Environmental Resources Management

EMBARCADERO COVE
REMEDIAL INVESTIGATION
SECOND PHASE
WORKPLAN

PORT OF OAKLAND
OAKLAND, CALIFORINA

Prepared by:

ERM-West
Walnut Creek, CA 94596

January 22, 1988

ERM-West
Environmental Resources Management

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Reply To:

January 25, 1988 Walnut Creek

Ms. Denise Kato
Department of Health Services
5850 Shell Mound Road
Emeryville, CA 94608

Dear Ms. Kato:

Enclosed for your review is a revised workplan for the Phase Two Remedial Investigation of the Port of Oakland Embarcadero Cove site. This revision responds to the comments presented in the Department of Health Services' letter of December 24, 1987.

The Community Relations Plan and Health and Safety Plan are being prepared under separate covers as "stand alone" documents. This strategy is being followed because these documents will have different uses and distribution lists than the workplan.

We anticipate your review and approval of this document. If you have any questions, please contact either Richard Knapp or me.

Yours truly,

ERM-WEST

Stephen J. Nelson, P.E.
Principal

SJN/293

Enclosure - Noted

cc: California Regional Water Quality Control Board, San Francisco Region - Attention: Donald Dalke
Alameda County Health Department - Attention: Rafat Shahid
Port of Oakland - Attention: Neil Werner

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* In pocket inside rear cover.

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SECTION ONE

INTRODUCTION

This workplan for the Port of Oakland-Embarcadero Cove site addresses additional site investigation procedures that have been requested by the California Department of Health Services. The additional site investigation includes:

- installing thirteen soil borings and analyzing soil samples from the borings for volatile organics, phenols, organochlorine pesticides, and PCBs;
- installing and developing one deep and seven shallow groundwater monitoring wells and analyzing groundwater samples for volatile organics, phenols, organochlorine pesticides, and PCBs and for fuel fingerprinting;
- monitoring water levels and tidal influences and conducting hydrologic tests of the deep and shallow water-bearing zones.

SITE LOCATION

The Embarcadero Cove site (the site) is located in western Oakland, California, northwest of the intersection of Embarcadero and Dennison Streets (Figure 1-1). The western waterfront margin of the site is formed by the Brooklyn Basin, and the site faces Government Island (Coast Guard Island) and the Alameda Harbor. Although the site is fenced, public access to the waterfront walkway and park are maintained.

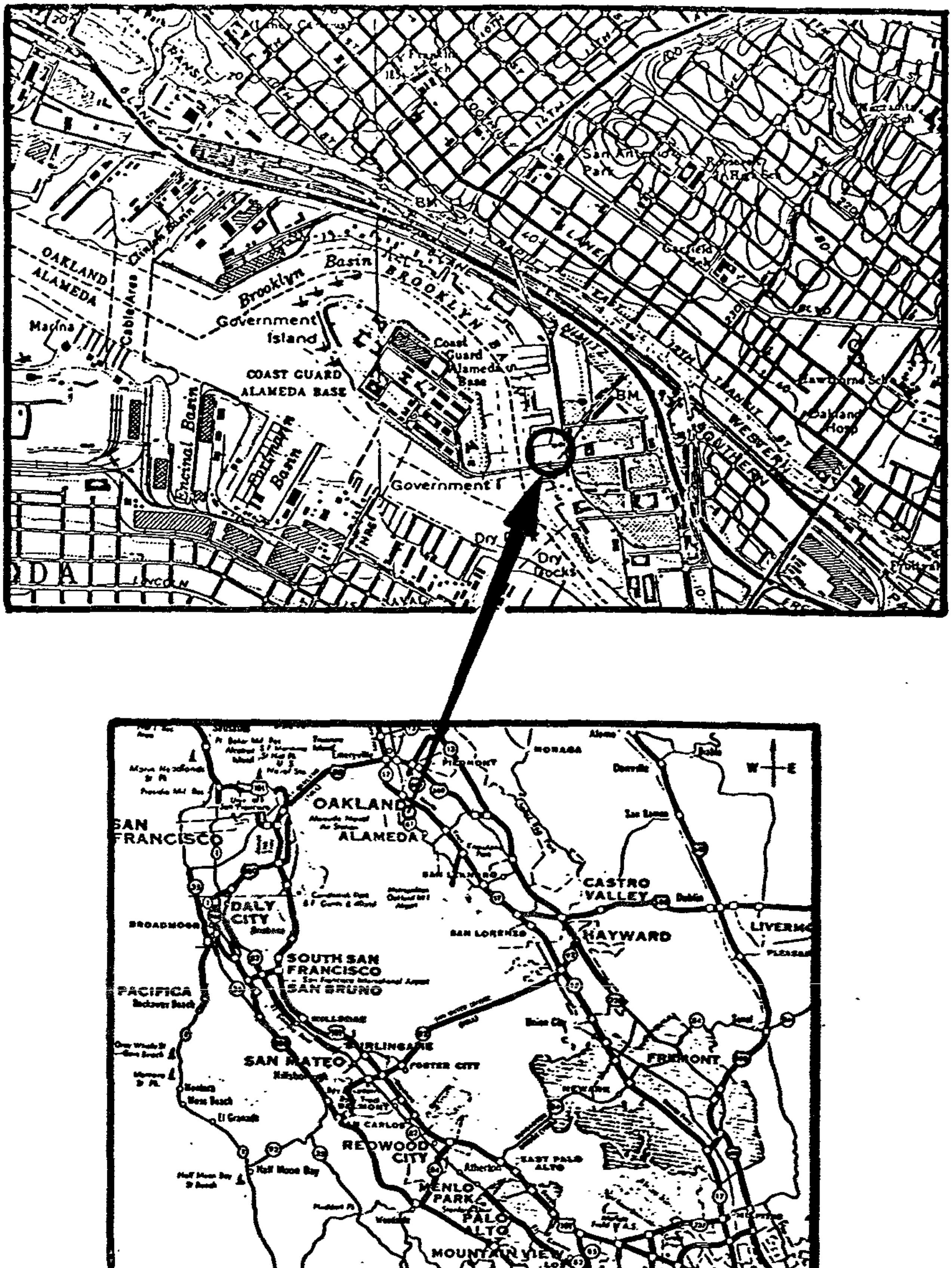

FIGURE 1-1. SITE LOCATION MAP.

Land use around the Embarcadero Cove site is principally commercial and light industrial. Waterfront property in the area is used for various maritime operations related to fisheries, shipbuilding and repair, and cargo transportation. Restaurants, shops, and commercial offices are common, and there are a variety of other commercial operations in the immediate area. In addition, portions of the waterfront, including that bordering the site, have been designated as public-access recreational areas. The closest residential area is to the northeast, approximately one-half mile from the site.

WORKPLAN FORMAT

This workplan addresses the intended scope of the additional site investigation at Embarcadero Cove. The work plan elements, with the exception of the Health and Safety Plan, are presented in various sections of this document, as described below:

- Section Two: Sampling Plan
- Section Three: Analytical Protocol
- Section Four: Quality Assurance
- Section Five: Historical Site Review
- Section Six: Project Schedule and Deliverables

Because the Health and Safety Plan will be distributed to personnel working on-site, it has been prepared under separate cover as a "stand alone" document. The site health and safety procedures described in the Health and Safety Plan, however, are hereby explicitly incorporated into this work plan.

SECTION TWO

SAMPLING PLAN

This section identifies the locations selected for sampling, the rationale for selecting individual sampling locations, the types of samples, the number of samples, and a description of the sampling methods.

The boring and sampling locations for soils and groundwater were selected primarily from locations of former site structures (above-ground tanks and process buildings) and activities and the results of previous site investigations. The rationale for specific sampling locations is explained in further detail below. Sampling procedures are also discussed in this section.

SOIL BORINGS

A total of thirteen additional soil borings will be completed. Eleven of these borings will be situated at various locations on the site. Six of these eleven borings will be completed as monitoring wells. The twelfth and thirteenth borings will be completed as offsite shallow monitoring wells, one of which will be in an upgradient location.

This soil boring program has been developed to aid in further defining the nature and extent of chemical occurrence on-site. Table 2-1 summarizes information on each boring, including selection rationale, proposed depths and sampling and analytical schedules. Figure 2-1 identifies the locations of the existing and proposed borings and monitoring wells. Figure 2-1 also indicates the apparent locations of former structures and past

TABLE 2-1
SOIL BORING INFORMATION

BORING/WELL NUMBER	PROPOSED DEPTH, FT	SOIL SAMPLING SCHEDULE DEPTHS	SOIL SAMPLING SCHEDULE AN. METHODS	PURPOSE/RATIONALE
W12R	20	NONE	NA	REPLACE DESTROYED WELL W12.
W15	20	5 FT. INTERVALS	8020, 8040, 8080	MONITOR SHALLOW AQUIFER IN SOUTHWEST CORNER OF SITE
W16	20	5 FT. INTERVALS	8020, 8040, 8080	MONITOR SHALLOW AQUIFER UNDERLYING FORMER DRUM STORAGE AREA WEST OF W6
W17	20	5 FT. INTERVALS	8020, 8040, 8080	MONITOR SHALLOW AQUIFER ALONG THE WATERFRONT ON THE WEST SIDE OF THE SITE.
W18	20	5 FT. INTERVALS	8010, 8020, 8040, 8080	PROVIDE INFORMATION ON SHALLOW AQUIFER IN FORMER DRUM STORAGE AREA BETWEEN WELLS 6 AND 9.
W19	50	5', 10', 15', 20', 30', 40', 50'	8020, 8040, 8080	MONITOR DEEPER AQUIFER IN THE VICINITY OF WELL 9
W20	20	5 FT. INTERVALS	8020, 8040, 8080	ESTABLISH OFF-SITE UPGRADIENT MONITORING WELL
W21	20	5 FT. INTERVALS	8020, 8040, 8080	MONITOR SHALLOW AQUIFER ON SOUTH EDGE OF PROPERTY DOWNGRADIENT FROM W6
B22	50	5', 10', 15', 20', 30', 40', 50'	8020, 8040, 8080	PROVIDE DEEP LITHOLOGY AND SOIL SAMPLES FROM FORMER DRUM STORAGE AREA NEAR SOUTHWEST CORNER OF SITE.

TABLE 2-1
SOIL BORING INFORMATION

BORING/WELL NUMBER	PROPOSED DEPTH, FT	SOIL SAMPLING SCHEDULE		PURPOSE/RATIONALE
		DEPTHS	AN. METHODS	
B23	20	5 FT. INTERVALS	8020, 8040, 8080	COLLECT SOIL SAMPLES IN FORMER GRID NUMBER 11
B24	50	5', 10', 15', 20', 30', 40', 50'	8020, 8040, 8080	COLLECT DEEP SOIL SAMPLES NEAR W6
B25	20	5 FT. INTERVALS	8020, 8040, 8080	EVALUATE DEPTH OF CHEMICAL OCCURRENCE NEAR FORMER GRIDS 24 AND 25
B26	20	5 FT. INTERVALS	8010, 8020, 8040, 8080	PROVIDE SOIL SAMPLES AT LOCATION OF FORMER DRUM CLEANING BUILDING

site activities that may have contributed to the occurrence of chemicals on-site.

Shallow borings will be drilled to a depth of approximately 20 feet using hollow stem augers powered by a truck-mounted drill rig. This depth will provide completion through the uppermost water-bearing zone. Deep borings will be drilled to a depth of approximately 50 feet. This depth corresponds to the second water-bearing zone beneath the site.

Two methods will be used to complete the deep borings. To install W19, the boring will be drilled using 16-inch diameter flight augers. The augers will be removed from the borehole and 12-inch diameter steel casing will be installed to the bottom of the hole and pressure-grouted in place to seal off the upper water-bearing zone. Drilling will then continue with 10-inch augers to the desired depth. For borings B22 and B24, the upper 20 feet will be completed with 12-inch diameter augers. To complete the boring below 20 feet depth, the 12-inch diameter augers will be left in place to seal off the upper water-bearing zone. The boring will then be completed with 6-inch diameter augers inserted inside the 12-inch diameter augers.

For purposes of logging, soil samples will be collected continuously for each boring. Chemical analysis will be performed on samples at five foot intervals for borings twenty feet deep (Table 2-1). Deep borings (50′ depth) will be analyzed every five feet to a depth of twenty feet, then at depths of thirty, forty and fifty feet.

Shelby tubes will be the preferred sampling vehicles for each boring, with the California sampler (fitted with brass tube liners) used as an alternative. The Shelby tubes will be a minimum of 30 inches in length and have a maximum diameter of 2

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS MORE THAN 50% RETAINED ON NO. 200 SIEVE*	GRAVELS 50% OR MORE OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS	GW	WELL-GRADED GRAVELS AND GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
			GP	POORLY GRADED GRAVELS AND GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SANDS MORE THAN 50% OF COARSE FRACTION PASSES NO. 4 SIEVE	CLEAN SANDS	SW	WELL-GRADED SANDS AND GRAVELLY SANDS, LITTLE OR NO FINES
			SP	POORLY GRADED SANDS AND GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES	SM	SILTY SANDS, SAND-SILT MIXTURES
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE-GRAINED SOILS 50% OR MORE PASSES NO. 200 SIEVE*	SILTS AND CLAYS	LIQUID LIMIT 50% OR LESS	ML	INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50%	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDS OR SILTS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS			PT	PEAT, MUCK AND OTHER HIGHLY ORGANIC SOILS

* BASED ON THE MATERIAL PASSING THE 3 INCH (75 mm) SIEVE.

FIGURE 2-2. UNIFIED SOIL CLASSIFICATION SYSTEM.

inches. The Shelby tubes and brass tubes will be steam cleaned prior to use. A sufficient number of tubes will be provided to collect all the anticipated samples before going into the field.

The Shelby tubes containing the samples will be cut into 1-foot sections to expose the ends for classification prior to capping, labeling, and storage. Further division of 1-foot section into 6-inch lengths will yield discrete samples and duplicates for the Department of Health Services, if requested. All exposed section ends will be described and classified for lithology. Shelby tubes containing soil samples for analysis will be covered with Teflon film and plastic caps to provide an airtight seal. Each sample will be appropriately labeled with the sample number, date, time, depth, investigator, and analysis required. The unique sample number will be recorded in the field log and maintained throughout transport, laboratory analysis, and reporting. Once labeled, each tube will be chilled on-site in a cooler. As standard procedure, chain-of-custody forms will be completed at the time of sampling, and the forms will accompany the samples to the laboratory. Samples will be handled, preserved, and transported to the laboratory for analysis by EPA approved methods.

All soil samples collected from each boring will be classified for lithology. The types of soils encountered will be classified visually according to the Unified Soil Classification System (USCS) shown on Figure 2-2. The drilling logs will describe lithologies, sampling depths, and drilling characteristics. Cuttings from each boring will be retained on-site with other soil from the site, pending results from sample analysis. Appropriate disposal will follow. Completed borings not intended for monitoring well construction will be backfilled with bentonite and an imported sand mixture (50/50). For borings B22 and B24, the 12-inch diameter augers used to seal the upper water-bearing zone will remain in place until the lower 30 feet of the boring is backfilled.

GROUNDWATER INVESTIGATION

Proposed groundwater investigation activities include completing additional groundwater monitoring wells into both the shallow and deeper aquifers at the site, measuring potentiometric surfaces in the aquifers on site, collecting and analyzing groundwater samples, and conducting hydrogeologic testing of aquifers. The procedures for conducting these investigations are described below.

Monitoring Well Construction

Both shallow and deep monitoring wells will be constructed on the site. Well permits will be obtained from the appropriate agencies (California Department of Water Resources and Alameda County). The shallow wells will be drilled to a maximum depth of approximately 20 feet and the deep well to a depth of approximately 50 feet. Specific construction methods are described below.

Shallow Monitoring Wells. Upon completion of the boring, the monitoring wells will be constructed using 2-inch diameter, flush-threaded, PVC well casing and screen, capped at the bottom with a threaded PVC plug. The casing and screen will be inserted down through the hollow stem augers, after which the auger will be pulled in 5-foot sections. As the augers are removed, sand for the filter pack will be poured in the annulus between the PVC casing and the augers in an amount sufficient to fill the hole to approximately 2 feet above the perforated section of casing. A 3-

foot bentonite pellet seal will then be placed above the filter pack. Concrete grout will fill the remainder of the annular space to the ground surface. A concrete utility box with locking steel cover will be placed over the top of the well casing and anchored into the concrete seal.

This protective box will be positioned slightly above grade and the concrete backfill around it sloped to promote surface water drainage away from the well. The top of the well casing will be covered with a watertight PVC cap. Construction details for the shallow monitoring well design are presented in Figure 2-3.

Deep Monitoring Well. Well W19 will be drilled to a total depth of approximately 50 feet. A cased deep boring will first be constructed as described previously. Four-inch diameter well casing and screen will then be inserted inside the hollow stem augers. As the augers are removed, the filter pack will be poured around the screened interval, followed by three feet of bentonite pellets. The casing will be grouted and secured with a locking utility box, as described above for the shallow monitoring wells. Typical construction of a deep monitoring well is presented in Figure 2-4.

Well Development

All monitoring wells, both existing and new, will be developed (or redeveloped) to improve hydraulic connection between the well and the water-bearing formation. Development will consist of surging, pumping and/or bailing each well until the discharge is free of sediment and turbidity. Surging may involve use of a valved surge block. Groundwater removed from the

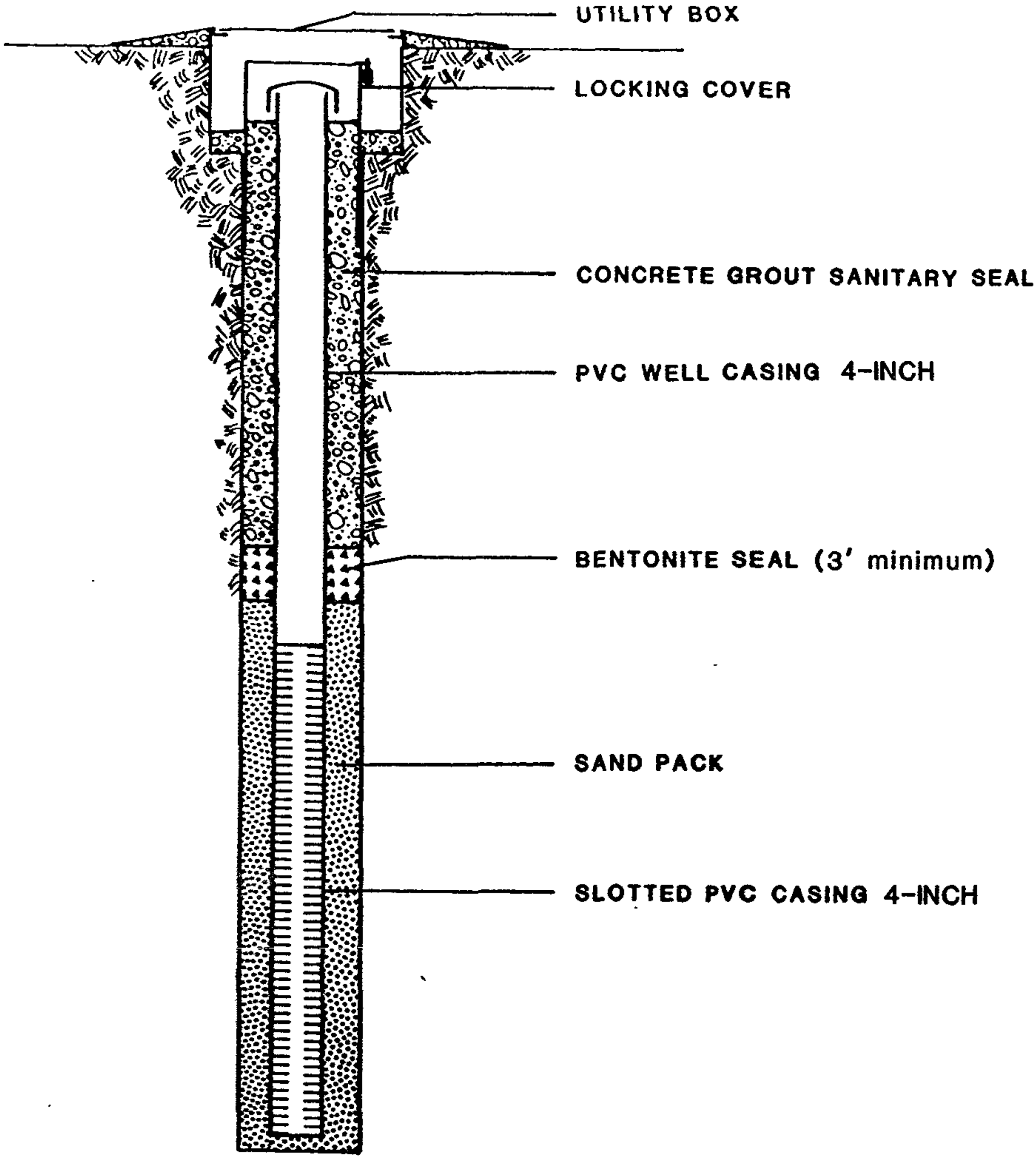

FIGURE 2-3. SHALLOW MONITORING WELL DESIGN.

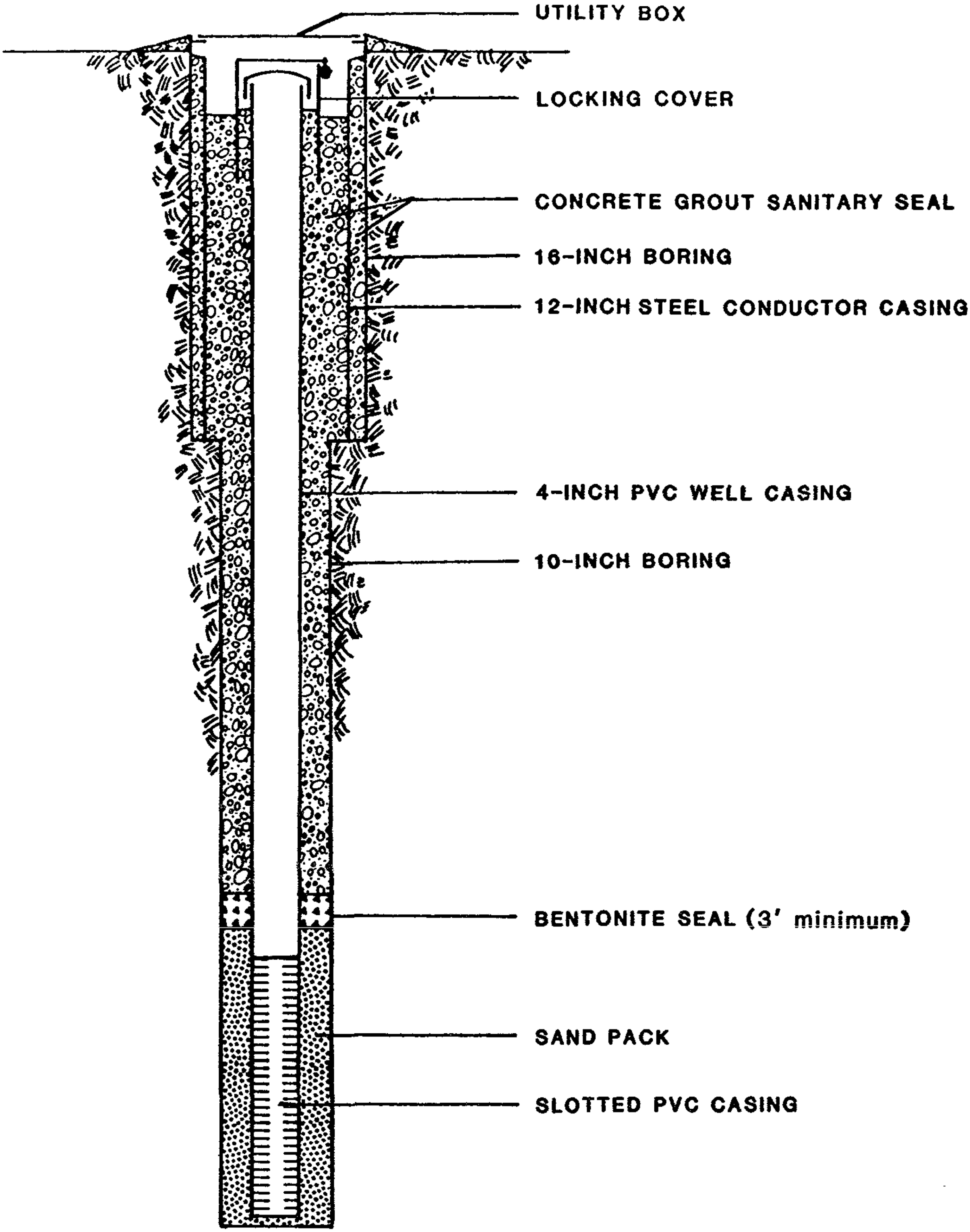

FIGURE 2-4. DEEP MONITORING WELL DESIGN.

monitoring wells will be contained in 55-gallon drums and stored on-site pending the outcome of analysis.

Water Level Monitoring

After monitoring well installation and development, the top of the well casing will be surveyed to determine its elevation relative to USC&GS datum. Prior to sampling, the static water level in each well will be measured. These measurements will provide the basis for determining the elevation of the potentiometric surface.

Groundwater level measurements will be made using either dedicated tapes or an electric well sounder. If an electric well sounder is used, it will be decontaminated between each use to prevent cross contamination between wells. Groundwater levels will be monitored monthly for the first six months, then quarterly thereafter.

To determine possible tidal influences on groundwater at the site, continuous water level measurements will be made at wells W7, W9, W11, W17, W19, and W21. These wells were selected to provide shallow and deep well pairs at locations near the waterfront, near the utility trench, and in the site interior. Comparisons of these data should indicate relative differences in tidal effects in relation to aquifer depth, distance from the waterfront, and distance from the utility trench.

Groundwater Sampling

Groundwater samples will be collected from all monitoring wells following development. Groundwater samples will be taken every two months for the first six months. A volume of water equal to at least four well volumes will be removed from each well prior to sampling to ensure the collection of representative formation water. Water will be removed until temperature, conductivity, and pH measurements stabilize.

Water samples will be analyzed for purgeable aromatics, phenols, organochlorine pesticides and PCBs by EPA Methods 602, 604 and 608. Samples from wells 6, 9 and 18 will also be analyzed for purgeable halocarbons by EPA Method 601 and for fuel fingerprinting by a modified EPA Method 615. These wells were selected for these additional analyses because they are in the area where levels of organic constituents have been highest in the past and because they are near the former drum cleaning areas. Sample collection and container selection will follow EPA protocol. All groundwater samples will be collected, handled, preserved and transported to the laboratory in accordance with EPA approved procedures. To help minimize the possibility of cross contamination and the need to decontaminate sampling equipment between wells, separate bailers will be dedicated to each well.

All samples will be collected using clean Teflon bailers. Samples for analysis by EPA Methods 601 or 602 will be immediately transferred to two clean volatile organic analysis (VOA) vials, filling each completely. Each sample vial will then be capped with a Teflon septum cap such that zero headspace is achieved and no air bubbles are evident. Groundwater samples for analysis by EPA Methods 604, 608, and 615-modified will be collected in 1-liter amber glass bottles with teflon-lined screw caps. All of the containers will be labeled (well number, date, time, job number, sampler, and analyses required) and chilled in a cooler. Analytical methods are discussed in more detail in Section Three.

Aquifer Testing

Aquifer pumping tests will be performed on the shallow and the deep water-bearing zones. This program will include water level observations at selected locations to aid in evaluating hydrogeologic conditions. A small submersible pump capable of pumping from 0.5 to 10 gallons per minute will be employed for both tests.

The shallow well test will be performed in the vicinity of proposed well W18, which lies in the center of the site. This location has been chosen because its geology will best characterize the site. Two 2-inch diameter piezometers placed 10 feet and 20 feet from well W18 will be utilized as primary observation wells for the test. Figure 2-5 illustrates the construction of an observation piezometer. In addition, water levels at selected other wells, including the deep wells, will be monitored, but at lesser frequency.

The deep pumping test will be performed using proposed deep well W19. The 4-inch diameter well will be used as the pumping well and the existing 2-inch wells W7 and W11 will be the primary observation wells. Responses in selected shallow wells will also be monitored, but at lesser frequency.

For a minimum of 24 hours before the test, hourly water levels will be recorded in each observation well at the pumping test site. Pre-pumping data will be analyzed to assess the magnitude of tidal or barometric influences on water levels and to detect long-term water level fluctuations that may influence

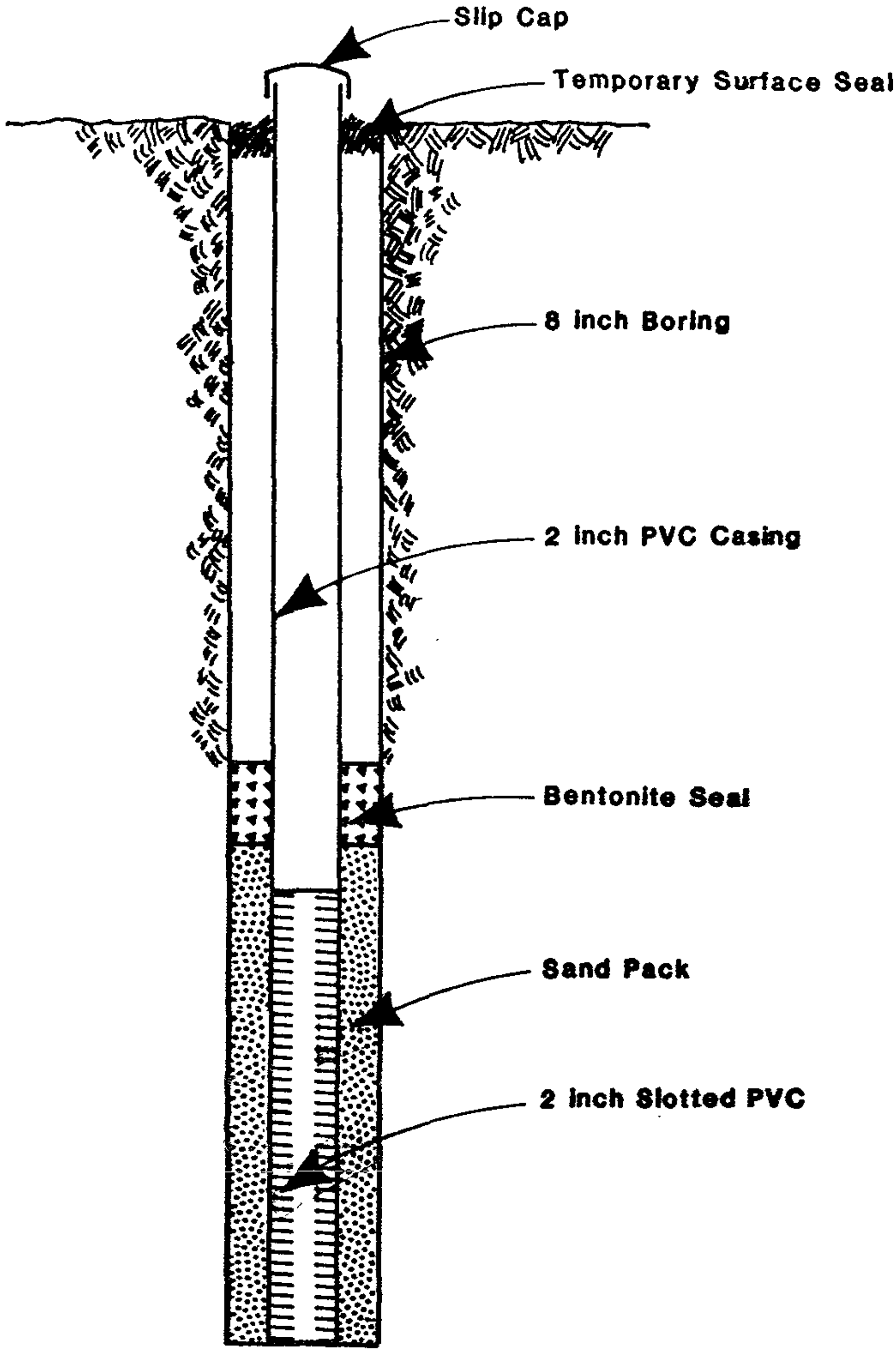

Figure 2-5

Typical Piezometer Construction

measurements collected during the pump test. Immediately preceding each test, at least three water level measurements taken approximately 5 minutes apart will be recorded from the observation wells and the pumping well to define a pretest static water level or to detect any current trend in water levels.

Although the duration of the pump tests may be modified in response to physical constraints at well locations or formation characteristics, a 24-hour pumping time is planned for each aquifer test. If steady-state drawdown conditions are observed in all wells for at least three hours, and if a minimum of 8 hours of pumping have elapsed, then the test will be terminated early.

A preliminary schedule for water level measurements has been developed. This schedule will be refined, as necessary, during a preliminary assessment of the yield of each well. During this assessment, the appropriate pump size and pumping rate will also be finalized. The preliminary water level measurement schedule is as follows:

- Between 0 and 5 minutes: measurements every 30 seconds
- Between 5 and 10 minutes: measurements every minute
- Between 10 and 30 minutes: measurements 5 minutes
- Between 30 and 100 minutes: measurements every 10 minutes
- Between 100 minutes and 5 hours: measurements every 30 minutes
- Between 5 hours and shut down of pump: 1 to 2-hour intervals, depending on rate of water-level changes

After the pump is shut down, recovery water levels will be recorded until at least 50 percent of the pumping time has elapsed or until static levels are observed for at least two hours, whichever comes first. The decision as to when to stop monitoring recovery will also be based on a plot of the recovery curve which normally indicates data are sufficient for analysis after 50 percent of pumping time has elapsed. Water levels will be recorded during recovery on the same schedule as during pumping with time zero corresponding to the time the pump is shut off.

Pressure transducers and a central recording unit will be used to measure the drawdown and elapsed time in the pumping well and nearby observation wells. Other remote wells may be monitored manually to further assess the cone of depression resulting from pumping or to assess background effects on area water levels.

Groundwater discharged from the pumping wells will be contained on-site in drums or a Baker tank pending completion of chemical analyses from the monitoring wells. Disposal of the water will be based on the results of the chemical analyses.

Data from the pump tests will be used to qualitatively assess hydraulic connections between the upper and lower water bearing zones. If possible, transmissivity and groundwater flow rates will also be calculated to aid in estimating contaminant migration. If no response in the observation wells is observed, a maximum transmissivity estimate will be calculated by assuming a minimum detected response at the termination of pumping at a distance equal to the distance between the observation well and the pumping well.

AIR MONITORING

Air monitoring will be conducted upwind and downwind of the site during drilling activities to monitor releases of chemicals from the site and to provide continuous monitoring of exposure levels as part of the Health and Safety Plan. Because of the increased potential for creating dust and releasing vapors during site investigation activities, these conditions are believed to represent "worst case" conditions for potential air releases. These monitoring procedures are described in the Health and Safety Plan for the site.

SECTION THREE

ANALYTICAL PROTOCOL

The soil and groundwater samples collected for chemical analysis will each be analyzed for pentachlorophenol (EPA method 604/8040), organochlorine pesticides (PCBs) (EPA method 608/8080) and purgeable aromatic organic compounds (EPA method 602/8020). Soil and groundwater samples from the former drum cleaning area will be analyzed for chlorinated solvents (EPA method 601/8010), and oily samples will be analyzed for oil and grease (EPA 9070 and EPA 9071).

Specific methodology and corresponding anticipated detection limits are listed on Table 3-1. Sample selection and analyses have the primary goal of generating information that will characterize specific subsurface conditions. Analytical methods and procedures to be used will comply with those in the EPA publication entitled "Test Methods for Evaluating Solid Waste Physical/Chemical Methods" (SW-846, 3rd Edition, 1986). Applicable detection limits listed in Table 3-1 are in accordance with detection limits in the publication.

Sample analysis will be conducted by state-certified laboratories. Anlab Analytical Services, Sacramento, California, and/or Central Coast Analytical Services, San Luis Obispo, California, will be contracted to provide analytical services for the Embarcadero Cove investigation.

TABLE 3-1

ANALYTICAL PROCEDURES

METHOD	NAME/NUMBER		ANALYTICAL GROUP	MATRIX	ESTIMATED RANGE OF DETECTION LIMIT (ug/l)
GC	EPA	601	Purgeable Halocarbons	Water	0.01 - 1.81
GC	EPA	602	Purgeable Aromatics	Water	0.2 - 0.4
GC	EPA	8010	Purgeable Halocarbons	Soil/ Water	0.03 - 0.52
GC	EPA	8020	Volatile Organics	Soil/ Water	0.2 - 0.4
GC	EPA	608	Organochlorine Pesticides and PCBs	Water	0.003 - 0.24
GC	EPA	8080	Organochlorine Pesticides and PCBs	Soil/ Water	0.003 - 0.24
GC	EPA	604	Phenols	Water	0.14 - 16.0
GC	EPA	8040	Phenols	Soil/ Water	0.58 - 2.2
Gravi- metric	EPA	9070	Oil and Grease	Water	5 - 1000 mg/l
Gravi- metric	EPA	9071	Oil and Grease	Soil	Unknown

SECTION FOUR

QUALITY ASSURANCE

Quality Assurance for the collection, analysis, and evaluation of environmental samples spans a broad range of field and laboratory operations. This section details the specific procedures, reviews, and audits that are an integral part of ERM-West Quality Assurance.

QUALITY ASSURANCE PROCEDURES

Proper collection and handling are essential in ensuring the quality of a sample. Each sample will be collected in a suitable container, preserved correctly, and stored prior to analysis no longer than the maximum allowable holding time (according to EPA protocol). Sample containers and preservatives that will be used for the Port of Oakland site are listed in Table 4-1, along with the maximum allowable holding time for each parameter. Groundwater sample containers will be precleaned at the laboratory in accordance with EPA protocol. All Shelby tubes will be steam cleaned on-site prior to sample collection.

SAMPLE IDENTIFICATION AND CHAIN-OF-CUSTODY PROCEDURES

Sample identification and chain-of-custody procedures ensure sample integrity and document sample possession from the time of collection to its ultimate disposal. Each sample container will have a label affixed to identify the job number, date, time of sample collection, investigator, analyses requested, and sample

TABLE 4-1: SAMPLE CONTAINERS, PRESERVATIVES, AND MAXIMUM ALLOWABLE HOLDING TIMES

PARAMETER	CONTAINER	PRESERVATIVE	MAXIMUM ALLOWABLE HOLDING TIME
Purgeable organics EPA Method 601/ 8010:	Water: Two 40-ml vials filled to eliminate headspace; capped with Teflon lined septum lid. Soil: 6-inch steel or brass tube sealed with Teflon film and plastic cap.	Cool to 4 degrees C; Water only: 0.008% $Na_2S_2O_3$	14 days for analysis
Extractable organics EPA Method 602/8020:	Water: One 1-liter glass with Teflon-lined screw caps. Soil: 6-inch steel or brass tube sealed with Teflon film and plastic cap.	Cool to 4 degrees C	7 days to extraction, 40 days for analysis
Organo-Chlorine pesticides EPA Method 608/ 8080, and Phenols EPA Method 604/8040	Water: One 1-liter glass with Teflon-lined screw caps. Soil: 6-inch steel or brass tube sealed with Teflon film and plastic cap.	Cool to 4 degrees C	7 days to extraction 40 days for analysis

number unique to that sample. The depth of soil samples will also be recorded on the label. This information, in addition to a description of the sample, field measurements made, sampling methodology, names of on-site personnel, and any other pertinent field observations, will be recorded on the boring log or in the field log book.

The primary responsibility for project quality will rest with the Project Manager. Secondary responsibility will rest with the Field Project Officer. Independent quality assurance review will be provided by senior technical reviewers.

A chain-of-custody form (Figure 4-1) will be used to record possession of the sample from time of collection to its arrival at the lab. The sample control officer at the lab will verify sample integrity and confirm that it was collected in the proper container, preserved correctly, and that there is an adequate volume for analysis. If these conditions are met, the sample will be assigned a unique log number for identification throughout analysis and reporting. The sample description, date received, clients' name, analyses required, sample collector, and condition of the sample will also be recorded in a laboratory log book.

SPLIT, DUPLICATE AND BLANK SAMPLES

Duplicate soil samples collected in Shelby tubes will be provided to the appropriate agencies, if requested. Additional soil duplicates will not be obtained for analysis due to significant soil variability; however, replication and further quality assurance on soil samples will be performed at the laboratory level.

CHAIN OF CUSTODY AND SAMPLE IDENTIFICATION RECORD

ERM-West
Environmental
Resources
Management

1777 Botelho Drive
Suite 260
Walnut Creek, CA 94596
(415) 946-0455

Client: ______________
Sampler (s): ______________
Date: ______________
Weather: ______________

Job Location: ______________
Job No: ______________
No. of Samples Collected: ______________
page _____ of _____

Sample ID #	Time	Sample Type Water Comp.	Water Grab	Soil Comp.	Soil Grab	Volume	No. of Contnrs. Contnr. Type	Preser-vative	Iced (Y/N)	Sampling Method	Analyses

Comments: ______________

Custody Record
Signature, Date/Time
Relinquished: ______________
Received: ______________
Relinquished: ______________
Received: ______________
Relinquished: ______________
Received: ______________
Relinquished: ______________
Received: ______________

Name and Address of
Receiving Laboratory
____

FIGURE 4-1. CHAIN OF CUSTODY FORM.

Groundwater sample splits will also be provided, if requested. Field duplicates (10 percent) of the liquid samples will be collected daily for test of quality assurance in the field. One field blank or travel blank will also accompany each daily set of liquid samples to the laboratory for analysis. The blanks and duplicates will be analyzed for the same parameters as those for groundwater samples.

LABORATORY QUALITY CONTROL

Soil and water analyses will be performed by a State-of-California certified laboratory. Analyses will be performed by Central Coast Analytical Services, San Luis Obispo, and/or Anlab Analytical Laboratory, Sacramento. Central Coast Analytical Services maintains a well-established and documented quality assurance/quality control (QA/QC) program. The laboratory adheres strictly to Section 10 ("Quality Control/Quality Assurance") of "Test Methods for Evaluating Solid Waste" (EPA SW-846, November 1986) and to the "Handbook for Analytical Quality Control in Water and Wastewater Laboratories" (EPA Manual 600/4-79-019, March 1979).

In addition, Central Coast Analytical Services (CCAS) maintains the following daily routine QA/QC procedures:

I. REPLICATE SAMPLES - Replicate samples are a measure of precision. One in ten is split for duplicate analysis in order to verify that acceptable precision is achieved. If acceptable precision is not verified, further analyses are halted until a cause has been identified and corrective actions taken.

II. SPIKED SAMPLES - Spiked samples are a measure of accuracy. One sample in ten is spiked with several of the Priority Pollutants in the class under investigation. The analyst usually selects the same sample as was used for the duplicate analysis. In this way, the analyst can base the percent recovery upon the amount added and the mean of the duplicate determinations and thereby minimize the effect of precision upon the determination of accuracy. Again, if acceptable recoveries are not obtained, further analyses are halted until a cause has been identified and corrective actions taken.

III. CERTIFIED REFERENCE SAMPLES - In order to establish state certification for drinking water, CCAS received performance evaluation samples from the State Department of Health Services. After reporting the results, CCAS received notice that it had achieved a perfect score for all of the parameters included in the test. A performance of 80 percent correct is sufficient to pass. Such standards are also submitted to CCAS by clients on a regular basis. Results not within the acceptance range are investigated. Other certified standards such as the EPA and NBS certified reference materials are run along with samples in order to further certify accuracy.

IV. INTERNAL STANDARDS - Known amounts of internal standards are added to every sample or sample extract. This method permits compensation for minor changes in purging efficiency or instrument performance by relating each value to the response of the nearest internal standard. Differences in internal standard response outside the acceptance range established for each instrument constitute grounds for rejecting the data. The analyst is then required to determine the cause of the problem before reanalyzing the samples.

V. DAILY STANDARD AND BLANK RUNS - Each day's runs are preceded by instrument tuning, initialization of retention times and response factors based on at least one standard run containing all of the compounds to be determined plus the internal standards, and a blank run. Both hard copies and computerized records of all such runs are kept. The blank run is compared with acceptance criteria established for the laboratory. If an acceptable blank is not obtained, the problem must be corrected before real samples are processed.

VI. VERIFICATION OF RESULTS WITH AN ALTERNATIVE METHOD - The laboratory provides a full range of analytical capabilities. This range of capabilities often make it possible to determine a given parameter by one or more alternate methods. For example, calcium may be determined by atomic absorption, EDTA titration or ion chromatography. Fuel-related materials may be determined by flame ionization detection or by GC/MS in selective ion mode. Purgeable organics in soil may be determined by headspace, purge and trap with sonication or by preextraction with methanol followed by purge and trap analysis. Polychlorinated biphenyls may be determined by electron capture gas chromatography or by selective ion mass spectrometry.

VII. MISCELLANEOUS CHECKS FOR ACCURACY - Where applicable, accuracy is also checked by a cation-anion balance. Consistent relationships can often be established between BOD, COD, TKN, ammonia and other parameters. Dissolved solids, conductance, hardness, calcium and magnesium frequently serve as checks against each other. Relationships to past results and/or consistency with sample history can often be established.

In the field of trace analysis, it is important to regularly verify the purity of solvents, reagents and gases that are used in analytical procedures. CCAS maintains service contracts on all major instrumentation. The instruments are serviced and maintained regularly.

Sample analyses may also be performed by Anlab Analytical Laboratory (Anlab), Sacramento, a certified (State of California) laboratory. The QA/QC program maintained by Anlab is in accordance with the aforementioned EPA documents: Section 10 of "Test Methods for Evaluating Solid Waste" and "Handbook for Analytical Quality Control in Water and Wastewater Laboratories". As a daily routine practice, a minimum of 10 percent duplicate samples are analyzed in the laboratory for quality assurance. Specific QA/QC procedures for Anlab are presented below:

Anlab's quality control program begins at the sample bottle preparation stage. All bottles are washed and rinsed according to EPA or State of California DHS protocol. A minimum of ten percent (10%) of all of the containers are quality control checked for the test parameters to insure their integrity. Sample containers are then labeled according to the type of wash/rinse they received. When the bottles are removed for sample collection, preservatives are added and labeled on the container for the sampler.

Along with the Chain-of-Custody, a log-in sheet is generated at the laboratory including any pertinent information that will be integral in the analysis.

All of the analyses performed in the laboratory have accompanying Quality Control protocol as required by EPA. All of these protocol are adhered to and records, worksheets, graphs, curves, statistics, and calculations are all maintained with the analytical data. Unless requested otherwise, all holding times used are dictated by the current EPA or Standard Methods.

In general, Anlab's quality control includes:

- 3 point calibration curve (use at least five in most cases);
- Method blanks;
- Sample duplicates (min. 10%);
- Sample spikes (min. 10%);
- Reagent blanks;
- Travel blanks (with all sample bottles sent out);
- Field blanks (when supplied);
- Field duplicates (when supplied);
- Comparison of precision, accuracy, and true values to known or accepted EPA ranges;
- EPA, ERA, In-House Quality Control check samples monitored on an ongoing basis throughout the lab.

Failure of any one of these criteria is cause to stop analysis, evaluate the problem, rectify, demonstrate the ability to produce correct data, and then continuation with the analysis.

All data are checked first by the analyst prior to completion and then are checked by the lab supervisor, who dates and initials the worksheet only if found correct. The report is generated and then the data is again reviewed by the person who will approve the report and a person who will certify the data. All data records are maintained for a minimum of four years.

CALIBRATION PROCEDURES AND FREQUENCY

Proper calibration of field and laboratory instruments is essential to preserve the integrity of the collected data. All instruments have unique calibration procedures. The calibration of field and laboratory instruments is discussed below.

Field Equipment

Field equipment used by ERM-West for monitoring the Embarcadero Cove site will be fiberglas measuring tapes, pressure transducers and turbidity, pH, temperature and conductivity meters.

Fiberglas tape and temperature meters retain precision during use and need no calibration. The tape is replaced when the graduations become difficult to read. The equipment is dedicated to the site and stored away from potential sources of contamination or damage.

The pressure transducer is tested and calibrated before shipment from the factory. Each time the instrument is turned on it performs several self-diagnostic checks.

The pH and conductivity meters are routinely calibrated in the field before samples are tested. The pH meter is calibrated with a 2-point process using standards of pH 4.00 and 7.00 or pH 7.00 and 10.00. Calibration is checked with a standard of pH 7.00 after every five samples. Deviation from the standard by >0.05 units requires recalibration. The conductivity meter is calibrated using a single standard solution that has a conductivity similar to that expected in the sample. Calibration is checked after every five samples. Deviation from the standard by >10 umhos/cm on the 1000 umhos/cm range requires recalibration.

The turbidimeter is calibrated with a single standard for the scale selected. For example, standard solutions of 0.5, 5.0, and 40 NTUs (nephelometric turbidity units) are available for an instrument with ranges of 0-1.0, 0-10.0, and 0-100. Deviation of more than 5 NTUs on the 0-100 scale requires recalibration.

Laboratory Equipment

Lab equipment used for chemical analysis of samples are a gas chromatograph (GC), a gas chromatograph/mass spectrometer (GC/MS) and an atomic absorption spectrophotometer.

Analytical equipment used by subcontracted labs will be regularly maintained by trained personnel. Spectrophotometers are checked according to the EPA "Analytical Quality Control Manual" and manufacturer's instruction manual for alignment and operating parameters on a quarterly basis. The results of the checks will be entered in a bound notebook that is assigned to the instrument.

Care and maintenance will be performed annually. If there is any indication that the instrument is not operating properly, the condition will be brought to the attention of the laboratory supervisor for corrective measures.

Chromatographic apparati will be standardized each run using either internal or external standards. Standards will be used to establish absolute retention times, relative retention times, and integrated peak areas under standard conditions. These values are logged in a bound notebook assigned to the instrument. Significant variance of the values will be reported to the laboratory supervisor for corrective measures.

DATA REDUCTION, VALIDATION, AND REPORTING

Raw field and laboratory data are reduced to produce meaningful values that pertain to the site investigation. Once reduced, these data are validated prior to reporting.

Field Data

Data collected in the field include water level measurements, pH, EC, temperature and soil logs. Raw water level data are reduced by subtracting measured values (depth to water) from surveyed well casing elevations. Calculations are performed by an electronic data management system, and are checked with manually calculated values.

The validity of water level data is checked when values are contoured. A sufficient data base for water levels has been established to indicate that the contoured water table is nearly planar. Outliers, if used, would create anomalous contour patterns. These data are considered invalid measurements and are therefore excluded. Data are reported in tabular form and represented graphically on contoured maps.

The pH, EC and temperature data need no reduction and are reported in tabular form. Aquifer test data will also be reported in tabular form. All calculations, plots, and graphs will be provided.

Laboratory Data

Data reduction, validation and reporting are performed by the contracted analytical laboratory. The laboratory supervisor and/or the quality assurance officer are designated as responsible individuals for handling data.

All calculations for data reduction will be recorded in writing to insure proper concentrations. Computer recording of data will be used when possible to accurately acquire retention and response values. These will be checked manually. Chromatographs will be retained by the laboratory for two years.

Physical tests on soils require various calculations and reductions, these will be recorded in writing on the lab test result forms. These calculations are double checked, reviewed and compared to anticipated results.

The acceptable recovery range for laboratory performance is between 90 and 110 percent for most analyses, and between 85 and 120 percent for organic analyses. Some individual compounds, however, may vary from this range. Acceptable recovery ranges for each compound analyzed are tabulated in the Federal Register, Volume 49 Number 209 (Friday, October 26, 1984). Recovery ranges that are not tabulated will be calculated following guidelines from the document referenced above.

Volatile organic carbon (VOC) outliers will be identified by comparison with control charts for individual compounds. Control charts will be tabulated daily from spiked analyses. Outliers are identified as those data that fall outside of the upper and lower control limits.

Individual samples and duplicate samples that are analyzed at different dilutions from the rest of the sample shipment will be reported in concentrations that are normalized to the undiluted condition in which they were received by the lab. Laboratory data reduction and quality control will carefully review data from diluted samples to assure they are normalized to the undiluted concentration.

All analyses will be reviewed by the QA/QC officer. Data that do not meet required criteria will be rejected. Analyses will be considered out-of-control if duplicates are not within 10 percent, if standards do not fall within range, or if spikes are not within range. Duplicates within 10 percent are usually attainable for organic analyses; exceptions are due to matrix interferences. Samples found to be out-of-control dictate that analyses will be reviewed and corrective action taken, including sample re-analysis.

Outlier data detected through QC review by ERM-West prompts an internal review of either laboratory or field procedures. If a laboratory generates a report containing questionable data, the lab is requested to review the data through a repeat of their internal quality control. Inaccurate laboratory reports are then appended by either a letter from the lab director with an explanation of the review and correction, or a reissued and corrected laboratory report. Both original and appended reports from the laboratory are included in technical reports submitted to the regulatory agencies. If outliers are deleted from the database, the reason for doing so is reported.

Outliers that result from field collection of data are identified and corrected. If outliers are discovered after a technical report is submitted, a revised and corrected technical report is issued with an explanation of the outlier; the corrected data, if appropriate; and the treatment of the outlier data.

PERFORMANCE AND SYSTEMS AUDITS

Performance and systems audits are performed by ERM-West and contracted laboratory personnel. The audits are designed to ensure the smooth and accurate operation of field and laboratory procedures, and to detect performance and systems errors before the data quality is threatened.

On-Site Audit

An on-site system audit will be performed during major field activities to review all field-related quality assurance activities. The system audit will be conducted by the Project Manager. Figure 4-2 presents ERM's Quality Assurance Audit Forms.

Specific elements of the on-site audit include the verification of:

- Completeness and accuracy of sample chain-of-custody forms, including documentation of times, dates, transaction descriptions, and signatures.

- Completeness and accuracy of sample identification labels,including notation of time, date, location, type of sample, person collecting sample, preservation method used, and type of testing required.

FIGURE 4-2
ERM QUALITY ASSURANCE AUDIT FORM

PROJECT ______________________________ Job # ____________________

DATE ____________________ AUDIT CONDUCTED FROM ___ HR. TO ___ HR.

AUDITOR(S): ______________________________________

____

ON-SITE PERSONNEL: ______________________________

____

Audit Conducted on the Following:

_______ Soil Sampling

_______ Surface Water/Sediment

_______ Ground Water

_______ Decontamination

_______ Health & Safety

Sample Collection:

Do sampling locations agree with those specified in the Work Plan? _______

Is the location of sampling collection documented sufficiently to allow it to be found/sampled again in the future? _______

Is sampling proceeding from the suspected least contaminated area to the most contaminated area? _______

Have sample bottles been labeled properly? _______

Have proper containers and preservatives been used? _______

Are samples being refrigerated/iced immediately after collection? _______

Does a travel blank exist for each matrix present? _______

Does the potential for sample cross-contamination exist based on procedures observed? _______

FIGURE 4-2
(Continued)

Soil Sampling

Type: _______ Hand _______ Auger or Rig

Are samples being collected at proper depths? _______

Are samples being screened with an OVA (if specified in Work Plan and applicable)? _______

Is a description of soils/materials being logged? _______

Have soils been homogenized where applicable (Specified by the Sampling Plan)? _______

Surface Water/Sediment Sampling (Check if not applicable) _______

Have stream flow and velocity parameters been noted? _______
Estimated _______ or Measured _______

Has the sampler acquired the water sample upstream of his position to minimize suspended sediment from entering the sample? _______

Have sediments been characterized as to type and size distribution? _______

Has the proper sediment fraction (fine, depth) been sampled for the analyses of interest? _______

Are the selected locations effectively monitoring effects of the potential source? _______

Groundwater Sampling (Check if not applicable) _______

Have the well specifications been noted properly (i.e., Total Depth, Casing Diameter, Depth-to-water, etc.)? _______

Has the purge volume been calculated properly? _______

What evacuation method has been used?

_______ Bailer _______ Submersible

_______ Bladder Pump _______ Other

FIGURE 4-2
(Continued)

If metals are being analyzed, have the samples been field filtered? ________

Are field pH, conductivity, and temperature being measured? _____ Is there documentation of calibrating the instruments? ________

Is bailer line and bailer dedicated to each well and line disposed of after use? ________
Bailer type ____________ Line type ______________

Have appropriate measures been taken to dispose of contaminated purge water? ________

For Domestic Wells - Has as much information on the well and distribution system been obtained, i.e., depth, casing type, diameter, treatment present, etc.? ________

Has the sample been collected prior to treatment and as close to the well head as possible? ________

Has the domestic well been purged sufficiently to reach temperature stabilization? ________

Decontamination:

Has sampling equipment been decontaminated properly for the given analytes? ________

Have the proper decontamination solutions been used? ________

For large equipment (backhoes, drill rigs), has decontamination taken place in an appropriate area? ________

Has decontaminated water/solution been collected for proper disposal? _______ Where disposed? ____________________

Safety:

Is the proper level of protective clothing being worn for the task? _______ Level A __ B __ C __ D __

Is the site Health and Safety Plan present with proper emergency contacts included? ________

Is monitoring equipment present? _______ OVA _______

H_2, O_2 meter ______ Explosimeter ______ Other _______

FIGURE 4-2
(Continued)

Is the vehicle equipped with a First Aid Kit? ______

Is contaminated protective clothing being disposed of properly? ______

Are personnel aware of the contaminants present at the site? ______

General:

Are employees conducting the investigation in a professional manner? ______

Are the objectives of the sampling activities understood by the field personnel? ______

Are weather conditions affecting sample quality or representativeness?

Audit Summary and Comments:

Signed by: ______________________ Print: ________________

______________________ ________________

______________________ ________________

Date: ______________________

- Completeness and accuracy of field notebooks, including documentation of times, dates, drillers' names, sampling method used, sampling locations, number of samples taken, name of person collecting samples, types of samples, results of field measurements, soil logs, and any problems encountered during sampling.

- Adherence to health and safety guidelines outlined in the Site Health and Safety Plan including wearing of proper protective clothing.

- Adherence to decontamination procedures, including proper decontamination of pumps and pump tubing, bailers, and sampling equipment.

- Adherence to sample collection, preparation, preservation, and storage procedures.

Internal Laboratory Audits

Central Coast Analytical Services and Anlab perform regular systems and performance audits. ERM's Quality Assurance Officer will also conduct a system audit of the laboratories once during the project to insure that proper quality assurance measures are being incorporated into the sample handling and analysis. Figure 4-3 lists the checklist that will be used for the system audit.

FIGURE 4-3
ERM SYSTEMS AUDIT CHECKLIST

I. Chain-of-Custody

- Log-In Procedures Evaluated

  - Sample Custodian is Assigned and Oversees Sample Transfers

  - Sample Routing and Pickup is Documented and Accounted For

  - Separate Area for Sample Storage and maintained in Locked Storage

II. Sample Preparation

- Correct Sample Preparation Procedures Are Followed

- Areas Designated for Sample Preparation (Organic and Inorganic)

- Holding Times Maintained

III. QA/QC Procedures

- Procedures are being Followed According to Methods Specified

- Data Validation and Reduction Processes Reviewed by Group Leaders

- Proper Documentation of QA Procedures

- Internal QC Maintained

- Data Transfers and Reporting Checked by Group Leaders

- Awareness of Personnel of QA Requirements

IV. Equipment Maintenance

- Maintenance Logs are Up-to-Date

- Instrumentation is in Repair

- Reasonable Spare Parts are on Hand

V. Miscellaneous

- Overall Housekeeping in Order

- Certifications Up-to-Date

ERM's Performance Audit of Central Coast Analytical and Anlab Analytical Laboratory

CCAS and Anlab will perform monthly audits for both personnel and equipment. Performance audits of personnel include review of training and job effectiveness.

Systems audits will be conducted on all analytical equipment for calibration and proper operation. All care and maintenance of analytical equipment will be performed by a trained specialist at least yearly. Reports of audits will be received by the laboratory supervisor.

Results of both the field and laboratory audit will be submitted to the ERM Project Manager for review. If the results of the audit necessitate further action, the Project Manager will be notified of such and will be appraised of any action taken.

CORRECTIVE ACTION

Corrective action resulting from systems errors or data from that is deemed out-of-control is performed by both the contracted laboratories and by ERM-West. Preventive maintenance is also performed by both ERM-West and by contracted laboratories.

Laboratory Corrective Action

Corrective action for Central Coast Analytical or Anlab is the responsibility of the respective Laboratory Supervisors. Both will provide documentation as to what, if any, corrective actions were initiated concerning this study and report them to the ERM Quality Assurance Manager. Such action will entail a review of the analyst's work, check of the instrumentation, and a repeat of the analysis.

ERM Corrective Action

Field quality assurance activities will be reported typically to the ERM Project Manager. Problems encountered during the study affecting quality assurance will be reported on a Corrective Action Form as presented in Figure 4-4. The Project Manager will be responsible for initiating the corrective actions and for insuring that the actions are taken in a timely manner, and that the desired results are produced. The Project Manager will report to the Quality Assurance Manager on all necessary corrective actions taken, the outcome of these actions, and their effect on data produced. All corrective action taken will be reported to the Port of Oakland representative.

Preventive Maintenance

The following equipment utilized in the course of the Embarcadero Cove investigation requires maintenance: pH meter, conductivity meter, gas chromatograph/mass spectrophotometer, turbidimeter and pressure transducer. Maintenance of these instruments is performed according to specified procedures. A sufficient inventory of instrument spare parts will be maintained to avoid prolonged downtime. Preventive maintenance is summarized in Table 4-2.

FIGURE 4-4
ERM CORRECTIVE ACTION FORM

Corrective Action Form

Date: ______________________________

Job Name: ______________________________

Initiator's Name and Title: ______________________________

Problem Description:

____

Reported To:

____

Corrective Action:

____

Reviewed and Implemented By: ______________________________

cc: Project Manager - ______________________________

TABLE 4-2

PREVENTIVE MAINTENANCE CHART

EQUIPMENT	MAINTENANCE	INTERVAL	CRITICAL SPARE PARTS
pH Meter	Probe Inspection	Quarterly	Replacement Probe
Tape Measure	Inspection for Damage	Each Use	Replacement Tape
Chromatographic Analytical Equipment	Routine Inspection	Monthly	Purge and Trap Devices, Chromatographic Columns, Syringes, Syringe valves, Reagents, Detectors
Pressure Transducer	Routine Inspection Check Battery Life	Monthly	Battery Cable

OVERALL PROJECT ASSESSMENT

Overall data quality will be assessed by a thorough understanding of the data quality objectives that are stated during the design phase of the investigation. By maintaining thorough documentation of all decisions made during each phase of sampling, performing field and laboratory audits, thoroughly reviewing (validating) the analytical data as it is generated by the laboratory, and providing appropriate feedback as problems arise in the field or at the laboratory, ERM will closely monitor data accuracy, precision and completeness.

Field Quality Assessment

To assure that all field data are collected accurately and correctly, specific written instructions will be issued to all personnel involved in field data acquisition by the Project Manager. The Project Manager will perform a field audit during the investigation to document that the appropriate procedures are being followed with respect to sample (and blank) collection. This audit will include a thorough review of the field books used by the Project personnel to insure that all tasks were performed as specified in the instructions. The field audit will necessarily enable the data quality to be assessed with regard to the field operations.

The evaluation (data review) of field blanks, and other field QC samples will provide definitive indications of the data quality. If a problem that can be isolated arises, corrective actions can be instituted for future field efforts.

Laboratory Data Quality Assessment

Standard statistical evaluations of analytical data will be performed by Central Coast Analytical Laboratories and Anlab Analytical Laboratory. These will be performed routinely to assess the necessary accuracy and completeness of the data generated. The precision and accuracy of analytical data generated will meet or exceed EPA established criteria as described in EPA-Methods (SW-846) "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods."

ERM Data Validation

All analytical data generated during the investigation will undergo a rigorous ERM data review. This review will be performed in accordance with ERM Standard Sample Collections and Procedures.

A preliminary review will be performed to verify all necessary paperwork (chain-of-custodies, traffic reports, analytical reports, laboratory personnel signatures) and deliverables, as stated in this Sample Plan.

A detailed quality assurance review will be performed by the ERM Quality Assurance Manager (or a staff reviewer) to verify the qualitative and quantitative reliability of the data as it is presented. This review will include a detailed review and interpretation of all data generated by Central Coast Analytical and Anlab. The primary tools that will be used by experienced professionals will be guidance documents, established (contractual) criteria, and professional judgment. Table 4-3 presents the items examined during the quality assurance review.

TABLE 4-3

ITEMS REVIEWED DURING THE ERM DATA VALIDATION

Areas Examined	Applicability (organic, inorganic, both)
ERM and Laboratory Chain of Custodies (Traffic Reports, Field Notes, Etc.) Laboratory Narrative and QC Summaries	Both
Holding Times	Both
Extraction/Digestion Logs	Both
Blanks - field and laboratory (accuracy)	Both
Instrument Tune	Organic
Standards	Both
Linearity	Both
Sensitivity/Stability	Both
Selectivity/Specificity	Both
EPA Criteria (SPCC & LCS)	Both
Variability of Technique (internal standards)	Organic
Analyze Breakdown	Organic
Analytical Sequence	Organic
ICP Interference	Inorganic
Control Standards	Inorganic
Samples	
Detection Limit	Both
Instrument Printouts	Both

TABLE 4-3
(Continued)

ICP data	Inorganic
AA data	Inorganic
GC data	Organic
GG/MS data	Organic
Autoanalyzer data	Inorganic
Qualitative Identification	Both
Mass spectra	
Pesticide/PCB results	
Tentatively identified compounds	
Quantitative Reliability	Both
Calculations/Equations	Both
Matrix spikes (accuracy)	Both
Bias	
Matrix spike duplicates	Organic
Bias	
Accuracy & Precision	
Surrogate Spikes	Organic
Duplicates (field and laboratory)	Both
Precision	
Representativeness	
Post-Digestion Spikes	Inorganic
Matrix Effects	

Based upon the review of the analytical data, an organic and inorganic quality assurance report will be prepared that will state in a technical yet "user friendly" fashion the qualitative and quantitative reliability of the analytical data. During the course of the data review, an organic and inorganic support documentation package is prepared that will provide the backup information that will accompany all qualifying statements presented in the quality assurance review.

Once the review has been completed, the Quality Assurance Manager will then submit these data to the Project Manager. These approved data tables and quality assurance reviews will be signed and dated by the Quality Assurance Manager.

Data Management Quality Assessment

As the analytical data generated from the subject investigation are validated, qualified and submitted to the Project Manager, the quality of the data will be assessed from an overall management perspective by direct comparison of analytical results obtained from previous samplings. Information that can be obtained includes comparison of results obtained from samples taken within the same general vicinity, and the identification of missing data points. By examination of the data at the "back-end" of the process, the data quality can be assessed with respect to representativeness, precision, compatibility and completeness.

Quality Assurance Reports to Management

Every sixty (60) days after project initiation the Project Manager, in conjunction with the Quality Assurance Manager and Officer, will submit summaries of all applicable quality assurance activities. These summaries shall contain at least the following types of information:

- The status and coverage of various laboratory and field quality assurance project activities.

- Data quality assurance reviews including assessment of: accuracy, precision, completeness, representativeness, and comparability.

- Significant quality assurance problems discovered, corrective actions taken, progress and improvements, plans, and recommendations for further implementation or updating of the investigative Quality Assurance Plan.

- Any significant field observations noted in the field notebook during the sampling procedures.

These quality assurance reports to management will be submitted to the appropriate Port of Oakland representative(s).

SECTION FIVE

HISTORICAL SITE REVIEW

The Embarcadero Cove site has had a history of industrial use spanning the past 60 to 70 years. These operations ceased in the early 1970s. Site investigations for surface and subsurface contamination were initiated in 1981. The following is a summary of these aspects of the site history.

SITE HISTORY

In the late nineteenth and early twentieth centuries, an abandoned estuarine channel parallel to the Oakland inner harbor was excavated and extended to create the Brooklyn Basin, which now isolates Government Island from the mainland. The excavated material was used as fill to bring low lying tidal areas above high water and to move the shoreline to the south and west. The Embarcadero Cove site is one such area created with this fill.

The site was leased by the Port of Oakland to a number of industrial operations over the past 60 to 70 years. Several oil companies, including Texaco and Ventura Oil Company, used the site prior to 1955 to store and blend gasoline and lubricating oils. In 1955, Wood Treating Chemical Company began handling a variety of wood preservatives (most notably pentachlorophenol) and other pesticides and herbicides at the site. The Garrity Company acquired this operation in 1965 and continued to handle the Wood Treating Chemical Company's products, along with additional pesticides and herbicides. A historical site plan is illustrated on Figure 5-1.

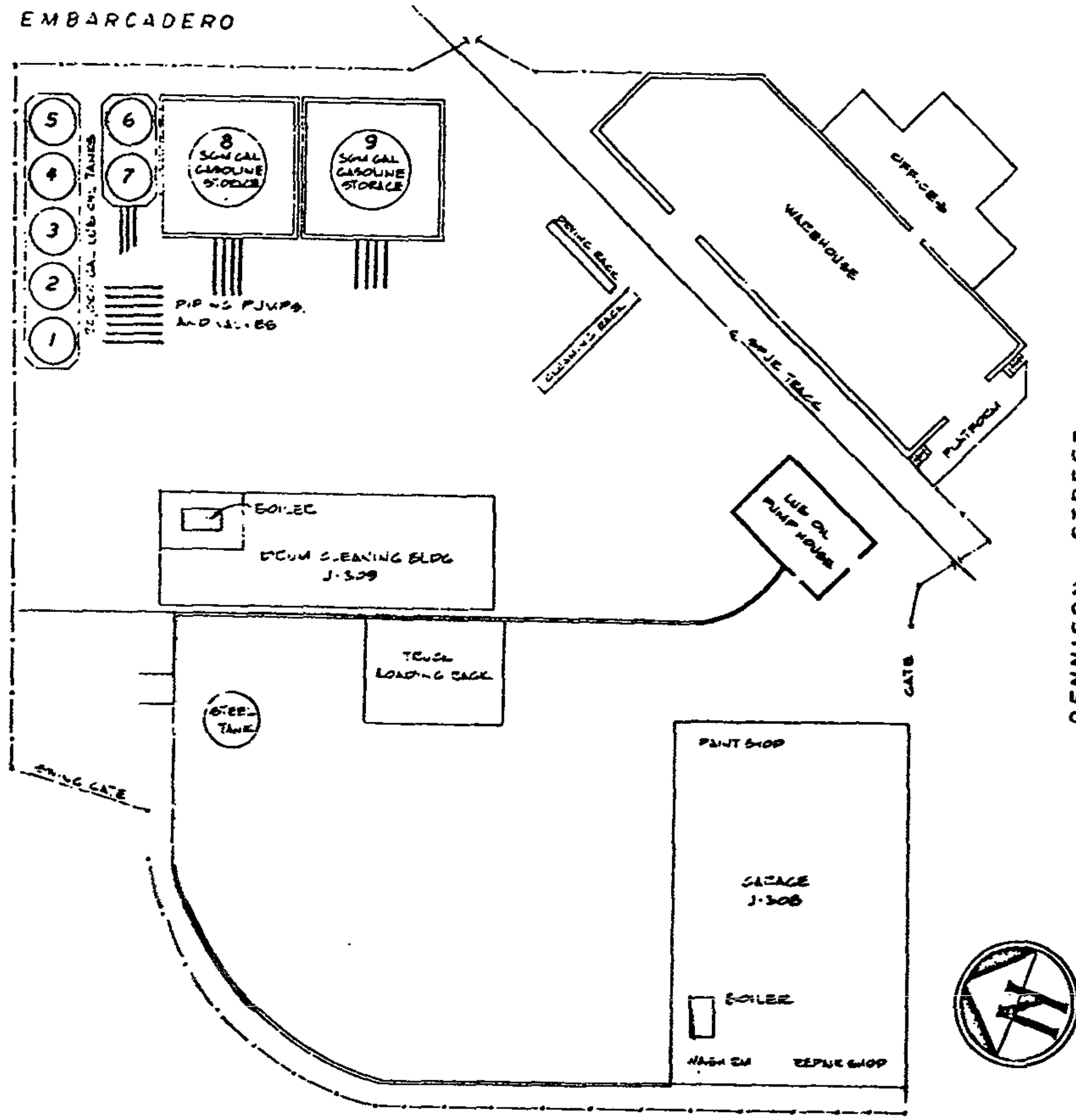

Figure 5-1

Historical Site Plan

ERM-West 11/87
Job #293

Garrity continued operations until 1970, at which time all industrial activities on the site were halted. Buildings and other facilities on site were dismantled or demolished and removed during the period 1970-1972. The site has remained vacant since that time. Commercial development is planned for the site.

As landlord, the Port of Oakland did not conduct any operations or activities at the site; all known site activities that could have contributed to the observed occurrence of chemicals at the site were underrtaken by site tenants. Accordingly, the Port does not have detailed information on the types, volumes and concentrations of hazardous materials used at the site.

The Embarcadero Cove site has drawn the attention of local and state regulatory agencies since the early 1950s when off-site migration of chemicals used at the site was first detected. At that time, the Fish and Game Commission and the Oakland Fire Marshal were the active regulatory agencies. Subsequent regulatory activity has been conducted by the Regional Water Quality Control Board (RWQCB) and the California Department of Health Services (DOHS) with the latter as the lead agency.

The Port of Oakland has undertaken studies to identify the occurrence and extent of on-site contamination since 1981. As a result of these studies, the California Department of Health Services has classified the site as a hazardous waste disposal site.

SITE INVESTIGATIONS

Beginning in 1981, investigations of the Embarcadero Cove site have been performed to define and describe the geology, hydrogeology, and the type and extent of contamination. Data from 14 borings, nine of which were completed as monitoring wells, have been integrated to depict subsurface conditions at the site. In addition, soil samples were collected from a dirt pile on-site and from materials excavated for an East Bay Municipal Utility District trench that paralleled the water front walkway.

Lenses of silt and sand occur in most wells and borings at depths of 5 to 10 feet, 15 to 20 feet and 40 to 42 feet below ground surface. Horizontal continuity between lithologic units encountered in fill has not been confirmed, and lateral continuity of the shallowest lenses is unlikely. Continuity between silty lenses at 15 to 20 feet is more likely but still uncertain as this zone is at least partially within fill. Coarse sediments encountered between 40 and 42 feet below ground surface can be correlated more confidently.

During drilling, saturated sediments were encountered in the three previously referenced silty zones. In the shallow zone, water was encountered at varying depths, indicating that the shallow silty and sandy lenses are discontinuous.

An analysis of the saturated zones suggests that two aquifers exist on the Embarcadero Cove site. The first occurs in the 15 to 20 foot silty zone. Silt in this interval was saturated in all borings and wells where it was encountered. Water levels in wells in this aquifer are seven to eight feet below ground surface (four to five feet above mean sea level (msl)), indicating that the aquifer is under confined hydrostatic pressure and that some continuity exists between silty lenses at this depth. The shallow aquifer has a water table gradient of about 0.5 percent in a southerly direction. Notably, Well W5 has a higher water level than other wells and is probably not in hydrologic contact with them.

The two deep wells, which are in the 40 to 42 foot silty zone, have similar water levels and are probably hydrologically connected. The piezometric surface for this deep aquifer is about nine feet below ground surface (or three feet msl), indicating that this aquifer is also under hydrostatic pressure and is confined. Water level data from these two wells indicate a southerly component of flow in this aquifer.

Areas of subsurface soil and shallow groundwater contain moderate to high levels of several synthetic organic chemicals. The predominant constituent accounting for the highest concentrations found in both soils and groundwaters is pentachlorophenol (PCP). In addition, isolated areas of subsurface soils were found to contain the pesticides chlordane, dieldrin, and DDT and its breakdown products, while some groundwater samples contain low levels of toluene, xylenes, DDD and PCBs. Low levels of dioxins and furans, apparently associated with the PCP, have been detected in on-site soils and groundwaters, but the forms of these compounds of greatest health concern (tetrachlorodibenzodioxin and tetrachlorodibenzofuran) have not been detected in any samples tested.

The only observed off-site migration of any of these constituents has been trace (<15 ppb) levels of PCP in shallow groundwaters. The absence of significant off-site migration is likely due to the low overall permeability of soils at the site and the isolated occurrences of the contaminants themselves. There is low potential for direct human exposure due to the isolated nature of the contamination, the absence of any nearby potable water withdrawals, the restricted access to the site itself, and the lack of significant off site contamination.

SECTION SIX

PROJECT SCHEDULE AND DELIVERABLES

An implementation schedule for this Remedial Investigation, Second Phase Workplan is shown on Table 6-1. The proposed schedule for implementation will be to start the field work within 30 calendar days of the date of approval of the workplan. The field work task could be delayed by adverse weather conditions. The Port of Oakland will notify DHS of actual dates of field work 48 hours prior to conducting the work so that DHS personnel or their representatives can be present to observe and obtain split or duplicate samples.

Monthly summary reports will be submitted by the 15th day of each month. Each report will indicate progress made toward compliance by summarizing specific actions performed in the previous month and actions proposed during the current calendar month.

Because of the possibility that these studies might not be sufficient to conclude remedial investigations, it is proposed that the results of these investigations be summarized in a letter report, together with recommendations for any additional needed investigation activities. The letter report will include narrative summaries, updated figures and tables as relevant, copies of boring logs and analytical reports, and a workplan for any additional recommended site investigation. After DHS concurrence in the closure of remedial investigation activities is obtained, the findings of the additional investigation activities would be incorporated into the Draft Remedial Investigation Report.

TABLE 6-1

PROPOSED PROJECT SCHEDULE

TASK	SCHEDULE
Commence Field Work	30 days*
Begin Water-level Measurements	Monthly*
Conduct Soil Sampling	8 weeks*
Install Monitoring Wells	8 weeks*
Complete First Quarter Monitoring	8 weeks*
Conduct Pumping Tests	10 weeks*
Complete Chemical Analyses	10 weeks*
Submit Letter Report on RI Studies	16 weeks*
Receive Agency Review and Approval	-
Submit Draft Remedial Investigation Report	8 weeks**
Receive Agency Review and Approval	-
Submit Final Remedial Investigation Report	8 weeks**
Receive Agency Review and Approval	-

* After approval of work plan.

** After approval of preceding document.

A final Remedial Investigation Report will be prepared to document the work performed and the data generated. A draft report will be provided for review prior to preparing a final draft. The final report will incorporate review comments and changes received prior to printing the final report. All of the data reports will be included as appendices to the final report.


W14
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FIGURE 2-1
Location of Borings
and
Monitoring Wells