Environmental
Science &
Engineering, Inc.
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August 24, 1993

Ms. Juliet Shin
Hazardous Materials Specialist
Alameda Health Care Services Agency
Department of Environmental Health
80 Swan Way, #200
Oakland, California 94621

**SUBJECT: WORKPLAN FOR REMEDIAL INVESTIGATION
FORMER BILL CHUN'S SERVICE STATION
2301 SANTA CLARA AVENUE
ALAMEDA, ALAMEDA COUNTY, CALIFORNIA
ESE PROJECT #6-93-5112**

Dear Ms. Shin:

Environmental Science & Engineering, Inc. (ESE) presents the subject workplan for Remedial Investigation at the subject site for review and comment by the Alameda County Health Care Services Agency, Department of Environmental Health (Alameda County). The objective of the scope of work outlined herein is to delineate the vertical and horizontal impact of petroleum hydrocarbons in the subsurface. Tasks associated with these objectives are described below. All aspects of the work described in this workplan will be conducted under the direct oversight of a Registered California Geologist.

1.0 BACKGROUND

Investigation at the subject site (see Figure 1 - Location Map) was initiated on July 31, 1992 when three steel underground gasoline tanks (two 550-gallon and one 285-gallon) were removed from the site. The consultant of record (Parker Environmental Services) reported that the 285-gallon tank was observed to have a two-inch diameter hole at its base.

One soil sample was collected from beneath each tank and from beneath the former fuel island, and two soil samples were collected from the stockpile resulting from tank excavation. Analytical results for soil samples reported concentrations of Total Petroleum Hydrocarbons as Gasoline (TPH-G) ranging from 2.1 to 16,000 milligrams per Kilogram (mg/Kg) or parts per million (ppm). Concentrations of Benzene, Toluene, Ethylbenzene, and Total Xylenes (BTEX) were shown to range from 0.011 to 1,400 ppm.

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In January 1993, ESE conducted a Preliminary Site Assessment (PSA) at the subject site. Three ground-water monitoring wells (MW-1, MW-2, and MW-3; Figure 2 - Site Map) were installed and soil and ground-water samples were collected during those activities. Analytical results for soil samples collected from MW-1, MW-2, and MW-3 reported concentrations of TPH-G ranging from 640 ppm to 5,800 ppm. Concentrations of BTEX were shown to range from non-detectable to 1,200 ppm. Analytical results for ground-water samples reported concentrations of TPH-G ranging from 8,500 micrograms per liter (ug/L) or parts per billion (ppb) to 110,000 ppb. Concentrations of BTEX were shown to range from non-detectable to 20,000 ppb. Samples from wells MW-1 and MW-2 reported 1,2-Dichloroethane (EDC) present at concentrations of 470 ppb and 550 ppb, respectively. Results of the investigation are summarized in ESE's March 31, 1993 "Report on Preliminary Site Assessment at the Former Bill Chun Texaco Service".

2.0 SCOPE OF WORK

Environmental Science & Engineering, Inc. will perform five tasks as part of this remedial investigation. These tasks are:

- Prepare a site health & safety plan,
- Obtain permits and coordinate site clearance,
- Conduct remedial investigation,
- Prepare a report of findings, and
- Initiate quarterly monitoring and reporting.

Activities associated with each task are described below.

2.1 TASK 1 - PREPARE A SITE HEALTH & SAFETY PLAN

To ensure the safety of ESE field personnel and representatives of the client, Alameda County, City of Alameda, and any other authorized personnel, ESE will prepare a site specific health & safety plan (HASP) that addresses potential physical and chemical hazards associated with the proposed work. The HASP plan will be reviewed and approved by ESE's Concord Office Health & Safety Officer prior to its implementation. All personnel who are to be present during any of the proposed activities will be required to review the plan and to acknowledge its receipt and review before being allowed within the work zone.

2.2 TASK 2 - OBTAIN PERMITS AND COORDINATE SITE CLEARANCE

ESE will prepare and submit the appropriate well permit applications to drill the borings and install the wells from the Alameda County Zone 7 Water Agency (Zone 7). ESE will coordinate clearance from underground utilities through Underground Service Alert (USA) prior to implementing the drilling phase of the remedial investigation.

2.3 TASK 3 - CONDUCT REMEDIAL INVESTIGATION

Three subtasks are associated with the remedial investigation work. These subtasks are as follows:

- Additional soil borings and ground-water monitoring wells,
- Development of four new wells and sampling all seven wells, and
- Aquifer testing in existing and new monitoring wells.

Each subtask is discussed in detail below.

2.3.1 Additional Soil Borings and Ground-Water Monitoring Wells

ESE will direct the drilling of four additional soil borings (MW-4, MW-5, MW-6, and MW-7; Figure 2) to an approximate depth of 25 feet below ground surface (bgs). The purpose of borings MW-4, MW-5, and MW-6 will be to provide additional definition of petroleum hydrocarbons in soil and ground water at the downgradient margin of the site. MW-7 will be installed to evaluate conditions presumably upgradient from the former tanks.

Borings will be drilled in accordance with ESE Standard Operating Procedure (SOP) No. 1 for Soil Borings and Soil Sampling with Hollow-Stem Augers in Unconsolidated Formations (attached). ESE will collect soil samples at five-foot intervals while drilling to visually evaluate soil characteristics and to screen soil for organic vapors using a photoionization detector (PID). One soil sample from the approximate ground-water/unsaturated zone interface will be submitted to a state-certified laboratory to be analyzed for TPH-G, Total Petroleum Hydrocarbons as Diesel (TPH-D) and BTEX using Environmental Protection Agency (EPA) method 8240/8260.

Upon completing the drilling phase, ESE will direct the installation of two-inch diameter monitoring wells in the borings in accordance with ESE SOP No. 2 for Monitoring Well Installation and Development (attached). The procedures described therein are consistent with California Well Standards established by the Department of Water Resources. ESE will develop the four new wells using mechanical surging and bailing techniques in accordance with ESE SOP No. 2.

2.3.2 Development of Four New Wells and Sampling of All Wells

A minimum of 72 hours following well development, ESE will measure static water levels in the new and existing wells, then purge all wells and collect ground-water samples in accordance with ESE SOP No. 3 for Ground-water Monitoring and Sampling from Monitoring Wells (attached). Ground-water samples collected from the wells will be submitted to a State-certified laboratory to be analyzed for TPH-G, TPH-D, and BTEX using EPA method 8240/8260. ESE will also survey top of casing elevations for the new wells relative to the existing wells for the purpose of standardizing ground-water elevation measurements.

2.3.3 Aquifer Testing In New and Existing Wells

Previous work demonstrated that shallow site ground water has been impacted by petroleum hydrocarbons. Therefore, it will be necessary to evaluate the feasibility of ground-water extraction in association with site remediation. In order to effectively design a ground-water extraction system (should one be necessary), field-derived values for water bearing zone parameters such as hydraulic conductivity (K) and transmissivity (T) must be obtained. K and T are essential elements in determining potential flow to extraction wells, estimating radii of influence resulting from extraction, and determining the rate of ground-water flow at the site.

ESE's experience at the site has indicated that existing monitoring wells are slow to recover during purge and sample activities and tend to bail dry. ESE will conduct bail down, or "slug", tests in each of the three existing and four new monitoring wells to provide estimates of K and T for the water-bearing zone. The procedure for conducting these tests will be to instantaneously introduce a solid cylinder of PVC (a slug) into a well and record the corresponding downward recovery of the ground-water level using an electronic datalogger. Following recovery to the static level, upward recovery of the ground-water level in response to removal of the slug will be recorded. This procedure will be repeated for each well.

Slug test data will be downloaded from the datalogger onto a personal computer, on which field results will be evaluated using interactive curve-matching software for establishing aquifer parameters. Using the subsequent estimates for K and T, ESE will model the water bearing zone for flow and advective contaminant transport using a modular two-dimensional finite-difference ground water flow model such as MODFLOW (USGS), DREAM, or Flowpath. The objective for modeling the system will be to evaluate various pumping schemes in terms of appropriate number of wells and optimum flow rates, should an extraction system be necessary.

Results of aquifer testing will be incorporated with the report of findings. Raw data (datalogger results, type curves for aquifer parameters, and flow modeling plots) will be incorporated as appendices to the report.

2.4 TASK 4 - PREPARE A REPORT OF FINDINGS

Upon completion of field activities, receipt of analytical results for soil and ground-water samples, and evaluation of aquifer testing data, ESE will prepare a report of findings and submit it to Alameda County for review and comment. The report will detail all activities and results associated with the investigation. Results will be summarized in both tabular and graphical form, and all raw data (laboratory reports, boring/well completion logs, field logs, etc.) will be incorporated as appendices to the report.

2.5 TASK 5 - INITIATE QUARTERLY MONITORING AND REPORTING

In accordance with Alameda County requirements for quarterly monitoring, ESE will implement a program of ground-water monitoring and reporting. The report of findings for the remedial investigation will also serve as the Third Quarter 1993 Monitoring Report. Thereafter, monitoring and reporting will be conducted on a quarterly basis.

3.0 PROGRESS AND REPORTING SCHEDULE

ESE will perform the referenced tasks in a timely manner subject to the schedule presented in Table 1. Note that some tasks will be conducted concurrently with others.

**TABLE 1
PROGRESS AND REPORTING SCHEDULE
FOR REMEDIAL INVESTIGATION
Former Bill Chun's Service Station
2301 Santa Clara Avenue, Alameda, California**

TASK	ESTIMATED COMPLETION DATE
Prepare HASP	8/30/93
Obtain Permits/Site Clearance	8/30/93
Remedial Investigation:	
- Install/Develop Add'l Wells	9/3/93
- Sample All Wells	9/7/93
- Aquifer Testing	9/8/93
Submit Report of Findings	9/24/93
Perform Quarterly Monitoring and Reporting	
- Fourth Quarter 1993	1/15/94
- First Quarter 1994	4/15/94

If you have any questions or require additional information regarding this workplan, please contact Mike Quillin at (510) 685-4053.

Sincerely,

ENVIRONMENTAL SCIENCE & ENGINEERING, INC.

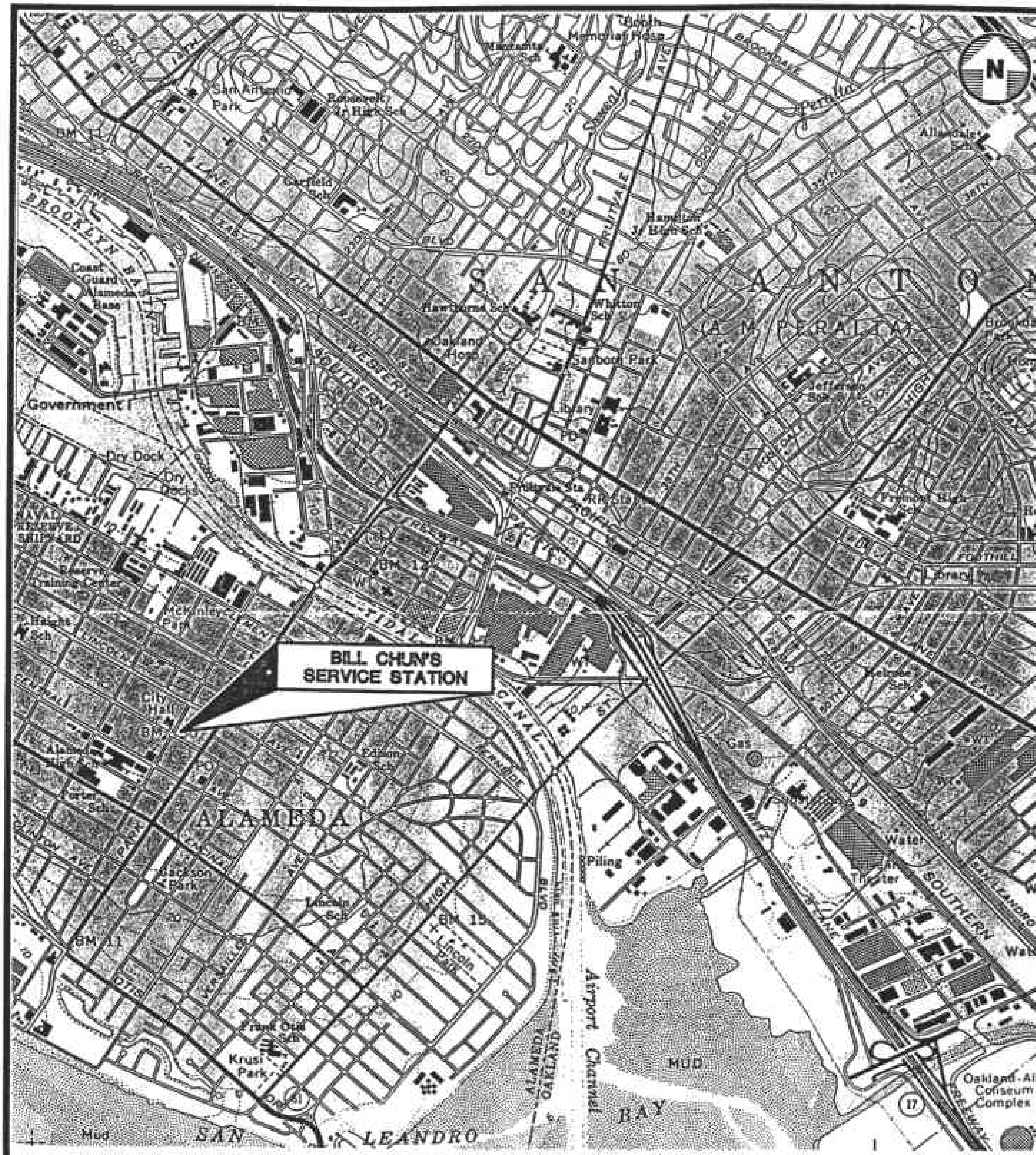
Christopher H. Valcheff
Staff Geologist

Michael E. Quillin, R.G. 5315
Senior Hydrogeologist

CHV/MEQ:sf

Attachments: Figures (2)
ESE SOPs (3)

cc: Mr. Wayne Chun



SCALE 1:24,000

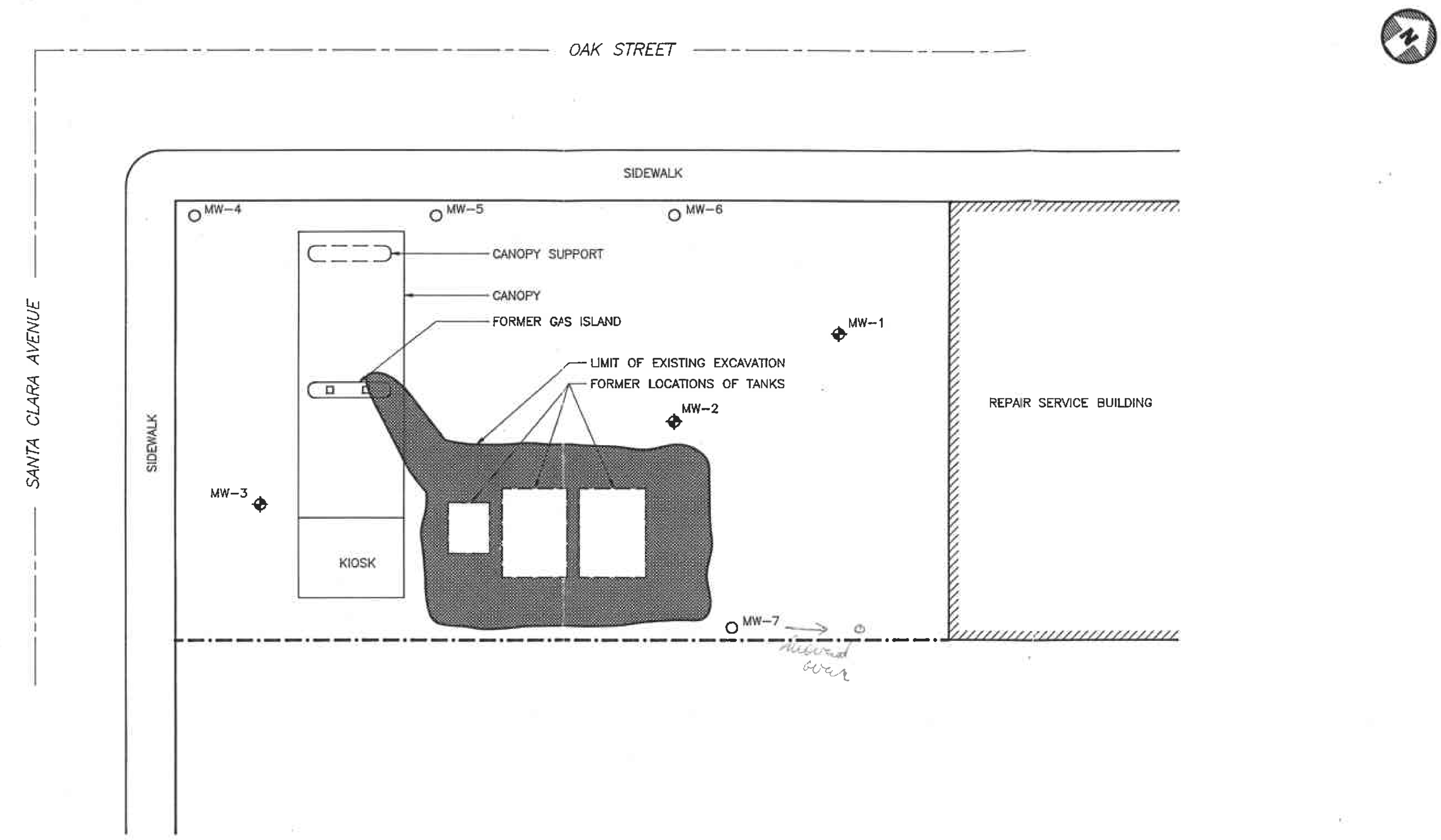
1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

ADAPTED FROM U.S.G.S. OAKLAND EAST 7.5 MINUTE TOPOGRAPHIC QUADRANGLE MAP, 1959, PHOTOREVISED 1980.

ESE A CILCORP Company — Environmental Science & Engineering, Inc.	DATE 8/93	LOCATION MAP	FIGURE NO. 1
	REVISED		
4090 NELSON AVENUE, SUITE J CONCORD, CA 94520	CAD FILE 51121001	BILL CHUN'S SERVICE STATION 2301 SANTA CLARA AVENUE ALAMEDA, CALIFORNIA	PROJ. NO. 6-93-5112



LEGEND

- EXISTING MONITORING WELL LOCATION
- PROPOSED MONITORING WELL LOCATION
- PROPERTY BOUNDARY

SCALE
0 10 FEET

ESE A CILCORP Company Environmental Science & Engineering, Inc.	DATE 8/93	SITE MAP	FIGURE NO. 2
4090 NELSON AVENUE, SUITE J CONCORD, CA 94520	REVISED / CAD FILE 51121C02	BILL CHUN'S SERVICE STATION 2301 SANTA CLARA AVENUE ALAMEDA, CALIFORNIA	PROJ. NO. 6-93-5112

ENVIRONMENTAL SCIENCE & ENGINEERING, INC.
CONCORD, CALIFORNIA OFFICE

STANDARD OPERATING PROCEDURE NO. 1
FOR SOIL BORINGS AND SOIL SAMPLING WITH HOLLOW-STEM AUGERS
IN UNCONSOLIDATED FORMATIONS

Environmental Science & Engineering, Inc. (ESE) typically drills soil borings using a truck-mounted, continuous-flight, hollow-stem auger drill rig. The drill rig is owned and operated by a drilling company possessing a valid State of California C-57 license. The soil borings are conducted under the direct supervision and guidance of an experienced ESE geologist. The ESE geologist logs each borehole during drilling in accordance with the Unified Soil Classification System (USCS). Additionally, the ESE geologist observes and notes the soil color, relative density or stiffness, moisture content, odor (if obvious) and organic content (if present). The ESE geologist will record all observations on geologic boring logs.

Soil samples are collected during drilling at a minimum of five-foot intervals by driving an 18-inch long Modified California Split-spoon sampler (sampler), lined with new, thin-wall brass sleeves, through the center of and ahead of the hollow stem augers, thus collecting a relatively undisturbed soil sample core. The brass sleeves are typically 2-inches in diameter and 6-inches in length. The sampler is driven by dropping a 140-pound hammer 30-inches onto rods attached to the top of the sampler. Soil sample depth intervals and the number of hammer blows required to advance the sampler each six-inch interval are recorded by the ESE geologist on geologic boring logs. The ends of one brass sleeve are covered with Teflon sheeting, then covered with plastic end caps. The end caps are sealed to the brass sleeve using duct tape. Each sample is then labeled and placed on ice in a cooler for transport under chain of custody documentation to the designated analytical laboratory. A portion of the remaining soil in the sampler is placed in either a new Ziploc® bag or a clean Mason Jar® and set in direct sunlight to enhance the volatilization of any Volatile Organic Compounds (VOCs) present in the soil. After approximately 15-minutes that sample is screened for VOCs using a photoionization detector (PID). The PID measurements will be noted on the geologic boring logs. The PID provides qualitative data for use in selecting samples for laboratory analysis. Soil samples from the saturated zone (beneath the ground-water table) are collected as described above, are not screened with the PID, and are not submitted to the analytical laboratory. The samples from the saturated zone are used for descriptive purposes. Soil samples from the saturated zone may be retained as described above for physical analyses (grain size, permeability and porosity testing).

If the soil boring is not going to be completed as a well, then the boring is typically terminated upon penetrating the saturated soil horizon or until a predetermined interval of soil containing no evidence of contamination is penetrated. This predetermined interval is typically based upon site specific regulatory or client guidelines. The boring is then backfilled using either neat cement, neat cement and bentonite powder mixture (not exceeding 5% bentonite), bentonite pellets, or a sand and cement mixture (not exceeding a 2:1 ratio of sand to cement). However, if the boring is to be completed as a monitoring well, then the boring is continued until either a competent, low estimated-permeability, lower confining soil layer is found or 10 to 15-feet of the saturated soil horizon is penetrated, whichever occurs first. If a low estimated-permeability soil layer is found, the soil boring will be advanced approximately five-feet into that layer to evaluate its competence as a lower confining layer, prior to the termination of that boring.

All soil sampling equipment is cleaned between each sample collection event using an Alconox® detergent and tap water solution followed by a tap water rinse. Additionally, all drilling equipment and soil sampling equipment is cleaned between borings, using a high pressure steam cleaner, to prevent cross-contamination. All wash and rinse water is collected and contained onsite in Department of Transportation approved containers (typically 55-gallon drums) pending laboratory analysis and proper disposal/recycling.

Environmental Science & Engineering, Inc. (ESE) typically installs ground-water monitoring wells in unconsolidated sediments drilled using a truck-mounted hollow-stem auger drill rig. The design and installation of all monitoring wells is performed and supervised by an experienced ESE geologist. Figure A - Typical ESE Monitoring Well Construction Diagram (attached) graphically displays a typical ESE well completion. Prior to the construction of the well, the portion of the borehole that penetrates a lower confining layer (if any) is filled with bentonite pellets. The monitoring well is then constructed by inserting polyvinylchloride (PVC) pipe through the center of the hollow stem augers. The pipe (well-casing) is fastened together by joining the factory threaded pipe ends. ESE typically uses two-inch or four-inch diameter pipe for ground-water monitoring wells. The diameter of the borehole is typically 6-inches greater than that of the diameter of the well-casing, but is at least four-inches greater than that of the well casing. The lowermost portion of the well-casing will be factory perforated (typically having slot widths of 0.010-inch or 0.020-inch). The slotted portion of the well-casing will extend from the bottom of the boring up to approximately five-feet above the occurrence of ground water. A PVC slip or threaded cap will be placed at the bottom end of the well-casing, and a locking expandable well cap will be placed over the top (or surface) end of the well-casing. A sand pack (typically No. 2/12 or No. 3 Monterey sand) will be placed in the borehole annulus, from the bottom of the well-casing up to one to two-feet above the top of the slotted portion, by pouring the clean sand through the hollow stem augers. One to two-feet of bentonite pellets will be placed on top of the sand pack. The bentonite pellets will then be hydrated with three to four-gallons of potable water, to protect the sand pack from intrusion during the placement of the sanitary seal. The sanitary seal (grout) will consist of either neat cement, a neat cement and bentonite powder mixture (containing no more than 5% bentonite), or a neat cement and sand mixture (containing no more than a 2:1 sand to cement ratio). If, the grout seal is to be greater than 30-feet in depth or if standing water is present in the boring on top of the bentonite pellet seal, then the grout mixture will be tremied into the boring from the top of the bentonite seal using either a hose, pipe or the hollow-stem augers, which serve as a tremie. The well will be protected at the surface by a water tight utility box. The utility box will be set into the grout mixture so that it is less than 0.1-foot above grade, to prevent the collection of surface water at the well head. If the well is set within the public right of way, then the utility box will be Department of Transportation (DOT) traffic rated, and the top of the box will be set flush to grade. If the well is constructed in a vacant field a brightly painted metal standpipe may be used to protect the well from traffic. If a standpipe is used, it will be held in place with a grout mixture and will extend one to two-feet above ground surface. All well completion details will be recorded by the ESE geologist on the geologic boring logs.

Subsequent to the solidification of the sanitary seal of the well (a minimum of 72 hours), the new well will be developed by an ESE geologist or field technician. Well development will be performed using surging, bailing and overpumping techniques. Surging is performed by raising and lowering a surge block through the water column within the slotted interval of the well casing. The surge block utilized has a diameter just smaller than that of the well casing, thus, forcing water flow through the sand pack due to displacement and vacuum caused by the movement of the surge block. Bailing is performed by lowering a bailer to the bottom of the well and gently bouncing the bailer off of the well end cap, then removing the full bailer and repeating the procedure. This will bring any material (soil or PVC fragments) that may have accumulated in the well into suspension for removal. Overpumping is performed by lowering a submersible pump to the bottom of each well and pumping at the highest sustainable rate without completely evacuating the well casing. Effective well development will settle the sand pack surrounding the well-casing, which will improve the filtering properties of the sand pack and allow water to flow more easily through the sand pack; improve the communication between the aquifer and the well by aiding the removal of any smearing of fine sediments along the borehole penetrating the aquifer; and, remove fine sediments and any foreign objects (PVC fragments) from the well casing. The ESE geologist or technician will monitor the ground water purged from the well during development for clarity, temperature, pH and conductivity. Development of the well will proceed until the well produces relatively clear, sand-free water with stable temperature, pH and conductivity measurements. At a minimum, 10 well-casing volumes of ground water will be removed during the development process. Measurements of temperature, conductivity, pH and volume of the purged water and observations of purge water clarity and sediment content will be recorded on the ESE Well Development Data Forms. All equipment used during the well development procedure will be cleaned using an Alconox® detergent and tap water solution followed by a tap water rinse prior to use in each well. All ground water purged during the well development process and all equipment rinse water will be collected and contained onsite in DOT approved containers (typically 55-gallon drums) pending analytical results and proper disposal or recycling.

ENVIRONMENTAL SCIENCE & ENGINEERING, INC.
CONCORD, CALIFORNIA OFFICE

STANDARD OPERATING PROCEDURE NO. 3
FOR GROUND-WATER MONITORING AND SAMPLING FROM MONITORING WELLS

Environmental Science & Engineering, Inc. (ESE) typically performs ground-water monitoring at project sites on a quarterly basis. As part of the monitoring program an ESE staff member will first gauge the depth to water and free product (if present) in each well, then collect ground-water samples from each well. Depth to water measurements are taken by lowering an electric fiberglass tape measure into the well and recording the occurrence of water in feet below a fixed datum set on the top of the well-casing. If free-phase liquid hydrocarbons (free product) are known or suspected to be present in the well, then an electric oil/water interface probe is used to determine the depth to the occurrence of ground-water and the free product in feet below the fixed datum on the top of the well-casing. Depth to water and depth to product measurements are measured and recorded within an accuracy of 0.005-foot. The electric tape and the electric oil/water interface probe are washed with an Alconox® detergent and tap water solution then rinsed with tap water between uses in different wells.

Ground-water samples are collected from a well subsequent to purging a minimum of three to four well-casing volumes of ground water from the well, if the well bails dry prior to the removal of the required minimum volume, then the samples are collected upon the recovery of the ground water in that well to 80% of its initial static level. Ground water is typically purged from monitoring wells using either a hand-operated positive displacement pump, constructed of polyvinylchloride (PVC); a new (precleaned), disposable polyethylene bailer; or, a variable-flow submersible pump, constructed of stainless steel and Teflon®. The hand pumps and the submersible pumps are cleaned between each use with an Alconox® detergent and tap water solution followed by a tap water rinse. During the well purging process the conductivity, pH and temperature of the ground water are monitored by the ESE staff member. Ground-water samples are collected from the well subsequent to the stabilization of the of the conductivity, pH and temperature of the purge water, and the removal of four well-casing volumes of ground-water (unless the well bails dry). The parameters are deemed to have stabilized when two consecutive measurements are within 10% of each other, for each respective parameter. The temperature, pH, conductivity and purge volume measurements, and observations of water clarity and sediment content will be documented by the ESE staff member on ESE Ground-Water Sampling Data Forms.

Ground-water samples are collected by lowering a new (precleaned), disposable polyethylene bailer into the well using new, disposable nylon cord. The filled bailer is retrieved, emptied, then filled again. The ground water from this bailer is decanted into appropriate laboratory supplied glassware and/or plastic containers (if sample preservatives are required, they are added to the empty containers at the laboratory prior to the sampling event). The containers are filled carefully so that no headspace is present to avoid volatilization of the sample. The filled sample containers are then labeled and placed in a cooler with ice for transport under chain of custody documentation to the designated analytical laboratory. The ESE staff member will document the time and method of sample collection, and the type of sample containers and preservatives (if any) used. These facts will appear on the ESE Ground-Water Sampling Data Forms. ESE will collect a duplicate ground-water sample from one well for every ten wells sampled at each site. The duplicate will be a blind sample (its well designation will be unknown to the laboratory). The duplicate sample is for Quality Assurance and Quality Control (QA/QC) purposes, and provides a check on ESE sampling procedures and laboratory sample handling procedures. When VOCs are included in the laboratory analyses, ESE will include a trip blank, if required, in the cooler with the ground-water samples for analysis for the identical VOCs. The trip blank is supplied by the laboratory and consists of deionized water. The trip blank is for QA/QC purposes and provides a check on both ESE and laboratory sample handling and storage procedures. Since disposable bailers are used for sample collection, and are not reused, no equipment blank (rinsate) samples are collected.