ENSR
Consulting • Engineering • Remediation

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April 5, 2000
Project: 6908-112.310

Mr. Barney Chan
Alameda County Department of Environmental Health
1131 Harbor Bay Parkway, 2nd Floor
Alameda, California, 94502

Subject: **Fourth Quarter 1999 Groundwater Monitoring Report**
Oakland International Airport
United Airlines Building M-110
1100 Airport Drive, Oakland, California
StID # 1049

Dear Mr. Chan:

ENSR Corporation (ENSR), on behalf of United Airlines, is pleased to provide this report documenting the results of quarterly groundwater monitoring conducted at the Oakland International Airport, United Airlines Building M-110, 1100 Airport Drive, Oakland, California **(Figure 1 – Site Location Map)** on December 27, 1999. The monitoring event included the collection of depth to groundwater measurements and groundwater samples from monitoring wells MW-1, MW-2, and MW-3 **(Figure 2 – Site Map).**

BACKGROUND

On January 15, 1999, one 10,000-gallon diesel fuel underground storage tank (UST) and one 10,000-gallon unleaded gasoline UST were removed from the Site, along with a dispenser island and associated piping. Approximately 758 cubic-yards of soil were removed and properly disposed of during over-excavation activities. The results of the UST removal activities are documented in ENSR's report titled, "*Underground Storage Tanks Closure Report*", dated March 1999.

On July 21, 1999, three 4-inch-diameter groundwater monitoring wells (MW-1, MW-2, and MW-3) were completed to a depth of approximately 25 feet below ground surface (bgs), and developed per the guidelines stipulated by the California Code of Regulations, Title 23, Subchapter 16, Article 4, Sections 2647 and 2648. The results of the well installations documented in ENSR's report titled, "*Results Report: Installation of Groundwater Monitoring Wells*", dated September 1999.

SITE DESCRIPTION

The San Francisco Bay Area lies within the Coast Ranges geomorphic province, which is characterized by a series of nearly parallel mountain ranges that trend obliquely to the coast in a northwesterly direction. Generally, the bedrock underlying San Francisco Bay is composed of sandstone, siltstone, chert and greenstone of the Franciscan Formation. Sediments within the

Bay consist of "older bay mud", overlain by either a sand unit or "younger bay mud". Younger Bay Mud consists of a soft, uniform, gray, silty clay containing silt, minor fine sand and fragments of shells (Geology of San Francisco Bay, California Division of Mines and Geology).

The subject area is located on the northwest side of United Airlines Building M-110, which is used for airplane maintenance. The surrounding surface area is a graded, relatively flat area paved with asphalt concrete. The site exists at an approximate elevation of five feet above mean sea level. The nearest body of water is the San Francisco Bay located approximately 0.5 miles south of the Site (U.S.G.S. San Leandro Quadrangle, Photo-revised 1980).

Soils encountered during well installation consisted of sand (SP) to depths of approximately 13-feet bgs, clay (CL) to depths of 13 to 18 feet bgs; and clayey sand (SC) to depths of 25 feet bgs. A copy of the well logs is presented in **Appendix A.**

GROUNDWATER MONITORING

Groundwater Levels

On December 27, 1999, depth to groundwater measurements were collected from monitoring wells MW-1, MW-2, and MW-3 prior to purging and sampling. The measurements were recorded to the nearest 0.01 foot from the referenced (top-of-casing) elevations.

The inferred groundwater flow direction was toward the southwest at a hydraulic gradient of approximately 0.0006 ft/ft. **Figure 3** is a potentiometric surface map generated from the groundwater data collected.

The groundwater monitoring wells were surveyed by Tronoff Associates of Emeryville, California, a California licensed land surveyor. A copy of the well survey is presented in **Appendix A**, and groundwater level data is summarized in **Table 1.**

Sampling Activities

On December 27, 1999 groundwater samples were collected from monitoring wells MW-1, MW-2, and MW-3. Prior to sampling, each monitoring well was purged of approximately four well casing volumes using a submersible pump. Physical properties, including temperature, pH, and conductivity, were monitored during purging activities. The groundwater samples were collected after these parameters showed relative stability (e.g., less than 10% change), and the water level in each well recharged 80% of the depth measured prior to purging.

Generated purge water and wash water was containerized onsite in 55-gallon drums. A total of three drums of water were generated. Based on analytical groundwater results, the water in these drums will be disposed of at an appropriate facility.

Groundwater samples were collected using a new disposable bailer for each well. The groundwater samples were transferred to the appropriate sample containers and stored in a cooler containing ice for preservation. The samples were delivered under chain-of-custody to McCampbell Analytical, Inc. of Pacheco, California, a California certified laboratory. Field documentation forms and ENSR's standard operating procedures (SOPs) are presented in **Appendix B.**

Groundwater samples were submitted for the following chemical analysis:

- Total Petroleum Hydrocarbons as diesel (TPH-d) fuel by DHS Luft;
- Total Petroleum Hydrocarbons as gasoline (TPH-g) by DHS Luft;
- Benzene, toluene, ethylbenzene and total xylenes (BTEX) by EPA Method 8020; and
- Oxygenates including Methyl tert-butyl ether (MTBE), Di-isopropyl Ether (DIPE), Ethyl tert-Butyl Ether (ETBE), tert-Amyl Methyl Ether (TAME), and tert-butanol by EPA Method 8260.

One groundwater sample (from MW-1) was also submitted for the following water quality analysis:

- General Mineral by EPA 6000/7000 Series Method; and
- Total Dissolved Solids (TDS) by EPA Method 160.1.

Laboratory Results

The chemical analytical results of groundwater samples collected from monitoring wells MW-1, MW-2, and MW-3 are summarized in **Table 2**. Copies of the laboratory data sheets are included in **Appendix C.**

The following is a summary of the analytical results:

- TPH-d was detected in groundwater samples MW-2 at 180 micrograms per Liter (µg/L) and monitoring well MW-3 at 90 µg/L;
- TPH-g was detected in groundwater sample MW-2 at 110 µg/L;
- Benzene was detected in groundwater sample MW-2 at 43 µg/L; and
- MTBE was detected in groundwater samples MW-2 at 110 µg/L, and MW-3 at 270 µg/L.

Water quality analyses were performed on a groundwater sample collected from monitoring well MW-1. The results are summarized in **Table 3** and the laboratory data sheets are presented in **Attachment 3**. The analytical results indicated the following:

- TDS for groundwater sample MW-1 was 6,130 milligrams per Liter (mg/L);
- Total Hardness/CaCO3 for groundwater sample MW-1 was 935 mg/L;
- Total Alkalinity for groundwater sample MW-1 was 800 mg/L; and
- Sodium for groundwater sample MW-1 was 1,780 mg/L.

CONCLUSIONS/RECOMMENDATIONS

Based on the reversal of groundwater flow direction from the previous monitoring event, it appears that groundwater flow direction is under tidal influence. Relatively low levels of petroleum hydrocarbon constituents are present in groundwater monitoring wells MW-2 and MW-3. This site appears to be excluded from the California State Water Board "Sources of Drinking Water" policy, based on the relatively high levels of total dissolved solids (greater than 3,000 mg/L). Quarterly groundwater monitoring will continue at this site.

If you have any questions or comments regarding this report, please call Mr. Alan Klein at (916) 362-7100.

Sincerely,

ENSR

Alan J. Klein, R.E.A.
Senior Environmental Scientist

Alan D. Gibbs, R.G., C.H.G., REA II
Department Manager

Attachments:

cc: Mr. Dennis Moulton, United Air Lines, Inc.
Mr. Steve Sulgit, United Air Lines, Inc.
Mr. Ted Wells, United Air Lines, Inc.
Mr. Dan Klettke, Port of Oakland Environmental Compliance

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TABLE 1
GROUNDWATER LEVEL DATA
Oakland International Airport
United Airlines Building M-110

Well	Date	Reference Level (feet)	Depth to Groundwater (feet)	Groundwater Elevation (feet)
MW-1	7/28/99 12/27/99	10.91	6.12 6.37	4.79 4.54
MW-2	7/28/99 12/27/99	12.30	7.47 7.83	4.83 4.47
MW-3	7/28/99 12/27/99	12.51	7.67 8.05	4.84 4.46

TABLE 2

ANALYTICAL RESULTS – GROUNDWATER

Oakland International Airport

United Airlines Building M-110

Sample ID	Date Collected	Total Petroleum Hydrocarbons		MTBE (µg/L)	Volatile Organic Compounds			
		Diesel (µg/L)	Gasoline (µg/L)		Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)
MW-1	7/28/99	ND	ND	ND	ND	ND	ND	ND
	12/27/99	ND	ND	ND	ND	ND	ND	ND
MW-2	7/28/99	160	ND	190	ND	ND	ND	ND
	12/27/99	180	110	110	43	ND	ND	ND
MW-3	7/28/99	ND	ND	270	ND	ND	ND	ND
	12/27/99	90	ND	270	ND	ND	0.54	ND
Reporting Limit		50	50	1.0	0.5	0.5	0.5	0.5

Notes:

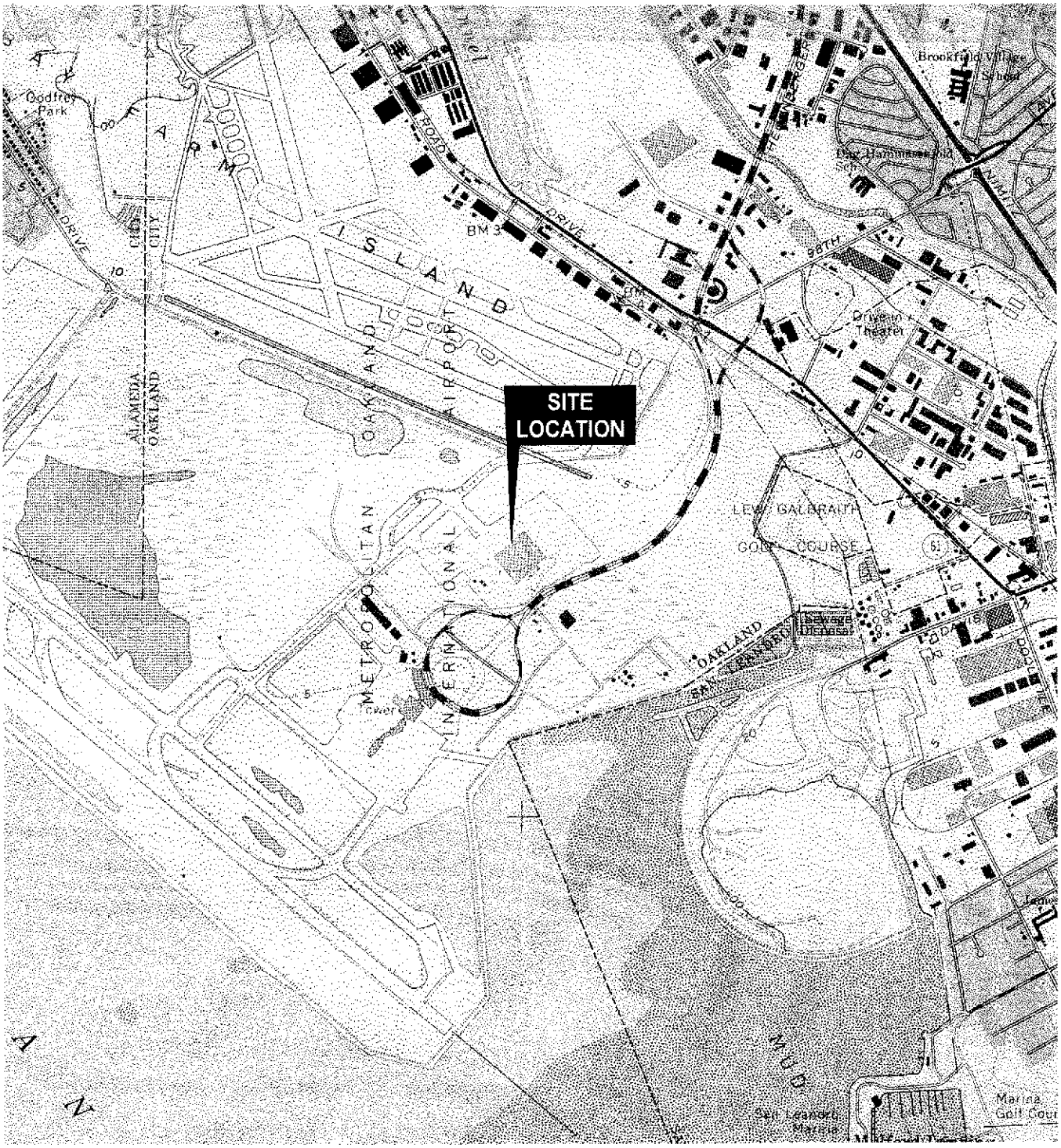
TTLC	Total Threshold Limit Concentration
MTBE	Methyl tert-Butyl Ether
NA	Not analyzed
ND	Not detected above laboratory reporting limits
µg/L	micrograms per Liter

TABLE 3
ANALYTICAL RESULTS - GROUNDWATER QUALITY
Oakland International Airport
United Airlines Building M-110

Sample ID	Date Collected	Total Dissolved Solids (mg/L)	Total Hardness/ CaCO3 (mg/L)	Total Alkalinity (mg/L)	Bicarbonate (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Calcium (mg/L)	Manganese (mg/L)	Iron (mg/L)	Copper (mg/L)	Zinc (mg/L)
MW-1	7/28/99 12/27/99	6,600 6,130	NA 935	NA 800	NA 800	210 140	2,300 1,780	81 52	180 144	2.4 1.75	55 9.3	0.066 ND	103 ND
Reporting Limit	---	10	1	10	10	1.0	1.0	1.0	1.0	0.01	0.1	0.05	0.05

Notes:

mg/L	milligrams per Liter
NA	Not analyzed
ND	Not detected above laboratory reporting limits



USGS 7.5 MINUTE
SAN LEANDRO, CA QUADRANGLE
1959, PHOTOREVISED 1980

NORTH

0 1000 2000

FEET

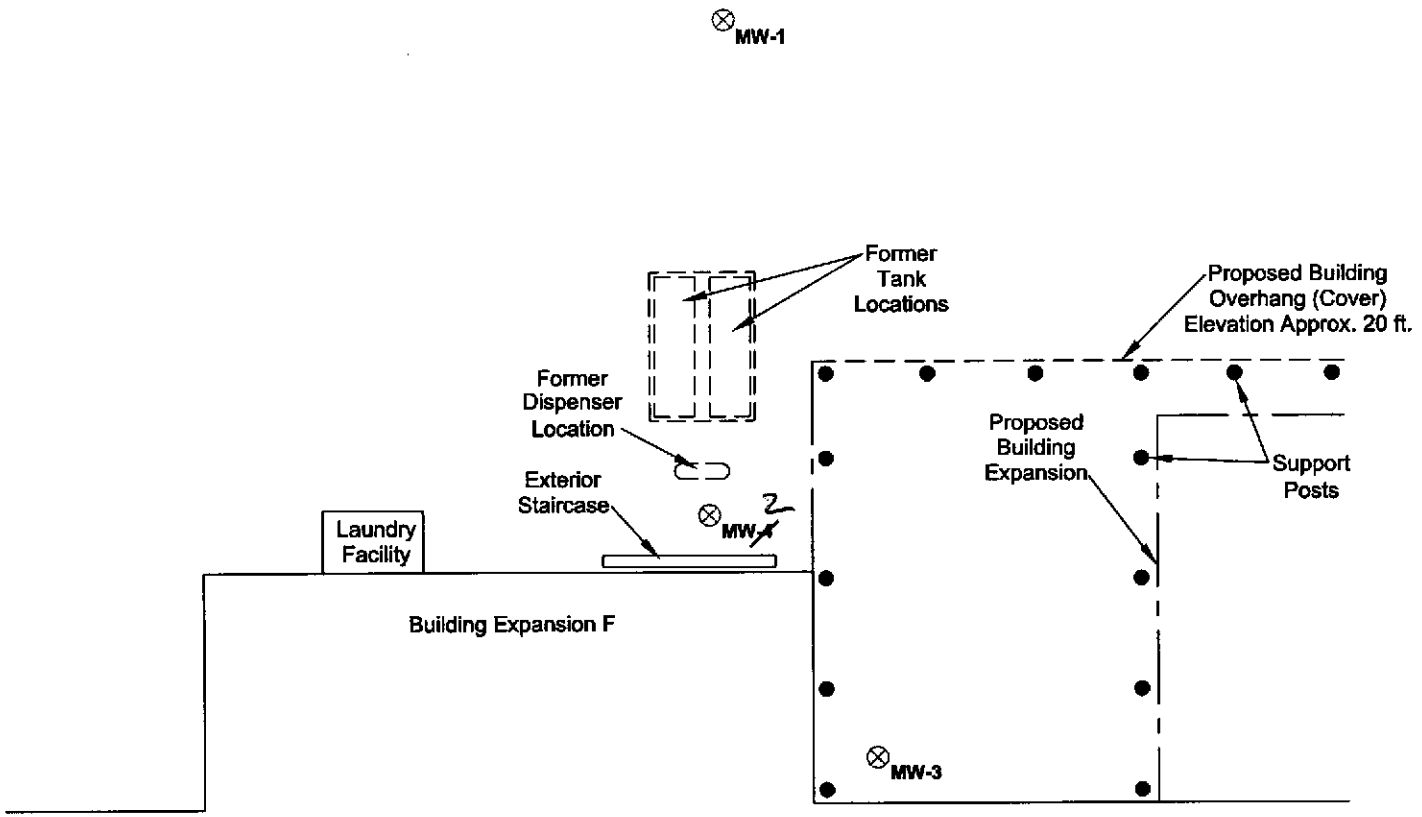
ENSR

FIGURE 1

SITE LOCATION MAP

United Airlines
Oakland International Airport
Oakland, CA

DRAWN: J. Gierek	DATE: 9/22/98	PROJECT NO: 6908-112-310	REV.
FILE: Ensr\6908\050\UAL_inf.dsf			



LEGEND

MW-1 Proposed Well Location

NORTH

0 20 40

APPROX. SCALE IN FEET

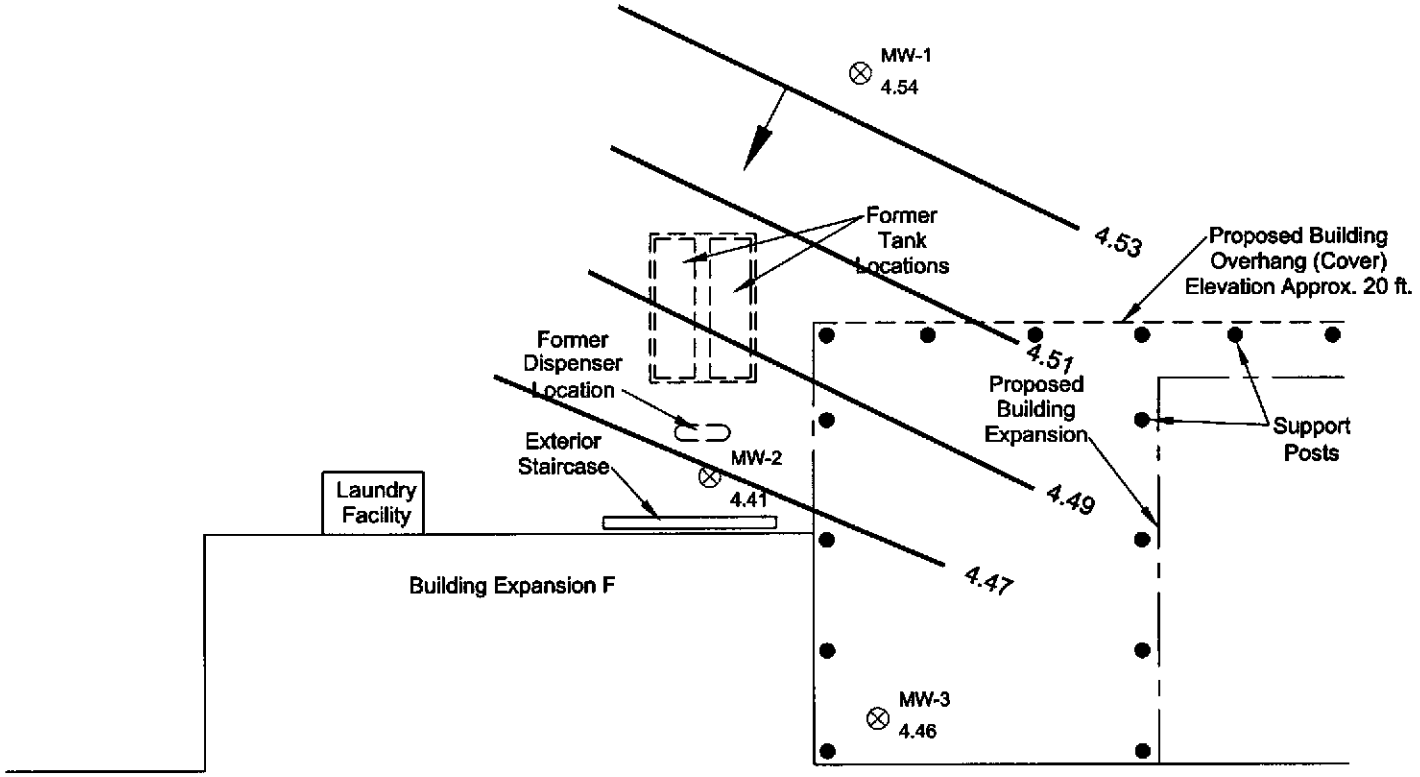
ENSR.

FIGURE 2

SITE MAP

United Airlines
Oakland International Airport
Oakland, CA

DRAWN: J. Gierek	DATE: 7/15/99	PROJECT NO: 6908-112-301	REV.
FILE: Ensr\6908\050\Proposed40.dwg			



LEGEND

- MW-1 — Monitoring Well
- 4.54 — Groundwater Elevation in feet
- Groundwater Elevation Contour
- Groundwater Flow Direction

Contour Interval = 0.02 ft
Hydraulic Gradient = 0.0006 ft/ft

NORTH

0 20 40
APPROX. SCALE IN FEET

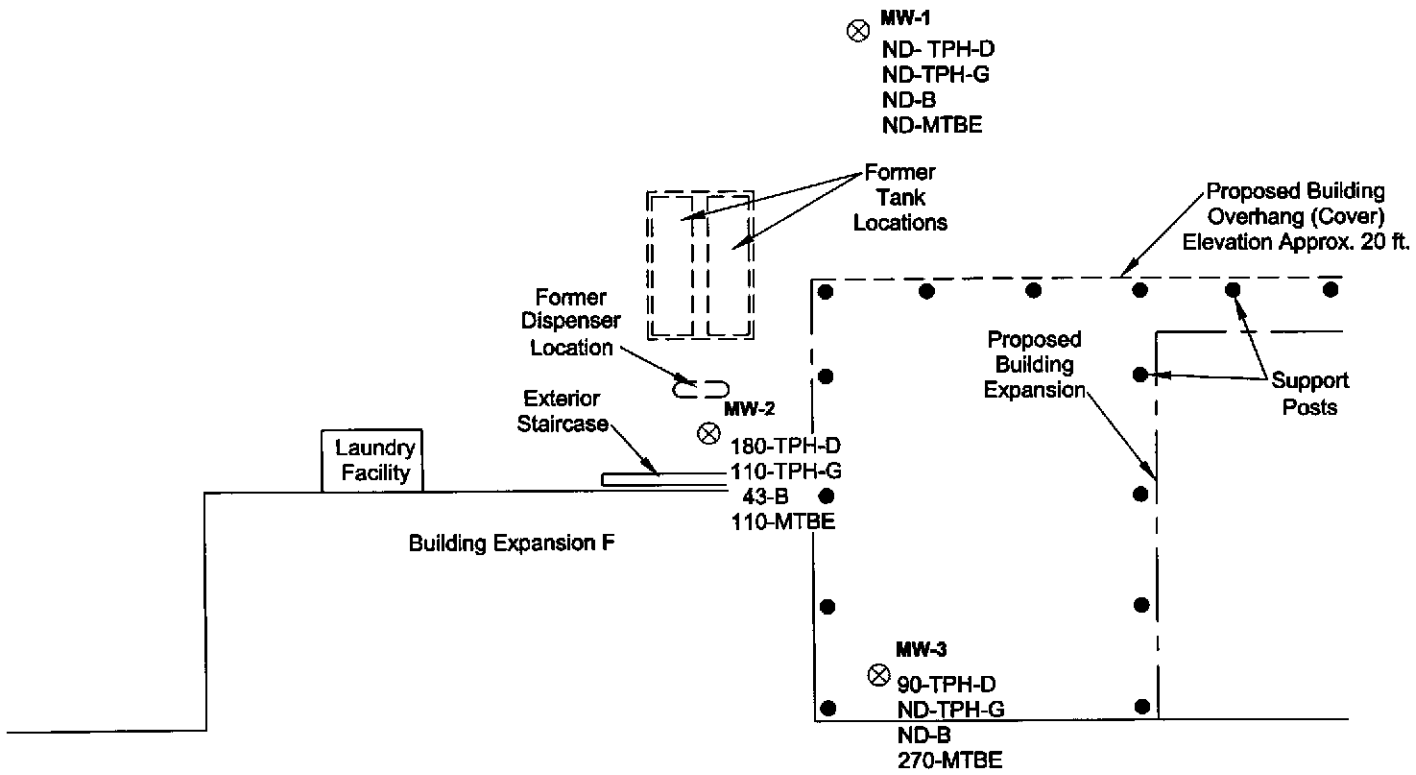
ENSR.

FIGURE 3

POTENTIOMETRIC SURFACE MAP
December 27, 1999

United Airlines
Oakland International Airport
Oakland, CA

DRAWN: J. Gierek	DATE: 1/25/00	PROJECT NO: 6908-112-310	REV.
FILE: Ensr\6908\050\Pot_1_00.dwg			



LEGEND

⊗ MW-2	=	Monitoring Well
TPH-D	=	TPH as Diesel
TPH-G	=	TPH as Gasoline
B	=	Benzene
MTBE	=	Methyl tert-Butyl Ether
ND	=	Non-detect

NOTE: All measurements in parts per billion.

NORTH

0 20 40

APPROX. SCALE IN FEET

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FIGURE 4

DISTRIBUTION OF TPH-D, TPH-G, BENZENE, & MTBE IN GROUNDWATER

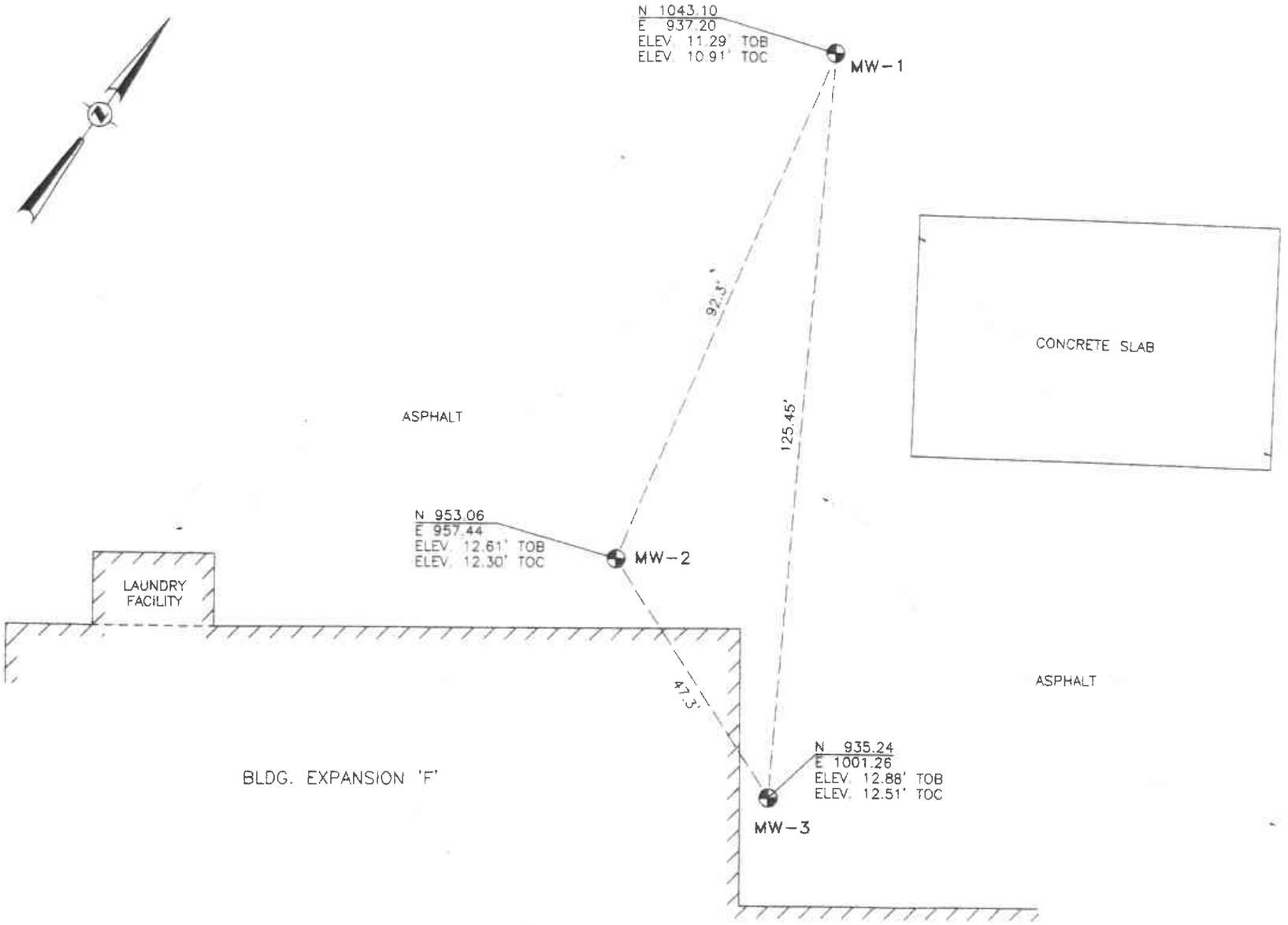
December 27, 1999

United Airlines
Oakland International Airport
Oakland, CA

DRAWN: J. Gierek	DATE: 1/25/00	PROJECT NO: 6908-112-310	REV.
FILE: Ensr\6908\050\Dist_1_00.dwg			

APPENDIX A

WELL LOGS AND WELL SURVEY DATA



NOTES

1. VERTICAL DATUM: ASSUMED TO BE CITY OF OAKLAND PER GRADING PLAN DRAWING SP-2D, PORT FILE AA-1285, 10/16/77.
2. COORDINATE BASIS: LOCAL
3. TOE = SET PUNCH MARK N'LY SIDE WELL BOX
4. TOB = MARK N'LY SIDE TOP 4" PVC CASING.

GROUNDWATER MONITORING WELL SURVEY
UNITED AIRLINES FACILITY
OAKLAND INTERNATIONAL AIRPORT

ALAMEDA COUNTY, CALIFORNIA

PREPARED FOR

ENSR

BY

TRONOFF ASSOCIATES - LAND SURVEYORS

5850 SHELLMOUND WAY, SUITE 300 EMERYVILLE, CA.

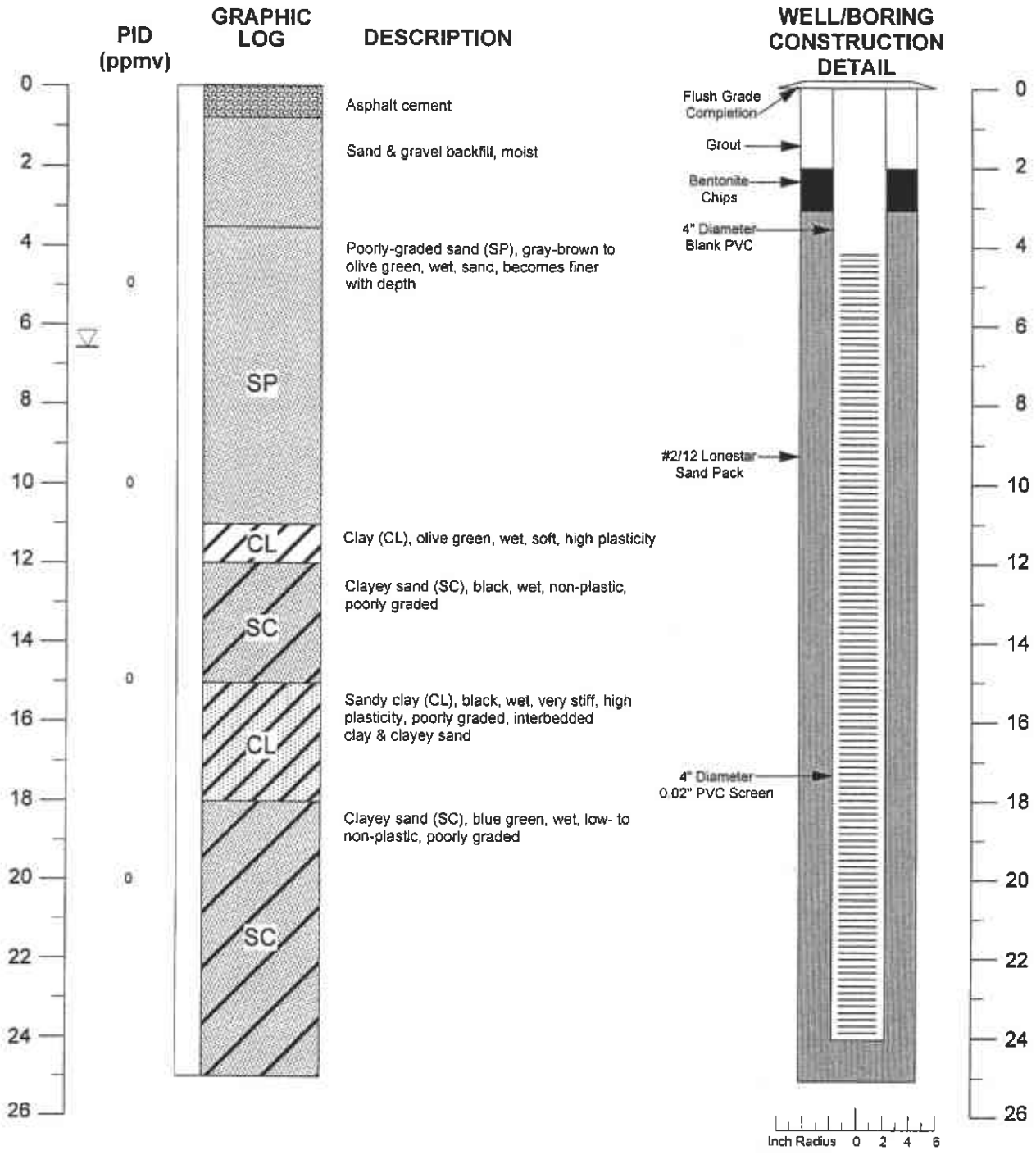
(510) 428-1515

SCALE 1"= 20' AUGUST 23, 1999

SURVEY NO. 4194

LICENSED LAND SURVEYOR
BRUCE T. TRONOFF
NO. 6415
STATE OF CALIFORNIA

BRUCE T. TRONOFF, LAND SURVEYOR NO. 6415 (RENEWAL DATE 12/31/02)



Driller:	Gregg Drilling	End Date:	7/21/99	Type of Sampler:	Split spoon
Drilling Method:	Hollow Stem Auger	Groundwater:	6.5 ft. bgs	TD (Total Depth):	25 ft. bgs
Start Date:	7/21/99	Sampler:	Jeff Wendt		

Legend

- Water level in completed well
- First water found during drilling
- Location of recovered drill sample
- Location of sample sealed for chemical analysis
- Contact: Solid where certain
- Contact: Dotted where approximate
- Contact: Dashed where uncertain

Monitoring Well MW-1

United Airlines
1100 Airport Drive
Oakland, CA

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Page: 1 of 1

Drawn By:	J. Gierek	Date: 7/28/99	Job Number: 6908-050
Revised By:	J. Gierek	Date: 8/10/99	

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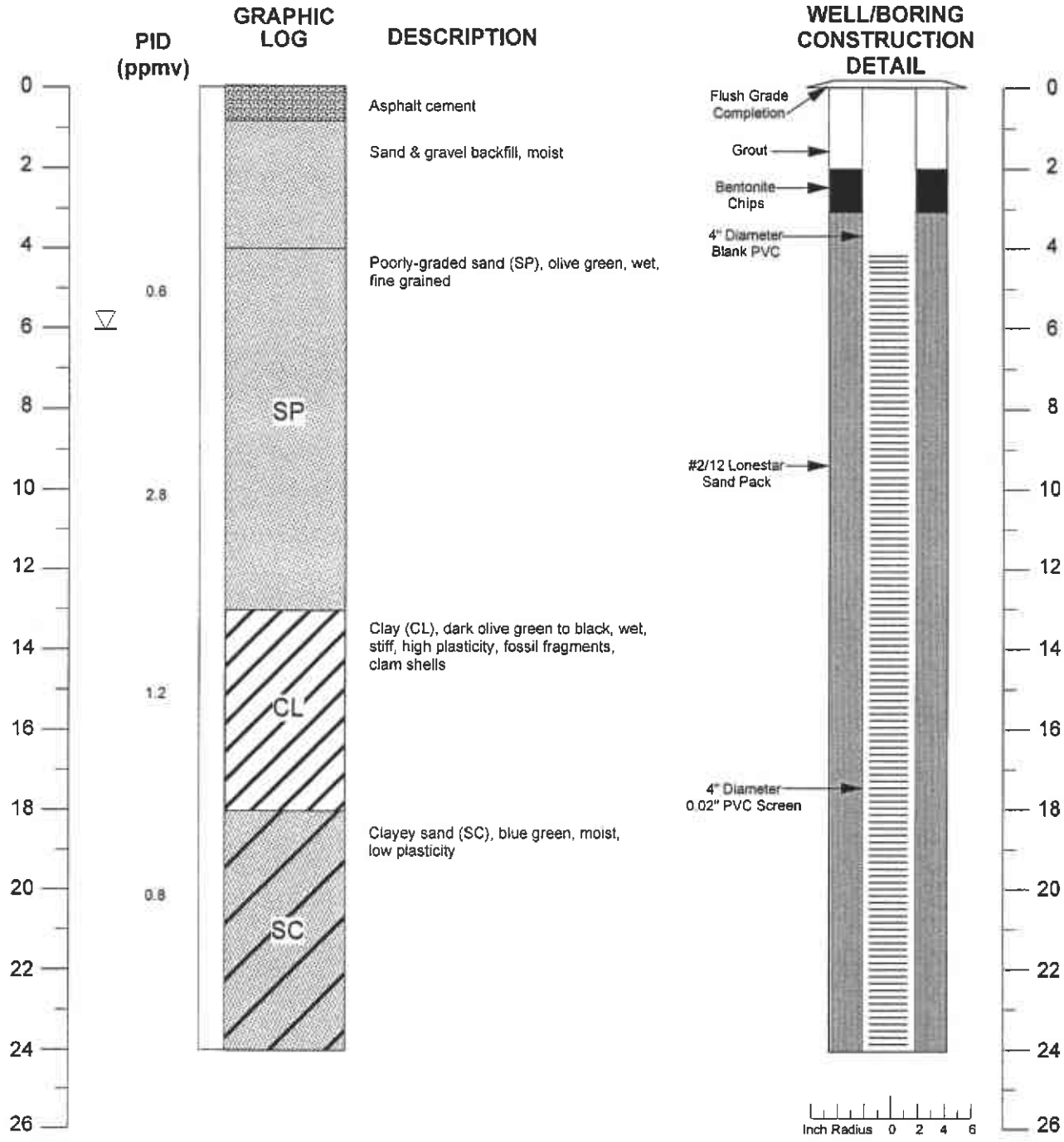

Driller:	Gregg Drilling	End Date:	7/21/99	Type of Sampler:	Split spoon
Drilling Method:	Hollow Stem Auger	Groundwater:	6 ft. bgs	TD (Total Depth):	24 ft. bgs
Start Date:	7/21/99	Sampler:	Jeff Wendt		

Legend

- Water level in completed well
- First water found during drilling
- Location of recovered drill sample
- Location of sample sealed for chemical analysis
- Contact: Solid where certain
- Contact: Dotted where approximate
- Contact: Dashed where uncertain

Monitoring Well MW-2

United Airlines
1100 Airport Drive
Oakland, CA

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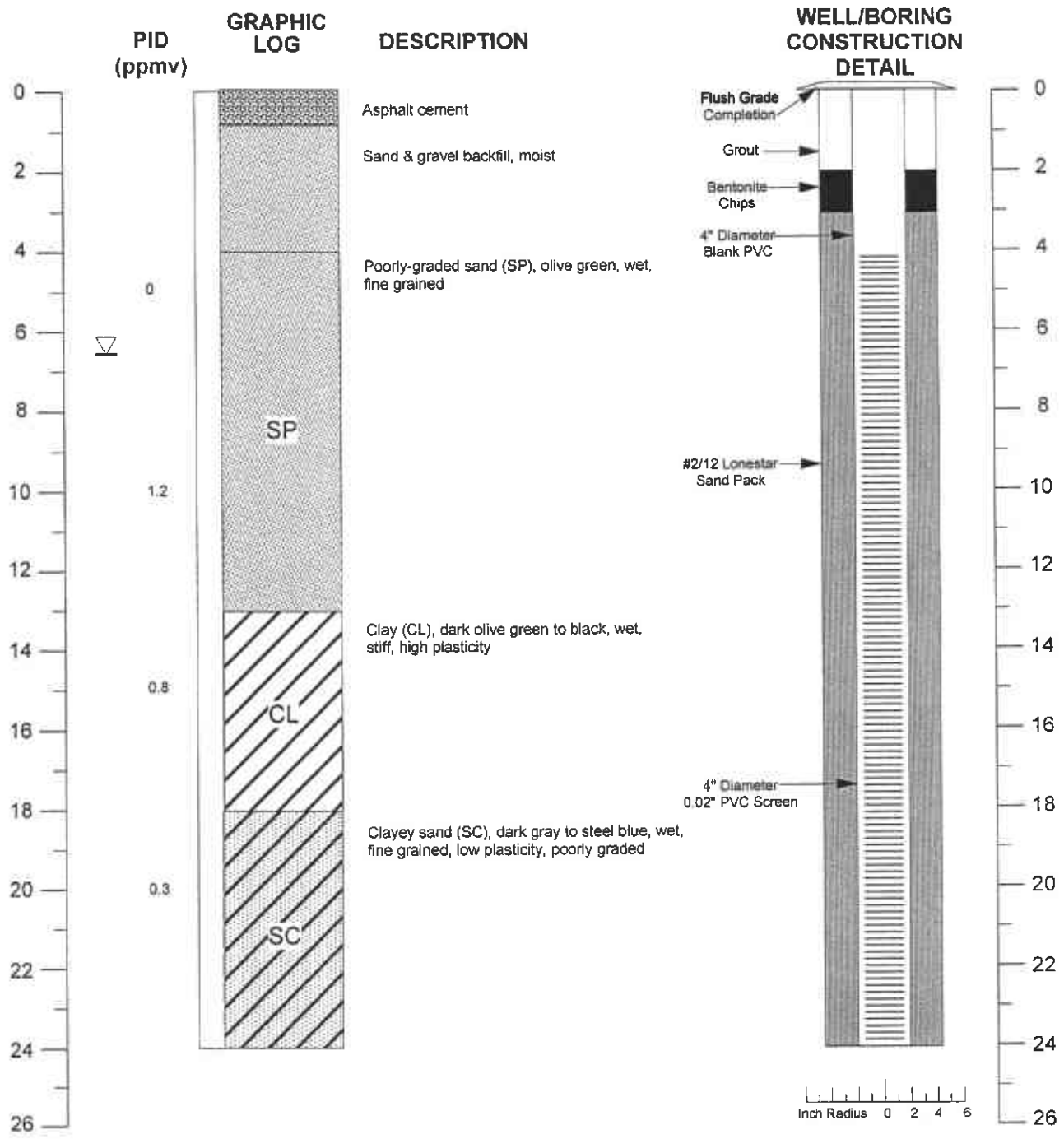
Page: 1 of 1

Drawn By:	J. Gierek	Date:	7/26/99
Revised By:	J. Gierek	Date:	8/10/99

Job Number: 6908-050

Ensr\6908\050\borings.dsf



Driller:	Gregg Drilling	End Date:	7/21/99	Type of Sampler:	Split spoon
Drilling Method:	Hollow Stem Auger	Groundwater:	6.5 ft. bgs	TD (Total Depth):	24 ft. bgs
Start Date:	7/21/99	Sampler:	Jeff Wendt		

Legend

- Water level in completed well
- First water found during drilling
- Location of recovered drill sample
- Location of sample sealed for chemical analysis
- Contact: Solid where certain
- Contact: Dotted where approximate
- Contact: Dashed where uncertain

Monitoring Well MW-3

United Airlines
1100 Airport Drive
Oakland, CA

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Drawn By:	J. Gierek	Date:	7/28/99
Revised By:	J. Gierek	Date:	8/10/99

Job Number: 6908-050

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APPENDIX B

FIELD SHEETS AND ENSR SOPS

ENSR

GROUNDWATER/LIQUID LEVEL DATA

(measurements in feet)

Project Address: 1100 Airport Drive Bldg-110,Oakland,CA. **Date:** 12/27/99

Recorded by: TR **Project No.:** ~~6908.050.300~~ 6908-082.120

Well No.	Time	Well Elev	Measured Total Depth	Depth to Gr. Water	Depth to Product	Product Thickness	GW Elev	Comments (TOC/TOB) (product skimmer in well)
MW-1	0825	10.91	23.30	6.37	N/A	N/A	4.54	
MW-2	0829	12.30	22.10	7.83	↓	↓	4.47	
MW-3	0827	12.51	22.80	8.05	↓	↓	4.46	

Notes:

MONITORING WELL SAMPLING INFORMATION SHEET

ENSR

Client: UAL-OAKLAND

Project No: 6908-~~082.120~~ 082.120

Site: BLDG 110, OAKLAND INT. AIRPORT
OAKLAND, CA

Well Designation: MW-1

Is setup of traffic control devices required?:	NO	YES	Setup & Takedown time: _____ hours
Is there standing water in well box?:	NO	YES	(Above TOC Below TOC)
Is Top of Casing cut level?:	NO	YES	(If NO please explain in remarks)
Is well cap sealed and locked?:	NO	YES	(If NO please explain in remarks)

Height of Well Casing Riser (in inches): _____

General condition of Wellhead assembly: Excellent Good Fair Poor (Explain in remarks)

Purging Equipment: _____ 2" Disposable bailer _____ Submersible pump
_____ 2" PVC bailer _____ Dedicated bailer
_____ 4" PVC bailer

Sampled with: Disposable bailer: _____ Teflon bailer: _____

Well diameter:	2"___	3"___	4" X	6"___	8"___
Purge Vol. Multiplier:	0.163	0.367	0.653	1.47	2.61 gal/ft.

Initial Measurement
Time: 0825
Depth of well: 23.30
Depth to water: 6.37

Recharge Measurement
Time: 0913
Depth to water: _____

Calculated purge: 34
Actual purge: 25

Start purge: 0855 Sampling time: 0915 Sampling Date: 12/27/99

Time	Temp (F)	E.C.	pH	Turbidity	0 (ppm)	Volume (Gal.)
0859 ~~0902~~	61.3	6.14mS	7.13		1.1	11
0903	65.0	7.60	7.29			22
0907	66.4	7.17 ↓	7.34		1.5	25 ADD

Sample appearance: SEMI-CLEAR

QC samples collected at his well: NONE Lock: DOLPHIN

Equipment replaced: (Check all that apply) Note condition of replaced item.

2" Locking Cap:	Lock #2357:	Lock #0909:
3" Locking Cap:	Lock #3753:	Lock-Dolphin:
4" Locking Cap:	Chevron Lock:	

Remarks: _____

Signature: _____ Review: _____

MONITORING WELL SAMPLING INFORMATION SHEET

ENSR

Client: UAL-OAKLAND

Project No: 6908-082.120

Site: BLDG 110, OAKLAND INT. AIRPORT
OAKLAND, CA

Well Designation: MW-2

Is setup of traffic control devices required?: (NO) YES Setup & Takedown time: _____ hours

Is there standing water in well box?: (NO) YES (Above TOC Below TOC)

Is Top of Casing cut level?: NO (YES) (If NO please explain in remarks)

Is well cap sealed and locked?: NO (YES) (If NO please explain in remarks)

Height of Well Casing Riser (in inches): 8

General condition of Wellhead assembly: Excellent (Good) Fair Poor (Explain in remarks)

Purging Equipment: _____ 2" Disposable bailer X Submersible pump

_____ 2" PVC bailer _____ Dedicated bailer

_____ 4" PVC bailer

Sampled with: Disposable bailer: X Teflon bailer: _____

Well diameter:	2"___	3"___	4" X	6"___	8"___
Purge Vol. Multiplier:	0.163	0.367	0.653	1.47	2.61 gal/ft.

Initial Measurement

Time: 0829

Depth of well: 22.10

Depth to water: 7.83

Recharge Measurement

Time: 1037

Depth to water: 8.31

Calculated purge: 28

Actual purge: 20

Start purge: 1015 Sampling time: 1040 Sampling Date: 12/27/99

Time	Temp (F)	E.C.	pH	Turbidity	0 (ppm)	Volume (Gal.)
1020	61.7	3.95mS	7.27		1.3	10
1024	63.6	5.10	7.27			20
1025						DRY

Sample appearance: SEMI-CLEAR

QC samples collected at his well: NONE Lock: NONE.

Equipment replaced: (Check all that apply) Note condition of replaced item.

2" Locking Cap: Lock #2357: Lock #0909:

3" Locking Cap: Lock #3753: Lock-Dolphin:

4" Locking Cap: Chevron Lock:

Remarks: _____

Signature: _____ Review: _____

MONITORING WELL SAMPLING INFORMATION SHEET

ENSR

Client: UAL-OAKLAND

Project No: 6908-082.120

Site: BLDG 110, OAKLAND INT. AIRPORT
OAKLAND, CA

Well Designation: MW-3

Is setup of traffic control devices required?: (NO) YES Setup & Takedown time: _____ hours

Is there standing water in well box?: (NO) YES (Above TOC Below TOC)

Is Top of Casing cut level?: NO (YES) (If NO please explain in remarks)

Is well cap sealed and locked?: ~~NO~~ (YES) (If NO please explain in remarks)

Height of Well Casing Riser (in inches): 12

General condition of Wellhead assembly: Excellent (Good) Fair Poor (Explain in remarks)

Purging Equipment: _____ 2" Disposable bailer X Submersible pump

_____ 2" PVC bailer _____ Dedicated bailer

_____ 4" PVC bailer

Sampled with: Disposable bailer: Y Teflon bailer: _____

Well diameter:	2"___	3"___	4" X	6"___	8"___
Purge Vol. Multiplier:	0.163	0.367	0.653	1.47	2.61 gal/ft.

Initial Measurement

Time: 0827

Depth of well: 22.80

Depth to water: 8.05

Recharge Measurement

Time: 1045

Depth to water: 8.32

Calculated purge: ~~20~~ 30

Actual purge: 30

Start purge: 0938 Sampling time: 1050 Sampling Date: 12/27/99

Time	Temp (F)	E.C.	pH	Turbidity	0 (ppm)	Volume (Gal.)
0943	60.5	4.17mS	7.47		1.8	10
0946	63.7	5.55	7.44			20
0950	64.1	5.61 ↓	7.48			30 DRY

Sample appearance: CLEAR / SEMI-CLOUDY

QC samples collected at his well: NONE

Lock: ~~LOCK~~ DOLPHIN

Equipment replaced: (Check all that apply) Note condition of replaced item.

2" Locking Cap: Lock #2357: Lock #0909:

3" Locking Cap: Lock #3753: Lock-Dolphin:

4" Locking Cap: Chevron Lock:

Remarks: _____

Signature: _____ Review: _____

SAMPLE IDENTIFICATION AND CHAIN-OF-CUSTODY PROCEDURES

SOP-4

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 submitted for analysis is labeled to identify the job number, date, time of sample collection, a sample number unique to the sample, any name(s) of on-site personnel and any other pertinent field observations also recorded on the field excavation or boring log.

Chain-of-custody forms are used to record possession of the sample from time of collection to its arrival at the laboratory. During shipment, the person with custody of the samples will relinquish them to the next person by signing the chain-of-custody form(s) and noting the date and time. The sample-control officer at the laboratory will verify sample integrity, correct preservation, confirm collection in the proper container(s), and ensure adequate volume for analysis.

If these conditions are met, the samples will be assigned unique laboratory log numbers for identification throughout analysis and reporting. The log numbers will be recorded on the chain-of-custody forms and in the legally-required log book maintained in the laboratory. The sample description, date received, client's name, and any other relevant information will also be recorded.

LABORATORY ANALYTICAL QUALITY ASSURANCE AND CONTROL

SOP-5

In addition to routine instrument calibration, replicates, spikes, blanks, spiked blanks, and certified reference materials are routinely analyzed at method-specific frequencies to monitor precision and bias. Additional components of the laboratory Quality Assurance/Quality Control program include:

1. Participation in state and federal laboratory accreditation/certification programs;
2. Participation in both U.S. EPA Performance Evaluation studies (WS and WP studies) and inter-laboratory performance evaluation programs;
3. Standard operating procedures describing routine and periodic instrument maintenance;
4. "Out-of-Control"/Corrective Action documentation procedures; and,
5. Multi-level review of raw data and client reports.

GROUNDWATER PURGING AND SAMPLING

SOP-7

Prior to water sampling, each well is purged by evacuating a minimum of three wetted well-casing volumes of groundwater. When required, purging will continue until either the discharge water temperature, conductivity, or pH stabilize to within 10% of previously measured values; and a maximum of ten wetted casing volumes of groundwater have been recovered, or the well is bailed dry. When practical, the groundwater sample should be collected when the water level in the well recovers to at least 80 percent of its static level. Field measurements, observations and procedures are noted.

The sampling equipment consists of a clean bailer, or stainless steel bladder pump with a "Teflon" bladder. If the sampling system is dedicated to the well, then the bailer is usually "Teflon," but the bladder pump may be PVC with a polypropylene bladder. Sample container type, preservation, and volume depends on the intended analyses.

The groundwater sample is decanted into each VOA vial in such a manner that there is no meniscus at the top of the vial. A cap is quickly secured to the top of the vial. The vial is then inverted and gently tapped to see if air bubbles are present. If none are present, the vial is labeled and refrigerated for delivery, under strict chain-of-custody, to the analytical laboratory. Label information should include a unique sample identification number, job identification number, date, time, and the sampler's initials.

For quality control purposes, a duplicate water sample may be collected from a well. When required, a trip blank is prepared at the laboratory and placed in the transport cooler. It is labeled similar to the well samples, remains in the cooler during transport, and is analyzed by the laboratory along with the groundwater samples. In addition, a field blank may be prepared in the field when sampling equipment is not dedicated. The field blank is prepared after a pump or bailer has been either steam cleaned or properly washed, prior to use in the next well, and is analyzed along with the other samples. The field blank analysis demonstrates the effectiveness of in-field cleaning procedures to prevent cross-contamination.

To minimize the potential for cross-contamination between wells, all well development and water sampling equipment not dedicated to a well is either steam cleaned or properly washed between use. As a second precautionary measure, wells are sampled in order of lowest to highest concentrations as established by available previous analytical data.

In the event the water samples cannot be submitted to the analytical laboratory on the same day they are collected (e.g., due to weekends or holidays), the samples are temporarily stored until the first opportunity for submittal either on ice in a cooler, such as when in the field, or in a refrigerator.

MEASURING LIQUID LEVELS USING A WATER LEVEL INDICATOR OR INTERFACE PROBE

SOP-12

Field equipment used for liquid-level gauging typically includes the measuring probe (water level or interface) and a clean product bailer(s). The field kit also includes cleaning supplies (buckets, TSP, spray bottles, and deionized water) to be used in cleaning the equipment between wells.

Prior to measurement, the probe tip is lowered into the well until it touches bottom. Using the previously established top-of-casing or top-of-box (i.e., wellhead vault) point, the probe cord (or halyard) is marked and a measuring tape (graduated in hundredths of a foot) is used to determine the distance between the probe end and the marking on the cord. This measurement is then recorded on the liquid-level data sheet as the "Measured Total Depth" of the well.

When necessary in using the interface probe to measure liquid levels, the probe is first electrically grounded to either the metal stove pipe or another metal object nearby. When no ground is available, reproducible measurements can be obtained by clipping the ground lead to the handle of the interface probe case.

The probe tip is then lowered into the well and submerged in the groundwater. An oscillating (beeping) tone indicates the probe is in water. The probe is slowly raised until either the oscillating tone ceases or becomes a steady tone. In either case, this is the depth-to-water (DTW) indicator and the DTW measurement is made accordingly. The steady tone indicates floating hydrocarbons. In this case, the probe is slowly raised until the steady tone ceases. This is the depth-to-product (DTP) indicator and the measurement of DTP is recorded. A corrected depth to groundwater to account for floating hydrocarbons can be calculated by using the following formula:

CDTW = DTW - (SP.G x LHT).
CDTW = Corrected depth to groundwater.
DTW = Measured depth to groundwater.
SP.G = Specific gravity: unweathered gasoline = 0.75; diesel = 0.80
LHT = Measured liquid hydrocarbon thickness.

The corresponding groundwater elevation is the difference between a previously determined well reference elevation and either the depth to groundwater or the corrected depth to groundwater.

The process of lowering and raising the probe must be repeated several times to ensure accurate measurements. The DTW and DTP measurements are recorded on the liquid-level data sheet. When floating product is indicated by the probe's response, a product bailer is lowered partially through the product-water interface to confirm the product on the water surface, and as further indication of product thickness, particularly in cases where the product layer is quite thin. Either this measurement or the difference between DTW and DTP is recorded on the data sheet as "product thickness."

In order to avoid cross-contamination of wells during the liquid-level measurement process, wells are measured in the order of "clean" to "dirty" (where such information is available). In addition, all measurement equipment is cleaned with TSP or similar solution and thoroughly rinsed with deionized water before use, between measurements in respective wells, and at the completion of the day's activities.

APPENDIX C

LABORATORY ANALYTICAL REPORT AND CHAIN OF CUSTODY DOCUMENTATION

CL

McCAMPBELL ANALYTICAL INC.
110 2nd Avenue South, #D7, Pacheco, CA 94553-5560
Telephone : 925-798-1620 Fax : 925-798-1622
http://www.mccampbell.com E-mail: main@mccampbell.com

ENSR 10324 Placer Lane, #200 Sacramento, CA 95827	Client Project ID: #6908-082.120; UAL/Oakland Bldg 110	Date Sampled: 12/27/99
		Date Received: 12/27/99
	Client Contact: Alan Klein	Date Extracted: 12/27/99
	Client P.O:	Date Analyzed: 12/27/99

01/04/2000

Dear Alan:

Enclosed are:

1). the results of **3** samples from your **#6908-082.120; UAL/Oakland Bldg 110** project,

2). a QC report for the above samples

3). a copy of the chain of custody, and

4). a bill for analytical services.

All analyses were completed satisfactorily and all QC samples were found to be within our control limits. If you have any questions please contact me. McCampbell Analytical Laboratories strives for excellence in quality, service and cost. Thank you for your business and I look forward to working with you again.

Yours truly,

Edward Hamilton, Lab Director

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ENSR 10324 Placer Lane, #200 Sacramento, CA 95827	Client Project ID: #6908-082.120; UAL/Oakland Bldg 110	Date Sampled: 12/27/99
		Date Received: 12/27/99
	Client Contact: Alan Klein	Date Extracted: 12/27-12/28/99
	Client P.O:	Date Analyzed: 12/27-12/28/99

Gasoline Range (C6-C12) Volatile Hydrocarbons as Gasoline*, with Methyl tert-Butyl Ether* & BTEX*

EPA methods 5030, modified 8015, and 8020 or 602; California RWQCB (SF Bay Region) method GCFID(5030)

Lab ID	Client ID	Matrix	TPH(g)+	MTBE	Benzene	Toluene	Ethylben-zene	Xylenes	% Recovery Surrogate
28152	MW1	W	ND	---	ND	ND	ND	ND	102
28153	MW2	W	110,c	---	43	ND	ND	ND	100
28154	MW3	W	ND	---	ND	ND	0.54	ND	102
Reporting Limit unless otherwise stated; ND means not detected above the reporting limit		W	50 ug/L	5.0	0.5	0.5	0.5	0.5	
		S	1.0 mg/kg	0.05	0.005	0.005	0.005	0.005	

* water and vapor samples are reported in ug/L, wipe samples in ug/wipe, soil and sludge samples in mg/kg, and all TCLP and SPLP extracts in ug/L

cluttered chromatogram; sample peak coelutes with surrogate peak

+The following descriptions of the TPH chromatogram are cursory in nature and McCampbell Analytical is not responsible for their interpretation: a) unmodified or weakly modified gasoline is significant; b) heavier gasoline range compounds are significant(aged gasoline?); c) lighter gasoline range compounds (the most mobile fraction) are significant; d) gasoline range compounds having broad chromatographic peaks are significant; biologically altered gasoline?; e) TPH pattern that does not appear to be derived from gasoline (?); f) one to a few isolated peaks present; g) strongly aged gasoline or diesel range compounds are significant; h) lighter than water immiscible sheen is present; i) liquid sample that contains greater than ~5 vol. % sediment; j) no recognizable pattern.

DHS Certification No. 1644

Edward Hamilton, Lab Director

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ENSR 10324 Placer Lane, #200 Sacramento, CA 95827	Client Project ID: #6908-082.120; UAL/Oakland Bldg 110	Date Sampled: 12/27/99
		Date Received: 12/27/99
	Client Contact: Alan Klein	Date Extracted: 12/27/99
	Client P.O:	Date Analyzed: 12/27/99

Diesel Range (C10-C23) Extractable Hydrocarbons as Diesel *

EPA methods modified 8015, and 3550 or 3510; California RWQCB (SF Bay Region) method GCFID(3550) or GCFID(3510)

Lab ID	Client ID	Matrix	TPH(d)+	% Recovery Surrogate
28152	MW1	W	ND	99
28153	MW2	W	180,a/e	101
28154	MW3	W	90,a/e	102
Reporting Limit unless otherwise stated; ND means not detected above the reporting limit		W	50 ug/L	
		S	1.0 mg/kg	

* water and vapor samples are reported in ug/L, wipe samples in ug/wipe, soil and sludge samples in mg/kg, and all TCLP / STLC / SPLP extracts in ug/L

cluttered chromatogram resulting in coeluted surrogate and sample peaks, or; surrogate peak is on elevated baseline, or; surrogate has been diminished by dilution of original extract.

+The following descriptions of the TPH chromatogram are cursory in nature and McCampbell Analytical is not responsible for their interpretation: a) unmodified or weakly modified diesel is significant; b) diesel range compounds are significant; no recognizable pattern; c) aged diesel? is significant); d) gasoline range compounds are significant; e) medium boiling point pattern that does not match diesel (Fuel oil); f) one to a few isolated peaks present; g) oil range compounds are significant; h) lighter than water immiscible sheen is present; i) liquid sample that contains greater than ~5 vol. % sediment.

DHS Certification No. 1644

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ENSR 10324 Placer Lane, #200 Sacramento, CA 95827	Client Project ID: #6908-082.120; UAL/Oakland Bldg 110	Date Sampled: 12/27/99
		Date Received: 12/27/99
	Client Contact: Alan Klein	Date Extracted: 12/28/99
	Client P.O:	Date Analyzed: 12/28/99

Oxygenated Volatile Organics By GC/MS

EPA method 8260 modified

Lab ID	28152	28153	28154		Reporting Limit	
Client ID	MW1	MW2	MW3			
Matrix	W	W	W		S	W
Compound	Concentration*				ug/kg	ug/L
Di-isopropyl Ether (DIPE)	ND	ND<5	ND<10		5.0	1.0
Ethyl tert-Butyl Ether (ETBE)	ND	ND<5	ND<10		5.0	1.0
Methyl-tert Butyl Ether (MTBE)	ND	110	270		5.0	1.0
tert-Amyl Methyl Ether (TAME)	ND	ND<5	ND<10		5.0	1.0
tert-Butanol	ND	ND<25	ND<50		25	5.0
Surrogate Recoveries (%)						
Dibromofluoromethane	99	96	106			
Comments:						

* water samples are reported in ug/L, soil and sludge samples in ug/kg, wipes in ug/wipe and all TCLP / STLC / SPLP extracts in ug/L

ND means not detected above the reporting limit; N/A means surrogate not applicable to this analysis

(h) lighter than water immiscible sheen is present; (i) liquid sample that contains greater than ~5 vol. % sediment; (j) sample diluted due to high organic content

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		Date Received: 12/27/99
	Client Contact: Alan Klein	Date Extracted: 12/27/99
	Client P.O:	Date Analyzed: 12/27/99

Analytical methods			pH	Total Solids	Total Suspended Solids	Total Dissolved Solids	Specific Conductance
			EPA 150.1, 9040, 9045	EPA 160.3, SM2540B	EPA 160.2, SM2540D	EPA160.1, SM2540C	EPA 120.1, 9050 SM2510
Lab ID	Client ID	Matrix	pH @ _°C	TS	TSS	TDS	Conductivity
28152	MW1	W	—	—	—	5800	—
Reporting Limit or Method Accuracy unless otherwise stated; ND means not detected above the reporting limit; N/A means not applicable		W	± 0.05	10 mg/L	4 mg/L	20 mg/L	10 µmhos/cm
		S	± 0.1	N/A	N/A	N/A	N/A
Reporting Units		—	-log(a$_H$$^+$) @ _ °C	mg/L	mg/L	mg/L	µmhos/cm @ _ °C

DHS Certification No. 1644

_____Edward Hamilton, Lab Director

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QC REPORT

Date: 12/26/99-12/27/99 Matrix: Water

Extraction: N/A

Compound	Concentration: ug/L				%Recovery		RPD
	Sample	MS	MSD	Amount Spiked	MS	MSD	
SampleID: 25438				Instrument: GC-7			
Xylenes	0.000	337.0	332.0	300.00	112	111	1.5
Ethyl Benzene	0.000	108.0	107.0	100.00	108	107	0.9
Toluene	0.000	107.0	107.0	100.00	107	107	0.0
Benzene	0.000	106.0	106.0	100.00	106	106	0.0
MTBE	0.000	83.0	85.0	100.00	83	85	2.4
GAS	0.000	1084.5	1044.6	1000.00	108	104	3.8
SampleID: 122799				Instrument: GC-2 A			
TPH (diesel)	0.000	278.0	278.0	300.00	93	93	0.0
SampleID: 122799				Instrument: IR-1			
TRPH	0.000	28.0	27.6	23.70	118	116	1.4

$$\%\ \text{Recovery} = \frac{(MS - Sample)}{AmountSpiked} \cdot 100$$

$$\text{RPD} = \frac{(MS - MSD)}{(MS + MSD)} \cdot 2 \cdot 100$$

RPD means Relative Percent Deviation

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QC REPORT

VOCs (EPA 8240/8260)

Date: 12/28/99-12/29/99 Matrix: Water

Extraction: N/A

Compound	Concentration: ug/L				%Recovery		RPD
	Sample	MS	MSD	Amount Spiked	MS	MSD	
SampleID: 28358				Instrument: GC-10			
Tolune	0.000	104.0	93.0	100.00	104	93	11.2
Benzene	0.000	110.0	103.0	100.00	110	103	6.6
Chlorobenzene	0.000	110.0	98.0	100.00	110	98	11.5
Trichloroethane	0.000	94.0	84.0	100.00	94	84	11.2
1,1-Dichloroethene	0.000	93.0	100.0	100.00	93	100	7.3
tret-Amyl Methyl Ether	0.000	103.0	94.0	100.00	103	94	9.1
Methyl tret-Butyl Ether	0.000	95.0	88.0	100.00	95	88	7.7
Ethyl tret-Butyl Ether	0.000	94.0	90.0	100.00	94	90	4.3
Di-isopropyl Ether	0.000	102.0	101.0	100.00	102	101	1.0

$$\%\ \text{Recovery} = \frac{(MS - Sample)}{AmountSpiked} \cdot 100$$

$$\text{RPD} = \frac{(MS - MSD)}{(MS + MSD)} \cdot 200$$

RPD means Relative Percent Deviation

GeoAnalytical Laboratories, Inc.

1405 Kansas Avenue Modesto, CA 95351 Phone (209) 572-0900 Fax (209) 572-0916

CERTIFICATE OF ANALYSIS

General Minerals

Report # K362-01

Date: 12/30/99

McCampbell Analytical
110 2nd Avenue South
Pacheco CA 94553-5560

Project: 18237 ENSR

PO#

Date Rec'd: 12/28/99
Date Started: 12/28/99
Date Completed: 12/30/99

Date Sampled: 12/27/99
Time:
Sampler :

Sample ID: MW1
Lab ID: K38126

Method	MDL	Analyte	Results	Units
6010	1.0	Calcium	144	mg/L
6010	1.0	Magnesium	140	
6010	1.0	Sodium	1780	
6010	1.0	Potassium	52	
2340B	1	Total Hardness/CaCO3	935	
310.1	10	Total Alkalinity	800	
310.1	10	Carbonate	ND	
310.1	10	Bicarbonate	800	
310.1	10	Hydroxide Alkalinity	ND	
300	1	Sulfate	430	
300	1	Chloride	2650	
425.1	0.05	MBAS	ND	
6010	0.1	Iron	9.3	
6010	0.05	Copper	ND	
6010	0.05	Zinc	ND	
6010	0.01	Manganese	1.75	
160.1	10	Total Dissolved Solids	6130	
150.1	NA	pH	7.48	Std.Units
120.1	1	Specific Conductance	10290	µmhos/cm

Ramiro Salgado
Chemist

Certification # 1157

Donna Keller
Laboratory Director

M901376

18237 zens 36

ENSR CHAIN OF CUSTODY RECORD

Page 1 of 1

Client/Project Name: UAL/OAKLAND BLDG 110	Project Location: 1100 AIRPORT DR OAKLAND, CA.
Project Number: 6908-082.120	Field Logbook No.:
Sampler: (Print Name) /Affiliation: TRACE RANKIN / ENSR	Chain of Custody Tape No.:
Signature:	Send Results/Report to: ALAN KLEIN 10324 PLACER LN #200 SACTO PH(916)362-7100 / FAX (916)362-8100

Analysis Requested

Field Sample No./ Identification	Date	Time	Grab	Comp	Sample Container (Size/Matl)	Sample Type (Liquid, Sludge, Etc.)	Preservative	Field Filtered	TPH-GRO	TPH-D	MTBE by 8260	General Minerals SDA 6000 7000 TDS SPA 160.1			Lab I.D.	Remarks
MW-1	12/27/99	0915	X		4 VOAs 2 L Poly 2 L Poly	AMBER WATER	HCL NITRIC ICE	NO	X	X	X	X	X			28152
MW2	12/27/99	1040	X		4 VOAs 2 L GL Am		HCL ICE	NO								28153
MW3	12/27/99	1050	X		↓	↓	↓	NO	↓	↓	↓					28154

MW-1: 4 VOAs w/HCL; 2 GLASS AMBER LITER (CHEM PRESS); 2 LITER POLY - NITRIC; 2 LITERS POLY - NON PRESS

VOAS | O&G | METALS | OTHER

ICE/T ✓
GOOD CONDITION ✓
HEAD SPACE ABSENT ✓
PRESERVATION APPROPRIATE ✓
CONTAINERS ✓

Relinquished by: (Print Name) TRACE RANKIN Signature:	Date: 12/27/99 Time: 1155	Received by: (Print Name) Signature: Jina A Butler	Date: 12/27/99 Time: 11:55
Relinquished by: (Print Name) Signature:	Date: Time:	Received by: (Print Name) Signature:	Date: Time:
Relinquished by: (Print Name) Signature:	Date: Time:	Received by: (Print Name) Signature:	Date: Time:

Analytical Laboratory (Destination):
McCAMPBELL ANALYTICAL
110 2ND AVE SOUTH #D7
PACHECO, CA. 94553
PH (925)798-1620
FAX (925)798-1622

Serial No. 29171

GeoAnalytical Laboratories, Inc.

1405 Kansas Avenue Modesto, CA 95351 Phone (209) 572-0900 Fax (209) 572-0916

Report# K362-01

QC REPORT

McCampbell Analytical
110 2nd Avenue South
Pacheco CA 94553-5560

Dates Analyzed 12/28/99-12/30/99

Analyte	Batch #	Method	Original	Duplicate	MS % Recovery	MSD % Recovery	RPD	RPD	Blank
Calcium	I05851	6010			93.8	95.8		2.1	ND
Magnesium	I05852	6010			93.6	95.0		1.6	ND
Sodium	I05854	6010			94.9	96.0		1.2	ND
Potassium	I05853	6010			98.5	100.6		2.2	ND
Hardness	I05893	SM2340B			91.8	95.0		3.4	ND
Total Alkalinity	I05910	310.1			100.0	100.0		0.0	ND
Carbonate	I05910	310.1			100.0	100.0		0.0	ND
Bicarbonate	I05910	310.1			100.0	100.0		0.0	ND
Hydroxide Alkalinity	I05910	310.1			100.0	100.0		0.0	ND
Sulfate	I05838	300			120.0	120.0		0.0	ND
Chloride	I05836	300			104.0	104.0		0.0	ND
MBAS	I05832	425.1			104.0	104.0		0.0	ND
Iron	I05864	6010			88.0	88.0		0.0	ND
Copper	I05863	200.7			88.0	86.0		2.3	ND
Zinc	I05870	6010			98.0	96.0		2.1	ND
Manganese	I05865	6010			98.0	98.0		0.0	ND
TDS (Filterable Residue)	I05903	160.1	270	270			0.0		ND
pH	I05839	150.1	7.48	7.48			0.0		ND
Specific Conductance (EC)	I05840	120.1	10330	10290			0.4		ND

Ramiro Salgado
Chemist

Certification # 1157

Donna Keller
Laboratory Director

K362-01

McCAMPBELL ANALYTICAL INC.

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CHAIN OF CUSTODY RECORD

TURN AROUND TIME ☐ RUSH ☐ 24 HOUR ☐ 48 HOUR ☒ 5 DAY ☐ ROUTINE

Report To: Ed Hamilton Bill To: MAI

Project #: 18237 Project Name: ENSR

Project Location:

SAMPLE ID	LOCATION	SAMPLING Date	SAMPLING Time	# Containers	Type Containers	MATRIX Water	MATRIX Soil	MATRIX Air	MATRIX Sludge	MATRIX Other	METHOD PRESERVED Ice	METHOD PRESERVED HCl	METHOD PRESERVED HNO_3	METHOD PRESERVED Other	ANALYSIS REQUEST EPA 601/8010	EPA 602/8020	EPA 608/808	EPA 608/8080-PCB's only	EPA 624/8240/8260	EPA 625/8270	CAM – 17 Metals	EPA – Priority Pollutant Metals	LUFT Metals	LEAD (7240/7421/239.2/6010)	ORGANIC LEAD	RCI	OTHER Conrad Minerals	OTHER	OTHER	OTHER	OTHER	OTHER	COMMENTS
MW1		12/27/99		1	poly	X					X																X	K38126					28152

Relinquished By:	Date:	Time:	Received By:
Nina A Butler	12/27/99		Cal Overnight
Relinquished By: California Overnight	Date: 12/28/99	Time: 10:14	Received By: Jennifer Hoffman
Relinquished By:	Date:	Time:	Received By:

Remarks: