-quality Sierra water supply underground for future use during a drought or earthquake. By using the same well for both injection and extraction, the District plans to extract virtually the same high quality water supply as was injected. The results of the pilot projects, along with an assessment of local groundwater resources, will be used to determine EBMUD's future plans for beneficial use of the Plain. Potential beneficial uses by EBMUD include ASR wells, municipal extraction wells, and non-potable irrigation wells. The potential locations of these facilities are not known, but may include nearly any part of the East Bay Plain within the EBMUD service area. Aquifers likely to be used would be below the Yerba Buena Mud.

15.6 EBMUD's Backflow Prevention Database can be used to supplement ACFCWCD well searches.

Two public databases that contain information on existing wells in the East Bay Plain yield notably different estimates. The ACFCWCD database covers the Alameda County portion of the East Bay Plain. EBMUD maintains a database of addresses where they have installed backflow prevention devices at residential or commercial properties that have volunteered that they have wells. EBMUD's database covers the entire East Bay Plain with the exception of Hayward, which is outside their service area. Comparisons between the two databases yield notably different estimates regarding the number of wells in different communities. The following table provides an example of the differences between the databases in the number of wells in selected cities.

Table 10. Comparison of EBMUD and ACFCWCD Well Databases

City	[1]EBMUD Backflow Prevention Database	[2]ACFCWCD Well Permit Database
Alameda	400	2
Oakland	400	32
San Leandro	1958	76
San Lorenzo	756	14

Note:
[1] EBMUD database only includes wells owned by property owners that voluntarily agreed to participate in its backflow prevention program.
[2] ACFCWCD database only includes wells drilled after 7/17/73 and wells documented by DWR for the groundwater investigation in Alameda County in the 1960's.
Above statistics are for all domestic, municipal, industrial and agricultural wells.

Currently, environmental consultants use the ACFCWCD database to search for active wells in the vicinity of groundwater pollution sites. Since the EBMUD backflow database has a greater number of wells, consultants should also search this database although there may be privacy issues to be resolved.

16.0 ANSWERS TO KEY QUESTIONS

At the outset of this beneficial use evaluation, the committee posed six key questions:

Question No. 1. What are the current and planned future groundwater beneficial uses of the East Bay Plain?

Answer: All groundwater beneficial uses currently exist in the East Bay Plain. However, the existing uses are relatively limited in certain Sub-Areas. The only firm plans for future use are by the City of Hayward for Emergency Supply (see Section 13.4.1). In addition, EBMUD is evaluating the potential for use of the East Bay Plain for storage of imported surface water and/or use of native groundwater (see Section 13.4.2).

Background: Groundwater was the major source of drinking water in the East Bay prior to the development and import of a Sierra water supply in the 1930s to serve a growing population and to solve water supply reliability problems. Since that time, groundwater has served only a minor role in water supply, primarily for industrial or irrigation purposes. However, following 60 years of near obscurity, there has been a recent resurgence in interest in using groundwater as a supplemental water supply (e.g., Hayward's emergency groundwater municipal supply system) and some others are being seriously considered (EBMUD's groundwater storage and retrieval project). A new test well was drilled by EBMUD in the San Lorenzo area during 1998. The 660-feet deep well was constructed to evaluate the potential for using the East Bay Plain aquifer to store imported surface water. The water would be used in the event of a drought or after a major earthquake. EBMUD is evaluating another well site near the Oakland Coliseum and may consider other sites within the East Bay Plain. Such storage is attractive because it would provide a reliable, although limited, emergency supply west of the Hayward Fault. The City of Hayward has in the past few years installed four wells as part of a five well project to provide a 7-day emergency municipal water supply in the event of an emergency (e.g., earthquake).

Question No. 2. Can the East Bay Plain be subdivided into Sub-Areas based on hydrogeology?

Answer: Yes, and it should be. The East Bay Plain has been subdivided by several previous investigators (Todd, 1986; Muir, 1988; Maslonkowski, 1988; Figuers 1998). Figuers' subdivision is a refinement and expansion of Muir and Maslonkowski's work. For this beneficial use evaluation, it is recommended that the Basin Plan be revised to incorporate the groundwater basin subdivisions of Figuers (1998).

Background:
The East Bay Plain can be subdivided into six Sub-Areas (Figuers, 1998), (Figure 13). The Sub-Areas laterally merge into one another, and there are few distinct subdivisions based upon depositional source. No distinct flow boundaries/barriers, topographic, or geologic features provide easily recognizable boundaries. The Sub-Areas were based on a combination of previously defined boundaries and a specific analysis requested by the Regional Board of Figuers of geologic, hydrogeologic, and geomorphic factors available from historical and contemporary data.

Question No. 3. Where is the use of the East Bay Plain limited?

Answer: Groundwater uses in portions of the East Bay Plain Sub-Areas are limited by several factors: 1) existing high TDS levels in shallow Bay Front aquifers, 2) the existing high TDS levels in artificial fills, 3) the potential for saltwater intrusion, 4) volatile organic compound groundwater contamination in portions of the shallow aquifers, 5) lack of significant water quantities and/or storage, and 6) shallow non-point source groundwater contamination from leaking sewer lines, septic systems and applied fertilizers.

Background:
Based upon an analysis of the available data, some limitations on the use of the Sub-Areas are as follows:

Table 11. Municipal Beneficial Use Limiting Factors in the East Bay Plain

Sub-Areas	Extensive Shallow VOC Groundwater Pollution	Existing High TDS Levels in Artificial Fill	Existing High TDS Level in Shallow Bay Front Aquifers
Richmond		√	√
Berkeley			
Oakland		√	√
San Leandro	√		
San Lorenzo			
Central		√	√

Question No. 4. Can the shallow and deep zones have different designations?

Answer: The question is applicable because most groundwater pollution in the Bay Area is shallow (i.e., less than 50 feet below the ground surface) and most use, other than for backyard irrigation, is from deeper aquifers, typically greater than 200 feet below ground surface. Based primarily upon available data, at this time it appears that the shallow and deep aquifers cannot have different designations in most of the East Bay Plain. However, there are localized situations where such differentiation can be made.

Background:
The Yerba Buena Mud forms a major aquitard between the shallow and deep aquifers throughout much of the southwest portion of the East Bay Plain. However, the integrity of the aquitard probably is compromised due to the drilling of wells in the 1890-1930 time frame. In Oakland, it is estimated that there are over 200 wells that penetrated the Yerba Buena Mud. Virtually none of these wells were properly destroyed. In the remaining portions of the East Bay Plain, the Yerba Buena Mud is not present and thus no natural aquitard separates the shallow and deep aquifers.

One exception is the area along the extreme western East Bay Plain Shoreline where artificial fill was placed after 1930. In this area the Yerba Buena Mud is continuous and should form a natural barrier to minimize the downward spread of pollution.

From a hydrogeologic standpoint, no aquitard is impermeable. However, for significant downward migration to occur several factors need to be present. First, a pollution source must be present with high enough residual concentrations to be detectable if it migrates from the shallow to the deeper aquifers. Second, there must be a pathway for the pollutants to migrate from the shallow to the deep aquifers. This pathway may be a man-made conduit such as an improperly installed or abandoned well, or natural discontinuities in the aquitard itself. Lastly, a gradient must be present that drives the contaminants downward. This can be due to hydraulic gradient downward caused by pumping from the lower aquifer, or a density gradient caused by the presence of dense non-aqueous phase liquids such as free phase solvents or PCBs.

In the Santa Clara Valley, shallow groundwater contamination has rarely migrated through the regional aquitard and effected the deeper aquifers. However, of the several sites with pollution below the regional aquitard, nearly all are believed to be due to vertical migration along abandoned or poorly destroyed wells.

Question No. 5. Should any current beneficial use designations change?

Answer: Groundwater beneficial uses should be changed in the vicinity of the Port of Oakland Alameda Point and the Chevron Refinery in Richmond for artificial fill. Such changes are described in Section 17.9.

Background:
The current Basin Plan designates all groundwater beneficial uses as "existing." While this designation is appropriate for the East Bay Plain as a whole, the designations do not apply when the basin is appropriately divided into Sub-Areas.

As outlined in the discussion of Question 3, municipal and domestic supply beneficial use is limited in several areas of the East Bay Plain. Most notably, the shallow artificial fill along the Bay-front is unlikely to be used as a source of drinking water due to the existing high TDS, potential for saltwater intrusion, and relatively low yield.

Question No. 6. Are there any areas requiring special protection programs?

Answer: Several areas should receive additional focus. First, the deeper portions of the basin in the San Lorenzo, San Leandro, Southern Oakland and Richmond Sub-Areas appear to be the most likely areas for future potential MUN beneficial use. Monitoring the deeper aquifers for organic pollutants is necessary. Second, a well destruction program should be initiated to locate and seal abandoned wells in the East Bay Plain. Former wells located near emergency water supply wells, and aquifer storage and recovery wells would be primary candidates for determining their location and destruction. Third, the existing water supply systems listed in Section 13.3 should be subject to a source water protection program.

17.0 RECOMMENDATIONS

Based on the analysis and findings of this report, the following recommendations are made:

17.1 The Regional Board should amend the Basin Plan to recognize the East Bay Plain Basin Sub-Areas. (As shown on Figure 13).

17.2 The existing ACFCWCD regional groundwater monitoring network should be expanded to include more wells, monitored more frequently, and for a larger list of chemicals of concern. A similar network is also needed in the Contra Costa County portion of the East Bay Plain.

Such a network could be modeled after the proposed monitoring program developed as part of a USEPA grant application (City of Emeryville, 1998). The grant was not funded, but the cooperating agencies are interested in the network. The grant sought to create the "East Bay Groundwater Awareness and Information Network" (GAIN). The objective of GAIN are (1) to design a community based, time relevant groundwater monitoring program network, (2) cultivate public interest in obtaining and using information, (3) complete a time relevant groundwater monitoring network, and (4) manage, process, and deliver groundwater monitoring data to the public. GAIN is designed to provide East Bay residents with the ability to gauge for themselves the overall "health" of their deep groundwater resources. GAIN also targets localized areas where groundwater is contaminated and residents have requested monitoring data to guide decisions affecting economic revitalization.

17.3 Agencies within the East Bay Plain should make their well databases more accessible to the public.

A well search is typically required as a part of a groundwater contamination investigation that involves a plume that has migrated offsite and beneath adjacent properties. The purpose is to determine if any groundwater wells could be impacted by the plume, and to notify the well owner if necessary. A well search may include a database review, door-to-door surveys and/or targeted mailings.

Five agencies maintain well databases in the East Bay Plain. ACFCWCD is the primary well permitting agency in the Alameda County Portion of the basin, and well searches can be requested by contacting Andreas Godfrey at 510-670-5575. EBMUD has a database of well owners in its area for their Backflow Prevention Program (see Figure 18). The Regional Board has a database of historic wells that are shown in Figure 2 of this report. Contra Costa County and the City of Berkeley both permit well installations in their respective jurisdictions, but, well searches are not currently publicly available. Both Contra Costa County and the City of Berkeley have plans to make their well databases more accessible in the future.

FIGURE 19. PROPOSED GROUNDWATER MANAGEMENT ZONES AND DEDESIGNATION AREAS

Plans are under way to coordinate EBMUD's backflow database and the historic well locations contained in Figuers (1998) with ACFCWCD's database and make all three databases available at one agency.

17.4 The Regional Board Staff should encourage the use of aquifers in the East Bay Plain for groundwater storage.

An increase in local storage capacity would be a small but significant step towards implementing the recommendations of the Comprehensive Conservation and Management Plan (CCMP) prepared by the San Francisco Estuary Project. The CCMP encourages the use of groundwater basins with the capacity to store additional water to be used as "water banks." Freshwater inflow is a major factor that determines environmental conditions in the Estuary. The volume and timing of freshwater inflow affects the Estuary's circulation and water quality, conditions for wildlife and the survival of aquatic species. If groundwater from existing sources or surface water is stored in these aquifers (either from surface water sources in wet years or from treated wastewater), demand on limited surface water resources can be reduced.

17.5 The Regional Board staff should encourage the establishment of a basin-wide groundwater management program.

This could take the form of a formal AB 3030 Groundwater Management Plan with a Wellhead Protection Plan included, a stand-alone Wellhead Protection Plan, or a regional plan that addresses issues specific to the East Bay Plain.

Currently, much historical and geological information is available on the past use of groundwater, water availability and quality, as well as problems encountered by past use. EBMUD is currently evaluating the potential of using the East Bay Plain for conjunctive use and has drilled two deep wells in the study area. At a minimum, it would be useful for both planning purposes and water quality protection to develop some type of plan that would address the specific issues within the potential capture zones of the new wells.

Elements of the management plan could address: saltwater intrusion, overdraft, delineation of the aquifer and its recharge areas, location of potential sources of contamination (e.g., a source water protection plan), a plan to decommission old wells, conjunctive use, proper well construction, coordination with local, state and federal agencies, and review of land use planning activities that might create a risk to groundwater.

If EBMUD's pilot groundwater storage project is successful, then they would be the obvious local agency to assume a management role in the East Bay Plain. In addition, the ACFCWCD charter provides the county with some groundwater management authority. By monitoring both groundwater levels and quality, ACFCWCD is practicing the first level of groundwater management.

17.6 The methods required for conducting a Vertical Conduit Study and Well Search in the East Bay Plain should be formalized by the Regional Board.

There is no formal guidance that describes the necessary tasks for conducting Vertical Conduit Studies or Well Searches in the East Bay Plain. Given the importance of such studies as part of groundwater contamination investigations, it is recommended that the information collected in this report as well as other references on the subject be compiled into a single document.

Cities within the East Bay Plain and Alameda and Contra Costa Counties should consider implementing a well abandonment program similar to the one developed by the Alameda County Water District. Such a program would require developers to destroy any abandoned wells prior to redevelopment.

17.7 The Regional Board should encourage the establishment of a vertical conduit location and abandonment program.

It is estimated that there are 15,000 historical wells in the East Bay Plain that were drilled between 1860 and 1950. Most of these wells have been abandoned but not properly destroyed. Some of these wells may pose a current threat to the East Bay Plain because they provide a potential vertical pathway for shallow contamination to migrate into the deeper zones. The program could be implemented by Contra Costa and Alameda counties.

17.8 The GIS coverages that were developed as part of this Beneficial Use Evaluation should be updated regularly and made accessible to the public on the Internet.

The databases include location information on groundwater pollution sites and historical and modern well locations. A dedicated funding source for maintaining these coverages will need to be located. The GIS analysis conducted for this project identifies areas where their efforts can be targeted.

17.9 Proposed Groundwater Management Zones and Dedesignation Areas

The East Bay Plain can be subdivided into three management zones for purposes of prioritizing groundwater remediation and dedesignating beneficial uses. Subdivisions were developed by utilizing the information presented in this report on water quality, historic, existing and probable-future beneficial uses, and hydrogeology.

The following subdivisions are proposed for preserving and restoring groundwater beneficial uses in the East Bay Plain. A description of each subdivision is included below, summarized on Tables 12 and 13 and shown graphically on Figure 19.

Zone A - Significant drinking water resource. Remedial strategies should be focused on actively maintaining or restoring groundwater quality to drinking water quality objectives. These areas historically supported a municipal beneficial use prior to the 1930's and likely could, with proper management, be used as a limited municipal source of drinking water in the future. In Hayward and San Leandro, there are five permitted small water system wells that serve, collectively, over 200 individual users. However, relatively low recharge rates limit the sustained yields. Cleanup, spill prevention and education efforts within the source water protection zones of existing municipal wells should be the top priority of local and state programs.

Portions of Zone A may warrant higher concern. For example, areas within Zone A with a high density of potential conduit wells and/or shallow backyard wells may need to receive higher priority and be subject to more detailed investigations than other areas. An example of delineating such areas is shown on Figure B-3 in Appendix B.

From a beneficial use perspective, these areas are of higher concern because 1) historic wells may act as vertical conduits and allow shallow contamination to migrate into deeper aquifers, 2) current backyard irrigation wells may represent an incidental drinking water exposure pathway to groundwater contamination as well as a non-drinking water pathway (e.g., volatilization or irrigation of fruits and vegetables), and 3) contamination sites within source water protection zones may impact existing or planned drinking water wells.

Investigation and remediation of groundwater contamination sites within areas of higher concern should be tailored to address the potential for beneficial uses to be impaired due to any of the three above issues. Depending on the site-specific circumstances, this may include a more in-depth investigation (to identify the location of historic or current wells) or more aggressive remediation (to protect current or planned drinking water wells). Groundwater contamination sites within source water protection zones should be the top priority of local and state programs.

Within Zone A, there are also areas that may warrant less aggressive remediation on a case-by-case basis. As a mechanism to both recognize that the shallow groundwater is unlikely to be used for drinking water, but still safe guard the deeper aquifers for future drinking water supply uses, a less aggressive remediation strategy is recommended. Criteria for allowing less aggressive remediation in Zone A areas is discussed in Recommendation 17.10.

Zone B - Groundwater that is unlikely to be used as a drinking water resource. While these areas meet the broad "sources of drinking water" criteria, limiting factors related to yield and water quality restrict practical uses. Remedial strategies should reflect the low probability that groundwater in this zone will be used as a source of drinking water in the foreseeable future. However, other beneficial uses/exposure pathways exist and should be protected. These include domestic irrigation, industrial process supply, human health, and ecological receptors. The potential for exposure via incidental ingestion from back yard wells should be evaluated. Appendix B highlights areas within Zone B that have the highest density of backyard wells. Zone B areas should utilize risk based corrective action in establishing groundwater cleanup standards. Passive remediation to restore MUN beneficial uses as a long-term goal is recommended.

Important Note - This report is not recommending beneficial use dedesignation for Zone B areas. Furthermore, these recommendations should not be considered as advocating a "No Action" approach to groundwater pollution. Rather, Zone B is an area where other, non-drinking water, exposure pathways are more likely to "drive" remediation.

Within the Easy Bay Plain, areas proposed for Zone B management are:

> **Berkeley Sub-Area Groundwater Management Zone:** Groundwater extraction for municipal drinking water supply is unlikely in the Berkeley Sub-Area due to the relatively thin aquifer (ranging from 10 to 300 feet thick, and averaging 100-200 feet thick) and limited groundwater recharge (Figuers, 1998). Accordingly, remedial strategies should be focused on actively protecting existing domestic irrigation and industrial uses and potential aquatic receptors rather than as a municipal drinking water supply. Achievement of drinking water objectives within a reasonable time period is an appropriate long-term goal. At a minimum, groundwater pollutant sites would be regulated pursuant to SWRCB Resolution 92-49, and need to demonstrate 1) that reasonably adequate source removal has occurred, 2) the plume has been reasonably defined both laterally and vertically and 3) a long-term monitoring program is established to verify that the plume is stable and will not impact ecological receptors or human health (e.g., from volatilization into trenches and buildings).

> **Emeryville Brownfields Groundwater Management Zone:** Groundwater is not currently used for any municipal, domestic, industrial, or agricultural purpose in Emeryville. No extractive beneficial uses are planned in the future. Remedial strategies should focus on protecting potential aquatic receptors and potential future irrigation or industrial uses. Achievement of drinking water objectives within a reasonable time period is an appropriate long term goal. Emeryville has developed a sub-regional groundwater monitoring plan that will provide information on both the shallow and deeper aquifer water quality. In addition, Emeryville has developed a detailed GIS system for tracking contaminated properties that will help to prevent inappropriate land uses. Lastly, Emeryville may consider assuming some of the liability for the groundwater pollution as well as overseeing smaller cleanups under an agreement with DTSC and the Regional Board.

Zone C - Shallow, nonpotable groundwater proposed for dedesignation of the Municipal Supply Beneficial Use. The Regional Board should locally dedesignate the municipal beneficial use for brackish, shallow groundwater in Bay-front artificial fill, young bay mud and the San Antonio Formation/Merritt Sand. This groundwater meets the exemption criteria of the State Water Resources Control Board's (SWRCB's) Sources of Drinking Water Policy because the groundwater could not reasonably be expected to serve as a public water supply and exceeds the 3000 mg/L total dissolved solids criteria. Cleanup should be protective of ecological receptors and human health. In addition, pollution sites will continue to be required to demonstrate 1) that reasonably adequate source removal has occurred, 2) the plume has been reasonably defined both laterally and vertically and 3) a long-term monitoring program is established to verify that the plume is stable and will not impact ecological receptors or human health (Pursuant to SWRCB Resolution 92-49. Remedial strategies should focus on other exposure pathways such as human health and ecological receptors.

In addition, for Zone C areas overlying more productive, although currently unused deeper aquifers, potential vertical conduits should be located and properly destroyed. Contamination in deep zones underlying Zone C would be subject to the requirements of Zone A.

Two shallow groundwater areas in the East Bay Plain are recommended for dedesignation. Any deep aquifers in these areas would continue to be designated as MUN.

Oakland Shoreline/Alameda Point Brackish Shallow Groundwater Zone: In this zone, shallow bay-front groundwater in the artificial fill, Young Bay Mud and San Antonio/Merritt Formations generally exceeds the 3000 mg/l TDS criteria (SWRCB Resolution No. 88-63). Dedesignation of the municipal beneficial use in this area is therefore warranted. While some artificial fill has TDS below 3000 mg/l (due to recharge from rainfall, landscape irrigation and leaking water pipes), most groundwater to a depth of 100 feet below ground surface is not a Resolution No. 89-39 source of drinking water. An evaluation of TDS data in the vicinity of the FISCO Navy Base, Port of Oakland and Alameda Point is included in Appendix G. A review of groundwater TDS data from other portions of the Port of Oakland High TDS Zone (i.e., Port of Oakland, Alameda Point, Oakland Army Base) shows similar results.

Chevron Richmond Refinery: This is a large refining complex and tankfield. Over 300 different refined petroleum products are manufactured and stored at the refinery. The refinery was built at the turn of the century. The 2900-acre refinery lies along the southern shore of San Pablo Bay in Contra Costa County. Portions of the property were created from bay fill.

Groundwater pollution at the refinery is prevented from migrating off site by a four-mile long slurry wall/ groundwater interceptor trench, known as the Groundwater Protection System (GPS). Groundwater extraction through the trenches and/or wells establishes and maintains a contiguous capture zone, which prevents migration of potentially contaminated shallow groundwater past the GPS alignment. A low permeability Bay Mud “floor” inhibits vertical transport of shallow contaminants to the underlying deeper aquifers (see Appendix D for more detail). Since 1988, Chevron has spent approximately $100 million on groundwater remediation at the Richmond Refinery.

Dedesignation of the municipal beneficial use of the shallow groundwater (to approximately 100 feet) is proposed beneath the “Flats Zone” which comprises the flatland marsh area bounded by San Pablo Bay to the north and extending south along the northeast side of Potrero-San Pablo Ridge. The Regional Board has previously found that the GPS is a satisfactory corrective action measure and protects beneficial uses of San Francisco Bay and underlying deeper aquifers.

17.10 Less Aggressive Remediation Approach

Within the East Bay Plain, there are groundwater pollution plumes that may warrant less aggressive remediation on a case-by-case basis. In general aggressive cleanup may not be warranted when the plume is shallow, concentrations are declining and no beneficial uses are threatened. The requirement for aggressive cleanup can possess a serious obstacle to redevelopment of blighted brownfields. The goal of the proposed Less Aggressive Remediation Approach is to outline "basin specific" situations where less aggressive remediation may be acceptable.

One example is pollution in shallow deposits above the Yerba Buena Mud. Groundwater in these shallow deposits is unlikely to be used as a source of drinking water (due to low yield, elevated levels of coliform from leaking sewer pipes, and requirement for a 50-foot well seal for new municipal wells). However, deeper aquifers beneath the Yerba Buena Mud do have a high potential for municipal development. Therefore, it is important that existing pollution in the shallow deposits is prevented from migrating into the deeper aquifers below the Yerba Buena Mud. As a mechanism to both recognize that the shallow groundwater is unlikely to be used for drinking water, and to safe guard the deeper aquifers for future drinking water supply uses, the following approach is recommended.

Ultimately, the remedial options that would be part of less aggressive strategy are dependent on site specific conditions. However, likely options could include restricting groundwater remediation to the source area only, allowing monitored natural attenuation, or implementing pump-and-treat solely to limit plume migration.

Less Aggressive Remediation Approach Criteria: The Regional Board should consider allowing less aggressive remediation within Zone A, on a case-by-case basis, provided that the responsible party demonstrates to the satisfaction of the Board, at a public meeting, that the following criteria are addressed:

1) the pollution is pre-existing and has not occurred subsequent to this policy;
2) pollutants are reasonably characterized both laterally and vertically;
3) the source is reasonably removed or remediated;
4) pollutant concentrations are stable or declining, and the requisite concentration levels will be attained within a reasonably defined time period;
5) the shallow aquifer is separated from the deeper aquifer by a continuous confining layer (the Yerba Buena Mud or its lateral equivalent aquitard);
6) potential vertical conduits are properly destroyed;
7) existing groundwater and surface water beneficial uses are not impacted by the pollutants;
8) the proposal is consistent with any local groundwater management plans and well head

protection areas (current or future).

The Regional Board should provide a 30-day public notice to all known, interested parties when considering taking such an action.

Comparison of "Less Aggressive Remediation Approach" **to "Containment Zone Policy":** Both the Containment Zone Policy and the proposed Less Aggressive Remediation Approach specify criteria to address existing pollution plumes. The following discussion provides a brief summary of the Containment Zone Policy and then contrasts key differences.

The Containment Zone Policy (SWRCB Order No. 92-49) provides a mechanism for regulating groundwater pollution where "attainment of applicable water quality objectives cannot reasonably be achieved," and is defined as a specific portion of a water bearing unit where the Regional Board finds that it is unreasonable to remediate to the levels that achieve water quality objectives.

The Containment Zone Policy establishes a number of conditions that must be satisfied before a containment zone may be adopted by a Regional Board. For instance, a containment zone applicant must "take all actions necessary to prevent the migration of pollutants beyond the boundaries of the containment zone in concentrations which exceed water quality objectives." Additionally, the applicant "must verify containment with an approved monitoring program and must provide reasonable mitigation measures to compensate for any significant adverse environmental impacts attributable to the discharge." Most significantly perhaps, the applicant "must propose and agree to implement a management plan to assess, cleanup, abate, manage, monitor, and mitigate the remaining significant human health, water quality, and environmental impacts to the satisfaction of the Regional Water Board."

There are two key differences between the Less Aggressive Remediation Approach and the Containment Zone Policy. The Less Aggressive Remediation Approach is a "basin-specific" approach that allows for management of plumes where requisite concentration levels will be attained within a reasonably defined time period. In contrast, the Containment Zone Policy is a statewide policy and addresses groundwater pollution where attainment of applicable water quality objectives cannot reasonably be achieved. Thus the Less Aggressive Remediation Approach differs because it based on local conditions and aimed at sites that will eventually meet applicable water quality objectives.

Table 12. Summary of Proposed East Bay Plain Groundwater Management Zones

Table 13. Proposed Strategy by Sub-Area for Addressing Groundwater Contamination in the East Bay Plain

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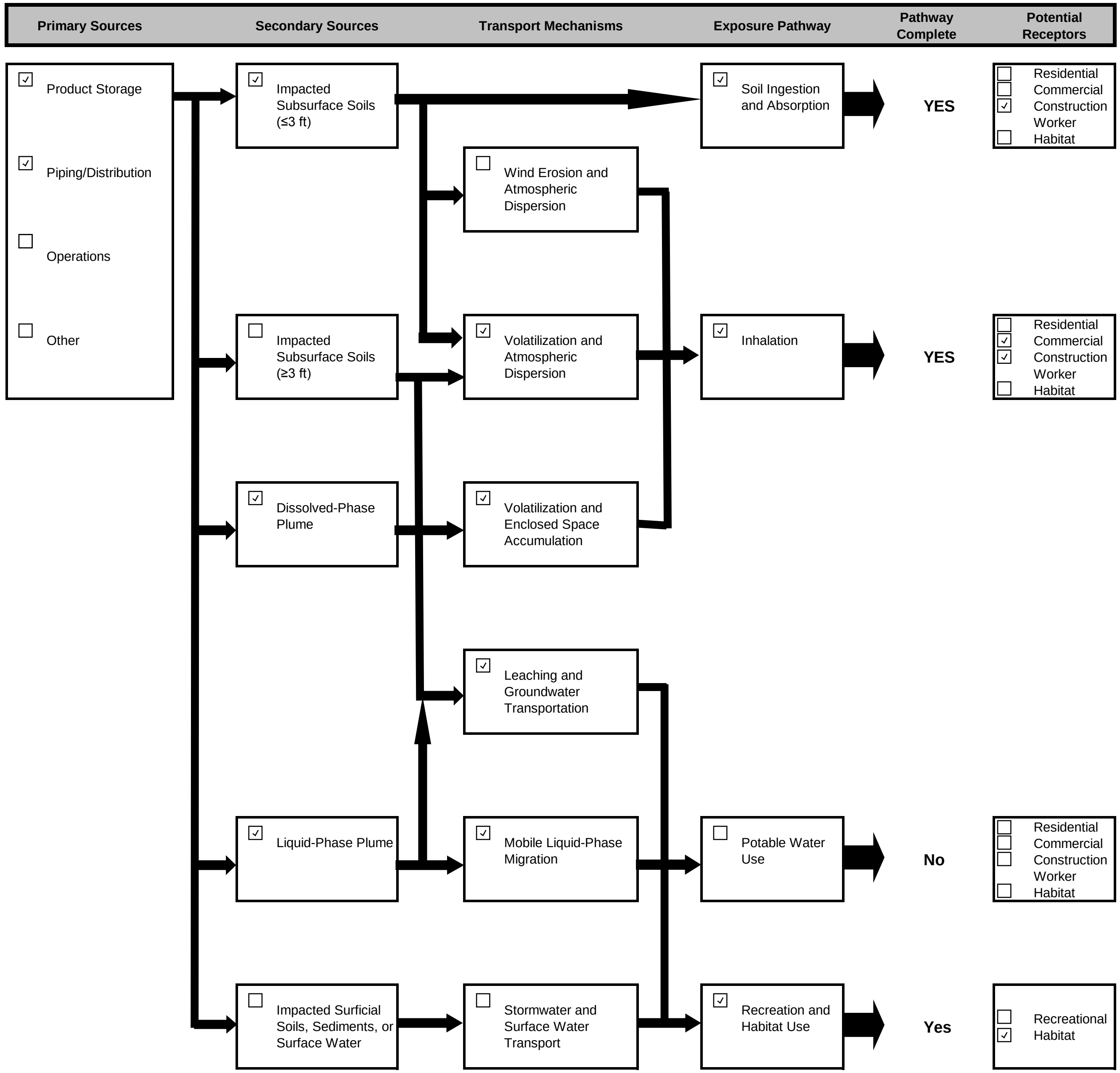
CAMBRIA

Exposure Evaluation Flowchart - Shell-branded Service Station, 1800 Powell Street, Emeryville, California

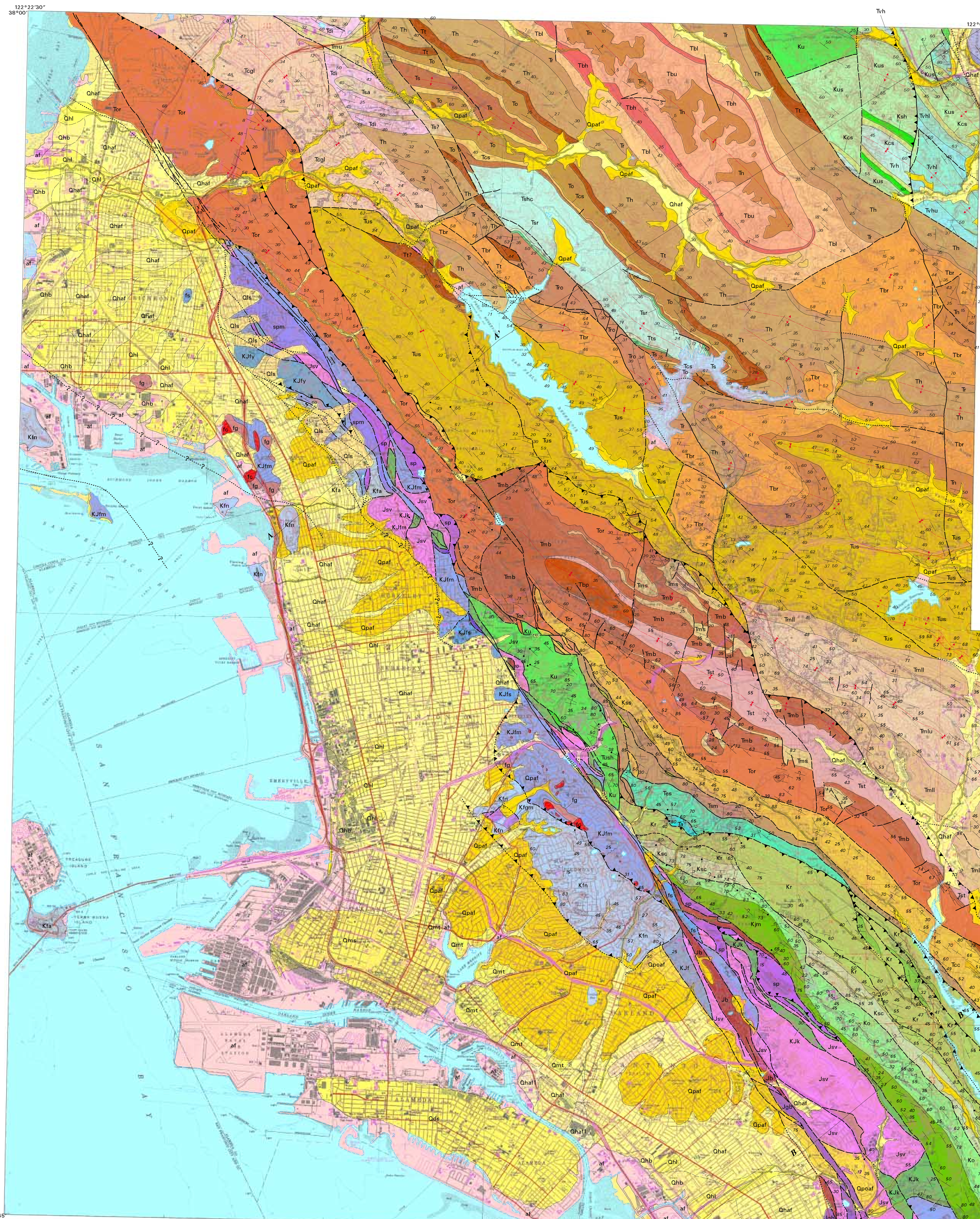


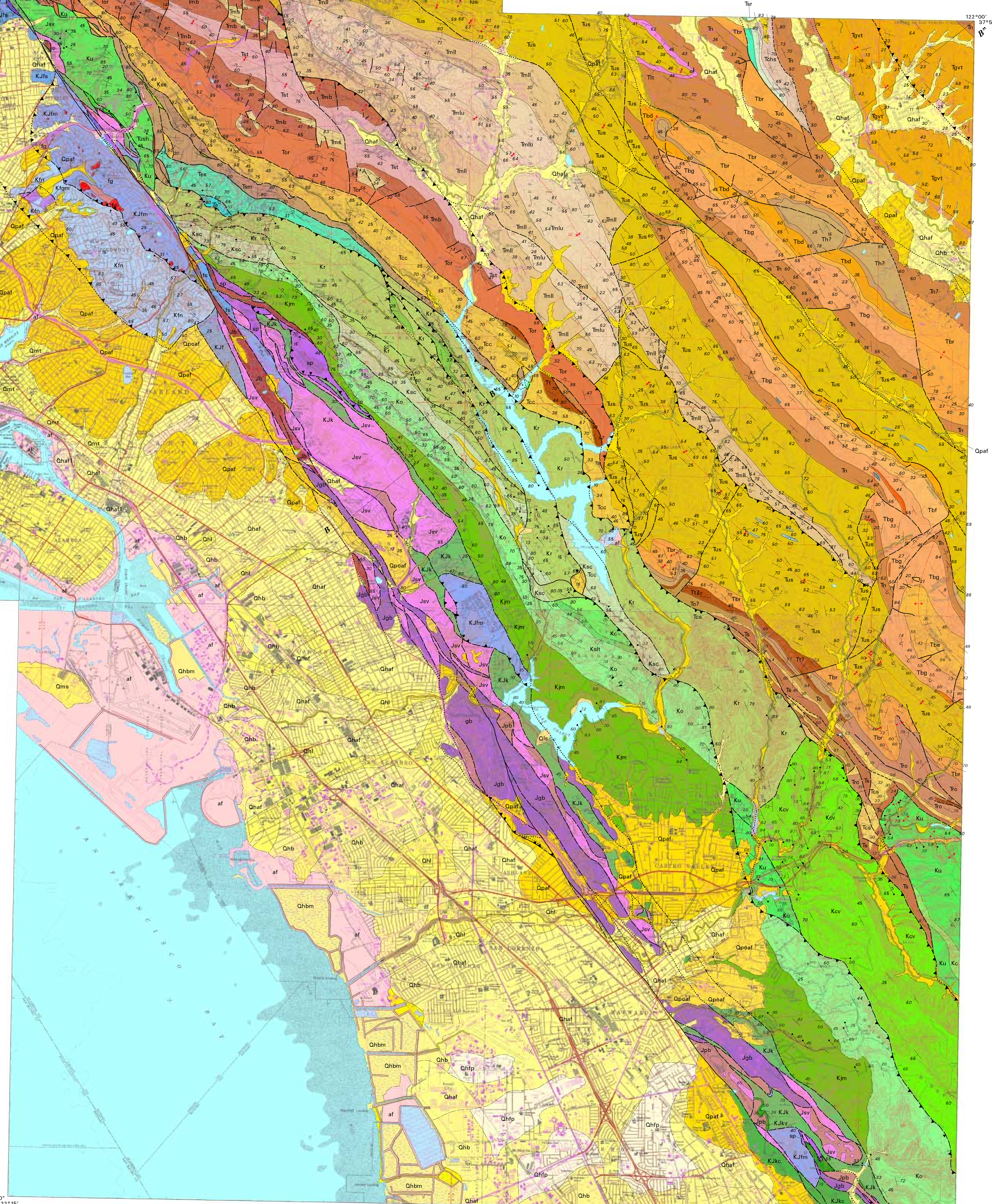
Flowchart based on ASTM E1739

Exposure Eval Flowchart
3/30/2010

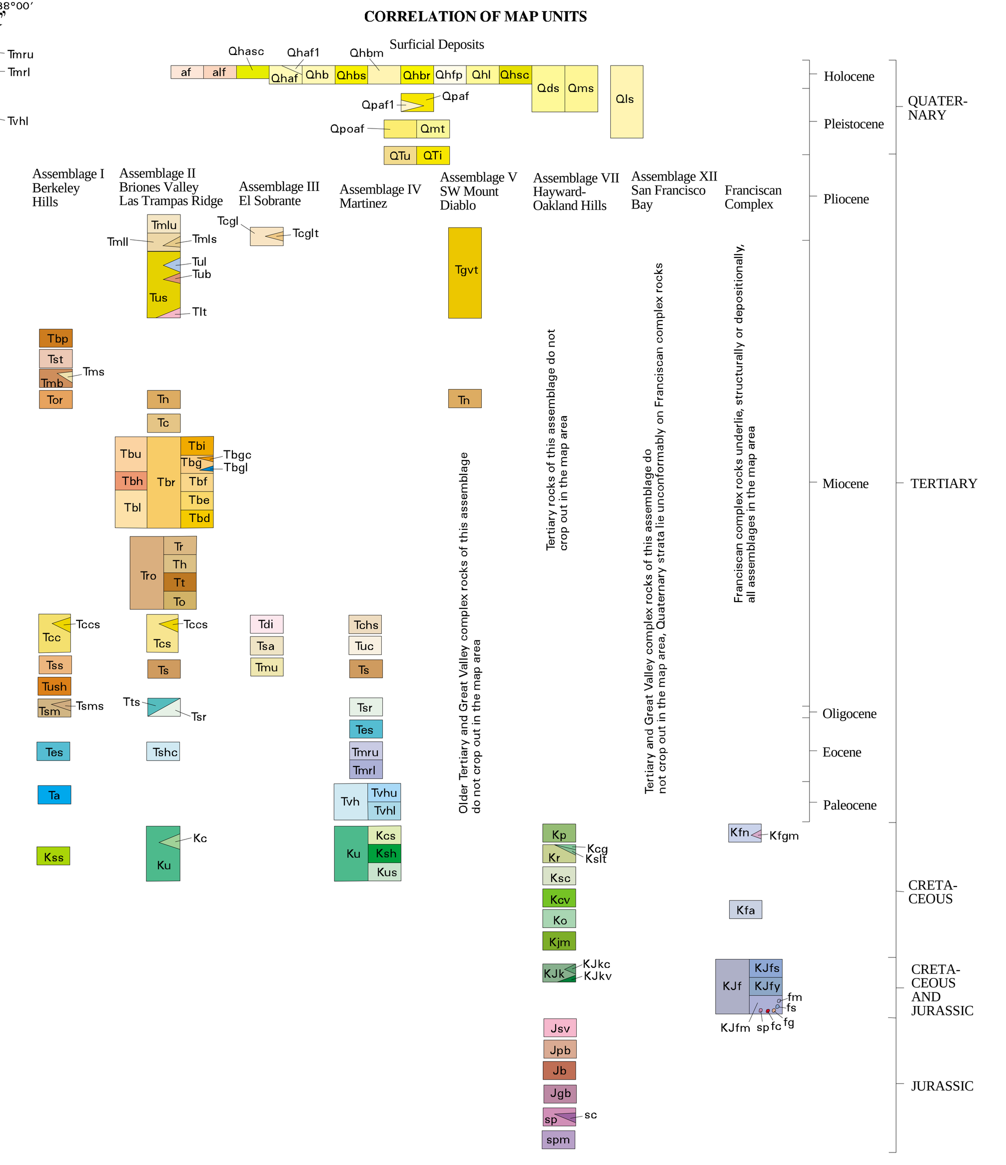
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MF- 2342, Version 1.0
Pamphlet accompanies map





CORRELATION OF MAP UNITS



LIST OF MAP UNITS

Surficial Deposits

- af — Artificial fill (Historic)
- alf — Artificial levee fill (Historic)
- Ghasc — Artificial stream channels (Historic)
- Qhaf1 — Younger alluvial fan deposits (Holocene)
- Qhaf — Alluvial fan and fluvial deposits (Holocene)
- Qhb — Basin deposits (Holocene)
- Qhbs — Basin deposits, salt affected (Holocene)
- Qhbm — Bay mud (Holocene)
- Qhbr — Beach ridge deposits (Holocene)
- Qhfp — Floodplain deposits (Holocene)
- Qhl — Natural levee deposits (Holocene)
- Qhsc — Stream channel deposits (Holocene)
- Qds — Dune sand (Holocene and Pleistocene)
- Qms — Merritt sand (Holocene and Pleistocene)
- Qls — Landslide deposits (Holocene and/or Pleistocene)
- Qpaf — Alluvial fan and fluvial deposits (Pleistocene)
- Qpaf1 — Alluvial terrace deposits (Pleistocene)
- Qmt — Marine terrace deposits (Pleistocene)
- Qpoaf — Older alluvial fan deposits (Pleistocene)
- QTi — Irvington Gravels of Savage (1951) (Pleistocene and Pliocene (?))
- QTu — Undifferentiated continental gravels (Pleistocene and/or Pliocene)

Assemblage I

- Tbp — Bald Peak Basalt (late Miocene)
- Tst — Siesta Formation (late Miocene)
- Tmb — Moraga Formation (late Miocene)
- Tma — Interflow sedimentary rocks
- Tor — Orinda Formation (late Miocene)
- Tcc — Claremont chert (late to middle Miocene)
- Tccs — Interbedded sandstone
- Tss — Unnamed sandstone (Miocene (?))
- Tsuh — Unnamed gray mudstone (early Miocene)
- Tem — Unnamed glauconitic mudstone (Miocene and Oligocene (?))
- Tems — Interbedded sandstone
- Tes — Unnamed mudstone (Eocene)
- Tp — Unnamed glauconitic sandstone (Paleocene)

Great Valley Complex

- Kss — Unnamed lithic sandstone (Cretaceous)

Assemblage II

Mulholland Formation of Hann (1952) (Pliocene and late Miocene)

- Tmlu — Upper member
- Tmll — Lower member
- Tmls — Sandstone marker beds
- Tus — Unnamed sedimentary and volcanic rocks (late Miocene)
- Tub — Interbedded basalt
- Tul — Interbedded limestone
- Tlt — Lafayette Tuff (late Miocene)
- Tn — Neroly Sandstone (late Miocene)
- Tc — Cierbo Sandstone (late Miocene)
- Tbr — Briones Formation (late and middle Miocene)

In southern part of the assemblage, locally divided into:

- Tbi — I member of Wagner (1978)
- Tbg — G member of Wagner (1978)
- Tbgc — Conglomerate
- Tbgl — Limestone
- Tbf — F member of Wagner (1978)
- Tbe — E member of Wagner (1978)
- Tbd — D member of Wagner (1978)

In northern part of the assemblage, locally divided into:

- Tbu — Upper sandstone and shale member
- Tbh — Hercules shale member
- Tbl — Lower sandstone and siltstone member
- Tro — Rodeo Shale, Hambre Sandstone, Tice Shale, and Oursan Sandstone, undivided (middle Miocene)
- Tr — Rodeo Shale (middle Miocene)
- Th — Hambre Sandstone (middle Miocene)
- Tt — Tice Shale (middle Miocene)
- To — Oursan Sandstone (middle Miocene)
- Tcs — Claremont Shale (middle Miocene)
- Tcss — Sandstone interbeds
- Ts — Sobrante Sandstone (middle Miocene)
- Tts — Tuffaceous sandstone (Miocene and/or Oligocene)
- Tsr — San Ramon Sandstone (Miocene and/or Oligocene)
- Tshc — Shale and claystone (Eocene)

Great Valley Complex

- Ku — Unnamed sedimentary rocks (Late Cretaceous, Turonian and Cenomanian)
- Kc — Conglomerate

Assemblage III

- Tcgl — Conglomerate, sandstone, and siltstone (Pliocene and Miocene)
- Tcgft — Rhyolite tuff and tuff breccia
- Td — Diatomite (Miocene)
- Tss — Sandstone (Miocene)
- Tmu — Mudstone, shale, siltstone (Miocene)

Assemblage IV

- Tcha — Unnamed shale (Miocene)
- Tcc — Unnamed conglomerate (Miocene)
- Ts — Sobrante Sandstone (Miocene)
- Tsr — San Ramon Sandstone (Miocene and/or Oligocene)
- Tes — Escobar Sandstone of Weaver (1953) (Eocene)

Muir Shale of Weaver (1953), (Paleocene)

- Tmu — Upper member
- Tmul — Lower member
- Tvh — Vine Hill Sandstone of Weaver (1953) (Paleocene)
- Tchu — Upper member
- Tchl — Lower member

Great Valley Complex

- Ku — Undivided Great Valley complex rocks (Cretaceous)
- Kcs — Gray-massive quartz arenite
- Ksh — Siltstone and shale
- Kss — Sandstone, siltstone, and shale

Assemblage V

- Tgvt — Green Valley and Tassajara Formations of Conduit (1938), undivided (Pliocene and Miocene)
- Tn — Neroly Sandstone (Miocene)

Assemblage VII

Great Valley Complex

- Kp — Pinehurst Shale (Late Cretaceous, Campanian)
- Kr — Redwood Canyon Formation (Late Cretaceous, Campanian)
- Ksc — Shephard Creek Formation (Late Cretaceous, Campanian)
- Kcv — Unnamed sandstone, conglomerate, and shale of the Castro Valley area (Late Cretaceous, Turonian and younger (?))
- Ko — Oakland Conglomerate (Late Cretaceous, Turonian and/or Cenomanian)
- Kcg — Conglomerate
- Ksh — Siltstone
- Kjm — Joaquin Miller Formation (Late Cretaceous, Cenomanian)
- KJk — Knoxville Formation (Early Cretaceous and Late Jurassic)
- KJkc — Conglomerate
- KJkv — Volcaniclastic breccia
- Jkv — Keratophyre and quartz keratophyre (Late Jurassic)

Coast Range ophiolite (Jurassic)

- Jpb — Pillow basalt, basalt breccia, and minor diabase
- Jb — Massive basalt and diabase
- Jgb — Gabbro
- sp — Serpentinite
- sc — Silica-carbonate rock
- spm — Serpentinite matrix mélange

Franciscan Complex

- KJf — Undivided Franciscan complex rocks (Cretaceous and Jurassic)
- Kfn — Sandstone of the Novato Quarry terrane of Blake and others (1984) (Late Cretaceous)
- Kfgm — Fine-grained quartz diorite (Late Cretaceous (?))
- KfA — Sandstone of the Alcatraz terrane of Blake and others (1984) (Cretaceous)
- KJfy — Metasandstone of the Yolla Bolly terrane of Blake and others (1984) (Cretaceous(?) and Late Jurassic)
- KJfs — Franciscan complex sandstone, undivided (Late Cretaceous to Late Jurassic)
- KJfm — Franciscan complex, mélange (Cretaceous to Late Jurassic), includes mapped locally: Graywacke and meta-graywacke blocks
- fs —
- sp — Serpentinite blocks
- ch — Chert blocks
- fg — Greenstone blocks
- fm — Schist blocks

Contact—Depositional or intrusive contact, dashed where approximately located, dotted where concealed

Fault—Dashed where approximately located, small dashes where inferred, dotted where concealed, queried where location is uncertain.

Reverse or thrust fault—Dashed where approximately located, dotted where concealed

Normal fault—Dashed where approximately located, dotted where concealed

Anticline—Shows fold axis, dashed where approximately located, dotted where concealed

Syncline

Strike and dip of bedding

Strike and dip of bedding, top indicator observed

Strike and dip of bedding, approximate

Overturned bedding

Overturned bedding, top indicator observed

Horizontal bedding

Vertical bedding

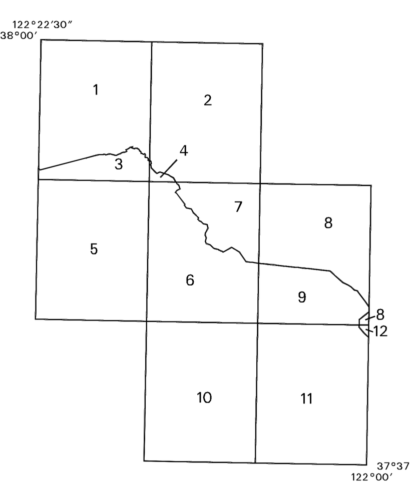
Vertical bedding, top indicator observed

Strike and dip of foliation

Vertical foliation

Strike and dip of joints

INDEX MAP SHOWING SOURCES OF DATA



EXPLANATION

Quaternary surficial deposits modified from Helley and Graymer (1997a,b)

1. Extensive new mapping by author, modifying Graymer and others (1994), Wagner (1978), Dibblee (1980d), and Sheehan (1956). Some data from Blake and others (1974).

2. New mapping by author modifying Graymer and others (1994), Wagner (1978), Pease (1954), and Dibblee (1980e). See also Dooman (1957).

3. New mapping by author modifying Graymer and others (1996), Dibblee (1980d), and Blake and others (1974).

4. New mapping by author, modifying Graymer and others (1996), Wagner (1978), Dibblee (1980e), and Pease (1954).

5. New mapping by author in the small area of bedrock exposure. Yerba Buena Island from Blake and others, 1999. See also Radbruch (1957).

6. Some new mapping by author modifying Graymer and others (1996), Radbruch (1969), and Radbruch and Case (1967).

7. New mapping by author modifying Graymer and others (1994), Radbruch (1969), Wagner (1978), and Radbruch and Case (1967).

8. New mapping by author modifying Graymer and others (1994), Wagner (1978), Hart (1952), Dibblee (1980c), Aarons (1958), and Sonneman and Switzer (unpublished maps, 1961-62).

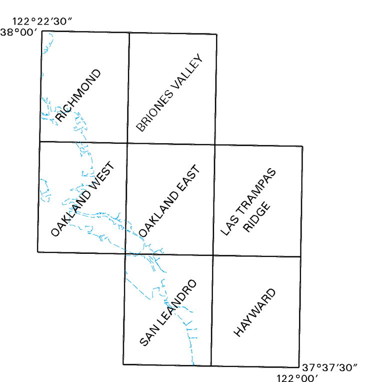
9. Some new mapping by author modifying Graymer and others (1996), Wagner (1978), Hart (1952), Dibblee (1980c), Aarons (1958), and Sonneman and Switzer (unpublished maps, 1961-62).

10. New mapping by author modifying Graymer and others (1996).

11. New mapping by author modifying Graymer and others (1996), Dibblee (1980b), Robinson (1956), and Wagner (1978).

12. Modified from Graymer and others (1994) and Wagner (1978).

See the pamphlet (oakmf.pdf, oakmf.ps, oakgeo.txt, oakgeo.pdf, or oakgeo.ps) for complete references.



INDEX MAP OF QUADRANGLES

Base derived from U.S. Geological Survey Digital Raster Graphic (DRG) files of Richmond (1980), Briones Valley (1968), Oakland West (1980), Oakland East (1980), Las Trampas Ridge (1980), San Leandro (1980), and Hayward (1980) 7.5 minute topographic quadrangles. DRG files available on the USGS Mapping Division San Francisco Bay area web-site: http://bard.wr.usgs.gov

Stateplane projection, California coordinate system, zone 3

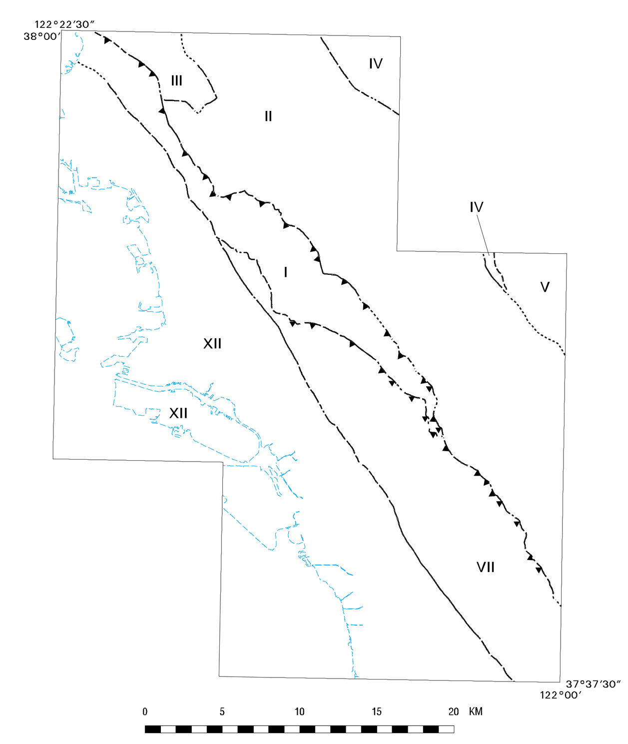
SCALE 1:50000

CONTOUR INTERVAL 50 METERS

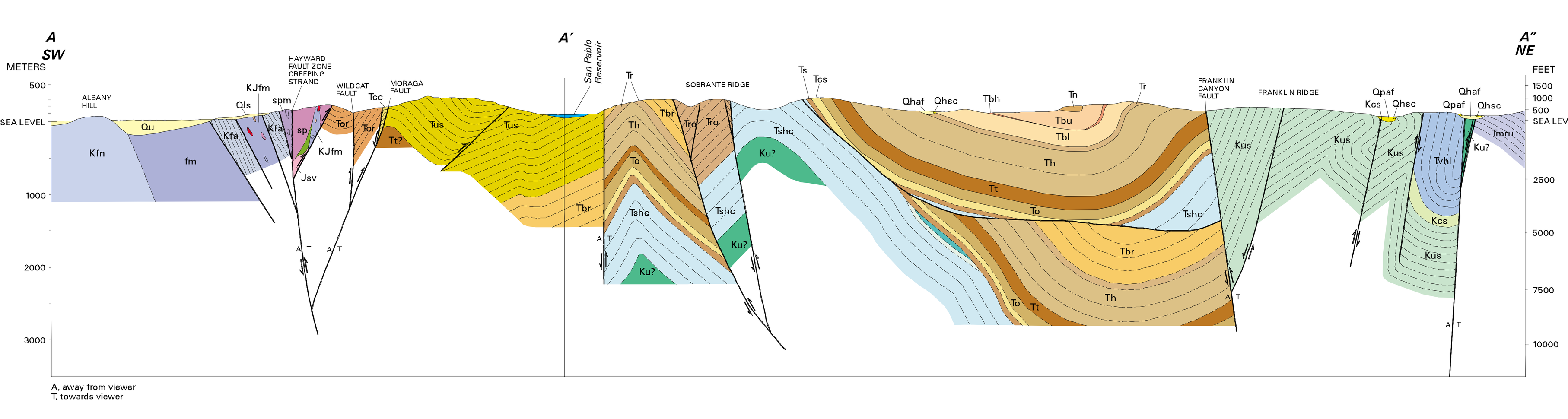
Digital Cartography by R.W. Graymer and R.E. Stamski, 1999-2000

Edited by Jan Zigler

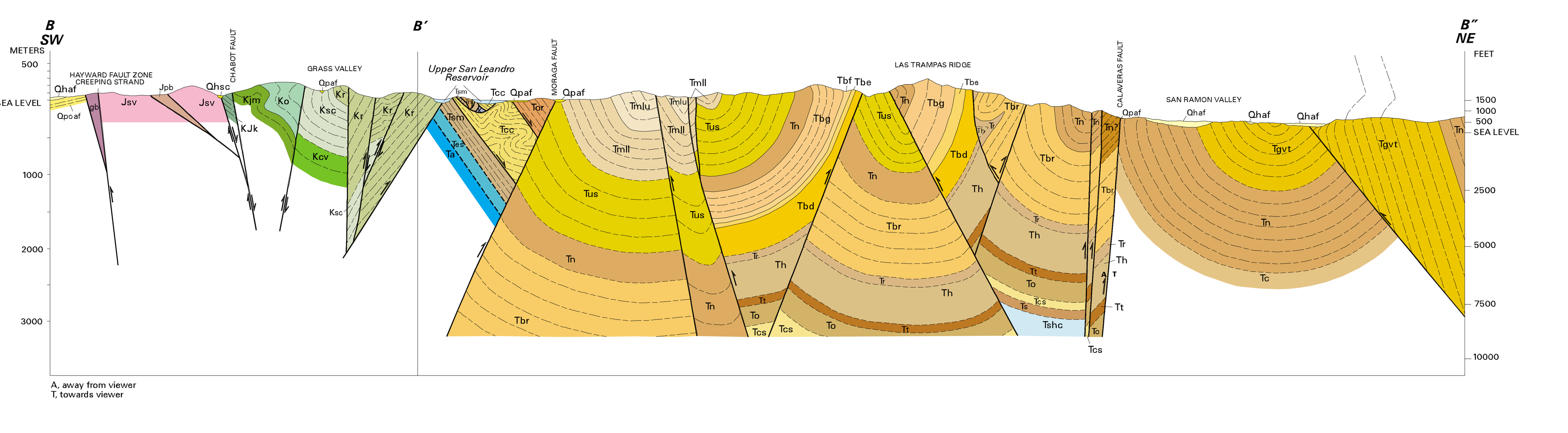
Manuscript approved for publication, June 21, 2000



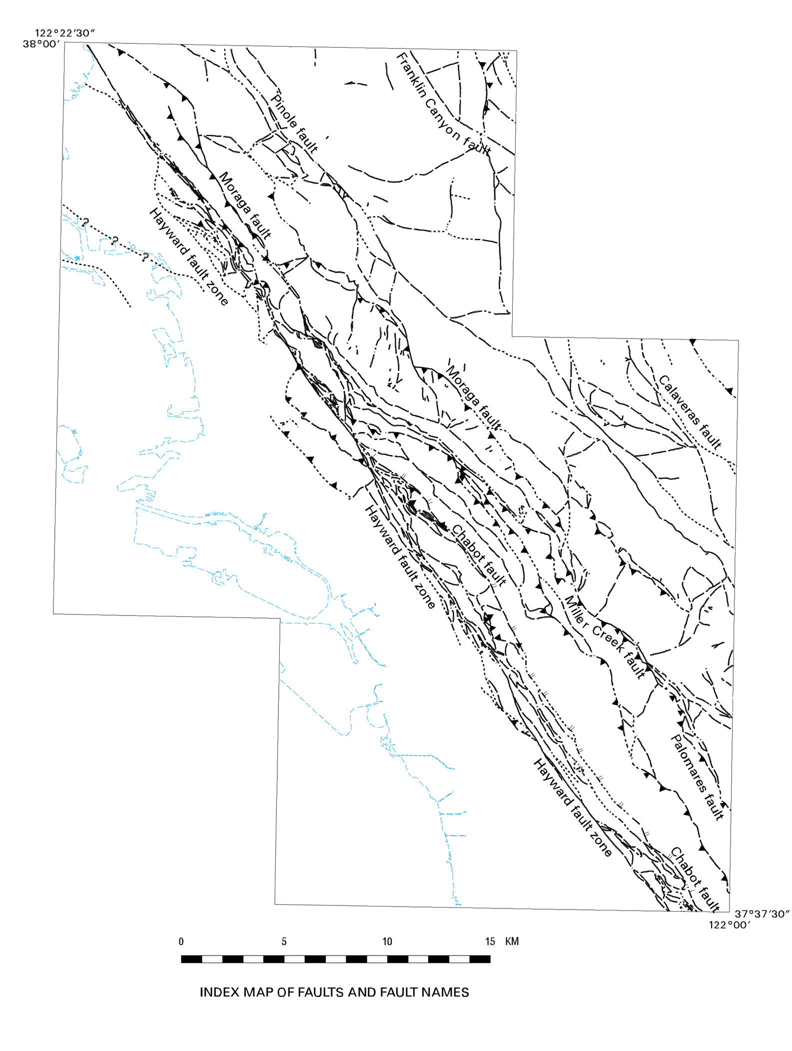
INDEX MAP OF ASSEMBLAGES
(Assemblages are defined and discussed in the accompanying pamphlet)



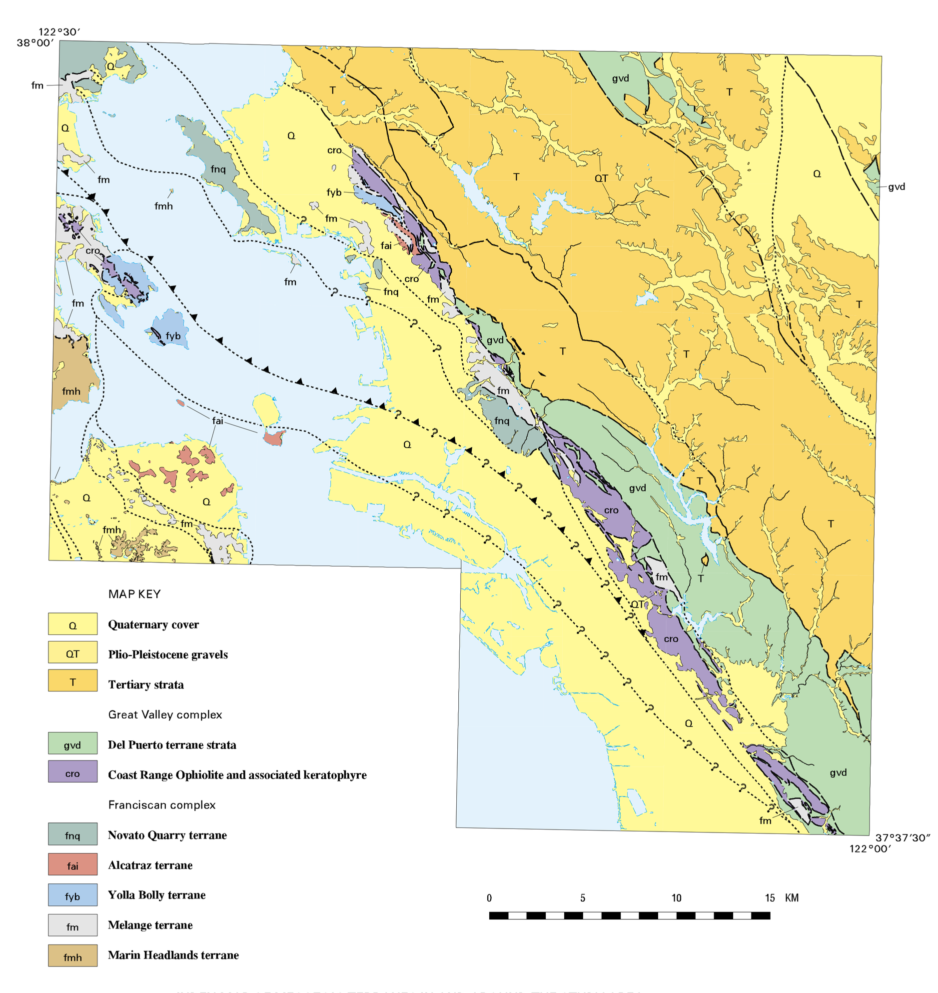
A. away from viewer
T. towards viewer



A. away from viewer
T. towards viewer



INDEX MAP OF FAULTS AND FAULT NAMES



MAP KEY

- Q — Quaternary cover
- QT — Plio-Pleistocene gravels
- T — Tertiary strata

Great Valley complex

- gvd — Del Puerto terrane strata
- crs — Coast Range Ophiolite and associated keratophyre

Franciscan complex

- fnq — Novato Quarry terrane
- fa — Alcatraz terrane
- fyb — Yolla Bolly terrane
- fm — Melange terrane
- fmh — Marin Headlands terrane

INDEX MAP OF MESOZOIC TERRANES IN AND AROUND THE STUDY AREA
(Terranes are defined and discussed in the accompanying pamphlet. Also see Blake and others, 1999)

GEOLOGIC MAP AND MAP DATABASE OF THE OAKLAND METROPOLITAN AREA, ALAMEDA, CONTRA COSTA, AND SAN FRANCISCO COUNTIES, CALIFORNIA

By
R.W. Graymer

2000

Digital data and cartography prepared using ArcInfo 7.1.2 running under Solaris 2.6 on a UNIX workstation.

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Background info

Site: 204-2495-0101
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1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐

PHASE II-ENVIRONMENTAL SITE ASSESSMENT

SAN FRANCISCO/OAKLAND BAY BRIDGE HOLIDAY INN
EMERYVILLE, CALIFORNIA

PREPARED FOR:
MS. JAN ROBBINS
VICE PRESIDENT J.Q. INDUSTRIES
J.Q. HAMMOND PARKWAY
SPRINGFIELD, MISSOURI 65806
CERTIFIED PROJECT NO: S90121
AUGUST 2, 1989

PREPARED BY: Chad M. Nichols
CHAD M. NICHOLS
PROJECT MANAGER

REVIEWED BY: Marc D. Cunningham
MARC D. CUNNINGHAM
DIVISION VICE PRESIDENT

TABLE OF CONTENTS

Certified Engineering & Testing Company™

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August 21, 1989

Ms. Jan Robbins
Vice President J.Q. Industries
300 Hammond Parkway, Suite 900
Springfield, Missouri 65806

Subject: Phase II Environmental Site Assessment for San Francisco/ Oakland Bay Bridge Holiday Inn.

Dear Ms. Robbins:

Enclosed, you will find the analytical results and conclusions of the Phase II segment of Certified Engineering & Testing Company's Environmental Site Assessment for the San Francisco/Oakland Bay Bridge Holiday Inn Hotel Complex, located in Emeryville, California.

Our investigation encompassed a limited subsurface investigation which involved drilling, soil and groundwater sampling at two opposing locations on the Holiday Inn site.

Specific details as to the nature of the analytical testing, the investigative procedures followed, and the sampling protocols observed are presented in the accompanying report. Additionally, the analytical analysis, as reported by the laboratory, are also attached.

The scope of this sampling investigation can offer only a reconnaissance as to the nature of the underlying soils and groundwater. Certified recommends that a copy of this report be submitted to the Regional Water Quality Control Board, San Francisco Bay Region, located at 1111 Jackson Street, Room 6000, Oakland, California 94607.

Certified Engineering & Testing Company, Inc.
725 Greenwich Street, Suite 304, San Francisco, CA 94133 (415) 986-6877 TeleFAX (415) 986-4283

Please feel free to contact us at your convenience. Thank you for retaining Certified Engineering.

Sincerely,

Chad Nichols

Chad Nichols
Project Manager

CN/dg

Encl.

INTRODUCTION

Certified Engineering and Testing was retained by Ms. Jan Robbins, of J.Q. Industries to perform a subsurface investigation of the San Francisco/Oakland Bay Bridge Holiday Inn Hotel In the city of Emeryville, California (refer to site plan).

A Phase I environmental site investigation, performed in June 1988, was concluded with a recommendation to further investigate the subsurface soils and groundwater.

The Phase II portion of this investigation, included the physical inspection of the site, was performed on July 13, 1989, by Chad Nichols of Certified Engineering and Testing, with the accompaniment of Mr. Bahman R. Rafighi, the hotel manager. The site investigation was performed on July 15, 1989 (Please see Figure 1, Appendix "A", for site description and sampling locations).

The scope of our investigation included the following:

1. The drilling of two shallow soil borings to obtain representative soil and groundwater samples from each location.

2. Analytical analysis of one soil and one groundwater sample from each boring, the interpretation of the laboratory results, and report preparation.

II. SITE DESCRIPTION

For background information on this property, please refer to the site description provided in the Phase I Environmental Site Assessments by Certified, dated June 16, 1988. A brief summary of the findings are as follows:

1. Historical usage of the site as a varnish-producing firm resulting in possible lead, solvent, and hydrocarbon disposal on site.
2. Numerous off-site and up gradient fuel and toxic release locations within close proximity of the Holiday Inn, were documented and may pose a significant potential for groundwater and soil contamination.

SUBSURFACE GEOLOGY AND HYDROLOGY

Historical information and air photo observations indicate the subsurface soils are comprised of imported artificial fill materials. They include industrial refuge, rip-rap, concrete blocks, and any other material which may have assisted in bringing the area up to and above existing sea level. Wave-action and long-shore ocean currents have since reworked the imported clays to produce sands and fine silty muds around the periphery of the spit.

Underlying the imported debris, exists naturally deposited, organic silty clays interbedded with thin layers of discontinuous sandy deposits, which is characteristic of a shallow, near-shore depositional environment.

Prediction of the actual groundwater gradient and velocity of movement was not determined in this investigation, and may not be possible. Although regional, onshore groundwater movement has been determined to flow toward the Bay, the reclaimed property (underlying the Holiday Inn) is more likely to be influenced by the continuous tidal, current, and wave action associated with the San Francisco Bay.

III. FIELD INVESTIGATION

The determination of historic use of the site and immediate vicinity was fully addressed in Certified's Phase I report. This also included abandoned, hazardous waste sites and confirmed fuel and solvent release locations up gradient, relative to the subject property.

Boring permits, for this secondary investigation, were not required by Alameda County and the City of Emeryville.

Evaluation of available aerial photos, in conjunction with the findings from the Phase I report, aided in the determination of the two boring locations. The aerial photos offered a more regional observation and enabled Certified to determine a sampling location that could more fully evaluate the soils and groundwater.

SOIL BORINGS

On July 15, 1989, the two soils borings were drilled to maximum depth of six feet. The borings were advanced with the use of a jeep-mounted, 12-inch, solid stem-auger. Prior to drilling of each boring, the auger flights and sampling equipment were steam cleaned to prevent cross contamination.

Logging of the soils adjacent to the Shell Station, revealed a two foot surficial layer of organic, sandy to gravelly clays with a distinct hydrocarbon odor. From two to seven feet, the colors of the clays varied from light to dark gray and concrete fragments, up to eight inches diameter, were encountered to the termination of the boring. Initial groundwater was noted at a depth of six and a half feet and rose to a static level of six feet.

The No. 2 boring was located on the western periphery of the subject site, adjacent to the property boundary hedge line. A minimum of eight inches of baserock, overlying a plastic vapor membrane was penetrated. Immediately below, four inches of medium to fine grained, imported brown sand was found to overlie a medium brown, sandy to silty clay. This clay graded from gravelly to a cobbley composition of cement and brick fragments. Initial groundwater was logged at five and a quarter feet and the boring was terminated at five and a half feet.

Certified Engineering's geologist supervised the drilling operations, logged the borings, and collected soil samples. The soils were sampled at a depth of three feet below grade in both borings by driving a hand-sampling device into the native formation.

Additionally, during the drilling procedures, the soil cuttings from the boreholes were analyzed with an H*NU photoionization detector which is capable of measuring organic vapors. The instrument can detect the presence of organic vapors to the part per million (ppm) level. The H*NU detector does not provide an accurate parts per million analysis for hydrocarbon compounds such as diesel, which is not highly volatile. Other compounds, such as unleaded and leaded fuels, are easily detected. No detection was noted in the soils of either boring.

The soil samples were sealed using aluminum foil, plastic end caps, and duct tape. The samples were immediately placed on ice awaiting transportation to a state certified laboratory under proper chain of custody protocol. The Chain of Custody Record is included in Appendix B.

Soils encountered in the borings were classified in accordance with the Unified Soil Classification System, as described in Figure 1, Appendix C. Logs of the borings are presented in Appendix C.

The borings were backfilled with the drilled spoils and compacted to prevent subsidence.

GROUNDWATER SAMPLING

Grab groundwater samples were retrieved from soil borings using an acetone rinsed, steam cleaned bailer. Prior to sampling the water for a chemical analysis, a sample from the surface of the water in each boring was taken for a subjective evaluation of groundwater quality. (No floating product or obvious sheen was noted in either of the water samples)

Similar to the soil sampling, the groundwater samples were sealed in labeled, laboratory-cleaned glass containers fitted with teflon septa. The samples were immediately placed on ice awaiting transportation to a state certified laboratory under proper chain of custody protocol. The Chain of Custody Record for samples tested is included in Appendix B.

IV. SUMMARY OF ANALYTICAL RESULTS

The soil and grab groundwater samples were submitted to Anametrix laboratory in San Jose, California for analysis. The chemical analysis for the soils and water included the following:

EPA-624 (Water) EPA-8240 (Soil)	Total Volatile Hydrocarbons. This analysis includes most organic solvents with the use of a gas chromatography and mass spectrometer. Analysis also includes Total Volatile Hydrocarbons and Benzene, Toluene, Ethylbenzene and Xylene.
EPA-625 (Water) EPA-8270 (Soil)	Base, Neutral, and Acid Extractables by gas chromatography and mass spectrometer. Analysis detects most semi-volatile organic compounds.
EPA-5030 (Water) EPA-5030 (Soil)	Total Petroleum Hydrocarbons for gasoline with BTEX distinction.
EPA-3510 (Water) EPA-3550 (Soil)	Total Petroleum Hydrocarbons for diesel compounds.

EPA-608 (Water)

EPA-8080 (Soil) Organochlorinated Pesticides and Polychlorinated Biphenyls (PCB) by gas chromatography.

Priority Metals -- A combination of analysis including Sb, Sb, As, Be, Cd, Cr Cu, Pb, Ni, Hg, Se, Ag, Tl, and Zn.

Laboratory results are included in Appendix B.

INTERPRETATION OF GROUNDWATER ANALYTICAL RESULTS

Interpretation of groundwater quality conditions was limited by the small number of samples collected.

The grab groundwater samples taken from borings B-1 and B-2 were found to be free of volatile and semi volatile (EPA Tests 624 and 625) compounds. The analysis for gasoline and diesel (EPA-5030/3510) did detect minor traces amounting to less than 50 ppb in both groundwater samples. The constituents of Gasoline, Benzene, Toluene, Ethylbenzene, and Xylene were detected in quantities of <.5 ppb, which is below California Department of Health Services (DOHS) Applied Action Levels. The exception is the identification of 3 ppb Xylenes in the B-1 water sample. This also is below established action levels.

Additionally, testing for Polychlorinated Biphenyls (PCB's) EPA Test 608 in conjunction with organochlorinated pesticides, did not detect their presence in either groundwater sample.

The analysis of priority metals in the groundwater did identify trace amounts from 11 of the 13 metals tested for. All were below action levels designated by the State of California and probably represents ambient background levels.

INTERPRETATION OF SOIL ANALYTICAL RESULTS

A total of seven volatile organochlorinated solvents were detected in the near-surface soils of boring No. 1. This also included four "tentatively identified compounds", other than priority pollutants, that showed significant chromatographic peaks. Additionally, minor amounts of three PCB's were identified in boring No. 1. Elevated levels of gasoline and diesel were seen in both soil boring samples and lastly, varying concentrations of metals were isolated in both soil samples.

Boring No. 1 was located adjacent to the eastern fenceline separating the project site and the Shell Service Station. The boring location was chosen by virtue to its proximity to the Shell facility, associated gasoline storage tanks, and because of its possible up gradient position to migrating groundwaters. The borehole was placed in the planter area and did not require coring of the concrete asphalt. The single sample was extracted at the three foot depth by removing the auger flight and hammering a hand-sampling device into the undisturbed soil. The following is a listing of the detected compounds, along with their description (if known), quantity detected and cleanup level (when available).

BORING B-1 (Soils)

Identified Organic Compounds (EPA-8240):

2-Butanone	100 ppb (Parts Per Billion) Also known as Methylethyl Keytone in use as a solvent for surface coatings, synthetic resins, and smokeless powder. Recommended cleanup level has not been established.
1,1,1-Trichloroethane	21 ppb Use in cold metal cleaning and plastic molds. Irritating to eyes and mucous membranes. DOHS recommended cleanup level is 330 ppb.
Benzene	46 ppb Carcinogenic. Can be absorbed through skin causing irritation to mucous membranes, convolutions, and death by respiratory failure. A gasoline derivative, use in dyes, linoleum, oil cloth, airplane dope, varnishes, and lacquers. Recommended DOHS cleanup level ranges from 7-700 ppb.

Trichloroethene 82 ppb

Common solvent in use for resins, paints, and varnishes. Also used for degreasing in dry cleaning and micro chip production. Recommended cleanup level is 280-2,500 ppb.

Toluene 15 ppb

Also a gasoline additive and used in dyes, paints, lacquers resins, but less toxic than benzene. Recommended clean-up level ranges from 1,000-100,000 ppb.

Chlorobenzene 45 ppb

Commonly used as a solvent in paints, varnishes lacquers, and DDT production. Recommended cleanup level is set at 3,000 ppb.

Tentatively Identified Compounds (EPA-8240):

(Soils)

1-Methylethylbenzene

24 ppb

Common use in phenol and acetone compounds.

Camphene 10 ppb

Occurring in oils such as turpentine.

Limonene 5 ppb

Solvent used in manufacturing resins, wetting/dispersing agents. Known to cause skin irritation and sensitizer.

1-Methyl-3-(1-Methylethyl)benzene

<5 ppb

No information available.

Identified Semi-volatile Organic Compounds (EPA-8270):

(Soils)

Phenanthrene	16,000 ppb
	Associated with coal tar production. DOHS cleanup level is set at 3,200 ppb.
Anthracene	5,300 ppb
	Coal tar derivative and important constituent in dye manufacturing. cleanup level is not established for soils.
Fluoranthene	33,000 ppb
	No information available. No levels have been established for soil.
Pyrene	46,000 ppb
	Coal tar derivative.
Benzo(a)Anthracene	
	24,000 ppb
	No information available.
Chrysene	30,000 ppb
	Coal tar distillate. Used in cold organic cleaning solvents.
Benzo(a)Pyrene	44,000 ppb
	Coal tar derivative and EPA human carcinogen. Exposure at any level may be hazardous.
Naphthalene	1,800 ppb
	Coal tar/tar camphor constituent in use with dye manufacturing, solvents, lubricants, motor fuels, and insecticides.

Acenaphthene 4,900 ppb

Petroleum residue and coal tar products. Used with dyes, plastics, insecticides, and fungicides. DOHS cleanup level set at 900 ppb.

Tentatively Identified Compounds (EPA-8270):
(Soils)

Benzaldehyde 20,000 ppb

Used in the manufacture of dyes and perfumery.

1-Phenylethanone

56,000 ppb

Used as orange-blossom odor in perfumery.

Benzol Chloride

5,800 ppb

Carcinogen obtained by coking of coal for gasification. Used in dyes, varnishes, wax, etc.

1-Methylnapthalene

1,700 ppb

No information available.

Dibenzothiophene

1,700 ppb

No information available.

9-Nitrous-9H-carbazole

6,800 ppb

No information available.

2-Methylanthracene

5,800 ppb

No information available.

4H-Cyclopental(DEF)phenanthrene

12,000 ppb

No information available.

2-Phenylnaphthalene

3,800 ppb

No information available.

11H-benzo(A)fluorene

19,000 ppb

No information available.

Other Polynuclear aromatic

5,300 ppb

No information available.

Total Petroleum Hydrocarbon Compounds:

(Soils)

Total Gasoline 5,700 ppb

Total Diesel 170,000 ppb

GROUNDWATER B-1

Total Petroleum Hydrocarbon Compounds:

Xylenes 3 ppb

The B-2 boring was placed along the western hedgeline, approximately 50 feet from Powell Street. The soils encountered appeared to consist of imported, fill materials. The following is a list of compounds detected in the soil sample taken from three feet below the existing ground surface.

BORING B-2

Identified Organic Compounds (EPA-8240):

(Soils)

Trichloroethene	15 ppb

Soil cleanup levels range from 280-2,500 ppb.

Tentatively Identified Semi-volatile Compounds (EPA-8270):

(Soils)

Molecular Sulfur	1,600 ppb

Total Petroleum Hydrocarbon Compounds:

(Soils)

Total Gasoline	9,000 ppb
Total Diesel	210,000 ppb

GROUNDWATER B-2

No detection.

V. SUMMARY AND CONCLUSIONS

A limited soil and groundwater investigation was conducted, which included drilling and sampling two shallow soil borings. The purpose of the investigation was to provide a preliminary, quantitative assessment of contaminant compounds occurring in the soil and groundwater as a result of past activities at the site. Data and the above discussion allows us to provide the following conclusions regarding the physical setting and occurrence of soil and groundwater contamination beneath the subject property.

The soils analyzed in borings (B-1 and B-2) were found to contain as many as six volatile organic compounds and five more tentatively identified organic compounds from chromatographic peaks. Additionally, nine semi-volatile compounds and 11 tentatively identified compounds were recognized in the soil sample.

Most of these compounds, whether in-house information was available or not, appeared to have similar chemical characteristics. By definition, their uses include: manufacturing of dyes, resins, varnishes, lacquers, and DDT. Another similarity of note is that many of these compounds are derivatives of "coal tars".

Hydrocarbon compounds were detected in both soil samples. Although both soil samples had detected diesel in excess of the arbitrary action level of 100 ppm (B-1-3 @ 170 ppm and B-2-3 @ 210 ppm), the levels do not appear high enough to indicate possible spillage and/or leakage originating from the Shell Gasoline Station on the eastern property boundary.

The analysis of the groundwater from each boring (W-1 and W-2), was virtually detection free of the similar compounds detected in the soils. The reason for this may be attributed to the active ovement of groundwater as a result of continuous tidal, wave and current movements. The higher permeability of the sites infilling material, may allow a "washing" effect to occur.

Highlighted during the Phase I portion of this investigation were several on and off-site concerns that were within Certified's radius of investigation. Based on the analytical results, three of the off-site concerns may be involved.

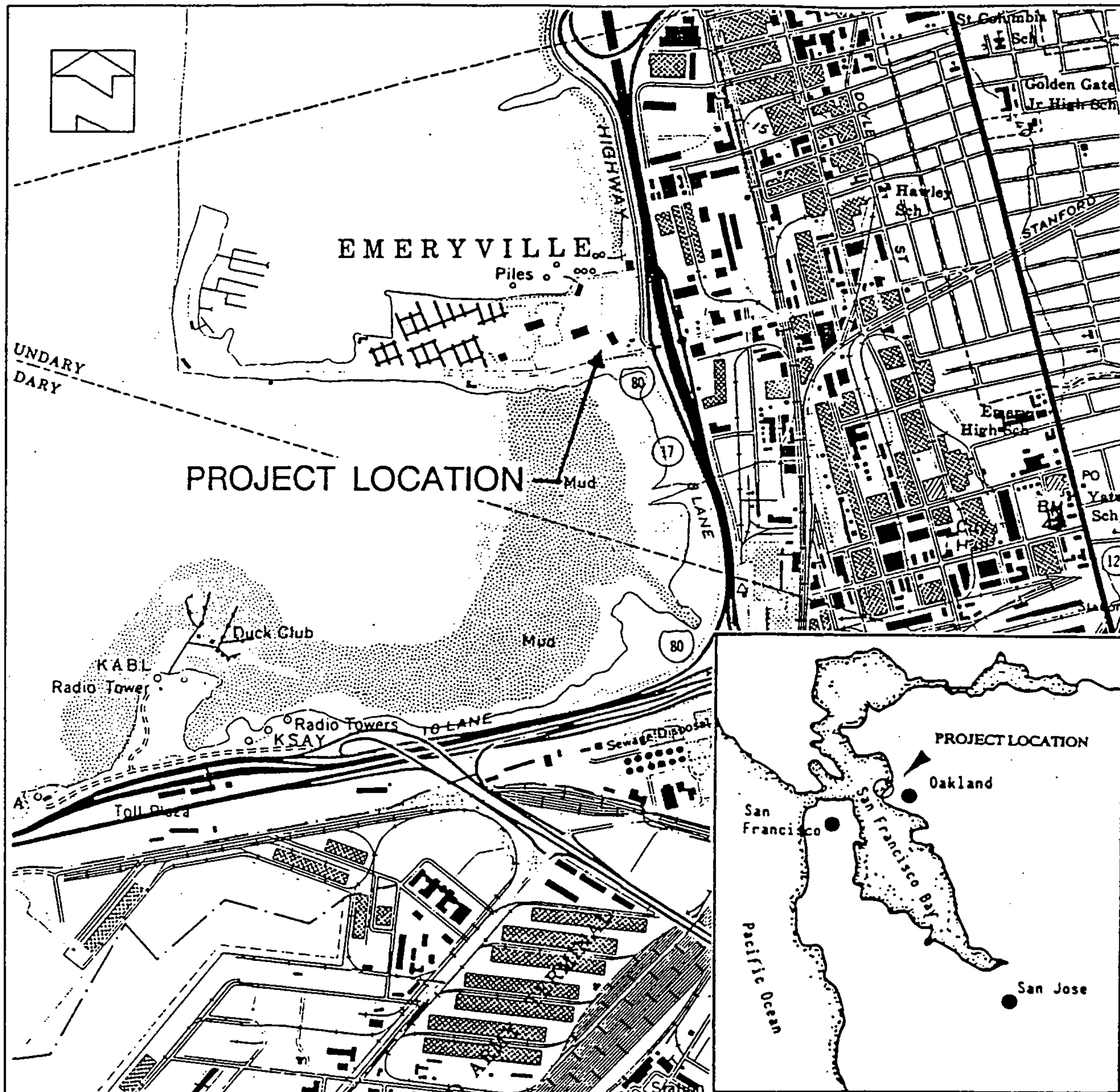
The first, PABCO/Fiberboard and its varnish production facility, adjacent to the subject site. A potential for release of paints, varnishes, roofing paper, felt, and linoleum had been speculated for this site.

The second, American Bitumals and Asphalt, an EPA Superfund Cleanup Site, has had reported releases of Vinyl Chloride, hydrocarbon compounds, and Dichloroethylene to the soils and groundwater in the vicinity.

The third site, Nielsen Freight Lines, has reported oil spillage in conjunction with earlier industrial operations including tar-paper and paint components production.

All three of the sites are located up gradient, or adjacent to the Holiday Inn facility, with respect to groundwater flow. Fill materials may have been used from these locations to assist in the infilling of the tidal marshes where the subject site is now located. The products and by-products produced by these firms are similar in nature to many of the compounds depicted in the soil analysis.

Based on site conditions, which appear homogeneous to the areas investigated, it is feasible that soil and groundwater contaminants exist throughout the subject site. However, since the soil contamination has been effectively sealed from human activity, no further investigation is recommended.



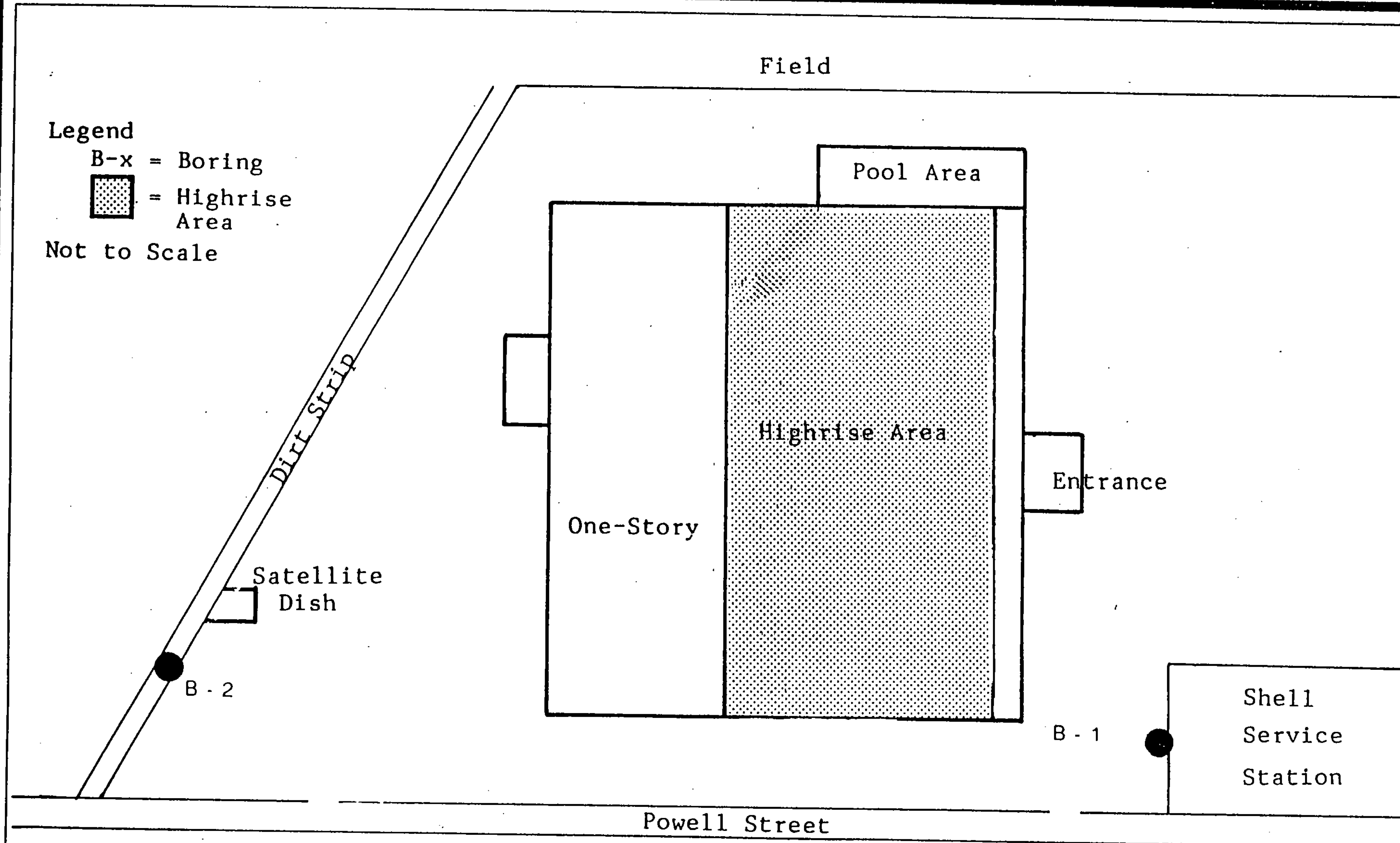
SCALE 1:24000

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CERTIFIED		PROJECT LOCATION Emeryville Holiday Inn Emeryville, CA	FIGURE 1
DATE: 7/89	PROJECT: S90121		



CERTIFIED

Project: S90121 | Date: 8/89

LOCATION OF BORINGS
Holiday Inn
Emeryville, CA

FIGURE 2

PRIMARY DIVISIONS			SECONDARY DIVISIONS
COARSE GRAINED SOILS	GRAVELS	CLEAN GRAVEL	Well graded gravels, gravel-sand mixtures little or no fines.
			Poorly graded gravels or gravel-sand mixtures, little or no fines
		GRAVEL WITH FINES	Silty gravels, gravel-sand-silt mixtures
			Clayey gravels, gravel-sand-clay mixtures
	SANDS	CLEAN SANDS	Well graded sands; gravelly sands.
			Poorly graded sands or gravelly sands.
		SANDS WITH FINES	Silty sands; sand-silt mixtures
			Clayey sands; sand-clay mixtures.
FINE GRAINED SOILS	SILTS & CLAYS LIQUID LIMIT IS LESS THAN 50%		Inorganic silts and very fine sands.
			Inorganic clays; gravelly clays, sandy clays.
			Organic silts and silty clays.
	SILTS & CLAYS LIQUID LIMIT IS GREATER THAN 50%		Inorganic silts; micaceous fine sandy or silty soils; elastic silts.
			Inorganic clays of high plasticity.
			Organic clays ; organic silts.
HIGHLY ORGANIC SOILS			Peat and other highly organic soils.

RELATIVE DENSITY

SANDS & GRAVELS	BLOWS/FOOT
VERY LOOSE	0 - 4
LOOSE	4 - 10
MED. DENSE	10 - 30
DENSE	30 - 50
VERY DENSE	OVER 50

CONSISTENCY

SILTS & CLAYS	STRENGTH**	BLOWS/FOOT*
VERY SOFT	0 - 1/4	0 - 2
SOFT	1/4 - 1/2	2 - 4
FIRM	1/2 - 1	4 - 8
STIFF	1 - 2	8 - 16
VERY STIFF	2 - 4	16 - 32
HARD	OVER 4	OVER 32

CERTIFIED ENGINEERING	UNIFIED SOIL CLASSIFICATION SYSTEM	PROJECT
	HOLIDAY INN	S90121
	EMERYVILLE, CA	DATE: *8-89

BORING B – 1
SHEET 1 of 1

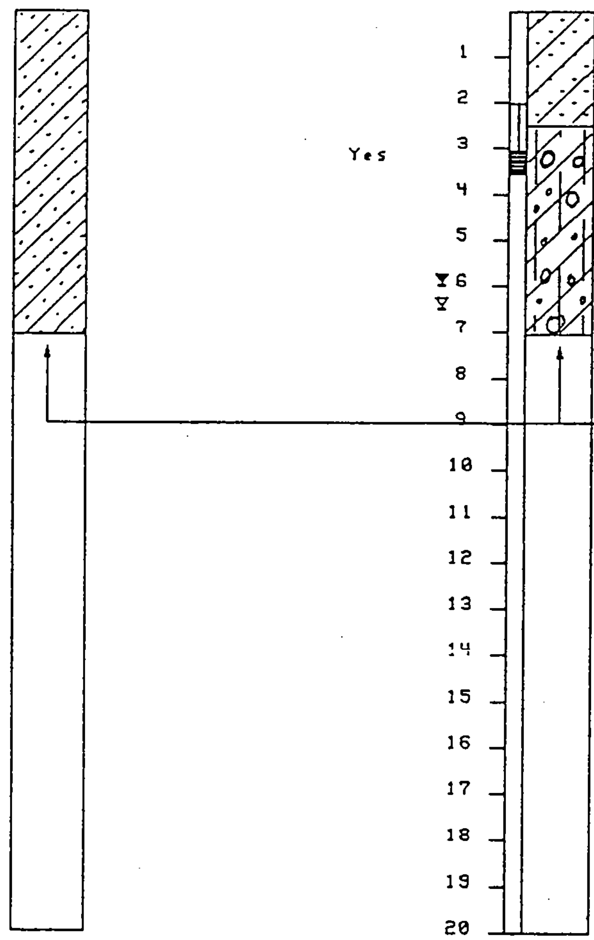
Logged by: Chad Nichols
Edited by: Chad Nichols

Drilling Contractor: Mad Dog Drilling
Drill Rig Type: Portable Auger Jeep

Hammer Wt.: 140# Drop: 30"

Sampler Type: NA

BACKFILL | BLOWS/6" | INCHES DRIVEN | INCHES RECOVERED | HC Odor | Depth (ft)



Brown organic sandy-gravelly clay; damp; slight hydrocarbon odor.

Gray silty-clay; moist-wet; gravel to cobbles (Concrete & Brick).

Color change to dark gray; cement fragments gravelly; imported fill materials varying color in clayey materials: brown to black.

Boring terminated at 7.0 feet.

CERTIFIED	HOLIDAY INN	PROJECT # S90121
	Emeryville, CA	DATE: 7/39

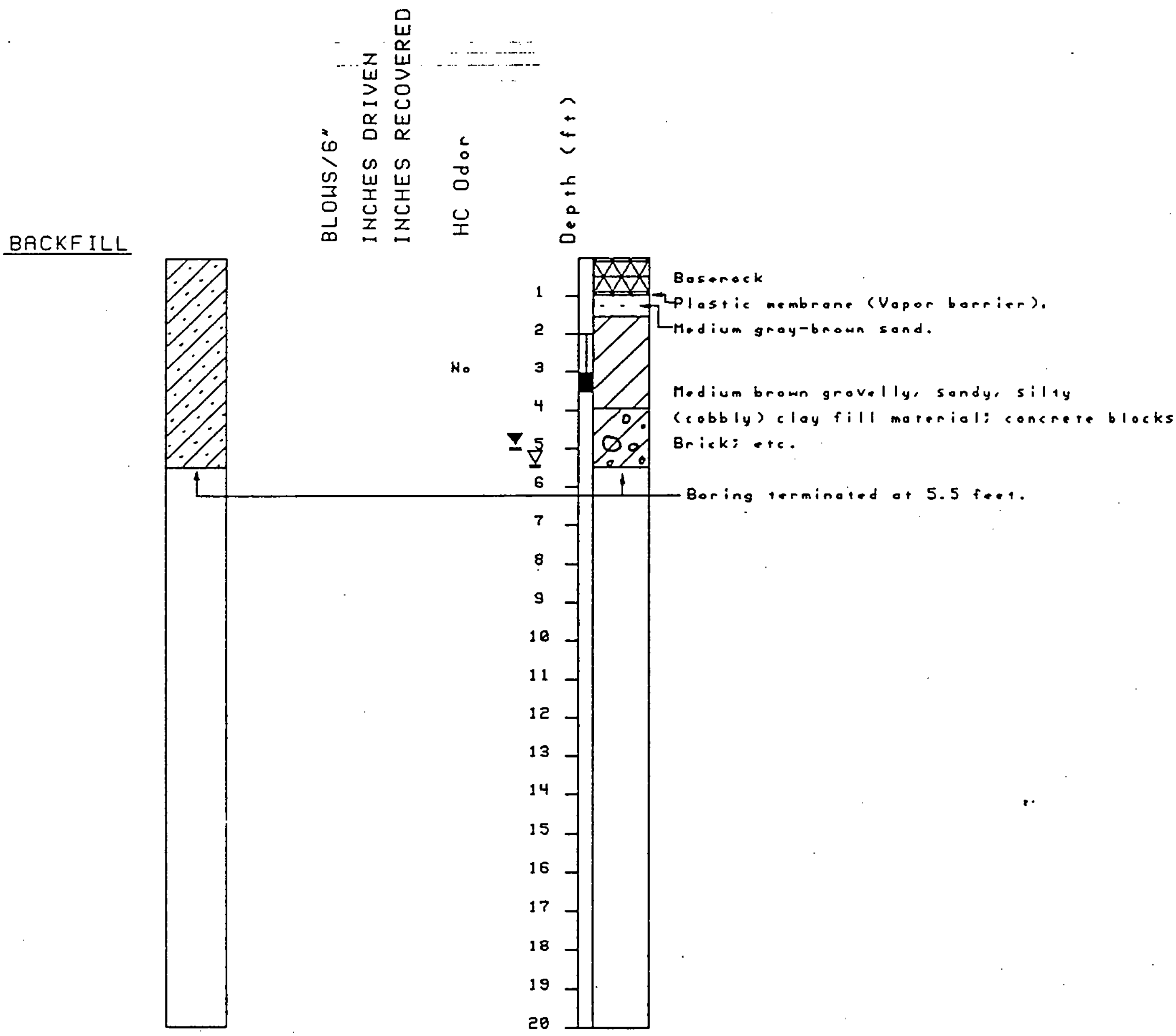
BORING B - 2
SHEET 1 of 1

Logged by: Chad Nichols
Edited by: Chad Nichols

Drilling Contractor: Mad Dog Drilling
Drill Rig Type: Portable Auger Jeep

Hammer Wt.: 140#   Drop: 30"

Sampler Type: NA



CERTIFIED	HOLIDAY INN	PROJECT # S90121
	Emeryville, CA	DATE: 7/89

AIN F C TOL REC D

CERTIFIED ENGINEERING
725 Greenwwich Street St. 204
San Francisco, CA 94133
415-986-6872

FAX
415-986-4283

roject #	Project Name:
90121	HOLIDAY INN - EMERYVILLE

ell or oring #	Date	Location	Number of Samples	624 Vol.	625 Semi Vol.	5030 TPH-G	3510 TPH-D	608 PCB's	PRIORITY METALS						Rem
-6-1	7/14		1 ltr.	X	X	X	X	X	X						
-3-2	7/14		1 ltr.	X	X	X	X	X	X						

Relinquished by: (Signature)	Date	Time	Recieved by: (Signature)	Date	Time	Remar
Chad Michaels	7/18/87		Tajli Memarzadi	7/18/89	10:35	
Relinquished by: (Signature)	Date	Time	Recieved by: (Signature)	Date	Time	Remar

CERTIFIED ENGINEERING & TESTING COMPANY
Environmental Consultants
725 GREENWICH STREET • SUITE 204 • SAN FRANCISCO, CA 94133
Telephone: (415) 986-6872
FAX: (415) 986-4283

SAMPLER (signature): Chad Nichols

Phone: 415-986-6872

LABORATORY: Anametrix

TURNAROUND TIME: 2 wks

Project Leader: Chad Nichols

Phone No. 415-986-6872

SHIPPING INFORMATION:

Shipper

Address

Date Shipped

Service Used

Airbill No. Cooler No.

Relinquished by: (signatures)	Received by: (signatures)	Date	Time
Chad Nichols			
	Received for laboratory by: Ty [illegible]	7/14/89	1514

LABORATORY SHOULD SIGN UPON RECEIPT AND RETURN A COPY OF THIS FORM WITH THE LABORATORY RESULTS

Sample No.	Site Identification	Date Sampled	Analyses Requested	~~Sample Condition Upon Receipt~~
1) B-1-3		7/14/89	8240/8270/5030/3550	/8080 (PCB)/ Prior. Metals
2) B-2-3		7/14/89	8240/8270/5030/3550	/8080/ Priority Metals
3) B-1	(2 Ltr/2 40 ml)	7/14/89	624/625/5030/3510/ 608	/ Priority Metals
4) B-2	(2 Ltr/2 40 ml)	7/14/89	624/625/5030/3510/ 608	/ Priority Metals

Legend
624/625 } Priority P[illegible]
8240/8270 } & BTEX
5030 — TPH-G
3550/3510 — TPH-D
8080/608 — PCB's
Priority Metals — same

REPORT SUMMARY
ANAMETRIX, INC. (408) 432-8192

Client : Certified Engineering & Testing
Address : 725 Greenwich Street
Suite 204
City : San Francisco, CA 94133
Attn. : Chad Nichols

Anametrix W.O.#: 7907098
Date Received : 07/14/89
Purchase Order#: N/A
Project No. : S90121
Date Released : 08/02/89

Anametrix I.D.	Sample I.D.	Matrix	Date Sampled	Method	Date Extract	Date Analyzed	Inst I.D.
RESULTS							
8907098-03	B-1	WATER	07/14/89	625	07/19/89	07/22/89	F2
8907098-04	B-2	WATER	07/14/89	625	07/19/89	07/22/89	F2
8907098-01	B-1-3	SOIL	07/14/89	8270	07/19/89	08/02/89	F2
8907098-02	B-2-3	SOIL	07/14/89	8270	07/19/89	07/24/89	F2
TENTATIVELY INDENTIFIED COMPOUNDS (Extra)							
8907098-01	B-1-3	SOIL	07/14/89	8270	07/19/89	08/02/89	F2
8907098-02	B-2-3	SOIL	07/14/89	8270	07/19/89	07/24/89	F2
QUALITY ASSURANCE (QA)							
2CB0721C02	METHOD BLANK	WATER	N/A	625	07/19/89	07/21/89	F2
2CB0719C01	METHOD BLANK	SOIL	N/A	8270	07/19/89	07/20/89	F2

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Anametrix I.D.	Sample I.D.	Matrix	Date Sampled	Method	Date Extract	Date Analyzed	Inst I.D.
RESULTS							
8907098-01	B-1-3	SOIL	07/14/89	TPH	07/19/89	07/25/89	N/A
8907098-02	B-2-3	SOIL	07/14/89	TPH	07/19/89	07/25/89	N/A
8907098-03	B-1	WATER	07/14/89	TPH	07/19/89	07/24/89	N/A
8907098-04	B-2	WATER	07/14/89	TPH	07/19/89	07/24/89	N/A

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Purchase Order#: N/A
Project No. : S90121
Date Released : 08/02/89

Anametrix I.D.	Sample I.D.	Matrix	Date Sampled	Method	Date Extract	Date Analyzed	Inst I.D.
RESULTS							
8907098-03	B-1	WATER	07/14/89	608	07/19/89	07/24/89	HP5
8907098-04	B-2	WATER	07/14/89	608	07/19/89	07/24/89	HP5
8907098-01	B-1-3	SOIL	07/14/89	8080	07/19/89	07/25/89	HP5
8907098-02	B-2-3	SOIL	07/14/89	8080	07/19/89	07/25/89	HP5
QUALITY ASSURANCE (QA)							
PWBL072189	METHOD BLANK	WATER	N/A	608	07/19/89	07/24/89	HP5
PSBL072189	METHOD BLANK	SOIL	N/A	8080	07/19/89	07/24/89	HP5

REPORT SUMMARY
ANAMETRIX, INC. (408) 432-8192

Client : Certified Engineering & Testing
Address : 725 Greenwich Street
Suite 204
City : San Francisco, CA 94133
Attn. : Chad Nichols

Anametrix W.O.#: B907098
Date Received : 07/14/89
Purchase Order#: N/A
Project No. : S90121
Date Released : 08/02/89

Anametrix I.D.	Sample I.D.	Matrix	Date Sampled	Method	Date Extract	Date Analyzed	Inst I.D.
RESULTS							
8907098-01	B-1-3	SOIL	07/14/89	METAL		07/20/89	AA1\
8907098-02	B-2-3	SOIL	07/14/89	METAL		07/20/89	AA1\
8907098-03	B-1	WATER	07/14/89	METAL		07/20/89	AA1\
8907098-04	B-2	WATER	07/14/89	METAL		07/20/89	AA1\
QUALITY ASSURANCE (QA)							
MB071989S	METHOD BLANK	SOIL	N/A	METAL		07/20/89	AA1\
MB071989W	METHOD BLANK	WATER	N/A	METAL		07/20/89	AA1\

ORGANIC ANALYSIS DATA SHEET - EPA METHOD 624/8240
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : S90121 B-1-3
Matrix : SOIL
Date sampled : 07/14/89
Date analyzed: 07/20/89
Dilut. factor: NONE

Anametrix I.D. : 8907098-01
Analyst : LN
Supervisor : PG
Date released : 08/02/89
Instrument ID : F1

CAS #	Compound Name	Reporting Limit (ug/Kg)	Amount Found (ug/Kg)
74-87-3	* Chloromethane	10	ND
75-01-4	* Vinyl Chloride	10	ND
74-83-9	* Bromomethane	10	ND
75-00-3	* Chloroethane	10	ND
75-69-4	* Trichlorofluoromethane	5	ND
75-35-4	* 1,1-Dichloroethene	5	ND
76-13-1	# Trichlorotrifluoroethane	5	ND
67-64-1	**Acetone	20	ND
75-15-0	**Carbondisulfide	5	ND
75-09-2	* Methylene Chloride	5	ND
156-60-5	* Trans-1,2-Dichloroethene	5	ND
75-34-3	* 1,1-Dichloroethane	5	ND
78-93-3	**2-Butanone	20	100
156-59-2	* Cis-1,2-Dichloroethene	5	ND
67-66-3	* Chloroform	5	ND
71-55-6	* 1,1,1-Trichloroethane	5	21
56-23-5	* Carbon Tetrachloride	5	ND
71-43-2	* Benzene	5	46
107-06-2	* 1,2-Dichloroethane	5	ND
79-01-6	* Trichloroethene	5	82
78-87-5	* 1,2-Dichloropropane	5	ND
75-27-4	* Bromodichloromethane	5	ND
110-75-8	* 2-Chloroethylvinylether	5	ND
108-05-4	**Vinyl Acetate	10	ND
10061-02-6	* Trans-1,3-Dichloropropene	5	ND
108-10-1	**4-Methyl-2-Pentanone	10	ND
108-88-3	* Toluene	5	15
10061-01-5	* cis-1,3-Dichloropropene	5	ND
79-00-5	* 1,1,2-Trichloroethane	5	ND
127-18-4	* Tetrachloroethene	5	ND
591-78-6	**2-Hexanone	10	ND
124-48-1	* Dibromochloromethane	5	ND
108-90-7	* Chlorobenzene	5	45
100-41-4	* Ethylbenzene	5	ND
1330-20-7	**Total Xylenes	5	ND
100-42-5	**Styrene	5	ND
75-25-2	* Bromoform	5	ND
79-34-5	* 1,1,2,2-Tetrachloroethane	5	ND
541-73-1	* 1,3-Dichlorobenzene	5	ND
106-46-7	* 1,4-Dichlorobenzene	5	ND
95-50-1	* 1,2-Dichlorobenzene	5	ND

CAS #	Surrogate Compounds	Limits	% Recovery
17060-07-0	1,2-Dichloroethane-d4	73-130%	90%
2037-26-5	Toluene-d8	74-121%	95%
460-00-4	p-Bromofluorobenzene	70-124%	98%

ORGANICS ANALYSIS DATA SHEET - 624/8240 TENTATIVELY IDENTIFIED COMPOUNDS
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : S90121 B-1-3
Matrix : SOIL
Date Sampled : 07/14/89
Analyzed VOA : 07/20/89
Dilution VOA : NONE

Anametrix I.D. : 8907098-01
Analyst : LM
Supervisor : PG
Date Released : 08/02/89

	CAS #	Scan#	Volatile Fraction Compound Name	Det. Limit ppb	Amt. Found ppb
1	98-82-8	896	1-methylethylbenzene	5	20
2	79-92-5	907	camphene	5	10
3	138-86-3	995	limonene	5	5
4	535-77-3	1002	1-methyl-3-(1-methylethyl)benzene	5	<5

Tentatively identified compounds are significant chromatographic peaks (TICs) other than priority pollutants. TIC spectra are compared with entries in the National Bureau of Standards mass spectral library. Identification is made by following US EPA guidelines and acceptance criteria. TICs are quantitated by using the area of the nearest internal standard and assuming a response factor of one (1). Values calculated are ESTIMATES ONLY.

ORGANIC ANALYSIS DATA SHEET -- EPA METHOD 625/8270
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : S90121 B-1-3
Matrix : SOIL
Date sampled : 07/14/89
Date ext. : 07/19/89
Date analyzed: 08/02/89
Dilut. factor: 5

Anametrix I.D. : 8907098-01
Analyst : UH
Supervisor : PG
Date released : 08/02/89
Weight ext. : 30 g
Instrument ID : F2

CAS #	Compound Name	Reporting Limit (ug/Kg)	Amount Found (ug/Kg)
62-75-9	* N-Nitrosodimethylamine	1650	ND
108-95-2	* Phenol	1650	ND
62-53-3	**Aniline	1650	ND
111-44-4	* bis(-2-Chloroethyl)Ether	1650	ND
95-57-8	* 2-Chlorophenol	1650	ND
541-73-1	* 1,3-Dichlorobenzene	1650	ND
106-46-7	* 1,4-Dichlorobenzene	1650	ND
100-51-6	**Benzyl Alcohol	1650	ND
95-50-1	* 1,2-Dichlorobenzene	1650	ND
95-48-7	**2-Methylphenol	1650	ND
108-60-1	**bis(2-chloroisopropyl)Ether	1650	ND
106-44-5	**4-Methylphenol	1650	ND
621-64-7	* N-Nitroso-Di-n-Propylamine	1650	ND
67-72-1	* Hexachloroethane	1650	ND
98-95-3	* Nitrobenzene	1650	ND
78-59-1	* Isophorone	1650	ND
88-75-5	* 2-Nitrophenol	1650	ND
105-67-9	* 2,4-Dimethylphenol	1650	ND
65-85-0	**Benzoic Acid	8000	ND
111-91-1	* bis(-2-Chloroethoxy)Methane	1650	ND
120-83-2	* 2,4-Dichlorophenol	1650	ND
120-82-1	* 1,2,4-Trichlorobenzene	1650	ND
91-20-3	* Naphthalene	1650	1800
106-47-8	**4-Chloroaniline	1650	ND
87-68-3	* Hexachlorobutadiene	1650	ND
59-50-7	* 4-Chloro-3-Methylphenol	1650	ND
91-57-6	**2-Methylnaphthalene	1650	ND
77-47-4	* Hexachlorocyclopentadiene	1650	ND
88-06-2	* 2,4,6-Trichlorophenol	1650	ND
95-95-4	**2,4,5-Trichlorophenol	8000	ND
91-58-7	* 2-Chloronaphthalene	1650	ND
88-74-4	**2-Nitroaniline	8000	ND
131-11-3	* Dimethyl Phthalate	1650	ND
208-96-8	* Acenaphthylene	1650	ND
99-09-2	**3-Nitroaniline	8000	ND
83-32-9	* Acenaphthene	1650	4900
51-28-5	* 2,4-Dinitrophenol	8000	ND
100-02-7	* 4-Nitrophenol	8000	ND
132-64-9	**Dibenzofuran	1650	ND

ND : Not detected at or above practical quantitation limit for the method.
* A 625 approved compound (Federal Register, 10/26/84).
** A compound on the U.S. EPA CLP Hazardous Substance List (HSL).

ORGANIC ANALYSIS DATA SHEET -- EPA METHOD 625/8270
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : S90121 B-1-3
Matrix : SOIL
Date sampled : 07/14/89
Date ext. : 07/19/89
Date analyzed: 08/02/89
Dilut. factor: 5

Anametrix I.D. : 8907098-01
Analyst : UM
Supervisor : PG
Date released : 08/02/89
Weight ext. : 30 g
Instrument ID : F2

CAS #	Compound Name	Reporting Limit (ug/Kg)	Amount Found (ug/Kg)
121-14-2	* 2,4-Dinitrotoluene	1650	ND
606-20-2	* 2,6-Dinitrotoluene	1650	ND
84-66-2	* Diethylphthalate	1650	ND
7005-72-3	* 4-Chlorophenyl-phenylether	1650	ND
86-73-7	* Fluorene	1650	ND
100-01-6	**4-Nitroaniline	8000	ND
534-52-1	**4,6-Dinitro-2-Methylphenol	8000	ND
86-30-6	* N-Nitrosodiphenylamine	1650	ND
122-66-7	**Azobenzene	1650	ND
101-55-3	* 4-Bromophenyl-phenylether	1650	ND
118-74-1	* Hexachlorobenzene	1650	ND
87-86-5	* Pentachlorophenol	8000	ND
85-01-8	* Phenanthrene	1650	16000
120-12-7	* Anthracene	1650	5300
84-74-2	* Di-n-Butylphthalate	1650	ND
206-44-0	* Fluoranthene	1650	33000
92-87-5	* Benzidine	8000	ND
129-00-0	* Pyrene	1650	46000
85-68-7	* Butylbenzylphthalate	1650	ND
91-94-1	* 3,3'-Dichlorobenzidine	3300	ND
56-55-3	* Benzo(a)Anthracene	1650	24000
117-81-7	* bis(2-Ethylhexyl)Phthalate	1650	ND
218-01-9	* Chrysene	1650	30000
117-84-0	* Di-n-Octyl Phthalate	1650	ND
205-99-2	* Benzo(b)Fluoranthene	1650	ND
207-08-9	* Benzo(k)Fluoranthene	1650	ND
50-32-8	* Benzo(a)Pyrene	1650	44000
193-39-5	* Indeno(1,2,3-cd)Pyrene	1650	ND
53-70-3	* Dibenz(a,h)Anthracene	1650	ND
191-24-2	* Benzo(g,h,i)Perylene	1650	ND

CAS #	Surrogate Compounds	Limits	%Recovery
367-12-4	2-Fluorophenol	15-83%	65%
4165-62-2	Phenol-d6	18-92%	77%
4165-60-0	Nitrobenzene-d5	12-80%	69%
321-60-8	2-Fluorobiphenyl	16-100%	93%
118-79-6	2,4,6-Tribromophenol	15-135%	92%
1718-51-0	Terphenyl-d14	15-117%	94%

ND : Not detected at or above practical quantitation limit for the method.
* A 625 approved compound (Federal Register, 10/26/84).
** A compound on the U.S. EPA CLP Hazardous Substance List (HSL).

ORGANICS ANALYSIS DATA SHEET - 625/8270 TENTATIVELY IDENTIFIED COMPOUNDS
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : S90121 B-1-3
Matrix : SOIL
Date Sampled : 07/14/89
Analyzed SV : 08/02/89
Dilution SV : 1:5

Anametrix I.D. : 8907098-01
Analyst : LM
Supervisor : PG
Date Released : 08/02/89

	CAS #	Scan#	Semivolatile Fraction Compound Name	Det. Limit ppb	Amt. Found ppb
1	100-52-7	529	benzaldehyde	1700	20000
2	98-86-2	654	1-phenylethanone	1700	56000
3	98-88-4	659	benzoyl chloride	1700	5800
4	90-12-0	881	1-methylnapthalene	1700	1700
5	132-65-0	1244	dibenzothiophene	1700	1700
6	2788-23-0	1297	9-nitroso-9H-carbazole	1700	6800
7	613-12-7	1342	2-methylanthracene	1700	5800
8	203-64-5	1355	4H-cyclopenta(DEF)phenanthrene	1700	12000
9	612-94-2	1384	2-phenylnaphthalene	1700	3800
.0	238-84-6	1534	11H-benzo(A)fluorene	1700	19000
.1		1689	unknown ploynuclear aromatic hydrocarbon	1700	5300

'entatively identified compounds are significant chromatographic peaks (TICs) ›ther than priority pollutants. TIC spectra are compared with entries in the ational Bureau of Standards mass spectral library. Identification is made y following US EPA guidelines and acceptance criteria. TICs are quantitated y using the area of the nearest internal standard and assuming a response actor of one (1). Values calculated are ESTIMATES ONLY.

ORGANIC ANALYSIS DATA SHEET -- EPA METHOD 608/8080
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : S90121 B-1-3
Matrix : SOIL
Date sampled : 07/14/89
Date ext. : 07/19/89
Date analyzed: 07/25/89
Dilution : NONE

Anametrix I.D. : 8907098-01
Analyst : MCT
Supervisor : JMS
Date released : 08/02/89
Weight ext. : 30 g
Instrument ID : HP5

CAS #	Compound Name	Reporting Limit (ug/Kg)	Amount Found (ug/Kg)
1104-28-2	Aroclor 1221	80	ND
11141-16-5	Aroclor 1232	80	ND
53469-21-9	Aroclor 1242	80	ND
12672-29-6	Aroclor 1248	80	ND
11097-69-1	Aroclor 1254	160	ND
11096-82-5	Aroclor 1260	160	ND
12674-11-2	Aroclor 1016	80	ND

ND : Not detected at or above the practical quantitation limit for the method.

ANALYSIS DATA SHEET - PETROLEUM HYDROCARBON COMPOUNDS
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : S90121 B-1-3
Matrix : SOIL
Date sampled : 07/14/89
Date anl.TPHg: 07/25/89
Date ext.TPHd: 07/19/89
Date anl.TPHd: 07/24/89

Anametrix I.D. : 8907098-01
Analyst :
Supervisor :
Date released : 08/02/89
Date ext. TOG : N/A
Date anl. TOG : N/A

CAS #	Compound Name	Reporting Limit (ug/kg)	Amount Found (ug/kg)
	TPH as Gasoline	1000	5700
	TPH as Diesel	10000	170000

ND - Not detected at or above the practical quantitation limit for the method.
TPHg - Total Petroleum Hydrocarbons as gasoline is determined by GCFID using EPA Method 5030.
TPHd - Total Petroleum Hydrocarbons as diesel is determined by GCFID following either EPA Method 3510 or 3550.

All testing procedures follow California Department of Health Services (Cal-DHS) approved methods.

ANALYSIS DATA SHEET - PRIORITY POLLUTANT METALS
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : S90121 B-1-3
Matrix : SOIL
Date Sampled : 07/14/89
Date Prepared: 07/19/89
Date Analyzed: 07/20/89

Anametrix ID : 8907098-01
Analyst : MN
Supervisor : ?
Instrument ID: AA1\ICP1
Date released: 08/02/89

EPA METHOD NO.	COMPOUNDS	Reporting Limit (mg/Kg)	Amount Found (mg/Kg)
6010	Silver (Ag)	0.5	ND
7060	Arsenic (As)	0.05	5.08
6010	Beryllium (Be)	0.5	ND
6010	Cadmium (Cd)	0.5	ND
6010	Total Chromium (TTl Cr)	0.5	17.4
6010	Copper (Cu)	0.5	74.6
7471	Mercury (Hg)	0.025	0.040
6010	Nickel (Ni)	1.0	26.4
6010	Lead (Pb)	1.0	31.7
6010	Antimony (Sb)	2.0	2.14
7740	Selenium (Se)	0.1	ND
6010	Thallium (Tl)	2.0	5.18
6010	Zinc (Zn)	0.5	78.0

ND : Not detected at or above the practical quantitation limit for the method.

ORGANIC ANALYSIS DATA SHEET - EPA METHOD 624/8240
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : S90121 B-2-3
Matrix : SOIL
Date sampled : 07/14/89
Date analyzed: 07/20/89
Dilut. factor: NONE

Anametrix I.D. : 8907098-04
Analyst : UM
Supervisor : PG
Date released : 08/02/89
Instrument ID : F1

CAS #	Compound Name	Reporting Limit (ug/Kg)	Amount Found (ug/Kg)
74-87-3	* Chloromethane	10	ND
75-01-4	* Vinyl Chloride	10	ND
74-83-9	* Bromomethane	10	ND
75-00-3	* Chloroethane	10	ND
75-69-4	* Trichlorofluoromethane	5	ND
75-35-4	* 1,1-Dichloroethene	5	ND
76-13-1	# Trichlorotrifluoroethane	5	ND
67-64-1	**Acetone	20	ND
75-15-0	**Carbondisulfide	5	ND
75-09-2	* Methylene Chloride	5	ND
156-60-5	* Trans-1,2-Dichloroethene	5	ND
75-34-3	* 1,1-Dichloroethane	5	ND
78-93-3	**2-Butanone	20	ND
156-59-2	* Cis-1,2-Dichloroethene	5	ND
67-66-3	* Chloroform	5	ND
71-55-6	* 1,1,1-Trichloroethane	5	ND
56-23-5	* Carbon Tetrachloride	5	ND
71-43-2	* Benzene	5	ND
107-06-2	* 1,2-Dichloroethane	5	ND
79-01-6	* Trichloroethene	5	15
78-87-5	* 1,2-Dichloropropane	5	ND
75-27-4	* Bromodichloromethane	5	ND
110-75-8	* 2-Chloroethylvinylether	5	ND
108-05-4	**Vinyl Acetate	10	ND
10061-02-6	* Trans-1,3-Dichloropropene	5	ND
108-10-1	**4-Methyl-2-Pentanone	10	ND
108-88-3	* Toluene	5	ND
10061-01-5	* cis-1,3-Dichloropropene	5	ND
79-00-5	* 1,1,2-Trichloroethane	5	ND
127-18-4	* Tetrachloroethene	5	ND
591-78-6	**2-Hexanone	10	ND
124-48-1	* Dibromochloromethane	5	ND
108-90-7	* Chlorobenzene	5	ND
100-41-4	* Ethylbenzene	5	ND
1330-20-7	**Total Xylenes	5	ND
100-42-5	**Styrene	5	ND
75-25-2	* Bromoform	5	ND
79-34-5	* 1,1,2,2-Tetrachloroethane	5	ND
541-73-1	* 1,3-Dichlorobenzene	5	ND
106-46-7	* 1,4-Dichlorobenzene	5	ND
95-50-1	* 1,2-Dichlorobenzene	5	ND

CAS #	Surrogate Compounds	Limits	% Recovery
17060-07-0	1,2-Dichloroethane-d4	73-130%	102%
2037-26-5	Toluene-d8	74-121%	85%
460-00-4	p-Bromofluorobenzene	70-124%	94%

ORGANIC ANALYSIS DATA SHEET -- EPA METHOD 625/8270
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : S90121 B-2-3
Matrix : SOIL
Date sampled : 07/14/89
Date ext. : 07/19/89
Date analyzed: 07/24/89
Dilut. factor: NONE

Anametrix I.D. : 8907098-02
Analyst : UY
Supervisor : PG
Date released : 08/02/89
Weight ext. : 30 g
Instrument ID : F2

CAS #	Compound Name	Reporting Limit (ug/Kg)	Amount Found (ug/Kg)
62-75-9	* N-Nitrosodimethylamine	330	ND
108-95-2	* Phenol	330	ND
62-53-3	**Aniline	330	ND
111-44-4	* bis(-2-Chloroethyl)Ether	330	ND
95-57-8	* 2-Chlorophenol	330	ND
541-73-1	* 1,3-Dichlorobenzene	330	ND
106-46-7	* 1,4-Dichlorobenzene	330	ND
100-51-6	**Benzyl Alcohol	330	ND
95-50-1	* 1,2-Dichlorobenzene	330	ND
95-48-7	**2-Methylphenol	330	ND
108-60-1	**bis(2-chloroisopropyl)Ether	330	ND
106-44-5	**4-Methylphenol	330	ND
621-64-7	* N-Nitroso-Di-n-Propylamine	330	ND
67-72-1	* Hexachloroethane	330	ND
98-95-3	* Nitrobenzene	330	ND
78-59-1	* Isophorone	330	ND
88-75-5	* 2-Nitrophenol	330	ND
105-67-9	* 2,4-Dimethylphenol	330	ND
65-85-0	**Benzoic Acid	1600	ND
111-91-1	* bis(-2-Chloroethoxy)Methane	330	ND
120-83-2	* 2,4-Dichlorophenol	330	ND
120-82-1	* 1,2,4-Trichlorobenzene	330	ND
91-20-3	* Naphthalene	330	ND
106-47-8	**4-Chloroaniline	330	ND
87-68-3	* Hexachlorobutadiene	330	ND
59-50-7	* 4-Chloro-3-Methylphenol	330	ND
91-57-6	**2-Methylnaphthalene	330	ND
77-47-4	* Hexachlorocyclopentadiene	330	ND
88-06-2	* 2,4,6-Trichlorophenol	330	ND
95-95-4	**2,4,5-Trichlorophenol	1600	ND
91-58-7	* 2-Chloronaphthalene	330	ND
88-74-4	**2-Nitroaniline	1600	ND
131-11-3	* Dimethyl Phthalate	330	ND
208-96-8	* Acenaphthylene	330	ND
99-09-2	**3-Nitroaniline	1600	ND
83-32-9	* Acenaphthene	330	ND
51-28-5	* 2,4-Dinitrophenol	1600	ND
100-02-7	* 4-Nitrophenol	1600	ND
132-64-9	**Dibenzofuran	330	ND

ND : Not detected at or above practical quantitation limit for the method.
* A 625 approved compound (Federal Register, 10/26/84).
** A compound on the U.S. EPA CLP Hazardous Substance List (HSL).

ORGANIC ANALYSIS DATA SHEET -- EPA METHOD 625/8270
ANAMETRIX, INC. (408) 432-8192

Sample I.D.	: S90121 B-2-3	Anametrix I.D.	: 8907098-02
Matrix	: SOIL	Analyst	: JM
Date sampled	: 07/14/89	Supervisor	: PG
Date ext.	: 07/19/89	Date released	: 08/02/89
Date analyzed	: 07/24/89	Weight ext.	: 30 g
Dilut. factor	: NONE	Instrument ID	: F2

CAS #	Compound Name	Reporting Limit (ug/Kg)	Amount Found (ug/Kg)
121-14-2	* 2,4-Dinitrotoluene	330	ND
606-20-2	* 2,6-Dinitrotoluene	330	ND
84-66-2	* Diethylphthalate	330	ND
7005-72-3	* 4-Chlorophenyl-phenylether	330	ND
86-73-7	* Fluorene	330	ND
100-01-6	**4-Nitroaniline	1600	ND
534-52-1	**4,6-Dinitro-2-Methylphenol	1600	ND
86-30-6	* N-Nitrosodiphenylamine	330	ND
122-66-7	**Azobenzene	330	ND
101-55-3	* 4-Bromophenyl-phenylether	330	ND
118-74-1	* Hexachlorobenzene	330	ND
87-86-5	* Pentachlorophenol	1600	ND
85-01-8	* Phenanthrene	330	ND
120-12-7	* Anthracene	330	ND
84-74-2	* Di-n-Butylphthalate	330	ND
206-44-0	* Fluoranthene	330	ND
92-87-5	* Benzidine	1600	ND
129-00-0	* Pyrene	330	ND
85-68-7	* Butylbenzylphthalate	330	ND
91-94-1	* 3,3'-Dichlorobenzidine	660	ND
56-55-3	* Benzo(a)Anthracene	330	ND
117-81-7	* bis(2-Ethylhexyl)Phthalate	330	ND
218-01-9	* Chrysene	330	ND
117-84-0	* Di-n-Octyl Phthalate	330	ND
205-99-2	* Benzo(b)Fluoranthene	330	ND
207-08-9	* Benzo(k)Fluoranthene	330	ND
50-32-8	* Benzo(a)Pyrene	330	ND
193-39-5	* Indeno(1,2,3-cd)Pyrene	330	ND
53-70-3	* Dibenz(a,h)Anthracene	330	ND
191-24-2	* Benzo(g,h,i)Perylene	330	ND

CAS #	Surrogate Compounds	Limits	%Recovery
367-12-4	2-Fluorophenol	15-83%	55%
4165-62-2	Phenol-d6	18-92%	58%
4165-60-0	Nitrobenzene-d5	12-80%	52%
321-60-8	2-Fluorobiphenyl	16-100%	66%
118-79-6	2,4,6-Tribromophenol	15-135%	117%
1718-51-0	Terphenyl-d14	15-117%	89%

ND : Not detected at or above practical quantitation limit for the method.
* A 625 approved compound (Federal Register, 10/26/84).
** A compound on the U.S. EPA CLP Hazardous Substance List (HSL).

ORGANICS ANALYSIS DATA SHEET - 625/8270 TENTATIVELY IDENTIFIED COMPOUNDS
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : S90121 B-2-3
Matrix : SOIL
Date Sampled : 07/14/89
Analyzed SV : 07/24/89
Dilution SV : NONE

Anametrix I.D. : 8907098-02
Analyst : UM
Supervisor : PG
Date Released : 08/02/89

	CAS #	Scan#	Semivolatile Fraction Compound Name	Det. Limit ppb	Amt. Found ppb
1	10544-50-0	1495	molecular sulfur	330	1600

entatively identified compounds are significant chromatographic peaks (TICs) ther than priority pollutants. TIC spectra are compared with entries in the ational Bureau of Standards mass spectral library. Identification is made y following US EPA guidelines and acceptance criteria. TICs are quantitated y using the area of the nearest internal standard and assuming a response actor of one (1). Values calculated are ESTIMATES ONLY.

ORGANIC ANALYSIS DATA SHEET -- EPA METHOD 608/8080
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : S90121 B-2-3
Matrix : SOIL
Date sampled : 07/14/89
Date ext. : 07/19/89
Date analyzed: 07/25/89
Dilution : NONE

Anametrix I.D. : 8907098-02
Analyst : MCT
Supervisor : DS
Date released : 08/02/89
Weight ext. : 30 g
Instrument ID : HP5

CAS #	Compound Name	Reporting Limit (ug/Kg)	Amount Found (ug/Kg)
1104-28-2	Aroclor 1221	80	ND
11141-16-5	Aroclor 1232	80	ND
53469-21-9	Aroclor 1242	80	ND
12672-29-6	Aroclor 1248	80	ND
11097-69-1	Aroclor 1254	160	ND
11096-82-5	Aroclor 1260	160	ND
12674-11-2	Aroclor 1016	80	ND

ND : Not detected at or above the practical quantitation limit for the method.

ANALYSIS DATA SHEET - PETROLEUM HYDROCARBON COMPOUNDS
ANAMETRIX, INC. (408) 432-8192

Sample I.D.	: S90121 B-2-3	Anametrix I.D.	: 8907098-02
Matrix	: SOIL ←	Analyst	: CZ
Date sampled	: 07/14/89	Supervisor	: TC
Date anl.TPHg	: 07/25/89	Date released	: 08/02/89
Date ext.TPHd	: 07/19/89	Date ext. TOG	: N/A
Date anl.TPHd	: 07/24/89	Date anl. TOG	: N/A

CAS #	Compound Name	Reporting Limit (ug/kg)	Amount Found (ug/kg)
	TPH as Gasoline	1000	9000
	TPH as Diesel	10000	→ 210000

ND - Not detected at or above the practical quantitation limit for the method.

TPHg - Total Petroleum Hydrocarbons as gasoline is determined by GCFID using EPA Method 5030.

TPHd - Total Petroleum Hydrocarbons as diesel is determined by GCFID following either EPA Method 3510 or 3550.

All testing procedures follow California Department of Health Services (Cal-DHS) approved methods.

ANALYSIS DATA SHEET - PRIORITY POLLUTANT METALS
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : S90121 B-2-3
Matrix : SOIL
Date Sampled : 07/14/89
Date Prepared: 07/19/89
Date Analyzed: 07/20/89

Anametrix ID : 8907098-02
Analyst : MN
Supervisor : RA
Instrument ID: AA1\ICP1
Date released: 08/02/89

EPA METHOD NO.	COMPOUNDS	Reporting Limit (mg/Kg)	Amount Found (mg/Kg)
6010	Silver (Ag)	0.5	ND
7060	Arsenic (As)	0.05	4.92
6010	Beryllium (Be)	0.5	ND
6010	Cadmium (Cd)	0.5	0.644
6010	Total Chromium (TTl Cr)	0.5	24.8
6010	Copper (Cu)	0.5	38.3
7471	Mercury (Hg)	0.025	0.202
6010	Nickel (Ni)	1.0	54.3
6010	Lead (Pb)	1.0	125
6010	Antimony (Sb)	2.0	4.34
7740	Selenium (Se)	0.1	ND
6010	Thallium (Tl)	2.0	7.47
6010	Zinc (Zn)	0.5	187

ND : Not detected at or above the practical quantitation limit for the method.

ORGANIC ANALYSIS DATA SHEET - EPA METHOD 624/8240
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : S90121 B-1
Matrix : WATER
Date sampled : 07/14/89
Date analyzed: 07/21/89
Dilut. factor: NONE

Anametrix I.D. : 8907098-03
Analyst : UH
Supervisor : PG
Date released : 08/02/89
Instrument ID : F3

CAS #	Compound Name	Reporting Limit (ug/l)	Amount Found (ug/l)
74-87-3	* Chloromethane	10	ND
75-01-4	* Vinyl Chloride	10	ND
74-83-9	* Bromomethane	10	ND
75-00-3	* Chloroethane	10	ND
75-69-4	* Trichlorofluoromethane	5	ND
75-35-4	* 1,1-Dichloroethene	5	ND
76-13-1	# Trichlorotrifluoroethane	5	ND
67-64-1	**Acetone	20	ND
75-15-0	**Carbondisulfide	5	ND
75-09-2	* Methylene Chloride	5	ND
156-60-5	* Trans-1,2-Dichloroethene	5	ND
75-34-3	* 1,1-Dichloroethane	5	ND
78-93-3	**2-Butanone	20	ND
156-59-2	* Cis-1,2-Dichloroethene	5	ND
67-66-3	* Chloroform	5	ND
71-55-6	* 1,1,1-Trichloroethane	5	ND
56-23-5	* Carbon Tetrachloride	5	ND
71-43-2	* Benzene	5	ND
107-06-2	* 1,2-Dichloroethane	5	ND
79-01-6	* Trichloroethene	5	ND
78-87-5	* 1,2-Dichloropropane	5	ND
75-27-4	* Bromodichloromethane	5	ND
110-75-8	* 2-Chloroethylvinylether	5	ND
108-05-4	**Vinyl Acetate	10	ND
10061-02-6	* Trans-1,3-Dichloropropene	5	ND
108-10-1	**4-Methyl-2-Pentanone	10	ND
108-88-3	* Toluene	5	ND
10061-01-5	* cis-1,3-Dichloropropene	5	ND
79-00-5	* 1,1,2-Trichloroethane	5	ND
127-18-4	* Tetrachloroethene	5	ND
591-78-6	**2-Hexanone	10	ND
124-48-1	* Dibromochloromethane	5	ND
108-90-7	* Chlorobenzene	5	ND
100-41-4	* Ethylbenzene	5	ND
1330-20-7	**Total Xylenes	5	ND
100-42-5	**Styrene	5	ND
75-25-2	* Bromoform	5	ND
79-34-5	* 1,1,2,2-Tetrachloroethane	5	ND
541-73-1	* 1,3-Dichlorobenzene	5	ND
106-46-7	* 1,4-Dichlorobenzene	5	ND
95-50-1	* 1,2-Dichlorobenzene	5	ND

CAS #	Surrogate Compounds	Limits	% Recovery
17060-07-0	1,2-Dichloroethane-d4	75-113%	91%
2037-26-5	Toluene-d8	83-110%	97%
460-00-4	p-Bromofluorobenzene	82-114%	100%

ORGANIC ANALYSIS DATA SHEET -- EPA METHOD 625/8270
ANAMETRIX, INC. (408) 432-8192

Sample I.D.	: S90121 B-1	Anametrix I.D.	: 8907098-03
Matrix	: WATER	Analyst	: LH
Date sampled	: 07/14/89	Supervisor	: PG
Date ext.	: 07/19/89	Date released	: 08/02/89
Date analyzed	: 07/22/89	Volume ext.	: 1 LITER
Dilut. factor	: NONE	Instrument ID	: F2

CAS #	Compound Name	Reporting Limit (ug/l)	Amount Found (ug/l)
62-75-9	* N-Nitrosodimethylamine	10	ND
108-95-2	* Phenol	10	ND
62-53-3	**Aniline	10	ND
111-44-4	* bis(-2-Chloroethyl)Ether	10	ND
95-57-8	* 2-Chlorophenol	10	ND
541-73-1	* 1,3-Dichlorobenzene	10	ND
106-46-7	* 1,4-Dichlorobenzene	10	ND
100-51-6	**Benzyl Alcohol	10	ND
95-50-1	* 1,2-Dichlorobenzene	10	ND
95-48-7	**2-Methylphenol	10	ND
108-60-1	**bis(2-chloroisopropyl)Ether	10	ND
106-44-5	**4-Methylphenol	10	ND
621-64-7	* N-Nitroso-Di-n-Propylamine	10	ND
67-72-1	* Hexachloroethane	10	ND
98-95-3	* Nitrobenzene	10	ND
78-59-1	* Isophorone	10	ND
88-75-5	* 2-Nitrophenol	10	ND
105-67-9	* 2,4-Dimethylphenol	10	ND
65-85-0	**Benzoic Acid	50	ND
111-91-1	* bis(-2-Chloroethoxy)Methane	10	ND
120-83-2	* 2,4-Dichlorophenol	10	ND
120-82-1	* 1,2,4-Trichlorobenzene	10	ND
91-20-3	* Naphthalene	10	ND
106-47-8	**4-Chloroaniline	10	ND
87-68-3	* Hexachlorobutadiene	10	ND
59-50-7	* 4-Chloro-3-Methylphenol	10	ND
91-57-6	**2-Methylnaphthalene	10	ND
77-47-4	* Hexachlorocyclopentadiene	10	ND
88-06-2	* 2,4,6-Trichlorophenol	10	ND
95-95-4	**2,4,5-Trichlorophenol	50	ND
91-58-7	* 2-Chloronaphthalene	10	ND
88-74-4	**2-Nitroaniline	50	ND
131-11-3	* Dimethyl Phthalate	10	ND
208-96-8	* Acenaphthylene	10	ND
99-09-2	**3-Nitroaniline	50	ND
83-32-9	* Acenaphthene	10	ND
51-28-5	* 2,4-Dinitrophenol	50	ND
100-02-7	* 4-Nitrophenol	50	ND
132-64-9	**Dibenzofuran	10	ND

ND : Not detected at or above the practical quantitation limit for the method.
* A 625 approved compound (Federal Register, 10/26/84).
** A compound on the U.S. EPA CLP Hazardous Substance List (HSL).

ORGANIC ANALYSIS DATA SHEET -- EPA METHOD 625/8270
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : S90121 B-1
Matrix : WATER
Date sampled : 07/14/89
Date ext. : 07/19/89
Date analyzed: 07/22/89
Dilut. factor: NONE

Anametrix I.D. : 8907098-03
Analyst : JM
Supervisor : PG
Date released : 08/02/89
Volume ext. : 1 LITER
Instrument ID : F2

CAS #	Compound Name	Reporting Limit (ug/l)	Amount Found (ug/l)
121-14-2	* 2,4-Dinitrotoluene	10	ND
606-20-2	* 2,6-Dinitrotoluene	10	ND
84-66-2	* Diethylphthalate	10	ND
7005-72-3	* 4-Chlorophenyl-phenylether	10	ND
86-73-7	* Fluorene	10	ND
100-01-6	**4-Nitroaniline	50	ND
534-52-1	**4,6-Dinitro-2-Methylphenol	50	ND
86-30-6	* N-Nitrosodiphenylamine	10	ND
122-66-7	**Azobenzene	10	ND
101-55-3	* 4-Bromophenyl-phenylether	10	ND
118-74-1	* Hexachlorobenzene	10	ND
87-86-5	* Pentachlorophenol	50	ND
85-01-8	* Phenanthrene	10	ND
120-12-7	* Anthracene	10	ND
84-74-2	* Di-n-Butylphthalate	10	ND
206-44-0	* Fluoranthene	10	ND
92-87-5	* Benzidine	50	ND
129-00-0	* Pyrene	10	ND
85-68-7	* Butylbenzylphthalate	10	ND
91-94-1	* 3,3'-Dichlorobenzidine	20	ND
56-55-3	* Benzo(a)Anthracene	10	ND
117-81-7	* bis(2-Ethylhexyl)Phthalate	10	ND
218-01-9	* Chrysene	10	ND
117-84-0	* Di-n-Octyl Phthalate	10	ND
205-99-2	* Benzo(b)Fluoranthene	10	ND
207-08-9	* Benzo(k)Fluoranthene	10	ND
50-32-8	* Benzo(a)Pyrene	10	ND
193-39-5	* Indeno(1,2,3-cd)Pyrene	10	ND
53-70-3	* Dibenz(a,h)Anthracene	10	ND
191-24-2	* Benzo(g,h,i)Perylene	10	ND

CAS #	Surrogate Compounds	Limits	%Recovery
367-12-4	2-Fluorophenol	11-70%	30%
4165-62-2	Phenol-d6	10-62%	27%
4165-60-0	Nitrobenzene-d5	20-105%	52%
321-60-8	2-Fluorobiphenyl	26-110%	54%
118-79-6	2,4,6-Tribromophenol	26-154%	46%
1718-51-0	Terphenyl-d14	16-131%	98%

ND : Not detected at or above the practical quantitation limit for the method.
* A 625 approved compound (Federal Register, 10/26/84).
** A compound on the U.S. EPA CLP Hazardous Substance List (HSL).

ORGANIC ANALYSIS DATA SHEET -- EPA METHOD 608/8080
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : S90121 B-1
Matrix : WATER
Date sampled : 07/14/89
Date ext. : 07/19/89
Date analyzed: 07/24/89
Dilution : NONE

Anametrix I.D. : 8907098-03
Analyst : [illegible]
Supervisor : [illegible]
Date released : 08/02/89
Volume ext. : 1 LITER
Instrument ID : HP5

CAS #	Compound Name	Reporting Limit (ug/l)	Amount Found (ug/l)
1104-28-2	Aroclor 1221	0.5	ND
11141-16-5	Aroclor 1232	0.5	ND
53469-21-9	Aroclor 1242	0.5	ND
12672-29-6	Aroclor 1248	0.5	ND
11097-69-1	Aroclor 1254	1	ND
11096-82-5	Aroclor 1260	1	ND
12674-11-2	Aroclor 1016	0.5	ND

ND : Not detected at or above the practical quantitation limit for the method.

ANALYSIS DATA SHEET - PETROLEUM HYDROCARBON COMPOUNDS
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : S90121 B-1
Matrix : WATER
Date sampled : 07/14/89
Date anl.TPHg: 07/24/89
Date ext.TPHd: 07/19/89
Date anl.TPHd: 07/21/89

Anametrix I.D. : 8907098-03
Analyst : MCT
Supervisor : TC
Date released : 08/02/89
Date ext. TOG : N/A
Date anl. TOG : N/A

CAS #	Compound Name	Reporting Limit (ug/l)	Amount Found (ug/l)
71-43-2	Benzene	0.5	ND
108-88-3	Toluene	0.5	ND
100-41-4	Ethylbenzene	0.5	ND
1330-20-7	Total Xylenes	1	3
	TPH as Gasoline	50	ND
	TPH as Diesel	50	ND

ND - Below reporting limit.
TPHg - Total Petroleum Hydrocarbons as gasoline is determined by GCFID using EPA Method 5030.
TPHd - Total Petroleum Hydrocarbons as diesel is determined by GCFID following either EPA Method 3510 or 3550.
BTEX - Benzene, Toluene, Ethylbenzene, and Total Xylenes are determined by modified EPA 8020.

All testing procedures follow California Department of Health Services (Cal-DHS) approved methods.

ANALYSIS DATA SHEET - PRIORITY POLLUTANT METALS
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : S90121 B-1
Matrix : WATER
Date Sampled : 07/14/89
Date Prepared: 07/19/89
Date Analyzed: 07/20/89

Anametrix ID : 8907098-03
Analyst : MN
Supervisor : RA
Instrument ID: AA1\ICP1
Date released: 08/02/89

EPA METHOD NO.	COMPOUNDS	Reporting Limit (mg/l)	Amount Found (mg/l)
6010	Silver (Ag)	0.01	0.249
7060	Arsenic (As)	0.001	0.045
6010	Beryllium (Be)	0.01	ND
6010	Cadmium (Cd)	0.01	ND
6010	Total Chromium (TTl Cr)	0.01	0.012
6010	Copper (Cu)	0.01	0.022
7470	Mercury (Hg)	0.001	0.001
6010	Nickel (Ni)	0.02	0.026
6010	Lead (Pb)	0.02	0.098
6010	Antimony (Sb)	0.04	0.043
7740	Selenium (Se)	0.002	0.006
6010	Thallium (Tl)	0.04	0.282
6010	Zinc (Zn)	0.01	0.398

ND : Not detected at or above the practical quantitation limit for the method.

ORGANIC ANALYSIS DATA SHEET - EPA METHOD 624/8240
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : S90121 B-2
Matrix : WATER
Date sampled : 07/14/89
Date analyzed: 07/20/89
Dilut. factor: NONE

Anametrix I.D. : 8907098-04
Analyst : JM
Supervisor : PG
Date released : 08/02/89
Instrument ID : F3

CAS #	Compound Name	Reporting Limit (ug/l)	Amount Found (ug/l)
74-87-3	* Chloromethane	10	ND
75-01-4	* Vinyl Chloride	10	ND
74-83-9	* Bromomethane	10	ND
75-00-3	* Chloroethane	10	ND
75-69-4	* Trichlorofluoromethane	5	ND
75-35-4	* 1,1-Dichloroethene	5	ND
76-13-1	# Trichlorotrifluoroethane	5	ND
67-64-1	**Acetone	20	ND
75-15-0	**Carbondisulfide	5	ND
75-09-2	* Methylene Chloride	5	ND
156-60-5	* Trans-1,2-Dichloroethene	5	ND
75-34-3	* 1,1-Dichloroethane	5	ND
78-93-3	**2-Butanone	20	ND
156-59-2	* Cis-1,2-Dichloroethene	5	ND
67-66-3	* Chloroform	5	ND
71-55-6	* 1,1,1-Trichloroethane	5	ND
56-23-5	* Carbon Tetrachloride	5	ND
71-43-2	* Benzene	5	ND
107-06-2	* 1,2-Dichloroethane	5	ND
79-01-6	* Trichloroethene	5	ND
78-87-5	* 1,2-Dichloropropane	5	ND
75-27-4	* Bromodichloromethane	5	ND
110-75-8	* 2-Chloroethylvinylether	5	ND
108-05-4	**Vinyl Acetate	10	ND
10061-02-6	* Trans-1,3-Dichloropropene	5	ND
108-10-1	**4-Methyl-2-Pentanone	10	ND
108-88-3	* Toluene	5	ND
10061-01-5	* cis-1,3-Dichloropropene	5	ND
79-00-5	* 1,1,2-Trichloroethane	5	ND
127-18-4	* Tetrachloroethene	5	ND
591-78-6	**2-Hexanone	10	ND
124-48-1	* Dibromochloromethane	5	ND
108-90-7	* Chlorobenzene	5	ND
100-41-4	* Ethylbenzene	5	ND
1330-20-7	**Total Xylenes	5	ND
100-42-5	**Styrene	5	ND
75-25-2	* Bromoform	5	ND
79-34-5	* 1,1,2,2-Tetrachloroethane	5	ND
541-73-1	* 1,3-Dichlorobenzene	5	ND
106-46-7	* 1,4-Dichlorobenzene	5	ND
95-50-1	* 1,2-Dichlorobenzene	5	ND

CAS #	Surrogate Compounds	Limits	% Recovery
17060-07-0	1,2-Dichloroethane-d4	75-113%	88%
2037-26-5	Toluene-d8	83-110%	97%
460-00-4	p-Bromofluorobenzene	82-114%	101%

ORGANIC ANALYSIS DATA SHEET -- EPA METHOD 625/8270
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : S90121 B-2
Matrix : WATER
Date sampled : 07/14/89
Date ext. : 07/19/89
Date analyzed: 07/22/89
Dilut. factor: NONE

Anametrix I.D. : 8907098-04
Analyst : UM
Supervisor : PG
Date released : 08/02/89
Volume ext. : 1 LITER
Instrument ID : F2

CAS #	Compound Name	Reporting Limit (ug/l)	Amount Found (ug/l)
62-75-9	* N-Nitrosodimethylamine	10	ND
108-95-2	* Phenol	10	ND
62-53-3	**Aniline	10	ND
111-44-4	* bis(-2-Chloroethyl)Ether	10	ND
95-57-8	* 2-Chlorophenol	10	ND
541-73-1	* 1,3-Dichlorobenzene	10	ND
106-46-7	* 1,4-Dichlorobenzene	10	ND
100-51-6	**Benzyl Alcohol	10	ND
95-50-1	* 1,2-Dichlorobenzene	10	ND
95-48-7	**2-Methylphenol	10	ND
108-60-1	**bis(2-chloroisopropyl)Ether	10	ND
106-44-5	**4-Methylphenol	10	ND
621-64-7	* N-Nitroso-Di-n-Propylamine	10	ND
67-72-1	* Hexachloroethane	10	ND
98-95-3	* Nitrobenzene	10	ND
78-59-1	* Isophorone	10	ND
88-75-5	* 2-Nitrophenol	10	ND
105-67-9	* 2,4-Dimethylphenol	10	ND
65-85-0	**Benzoic Acid	50	ND
111-91-1	* bis(-2-Chloroethoxy)Methane	10	ND
120-83-2	* 2,4-Dichlorophenol	10	ND
120-82-1	* 1,2,4-Trichlorobenzene	10	ND
91-20-3	* Naphthalene	10	ND
106-47-8	**4-Chloroaniline	10	ND
87-68-3	* Hexachlorobutadiene	10	ND
59-50-7	* 4-Chloro-3-Methylphenol	10	ND
91-57-6	**2-Methylnaphthalene	10	ND
77-47-4	* Hexachlorocyclopentadiene	10	ND
88-06-2	* 2,4,6-Trichlorophenol	10	ND
95-95-4	**2,4,5-Trichlorophenol	50	ND
91-58-7	* 2-Chloronaphthalene	10	ND
88-74-4	**2-Nitroaniline	50	ND
131-11-3	* Dimethyl Phthalate	10	ND
208-96-8	* Acenaphthylene	10	ND
99-09-2	**3-Nitroaniline	50	ND
83-32-9	* Acenaphthene	10	ND
51-28-5	* 2,4-Dinitrophenol	50	ND
100-02-7	* 4-Nitrophenol	50	ND
132-64-9	**Dibenzofuran	10	ND

ND : Not detected at or above the practical quantitation limit for the method.
* A 625 approved compound (Federal Register, 10/26/84).
** A compound on the U.S. EPA CLP Hazardous Substance List (HSL).

ORGANIC ANALYSIS DATA SHEET -- EPA METHOD 625/8270
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : S90121 B-2
Matrix : WATER
Date sampled : 07/14/89
Date ext. : 07/19/89
Date analyzed: 07/22/89
Dilut. factor: NONE

Anametrix I.D. : 8907098-04
Analyst : VM
Supervisor : PG
Date released : 08/02/89
Volume ext. : 1 LITER
Instrument ID : F2

CAS #	Compound Name	Reporting Limit (ug/l)	Amount Found (ug/l)
121-14-2	* 2,4-Dinitrotoluene	10	ND
606-20-2	* 2,6-Dinitrotoluene	10	ND
84-66-2	* Diethylphthalate	10	ND
7005-72-3	* 4-Chlorophenyl-phenylether	10	ND
86-73-7	* Fluorene	10	ND
100-01-6	**4-Nitroaniline	50	ND
534-52-1	**4,6-Dinitro-2-Methylphenol	50	ND
86-30-6	* N-Nitrosodiphenylamine	10	ND
122-66-7	**Azobenzene	10	ND
101-55-3	* 4-Bromophenyl-phenylether	10	ND
118-74-1	* Hexachlorobenzene	10	ND
87-86-5	* Pentachlorophenol	50	ND
85-01-8	* Phenanthrene	10	ND
120-12-7	* Anthracene	10	ND
84-74-2	* Di-n-Butylphthalate	10	ND
206-44-0	* Fluoranthene	10	ND
92-87-5	* Benzidine	50	ND
129-00-0	* Pyrene	10	ND
85-68-7	* Butylbenzylphthalate	10	ND
91-94-1	* 3,3'-Dichlorobenzidine	20	ND
56-55-3	* Benzo(a)Anthracene	10	ND
117-81-7	* bis(2-Ethylhexyl)Phthalate	10	ND
218-01-9	* Chrysene	10	ND
117-84-0	* Di-n-Octyl Phthalate	10	ND
205-99-2	* Benzo(b)Fluoranthene	10	ND
207-08-9	* Benzo(k)Fluoranthene	10	ND
50-32-8	* Benzo(a)Pyrene	10	ND
193-39-5	* Indeno(1,2,3-cd)Pyrene	10	ND
53-70-3	* Dibenz(a,h)Anthracene	10	ND
191-24-2	* Benzo(g,h,i)Perylene	10	ND

CAS #	Surrogate Compounds	Limits	%Recovery
367-12-4	2-Fluorophenol	11-70%	21%
4165-62-2	Phenol-d6	10-62%	21%
4165-60-0	Nitrobenzene-d5	20-105%	42%
321-60-8	2-Fluorobiphenyl	26-110%	48%
118-79-6	2,4,6-Tribromophenol	26-154%	34%
1718-51-0	Terphenyl-d14	16-131%	90%

ND : Not detected at or above the practical quantitation limit for the method.
* A 625 approved compound (Federal Register, 10/26/84).
** A compound on the U.S. EPA CLP Hazardous Substance List (HSL).

ORGANIC ANALYSIS DATA SHEET -- EPÅ METHOD 608/8080
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : S90121 B-2
Matrix : WATER
Date sampled : 07/14/89
Date ext. : 07/19/89
Date analyzed: 07/24/89
Dilution : NONE

Anametrix I.D. : 8907098-04
Analyst : MCT
Supervisor : [illegible]
Date released : 08/02/89
Volume ext. : 1 LITER
Instrument ID : HP5

CAS #	Compound Name	Reporting Limit (ug/l)	Amount Found (ug/l)
1104-28-2	Aroclor 1221	0.5	ND
11141-16-5	Aroclor 1232	0.5	ND
53469-21-9	Aroclor 1242	0.5	ND
12672-29-6	Aroclor 1248	0.5	ND
11097-69-1	Aroclor 1254	1	ND
11096-82-5	Aroclor 1260	1	ND
12674-11-2	Aroclor 1016	0.5	ND

ND : Not detected at or above the practical quantitation limit for the method.

ANALYSIS DATA SHEET - PETROLEUM HYDROCARBON COMPOUNDS
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : S90121 B-2
Matrix : WATER
Date sampled : 07/14/89
Date anl.TPHg: 07/24/89
Date ext.TPHd: 07/19/89
Date anl.TPHd: 07/21/89

Anametrix I.D. : 8907098-04
Analyst : MG
Supervisor : TC
Date released : 08/02/89
Date ext. TOG : N/A
Date anl. TOG : N/A

CAS #	Compound Name	Reporting Limit (ug/l)	Amount Found (ug/l)
71-43-2	Benzene	0.5	ND
108-88-3	Toluene	0.5	ND
100-41-4	Ethylbenzene	0.5	ND
1330-20-7	Total Xylenes	1	ND
	TPH as Gasoline	50	ND
	TPH as Diesel	50	ND

ND - Below reporting limit.
TPHg - Total Petroleum Hydrocarbons as gasoline is determined by GCFID using EPA Method 5030.
TPHd - Total Petroleum Hydrocarbons as diesel is determined by GCFID following either EPA Method 3510 or 3550.
BTEX - Benzene, Toluene, Ethylbenzene, and Total Xylenes are determined by modified EPA 8020.

All testing procedures follow California Department of Health Services (Cal-DHS) approved methods.

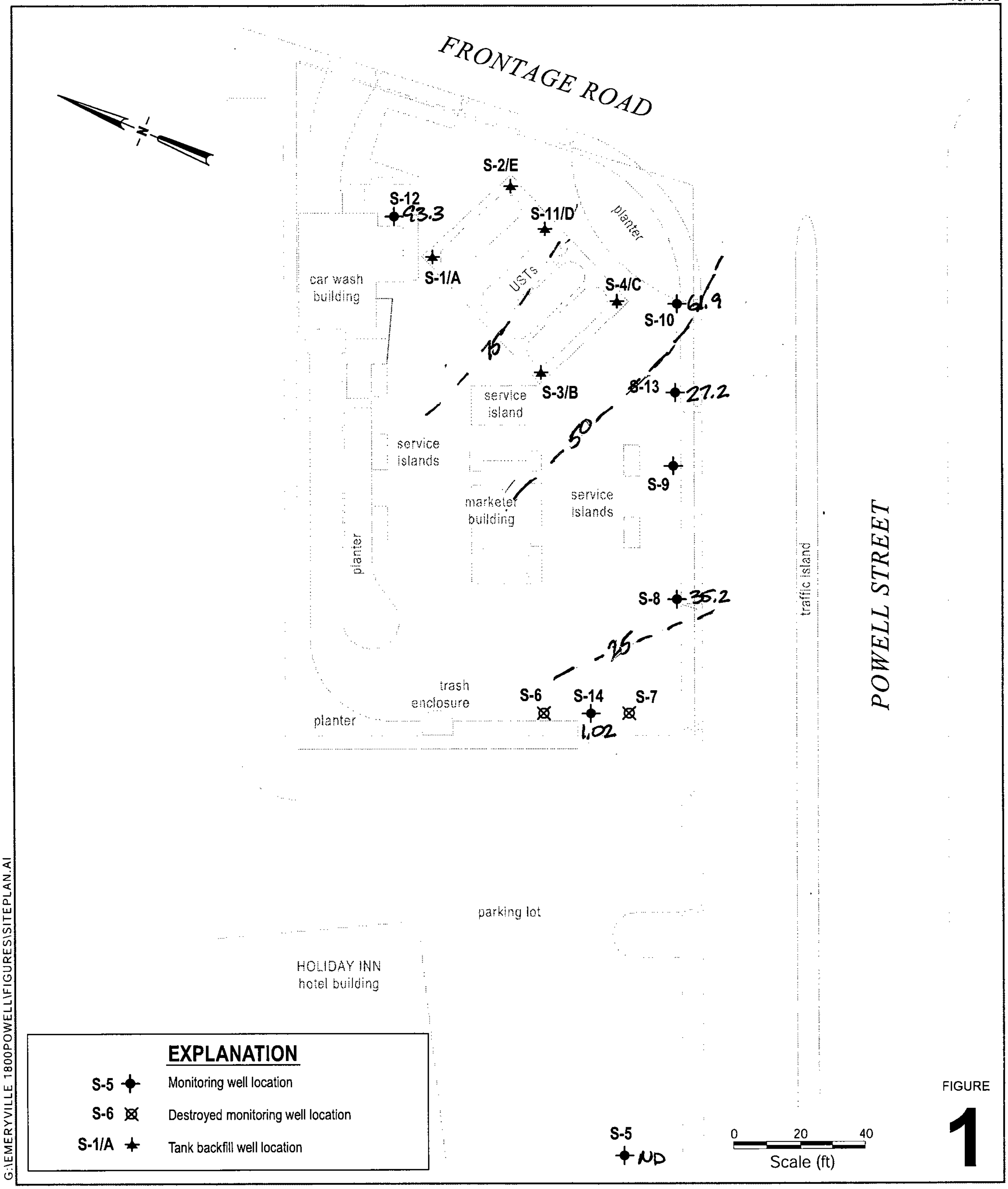
ANALYSIS DATA SHEET - PRIORITY POLLUTANT METALS
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : S90121 B-2
Matrix : WATER
Date Sampled : 07/14/89
Date Prepared: ;07/19/89
Date Analyzed: 07/20/89

Anametrix ID : 8907098-04
Analyst : MN
Supervisor : RA
Instrument ID: AA1\ICP1
Date released: 08/02/89

EPA METHOD NO.	COMPOUNDS	Reporting Limit (mg/l)	Amount Found (mg/l)
6010	Silver (Ag)	0.01	0.027
7060	Arsenic (As)	0.001	0.059
6010	Beryllium (Be)	0.01	ND
6010	Cadmium (Cd)	0.01	ND
6010	Total Chromium (TTl Cr)	0.01	0.013
6010	Copper (Cu)	0.01	0.023
7470	Mercury (Hg)	0.001	0.001
6010	Nickel (Ni)	0.02	0.021
6010	Lead (Pb)	0.02	0.076
6010	Antimony (Sb)	0.04	0.062
7740	Selenium (Se)	0.002	0.006
6010	Thallium (Tl)	0.04	0.291
6010	Zinc (Zn)	0.01	0.167

ND : Not detected at or above the practical quantitation limit for the method.



FIGURE

1

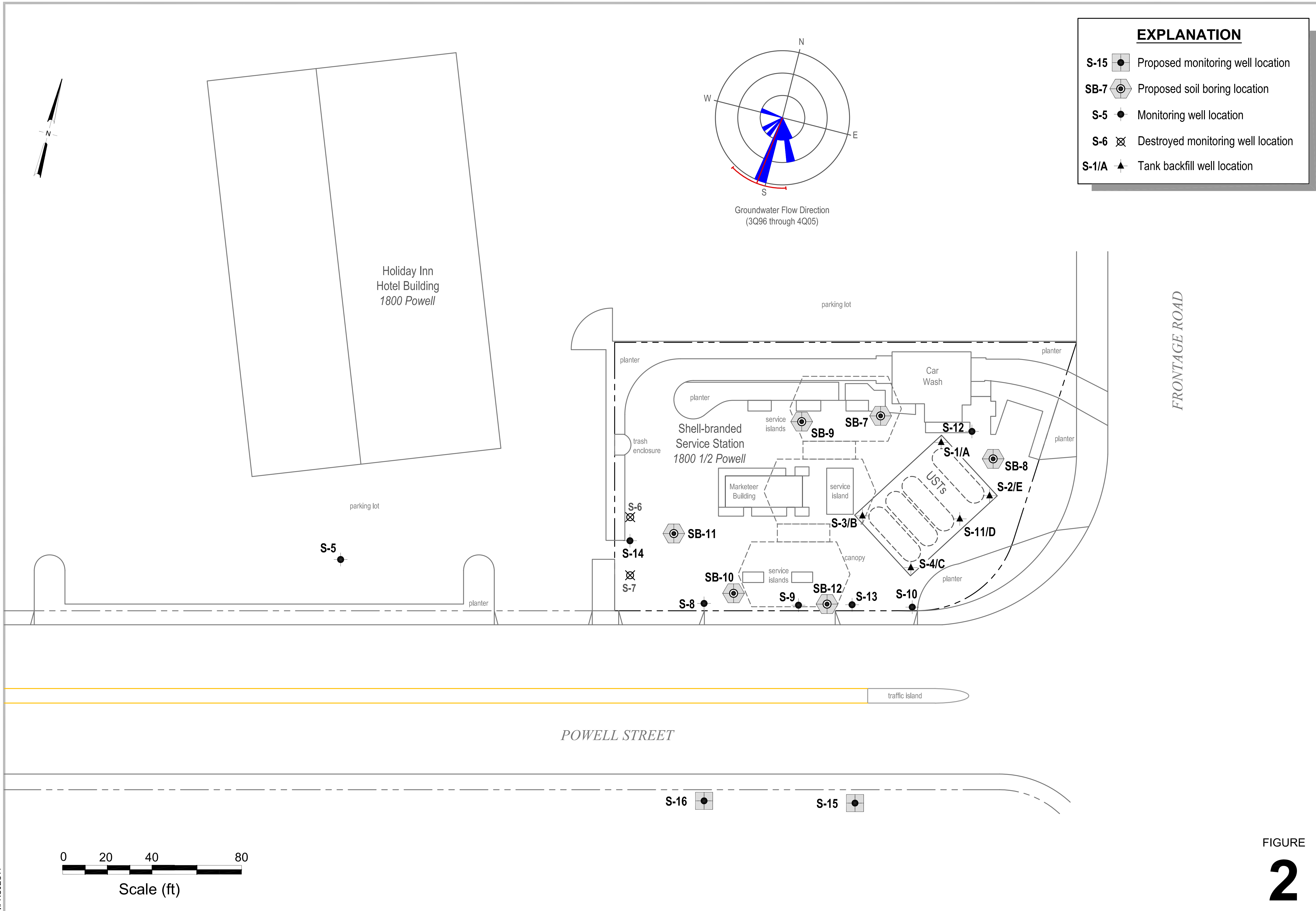
Shell-branded Service Station
1800 Powell Street
Emeryville, California
Incident #98995349

CAMBRIA

MTBE Isocons (ppb)
November 2005

Site Plan

01/09/06



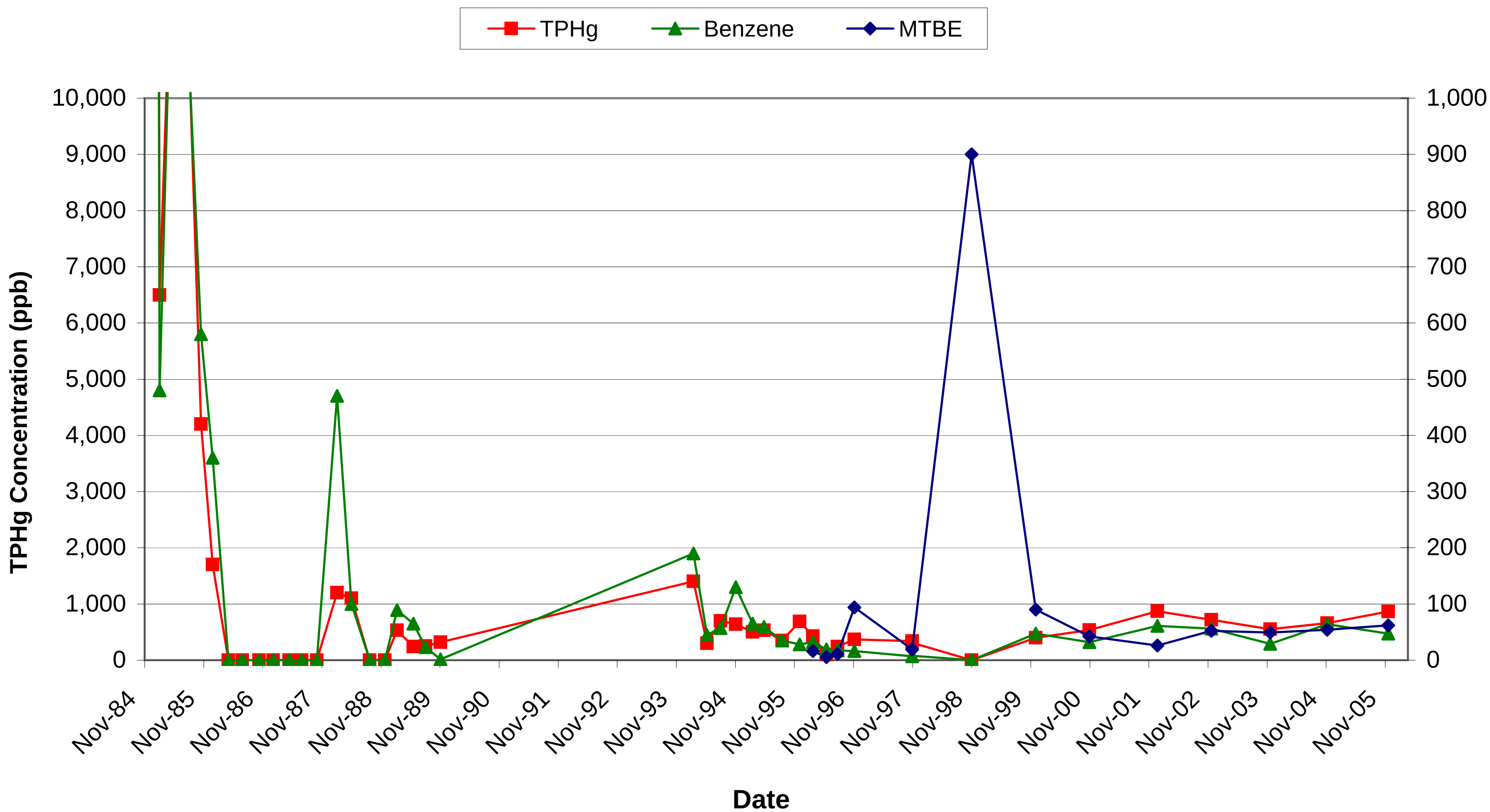
Site Plan

CAMBRIA

FIGURE
2

Shell-branded Service Station
1800 1/2 Powell Street
Emeryville, California
Incident No.98995349

F:\PROJECT\



Shell-branded Service Station
1800 Powell Street
Emeryville, California

CAMBRIA

S-10 Groundwater Concentrations

Field location of boring:	Project No.: 7605	Date: 11/08/89	Boring No: S-12
(See Plate 2)	Client: Shell Oil Company		
	Location: 1800 Powell Street		
	City: Emeryville, California		Sheet 1 of 2
	Logged by: J. Vargas	Driller: Bayland	
	Casing installation data:		

Drilling method: Hollow-Stem Auger

Hole diameter: 8-Inches - Reamed to 12-Inches

Top of Box Elevation: Datum:

Water Level	9 feet			
Time	8:30			
Date	11/09/89			

PID (ppm)	Blows/ft. or Pressure (psi)	Type of Sample	Sample Number	Depth (ft.)	Sample	Well Detail	Soil Group Symbol (USCS)	Description
								PAVEMENT SECTION - 19 inches
				1				
				2				FILL - Clayey Sand with Gravel (SC) - very dark gray (5Y 3/1), loose, damp; 35% fine to coarse sand; 25% fine to coarse gravel; 40% clay; trace construction debris; cobbles; moderate chemical odor.
				3				
				4				
	100	S&H						
25	100	push	S12-5	5				Tar Paper at 4.5 feet
	150							Increased sand to 55%; moderate chemical odor.
				6				
				7				
				8				
	500	S&H		9				
	14							Refuse and tar paper at 9.0 feet; medium dense; weak
17	12		S12-9.5	10				chemical odor.
				11				Water in cuttings - softer drilling
				12				
				13				
				14				
14.5	5	S&H	S12-14					refuse, saturated; weak chemical odor.
	5			15				
	7							
				16				
								softer at 16 feet.
				17				
				18				
				19				

Remarks:

GSI GeoStrategies Inc.

Log of Boring

BORING NO. **S-12**

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7605		11/89		

Field location of boring: (See Plate 2)	Project No.: 7605	Date: 11/08/89	Boring No: S-12
	Client: Shell Oil Company		
	Location: 1800 Powell Street		
	City: Emeryville, California		Sheet 2 of 2
	Logged by: J. Vargas	Driller: Bayland	
Drilling method: Hollow-Stem Auger	Casing installation data:		
Hole diameter:	Top of Box Elevation:	Datum:	

Water Level				
Time				
Date				

PID (ppm)	Blows/ft or Pressure (psi)	Type of Sample	Sample Number	Depth (ft.)	Sample	Well Detail	Soil Group Symbol (USCS)	Description
NS	2	S&H	S12-19					
	2			20				CLAYEY SAND (SC) - dark gray (5Y 4/1), loose,
	4						SC	saturated; 80% fine to medium sand; 20% clay; no
				21				chemical odor.
				22				
				23				CLAY with SAND (CL) - dark greenish gray (5G 4/1), stiff,
								damp; 80% clay; 20% fine to coarse sand; medium
				24				plasticity; no chemical odor.
	2	S&H						
	6			25				
1.3	6		S12-25				CL	
				26				
				27				
	6	S&H		28				color change to olive yellow (2.5Y 6/6), very stiff, damp;
1.6	12		S12-					no chemical odor.
	14		28.5	29				
								Bottom of boring at 29.0 feet.
				30				Bottom of sample at 29.0 feet.
				31				
				32				
				33				
				34				
				35				
				36				
				37				
				38				
				39				

Remarks:

GeoStrategies Inc.

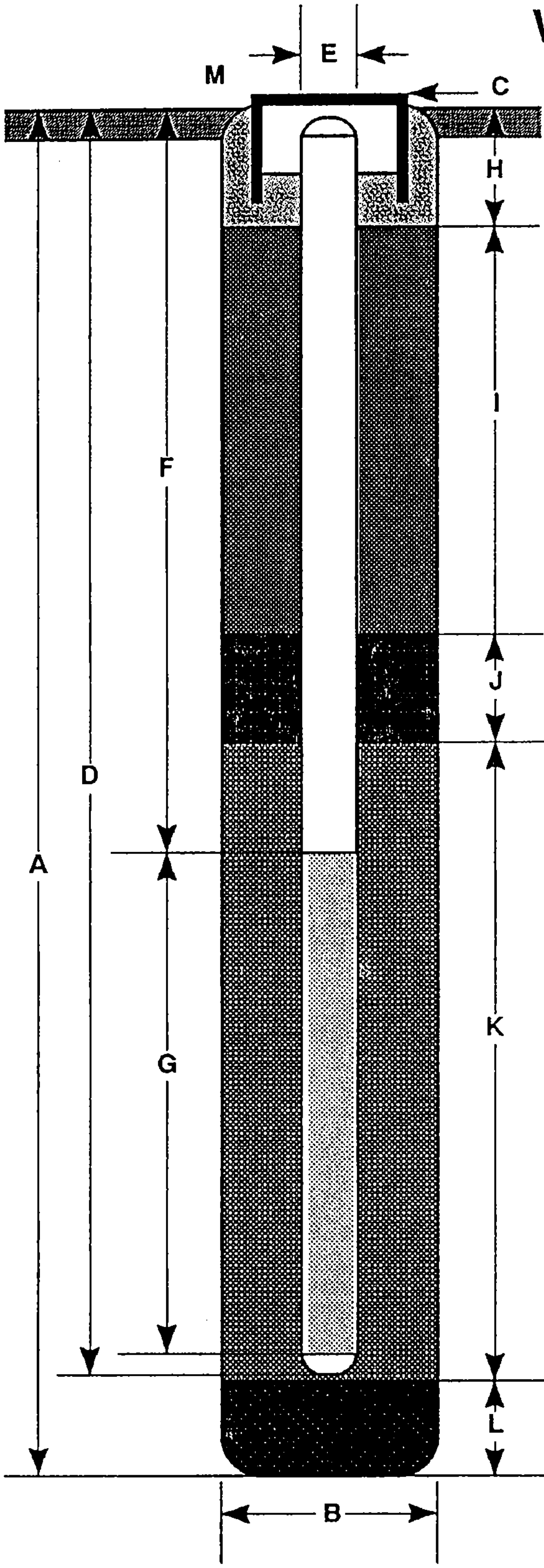
Log of Boring

BORING NO.

S-12

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7605		11/89		

WELL CONSTRUCTION DETAIL



A	Total Depth of Boring	29.0			ft.
B	Diameter of Boring	12			in.
	Drilling Method	Hollow-Stem Auger			
C	Top of Box Elevation				ft.
	☐ Referenced to Mean Sea Level				
	☐ Referenced to Project Datum				
D	Casing Length	24			ft.
	Material	Schedule 40 PVC			
E	Casing Diameter	3			in.
F	Depth to Top Perforations	9			ft.
G	Perforated Length	15			ft.
	Perforated Interval from	9	to	24	ft.
	Perforation Type	Machine Slot			
	Perforation Size	0.02			in.
H	Surface Seal from	0	to	0.5	ft.
	Seal Material	Concrete			
I	Backfill from	0.5	to	5	ft.
	Backfill Material	Cement Grout			
J	Seal from	5	to	7	ft.
	Seal Material	Bentonite			
K	Gravel Pack from	7	to	24	ft.
	Pack Material	Lonestar 2/12 Sand			
L	Bottom Seal	5			ft.
	Seal Material	Natural Clay			
M					

Note: Depths measured from initial ground surface.

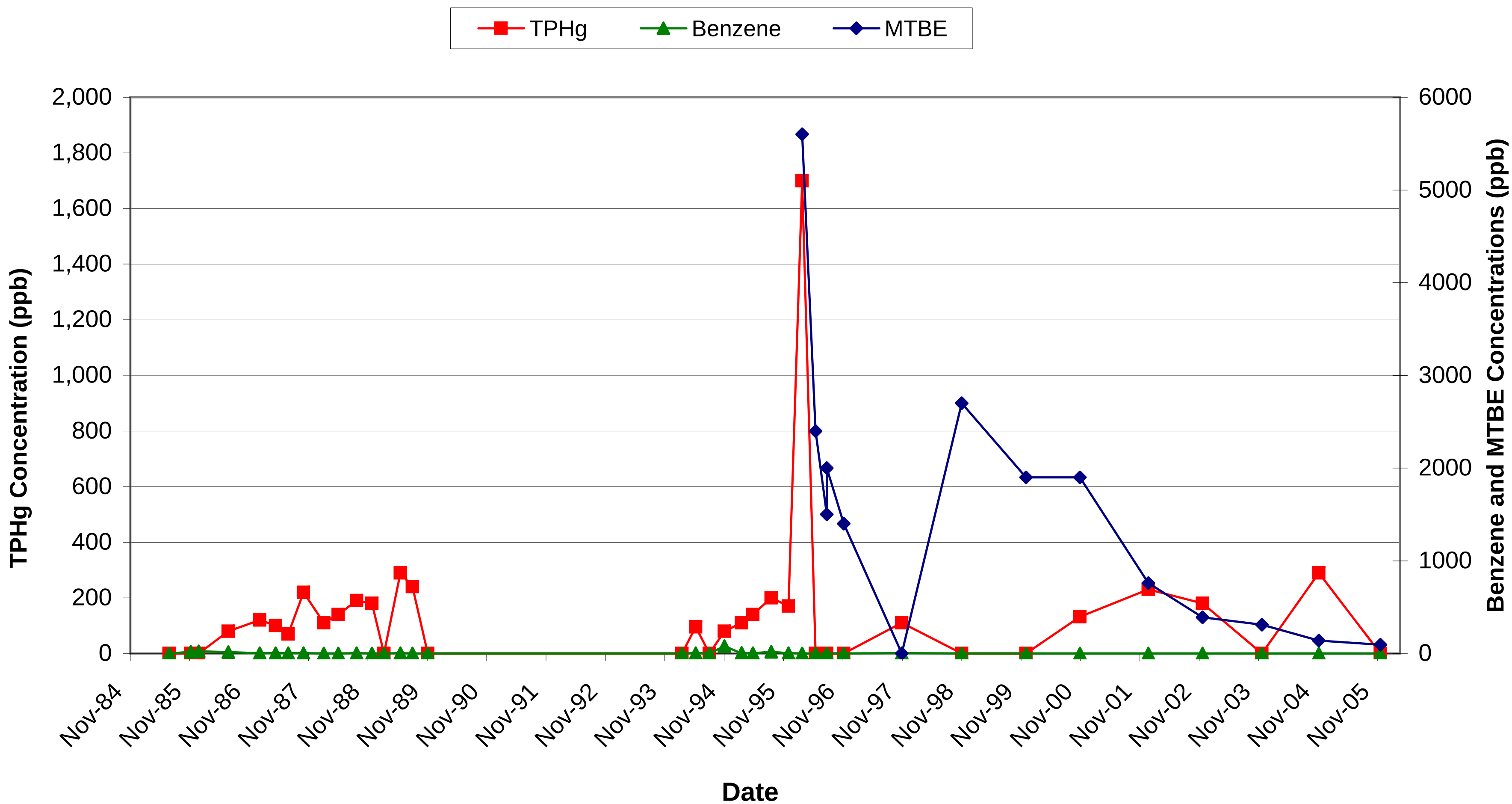
GSI GeoStrategies Inc.

Well Construction Detail

WELL NO.

S-12

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7605		11/89		



Shell-branded Service Station
1800 Powell Street
Emeryville, California

CAMBRIA

S-12 Groundwater Concentrations

Field location of boring:	Project No.: 7605	Date: 11/09/89	Boring No: S-13
(See Plate 2)	Client: Shell Oil Company		
	Location: 1800 Powell Street		
	City: Emeryville, California		Sheet 1 of 2
	Logged by: J. Vargas	Driller: Bayland	
	Casing installation data:		
Drilling method: Hollow-Stem Auger			
Hole diameter: 8-Inches	Top of Box Elevation:	Datum:	

Water Level	7.25 feet			
Time	11:30			
Date	11/09/89			

PID (ppm)	Blows/ft. or Pressure (psi)	Type of Sample	Sample Number	Depth (ft.)	Sample	Well Detail	Soil Group Symbol (USCS)	Description
								PAVEMENT SECTION - 20 inches
				1				
				2				FILL - Clayey Sand with Gravel (SC) - olive gray (5Y 4/3), loose, damp; 45% fine to coarse sand; 20% fine to coarse gravel; 25% clay; trace cobbles and boulders; construction debris; moderate chemical odor.
				3			SC	
				4				
				5				
	100	S&H						refuse and tar paper at 6.0 feet
78	150	push	S13-	6				
	150		6.0					
				7				SAND (SP) - olive (5Y 4/3), loose, damp; 100% fine sand; moderate chemical odor.
				8			SP	
	100		S13-	9				
93	100	S&H	9.0					color change to black (5Y 2.5/2), saturated at 9.0 feet; stronger chemical odor.
				10				
				11				sample refusal at 9.5 feet.
								concrete boulder at 9.5 feet.
				12				
				13				
								CLAYEY SAND (SC) - dark olive gray (5Y 3/2), loose, saturated; 60% fine to medium sand; 40% clay; weak chemical odor.
				14			SC	
	4							
90	2	S&H	S13-	15				
	2		15					
				16				
				17				
				18				SAND (SP) - dark olive gray (5Y 3/2), loose, saturated; 95% fine sand; 5% clay; trace shells; no chemical odor.
							SP	
				19				

Remarks:

GeoStrategies Inc.

Log of Boring

BORING NO. **S-13**

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7605		11/89		

Field location of boring:	Project No.: 7605	Date: 11/09/89	Boring No: S-13
(See Plate 2)	Client: Shell Oil Company		
	Location: 1800 Powell Street		
	City: Emeryville, California		Sheet 2 of 2
	Logged by: J. Vargas	Driller: Bayland	
	Casing installation data:		
Drilling method: Hollow-Stem Auger			
Hole diameter: 8-Inches	Top of Box Elevation:	Datum:	

Water Level				
Time				
Date				

PID (ppm)	Blows/ft. or Pressure (psi)	Type of Sample	Sample Number	Depth (ft.)	Sample	Well Detail	Soil Group Symbol (USCS)	Description
	1	S&H	S13-					
	2		19.5	20			SP	
3.9	1		S13-20				CH	CLAY (CH) - dark greenish gray (5BG 4/1), very soft,
				21				damp; trace roots; black organics; strong organic odor;
								no chemical odor.
				22				
								Bottom of boring at
				23				Bottom of sample at
				24				
				25				
				26				
				27				
				28				
				29				
				30				
				31				
				32				
				33				
				34				
				35				
				36				
				37				
				38				
				39				

Remarks:

GSI GeoStrategies Inc.

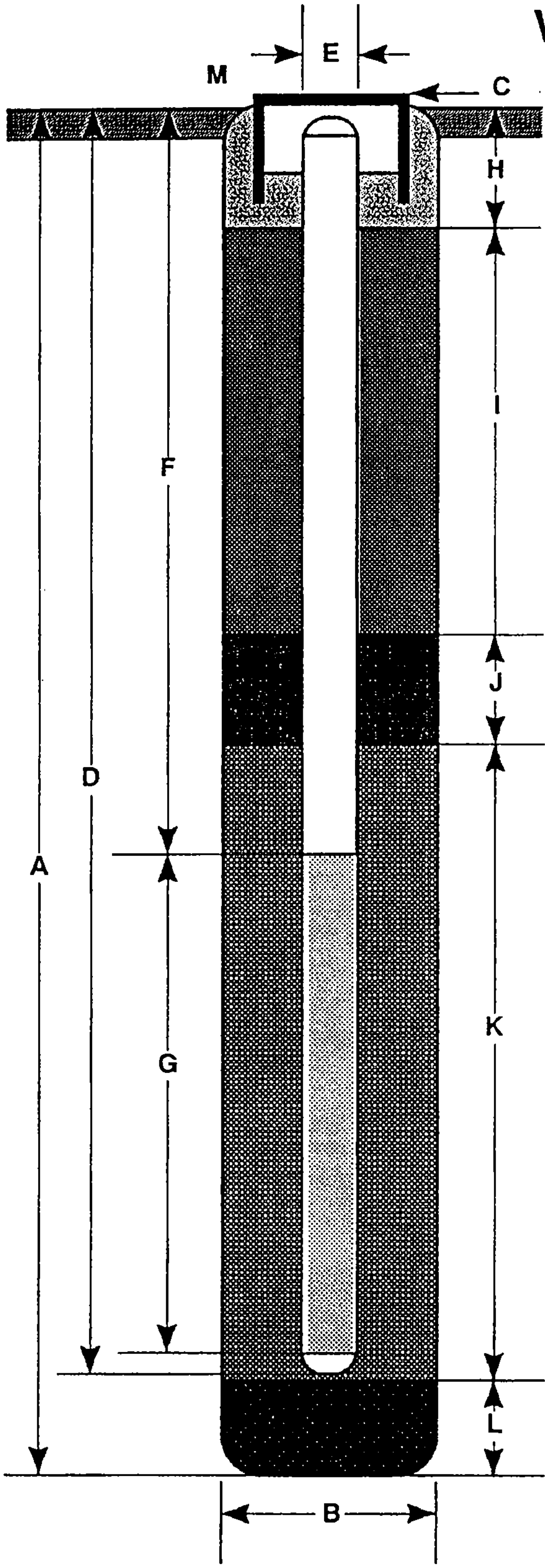
Log of Boring

BORING NO.

S-13

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7605		11/89		

WELL CONSTRUCTION DETAIL



A	Total Depth of Boring	20.5			ft.
B	Diameter of Boring	8			in.
	Drilling Method	Hollow-Stem Auger			
C	Top of Box Elevation				ft.
	☐ Referenced to Mean Sea Level				
	☐ Referenced to Project Datum				
D	Casing Length	20.5			ft.
	Material	Schedule 40 PVC			
E	Casing Diameter	3			in.
F	Depth to Top Perforations	7			ft.
G	Perforated Length	13.5			ft.
	Perforated Interval from	7	to	20.5	ft.
	Perforation Type	Machine Slot			
	Perforation Size	0.02			in.
H	Surface Seal from	0	to	0.5	ft.
	Seal Material	Concrete			
I	Backfill from	0.5	to	4	ft.
	Backfill Material	Cement Grout			
J	Seal from	4	to	5	ft.
	Seal Material	Bentonite			
K	Gravel Pack from	5	to	20.5	ft.
	Pack Material	Lonestar 2/12 Sand			
L	Bottom Seal				ft.
	Seal Material				
M	Christy Box with locking cap and lock.				

Note: Depths measured from initial ground surface.

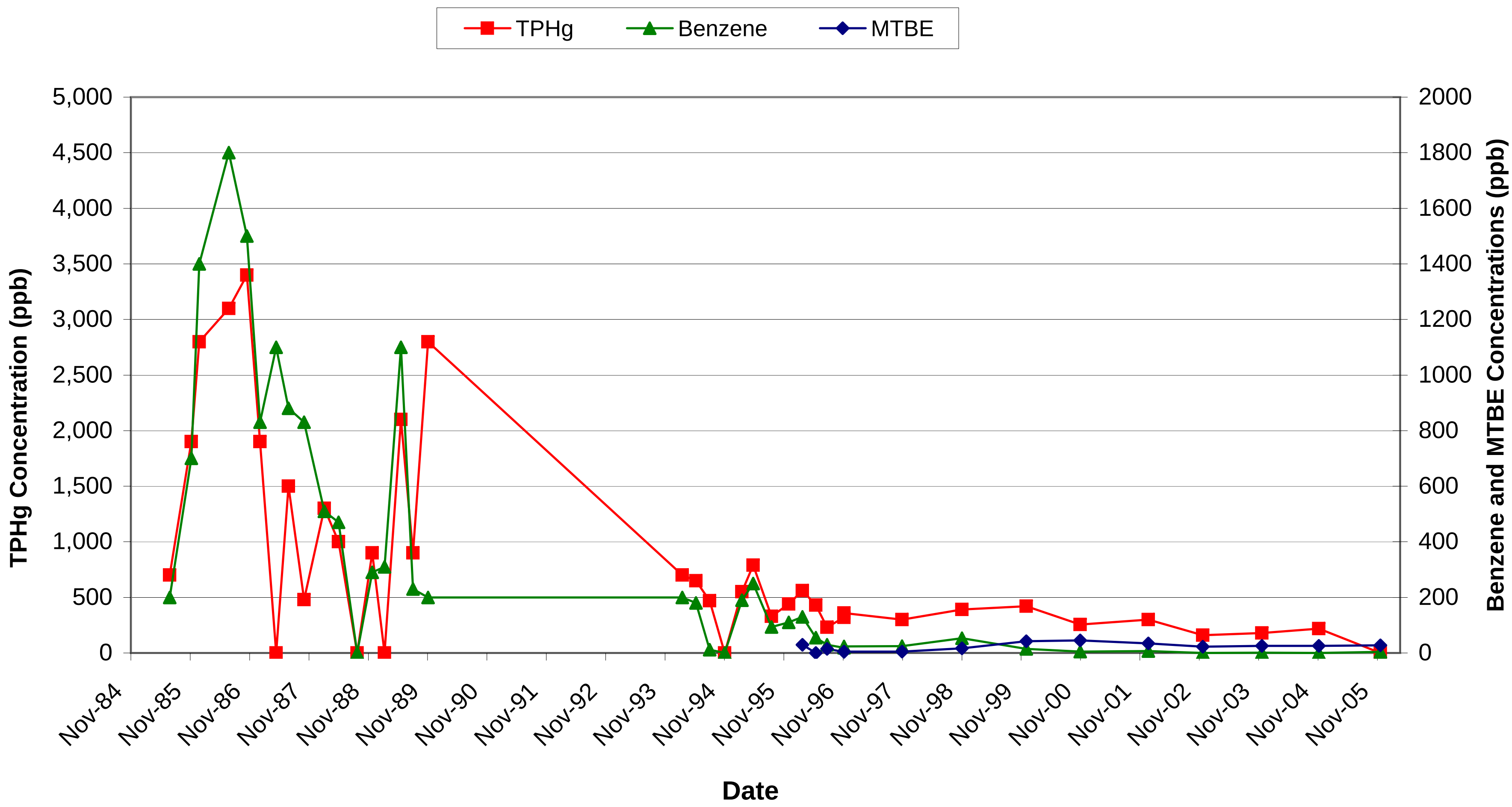
GSI GeoStrategies Inc.

Well Construction Detail

WELL NO.

S-13

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7605		11/89		



Shell-branded Service Station
1800 Powell Street
Emeryville, California

CAMBRIA

S-13 Groundwater Concentrations

Field location of boring:	Project No.: 7605	Date: 11/08/89	Boring No: S-14
(See Plate 2)	Client: Shell Oil Company		
	Location: 1800 Powell Street		
	City: Emeryville, California		Sheet 1 of 2
	Logged by: J. Vargas	Driller: Bayland	
	Casing installation data:		
Drilling method: Hollow-Stem Auger			
Hole diameter: 8-Inches - Reamed with 12-Inches	Top of Box Elevation:	Datum:	

Water Level	9.25 feet			
Time	8:30			
Date	11/09/89			

PID (ppm)	Blows/ft. or Pressure (psi)	Type of Sample	Sample Number	Depth (ft.)	Sample	Well Detail	Soil Group Symbol (USCS)	Description
				1				PAVEMENT SECTION - 2 feet
5.6								
				2				
1.6								Perched water at 2.0 feet (saturated)
				3				
							SC	FILL - Clayey Sand with Gravel - olive (5Y 4/3), loose,
				4				saturated; 40% fine to coarse gravel; 20% clay; trace
NS	NS	S&H						boulders; moderate chemical odor.
		push		5				
				6				
				7				
				8				
	11	S&H		9				
	21							refuse and tar paper; damp at 9.0 feet; moderate
25.5	22		S14-10	10				chemical odor.
				11				
				12				
				13				
				14				
	13	S&H	S14-					
	15		14.5	15				saturated; weak chemical odor.
4.9	13		S14-15					
				16				
				17				
				18				
				19				

Remarks:

GSI GeoStrategies Inc.

Log of Boring

BORING NO.

S-14

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7605		11/89		

*Field location of boring:	Project No.: 7605	Date: 11/08/89	Boring No: S-14
(See Plate 2)	Client: Shell Oil Company		
	Location: 1800 Powell Street		
	City: Emeryville, California		Sheet 2 of 2
	Logged by: J. Vargas	Driller: Bayland	
	Casing installation data:		
Drilling method: Hollow-Stem Auger			
Hole diameter:	Top of Box Elevation:	Datum:	

Water Level				
Time				
Date				

PID (ppm)	Blows/ft. or Pressure (psi)	Type of Sample	Sample Number	Depth (ft.)	Sample	Well Detail	Soil Group Symbol (USCS)	Description
	2	S&H						SAND (SP) - dark olive gray (5Y 3/2), loose, saturated;
	3			20				95% fine sand; 5% clay; no chemical odor.
0.3	4		S14-20				SP	
				21				
				22				
								stiffer at 22.0 feet.
				23				
				24				CLAY (CH) - dark greenish gray (5BG 4/1), very soft,
	0						CH	damp; 100% clay; high plasticity; trace roots and black
	0			25				organics; strong organic odor; no chemical odor.
0	1		S14-25					
				26				Bottom of boring at 25.5 feet.
								Bottom of sample at 25.5 feet.
				27				
				28				
				29				
				30				
				31				
				32				
				33				
				34				
				35				
				36				
				37				
				38				
				39				

Remarks:

GSI GeoStrategies Inc.

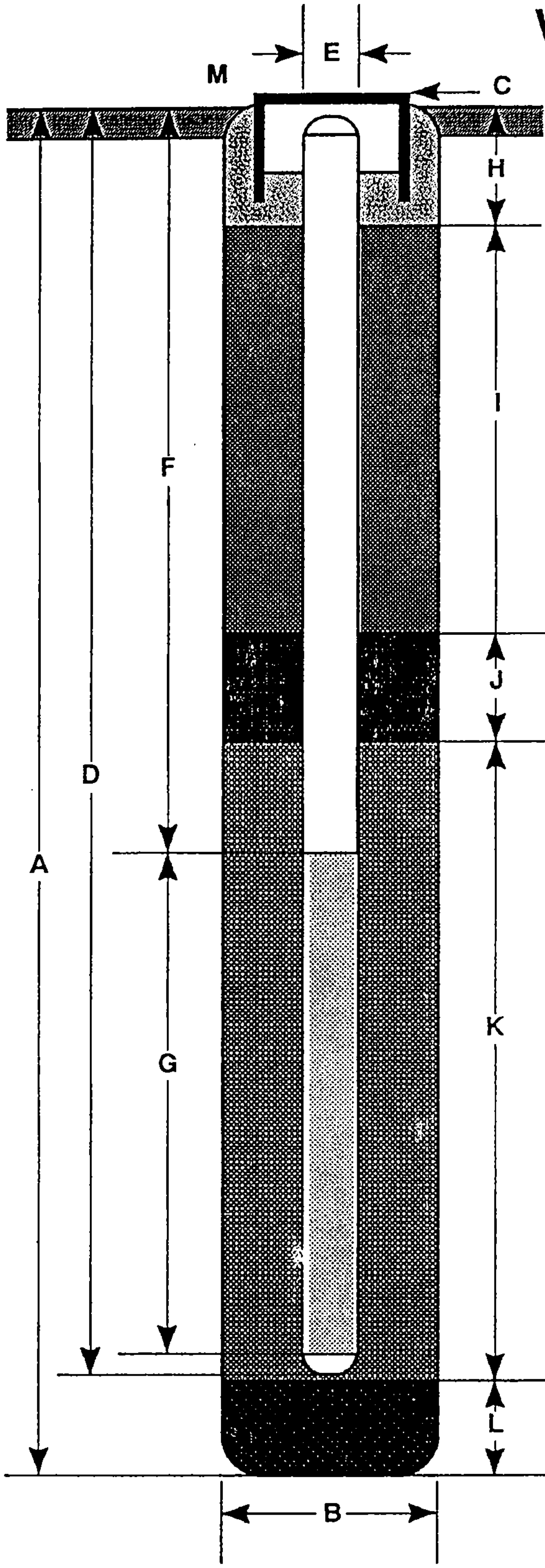
Log of Boring

BORING NO.

S-14

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7605		11/89		

WELL CONSTRUCTION DETAIL



A	Total Depth of Boring	25.5			ft.
B	Diameter of Boring	8			in.
	Drilling Method	Hollow-Stem Auger			
C	Top of Box Elevation				ft.
	☐ Referenced to Mean Sea Level				
	☐ Referenced to Project Datum				
D	Casing Length	24			ft.
	Material	Schedule 40 PVC			
E	Casing Diameter	3			in.
F	Depth to Top Perforations	7			ft.
G	Perforated Length	17			ft.
	Perforated Interval from	7	to	24	ft.
	Perforation Type	Machine Slot			
	Perforation Size	0.02			in.
H	Surface Seal from	0	to	0.5	ft.
	Seal Material	Concrete			
I	Backfill from	0.5	to	4	ft.
	Backfill Material	Cement Grout			
J	Seal from	4	to	5	ft.
	Seal Material	Bentonite			
K	Gravel Pack from	5	to	24	ft.
	Pack Material	Lonestar 2/12 Sand			
L	Bottom Seal	1.5			ft.
	Seal Material	Natural Clay			
M					

Note: Depths measured from initial ground surface.

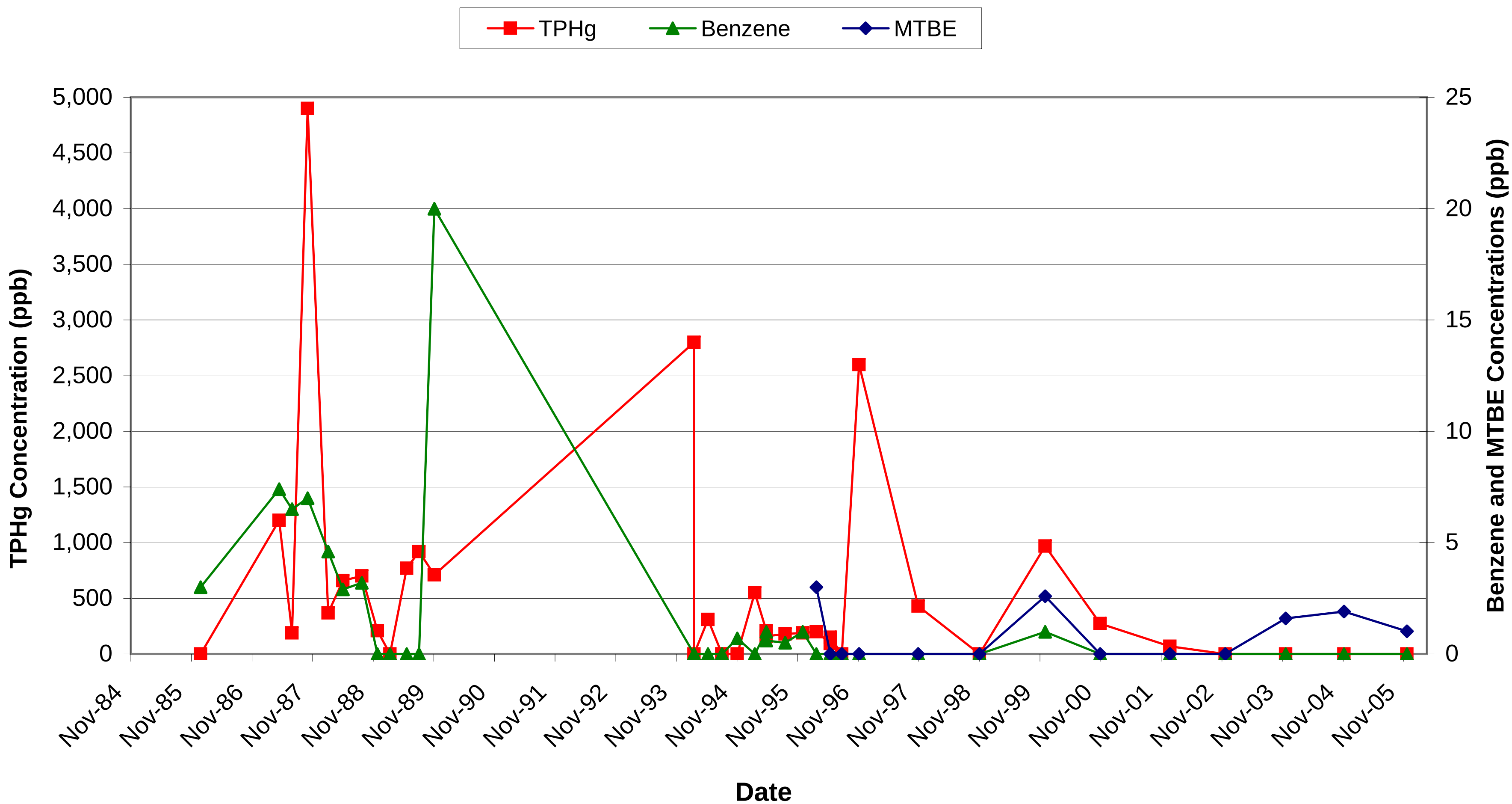
GSI GeoStrategies Inc.

Well Construction Detail

WELL NO.

S-14

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7605		11/89		



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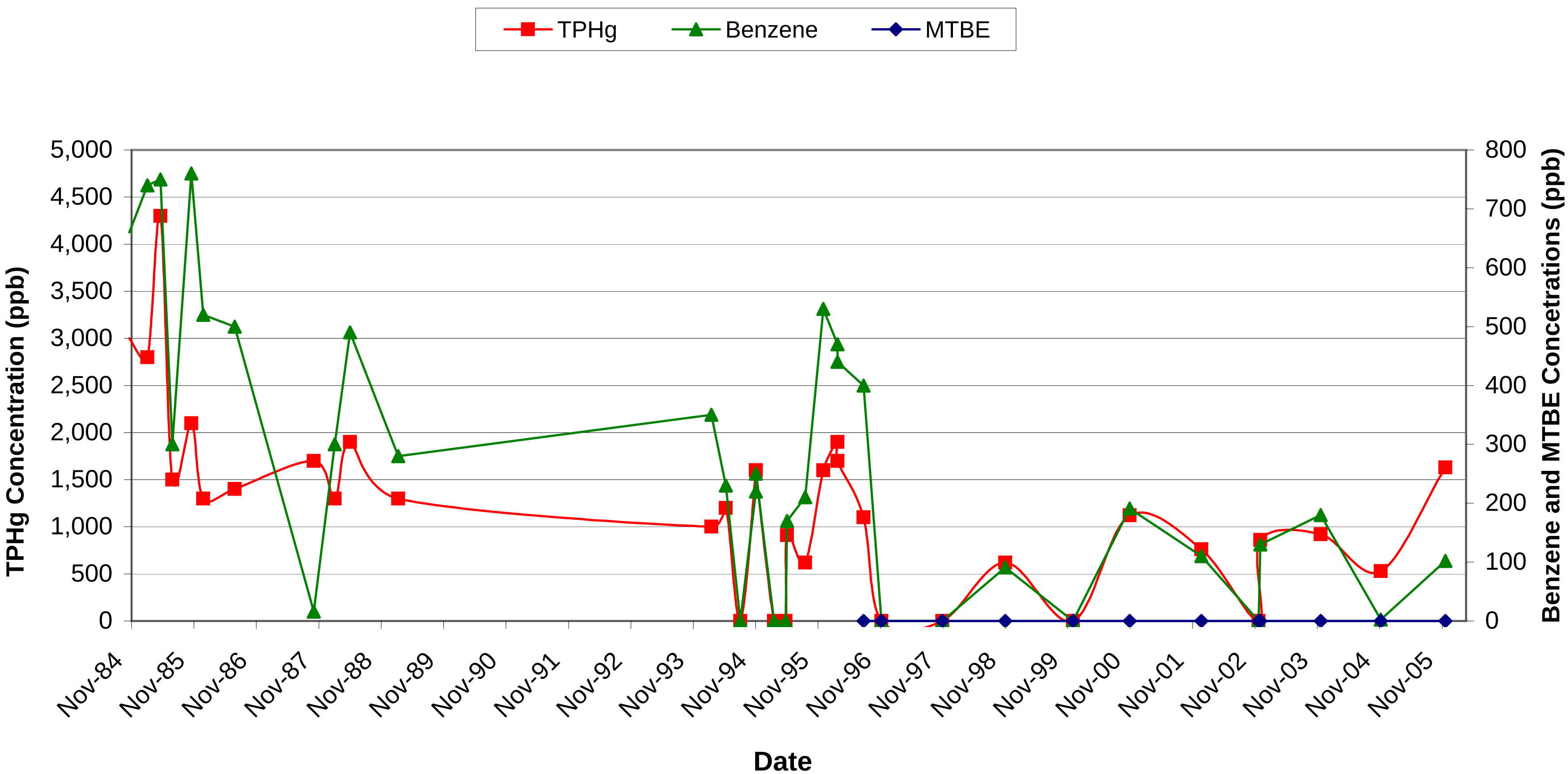
S-14 Groundwater Concentrations



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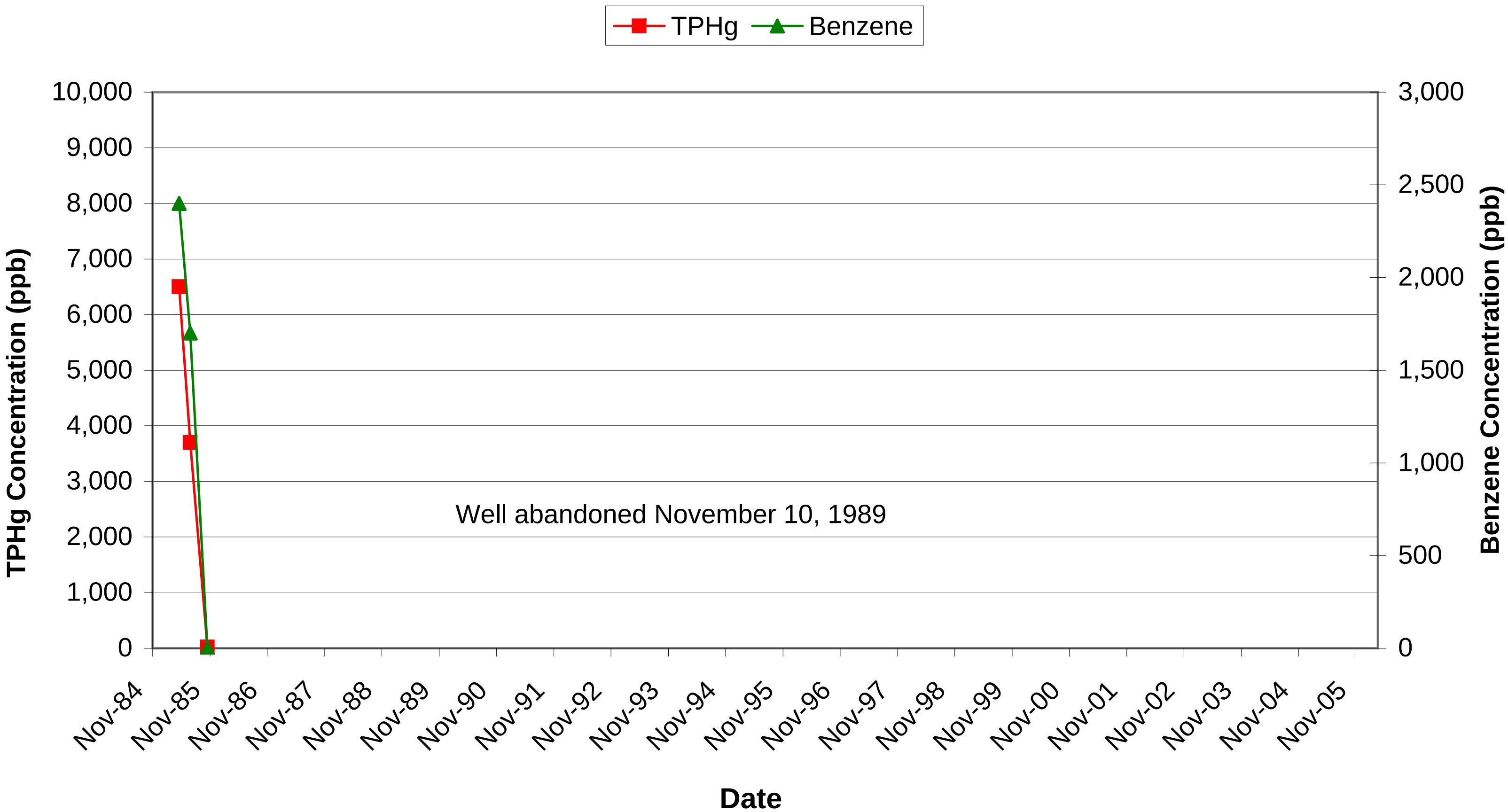
S-5 Groundwater Concentrations



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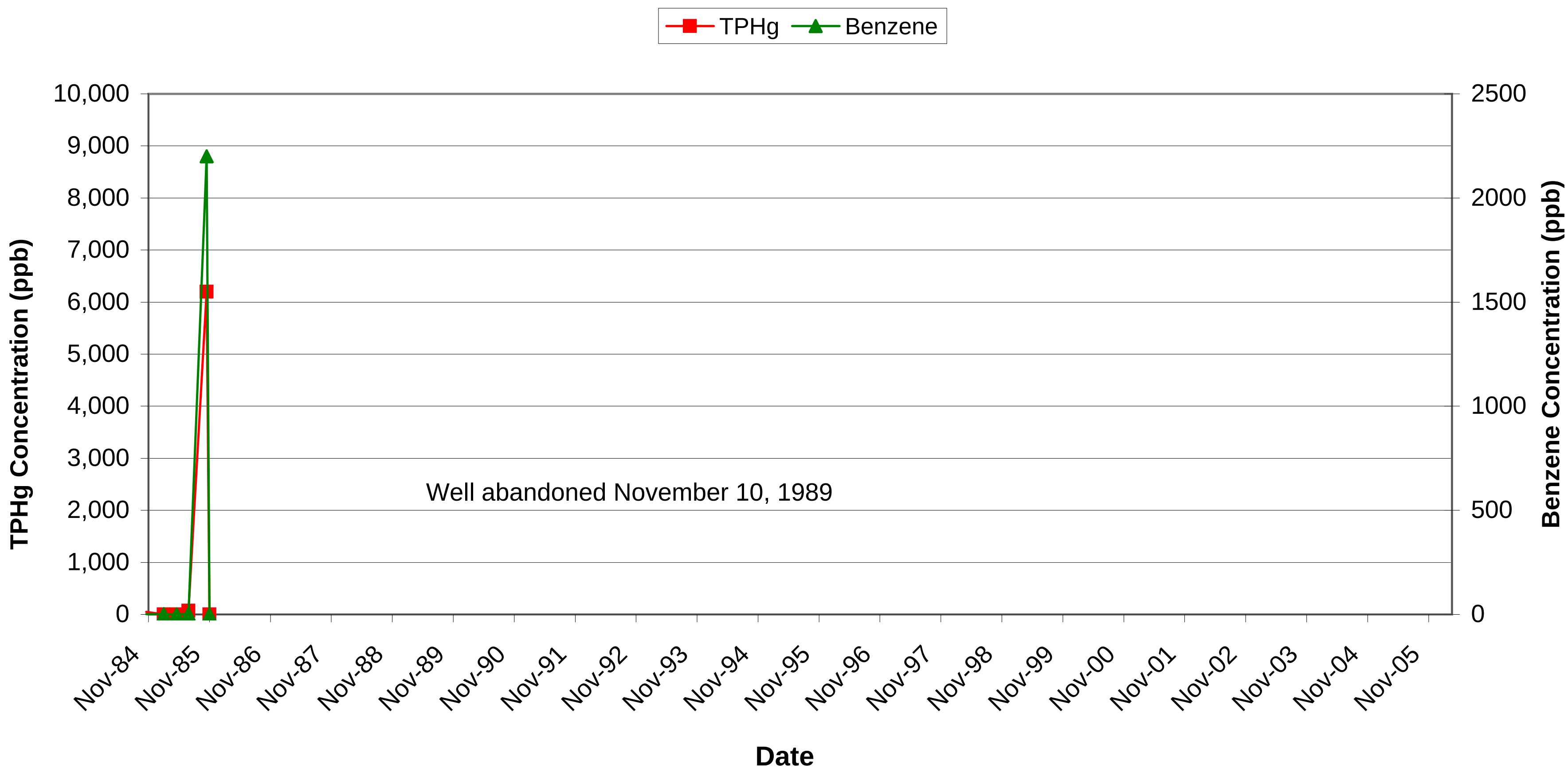
S-6 Groundwater Concentrations



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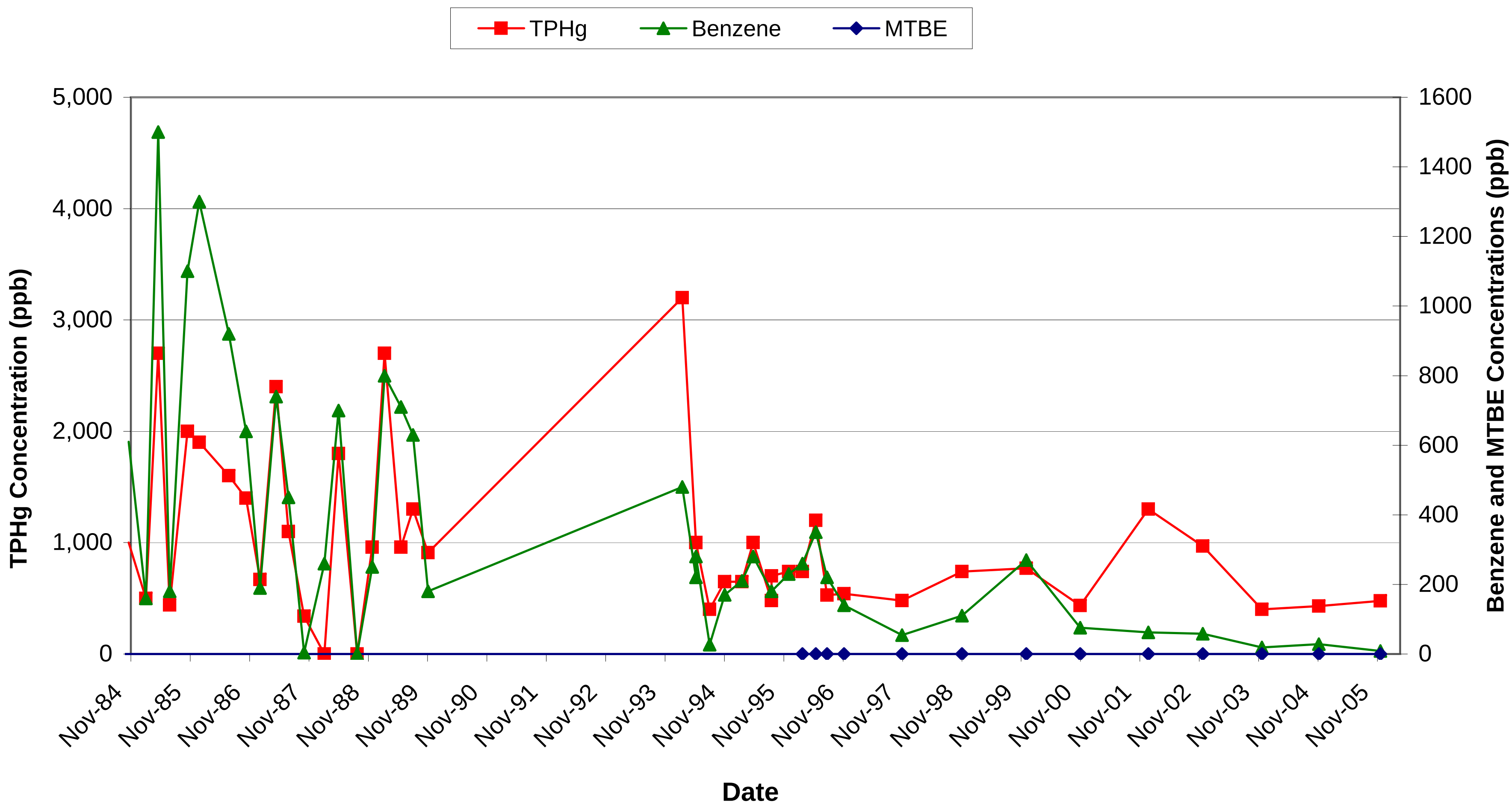
S-7 Groundwater Concentrations



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S-8 Groundwater Concentrations

Screening For Environmental Concerns At Sites With Contaminated Soil and Groundwater

Volume 1: Summary Tier 1 Lookup Tables

Prepared by:
California Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, California 94612

INTERIM FINAL - February 2005

TABLE B: SHALLOW SOIL ($\leq$3M BGS) - WATER <u>IS NOT</u> A CURRENT OR POTENTIAL SOURCE OF DRINKING WATER

Notes:

- Always compare final soil data for commercial/industrial sites to residential ESLs and evaluate need for formal land-use restrictions (see Section 2.10).
- Assumption that groundwater is not a current or potential source of drinking water should be approved by overseeing regulatory agency prior to use of this table (see Section 2.4).

TABLE B. ENVIRONMENTAL SCREENING LEVELS (ESLs)
Shallow Soils ($\leq$3m bgs)
Groundwater IS NOT a Current or Potential Source of Drinking Water

CHEMICAL PARAMETER	[1]Shallow Soil [2]Residential Land Use (mg/kg)	Commercial/ Industrial Land Use Only (mg/kg)	[3]Groundwater (ug/L)
ACENAPHTHENE	1.9E+01	1.9E+01	2.3E+01
ACENAPHTHYLENE	1.3E+01	1.3E+01	3.0E+01
ACETONE	5.0E-01	5.0E-01	1.5E+03
ALDRIN	3.2E-02	1.3E-01	1.3E-01
ANTHRACENE	2.8E+00	2.8E+00	7.3E-01
ANTIMONY	6.1E+00	4.0E+01	3.0E+01
ARSENIC	5.5E+00	5.5E+00	3.6E+01
BARIUM	7.5E+02	1.5E+03	1.0E+03
BENZENE	1.8E-01	3.8E-01	4.6E+01
BENZO(a)ANTHRACENE	3.8E-01	1.3E+00	2.7E-02
BENZO(b)FLUORANTHENE	3.8E-01	1.3E+00	2.9E-02
BENZO(k)FLUORANTHENE	3.8E-01	1.3E+00	4.0E-01
BENZO(g,h,i)PERYLENE	2.7E+01	2.7E+01	1.0E-01
BENZO(a)PYRENE	3.8E-02	1.3E-01	1.4E-02
BERYLLIUM	4.0E+00	8.0E+00	2.7E+00
BIPHENYL, 1,1-	6.5E+00	6.5E+00	5.0E+00
BIS(2-CHLOROETHYL)ETHER	3.7E-03	1.2E-02	6.1E+01
BIS(2-CHLOROISOPROPYL)ETHER	6.6E-01	6.6E-01	6.1E+01
BIS(2-ETHYLHEXYL)PHTHALATE	1.6E+02	5.3E+02	3.2E+01
BORON	1.6E+00	2.0E+00	1.6E+00
BROMODICHLOROMETHANE	1.4E-02	3.9E-02	1.7E+02
BROMOFORM	6.1E+01	6.9E+01	3.2E+03
BROMOMETHANE	2.2E-01	5.1E-01	1.6E+02
CADMIUM	1.7E+00	7.4E+00	1.1E+00
CARBON TETRACHLORIDE	1.2E-02	3.4E-02	9.3E+00
CHLORDANE	4.4E-01	1.7E+00	4.0E-03
CHLOROANILINE, p-	5.3E-02	5.3E-02	5.0E+00
CHLOROBENZENE	1.5E+00	1.5E+00	2.5E+01
CHLOROETHANE	6.3E-01	8.5E-01	1.2E+01
CHLOROFORM	8.8E-01	1.9E+00	3.3E+02
CHLOROMETHANE	7.0E-02	2.0E-01	4.1E+01
CHLOROPHENOL, 2-	1.2E-01	1.2E-01	1.8E+00
CHROMIUM (Total)	5.8E+01	5.8E+01	1.8E+02
CHROMIUM III	7.5E+02	7.5E+02	1.8E+02
CHROMIUM VI	1.8E+00	1.8E+00	1.1E+01
CHRYSENE	3.8E+00	1.3E+01	3.5E-01
COBALT	1.0E+01	1.0E+01	3.0E+00
COPPER	2.3E+02	2.3E+02	3.1E+00
CYANIDE (Free)	3.6E-03	3.6E-03	1.0E+00
DIBENZO(a,h)ANTHTRACENE	1.1E-01	3.8E-01	2.5E-01
DIBROMOCHLOROMETHANE	1.9E-02	5.4E-02	1.7E+02
1,2-DIBROMO-3-CHLOROPROPANE	4.5E-03	4.5E-03	2.0E-01
DIBROMOETHANE, 1,2-	7.3E-03	2.0E-02	1.5E+02
DICHLOROBENZENE, 1,2-	1.6E+00	1.6E+00	1.4E+01

TABLE B. ENVIRONMENTAL SCREENING LEVELS (ESLs)
Shallow Soils (≤3m bgs)
Groundwater IS NOT a Current or Potential Source of Drinking Water

	[1]Shallow Soil		
CHEMICAL PARAMETER	[2]Residential Land Use (mg/kg)	Commercial/ Industrial Land Use Only (mg/kg)	[3]Groundwater (ug/L)
DICHLOROBENZENE, 1,3-	7.4E+00	7.4E+00	6.5E+01
DICHLOROBENZENE, 1,4-	4.6E-02	1.3E-01	1.5E+01
DICHLOROBENZIDINE, 3,3-	4.0E-01	1.4E+00	2.5E+02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.3E+00	9.0E+00	1.0E-03
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.6E+00	4.0E+00	1.0E-03
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.6E+00	4.0E+00	1.0E-03
DICHLOROETHANE, 1,1-	3.2E-01	8.9E-01	4.7E+01
DICHLOROETHANE, 1,2-	2.5E-02	7.0E-02	2.0E+02
DICHLOROETHYLENE, 1,1-	4.3E+00	4.3E+00	2.5E+01
DICHLOROETHYLENE, Cis 1,2-	1.6E+00	3.6E+00	5.9E+02
DICHLOROETHYLENE, Trans 1,2-	3.1E+00	7.3E+00	5.9E+02
DICHLOROPHENOL, 2,4-	3.0E+00	3.0E+00	3.0E+00
DICHLOROPROPANE, 1,2-	5.1E-02	1.4E-01	1.0E+02
DICHLOROPROPENE, 1,3-	3.3E-02	9.3E-02	5.3E+01
DIELDRIN	2.3E-03	2.3E-03	1.9E-03
DIETHYLPHTHALATE	3.5E-02	3.5E-02	1.5E+00
DIMETHYLPHTHALATE	3.5E-02	3.5E-02	1.5E+00
DIMETHYLPHENOL, 2,4-	7.4E-01	7.4E-01	1.1E+02
DINITROPHENOL, 2,4-	2.1E-01	2.1E-01	7.5E+01
DINITROTOLUENE, 2,4-	8.6E-01	8.6E-01	1.2E+02
1,4 DIOXANE	1.8E+01	3.0E+01	5.0E+04
DIOXIN (2,3,7,8-TCDD)	4.6E-06	1.9E-05	5.0E-06
ENDOSULFAN	4.6E-03	4.6E-03	8.7E-03
ENDRIN	6.5E-04	6.5E-04	2.3E-03
ETHANOL	4.5E+01	4.5E+01	5.0E+04
ETHYLBENZENE	3.2E+01	3.2E+01	2.9E+02
FLUORANTHENE	4.0E+01	4.0E+01	8.0E+00
FLUORENE	8.9E+00	8.9E+00	3.9E+00
HEPTACHLOR	1.4E-02	1.4E-02	3.8E-03
HEPTACHLOR EPOXIDE	1.5E-02	1.5E-02	3.8E-03
HEXACHLOROBENZENE	2.7E-01	9.6E-01	3.7E+00
HEXACHLOROBUTADIENE	3.7E+00	2.2E+01	4.7E+00
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	4.9E-02	4.9E-02	8.0E-02
HEXACHLOROETHANE	1.2E+01	4.1E+01	1.2E+01
INDENO(1,2,3-cd)PYRENE	3.8E-01	1.3E+00	2.9E-02
LEAD	1.5E+02	7.5E+02	2.5E+00
MERCURY	3.7E+00	1.0E+01	1.2E-02
METHOXYCHLOR	1.9E+01	1.9E+01	1.9E-02
METHYLENE CHLORIDE	5.2E-01	1.5E+00	2.2E+03
METHYL ETHYL KETONE	1.3E+01	1.3E+01	1.4E+04
METHYL ISOBUTYL KETONE	3.9E+00	3.9E+00	1.7E+02
METHYL MERCURY	1.2E+00	1.0E+01	3.0E-03
METHYLNAPHTHALENE (total 1- & 2-)	2.5E-01	2.5E-01	2.1E+00
METHYL TERT BUTYL ETHER	2.0E+00	5.6E+00	1.8E+03

TABLE B. ENVIRONMENTAL SCREENING LEVELS (ESLs)
Shallow Soils (≤3m bgs)
Groundwater IS NOT a Current or Potential Source of Drinking Water

CHEMICAL PARAMETER	[1]Shallow Soil [2]Residential Land Use (mg/kg)	[1]Shallow Soil Commercial/ Industrial Land Use Only (mg/kg)	[3]Groundwater (ug/L)
MOLYBDENUM	4.0E+01	4.0E+01	2.4E+02
NAPHTHALENE	4.6E-01	1.5E+00	2.4E+01
NICKEL	1.5E+02	1.5E+02	8.2E+00
PENTACHLOROPHENOL	4.4E+00	5.0E+00	7.9E+00
PERCHLORATE	1.2E+00	1.2E+00	6.0E+02
PHENANTHRENE	1.1E+01	1.1E+01	4.6E+00
PHENOL	1.9E+01	1.9E+01	1.3E+03
POLYCHLORINATED BIPHENYLS (PCBs)	2.2E-01	7.4E-01	1.4E-02
PYRENE	8.5E+01	8.5E+01	2.0E+00
SELENIUM	1.0E+01	1.0E+01	5.0E+00
SILVER	2.0E+01	4.0E+01	1.9E-01
STYRENE	1.5E+01	1.5E+01	1.0E+02
tert-BUTYL ALCOHOL	5.7E+01	1.1E+02	1.8E+04
TETRACHLOROETHANE, 1,1,1,2-	3.0E+00	6.9E+00	9.3E+02
TETRACHLOROETHANE, 1,1,2,2-	9.1E-03	2.5E-02	1.9E+02
TETRACHLOROETHYLENE	8.7E-02	2.4E-01	1.2E+02
THALLIUM	1.0E+00	1.3E+01	2.0E+01
TOLUENE	9.3E+00	9.3E+00	1.3E+02
TOXAPHENE	4.2E-04	4.2E-04	2.0E-04
TPH (gasolines)	1.0E+02	4.0E+02	5.0E+02
TPH (middle distillates)	1.0E+02	5.0E+02	6.4E+02
TPH (residual fuels)	5.0E+02	1.0E+03	6.4E+02
TRICHLOROBENZENE, 1,2,4-	3.8E-01	1.0E+00	2.5E+01
TRICHLOROETHANE, 1,1,1-	7.8E+00	7.8E+00	6.2E+01
TRICHLOROETHANE, 1,1,2-	3.2E-02	8.9E-02	3.5E+02
TRICHLOROETHYLENE	2.6E-01	7.3E-01	3.6E+02
TRICHLOROPHENOL, 2,4,5-	1.8E-01	1.8E-01	1.1E+01
TRICHLOROPHENOL, 2,4,6-	6.9E+00	1.0E+01	4.9E+02
VANADIUM	1.1E+02	2.0E+02	1.9E+01

TABLE B. ENVIRONMENTAL SCREENING LEVELS (ESLs)
Shallow Soils ($\leq$3m bgs)
Groundwater IS NOT a Current or Potential Source of Drinking Water

CHEMICAL PARAMETER	[1]Shallow Soil [2]Residential Land Use (mg/kg)	[1]Shallow Soil Commercial/ Industrial Land Use Only (mg/kg)	[3]Groundwater (ug/L)
VINYL CHLORIDE	6.7E-03	1.9E-02	3.8E+00
XYLENES	1.1E+01	1.1E+01	1.0E+02
ZINC	6.0E+02	6.0E+02	8.1E+01
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)	2.0	4.0	not applicable
Sodium Adsorption Ratio	5.0	12	not applicable

Red: Updated with respect to ESLs presented in July 2003 document.

Notes:

1. Shallow soils defined as soils less than or equal to 3 meters (approximately 10 feet) below ground surface.
2. Category "Residential Land Use" generally considered adequate for other sensitive uses (e.g., day-care centers, hospitals, etc.)
3. Assumes potential discharge of groundwater into marine or estuary surface water system.

Source of soil ESLs: Refer to Appendix 1, Tables A-1 and A-2.

Source of groundwater ESLs: Refer to Appendix 1, Table F-1b.

Soil data should be reported on dry-weight basis (see Appendix 1, Section 6.2).

Soil ESLs intended to address direct-exposure, groundwater protection, ecologic (urban areas) and nuisance concerns under noted land-use scenarios. **Soil gas data should be collected for additional evaluation of potential indoor-air impacts at at sites with significant areas of VOC-impacted soil. See Section 2.6 and Table E.**

Groundwater ESLs intended to address surface water, indoor-air and nuisance concerns. **Use in conjunction with soil gas screening levels to more closely evaluate potential impacts to indoor-air if groundwater screening levels for this concern approached or exceeded (refer to Section 2.6 and Appendix 1, Table F-1a).**

Aquatic habitat goals for bioaccumulation concerns not considered in selection of groundwater goals (refer to Section 2.7).

Refer to appendices for summary of ESL components.

Soil and water ESLs for ethanol based on gross contamination concerns (see Appendix 1, Chapter 5 and related tables).

TPH -Total Petroleum Hydrocarbons. TPH ESLs must be used in conjunction with ESLs for related chemicals (e.g., BTEX, PAHs, oxidizers, etc.). See Volume 1, Section 2.2 and Appendix 1, Chapter 5.

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STANDARD FIELD PROCEDURES FOR GEOPROBE® SOIL AND GROUNDWATER SAMPLING

This document describes Cambria Environmental Technology's standard field methods for GeoProbe® soil and ground water sampling. These procedures are designed to comply with Federal, State and local regulatory guidelines. Specific field procedures are summarized below.

Objectives

Soil samples are collected to characterize subsurface lithology, assess whether the soils exhibit obvious hydrocarbon or other compound vapor odor or staining, estimate ground water depth and quality and to submit samples for chemical analysis.

Soil Classification/Logging

All soil samples are classified according to the Unified Soil Classification System by a trained geologist or engineer working under the supervision of a California Registered Geologist (RG) or a Certified Engineering Geologist (CEG). The following soil properties are noted for each soil sample:

- Principal and secondary grain size category (i.e., sand, silt, clay or gravel)
- Approximate percentage of each grain size category,
- Color,
- Approximate water or separate-phase hydrocarbon saturation percentage,
- Observed odor and/or discoloration,
- Other significant observations (i.e., cementation, presence of marker horizons, mineralogy), and
- Estimated permeability.

Soil Sampling

GeoProbe® soil samples are collected from borings driven using hydraulic push technologies. A minimum of one and one half ft of the soil column is collected for every five ft of drilled depth. Additional soil samples can be collected near the water table and at lithologic changes. Samples are collected using samplers lined with polyethylene or brass tubes driven into undisturbed sediments at the bottom of the borehole. The ground surface immediately adjacent to the boring is used as a datum to measure sample depth. The horizontal location of each boring is measured in the field relative to a permanent on-site reference using a measuring wheel or tape measure.

Drilling and sampling equipment is steam-cleaned or washed prior to drilling and between borings to prevent cross-contamination. Sampling equipment is washed between samples with trisodium phosphate or an equivalent EPA-approved detergent.

Sample Storage, Handling and Transport

Sampling tubes chosen for analysis are trimmed of excess soil and capped with Teflon® tape and plastic end caps. Soil samples are labeled and stored at or below 4°C on either crushed or dry ice, depending upon local regulations. Samples are transported under chain-of-custody to a State-certified analytic laboratory.

Field Screening

After a soil sample has been collected, soil from the remaining tubing is placed inside a sealed plastic bag and set aside to allow hydrocarbons to volatilize from the soil. After ten to fifteen minutes, a portable GasTech® or photoionization detector measures volatile hydrocarbon vapor concentrations in the bag's headspace, extracting the vapor through a slit in the plastic bag. The measurements are used along with the field observations, odors, stratigraphy and ground water depth to select soil samples for analysis.

Grab Ground Water Sampling

Ground water samples are collected from the open borehole using bailers, advancing disposable Tygon® tubing into the borehole and extracting ground water using a diaphragm pump, or using a hydro-punch style sampler with a bailer or tubing. The ground water samples are decanted into the appropriate containers supplied by the analytic laboratory. Samples are labeled, placed in protective foam sleeves, stored on crushed ice at or below 4° C, and transported under chain-of-custody to the laboratory.

Discrete Depth Soil and Ground Water Sampling

Soil and groundwater samples are collected for lithologic and chemical analysis using a direct driven, dual tube soil coring system. A hydraulic hammer drives sampling rods into he ground to collect continuous soil cores. Two nested sampling rods are driven at the same time: a larger diameter outer rod to act as a temporary drive casing and a smaller inner rod to retrieve soil cores. As the rods are advanced the soil is driven into a sample barrel that is attached to the end of the inner rod. The outer rod ensures that the sample is collected from the desired interval by preventing sloughing of the overlying material. After reaching the desired depth the inner rods are removed from the boring and the sleeves containing the soil sample are removed from the inner sample barrel. Sampling tubes chosen for analysis are trimmed of excess soil and capped with Teflon® tape and plastic end caps. Soil samples are labeled and stored at or below 4°C on either crushed or dry ice, depending upon local regulations. Samples are transported under chain-of-custody to a State-certified analytic laboratory.

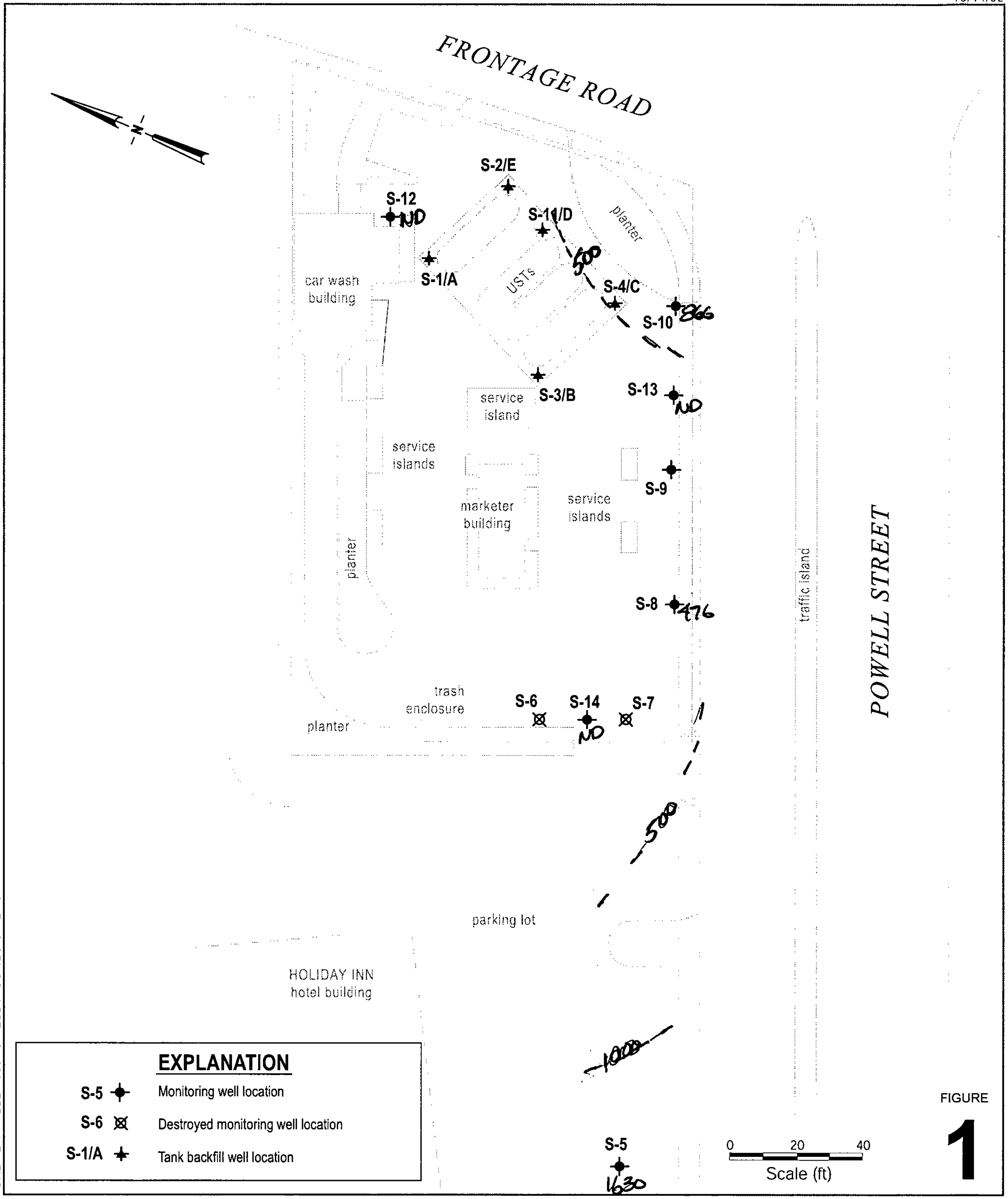
When collecting groundwater samples, the sample barrel and inner rods are removed from the boring once the targeted water bearing zone has been reached. The drive casing is pulled up from 0.5 to 5 feet to allow groundwater to enter the borehole. Small diameter well casing and screen is then installed in the borehole to facilitate sample collection. The drive casing is then pulled up sufficiently to expose the desired length of screen and samples are collected using a bailer, peristaltic, bladder or inertial pump. The ground water samples are decanted into the appropriate containers supplied by the analytic laboratory. Samples are labeled, placed in protective foam sleeves, stored on crushed ice at or below 4° C, and transported under chain-of-custody to the laboratory.

Duplicates and Blanks

Blind duplicate water samples are usually collected only for monitoring well sampling programs, at a rate of one blind sample for every 10 wells sampled. Laboratory-supplied trip blanks accompany samples collected for all sampling programs to check for cross-contamination caused by sample handling and transport. These trip blanks are analyzed if the internal laboratory quality assurance/quality control (QA/QC) blanks contain the suspected field contaminants. An equipment blank may also be analyzed if non-dedicated sampling equipment is used.

Grouting

If the borings are not completed as wells, the borings are filled to the ground surface with cement grout poured or pumped through a tremie pipe. If the dual tube system is used, the borings are filled to the ground surface with cement grout poured or pumped through the dual tube casing.



Shell-branded Service Station
1800 Powell Street
Emeryville, California
Incident #98995349

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TPHs Isocon (ppb)
November 2005

Site Plan

12/29/05

G:\EMERYVILLE 1800 POWELL\FIGURES\VICINITY.AI

0 1/8 1/4 1/2 1

SCALE : 1" = 1/4 MILE

Shell-branded Service Station

1800 1/2 Powell Street
Emeryville, California
Incident No.98995349

Vicinity Map

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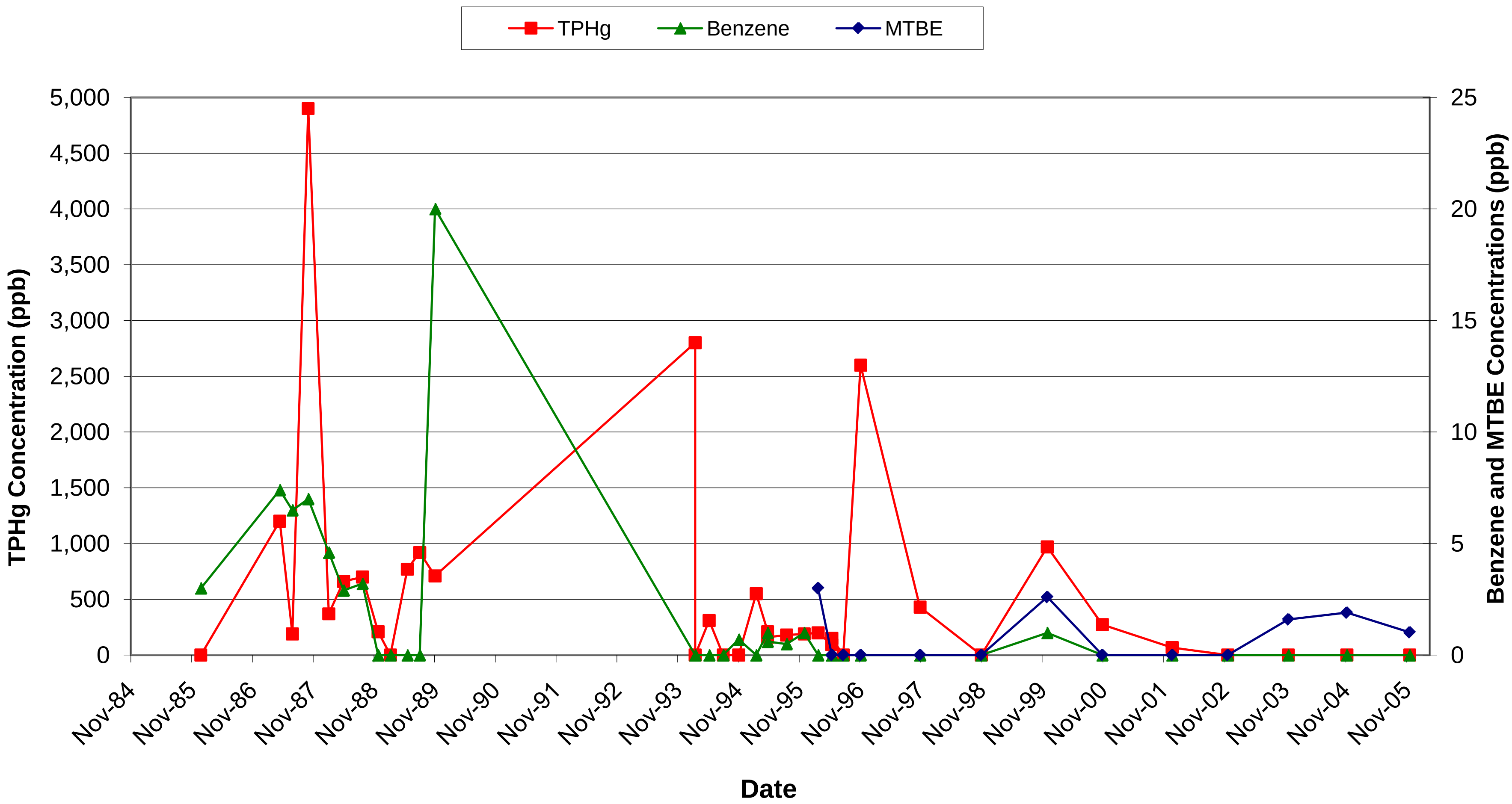

Shell-branded Service Station
1800 Powell Street
Emeryville, California

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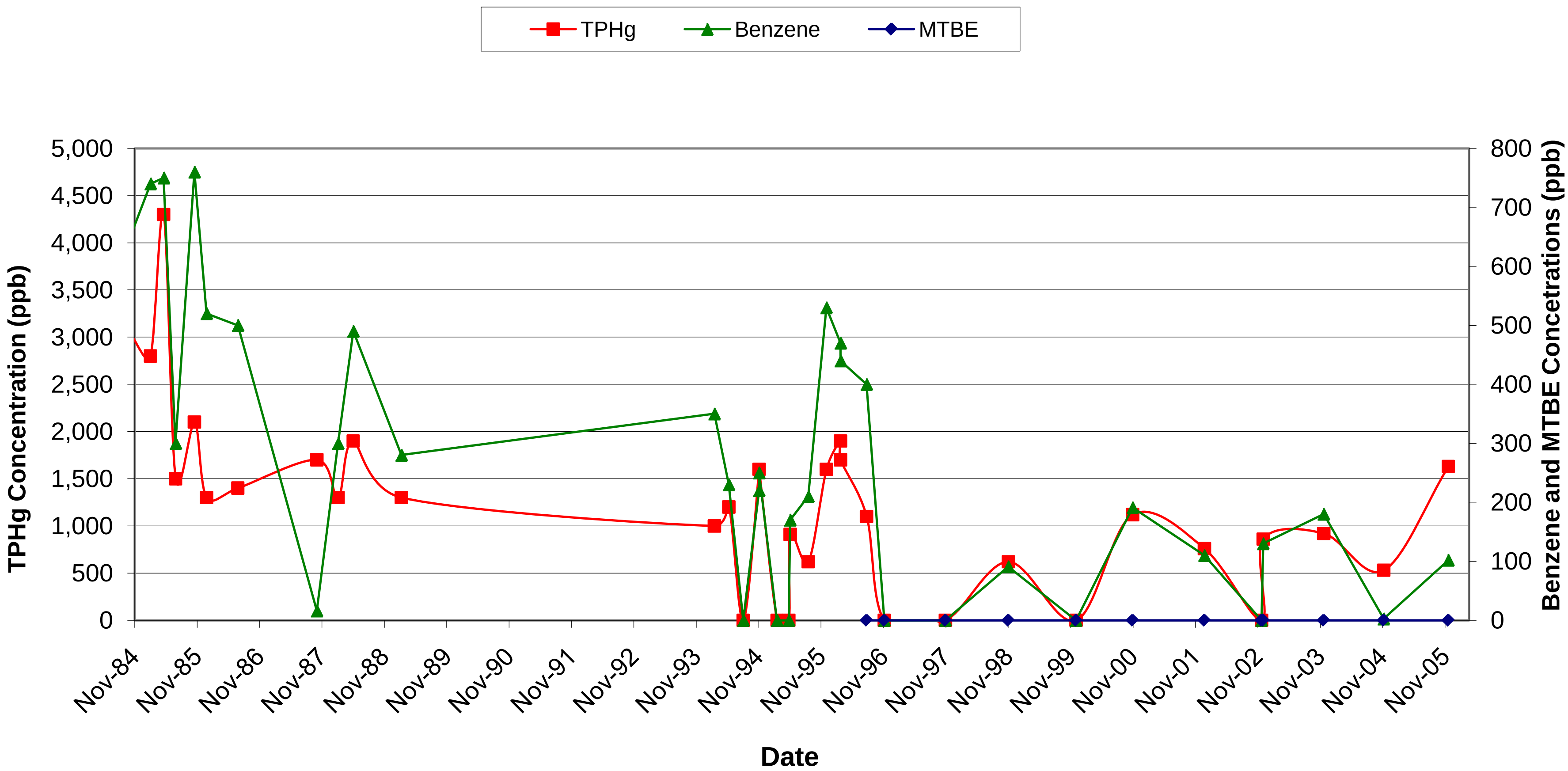
S-14 Groundwater Concentrations

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-5	10/26/1984	3,000	NA	660	20	20	70	NA	NA	11.72	NA	NA	NA
S-5	2/9/1985	2,800	NA	740	20	20	140	NA	NA	11.72	NA	NA	NA
S-5	4/27/1985	4,300	NA	750	10	20	<30	NA	NA	11.72	NA	NA	NA
S-5	7/6/1985	1,500	NA	300	8	7	9	NA	NA	11.72	NA	NA	NA
S-5	10/24/1985	2,100	NA	760	10	40	50	NA	NA	11.72	NA	NA	NA
S-5	1/3/1986	1,300	NA	520	9	8	10	NA	NA	11.72	NA	NA	NA
S-5	7/5/1986	1,400	NA	500	10	4	<10	NA	NA	11.72	8.36	3.36	NA
S-5	10/10/1987	1,700	NA	16	5.7	5.2	8.9	NA	NA	11.72	9.67	2.05	NA
S-5	2/11/1988	1,300	NA	300	5	<5	<5	NA	NA	11.72	9.00	2.72	NA
S-5	5/10/1988	1,900	NA	490	<0.5	<5	<5	NA	NA	11.72	8.61	3.11	NA
S-5	2/16/1989	1,300	NA	280	3	3.4	9.4	NA	NA	11.72	8.29	3.43	NA
S-5	2/21/1994	1,000	NA	350	<5	<5	<5	NA	NA	11.72	7.95	3.77	NA
S-5	5/16/1994	1,200	NA	230	<5	<5	<5	NA	NA	11.72	8.00	3.72	NA
S-5	8/9/1994	Well inaccessible		NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	11/9/1994	1,600	NA	220	3.2	1.8	5	NA	NA	11.72	8.32	3.40	NA
S-5 (D)	11/9/1994	1,600	NA	250	3.3	1.9	5.9	NA	NA	11.72	8.32	NA	NA
S-5	2/22/1995	Well inaccessible		NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	5/2/1995	Well inaccessible		NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	5/10/1995	910	NA	170	1.5	1.3	5.2	NA	NA	11.72	NA	NA	NA
S-5	8/24/1995	620	NA	210	<0.5	1.2	5.3	NA	NA	11.72	8.78	2.94	NA
S-5 (D)	12/8/1995	1,600	NA	530	1.8	1.1	5.4	NA	NA	11.72	9.78	1.94	NA
S-5	2/29/1996	1,900	NA	470	5.8	<5.0	<5.0	46	NA	11.72	7.64	4.08	NA
S-5 (D)	2/29/1996	1,700	NA	440	5.4	<5.0	<5.0	40	NA	11.72	7.64	4.08	NA
S-5	7/30/1996	1,100	NA	400	<5.0	<5.0	6.9	<25	NA	11.72	9.40	2.32	NA
S-5	11/11/1996	Well inaccessible		NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	11/3/1997	Well inaccessible		NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	11/6/1998	620	NA	91	<0.50	0.64	4.0	<2.5	NA	11.72	8.25	3.47	NA
S-5	12/7/1999	Well inaccessible		NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA

S-5	11/2/2000	1,120	NA	191	2.78	<2.50	3.56	<12.5	NA	11.72	8.55	3.17	NA
S-5	12/27/2001	760	NA	110	2.4	<0.50	5.8	NA	<5.0	11.72	7.64	4.08	NA
S-5	11/26/2002	Well inaccessible		NA	NA	NA	NA	NA	NA	14.07	NA	NA	NA
S-5	12/6/2002	860	NA	130	2.3	<0.50	6.0	NA	<5.0	14.07	8.62	5.45	NA
S-5	11/25/2003	920	NA	180	3.0	<1.0	6.2	NA	<1.0	14.07	9.32	4.75	NA
S-5	**11/10/2004**	**530**	**NA**	**2.4**	**0.68**	**<0.50**	**6.3**	**NA**	**<0.50**	**14.07**	**9.35**	**4.72**	**NA**
S-5	**11/23/2005**	**1630**	**NA**	**102.0**					**<0.50**	**14.07**	**9.35**	**4.72**	**NA**

32874.00
38718.00



Shell-branded Service Station
1800 Powell Street
Emeryville, California

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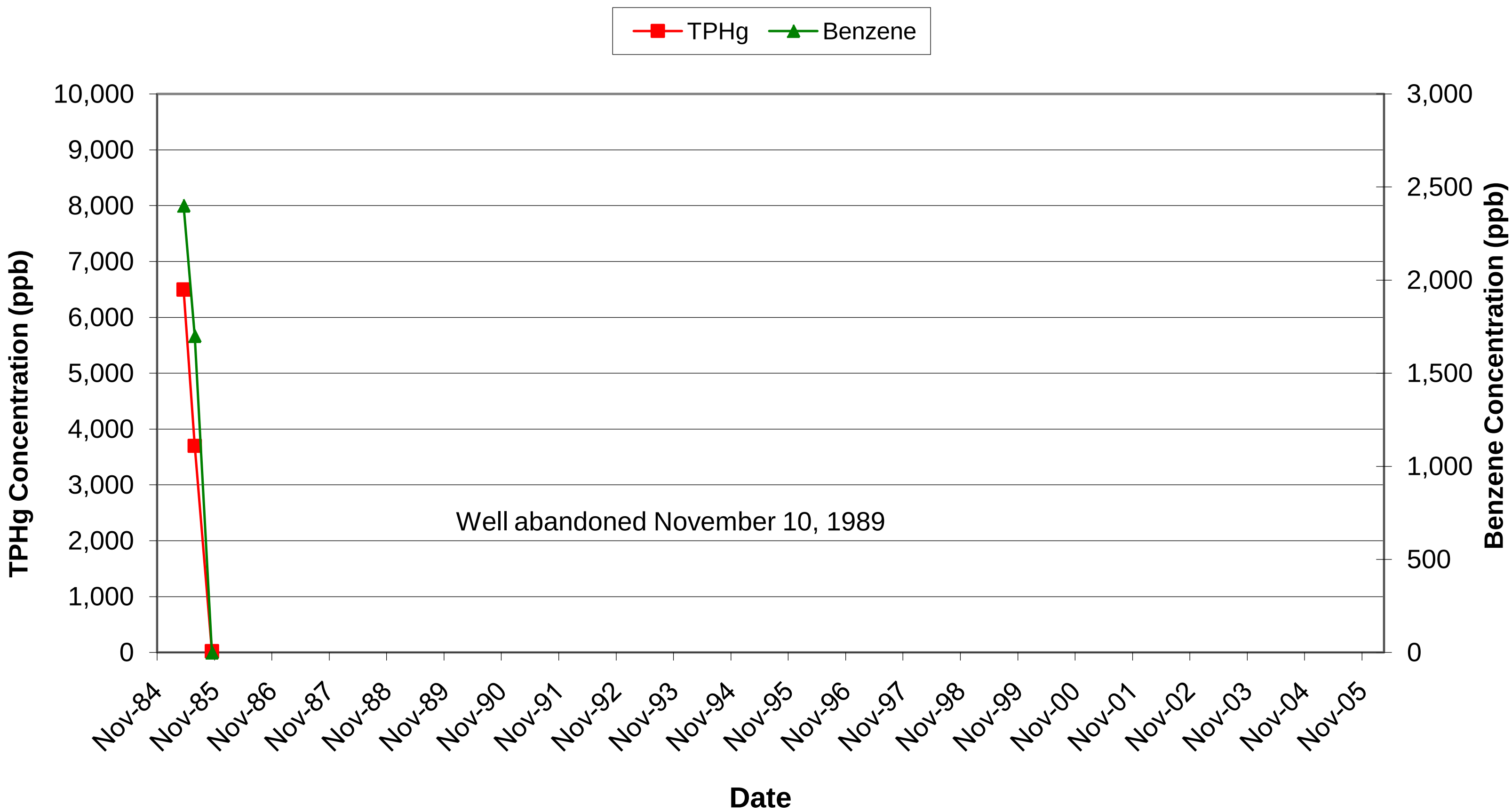
S-5 Groundwater Concentrations

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-6	4/27/1985	6,500	NA	2,400	30	50	210	NA	NA	NA	NA	NA	NA
S-6	7/6/1985	3,700	NA	1,700	34	55	200	NA	NA	NA	NA	NA	NA
S-6	10/24/1985	23	<0.5	<5	10	NA	NA	NA	NA	NA	NA	<50	NA

33604.00

33604.00



Shell-branded Service Station
1800 Powell Street
Emeryville, California

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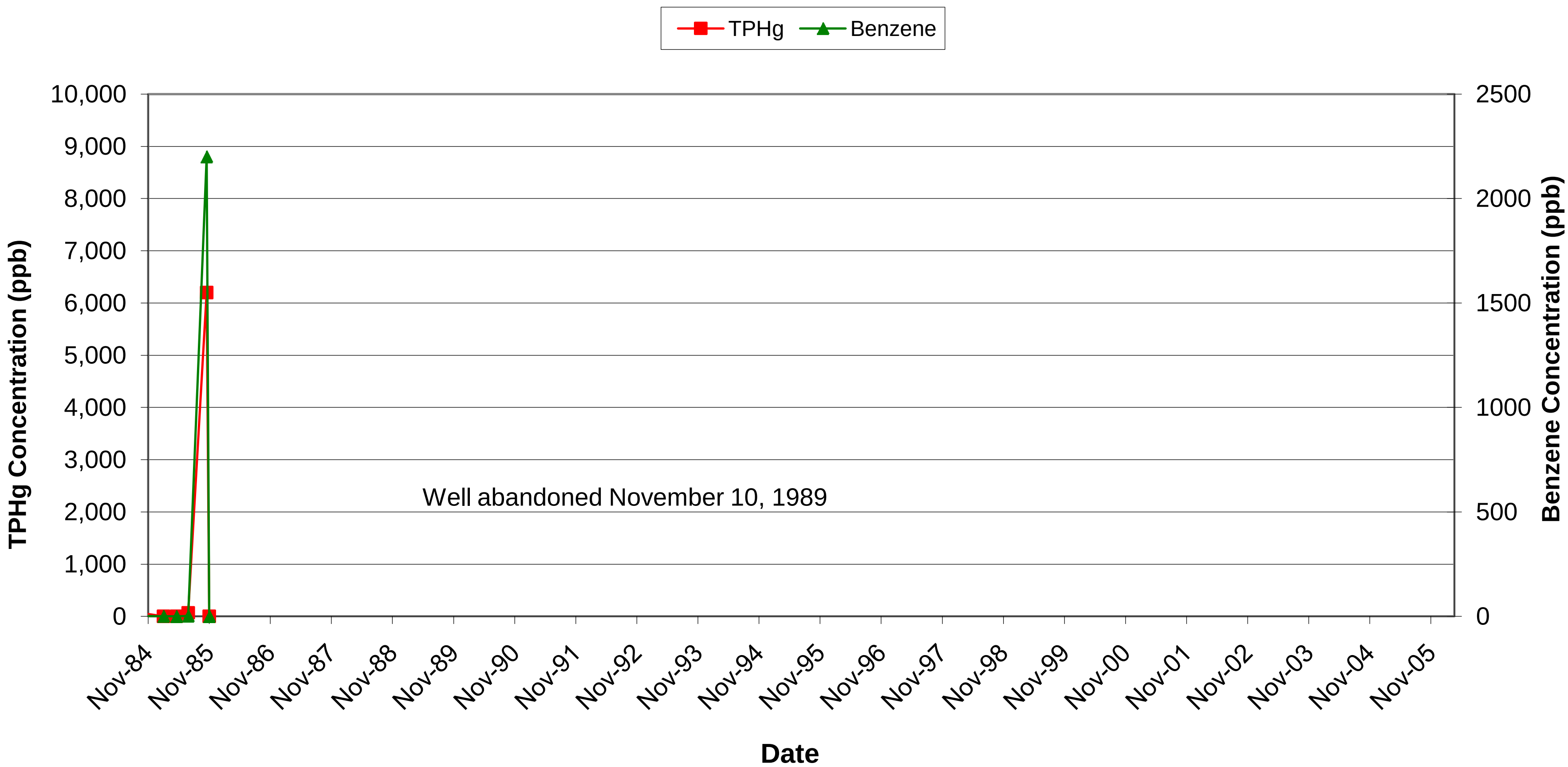
S-6 Groundwater Concentrations

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-7	10/26/1984	50	NA	1.1	<1	<1	4	NA	NA	NA	NA	NA	NA
S-7	2/9/1985	NA	NA	0.9	<1	<1	<3	NA	NA	NA	NA	NA	NA
S-7	4/27/1985	<50	NA	<1	<1	<1	<3	NA	NA	NA	NA	NA	NA
S-7	7/6/1985	70	NA	2.2	<1	<1	<3	NA	NA	NA	NA	NA	NA
S-7	10/24/1985	6,200	NA	2,200	130	190	660	NA	NA	NA	NA	NA	NA
S-7	11/9/1985	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA



Shell-branded Service Station
1800 Powell Street
Emeryville, California

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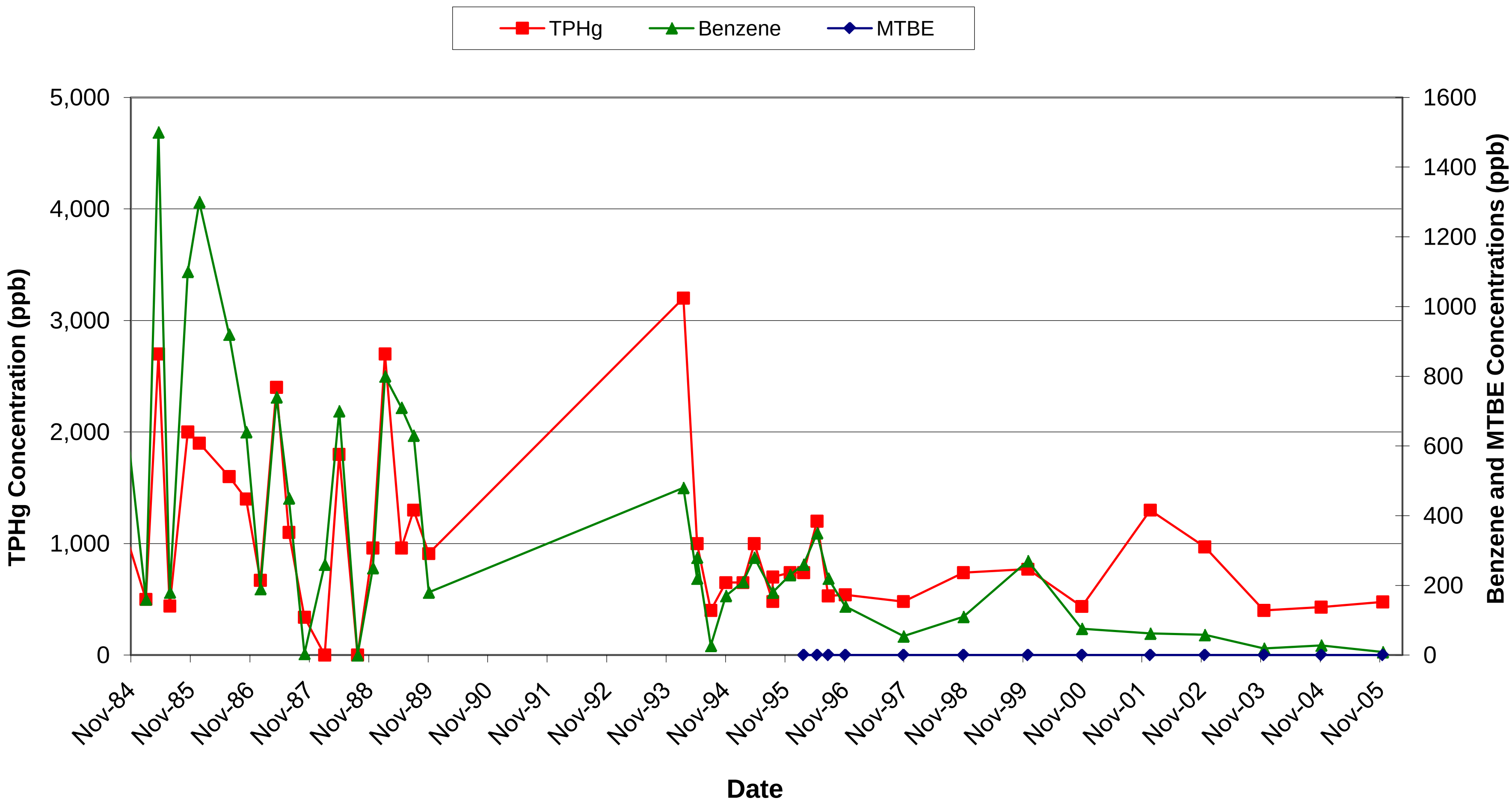
S-7 Groundwater Concentrations

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-8	10/26/1984	1,000	NA	610	9	1	42	NA	NA	12.76	NA	NA	NA
S-8	2/9/1985	500	NA	160	5	<2	17	NA	NA	12.76	NA	NA	NA
S-8	4/27/1985	2,700	NA	1500	20	10	40	NA	NA	12.76	NA	NA	NA
S-8	7/6/1985	440	NA	180	5	2	12	NA	NA	12.76	NA	NA	NA
S-8	10/24/1985	2,000	NA	1,100	17	5	70	NA	NA	12.76	NA	NA	NA
S-8	1/3/1986	1,900	NA	1,300	20	<10	70	NA	NA	12.76	NA	NA	NA
S-8	7/5/1986	1,600	NA	920	30	<10	60	NA	NA	12.76	9.50	3.26	NA
S-8	10/18/1986	1,400	NA	640	<10	<10	30	NA	NA	12.76	NA	NA	NA
S-8	1/13/1987	670	760	190	5.8	<0.5	19	NA	NA	12.76	NA	NA	NA
S-8	4/22/1987	2,400	NA	740	54	5.7	59	NA	NA	12.76	NA	NA	NA
S-8	7/7/1987	1,100	NA	450	15	<2.5	42	NA	NA	12.76	10.45	2.31	NA
S-8	10/10/1987	340	NA	4	0.6	<0.5	17	NA	NA	12.76	10.83	1.93	NA
S-8	2/11/1988	<1,000	NA	260	<10	<10	11	NA	NA	12.76	10.44	2.32	NA
S-8	5/10/1988	1,800	NA	700	14	<5	46	NA	NA	12.76	10.17	2.59	NA
S-8	8/31/1988	NA	NA	NA	NA	NA	NA	NA	NA	12.76	10.81	1.95	SPH
S-8	12/3/1988	960	NA	250	4.3	<2.5	14	NA	NA	12.76	10.81	1.95	NA
S-8	2/16/1989	2,700	NA	800	35	10	83	NA	NA	12.76	9.65	3.11	NA
S-8	5/28/1989	960	NA	710	25	84	80	NA	NA	12.76	10.46	2.30	NA
S-8	8/10/1989	1,300	NA	630	17	<5	46	NA	NA	12.76	10.59	2.17	NA
S-8	11/11/1989	910	NA	180	8	<2.5	15	NA	NA	12.76	10.29	2.47	NA
S-8	2/21/1994	3,200	NA	480	52	<5	130	NA	NA	12.76	9.52	3.24	NA
S-8	5/16/1994	1,000	NA	220	7.3	<5	28	NA	NA	12.76	9.49	3.27	NA
S-8 (D)	5/16/1994	1,000	NA	280	10	<5	29	NA	NA	12.76	9.49	3.27	NA
S-8	8/9/1994	400	NA	27	6.6	<0.5	18	NA	NA	12.76	10.37	2.39	NA
S-8	11/9/1994	650	NA	170	5.3	<0.5	17	NA	NA	12.76	9.58	3.18	NA
S-8	2/22/1995	650	NA	210	10	1.2	22	NA	NA	12.76	9.02	3.74	NA
S-8	5/2/1995	1,000	NA	280	17	1.4	32	NA	NA	12.76	8.45	4.31	NA
S-8	8/24/1995	480	NA	180	11	1	19	NA	NA	12.76	10.02	2.74	NA
S-8 (D)	8/24/1995	700	NA	180	6.5	<0.5	17	NA	NA	12.76	10.02	2.74	NA
S-8	12/8/1995	740	NA	230	6.9	0.7	15	NA	NA	12.76	10.65	2.11	NA
S-8	2/29/1996	740	NA	260	8.1	<5.0	19	58	NA	12.76	9.10	3.66	NA

S-8	5/22/1996	1,200	NA	350	10	<5.0	23	74	NA	12.76	10.14	2.62	NA
S-8	7/30/1996	530	NA	220	20	6.3	36	69	NA	12.76	10.51	2.25	NA
S-8	11/11/1996	540	NA	140	3.7	<2.0	17	42	NA	12.76	10.23	2.53	NA
S-8	11/3/1997	480	NA	54	3.5	<0.50	12	40	NA	12.76	9.40	3.36	NA
S-8	11/6/1998	740	NA	110	10	2.8	26	31	NA	12.76	9.78	2.98	NA
S-8	12/7/1999	770	NA	270	16	<2.0	33	75	NA	12.76	10.14	2.62	NA
S-8	11/2/2000	436	NA	75.8	6.18	0.549	14.9	81.5	NA	12.76	9.45	3.31	NA
S-8	12/27/2001	1,300	NA	62	11	1.8	31	NA	86	12.76	9.19	3.57	NA
S-8	11/26/2002	970	NA	58	3.8	0.51	15	NA	35	15.00	10.10	4.90	NA
S-8	11/25/2003	400	NA	19	4.4	<0.50	15	NA	34	15.00	10.49	4.51	NA
S-8	**11/10/2004**	**430**	**NA**	**28**	**3.4**	**<0.50**	**11**	**NA**	**25**	**15.00**	**10.45**	**4.55**	**NA**
S-8	**11/23/2005**	476		8.72					35.2				



Shell-branded Service Station
1800 Powell Street
Emeryville, California

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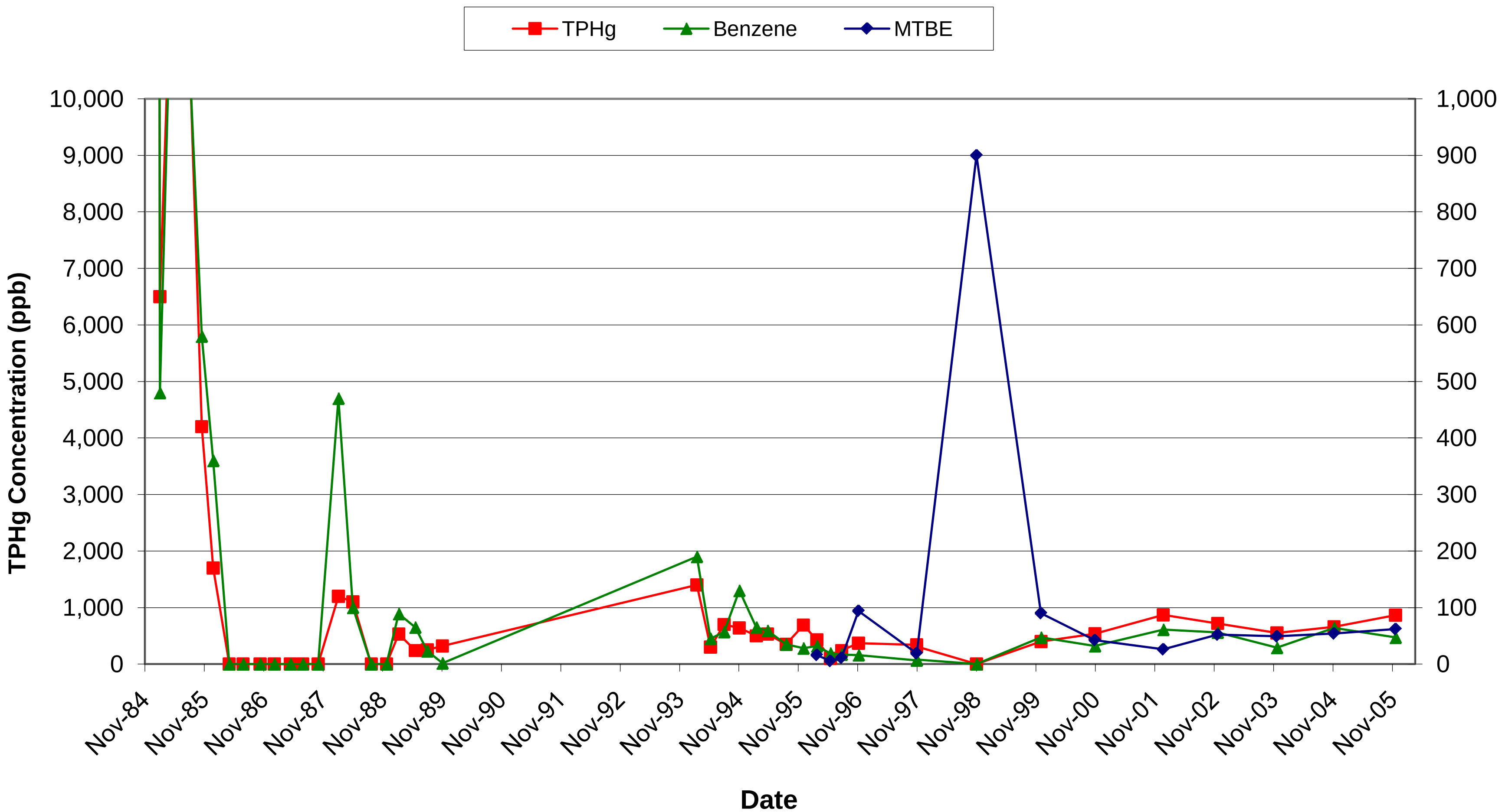
S-8 Groundwater Concentrations

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-10	10/26/1984	700,000	NA	37,000	100,000	20,000	110,000	NA	NA	12.58	NA	NA	NA
S-10	2/9/1985	6,500	NA	480	700	100	1,800	NA	NA	12.58	NA	NA	NA
S-10	4/27/1985	13,000	NA	1,300	500	600	3,700	NA	NA	12.58	NA	NA	NA
S-10	7/6/1985	14,000	NA	1,300	310	270	2,400	NA	NA	12.58	NA	NA	NA
S-10	10/24/1985	4,200	NA	580	34	4	440	NA	NA	12.58	NA	NA	NA
S-10	1/3/1986	1,700	NA	360	10	7.8	170	NA	NA	12.58	NA	NA	NA
S-10	4/11/1986	NA	NA	NA	NA	NA	NA	NA	NA	12.58	NA	NA	0.01
S-10	7/5/1986	NA	NA	NA	NA	NA	NA	NA	NA	12.58	9.16	3.42	0.01
S-10	10/18/1986	NA	NA	NA	NA	NA	NA	NA	NA	12.58	NA	NA	0.03
S-10	1/13/1987	NA	NA	NA	NA	NA	NA	NA	NA	12.58	NA	NA	0.03
S-10	4/22/1987	NA	NA	NA	NA	NA	NA	NA	NA	12.58	NA	NA	0.01
S-10	7/7/1987	NA	NA	NA	NA	NA	NA	NA	NA	12.58	9.41	3.17	0.03
S-10	10/10/1987	NA	NA	NA	NA	NA	NA	NA	NA	12.58	7.77	4.81	SPH
S-10	2/11/1988	1,200	NA	470	16	<5	14	NA	NA	12.58	6.41	6.17	NA
S-10	5/10/1988	1,100	NA	100	6	4	19	NA	NA	12.58	9.04	3.54	NA
S-10	8/31/1988	NA	NA	NA	NA	NA	NA	NA	NA	12.58	9.38	3.20	0.01
S-10	12/3/1988	NA	NA	NA	NA	NA	NA	NA	NA	12.58	6.89	5.69	SPH
S-10	2/16/1989	530	NA	89	8.5	1.6	4.5	NA	NA	12.58	7.34	5.24	NA
S-10	5/28/1989	240	NA	65	3.8	2.2	8.6	NA	NA	12.58	6.60	5.98	NA
S-10	8/10/1989	250	NA	23	4.1	<1	6.4	NA	NA	12.58	9.09	3.49	NA
S-10	11/11/1989	320	NA	1.6	1.3	1.4	6.2	NA	NA	12.58	6.58	6.00	NA
S-10	2/21/1994	1,400	NA	190	9.9	<2.5	19	NA	NA	12.58	8.32	4.26	NA
S-10	5/16/1994	300	NA	45	8.6	6.2	19	NA	NA	12.58	8.35	4.23	NA
S-10	8/8/1994	700	NA	57	14	<0.5	9.3	NA	NA	12.58	8.66	3.92	NA
S-10	11/9/1994	640	NA	130	2	1.6	4.1	NA	NA	12.58	6.68	5.90	NA
S-10	2/22/1995	500	NA	65	5.9	1	8.2	NA	NA	12.58	9.12	3.46	NA
S-10	5/2/1995	530	NA	59	2.3	0.8	8.2	NA	NA	12.58	9.50	3.08	NA
S-10	8/24/1995	350	NA	35	4.6	<0.5	6.7	NA	NA	12.58	10.06	2.52	NA
S-10	12/8/1995	690	NA	28	4.6	0.9	8.6	NA	NA	12.58	10.08	2.50	NA
S-10	2/29/1996	430	NA	32	1.8	0.5	5.8	16	NA	12.58	5.32	7.26	NA
S-10	5/22/1996	100	1,200	19	0.63	<0.5	1.4	5.3	NA	12.58	6.04	6.54	NA
S-10	7/30/1996	240	13,000	17	<1.2	<1.2	7.8	11	NA	12.58	10.48	2.10	NA
S-10	11/11/1996	370	4,800	16	1.1	<0.5	7	94	NA	12.58	10.31	2.27	NA

S-10	11/3/1997	340	1,100	6.7	2.1	<0.50	3.3	19	NA	12.58	9.53	3.05	NA
S-10 (D)	11/3/1997	310	1,100	7.8	1.3	<0.50	3.1	19	NA	12.58	9.53	3.05	NA
S-10	11/6/1998	<250	2,000	<2.5	<2.5	<2.5	6.5	900	NA	12.58	5.12	7.46	NA
S-10	12/7/1999	400	2,230	47	33	10	29	90	NA	12.58	7.95	4.63	NA
S-10	11/2/2000	536	14,500	32.0	3.08	<0.500	2.98	42.3	NA	12.58	7.05	5.53	NA
S-10	12/27/2001	870	6,600	61	4.9	2.5	15	NA	26	12.58	7.43	5.15	NA
S-10	11/26/2002	720	9,800	56	3.5	<0.50	8.4	NA	52	15.11	9.75	5.36	NA
S-10	11/25/2003	550	530 m	29	2.7	<0.50	8.4	NA	49	15.11	9.00	6.11	NA
S-10	**11/10/2004**	**660**	**1,500 m**	**64**	**5.0**	**0.61**	**14**	**NA**	**54**	**14.93 o**	**9.50**	**5.43**	**NA**
S-10	**11/23/2005**	866		47					61.9				



Shell-branded Service Station
1800 Powell Street
Emeryville, California

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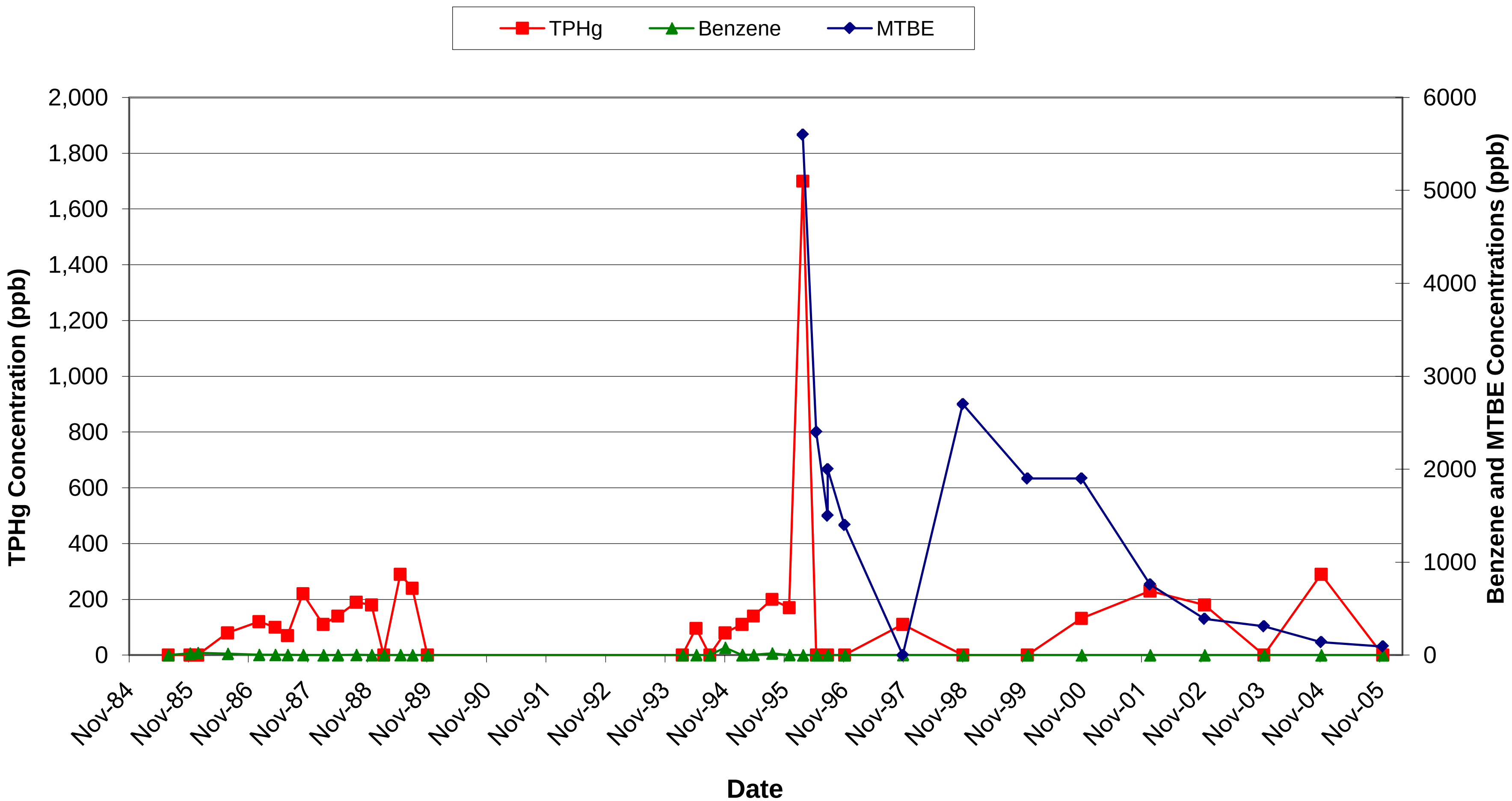
S-10 Groundwater Concentrations

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	Thickness (ft.)
S-12	7/6/1985	<250	2,200	0.71	<0.5	<0.5	<3.6	NA	NA	12.84	8.22	NA	NA
S-12	11/16/1985	<250	1,400	18	<2	<2	<5	NA	NA	12.84	NA	NA	NA
S-12	1/3/1986	<250	NA	24	2	<2	<5	NA	NA	12.84	NA	NA	NA
S-12	7/5/1986	80	NA	15	0.7	<0.5	2	NA	NA	12.84	8.27	4.57	NA
S-12	1/13/1987	120	1,000	3.6	0.8	<0.5	2.9	NA	NA	12.84	NA	NA	NA
S-12	4/22/1987	100	820	3.7	3.8	0.8	11	NA	NA	12.84	NA	NA	NA
S-12	7/7/1987	70	NA	2.5	0.8	<0.5	2.4	NA	NA	12.84	9.50	3.34	NA
S-12	10/10/1987	220	2,500	2.1	0.7	<0.5	1.2	NA	NA	12.84	9.90	2.94	NA
S-12	2/11/1988	110	2,500	0.8	<0.5	<0.5	1.3	NA	NA	12.84	9.43	3.41	NA
S-12	5/10/1988	140	3,800b	0.8	0.8	<0.5	2.5	NA	NA	12.84	8.65	4.19	NA
S-12	8/31/1988	190	2,600b	3	15	0.5	4.5	NA	NA	12.84	9.86	2.98	NA
S-12	12/3/1988	180	3,900b	1.2	1	1	7.7	NA	NA	12.84	9.93	2.91	NA
S-12	2/16/1989	350c	2,100b	0.6	<0.5	0.5	5.5	NA	NA	12.84	8.08	4.76	NA
S-12	5/28/1989	290	2,200	2	1.6	4.4	6	NA	NA	12.84	9.08	3.76	NA
S-12	8/10/1989	240	720	0.7	<0.5	<0.5	1.1	NA	NA	12.84	9.35	3.49	NA
S-12	11/11/1989	210c	4,100	0.7	0.5	<0.5	3.4	NA	NA	12.84	9.28	3.56	NA
S-12	2/21/1994	240d	2,200e	0.7	<0.5	<0.5	3.6	NA	NA	12.84	8.22	4.62	NA
S-12	5/16/1994	96	2,200	1.5	<0.5	<0.5	2	NA	NA	12.84	8.92	3.92	NA
S-12	8/8/1994	110f	3,500g	<0.5	<0.5	<0.5	<0.5	NA	NA	12.84	NA	0.00	NA
S-12	11/9/1994	80	5,400g	80	<0.5	<0.5	0.6	NA	NA	12.84	7.56	5.28	NA
S-12	2/22/1995	110	2,900g,h	0.7	<0.5	<0.5	3.7	NA	NA	12.84	7.98	4.86	NA
S-12 (D)	2/22/1995	110	3,400g,h	4.8	7.1	<0.5	2.1	NA	NA	12.84	7.98	4.86	NA
S-12	5/2/1995	140	2,800	2.4	1.1	0.8	4.3	NA	NA	12.84	8.44	4.40	NA
S-12	8/24/1995	200	1,600	19	12	5.6	24	NA	NA	12.84	9.00	3.84	NA
S-12	12/8/1995	170	2,700	2.2	0.7	0.9	3.6	NA	NA	12.84	9.62	3.22	NA
S-12	2/29/1996	1,700	2,200	<5.0	<5.0	<5.0	<5.0	5,600	NA	12.84	7.64	5.20	NA
S-12	5/22/1996	<1,000	5,700	<10	<10	<10	<10	2,400	NA	12.84	8.94	3.90	NA
S-12	7/30/1996	<500	3,200	<5.0	<5.0	<5.0	<5.0	1,500	NA	12.84	9.71	3.13	NA
S-12 (D)	7/30/1996	<500	2,900	<5.0	<5.0	<5.0	<5.0	NA	2,000	12.84	9.71	3.13	NA
S-12	11/11/1996	<500	6,900	<5.0	<5.0	<5.0	<5.0	1,400	NA	12.84	9.65	3.19	NA
S-12	11/3/1997	110	2,800	2.1	<0.50	<0.50	1.3	NA	NA	12.84	8.73	4.11	NA
S-12	11/6/1998	<500	2,900	<5.0	<5.0	<5.0	<5.0	2,700	NA	12.84	8.85	3.99	NA
S-12	12/7/1999	<500	2,800	<5.0	<5.0	<5.0	<5.0	1,900	NA	12.84	8.32	4.52	NA

S-12	11/2/2000	132	4,000	0.642	<0.500	<0.500	1.07	1,900	2,230 k	12.84	7.50	5.34	NA
S-12	12/27/2001	230	2,700	<2.0	<2.0	<2.0	<2.0	NA	760	12.84	7.00	5.84	NA
S-12	11/26/2002	180	540	<1.0	<1.0	<1.0	1.7	NA	390	14.87	8.35	6.52	NA
S-12	11/25/2003	<250	2,600 m	<2.5	<2.5	<2.5	<5.0	NA	310	14.87	6.04	8.83	NA
S-12	**11/10/2004**	**290**	**1,000 m**	**<1.0**	**1.2**	**<1.0**	**5.0**	**NA**	**140**	**14.87**	**7.80**	**7.07**	**NA**
S-12	**11/23/2005**	<50		<0.50					93.3				



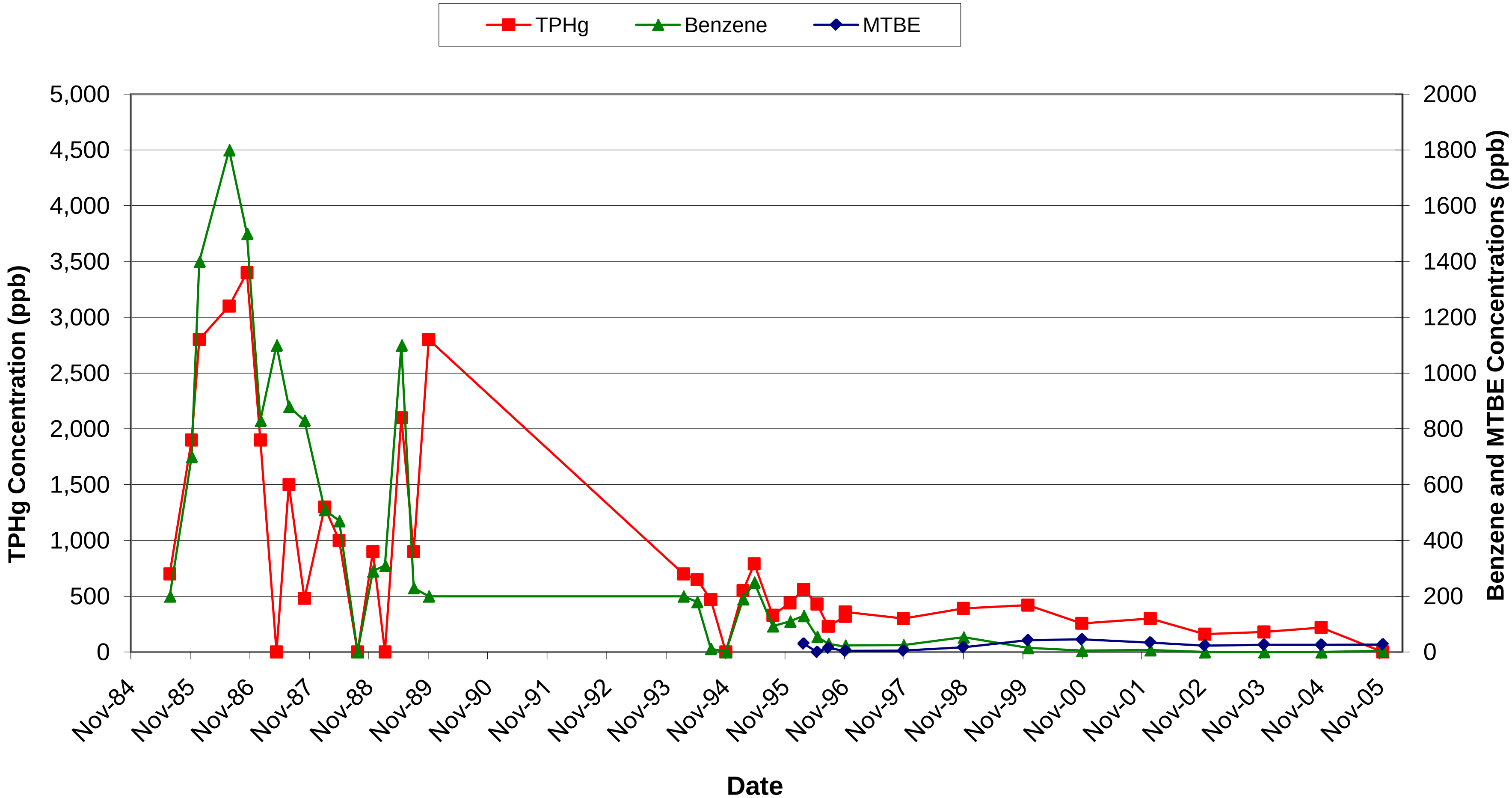
Shell-branded Service Station
1800 Powell Street
Emeryville, California

CAMBRIA

S-12 Groundwater Concentrations

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	Thickness (ft.)
S-13	7/6/1985	700	3,600	200	<5	<5	45	NA	NA	12.59	9.26	NA	NA
S-13	11/16/1985	1,900	2,000	700	160	70	340	NA	NA	12.59	NA	NA	NA
S-13	1/3/1986	2,800	NA	1,400	130	10	500	NA	NA	12.59	NA	NA	NA
S-13	7/5/1986	3,100	NA	1,800	60	40	270	NA	NA	12.59	9.47	3.12	NA
S-13	10/23/1986	3,400	NA	1,500	28	28	250	NA	NA	12.59	NA	NA	NA
S-13	1/13/1987	1,900	900	830	15	<10	99	NA	NA	12.59	NA	NA	NA
S-13	4/22/1987	2,900c	770h	1,100	20	30	140	NA	NA	12.59	NA	NA	NA
S-13	7/7/1987	1,500	NA	880	10	6	160	NA	NA	12.59	10.38	2.21	NA
S-13	10/10/1987	480	2,400	830	15	<0.5	120	NA	NA	12.59	10.78	1.81	NA
S-13	2/11/1988	1,300	1,300	510	<10	<10	86	NA	NA	12.59	10.48	2.11	NA
S-13	5/10/1988	1,000	1,300b	470	<0.5	<5	50	NA	NA	12.59	9.48	3.11	NA
S-13	8/31/1988	NA	NA	NA	NA	NA	NA	NA	NA	12.59	10.74	1.85	SPH
S-13	12/3/1988	900	2,400b	290	4.6	<2.5	20	NA	NA	12.59	10.30	2.29	NA
S-13	2/16/1989	840c	1,200b	310	3.5	<2.5	27	NA	NA	12.59	7.60	4.99	NA
S-13	5/28/1989	2,100	4,600	1,100	19	50	350	NA	NA	12.59	10.60	1.99	NA
S-13	8/10/1989	900	2,300	230	16	6.9	65	NA	NA	12.59	10.58	2.01	NA
S-13	11/11/1989	2,800	2,800	200	15	8.6	58	NA	NA	12.59	9.84	2.75	NA
S-13	2/21/1994	700	1,800d	200	<5	<5	45	NA	NA	12.59	9.26	3.33	NA
S-13	5/16/1994	650	1,700	180	2.5	<2.5	21	NA	NA	12.59	9.62	2.97	NA
S-13	8/8/1994	470	2,600g	12	1.5	0.5	14	NA	NA	12.59	10.32	2.27	NA
S-13	11/9/1994	Well inaccessible		NA	NA	NA	NA	NA	NA	12.59	NA	NA	NA
S-13	2/22/1995	550	2,400g,h	190	4	<0.5	17	NA	NA	12.59	8.92	3.67	NA
S-13	5/2/1995	790	2,100	250	6.9	1.2	22	NA	NA	12.59	9.52	3.07	NA
S-13	8/24/1995	330	1,500	93	<0.5	<0.5	2	NA	NA	12.59	10.02	2.57	NA
S-13	12/8/1995	440	2,400	110	2.2	0.8	23	NA	NA	12.59	10.75	1.84	NA
S-13	2/29/1996	560	2,500	130	<5.0	<5.0	30	30	NA	12.59	9.02	3.57	NA
S-13	5/22/1996	430	3,700	55	1.6	310	27	<5.0	NA	12.59	10.20	2.39	NA
S-13	7/30/1996	230	1,600	30	2	1.4	17	15	NA	12.59	10.42	2.17	NA
S-13	11/11/1996	320	2,700	19	1.1	<0.5	14	3.5	NA	12.59	10.28	2.31	NA
S-13 (D)	11/11/1996	360	2,400	24	1.3	<0.5	15	4.5	NA	12.59	10.28	2.31	NA
S-13	11/3/1997	300	1,900	25	1.4	0.63	12	5.0	NA	12.59	9.36	3.23	NA
S-13	11/6/1998	390	1,300	53	2.9	1.1	13	17	NA	12.59	9.85	2.74	NA

S-13	12/7/1999	420	1,430	15	6.2	2.6	15	42	NA	12.59	9.72	2.87	NA
S-13	11/2/2000	257	4,240	4.89	1.92	<0.500	5.17	45.1	NA	12.59	7.15	5.44	NA
S-13	12/27/2001	300	6,400	7.2	0.84	<0.50	6.0	NA	34	12.59	9.35	3.24	NA
S-13	11/26/2002	160	850	<0.50	<0.50	<0.50	2.6	NA	23	14.47	9.80	4.67	NA
S-13	11/25/2003	180	5,100 m	0.57	0.55	<0.50	3.0	NA	26	14.47	9.94	4.53	NA
S-13	**11/10/2004**	**220**	**1,900 m**	**<0.50**	**0.71**	**<0.50**	**2.8**	**NA**	**26**	**14.47**	**10.05**	**4.42**	**NA**
S-13	**11/23/2005**	<50		4.33					27.2				



Shell-branded Service Station
1800 Powell Street
Emeryville, California

CAMBRIA

S-13 Groundwater Concentrations

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-14	1/3/1986	<250	NA	3	2	<2	<5	NA	NA	12.69	NA	NA	NA
S-14	4/22/1987	1,200	18,000	7.4	2.7	15	110	NA	NA	12.69	NA	NA	NA
S-14	7/7/1987	190	NA	6.5	0.6	1.9	26	NA	NA	12.69	10.32	2.37	NA
S-14	10/10/1987	4,900	21,000	7	1.2	<0.5	25	NA	NA	12.69	10.77	1.92	NA
S-14	2/11/1988	370	12,000c	4.6	<2.5	<2.5	26	NA	NA	12.69	10.40	2.29	NA
S-14	5/10/1988	660	2,200b	2.9	<2.5	<2.5	24	NA	NA	12.69	9.66	3.03	NA
S-14	8/31/1988	700	7,900	3.2	<2.5	<2.5	15	NA	NA	12.69	10.74	1.95	NA
S-14	12/3/1988	210	11,000b	<0.5	<0.5	0.8	6.8	NA	NA	12.69	10.69	2.00	NA
S-14	2/16/1989	130c	5,700b	<0.5	<0.5	<0.5	4.4	NA	NA	12.69	9.69	3.00	NA
S-14	5/28/1989	770	5,200	<0.5	<0.5	<0.5	4.5	NA	NA	12.69	10.42	2.27	NA
S-14	8/10/1989	920	8,800	<1	<1	1.6	17	NA	NA	12.69	10.54	2.15	NA
S-14	11/11/1989	710	28,000	20	57	25	69	NA	NA	12.69	9.91	2.78	NA
S-14	2/21/1994	2,800	3,600	<5	<5	<5	14	NA	NA	12.69	9.30	3.09	NA
S-14	2/21/1994	2,300d	3,600e	<5.0	<5	<5	14	NA	NA	12.69	9.30	3.39	NA
S-14	5/16/1994	310	6,700	<2.5	<2.5	<2.5	3.1	NA	NA	12.69	9.54	3.15	NA
S-14	8/8/1994	480l	2,900	<0.5	0.6	<0.5	0.8	NA	NA	12.69	10.29	2.40	NA
S-14 (D)	8/8/1994	590l	2,900	<0.5	0.6	<0.5	1.5	NA	NA	12.69	10.29	2.40	NA
S-14	11/9/1994	170i	6,400g	0.7	<0.5	<0.5	2.7	NA	NA	12.69	9.52	3.07	NA
S-14	2/22/1995	550	7,000g,h	<0.5	<0.5	<0.5	1.6	NA	NA	12.69	9.18	3.51	NA
S-14	5/2/1995	210	2,300	1	0.9	1.1	6.3	NA	NA	12.69	9.49	3.20	NA
S-14 (D)	5/2/1995	160	2,600	0.6	0.6	0.7	3.8	NA	NA	12.69	9.49	3.20	NA
S-14	8/24/1995	180	3,700	0.5	<0.5	<0.5	1.3	NA	NA	12.69	9.94	2.75	NA
S-14	12/8/1995	190	4,900	1	<0.5	0.6	4.6	NA	NA	12.69	10.65	2.04	NA
S-14	2/29/1996	200	11,000	<0.5	<0.5	<0.5	2	3	NA	12.69	8.90	3.79	NA
S-14	5/22/1996	93	3,800	<0.5	<0.5	<0.5	1.6	<2.5	NA	12.69	10.10	2.59	NA
S-14 (D)	5/22/1996	150	3,900	<0.5	<0.5	<0.5	1.8	<2.5	NA	12.69	10.10	2.59	NA
S-14	7/30/1996	<50	2,500	<0.5	<0.5	<0.5	0.89	<2.5	NA	12.69	10.37	2.32	NA
S-14	11/11/1996	2,600	27,000	<2.5	<2.5	<2.5	3.9	<12	NA	12.69	10.29	2.40	NA
S-14	11/3/1997	430	1,800	<0.50	<0.50	<0.50	1.7	<2.5	NA	12.69	9.52	3.17	NA
S-14	11/6/1998	Well inaccessible		NA	NA	NA	NA	NA	NA	12.69	NA	NA	NA

S-14	12/7/1999	970	5,920	1.0	1.1	0.59	3.5	2.6	NA	12.69	9.73	2.96	NA
S-14	11/2/2000	273	535,000	<0.500	<0.500	<0.500	1.59	<2.50	NA	12.69	9.98	2.71	NA
S-14	12/27/2001	68	20,000	<0.50	<0.50	<0.50	1.3	NA	<5.0	12.69	9.33	3.36	NA
S-14	11/26/2002	<50	2,400	<0.50	<0.50	<0.50	0.91	NA	<5.0	14.51	9.70	4.81	NA
S-14	11/25/2003	78 m	4,400 m	<0.50	<0.50	<0.50	1.2	NA	1.6	14.51	9.99	4.52	NA
S-14	**11/10/2004**	**74 p**	**2,500 m**	**<0.50**	**<0.50**	**<0.50**	**<1.0**	**NA**	**1.9**	**14.51**	**10.05**	**4.46**	**NA**
S-14	**11/23/2005**	<50		**<0.50**					1.02				

WELL CONCENTRATIONS
Shell-branded Service Station
1784 150th Avenue
San Leandro, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-5	10/26/1984	3,000	NA	660	20	20	70	NA	NA	11.72	NA	NA	NA
S-5	2/9/1985	2,800	NA	740	20	20	140	NA	NA	11.72	NA	NA	NA
S-5	4/27/1985	4,300	NA	750	10	20	<30	NA	NA	11.72	NA	NA	NA
S-5	7/6/1985	1,500	NA	300	8	7	9	NA	NA	11.72	NA	NA	NA
S-5	10/24/1985	2,100	NA	760	10	40	50	NA	NA	11.72	NA	NA	NA
S-5	1/3/1986	1,300	NA	520	9	8	10	NA	NA	11.72	NA	NA	NA
S-5	7/5/1986	1,400	NA	500	10	4	<10	NA	NA	11.72	8.36	3.36	NA
S-5	10/18/1986	4,200	NA	1,100	9	14	7	NA	NA	11.72	NA	NA	NA
S-5	1/13/1987	4,500	6,100	1,100	15	30	25	NA	NA	11.72	NA	NA	NA
S-5	7/7/1987	3,200	NA	1,000	16	9	12	NA	NA	11.72	9.15	2.57	NA
S-5	10/10/1987	1,700	NA	16	5.7	5.2	8.9	NA	NA	11.72	9.67	2.05	NA
S-5	2/11/1988	1,300	NA	300	5	<5	<5	NA	NA	11.72	9.00	2.72	NA
S-5	5/10/1988	1,900	NA	490	<0.5	<5	<5	NA	NA	11.72	8.61	3.11	NA
S-5	8/31/1988	6,700	NA	760	26	<25	<25	NA	NA	11.72	9.61	2.11	NA
S-5	12/3/1988	2,900	NA	890	5.3	7.3	13	NA	NA	11.72	9.47	2.25	NA
S-5	2/16/1989	1,300	NA	280	3	3.4	9.4	NA	NA	11.72	8.29	3.43	NA
S-5	8/10/1989	1,700	NA	530	5.5	<5	5.8	NA	NA	11.72	9.30	2.42	NA
S-5	11/11/1989	NA	NA	NA	NA	NA	NA	NA	NA	11.72	9.42	2.30	NA
S-5	2/21/1994	1,000	NA	250	<5	<5	<5	NA	NA	11.72	7.95	3.77	NA
S-5 (D)	2/21/1994	1,300	NA	220	<5	<5	11	NA	NA	11.72	7.95	3.77	NA
S-5	5/16/1994	1,200	NA	230	<5	<5	<5	NA	NA	11.72	8.00	3.72	NA
S-5	8/9/1994	Well inaccessible		NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	11/9/1994	1,600	NA	220	3.2	1.8	5	NA	NA	11.72	8.32	3.40	NA
S-5 (D)	11/9/1994	1,600	NA	250	3.3	1.9	5.9	NA	NA	11.72	8.32	NA	NA
S-5	2/22/1995	Well inaccessible		NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	5/2/1995	Well inaccessible		NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	5/10/1995	910	NA	170	1.5	1.3	5.2	NA	NA	11.72	NA	NA	NA
S-5	8/24/1995	620	NA	210	<0.5	1.2	5.3	NA	NA	11.72	8.78	2.94	NA
S-5	12/8/1995	1,600	NA	510	3.3	1.5	6.6	NA	NA	11.72	9.78	1.94	NA
S-5 (D)	12/8/1995	1,600	NA	530	1.8	1.1	5.4	NA	NA	11.72	9.78	1.94	NA
S-5	2/29/1996	1,900	NA	470	5.8	<5.0	<5.0	46	NA	11.72	7.64	4.08	NA
S-5 (D)	2/29/1996	1,700	NA	440	5.4	<5.0	<5.0	40	NA	11.72	7.64	4.08	NA
S-5	5/22/1996	1,200	NA	490	<10	<10	<10	<50	NA	11.72	8.60	3.12	NA

WELL CONCENTRATIONS
Shell-branded Service Station
1784 150th Avenue
San Leandro, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-5	7/30/1996	1,100	NA	400	<5.0	<5.0	6.9	<25	NA	11.72	9.40	2.32	NA
S-5	11/11/1996	Well inaccessible		NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	11/3/1997	Well inaccessible		NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	11/6/1998	620	NA	91	<0.50	0.64	4.0	<2.5	NA	11.72	8.25	3.47	NA
S-5	12/7/1999	Well inaccessible		NA	NA	NA	NA	NA	NA	11.72	NA	NA	NA
S-5	11/2/2000	1,120	NA	191	2.78	<2.50	3.56	<12.5	NA	11.72	8.55	3.17	NA
S-5	12/27/2001	760	NA	110	2.4	<0.50	5.8	NA	<5.0	11.72	7.64	4.08	NA
S-5	11/26/2002	Well inaccessible		NA	NA	NA	NA	NA	NA	14.07	NA	NA	NA
S-5	12/6/2002	860	NA	130	2.3	<0.50	6.0	NA	<5.0	14.07	8.62	5.45	NA
S-5	11/25/2003	920	NA	180	3.0	<1.0	6.2	NA	<1.0	14.07	9.32	4.75	NA
S-5	**11/10/2004**	**530**	**NA**	**2.4**	**0.68**	**<0.50**	**6.3**	**NA**	**<0.50**	**14.07**	**9.35**	**4.72**	**NA**
S-6	4/27/1985	6,500	NA	2,400	30	50	210	NA	NA	NA	NA	NA	NA
S-6	7/6/1985	3,700	NA	1,700	34	55	200	NA	NA	NA	NA	NA	NA
S-6	10/24/1985	23	<0.5	<5	10	NA	NA	NA	NA	NA	NA	<50	NA
S-6	11/8/1985	Well abandoned		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-7	10/26/1984	50	NA	1.1	<1	<1	4	NA	NA	NA	NA	NA	NA
S-7	2/9/1985	NA	NA	0.9	<1	<1	<3	NA	NA	NA	NA	NA	NA
S-7	4/27/1985	<50	NA	<1	<1	<1	<3	NA	NA	NA	NA	NA	NA
S-7	7/6/1985	70	NA	2.2	<1	<1	<3	NA	NA	NA	NA	NA	NA
S-7	10/24/1985	6,200	NA	2,200	130	190	660	NA	NA	NA	NA	NA	NA
S-7	11/9/1985	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-8	10/26/1984	1,000	NA	610	9	1	42	NA	NA	12.76	NA	NA	NA
S-8	2/9/1985	500	NA	160	5	<2	17	NA	NA	12.76	NA	NA	NA
S-8	4/27/1985	2,700	NA	1500	20	10	40	NA	NA	12.76	NA	NA	NA
S-8	7/6/1985	440	NA	180	5	2	12	NA	NA	12.76	NA	NA	NA
S-8	10/24/1985	2,000	NA	1,100	17	5	70	NA	NA	12.76	NA	NA	NA
S-8	1/3/1986	1,900	NA	1,300	20	<10	70	NA	NA	12.76	NA	NA	NA
S-8	7/5/1986	1,600	NA	920	30	<10	60	NA	NA	12.76	9.50	3.26	NA
S-8	10/18/1986	1,400	NA	640	<10	<10	30	NA	NA	12.76	NA	NA	NA
S-8	1/13/1987	670	760	190	5.8	<0.5	19	NA	NA	12.76	NA	NA	NA

WELL CONCENTRATIONS
Shell-branded Service Station
1784 150th Avenue
San Leandro, CA

Well ID	**Date**	**TPPH** (ug/L)	**TEPH** (ug/L)	**B** (ug/L)	**T** (ug/L)	**E** (ug/L)	**X** (ug/L)	**MTBE 8020** (ug/L)	**MTBE 8260** (ug/L)	**TOC** (MSL)	**Depth to Water** (ft.)	**GW Elevation** (MSL)	**SPH Thickness** (ft.)
S-8	4/22/1987	2,400	NA	740	54	5.7	59	NA	NA	12.76	NA	NA	NA
S-8	7/7/1987	1,100	NA	450	15	<2.5	42	NA	NA	12.76	10.45	2.31	NA
S-8	10/10/1987	340	NA	4	0.6	<0.5	17	NA	NA	12.76	10.83	1.93	NA
S-8	2/11/1988	<1,000	NA	260	<10	<10	11	NA	NA	12.76	10.44	2.32	NA
S-8	5/10/1988	1,800	NA	700	14	<5	46	NA	NA	12.76	10.17	2.59	NA
S-8	8/31/1988	NA	NA	NA	NA	NA	NA	NA	NA	12.76	10.81	1.95	SPH
S-8	12/3/1988	960	NA	250	4.3	<2.5	14	NA	NA	12.76	10.81	1.95	NA
S-8	2/16/1989	2,700	NA	800	35	10	83	NA	NA	12.76	9.65	3.11	NA
S-8	5/28/1989	960	NA	710	25	84	80	NA	NA	12.76	10.46	2.30	NA
S-8	8/10/1989	1,300	NA	630	17	<5	46	NA	NA	12.76	10.59	2.17	NA
S-8	11/11/1989	910	NA	180	8	<2.5	15	NA	NA	12.76	10.29	2.47	NA
S-8	2/21/1994	3,200	NA	480	52	<5	130	NA	NA	12.76	9.52	3.24	NA
S-8	5/16/1994	1,000	NA	220	7.3	<5	28	NA	NA	12.76	9.49	3.27	NA
S-8 (D)	5/16/1994	1,000	NA	280	10	<5	29	NA	NA	12.76	9.49	3.27	NA
S-8	8/9/1994	400	NA	27	6.6	<0.5	18	NA	NA	12.76	10.37	2.39	NA
S-8	11/9/1994	650	NA	170	5.3	<0.5	17	NA	NA	12.76	9.58	3.18	NA
S-8	2/22/1995	650	NA	210	10	1.2	22	NA	NA	12.76	9.02	3.74	NA
S-8	5/2/1995	1,000	NA	280	17	1.4	32	NA	NA	12.76	8.45	4.31	NA
S-8	8/24/1995	480	NA	180	11	1	19	NA	NA	12.76	10.02	2.74	NA
S-8 (D)	8/24/1995	700	NA	180	6.5	<0.5	17	NA	NA	12.76	10.02	2.74	NA
S-8	12/8/1995	740	NA	230	6.9	0.7	15	NA	NA	12.76	10.65	2.11	NA
S-8	2/29/1996	740	NA	260	8.1	<5.0	19	58	NA	12.76	9.10	3.66	NA
S-8	5/22/1996	1,200	NA	350	10	<5.0	23	74	NA	12.76	10.14	2.62	NA
S-8	7/30/1996	530	NA	220	20	6.3	36	69	NA	12.76	10.51	2.25	NA
S-8	11/11/1996	540	NA	140	3.7	<2.0	17	42	NA	12.76	10.23	2.53	NA
S-8	11/3/1997	480	NA	54	3.5	<0.50	12	40	NA	12.76	9.40	3.36	NA
S-8	11/6/1998	740	NA	110	10	2.8	26	31	NA	12.76	9.78	2.98	NA
S-8	12/7/1999	770	NA	270	16	<2.0	33	75	NA	12.76	10.14	2.62	NA
S-8	11/2/2000	436	NA	75.8	6.18	0.549	14.9	81.5	NA	12.76	9.45	3.31	NA
S-8	12/27/2001	1,300	NA	62	11	1.8	31	NA	86	12.76	9.19	3.57	NA
S-8	11/26/2002	970	NA	58	3.8	0.51	15	NA	35	15.00	10.10	4.90	NA
S-8	11/25/2003	400	NA	19	4.4	<0.50	15	NA	34	15.00	10.49	4.51	NA
S-8	**11/10/2004**	**430**	**NA**	**28**	**3.4**	**<0.50**	**11**	**NA**	**25**	**15.00**	**10.45**	**4.55**	**NA**

WELL CONCENTRATIONS
Shell-branded Service Station
1784 150th Avenue
San Leandro, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-9	10/26/1984	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	2/9/1985	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	1.30
S-9	4/27/1985	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	1.25
S-9	7/6/1985	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	1.20
S-9	10/24/1985	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	1/3/1986	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	4/11/1986	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	7/5/1986	NA	NA	NA	NA	NA	NA	NA	NA	12.75	9.67	3.08	SPH
S-9	10/18/1986	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	1/13/1987	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	4/22/1987	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	7/7/1987	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	10/10/1987	NA	NA	NA	NA	NA	NA	NA	NA	12.75	22.30	-9.55	SPH
S-9	2/24/1994	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	5/16/1994	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	1.50
S-9	8/9/1994	NA	NA	NA	NA	NA	NA	NA	NA	12.75	11.80	NA	2.00
S-9	11/9/1994	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	2/22/1995	NA	NA	NA	NA	NA	NA	NA	NA	12.75	11.40	NA	2.38
S-9	5/2/1995	NA	NA	NA	NA	NA	NA	NA	NA	12.75	11.83	NA	2.12
S-9	12/8/1995	NA	NA	NA	NA	NA	NA	NA	NA	12.75	11.92	NA	1.06
S-9	02/29/1996 a	NA	NA	NA	NA	NA	NA	NA	NA	12.75	12.10	2.88	2.79
S-9	05/22/1996 a	NA	NA	NA	NA	NA	NA	NA	NA	12.75	11.71	2.44	1.75
S-9	07/30/1996 a	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	11/11/1996 a	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	9.00
S-9	11/03/1997 a	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	11/06/1998 a	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	SPH
S-9	12/07/1999 a	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	NA
S-9	11/02/2000 a	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	NA
S-9	12/27/2001 a	NA	NA	NA	NA	NA	NA	NA	NA	12.75	NA	NA	NA
S-9	11/26/2002 a	NA	NA	NA	NA	NA	NA	NA	NA	14.83	NA	NA	NA
S-9	11/25/2003 a	NA	NA	NA	NA	NA	NA	NA	NA	14.83	NA	NA	NA
S-9	**11/25/2003 a**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**14.98 n**	**NA**	**NA**	**NA**

WELL CONCENTRATIONS
Shell-branded Service Station
1784 150th Avenue
San Leandro, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-10	10/26/1984	700,000	NA	37,000	100,000	20,000	110,000	NA	NA	12.58	NA	NA	NA
S-10	2/9/1985	6,500	NA	480	700	100	1,800	NA	NA	12.58	NA	NA	NA
S-10	4/27/1985	13,000	NA	1,300	500	600	3,700	NA	NA	12.58	NA	NA	NA
S-10	7/6/1985	14,000	NA	1,300	310	270	2,400	NA	NA	12.58	NA	NA	NA
S-10	10/24/1985	4,200	NA	580	34	4	440	NA	NA	12.58	NA	NA	NA
S-10	1/3/1986	1,700	NA	360	10	7.8	170	NA	NA	12.58	NA	NA	NA
S-10	4/11/1986	NA	NA	NA	NA	NA	NA	NA	NA	12.58	NA	NA	0.01
S-10	7/5/1986	NA	NA	NA	NA	NA	NA	NA	NA	12.58	9.16	3.42	0.01
S-10	10/18/1986	NA	NA	NA	NA	NA	NA	NA	NA	12.58	NA	NA	0.03
S-10	1/13/1987	NA	NA	NA	NA	NA	NA	NA	NA	12.58	NA	NA	0.03
S-10	4/22/1987	NA	NA	NA	NA	NA	NA	NA	NA	12.58	NA	NA	0.01
S-10	7/7/1987	NA	NA	NA	NA	NA	NA	NA	NA	12.58	9.41	3.17	0.03
S-10	10/10/1987	NA	NA	NA	NA	NA	NA	NA	NA	12.58	7.77	4.81	SPH
S-10	2/11/1988	1,200	NA	470	16	<5	14	NA	NA	12.58	6.41	6.17	NA
S-10	5/10/1988	1,100	NA	100	6	4	19	NA	NA	12.58	9.04	3.54	NA
S-10	8/31/1988	NA	NA	NA	NA	NA	NA	NA	NA	12.58	9.38	3.20	0.01
S-10	12/3/1988	NA	NA	NA	NA	NA	NA	NA	NA	12.58	6.89	5.69	SPH
S-10	2/16/1989	530	NA	89	8.5	1.6	4.5	NA	NA	12.58	7.34	5.24	NA
S-10	5/28/1989	240	NA	65	3.8	2.2	8.6	NA	NA	12.58	6.60	5.98	NA
S-10	8/10/1989	250	NA	23	4.1	<1	6.4	NA	NA	12.58	9.09	3.49	NA
S-10	11/11/1989	320	NA	1.6	1.3	1.4	6.2	NA	NA	12.58	6.58	6.00	NA
S-10	2/21/1994	1,400	NA	190	9.9	<2.5	19	NA	NA	12.58	8.32	4.26	NA
S-10	5/16/1994	300	NA	45	8.6	6.2	19	NA	NA	12.58	8.35	4.23	NA
S-10	8/8/1994	700	NA	57	14	<0.5	9.3	NA	NA	12.58	8.66	3.92	NA
S-10	11/9/1994	640	NA	130	2	1.6	4.1	NA	NA	12.58	6.68	5.90	NA
S-10	2/22/1995	500	NA	65	5.9	1	8.2	NA	NA	12.58	9.12	3.46	NA
S-10	5/2/1995	530	NA	59	2.3	0.8	8.2	NA	NA	12.58	9.50	3.08	NA
S-10	8/24/1995	350	NA	35	4.6	<0.5	6.7	NA	NA	12.58	10.06	2.52	NA
S-10	12/8/1995	690	NA	28	4.6	0.9	8.6	NA	NA	12.58	10.08	2.50	NA
S-10	2/29/1996	430	NA	32	1.8	0.5	5.8	16	NA	12.58	5.32	7.26	NA
S-10	5/22/1996	100	1,200	19	0.63	<0.5	1.4	5.3	NA	12.58	6.04	6.54	NA
S-10	7/30/1996	240	13,000	17	<1.2	<1.2	7.8	11	NA	12.58	10.48	2.10	NA
S-10	11/11/1996	370	4,800	16	1.1	<0.5	7	94	NA	12.58	10.31	2.27	NA

WELL CONCENTRATIONS
Shell-branded Service Station
1784 150th Avenue
San Leandro, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-10	11/3/1997	340	1,100	6.7	2.1	<0.50	3.3	19	NA	12.58	9.53	3.05	NA
S-10 (D)	11/3/1997	310	1,100	7.8	1.3	<0.50	3.1	19	NA	12.58	9.53	3.05	NA
S-10	11/6/1998	<250	2,000	<2.5	<2.5	<2.5	6.5	900	NA	12.58	5.12	7.46	NA
S-10	12/7/1999	400	2,230	47	33	10	29	90	NA	12.58	7.95	4.63	NA
S-10	11/2/2000	536	14,500	32.0	3.08	<0.500	2.98	42.3	NA	12.58	7.05	5.53	NA
S-10	12/27/2001	870	6,600	61	4.9	2.5	15	NA	26	12.58	7.43	5.15	NA
S-10	11/26/2002	720	9,800	56	3.5	<0.50	8.4	NA	52	15.11	9.75	5.36	NA
S-10	11/25/2003	550	530 m	29	2.7	<0.50	8.4	NA	49	15.11	9.00	6.11	NA
S-10	**11/10/2004**	**660**	**1,500 m**	**64**	**5.0**	**0.61**	**14**	**NA**	**54**	**14.93 o**	**9.50**	**5.43**	**NA**
S-12	7/6/1985	<250	2,200	0.71	<0.5	<0.5	<3.6	NA	NA	12.84	8.22	NA	NA
S-12	11/16/1985	<250	1,400	18	<2	<2	<5	NA	NA	12.84	NA	NA	NA
S-12	1/3/1986	<250	NA	24	2	<2	<5	NA	NA	12.84	NA	NA	NA
S-12	7/5/1986	80	NA	15	0.7	<0.5	2	NA	NA	12.84	8.27	4.57	NA
S-12	10/18/1986	150	NA	12	9	<0.5	3.6	NA	NA	12.84	NA	NA	NA
S-12	1/13/1987	120	1,000	3.6	0.8	<0.5	2.9	NA	NA	12.84	NA	NA	NA
S-12	4/22/1987	100	820	3.7	3.8	0.8	11	NA	NA	12.84	NA	NA	NA
S-12	7/7/1987	70	NA	2.5	0.8	<0.5	2.4	NA	NA	12.84	9.50	3.34	NA
S-12	10/10/1987	220	2,500	2.1	0.7	<0.5	1.2	NA	NA	12.84	9.90	2.94	NA
S-12	2/11/1988	110	2,500	0.8	<0.5	<0.5	1.3	NA	NA	12.84	9.43	3.41	NA
S-12	5/10/1988	140	3,800b	0.8	0.8	<0.5	2.5	NA	NA	12.84	8.65	4.19	NA
S-12	8/31/1988	190	2,600b	3	15	0.5	4.5	NA	NA	12.84	9.86	2.98	NA
S-12	12/3/1988	180	3,900b	1.2	1	1	7.7	NA	NA	12.84	9.93	2.91	NA
S-12	2/16/1989	350c	2,100b	0.6	<0.5	0.5	5.5	NA	NA	12.84	8.08	4.76	NA
S-12	5/28/1989	290	2,200	2	1.6	4.4	6	NA	NA	12.84	9.08	3.76	NA
S-12	8/10/1989	240	720	0.7	<0.5	<0.5	1.1	NA	NA	12.84	9.35	3.49	NA
S-12	11/11/1989	210c	4,100	0.7	0.5	<0.5	3.4	NA	NA	12.84	9.28	3.56	NA
S-12	2/21/1994	240d	2,200e	0.7	<0.5	<0.5	3.6	NA	NA	12.84	8.22	4.62	NA
S-12	5/16/1994	96	2,200	1.5	<0.5	<0.5	2	NA	NA	12.84	8.92	3.92	NA
S-12	8/8/1994	110f	3,500g	<0.5	<0.5	<0.5	<0.5	NA	NA	12.84	NA	0.00	NA
S-12	11/9/1994	80	5,400g	80	<0.5	<0.5	0.6	NA	NA	12.84	7.56	5.28	NA
S-12	2/22/1995	110	2,900g,h	0.7	<0.5	<0.5	3.7	NA	NA	12.84	7.98	4.86	NA
S-12 (D)	2/22/1995	110	3,400g,h	4.8	7.1	<0.5	2.1	NA	NA	12.84	7.98	4.86	NA

WELL CONCENTRATIONS
Shell-branded Service Station
1784 150th Avenue
San Leandro, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-12	5/2/1995	140	2,800	2.4	1.1	0.8	4.3	NA	NA	12.84	8.44	4.40	NA
S-12	8/24/1995	200	1,600	19	12	5.6	24	NA	NA	12.84	9.00	3.84	NA
S-12	12/8/1995	170	2,700	2.2	0.7	0.9	3.6	NA	NA	12.84	9.62	3.22	NA
S-12	2/29/1996	1,700	2,200	<5.0	<5.0	<5.0	<5.0	5,600	NA	12.84	7.64	5.20	NA
S-12	5/22/1996	<1,000	5,700	<10	<10	<10	<10	2,400	NA	12.84	8.94	3.90	NA
S-12	7/30/1996	<500	3,200	<5.0	<5.0	<5.0	<5.0	1,500	NA	12.84	9.71	3.13	NA
S-12 (D)	7/30/1996	<500	2,900	<5.0	<5.0	<5.0	<5.0	NA	2,000	12.84	9.71	3.13	NA
S-12	11/11/1996	<500	6,900	<5.0	<5.0	<5.0	<5.0	1,400	NA	12.84	9.65	3.19	NA
S-12	11/3/1997	110	2,800	2.1	<0.50	<0.50	1.3	NA	NA	12.84	8.73	4.11	NA
S-12	11/6/1998	<500	2,900	<5.0	<5.0	<5.0	<5.0	2,700	NA	12.84	8.85	3.99	NA
S-12	12/7/1999	<500	2,800	<5.0	<5.0	<5.0	<5.0	1,900	NA	12.84	8.32	4.52	NA
S-12	11/2/2000	132	4,000	0.642	<0.500	<0.500	1.07	1,900	2,230 k	12.84	7.50	5.34	NA
S-12	12/27/2001	230	2,700	<2.0	<2.0	<2.0	<2.0	NA	760	12.84	7.00	5.84	NA
S-12	11/26/2002	180	540	<1.0	<1.0	<1.0	1.7	NA	390	14.87	8.35	6.52	NA
S-12	11/25/2003	<250	2,600 m	<2.5	<2.5	<2.5	<5.0	NA	310	14.87	6.04	8.83	NA
S-12	**11/10/2004**	**290**	**1,000 m**	**<1.0**	**1.2**	**<1.0**	**5.0**	**NA**	**140**	**14.87**	**7.80**	**7.07**	**NA**
S-13	7/6/1985	700	3,600	200	<5	<5	45	NA	NA	12.59	9.26	NA	NA
S-13	11/16/1985	1,900	2,000	700	160	70	340	NA	NA	12.59	NA	NA	NA
S-13	1/3/1986	2,800	NA	1,400	130	10	500	NA	NA	12.59	NA	NA	NA
S-13	7/5/1986	3,100	NA	1,800	60	40	270	NA	NA	12.59	9.47	3.12	NA
S-13	10/23/1986	3,400	NA	1,500	28	28	250	NA	NA	12.59	NA	NA	NA
S-13	1/13/1987	1,900	900	830	15	<10	99	NA	NA	12.59	NA	NA	NA
S-13	4/22/1987	2,900c	770h	1,100	20	30	140	NA	NA	12.59	NA	NA	NA
S-13	7/7/1987	1,500	NA	880	10	6	160	NA	NA	12.59	10.38	2.21	NA
S-13	10/10/1987	480	2,400	830	15	<0.5	120	NA	NA	12.59	10.78	1.81	NA
S-13	2/11/1988	1,300	1,300	510	<10	<10	86	NA	NA	12.59	10.48	2.11	NA
S-13	5/10/1988	1,000	1,300b	470	<0.5	<5	50	NA	NA	12.59	9.48	3.11	NA
S-13	8/31/1988	NA	NA	NA	NA	NA	NA	NA	NA	12.59	10.74	1.85	SPH
S-13	12/3/1988	900	2,400b	290	4.6	<2.5	20	NA	NA	12.59	10.30	2.29	NA
S-13	2/16/1989	840c	1,200b	310	3.5	<2.5	27	NA	NA	12.59	7.60	4.99	NA
S-13	5/28/1989	2,100	4,600	1,100	19	50	350	NA	NA	12.59	10.60	1.99	NA
S-13	8/10/1989	900	2,300	230	16	6.9	65	NA	NA	12.59	10.58	2.01	NA

WELL CONCENTRATIONS
Shell-branded Service Station
1784 150th Avenue
San Leandro, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-13	11/11/1989	2,800	2,800	200	15	8.6	58	NA	NA	12.59	9.84	2.75	NA
S-13	2/21/1994	700	1,800d	200	<5	<5	45	NA	NA	12.59	9.26	3.33	NA
S-13	5/16/1994	650	1,700	180	2.5	<2.5	21	NA	NA	12.59	9.62	2.97	NA
S-13	8/8/1994	470	2,600g	12	1.5	0.5	14	NA	NA	12.59	10.32	2.27	NA
S-13	11/9/1994	Well inaccessible		NA	NA	NA	NA	NA	NA	12.59	NA	NA	NA
S-13	2/22/1995	550	2,400g,h	190	4	<0.5	17	NA	NA	12.59	8.92	3.67	NA
S-13	5/2/1995	790	2,100	250	6.9	1.2	22	NA	NA	12.59	9.52	3.07	NA
S-13	8/24/1995	330	1,500	93	<0.5	<0.5	2	NA	NA	12.59	10.02	2.57	NA
S-13	12/8/1995	440	2,400	110	2.2	0.8	23	NA	NA	12.59	10.75	1.84	NA
S-13	2/29/1996	560	2,500	130	<5.0	<5.0	30	30	NA	12.59	9.02	3.57	NA
S-13	5/22/1996	430	3,700	55	1.6	310	27	<5.0	NA	12.59	10.20	2.39	NA
S-13	7/30/1996	230	1,600	30	2	1.4	17	15	NA	12.59	10.42	2.17	NA
S-13	11/11/1996	320	2,700	19	1.1	<0.5	14	3.5	NA	12.59	10.28	2.31	NA
S-13 (D)	11/11/1996	360	2,400	24	1.3	<0.5	15	4.5	NA	12.59	10.28	2.31	NA
S-13	11/3/1997	300	1,900	25	1.4	0.63	12	5.0	NA	12.59	9.36	3.23	NA
S-13	11/6/1998	390	1,300	53	2.9	1.1	13	17	NA	12.59	9.85	2.74	NA
S-13	12/7/1999	420	1,430	15	6.2	2.6	15	42	NA	12.59	9.72	2.87	NA
S-13	11/2/2000	257	4,240	4.89	1.92	<0.500	5.17	45.1	NA	12.59	7.15	5.44	NA
S-13	12/27/2001	300	6,400	7.2	0.84	<0.50	6.0	NA	34	12.59	9.35	3.24	NA
S-13	11/26/2002	160	850	<0.50	<0.50	<0.50	2.6	NA	23	14.47	9.80	4.67	NA
S-13	11/25/2003	180	5,100 m	0.57	0.55	<0.50	3.0	NA	26	14.47	9.94	4.53	NA
S-13	**11/10/2004**	**220**	**1,900 m**	**<0.50**	**0.71**	**<0.50**	**2.8**	**NA**	**26**	**14.47**	**10.05**	**4.42**	**NA**
S-14	11/16/1985	<250	400	3	<2	<2	<5	NA	NA	12.69	NA	NA	NA
S-14	1/3/1986	<250	NA	3	2	<2	<5	NA	NA	12.69	NA	NA	NA
S-14	4/22/1987	1,200	18,000	7.4	2.7	15	110	NA	NA	12.69	NA	NA	NA
S-14	7/7/1987	190	NA	6.5	0.6	1.9	26	NA	NA	12.69	10.32	2.37	NA
S-14	10/10/1987	4,900	21,000	7	1.2	<0.5	25	NA	NA	12.69	10.77	1.92	NA
S-14	2/11/1988	370	12,000c	4.6	<2.5	<2.5	26	NA	NA	12.69	10.40	2.29	NA
S-14	5/10/1988	660	2,200b	2.9	<2.5	<2.5	24	NA	NA	12.69	9.66	3.03	NA
S-14	8/31/1988	700	7,900	3.2	<2.5	<2.5	15	NA	NA	12.69	10.74	1.95	NA
S-14	12/3/1988	210	11,000b	<0.5	<0.5	0.8	6.8	NA	NA	12.69	10.69	2.00	NA
S-14	2/16/1989	130c	5,700b	<0.5	<0.5	<0.5	4.4	NA	NA	12.69	9.69	3.00	NA

WELL CONCENTRATIONS
Shell-branded Service Station
1784 150th Avenue
San Leandro, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
S-14	5/28/1989	770	5,200	<0.5	<0.5	<0.5	4.5	NA	NA	12.69	10.42	2.27	NA
S-14	8/10/1989	920	8,800	<1	<1	1.6	17	NA	NA	12.69	10.54	2.15	NA
S-14	11/11/1989	710	28,000	20	57	25	69	NA	NA	12.69	9.91	2.78	NA
S-14	2/21/1994	2,800	3,600	<5	<5	<5	14	NA	NA	12.69	9.30	3.09	NA
S-14	2/21/1994	2,300d	3,600e	<5.0	<5	<5	14	NA	NA	12.69	9.30	3.39	NA
S-14	5/16/1994	310	6,700	<2.5	<2.5	<2.5	3.1	NA	NA	12.69	9.54	3.15	NA
S-14	8/8/1994	480I	2,900	<0.5	0.6	<0.5	0.8	NA	NA	12.69	10.29	2.40	NA
S-14 (D)	8/8/1994	590I	2,900	<0.5	0.6	<0.5	1.5	NA	NA	12.69	10.29	2.40	NA
S-14	11/9/1994	170i	6,400g	0.7	<0.5	<0.5	2.7	NA	NA	12.69	9.52	3.07	NA
S-14	2/22/1995	550	7,000g,h	<0.5	<0.5	<0.5	1.6	NA	NA	12.69	9.18	3.51	NA
S-14	5/2/1995	210	2,300	1	0.9	1.1	6.3	NA	NA	12.69	9.49	3.20	NA
S-14 (D)	5/2/1995	160	2,600	0.6	0.6	0.7	3.8	NA	NA	12.69	9.49	3.20	NA
S-14	8/24/1995	180	3,700	0.5	<0.5	<0.5	1.3	NA	NA	12.69	9.94	2.75	NA
S-14	12/8/1995	190	4,900	1	<0.5	0.6	4.6	NA	NA	12.69	10.65	2.04	NA
S-14	2/29/1996	200	11,000	<0.5	<0.5	<0.5	2	3	NA	12.69	8.90	3.79	NA
S-14	5/22/1996	93	3,800	<0.5	<0.5	<0.5	1.6	<2.5	NA	12.69	10.10	2.59	NA
S-14 (D)	5/22/1996	150	3,900	<0.5	<0.5	<0.5	1.8	<2.5	NA	12.69	10.10	2.59	NA
S-14	7/30/1996	<50	2,500	<0.5	<0.5	<0.5	0.89	<2.5	NA	12.69	10.37	2.32	NA
S-14	11/11/1996	2,600	27,000	<2.5	<2.5	<2.5	3.9	<12	NA	12.69	10.29	2.40	NA
S-14	11/3/1997	430	1,800	<0.50	<0.50	<0.50	1.7	<2.5	NA	12.69	9.52	3.17	NA
S-14	11/6/1998	Well inaccessible		NA	NA	NA	NA	NA	NA	12.69	NA	NA	NA
S-14	12/7/1999	970	5,920	1.0	1.1	0.59	3.5	2.6	NA	12.69	9.73	2.96	NA
S-14	11/2/2000	273	535,000	<0.500	<0.500	<0.500	1.59	<2.50	NA	12.69	9.98	2.71	NA
S-14	12/27/2001	68	20,000	<0.50	<0.50	<0.50	1.3	NA	<5.0	12.69	9.33	3.36	NA
S-14	11/26/2002	<50	2,400	<0.50	<0.50	<0.50	0.91	NA	<5.0	14.51	9.70	4.81	NA
S-14	11/25/2003	78 m	4,400 m	<0.50	<0.50	<0.50	1.2	NA	1.6	14.51	9.99	4.52	NA
S-14	**11/10/2004**	**74 p**	**2,500 m**	**<0.50**	**<0.50**	**<0.50**	**<1.0**	**NA**	**1.9**	**14.51**	**10.05**	**4.46**	**NA**

Abbreviations:

TPPH = Total petroleum hydrocarbons as gasoline by EPA Method 8260B; prior to June 11, 2001, analyzed by EPA Method 8015.

TEPH = Total petroleum hydrocarbons as diesel by modified EPA Method 8015.

BTEX = Benzene, toluene, ethylbenzene, xylenes by EPA Method 8260B; prior to June 11, 2001, analyzed by EPA Method 8020.

MTBE = Methyl tertiary butyl ether

DIPE = Di-isopropyl ether, analyzed by EPA Method 8260

WELL CONCENTRATIONS
Shell-branded Service Station
1784 150th Avenue
San Leandro, CA

Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)

ETBE = Ethyl tertiary butyl ether, analyzed by EPA Method 8260
TAME = Tertiary amyl methyl ether, analyzed by EPA Method 8260
TBA = Tertiary butyl alcohol, analyzed by EPA Method 8260
1,2-DCA = 1,2-dichloroethane, analyzed by EPA Method 8260
EDB = 1,2-dibromomethane or ethlyene dibromide, analyzed by EPA Method 8260
TOC = Top of Casing Elevation
SPH = Separate-Phase Hydrocarbons
GW = Groundwater
DO = Dissolved Oxygen
ug/L = Parts per billion
ppm = Parts per million
MSL = Mean sea level
ft. = Feet
<n = Below detection limit
(D) = Duplicate sample
NA = Not applicable

Notes:
a = Chromatogram pattern indicates an unidentified hydrocarbon.
b = Samples not analyzed due to laboratory oversight.
c = Hydrocarbon does not match pattern of laboratory's standard.
d = The concentration reported reflects individual or discrete unidentified peaks not matching a typical fuel pattern.
e = Estimated value. The concentration exceeded the calibration of analysis.

WELL CONCENTRATIONS
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Well ID	Date	TPPH (ug/L)	TEPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)

f = Quantit. of unknown hydrocarbon(s) in sample based on gasoline.
* = Sample analyzed out of EPA recommended hold time.
Site surveyed January 23, 2002 by Virgil Chavez Land Surveying of Vallejo, CA.
Survey data for wells MW-7 and MW-8 provided by Cambria Environmental Technology.
Wells MW-9, MW-10, and MW-11 surveyed December 11, 2003 by Virgil Chavez Land Surveying of Vallejo, CA.

	MW-1			MW-2			MW-3			MW-10			MW-9	
TPHg	benzene	MTBE	TPHg	benzene	MTBE	TPHg	benzene	MTBE	TPHg	benzene	MTBE	TPHg	benzene	MTBE

Shallow

TPHg

		Times				
	X - distanc	12/27/2001	11/26/2002	11/25/2003	11/10/2004	11/23/2005
S-12	-40	230	180	0	**290**	0
S-10	40	870	720	550	**660**	866
S-13	48	300	160	180	**220**	0
S-8	100	1,300	970	400	**430**	476
S-14	127	68	0	78	**74**	0
S-5	256	760	860	920	**530**	1,630

Benzene

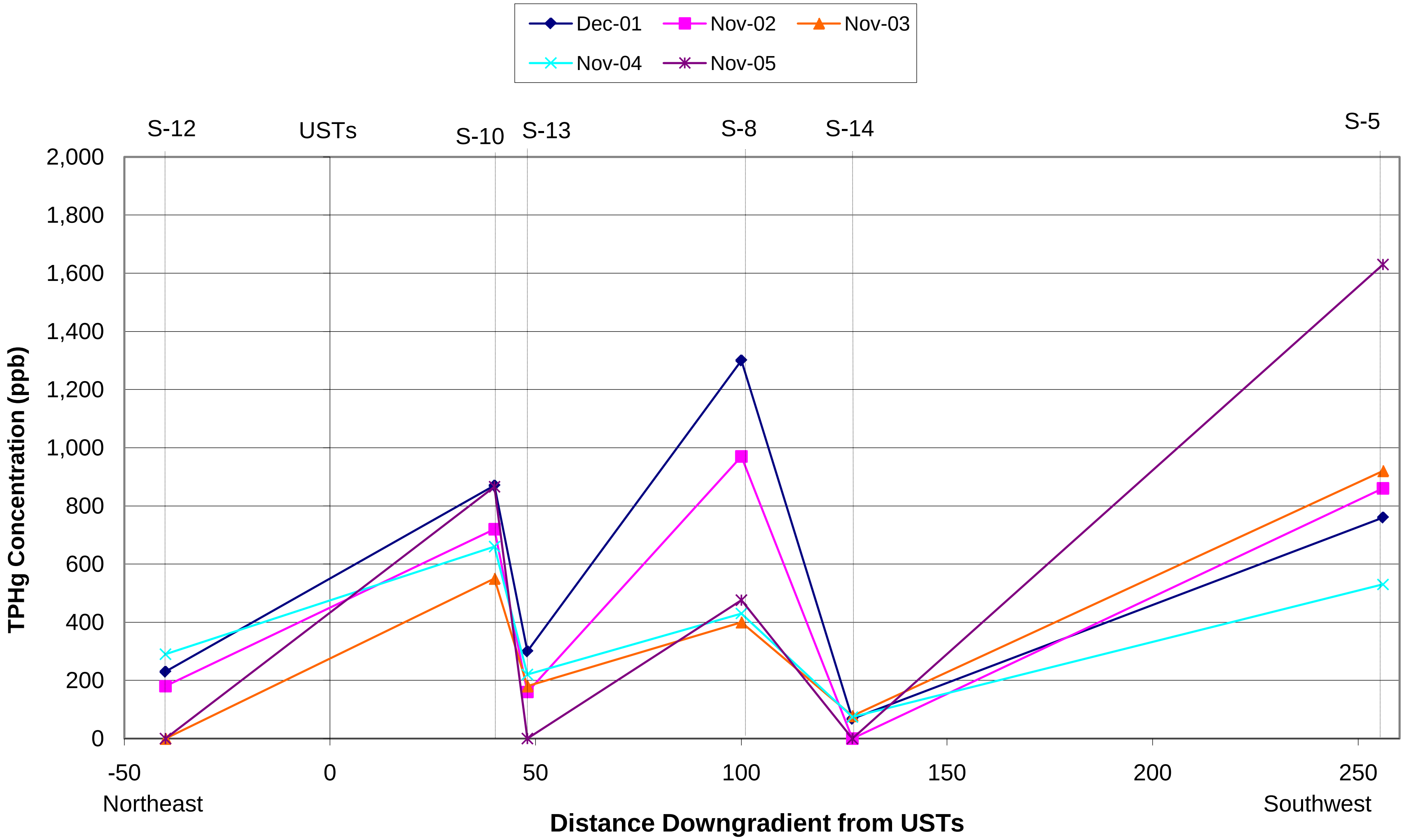
	X - distanc	12/27/2001	11/26/2002	11/25/2003	11/10/2004	11/23/2005
S-12	-40	0	0	0	**0**	0
S-10	40	61	56	29	**64**	47
S-13	48	7.2	0	0.57	**0**	4
S-8	100	62	58	19	**<28.00**	9
S-14	127	0	0	0	0	0
S-5	256	110	130	180	**<2.40**	102

MTBE

	X - distanc	12/27/2001	11/26/2002	11/25/2003	11/10/2004	11/23/2005
S-12	-40	760.0	390.0	310.0	140.0	93.3
S-10	40	26.0	52.0	49.0	**54.0**	61.9
S-13	48	34.0	23.0	26.0	26.0	27.2
S-8	100	86.0	35.0	34.0	**25.0**	35.2
S-14	127	0.0	0.0	1.6	**1.9**	1.02
S-5	256	0	0	0	0	0

TBA

	X - distanc	########				
S-12	-40	398.0				
S-10	40	0.0				
S-13	48	30.3				
S-8	100	20.1				
S-14	127	0.0				
S-5	256	0				



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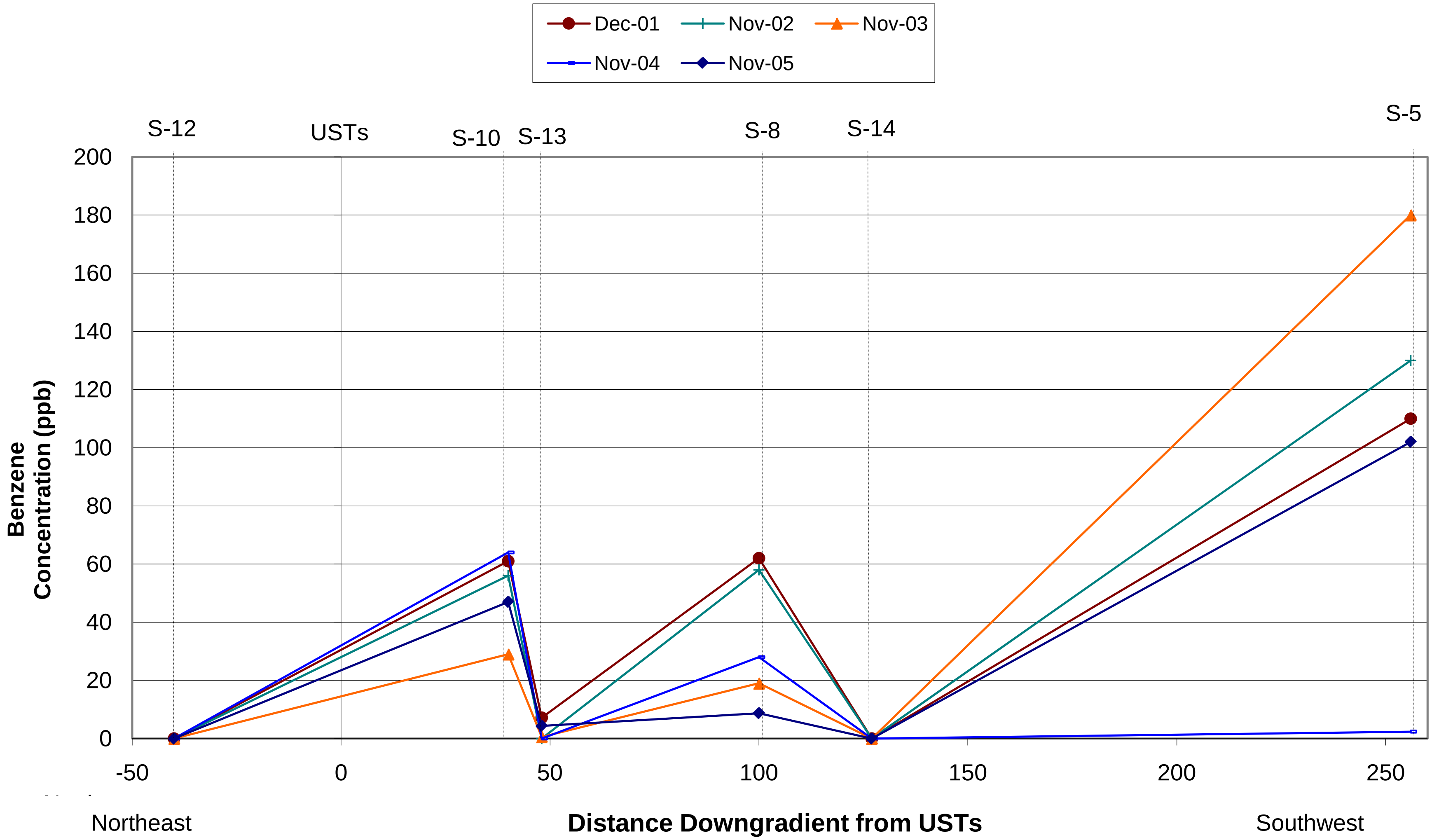
TPHg Groundwater Concentration



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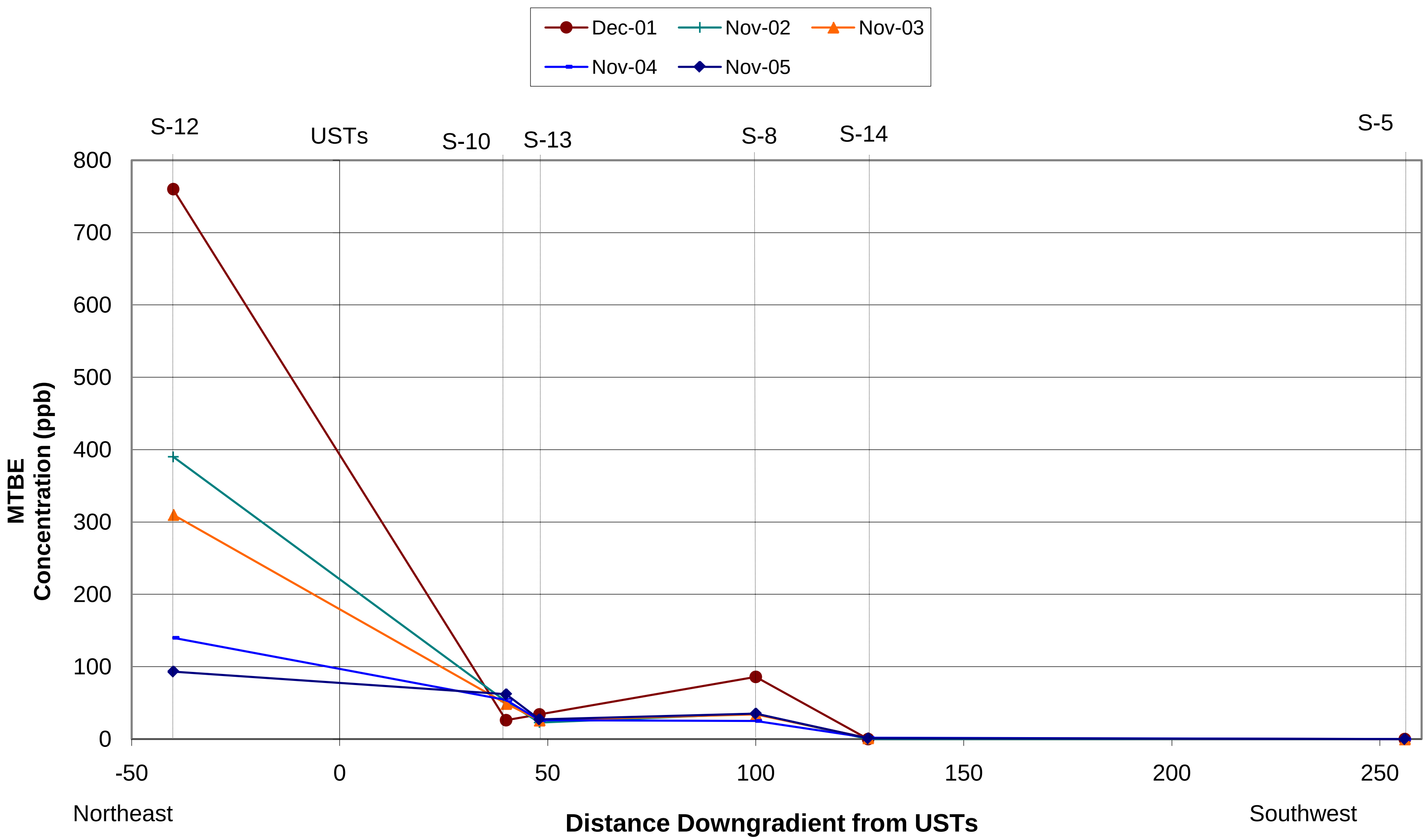
Benzene Groundwater Concentration



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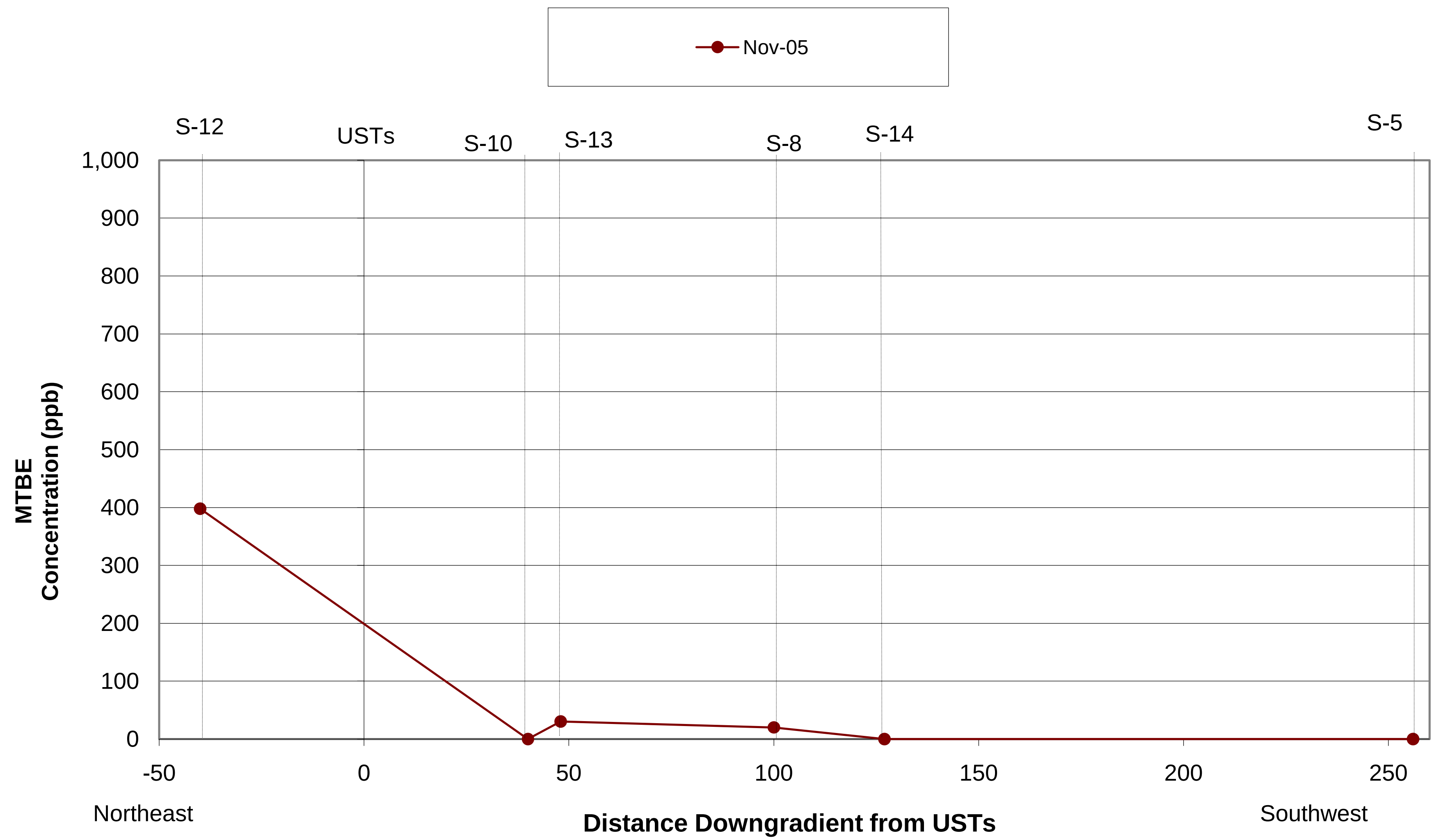
CAMBRIA

MTBE Groundwater Concentration



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CAMBRIA

TBA Groundwater Concentration

CAMBRIA

STANDARD FIELD PROCEDURES FOR INSTALLING MONITORING WELLS

This document describes Cambria Environmental Technology's standard field methods for drilling, installing, developing and sampling groundwater monitoring wells. These procedures are designed to comply with Federal, State and local regulatory guidelines. Specific field procedures are summarized below.

Well Construction and Surveying

Groundwater monitoring wells are installed in soil borings to monitor groundwater quality and determine the groundwater elevation, flow direction and gradient. Well depths and screen lengths are based on groundwater depth, occurrence of hydrocarbons or other compounds in the borehole, stratigraphy and State and local regulatory guidelines. Well screens typically extend 10 to 15 feet below and 5 feet above the static water level at the time of drilling. However, the well screen will generally not extend into or through a clay layer that is at least three feet thick.

Well casing and screen are flush-threaded, Schedule 40 PVC. Screen slot size varies according to the sediments screened, but slots are generally 0.010 or 0.020 inches wide. A rinsed and graded sand occupies the annular space between the boring and the well screen to about one to two ft above the well screen. A two feet thick hydrated bentonite seal separates the sand from the overlying sanitary surface seal composed of Portland type I,II cement.

Well-heads are secured by locking well-caps inside traffic-rated vaults finished flush with the ground surface. A stovepipe may be installed between the well-head and the vault cap for additional security. The well top-of-casing elevation is surveyed with respect to mean sea level and the well is surveyed for horizontal location with respect to an onsite or nearby offsite landmark.

Well Development

Wells are generally developed using a combination of groundwater surging and extraction. Surging agitates the groundwater and dislodges fine sediments from the sand pack. After about ten minutes of surging, groundwater is extracted from the well using bailing, pumping and/or reverse air-lifting through an eductor pipe to remove the sediments from the well. Surging and extraction continue until at least ten well-casing volumes of groundwater are extracted and the sediment volume in the groundwater is negligible. This process usually occurs prior to installing the sanitary surface seal to ensure sand pack stabilization. If development occurs after surface seal installation, then development occurs 24 to 72 hours after seal installation to ensure that the Portland cement has set up correctly.

All equipment is steam-cleaned prior to use and air used for air-lifting is filtered to prevent oil entrained in the compressed air from entering the well. Wells that are developed using air-lift evacuation are not sampled until at least 24 hours after they are developed.

Groundwater Sampling

Depending on local regulatory guidelines, three to four well-casing volumes of groundwater are purged prior to sampling. Purging continues until groundwater pH, conductivity, and temperature have stabilized. Groundwater samples are collected using bailers or pumps and are decanted into the appropriate containers supplied by the analytic laboratory. Samples are labeled, placed in protective foam sleeves, stored on crushed ice at or below 4°C, and transported under chain-of-custody to the laboratory. Laboratory-supplied trip blanks accompany the samples and are analyzed to check for cross-contamination. An equipment blank may be analyzed if non-dedicated sampling equipment is used.