ALLCAL ENVIRONMENTAL

September 25, 2001

# PROPOSED WORK PLAN FOR PHASE IV FURTHER ASSESSMENT

Morris F. Donnelly
Jeffery W. Kerry
Kerry & Associates
151 Callan Avenue, Suite 202
San Leandro, CA 94577

RE: Palace Garage, 14336 Washington Avenue, San Leandro, CA 94587, STID 2355

Dear Messrs. Donnelly and Kerry:

Thank you for contracting with ALLCAL Environmental (ALLCAL) to write this work plan for a further soil and groundwater assessment (Phase IV) at the above referenced property. The assessment, and this work plan, is required by the Alameda County Health Care Services Agency (ACHCSA) in a July 13, 2001, letter (attached) to you (Client).

## BACKGROUND

### Tank Closure and Soil Remediation

The following discussion of tank closure and soil remediation is summarized from information provided by the Client.

On February 11, 1991, a 550-gallon, gasoline, single-walled steel UST was removed by Verl's Construction, Inc. (Verl). The UST and its associated dispenser and piping were located at the north corner of the Palace Garage building (Figure 1). Examination of the UST, after its removal, revealed four small holes at the top of the southerly end of the tank. Two holes were pin-size and the other two were about .25- and .5-inches in diameter. The piping appeared to be in good condition. Soil in the tank excavation contained gasoline contamination based on visual observations, the presence of odor, and head-space analysis using a photo-ionization detector (PID). A discrete soil sample was collected for chemical analysis from native soil directly below the tank at a depth of about 10 feet below grade. Results of chemical analyses detected total petroleum hydrocarbons as gasoline (TPHG) at a concentration of 19 parts per million (ppm). Benzene, toluene, ethylbenzene, and xylenes (BTEX) were detected at concentrations of .21 ppm, .41 ppm, .043 ppm, and .14 ppm, respectively. Organic lead was detected at a concentration of 7 ppm.

On the day of the UST removal, additional soil excavation (over-excavation) was conducted to

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remove contaminated soil. The Client reports that soil was removed to the depth that the on-site backhoe could reach, about 18 to 20 feet. A March 7, 1991, UST closure report prepared by Century West Engineering Corporation (Century West) included PID head-space measurements, from 5 to 12.5 feet deep, that were recorded during over-excavation activities. The head-space measurements showed increasing field vapors, from 170 ppm at 5 feet below grade to 880 ppm at 12.5 feet below grade. A February 25, 1991, letter from Verl indicates that soil samples from the bottom of the final excavation had vapor concentrations "substantially" lower than those shallower in the excavation; however, there is no documentation of these lower concentrations. A composite soil sample was collected for chemical analysis from the stockpiled soil (resulting from tank removal and over-excavation activities) to assess disposal options. Results of chemical analyses detected concentrations of TPHG at 1,900 ppm. BTEX were detected at concentrations of 1.2 ppm, 14 ppm, 11 ppm, and 67 ppm, respectively. Organic lead was detected at a concentration of 9.9 ppm.

After conducting remedial over-excavation, the hole was lined with plastic and backfilled with pea gravel.

No groundwater was encountered during the tank removal or over-excavation activities.

The excavated soil was spread and aerated on site. After aeration, Century West sampled and characterized the soil for offsite disposal. Verl hauled and disposed of the soil to a landfill in Richmond, California.

**Soil and Groundwater Assessments**

The following discussion of results of soil and groundwater assessments is summarized from the following ALLCAL reports:

- *REPORT OF SOIL AND GROUNDWATER ASSESSMENT AND PROPOSED WORK PLAN FOR FURTHER ASSESSMENT*, (PHASE I) February 17, 1999.

- *REPORT OF PHASE II SOIL AND GROUNDWATER ASSESSMENT AND PROPOSED WORK PLAN FOR PHASE III FURTHER ASSESSMENT*, April 9, 1999.

- *REPORT OF PHASE III SOIL AND GROUNDWATER ASSESSMENT*, August 25, 1999.

- *REPORT OF WELL INSTALLATION*, June 23, 2000.

- *THIRD QUARTER GROUNDWATER MONITORING REPORT, AUGUST 23, 2000*, September 12, 2000.

- *FOURTH QUARTER GROUNDWATER MONITORING REPORT, NOVEMBER 28, 2000*, December 19, 2000.

- *FIRST QUARTER GROUNDWATER MONITORING REPORT, FEBRUARY 27, 2001*, March 14, 2001.

The following is a summary of the results of three phases of soil and groundwater assessment conducted by GeoProbe push-tool technology and four quarterly groundwater monitoring events of three installed groundwater monitoring wells. The reader is referred to attached TABLE 1 and TABLE 2 for analytical results for all soil and "grab" groundwater samples and groundwater monitoring well samples, respectively. Figures 2 and 3 present graphical interpretations of the TPHG and benzene groundwater plumes as interpreted from "grab" groundwater samples.

**Phase I Soil and Groundwater Assessment - 2/1/99**

On February 1, 1999, ALLCAL supervised the drilling of four soil borings (SB-1 through SB-4; Figure 1) to assess gasoline contamination in the soil and groundwater in the area of the former UST. Chemical analytical results were evaluated with respect to the American Society of Testing and Materials' (ASTM) Standard for Risked Based Corrective Action (RBCA) ASTM E-1739-95. Analytical results suggested that soil contamination by benzene may pose a cancer risk as leachate in the area of the former dispenser (SB-1), and groundwater contamination by benzene may pose a cancer risk in terms of vapor intrusion into the onsite building, near SB-1 and into the neighboring building across the driveway, near SB-2.

Based on the above results, ALLCAL conducted a Phase II soil and groundwater assessment.

**Phase II Soil and Groundwater Assessment - 3/23/99**

On March 23, 1999, ALLCAL supervised the drilling of three additional soil borings (SB-5, SB-6, and SB-7; Figure 1) to further assess gasoline contamination in the soil and groundwater in the area of the former UST. Field observations indicated that no contamination was present in the soil, however, analytical results suggested that groundwater contamination by benzene may pose a cancer risk, in terms of vapor intrusion into buildings, in the area of borings SB-5 and SB-6.

Based on the above results, ALLCAL conducted a Phase III soil and groundwater assessment which included both on-site and off-site borings.

**Phase III Soil and Groundwater Assessment - 7/29/99**

On July 29, 1999, ALLCAL supervised the drilling of eight additional soil borings (SB-8 through SB-15; Figure 1) to assess the limits of the gasoline contamination. At that time, these borings appeared to have adequately assessed the aerial extent of the soil and groundwater contaminant plumes. The soil plume appeared to be limited in aerial and vertical extent (the areas of SB-1 and SB-6) and of low concentrations. The groundwater plume appeared to mostly underlie the driveway and adjacent northerly property and elongated in the direction of the driveway (Figures 2 and 3).

Based on the above results, the ACHCSA requested the installation of three groundwater monitoring wells and four quarterly sampling events to better characterize the dissolved gasoline plume and establish groundwater gradient.

**Installation of Three Groundwater Monitoring Wells - 5/10/00**

On May 10, 2000, ALLCAL supervised the installation of three 2-inch diameter groundwater monitoring wells (MW-1 through MW-3). Wells MW-1 and MW-2 were installed near the northeasterly and southwesterly ends of the driveway, respectively, and well MW-3 was installed off site in the parking lane of Washington Avenue near former boring SB-9 (Figure 1). Well MW-1 was installed at a location believed to have the highest concentration of gasoline constituents in the ground water. Well MW-2 was installed at a location believed to be in the downgradient fringe of the plume, and well MW-3 was installed in a location believed to be downgradient of the plume. All wells were constructed to a depth of about 24 feet.

**Results of Four Quarterly Groundwater Sampling Events**

The three installed groundwater monitoring wells were sampled on 5/19/00, 8/23/00, 11/28/00, and 2/27/01. Analytical results detected gasoline constituents for all sampling events of wells MW-1 and MW-2. Analytical results for well MW-3 were non-detectable for gasoline constituents for all sampling events. MTBE was non-detectable for all sampling events for all wells. In wells MW-1 and MW-2, the detection limit for MTBE was elevated due to the high TPHG concentrations detected in those wells.

TPHG and benzene concentrations for well MW-1 ranged from a low of 9000 ppb to 52000 ppb, and 390 ppb to 1800 ppb, respectively. TPHG and benzene concentrations for well MW-2 ranged from a low of 6400 ppb to 9300 ppb, and 1100 ppb to 1900 ppb, respectively. See attached TABLE 2 for a summary of all groundwater monitoring well analytical results.

**Request for Additional Assessment Work**

Because well MW-2 has concentrations of gasoline constituents that suggest the well is not located in the downgradient fringe of the plume as originally intended, the ACHCSA has required that two additional GeoProbe push-tool technology borings be conducted downgradient of well MW-2 (see attached July 13, 2001, letter). The borings are proposed to be located on site at the end of the driveway, near the sidewalk, and in front of the building that occupies the subject property. The purpose of the borings is to collect soil and "grab" groundwater samples for chemical analyses and to find the "end point" of the plume. If, at the time of drilling the "end point" of the plume is believed to have been found, one or both of the borings may be converted to a small-diameter groundwater monitoring well.

**PROPOSED WORK PLAN FOR FURTHER SITE ASSESSMENT**

Two on-site GeoProbe push-tool technology borings (SB-16 and SB-17) are proposed to be drilled to further assess the downgradient limit of the dissolved gasoline plume. The borings are proposed to be located at the end of the driveway, near the sidewalk, and in front of the building that occupies the subject property. Proposed boring locations are shown in the attached Figure 1. One or both borings may be converted into monitoring well points at the time soil borings are being conducted.

**Proposed Soil and Groundwater Assessment Methodology**

ALLCAL proposes to collect, handle, and analyze soil and groundwater samples as described in the previously approved January 20, 1999, work plan, with the exception that "grab" groundwater samples will be collected with a "mini" stainless-steel bailer.

One soil sample is proposed to be collected from each boring at a depth about 1 to 2 feet above groundwater. Additional soil samples will be collected if apparent significant contamination is present in any of the borings.

**Conversion of Boring(s) to Groundwater Monitoring Wells**

One or both borings are proposed to be converted into monitoring well points, at the time of soil boring activities, based on the following field observations:

> If groundwater in *both* borings is estimated to be *uncontaminated* (based on field observations that include absence of hydrocarbon staining, sheen and/or odor), both borings are proposed to be converted into small-diameter groundwater monitoring points.
>
> If the groundwater in only *one* of the borings is estimated to be *uncontaminated*, that boring is proposed to be converted into a small-diameter groundwater monitoring point.
>
> If the groundwater in *both* borings is estimated to be *contaminated*, the boring that is estimated to have the least contamination is proposed to be converted into a small-diameter groundwater monitoring point.

*Proposed Well Installation and Development Procedures*:

The first five feet of the borings will be drilled by using a 5-inch diameter hand-auger. This size hole will provide the annular thickness of sanitary seal required by the California Department of Water Resources. The remainder of the borings will be drilled using GeoProbe push-tool technology. Based on an estimated depth to groundwater of about 12 feet, the borings are proposed to be drilled to a total depth of about 22 feet. The boring)s) will be converted into a groundwater monitoring point by installing 1-inch diameter, flush-threaded, schedule 40, polyvinyl chloride casing and 0.010-inch machine-slotted screen. The exact depth of the boring and screen length will be determined by the geologic profile, actual depth of groundwater, and whether the groundwater is confined or unconfined. If groundwater is unconfined, the screen is proposed to extend about 5 feet above and about 10 feet below the water table surface. The length of screen below the water table surface may be less than 10 feet if an aquiclude/aquitard is encountered. If groundwater is confined, the screen length will extend from the upper contact of the aquifer to a maximum depth of 10 feet. If the aquifer is less than 10 feet thick, the screen length will equal the thickness of the aquifer. A sand pack of No. 2/12 filter sand will be placed in the annular space from the bottom of the boring to a maximum of 2 feet above the top of the screened interval. Approximately 1 foot of bentonite will be placed above the sand pack followed by a neat cement slurry seal. A traffic-rated, bolt-locked, vault box will be set in concrete to protect the well. A water-tight locking well cap with lock will be installed on each well casing.

Attached Appendix A documents ALLCAL's protocol relative to groundwater monitoring well construction procedures.

After a minimum of 48 hours following well construction, the well(s) will be developed by removing water with a peristaltic pump and/or by bailing with a PVC bailer, with intervening periods of surging, until the well is free of sand, silt, and turbidity or no further improvement is apparent.

Development water will be stored on site in a 55-gallon drum. The drum will be labeled to show contents, date filled, suspected contaminant, company name, contact person, and telephone number. Security and proper disposal of the water and drum is the Client's responsibility. After the water is characterized by chemical analysis, ALLCAL can provide recommendations and assist the Client in proper disposal of the water and pails as an additional work item.

Attached Appendix B documents ALLCAL's protocol relative to groundwater monitoring well development procedures.

*Surveying of Monitoring Well Point(s)*

ALLCAL proposes that the well point(s)'s horizontal location be surveyed relative to longitude and latitude, and the top(s)-of-casing be surveyed relative to sea level by a California Professional Civil Engineer or Licensed Land Surveyor within the accuracies required by the State Water Resources Control Board.

*Proposed Groundwater Sampling Procedure*:

After a minimum of 48 hours after well development, ALLCAL proposes that the new well point(s) and the three existing monitoring wells be sampled and gradient evaluated according to the sampling protocol used to date.

**Permits and Site Health and Safety Plan**

Soil boring/well construction permits will be obtained from the ACPWA and all work will be conducted under ALLCAL's previously approved SITE HEALTH AND SAFETY PLAN.

**Report**

The information collected, analytical results, and ALLCAL's conclusions and recommendations will be summarized in a report. The report will describe the work performed and include: copies of all required permits, a detailed site plan showing location(s) of the installed monitoring well(s), a graphic boring log(s), a graphic well construction detail(s), the surveyor's report, and a copy of the certified analytical report and chain-of-custody.

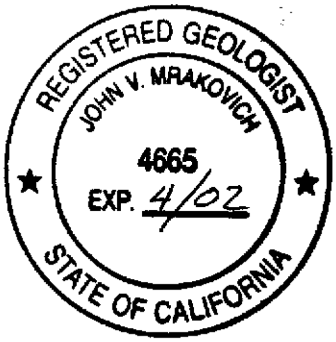
**Time Schedule**

ALLCAL proposes to conduct the above scope of work within four weeks of obtaining approval of the above work plan from the Client and the ACHCSA and on obtaining contractual agreement with the Client.

If you have any questions, please call me at (510) 581-2320.

Sincerely,

John V. Mrakovich, Ph.D.
Registered Geologist No. 4665



ALAMEDA COUNTY
**HEALTH CARE SERVICES**
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ENVIRONMENTAL PROTECTION
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July 13, 2001

STID 2355

Morris F. Donnelly
Jeffrey W. Kerry
Kerry & Associates
151 Callahan Avenue, Ste. 202
San Leandro, CA 94577

RE: Palace Garage, 14336 Washington Avenue, San Leandro

Dear Messrs. Donnelly and Kerry:

Thank you for our receipt of the February 27, 2001 All Cal Property Service, Inc. (All Cal) report documenting the results of the 1st quarter 2001 sampling and monitoring activities at your site. This report represents one full year of well sampling and monitoring at this site.

The assessment work performed to date has generated good data, allowing a fairly good understanding of the dissolved gasoline plume geometry and contaminant distribution. However, the plume, as currently investigated, is still not fully defined, particularly in the downgradient direction from the former underground storage tank (UST) location. The downgradient "end point" of the plume has not been identified. Consequently, additional assessment work is required to satisfy this fundamental requirement.

I spoke with All Cal's John Mrakovich last week to discuss the expected scope of the next phase of the assessment. We still anticipate using GeoProbe® push-tool technology, as in the earliest phases of the investigation. Two sample points located close to Washington Avenue appear appropriate – one in front of your building, and another at the foot of the driveway leading between your and the neighboring building - with the option of installing one or two small-diameter, prepackaged wells if deemed prudent at the time of drilling to facilitate future sampling.

Please have your consultant submit a work plan for this next phase of the assessment to this office for review.

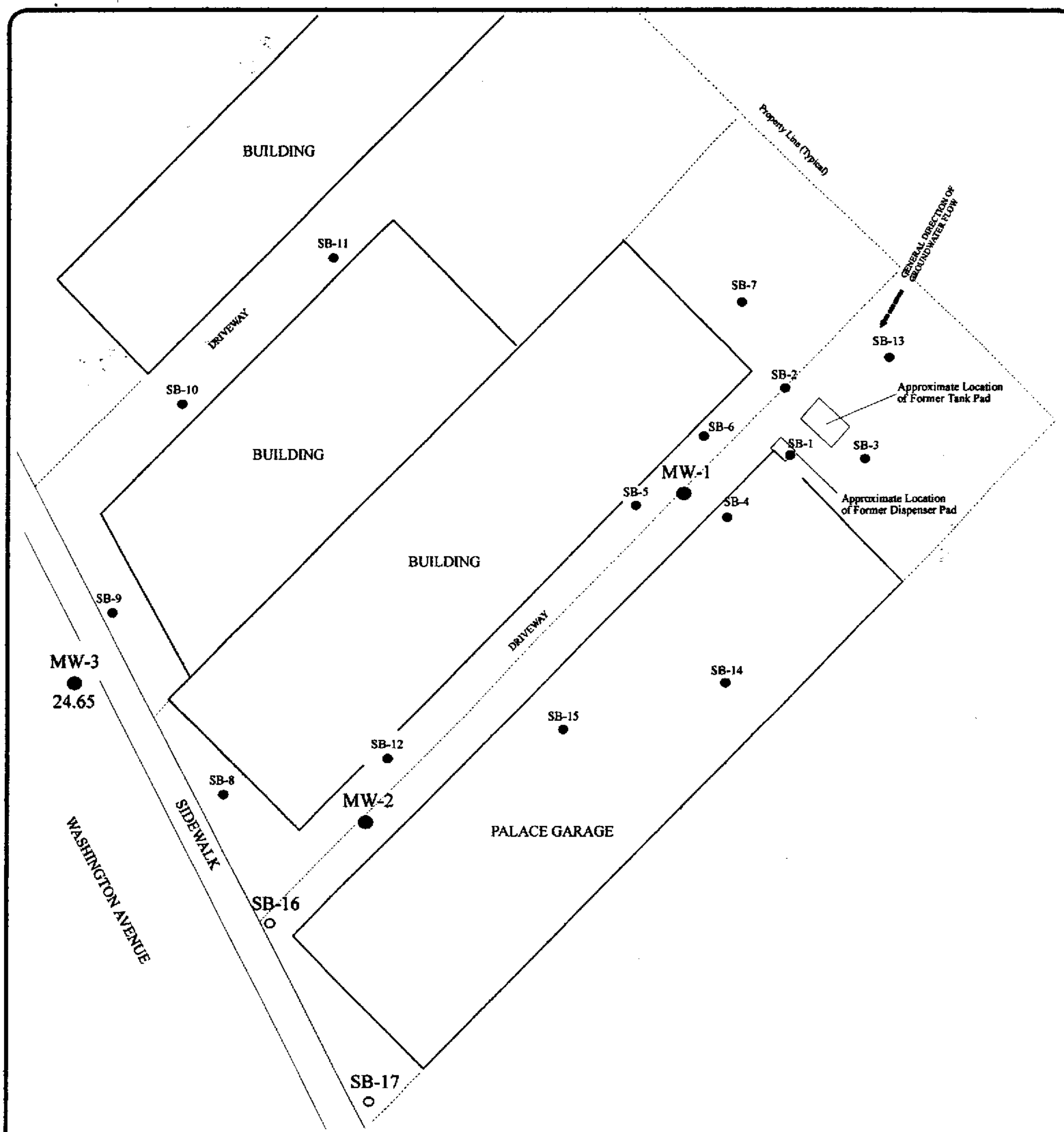
<u>This work plan is due within 60 days of the date of this letter.</u>

Please call me at (510) 567-6783 should you have any questions.

Sincerely,

Scott O. Seery, CHMM
Hazardous Materials Specialist

cc: Chuck Headlee, RWQCB
Mike Bakaldin, San Leandro Hazardous Materials Program
John Mrakovich, All Cal Property Services, Inc.
P. O. Box 1652, Twain Harte, CA 95383




## Legend

SB-1 ● Name and Location of Soil Boring

SB-16 ○ Name and Location of Proposed Soil Boring

MW-1 ● Name and Location of Groundwater Monitoring Well

0 — 30
Approximate Scale (ft)

N

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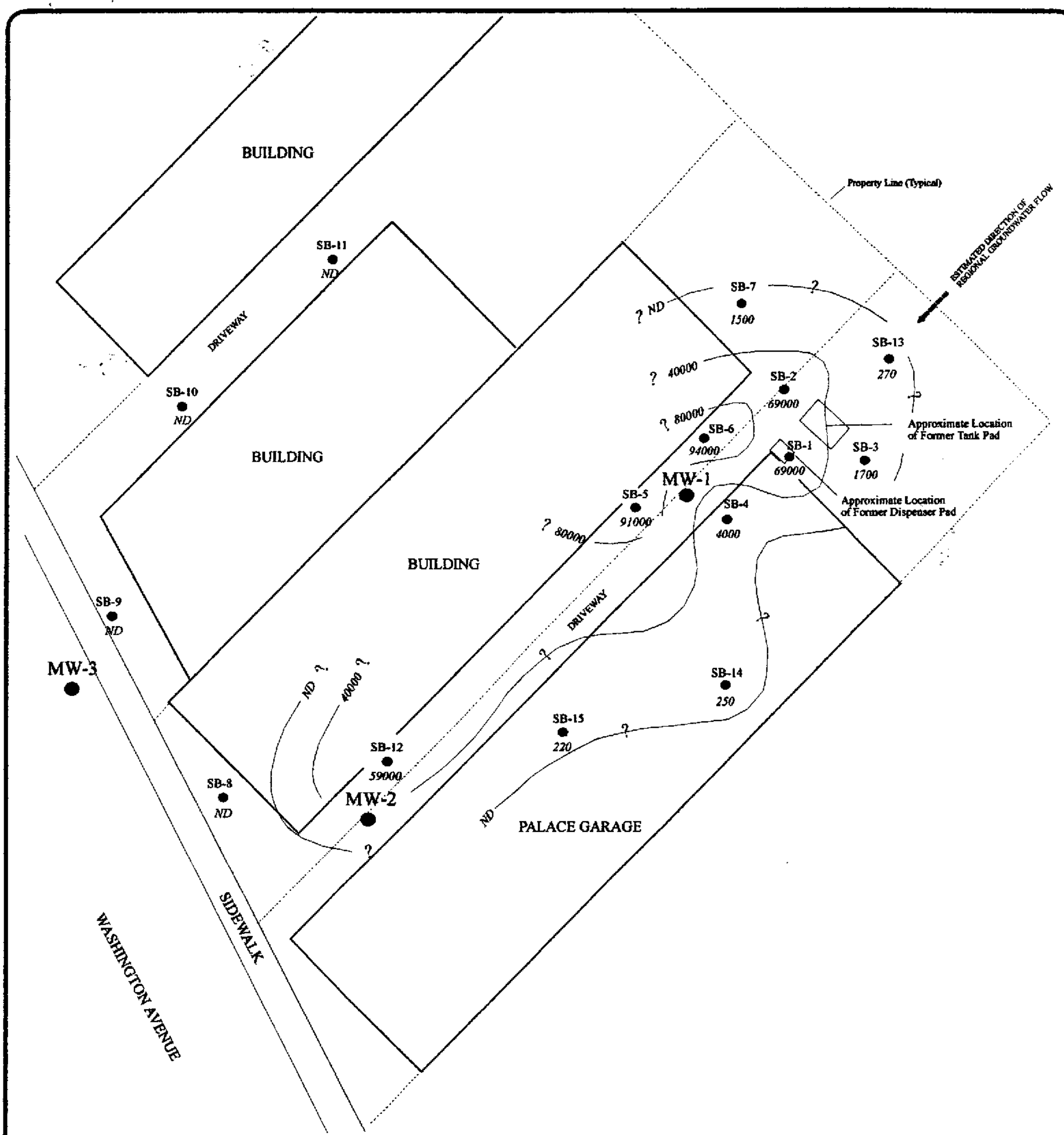
**FIGURE 1**

**SITE PLAN - PALACE GARAGE**

**PROPOSED SOIL BORING LOCATIONS**

14336 WASHINGTON AVENUE
SAN LEANDRO, CA 94577




# Legend

SB-1
● Name and Location of Soil Boring with TPHG Concentration in ppb
69000

MW-1
● Name and Location of Groundwater Monitoring Well

*ND* = Nondetectable

40000 ⌒ TPHG Isoconcentration Contour (ppb). Data Spans From 2/1/99 to 7/29/99.

Contour Interval = 40000 ppb

0 — 30
Approximate Scale (ft)

N ↑

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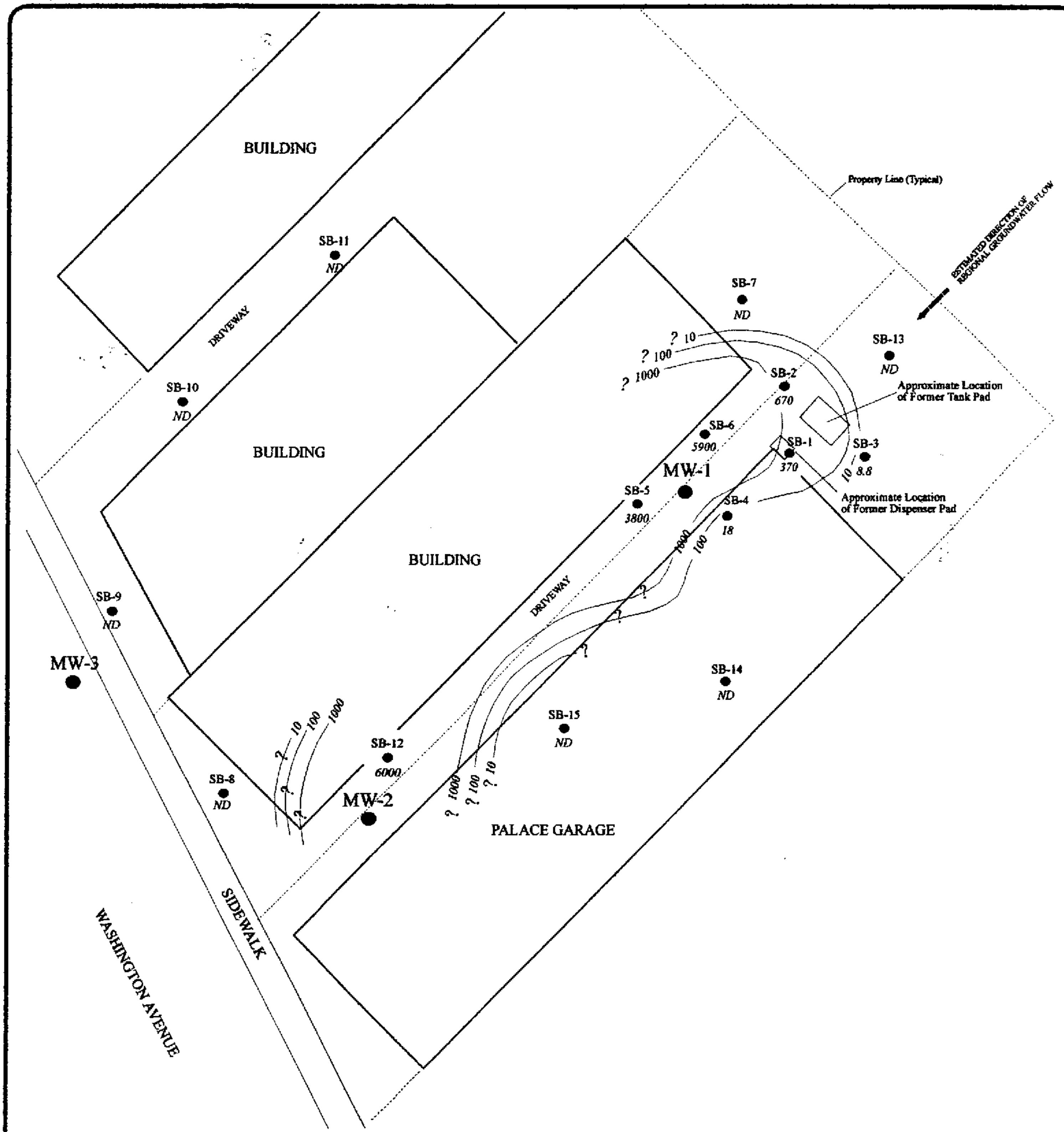
**FIGURE 2**

**SITE PLAN - PALACE GARAGE**

*ESTIMATED TPHG ISOCONCENTRATION MAP GROUNDWATER (2/1/99-7/29/99)*

14336 WASHINGTON AVENUE
SAN LEANDRO, CA 94577




## Legend

SB-1 1500 Name and Location of Soil Boring with Benzene Concentration in ppb

MW-1 Name and Location of Groundwater Monitoring Well

*ND* = Nondetectable

1000 Benzene Isoconcentration Contour (ppb). Data Spans From 2/1/99 to 7/29/99.

Logarithmic Contour Interval Beginning with 10 ppb

0 30
Approximate Scale (ft)

N

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**FIGURE 3**

**SITE PLAN - PALACE GARAGE**

*ESTIMATED BENZENE ISOCONCENTRATION MAP GROUNDWATER (2/1/99-7/29/99)*

14336 WASHINGTON AVENUE
SAN LEANDRO, CA 94577

## TABLE 1

## SUMMARY OF SOIL AND GROUNDWATER CHEMICAL ANALYSES

| Soil Boring | Matrix | Depth (ft) | TPHG | Benzene | Toluene | Ethyl-benzene | Xylenes | MTBE |
|---|---|---|---|---|---|---|---|---|
| SB-1 | soil[1] | 10-10.5 | 440b | 0.51 | 2.6 | 8.1 | 47 | <0.5 |
| SB-1 | soil | 15-15.5 | 4700a | 12 | 21 | 88 | 480 | <10 |
| SB-2 | soil | 10-10.5 | <1.0 | 0.016 | 0.012 | <0.005 | 0.016 | <0.05 |
| SB-2 | soil | 15-15.5 | 790a | 0.64 | 4.8 | 5.3 | 18 | <0.5 |
| SB-3 | soil | 10-10.5 | <1.0 | <0.005 | <0.005 | <0.005 | <0.005 | <0.05 |
| SB-3 | soil | 15-15.5 | <1.0 | <0.005 | 0.021 | <0.005 | 0.010 | <0.05 |
| SB-4 | soil | 11.5-12 | <1.0 | <0.005 | 0.010 | <0.005 | 0.007 | <0.05 |
| SB-4 | soil | 15-15.5 | 35bj | 0.029 | 0.32 | 0.13 | 0.22 | <0.05 |
| SB-5 | soil | 11.5-12 | 2.8a | 0.092 | 0.023 | 0.064 | 0.11 | <0.05 |
| SB-5 | soil | 15-15.5 | 1900a | 4.3 | 14 | 35 | 170 | <10 |
| SB-6 | soil | 10-10.5 | 880a | 3.5 | 16 | 18 | 89 | <1 |
| SB-6 | soil | 15-15.5 | 3200a | 22 | 160 | 89 | 460 | <10 |
| SB-7 | soil | 10-10.5 | <1.0 | <0.005 | <0.005 | <0.005 | <0.005 | <0.05 |
| SB-7 | soil | 15-15.5 | <1.0 | <0.005 | <0.005 | <0.005 | <0.005 | <0.05 |
| SB-8 | soil | 14-14.5 | <1.0 | <0.005 | <0.005 | <0.005 | <0.005 | <0.05 |
| SB-9 | soil | 15-15.5 | <1.0 | <0.005 | <0.005 | <0.005 | <0.005 | <0.05 |
| SB-10 | soil | 14.5-15 | <1.0 | <0.005 | <0.005 | <0.005 | <0.005 | <0.05 |
| SB-11 | soil | 15-15.5 | <1.0 | <0.005 | <0.005 | <0.005 | <0.005 | <0.05 |
| SB-12 | soil | 15-15.5 | <1.0 | <0.005 | <0.005 | <0.005 | <0.005 | <0.05 |
| SB-13 | soil | 7.5-8 | <1.0 | <0.005 | <0.005 | <0.005 | <0.005 | <0.05 |
| SB-13 | soil | 15-15.5 | 460a | 6.3 | 3.3 | 13 | 42 | <0.50 |
| SB-14 | soil | 15-15.5 | <1.0 | <0.005 | <0.005 | <0.005 | <0.005 | <0.05 |
| SB-15 | soil | 15-15.5 | <1.0 | <0.005 | <0.005 | <0.005 | <0.005 | <0.05 |
| SB-1 | water[2] | 17-21 | 69000ah | 370 | 6200 | 3500 | 15000 | <200 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SB-2 | water | 17-21 | 69000ah | 670 | 760 | 2700 | 8600 | <400 |
| SB-3 | water | 17-21 | 1700a | 8.8 | 28 | 52 | 160 | <5.0 |
| SB-4 | water | 17-21 | 4000a | 18 | 170 | 120 | 480 | <10.0 |
| SB-5 | water | 16-20 | 91000ahi | 3800 | 4300 | 4600 | 21000 | <200 |
| SB-6 | water | 16-20 | 94000ah | 5900 | 10000 | 5000 | 25000 | <900 |
| SB-7 | water | 16-20 | 1500bji | <0.5 | 0.89 | 3.6 | 1.1 | <10 |
| SB-8 | water | 16-20 | <50 | <0.5 | <0.5 | <0.5 | <0.5 | <5.0 |
| SB-9 | water | 16-20 | <50 | <0.5 | <0.5 | <0.5 | <0.5 | <5.0 |
| SB-10 | water | 16-20 | <50 | <0.5 | <0.5 | <0.5 | <0.5 | <5.0 |
| SB-11 | water | 16-20 | <50 | <0.5 | <0.5 | <0.5 | <0.5 | <5.0 |
| SB-12 | water | 16-20 | 59000ah | 6000 | 560 | 4500 | 10000 | <200 |
| SB-13 | water | 16-20 | 270bj | <0.5 | 0.53 | 5.4 | 15 | <5.0 |
| SB-14 | water | 16-20 | 250j | <0.5 | 8.0 | <0.5 | <0.5 | <5.0 |
| SB-15 | water | 16-20 | 220j | <0.5 | 6.5 | <0.5 | <0.5 | <5.0 |

[1] Contaminant concentrations for soil reported in parts per million (ppm). [2] Contaminant concentrations for water reported in parts per billion (ppb). a) Unmodified or weakly modified gasoline is significant. b) Heavier gasoline range compounds are significant (aged gasoline?). h) Higher than water immiscible sheen is present. i) liquid sample contains greater than~5 vol.% sediment. j) No recognizable pattern.

## TABLE 2
## SUMMARY OF GROUNDWATER CHEMICAL ANALYSES (ppb)

| Well | Date | Depth to Water(ft) | TPHG | MTBE | Benzene | Toluene | Ethyl-benzene | Xylenes |
|---|---|---|---|---|---|---|---|---|
| MW-1 | 5/19/00 | 12.47 | 52000,a | <200 | 1600 | 3300 | 1600 | 7900 |
| | 8/23/00 | 13.88 | 44000,a | <200 | 1800 | 4100 | 1500 | 8600 |
| | 11/28/00 | 14.72 | 9000,a | <50 | 390 | 920 | 370 | 2000 |
| | 2/27/01 | 13.85 | 42000,a | <200 | 1500 | 3300 | 1600 | 8900 |
| MW-2 | 5/19/00 | 12.30 | 7500,a | <20 | 1400 | 55 | 440 | 270 |
| | 8/23/00 | 13.76 | 9300,a | <200 | 1500 | 54 | 280 | 130 |
| | 11/28/00 | 14.57 | 7600,a | <20 | 1900 | 30 | 130 | 36 |
| | 2/27/01 | 13.68 | 6400,a | <30 | 1100 | 18 | 48 | 12 |
| MW-3 | 5/19/00 | 12.23 | <50 | <5.0 | <0.5 | <0.5 | <0.5 | <0.5 |
| | 8/23/00 | 13.69 | <50 | <5.0 | <0.5 | <0.5 | <0.5 | <0.5 |
| | 11/28/00 | 14.47 | <50 | <5.0 | <0.5 | <0.5 | <0.5 | <0.5 |
| | 2/27/01 | 13.56 | <50 | <5.0 | <0.5 | <0.5 | <0.5 | <0.5 |

a = The laboratory interprets the TPH chromatogram to indicate that unmodified or weakly modified gasoline is significant.

# ATTACHMENT A

## SMALL-DIAMETER MONITORING WELL CONSTRUCTION PROCEDURE

Casing Diameter: The minimum diameter of well casings will be 1 inch (nominal).

Borehole Diameter: The diameter of the borehole will be 6 inches for the first five feet and 2.5 inches for the remainder of the well casing.

Unconfined Wells: The borehole will be advanced through the aquifer to an underlying competent aquitard. The competency of the aquitard may be tested by sampling 5 feet into the underlying aquitard and backfilling the excess hole with either bentonite pellets or neat cement placed by tremie pipe method. An aquitard found to be less than 5 feet thick, may be assumed to represent a local lens. The screened interval will begin a minimum of 5 feet above the saturated zone and extend the full thickness of the aquifer or no more than 20 feet into the saturated zone, whichever is reached first. The well screen will not extend into the aquitard, nor will the screened interval exceed 25 feet in length.

Confined Wells: The bottom of the well screen in a confined aquifer will be determined by presence or lack of a competent (5 foot) aquitard as described above. The screened interval in a confined zone will extend across the entire saturated zone of the aquifer or up to a length of 20 feet, which ever is less. The screened zone and filter pack will not cross-connect to another aquifer.

Casing Materials: Well casing will be constructed of materials that have the least potential for affecting the quality of the water sample. The most suitable material for a particular installation will depend upon the parameters to be monitored. Acceptable materials include PVC, stainless steel, or low carbon steel.

Casing Joints: Joints will be connected by flush threaded couplers. Organic bonding compounds and solvents will not be used on joints.

Well Screen Slots: Well screen will be factory slotted. The size of the slots will be selected to allow sufficient groundwater flow to the well for sampling, minimize the passage of formation materials into the well, and ensure sufficient structural integrity to prevent the collapse of the intake structure.

Casing Bottom Plug: The bottom of the well casing will be permanently plugged, either by flush threaded screw-on or friction cap. Friction caps will be secured with stainless steel set screws. No organic solvents or cements will be applied.

Filter Pack Material: Filter envelope materials will be durable, water worn, and washed clean of silt, dirt, and foreign matter. Sand-size particles will be screened silica sand. Particles will be well rounded and graded to an appropriate size for retention of aquifer materials.

Bentonite Seal Material: Bentonite will be pure and free of additives that may effect groundwater quality. Bentonite will be hydrated with clean water.

Grout Seal Material: Cement grout will consist of a proper mixture if Type 1/11 Portland cement, hydrated with clean water. Up to 3% bentonite may be added to the mixture to control shrinkage.

Decontamination: All downhole tools, well casings, casing fittings, screens, and all other components that are installed in the well will be thoroughly cleaned immediately before starting each well installation. When available, each component will be cleaned with a high temperature, high pressure washer for a minimum of five minutes. When a washer is not available, components will be cleaned with water and detergent or tri-sodium phosphate, rinsed in clean water, than rinsed in distilled water.

Soil and water sampling equipment and material used to construct the wells will not donate to, capture, mask, nor alter the chemical composition of the soil and groundwater.

Drilling Methods: Acceptable drilling methods include solid and hollow-stem auger, percussion, direct circulation mud and air rotary, and reverse rotary. The best alternative is that which minimizes the introduction of foreign materials or fluids. If drilling fluid is employed, drilling fluid additives will be limited to inorganic and non-hazardous compounds. Compressed air introduced to the borehole will be adequately filtered to remove oil and particulates.

Casing Installation: The casing will be set under tension to ensure straightness. Centralizers will be used where necessary to prevent curvature or stress to the casing.

Sand Pack Installation: The sand pack will be installed so as to avoid bridging and the creation of void spaces. The tremie pipe method will be used where installation conditions or local regulations require. Drilling mud, when used, will be thinned prior to pack placement. The sand pack will cover the entire screened interval and rise a minimum of two feet above the highest perforation.

Bentonite Seal Placement: The bentonite seal will be placed by a method that prevents bridging. Bentonite pellets can be placed by free fall if proper sinking through annular water can be assured. Bentonite slurry will be placed by the tremie pipe method from the bottom upward. The bentonite seal should not be less than 1 foot in thickness above the sand pack.

Grout Seal Placement: The cement grout mixture will be hydrated with clean water and thoroughly mixed prior to placement. If substantial groundwater exists in the bore hole, the grout will be placed by tremie pipe method from the bottom upward. In a dry borehole, the grout may be surface poured. Grout will be placed in one continuous lift and will extend to the surface or to the well vault if the wellhead is completed below grade. A minimum of 5 feet of grout seal will be installed, unless impractical due to the willow nature of the well.

Surface Completion: The wellhead will be protected from fluid entry, accidental damage, unauthorized access, and vandalism. A watertight cap will be installed on the well casing. Access to the casing will be controlled by a keyed lock.

Wellheads completed below grade will be completed in a concrete and/or steel vault, installed to drain surface runoff away from the vault.

Well Identification: Each well will be identified by well number, owner, and type of installation. Construction data, including depth, hole and casing diameter, and screened interval will be noted.

# ATTACHMENT B

## GROUNDWATER MONITORING WELL DEVELOPMENT PROCEDURE

INTRODUCTION

Newly installed groundwater monitoring wells will be developed to restore natural hydraulic conductivity of the formation, remove sediments from well casing and filter pack, stabilize the filter pack and aquifer material, and promote turbidity-free groundwater samples.

Wells may be developed by bailing, mechanical pumping, air lift pumping, surging, swabbing, or an effective combination of methods. Wells will be developed until the water is free of sand, silt, and turbidity or no further improvement is achieved.

In some cases where low permeability materials are involved or the drilling mud used fails to respond to cleanup, initial development pumping may immediately dewater the well casing and thereby inhibit development. When this occurs, clean, potable grade water may be introduced into the well, followed by surging of the introduced waters with a surge block. This operation will be followed by pumping. The procedure may be repeated as required to establish full development.

METHODOLOGY

Seal Stabilization: Cement and bentonite annular seals will set and cure not less then 24 hours prior to well development.

Decontamination: All well development tools and equipment will be thoroughly cleaned immediately before starting each well installation. When available, each component will be cleaned with a high temperature, high pressure washer for a minimum of five minutes. When a washer is not available, components will be cleaned with clean water, then rinsed with distilled water.

Development equipment will not donate to, capture, mask, nor alter the chemical composition of the soils and groundwater.

Introduction of Water: Initial development of wells in low permeability materials may dewater the casing and filter pack. When this occurs, clean, potable water will be introduced into the well to enhance development.

Bailing: Development will begin by bailing to remove heavy sediments from the well casing. Care will be taken to not damage the well bottom cap during lowering of the bailer.

Surging: Care will be exercised when using a surge block to avoid damaging the well screen and casing. When surging wells screened in coarse (sand/gravelly) aquifers, the rate of surge block lifting

will be slow and constant. When surging wells screened in fine (silty) aquifers, more vigorous lifting may be required. Between surging episodes, wells will be bailed to remove accumulated sediments.

Pumping: Development pumping rates will be less than the recharge rate of the well in order to avoid de-watering.

Discharged Water Containment and Disposal: All water and sediment generated by well development will be stored in 55-gallon steel drums. Development water will be temporarily contained on site, pending sampling and laboratory analysis. All hazardous development water will be transported off site by a licensed transporter to a hazardous waste disposal or treatment facility. No hazardous development water will be released to the environment.