STREAMBORN

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16 January 2004

Project No. P257

Letter Report
Site-Specific Risk Assessment and Site Conceptual Model
4401 Market Street
Oakland CA
RO No. 132

Dear Mr. Damele:

This letter report presents our site-specific risk assessment and site conceptual model for 4401 Market Street, Oakland CA (Figure 1). This report has been prepared pursuant to a request by the Alameda County Health Care Services Agency (ACHCSA 2003).

Activities included (1) summarizing historical soil, groundwater, and hydrogeologic data, (2) preparation of a site conceptual model, and (3) preparation of a site-specific risk assessment.

BACKGROUND

Table 1 provides a chronology of environmental activities associated with the site. Table 8 provides a bibliography.

In June 1990, one 1,000-gallon underground gasoline tank and three 500-gallon underground gasoline tanks were removed from the southeast portion of 4401 Market Street. During tank removal, soil samples were collected from beneath the tanks and associated piping.

In October 1994, seven soil borings were drilled and three of the borings were completed as 2-inch diameter monitoring wells (MW1, MW2, and MW3). Soil samples were collected from each of the borings and groundwater samples were collected from the monitoring wells. Groundwater monitoring was conducted periodically between November 1994 and June 1997.

In April and July 1999, nine soil borings were drilled. Soil and grab groundwater samples were collected from each of the borings. The investigation encountered free product, presumably gasoline, in boring SB2 on the south side of 44th Street.

In January 2001, four 2-inch diameter monitoring wells (MW4, MW5, MW6, and MW7) were installed. Soil samples were collected during drilling.

Groundwater monitoring was conducted periodically between February 2001 and September 2003 for all seven monitoring wells.

From February to November 2001, free product monitoring was conducted monthly for monitoring wells MW4, MW5, and MW6; free product was not detected.

SUBSURFACE CONDITIONS

Soils encountered in the borings typically consisted of the following:

- Layers of silt and clay with varying amounts of sand, starting at the ground surface and extending to a depth of approximately 17 to 20 feet.
- Layers of sand containing varying amounts of gravel, clay, and silt; starting at a depth of approximately 17 to 20 feet and extending to the maximum depth drilled (25 feet).

Groundwater has historically been measured at depths between approximately 12 and 16 feet. The groundwater gradient has historically been measured in a southwesterly direction, with a magnitude of approximately 0.01.

Groundwater level and gradient information are summarized in Table 3. The groundwater gradient and magnitude from the most recent monitoring event (29 September 2003) are summarized on Figure 3. A rose diagram depicting historic groundwater gradient data is presented on Figure 4.

A cross-section of subsurface conditions is presented on Figure 6 (cross-section location shown on Figure 5).

NATURE AND EXTENT OF RESIDUAL SOIL AND GROUNDWATER CONTAMINATION

Soil and groundwater sampling locations are shown on Figure 2.

Soil samples were collected during tank removal and during the drilling of soil borings and monitoring wells. In total, 58 soil samples were collected from 26 locations at depths between approximately 7.5 to 21.5 feet. Soil samples were analyzed for TPH-gasoline, BTEX, and fuel oxygenates. Soil analytical results are summarized in Tables 6a and 6b.

Soil analytical results reveal the following:

- The maximum measured soil concentrations were:
  - TPH-gasoline = 1,300 mg/kg in B10 at a depth of 15-15.5 feet.
  - Benzene = 12 mg/kg in B10 at a depth of 15-15.5 feet.

- Toluene = 24 mg/kg in S5 and S6 at depths of 8-8.5 feet.
- Ethylbenzene = 26 mg/kg in S6 at a depth of 8.5 feet.
- Xylenes = 100 mg/kg in B10 at a depth of 15-15.5 feet.

- Fuel oxygenates were not detected.

In general, soil contamination exists beneath the former tanks and extends laterally approximately 50 feet downgradient of the former tanks. In the area of the former tanks, soil contamination extends vertically from the base of the tanks to the groundwater table/smear zone (from approximately 7 to 16 feet deep). Downgradient of the former tanks, soil contamination is generally coincident with the groundwater table/smear zone (approximately 10-16 feet deep).

Groundwater samples were collected from the monitoring wells over the period November 1994 through September 2003. Groundwater samples were analyzed for TPH-gasoline, BTEX, and fuel oxygenates. Groundwater purging and sampling information is summarized in Table 3 and groundwater analytical results are summarized in Table 4.

Groundwater analytical results reveal the following:

- Groundwater contamination is currently confined to wells MW2, MW4, and MW5.
- Groundwater contamination consists of TPH-gasoline and BTEX; fuel oxygenates have typically been nondetect.

The predominant and most elevated contaminant is TPH-gasoline. Accordingly, TPH-gasoline serves as a reliable indicator of the extent of groundwater contamination. Figure 7 provides our interpretation of the extent of TPH-gasoline in groundwater based on the most recent measurements (29 September 2003). Figure 7 indicates that groundwater contamination extends laterally approximately 100 feet downgradient of the former tanks.

Although free phase product (presumably gasoline) had been observed during soil sampling at/near the site, free product measurements in wells MW4, MW5, and MW6 did not reveal detectable free product (Table 5). Wells MW4, MW5, and MW6 were screened across the water table and would have allowed the detection of free product, if present. Accordingly, we conclude that free phase product does not exist to any significant extent.

FATE OF CONTAMINATION

Temporal groundwater measurements (Table 4) indicate that natural attenuation has been effective in reducing the concentration and mass of dissolved petroleum hydrocarbons released from the former tanks. Groundwater parameters (Table 3) of pH, dissolved oxygen, and oxidation-reduction potential (ORP) confirm that subsurface conditions are conducive to natural attenuation, particularly intrinsic bioremediation.

Figures 8 and 9 present temporal plots of benzene and TPH-gasoline in monitoring wells MW2, MW4, and MW5 (the wells with detectable concentrations). The data demonstrate “classic” first-order natural attenuation, indicative of intrinsic bioremediation (Wiedemeier et. al. 1999). On the basis of Figures 8 and 9, we conclude that natural attenuation mechanisms are operative at the site and, given sufficient time, natural attenuation mechanisms will eventually reduce contaminant concentrations below detection limits. Although temporal measurements have only been conducted for groundwater, we expect the same natural attenuation mechanisms have been and will continue to be operative for soil.

SITE-SPECIFIC RISK ASSESSMENT

Tier-1 Risk Assessment

A Tier-1 Risk Assessment refers to the comparison of measured soil and groundwater concentrations to screening levels. The screening levels are also known as diminutive levels or thresholds of concern. In general, measured concentrations that are below the screening levels are presumed to present insignificant risk.

Table 4 provides a comparison of groundwater concentrations measured in the monitoring wells against (1) drinking water criteria, and (2) criteria for volatilization of contaminants from groundwater to indoor air (exposure via inhalation) assuming residential development. These two pathways represent the highest risk for exposure to contaminated groundwater at and near the site.

The Table 4 comparison indicates the following:

- Screening criteria are exceeded for TPH-gasoline and benzene with respect to the drinking water pathway.
- The other contaminants and pathways are below screening levels.

The site and surrounding area are served by a municipal source of drinking water (East Bay Municipal Utility District). The site and surrounding area are within an urban setting where individual domestic wells are highly unlikely. Figures 8 and 9 demonstrate that natural attenuation will likely cause groundwater concentrations to be below the screening levels in the foreseeable future (circa 2007). Accordingly, we conclude that the measured groundwater concentrations do not present significant risk.

Tables 6a and 6b provide a comparison of soil concentrations against (1) criteria for volatilization of contaminants from soil to indoor air (exposure via inhalation), and (2) criteria for direct exposure to soil (ingestion and direct contact). Both pathways have been screened assuming residential development. These two pathways represent the highest risk for exposure to contaminated soil at and near the site, recognizing that any pathway from soil to groundwater to humans has been implicitly addressed in Table 4.

The Table 6a and 6b comparisons indicate the following:

- Screening criteria are very occasionally exceeded for ethylbenzene and/or xylenes (volatilization scenario).
- Screening criteria are occasionally exceeded for benzene (either exposure scenario). The frequency and magnitude of the benzene exceedances are greater than that for ethylbenzene and/or xylenes.

On the basis of the Tier-1 Risk Assessment, we conclude that a Tier-2 Risk Assessment is warranted for potential exposure to benzene-contaminated soil.

Tier-2 Risk Assessment

A Tier-2 Risk Assessment refers to the calculation of human exposure and risk using site-specific parameters. In general, the use of site-specific parameters provides a more accurate risk assessment, compared to the conservative assumptions typically employed for Tier-1.

The greatest risk from benzene-contaminated soil is posed by (1) volatilization of benzene from vadose zone (unsaturated) soil and (2) migration of benzene vapors to indoor (confined) air where the vapors are inhaled by human occupants. This hypothetical pathway assumes benzene vapors enter overlying, ground-floor living spaces via foundation cracks.

Benzene is a known human carcinogen. For benzene, the State of California recommends inhalation and oral cancer slope factors that are different from those recommended by the US Environmental Protection Agency. For both inhalation and oral pathways, the State of California cancer slope factors are approximately 3.4 times more potent, or more conservative (CalEPA 1999). Our calculations employed the California slope factors.

Table 7 provides our calculation of the excess lifetime cancer risks resulting from the hypothesized benzene exposure. The calculation accounts for (1) residential exposure scenario versus (2) commercial/industrial exposure scenario. The calculation also accounts for (1) the highest measured benzene concentration in soil versus (2) the average of all detected benzene concentrations in soil.

Our calculated excess lifetime cancer risk varies from approximately 1.5×10^{-4} to 3.6×10^{-5} (probability of 1.5 in 10,000 to 3.5 in 100,000), depending on the exposure scenario and employed concentration. In general, residential risks below 10^{-6} (1 in 1,000,000) and commercial/industrial risks below 10^{-4} (1 in 10,000) are considered acceptable. Accordingly, we conclude that calculated commercial/industrial risks are acceptable and that calculated residential risks bear further consideration.

In addition to samples collected from beneath the former tanks, benzene has been detected in soil only at SB2, MW2, and B10. Accordingly, residential occupancy could hypothetically coincide with benzene-contaminated soil only at the southeast corner of 4401 Market Street (area of the former tanks). The remaining benzene-contaminated soil is located beneath 44th Street and not subject to overlying residential occupancy. We believe it unlikely that future site development would construct ground floor residential occupancy in the area of the former tanks because such a location, at the corner of 44 Street and Market Street, would be relatively public and noisy. For example, none of the nearby residences occupy similar locations near the street corners.

Our risk calculations employed the originally-measured soil concentrations; however, observed natural attenuation in groundwater at the site indicates the actual, present-day soil concentrations would be significantly lower. Furthermore, we believe natural attenuation will eventually reduce soil concentrations to nondetect.

Because of (1) the low probability that residential development would occur in the area of the former tanks, and (2) the natural attenuation of benzene at the site, we believe that benzene-contaminated soil presents an insignificant risk at the site.

CASE CLASSIFICATION ACCORDING TO REGIONAL WATER QUALITY CONTROL BOARD GUIDELINES

The following case classification is based on “Interim Guidance on Required Cleanup of Low Risk Fuel Sites” (RWQCB 1996). The guidance sets forth criteria for a “Low Risk Groundwater Case”. Each of the criteria is addressed below.

The leak has been stopped and ongoing sources, including free product, have been removed or remediated

The underground tanks were removed in 1990. Free product was observed during a 1999 investigation, but has not been observed since. Ongoing contaminant sources no longer exist, as demonstrated by decreasing contaminant concentrations, with time, in the monitoring wells.

The site has been adequately characterized

The site has been investigated since 1990 when the tanks were removed and contamination was initially discovered. Since 1990, the following has been performed:

- 20 borings have been drilled, 7 of which were completed as monitoring wells. 58 soil samples have been collected and analyzed for selected analytes, including TPH-gasoline, BTEX, and fuel oxygenates.
- Groundwater monitoring was performed from November 1994 through September 2003. Groundwater levels have been measured on 18 occasions. Groundwater samples have been collected on 14 occasions. 58 groundwater samples have been collected and analyzed for selected analytes, including TPH-gasoline, BTEX, and fuel oxygenates.

Investigation activities have adequately characterized the hydrogeologic, contaminant, and geochemical characteristics of the property.

The dissolved hydrocarbon plume is not migrating

Groundwater monitoring has revealed a trend of decreasing concentrations with time (Tables 4, Figures 8 & 9). The data show that the dissolved hydrocarbon plume is not migrating; instead, the data show that the dissolved hydrocarbon plume is shrinking with time. The most downgradient well (MW7) has remained nondetect.

No water wells, deeper drinking water aquifers, surface water, or other sensitive receptors are likely to be impacted

Streamborn previously conducted a sensitive receptor survey (Streamborn 2001d). No water wells exist on the property or bordering properties and it is unlikely that water wells will be constructed in the future given the availability of municipal water and existing restrictions regarding water wells in urbanized areas of Oakland.

Although deeper aquifers have not been explored at the site, it is unlikely that contamination has migrated vertically given (1) the observed limited lateral extent of contamination, and (2) the characteristics of the contaminants as lighter-than-water, non-aqueous chemicals. No surface water features are located within 500-feet of the site. The site and surrounding area are currently served by municipal stormwater sewers and have been for many years. There are no other sensitive receptors at or near the site.

The site presents no significant risk to human health

Our Tier-1 and Tier-2 Risk Assessments indicate the residual contamination presents insignificant risk to human health. With time, the contaminants will naturally biodegrade and the risks will be eliminated.

The site presents no significant risk to the environment

Contamination is currently confined to groundwater and subsurface soil at and in the immediate vicinity of the site. Contaminants are not expected to migrate further. No environmental receptors are located within 500 feet of the site. Accordingly, we believe the site presents no significant risk to the environment.

CONCLUSIONS

On the basis of the work described herein, we conclude the following:

- Residual soil and groundwater contamination at the site is decreasing with time due to natural attenuation processes. Soil and groundwater concentrations will likely be below detection limits in the foreseeable future.
- Residual soil and groundwater contamination presents insignificant risks to human health and the environment.

- The site should be considered a Low Risk Groundwater Case according to the guidelines of the Regional Water Quality Control Board. Case closure should be granted for the site.

Please contact us with any questions or comments.

Sincerely,

STREAMBORN

Douglas W. Lovell, PE
Geoenvironmental Engineer

Attachments

cc: Don Hwang/Alameda County Health Care Services Agency, Alameda CA

Table 1 (Page 1 of 2)

Environmental Chronology

4401 Market Street, Oakland CA

Date	Activities Performed By	Description
Unknown	Unknown	• Four underground gasoline tanks (one 1,000-gallon and three 500-gallon tanks) were installed. • W.A. Craig reported that the structure at 4401 Market Street was constructed in 1943 and used as a gasoline station until the 1970s.
22 June 1990	Environmental Bio-Systems	• The 4 underground gasoline tanks were removed. Removal of the fuel dispensers, product piping, and pump island was not documented. Soil excavated during tank removal was reused to backfill the excavations. • Soil samples were collected from below the tanks. Samples of the excavated soil were also collected. Soil samples were analyzed for TPH-gasoline and BTEX. Soil sampling indicated a release of gasoline.
6 September 1990	W.A. Craig	• Two trenches were excavated to depths of approximately 5 feet in the vicinity of the former dispenser island. • Contaminated soil was observed during excavation but no laboratory analyses were performed. The excavated soil was reused to backfill the trenches.
27 and 28 October 1994	W.A. Craig	• Seven borings were drilled to depths of approximately 25 feet at and near 4401 Market Street (SB1, SB2, SB3, SB4, MW1, MW2, and MW3); three of the borings were completed as monitoring wells (MW1, MW2, and MW3). Soil samples were collected during drilling. • Free product, presumably gasoline, was observed in boring SB2, located near the southwest corner of 4401 Market Street. • Soil samples were analyzed for TPH-gasoline and BTEX.
8 November 1994	W.A. Craig	• Groundwater monitoring was conducted for wells MW1, MW2, and MW3. • Samples were analyzed for TPH-gasoline and BTEX.
14 February 1995	W.A. Craig	• Groundwater monitoring was conducted for wells MW1, MW2, and MW3. • Samples were analyzed for TPH-gasoline and BTEX.
7 June 1995	W.A. Craig	• Groundwater monitoring was conducted for wells MW1, MW2, and MW3. • Samples were analyzed for TPH-gasoline and BTEX.
29 August 1995	W.A. Craig	• Groundwater monitoring was conducted for wells MW1, MW2, and MW3. • Samples were analyzed for TPH-gasoline and BTEX.
8 December 1995	W.A. Craig	• Groundwater monitoring was conducted for wells MW1, MW2, and MW3. • Samples were analyzed for TPH-gasoline and BTEX.
7 March 1996	W.A. Craig	• Groundwater monitoring was conducted for wells MW1, MW2, and MW3. • Samples were analyzed for TPH-gasoline, BTEX, and MtBE.
19 June 1996	W.A. Craig	• Groundwater monitoring was conducted for wells MW1, MW2, and MW3. • Samples were analyzed for TPH-gasoline, BTEX, and MtBE.
20 December 1996	W.A. Craig	• Groundwater monitoring was conducted for wells MW1, MW2, and MW3. • Samples were analyzed for TPH-gasoline, BTEX, and MtBE.
12 June 1997	W.A. Craig	• Groundwater monitoring was conducted for wells MW1, MW2, and MW3. • Samples were analyzed for TPH-gasoline, BTEX, and MtBE.
31 March 1999	Streamborn	• Groundwater levels measured in wells MW1, MW2, and MW3.
April and July 1999	Streamborn	• Nine borings were drilled to depths of approximately 20 feet near 4401 Market Street (B8 through B16). Free product, presumably gasoline, was observed in boring B10, located on the south side of 44th Street, adjacent to 903 44th Street. Soil samples were collected during drilling. Groundwater samples were collected from temporary casings installed in the borings. The borings were grouted upon completion of groundwater sampling. • Soil samples and groundwater samples were analyzed for TPH-gasoline, BTEX, and fuel oxygenates.
4-5 January 2001	Streamborn	• Four monitoring wells (MW4, MW5, MW6, and MW7) were installed to depths of approximately 25 feet near 4401 Market Street. Soil samples were collected during drilling. • Soil samples were analyzed for TPH-Gasoline, BTEX, and fuel oxygenates. • An elevation survey was performed for the newly-installed monitoring wells.

Table 1 (Page 2 of 2)

Environmental Chronology

4401 Market Street, Oakland CA

Date	Activities Performed By	Description
1 February 2001	Streamborn	• Wells MW4, MW5, MW6, and MW7 were developed. • Groundwater samples were collected from wells MW1, MW3, MW4, MW5, MW6, and MW7. Samples were analyzed for TPH-Gasoline, BTEX, and fuel oxygenates. • Water levels were measured in wells MW1, MW2, MW3, MW4, MW5, MW6, and MW7. • Wells MW4, MW5, and MW6 were monitored for free product; no free product was detected.
9 March 2001	Streamborn	• Water levels were measured in wells MW1, MW2, MW3, MW4, MW5, MW6, and MW7. • Wells MW4, MW5, and MW6 were monitored for free product; no free product was detected.
23 April 2001	Streamborn	• Water levels were measured in MW1, MW2, MW3, MW4, MW5, MW6, and MW7. • Wells MW4, MW5, and MW6 were monitored for free product; no free product was detected.
30 May 2001	Streamborn	• Groundwater samples were collected from wells MW1, MW3, MW4, MW5, MW6 and MW7. Samples were analyzed for TPH-Gasoline, BTEX, and fuel oxygenates. • Water levels were measured in wells MW1, MW2, MW3, MW4, MW5, MW6, and MW7. • Wells MW4, MW5, and MW6 were monitored for free product; no free product was detected.
19 June 2001	Streamborn	• Water levels were measured in MW1, MW2, MW3, MW4, MW5, MW6, and MW7. • Wells MW4, MW5, and MW6 were monitored for free product; no free product was detected.
19 July 2001	Streamborn	• Water levels were measured in MW1, MW2, MW3, MW4, MW5, MW6, and MW7. • Wells MW4, MW5, and MW6 were monitored for free product; no free product was detected.
22 August 2001	Streamborn	• Groundwater samples were collected from wells MW1, MW3, MW4, MW5, MW6 and MW7. Samples were analyzed for TPH-Gasoline, BTEX, and fuel oxygenates. • Water levels were measured in wells MW1, MW2, MW3, MW4, MW5, MW6, and MW7. • Wells MW4, MW5, and MW6 were monitored for free product; no free product was detected.
29 November 2001	Streamborn	• Groundwater samples were collected from wells MW1, MW3, MW4, MW5, MW6 and MW7. Samples were analyzed for TPH-Gasoline, BTEX, and fuel oxygenates. • Water levels were measured in wells MW1, MW2, MW3, MW4, MW5, MW6, and MW7.
29 September 2003	Streamborn	• Groundwater samples were collected from wells MW1, MW3, MW4, MW5, MW6 and MW7. Samples were analyzed for TPH-Gasoline, BTEX, and fuel oxygenates. • Water levels were measured in wells MW1, MW2, MW3, MW4, MW5, MW6, and MW7. • Wells MW4, MW5, and MW6 were monitored for free product; no free product was detected.

General Note

(a) TPH = total petroleum hydrocarbons. BTEX = benzene, toluene, ethylbenzene, and xylenes. MtBE = methyl tert-butyl ether.

Table 2

Groundwater Levels and Gradient Data Since 2001

4401 Market Street, Oakland CA

Location	**MW1**		**MW2**		**MW3**		**MW4**		**MW5**		**MW6**		**MW7**		Groundwater Gradient	
Ground Surface	Elev = 998.74		Elev = 998.07		Elev = 999.64		Elev = 998.18		Elev = 997.78		Elev = 998.02		Elev = 999.12			
Measuring Point	TOC N Side, Elev = 998.22		TOC N Side, Elev = 997.73		TOC N Side, Elev = 998.90		TOC N Side, Elev = 997.87		TOC N Side, Elev = 997.33		TOC N Side, Elev = 997.50		TOC N Side, Elev = 998.69			
Intercepted Interval	Depth	Elev	Depth	Elev	Depth	Elev	Depth	Elev	Depth	Elev	Depth	Elev	Depth	Elev		
	19 to 25.5	972.9 to 979.7	19 to 27.5	970.6 to 979.1	19 to 27.5	972.1 to 980.6	9 to 25	973.2 to 989.2	9 to 25	972.8 to 988.8	9 to 25	973.0 to 989.0	9 to 25	974.1 to 990.1	Direction	Magnitude
1 February 2001	13.77	984.45	13.21	984.52	14.01	984.89	13.22	984.65	13.14	984.19	13.31	984.19	14.76	983.93		
9 March 2001	12.54	985.68	12.30	985.43	13.32	985.58	12.28	985.59	11.70	985.63	12.54	984.96	13.94	984.75	N 130˚ E	0.01
23 April 2001	14.01	984.21	13.36	984.37	14.15	984.75	13.05	984.82	13.30	984.03	13.39	984.11	14.63	984.06		
30 May 2001	14.74	983.48	NM	NM	14.67	984.23	13.93	983.94	14.14	983.19	14.17	983.33	15.79	982.90	N 222˚ E	0.01
19 June 2001	14.83	983.39	13.93	983.80	14.67	984.23	15.47	982.40	14.29	983.04	14.34	983.16	15.87	982.82		
19 July 2001	15.04	983.18	14.51	983.22	14.84	984.06	14.73	983.45	14.48	982.85	14.47	983.03	15.99	982.70		
22 August 2001	15.03	983.19	14.48	983.25	14.83	984.07	14.63	983.24	14.58	982.75	14.57	982.93	16.15	982.54	N 217˚ E	0.01
29 November 2001	12.59	985.63	12.01	985.72	12.66	986.24	12.78	985.09	11.05	986.28	11.42	986.08	12.94	985.75		
29 September 2003	15.05	983.17	14.50	983.23	14.94	983.96	14.53	983.34	14.53	982.80	14.52	982.98	16.19	982.50	N 229˚ E	0.009
Total Depth (last measurement)	24.7		24.6		24.7		24.7		24.7		24.8		24.6			

General Notes

(a) Measurements are cited in units of feet, referenced to a site-specific datum (not Mean Sea Level).

(b) TOC = top of PVC casing. N = north. Measuring points are the top of PVC casing, north side.

(c) The depth to water and total depth were measured relative to the top of PVC casing.

(d) The depth of the intercepted interval was measured relative to the ground surface, and corresponds to the sand pack interval.

Table 3

Groundwater Purging and Sampling Information Since 2001

4401 Market Street, Oakland CA

Location	Sample Date	Sample Type	Dissolved Oxygen (mg/L)	pH	Specific Conductance (µS/cm)	Temper-ature (˚C)	ORP (mV)	Turbidity and Color	Purge Method	Purge Duration (minutes)	Volume Purged (gallons)	Purged Dry ?	Standing Water Casing Volumes Removed
MW1	1 Feb 2001	GB	3.1	6.7	530	18.3	-210	Clear, none	SP	9	±5	Yes	±3
	30 May 2001	GB	1.0	6.8	560	24.2	30	Clear, none	SP	40	±5	Yes	±3
	22 Aug 2001	GB	3.0	6.9	510	20.4	50	Clear, none	SP	8	±5	Yes	±3
	29 Nov 2001	GB	NM	6.7	480	20.9	-170	Clear, none	SP	15	±4	Yes	±2
	29 Sep 2003	GB	1.6	6.3	520	21.5	130	Clear, none	SP	15	±5	Yes	±3
MW2	29 Sep 2003	GB	1.6	6.6	560	21.9	-80	Clear, none	SP	20	±5	No	±3
MW3	1 Feb 2001	GB	5.0	6.7	370	17.4	-230	Clear, none	SP	4	±5	No	±3
	30 May 2001	GB	5.8	7.0	390	23.6	60	Clear, none	SP	26	±5	Yes	±3
	22 Aug 2001	GB	4.5	7.1	370	21.5	90	Cloudy, brown	SP	6	±5	Yes	±3
	29 Nov 2001	GB	NM	6.8	330	19.3	20	Clear, none	SP	10	±6	Yes	±3
	29 Sep 2003	GB	4.5	6.6	370	19.6	190	Clear, none	SP	10	±5	Yes	±3
MW4	1 Feb 2001	GB	5.2	6.8	580	18.2	-210	Cloudy, gray	SP	47	±15	Yes	±9
	30 May 2001	GB	1.5	6.8	700	22.8	20	Clear, none	SP	23	±6	Yes	±3
	22 Aug 2001	GB	2.1	6.9	540	21.2	-20	Clear, none	SP	5	±5	No	±3
	29 Nov 2001	GB	NM	6.7	550	19.5	-170	Clear, none	SP	16	±5	Yes	±3
	29 Sep 2003	GB	1.5	6.5	560	22.4	30	Clear, none	SP	10	±5	No	±3
MW5	1 Feb 2001	GB	0.8	6.7	640	18.1	-250	Turbid, brown	SP	18	±20	No	±10
	30 May 2001	GB	1.2	7.0	630	19.6	20	Clear, none	SP	4	±6	No	±3
	22 Aug 2001	GB	2.2	7.0	600	20.0	-40	Clear, none	SP	5	±5	No	±3
	29 Nov 2001	GB	NM	6.9	610	19.6	-170	Clear, none	SP	8	±7	No	±3
	29 Sep 2003	GB	1.6	6.7	560	21.9	-60	Clear, none	SP	10	±5	No	±3
MW6	1 Feb 2001	GB	2.8	6.7	510	18.7	-360	Opaque, brown	SP	23	±20	No	±11
	30 May 2001	GB	2.9	6.8	470	24.2	80	Turbid, brown	SP	5	±6	No	±3
	22 Aug 2001	GB	2.6	6.9	400	21.0	30	Turbid, green	SP	5	±5	No	±3
	29 Nov 2001	GB	NM	6.8	390	19.5	-160	Clear, none	SP	8	±7	No	±3
	29 Sep 2003	GB	2.1	6.6	470	25.5	180	Clear, none	SP	10	±5	No	±3
MW7	1 Feb 2001	GB	3.0	6.8	430	16.1	-200	Cloudy, brown	SP	25	±17	No	±11
	30 May 2001	GB	3.1	6.8	500	23.6	60	Clear, none	SP	5	±5	No	±3
	22 Aug 2001	GB	4.6	6.9	420	19.3	20	Turbid, gray	SP	5	±5	No	±3
	29 Nov 2001	GB	NM	6.7	400	19.2	-2	Clear, none	SP	6	±6	No	±3
	29 Sep 2003	GB	2.4	6.3	410	19.0	180	Clear, none	SP	10	±4	No	±3

General Notes

(a) ORP = oxidation/reduction potential.

(b) NM = not measured.

(c) Entries in this table correspond to the end of purging (time of sampling).

(d) SP = submersible purge pump.

(e) GB = grab sample collected using a Teflon bailer fitted with a bottom-emptying device.

Table 4 (Page 1 of 2)

Groundwater Analytical Data from Monitoring Wells

4401 Market Street, Oakland CA

Location	Sample Date	Sampled By	TPH-Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	Methyl Tert-Butyl Ether (µg/L)	Tert-Butyl-Alcohol (µg/L)	Other Fuel Oxygenates (µg/L)
MW1	8 Nov 1994	W.A. Craig	54	<0.5	<0.5	<0.5	1.2	NA	NA	NA
	14 Feb 1995	W.A. Craig	71	<0.5	<0.5	<0.5	0.97	NA	NA	NA
	7 Jun 1995	W.A. Craig	540	0.6	<0.5	1.7	1.3	NA	NA	NA
	29 Aug 1995	W.A. Craig	440	<0.5	<0.5	1.3	1.1	NA	NA	NA
	8 Dec 1995	W.A. Craig	<50	<0.5	<0.5	<0.5	<0.5	NA	NA	NA
	7 Mar 1996	W.A. Craig	77	<0.5	<0.5	<0.5	<0.5	44	NA	NA
	19 Jun 1996	W.A. Craig	500	<0.5	<0.5	0.85	0.36	84	NA	NA
	20 Dec 1996	W.A. Craig	<50	<0.5	<0.5	<0.5	<0.5	28	NA	NA
	12 Jun 1997	W.A. Craig	190	<0.5	<0.5	<0.5	<0.5	12	NA	NA
	1 Feb 2001	Streamborn	<50	<0.5	<0.5	<0.5	1.1	<5.0	<5.0	<5.0 to <10
	30 May 2001	Streamborn	<50	<0.5	<0.5	<0.5	<0.5	<5.0	<5.0	<5.0
	22 Aug 2001	Streamborn	<50	<0.5	<0.5	<0.5	<0.5	<5.0	100	<5.0 to <10
	29 Nov 2001	Streamborn	<50	<0.5	<0.5	<0.5	<0.5	<5.0	<5.0	<5.0 to <10
	29 Sep 2003	Streamborn	<50	<0.5	<0.5	<0.5	<1.0	<0.5	<5.0	<0.5 to <1.0
MW2	8 Nov 1994	W.A. Craig	20,000	1,400	960	980	4,600	NA	NA	NA
	14 Feb 1995	W.A. Craig	8,600	380	210	410	2,000	NA	NA	NA
	7 Jun 1995	W.A. Craig	6,200	500	78	270	1,200	NA	NA	NA
	29 Aug 1995	W.A. Craig	4,100	330	61	210	980	NA	NA	NA
	8 Dec 1995	W.A. Craig	9,400	360	190	440	2,000	NA	NA	NA
	7 Mar 1996	W.A. Craig	12,000	790	170	440	2,000	18	NA	NA
	19 Jun 1996	W.A. Craig	9,000	520	82	350	1,500	<5.0	NA	NA
	20 Dec 1996	W.A. Craig	13,000	830	180	410	2,200	<16	NA	NA
	12 Jun 1997	W.A. Craig	5,100	320	32	190	880	<36	NA	NA
	29 Sep 2003	Streamborn	220	5.5	<0.5	2.1	9.1	<0.5	24	DIPE = 1.3 Others = <0.5
MW3	8 Nov 1994	W.A. Craig	<50	0.71	0.84	1.2	5.8	NA	NA	NA
	14 Feb 1995	W.A. Craig	<50	<0.5	<0.5	<0.5	<0.5	NA	NA	NA
	7 Jun 1995	W.A. Craig	<50	<0.5	<0.5	<0.5	1.6	NA	NA	NA
	29 Aug 1995	W.A. Craig	<50	<0.5	<0.5	<0.5	<0.5	NA	NA	NA
	8 Dec 1995	W.A. Craig	<50	<0.5	<0.5	<0.5	<0.5	NA	NA	NA
	7 Mar 1996	W.A. Craig	<50	<0.5	<0.5	<0.5	<0.5	<5.0	NA	NA
	19 Jun 1996	W.A. Craig	<50	<0.5	<0.5	<0.5	<0.5	<5.0	NA	NA
	20 Dec 1996	W.A. Craig	<50	<0.5	<0.5	<0.5	<0.5	<5.0	NA	NA
	12 Jun 1997	W.A. Craig	<50	<0.5	<0.5	<0.5	<0.5	<5.0	NA	NA
	1 Feb 2001	Streamborn	<50	<0.5	<0.5	<0.5	<0.5	<5.0	<5.0	<5.0 to <10
	30 May 2001	Streamborn	<50	<0.5	<0.5	<0.5	<0.5	<5.0	<5.0	<5.0 to <10
	22 Aug 2001	Streamborn	<50	<0.5	<0.5	<0.5	<0.5	<5.0	14	<5.0 to <10
	29 Nov 2001	Streamborn	<50	<0.5	<0.5	<0.5	<0.5	<5.0	<5.0	<5.0 to <10
	29 Sep 2003	Streamborn	<50	<0.5	<0.5	<0.5	<1.0	<0.5	<5.0	<0.5 to <1.0
MW4	1 Feb 2001	Streamborn	1,500	58	1.3	83	320	<5.0	16	<5.0 to <10
	30 May 2001	Streamborn	1,000	19	<0.5	50	3.4	<5.0	23	<5.0 to <10
	22 Aug 2001	Streamborn	220	<0.5	<0.5	3.2	2.7	<5.0	8.8	<5.0 to <10
	29 Nov 2001	Streamborn	3,100	110	<5.0	120	410	<5.0	<5.0	<5.0 to <10
	29 Sep 2003	Streamborn	140	<0.5	<0.5	<0.5	<1.0	<0.5	<5.0	<0.5 to <1.0
MW5	1 Feb 2001	Streamborn	1,200	57	1.8	45	160	<5.0	<5.0	<5.0 to <10
	30 May 2001	Streamborn	570	20	<0.5	26	22	<5.0	<5.0	<5.0 to <10
	22 Aug 2001	Streamborn	380	19	0.67	31	17	<5.0	<5.0	<5.0 to <10
	29 Nov 2001	Streamborn	1,600	73	2.1	78	180	<5.0	<5.0	<5.0 to <10
	29 Sep 2003	Streamborn	460	2.6	<0.5	0.69	<1.0	<0.5	<5.0	<0.5 to <1.0
MW6	1 Feb 2001	Streamborn	260	8.0	<0.5	22	23	<5.0	<5.0	<5.0 to <10
	30 May 2001	Streamborn	53	<0.5	<0.5	<0.5	<0.5	<5.0	<5.0	<5.0 to <10
	22 Aug 2001	Streamborn	<50	<0.5	<0.5	<0.5	<0.5	<5.0	<5.0	<5.0 to <10
	29 Nov 2001	Streamborn	130	5.7	<0.5	1.6	5.0	<5.0	<5.0	<5.0 to <10
	29 Sep 2003	Streamborn	<50	<0.5	<0.5	<0.5	<1.0	<0.5	<5.0	<0.5 to <1.0
MW7	1 Feb 2001	Streamborn	<50	<0.5	<0.5	<0.5	<0.5	<5.0	<5.0	<5.0 to <10
	30 May 2001	Streamborn	<50	<0.5	<0.5	<0.5	<0.5	<5.0	<5.0	<5.0 to <10
	22 Aug 2001	Streamborn	<50	<0.5	<0.5	<0.5	<0.5	<5.0	<5.0	<5.0 to <10
	29 Nov 2001	Streamborn	<50	<0.5	<0.5	<0.5	<0.5	<5.0	<5.0	<5.0 to <10
	29 Sep 2003	Streamborn	<50	<0.5	<0.5	<0.5	<1.0	<0.5	<5.0	<0.5 to <1.0

Candidate Screening Criteria - Drinking Water Criteria	100 T&O	1 CA MCL	150 CA MCL	300 CA MCL	1,750 CA MCL	13 CA MCL	12 CA DWAL	
Candidate Screening Criteria - Volatilization from Groundwater to Indoor Air (Residential Land Use, High Permeability Soil) (most conservative screening level)		530	500,000	14,000	150,000	24,000		

Table 4 (Page 2 of 2)

Groundwater Analytical Data from Monitoring Wells

4401 Market Street, Oakland CA

General Notes

(a) TPH = total petroleum hydrocarbons. MtBE = methyl tert-butyl ether. DiPE = di-isopropyl ether.

(b) NA = not analyzed.

(c) MCL = Maximum Contaminant Level.

(d) DWAL = drinking water action level.

(e) T&O = taste and odor threshold.

(f) Candidate screening criteria from: *Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater, Interim Final - July 2003*. Prepared by the San Francisco Bay Regional Water Quality Control Board, Oakland CA. 21 July 2003.

Table 5

Free Product Monitoring in Monitoring Wells MW4, MW5, and MW6

4401 Market Street, Oakland CA

Date	MW4 (feet)	MW5 (feet)	MW6 (feet)
1 February 2001	<0.005	<0.005	<0.005
9 March 2001	<0.005	<0.005	<0.005
23 April 2001	<0.005	<0.005	<0.005
30 May 2001	<0.005	<0.005	<0.005
19 June 2001	<0.005	<0.005	<0.005
19 July 2001	<0.005	<0.005	<0.005
22 August 2001	<0.005	<0.005	<0.005
29 November 2001	<0.005	<0.005	<0.005

General Note

(a) Free product monitoring was performed using a Water Mark Interface meter: Model H.OIL.

Table 6a

Soil Analytical Data During Tank Removal

4401 Market Street, Oakland CA

Location	Sample Depth (feet)	Location Description	Sample Date	Sample Type	TPH-Gasoline (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethyl-benzene (mg/kg)	Total Xylenes (mg/kg)
S2	±8.5	±2-feet below invert of middle 500-gallon gasoline tank	22 June 1990	Grab (liner)	360	0.99	12	9.5	53
S3	±7.5	±2-feet below invert of southern 500-gallon gasoline tank	22 June 1990	Grab (liner)	160	1.2	2.5	2.8	13
S4	±8	±2-feet below invert at non-fill end of 1,000-gallon gasoline tank	22 June 1990	Grab (liner)	210	3.3	9.4	7.6	32
S5	±8	±2-feet below invert at fill end of 1,000-gallon gasoline tank	22 June 1990	Grab (liner)	870	3.2	24	20	110
S6	±8.5	±2-feet below invert of northern 500-gallon gasoline tank	22 June 1990	Grab (liner)	730	5	24	26	140
S8	±15	±8.5-feet below inverts and midway between the two northern 500-gallon gasoline tanks	22 June 1990	Grab (liner)	260	3.7	14	7.1	33

Candidate Screening Criteria - Volatilization from Soil to Indoor Air (Residential Land Use)		0.18	180	4.7	45
Candidate Screening Criteria - Direct Exposure to Soil (Residential Land Use)		0.18	130 HQ = 0.2	1,800 HQ = 0.2	4,700 HQ = 0.2

General Note

(a) TPH = total petroleum hydrocarbons.

(b) HQ = hazard quotient. The San Francisco Bay Regional Water Quality Control Board recommended a hazard quotient of 0.2 for screening purposes.

(c) Candidate screening criteria from: *Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater, Interim Final - July 2003*. Prepared by the San Francisco Bay Regional Water Quality Control Board, Oakland CA. 21 July 2003.

Table 6b

Soil Analytical Data from Borings and Wells

4401 Market Street, Oakland CA

Location	Sample Depth (feet)	Sample Date	Sampled By	TPH-Gasoline (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethyl-benzene (mg/kg)	Total Xylenes (mg/kg)	MtBE (mg/kg)	Other Fuel Oxygenates (mg/kg)
SB1	10 to 10.5	27 October 1994	WAC	<1	<0.005	<0.005	<0.005	<0.005	NM	NM
	15 to 15.5	27 October 1994	WAC	72	<0.01	0.13	0.21	0.18	NM	NM
	20 to 20.5	27 October 1994	WAC	<1	<0.005	<0.005	<0.005	<0.005	NM	NM
SB2	10 to 10.5	27 October 1994	WAC	40	0.079	0.034	0.43	4.7	NM	NM
	15 to 15.5	27 October 1994	WAC	19	0.46	0.041	0.31	4.2	NM	NM
	20 to 20.5	27 October 1994	WAC	5.7	0.006	<0.005	0.010	0.079	NM	NM
SB3	10 to 10.5	27 October 1994	WAC	<1	<0.005	<0.005	<0.005	<0.005	NM	NM
	15 to 15.5	27 October 1994	WAC	<1	<0.005	<0.005	<0.005	<0.005	NM	NM
	19.5 to 20	27 October 1994	WAC	<1	<0.005	<0.005	<0.005	<0.005	NM	NM
SB4	10 to 10.5	28 October 1994	WAC	<1	<0.005	0.005	0.006	0.016	NM	NM
	15 to 15.5	28 October 1994	WAC	220	<0.01	0.60	0.46	0.93	NM	NM
	19.5 to 20	28 October 1994	WAC	<1	<0.005	<0.005	<0.005	<0.005	NM	NM
MW1	10 to 10.5	27 October 1994	WAC	<1	<0.005	<0.005	<0.005	<0.005	NM	NM
	15 to 15.5	27 October 1994	WAC	<1	<0.005	<0.005	0.005	<0.005	NM	NM
	20 to 20.5	27 October 1994	WAC	<1	<0.005	<0.005	<0.005	<0.005	NM	NM
MW2	10 to 10.5	28 October 1994	WAC	<1	<0.005	<0.005	<0.005	<0.005	NM	NM
	15 to 15.5	28 October 1994	WAC	97	1.5	1.4	2.3	12	NM	NM
	20 to 20.5	28 October 1994	WAC	2.0	<0.005	0.009	0.016	0.062	NM	NM
MW3	10 to 10.5	28 October 1994	WAC	1.1	<0.005	0.006	<0.005	0.010	NM	NM
	15 to 15.5	28 October 1994	WAC	<1	<0.005	<0.005	<0.005	<0.005	NM	NM
	20 to 20.5	28 October 1994	WAC	<1	<0.005	<0.005	<0.005	<0.005	NM	NM
B8	11.5 to 12	8 April 1999	Streamborn	<1.0	<0.005	<0.005	<0.005	<0.005	<0.005	NM
	15 to 15.5	8 April 1999	Streamborn	<1.0	<0.005	<0.005	<0.005	<0.005	<0.005	NM
B9	11.5 to 12	8 April 1999	Streamborn	<1.0	<0.005	<0.005	<0.005	<0.005	<0.005	NM
	15 to 15.5	8 April 1999	Streamborn	110	<0.62	<0.62	<0.62	<0.62	<0.62	NM
B10	11.5 to 12	8 April 1999	Streamborn	<1.0	<0.005	<0.005	<0.005	<0.005	<0.005	NM
	15 to 15.5	8 April 1999	Streamborn	1,300	12	22	25	100	<3.1	NM
B11	11.5 to 12	8 April 1999	Streamborn	<1.0	<0.005	<0.005	<0.005	<0.005	<0.005	NM
	15 to 15.5	8 April 1999	Streamborn	140	<0.62	<0.62	1.8	8.9	<0.62	NM
B12	11.5 to 12	8 April 1999	Streamborn	<1.0	<0.005	<0.005	<0.005	<0.005	<0.005	NM
	15 to 15.5	8 April 1999	Streamborn	<1.0	<0.005	<0.005	<0.005	<0.005	<0.005	NM
B13	11.5 to 12	9 July 1999	Streamborn	<1.0	<0.005	<0.005	<0.005	<0.005	<0.005	NM
	15 to 15.5	9 July 1999	Streamborn	<1.0	<0.005	<0.005	<0.005	<0.005	<0.005	NM
B14	11.5 to 12	9 July 1999	Streamborn	<1.0	<0.005	<0.005	<0.005	<0.005	<0.005	NM
	15 to 15.5	9 July 1999	Streamborn	3.6	<0.005	<0.005	<0.005	0.036	<0.005	NM
	21 to 21.5	9 July 1999	Streamborn	2.1	<0.005	<0.005	0.059	0.32	<0.005	NM
B15	11.5 to 12	9 July 1999	Streamborn	<1.0	<0.005	<0.005	<0.005	<0.005	<0.005	NM
	15 to 15.5	9 July 1999	Streamborn	<1.0	<0.005	<0.005	<0.005	<0.005	<0.005	NM
	17.5 to 18	9 July 1999	Streamborn	<1.0	<0.005	<0.005	<0.005	<0.005	<0.005	NM
B16	11.5 to 12	9 July 1999	Streamborn	<1.0	<0.005	<0.005	<0.005	<0.005	<0.005	NM
	15 to 15.5	9 July 1999	Streamborn	<1.0	<0.005	<0.005	<0.005	<0.005	<0.005	NM
	19.5 to 20	9 July 1999	Streamborn	<1.0	<0.005	<0.005	<0.005	<0.005	<0.005	NM
MW4	12.5 to 13	5 January 2001	Streamborn	25	<0.62	<0.62	<0.62	<0.62	<0.005	<0.005 to <0.010
	14 to 14.5	5 January 2001	Streamborn	29	<0.62	<0.62	<0.62	<0.62	<0.023	<0.023 to <0.046
	15.5 to 16	5 January 2001	Streamborn	140	<3.1	<3.1	<3.1	5.3	<0.023	<0.023 to <0.046
MW5	12.5 to 13	4 January 2001	Streamborn	120	<3.1	<3.1	<3.1	9.2	<0.019	<0.019 to <0.038
	14 to 14.5	4 January 2001	Streamborn	560	<1.2	<1.2	8.5	43	<0.023	<0.023 to <0.045
	15.5 to 16	4 January 2001	Streamborn	93	<0.62	0.79	1.3	7.6	<0.022	<0.022 to <0.043
MW6	12.5 to 13	4 January 2001	Streamborn	91	<0.62	<0.62	1.0	1.3	<0.016	<0.016 to <0.038
	14 to 14.5	4 January 2001	Streamborn	200	<3.1	<3.1	<3.1	<3.1	<0.020	<0.020 to <0.040
MW7	10 to 10.5	5 January 2001	Streamborn	<1.0	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005 to <0.010
	15 to 15.5	5 January 2001	Streamborn	<1.0	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005 to <0.010

Candidate Screening Criteria - Volatilization from Soil to Indoor Air (Residential Land Use)		0.18	180	4.7	45	2.0	
Candidate Screening Criteria - Direct Exposure to Soil (Residential Land Use)		0.18	130 HQ = 0.2	1,800 HQ = 0.2	4,700 HQ = 0.2	1,100 HQ = 0.2	

General Notes

(a) TPH = total petroleum hydrocarbons. MtBE = methyl tert-butyl ether. NM = not measured.

(b) WAC = W.A. Craig (Napa CA). Streamborn = Streamborn (Berkeley CA).

(c) HQ = hazard quotient. The San Francisco Bay Regional Water Quality Control Board recommended a hazard quotient of 0.2 for screening purposes.

(d) Candidate screening criteria from: *Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater, Interim Final - July 2003*. Prepared by the San Francisco Bay Regional Water Quality Control Board, Oakland CA. 21 July 2003.

Table 7 (Page 1 of 2)

Excess Individual Lifetime Cancer Risk Due to Benzene Exposure

4401 Market Street, Oakland CA

Inhalation of Vapors that Volatilized from Soil and Intruded into Occupied Buildings

$$\text{Excess Individual Lifetime Cancer Risk} = \frac{C_s \times SF_i \times IR_{air} \times EF \times ED \times VF_{sesp}}{BW \times AT_c \times 365 \text{ days/year}}$$

Variable	Maximum Measured Value - Residential Scenario (B10, 15-15.5', 1999)	Maximum Measured Value - Commercial/ Industrial Scenario (B10, 15-15.5', 1999)	Average of All Measurements Above the Detection Limit - Residential Scenario	Average of All Measurements Above the Detection Limit - Commercial/ Industrial Scenario
C_s = contamination concentration	12 mg/kg	12 mg/kg	7.0 mg/kg	7.0 mg/kg
SF_i = inhalation cancer slope factor	0.1 kg-day/mg	0.1 kg-day/mg	0.1 kg-day/mg	0.1 kg-day/mg
IR_{air} = daily indoor inhalation rate	15 m^3/day	20 m^3/day	15 m^3/day	20 m^3/day
EF = exposure frequency	350 days/year	250 days/year	350 days/year	250 days/year
ED = exposure duration	10 years	10 years	10 years	10 years
VF_{sesp} = volatilization factor for subsurface soil to enclosed space vapors	0.0043 kg/m^3	0.0018 kg/m^3	0.0043 kg/m^3	0.0018 kg/m^3
BW = adult body weight	70 kg	70 kg	70 kg	70 kg
AT_c = averaging time for carcinogens	70 years	70 years	70 years	70 years

Calculated Excess Individual Lifetime Cancer Risk Using Maximum Measured Value		**Calculated Excess Individual Lifetime Cancer Risk Using the Average of All Measurements Above the Detection Limit**	
Residential	**Commercial/Industrial**	**Residential**	**Commercial/Industrial**
1.5×10^{-4}	**6.0×10^{-5}**	**8.8×10^{-5}**	**3.6×10^{-5}**

$$\text{Volatilization Factor } (VF_{sesp}) = \frac{[H \times r_s \times D_s] / \{[q_{ws} + (f_{oc} \times k_{oc} \times r_s) + (H \times q_{as})] \times ER \times L_B \times L_S\}}{1 + (D_s / [ER \times L_B \times L_S]) + [(D_s \times L_{crack}) / (D_{crack} \times h \times L_S)]} \times \frac{1{,}000 \text{ cm}^3\text{-kg}}{\text{m}^3\text{-g}}$$

Variable	Residential Value	Commercial/Industrial Value
H = Henry's Law constant	0.22	0.22
r_s = soil bulk density	1.7 g/cm^3	1.7 g/cm^3
D_s = effective diffusion coefficient in soil based on vapor-phase concentration	0.0073 cm^2/s	0.0073 cm^2/s
q_{ws} = volumetric water content in vadose zone soils	0.12	0.12
f_{oc} = fraction of organic carbon in soil	0.02	0.02
k_{oc} = carbon water sorption coefficient	38 L/kg	38 L/kg
q_{as} = volumetric air content in vadose zone soils	0.26	0.26
ER = enclosed-space air exchange rate	0.00014 s^{-1}	0.00023 s^{-1}
L_B = enclosed-space volume/infiltration area ratio	200 cm	300 cm
L_S = depth to subsurface soil sources	300 cm	300 cm
L_{crack} = enclosed-space foundation or wall thickness	15 cm	15 cm
D_{crack} = effective diffusion coefficient through foundation cracks	0.0073 cm^2/s	0.0073 cm^2/s
h = areal fraction of cracks in foundations/walls	0.001	0.001

Volatilization Factor (VF_{sesp})	
Residential	Commercial/Industrial
0.0043 kg/m^3	0.0018 kg/m^3

Table 7 (Page 2 of 2)

Excess Individual Lifetime Cancer Risk Calculations Due to Benzene Exposure

4401 Market Street, Oakland CA

Effective Diffusion Coefficient Through Foundation Cracks (D_{crack}) $= \dfrac{D^{air} \times (q_{acrack})^{3.33}}{(q_T)^2} + \dfrac{D^{water} \times (q_{wcrack})^{3.33}}{H \times (q_T)^2}$

Variable	Residential Value	Commercial/Industrial Value
D^{air} = diffusion coefficient in air	0.093 cm^2/s	0.093 cm^2/s
q_{acrack} = volumetric air content in foundation wall/cracks	0.26	0.26
q_T = total soil porosity	0.38	0.38
D^{water} = diffusion coefficient in water	0.000011 cm^2/s	0.000011 cm^2/s
q_{wcrack} = volumetric water content in foundation wall/cracks	0.12	0.12
H = Henry's Law constant	0.22	0.22

Effective Diffusion Coefficient Through Foundation Cracks (D_{crack})	
Residential	Commercial/Industrial
0.0073 cm^2/s	0.007 cm^2/s

Effective Diffusion Coefficient in Soil Based on Vapor-Phase Concentration (D_s) $= \dfrac{D^{air} \times (q_{as})^{3.33}}{(q_T)^2} + \dfrac{D^{water} \times (q_{ws})^{3.33}}{H \times (q_T)^2}$

Variable	Residential Value	Commercial/Industrial Value
D^{air} = diffusion coefficient in air	0.093 cm^2/s	0.093 cm^2/s
q_{as} = volumetric air content in vadose zone soils	0.26	0.26
q_T = total soil porosity	0.38	0.38
D^{water} = diffusion coefficient in water	0.000011 cm^2/s	0.000011 cm^2/s
q_{ws} = volumetric water content in vadose zone soils	0.12	0.12
H = Henry's Law constant	0.22	0.22

Effective Diffusion Coefficient in Soil Based on Vapor-Phase Concentration (D_s)	
Residential	Commercial/Industrial
0.0073 cm^2/s	0.0073 cm^2/s

General Notes

(a) All equations and variables were taken from ASTM 1739-95 (ASTM 1998) except as noted below.

(b) The cancer slope factors (SF_o and SF_i) were taken as 0.1 kg-day/mg (instead of the value of 0.029 kg-day/mg cited in the ASTM standard). The actual slope factors were based on State of California guidance (CalEPA 1999).

(c) The exposure duration (ED) was taken as 5 years (instead of the 25 or 30 years cited in the ASTM standard). The actual exposure duration was based on the observed natural biodegradation that will decrease the soil and groundwater concentrations with time, eventually leading to nondetectable concentrations.

(d) The fraction of organic carbon (f_{oc}) was taken as 0.02 (instead of the value of 0.01 cited in the ASTM standard). The actual fraction of organic carbon was based on the soil types of gravelly silt and gravelly clay that are present in the subsurface (Weidemeier et. al. 1999).

(e) The depth to contaminated soil (L_s) was taken as 300 cm = 10 feet (instead of the vale of 100 cm cited in the ASTM standard). The actual depth to contaminated soil was based on site-specific soil sampling data.

(f) The areal fraction of cracks in foundations/walls (h) was taken as 0.001 (instead of the value of 0.01 cited in the ASTM standard). The actual areal fraction of cracks was based on fact that residential development will require new construction at the site and will be subject to fewer cracks.

Table 8

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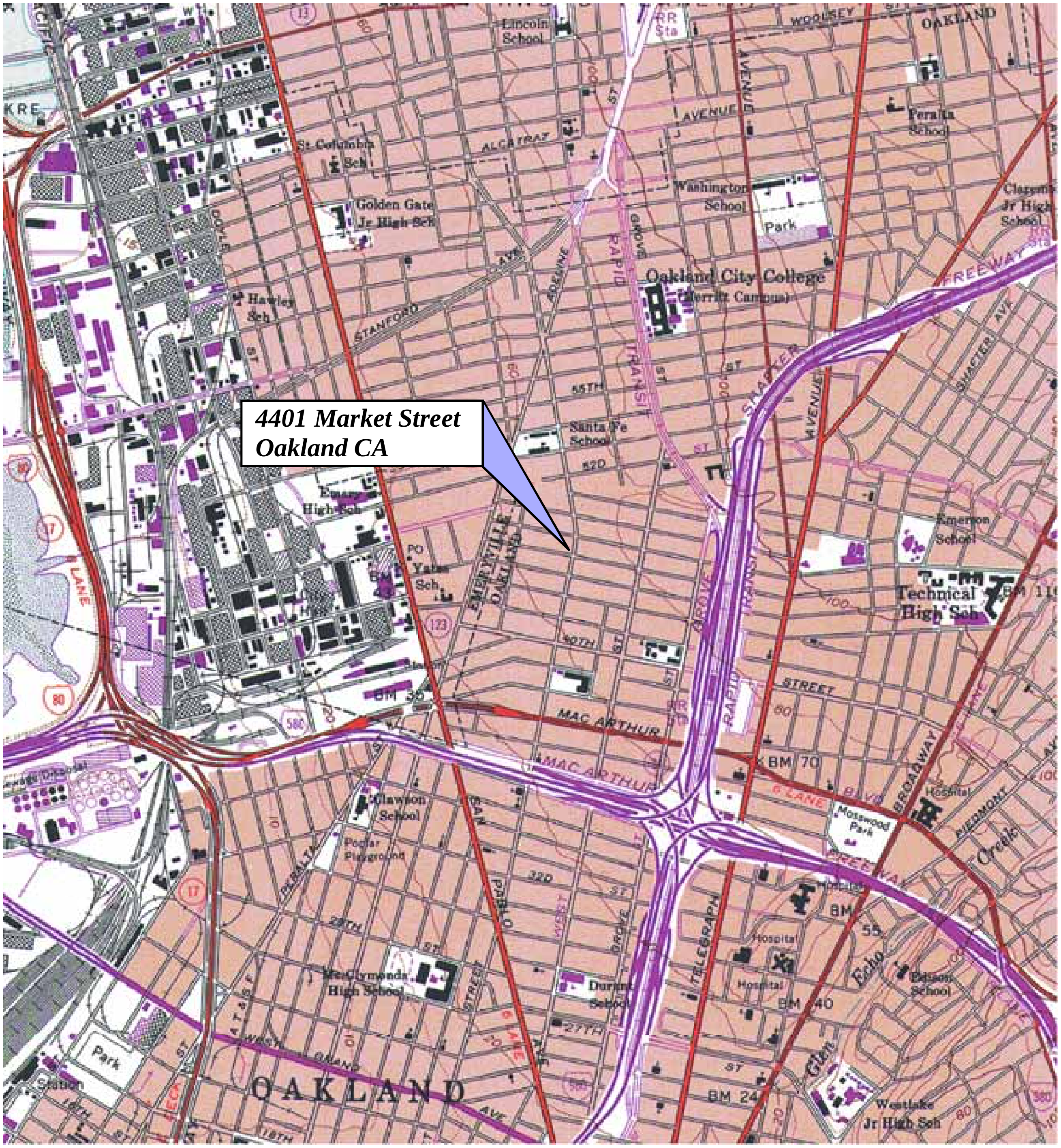

Basemap: U.S. Geological Survey, 7.5 Minute Quadrangle, Oakland West CA, 1959 (Photorevised 1980).

0 1

Approximate Scale in Miles

0 2,000 4,000

Approximate Scale in Feet

Figure 1

Location Map

4401 Market Street
Oakland CA

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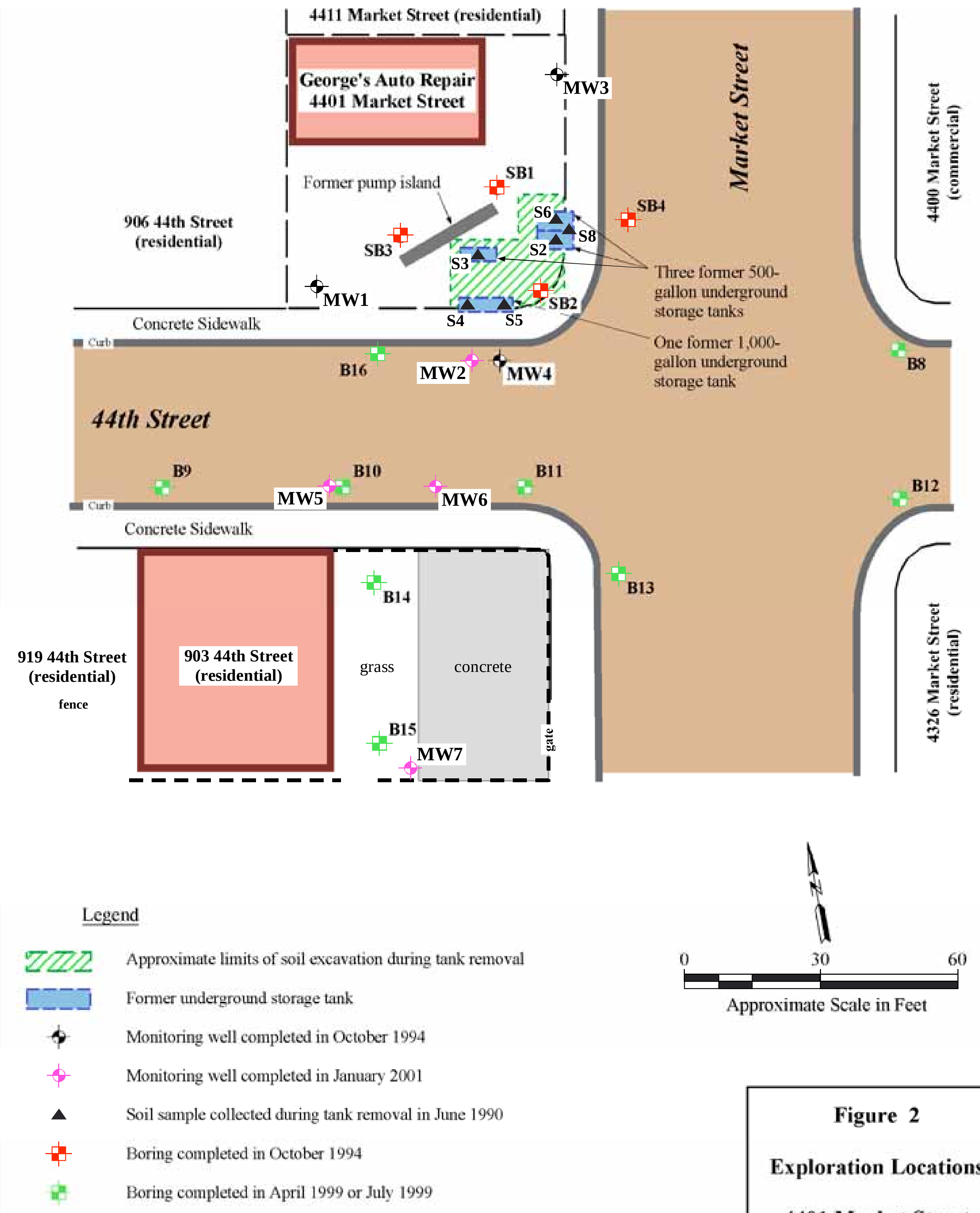


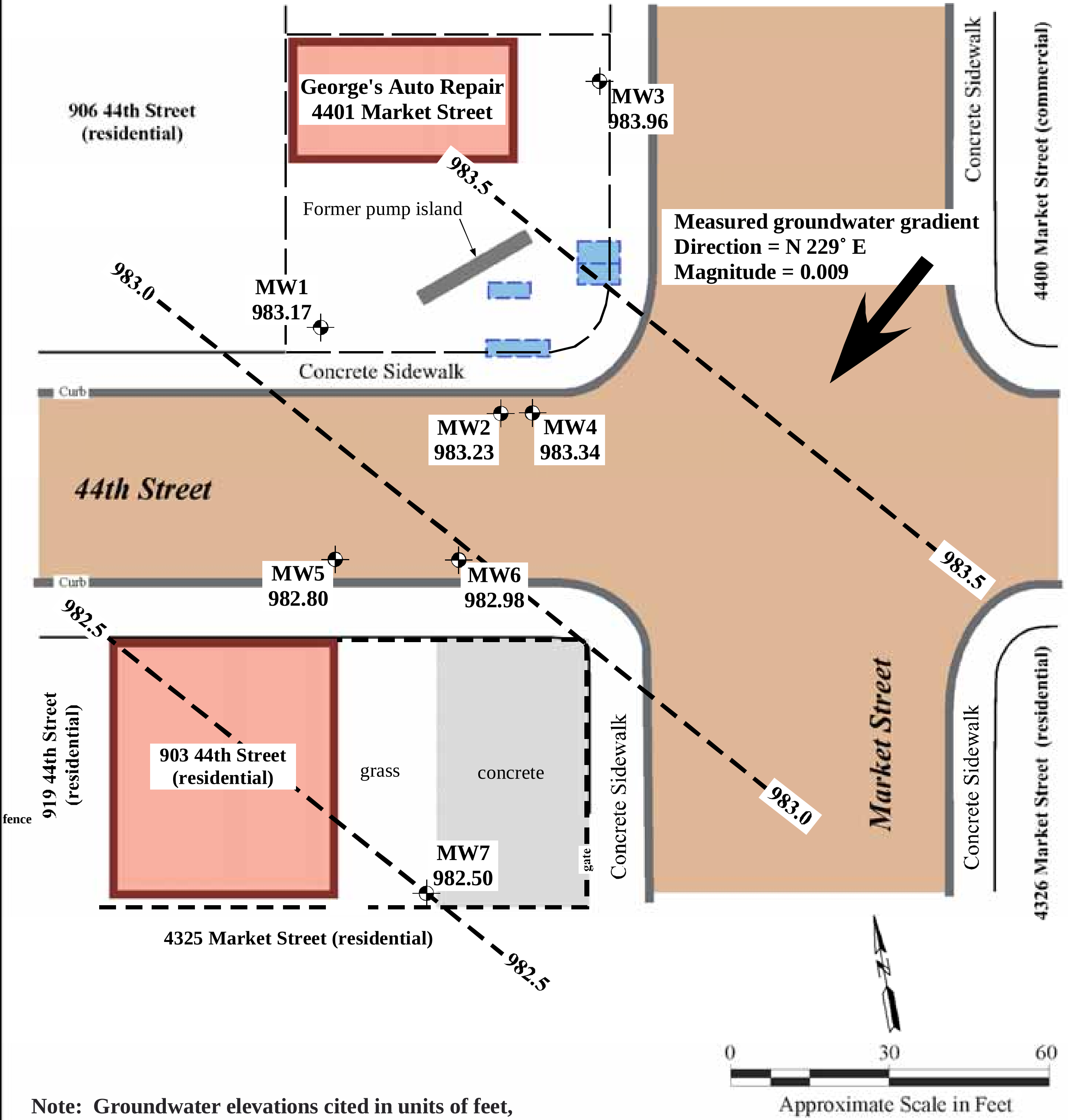
Figure 2

Exploration Locations

4401 Market Street
Oakland CA

Locations of former underground tanks and pump island from W.A. Craig report dated 1994.

STREAMBORN



Note: Groundwater elevations cited in units of feet, referenced to site-specific datum (not Mean Sea Level).

Legend

Monitoring well

Former underground tank

Locations of former underground tanks and pump island from W.A. Craig report dated 1994.

Figure 3

Groundwater Levels and Gradient (29 September 2003)

4401 Market Street Oakland CA

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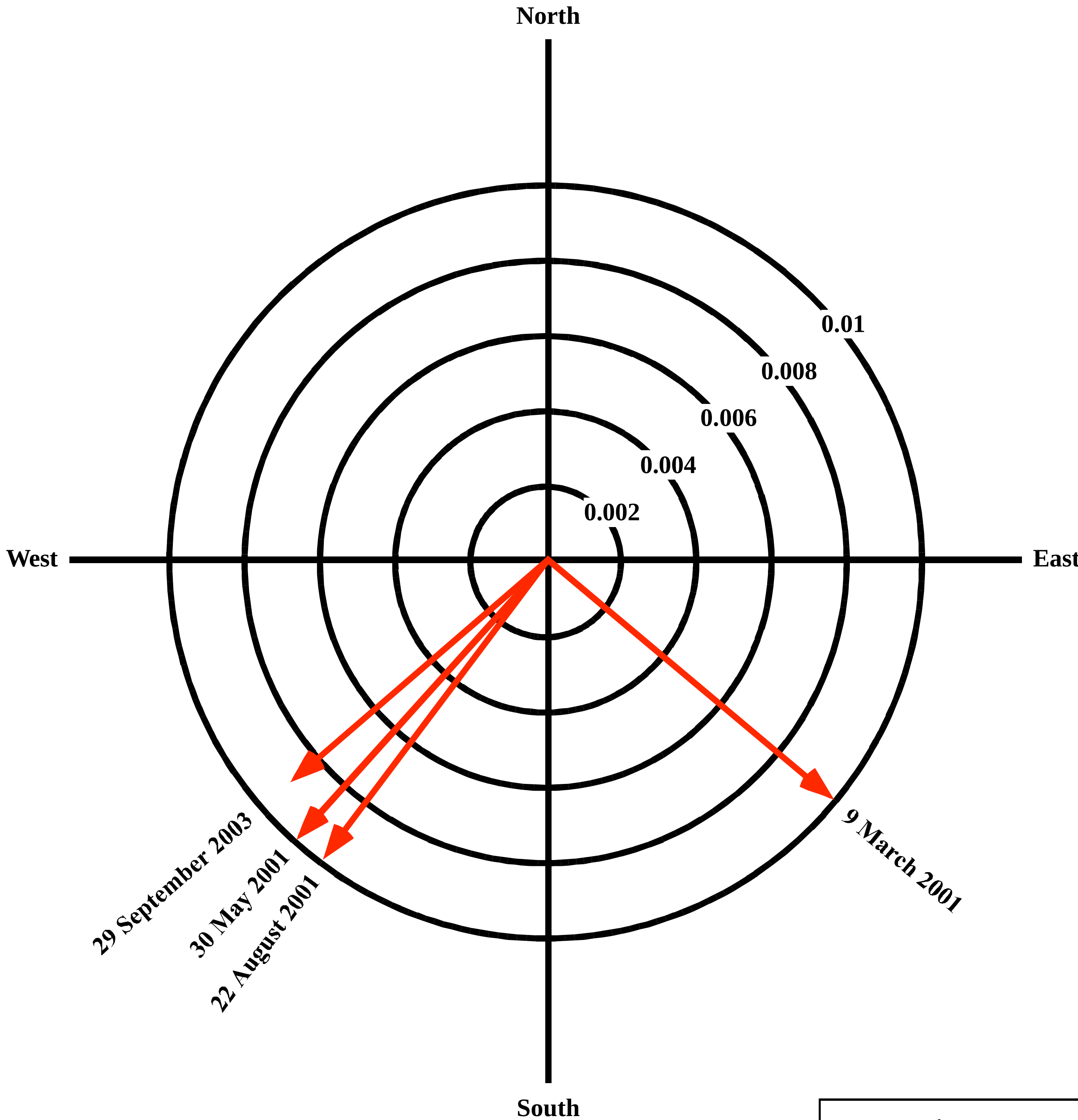

Figure 4

Rose Diagram of the Groundwater Gradient

4401 Market Street
Oakland CA

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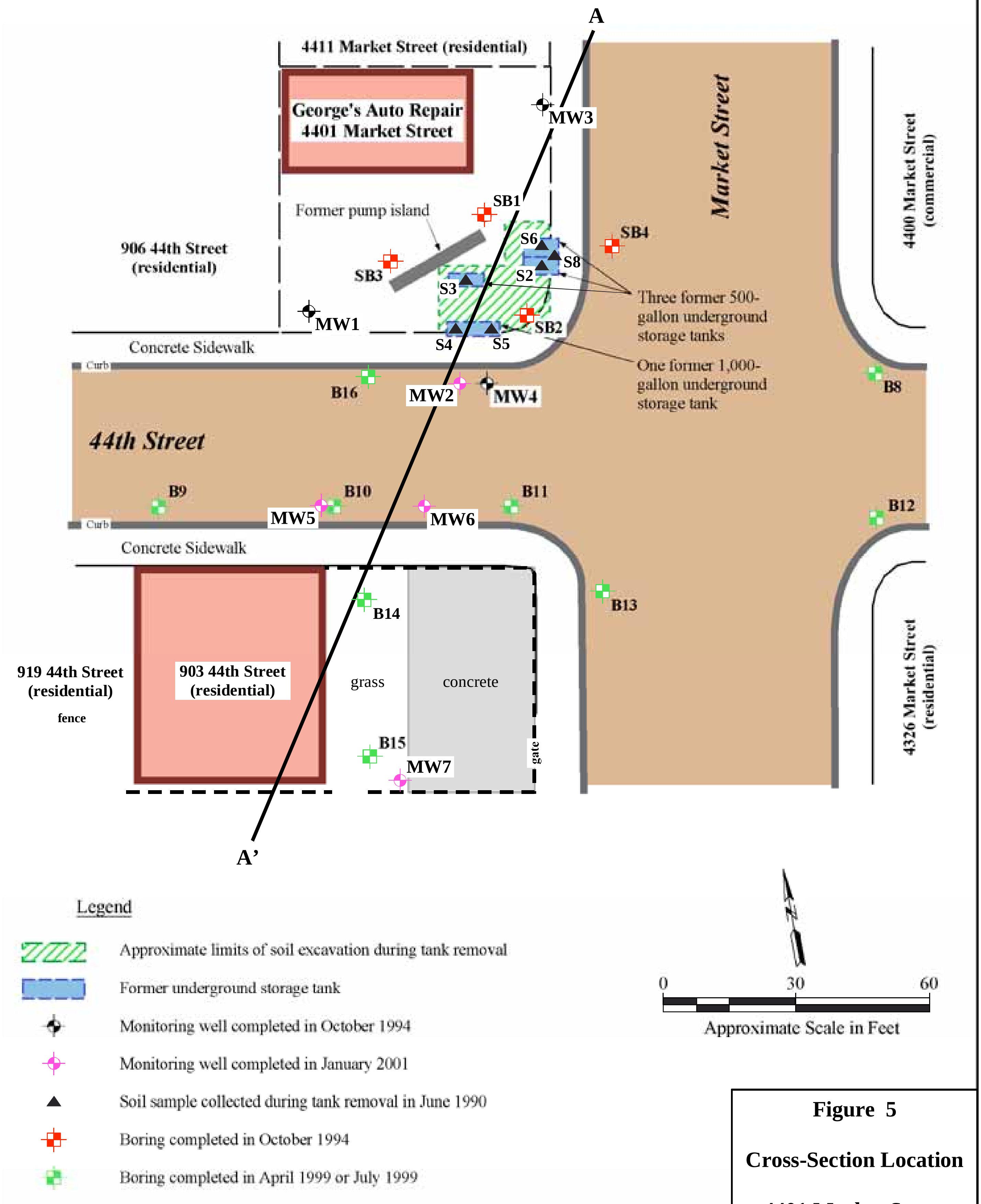

Locations of former underground tanks and pump island from W.A. Craig report dated 1994.

Figure 5

Cross-Section Location

4401 Market Street
Oakland CA

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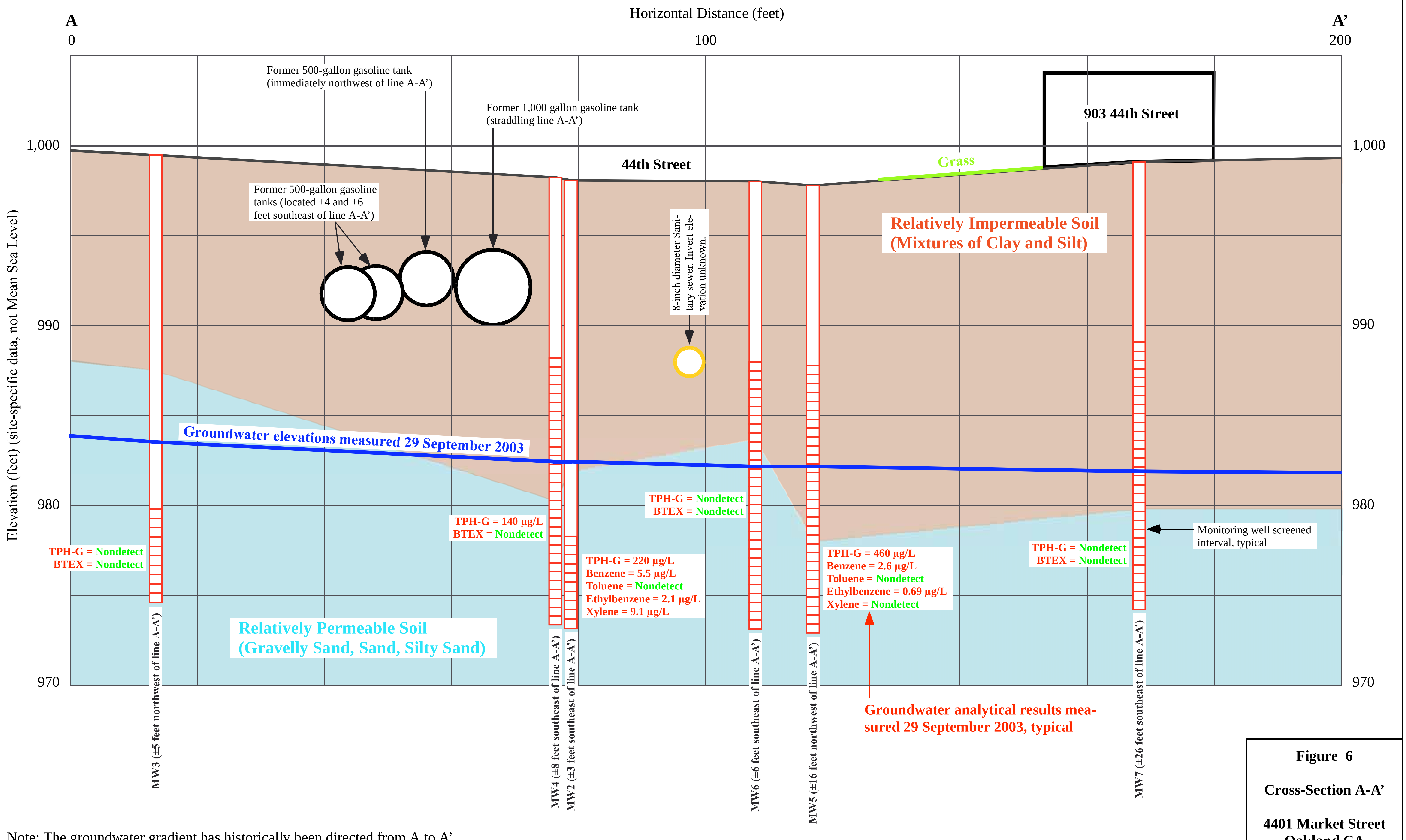

Figure 6

Cross-Section A-A'

4401 Market Street
Oakland CA

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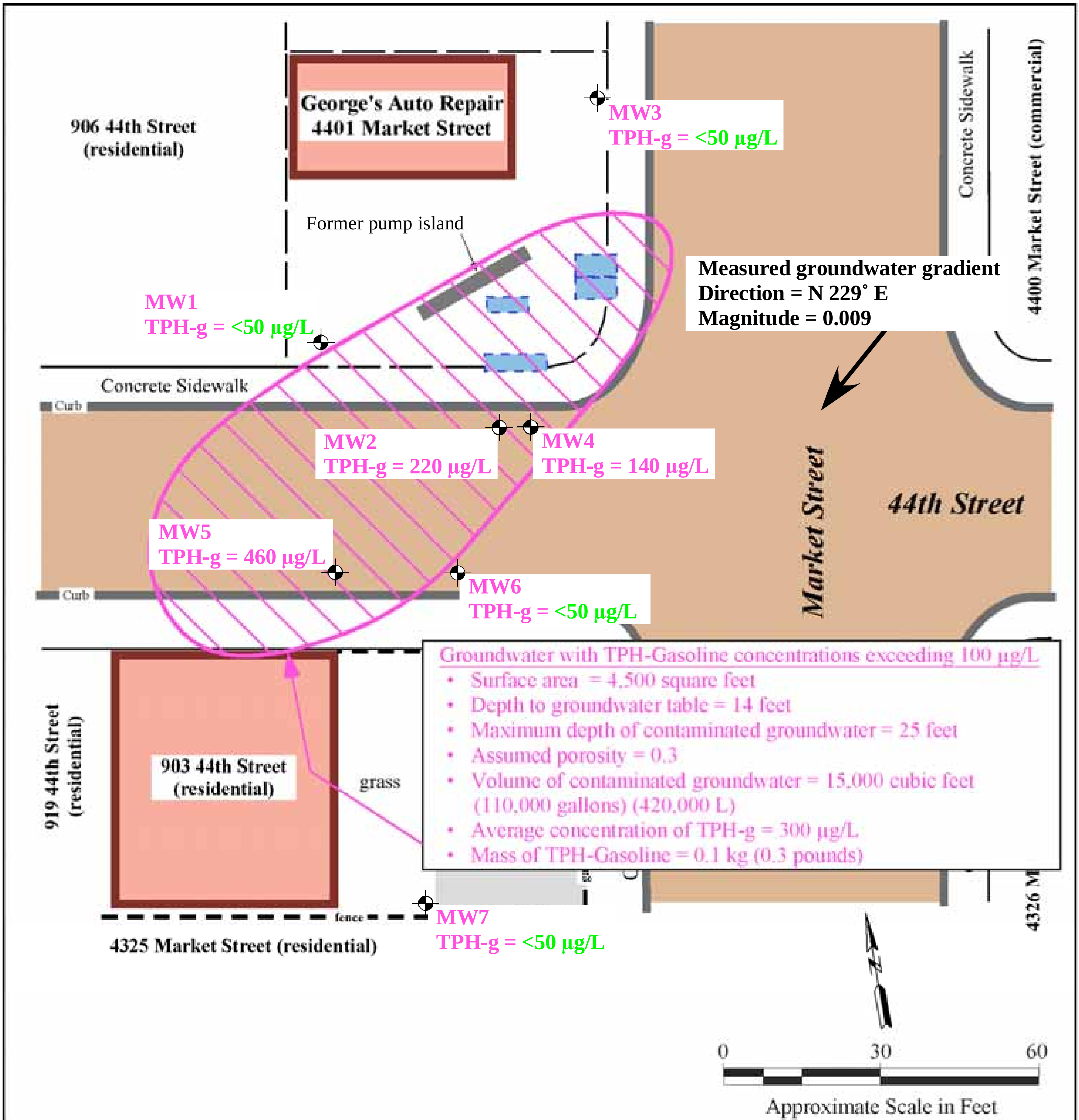

Legend

- Monitoring well
- Former underground storage tank

TPH-g = Total Petroleum Hydrocarbons as Gasoline

Locations of former underground tanks and pump island from W.A. Craig report dated 1994.

Figure 7

Extent of TPH-Gasoline in Groundwater (29 September 2003)

4401 Market Street Oakland CA

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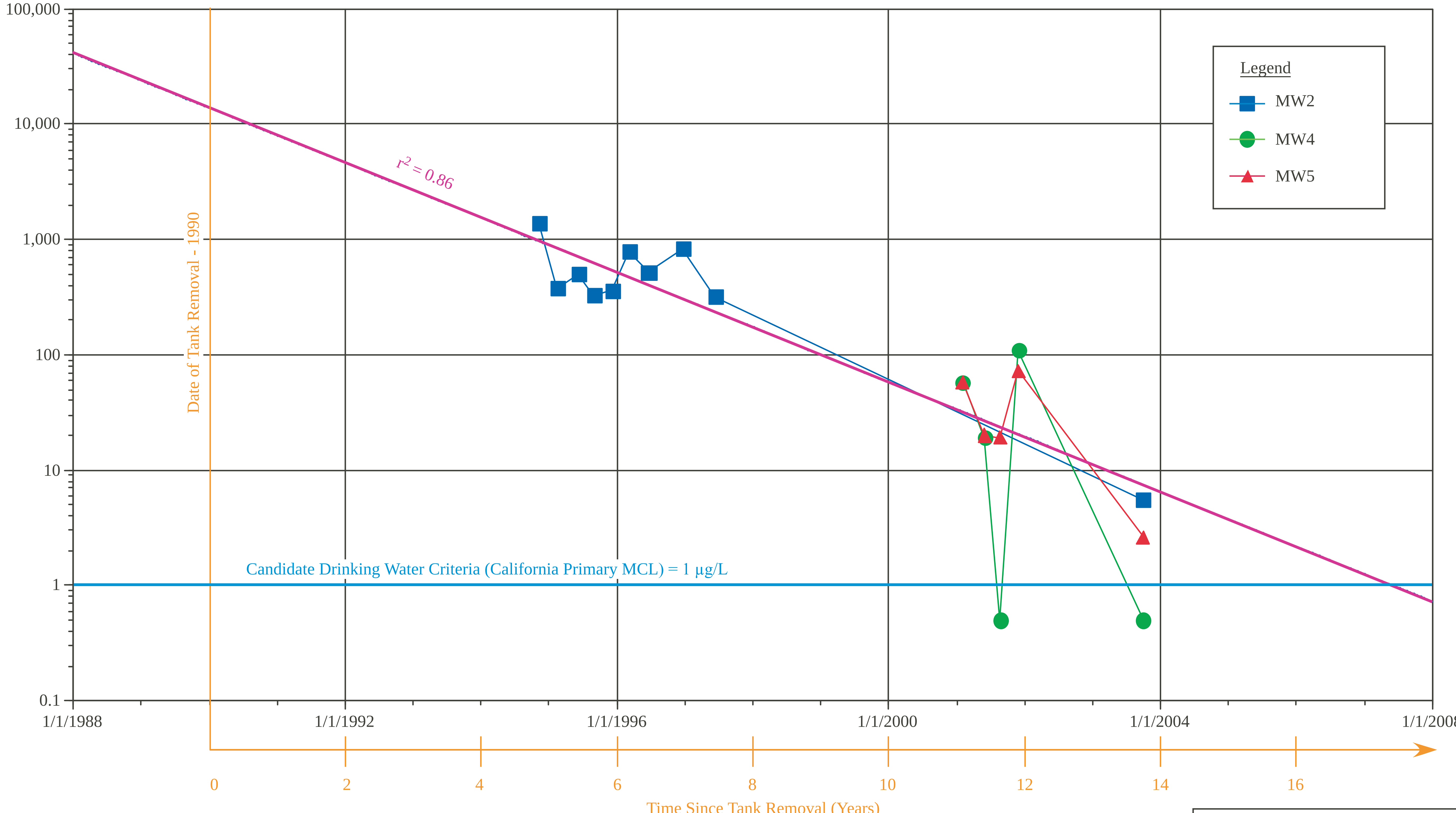

First Order Biodegradation Equation

$C_t = (13{,}670\ \mu g/L)(e^{(-0.546t)})$

Where t = years since 1990

Time for the benzene concentration to reach 1µg/L

$1 = (13{,}670\ \mu g/L)(e^{(-0.546t)})$

t = 17 years + 1990 = 2007

Figure 8

Benzene in Groundwater Versus Time for Wells MW2, MW4, and MW5

4401 Market Street
Oakland CA

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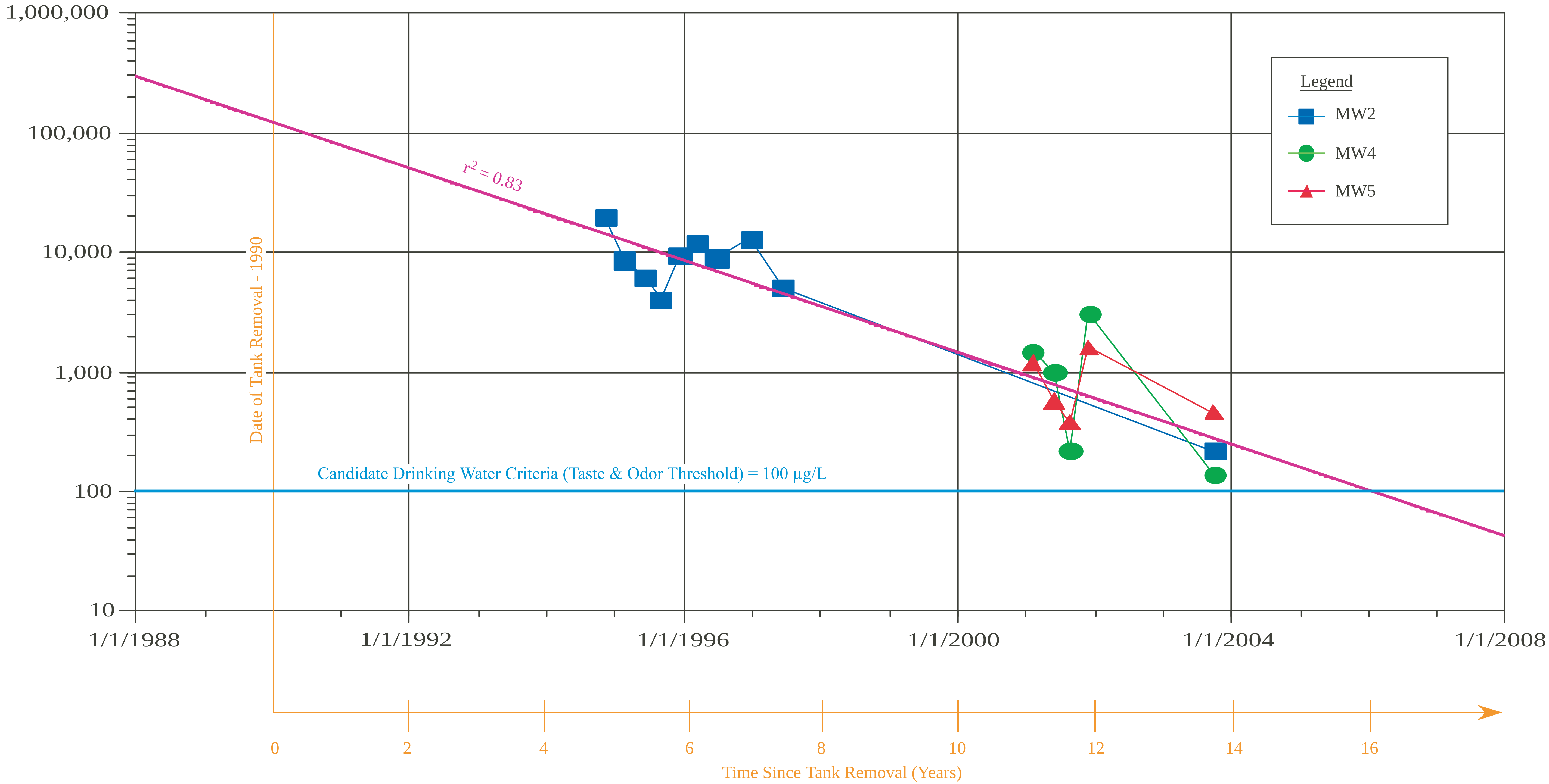

First Order Biodegradation Equation

C_t = (106,530 µg/L)(e $^{(-0.424t)}$)

Where t = years since 1990

Time for the TPH-Gasoline concentration to reach 100 µg/L

100 µg/L = (106,530 µg/L)(e $^{(-0.424t)}$)

t = 16 years + 1990 = 2006

Figure 9

TPH-Gasoline in Groundwater Versus Time for Wells MW2, MW4, and MW5

4401 Market Street
Oakland CA

STREAMBORN