OWENS-BROCKWAY
GLASS CONTAINERS
a unit of Owens-Illinois

ENVIRONMENTAL PROTECTION

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February 17, 2000

#866

Mr. Barney M. Chan
Alameda County Health Care Services
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

Subject: Work Plan - Owens-Brockway Oakland Plant

Dear Mr. Chan:

The attached Work Plan describes additional groundwater investigation and monitoring activities at our Oakland plant in response to your December 29, 1999 letter. We propose to implement the Work Plan and evaluate the data before preparing the Corrective Action Plan requested in your letter. We are, however, implementing passive oil skimming in the wells containing separate phase petroleum hydrocarbons. This activity is described in the Work Plan.

For the proposed investigation activities, Kennedy/Jenks' site safety and health plan will address hazards associated with the groundwater investigation, sampling and residuals management. Therefore, we do not plan to prepare a Risk Management Plan (RMP) at this time. We believe an RMP may be appropriate once the investigation is complete and the feasibility of remedial options, if necessary, is evaluated.

Sincerely,

Robert C. Neal

Robert C. Neal, P.E.
Environmental Administrator

Post Office Box 1019 Oakland, California 94604

Kennedy/Jenks Consultants

622 Folsom Street
San Francisco, California 94107

Work Plan

Owens-Brockway Glass Containers
3600 Alameda Avenue
Oakland, California

16 February 2000

REGISTERED GEOLOGIST
MICHAEL LAWRENCE MC LEOD
No. 5977
Exp. 9/30/01
STATE OF CALIFORNIA

Prepared for

Owens-Brockway Glass Containers
3600 Alameda Avenue
Oakland, California 94601

Table of Contents

Table of Contents (cont'd)

List of Tables

List of Figures

List of Appendices

Section 1: Introduction

Kennedy/Jenks Consultants (Kennedy/Jenks) prepared this Work Plan (Work Plan) on behalf of Owens-Brockway Glass Containers (Owens-Brockway). This Work Plan was prepared in response to the 29 December 1999 letter from Alameda County Department of Environmental Health (ACDEH). The Owens-Brockway plant is located at 3600 Alameda Avenue, Oakland, California (the Site). The Site location is shown on Figure 1.

Section 2: Background

The Oakland plant was constructed in 1936 and occupies a city block which is bounded by Alameda and Fruitvale Avenues, the Inner Harbor Channel, 37th and 8th Streets. The plant includes a glass manufacturing operation, warehouses, and paved outdoor storage areas. The Site plan is shown on Figure 2.

2.1 Historical Investigation and Remedial Activities

Historically, fuel oil (or furnace fuel) used to operate the plant was stored in large underground storage tanks (USTs) on the west side of the plant until the late 1980s. Soil containing petroleum hydrocarbons (PHCs) was encountered in July 1986 during construction of a fork lift ramp to the plant's basement.

As a result of this discovery, sixteen exploratory soil borings were advanced by Exceltech, Inc. during July 1986 in the vicinity of the ramp, the USTs and the former maintenance building. Eighteen groundwater monitoring wells were subsequently installed at the Site from July 1986 through December 1986, the deepest of which was advanced to approximately 32 feet below ground surface (bgs). The well construction details are summarized in Table 1. The soil and groundwater samples collected in the vicinity of the USTs contained low boiling range (purgeable) PHCs and high boiling range (extractable) PHCs. In addition, benzene, toluene, ethylbenzene and total xylenes (BTEX) were detected in soil and groundwater samples. Several groundwater samples in the vicinity of the tanks and the maintenance shop contained detectable levels of halogenated volatile organic compounds (HVOCs). The results of these activities were documented in Exeltech's February 1987 report entitled *Soil and Groundwater Contamination Investigation.*

In September 1986, a 16,000-gallon fuel oil UST was removed, its source pipeline was capped, and 148 cubic yards of petroleum-impacted soil was excavated and disposed at Chemical Waste Management's Kettleman Hills Class I facility. A 36-inch diameter recovery well was installed in the tank excavation and equipped with a product recovery device in 1987. The original recovery well (R-1) was upgraded and a second recovery well (R-2) was installed near Monitoring Well MW-2 in 1989. The two recovery wells were operated for several months without collecting any PHCs. They are now inoperable.

Owens-Brockway also operated four USTs (one 350-gallon, two 8,000-gallon and one 12,000-gallon) located adjacent to the power building. These four USTs were removed and replaced with two double-walled fiberglass, monitored USTs (gasoline and diesel) during 1986. According to Exceltech, visual evidence of releases from these tanks was noted during the removal activities. Three of the monitoring wells (MW-16, 17 and 18) were installed in the vicinity of these tanks. These gas and diesel USTs, installed in 1986, were removed on 9 October 1998 under the oversight of the Oakland Fire Department.

The *September Quarterly Ground-Water Sampling Report*, prepared by Ensco Environmental Services in November 1988, reported that the monitoring well network at the Site was sampled six times between April 1987 and September 1988 (Table 2 summarizes the historical groundwater analytical data) The field measurements indicated that several wells contained separate-phase petroleum product.

Since the monitoring wells were initially installed, Wells MW-3 and MW-18 have been destroyed during construction activities at the plant.

2.2 Investigation and Sampling Activities (1997 to Present)

In a letter to Owens-Brockway dated 28 April 1997, ACDEH requested that Owens-Brockway resume groundwater monitoring at the Site. ACDEH requested that Wells MW-1, 2, 5, 6, 7, 8, 9, 10, 13, 15, and 17 be sampled and analyzed for total petroleum hydrocarbons as gasoline (TPHg), diesel (TPHd) and motor oil (TPHmo); BTEX; and all wells except MW-13, 15, and 17 should be analyzed HVOCs and polychlorinated biphenyls (PCBs).

Prior to conducting groundwater sampling, the groundwater depth and petroleum product thickness in Wells MW-2, 5, 6, 7, 8, 9 and 17 were measured twice during the week of 11 August 1997, and then once per week for three consecutive weeks beginning 26 August 1997. Following the thickness measurement in each well, the recoverable petroleum product from each well was removed with a bailer and contained in a 55-gallon drum for disposal to the oil-water separator associated with the plant. Wells MW-5, 6, 7, 9, and 17 were also cleaned by attaching absorbent pads to PVC pipe and swabbing the inside of the casings.

Following the measurement of depth to groundwater and purging operations, groundwater samples were collected on 16 September 1997 from Wells MW-1, 5, 7, 8, 9, 10, 13, 15, and 17. Wells MW-2 and MW-6 contained separate-phase petroleum product; therefore, groundwater samples were not collected from them, although a product sample was obtained from Well MW-2 and analyzed by gas chromatography techniques in order to compare the product sample to hydrocarbon fuel standards ("fingerprinting").

Samples collected from Wells MW-1, 5, 7, 8, 9, 10, 13, 15, and 17 were analyzed for purgeable and extractable petroleum hydrocarbons by EPA Method 8015 Modified and for BTEX by EPA Method 8020. The groundwater samples collected from Wells MW-1, 5, 7, 8, 9, and 10 were also analyzed for HVOCs by EPA Method 8260 and for PCBs by EPA Method 8080.

The groundwater elevations are tabulated in Table 3 and presented on Figure 3. On 16 September 1997, the hydraulic gradient ranged from 0.01 to 0.024 feet/foot in a south to southwesterly direction toward the Harbor Channel. This is consistent with historical information.

No HVOCs or PCBs were detected in the samples analyzed. Results of the groundwater analyses for PHCs and BTEX are summarized in Table 2. The chromatogram for the product sample collected from Well MW-2 contained hydrocarbons in the C10 to C22 range; however, the pattern did not match the laboratory's diesel standard. Extractable PHCs (TPHd and TPHmo) were detected in groundwater in all the monitoring wells sampled on 16 September 1997. Purgeable PHCs (TPHg) were detected in the groundwater samples collected from Wells MW-7, 9, and 17. The analytical results typically did not match the gasoline, diesel, and motor oil standards. The results of this sampling event and the product thickness monitoring were presented in the 19 November 1997 letter report prepared by Kennedy/Jenks.

A groundwater monitoring event was conducted on 2 November 1998. Groundwater samples were collected from Wells MW-1, MW-8, MW-10, MW-13, MW-15 and MW-17 following depth to groundwater measurements and purging operations. Five wells (MW-2, MW-5, MW-6, MW-7 and MW-9) were not sampled due to the presence of separate-phase petroleum. The analytical results are presented in Table 2. A detailed description of this monitoring event and the results were provided in the 19 November 1998 report entitled *Groundwater Monitoring Event – 2 November 1998* prepared by Kennedy/Jenks.

On 26 and 27 January 1999, Kennedy/Jenks advanced five soil borings to collect reconnaissance groundwater samples to further assess the extent of PHCs in shallow groundwater downgradient of the western portion of the Site. Groundwater samples collected from Borings KB-3, KB-4 and KB-5 contained PHCs measured as total purgeable petroleum hydrocarbons (TPPHs) and total extractable petroleum hydrocarbons (TEPHs) as well as low concentrations of benzene and total xylenes. The analytical results are presented on Table 4 and the boring locations are shown on Figure 3 (Kennedy/Jenks 1999).

2.3 Historical Product Removal Activities

As described in Section 2.1, two product recovery wells were installed in 1987 and 1989 and were operated for several months each without recovering any PHCs. The wells are now inoperable.

During August and September 1997, as discussed in Section 2.2, recoverable petroleum product was removed from Wells 2, 5, 6, 7, 8, 9 and 17 using a bailer and absorbent pads. This activity did remove small amounts of PHCs, but was labor intensive and was discontinued in October 1997.

On 30 June 1999, Owens-Brockway installed a Petro-Trap™ device in Well MW-2. This device is a static or passive oil skimmer. The Petro-Trap™ was removed several times over the next month to assess its performance. During this time only groundwater was recovered in the device's collection container. The Petro-Trap™ and a sample of the Site's petroleum were sent to the manufacturer, EnviroProducts, for inspection and evaluation. According to EnviroProducts, the filter swells in the presence of the petroleum causing the filter to pop out of the holder. This prevents the petroleum from entering the collection container. Envirotech was unable to provide a satisfactory resolution to this problem and Owens-Brockway rescinded their purchase of the Petro-Trap™. **Other passive/static removal devices have been evaluated and Owens-Brockway will be installing Soakease™ absorbent devices in the seven wells listed above by the end of March 2000. This** device has replaceable absorbent tubes. It is anticipated these devices will work as promised by absorbing PHCs that enter the well casing through the screened interval.

Section 3: Scope of Work and Objectives

3.1 PHC Product Removal

As discussed in Section 2.3, Owens-Brockway plans to install static skimmers in seven wells to remove PHC product to the extent practicable. Due to the fine-grained nature of the sediments, this will likely be a long-term, slow recovery process.

3.2 Installation of Two New Groundwater Monitoring Wells

Owens-Brockway will install a shallow groundwater monitoring well (MW-19) near Boring KB-5, located on the bank of the Oakland estuary, in order to monitor the offsite, downgradient extent of the PHCs in groundwater.

In addition, Owens-Brockway proposes to install an additional monitoring well (MW-20) downgradient of Well MW-16 to assess and monitor the extent of PHCs in groundwater further downgradient from the two USTs removed in 1998.

The locations of the two proposed wells, MW-19 and MW-20, are shown on Figure 3.

3.3 Groundwater Monitoring

The concentrations of PHCs in groundwater at the Site have not significantly changed since monitoring began in 1986. Furthermore, the results of the November 1998 groundwater sampling are substantially similar to the data collected in September 1997. On the basis of these consistent long-term monitoring results, Owens-Brockway proposes to conduct groundwater monitoring annually for existing wells MW-2, 5, 6, 7, 8, 9, 13, 15, 16, and 17.

Once installed, we propose to collect quarterly groundwater samples from the two new wells for one year. At that time we will evaluate the results and potentially propose a reduced monitoring schedule.

Section 4: Field Procedures

4.1 PHC Product Removal Activities

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Owens-Brockway will install Soakease™ devices in Wells MW-2, 5, 6, 7, 9, 16 and 17 before the end of March 2000. These seven wells will be inspected at least monthly to determine if the absorbent tubes are saturated with PHCs. Once used, the tubes will be removed and replaced with a new tube. The used absorbent tubes will be stored onsite in a 55-gallon drum pending appropriate offsite disposal. We anticipate several of the wells (MW-2 and MW-7) will require more frequent replacement of the tubes.

4.2 Installation of Groundwater Monitoring Wells

Following approval of this Work Plan by ACDEH, Kennedy/Jenks will apply for the necessary drilling permits with Alameda County Public Works (ACPW) prior to starting the field activities. Drilling activities will be coordinated with ACPW to allow for scheduling of any inspections. In addition, an excavation permit from the City of Oakland will be obtained by the drilling contractor.

Prior to drilling, Kennedy/Jenks will contact Underground Services Alert (USA) to mark the buried utilities in the vicinity of the two wells. In addition, a private locator will be retained by Kennedy/Jenks to attempt to locate buried utilities and other subsurface obstructions.

Two soil borings will be drilled to install monitoring wells MW-19 and MW-20. The proposed well locations are shown on Figure 3.

The soil borings will be advanced with a hollow-stem auger drilling rig. The borings will be continuously cored and the soils will be lithologically logged by a Kennedy/Jenks geologist or engineer using the Unified Soil Classification System (ASTM D 2488-93) under the direction of a California Registered Geologist. One soil sample from each boring will be collected for laboratory analysis. Field documentation will include the completion of boring well construction logs. The two soil samples will be analyzed for TPPH and TEPH by EPA Method 8015 modified and for BTEX by EPA Method 8020.

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Based upon historical water level measurements in monitoring wells located at the Site, shallow groundwater is expected at a depth of approximately 9 to 13 feet bgs. The monitoring wells will be constructed with 2-inch diameter Schedule 40 PVC casing to a depth of approximately 25 feet. The screened interval and slot size will be selected based upon lithologic logging data collected during drilling and data obtained during earlier investigations. We anticipate a 10 to 20-foot screen interval with 0.01-inch slot will be installed in the wells. Because the water level is tidally influenced and the constituents to be monitored are less dense than water, the top of the screen interval will be placed above the high water elevation.

The remainder of each well above the screened section will consist of flush-threaded, 2-inch diameter, Schedule 40 blank PVC casing. A continuous filter pack will be placed in the annular space between the screened section and the wall of the boring. The filter pack will consist of washed, packaged sand sized accordingly for the well screen slot size selected. The filter pack will extend upwards from the bottom of the boring to one to two feet above the screened section. Above the filter pack, a one- to two-foot layer of protective bentonite clay pellets will be placed to minimize downward migration of the grout seal into the filter pack. A cement/bentonite grout will be placed so as to extend continuously from the top of the bentonite pellet layer to less than one foot below grade. A locking expansion cap and well-housing enclosure will be installed to control access to the well opening. Each well will be completed approximately at grade and furnished with a sloping concrete apron to facilitate surface drainage away from the well.

After waiting a minimum of 24 hours to allow curing of the grout and concrete, the monitoring wells will be developed by surging and pumping until the water removed from the wells is sediment-free or until no further improvement in water quality is observed. The wells will be allowed to recover for a minimum of 72 hours following well development prior to purging and sampling.

A detailed description of the equipment and procedures to be used during the well installation and development is included in Appendix A.

The locations and well casing elevations of the two newly installed monitoring wells will be horizontally and vertically surveyed by a licensed surveyor. The ground surface and well casing elevation will be surveyed to the nearest 0.01 feet relative to mean sea level. The ground surface and casing will also be surveyed to the National Geodetic Vertical Datum (NGVD 1928). Horizontal locations of these two wells will be surveyed to 0.1 feet and tied into the survey of the existing well network.

4.3 Investigation-Derived Residuals

Borehole cuttings, development and purge water, and other investigation-derived residuals will be contained in either DOT-approved 55-gallon drums with bolt-on lids, which will be sealed, dated, and labeled as to their contents. These residuals will be stored at the Site prior to disposal, pending receipt of laboratory analytical results for the soil and groundwater samples.

4.4 Groundwater Monitoring Well Sampling

Eleven existing monitoring wells (MW-2, MW-5, MW-6, MW-7, MW-8, MW-9, MW-10, MW-13, MW-15, MW-16, and MW-17) will be sampled annually in accordance with the procedures included in Appendix B. The groundwater samples will be analyzed for TPPH and TEPH by EPA Method 8015 modified and for BTEX by EPA Method 8020. A groundwater sample will not be collected from those wells containing separate-phase PHCs. The product thickness will be measured in those wells with separate-phase PHCs present.

The two newly installed wells will be sampled quarterly for one year. The groundwater samples will be analyzed for TPPH and TEPH by EPA Method 8015 and for BTEX by EPA Method 8020.

The samples will be stored at about 4 degrees centigrade in a cooled container until delivery under chain-of-custody procedures to a California-certified laboratory for analysis. The samples will be analyzed on a standard turnaround schedule.

Section 5: Quality Assurance/Quality Control

In order to validate the groundwater sample results, one duplicate groundwater sample will be collected and analyzed by EPA Method 8015 Modified for TPPH and TEPH, and for BTEX by EPA Method 8020 during each monitoring event. Duplicate samples measure consistency in sampling and analysis. A travel blank will accompany the sample container during each event and will be analyzed for BTEX.

Section 6: Reporting

Following installation of the two groundwater monitoring wells, a brief letter report will be prepared. The report will be submitted to ACDEH under signature of a California Registered Geologist or Engineer. The report will include a description of field procedures, observations, and conclusions.

The results of the periodic groundwater monitoring well sampling will be submitted to ACDEH in separate documents following each event.

Section 7: Schedule

Owens-Brockway is prepared to initiate the proposed scope of work following approval of this Work Plan by ACDEH. After obtaining the drilling permits, we anticipate that the well installation activities will require one day. The actual drilling schedule will depend upon the availability of drilling contractors.

The well installation will be followed by well development and sampling of the two newly constructed wells, MW-19 and MW-20. The other wells proposed to be sampled annually (Section 3.3), will be sampled at the same time that the two new wells are sampled. The subsequent quarterly sampling of MW-19 and MW-20 will follow thereafter.

The report documenting the well installation and initial groundwater sampling will be submitted to ACDEH within six weeks of receipt of the analytical reports. The quarterly groundwater monitoring reports will be submitted six weeks following the sampling event.

References

Ensco 1988. September Quarterly Groundwater Sampling and Analysis for O.I. Glass Container Division, S.T.S., 3600 Alameda Avenue, Oakland, California. Ensco Environmental Services, Inc., November 1988.

Exceltech 1987. Soil and Groundwater Contamination Investigation, Owens-Illinois Glass Container Division, 3600 Alameda Avenue, Oakland, California. Exceltech, Inc., February 1987.

Kennedy/Jenks 1997. Groundwater Monitoring, Owens-Brockway Oakland Plant, Kennedy/Jenks Consultants. 19 November 1997.

Kennedy/Jenks 1998. Groundwater Monitoring Event – 2 November 1998, Owens-Brockway Oakland Plant, 19 November 1998.

Kennedy/Jenks 1999. Groundwater Investigation Report, Owens-Brockway Glass Containers, 3600 Alameda Avenue, Oakland, California, 22 April 1999.

Tables

Table 1: Summary of Well Construction Details

Well Number	Date Installed	Measurement Elevation[(a)]	Top of Screen[(b)]	Screen Length	Well Depth[(c)]	Casing Diameter (inches)	Comments
MW-1	9/12/86	16.02	8	21	29	2	
MW-2	9/12/86	17.11	10	20	30	2	
MW-3	9/12/86	15.46	10	20	30	2	Destroyed
MW-4	9/29/86	16.02	8.5	20	28.5	2	TOCE = 18.05 (11/88 report)
MW-5	9/29/96	16.19	8.5	20	28.5	2	
MW-6	9/29/96	17.48	12.5	16	28.5	2	
MW-7	9/30/86	16.11	12.5	11	23.5	2	TOCE = 15.76 (11/88 report)
MW-8	10/22/86	16.57	15	13.5	28.5	2	
MW-9	7/23/86	7.33[(d)]	5	10	20	2	
MW-10	10/22/86	15.96	10	15	25	2	
MW-11	11/24/86	13.99	10	20	30	2	
MW-12	11/24/86	13.83	11	15	26	2	
MW-13	12/11/86	13.98	9.5	15	24.5	2	
MW-14	11/25/86	14.78	10	15	25	2	
MW-15	12/17/86	15.16	9.5	20	29.5	2	
MW-16	12/12/86	13.48	10	14.5	24.5	2	
MW-17	12/15/86	14.17	9.5	15	24.5	2	
MW-18	12/15/86	14.89	9	15	24	2	Destroyed
R-1	1987	NM[(e)]	NA	NA	24	36	
R-2	1989	NM	NA	NA	NA	12	

(a) Top of casing elevation (TOCE) except where noted; measured in feet above US Coast and Geodetic Datum (mean sea level). Elevations measured by Exceltech in 1986.
(b) Depth to top of screened interval (feet below top of casing).
(c) Depth to bottom of screened interval (feet below top of casing).
(d) Well casing elevation was not measured for this well; well is located beneath forklift ramp and this measurement is the ground surface elevation in feet MSL.
(e) NM = not measured
(f) NA = not available

Table 2: Summary of Groundwater Analytical Results

Well Number	Date Sampled	TPPH [a] (µg/l) [h]	TEPH [b] (mg/l)	O&G [c] (mg/l)	B [d] (µg/l)	T [e] (µg/l)	E [f] (µg/l)	X [g] (µg/l)
MW-1	9/23/86	<0.01 [i]	NA [j]	25	<10	<10	NA	<10
	4/9/87	BDL [k]	NA	NA	BDL	BDL	NA	BDL
	9/16/87 [l]	–	–	–	–	–	–	–
	12/1/87 [l]	–	–	–	–	–	–	–
	3/7/88 [l]	–	–	–	–	–	–	–
	6/8/88 [l]	–	–	–	–	–	–	–
	9/14/88 [l]	–	–	–	–	–	–	–
	9/16/97	<50	0.190	<0.300	<0.5	<0.5	<0.5	<0.5
	11/2/98	<50	0.160	NA	<0.5	<0.5	<0.5	<0.5
MW-2	4/9/87 [m]	–	–	–	–	–	–	–
	9/16/87 [m]	–	–	–	–	–	–	–
	12/1/87 [m]	–	–	–	–	–	–	–
	3/7/88 [l]	–	–	–	–	–	–	–
	6/8/88 [l]	–	–	–	–	–	–	–
	9/14/88 [l]	–	–	–	–	–	–	–
	9/16/97 [m]	–	–	–	–	–	–	–
	11/2/98 [m]	–	–	–	–	–	–	–
MW-3 [n]	9/23/86	<10	NA	18	<10	<10	NA	<10
	4/9/87	370	NA	NA	BDL	BDL	NA	BDL
	9/16/87 [m]	–	–	–	–	–	–	–
	12/1/87 [m]	–	–	–	–	–	–	–
	3/7/88	NA	190	NA	NA	NA	NA	NA
	6/9/88	NA	16	NA	NA	NA	NA	NA
	9/14/88 [m]	–	–	–	–	–	–	–
MW-4	10/3/86	20	NA	7.2	<5	<5	NA	<5
	4/9/87	BDL	NA	NA	BDL	BDL	NA	BDL
	9/16/87	1.3	0.66	NA	BDL	BDL	NA	BDL
	12/1/87	BDL	0.100	NA	BDL	BDL	NA	8.9
	3/7/88	BDL	BDL	NA	BDL	BDL	NA	BDL
	6/8/88	BDL	BDL	NA	BDL	BDL	NA	BDL
	9/14/88	BDL	0.100	NA	BDL	BDL	NA	BDL
MW-5	10/3/86	1,400	NA	24	<5	<5	NA	6.6
	4/9/87	54	NA	NA	BDL	BDL	NA	BDL
	9/16/87	NA	96	NA	NA	NA	NA	NA
	12/1/87	NA	2	NA	NA	NA	NA	NA
	3/9/88	NA	BDL	NA	NA	NA	NA	NA
	6/9/88	NA	12	NA	NA	NA	NA	NA
	9/14/88	NA	6.3	NA	NA	NA	NA	NA
	9/16/97	<50	7.5	4.1	<0.5	<0.5	<0.5	<0.5
	11/2/98 [m]	–	–	–	–	–	–	–

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Well Number	Date Sampled	TPPH [a] (µg/l) [h]	TEPH [b] (mg/l)	O&G [c] (mg/l)	B [d] (µg/l)	T [e] (µg/l)	E [f] (µg/l)	X [g] (µg/l)
MW-6	4/9/87[m]	–	–	–	–	–	–	–
	9/16/87	NA	400	NA	NA	NA	NA	NA
	12/1/87	NA	30	NA	NA	NA	NA	NA
	3/9/88	NA	9.8	NA	NA	NA	NA	NA
	6/9/88	NA	63	NA	NA	NA	NA	NA
	9/14/88	NA	140	NA	NA	NA	NA	NA
	9/16/97[m]	–	–	–	–	–	–	–
	11/2/98 [m]	–	–	–	–	–	–	–
MW-7	10/3/86	260	NA	8	<5	<5	NA	<5
	4/9/87[m]	–	–	–	–	–	–	–
	9/16/87	NA	790	NA	NA	NA	NA	NA
	12/1/87	NA	5.3	NA	NA	NA	NA	NA
	3/9/88	NA	BDL	NA	NA	NA	NA	NA
	6/9/88	NA	12	NA	NA	NA	NA	NA
	9/14/88	NA	67	NA	NA	NA	NA	NA
	9/16/97	850	26	11	<0.5	<0.5	<0.5	<0.5
	11/2/98 [m]	–	–	–	–	–	–	–
MW-8	10/23/86	1,300	NA	14	<0.2	<0.2	NA	<1
	4/9/87	73	NA	NA	BDL	BDL	NA	BDL
	9/16/87[m]	–	–	–	–	–	–	–
	12/1/87	NA	0.630	NA	NA	NA	NA	NA
	3/9/88	NA	2.6	NA	NA	NA	NA	NA
	6/9/88	NA	1.7	NA	NA	NA	NA	NA
	9/14/88	NA	0.150	NA	NA	NA	NA	NA
	8/12/97[m]	–	–	–	–	–	–	–
	9/16/97	<50	0.29	<0.300	<0.5	<0.5	<0.5	<0.5
	11/2/98	<50	1.3	NA	<0.5	<0.5	<0.5	<0.5
MW-9	4/9/87[m]	–	–	–	–	–	–	–
	9/16/87	NA	1.3	NA	NA	NA	NA	NA
	12/1/87	NA	18	NA	NA	NA	NA	NA
	3/9/88	NA	47	NA	NA	NA	NA	NA
	6/8/88[m]	–	–	–	–	–	–	–
	9/14/88[m]	–	–	–	–	–	–	–
	9/16/97	6,000	19	9	<13	<13	<13	18
	11/2/98 [m]	–	–	–	–	–	–	–
MW-10	10/23/86	380	NA	7.2	<0.2	<0.2	NA	<0.2
	4/9/87	300	NA	NA	BDL	BDL	NA	BDL
	9/16/87	NA	3.8	NA	NA	NA	NA	NA
	12/1/87	NA	0.59	NA	NA	NA	NA	NA
	3/8/88	NA	BDL	NA	NA	NA	NA	NA
	6/8/88	NA	3.8	NA	NA	NA	NA	NA
	9/14/88	NA	0.570	NA	NA	NA	NA	NA
	9/16/97	<50	1.3	<0.300	<0.5	<0.5	<0.5	<0.5
	11/2/98	<50	1.4	NA	<0.5	<0.5	<0.5	<0.5

Table 2: Summary of Groundwater Analytical Results

Well Number	Date Sampled	TPPH [a] (µg/l) [h]	TEPH [b] (mg/l)	O&G [c] (mg/l)	B [d] (µg/l)	T [e] (µg/l)	E [f] (µg/l)	X [g] (µg/l)
MW-11	12/5/86	<8	NA	1.2	<0.4	<0.4	NA	1.4
	4/9/87	BDL	NA	NA	BDL	BDL	NA	BDL
	9/16/87	BDL	NA	NA	BDL	BDL	NA	BDL
	12/1/87	BDL	NA	NA	0.8	BDL	NA	10
	3/7/88	BDL	BDL	NA	BDL	BDL	NA	BDL
	6/8/88	BDL	BDL	NA	BDL	BDL	NA	BDL
	9/14/88	BDL	100	NA	BDL	BDL	NA	BDL
MW-12	12/5/86	100	NA	2.5	0.49	1	NA	1.3
	4/9/87	BDL	NA	NA	BDL	BDL	NA	BDL
	9/16/87	BDL	NA	NA	BDL	BDL	NA	BDL
	12/1/87	BDL	NA	NA	BDL	BDL	NA	13
	3/7/88	BDL	BDL	NA	BDL	BDL	NA	BDL
	6/8/88	BDL	BDL	NA	BDL	BDL	NA	BDL
	9/14/88	BDL	0.120	NA	BDL	BDL	NA	BDL
MW-13	12/24/86	<10	NA	57	<0.2	<0.9	NA	<0.9
	4/9/87	BDL	NA	NA	BDL	BDL	NA	BDL
	9/16/87	BDL	NA	NA	BDL	BDL	NA	BDL
	12/1/87	BDL	NA	NA	1.6	BDL	NA	12
	3/8/88	7.7	BDL	NA	BDL	BDL	NA	BDL
	6/8/88	BDL	BDL	NA	BDL	BDL	NA	BDL
	9/14/88	BDL	0.130	NA	BDL	BDL	NA	BDL
	9/16/97	<50	0.120	<0.300	<0.5	<0.5	<0.5	<0.5
	11/2/98	<50	0.120	NA	<0.5	<0.5	<0.5	<0.5
MW-14	12/5/86 [o]	<8	NA	3.2	<0.4	<0.2	NA	<0.2
	4/9/87	BDL	NA	NA	BDL	BDL	NA	BDL
	9/16/87	1.7	0.056	NA	BDL	BDL	NA	BDL
	12/1/87	BDL	0.066	NA	1.2	4	NA	10
	3/7/88	20	BDL	NA	BDL	BDL	NA	BDL
	6/8/88 [l]	–	–	–	–	–	–	–
	9/14/88 [l]	–	–	–	–	–	–	–
MW-15	12/24/86	120	NA	1.6	<0.2	<0.9	NA	9.2
	4/9/87	BDL	NA	NA	BDL	BDL	NA	BDL
	9/16/87	8.4	BDL	NA	BDL	BDL	NA	BDL
	12/1/87	BDL	NA	NA	3.3	0.84	NA	14
	3/8/88	90	BDL	NA	0.8	BDL	NA	BDL
	6/9/88	53	BDL	NA	BDL	BDL	NA	BDL
	9/14/88	NA	0.100	NA	NA	NA	NA	NA
	9/16/97	<50	0.890	0.380	<0.5	<0.5	<0.5	<0.5
	11/2/98	<50	0.340	NA	<0.5	<0.5	<0.5	<0.5
MW-16	12/24/86	<10	NA	1.2	<0.2	<0.9	NA	<0.9
	4/9/87	BDL	NA	NA	BDL	BDL	NA	BDL
	9/16/87	BDL	0.064	NA	BDL	BDL	NA	BDL
	12/1/87	120	0.150	NA	1	0.37	NA	9.1
	3/7/88	10	BDL	NA	0.5	BDL	NA	BDL
	6/8/88	BDL	BDL	NA	BDL	BDL	NA	BDL
	9/14/88	BDL	0.190	NA	BDL	BDL	NA	BDL
	9/16/97 [m]	–	–	–	–	–	–	–

Table 2: Summary of Groundwater Analytical Results

Well Number	Date Sampled	TPPH [a] (µg/l) [h]	TEPH [b] (mg/l)	O&G [c] (mg/l)	B [d] (µg/l)	T [e] (µg/l)	E [f] (µg/l)	X [g] (µg/l)
MW-17	12/24/86	240	NA	2.4	5	1.2	NA	14
	4/9/87	BDL	NA	NA	BDL	BDL	NA	BDL
	9/16/87	44	0.680	NA	BDL	BDL	NA	0.55
	12/1/87	540	1.3	NA	7.8	2.4	NA	28
	3/8/88	4,300	3.8	NA	83	BDL	NA	46
	6/8/88 [l]	–	–	–	–	–	–	–
	9/14/88	54,000	64	NA	BDL	BDL	NA	BDL
	9/16/97	1,900	110	9.6	<0.5	<0.5	<0.5	<0.5
	11/2/98	<50	16	NA	<0.5	<0.5	<0.5	0.6
MW-18 [n]	12/24/86	<20	NA	1.6	<0.3	<0.3	NA	0.99
	4/9/87	BDL	NA	NA	BDL	BDL	NA	BDL
	9/16/87	BDL	0.480	NA	BDL	BDL	NA	BDL
	12/1/87	BDL	0.18	NA	BDL	BDL	NA	6.6
	3/7/88	BDL	BDL	NA	BDL	BDL	NA	BDL
	6/8/88	BDL	BDL	NA	BDL	BDL	NA	BDL
	9/14/88	BDL	0.190	NA	BDL	BDL	NA	BDL

(a) TPPH = total purgeable petroleum hydrocarbons using EPA Method 8015 modified.
(b) TEPH = total extractable petroleum hydrocarbons using EPA Method 8015 modified.
(c) O&G = total oil and grease.
(d) B = benzene using EPA Method 8020
(e) T = toluene using EPA Method 8020
(f) E = ethylbenzene using EPA Method 8020
(g) X = total xylenes using EPA Method 8020
(h) (µg/l) = micrograms per liter; (mg/l) = milligrams per liter
(i) < = analyte not present in the sample at or above the indicated detection limit
(j) NA = not analyzed
(k) BDL = below detection limit; actual limit not available for compilation of this table.
(l) Not sampled; well inaccessible.
(m) Not sampled; separate-phase petroleum product present.
(n) Well destroyed.
(o) Other volatile organic compounds were detected in the 12/5/86 sample collected from Well MW-14 using EPA Method 8010 (the sum of 1,1,2,2-tetrachloroethane, 1,1,1,2-tetrachloroethane and perchloroethene was 190 µg/l).

Table 3: Summary of Groundwater Depths and Elevations

Well Number	Date Sampled	Depth to Water[a] (feet)	Groundwater Elevation[b] (feet)
MW-1	9/23/86	NM	–
	4/9/87	8.98	7.04
	9/16/87	NM	–
	12/1/87	NM	–
	3/7/88	NM	–
	6/8/88	NM	–
	9/14/88	NM	–
	9/16/97	9.35	6.67
	11/2/98	9.16	6.86
MW-2	4/9/87	NM	–
	9/16/87	NM	–
	12/1/87	20.19	-3.08
	3/7/88	NM	–
	6/8/88	NM	–
	9/14/88	NM	–
	8/12/97	15.15	1.96
	8/14/97	12.58	4.53
	8/26/97	11.58	5.53
	9/2/97	11.29	5.82
	9/9/97	11.50	5.61
	9/16/97	11.83	5.28
	11/2/98	12.10	5.01
MW-3[c]	9/23/86	NM	–
	4/9/87	10.53	4.93
	9/16/87	11.44	4.02
	12/1/87	12.73	2.73
	3/7/88	15.22	0.24
	6/9/88	14.78	0.68
	9/14/88	NM	–
MW-4	10/3/86	NM	–
	4/9/87	8.73	7.29
	9/16/87	10.53	5.49
	12/1/87	9.08	6.94
	3/7/88	9.05	6.97
	6/8/88	9.25	6.77
	9/14/88	10.47	5.55
	11/2/98	NM	–

Table 3: Summary of Groundwater Depths and Elevations

Well Number	Date Sampled	Depth to Water[a] (feet)	Groundwater Elevation[b] (feet)
MW-5	10/3/86	NM	–
	4/9/87	12.02	4.17
	9/16/87	11.77	4.42
	12/1/87	11.37	4.82
	3/9/88	13.06	3.13
	6/9/88	12.74	3.45
	9/14/88	13.38	2.81
	8/12/97	11.81	4.38
	8/14/97	11.91	4.28
	8/26/97	11.42	4.77
	9/2/97	10.50	5.69
	9/9/97	11.25	4.94
	9/16/97	12.30	3.89
	11/2/98	11.48	4.71
MW-6	4/9/87	13.28	4.20
	9/16/87	13.40	4.08
	12/1/87	13.04	4.44
	3/9/88	15.00	2.48
	6/9/88	14.56	2.92
	9/14/88	14.90	2.58
	8/12/97	13.96	3.52
	8/14/97	13.91	3.57
	8/26/97	13.58	3.90
	9/2/97	8.91	8.57
	9/9/97	10.91	6.57
	9/16/97	11.96	5.52
	11/2/98	13.20	4.28
MW-7	10/3/86	NM	–
	4/9/87	12.13	3.98
	9/16/87	12.29	3.82
	12/1/87	11.24	4.87
	3/9/88	11.85	4.26
	6/9/88	12.46	3.65
	9/14/88	12.97	3.14
	8/12/97	11.91	4.20
	8/14/97	11.83	4.28
	8/26/97	11.00	5.11
	9/2/97	10.83	5.28
	9/9/97	11.58	4.53
	9/16/97	12.15	3.96
	11/2/98	12.24	3.87

Table 3: Summary of Groundwater Depths and Elevations

Well Number	Date Sampled	Depth to Water[a] (feet)	Groundwater Elevation[b] (feet)
MW-8	10/23/86	NM	–
	4/9/87	10.35	6.22
	9/16/87	10.71	5.86
	12/1/87	9.89	6.68
	3/9/88	9.61	6.96
	6/9/88	9.96	6.61
	9/14/88	10.71	5.86
	8/12/97	10.04	6.53
	9/16/97	9.90	6.67
	11/2/98	9.80	6.77
MW-9 [d]	4/9/87	NM	–
	9/16/87	NM	–
	12/1/87	6.83	–
	3/9/88	6.44	–
	6/8/88	NM	–
	9/14/88	7.70	–
	8/12/97	6.83	–
	8/14/97	6.46	–
	8/26/97	6.29	–
	9/2/97	6.33	–
	9/9/97	6.58	–
	9/16/97	6.62	–
	11/2/98	6.90	–
MW-10	10/23/86	NM	–
	4/9/87	10.29	5.67
	9/16/87	11.19	4.77
	12/1/87	10.08	5.88
	3/8/88	10.36	5.60
	6/8/88	10.89	5.07
	9/14/88	11.34	4.62
	9/16/97	10.27	5.69
	11/2/98	10.30	5.66
MW-11	12/5/86	–	–
	4/9/87	9.02	4.97
	9/16/87	9.96	4.03
	12/1/87	9.44	4.55
	3/7/88	9.31	4.68
	6/8/88	9.42	4.57
	9/14/88	9.10	4.89
	11/2/98	NM	–

Table 3: Summary of Groundwater Depths and Elevations

Well Number	Date Sampled	Depth to Water[a] (feet)	Groundwater Elevation[b] (feet)
MW-12	12/5/86	NM	–
	4/9/87	6.83	7.00
	9/16/87	7.80	6.03
	12/1/87	7.59	6.24
	3/7/88	7.02	6.81
	6/8/88	7.38	6.45
	9/14/88	8.14	5.69
	11/2/98	NM	–
MW-13	12/24/86	NM	–
	4/9/87	10.79	3.19
	9/16/87	10.98	3.00
	12/1/87	10.21	3.77
	3/8/88	10.51	3.47
	6/8/88	10.85	3.13
	9/14/88	10.93	3.05
	9/16/97	10.55	3.43
	11/2/98	10.98	3.00
MW-14	12/5/86	NM	–
	4/9/87	7.17	7.61
	9/16/87	8.78	6.00
	12/1/87	8.26	6.52
	3/7/88	7.26	7.52
	6/8/88	NM	–
	9/14/88	NM	–
	11/2/98	NM	–
MW-15	12/24/86	NM	–
	4/9/87	11.88	3.28
	9/16/87	11.77	3.39
	12/1/87	11.25	3.91
	3/8/88	11.24	3.92
	6/9/88	12.15	3.01
	9/14/88	12.34	2.82
	9/16/97	11.92	3.24
	11/2/98	11.60	3.56
MW-16	12/24/86	NM	–
	4/9/87	9.47	4.01
	9/16/87	10.07	3.41
	12/1/87	9.23	4.25
	3/7/88	9.46	4.02
	6/8/88	9.56	3.92
	9/14/88	9.99	3.49
	9/16/97	7.32	6.16
	11/2/98	NM	–

Table 3: Summary of Groundwater Depths and Elevations

Well Number	Date Sampled	Depth to Water[(a)] (feet)	Groundwater Elevation[(b)] (feet)
MW-17	12/24/86	NM	–
	4/9/87	9.95	4.22
	9/16/87	10.59	3.58
	12/1/87	9.87	4.30
	3/8/88	10.10	4.07
	6/8/88	NM	–
	9/14/88	10.58	3.59
	8/12/97	9.54	4.63
	8/14/97	9.58	4.59
	8/26/97	9.25	4.92
	9/2/97	9.50	4.67
	9/9/97	9.58	4.59
	9/16/97	9.74	4.43
	11/2/98	9.96	4.21
MW-18[(c)]	12/24/86	NM	–
	4/9/87	9.91	4.98
	9/16/87	10.37	4.52
	12/1/87	10.19	4.7
	3/7/88	9.60	5.29
	6/8/88	10.01	4.88
	9/14/88	10.82	4.07

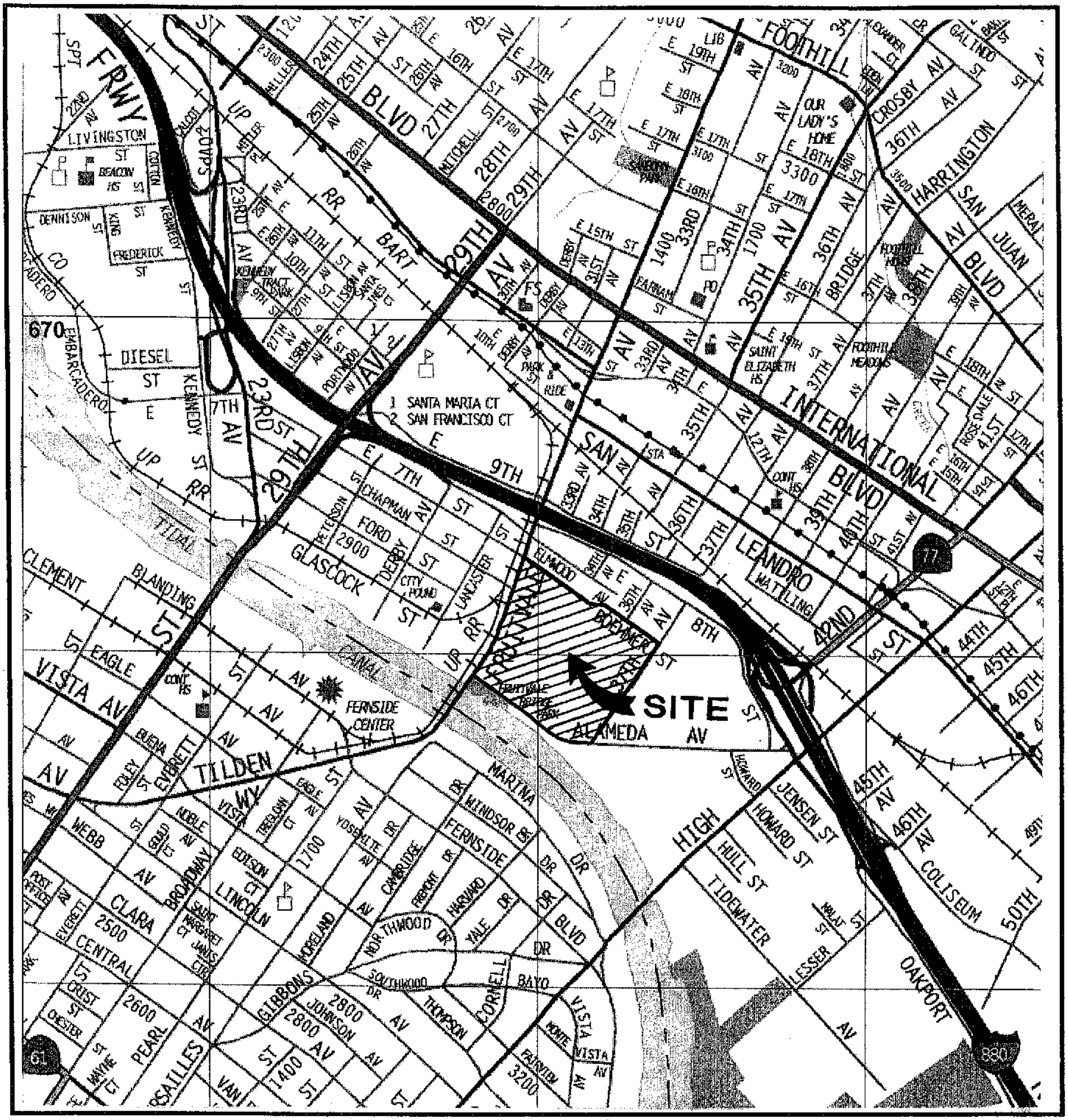
(a) Depth to water measured from the top of the well casing. Not corrected for product thickness.
(b) Groundwater elevations are reported in feet above mean sea level.
(c) Well destroyed.
(d) Casing elevation not measured.
(e) NM = not measured

Table 4: Groundwater Analytical Results 27 January 1999 Reconnaissance Samples

Boring Number	TPPH[a] (µg/l)[g]	TEPH[b] (µg/l)	TEPH (w/silica gel) (µg/l)	B[c] (µg/l)	T[d] (µg/l)	E[e] (µg/l)	X[f] (µg/l)
KB-1	<50[h]	<50	NA[i]	<0.5	<0.5	<0.5	<0.5
KB-2	<50	<50	NA	<0.5	<0.5	<0.5	<0.5
KB-3	110 (160)[j]	420 (490)	<50 (NA)	1.4 (1.5)	<0.5 (1.1)	<0.5 (<0.5)	3.3 (2.9)
KB-4	590	360	<50	<0.5	<0.5	<0.5	<0.5
KB-5	1,500	1,400	730	<0.5	<0.5	<0.5	0.88

(a) TPPH = total purgeable petroleum hydrocarbons using EPA Method 8015 modified
(b) TEPH = total extractable petroleum hydrocarbons using EPA Method 8015 modified. The laboratory identified the TEPHs as within the quantification range (C6-C10) for stoddard solvent. The chromatographic pattern was not typical of fuel. This is likely due to weathering effects.
(c) B = benzene using EPA Method 8020
(d) T = toluene using EPA Method 8020
(e) E = ethylbenzene using EPA Method 8020
(f) X = total xylenes using EPA Method 8020
(g) (µg/l) = micrograms per liter
(h) < = analyte not present in the sample at or above the indicated detection limit
(i) NA = Not analyzed
(j) Duplicate sample results indicated in parentheses.

Figures



N

Not to Scale

Kennedy/Jenks Consultants

Owens Brockway
Oakland, California

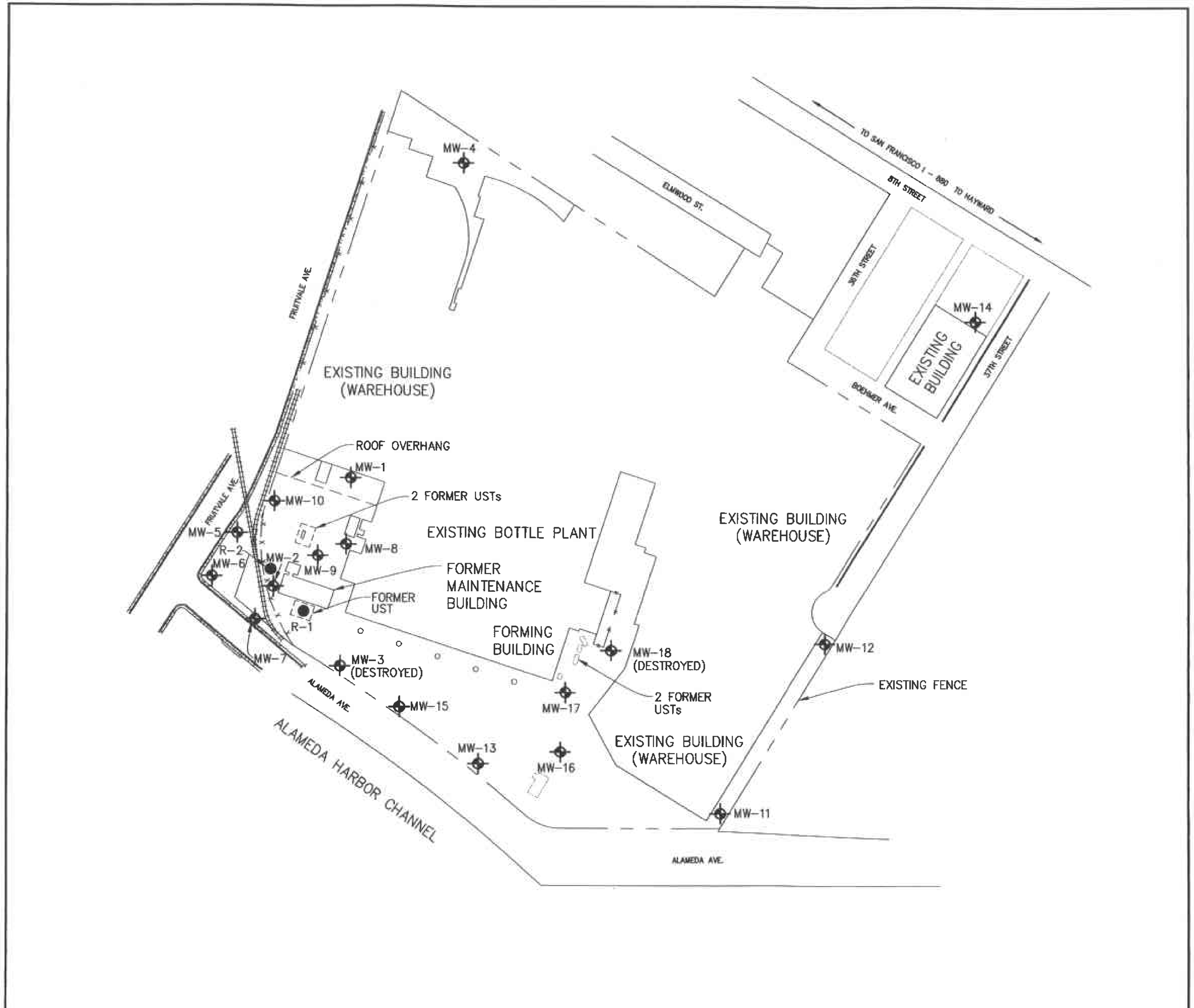
Site Location

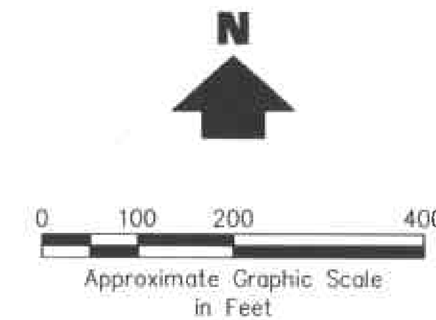
K/J 950007.30
February 2000

Figure 1

SOURCE

The Thomas Guide Digital Edition
1999 Bay Area, Thomas Bros. Maps





LEGEND

MW-2 GROUNDWATER MONITORING WELL

R-1 PRODUCT RECOVERY WELL

SOURCE

Site Plan for Soil and Groundwater Investigation, Exceltech, February 1987.

Kennedy/Jenks Consultants

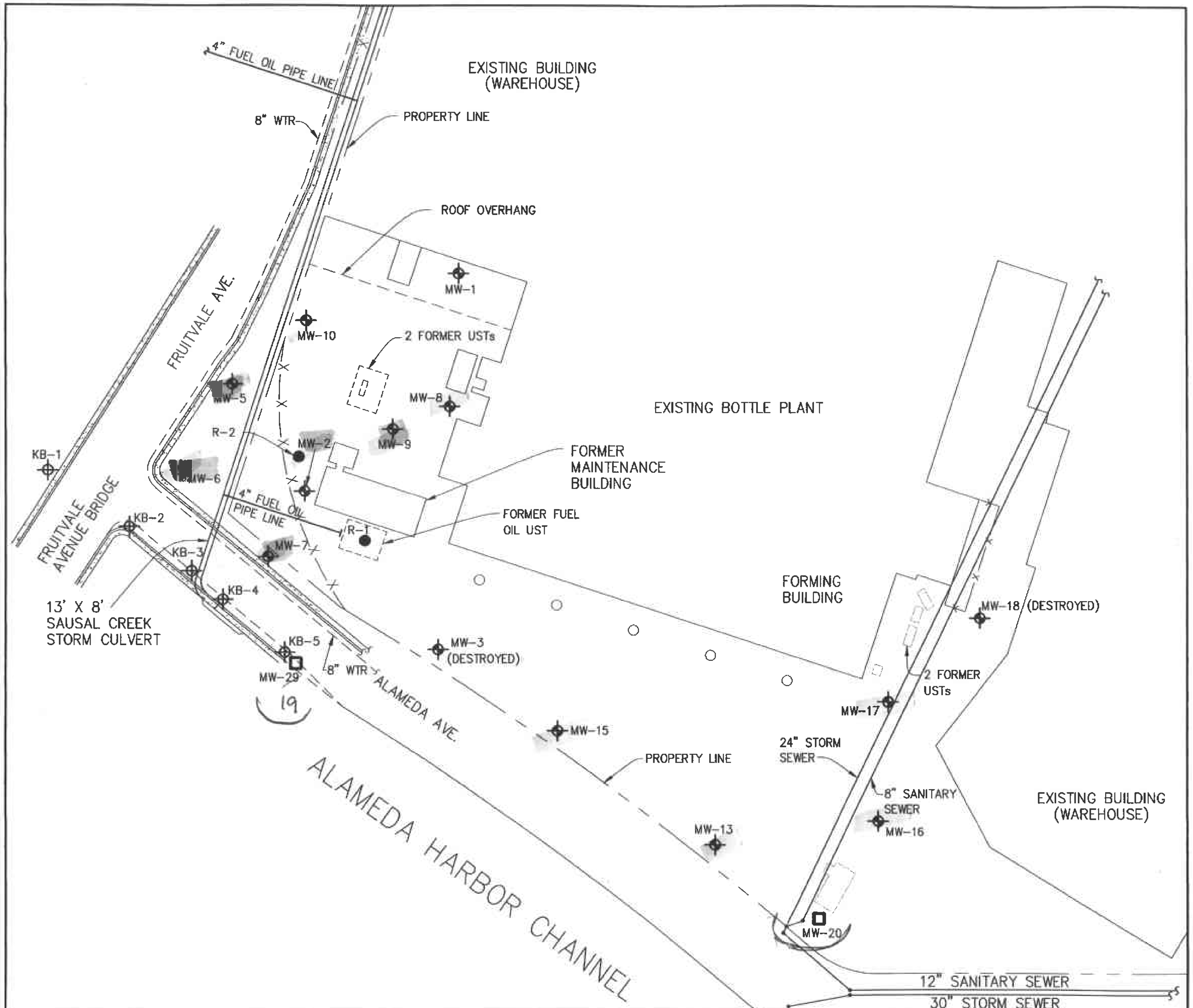
Owens Brockway
Oakland, California

Site Plan

K/J 950007.30
February 2000

Figure 2

FILE: N:\95.isb\950007.30\Feb00f2.dwg.DWG 02/16/00 at 08:06



N

0 50 100 200

Approximate Graphic Scale in Feet

LEGEND

MW-20	PROPOSED GROUNDWATER MONITORING WELL
MW-2	GROUNDWATER MONITORING WELL
R-1	PRODUCT RECOVERY WELL
KB-1	SOIL BORING – JANUARY 1999

SOURCE

Site Plan for Soil and Groundwater Investigation, Exceltech, February 1987.

Kennedy/Jenks Consultants

Owens Brockway
Oakland, California

Proposed Monitoring Well Locations

K/J 950007.30
February 2000

Figure 3

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Appendix A

Well Construction and Development Procedures

Appendix A: Well Construction and Development Procedures

A.1 Introduction

This guideline describes procedures used by Kennedy/Jenks Consultants personnel for well construction and development following completion of boring and soil sampling procedures (described in Standard Operating Guideline, Boring and Subsurface Soil Sampling).

A.2 Well Construction Materials

- 2-inch or 4-inch Schedule 40 PVC blank casing
- 2-inch or 4-inch Schedule 40 PVC slotted casing, of appropriate slot size
- 2-inch or 4-inch Schedule 40 PVC threaded and slip caps
- 2-inch or 4-inch Schedule 40 stainless steel blank casing
- 2-inch or 4-inch Schedule 40 stainless steel wire wrapped casing, of appropriate slot size
- 2-inch or 4-inch stainless steel threaded and slip caps
- Stainless steel well centralizers
- 12-inch x 0.25-inch mild steel isolation casing with welded centralizers
- Hasp-locking standpipes
- Ground-level traffic-rated watertight well housing enclosure
- Locking expansion plugs
- Combination or key lock
- Filter pack sand (refer to Standard Operating Guideline, Design of Filter Packs and Selection of Well Screens for Monitoring Wells)
- Type I or II Portland cement
- Concrete
- Bentonite powder
- 0.25-inch bentonite pellets or chips.

A.3 Well Development Equipment

- 2-inch or 4-inch-diameter vented surge block
- 1-inch dedicated PVC hose for monitoring well development and purging
- Centrifugal surface pump
- Submersible pump (4-inch-diameter wells or larger)
- 55-gallon DOT-approved drums
- Teflon, stainless steel or PVC bailer

- Teflon-coated bailer retrieval wire
- Airlift pump with foot valve and compressor
- Bladder pump (2-inch diameter wells only)

A.4 Typical Procedure

1. Following completion of selected borings, install the monitoring well casing through the center of the hollow stem auger, drive casing, or open boring. The monitoring well consists of a PVC Schedule 40 slotted well casing of appropriate diameter and a blank casing with a threaded bottom cap and a slip or threaded top cap or watertight expansion plug. The casing string must be held in tension during initial installation.

2. Place clean, well graded sand around the slotted section of the monitoring well to serve as the filter pack. The grade of sand is chosen on the basis of aquifer units encountered (refer to Standard Operating Guideline, Design of Filter Packs and Selection of Well Screens for Monitoring Wells). The filter pack is emplaced as the auger or temporary casing is removed from the boring.

3. Ensure that filter pack sand for the well extends to approximately 3 feet above the top of the screened interval.

4. If required in the well construction permit, notify the appropriate inspector prior to placing the well seal.

5. Place a 2- to 3-foot thick bentonite pellet seal above the sand pack, as the auger and/or casing is removed from the boring. If the seal is placed above the water table, the bentonite pellets must be hydrated with potable water prior to placement of the annular seal.

6. Fill the remainder of the annulus between the well casing and the borehole wall with cement/bentonite grout (with approximately 5 percent bentonite), or a high-solids bentonite slurry (11 to 13 pounds per gallon), to a depth of approximately 1 foot below ground surface. If the water level is higher than the seal, use a tremie pipe to place the grout.

7. Install either a threaded cap or a locking watertight expansion plug on the monitoring well. Place a steel hasp-locking well housing over the top of the well and cement it into the annulus of the boring.

8. Place a traffic-rated precast concrete or steel well enclosure approximately 1 to 2 inches above grade, and cement it into place with concrete. Have a concrete apron constructed around the well housing enclosure to facilitate runoff.

9. For aboveground completion, ensure that the well casing extends approximately 3 feet above ground surface. An 8-inch diameter hasp-locking steel well housing surrounds the well casing. Traffic bollards can be installed around the well housing as necessary.

10. Repeat Steps 1 through 9 for all monitoring wells at site.

11. Following the curing of the grout (approximately 24 hours), each monitoring well is developed. Prior to development activities, measure the depth in each well to static water level and total casing depth.

12. Also prior to well development, if applicable, check the water interface of each monitoring well for the presence of floating product (NAPL). Use a clear bailer or color indicator paste for the inspection.

13. If a monitoring well has a water level of less than 25 feet, it may be developed by using a centrifugal surface pump with dedicated 1-inch I.D. clear flex suction hose, placed with the hose intake placed temporarily at all levels of the screened interval. If the well is greater than 25 feet deep, a submersible pump or airlift pump with air filter is used for development. In either case, a surge block of appropriate size can be moved up and down inside the screened section of the well casing to create a surging action that hydraulically stresses the filter pack.

14. During development of each well, ensure that field parameters and observations are recorded on a Kennedy/Jenks Consultants purge and sample form (attached). Information to be recorded includes, but is not limited to, the following items:

    a. Depth to water

    b. Development time and volume

    c. Development (flow) rate

    d. pH, temperature, specific conductivity, and turbidity

    e. Other observations, as appropriate (e.g., color, presence of odors, or sheen)

15. Develop each monitoring well until water of relatively low turbidity is removed from the casing.

16. When development of each well is discontinued, record the following field parameters/observations:

    a. Depth to water

    b. Temperature

    c. pH

    d. Specific conductance

    e. Turbidity

    f. Color

A.5 Investigation-Derived Wastes

Place groundwater produced by well development in appropriately labeled containers for disposition by the client. Kennedy/Jenks Consultants is available to assist the client with options for disposition of groundwater.

Appendix B

Groundwater Sampling Procedures

Appendix B: Groundwater Sampling Procedures

B.1 Introduction

This guideline describes procedures typically followed by Kennedy/Jenks Consultants (K/J) personnel during groundwater sampling of monitoring wells.

B.2 Equipment/Materials

- Water level depth probe
- Centrifugal surface pump
- 1-inch dedicated PVC hose for each shallow monitoring well
- Laboratory-cleaned or sanitized disposable bailers with disposable cord
- Submersible pump
- Bottom-emptying bailer (2- or 4-inch diameter)
- Temperature and specific conductivity meter
- pH meter
- Appropriate glassware and sample containers
- K/J's Groundwater Purge And Sample forms (F-43)

B.3 Typical Procedure

All data and information collected during this procedure shall be recorded on K/J Groundwater Purge And Sample form (F-43).

1. Prior to groundwater sampling, make initial measurements of depth to static water level and total casing depth in all wells to be sampled. Calculate the total well volume of water for purge volumes for each well. Check monitoring well for nonaqueous phase liquid (NAPL) with a bailer, separate phase sounding probe or color indicator paste if applicable.

2. If NAPL is present, collect a sample of the product for potential laboratory analysis, bail the product from the well and allow the well to recover for approximately 24 hours. After the well has recovered, check for NAPL and collect a second sample of the product, if present, for potential laboratory analysis. Wells that contain NAPL should not be purged and sampled.

3. Initiate purging, using one of the following methods:

   a. A centrifugal surface pump with dedicated 1-inch I.D. clear flex suction hose with check valve, placed with the hose intake near the casing bottom, if the groundwater depth is less than approximately 25 feet.

   b. Laboratory-cleaned or disposable bailers.

   c. A submersible pump placed above or below the screen section if the water level is greater than 25 feet.

4. At the beginning of purging, and periodically afterwards, collect a sample of purged groundwater in a clean container and record the following field parameters/observations.

   a. Purge volume and time

   b. Temperature

   c. pH

   d. Specific conductance

   e. Depth to water

   f. Turbidity

   g. Color

   h. Other observations as appropriate (draw down in well during purge, presence of oil, odors)

5. For wells providing sufficient yield, continue purging until field parameters stabilize or at least three casing volumes are removed. Wells providing insufficient yield are purged dry once, allowed to recover to 80 percent of original water levels, and purged dry again. Wells with extremely low yields are purged dry only once.

6. Following purging, allow wells to recover to approximately 80 percent of original water levels and then collect samples.

7. Samples will typically be collected using clean bottom-employing bailers. Prior to sample collection, purge the bailer three times with water from the well. During sample collection, allow a 4- to 6-inch column of water to be purged from the bottom of the bailer before filling the appropriate sample containers. If the collected water is very turbid, or a bottom-emptying bailer is not used, carefully decant the water from the bailer into the appropriate sample containers. An attempt should be made to avoid agitation of the sample. When sampling for volatile organic compounds (VOCs), turn the bottle upside down to identify possible headspace. If bubbles occur, refill sample.

8. When multiple analyses will be performed, samples should be collected in order of decreasing sensitivity to volatilization (i.e., VOC samples first and metals last).

9. Collect groundwater samples using precleaned Teflon or stainless steel bailers, disposable bailer or precleaned Kemmerer (depth-specific) samplers. During sampling, record field parameters/observations as described in Step 4 on K/J form F-43. As required by anticipated analyses, label and fill containers according to the following guidelines.

   a. Total petroleum hydrocarbons (TPHs): 1L amber glass bottle.

   b. Benzene, toluene, xylene, and ethylbenzene (BTEX) compounds: three to six 40ml brown glass volatile organic analysis (VOA) vials with Teflon septa.

c. VOCs: three to six 40ml brown glass VOA vials with Teflon septa.

d. Metals and polychlorinated biphenyls (PCBs): 1L amber glass bottles. Samples will not be field-filtered of the samples can be filtered in the laboratory within 12 hours of collection. Otherwise, field filtering should be performed. Preserve the samples with the appropriate preservative, where applicable.

10. Ensure that each sample label documents sample, designation, type, date and time of collection, collector(s), location, and any additional information.

11. Complete chain-of-custody records and include them with the samples, which are to be transported to the laboratory in insulated containers at 4°C.

12. Each day, calibrate pH meters with buffer solutions and calibrate specific conductance meters using standard solutions.

B.4 Quality Control/Quality Assurance

13. Collect duplicate samples immediately after the original samples are collected. Approximately one duplicate sample is obtained for each quarterly sampling event or for each ten original samples. Purging is not performed between original sample collection and collection of duplicate samples. Original and duplicate samples are collected sequentially, without appreciable delay between collection cycles. Duplicate samples will be submitted to the laboratory blind (i.e., not identifying the samples as a duplicate).

14. Prepare rinsate field blanks by pouring deionized water over, around, and through the various sampling implements contacting a natural sample, including the bailer rope and filter. Rinsate field blank will be submitted to the laboratory blind (i.e., not identifying the sample as a blank).

15. The purpose of a transfer blank is to monitor for entrainment of contaminants into the sample form existing atmospheric conditions at the sampling location during the sample collection process. Transfer blanks will be routinely prepared when there is no rinsate blank collected. A transfer blank is prepared by filling sample containers with distilled or deionized water at a given sampling location. Transfer blank are analyzed for the same parameters as the environmental samples.

16. At least one type of field blank sample (rinsate or transfer) will be required per day of water sampling. All field blanks will be collected, preserved, labeled, and treated like any other sample. They shall be sent blind to the laboratory. In the field notebook, the samples will be noted as blanks (rinsate, transfer, trip).

17. Volatile organic samples are susceptible to contamination by diffusion of organic contaminants through the Teflon-faced silicone rubber septum of the sample vial. Therefore, trip blanks will be analyzed to monitor for possible sampling contamination during shipment. Trip blanks will be prepared by filling VOA vials from organic-free water and shipping the blanks with field containers. Trip blanks accompany the sample bottles through collection and shipment to the laboratory and are stored with the samples.

B.5 Equipment Cleaning

Prior to each sampling event, clean sampling equipment, including any purge bailers with high purity phosphate-free soap. After washing the equipment, rinse it with potable water and methanol and/or 0.1N nitric acid as appropriate. Double-rinse with deionized water. Onsite, one set of (dedicated) sampling implements is used per well. Prior to returning the sampling implements to the laboratory (for thorough cleaning), ensure that these items are cleaned onsite. For additional details, see SOG-2 - Equipment Decontamination. Disposable equipment (i.e., bailers) will be field cleaned and returned to the field equipment manager for disposal.

B.6 Investigation-Derived Wastes

Purge water is contained onsite, labeled, and placed in an appropriate container for disposition by the client.