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22 December 1997

Ms. Susan Hugo
Alameda County Health Care Services Agency
Department of Environmental Health
Division of Environmental Protection
1131 Harbor Bay Parkway, Room 250
Alameda, California 94502-6577

Subject: Closure Report
Former Rifkin Underground Storage Tanks
Chiron Corporation, Emeryville, California
(EKI 970001.81)

Dear Ms. Hugo:

On behalf of Chiron Corporation ("Chiron"), Erler & Kalinowski, Inc. is pleased to submit this Closure Report for five underground storage tanks formerly located adjacent to the eastern boundary of the former Rifkin Property in Emeryville, California ("Rifkin USTs"). The former Rifkin Property is located at 4525 through 4563 Horton Street and is currently owned by Chiron. The Rifkin USTs were excavated and disposed of by prior owners of the former Rifkin Property and the Receiver of the former Rifkin Property in 1988 and 1993.

Pursuant to ACDEH direction, this report has been prepared in accordance with American Society for Testing and Materials ("ASTM") guidance document entitled *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites*, dated November 1995. Closure by the Alameda County Department of Public Health ("ACDEH") of three of the five former Rifkin USTs is requested on the basis of the results presented herein. Additional investigations have been proposed by Sherwin-Williams downgradient of the two remaining former Rifkin USTs. Assuming data obtained during these planned additional groundwater investigations do not alter conclusions regarding the magnitude and risk associated with detected residual soil and groundwater concentrations near these former USTs, Chiron will request closure of the two remaining Rifkin USTs in a subsequent addendum to this report.

If you have any questions, please do not hesitate to call.

Very truly yours,

ERLER & KALINOWSKI, INC.

Vera H. Nelson

Vera H. Nelson, P.E.
Project Manager

Michael T Beck

Michael T. Beck, P.E.
Project Engineer

cc: Mr. Ric Notini (Chiron Corporation)
Mr. Mark Johnson (California Regional Water Quality Control Board)

Erler &
Kalinowski, Inc.

CLOSURE REPORT

Former Rifkin Underground Storage Tanks

Chiron Corporation
Emeryville, California
(EKI 970001.81)

22 December 1997

Chiron Corporation—Emeryville, California
Former Underground Storage Tanks at the Former Rifkin Property (4525 to 4563 Horton Street)
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1. INTRODUCTION

At the request of Chiron Corporation ("Chiron"), Erler & Kalinowski, Inc. ("EKI") has prepared this report for submittal to the Alameda County Department of Environmental Health ("ACDEH"). This report summarizes information relating to the removal of five underground storage tanks ("Rifkin USTs") formerly located on City of Emeryville Property beneath the sidewalk on the south side of Horton Street just east of the former Rifkin Property (i.e., 4525 through 4563 Horton Street) in Emeryville, California (Figures 1 and 2). This report also presents results of soil and groundwater investigations performed by EKI and others subsequent to removal of these tanks. Reports by others documenting prior investigations related to the Rifkin USTs and removal of the Rifkin USTs are listed in Section 7. Pursuant to ACDEH direction, this report has been prepared in accordance with the American Society for Testing and Materials ("ASTM") guidance document entitled *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites*, dated November 1995 (ASTM, 1995).

The five Rifkin USTs were excavated in 1988 and 1993. Closure by the ACDEH of three of the five former Rifkin USTs is requested on the basis of the results presented herein (i.e., 550-gallon gasoline tank, 500-gallon paint thinner tank, and 1,500-gallon diesel tank) and closure of the two remaining former Rifkin USTs (i.e., 1,500-gallon heating oil tank and 1,000-gallon gasoline tank) will be addressed in a subsequent addendum, pending the results of additional investigations currently proposed by Sherwin Williams on the former Rifkin Property, which is located just west of the former Rifkin UST locations (see Figure 2). The data presented herein are consistent with information provided during a meeting on 29 July 1997 with representatives of Chiron, EKI, and the ACDEH.

2. BACKGROUND

This section provides background information for the former Rifkin Property, including the site setting, development, water supply, surface water, geology, and hydrogeology. This section also briefly discusses identified impacts to groundwater on the former Rifkin Property from chemical migration from upgradient sites. This information was previously presented in a report by Erler & Kalinowski Inc. ("EKI") entitled *Preliminary Site Investigation Report, Chiron Corporation, Emeryville, California*, dated 8 September 1993, which was submitted to Alameda County Department of Environmental Health ("ACDEH") and the Regional Water Quality Control Board ("RWQCB").

2.1 Setting

The former Rifkin Property is located on the western side of Horton Street between 45th and 53rd Streets in Emeryville, California (Figure 1). Land use in the vicinity is commercial and industrial.

2.2 Development

Chiron purchased the former Rifkin Property in 1996. At that time, the property was occupied by a vacant one and two-story brick warehouse building that had been subdivided into numerous rental units. Street addresses of these subdivisions ranged from 4525 to 4563 Horton Street (Figure 2) (EKI, 1993). In the spring of 1997, Chiron demolished the southernmost portion of the building (i.e., 4525 through 4549 Horton Street) and constructed an asphalt parking lot over the concrete building floor and foundation of the former building (Figure 2).

Five USTs were located on City of Emeryville property just east of the former Rifkin Building under the sidewalk along Horton Street (Figure 2). These tanks were removed by Safety Specialists and TMC Environmental ("TMC") between 1988 and 1993 (prior to Chiron's purchase of the former Rifkin Property). The removal of the tanks was performed on behalf of prior owners of the former Rifkin Property and the Receiver. Information regarding the tank contents, tank removal activities, and associated soil excavation activities were obtained from reports prepared by Safety Specialists and TMC (SSP, 1988a,b; TMC, 1994a,b,c).

The tanks as identified by Safety Specialists and TMC, were as follows (from north to South):

- 1,500-gallon heating oil tank
- 1,000-gallon gasoline tank
- 550-gallon gasoline tank
- 500-gallon paint thinner tank
- 1,500-gallon diesel tank.

The basis upon which TMC and/or Safety Specialists identified the particular type of petroleum hydrocarbon formerly stored in each of these tanks is unclear and in some cases inconsistent with other information reviewed by EKI. However, for consistency EKI has maintained the specific tank contents designations previously adopted by TMC and Safety Specialists. Available information obtained and reviewed by EKI regarding the former contents of these USTs, including information provided by TMC and Safety Specialists is summarized in Appendix A.

The nearest building to the former Rifkin UST locations is the remaining building at 4561A Horton Street on the former Rifkin Property (Figure 2). Chiron currently occupies this building, which is located approximately 20 feet from the former 1,500-gallon heating oil tank location. Another building in the vicinity of the former Rifkin UST locations is located on the former Shell Property on eastern side of Horton Street (see Figure 2). The western wall of this building, which is currently occupied by Chiron, is approximately 60 feet from the former 550-gallon gasoline tank location (Figure 2).

As part of its campus expansion project, Chiron currently plans to construct a high-rise structure on the southern portion of the former Rifkin Property and low rise structures on the remainder of the former Rifkin Property. It is unlikely, however, that any future buildings constructed by Chiron would be placed over the former Rifkin UST locations, as such buildings would not encroach upon the existing sidewalk area. The schedule for construction of these buildings has not yet been established; however, construction of these buildings will not likely be initiated for at least 2 years.

2.3 Water Supply

Imported surface water is the source of potable water for businesses and residents within a four-mile radius area surrounding the former Rifkin UST locations. East Bay Municipal Utilities District ("EBMUD") serves this area.

2.4 Surface Water

Surface water drainage near the former Rifkin USTs flows via storm water sewers into the Temescal Creek Overflow culvert that flows from east to west beneath the former Rifkin Property (Figure 2). Some surface water drainage near the former Rifkin USTs may also flow into Temescal Creek, which flows from east to west just north of the

former Rifkin Property. These culverts converge west of the former Rifkin Property and drain into the San Francisco Bay, located approximately 2,000 feet west of the former Rifkin Property.

2.5 Geology

Information obtained from soil borings completed by EKI and others indicates that the area near the former Rifkin USTs is underlain by undifferentiated soil and alluvial material. The alluvial material, deposited in alluvial fan facies, is part of the Alameda Formation. The alluvial fan deposits consist of thick sequences of silty and sandy clay interbedded with thin, discontinuous sand and gravel lenses. The alluvial fan deposits grade laterally into marine facies of the Alameda Formation (NUS, 1991).

2.6 Hydrogeology

Two aquifer zones have been identified within the uppermost 40 feet of alluvial sediments on properties adjacent to the former Rifkin USTs. These aquifer zones generally consist of silty sand deposits that range from approximately 2 to 8 feet in thickness. The "shallow aquifer zone" generally exists between approximately 10 and 25 feet below ground surface ("bgs") and the "deeper aquifer zone" exists between approximately 30 and 40 feet bgs (EKI, 1993).

2.6.1 Shallow Aquifer Zone

In general, the groundwater table occurs at approximately 6 to 10 feet above mean sea level ("ft msl") near the former Rifkin USTs (i.e., a depth to water of approximately 5 to 12 feet below ground surface ("bgs")). Groundwater in the shallow aquifer zone appears to be unconfined to semi-confined and the natural direction of the hydraulic gradient is generally to the west or northwest (Appendix B) in the vicinity of the former Rifkin USTs. The hydraulic gradient is, however, locally diverted to the north on the western side of the former Rifkin Property due to presence of a slurry wall, which has been constructed through the shallow aquifer zone on the adjacent Sherwin-Williams Property (Appendix C).

Evaluation of available water level data indicates that groundwater in the shallow groundwater zone in the vicinity of the former Rifkin UST locations flows toward the Temescal Creek Overflow culvert and/or the main Temescal Creek Culvert. These culverts run underground, at the north end of the former Rifkin Property (Figure 2). Drainage pipes that permit groundwater inflow are visible within the Temescal Creek Overflow culvert and are shown on design drawings for the main Temescal Creek culvert (ACFCD, 1975). Therefore, both culverts potentially act as high permeability drains that can channelize and create preferential pathways for shallow groundwater flow.

2.6.2 Deeper Aquifer Zone

Information obtained from remedial investigations conducted at the adjacent Sherwin-Williams site also indicates that groundwater flow within the deeper aquifer zone is semi-confined to confined and the general direction of the hydraulic gradient in the deeper aquifer zone is to the west in the vicinity of the former Rifkin Property (LFR, 1991).

2.7 Impacts to Groundwater on the Former Rifkin Property

Chemicals of concern have been identified in shallow groundwater beneath the former Rifkin Property. In general, the highest chemical concentrations are present on the southern portion of the former Rifkin Property and are primarily the result of migration or releases from the adjacent Sherwin-Williams Site (Figure 2). Chemicals of concern that have migrated onto the former Rifkin Property from the Sherwin-Williams Site include: arsenic; volatile organic chemicals ("VOCs") (i.e., acetone, methyl ethyl ketone ["MEK"], and methyl isobutyl ketone ["MIBK"]); petroleum hydrocarbons; and benzene, toluene, ethylbenzene, and xylenes ("BTEX"). As a result, groundwater on the former Rifkin Property is currently being investigated and monitored by Sherwin-Williams (LFR, 1997b).

Evaluation of data also indicates that chemicals of concern are migrating onto the former Rifkin Property from the former Shell Property. Chemicals of concern migrating from the former Shell Property onto the former Rifkin Property include halogenated VOCs, petroleum hydrocarbons and limited BTEX.

Non-petroleum hydrocarbon-related compounds detected in groundwater on and in the vicinity of the former Rifkin Property (e.g., halogenated VOCs and arsenic) are not discussed in this report as these compounds are clearly the result of migration from off-site sources and are not related to the former Rifkin USTs. Reviews of environmental conditions near the former Rifkin USTs are discussed in prior EKI reports (EKI 1993, 1994, 1997).

In order to evaluate potential impacts to groundwater from the former Rifkin USTs, estimated distributions of total petroleum hydrocarbons and BTEX in the vicinity of the former Rifkin USTs are depicted on Figure 3 and Figure 4, respectively. Further discussion of these data is included in Section 4 of this report.

3. SUMMARY OF TANK REMOVAL AND ASSOCIATED SOIL AND GROUNDWATER SAMPLING ACTIVITIES

As discussed in Section 2.2, five USTs previously existed east of the former Rifkin Property under the Horton Street sidewalk. These USTs were removed between 1988 and 1993, prior to Chiron's purchase of the former Rifkin Property. Information regarding soil excavation and soil verification sampling performed in association with the removal of each of the five Rifkin USTs is presented in Sections 3.1 through 3.5 below. The tanks are discussed from north to south as they previously existed on City of Emeryville Property (Figure 2). The information presented in these sections was obtained from reports documenting tank removal and soil excavation activities prepared by Safety Specialists, Inc. ("SSI") in 1988 and TMC in 1994.

As discussed below, soil excavation activities associated with the former Rifkin USTs were in some cases terminated due to the presence of utility lines and building foundation walls. At these locations, hand augers were used to collect soil samples from as much as 5 feet into the excavation side walls to evaluate the lateral extent of chemicals of concern remaining in soil in the vicinity of the former Rifkin USTs. Chemical concentrations detected in these hand augered samples and samples collected from the bottom and sidewalls of each excavation are summarized in Table 1. Maximum chemical concentrations remaining in soil near each former Rifkin UST location are summarized in Table 2. Analytical results and locations of verification soil samples collected at the extents of the former 1,500-gallon heating oil tank, the former 1000-gallon gasoline tank, and the former 500 Gallon Paint Thinner tank are presented on Figures 5, 6 and 7, respectively. Chemical concentrations detected in soil samples collected from areas that were later excavated are not included in these tables and figures.

Available results of groundwater sampling conducted during and immediately subsequent to removal of these tanks are also presented in Section 3.1 through 3.5 below. Chemical concentrations in groundwater more recently detected at and downgradient of these tanks are discussed in Section 4. Potential human health risks and ecological risks associated with impacted soil and groundwater remaining in the vicinity of the former Rifkin USTs are evaluated in Section 5.

3.1 Former 1,500-Gallon Heating Oil Tank

On 24 November 1993, Bay Area Tank Removal, Inc. ("BATR") excavated and removed a 1,500-gallon heating oil UST located at 4549 Horton Street. The tank was corroded and holes in the tank were observed (TMC, 1994a). Product and return lines at the north end of the excavation were cut off and pinched at the building foundation wall (Figure 5). Soil contamination was reportedly present in the bottom of the excavation (TMC, 1994a).

On 10 January 1994, BATR over-excavated approximately 36 cubic yards of soil from the sidewalls and bottom of the tank excavation, to a depth of approximately 11 to 12 feet bgs. The excavation was terminated to the east due to the presence of a subsurface gas line and terminated to the west due to the presence of subsurface building foundations (Figure 5). ACDEH staff were present during the over-excavation and approved backfill of the excavation with imported soil.

3.1.1 Verification Soil Sampling

Prior to backfilling, eight verification soil samples (samples EW-1, EW-2, WW-1, WW-2, SW-1, SW-2, NW-1, and NW-2) were collected from the excavation sidewalls at the locations depicted on Figure 5. As shown on Figure 5, total petroleum hydrocarbons as diesel ("TPH-d") were detected at concentrations up to 15,700 mg/kg in these samples. Toluene, ethylbenzene, and xylenes were also detected in these samples at concentrations up to 0.3 mg/kg, 1.4 mg/kg, and 2.6 mg/kg, respectively. Individual soil sampling results are summarized in Table 1.

In order to evaluate the lateral extent of impacted soil in the vicinity of the excavation, a hand auger was used to collect seven additional soil samples between 2.5 and 4 feet beyond each of the excavation sidewalls (Figure 5). As shown on Figure 5, analytical results for these hand augered soil samples indicate that TPH-d concentrations detected at the extent of the excavation (i.e., 15,700 mg/kg) decrease substantially (i.e., to approximately 200 mg/kg) within a few feet of the limits of the excavation.

Maximum concentrations of chemicals of concern detected in soil remaining in the vicinity of the 1,500-gallon heating oil tank are as follows: total petroleum hydrocarbons as gasoline ("TPH-g") (33 mg/kg), TPH-d (15,700 mg/kg), benzene (1.2 mg/kg), toluene (2.6 mg/kg), ethylbenzene (1.4 mg/kg), xylenes (3.2 mg/kg), and lead (159 mg/kg) (see Table 2).

3.1.2 Groundwater Sampling

During the over-excavation of the 1,500-gallon heating oil UST, groundwater was encountered at a depth of 10 to 11 feet bgs, then rose in the excavation to a depth of approximately 8 feet bgs. No visible sheen or floating product was observed on the groundwater surface. A temporary observation well (OB-1) was installed in the excavation during backfilling (TMC, 1994b) (Figure 5). Several sets of groundwater samples were collected from temporary well OB-1 between January 1994 and December 1994. Analytical results for these samples are summarized in Table 3. Chemical concentrations detected in final grab groundwater samples collected from this well in December 1994 were as follows: TPH-d (300 ug/L), benzene (ND <0.5 ug/L), toluene (39 ug/L), ethylbenzene (1.8 ug/L), and xylenes (8.8 ug/L) acetone (1,300 ug/L), MEK (570 ug/L), and MIBK (370 ug/L) (see Table 3) (TMC, 1995a).

In December 1994, permanent observation wells were installed by TMC approximately 10 feet north of the 1,500-gallon heating oil tank (MW-2) and approximately 25 feet south of the 1,500-gallon heating oil tank (MW-1) (Figure 3). These wells have been monitored on a regular basis since their installation (Table 3). Discussions regarding concentrations of TPH, BTEX compounds, and lead detected in groundwater samples from existing MW-1, MW-2, and other nearby monitoring wells are presented in Section 4.

Although acetone, MEK, and MIBK were reported in grab groundwater samples collected from temporary well OB-1 in December 1994; none of these compounds, with the exception of MEK (maximum concentration of 25 ug/L), were detected in subsequent groundwater samples collected from permanent monitoring wells MW-1 and MW-2 in December 1994, March 1995, June 1995, and January 1996 (Table 3). Therefore, no discussion of these compounds is included in Section 4.

3.2 Former 1,000-Gallon Gasoline Tank

On 8 July 1988, Tank Excavators excavated and removed a 1,000-gallon gasoline UST located at 4549 Horton Street. No holes were noted during a visual inspection of the tank at the time of its removal (TMC, 1994c). ACDEH staff were present at the time of tank removal and specified the locations on the bottom of the excavation where two soil samples were collected by Safety Specialists, Inc. TPH-g, TPH-d, and BTEX compounds were detected in these soil samples. These sampling locations were later over-excavated.

On 14 November 1988, SSI installed a shallow groundwater monitoring well (MW-1) in the north end of the excavation. This well was destroyed in January 1994 to allow over-excavation of the former tank location. TPH-d, TPH-g, and BTEX compounds were detected in selected groundwater samples collected from former monitoring well MW-1. A sample collected from former monitoring well MW-1 by EKI in July 1993 was also analyzed for polychlorinated biphenyls ("PCBs") and lead. PCBs and lead were not detected in this sample above analytical reporting limits of 0.5 ug/L and 5 ug/L, respectively (EKI, 1993).

On 26 and 27 January 1994, BATR over-excavated approximately 36 cubic yards of soil from the sidewalls and bottom of the tank excavation, to a depth of approximately 9 to 11.5 feet bgs (TMC, 1994c). The excavation was terminated in the east direction due to encountering subsurface gas and sanitary sewer lines (Figure 6). The excavation was backfilled with imported soil.

3.2.1 Verification Soil Sampling

Prior to backfilling, 15 verification soil samples were collected from the excavation sidewalls and bottom in January 1994 (Figure 6). Only two soil samples (i.e., nos. 3-6 and 3-11) contained TPH-g, TPH-d or BTEX concentrations above the reported

laboratory limits of detection (see Table 1). Maximum detected concentrations of these compounds were as follows: TPH-g (128 mg/kg), TPH-d (242 mg/kg), benzene (5.4 mg/kg), toluene (11 mg/kg), ethylbenzene (3.8 mg/kg), and xylenes (11.8 mg/kg) (Table 1). Benzene was only detected in soil sample 3-6, which was collected from the eastern sidewall of the excavation adjacent to existing gas and sanitary sewer lines (Figure 6). In order to evaluate the lateral extent of impacted soil remaining in place near soil sampling location 3-6, three soil samples (samples 3-18, 3-19, and 3-20) were collected from 1 to 4.5 feet east of the excavation sidewall using a hand auger (Figure 6). No TPH-g, TPH-d, and BTEX compounds were detected in any of these samples. These data indicate that benzene and other compounds detected along the eastern sidewall of the excavation at soil sampling location 3-6 decrease to non-detectable levels within a few feet of the limits of the excavation.

Lead was detected in hand auger soil sample 3-20 at a concentration of 587 mg/kg. However, this elevated lead concentration is not likely not related to the 1000 gallon gasoline tank. This conclusion is based on the relative absence of lead in other hand auger soil samples collected closer to the eastern excavation sidewall (i.e., 9.0 mg/kg and 15 mg/kg in samples 3-18 and 3-19, respectively). The maximum concentration of lead remaining within the limits of the 1,000 gallon gasoline tank excavation is 161 mg/kg.

Maximum concentrations of organic compounds detected in soil remaining in the vicinity of the 1,500-gallon heating oil tank are as follows: TPH-g (128 mg/kg), TPH-d (242 mg/kg), benzene (5.4 mg/kg), toluene (11 mg/kg), ethylbenzene (3.8 mg/kg), xylenes (11.8 mg/kg) (Table 2).

3.2.2. Groundwater Sampling

During the over-excavation of the 1,000-gallon gasoline UST, groundwater was encountered at a depth of 8 to 10 feet bgs. No visible sheen or floating product was observed on the groundwater surface. A temporary observation well (OB-2) was installed in the excavation during the backfilling (TMC, 1994b) (Figure 6). Several sets of groundwater samples were collected from temporary well OB-2 between January 1994 and December 1994. Analytical results for these groundwater samples are listed in Table 3. Chemical concentrations detected in final grab groundwater samples collected from this well in December 1994 were as follows: TPH-d (1,400 ug/L), benzene (9.4 ug/L), toluene (12 ug/L), ethylbenzene (ND <0.5 ug/L), and xylenes (2.7 ug/L) (TMC, 1995a).

A permanent observation well, MW-1, was installed approximately 10 feet north of the 1,000-gallon gasoline UST excavation in December 1994 (Figure 3). This well has been monitored on a regular basis since its installation (see Table 3). Discussions regarding concentrations of petroleum hydrocarbons, BTEX compounds, and lead detected in groundwater samples from MW-1 and other nearby wells are presented in Section 4.

3.3 Former 550-Gallon Gasoline Tank

On 8 July 1988, Tank Excavators excavated and removed the 550-gallon gasoline UST located at 4549 Horton Street. This tank was located immediately south of the 1,000-gallon gasoline UST. No holes were noted during a visual inspection of the tank at the time of its removal (TMC, 1994c). ACDEH staff were present at the time of tank removal and specified the locations in the bottom of the excavation where two soil samples (sample numbers X-1 and X-2) were collected by SSI. The excavation was then backfilled with the excavated overburden material (TMC, 1994c).

On 26 January 1994, BATR excavated two exploratory trenches at the former location of the tank to a depth of 8 feet bgs, where undisturbed soil was encountered. Four soil samples were collected from within the trench (sample numbers 3-1 through 3-4).

In all, six soil samples were collected near the former UST. Individual soil sampling results are summarized in Table 1. Maximum concentrations of chemicals analyzed in these soil samples were as follows: TPH-g (41 mg/kg), TPH-d (ND <1 mg/kg), benzene (ND <0.1 mg/kg), toluene (ND <0.1 mg/kg), ethylbenzene (0.2 mg/kg), xylenes (1.0 mg/kg), and lead (28 mg/kg) (Table 2). Due to limited chemical concentrations detected in these soil samples, no further soil excavation or soil or groundwater sampling were conducted in the vicinity of this UST.

3.4 Former 500-Gallon Paint Thinner Tank

A 500-gallon paint thinner UST was formerly located at 4529 Horton Street. A sample of the tank's contents was collected in August 1993 as part of investigations conducted by EKI at the former Rifkin Property. The contents of the tank appeared to consist primarily of groundwater that had infiltrated into the UST (EKI, 1993). The tank water sample was analyzed for TPH-g, TPH-d, VOCs (including BTEX), semi-volatile organic compounds ("SVOCs"), PCBs, and five metals (cadmium, chromium, lead, nickel, and zinc). TPH-g and TPH-d were detected in this tank water sample at concentrations of 790 ug/L and 24,000 ug/L, respectively. The analytical laboratory tentatively identified these petroleum hydrocarbons as paint thinner. No VOCs, SVOCs, or PCBs were detected in this sample (EKI, 1993). Metals were detected in this sample at the following concentrations:

Metal	Detected Concentration (ug/L)
Cadmium	ND (<10)
Chromium	20
Lead	400
Nickel	50
Zinc	7,400

On 24 November 1993, BATR excavated and removed the paint thinner UST. The tank was corroded with obvious holes visible (TMC, 1994a). An odor was noted during the tank excavation. Two soil samples were collected from the excavation, one from beneath the center of the tank and one from the northwest sidewall. The samples were found to contain TPH-g and BTEX. No halogenated VOCs or organic lead were detected. These sampling locations were later over-excavated.

On 5 and 6 January 1994, BATR over-excavated approximately 72 cubic yards of soil from the sidewalls and bottom of the tank excavation, to a depth of approximately 11 to 12 feet bgs. The excavation was (a) terminated to the west due to the presence of a subsurface gas line, (b) terminated to the east due to the presence of Horton Street, and (c) terminated to the south due to the presence of a subsurface utility box and water line (Figure 7). An aboveground product line and hand pump were also encountered at the west end of the excavation (Figure 7). ACDEH staff were present during the over-excavation and approved the backfilling of the excavation with imported soil (TMC, 1994b).

3.4.1 Verification Soil Sampling

Ten verification soil samples were collected from the excavation sidewalls and bottom in January 1994 (Figure 7). Individual soil sampling results are summarized in Table 1. Maximum concentrations of chemicals of concern analyzed in these soil samples were as follows: TPH-g (2,630 mg/kg), TPH-d (123 mg/kg), benzene (0.3 mg/kg), toluene (ND <0.1 mg/kg), ethylbenzene (2.7 mg/kg), xylenes (5.8 mg/kg), and lead (13 mg/kg) (Table 2).

Soil samples containing detectable benzene concentrations (0.3 mg/kg) and TPH-g concentrations from 349 to 2,630 mg/kg were collected from the western sidewall of the excavation, where excavation was halted due to the presence of an underground gas line. Four soil samples were collected deeper into this sidewall using a hand auger (Figure 7). TPH-g at 380 mg/kg was the only compound detected in these and augered samples. These results indicate that TPH-d concentrations detected at the western extent of the

excavation (i.e., up to 2,630 mg/kg) decrease substantially (i.e., to approximately 400 mg/kg within three feet of the limits of the excavation (Figure 7).

3.4.2 Groundwater Sampling

During the excavation of the former 500-gallon paint thinner UST, groundwater was encountered at a depth of 10 to 11 feet bgs (TMC, 1994b). No visible sheen or floating product was observed on the groundwater surface. After approximately 250 gallons of water were pumped from the over-excavation of the former tank location, a groundwater sample was collected and analyzed for TPH-g, TPH-d, BTEX, and lead. None of these chemicals were detected (TMC, 1994b).

In December 1994, a permanent observation well (MW-3) was installed by TMC approximately 10 feet north of the 500-gallon paint thinner UST excavation (Figure 3). This well has been monitored on a regular basis since its installation (Table 3). Discussions regarding chemical concentrations detected in groundwater samples from this and other nearby wells are presented in Section 4.

3.5 Former 1,500-Gallon Diesel Tank

A 1,500-gallon diesel UST was formerly located at 4525 Horton Street. A sample of the contents of the tank was collected in July 1993 as part of investigations conducted by EKI at the former Rifkin Property. The contents of the tank appeared to consist primarily of groundwater that had infiltrated into the UST (EKI, 1993). The tank water sample was analyzed for TPH-g, TPH-d, VOCs (including BTEX), SVOCs, and PCBs. TPH-d was detected in this tank contents sample at 340,000 ug/L. The analytical laboratory tentatively identified these petroleum hydrocarbons as kerosene. No other compounds were detected in this tank contents sample (EKI, 1993).

On 24 November 1993, BATR excavated and removed the diesel UST and its contents. The tank was corroded with obvious holes visible (TMC, 1994a). Discolored soil was observed in the excavation, but no obvious odor was reported. Product and vent lines at the west side of the excavation were removed. Two soil samples were collected from the bottom of the excavation, and at the request of ACDEH staff, three additional samples were collected from the sidewalls of the excavation. These samples were analyzed for TPH-g, TPH-d, and BTEX. None of these compounds were detected (Table 1). The excavation was later backfilled with imported soil (TMC, 1994a). Due to absence of chemical concentrations detected in these soil samples, no further soil excavation or soil or groundwater sampling were conducted in the vicinity of this UST.

4. GROUNDWATER QUALITY

Concentrations of petroleum hydrocarbon-related compounds in groundwater adjacent to and downgradient of the former Rifkin UST locations are discussed in this section. For clarity, this section has been divided into two parts:

(a) groundwater conditions adjacent to and downgradient of the *northern* former Rifkin UST locations (i.e., the former 1,500-gallon heating oil tank, the former 1,000-gallon gasoline tank, and the former 550-gallon gasoline tank) (section 4.1); and

(b) groundwater conditions adjacent to and downgradient of the *southern* former Rifkin UST locations (i.e., 500-gallon paint thinner UST and the 1,500-gallon diesel UST) (Section 4.2).

Concentrations of TPH-d, TPH-g, BTEX, and lead detected in groundwater near the northern and southern former Rifkin UST locations are discussed in Sections 4.1 and 4.2, respectively. As discussed in Section 2.7, other compounds have been detected in groundwater on the former Rifkin Property (e.g., halogenated VOCs and arsenic), these compounds are not discussed because they are the result of migration from off-site, upgradient sources and are unrelated to the former Rifkin USTs. Additional information regarding lateral distribution of these compounds is presented in prior EKI's reports (EKI 1993, 1994, 1997). It should be noted that PCBs have not been detected in groundwater samples collected in the vicinity of the former Rifkin USTs.

Current estimated distributions of petroleum hydrocarbons (TPH-g and TPH-d) and BTEX in shallow groundwater in the vicinity of the former Rifkin USTs are presented on Figures 3 and 4, respectively. These figures present (1) most recent grab groundwater data and (2) most recent monitoring well data from the vicinity of the former Rifkin USTs. These figures do not include results of groundwater samples collected in the immediate vicinity of the former Rifkin USTs prior to the completion of soil excavation activities at these former Rifkin USTs locations in January 1994 (e.g., at former groundwater monitoring well MW-1). Results of groundwater samples collected from immediate vicinity of the former Rifkin USTs during soil excavation activities are discussed in Section 3.

As indicated on Figures 3 and 4, TPH and BTEX are migrating in shallow groundwater onto the former Rifkin Property from upgradient off-site sources. Concentrations of TPH and BTEX migrating onto the former Rifkin Property from the former Shell Property, (i.e., upgradient of the northern and southern former Rifkin UST locations, are generally consistent with TPH and BTEX concentrations detected at former Rifkin UST locations. Therefore, impacts to groundwater from the former Rifkin USTs are difficult to discern from these "background" levels. In addition, concentrations of TPH and BTEX migrating onto the southeastern portion of the former Rifkin Property from the Sherwin Williams

Site are significantly higher than the TPH or BTEX concentrations detected in groundwater near the former Rifkin UST locations. Further discussions regarding these issues are presented in Sections 4.1 and 4.2, below. Analytical results of recent groundwater samples collected in the immediate vicinity and downgradient of the northern and southern former Rifkin UST locations are summarized in Table 5. Potential human health risks and ecological risks associated with exposure to impacted groundwater near the former Rifkin USTs are discussed in Section 5.

4.1 Northern Former Rifkin UST Locations (Former Heating Oil and Gasoline USTs)

The northern former Rifkin USTs include the 1,500-gallon heating oil UST, the 1,000-gallon gasoline UST, and the 550-gallon gasoline UST. As discussed in Section 3.3, chemical concentrations detected in soil in the vicinity of the 550-gallon gasoline UST were very limited. Therefore, to the extent that any identified impacts to groundwater resulting from potential releases of petroleum hydrocarbon-related compounds at the northern former Rifkin USTs, such impacts are likely due to the 1,500-gallon heating oil UST and/or the 1,000-gallon gasoline UST. Thus, closure of the former 550-gallon gasoline UST is requested.

As indicated on Figures 3 and 4, groundwater sampling has been conducted in the immediate vicinity of the northern Rifkin UST locations at wells MW-1, MW-2, OB-1 and OB-2 and at nearby cross-gradient sampling locations CPT-3, CPT-4 and CPT-5 in Horton Street. Concentrations of TPH, BTEX, and lead detected at these locations are discussed in Sections 4.1.1, 4.1.2, and 4.1.3, respectively.

Groundwater sampling has not been conducted farther downgradient of the northern former Rifkin UST locations in the direction of the Temescal Creek Overflow culvert. Groundwater sampling has been proposed in this area down-gradient of the Rifkin USTs by Sherwin-Williams as part of report entitled *Work Plan for Site Investigation, Sherwin-Williams Facility, Emeryville, California*, dated 2 June 1997 and amended on 10 September 1997 (LFR, 1997a; LFR, 1997c). Proposed investigation by Sherwin-Williams will include the collection of grab groundwater samples in this area (LFR, 1997a). As discussed in Section 5.2.2.2, results of this sampling will be submitted to ACDEH prior to submittal of closure requests by Chiron for the former 1,500-gallon heating oil UST and the former 1,000-gallon gasoline UST.

4.1.1 Total Petroleum Hydrocarbons

Figure 3 depicts total petroleum hydrocarbon concentrations (TPH-g and TPH-d) detected in shallow groundwater adjacent to and in the vicinity of the former Rifkin UST locations. As indicated on Figure 3, TPH-g concentrations of up to 940 ug/L and TPH-d concentrations of up to 1,500 ug/L have been detected in recent shallow groundwater samples collected from monitoring wells MW-1 and MW-2 located adjacent to former

1,000-gallon gasoline tank and 1,500-gallon heating oil tank. These concentrations are similar to the TPH concentrations detected in grab groundwater samples CPT-3 through CPT-5, which are located along Horton Street north and south of MW-1 and MW-2. These CPT locations are upgradient of the former Rifkin Property and cross-gradient of the Rifkin USTs, but chemical concentrations detected at these CPT locations are indicative of background chemical concentrations in shallow groundwater (i.e., TPH-g up to 590 ug/L and TPH-d up to 4,200 ug/L) migrating onto the former Rifkin Property from upgradient sources (i.e., likely the former Shell facility). Therefore, current TPH-g and TPH-d impacts to groundwater from the northern former Rifkin USTs as monitored at MW-1 and MW-2 are comparable to these background levels and indicate no significant, incremental contribution of TPH-g and TPH-d. In addition, evaluation of trends in TPH-g and TPH-d concentrations detected in MW-1 and MW-2 since their installation in December 1994 indicate that concentrations of TPH-g and TPH-d are stable and/or decreasing (see discussion in Appendix D). These preliminary findings will be augmented by any subsequent investigations on the former Rifkin Property in down-gradient areas as discussed above.

4.1.2. Benzene, Ethylbenzene, Toluene, and Xylenes

BTEX compounds, primarily consisting of benzene, are also present in groundwater in the vicinity of the northern former Rifkin UST locations (Figure 4). Groundwater samples collected in June 1997 from monitoring wells MW-1 and MW-2 contained benzene concentrations of 32 and 27 ug/L, respectively. Concentrations of toluene, ethylbenzene, and xylenes in these samples ranged up to 0.9 ug/L, 0.7 ug/L, and 3 ug/L, respectively

Benzene concentrations recently detected in MW-1 and MW-2 are generally higher than benzene concentrations detected in samples collected from CPT-3 through CPT-5 along Horton Street (i.e., from <5 ug/L to 9.6 ug/L). Therefore, these data indicate that the former 1,000-gallon gasoline tank and/or the former 1,500-gallon heating oil tank may be the source of locally incremental benzene concentrations (i.e., approximately 30 ug/L or more) detected in shallow groundwater at MW-1 and MW-2. However, BTEX has been detected on the former Shell Property in the area upgradient of the northern former Rifkin USTs and no data exists immediately upgradient of the former Rifkin USTs as shown on Figure 4. Therefore, migration of benzene from the former Shell Property onto the former Rifkin Property upgradient of monitoring wells MW-1 and MW-2 can not be excluded.

Evaluation of trends in benzene concentrations detected in MW-1 and MW-2 indicates that benzene concentrations in these wells were potentially increasing in 1995 but stabilized in 1996 and 1997 (see Appendix D).

4.1.3 Lead

Lead was detected at concentrations of 30.8 and 55.7 ug/L groundwater samples collected by TMC in 1995 from monitoring wells MW-1 and MW-2, respectively (see Table 5). It is unclear, however, if these samples were filtered.

Lead was not detected in two groundwater samples collected by EKI at nearby locations (i.e., boring CPT-4 and former well MW-1), which were samples filtered prior to analysis. Therefore, it is likely that lead samples collected by TMC in 1995 from MW-1 and MW-2 were unfiltered, and reported lead concentrations in these samples do not represent dissolved lead concentrations in groundwater but are associated with fine-grained soil particles entrained during groundwater sampling.

4.1.4 Summary

As discussed in Section 3.3, chemical concentrations detected in soil in the vicinity of the 550-gallon gasoline UST are very limited and any locally incremental petroleum hydrocarbon related compounds are not likely due to this former UST. Thus, based on these data and the risk-based evaluation of soil and groundwater conditions summarized in Section 5, closure of the former 550-gallon gasoline UST is requested herein.

Based on available data collected adjacent to and upgradient of the northern former Rifkin USTs, no clear incremental contributions of petroleum hydrocarbons or lead have been identified in groundwater from the northern former Rifkin USTs. Locally incremental concentrations of benzene may be present in groundwater in the vicinity of the northern former Rifkin USTs. Results of additional groundwater sampling proposed upgradient and downgradient of the northern former Rifkin USTs by Sherwin-Williams will be used to augment these preliminary findings.

These results will be presented to ACDEH in an addendum, at which time closure of the former 1,000-gallon gasoline tank and former 1,500-gallon heating oil tank will be requested, assuming the additional data do not alter the conclusions presented in Section 5 herein regarding the magnitude and risk associated with detected residual petroleum hydrocarbon compounds in soil and groundwater near these former Rifkin UST locations.

4.2 Southern Former Rifkin UST Locations (Former Paint Thinner and Diesel USTs)

The southern former Rifkin USTs include the 500-gallon paint thinner UST and the 1,500-gallon diesel UST. As indicated on Figures 3 and 4, groundwater sampling has been conducted in the immediate vicinity and downgradient of the southern two former Rifkin UST locations at grab groundwater sampling locations Pit-2, 4543C, SB-1, SB-4, and SB-5 and monitoring wells MW-3, RP-1, and RP-2. Concentrations of petroleum

hydrocarbons, BTEX compounds, and lead detected at these locations are discussed in Sections 4.2.1, 4.2.2, and 4.2.3, respectively.

4.2.1 Petroleum Hydrocarbons

TPH-g concentrations of up to 550 ug/L and TPH-d concentrations of up to 900 ug/L have been detected in groundwater samples collected immediately adjacent to the southern former Rifkin USTs (i.e., at MW-3, RP-1, and Pit-2). TPH-d concentrations detected in these samples are generally consistent with TPH-d concentrations detected in upgradient samples CPT-1 and CPT-2 (i.e., 500 ug/L and 790 ug/L, respectively) in Horton Street. TPH-g and TPH-d concentrations detected in these samples are less than TPH-g and TPH-d concentrations detected in groundwater samples collected further west (i.e., potentially downgradient) of the southern former Rifkin USTs (i.e., 4543C, SB-1, SB-4 and SB-5). As indicated on Figure 3, grab groundwater sampling locations 4543C, SB-1, SB-4 and SB-5 are located at the fringe of a substantial TPH-g and TPH-g plume originating on the Sherwin-Williams Site (Section 2.7). TPH-g and TPH-d concentrations detected in these samples are as follows:

Sampling Location	TPH-g Concentration Detected (ug/L)	TPH-d Concentration Detected (ug/L)
4543C	160,000	43,000
SB-1	<4,000	5,300
SB-4	<5,000	4,200
SB-5	900	400

4.2.2 Benzene, Ethylbenzene, Toluene, and Xylenes

BTEX compounds were not detected in the groundwater samples collected at and downgradient of the southern former Rifkin USTs (Figure 4). BTEX compounds have also not been detected near the former Shell Property upgradient of the southern former Rifkin USTs. No BTEX compounds were detected in groundwater samples from monitoring wells MW-3, RP-1, and RP-2, or from borings SB-4, 4543-C, and SB-1. Toluene and xylenes were detected in the groundwater sample from boring SB-5; however, as is evident on Figure 4, this location is at the fringe of a substantial BTEX plume originating on the Sherwin-Williams Site.

4.2.3 Lead

Limited lead concentrations were detected in groundwater samples collected from monitoring wells located immediately downgradient of the southern former Rifkin USTs (i.e., concentrations of 10 and 10.8 ug/L from wells MW-3 and RP-1, respectively). As discussed in Section 4.1.3, these samples may not have been filtered prior to analysis.

Lead was detected at a concentration of 90 ug/L in one filtered groundwater sample from boring 4543-C (approximately 60 feet west of the southern former Rifkin USTs). As shown in Table 5, the detection of higher lead concentrations at boring 4543-C appears isolated in nature and may be the result of migration from the Sherwin Williams site.

4.2.4 Summary

Based on available data collected adjacent to and upgradient and downgradient of the southern former Rifkin USTs, no clear incremental contribution of petroleum hydrocarbon-related compounds from the southern former Rifkin UST locations to groundwater has been identified. Thus, based on these data and the risk-based evaluation of soil and groundwater conditions summarized in Section 5, closure of the former 500-gallon paint thinner UST and the 1,500-gallon diesel UST is requested.

5. RISK-BASED EVALUATION OF SOIL AND GROUNDWATER CONDITIONS

This section presents a human and ecological risk-based evaluation of chemical concentrations in soil and groundwater in the vicinity of the northern and southern former Rifkin UST locations. It identifies potential exposure pathways and estimates potential risks to human health and the environment resulting from identified chemicals of concern that remain in soil and groundwater in the vicinity of the northern and southern former Rifkin UST locations. The results of these human-health risk and environmental evaluations are summarized in sections 5.1 and 5.2, respectively.

5.1 Potential Risks to Human Health

The following evaluation of potential human health risks is based on the ASTM guidance document entitled *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites*, dated November 1995 (ASTM, 1995). This document is a useful guide to assess petroleum release sites based on the protection of human health and the environment. The document provides a tiered approach to evaluating petroleum release sites based on the complexity and levels of risk determined for a given site. The following evaluation consists of a Tier 1 evaluation of chemicals remaining in soil and groundwater related to the northern and southern former Rifkin USTs.

5.1.1 Potential Human Receptors

The northern and southern former Rifkin USTs were located on City of Emeryville Property under the existing sidewalk between Horton Street and the recently-constructed asphalt parking lot on the former Rifkin Property in a commercial/Industrial area in Emeryville, California (Figure 2). As discussed in Section 2.2, no buildings are present above the former locations of the tanks. It is also unlikely that any future buildings constructed by Chiron would be placed over the northern and southern former Rifkin UST locations, as such buildings would not encroach upon the existing sidewalk area. Therefore, the only potential human receptors identified are the commercial/industrial occupants of buildings in the vicinity of the northern and southern former Rifkin UST sites, and less frequently, subsurface utility maintenance workers. Pedestrians traversing the sidewalk along Horton Street are also considered to be potentially exposed, though to a much lesser extent.

5.1.2 Soil Human Exposure Pathways

Chemicals remaining in soil after removal of the northern and southern former Rifkin USTs and over-excavation of surrounding soil were discussed in Section 3. Maximum chemical concentrations detected in soil in the vicinity of the tank excavations are summarized in Table 4. This summary includes the results for (1) verification soil

samples collected from the excavation sidewalls and bottom after the tanks were removed, and (2) soil samples collected within approximately 5 feet of the excavation limits using hand augers.

The only complete exposure pathways of on-site workers and passers-by to the detected chemicals of concern in soil are through inhalation of chemicals volatilized from soil to outdoor air. Occasional exposure to soil by maintenance workers during work on subsurface utilities (e.g., through dermal contact, incidental ingestion, or inhalation) is also possible. Volatilization from soil to indoor building air is unlikely because the former tank excavations where residual petroleum compounds exist are located at a distance of more than 20 feet from the nearest existing building. Dermal contact with soil and incidental ingestion of soil containing chemicals of concern are not complete exposure pathways for nearby building occupants or passers-by because (1) residual petroleum hydrocarbon compounds at the northern and southern former Rifkin USTs are located more 3 feet bgs, and (2) the northern and southern former Rifkin UST locations are covered by the existing sidewalk. Lastly, leaching of chemicals from soil to groundwater used for drinking water is not a complete exposure pathway because groundwater at the property is not used as a drinking water source.

Risk-based screening levels ("RBSLs") for soil, water, and air corresponding to various acceptable risk levels have been calculated for typical human exposure pathways (ASTM, 1995). The RBSLs for soil in commercial/industrial areas relating to potentially complete soil exposure pathways are listed in Table 4. The RBSLs for volatilization from soil to outdoor air are appropriate for on-site commercial workers, while the RBSLs for ingestion, dermal exposure, and inhalation from surficial soil are appropriate for maintenance workers (Table 4). Although the RBSLs shown in Table 4 are developed for commercial/industrial workers, these RBSLs are also protective of pedestrians. The RBSLs in Table 4 assume an exposure duration of 8 hours per day, for 250 days per year, over 25 years. For a pedestrian, the exposure duration (i.e., the time spent passing by the former tank locations) is expected to be far less, perhaps 5 to 10 minutes per day. As a result, RBSLs calculated for a pedestrian would be much greater (i.e., less stringent) than the values for workers shown in Table 4.

For each chemical, the RBSL in Table 4 corresponds to a 10^{-5} (i.e., one in one hundred thousand) incremental lifetime carcinogenic risk or a non-carcinogenic hazard quotient of one for a standard 25-year commercial/industrial exposure scenario as reported by ASTM (1995). For comparison, the U.S. EPA National Contingency Plan specifies an acceptable incremental risk range of 10^{-6} to 10^{-4} (i.e., one in one million to one in ten thousand) (U.S. EPA, 1989). The California Proposition 65 notification level for workers corresponds to an incremental cancer risk of 10^{-5} (i.e., one in one million) (22 CCR Section 12703). The RBSLs for benzene in Table 4 have been adjusted to account for the California carcinogenic slope factors for benzene (Cal-EPA, 1994).

No RBSL is given for lead in the ASTM guidance document. Instead, the U.S. EPA Region IX Preliminary Remediation Goal ("PRG") for lead in soil in industrial areas of

1,000 mg/kg was used (EPA, 1996). The PRG includes the ingestion, dermal contact, and particulate inhalation pathways and is based on a non-carcinogenic hazard quotient of one..

Consistent with the ASTM guidance document (ASTM, 1995), no RBSLs are presented for TPH-g and TPH-d. ASTM states that TPH quantification methods "usually determine the total amount of hydrocarbons present as a single number and give no information on the types of hydrocarbon present. The TPHs should not be used for risk assessment because the general measure of TPH provides insufficient information about the amounts of individual chemical(s) of concern present."

With the one exception, the detected chemical concentrations in soil at the northern and southern former Rifkin UST sites do not exceed the potentially applicable RBSLs. The exception is the benzene concentration (5.4 mg/kg) detected in a single sample from the sidewall of the former 1,000-gallon gasoline tank excavation. This sample was collected from the eastern sidewall where excavation was obstructed by subsurface gas and sanitary sewer lines. Soil samples collected from deeper into this sidewall did not contain detectable levels of benzene. Of the 15 soil samples collected in the vicinity of the former 1,000-gallon gasoline tank, only one contained benzene concentrations above method detection limits. Assuming benzene is present at one half the method detection limit in samples where benzene was not detected, the 95% upper confidence limit of the mean of the log-transformed concentrations in these 15 samples is calculated to be 0.47 mg/kg (Table 1). This upper estimate of the mean benzene concentration in soil is significantly less than the RBSL of 1.3 mg/kg.

The fact that the detected chemical concentrations in soil at the northern and southern former Rifkin UST sites do not exceed the potentially applicable RBSLs indicates that risk levels corresponding to the potentially complete soil exposure pathways (i.e., volatilization from soil to outdoor air and dermal contact, incidental ingestion, and inhalation) are below acceptable risk levels of 10^{-5} incremental cancer risk for carcinogens and a hazard quotient of one for non-carcinogens.

5.1.3 Groundwater Human Exposure Pathways

Petroleum hydrocarbon-related compounds detected in groundwater in the vicinity of the northern and southern former Rifkin USTs are discussed in Sections 3 and 4. Most recently detected concentrations of these compounds in groundwater monitoring well and grab groundwater samples collected adjacent to and immediately downgradient of the northern and southern former Rifkin USTs are presented in Table 5. The RBSLs for groundwater in commercial/industrial areas, reported by ASTM (1995), relating to potentially complete groundwater exposure pathways are also presented on Table 5. These RBSLs correspond to a 10^{-5} incremental lifetime carcinogenic risk or a non-carcinogenic hazard quotient of one for a standard 25-year commercial/industrial exposure scenario. The RBSLs for benzene in Table 5 have been adjusted to account for the California carcinogenic slope factors for benzene (Cal-EPA, 1994). Consistent with

the ASTM guidance document (ASTM, 1995), no RBSLs are presented for TPH-g and TPH-d (see Section 5.1.2).

Shallow groundwater near the northern and southern former Rifkin UST locations is not currently utilized, nor is it likely to be utilized in the future, as a drinking water source. East Bay Municipal Utilities District currently supplies imported surface water for drinking for residents and businesses in the City of Emeryville. Shallow groundwater in Emeryville is not suitable for drinking due to its generally of poor quality and limited rate of recharge. As discussed in EKI's *Final Health and Environmental Risk Assessment for properties North of 53rd Street,* dated 10 March 1995 (EKI, 1995), petroleum hydrocarbons and metals are present in shallow groundwater in many areas of Emeryville near the northern and southern former Rifkin UST locations and the shallow aquifer, which consists of thin and discontinuous sand and gravel lenses, produces limited quantities of water. Thus, ingestion of groundwater with chemicals of concern near these former Rifkin UST locations is not a complete exposure pathway.

The only complete exposure pathways for groundwater include volatilization of chemicals from groundwater to outdoor and indoor air. The RBSLs for groundwater in commercial/industrial areas relating to these potentially complete groundwater exposure pathways are listed in Table 5. The volatilization to outdoor and indoor air exposure pathways would be applicable for on-site outdoor and indoor workers, respectively. As discussed in Section 5.1.2, these RBSLs are also protective of pedestrians due to their expected short exposure duration at the former tank locations.

None of the petroleum hydrocarbon-related compounds recently detected in groundwater samples collected near or downgradient of the northern and southern former Rifkin UST locations exceed potentially applicable RBSLs. Therefore, given that chemical concentrations in groundwater appear to be stable or decreasing (Appendix D), it is concluded that risk levels corresponding to the potentially complete groundwater exposure pathways (i.e., volatilization from groundwater to indoor and outdoor air) are significantly below acceptable risk levels of 10^{-5} incremental cancer risk for carcinogens and a hazard quotient of one for non-carcinogens.

5.2 Potential Risks to the Environment

This section identifies potential environmental receptors that could be at risk from exposure to chemically impacted soil or groundwater from the northern and southern northern and southern former Rifkin USTs (e.g., sensitive plant species, wildlife, and aquatic organisms). It also addresses human health risks that could result from consumption of potentially impacted environmental receptors (e.g., humans eating fish) based on the surface water quality objectives considered herein.

5.2.1 Soil Exposure Pathways to Potential Environmental Receptors

As discussed in Section 2.1, the northern and southern former Rifkin USTs are located in a commercial/industrial area where a limited number of environmental receptors such as sensitive plant species or wildlife are likely to exist. In addition, locations of residual petroleum hydrocarbon compounds at the northern and southern northern and southern former Rifkin USTs (1) are more than three feet bgs and (2) are currently covered by the existing sidewalk. Therefore, it is unlikely that any such environmental receptors would be at risk due to residual chemicals of concern in soil at the northern and southern former Rifkin UST locations.

In addition, the existing sidewalk also limits potential leaching of chemicals of concern from soil at the northern and southern northern and southern former Rifkin UST locations that could enter groundwater and eventually impact wildlife or aquatic organisms. However, if such leaching occurs, current groundwater conditions should reflect maximum chemical concentrations that could result from leaching of chemicals remaining in soil at the northern and southern former Rifkin UST locations, given that most source soils have been removed from these former Rifkin UST locations. Therefore, risks to wildlife or aquatic organisms through potential leaching of chemicals from soil are encompassed within the evaluation of current groundwater exposure pathways and impacts as discussed below based on currently monitored groundwater conditions (Section 5.2.2).

5.2.2 Groundwater Exposure Pathways to Potential Environmental Receptors

The direction of groundwater flow in the vicinity of the northern and southern former Rifkin USTs is generally to the north or northwest (Section 2.6.1). San Francisco Bay, a surface water body with potentially sensitive aquatic receptors, is located approximately 2,000 feet west of the former Rifkin UST locations.

Temescal Creek is a potential conduit for chemicals in groundwater to reach San Francisco Bay. An overflow culvert to Temescal Creek runs underneath the northern portion of the former Rifkin Property and joins the Temescal Creek culvert approximately 120 feet downstream of the western property boundary. Drainage pipes, which permit groundwater inflow, are present within the Temescal Creek Overflow Culvert and Temescal Creek in the vicinity of the former Rifkin Property. Thus, chemicals in shallow groundwater could possibly reach San Francisco Bay through the Temescal Creek Overflow culvert and Temescal Creek. However, it is likely that chemical concentrations would dilute and attenuate in groundwater and in Temescal Creek prior to reaching San Francisco Bay.

Nevertheless, available data on measured concentrations of petroleum hydrocarbon-related chemicals detected in groundwater were evaluated based on water quality objectives for the receiving surface water body, San Francisco Bay (Table 6). Water quality criteria considered included marine and estuarien ambient water quality objectives

for (1) the protection of saltwater aquatic life and (2) for the protection of human health (based on consumption of saltwater aquatic organisms). These water quality criteria were obtained from the following sources:

- *Water Quality Control Plan for the San Francisco Bay Basin* (RWQCB, 1995): Water quality objectives for surface waters with salinities greater than 5 parts per thousand.
- *California Enclosed Bays and Estuaries Plan* (SWRCB, 1993).
- *Quality Criteria for Water 1986*, and update number 2 to *Quality Criteria for Water 1986* (U.S. EPA, 1986): U.S. EPA National Ambient Water Quality Criteria for Salt Water Aquatic Life Protection.
- *National Toxics Rule* (40 CFR Part 131).

Further discussions regarding these objectives and their relation to chemical concentrations detected in groundwater at the northern and southern former Rifkin USTs are presented in Sections 5.2.2.1 and 5.2.2.2 below.

5.2.2.1 Water Quality Objectives for Protection of Saltwater Aquatic Life

Current concentrations of petroleum hydrocarbon-related compounds detected in groundwater adjacent to and immediately downgradient of the northern and southern former Rifkin USTs (Table 5) do not exceed marine and estuarine ambient water quality objectives for the protection of saltwater aquatic life (Table 6), with the possible exception of lead in the vicinity of the northern former Rifkin USTs. Potentially elevated lead concentrations detected in groundwater in the vicinity of the northern former Rifkin USTs, however, appear to be associated with particulates in unfiltered samples, and, therefore, are unlikely to migrate within groundwater (Section 4.1.3 and 4.2.3). Further, given that concentrations of petroleum hydrocarbon-related compounds in groundwater adjacent to and immediately downgradient of the northern and southern former Rifkin USTs are stable or decreasing, it is concluded that potentially impacted groundwater from the former tanks do not exceed these water quality objectives and do not pose a significant risk to saltwater aquatic life.

5.2.2.2 Water Quality Objectives for Protection of Human Health based on Consumption of Saltwater Aquatic Organisms

With the exception of benzene concentrations detected in the immediate vicinity of the northern former tanks, concentrations of petroleum hydrocarbon-related compounds recently detected at and downgradient of the northern and southern northern and southern

former Rifkin USTs (Table 3) do not exceed marine and estuarine ambient water quality objectives for the protection of human health based on consumption of saltwater aquatic organisms.

As indicted in Table 3, benzene concentrations of 32 ug/L and 27 ug/L were recently detected in groundwater monitoring wells MW-1 and MW-2. These wells are located adjacent to the former 1,000-gallon gasoline tank and former 1,500-gallon heating oil tank located (the northern former Rifkin USTs). These concentrations exceed benzene water quality objective in surface water of 21 ug/L for the protection of human health based on consumption of saltwater aquatic organisms. It is unlikely, however, that benzene concentrations detected adjacent to these northern former Rifkin USTs pose a risk to humans through consumption of aquatic organisms. Prior to reaching San Francisco Bay, where salt water aquatic organisms could first be exposed to benzene concentrations, significant dilution and attenuation of these concentrations is likely to occur as a result of biodegradation in groundwater and volatilization in Temescal Creek. Therefore, given that concentrations of petroleum hydrocarbon-related compounds in groundwater adjacent to and immediately downgradient of the tanks are stable or decreasing, it is unlikely that potentially impacted groundwater from the former tanks poses a significant risk to humans through consumption of saltwater aquatic organisms.

However, further evaluation of concentrations of benzene and other petroleum related hydrocarbons downgradient of the northern former Rifkin USTs will be conducted on the basis of groundwater samples proposed for collection by Sherwin Williams on the former Rifkin Property. Collection of these samples has been proposed as part of Sherwin-Williams' 2 June 1997 Work Plan, which is currently under review by the Regional Water Quality Control Board (LFR, 1997). Proposed groundwater sampling locations are shown on Figure 3 of the 2 June 1997 Work Plan. A copy of this figure is included in Appendix E.

The Work Plan schedule indicates that analytical results from these samples will be available approximately 90 days after approval of the Work Plan. These data will be used to evaluate any additional, measured concentrations of benzene and other petroleum-related compounds in groundwater downgradient of the northern former Rifkin tanks. Data obtained as part of Sherwin-Williams proposed investigations will also be used to evaluate chemical concentrations in groundwater immediately upgradient of the northern former Rifkin USTs.

This information will be presented to ACDEH in an addendum, at which time closure of the former 1,000-gallon gasoline tank and former 1,500-gallon heating oil tank will be requested, assuming the additional data do not alter the conclusions presented herein regarding the magnitude and risk associated with detected residual petroleum hydrocarbon compounds in soil and groundwater near these former Rifkin UST locations.

6. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions have been made on the basis of available soil and groundwater data and the risk-based evaluation of chemical concentrations remaining in soil and groundwater in the vicinity of the former Rifkin UST locations:

Northern Former Rifkin USTs:

As discussed in Section 4, the northern former Rifkin USTs include the former 1,500-gallon heating oil tank, the former 1,000-gallon gasoline UST, and the former 550-gallon gasoline UST (see Figure 2). Soil and groundwater sampling has been conducted in the immediate vicinity of these tanks. Results of this sampling indicated that:

(a) concentrations of petroleum hydrocarbon-related compounds remaining in soil in the vicinity of the northern USTs are limited, and

(b) with the possible exception of benzene, no clear incremental contribution of these compounds currently exist in groundwater in the vicinity of the northern former Rifkin USTs.

In addition, risk evaluations performed pursuant to ASTM guidance (ASTM, 1995) indicate that, chemicals detected in soil and groundwater at the northern former Rifkin USTs do not pose significant risks to: (a) current and future site occupants and workers, (b) potential environmental receptors (i.e., sensitive plant species, wildlife, and aquatic organisms), or (c) humans through the consumption of potentially impacted saltwater aquatic organisms (see Section 5).

Additional investigations have been proposed by Sherwin-Williams downgradient of the tanks. Results of these additional groundwater investigations will be used to augment these findings, which are based on data collected in the immediate vicinity of the tanks. Assuming the additional data do not alter conclusions regarding the magnitude and risk associated with detected residual soil and groundwater concentrations near these former northern USTs, closure of these former USTs will be recommended subsequent to the completion of the proposed work by SW.

However, given the limited chemical concentrations detected in soil in the vicinity of the northern 550-gallon gasoline, we recommend that ACDEH grant immediate closure of this UST on the basis of the information provided herein. This recommendation is based on the conclusion that any locally incremental concentrations of petroleum hydrocarbon-related compounds that may be detected in groundwater in the vicinity of the northern USTs are the result of releases from the former 1,500-gallon heating oil tank or the former 1,000-gallon gasoline UST and not due to this former UST.

Southern Former Rifkin USTs:

As discussed in Section 4, the southern former Rifkin USTs include the former 500-gallon paint thinner UST and the former 1,500-gallon diesel UST (see Figure 2). Based on available soil and groundwater data collected at and downgradient of these southern former Rifkin USTs, no clear incremental contribution of petroleum hydrocarbon-related compounds to groundwater from these former USTs has been identified. Furthermore, chemicals detected in soil and groundwater at and downgradient of the southern former Rifkin USTs do not pose significant risks to: (a) current and future site occupants and workers, (b) potential environmental receptors (i.e., sensitive plant species, wildlife, and aquatic organisms), or (c) humans through the consumption of potentially impacted saltwater aquatic organisms (see Section 5). Therefore, Chiron recommends immediate closure of the southern former 500-gallon paint thinner UST and the southern former 1,500-gallon diesel UST.

Summary

Chiron recommends immediate closure of the following USTs:

- the northern former Rifkin 550-gallon gasoline tank (just east of 4543 Horton Street),
- the southern former Rifkin 500-gallon paint thinner tank (just east of 4525-4529 Horton Street), and
- the southern former Rifkin 1,500-gallon diesel tank (just east of 4525-4529 Horton Street).

Closure of the two remaining northern former Rifkin USTs (i.e., the 1,500-gallon heating oil tank and the 1,000-gallon gasoline tank) will be requested in a subsequent addendum to this report, assuming that the additional data do not alter the conclusions presented herein.

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Table 1
Concentrations of Petroleum Hydrocarbons and Related Chemicals Remaining in Soil After Excavation of the Former Rifkin USTs

Chiron Corporation
Emeryville, California

Tank Type	Sample ID	Sample Date	Sample Depth (feet bgs)	Sample Location in Excavation	Concentration in Soil (mg/kg)						
					TPH-g	TPH-d	Benzene	Toluene	Ethyl-benzene	Total Xylenes	Total Lead
1,500-Gallon Heating Oil Tank	EW-1	1/10/94	6	Eastern Sidewall	<1	11,100	<0.1	<0.1	0.4	0.5	<1
	EW-2	1/10/94	8	Eastern Sidewall	<1	15,700	<0.1	0.3	1.4	2.6	<1
	NW-1	1/10/94	9	Northern Sidewall	<1	4,980	<0.1	<0.1	<0.1	0.6	<1
	NW-2	1/10/94	5	Northern Sidewall	<1	37	<0.1	<0.1	<0.1	<0.1	<1
	SW-1	1/10/94	8	Southern Sidewall	<1	12,500	<0.1	0.2	0.3	0.2	<1
	SW-2	1/10/94	4.5	Southern Sidewall	<1	437	<0.1	<0.1	<0.1	<0.1	<1
	WW-1	1/10/94	10.5	Western Sidewall	<1	4,480	<0.1	<0.1	<0.1	0.5	<1
	WW-2	1/10/94	6	Western Sidewall	<1	9,490	<0.1	<0.1	<0.1	0.4	<1
	HAEW-4	1/13/94	4	East of Excavation	33	<1	1.2	2.6	0.7	3.2	20
	HAEW-8	1/13/94	8	East of Excavation	<1	<1	<0.1	<0.1	<0.1	<0.1	19
	HANW-4	1/13/94	4	North of Excavation	<1	202	<0.1	<0.1	0.1	0.1	9.0
	HANW-7.5	1/13/94	7.5	North of Excavation	<1	104	<0.1	<0.1	0.2	0.1	9.0
	HASW-4	1/13/94	4	South of Excavation	<1	<1	<0.1	<0.1	<0.1	<0.1	159
	HASW-7.5	1/13/94	7.5	South of Excavation	<1	<1	<0.1	<0.1	<0.1	<0.1	<1
	HAWW-8	1/13/94	8	West of Excavation	<1	<1	<0.1	<0.1	<0.1	<0.1	<1
	Maximum Detected Concentration				33	15,700	1.2	2.6	1.4	3.2	159

Table 1
Concentrations of Petroleum Hydrocarbons and Related Chemicals Remaining in Soil After Excavation of the Former Rifkin USTs

Chiron Corporation
Emeryville, California

Tank Type	Sample ID	Sample Date	Sample Depth (feet bgs)	Sample Location in Excavation	Concentration in Soil (mg/kg)						
					TPH-g	TPH-d	Benzene	Toluene	Ethyl-benzene	Total Xylenes	Total Lead
1,000-Gallon Gasoline Tank	MW-1-15	11/14/88	15	Below Excavation	NA	ND	ND	ND	ND	ND	NA
	3-5	1/26/94	5	Northern Sidewall	<1	<1	<0.1	<0.1	<0.1	<0.1	14
	3-6	1/26/94	5	Eastern Sidewall	128	<1	5.4	11	3.8	11.8	50
	3-7	1/26/94	5	Western Sidewall	<1	<1	<0.1	<0.1	<0.1	<0.1	47
	3-8	1/26/94	2	Bottom of Dispenser Area	<1	<1	<0.1	<0.1	<0.1	<0.1	161
	3-9	1/26/94	5	Southern Sidewall	<1	<1	<0.1	<0.1	<0.1	<0.1	86
	3-10	1/26/94	8	Southern Sidewall	<1	<1	<0.1	<0.1	<0.1	<0.1	<1
	3-11	1/26/94	9	Bottom of Excavation	<1	242	<0.1	<0.1	<0.1	0.1	8.0
	3-12	1/26/94	8	Eastern Sidewall	<1	<1	<0.1	<0.1	<0.1	<0.1	16
	3-13	1/26/94	8	Western Sidewall	<1	<1	<0.1	<0.1	<0.1	<0.1	10
	3-14	1/26/94	7	Northern Sidewall	<1	<1	<0.1	<0.1	<0.1	<0.1	11
	3-15	1/26/94	8	Northern Sidewall	<1	<1	<0.1	<0.1	<0.1	<0.1	13
	3-18	1/27/97	5	East of Excavation	<1	<1	<0.1	<0.1	<0.1	<0.1	9.0
	3-19	1/27/97	5	East of Excavation	<1	<1	<0.1	<0.1	<0.1	<0.1	15
	3-20	1/27/97	5	East of Excavation	<1	<1	<0.1	<0.1	<0.1	<0.1	587
	Maximum Detected Concentration				128	242	5.4	11	3.8	11.8	587

Table 1
Concentrations of Petroleum Hydrocarbons and Related Chemicals Remaining in Soil After Excavation of the Former Rifkin USTs

Chiron Corporation
Emeryville, California

Tank Type	Sample ID	Sample Date	Sample Depth (feet bgs)	Sample Location in Excavation	Concentration in Soil (mg/kg)						
					TPH-g	TPH-d	Benzene	Toluene	Ethyl-benzene	Total Xylenes	Total Lead
550-Gallon Gasoline Tank	X-1	9/30/88	12	Bottom of Excavation	5	NA	<0.05	<0.1	<0.1	<0.1	9.5
	X-2	9/30/88	12	Bottom of Excavation	41	NA	<0.05	<0.1	0.20	1.0	8.1
	3-1	1/26/94	5	Test Trench After Backfill	<1	<1	<0.1	<0.1	<0.1	<0.1	9.0
	3-2	1/26/94	8	Test Trench After Backfill	<1	<1	<0.1	<0.1	<0.1	<0.1	12
	3-3	1/26/94	5	Test Trench After Backfill	<1	<1	<0.1	<0.1	<0.1	<0.1	28
	3-4	1/26/94	8	Test Trench After Backfill	<1	<1	<0.1	<0.1	<0.1	<0.1	10
	Maximum Detected Concentration				41	<1	<0.1	<0.1	0.20	1.0	28

Table 1
Concentrations of Petroleum Hydrocarbons and Related Chemicals Remaining in Soil After Excavation of the Former Rifkin USTs

Chiron Corporation
Emeryville, California

Tank Type	Sample ID	Sample Date	Sample Depth (feet bgs)	Sample Location in Excavation	Concentration in Soil (mg/kg)						
					TPH-g	TPH-d	Benzene	Toluene	Ethyl-benzene	Total Xylenes	Total Lead
500-Gallon Paint Thinner Tank	BOTTOM 1	1/5/94	10.5	Bottom of Excavation	<1	NA	<0.1	<0.1	<0.1	<0.1	13
	WW-1	1/5/94	8.5	Western Sidewall	709	NA	0.30	<0.1	1.7	3.0	<1
	EW-2	1/6/94	8.5	Eastern Sidewall	254	123	<0.1	<0.1	<0.1	<0.1	4.0
	EW-3	1/6/94	9	Eastern Sidewall	25	<1	<0.1	<0.1	<0.1	<0.1	1.0
	NW-2	1/6/94	11.5	Northern Sidewall	<1	<1	<0.1	<0.1	<0.1	<0.1	8.0
	NW-3	1/6/94	9.5	Northern Sidewall	<1	<1	<0.1	<0.1	<0.1	<0.1	3.0
	SW-2	1/6/94	9	Southern Sidewall	56	<1	<0.1	<0.1	<0.1	0.1	<1
	SW-3	1/6/94	9	Southern Sidewall	259	<1	<0.1	<0.1	0.3	0.6	<1
	WW-2	1/6/94	10.5	Western Sidewall	349	<1	<0.1	<0.1	0.5	0.6	<1
	WW-3	1/6/94	9	Western Sidewall	2,630	<1	<0.1	<0.1	2.7	5.8	<1
	WW4-1	1/10/94	7	West of Excavation	<1	<1	<0.1	<0.1	<0.1	<0.1	<1
	WW4-2	1/10/94	8	West of Excavation	380	<1	<0.1	<0.1	0.2	0.2	<1
	WW5-1	1/10/94	7	West of Excavation	<1	<1	<0.1	<0.1	<0.1	<0.1	<1
	WW5-2	1/10/94	8	West of Excavation	<1	<1	<0.1	<0.1	<0.1	<0.1	<1
	Maximum Detected Concentration				2,630	123	0.30	<0.1	2.7	5.8	13

Table 1
Concentrations of Petroleum Hydrocarbons and Related Chemicals Remaining in Soil After Excavation of the Former Rifkin USTs

Chiron Corporation
Emeryville, California

Tank Type	Sample ID	Sample Date	Sample Depth (feet bgs)	Sample Location in Excavation	Concentration in Soil (mg/kg)						
					TPH-g	TPH-d	Benzene	Toluene	Ethyl-benzene	Total Xylenes	Total Lead
1,500-Gallon Diesel Tank	Tank 1 S	11/24/93	8.5	Bottom of Excavation	<1	<1	<0.1	<0.1	<0.1	<0.1	NA
	Tank 1 N	11/24/93	8.5	Bottom of Excavation	<1	<1	<0.1	<0.1	<0.1	<0.1	NA
	Tank 1 EW	11/24/93	7.5	Eastern Sidewall	<1	<1	<0.1	<0.1	<0.1	<0.1	NA
	Tank 1 NW	11/24/93	7.5	Northern Sidewall	<1	<1	<0.1	<0.1	<0.1	<0.1	NA
	Tank 1 SW	11/24/93	7.5	Southern Sidewall	<1	<1	<0.1	<0.1	<0.1	<0.1	NA
	Maximum Detected Concentration				<1	<1	<0.1	<0.1	<0.1	<0.1	NA

Abbreviations:
bgs = Below ground surface
NA = Not analyzed
ND = Not detected above laboratory method detection limits
TPH-g = Total petroleum hydrocarbons quantified as gasoline
TPH-d = Total petroleum hydrocarbons quantified as diesel

Table 2
Summary of Maximum Concentrations of Petroleum Hydrocarbons and Related Chemicals Remaining in Soil After Excavation of the Former Rifkin USTs

Chiron Corporation
Emeryville, California

Tank Description	Tank Removal Date	Excavation Completion Date	Excavation Depth (feet bgs)	Number of Verification Soil Samples	Maximum Concentration Detected in Soil (mg/kg)						
					TPH-g	TPH-d	Benzene	Toluene	Ethyl-benzene	Total Xylenes	Total Lead
1,500-Gallon Heating Oil Tank	11/24/93	1/10/94	12	15	33	15,700	1.2	2.6	1.4	3.2	159
1,000-Gallon Gasoline Tank	7/8/88	1/27/94	12	17	128	242	5.4 (1)	11	3.8	11.8	587
550-Gallon Gasoline Tank	9/30/88	9/30/88	12	6	41	<1	<0.1	<0.1	0.20	1.0	28
500-Gallon Paint Thinner Tank	11/24/93	1/6/94	12	14	2,630	123	0.30	<0.1	2.7	5.8	13
1,500-Gallon Diesel Tank	11/24/93	11/24/93	8.5	5	<1	<1	<0.1	<0.1	<0.1	<0.1	NA

Abbreviations:
bgs = Below ground surface
NA = Not analyzed
TPH-g = Total petroleum hydrocarbons quantified as gasoline
TPH-d = Total petroleum hydrocarbons quantified as diesel

Notes:
(1) The 95% upper confidence level of the mean benzene concentration in soil near the former 1,000-gallon gasoline tank excavation is 0.51 mg/kg. This calculation was performed using natural log-transformed data.

Table 3

Summary of Historic Concentrations of Petroleum Hydrocarbons and Related Chemicals Detected in Groundwater Adjacent to and Immediately Downgradient of the Former Rifkin USTs

Chiron Corporation

Tank Description	Monitoring Well or Grab Sample Location (1)	Sample Date	Concentration in Groundwater (ug/L)									
			TPH-g	TPH-d	Benzene	Toluene	Ethyl-benzene	Total Xylenes	acetone	MEK	MIBK	Total Lead
1,500-Gallon Heating Oil Tank	OB-1 (2)	1/11/94	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA	NA	NA
		1/19/94	<50	<50	<0.5	<0.5	<0.5	<0.5	NA	NA	NA	NA
		2/9/94	NA	<50	<0.5	<0.5	<0.5	<0.5	NA	NA	NA	NA
		2/9/94	NA	<50	<0.5	<0.5	<0.5	<0.5	NA	NA	NA	NA
		12/15/94	NA	300 (3)	<0.5	39	1.8	8.8	1300	570	370	NA
	MW-2	12/16/94	NA	12,000 (3)	17	1.9	<0.5	1.2	<4.2	<1.1	<1.4	NA
		3/28/95	3,000	4,400	16	1.1	<0.4	0.9	<5	<2	<2	55.7
		6/8/95	1,300	3,800	22	0.9	0.5	0.9	<5	<2	<2	30
		1/9/96	900	2,500	39	1.0	0.9	2.0	<100	<100	<100	NA
		4/17/96	620	4,600	32	1.3	8.0	<2	NA	NA	NA	NA
		7/31/96	710	3,200	42	1.6	0.9	<2	NA	NA	NA	NA
		11/19/96	370	3,200	18	1.7	0.7	4	NA	NA	NA	NA
		3/25/97	520	3,300	24	0.7	1.0	<2	NA	NA	NA	NA
		6/10/97	500	1,500	27	0.5	<0.5	2	NA	NA	NA	NA

Table 3

Summary of Historic Concentrations of Petroleum Hydrocarbons and Related Chemicals Detected in Groundwater Adjacent to and Immediately Downgradient of the Former Rifkin USTs

Chiron Corporation

Tank Description	Monitoring Well or Grab Sample Location (1)	Sample Date	Concentration in Groundwater (ug/L)									
			TPH-g	TPH-d	Benzene	Toluene	Ethyl-benzene	Total Xylenes	acetone	MEK	MIBK	Total Lead
1,000-Gallon Gasoline Tank	OB-2 (4)	2/9/94	<50	15,000	<0.5	<0.5	<0.5	<0.5	NA	NA	NA	NA
		2/9/94	<50	14,000	<0.5	<0.5	<0.5	<0.5	NA	NA	NA	NA
		12/15/94	NA	1,400 (3)	9.4	12	<0.5	2.7	<4.2	<1.1	<1.4	NA
	MW-1	12/16/94	NA	16,000 (3)	16	2.7	<0.5	3.1	<4.2	<1.1	<1.4	NA
		3/28/95	7,410	3,600	28	1.3	9.3	2.5	<5	13	<2	30.8
		6/8/95	2,100	2,600	37	1.6	3.0	2.3	<5	25	<2	20
		1/9/96	1,300	4,000	53	3.0	2.0	6	<100	<100	<100	NA
		4/17/96	1,700	1,100	65	3.5	5.5	7	NA	NA	NA	NA
		7/31/96	2,400	12,000	53	9.8	12	14	NA	NA	NA	NA
		11/19/96	850	1,500	32	1.7	1.7	5	NA	NA	NA	NA
		3/25/97	990	1,800	49	2.2	2.4	5	NA	NA	NA	NA
		6/10/97	940	1,300	32	0.9	0.7	3	NA	NA	NA	NA

Table 3

Summary of Historic Concentrations of Petroleum Hydrocarbons and Related Chemicals Detected in Groundwater Adjacent to and Immediately Downgradient of the Former Rifkin USTs

Chiron Corporation

Tank Description	Monitoring Well or Grab Sample Location (1)	Sample Date	Concentration in Groundwater (ug/L)									
			TPH-g	TPH-d	Benzene	Toluene	Ethyl-benzene	Total Xylenes	acetone	MEK	MIBK	Total Lead
500-Gallon Paint Thinner Tank	Pit-2	1/6/94	<50	<50	<0.5	<0.5	<0.5	<0.5	NA	NA	NA	<1,000
	MW-3	12/16/94	NA	27,000 (3)	<0.5	<0.5	<0.5	<0.5	<4.2	<1.1	<1.4	NA
		3/28/95	2,000	1,500	<0.8	<0.4	<1	<0.4	<5	<2	<2	7
		6/8/95	430	550	<0.8	<0.4	<0.4	<0.4	<5	5.2	<2	10
		1/9/96	200	300	<5	<5	<5	<5	<100	<100	<100	NA
		4/17/96	160	180	<5	<5	<5	<5	NA	NA	NA	NA
		7/31/96	9,400	420	<5	<5	<5	<5	NA	NA	NA	NA
		11/19/96	470	460	<5	0.6	<5	4	NA	NA	NA	NA
		3/25/97	310	<50	<5	<5	<5	<5	NA	NA	NA	NA
		6/10/97	70	<50	<0.5	<0.5	<0.5	<0.5	NA	NA	NA	NA

Abbreviations:

bgs = below ground surface

NA = Not analyzed

TPH-g = Total petroleum hydrocarbons quantified as gasoline

TPH-d = Total petroleum hydrocarbons quantified as diesel

Notes:

(1) The locations of the temporary groundwater monitoring wells (i.e., OB-1 and OB-2) and the location of the grab groundwater sample from the paint thinner tank excavation (i.e., Pit-2) are shown on Figures 3 and 4.

(2) Monitoring well OB-1 was installed in the backfill of the excavation for the 1,500-gallon heating oil tank after impacted soil had been removed.

(3) Result obtained from an analyses by Advanced Materials Entigeering Research, Inc. entitled "TPH-Full Scan". It is not clear if this result includes TPH-g, TPH-g, or both.

(4) Monitoring well OB-2 was installed in the backfill of the excavation for the 1,000-gallon gasoline tank after impacted soil had been removed.

Table 4

Comparison of Maximum Concentrations of Petroleum Hydrocarbons and Related Chemicals Remaining in Soil with ASTM RBCA Tier 1 Risk-Based Screening Levels near the Former Rifkin UST Locations

Chiron Corporation
Emeryville, California

Tank Description	Number of Soil Samples	Maximum Concentration Detected in Soil (mg/kg)						
		TPH-g	TPH-d	Benzene	Toluene	Ethyl-benzene	Total Xylenes	Total Lead
1,500-Gallon Heating Oil Tank	15	33	15,700	1.2	2.6	1.4	3.2	159
1,000-Gallon Gasoline Tank	17	128	242	5.4 (1)	11	3.8	11.8	587
550-Gallon Gasoline Tank	6	41	<1	<0.1	<0.1	0.20	1.0	28
500-Gallon Paint Thinner Tank	14	2,630	123	0.30	<0.1	2.7	5.8	13
1,500-Gallon Diesel Tank	5	<1	<1	<0.1	<0.1	<0.1	<0.1	NA
RBCA Tier 1 Risk-Based Screening Levels (2)								
- Volatilization from Soil to Outdoor Air		-(3)	-	1.3	RES (4)	RES	RES	N/A (8)
- Ingestion, Dermal Exposure, and Inhalation from Surficial Soil		-	-	29	18,700	11,500	208,000	1,000 (9)
- Volatilization from Soil to Indoor Air		N/A (5)	N/A	N/A	N/A	N/A	N/A	N/A (5,8)
- Leaching from Soil to Groundwater for Drinking Water		N/A (6)	N/A	N/A	N/A	N/A	N/A	N/A
Are applicable Risk-Based Screening Levels exceeded?		-	-	**Yes/No (7)**	**No**	**No**	**No**	-

Abbreviations:
TPH-g = Total petroleum hydrocarbons quantified as gasoline
TPH-d = Total petroleum hydrocarbons quantified as diesel

Notes:
(1) The 95% upper confidence level for benzene concentration in soil near the former 1,000-gallon gasoline tank excavation is 0.51 mg/kg. This calculation was performed using natural log-transformed data.

(2) Risk-Based Screening Levels ("RBSLs") for commercial/industrial soil corresponding to 10^{-5} lifetime incremental carcinogenic risk or hazard quotient of 1 for each chemical (ASTM, 1995). RBSL for benzene was adjusted to account for California carcinogenic slope factor for this chemical

(3) Hyphen ("-") indicates that no value is provided for this chemical.

(4) "RES" indicates that risk level is not exceeded for pure compound present at any concentration.

Table 4

Comparison of Maximum Concentrations of Petroleum Hydrocarbons and Related Chemicals Remaining in Soil with ASTM RBCA Tier 1 Risk-Based Screening Levels near the Former Rifkin UST Locations

Chiron Corporation
Emeryville, California

(5) "N/A" indicates that exposure pathway is not applicable for detected chemicals at the former tank locations. Chemicals detected in soil are not located under or immediately adjacent to buildings.
(6) This exposure pathway is not applicable because groundwater at the site is not used for drinking water.
(7) Maximum benzene concentration detected in soil near the former 1,000-gallon gasoline tank (5.4 mg/kg) exceeds RBSL, but 95% upper confidence limit of mean benzene concentration (0.51 mg/kg) does not.
(8) This exposure pathway is not applicable for lead because lead is not a volatile compound.
(9) No RBSL is given in ASTM (1995). Value shown is the PRG for soil in industrial areas. The PRG value includes the ingestion, dermal contact, and inhalation exposure pathways and is based on a target carcinogenic risk of 10^{-6}.

Table 5
Recent Concentrations of Petroleum Hydrocarbons and Related Chemicals in Groundwater near the Former Rifkin UST Locations and Comparison with ASTM RBCA Tier 1 Risk-Based Screening Levels

Chiron Corporation
Emeryville, California

Tank Description	Well, Boring, or Sample I.D. (1)	Sample Date (2)	Concentration in Groundwater (ug/L)						
			TPH-g	TPH-d	Benzene	Toluene	Ethyl-benzene	Total Xylenes	Total Lead
Northern USTs									
1,500-Gallon Heating Oil Tank	OB-1 (3)	15 Dec 94	NA	300	<0.5	39	1.8	8.8	NA
	MW-2 (3)	10 Jun 97	500	1,500	27	0.5	<0.5	2	55.7 (4)
1,000-Gallon Gasoline Tank	OB-2 (3)	15 Dec 94	NA	1,400	9.4	12	<0.5	2.7	NA
and 500-Gallon Gasoline Tank	MW-1 (3)	10 Jun 97	940	1,300	32	0.9	0.7	3	30.8 (4)
Southern USTs									
500-Gallon Paint Thinner Tank	Pit-2*	6 Jan 94	<50	<50	<0.5	<0.5	<0.5	<0.5	<1,000
and 1,500-Gallon Diesel Tank	MW-3	10 Jun 97	70	<50	<0.5	<0.5	<0.5	<2	10 (4)
	RP-1	10 Jun 97	550	900	<0.5	<0.5	<0.5	<2	10.8 (4)
	SB-4 (5)	5 Apr 94	<5,000	4,200	<5	<5	<5	<10	NA
	SB-5 (5)	5 Apr 94	900	400	<30	240	<5	61	NA
	4543-C (5)	14 Jul 93	160,000	43,000	<2	<2	<2	<2	90 (6)
	RP-2 (5)	10 Jun 97	<50	130	<0.5	<0.5	<0.5	<2	10.5 (4)
	SB-1 (5)	5 Apr 94	<4,000	5,300	<5	<5	<5	<10	NA
RBCA Tier 1 Risk-Based Screening Levels (7)									
- Volatilization from Groundwater to Outdoor Air			- (8)	-	53,000	>S (9)	>S	>S	N/A (10)
- Vapor Intrusion from Groundwater to Indoor Air			-	-	210	85,000	>S	>S	N/A (10)
- Ingestion of Groundwater			N/A (11)	N/A	N/A	N/A	N/A	N/A	N/A
Are applicable Risk-Based Screening Levels exceeded?			-	-	**No**	**No**	**No**	**No**	-

Table 5
Recent Concentrations of Petroleum Hydrocarbons and Related Chemicals in Groundwater near the Former Rifkin UST Locations and Comparison with ASTM RBCA Tier 1 Risk-Based Screening Levels

Chiron Corporation
Emeryville, California

Abbreviations:
NA = Not analyzed
TPH-g = Total petroleum hydrocarbons quantified as gasoline
TPH-d = Total petroleum hydrocarbons quantified as diesel

Notes:
(1) Monitoring well location or grab groundwater sample from soil boring located less than 100 feet downgradient of former tank location; or grab groundwater sample from tank excavation as indicated by asterisk ("*").
(2) Date of most recent sampling from monitoring well or date of collection of grab groundwater sample.
(3) As indicated on Figure 3, these wells and borings are within the area apparently impacted by Shell on the former Rifkin Property. Chemicals migrating from the former Shell Property into this area include but are not limited to TPH, BTEX, and Arsenic.
(4) Lead concentration in samples collected in March or June 1995 by TMC Environmental (TMC, 26 July 1995). There is no indication in this report that these samples were filtered prior to analysis, thus the detected lead concentrations therefore are likely associated with fine-grained soil particles entrained in the groundwater sampling process.
(5) As indicated on Figure 3, these wells and borings are within the area apparently impacted by Sherwin-Williams on the former Rifkin Property. Chemicals migrating from the Sherwin-Williams Property into this area include but are not limited to TPH, BTEX, and Arsenic.
(6) Lead concentration in filtered groundwater samples collected in 1993 by EKI (EKI, 27 October 1993).
(7) Risk-Based Screening Levels ("RBSLs") for groundwater in commercial/industrial areas corresponding to 10^{-5} lifetime incremental carcinogenic risk or hazard quotient of 1 for each chemical (ASTM, 1995). RBSL for benzene was adjusted to account for California carcinogenic slope factor for this chemical.
(8) Hyphen ("-") indicates that no value is provided for this chemical.
(9) ">S" indicates that risk level is not exceeded for all possible dissolved concentrations of this chemical (i.e., risk-based value exceeds saturation concentration).
(10) This exposure pathway is not applicable for lead because lead is not a volatile compound.
(11) "N/A" indicates that exposure pathway is not applicable for detected chemicals at the former tank locations. Groundwater at the site is not used for drinking water.

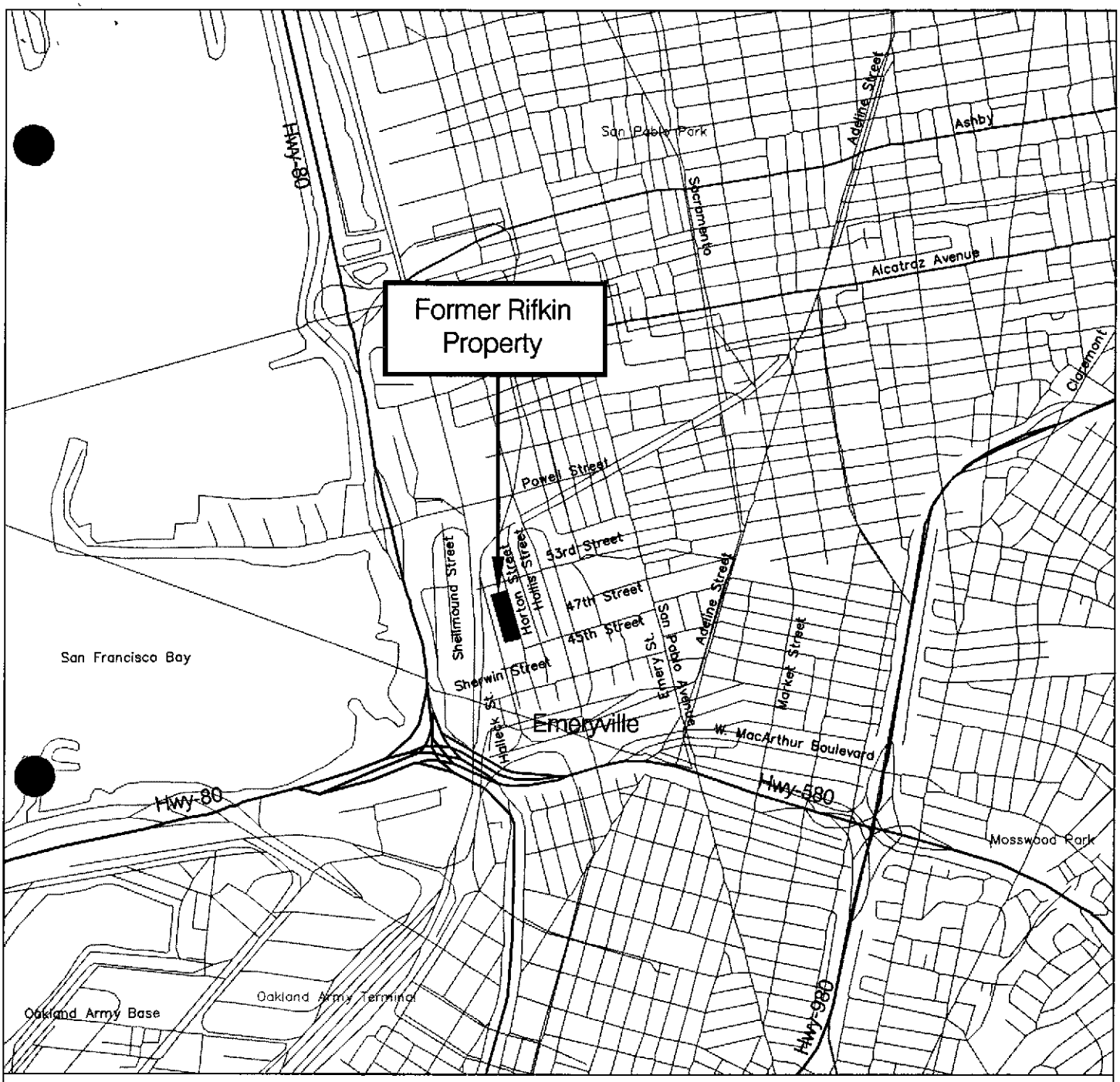
Table 6
Potentially Applicable Water Quality Objectives for San Francisco Bay

Chiron Corporation
Emeryville, California

Reference	Type	Concentration in Water (ug/L)						
		TPH-g	TPH-d	Benzene	Toluene	Ethyl-benzene	Total Xylenes	Total Lead
Objectives Based on Protection of Saltwater Aquatic Organisms								
San Francisco Bay Basin Water Quality Control Plan (1)	4-Day Average	NR	NR	NR	NR	NR	NR	5.6
California Enclosed Bays and Estuaries Plan (2)	4-Day Average	NR	NR	NR	NR	NR	NR	5.6 (1)
U.S. EPA National Ambient Water Quality Criteria (3)	Chronic	NR	NR	700	5,000	NR	NR	5.6
	Acute	NR	NR	5,100	6,300	430	NR	140
U.S. EPA National Toxics Rule (4)	4-Day Average	NR	NR	NR	NR	NR	NR	8.5
Objectives Based on Protection of Human Health (5)								
San Francisco Bay Basin Water Quality Control Plan		NR	NR	NR	NR	NR	NR	NR
California Enclosed Bays and Estuaries Plan		NR	NR	21	300,000	29,000	NR	NR
U.S. EPA National Ambient Water Quality Criteria		NR	NR	40	424,000	3,280	NR	NR
U.S. EPA National Toxics Rule		NR	NR	71	NR	29,000	NR	NR

Abbreviations:
TPH-g = Total petroleum hydrocarbons quantified as gasoline
TPH-d = Total petroleum hydrocarbons quantified as diesel
NR = None reported

Notes:
(1) Water Quality Control Plan for the San Francisco Bay Basin (RWQCB, 21 June 1995) for protection of saltwater aquatic life.
(2) California Enclosed Bays and Estuaries Plan (SWQRB, May 1993) for protection of saltwater aquatic life.
(3) U.S. EPA National Ambient Water Quality Criteria for protection of saltwater aquatic organisms (U.S. EPA, 1 May 1987).
(4) U.S. EPA National Toxics Rule (40 CFR 131, 22 December 1992), and revised metals criteria (3 May 1995), for protection of saltwater aquatic life.
(5) The objectives for protection of human health are based on human consumption of exposed aquatic organisms.



0 2500 5000

(Approximate Scale in Feet)

N

Erler & Kalinowski, Inc.

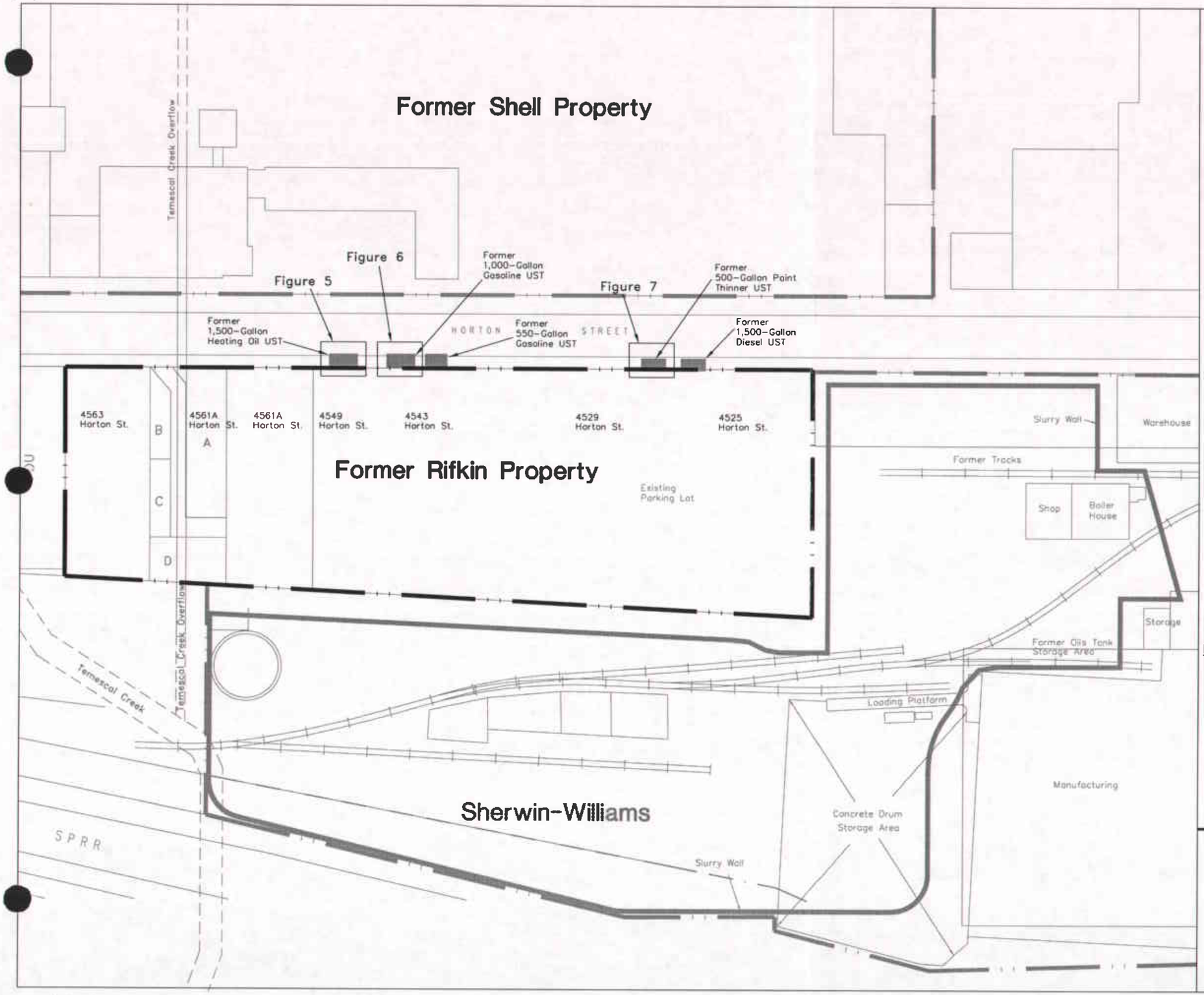
Site Location Map

Notes:

1. All locations are approximate.

Chiron Corporation
Emeryville, CA
December 1997
EKI 970001.81

Figure 1



N

74°

0 80 160

(Approximate Scale in Feet)

LEGEND

Property Boundary

D R A F T

Notes:

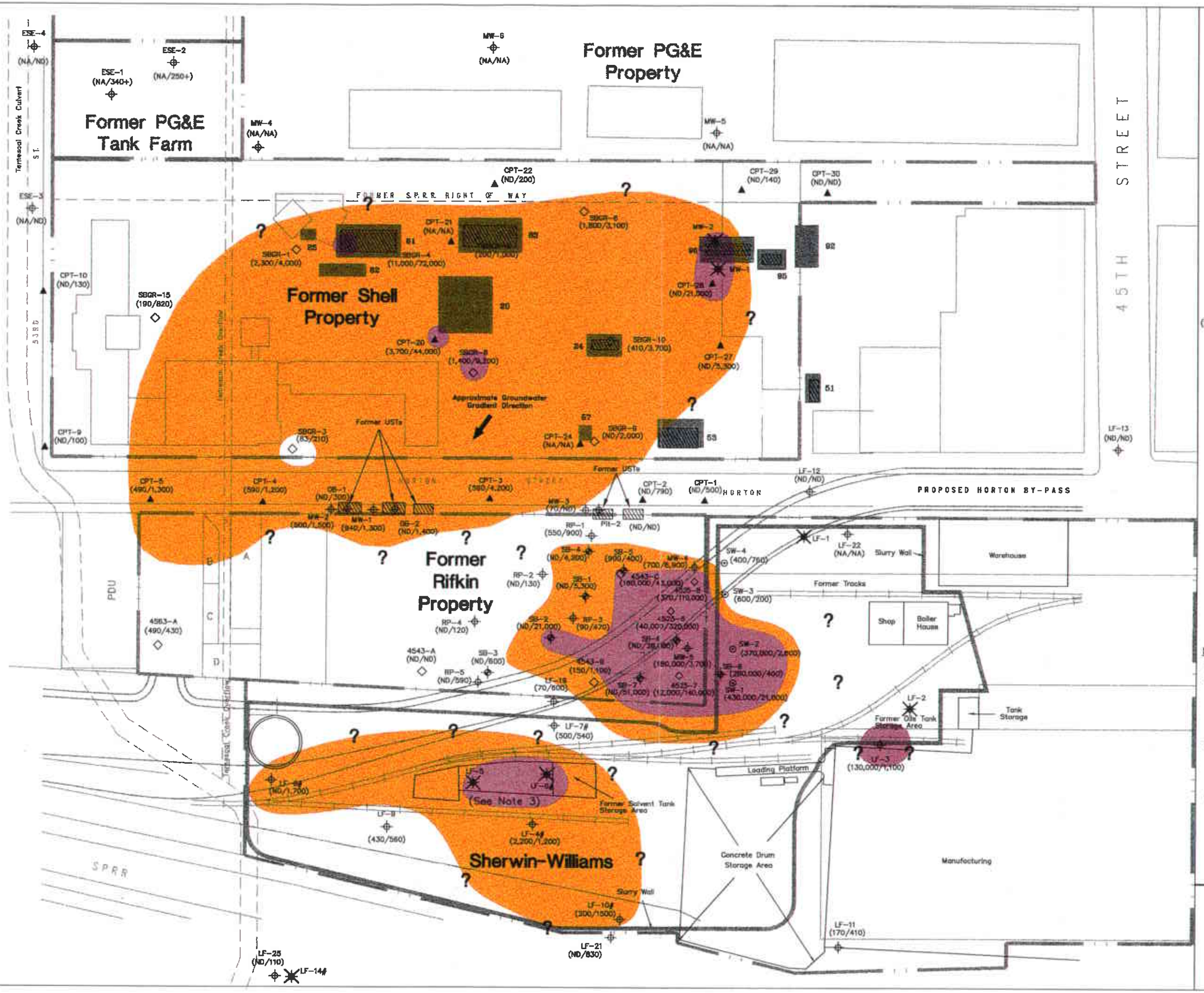
1. All locations are approximate.
2. UST=Underground Storage Tank.

Erler & Kalinowski, Inc.

Former Rifkin Underground Storage Tank Locations

Chiron
Emeryville, CA
December 1997
EKI 970001.81
Figure 2

97 Dec 22 21:50:56 F:\970001.81\NOV97\NOV-2.DWG



LEGEND

- Existing Monitoring Well Location
- Former Monitoring Well Location (Abandoned)
- Grab Groundwater Location by EKI
- CPT/Hydropunch Location by EKI
- Potential Tank Location
- Potential Source Area Location
- Grab Groundwater Location by Levine-Fricke
- Grab Groundwater Location by TMC
- # Not Sampled Since June 1993 or January 1994
- (ND) Not Detected
- (NA) Not Analyzed
- \+ Quantified as Dielectric Oil
- (600/200) (TPH gasoline/TPH diesel) (TPH) Concentrations in ug/L

- 1,000–10,000 ug/L
- >10,000 ug/L

Potential Source Area and Tank Locations Identified on Shell Development Company Property Map (24 May 1982)

- 20 Chemical Products Bldg
- 24 Fuel Tank (Abandoned)
- 25 Chemical Processing
- 51 Boilers Fuel Tank (15,000 gal.)
- 53 Tank Farm No. 4
- 57 Waste Hydrocarbon Disposal Unit
- 61 Tank Farm No. 1
- 62 Pump Shelter Tank Farm No. 1
- 83 Tank Farm No. 2
- 92 Solvent Storage Bldg.
- 95 Tank Farm No. 5 Tanks Removed 9/87
- 96 Tank Farm No. 3 Tanks Removed 7/87

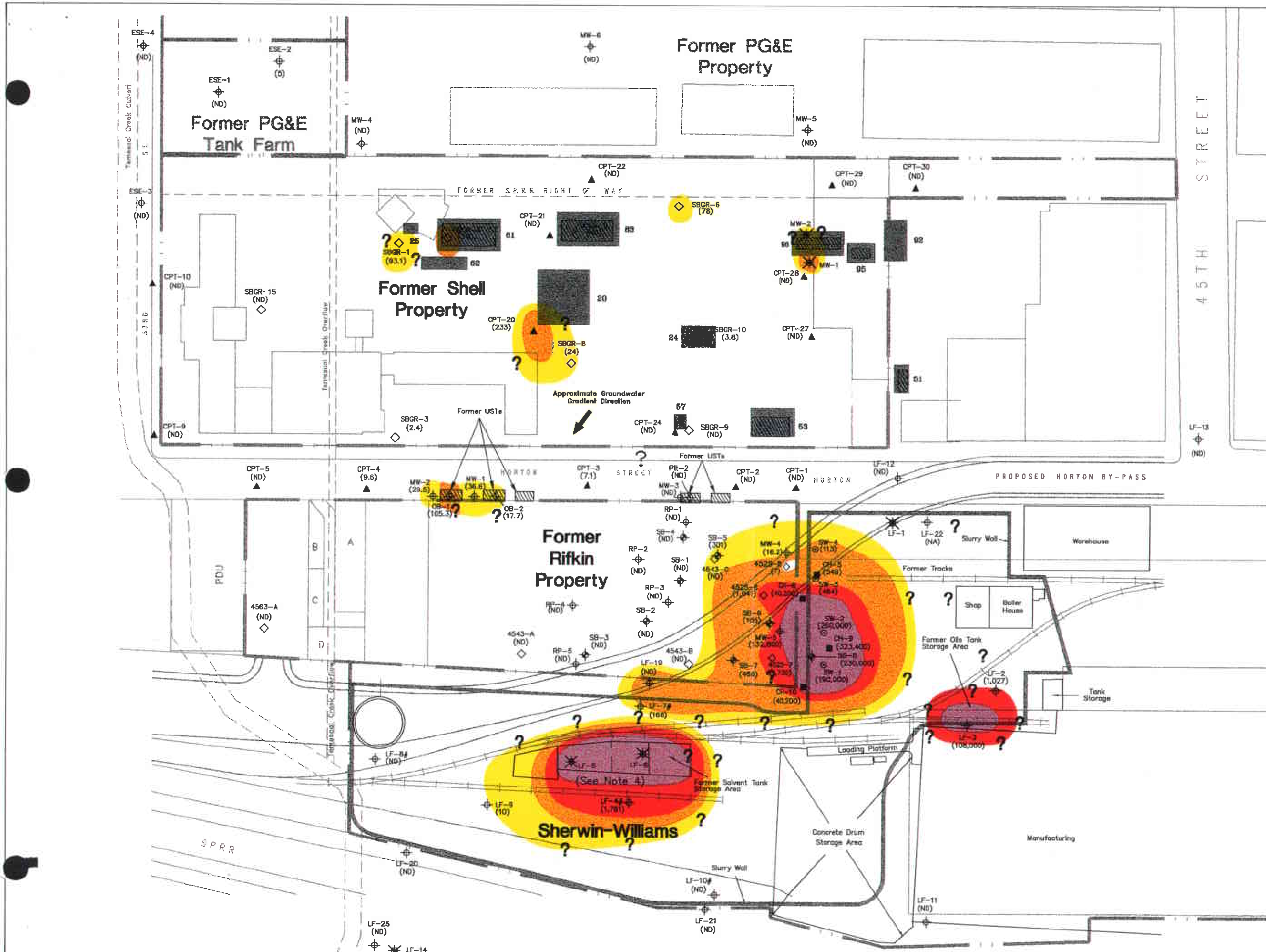
Notes:

1. All locations are approximate.
2. Data from wells MW-4, MW-5, and MW-6 on PG&E are from 1984. Data from MW-4 and MW-5 on Rifkin are from 1996. Data from MW-1, MW-2, MW-3, and RP-1 through RP-5 on Rifkin are from March 1997. Data from LF- wells are from March 1997 unless noted otherwise. Grab groundwater sampling data are from 1990 through 1997.
3. The contour indicating TPH concentrations greater then 10,000 ug/L in the vicinity of abandoned monitoring wells LF-5 and LF-6 is based on historic data from abandoned monitoring wells LF-5 and LF-6.
4. TPH gasoline and TPH diesel reflect Total Petroleum Hydrocarbons quantified within the gasoline and diesel ranges, respectively.

Erler & Kalinowski, Inc.

Total Petroleum Hydrocarbon Concentrations Detected in Shallow Groundwater Less Than 25 feet bgs

Chiron
Emeryville, CA
December 1997
EKI 970001.81
Figure 3



0 50 100
(Approximate Scale In Feet)

LEGEND

- Existing Monitoring Well Location
- Former Monitoring Well Location (Abandoned)
- Grab Groundwater Location by EKI
- CPT/Hydropunch Location by EKI
- Potential Tank Location
- Potential Source Area Location
- Grab Groundwater Location by Levine-Fricke
- Grab Groundwater Location by TMC
- # Not Sampled Since June 1993 or January 1994
- (11) Total BTEX Concetration Detected In Groundwater (ug/L)
- (ND) Not Detected
- (NA) Not Analyzed
- 10–100 ug/L
- 100–1,000 ug/L
- 1,000–10,000 ug/L
- >10,000 ug/L

Potential Source Area and Tank Locations Identified on Shell Development Company Property Map (24 May 1962)

20	Chemical Products Bldg
24	Fuel Tank (Abandoned)
25	Chemical Processing
51	Boilers Fuel Tank (15,000 gal.)
53	Tank Farm No. 4
57	Waste Hydrocarbon Disposal Unit
61	Tank Farm No. 1
62	Pump Shelter Tank Farm No. 1
83	Tank Farm No. 2
92	Solvent Storage Bldg.
95	Tank Farm No. 5 Tanks Removed 9/87
96	Tank Farm No. 3 Tanks Removed 7/87

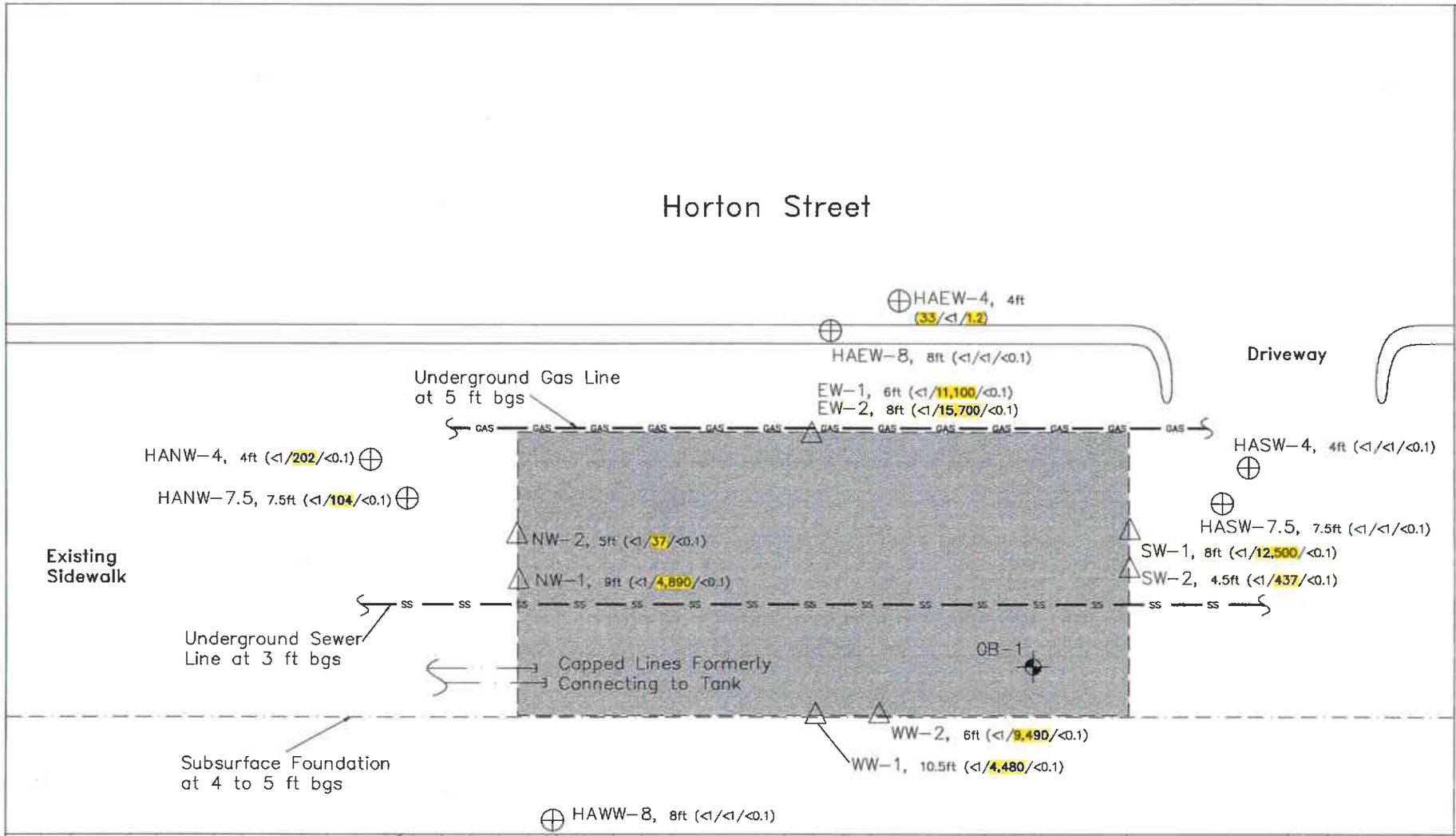
Notes:

1. All locations are approximate.
2. Data from wells MW-4, MW-5, and MW-6 on PG&E are from 1984. Data from MW-4 and MW-5 on Rifkin are from 1996. Data from MW-1, MW-2, MW-3, and RP-1 through RP-5 on Rifkin are from March 1997. Data from LF- wells are from March 1997 unless noted otherwise. Grab groundwater sampling data are from 1990 through 1997.
3. Concentrations shown indicate Total Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX) concentrations detected in groundwater.
4. The contour indicating BTEX concentrations greater than 10,000 ug/L in the vicinity of abandoned monitoring wells LF-5 and LF-6 is based on historic data from abandoned monitoring wells LF-5 and LF-6.

Erler & Kallnowski, Inc.

BTEX Concentration Detected In Shallow Groundwater (<25 feet bgs)

Chiron
Emeryville, CA
December 1997
EKI 970001.81
Figure 4



Former Rifkin Property
4549 Horton Street

PLAN VIEW (Excavation to 11 to 12 ft bgs)

N 74°

0 3 6

(Approximate Scale in Feet)

LEGEND

- Temporary Groundwater Monitoring Well
- Excavation Sidewall Soil Sample Location
- Excavation Bottom Soil Sample Location
- Hand Augered Soil Sample Location
- Excavation Limits

3-10, 8ft (<1/<1/<0.1)

- Concentration (mg/kg) (TPH-g/TPH-d/Benzene)
- Sample Depth (bgs)
- Sample I.D.

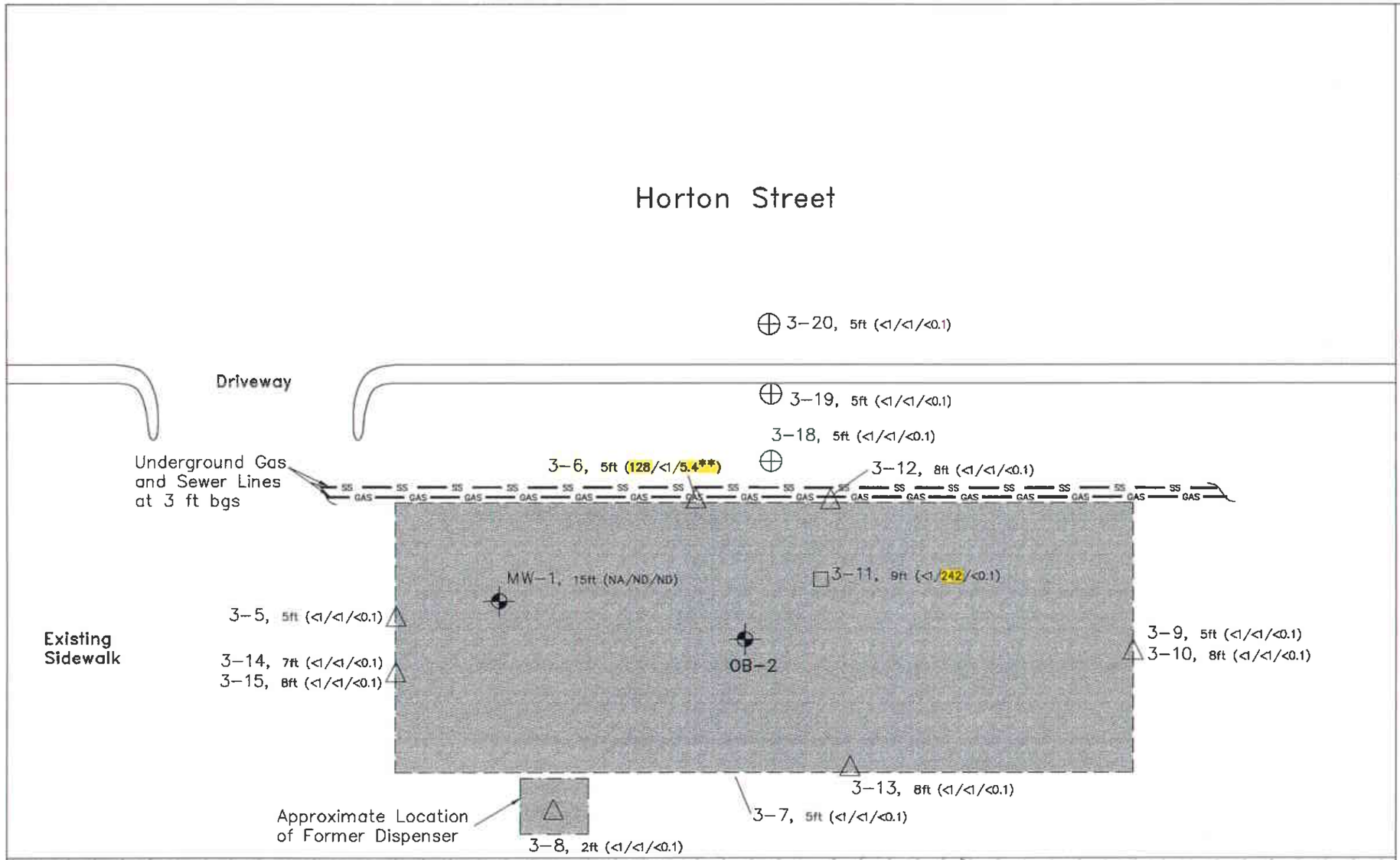
437 Concentration Above Detection Limits

Notes:

1. All locations are approximate.
2. TPH-g = Total Petroleum Hydrocarbons quantified as gasoline
   TPH-d = Total Petroleum Hydrocarbons quantified as diesel
   bgs = Below ground surface
   ND = Not Detected
3. Soil samples also analyzed for toluene, ethylbenzene, xylenes and total lead. Concentrations of these chemicals were less than ASTM RBCA Tier 1 RBSLs.
4. Figure based on TMC, 1 April 1994.

Erler & Kalinowski, Inc.

1,500-Gallon Heating Oil Tank Excavation
Former Rifkin Property
Chiron
Emeryville, CA
December 1997
EKI 970001.81
Figure 5



Former Rifkin
Property
4533 Horton Street

PLAN VIEW (Excavation to 9 to 12 ft bgs)

N 74°

0 3 6

(Approximate Scale in Feet)

LEGEND

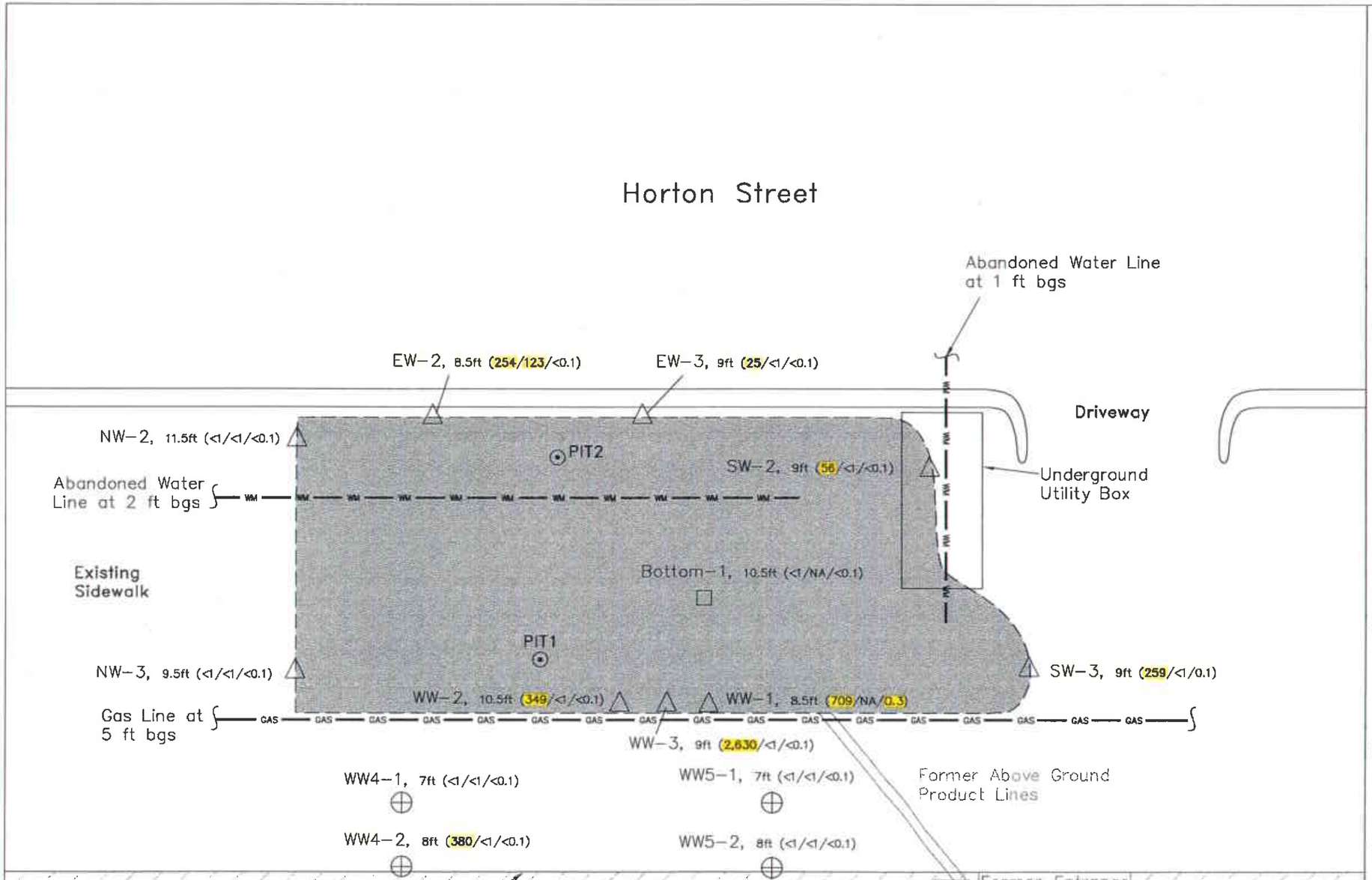
- Abandoned Groundwater Monitoring Well
- Excavation Sidewall Soil Sample Location
- Excavation Bottom Soil Sample Location
- Hand Augered Soil Sample Location
- Excavation Limits
- 3-10, 8ft (<1/<1/<0.1) — Concentration (mg/kg) (TPH-g/TPH-d/Benzene); Sample Depth (bgs); Sample I.D.
- ** Analyte exceeds ASTM RBCA Tier 1 RBSLs
- 242 Concentration Above Detection Limits

Notes:

1. All locations are approximate.
2. TPH-g = Total Petroleum Hydrocarbons quantified as gasoline
   TPH-d = Total Petroleum Hydrocarbons quantified as diesel
   bgs = Below ground surface
   ND = Not Detected
   NA = Not Analyzed
3. Soil samples also analyzed for toluene, ethylbenzene, xylenes and total lead. Concentrations of these chemicals were less than ASTM RBCA Tier 1 RBSLs.
4. Figure based on TMC, 25 April 1994.

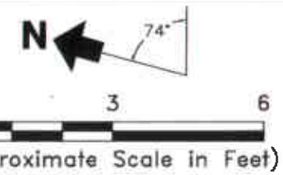
Erler & Kalinowski, Inc.

1,000-Gallon Gasoline
Tank Excavation
Former Rifkin Property
Chiron
Emeryville, CA
December 1997
EKI 970001.81
Figure 6



Former Rifkin
Property
4529 Horton Street

PLAN VIEW (Excavation to 11 to 12 ft bgs)



LEGEND

- ⊙ Grab Groundwater Sample Location from Excavation
- △ Excavation Sidewall Soil Sample Location
- □ Excavation Bottom Soil Sample Location
- ⊕ Hand Augered Soil Sample Location
- Excavation Limits
- 3-10, 8ft (<1/<1/<0.1) — Sample I.D. / Sample Depth (bgs) / Concentration (mg/kg) (TPH-g/TPH-d/Benzene)
- 259 Concentration Above Detection Limits

Notes:

1. All locations are approximate.
2. TPH-g = Total Petroleum Hydrocarbons quantified as gasoline
   TPH-d = Total Petroleum Hydrocarbons quantified as diesel
   bgs = Below ground surface
   ND = Not Detected
   NA = Not Analyzed
3. Soil samples also analyzed for toluene, ethylbenzene, xylenes and total lead. Concentrations of these chemicals were less than ASTM RBCA Tier 1 RBSLs.
4. Figure based on TMC, 1 April 1994.

Erler & Kalinowski, Inc.

500-Gallon Paint Thinner
Tank Excavation
Former Rifkin Property
Chiron
Emeryville, CA
December 1997
EKI 970001.81
Figure 7

APPENDIX A

Summary of Available Information
Regarding the Contents of the Former Rifkin USTs

APPENDIX A
Summary of Available Information Regarding the Contents of the Former Rifkin USTs

As discussed in Section 2.2, the basis upon which TMC and/or Safety Specialists identified the contents of the five former Rifkin USTs is unclear and in some cases inconsistent with other information obtained by EKI. However, in all cases, the available information suggests that the former Rifkin USTs were used for storage of various types of petroleum hydrocarbons.

Available information obtained and reviewed by EKI regarding the former contents of the five former Rifkin USTs (listed from north to south), including information provided by TMC and Safety Specialists is summarized below:

Tank Designation:	**Information Obtained by EKI Regarding the Former Tank Contents:**
1,500-gallon Heating Oil Tank	• A California Water Resources Control Board Underground Storage Tank Permit Application for tank removal submitted by the Receiver of the former Rifkin Property on 26 October 1993 lists the contents of this former UST as "heating oil" (ACDEH, 1997). • TMC identified this former UST as "1,500-gallon heating oil tank" in its report documenting the removal of this UST (TMC, 1994a).
1,000-gallon Gasoline Tank	• An Alameda County Health Care Services Agency Underground Tank Closure/Modification Plan submitted by the prior owner of the former Rifkin Property on 16 August 1988 lists the contents of this former UST as "gasoline" (SSP, 1988a). • TMC and Safety Specialists identified this former UST as the "1,000-gallon Gasoline Tank" in their reports regarding removal of and sampling at this UST (TMC, 1994c; SSP, 1988a,b,c)
550-gallon Gasoline Tank	• TMC and Safety Specialists identified this former UST as the "550-gallon gasoline tank" in reports documenting the removal of this UST and reports documenting associated environmental sampling (TMC, 1994c; SSP, 1988b,c);

APPENDIX A
Summary of Available Information Regarding the Contents of the Former Rifkin USTs

Tank Designation:	**Information Obtained by EKI Regarding the Former Tank Contents:**
500-gallon Paint Thinner Tank	• During its Preliminary Site Investigation of the former Rifkin Property, Harding Lawson observed identification tags fastened to this former UST. These tags were labeled as "Union Thinner No. 5" and "S-76 Solvent" (HLA, 1992). • In August 1993, EKI sampled the contents of this former UST. The tank contents sample was analyzed for petroleum hydrocarbons, VOCs, SVOCs, PCBs, and five metals (cadmium, chromium, lead, nickel, and zinc) (see Section 3.4). Petroleum hydrocarbons detected in this tank contents sample (TPHg and TPHd at concentrations of 790 ug/l and 24,000 ug/l, respectively) were tentatively identified as paint thinner. No VOCs, SVOCs, PCBs, or cadmium were detected in this tank contents sample. Four metals were detected in this tank contents sample at the following concentrations: Chromium (20 ug/l), lead (400ug/l), nickel (50 ug/l), and zinc (7,400 ug/l) (EKI, 1993). • A California Water Resources Control Board Underground Storage Tank Permit Application for tank removal submitted by the Receiver of the former Rifkin Property on 26 October 1993 lists the contents of this former UST as "heating oil" (ACDEH, 1997).
1,500-gallon Diesel Tank	• During its Preliminary Site Investigation of the former Rifkin Property, Harding Lawson noted that the cap on this former UST was labeled as "S.T. Johnson Co., Oil Burners" (HLA, 1992). • In July 1993, EKI sampled the contents of this former UST. The tank contents sample was analyzed for petroleum hydrocarbons, VOCs, SVOCs, and PCBs (see Section 3.5). Petroleum hydrocarbons detected in this tank contents sample (TPHd at a concentration of 340,000 ug/L) were tentatively identified as kerosene. No other compounds were detected in this tank contents sample (EKI, 1993). • A California Water Resources Control Board Underground Storage Tank Permit Application for tank removal submitted by the Receiver of the former Rifkin Property on 26 October 1993 lists the contents of this former UST as "heating oil" (ACDEH, 1997).

APPENDIX B

Figure 11 entitled "Groundwater Elevation Map, Higher High Tide, January 10, 1990"

from *Results of Second Phase Environmental Investigation, Sherwin-Williams Plan, Emeryville, California,* prepared by Levine-Fricke-Recon, dated 4 April 1990

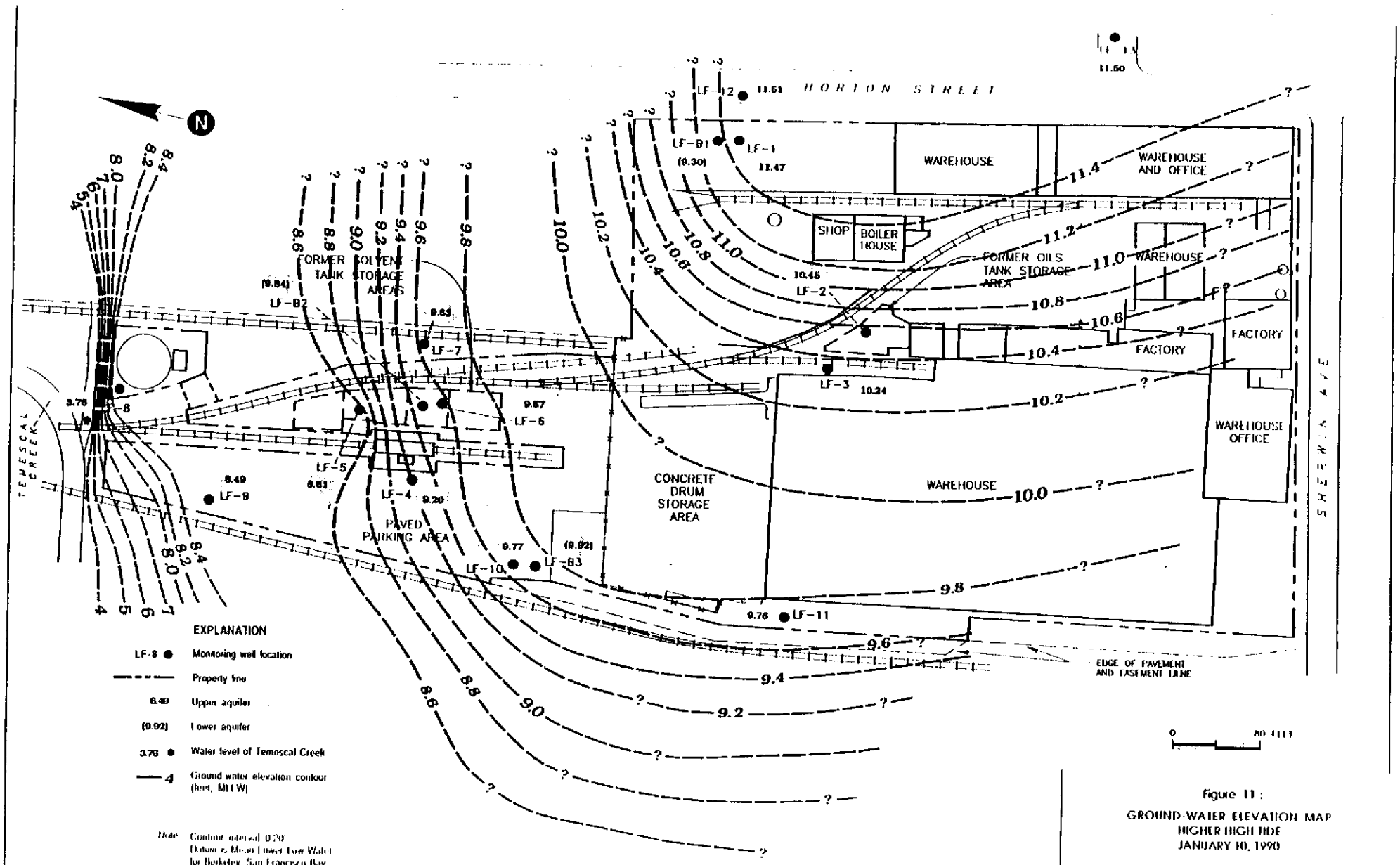


Figure 11 :
GROUND-WATER ELEVATION MAP
HIGHER HIGH TIDE
JANUARY 10, 1990

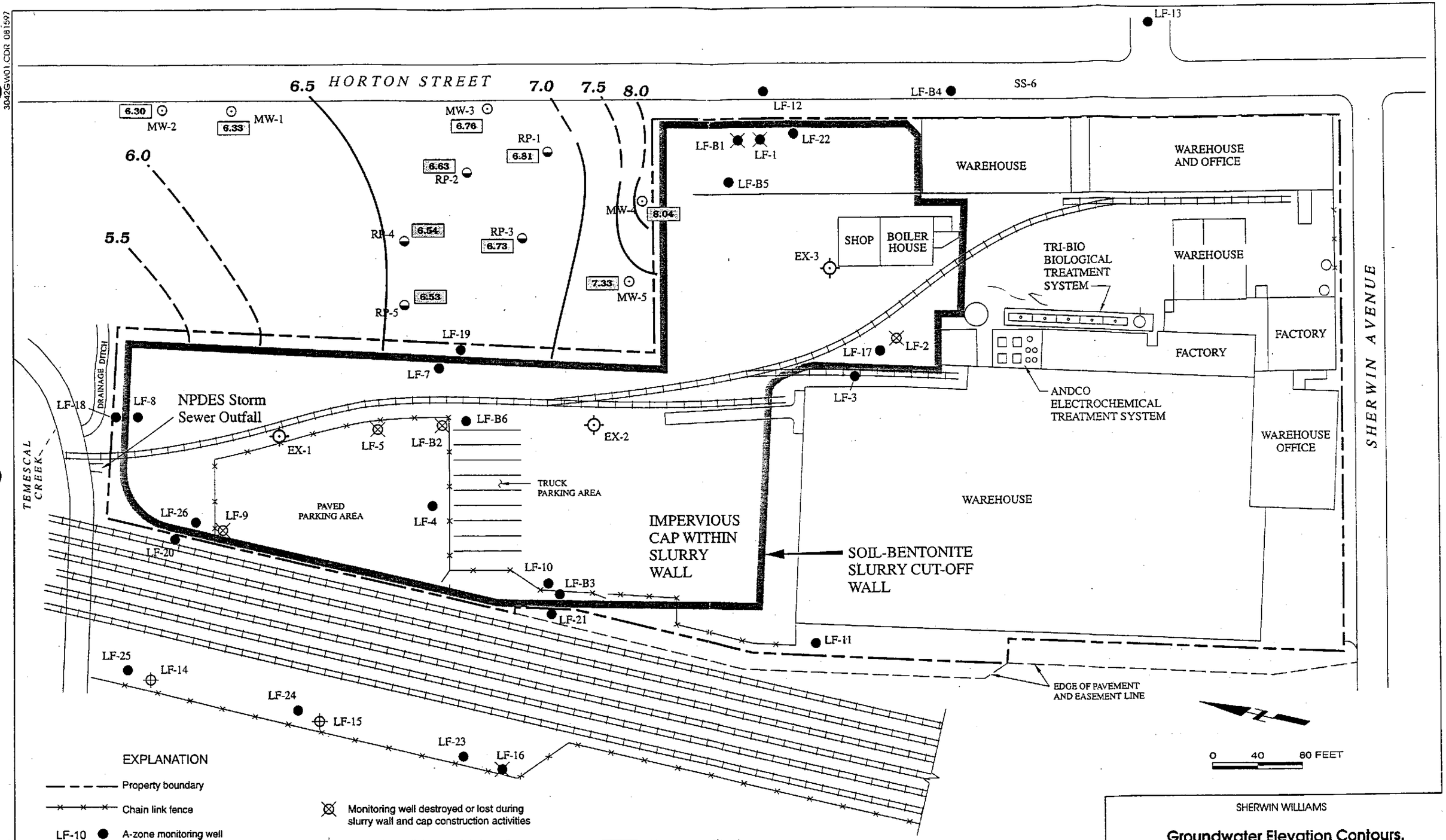
LEVINE • FRICKE

APPENDIX C

Figure 1 entitled "Groundwater Elevation Contours, May 30, 1997"

from *Quarterly Groundwater Monitoring Results for April 1 through June 30, 1997, A Portion of the Rifkin Property, 4525-4563 Horton Street, Emeryville, California,* prepared by Levine-Fricke-Recon, dated 18 August 1997

3042GW01.CDR 081597



EXPLANATION

- Property boundary
- Chain link fence
- LF-10 ● A-zone monitoring well
- LF-B3 ● B-zone monitoring well
- EX-1 ⊙ Groundwater extraction well location
- ✱ Monitoring well destroyed under permit
- ⊠ Monitoring well destroyed or lost during slurry wall and cap construction activities
- ⊕ Monitoring well destroyed during railway expansion activities
- ⊙ Rifkin property monitoring wells (TMC)
- ◒ Rifkin property monitoring wells (Levine-Fricke)
- 6.63 Groundwater elevation (feet above mean sea level)
- ~6.0 Groundwater elevation contour (feet above mean sea level; dashed where inferred)

SHERWIN WILLIAMS

Groundwater Elevation Contours, May 30, 1997

Levine-Fricke-Recon Figure 1

Project No. 3042

30429020.CDR 081597

APPENDIX D

Trend Analysis of Groundwater Monitoring Data

APPENDIX E

Figure 3 entitled "Proposed Work for the Rifkin Property"

from Draft *Work Plan for Site Investigation, The Sherwin-Williams Facility, 1450 Sherwin Avenue, Emeryville, California,*
prepared by Levine-Fricke-Recon, dated 2 June 1997

3435

53rd STREET

TEMESCAL CREEK OVERFLOW

HORTON STREET

45th ST.

EXPLANATION

- Property boundary
- Chain link fence
- LF-10 A-zone monitoring well
- LF-B3 B-zone monitoring well
- EX-1 Groundwater extraction well location
- Monitoring well destroyed under permit
- Monitoring well destroyed or lost during slurry wall and cap construction activities
- Monitoring well destroyed during railway expansion activities
- Rifkin property monitoring wells (TMC)
- Rifkin property monitoring wells (Levine•Fricke•Recon)
- Proposed CPT boring location and soil and groundwater sampling location
- Proposed monitoring well location
- Proposed groundwater extraction well location

LF-13

FORMER USTs

MW-1

MW-2

MW-3

FORMER USTs

LF-12

LF-B4

LF-B1

LF-1

LF-22

LF-B5

WAREHOUSE BLDG 31

WAREHOUSE AND OFFICE BLDG 1

RP-1

RP-2

RP-3

RP-4

RP-5

MW-4

MW-5

B

A

C

D

SHOP

BOILER HOUSE

EX-3

YARD A-2

TANK STORAGE BLDG 34

TRI-BIO BIOLOGICAL TREATMENT SYSTEM

WAREHOUSE BLDG 2

LF-19

LF-7

DRAINAGE DITCH

LF-18

LF-8

NPDES Storm Sewer Outfall

LF-17

LF-2

BLDG 29

STORAGE BLDG 4

PACKAGING/LAB BLDG 2

LF-3

TANK STORAGE

BLDG 30

ANDCO ELECTROCHEMICAL TREATMENT SYSTEM

LF-B6

EX-1

LF-5

LF-B2

EX-2

MANUFACTURING BLDG 35

TRUCK PARKING AREA

PAVED PARKING AREA

IMPERVIOUS CAP WITHIN SLURRY WALL

SOIL-BENTONITE SLURRY CUT-OFF WALL

TEMESCAL CREEK

LF-26

LF-9

LF-4

LF-20

LF-10

LF-B3

LF-21

LF-11

0 40 80 FEET

297

34355003.C

SHERWIN WILLIAMS

Proposed Work for the Rifkin Property

Levine-Fricke-Recon

Figure 3

Project No. 3435

APPENDIX D
Trend Analysis of Groundwater Monitoring Data

In order to evaluate temporal trends in petroleum hydrocarbon-related compounds detected in groundwater, concentrations of TPH-g and TPH-d concentrations detected in (a) wells MW-1 and MW-2, which are located adjacent to the northern former Rifkin UST locations, and (b) well MW-3, which is located adjacent to the southern former Rifkin UST locations (Figures 3 and 4) were evaluated. Due to potential issues related to benzene concentrations detected in groundwater near the northern former Rifkin USTs (Section 5), trends in benzene concentrations at monitoring wells MW-1 and MW-2 were also evaluated.

Groundwater samples from wells MW-1, MW-2 and MW-3 have been collected 9 times since December 1994 (Table 3). TPH-g, and TPH-d concentrations detected in groundwater samples collected from monitoring wells MW-1, MW-2 and MW-3 versus time are shown on Figures D-1 and D-2, respectively. As indicated on these figures, TPH-g concentrations appear to have declined since 1994, and TPH-d concentrations appear to have remained stable.

Benzene concentrations detected in monitoring wells MW-1 and MW-2 are shown on Figure D-3. As indicated on this figure, benzene concentrations appear to have increased between 1994 and 1995, but remained stable or decreased in 1996 and 1997.

Groundwater data for TPH-g, TPH-d, and BTEX compounds from monitoring wells MW-1, MW-2, and MW-3 were also statistically analyzed for trends using the Mann-Kendall test in order to further demonstrate that groundwater conditions are stable or improving. The results of the Mann-Kendall test indicate that no upward trend exists for the six analytes in any of the monitoring wells (i.e., a total of eighteen statistical tests). These results provide evidence of stable or improving groundwater conditions adjacent to the former Rifkin USTs. Further discussion regarding these tests is provided in Section D.1.

D.1 Mann-Kendall Trend Analysis of Groundwater Monitoring Data

This section presents the results of a statistical analysis to demonstrate that no significant upward trend exists in the groundwater monitoring data (i.e., to show that groundwater conditions are stable or improving.)

The groundwater data for TPH-g, TPH-d, and BTEX compounds from monitoring wells MW-1, MW-2, and MW-3 were statistically analyzed for a trend using the nonparametric Mann-Kendall test. The Mann-Kendall test is useful for detecting trends because the data do not have to be equally spaced in time and do not need to follow a particular distribution. For concentrations not detected above the laboratory method detection limit, a value equal to the detection limit value was used in the test. The null hypothesis tested

was "no upward trend exists." The alternative hypothesis was "an upward trend exists." The test was applied at a significance level equal to 0.05. Statistical guidance from the U.S. EPA (1994) recommends a significance level of 0.05 to help ensure adequate statistical power, while limiting the number of false positive results.

The number of measurements, "n", and the calculated "S" statistic are listed in Table D-1 for each chemical and for each well. According to Gilbert (1987), when S is less than zero, the null hypothesis, "no upward trend exists", is accepted. When S is greater than zero, if the probability associated with S *is greater than* the significance level of 0.05, the null hypothesis, "no upward trend exists", is also accepted.

As shown in Table D-2, the S statistic is negative for TPH-g and TPH-d in wells MW-1, MW-2, and MW-3, indicating that "no upward trend exists" for these analytes. The S statistic for benzene in well MW-1 is 8, corresponding to a probability level of 0.238 for S=8 and n=9 (Hollander and Wolfe, 1973). Because the probability of 0.238 is greater than significance level of 0.05, the null hypothesis, "no upward trend exists", is accepted. Similarly, for benzene in well MW-2, the probability value is greater than the significance level of 0.05 (Table D-2). Because benzene has not been detected in any groundwater samples from well MW-3, the data are clearly not increasing and the S statistic was not calculated. Likewise, for toluene, ethylbenzene, and xylenes, the S statistic is negative, the probability level is greater than 0.05, or the compound was never detected (ethylbenzene in MW-3). Therefore, the null hypothesis, "no upward trend exists" (i.e., there is no upward trend), is accepted for TPH-g, TPH-d, and all four BTEX compound concentrations in MW-1, MW-2, and MW-3.

The results of the Mann-Kendall test indicate that no upward trend exists for the three monitoring wells for the six analytes (i.e., a total of eighteen statistical tests) providing evidence of stable or improving groundwater conditions adjacent to the former Rifkin USTs (i.e., a stable or shrinking plume).

Table D-1
Concentrations of Petroleum Hydrocarbons and Related Chemicals in Groundwater Downgradient of Former Tank Locations at the Former Rifkin Property

Chiron Corporation
Emeryville, California

Well Number	Sample Date (1)	Concentration in Groundwater (ug/L)					
		TPH-g	TPH-d	Benzene	Toluene	Ethylbenzene	Total Xylenes
MW-1	16 Dec 94	NA	16,000 (3)	13	<0.4 (3)	<0.4	3.0
	28 Mar 95	7,410	3,600	28	1.3	9.3	2.5
	8 Jun 95	2,100	2,600	37	1.6	3.0	2.3
	9 Jan 96	1,300	4,000	53	3.0	2.0	6
	17 Apr 96	1,700	1,100	65	3.5	5.5	7
	31 Jul 96	2,400	12,000	53	9.8	12	14
	19 Nov 96	850	1,500	32	1.7	1.7	5
	25 Mar 97	990	1,800	49	2.2	2.4	5
	10 Jun 97	940	1,300	32	0.9	0.7	3
MW-2	16 Dec 94	NA	12,000 (3)	14	<0.4	<0.4	1.1
	28 Mar 95	3,000	4,400	16	1.1	<0.4	0.9
	8 Jun 95	1,300	3,800	22	0.9	0.5	0.9
	9 Jan 96	900	2,500	39	1.0	0.9	2.0
	17 Apr 96	620	4,600	32	1.3	8.0	<2
	31 Jul 96	710	3,200	42	1.6	0.9	<2
	19 Nov 96	370	3,200	18	1.7	0.7	4
	25 Mar 97	520	3,300	24	0.7	1.0	<2
	10 Jun 97	500	1,500	27	0.5	<0.5	2

Table D-1
Concentrations of Petroleum Hydrocarbons and Related Chemicals in Groundwater Downgradient of Former Tank Locations at the Former Rifkin Property

Chiron Corporation
Emeryville, California

Well Number	Sample Date (1)	Concentration in Groundwater (ug/L)					
		TPH-g	TPH-d	Benzene	Toluene	Ethylbenzene	Total Xylenes
MW-3	12/16/94	NA	27,000 (3)	<0.5	<0.5	<0.5	<0.5
	3/28/95	2,000	1,500	<0.8	<0.4	<1	<0.4
	6/8/95	430	550	<0.8	<0.4	<0.4	<0.4
	1/9/96	200	300	<5	<5	<5	<5
	4/17/96	160	180	<5	<5	<5	<5
	7/31/96	9,400	420	<5	<5	<5	<5
	11/19/96	470	460	<5	0.6	<5	4
	3/25/97	310	<50	<5	<5	<5	<5
	6/10/97	70	<50	<0.5	<0.5	<0.5	<0.5

Abbreviations:
NA = Not analyzed
TPH-g = Total petroleum hydrocarbons quantified as gasoline
TPH-d = Total petroleum hydrocarbons quantified as diesel

Notes:
(1) Groundwater samples in 1996 and 1997 were collected by Levine-Fricke-Recon (18 August 1997). Groundwater samples collected in 1994 and 1995 were collected by TMC Environmental.
(2) Result obtained from an analyses by Advanced Materials Entigeering Research, Inc. entitled "TPH-Full Scan". It is not clear if this result includes TPH-g, TPH-g, or both. This result was not used in the Mann-Kendall trend analysis for TPH-g and TPH-d.
(3) Less than symbol ("<") indicates that the compound was not present above the detection limit indicated.

Table D-2
Results of Trend Analysis for Groundwater Data from Downgradient Monitoring Wells MW-1 and MW-2 at the Former Rifkin Property (1)

Chiron Corporation
Emeryville, California

Statistical Parameters	Well MW-1					
	TPH-g	TPH-d	Benzene	Toluene	Ethylbenzene	Xylenes
n (2)	8	8	9	9	9	9
S (3)	-16	-8	8	10	-4	6
Mann-Kendall Probability (4)	NA (5)	NA	0.238	0.179	NA	0.306
Significance Level (6)	0.05	0.05	0.05	0.05	0.05	0.05
Result (7)	No upward trend	No upward trend	No upward trend	No upward trend	No upward trend	No upward trend

Statistical Parameters	Well MW-2					
	TPH-g	TPH-d	Benzene	Toluene	Ethylbenzene	Xylenes
n	8	8	9	9	9	9
S	-22	-11	14	6	12	11
Mann-Kendall Probability	NA	NA	0.090	0.306	0.130	0.155
Significance Level	0.05	0.05	0.05	0.05	0.05	0.05
Result	No upward trend	No upward trend	No upward trend	No upward trend	No upward trend	No upward trend

Table D-2
Results of Trend Analysis for Groundwater Data from Downgradient Monitoring Wells MW-1 and MW-2 at the Former Rifkin Property (1)

Chiron Corporation
Emeryville, California

Statistical Parameters	Well MW-2					
	TPH-g	TPH-d	Benzene	Toluene	Ethylbenzene	Xylenes
n	8	8	9	9	9	9
S	-10	-17	NC (8)	4	NC	4
Mann-Kendall Probability	NA	NA	NA	0.381	NA	0.381
Significance Level	0.05	0.05	0.05	0.05	0.05	0.05
Result	No upward trend	No upward trend	No upward trend	No upward trend	No upward trend	No upward trend

Abbreviations:

TPH-g = Total petroleum hydrocarbons quantified as gasoline

TPH-d = Total petroleum hydrocarbons quantified as diesel

Notes:

(1) The data from Table D-1 were evaluated using the Mann-Kendall test. A value equal to one half of the detection limit was used for concentrations reported to be less than laboratory method detection limits.

(2) "n" is the number of sampling events.

(3) "S" is the Mann-Kendall statistic calculated using the methodology described in Gilbert (1987).

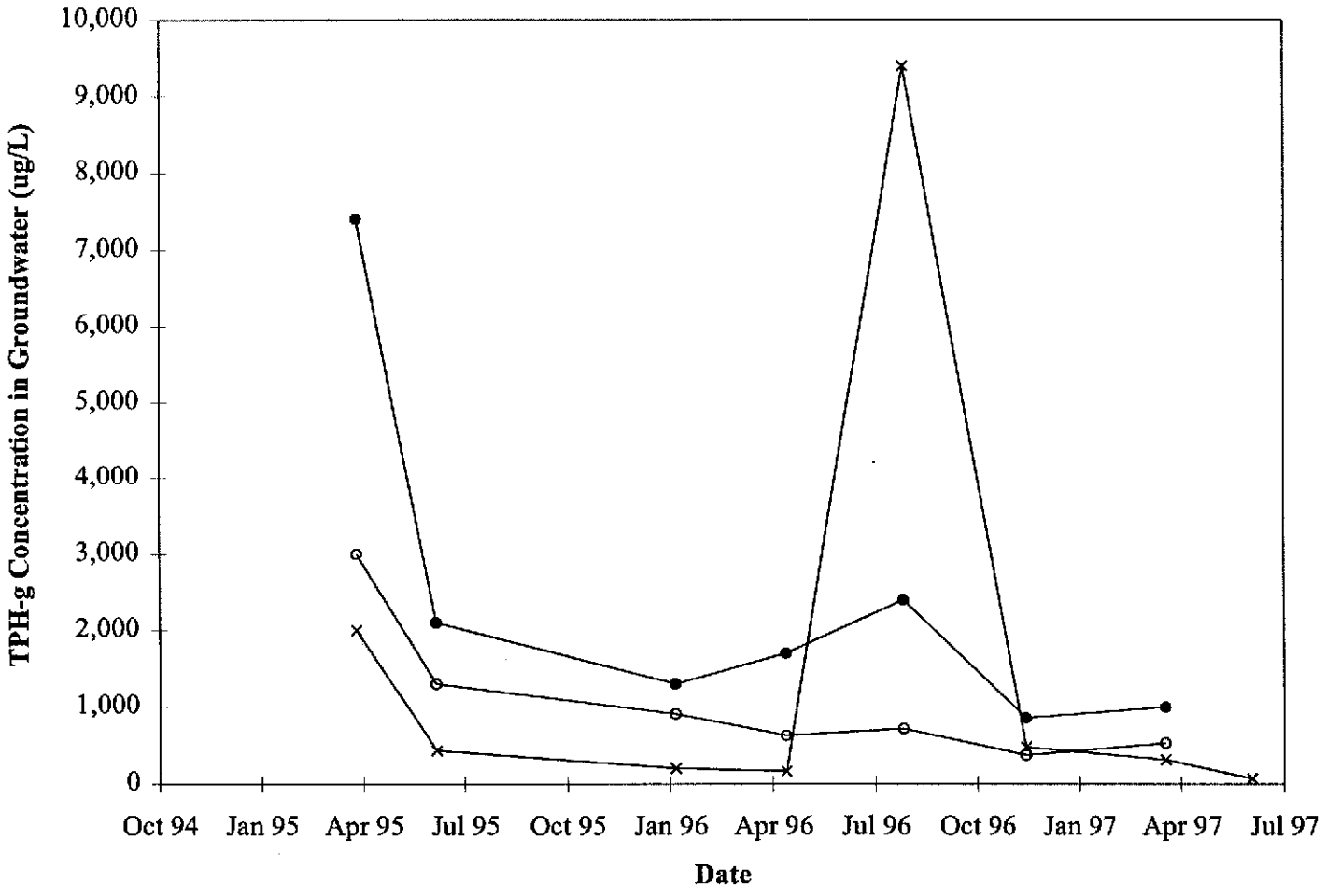
(4) Mann-Kendall probability is related to the values of S and n, and is obtained from Table A21 in Hollaender and Wolfe (1973).

(5) A negative S value indicates that the data are clearly not increasing and a Mann-Kendall probability is not applicable ("NA").

(6) A significance level of 0.05 is recommended by U.S. EPA (1994).

(7) A negative S value or a Mann-Kendall probability greater than the significance level indicates that there is no upward trend in the data (Gilbert, 1987).

(8) This compound was not detected in any samples from this well. Therefore, the data are clearly not increasing and the "S" statistic was not calculated.



LEGEND

- MW-1
- MW-2
- MW-3

Notes:

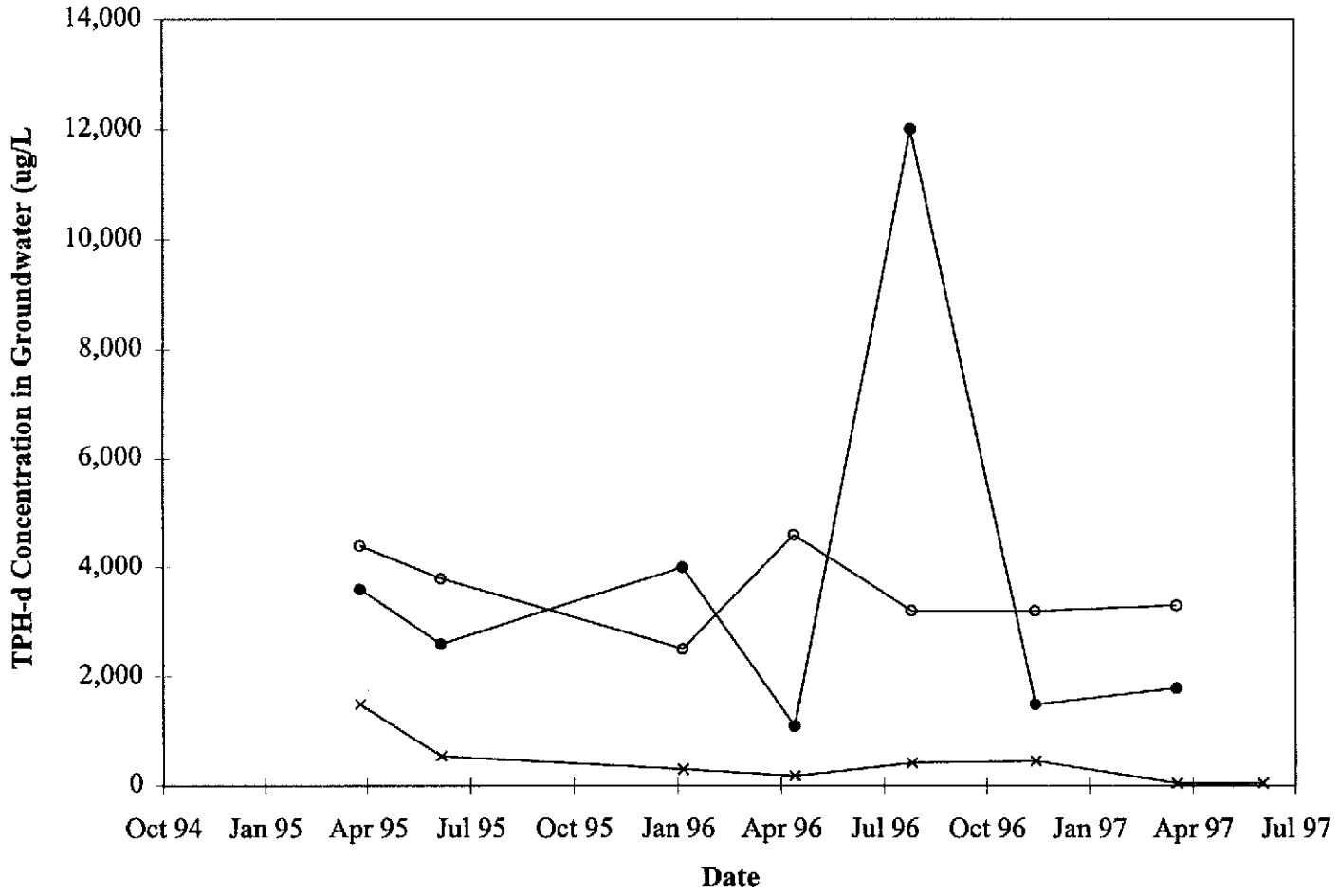
1. Samples collected in 1994 and 1995 were collected by TMC Environmental. Samples collected in 1996 and 1997 were collected by Levine-Fricke-Recon.

2. TPH-g = Total Petroleum Hydrocarbons quantified as gasoline.
   USTs = Underground Storage Tanks

Erler & Kalinowski, Inc.

TPH-g Concentrations in Groundwater Samples Collected Downgradient of Former USTs at the Former Rifkin Property

Chiron
Emeryville, California
October 1997
EKI 970001.81
Figure D-1



LEGEND

- MW-1
- MW-2
- MW-3

Notes:

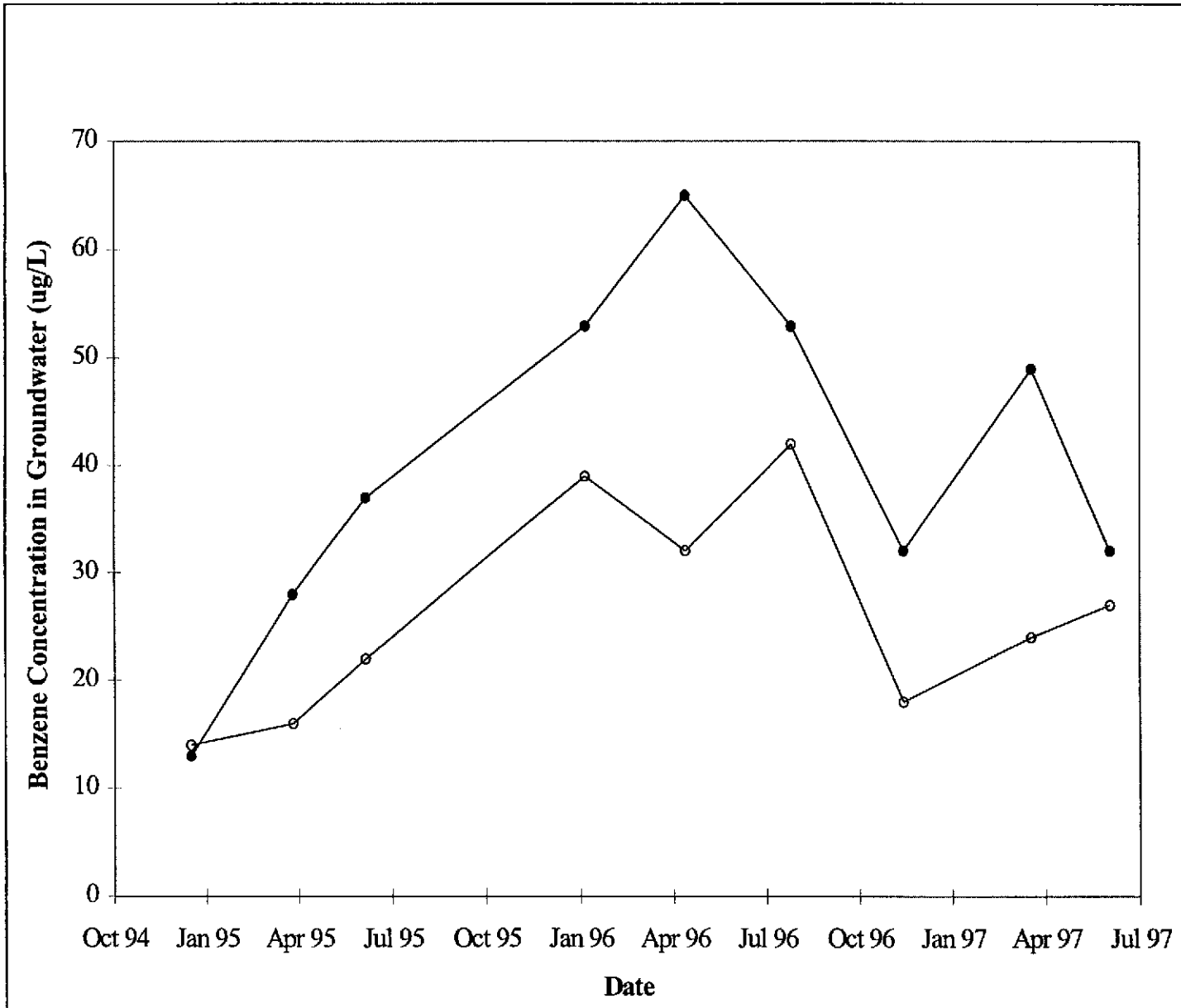
1. Samples collected prior to 1996 were collected by TMC Environmental. Samples collected from 1996 to 1997 were collected by Levine-Fricke-Recon.

2. TPH-d = Total Petroleum Hydrocarbons quantified as diesel
   USTs = Underground Storage Tanks

Erler & Kalinowski, Inc.

TPH-d Concentrations in Groundwater Samples Collected Downgradient of Former USTs at the Former Rifkin Property

Chiron
Emeryville, California
October 1997
EKI 970001.81
Figure D-2



LEGEND

MW-1

MW-2

Notes:

1. Samples collected in 1994 and 1995 were collected by TMC Environmental. Samples collected in 1996 and 1997 were collected by Levine-Fricke-Recon.
2. USTs = Underground Storage Tanks
3. Benzene has not been detected in samples collected from MW-3

Erler & Kalinowski, Inc.

Benzene Concentrations in Groundwater Samples Collected Downgradient of Former USTs at the Former Rifkin Property

Chiron
Emeryville, California
October 1997
EKI 970001.81
Figure D-3