GeoStrategies Inc.

WORK PLAN

UNOCAL Service Station No. 5760
376 Lewelling Boulevard
San Lorenzo, California
780905-11

September 1, 1992

GeoStrategies Inc.
2140 WEST WINTON AVENUE
HAYWARD, CALIFORNIA 94545
(510) 352-4800

September 1, 1992

UNOCAL Corporation
2000 Crow Canyon Place
San Ramon, California 94583

Attn: Ms. Penny Silzer

Re: WORK PLAN
UNOCAL Service Station No. 5760
376 Lewelling Boulevard
San Lorenzo, California 94583

Ms. Silzer:

This Work Plan prepared by GeoStrategies Inc. (GSI) is in response to a letter by the Alameda County Department of Environmental Health dated July 1, 1992.

GSI proposes to install one well down-gradient of the site on private property to attempt to delineate the dissolved hydrocarbon plume. The adjacent property owner to the south (Don Del Co.) is currently registered on the Regional Water Quality Control Board (RWQCB) fuel leak list. The extent of Don Del Co.'s responsibility along with the Transmission Repair across Usher Street require assessment prior to any implementation of remedial efforts (See Plate 2). GSI proposes to first delineate the hydrocarbon plume and conduct a file search of the Alameda County/RWQCB files on the adjacent property owners prior to the installation of an interim ground-water remediation system. GSI will perform all field work to comply with current RWQCB Bay Area Region, State of California Leaking underground Fuel Tanks (LUFT) manual and local agency guidelines.

SITE BACKGROUND

The underground storage tanks were replaced at this site during November and December 1987 by Gettler-Ryan Inc. and Geo-Test Inc. Well U-1 was installed in February 1988 in response to contamination observed during the underground tank replacement. A ground-water sample collected from monitoring well U-1 on February 9, 1988 contained benzene at a concentration of 3,600 ppb. Woodward-Clyde Consultants (WCC) documented the well installation in a report dated March 25, 1988. On August 5, 1990 GSI installed three groundwater monitoring wells (U-2 through U-4). The results of this phase of work are documented in the GSI Well Installation Report dated November 16, 1990.

On March 12 and 13, 1992, GSI installed four additional groundwater monitoring wells (U-5 through U-8). The results of this phase of work are documented in the GSI Well Installation Report dated June 15, 1992. Groundwater samples collected on April 7, 1992 detected 97,000 ppb TPH-Gasoline in monitoring Well U-3 and 6,600 ppb TPH-Gasoline in Well U-6.

HYDROGEOLOGIC CONDITIONS AND SITE GEOLOGY

The site is located approximately 500 feet north of San Lorenzo Creek. Local geology has been described as being flatland Holocene-age alluvial deposits consisting of unconsolidated moderately sorted permeable fine sand, silt, and clayey silt with a few thin beds of coarse sand. (Helley and Lajoie, 1979).

Available boring logs indicate the subsurface lithology consists of interfingering units of clay, silt and sands to a depth of 18 feet, where groundwater was encountered. The aquifer zone consists of a fairly continuous sand layer ranging from 5 to 10 feet in thickness. Below this sand zone is a clay/silt-rich zone approximately 5 to 10 feet in thickness. This clay zone may act locally as a aquitard impeding the vertical migration of petroleum hydrocarbons in soils and groundwater.

Groundwater was first encountered at approximately 18 feet below the surface. The water-bearing zone appears to be unconfined in nature.

SCOPE OF WORK

One soil boring will be drilled using hollow-stem auger drilling equipment to an anticipated depth of 30 feet or until an aquitard is reached. Soil samples will be collected with a California Modified split-barrel sampler equipped with pre-cleaned stainless steel liners, and advanced ahead of the drill bit. Soil samples will be collected at five-foot intervals, as a minimum, and at significant lithologic changes for lithologic identification, field head-space analysis, physical testing, and chemical analysis.

The boring will be logged by a GSI geologist using the Unified Soil Classification System (ASTM-D2488-84). Selected soil samples collected above the saturated zone will be analyzed for the presence of petroleum hydrocarbons. Additional samples may be selected for chemical analysis. Soil and groundwater samples collected from the exploratory boring and well will be analyzed at a California State-certified analytical laboratory for TPH-Gasoline according to EPA Method 8015 (Modified) and BTEX according to EPA Method 8020.

The monitoring well will be constructed using 2-inch-diameter Schedule 40 PVC casing. The well screen will extend a minimum of 5 feet above the equilibrated water-level. The annular sandpack will be placed from the total depth of the designed well and will extend to a minimum of 2-feet above the well screen. A minimum 1-foot bentonite seal, followed by a cement-grout seal to one-half foot below ground surface, will be placed above the sandpack. The well screen will be emplaced so that well design is compatible with subsurface geologic conditions. No well screen will be installed that could potentially permit cross contamination of adjacent aquifers.

GSI will conduct a file search at the Alameda County Department of Health, Mount Eden Fire Department and the Regional Water Quality Control Board to assess the potential off-site sources. The adjacent property owned by Don Del Company is currently on the RWQCB fuel leak list. Other properties adjacent to the site across Usher Street include a transmission repair business and possible former service station. This file search will provide information to evaluate if any potential sources of groundwater contamination exists on the immediate area surrounding this site.

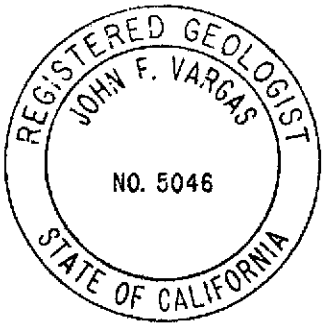
Upon completion of field work and receipt of chemical analytical data, a report will be prepared presenting the field and laboratory data including copies of the exploratory boring logs, chemical analytical reports site history as available, and narrative. This report will also summarize the file search and will be prepared under the supervision of a State of California Registered Professional Engineer.

If you have any questions, please call.

GeoStrategies Inc. by,

Thomas D. Leavitt
Geologist

Diane M. Lundquist
Senior Engineer
C 46725



TDL/DHP/rmt

Plate 1. Vicinity Map
Plate 2. Extended Site Plan

Appendix A: Field Methods and Procedures

QC Review: _____

780905-11

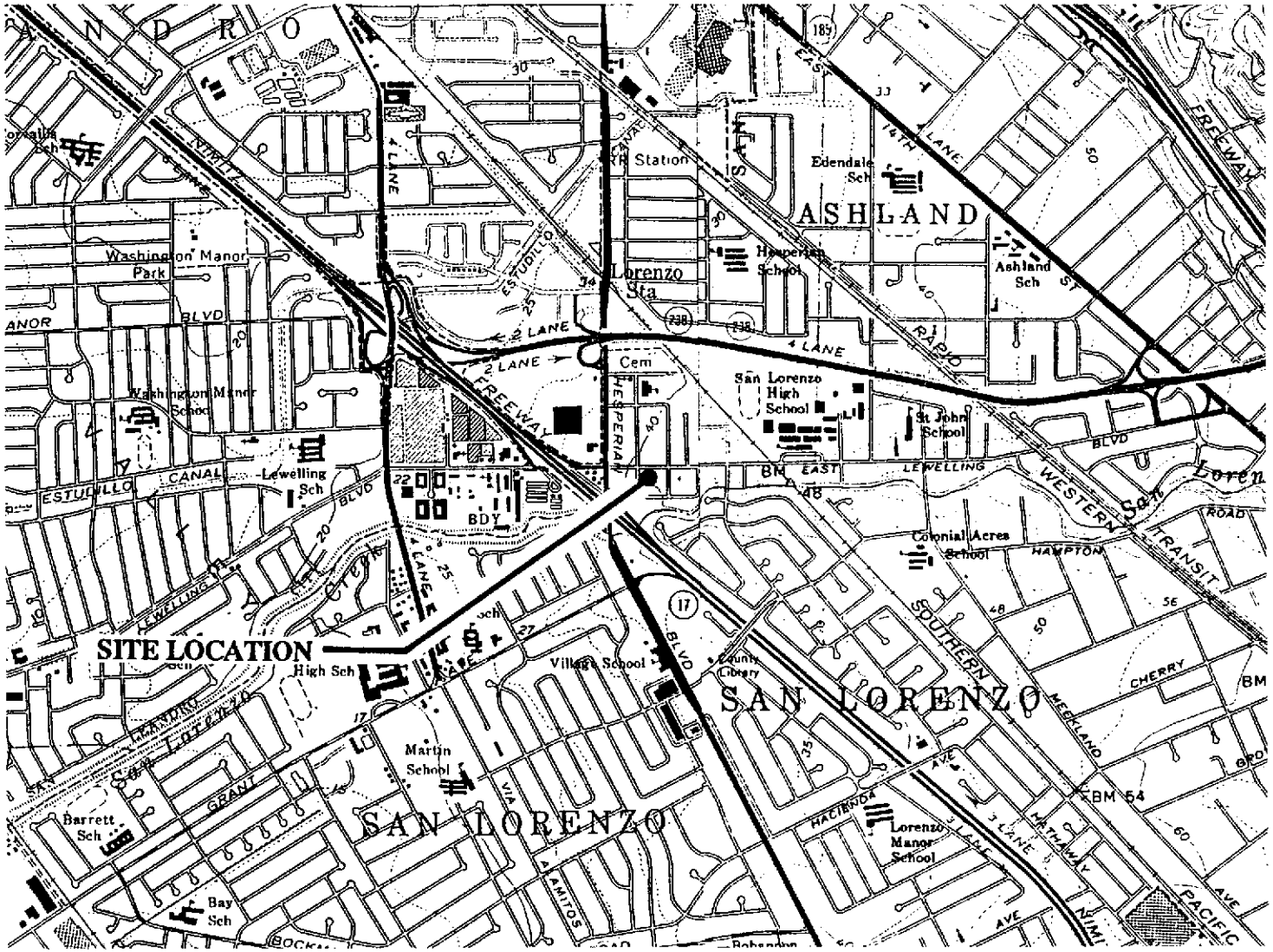
REFERENCES SITED

GeoStrategies Inc., 1990, Well Installation Report, Report No. 7809-3, dated November 16, 1990.

GeoStrategies Inc., 1992, Well Installation Report, Report No. 780902-10, dated June 15, 1992.

Helley, E.J. and others, 1979, Flatland deposits of the San Francisco Bay Region, California - Their geology and engineering properties, and their importance to comprehensive planning: U.S. Geological Survey Professional Paper 943.

Woodward-Clyde Consultants, 1988, Well Installation Report, Report No. 8820011A-0015, dated March 25, 1988.



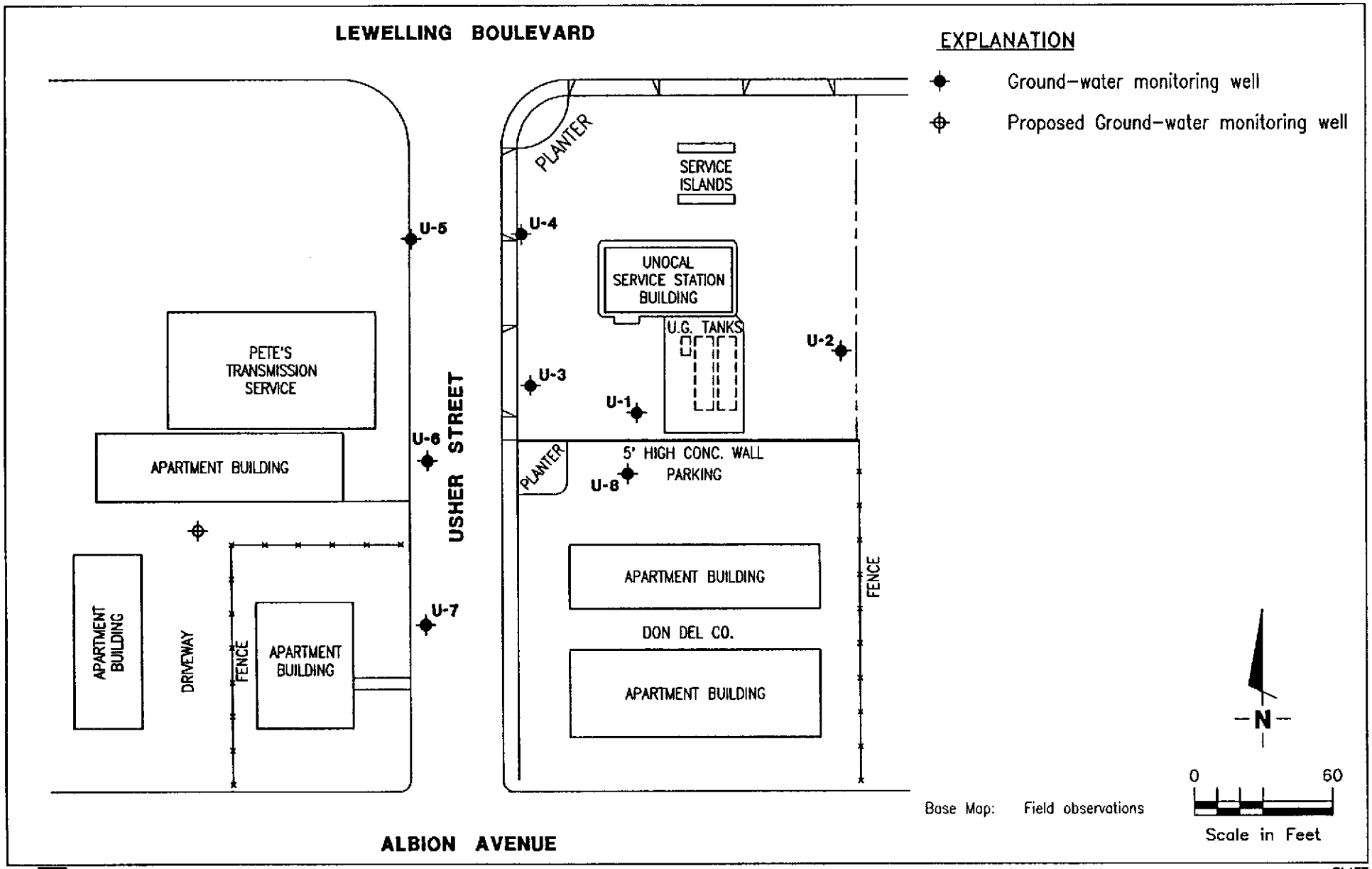
Base Map: USGS Topographic Map

GeoStrategies Inc.

VICINITY MAP
UNOCAL Service Station #5760
376 Lewelling Boulevard
San Lorenzo, California

PLATE 1

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
7809		2/91	



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EXTENDED SITE PLAN
UNOCAL Service Station #5760
376 Lewelling Boulevard
San Lorenzo, California

PLATE
2

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
780905-11	TPC	8/92	

APPENDIX A

FIELD METHODS AND PROCEDURES

FIELD METHODS AND PROCEDURES

EXPLORATION DRILLING

Mobilization

Prior to any drilling activities, GeoStrategies Inc. (GSI) will verify that necessary drilling permits have been secured.

Utility locations will be located and drilling will be conducted so as not to disrupt activities at a project site. GSI will obtain and review available public data on subsurface geology and if warranted, the location of wells within a half-mile of the project site will be identified. Drillers will be notified in advance so that drilling equipment can be inspected prior to performing work.

Drilling

The subsurface investigations are typically performed to assess the lateral and vertical extent of petroleum hydrocarbons present in soils and groundwater. Drilling methods will be selected to optimize field data requirements as well as be compatible with known or suspected subsurface geologic conditions.

Monitoring wells are installed using a truck-mounted hollow-stem auger drill rig or mud-rotary drill rig. Typically, the hollow-stem rig is used for wells up to 100 feet, if subsurface conditions are favorable. Wells greater than 100-feet deep are typically drilled using mud-rotary techniques. When mud rotary drilling is used, an electric log will be performed for additional lithological information. Also during mud rotary drilling, precautions will be taken to prevent mud from circulating contaminants by using a conductor casing to seal off contaminated zones. Samples will be collected for lithologic logging by continuous chip, and where needed by drive sample or core as specified by the supervising geologist.

Soil Sampling

Shallow soil borings will be drilled using a truck-mounted hollow-stem auger drilling rig, unless site conditions favor a different drilling method. Drilling and sampling methods will be consistent with ASTM Method D-1452-80. The auger size will be a minimum 6-inch nominal outside-diameter (O.D). No drilling fluids will be used during this drilling method. The augers and other tools used in the bore hole will be steam cleaned before use and between borings to minimize the possibilities of cross-contamination between borings.

Soil samples are typically collected at 5-foot intervals as a minimum from ground surface to total depth of boring. Additional soil samples will be collected based on significant lithologic changes and/or potential chemical content. Soil samples from each sampling interval will be lithologically described by a GSI geologist (Figure 1). Soil colors will be described using the Munsell Color Chart. Rock units will be logged using appropriate lithologic terms, and colors described by the G.S.A. Rock Color Chart.

Head-space analyses will be performed to check for the evidence of volatile organic compounds. Head-space analyses will be performed using an organic vapor analyzer; either an OVA, HNU, or OVM. Organic vapor concentrations will be recorded on the GSI field log of boring (Figure 1). The selection of soil samples for chemical analysis are typically based on the following criteria:

1) Soil discoloration
2) Soil odors
3) Visual confirmation of chemical in soil
4) Depth with respect to underground tanks (or existing grade)
5) Depth with respect to ground water
6) OVA reading

Soil samples (full brass liners) selected for chemical analysis are immediately covered with aluminum foil and the liner ends are capped to prevent volatilization. The samples are labeled and entered onto a Chain-of-Custody form, and placed in a cooler on blue ice for transport to a State-certified analytical laboratory.

Soil cuttings are stockpiled on-site. Soils are sampled and analyzed for site-specific chemical parameters. Disposition of soils is dependent of chemical analytical results of the samples.

Soil Sampling - cont.

Soil borings not converted to monitoring wells will be backfilled (sealed) to ground surface using either a neat cement or cement-bentonite grout mixture. Backfilling will be tremied by continuously pumping grout from the bottom to the top of the boring where depth exceeds 20' or as required by local permit requirements.

All field and office work, including exploratory boring logs, are prepared under the direction of a registered geologist.

Monitoring Well Installation

Monitoring well casing and screen will be constructed of Schedule 40, flush-joint threaded polyvinylchloride (PVC). The well screen will be factory mill-slotted unless additional open area is required (eg. conversion to an extraction well in a low-yield aquifer). The screen length will be placed adjacent to the aquifer material to a minimum of 2-feet above encountered water. No screen shall be placed in a borehole that potentially creates hydraulic interconnection of two or more aquifer units. Screen slot size and well sand pack will be compatible with encountered aquifer materials, as confirmed by sieve analysis.

Monitoring wells will be completed below grade (Figure 2) unless special conditions exist that require above-grade completion design. In the event a monitoring well is required in an aquifer unit beneath an existing aquifer, the upper aquifer will be sealed off by installing a steel conductor casing with an annular neat cement or cement-bentonite grout seal. This seal will be continuously tremie pumped from the bottom of the annulus to ground surface.

The monitoring well sand pack will be placed adjacent to the entire screened interval and will extend a recommended minimum distance of 2-feet above the top of the screen. No sand pack will be placed that interconnects two or more aquifer units. A minimum 2-foot bentonite pellet or bentonite slurry seal will be placed above the sand pack. Sand pack, bentonite, and cement seal levels will be confirmed by sounding the annulus with a calibrated weighted tape. The remaining annular space above the bentonite seal will be grouted with a bentonite-cement mixture and will be tremie-pumped from the bottom of the annular space to the ground surface. The bentonite content of the grout will not exceed 5 percent by weight. A field log of boring and a field well completion form will be prepared by GSI for each well installed.

Decontamination of drilling equipment before drilling and between wells will consist of steam cleaning, and/or Alconox wash.

Well Development

All newly installed wells will be properly developed within 48 hours of completion. No well will be developed until the well seal has set a minimum of 12 hours. Development procedures will include one or more of the methods described below:

Bailing

Bailing will be used to remove suspended sediments and drilling fluids from the well, where applicable. The bailer will be raised and lowered through the column of water in the well so as to create a gentle surging action in the screened interval. This technique may be used in conjunction with other techniques, such as pumping, and may be used alone if the well is of low yield.

Pumping

Pumping will be used in conjunction with bailing or surging. The pump will be operated in such a manner as to gently surge the entire screened interval of the well. This may involve operating the pump with a packer type mechanism attached and slowly raising and lowering the pump, or by cycling the pump off and on to allow water to move in and out of the screened interval. Care will be used not to overpump a well.

Surging

Surging will be performed on wells that are screened in known or suspected high yield formations and/or on larger diameter (recovery) wells. A surge block will be raised and lowered through the entire screened interval, forcing water in and out of the well screen and sand pack. Pumping or air lifting will be used in conjunction with this method of development to remove any sediment brought into the well during surging.

Air Lifting

Air lifting will be used to remove sediment from wells as an alternative to pumping under certain conditions. When appropriate, a surge block designed for use with air lifting will be used to agitate the entire screened interval and water will be lifted out of the well using forced air. When air lifting is performed, the air source will be either nitrogen or filtered air and the procedure will be performed gently to prevent any damage to the well screen or casing and to insure that discharged water is contained.

Well Development - cont.

All well developing equipment will be thoroughly decontaminated prior to development using a steam cleaner and/or Alconox detergent wash and clean water rinse. During development procedures, field parameters (temperature, specific conductance and pH) will be monitored and recorded on well development forms (Figure 3). Equilibration requirements consist of a minimum of three readings with the following accuracy standards:

pH	± 0.1 pH units
Specific Conductance	± 10% of full scale reading
Temperature	± 0.5 degrees Celsius

The wells will be developed until water is visibly clear and free of sediment, and well purging parameters stabilized. A minimum of 8 to 10 well volumes will be purged from each well, if feasible. If well purging parameters have not stabilized before 10 casing volumes have been removed, well development will continue until purging parameters have stabilized and formation water is being drawn into the well. The adequacy of well development will be judged by the field technician performing the well development and based on known formation conditions.

Well Surveying

Monitoring wells will be surveyed to obtain top of box elevations to the nearest ±0.01 foot. Water level measurements will be recorded to the nearest ±0.01 foot and referenced to Mean Sea Level (MSL). If additional wells are required, then existing and newly installed wells are surveyed relative to MSL.

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FIELD EXPLORATORY BORING LOG

FIGURE 1

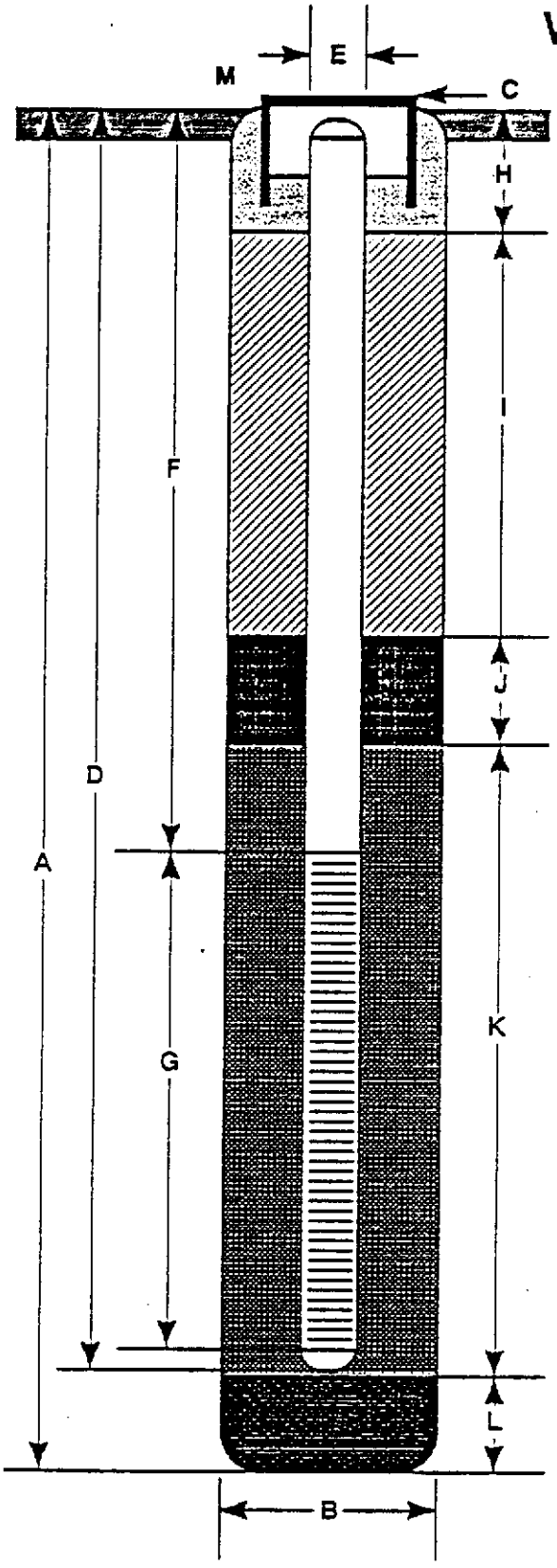
Field location of boring:	Project No.:	Date:	Boring No:
	Client:		
	Location:		
	City:		Sheet
	Logged by:	Driller:	of
Drilling method:	Casing installation data:		
Hole diameter:	Top of Box Elevation:		Datum:

								Water Level				
PID (ppm)	Blows/ft. or Pressure (psf)	Type of Sample	Sample Number	Depth (ft.)	Sample	Well Detail	Soil Group Symbol (USCS)	Time				
								Date				
								Description				

Remarks:

WELL CONSTRUCTION DETAIL

FIGURE 2



A Total Depth of Boring _____ ft.

B Diameter of Boring _____ in.
Drilling Method _____

C Top of Box Elevation _____ ft.
☐ Referenced to Mean Sea Level
☐ Referenced to Project Datum

D Casing Length _____ ft.
Material _____

E Casing Diameter _____ in.

F Depth to Top Perforations _____ ft.

G Perforated Length _____ ft.
Perforated Interval from _____ to _____ ft.
Perforation Type _____
Perforation Size _____ in.

H Surface Seal from _____ to _____ ft.
Seal Material _____

I Backfill from _____ to _____ ft.
Backfill Material _____

J Seal from _____ to _____ ft.
Seal Material _____

K Gravel Pack from _____ to _____ ft.
Pack Material _____

L Bottom Seal _____ ft.
Seal Material _____

M _____

Note: Depths measured from initial ground surface

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Well Construction Detail

WELL NO.

JOB NUMBER | REVIEWED BY RG/CEG | DATE | REVISED DATE | REVISED DATE

WELL DEVELOPMENT FORM FIGURE 3

Page_____ of_____

(to be filled out in office)

Client_____ SS#_____ Job#_____

Name_____ Location_____

Well#_____ Screened Interval_____ Depth_____

Aquifer Material_____ Installation Date _____

Drilling Method_____ Borehole Diameter_____

Comments regarding well installation:_____

(to be filled out in the field) Name_____

Date_____ Development Method_____

Total Depth_____ - Depth to liquid_____ = WaterColumn_____

Product thickness_____

_____ x _____ x _____ x 0.0408 = _____gals
Water Column Diameter (in.) #Vol

Purge Start_____ Stop_____ Rate_____ gpm

Gallons	Time	Clarity	Temp.	pH	Conductivity
0					

Total gallons removed_____ Development stop time_____

Depth to liquid _____at_____(time)

Odor of water_____ Water discharged to_____

Comments_____