Chevron U.S.A. Inc.
2410 Camino Ramon, San Ramon, California • Phone (415) 842-9500
Mail Address: P.O. Box 5004, San Ramon, CA 94583-0804

Marketing Department

91 JUL 16 PM 12:06

July 16, 1991

Mr. Gil Wistar
Alameda County Health Care Services
Department of Environmental Health
Hazardous Materials Program
80 Swan Way, Room 200
Oakland, CA 94621

Re: Former Chevron Service Station #9-1026
3701 Broadway
Oakland, CA 94611

Dear Mr. Wistar:

Enclosed we are forwarding a Work Plan dated July 1, 1991, prepared by our consultant Burlington Environmental Inc. which describes additional work steps we propose to take at the above referenced site. The proposed work is inclusive of conducting a pump test to assess hydraulic characteristics at the site and the deepening of existing monitor wells F and B-1 due to a lowering of groundwater surface beneath the site. Well B-1 will be constructed as a 4-inch diameter well for possible future extraction. Well F will be constructed as a 2-inch diameter well to allow for continued downgradient monitoring.

A site visit revealed that Wells F and ~~EA-2~~ EA-1 were not correctly plotted on previous maps, and that Well F is actually located hydraulically downgradient from decommissioned Well B-6. A revised map is included in this work plan.

Chevron will proceed with this work under self direction unless otherwise informed by your office. We would appreciate your review and concurrence.

If you have any questions or comments, please do not hesitate to contact me at (415) 842-9581.

Very truly yours,
CHEVRON U.S.A. INC.

Nancy Vukelich
Environmental Engineer

Enclosures

cc: Mr. Rich Hiett, RWQCB-Bay Area
Ms. B.C. Brummett-Owen
File (9-1026W1 Listing)

Mr. Bruce Bercovich
Kay & Merkel
100 The Embarcadero, 3rd Floor
San Francisco, CA 94105

BURLINGTON
ENVIRONMENTAL INC.
CHEMPRO Division

July 1, 1991
Project No. CHV 125/300

Ms. Nancy Vukelich
Environmental Engineer
Chevron U.S.A.
2410 Camino Ramon
San Ramon, California 94583

Re: **REVISED WORKPLAN FOR GROUNDWATER INVESTIGATION:**
Former Chevron Service Station No. 9-1026
3701 Broadway, Oakland, California

Dear Ms. Vukelich:

Burlington Environmental, Inc. - *Chempro Division* (Burlington) is pleased to submit this revised workplan to perform a groundwater investigation at former Chevron U.S.A., Inc. (Chevron) Service Station No. 9-1026, located at 3701 Broadway in Oakland, California. This investigation was requested by you in a meeting with Burlington representatives on April 8, 1991.

The revised workplan includes deepening groundwater monitoring wells B-1 and F, and performing a pumping test. The initial workplan included drilling and installing an additional groundwater monitoring well (B-10) in MacArthur Boulevard. Well B-10 was being installed to better define the extent of groundwater contamination hydraulically downgradient from decommissioned well B-6. However, a site visit revealed that wells F and EA-1 were not correctly located on previous maps, and that well F is located hydraulically downgradient from decommissioned well B-6. Therefore, due to the correct placement of well F, the additional well B-10 is not required. Due to a lowering of the groundwater surface beneath the site, wells B-1 and F need to be deepened to provide available water for groundwater sampling and extraction purposes. The pumping test is being performed in deepened well B-1 (to be named B-8) to better define the aquifer beneath the site and provide the most efficient well spacing for optimum site cleanup. Upon completion of the investigation, a report will be prepared presenting the findings.

BACKGROUND

Background information used to develop this workplan includes:

* IT Enviroscience. 1982. Progress Report #1, Gasoline Leakage, Chevron Service Station #1026, 3701 Broadway, Oakland, California. April 28, 1982.

950 Gilman Street, Suite B
Berkeley, California 94710
Tel: (415) 524-9372
Fax: (415) 524-7439

- Gettler-Ryan, Inc. 1986. Daily Monitor Records, Chevron Service Station #1026, 3701 Broadway, Oakland, California. September 22, 1986.

- EA Engineering, Science, and Technology, Inc. 1988. Report of Investigation, Soil Vapor Contaminant Assessment, Chevron Service Station 9-1026, Oakland, California. June 15, 1988.

- Groundwater Technology, Inc. 1990. Subsurface Soil Investigation, 3701 Broadway Avenue, Oakland, California. December, 1988.

- Weiss Associates. 1990. Former Chevron Service Station #9-1026, 3701 Broadway, Oakland, California. December 27, 1990.

SITE DESCRIPTION AND HISTORY

The site is located at the intersection of MacArthur Boulevard and Broadway in Oakland, California (see Figure 1). The site is currently being used as a parking lot for used cars by the Val Strough car dealership whose showroom is located on Broadway, adjacent to the site. Properties surrounding the site are occupied primarily by residential housing and commercial businesses. The site is located approximately 1,000 feet west of Glen Echo Creek, which flows into Lake Merritt; and approximately two miles east of San Francisco Bay.

IT Enviroscience (IT) submitted a report on April 28, 1982, describing the installation of nine groundwater monitoring wells (wells B-1 through B-4, and A, B, C, E, and F). Three existing wells (5 through 7) were previously installed. The wells were installed as a result of a tank test that indicated a leak in an unleaded gasoline storage tank. Also, gasoline odors had been noticed approximately three years earlier in the park across MacArthur Street from the station and at the motel to the west of the station. The wells were sampled, and eight of the twelve wells had a presence of phase separated hydrocarbons (PSH) reported.

On April 26, 1982, the underground fuel storage tanks were removed and PSH were observed in the excavation.

IT continued to conduct groundwater monitoring at the site from May 1982 through May 1983. Between August and December 1982, IT reported that all wells had a presence of PSH. In May 1983, the only wells reporting the presence of PSH were wells B and C.

In March 1984 the U.S. EPA sent notification to several gasoline retailers in the area stating that gasoline was entering Lake Merritt through the Glen Echo Creek storm drain. Samples were collected from the storm drain, nearby wells, and the onsite dispensers, and were analyzed by Gas Chromatography (GC). In August 1984 Chevron sent a letter to the EPA presenting the GC results and denying responsibility for the contamination present in the Glen Echo Creek storm drain.

In April 1985 Gettler-Ryan (GR) began routine monitoring of the wells at the site. Monitoring activities were reported for August and September 1986 and PSH were reportedly observed in five wells.

In February and April of 1988, EA Engineering, Science, and Technology, Inc., (EA) conducted a soil vapor contaminant assessment at the site. The work consisted of sampling the wells and installing additional groundwater monitoring wells (EA-1 and EA-2) in the public right-of-ways adjacent to the site.

In November 1988 Groundwater Technology, Inc., (GTI) performed a subsurface investigation at the site. The work consisted of collecting soil samples for chemical analysis. The results of the investigation indicated that two of areas of soil contamination in excess of 100 parts per million (ppm) are present in the vicinity of the former pump islands.

In May 1989 Weiss Associates (Weiss) began quarterly groundwater monitoring at the site. Weiss has continued to perform the quarterly sampling at the site.

Geologic and hydrogeologic data indicate that the site is underlain by low permeability clayey silts and silty clays to an approximate depth of 20 feet below ground level (BGL). A silty sand layer is present at approximately 20 feet BGL in boring logs A, C, and EA-2. On November 11, 1990, the groundwater level in the wells at the site ranged from 14.38 to 19.10 feet BGL. As indicated from the December 27, 1990, report by Weiss, the potentiometric surface of the aquifer slopes to the west-southwest with an approximate hydraulic gradient of 0.0083 ft/ft.

SCOPE OF WORK

TASK 1.0: SOIL AND GROUNDWATER INVESTIGATION:

The following scope of work has been prepared to further characterize the soil and groundwater beneath and downgradient of the site. The scope includes decommissioning two groundwater monitoring wells, replacing the decommissioned wells with one groundwater monitoring and one groundwater extraction well, and performing a pumping test. The results of the investigation will be presented in a report which will be signed and stamped by a registered California geologist.

A more detailed description of these tasks follows.

1.1 Prefield Activities

To prepare for field activities, Burlington will obtain drilling permits from Alameda County and encroachment permits from the City of Oakland, arrange for field materials and equipment, and contact Underground Services Alert (USA) an underground utility locating service to clear one of the boring locations. In addition, the Val Strough Car Dealership and the Chevron representative will be notified of the site work. The Chevron Maintenance Mechanic will also be notified of the site work and will be requested to be present the day site activities commence.

1.2 Well Decommissioning, Well Installation and Sampling

Groundwater monitoring wells B-1 and F will be decommissioned, and replaced with groundwater wells (see Figure 2). After well B-1 is decommissioned, well B-8

will be installed in the borehole provided by the decommissioning of well B-1. Well F will be decommissioned and well B-9 will be installed in the borehole provided by the decommissioning of well F.

Wells B-1 and F will be decommissioned by drilling out the polyvinyl chloride (PVC) well pipe with 10-inch outside diameter (OD) hollow-stem augers (HSA) to depths of approximately 35 and 40 feet BGL, respectively. The present depths of wells B-1 and F are 15.2 and 19.7 feet BGL, respectively. Soil samples will be collected for soil classification during drilling using a modified-California split-spoon sampler from 20 to 35 feet in well B-1 and from 25 to 40 feet BGL in well F. Soil sample collection will be conducted for lithological purposes only. The procedures for soil sampling and decontamination are presented in Appendix A. Wells B-8 and B-9 will then be installed in the boreholes provided by the decommissioning of wells B-1 and F, respectively. The drummed soil and grout produced during the decommissioning activities will be sampled for soil disposal purposes only. The soils will be drummed and subsequently sampled by driving a hand-held drive sampler with brass liners into the drummed soil. The full liners will be removed, the ends covered with foil, capped, taped, and placed in an iced cooler pending laboratory analysis.

Wells B-8 and B-9 will be constructed with schedule 40 PVC, and 0.020-inch machine-slotted well screen; the diameters of the wells will be 4-inch and 2-inch, respectively. The screened interval of B-8 will extend from 10 to 30 feet BGL. Additionally, well B-8 will be constructed with a 5-foot sump placed below the screen to collect fines that are pulled into the wells during groundwater extraction. The screened interval of B-9 will extend from 15 to 40 feet BGL. The sandpack will consist of No. 3 rounded sand, packed around the casing to a minimum of 2 feet above the screened section. The sandpack will be capped with a bentonite and cement seal and the wellhead will be protected with a locking vault box, as described in Appendix A.

The soil samples collected from the drummed soils from the well decommissioning will be analyzed for total petroleum hydrocarbons (TPH) (as gasoline) using modified EPA Method 8015; and benzene, toluene, ethylbenzene, and xylenes (BTEX) using EPA Method 8020. One soil sample will be analyzed for total organic lead and total lead for soil disposal purposes using California Department of Health Services method 338 and EPA method 7420, respectively. Soil sample analyses will be performed by Superior Precision Analytical Laboratory (Superior Laboratory) of San Francisco, California.

The newly installed wells will be developed to remove trapped sediments from within the gravel pack prior to sampling (see Appendix A). The wells will be sampled within 24 hours of development. Groundwater sampling procedures are presented in Appendix B. The groundwater samples will be analyzed for TPH using modified EPA method 8015 and BTEX using EPA method 602.

TASK 2.0: HYDRAULIC TESTING

Hydraulic characteristics at the site will be determined by performing hydraulic tests in well B-8 (formerly well B-1). The hydraulic testing will consist of three parts: (1) step-drawdown test, (2) constant-discharge test, and (3) water-level recovery. The tests will be conducted using well B-8 as the pumping well, and barometric changes

will also be monitored throughout the test by placing a transducer in a bucket of water.

A 6- to 8-hour step-drawdown test will be conducted to determine the appropriate pumping rate to be used during the constant-discharge test. The constant-discharge test will be conducted for up to 8 hours at a discharge rate determined from the step-drawdown test. The optimum discharge rate should stress the aquifer without dewatering the well. At the end of the constant-discharge test, water-level recovery data will be collected from the pumping well and the observation wells. A more detailed description of the hydraulic testing procedures are presented in Appendix C.

TASK 3.0: REPORT PREPARATION

Following completion of the site characterization, a Groundwater Investigation Report will be prepared and submitted to Chevron within eight weeks of completion of the field work. The report will be reviewed, signed, and stamped by a California registered geologist.

DRUM REMOVAL

During the drilling and soil sampling operations, soil cuttings will be produced. All soil cuttings will be drummed during the site investigation. Soil samples will be analyzed by Superior Laboratory to assist in the determination of the appropriate disposal facility. Burlington will haul and dispose of the soil for Chevron, to the landfill of their choice. The drums will be manifested, if necessary, and hauled by Burlington to the drum recycling center of Chevron's choice.

Water collected during the steam cleaning, well development, and groundwater sampling operations will be stored onsite and disposed of by a Chevron subcontractor. Once empty, the drums will be manifested by Chevron and hauled by Burlington to the drum recycling center of Chevron's choice.

We look forward to performing this work for you. If you have any questions, please do not hesitate to call.

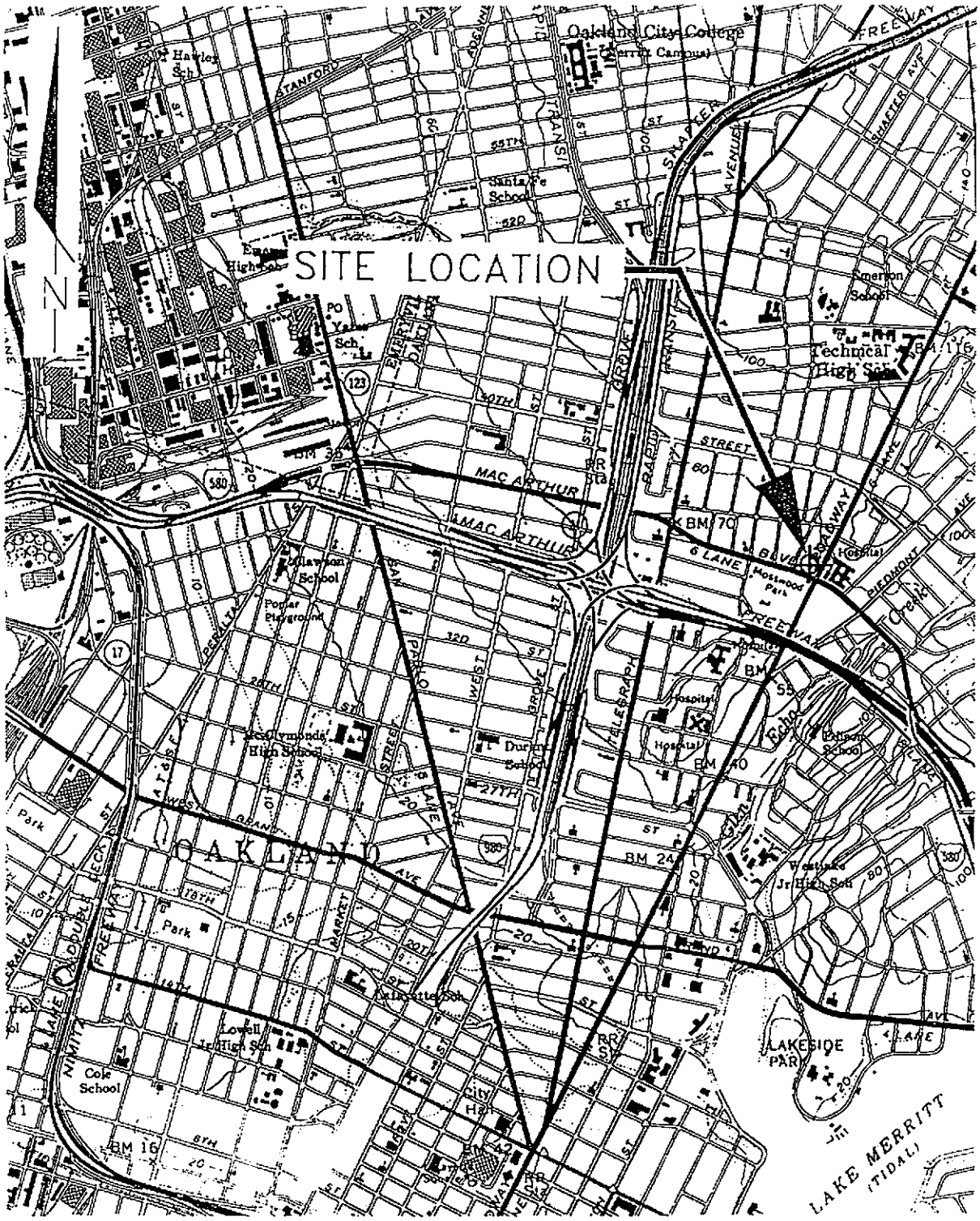
Very truly yours,
BURLINGTON ENVIRONMENTAL, INC.
CHEMPRO Division

Kyle S. Flory
Project Geologist

David C. Tight, R.G. No. 4603
Investigation/Remediation Manager

Enclosures

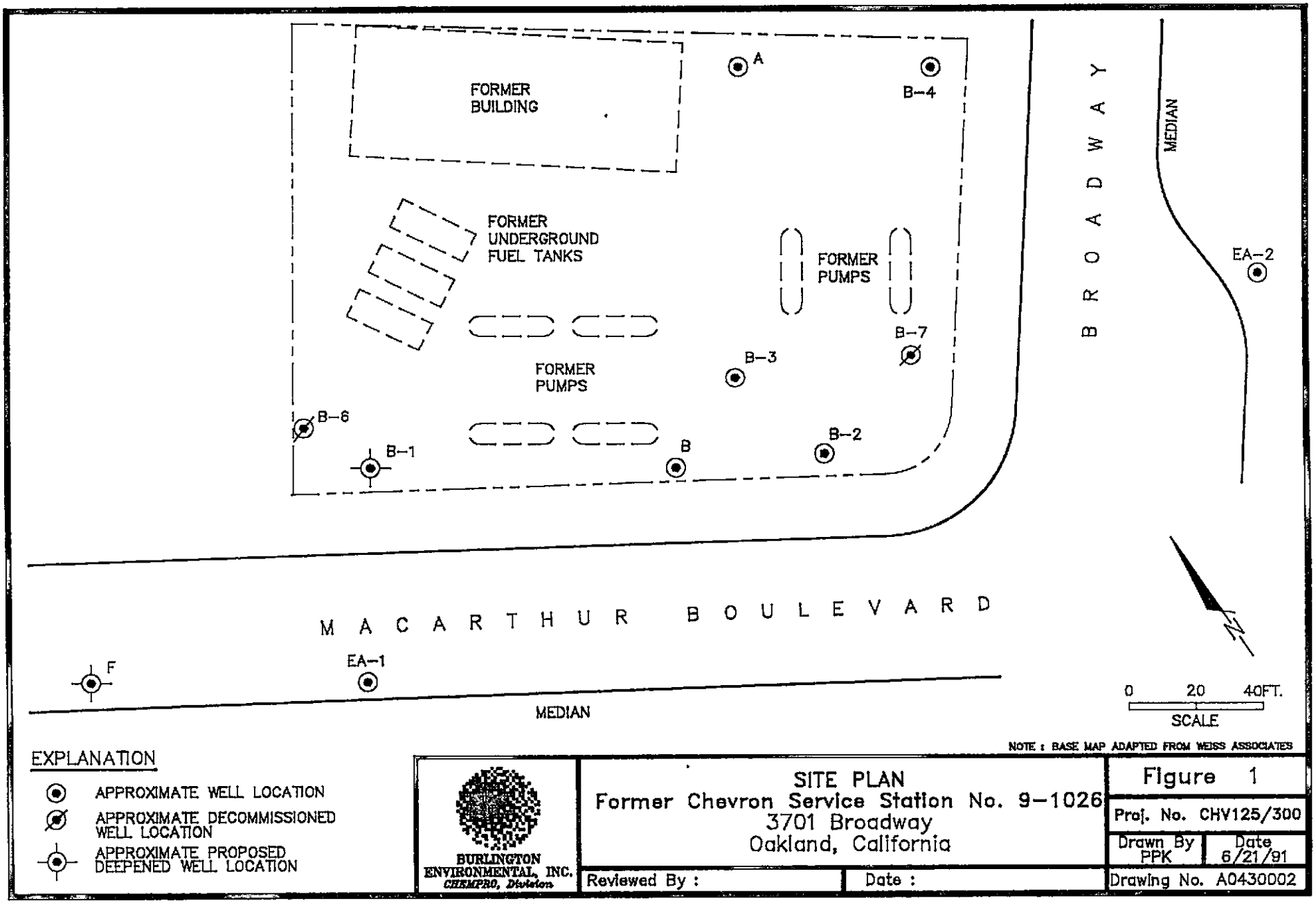
Figure 1 - Site Location Map
Figure 2 - Site Plan
Appendix A - Exploratory Boring, Decontamination, Well Decommissioning, and Well Installation Procedures
Appendix B - Groundwater Sampling and Analysis Procedures
Appendix C - Hydraulic Testing Procedures



BURLINGTON ENVIRONMENTAL, INC.
CHEMPRO Division

SITE LOCATION MAP
Chevron Station No. 9-1026
3701 Broadway
Oakland, California

DRAWN BY: PPK	
DATE: 05/17/1991	
PROJECT No. 300	FIGURE 1
Drawing No. A0630001	


FORMER BUILDING
A
B-4
FORMER UNDERGROUND FUEL TANKS
FORMER PUMPS
FORMER PUMPS
B-7
B-3
B-6
B-1
B
B-2
BROADWAY
MEDIAN
EA-2
MACARTHUR BOULEVARD
F
EA-1
MEDIAN
0 20 40FT.
SCALE
NOTE : BASE MAP ADAPTED FROM WEISS ASSOCIATES
EXPLANATION
APPROXIMATE WELL LOCATION
APPROXIMATE DECOMMISSIONED WELL LOCATION
APPROXIMATE PROPOSED DEEPENED WELL LOCATION
BURLINGTON ENVIRONMENTAL, INC.
CHEMPRO, Division
SITE PLAN
Former Chevron Service Station No. 9-1026
3701 Broadway
Oakland, California
Figure 1
Proj. No. CHV125/300
Drawn By PPK
Date 6/21/91
Reviewed By :
Date :
Drawing No. A0430002

revised map

Appendix A

EXPLORATORY BORING, DECONTAMINATION, WELL DECOMMISSIONING, AND WELL INSTALLATION PROCEDURES

Appendix A

Exploratory Boring, Decontamination, Well Decommissioning, and Well Installation Procedures

EXPLORATORY BORING

Before the exploratory borings are drilled at former Chevron Service Station No. 9-1026, a number of actions will be taken: drilling permits will be obtained from the Alameda County Flood Control and Water District, encroachment permits will be obtained from the city of Oakland prior to drilling in MacArthur Boulevard. In addition, Underground Service Alert (USA) will be contacted to schedule visits to the site by public and private utility companies. Each company will locate its utilities with the aid of maps, and the locating service will verify and mark these locations. All utility clearances will be coordinated with the station manager before drilling begins.

Field personnel will begin drilling by excavating the first four feet of soil with a hand auger to ensure that there are no subsurface obstructions. Exploratory borings will be drilled with a Mobile B-61 or a CME-75 drill rig. The Exploratory borings to be completed as 2-inch-diameter monitoring wells will be drilled with 8-inch outer-diameter (OD) hollow-stem augers (HSA). The borings for the extraction wells will be drilled with 10-inch OD HSA. The augers will be steam cleaned before each boring is drilled.

DECONTAMINATION PROCEDURES

Proper decontamination and cleansing of all equipment will be performed to prevent cross-contamination between wells and sampling locations. The two methods of decontamination used at the site will be steam cleaning and detergent washing followed by tap water and distilled water rinses. During field work, all equipment that will be placed in the borings or wells, or that will come in contact with groundwater will be decontaminated as follows:

Equipment	Decontamination procedures
Drill Rig	Steam cleaned prior to arriving on-site

Augers	Steam cleaned prior to drilling each boring
Drill Tools	Steam cleaned prior to drilling each boring
Split-Spoon Sampler	Steam cleaned between each boring, then Alconox™ (Alconox) washed, and tap water and distilled water rinsed between each sampling interval
PVC Casing	Steam cleaned before installing in well
Well Development Equipment	Alconox washed, and steam cleaned
Water Level Sensor	Alconox washed, tap water and distilled water rinsed between each use
Pumps	Steam cleaned between each use
Bailers	Steam cleaned between each use
Teflon™ Sampling Bailer	Alconox washed, then steam cleaned and rinsed with distilled water prior to sampling each well

The water used for steam cleaning will be obtained from the site or will be contained in the water tank of the drill rig or driller's support truck. Deionized water will be used for rinses. The water generated during decontamination procedures will be stored in 55-gallon drums onsite and will be disposed of by a contractor.

WELL DECOMMISSIONING

Groundwater monitoring wells, B-1 and F, will be decommissioned by drilling out the polyvinyl chloride (PVC) well pipe with 10-inch and 8-inch OD HSA, respectively. The monitoring wells will be overdrilled to a depth greater than the bottom of the boring. Soil samples will be collected for lithologic purposes only during the decommissioning/deepening of the wells. The soil and grout produced during the decommissioning activities will be sampled for soil disposal purposes only. The soils will be drummed and subsequently sampled by driving a hand-held drive sampler with brass liners into the drummed soil. The full liners will be removed, the ends covered with foil, capped, taped, and placed in an iced cooler pending laboratory analysis. The samples will be analyzed for total petroleum hydrocarbons (TPH) (as gasoline) using modified EPA Method 8015,

and BTEX using EPA Method 8020. Drill cuttings will be disposed of using the appropriate method based on the analyses of the soil samples collected.

WELL INSTALLATION

One decommissioned well, B-1, will be converted to an extraction well by installing 4-inch diameter, flush-threaded, PVC casing inside the borehole provided by the decommissioning. One decommissioned well, F, will be converted to a groundwater monitoring well by installing 2-inch diameter, flush-threaded, PVC casing inside the borehole provided by the decommissioning. No solvent cements will be used on the casing. The screened casing will be machine-slotted with 0.020-inch slots. Screened sections of casing will extend across the saturated interval to 5 to 10 feet across the aquifer. A threaded bottom cap will be attached to the bottom of the casing. The annular space surrounding the casing will be at least 2 inches thick, and packed with No. 3 sand to approximately 2 feet above the top of the screened interval. A minimum of 1 foot of bentonite seal will be set above the sandpack and neat cement will be tremie-grouted to the surface.

A traffic-rated vault box with a locking device will be set in concrete to protect the wells. Well tags will be affixed to the casing for identification. Well locations will be surveyed to the closest 1-foot Northing and Easting and top-of-casing elevations will be measured to the nearest 0.01 foot. Detailed well completion diagrams will then be prepared.

Well Development

Monitoring and extraction wells will be developed by surging, swabbing, bailing, and/or air lift methods until a non-turbid discharge is obtained. All development equipment will be steam cleaned between wells. Development and steam-cleaning water will be contained in 55-gallon drums until a Chevron contractor can collect the water and transport it off-site for treatment.

Appendix B

GROUNDWATER SAMPLING AND ANALYSIS PROCEDURES

Appendix B

Groundwater Sampling and Analysis Procedures

INTRODUCTION

The sampling and analysis procedures for water-quality monitoring programs are contained in this Appendix. These procedures will ensure that consistent and reproducible sampling methods will be used, proper analytical methods will be applied, analytical results will be accurate, precise, and complete, and the overall objectives of the monitoring program will be achieved.

SAMPLE COLLECTION

Sample collection procedures include: equipment cleaning, water-level and total well-depth measurements, and well purging and sampling.

Equipment Cleaning

Pre-cleaned sample bottles, caps, and septa will be provided by a Chevron-approved laboratory. All sampling containers will be used only once and discarded after analyses are completed.

Before starting the sampling event and between each event, all equipment to be placed in the well or come in contact with groundwater will be disassembled and cleaned thoroughly with detergent water, steam cleaned with tap water, and rinsed with Arrowhead™ distilled water. Any parts that may absorb contaminants, such as plastic pump valves or bladders, will be cleaned as described above or replaced. The water-level sounder will be washed with detergent and rinsed with distilled water before use in the each well. The rinse water will be stored in 55-gallon drums onsite and will be disposed of by Chevron.

Quality Control Samples

To determine if the Teflon™ (Teflon) bailer used for sampling is sufficiently decontaminated, rinse samples will be taken. One rinse sample will be collected

at the beginning of each day and additional rinse samples will collected every 20 samples. The samples will be collected by filling the Teflon sampling bailer with distilled water and then decanting that water into the sample vails. The rinse samples will be analyzed for the same parameters as the groundwater.

Water-Level, Floating-Hydrocarbon, and Total Well-Depth Measurements

Before purging and sampling, the depth to water, floating hydrocarbon thickness, and the total well depth will be measured using an electric sounder, a bottom-filling clear Lucite™ bailer, and/or an oil/water interface probe. The electric sounder, manufactured by Slope-Indicator, Inc., is a transistorized instrument that uses a reel-mounted, two conductor, coaxial cable that connects the control panel to the sensor. Cable markings are stamped at 1-foot intervals. An engineer's rule will be used to measure the depths to the nearest 0.01 foot. The water level will be measured by lowering the sensor into the monitoring well. A low current circuit is completed when the sensor contacts the water, which serves as an electrolyte. The current is amplified and fed across an indicator light and audible buzzer, signaling contact with water. A sensitivity control compensates for very saline or conductive water. After the water level is determined, the bailer will be lowered to a point just below the liquid level, retrieved, and inspected for floating hydrocarbons.

If floating product is encountered, its thickness will be measured with an oil/water interface probe. This instrument's dual-sensing probe utilizes an optical liquid sensor and electrical conductivity probe. The instrument emits a solid tone when immersed in oil, and an oscillating tone when immersed in water. If floating product greater than 1/32-inch in thickness is detected, a sample will not be collected from that well.

All liquid measurements will be recorded to the nearest 0.01 foot in the field logbook. The groundwater elevation at each monitoring well will be calculated by subtracting the measured depth to water from the surveyed well-casing elevation. Total well depth will be measured by lowering the sensor to the bottom of the well. Total well depth, used to calculate purge volumes and to determine whether the well screen is partially obstructed by silt, will be recorded to the nearest 0.5 foot in the field logbook.

Well Purging

Before sampling, standing water in the casing will be purged from the monitoring well using a piston pump. Samples will be collected after three well casing volumes have been purged, and the pH, specific conductance, and temperature have stabilized, or 5 well volumes have been evacuated. Some low yield monitoring wells are expected to be evacuated to dryness after the removal of less than three casing volumes. Such low yield monitoring wells will be allowed to recover for a minimum of two hours. If the well has recovered to 80% of its original water level after two hours, a sample will be collected. Otherwise, the well will be allowed to recover up to 24 hours prior to sampling. If insufficient water has recharged after 24 hours, the monitoring well will be recorded as dry for the sampling event.

All field measurements will be recorded in a waterproof field logbook. Water sample field data sheets will be prepared to record the field data. These data sheets will be reviewed by the sampling coordinator when the sampling event is completed.

The pH, specific conductance, and temperature meter will be calibrated each day before beginning field activities. The calibration will be checked once each day to verify meter performance. All field meter calibrations will be recorded in the field logbook.

Groundwater generated from well-purging operations will be contained for temporary storage in 55-gallon drums. All drums will be labeled and stored onsite in a location designated by the station manager. The sampler will record the following information on the drum label for each drum generated:

* Drum content (groundwater)
* Source (well designation)
* Date generated
* Client contact
* Project number
* Name of sampler

The groundwater will be stored onsite for a maximum of 90 days. We will notify the Chevron representative that the water is ready for removal and transport the drums off-site when the water has been removed.

Well Sampling

A Teflon bailer will be used for well sampling. Glass bottles of at least 40 milliliters volume and fitted with Teflon-lined septa will be used in sampling for volatile organics. These bottles will be filled completely to prevent air from remaining in the bottle. A positive meniscus forms when the bottles are completely full. A convex Teflon septum will be placed over the meniscus to eliminate air. After capping, the bottles will be inverted and tapped to verify that they do not contain air bubbles. The sample containers for other parameters will be filled, and capped. Duplicate sample analyses will be performed on five percent of the groundwater samples collected.

SAMPLE HANDLING AND DOCUMENTATION

The following section specifies the procedures and documentation used during sample handling.

Sample Handling

All sample containers will be labeled immediately following sample collection. Samples will be kept cool with cold packs until received by the laboratory. Cold packs will be replaced each day to maintain refrigeration. At the time of sampling, each sample will be logged on a Chain-of-Custody record which accompanies the sample to the Chevron approved laboratory.

Sample Documentation

The following procedures will be used during sampling and analysis to provide Chain-Of-Custody control:

* Field logbooks to document sampling activities in the field
* Labels to identify individual samples

* Chain-of-custody record sheets for documenting possession and transfer of samples

Field Logbook

In the field, the sampler will record the following information on the Water Sample Field Data Sheet for each sample collected:

* Project number
* Client name
* Location
* Name of sampler
* Date and time
* Pertinent well data (e.g., casing diameter, depth to water, total well depth)
* Calculated and actual purge volumes
* Purging equipment used
* Sampling equipment used
* Appearance of each sample (e.g., color, turbidity, sediment)
* Results of field analyses (i.e., temperature, pH, specific conductance)
* General comments

The field logbooks will be signed by the sampler.

Labels

Sample labels will contain the following information:

* Project number
* Sample number (i.e., well designation)
* Sampler's initials
* Date and time of collection
* Type of preservative used (if any)

Sampling and Analysis Chain-of-Custody Record

The Sampling and Analysis Chain-of-Custody record, initiated at the time of sampling, contains, but is not limited to, the well designation, sample type, analytical request, date of sampling, and the name of the sampler. The record sheet will be signed, and dated by the sampler when transferring the samples. The number of custodians in the chain of possession will be kept to a minimum.

Appendix C

Hydraulic Testing Procedures

Appendix C

Hydraulic Testing
Procedures

INTRODUCTION

The general procedures for hydraulic testing of aquifers and water-bearing zones are contained in this appendix. The procedures provide for consistent and reproducible testing methods. They are designed to produce data necessary to define the hydraulic characteristics of the aquifer and a consistent analytical approach to quantification of aquifer characteristics.

PUMPING TESTS

In general pumping tests consist of four parts: (1) baseline water-level measurements, (2) step-discharge pumping, (3) constant-discharge pumping, and (4) water-level recovery. The best results are obtained from a test in which the observation wells are located in the same water-bearing zone as the one being pumped. The pumping well should be of sufficient diameter to accommodate a constant-discharge pump and monitoring equipment. The monitoring equipment will consist of electric transducers and will be monitored by an In Situ Hermit^{R} Datalogger. To run the pump, a generator or permanent power source of at least 210 volts is required. All equipment is steam cleaned before and after testing. Discharge water that is pumped from the well will be contained in a Baker Tank™, and disposed of by Chevron.

Baseline Water-Level Survey

Before testing, baseline water levels in the pumping and observation wells are obtained. It is ideal to set up transducers in each well and obtain readings during a 24-hour period before testing. The baseline survey will record diurnal and other water-level trends which are used to compare with water level changes obtained during testing.

Step Discharge Testing

A step-discharge test is conducted to determine the well's efficiency and an appropriate sustainable pumping rate for the constant discharge test. During a step-discharge test, water from the well is pumped at increasing discharge rates over several time periods. The water level in the pumping well is monitored and recorded in the field with a pressure transducer/datalogger system and an electric sounder. The depth to water data is plotted versus time to determine the optimum pumping rate for a constant discharge pumping test. Each step is conducted until the drawdown within the well is relative stable.

Constant Discharge Test

During a constant discharge test, ground water is pumped from the test well at a constant rate determined from the step-discharge test. The pumping rate is dependent on the hydraulic properties of the test zone and length of time the well will be pumped. The optimum test stresses the water-bearing zone without dewatering the well during testing. In most cases it is important to pump the well long enough to overcome borehole storage effects, and to observe drawdown in an adjacent observation well. Tests are generally run for 4 to 24 hours of pumping.

Water Level Recovery Test

After pumping has ceased, recovery is monitored while the water level in the well returns to a static level, or until the water level has returned to 90 percent of the static level. Drawdown and recovery are monitored during the test with a pressure transducer and electric well sounder.

Analytical Methods

There are many different methods (e.g., Jacob, 1963; Theis, 1935; Boulton, 1963) used to analyze pumping test results. The method used is dependent on the type of aquifer being tested (confined, unconfined, or leaky). Depth-to-water information is plotted for all wells monitored during testing versus time. Drawdown and recovery data are used for the analysis. In general, several methods are used to get the best analysis of each test. Depending on the test

design and results, it will be possible to calculate hydraulic parameters including transmissivity, storativity, hydraulic conductivity, and radius of influence.