March 1988

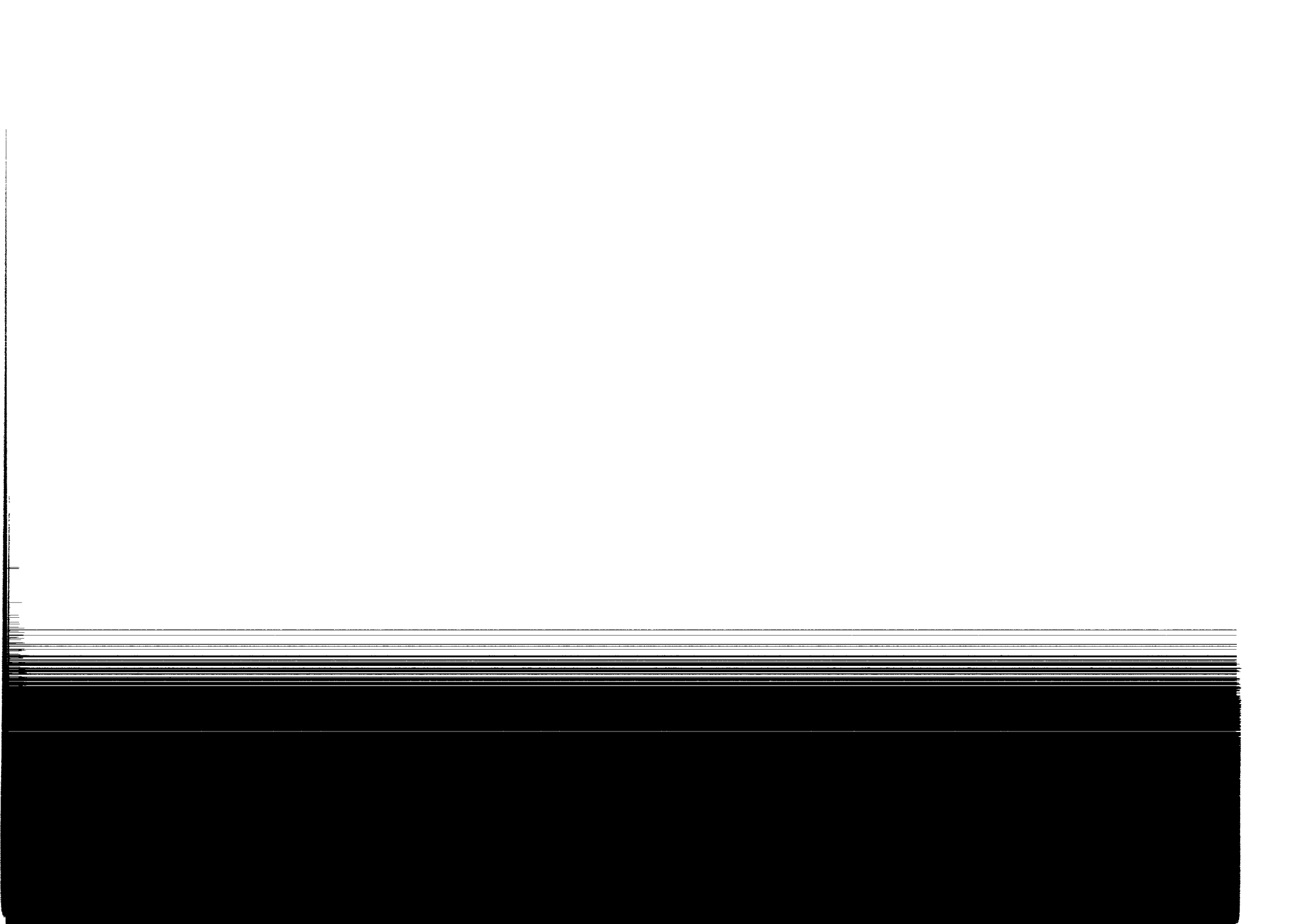
EPA-700/8-88-038

Hazardous Waste Ground-Water
Task Force

Evaluation of Texaco Refining and Marketing, Anacortes, Washington

EPA U.S. Environmental Protection Agency, Region 10

Washington State Department of Ecology



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAY 5 1988

OFFICE OF
ADMINISTRATION
AND RESOURCES
MANAGEMENT

MEMORANDUM

SUBJECT: Hazardous Waste Collection

FROM: Barbara S. Roth, Acting Chief
Information Services Branch

TO: See Addressees

This package contains the following report which is to be included in your Hazardous Waste Collection:

Hazardous Waste Ground-Water Task Force - Evaluation of Texaco Refining and Marketing, Inc., Anacortes, Washington.
EPA-700/8-88/038, March 1988.

If you have any questions, please contact Jean Davis at FTS 475-7705.

Attachment

ADDRESSEES:

EPA Librarians -- Regions 1-10; Edison, NJ; RTP, NC; Cincinnati, OH; Ada, OK; Las Vegas, NV; NEIC, Denver, CO; and Headquarters:

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MARCH 7, 1988

UPDATE OF THE HAZARDOUS WASTE GROUND WATER TASK FORCE EVALUATION OF TEXACO REFINING AND MARKETING, INC. ANACORTES, WASHINGTON FACILITY

The United States Environmental Protection Agency (EPA) Region 10 and the Washington Department of Ecology (Ecology), in conjunction with the EPA Hazardous Waste Ground Water Task Force (Task Force), conducted an evaluation of the ground water monitoring program at the Texaco Refining and Marketing, Inc. hazardous waste treatment, storage and disposal facility in Anacortes, Washington. The Texaco facility, which engages in the land treatment of hazardous waste, is located approximately 70 miles north of Seattle. The on-site field inspection was conducted on December 17, 1986 and from January 12 - 16, 1987.

Texaco is one of 58 facilities that have been evaluated by the Task Force. The purpose of the Task Force evaluations was to determine the adequacy of a facility's ground water monitoring program in regard to the applicable state and federal ground water monitoring requirements. The Task Force effort came about in response to concerns as to whether operators of hazardous waste treatment, storage and disposal facilities were complying with such requirements.

The inspection at Texaco resulted in findings that include the following, which are discussed fully in the text of the report:

1. The hydrogeologic characterization of the site was inadequate.
2. The ground water monitoring network was inadequate.
3. Improvements to the facility's sampling and analysis plan were needed.
4. Further analyses were determined to be necessary to determine whether the presence of certain inorganic constituents (metals) in downgradient wells are indicative of a release from the land treatment units or are naturally occurring.

Pursuant to the findings of the inspection, on September 30, 1987, Ecology issued an order to Texaco regarding the first three items listed above. A penalty of $6,000 was also assessed for the regulatory violations involved. Texaco was ordered to submit a proposal to improve its hydrogeologic characterization of the site, and to subsequently install an adequate monitoring system. An improved sampling and analysis plan was also required.

Although Texaco is appealing the penalty, it has agreed to comply with the terms of the order. A revised Sampling and Analysis Plan was submitted in October 1987. A proposal for site characterization work was submitted to Ecology on November 24, 1987. Ecology responded to that proposal on December 31, 1987. Texaco is now expected to proceed with the necessary site characterization and monitoring efforts needed for the facility to come into compliance with state and federal regulations.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 10

and

THE WASHINGTON DEPARTMENT OF ECOLOGY

HAZARDOUS WASTE GROUND WATER TASK FORCE INSPECTION

Texaco Marketing and Refining, Inc.

Anacortes, Washington

March 1988

Marcia L. Bailey,

Project Coordinator

RCRA Compliance Section

U.S. EPA Region 10

Acknowledgements

The substantial written contributions made to this report by Denis Erickson and Will Abercrombie are gratefully acknowledged.

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EXECUTIVE SUMMARY

BACKGROUND

This report describes the comprehensive ground water monitoring inspection conducted at Texaco Refining and Marketing, Inc. Puget Sound Plant (Texaco), a petroleum refinery in Anacortes, Washington. The inspection was conducted in January 1987 by Region 10 of the United States Environmental Protection Agency (EPA) and the Washington Department of Ecology (Ecology), in conjunction with the EPA Hazardous Waste Ground Water Task Force.

Texaco is an operating hazardous waste treatment, storage and disposal facility which engages in the land treatment of hazardous waste generated from its refinery operations. The facility is subject to the Resource Conservation and Recovery Act (as amended) and to the interim status and permit application standards promulgated and enforced by the state of Washington. The facility is seeking a final permit for its hazardous waste management activities, including land treatment. Texaco certified that it was in compliance with applicable ground water monitoring and financial assurance regulations by November 1985, as required by the Hazardous and Solid Waste Amendments of 1984, in order to to continue to engage in land treatment activities under interim status until a final permit determination is made.

The Texaco refinery, in operation since 1958, is situated two miles east of the city of Anacortes on the southern portion of March Point, a north-south oriented peninsula about 1.3 miles wide and 2.6 miles long. Hazardous and non-hazardous wastes have been disposed in the two land treatment units now designated only for hazardous waste. A third land treatment unit receives only non-hazardous waste. The two regulated units received hazardous waste both prior to and after November 19, 1980. Hazardous wastes applied to the land treatment units include slop oil emulsion solids, API sludge, leaded tank bottoms, refinery scale and refinery oily wastes. Texaco currently generates DAF float and heat exchanger bundle cleaning sludge, and plans to land treat DAF float/slop oil emulsion mixtures.

Objectives of the evaluation of Texaco included determining if:

(1) The ground water monitoring system is capable of immediately detecting any statistically significant amounts of hazardous waste or hazardous waste constituents that may migrate from the waste management units to the aquifer which is uppermost in the vicinity of each waste management unit;

(2) Designated RCRA monitoring wells are properly located and constructed;

(3) Texaco has developed and is following an adequate plan for ground water sampling and analysis, and if well purging and sampling are appropriately conducted;

(4) Required analyses and statistical tests have been conducted on samples from the designated RCRA monitoring wells;

(5) Ground water contamination currently exists;

(6) The hydrogeology of the site and the geochemistry of the ground water have been appropriately characterized; and

(7) Hazardous waste is appropriately characterized by Texaco prior to placing in the land treatment units.

The investigation team consisted of personnel from EPA Region 10; Ecology; EPA Headquarters; and contract personnel provided by EPA Headquarters for obtaining samples. To accomplish the objectives, the investigation team reviewed records, inspected the ground water monitoring system, conducted interviews with appropriate facility representatives, and collected samples from selected ground water monitoring wells, lysimeters and surface waters for extensive chemical analyses.

SUMMARY OF FINDINGS

1. Texaco's hydrogeologic characterization of the facility is inadequate. The hydrogeologic units defined by Texaco are based on stratigraphic boundaries rather than similarities of lithology and hydrogeologic properties. This approach has not defined the preferred pathways for ground water and contaminant movement.

2. Four hydrogeologic units at the facility are defined in this report: Shallow Zone, Upper Aquitard, Outwash Aquifer, and Lower Aquitard. These units are defined based on existing information, and will likely require refinement as additional hydrogeologic information is obtained through required site characterization efforts.

3. Extensive field studies including drilling and the installation of additional monitoring wells are needed to define the hydrogeology at both land treatment units and the seep area west of the west land treatment unit. The field studies should be designed to define the detailed lithology and hydrogeologic properties of all units including the Lower Aquitard.

4. The ground water monitoring network at Texaco does not satisfy interim status requirements, as described in 40 CFR §§ 265.90, 265.91 and 265.92. Although it is not possible to fully evaluate the adequacy of the monitoring network until the hydrogeology has been characterized, obvious deficiencies exist in the monitoring network. These deficiencies include inappropriate screening intervals (W-15, W-17), unknown well construction details (W-1, W-2, W-3), potentially broken casing (W-16), wells contaminated with grout sealant (W-11, W-12, W-13 and W-14), and inadequate well spacing.

5. The Sampling and Analysis Plan, along with a few sample collection procedures, required modifications. Appropriate instruments for obtaining pH values of samples in the field (as opposed to the

laboratory) should be acquired by Texaco, to avoid changes in sample chemistry which may occur when exposing the samples to air for even brief periods of time.

6. Texaco's current (at the time of the inspection) Waste Analysis Plan appeared to meet regulatory requirements.

7. Texaco should perform its required statistical tests using upgradient wells individualized to each of the two land treatment units, since the units are likely distinct geochemically, and upgradient water chemistry would not be expected to be the same at each unit.

8. A few inorganic hazardous constituents which are common to refinery wastes, and which have been identified in waste streams that are disposed in Texaco's land treatment units and in soil within the treatment zone, were detected during this inspection in various downgradient wells but not in background wells. These include cobalt, vanadium, cadmium, nickel and lead. These metals have been detected in some background soil cores and lysimeter samples obtained and analyzed by Texaco. Once an improved ground water monitoring network has been installed, appropriate analyses for these constituents should be made at all monitoring wells, to determine whether a release has occurred from the land treatment units or if such metals are naturally occuring in ground water at the observed levels.

INTRODUCTION

The United States Environmental Protection Agency (EPA) is charged with administration of the Resource Conservation and Recovery Act (RCRA), which regulates operations at hazardous waste treatment, storage and disposal facilities. Such facilities are subject to RCRA (as amended) and to regulations promulgated thereunder, found at 40 CFR Parts 260 through 268, and implemented through the hazardous waste permit program of 40 CFR Part 270. These facilities are also subject to applicable state regulations, and in some cases, state hazardous waste management programs may be in effect in lieu of federal rules and regulations. Such is the case in the state of Washington, which received Phase I authorization in August 1983 and full authorization in January 1986 to conduct its hazardous waste management program in lieu of the federal government*. The Department of Ecology (Ecology) is the state agency responsible for administration of state dangerous waste laws and regulations in Washington. The Hazardous and Solid Waste Amendments of 1984 (HSWA), and the regulations promulgated pursuant to those amendments, continue to be administered and enforced only by EPA in Region 10.

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* Although Washington statutes and regulations use the term "dangerous waste" instead of "hazardous waste," the latter term is used in this report to describe the subject wastes at the Texaco facility.

The federal and state statutes and regulations are intended to address hazardous waste management operations in a manner that ensures that hazardous waste is properly and safely managed. Ground water monitoring requirements for land disposal facilities are included as part of these regulations, and are intended to ensure that releases from hazardous waste management units will be immediately detected, and that when such a release is known or detected, that the nature and extent of the contamination will be fully characterized, to enable prediction of contaminant movement and to facilitate corrective action.

Facilities which engage in land disposal of hazardous waste are being evaluated throughout the United States to determine compliance with ground water monitoring requirements and to evaluate the degree to which such facilities are protecting the ground water beneath their sites. The inspections are being conducted in conjunction with the EPA Hazardous Waste Ground Water Task Force (Task Force). The Task Force was established by the EPA Administrator to address rising concerns regarding discoveries across the nation of incidents of serious ground-water contamination. Hazardous waste land disposal facilities are a potential source of contamination which occurs when pollutants such as toxic chemicals seep through the soil into underlying aquifers. Depending on the nature of both the aquifer and the contaminant, such contamination may move off-site with the ground water and cause serious consequences for downgradient users of the aquifer water and other environmental receptors.

The Task Force effort has two major goals: to determine whether regulated hazardous waste disposal facilities are meeting applicable state and federal requirements to protect ground water from contamination by hazardous waste and hazardous waste constituents; and to identify and evaluate causes of any deficiences in compliance and recommend measures to amend such deficiencies.

This report describes the Task Force inspection at the Texaco Refining and Marketing, Inc. Puget Sound Plant (Texaco), a petroleum refinery in Anacortes, Washington, which engages in the land treatment of hazardous waste generated on-site.

Objectives of the evaluation of Texaco include determination of compliance with the requirements of WAC-173-303-400(3)(a), which incorporates by reference 40 CFR Part 265, Subparts F through R (including interim status requirements for ground-water monitoring and operations at land treatment facilities); and WAC-173-303-806(4)(a)(xx), which describes ground water and other hydrogeologic characterization information required to be submitted with a facility's Part B permit application. Specific objectives of the evaluation at Texaco included determining if:

(1) The ground water monitoring system is capable of immediately detecting any statistically significant amounts of hazardous waste or hazardous waste constituents that may migrate from the waste management units to the aquifer which is uppermost in the vicinity of each waste management unit;

(2) Designated RCRA monitoring wells are properly located and constructed;

(3) Texaco has developed and is following an adequate plan for ground water sampling and analysis, and if well purging and sampling are appropriately conducted;

(4) Required analyses and statistical tests have been conducted on samples from the designated RCRA monitoring wells;

(5) Ground water contamination currently exists;

(6) The hydrogeology of the site and the geochemistry of the ground water have been appropriately characterized; and

(7) Hazardous waste is appropriately characterized by Texaco prior to placing in the land treatment units.

The investigation team consisted of personnel from EPA Region 10; Ecology; EPA Headquarters; and contract personnel provided by EPA Headquarters for obtaining samples. To accomplish the objectives, the investigation team reviewed records, inspected the ground water monitoring system, conducted interviews with appropriate facility representatives, and collected samples from selected ground water monitoring wells, lysimeters and surface waters for extensive chemical analyses.

THE INSPECTION

The inspection of the Texaco facility consisted of the following activities:

Review and evaluation of records and documents from the Region 10 office, Ecology, and Texaco;

Physical inspection of the facility on December 17, 1986, and from January 12 through 16, 1987, which included further review of records and obtaining ground-water, lysimeter and surface-water samples; and

Analysis of samples and subsequent evaluation of all available ground water sampling data.

Participants in the inspection team consisted of the following: Denis Erickson, Will Abercrombie, Dave Davies and David Frank, Ecology; Marcia Bailey, EPA Region 10; Brian Lewis, EPA Headquarters; and Mark McElroy, John Hatcher and Dennis Shea, the Versar sampling team.

REVIEW OF RECORDS AND DOCUMENTS

Records and documents from the EPA Region 10 and Ecology offices, compiled by an EPA contractor, were reviewed prior to and during the on-site inspection. Prior to the inspection, company personnel were requested to make

available specific, additional records during the inspection, including all ground water monitoring data not previously submitted to EPA. Requests for other records were requested during the inspection. A few records were requested by and mailed to EPA subsequent to the inspection.

During the inspection, a review of selected facility records was conducted to determine the nature, extent, and reliability of waste analyses and waste location records prepared by Texaco since the RCRA regulations came into effect in 1980. Facility representatives were interviewed to aid in identifying documents of interest and to discuss the contents of documents, and to discuss facility operations. A special session was held during the inspection in which the hydrogeologic characterization of the site was discussed among EPA, Ecology and facility representatives.

Records selected for review were copied by Texaco and made available to the inspectors. They included waste analysis plans used by Texaco from 1984 through the inspection dates; and a selection of the following records prepared from 1982 to the time of the inspection: waste analysis records for waste generated on-site and off-site, manifests, waste location records, lysimeter installation reports, material safety data sheets, waste minimization practices, waste stream characterizations, landfarm records and lab reports. Later supplied to EPA were the facility's ground water monitoring results and statistical evaluations for 1987.

FIELD ACTIVITIES

Field activities included identifying current waste management units and surface drainage routes, verifying monitoring well locations, obtaining ground water elevation and well depth measurements, collecting samples from 12 ground water monitoring wells, six lysimeters, and two surface drainage routes; and observing Texaco personnel purge and sample several monitoring wells.

Field Team Sampling Activities

On the first day of the inspection, organic vapor readings (using an HNU meter) and depth-to-water measurements were made by the field team at the ground water monitoring wells and piezometers. In all cases, attempts were made to identify and use the same measuring point on the well that the facility utilizes for such measurements. Total depth of wells and piezometers were measured where no dedicated pumps or bailers were present (results are reported in Appendix A). On subsequent days of the inspection, additional water level measurements were made at each well to be sampled.

Samples from 12 ground water monitoring wells, six lysimeters and two surface water drainage points were obtained by the field team during the inspection. Duplicates or replicates of samples from each well and of blank samples (trip and field) were provided to Texaco representatives. Texaco declined to obtain split samples from some lysimeters where the small quantity of water precluded sufficient sample collection. Duplicates of surface water samples were provided to Texaco.

A summary description of the sampling activities of the field team at each well is given in Table 1. Wells were purged and sampled using dedicated bladder-type pumps. Lysimeters were sampled using a bicycle-type vacuum pump and dedicated tubing for each lysimeter, provided and operated by Texaco. Task Force personnel operated the well equipment for purposes of purging and sample collection. Surface samples were obtained by Task Force personnel by holding the appropriate containers in a current of surface water.

Typically, samples were collected by the field team pursuant to the following procedures at each well:

- A depth-to-water measurement was made using an electrical tape designed for this purpose. The probe was cleaned subsequent to each use.

- The height of the water column was calculated from the measured depth to water and the depth to the bottom of the well (using the value reported in Texaco well-construction records).

- The volume of standing water in the casing was calculated.

- The well was purged of the volume of water indicated in Table 1. Purging activities at some wells required time lapses between subsequent purges and/or sampling events, depending upon individual well yields and casing volumes.

Table 1. Well and Lysimeter Sample Collection Locations and Descriptions

	Date	Depth to Water Measured.ft.	Depth of Well Reported.ft.	Casing Vol., g	Purge Vol.,g	Purge Time, hr	Sample Collection Time, hr	Samples Collected	Notes
East Land Treatment Unit Wells									
W-2(Background)	1/13	31.6	46.63	2.4	8	1445-1511	1515-1600	All (See Appendix B and Table 2)	
W-21	1/15	3.67	28.25	4	12	1138-1200	1205-1235	All plus matrix spike	
W-22	1/14	2.63	27.95	4.1	12.5	1337-1406	1422-1525	All plus duplicate & matrix spike	
W-23	1/15	3.07	27.74	11.84	12	1003-1032	1042-1107	All	
W-1	1/15	57.81	72.41	2.3	7	0850-0930	0935-0941	VOC,POC,POX	
	1/15						1245-1307	TOX, TOC, ext. org., metals, phenols	
	1/16						0920-0934	Balance of samples	
West Land Treatment Unit Wells									
W-31 (background)	1/12	16.4	29.38	2/08	6.5	1115-1136	1140-1220	All	Purge water foamy, turbid
W-16	1/12	52.75	60.91	1.3	4	1407-1427	1438-1512	VOC,POC,POX,TOX,TOC	
	1/13						1118-1159	Balance of samples	
W-17	1/13	50.17	62.03	1.9	5 liters (to dryness)	0905-0925	1046-1100	VOC,POC,POX,TOC	
	1/13						1340-1432	TOX, ext. org.	
	1/14						0915-0926	Ext. org., metals	
	1//14						1204-1210	Balance of samples	
	1/14								

Table 1 (cont.) Well and Lysimeter Sample Collection Locations and Descriptions

	Date	Depth to Water Measured.ft.	Depth of Well Reported.ft.	Casing Vol., g	Purge Vol.,g	Purge Time	Sample Collection Time	Samples Collected	Notes
West Land Treatment Unit Wells, cont.									
W-33	1/13	53.48	60.93	1.2	3.6	0957-1020	1023-1030	VOC,POC, POX	Air being drawn into well
	1/13						1239-1317	TOX, ext org.	
	1/13						1451-1525	Ext. org., metals	
	1/14						0935-0945	Balance of samples	
W-32	1/13	40.02	48.21	1.3	4	1230-1300	1315-1345	VOC, POC, POX, TOX,	well drying up
	1/14						1014-1109	Extr.org., TOC	
	1/15						1115	None	control box not functional
	1/15						1250-1315	Metals	
	1/16						0948-0954	Insufficient for further samples	
W-24	1/14	37.5	41.8	0.53	2	1145-1230	1230-1220	VOC,POC, POX, TOC, TOX	
	1/15						1055-1105	Stopped cycling after 200 ml; no samples	
	1/16						1542-1551	Extr. org. metals	
W-15	1/15	19.75	53.83	5.5	17	1355-1435	1445-1505	all	
Surface Water Samples									
West Land Treatment Unit Runoff Ditch	1/13						1210-1300	all	
East Land Treatment Unit Curtain Drain	1/14						1400-1500	all	

Table 1 (cont.) Well and Lysimeter Sample Collection Locations and Descriptions

Location	Date	Time (hr)	Activity
West Land Treatment Unit Lysimeters			
L-86-BG-TK1	1/13	0945	400 ml total metals, 500 ml dissolved metals. Applied vacuum.
(background)	1/13	1603	VOCs, POC, POX, 500 ml total metals. Applied vacuum.
	1/14	0930	600 ml dissolved metals. Applied vacuum.
	1/15	0926	VOCs, POC, POX, 300 ml BNSs. Applied vacuum.
	1/16	0923	400 ml BNAs.
L-11	1/13	0935	500 ml metals; applied vacuum.
	1/14	0920	0 vacuum, but no water present.
	1/15	0905	0 vacuum, appeared frozen; 50 ml obtained, not kept.
	1/16	0914	Less than 10 ml obtained; no samples.
L-8	1/14	0900	0 vacuum but no water. Applied vacuum. (Last sampled 12/85.)
	1/15	0850	0 vacuum. Apparently functional but no water present.
L-9	1/15	0900	0 vacuum. Lysimeter or line appeared plugged. No sample obtained.
	1/13	0920	Applied vacuum.
L-12	1/14	0913	200 ml dissolved metals. Applied vacuum.
	1/15	0910	VOCs, POC, POX. Applied vacuum.
	1/16	0909	TOC
East Land Treatment Unit Lysimeters			
L-6E	1/13	0955	900 ml metals. Applied vacuum.
	1/13	0410	VOCs, POX, POC. Applied vacuum.
	1/14	1000	POX, 920 ml BNAs. Applied vacuum.
	1/15	0940	TOC, 600 ml phenols. Applied vacuum.
	1/16	0932	1 liter herbicides, 900 ml phenols.

Table 1 (cont.) Well and Lysimeter Sample Collection Locations and Descriptions

Location	Date	Time (hr)	Activity
East Land Treatment Unit Lysimeters, cont.			
L-86-1	1/13	1008	500 ml dissolved metals, 400 ml total metals. Applied vacuum.
	1/13	1610	VOCS, POC. Applied vacuum.
	1/14	1015	800 ml BNS. Applied vacuum.
	1/14	1555	200 ml phenols. Applied vacuum.
	1/15	0950	POX, TOC, 300 ml phenols.
L-86-BG-SE	1/13	1011	400 ml dissolved metals, 400 ml total metals. Applied vacuum.
(Background)	1/13	1630	VOCs, POX, POC. Applied vacuum.
	1/14	1022	850 ml BNAs. Applied vacuum.
	1/15	1005	TOC, 500 ml phenols.

- Sample aliquots were collected three or more times during purging. Field measurements (water temperature, pH and specific conductance) were obtained from these aliquots (and are reported in Appendix A).

- Samples were obtained as soon as practicable after purging was completed. Containers were filled in the order shown in Table 2.

- Sample containers were filled directly from the pump discharge line.

- Samples were placed in an ice chest and returned to the Task Force staging area for shipment preparation. Samples obtained for the analysis of metals, TOC and total phenols were preserved (Table 2). Split samples for Texaco were similarly prepared and turned over to facility personnel at the end of each day.

- Each day, samples which had been obtained that day (and/or the afternoon of the previous day) were packaged and shipped, under chain-of-custody, to the EPA contract laboratories. Shipping procedures were according to applicable U.S. Department of Transportation regulations (40 CFR Parts 171-177). All samples were considered "environmental" for shipping purposes.

Samples were analyzed by the EPA contract laboratories for the parameter groups shown in Table 2. Specific analytes are listed in Appendix B. Complete sample sets were not obtained from the lysimeters due to insufficient volume available. One field blank was obtained, and a trip blank which

Table 2

ORDER OF SAMPLE COLLECTION;
CONTAINERS AND PRESERVATIVES

Parameter	Bottle	Preservative* (Concentration)
1. Volatile organic analysis (VOA)	2 40-ml VOA vials	
2. Purgeable organic carbon (POC)	1 40-ml VOA vials	
3. Purgeable organic halogens (POX)	1 40-ml VOA vials	
4. Total organic halogens (TOX)	1 1-qt. amber glass	
5. Total organic carbon (TOC)	1 4-oz. glass	H_2SO_4 (95-98%)
6. Extractable organics	4 1-qt. amber glass	
7. Total metals	1 1-qt. plastic	HNO_3 (95-98%)
8. Dissolved metals	1 1-qt. plastic	HNO_3 (95-98%)
9. Phenols	1 1-qt. amber glass	H_2SO_4 (95-98%)
10. Anions	1 1-qt. plastic	
11. Carbonate/Bicarbonate	1 1-qt. plastic	
12. Sulfate/chloride	1 1-qt. plastic	

* Volume added to each sample was 5 ml except for TOC, where about 1 ml was added.

accompanied the Versar personnel to the site was also submitted for analysis. The trip blank was composed of high purity water subjected to high performance liquid chromatography. Two sets of duplicate samples were obtained for analysis.

SITE HISTORY AND OPERATIONS

OVERVIEW

The Texaco Puget Sound Plant, a petroleum refinery, is an operating treatment, storage and disposal facility which is subject to RCRA, to the interim status and permit application standards promulgated and enforced by the state of Washington, and to applicable regulations promulgated pursuant to the Hazardous and Solid Waste Amendments (HSWA) of 1984. The facility is seeking a final permit for its hazardous waste management activities, including land treatment.

The location of the Texaco facility is on the southern portion of March Point, approximately two miles east of Anacortes, Skagit County, Washington. Anacortes is approximately 70 miles north of Seattle.

The majority of Texaco's wastes are, and historically have been, treated and disposed on-site in land treatment units. The method of disposal, land treatment or landfarming, involves spreading wastes over a soil field, and tilling them into the soil. Soil bacteria and microbes digest the organic fraction of the waste, while the inorganic fraction (mostly heavy metals) is reduced and bound to soil particles. Landfarming of hazardous waste is a common practice at refineries in Washington.

The Texaco Puget Sound Plant began operation in the fall of 1958. Texaco has engaged in land treatment of hazardous waste both before and after

November 19, 1980, and the facility certified that it was in compliance with applicable ground water monitoring and financial assurance regulations by November 1985, as required by the Hazardous and Solid Waste Amendments of 1984, enabling the facility to continue to engage in land treatment activities under interim status, until a final permit determination is made.

PERMITS HISTORY

Texaco's Part A permit application was received by EPA on November 17, 1980. EPA called for Texaco's Part B permit application on September 21, 1983. The Part B application was received on March 26, 1984. A Notice of Deficiency (NOD) and warning letter was sent to Texaco May 24, 1984. Texaco resubmitted its Part B application on October 1, 1984. EPA sent a second NOD to Texaco on July 18, 1985. Texaco made new Part B application submittals on November 9, 1985 and on January 6, 1987. The land treatment demonstration portion of the permit application was submitted in September 1987.

COMPLIANCE HISTORY

The following compliance orders had been issued to Texaco regarding its hazardous waste management activities:

January 31, 1984: Ecology ordered Texaco to install vadose monitoring. A penalty of $1,000 was assessed.

February 7, 1984: Ecology ordered Texaco to submit a ground water plan capable of immediately detecting any significant amounts of hazardous waste or hazardous waste constituents, including a sampling and analysis plan. A ten thousand dollar penalty was assessed. Texaco appealed that order on March 19, 1984, and the order and penalty were rescinded on May 15, 1984. Both parties then agreed to the terms of a stipulation that included the installation of five additional wells at Texaco.

September 14, 1984: EPA and Texaco entered into a Consent Agreement and Final Order for Texaco's failure to submit a complete Part B permit application with the period specified in EPA's NOD.

December 4, 1984: Ecology issued an order requiring Texaco to install replacement wells and issued a penalty of $10,000 for failure to properly install a ground-water monitoring system. The Pollution Control Hearings Board reduced the penalty to $1,500.

April 23, 1987: Ecology issued an order to Texaco to comply with several hazardous waste management regulations regarding the designation of dangerous waste, accumulation of dangerous waste, inspection procedures, personnel training, container management and discharge of solvents. A penalty of $20,000 was assessed and is being appealed by Texaco.

September 30, 1987: Ecology ordered Texaco to rectify many of the ground water monitoring and hydrogeologic characterization deficiencies

identified as a result of the Task Force inspection. A penalty of $6,000 was assessed and is being appealed by Texaco.

FACILITY DESCRIPTION

The Texaco Puget Sound Plant refines crude oil into a variety of marketable products, primarily motor gasoline, diesel fuel, home heating oil and jet fuel. Liquefied petroleum gas, heavy industrial fuel oil, and petroleum coke are also produced. The rated plant production capacity is 78,000 barrels per day. The major processing units include: Atmospheric and Vacuum Distillation, Butane De-asphalting, Fluid Catalytic Cracking, Hydrogen Desulphurization, Catalytic Reforming, Alkylation and Coking.

The petroleum refining operations occupy the central portion of the property. Two water reservoirs are located in the north-central portion of the property, and land treatment units (landfarms) are located east and west of the reservoirs. The western flank of the site is characterized by pastureland-type vegetation interspersed with low, shrubby growth and deciduous trees. The eastern flank is characterized by mixed forest near the site boundaries. Grading activities associated with the development of the plant have disturbed a large portion of the site over the past 25 years. Consequently, there is not a common depth to the base of the treatment zone in each plot. Just north of Texaco's refinery on the same peninsula is Shell's March Point Oil Refinery. The facilities share a common fence line.

The regulated land treatment units consist of two landfarms. The east landfarm consists of 9 cells encompassing a total of 7.14 acres, and the west landfarm consists of 7 cells encompassing a total of 6.17 acres. A landfarm for the treatment of non-hazardous wastes is located adjacent and south of the west hazardous waste landfarm. Prior to April 1985, hazardous and non-hazardous wastes were not segregated, and both waste types were disposed in the east and west landfarms. A separate landfarm was brought into use at that time, and has been used since then for land treatment of non-hazardous wastes. At the time of this inspection, the east landfarm had not received waste since September 1984, due to problems with the high water table in that area. At the same time, the west landfarm reportedly had last received waste in October 1986. At the time of the inspection, there were no known solid waste management units which accepted hazardous waste prior to, but not after, November 19, 1980.

GEOLOGY AND HYDROGEOLOGY

SETTING

The Texaco Refinery is located in northwestern Washington at the northern extent of the Puget Sound Lowland. The topography of the peninsula ranges from a maximum elevation (Mean Sea Level) of about 190 feet near the center of the peninsula to sea level. The topographic expression of the peninsula is asymmetric with a steeper slope on the west side and a more gradual slope on the east side. Figures 1a and 1b deptict the refinery setting.

REGIONAL GEOLOGY

The regional geology of the vicinity is characterized by glacial sediments that were deposited by multiple glacial episodes in the Puget Sound area. The last glacial advance receded about 10,000 years before the present. The existing topography and most of the deposits observed beneath the refinery were formed during this most recent glacial episode. The deposits consist of interlayered mixtures of gravel, sand, silt, and clay. The deposits show rapid lateral and vertical variations in texture which are typical for glacial deposits. The bedrock in the vicinity consists of pre-Tertiary sedimentary and metasedimentary rocks. It does not outcrop at the facility and has not been observed in any borings drilled on-site. The existing data suggest that bedrock does not significantly influence the hydrogeology of the facility as it pertains to ground water monitoring at the regulated units.

REGIONAL HYDROGEOLOGY

The regional ground water system has not been clearly defined. Based on the proximity to base level (sea level), the area can be characterized as a regional discharge area. Hydraulically, the deep aquifer systems would be expected to show vertical upward gradients as ground water flows toward base level. Because March Point is surrounded by sea level surface water on three sides, ground water beneath the peninsula most likely has limited hydraulic connection with regionally extensive aquifers.

A number of private water supply wells are known to exist on March Point. Prior to 1955, ground water on the peninsula was used for domestic supplies and irrigation. In 1955, the city of Anacortes extended its distribution system to the peninsula, and ground water use was discontinued. Springs on the Shell property to the north are used for stock watering. Northwest Petrochemical, also located on March Point, operated injection wells for industrial wastes, but reportedly those wells have been sealed or grouted.

SITE GEOLOGY

The site geology is known from geologic logs of about 50 geotechnical soil borings, monitoring wells, and piezometers in the vicinity of the regulated units. The locations of the borings, wells and piezometers are shown in Figures 2a and 2b. Texaco has identified four geologic units: glacial till, outwash sand, interglacial sediments, and older glacial drift. The subsurface relationship of these units is shown in geologic

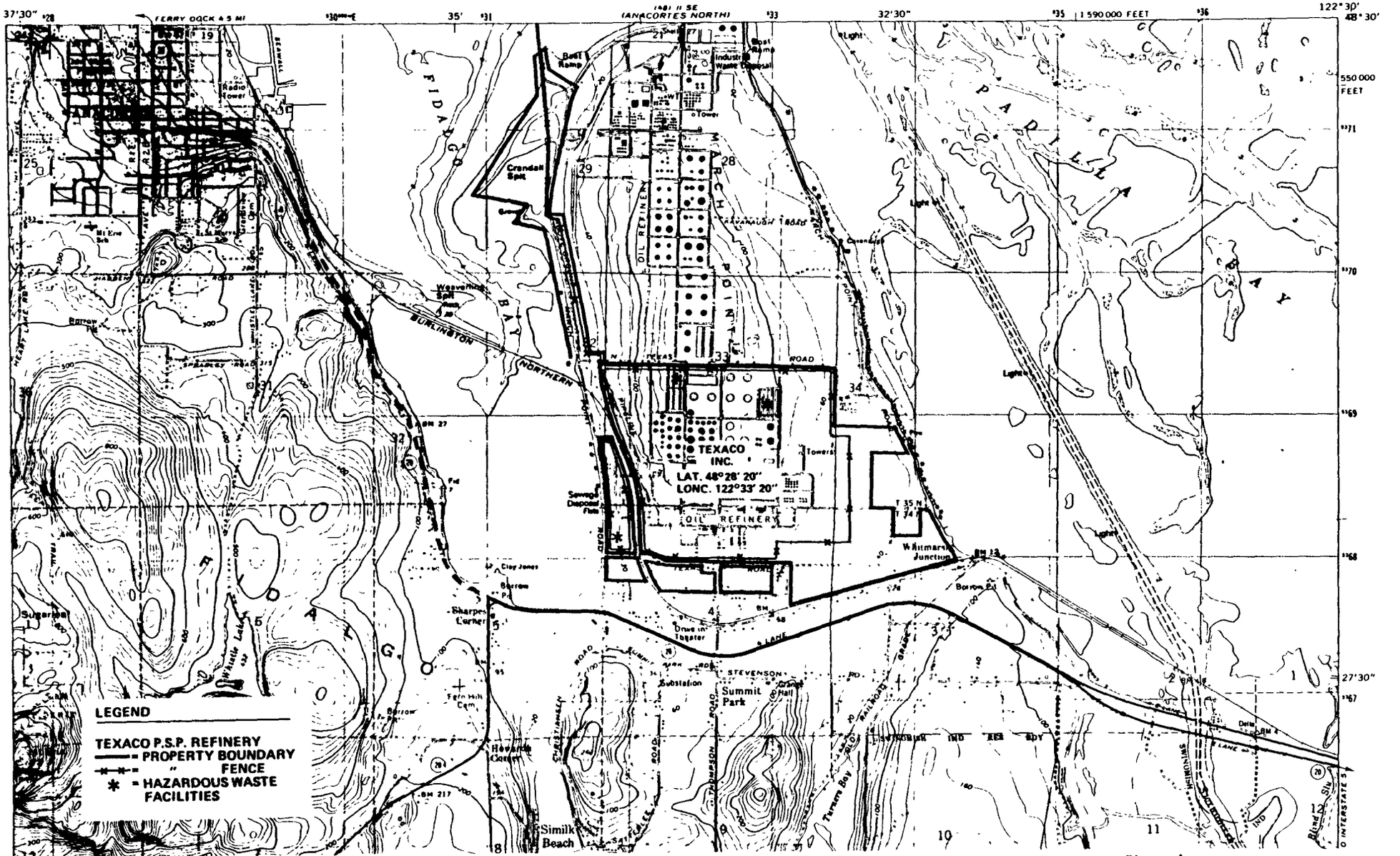
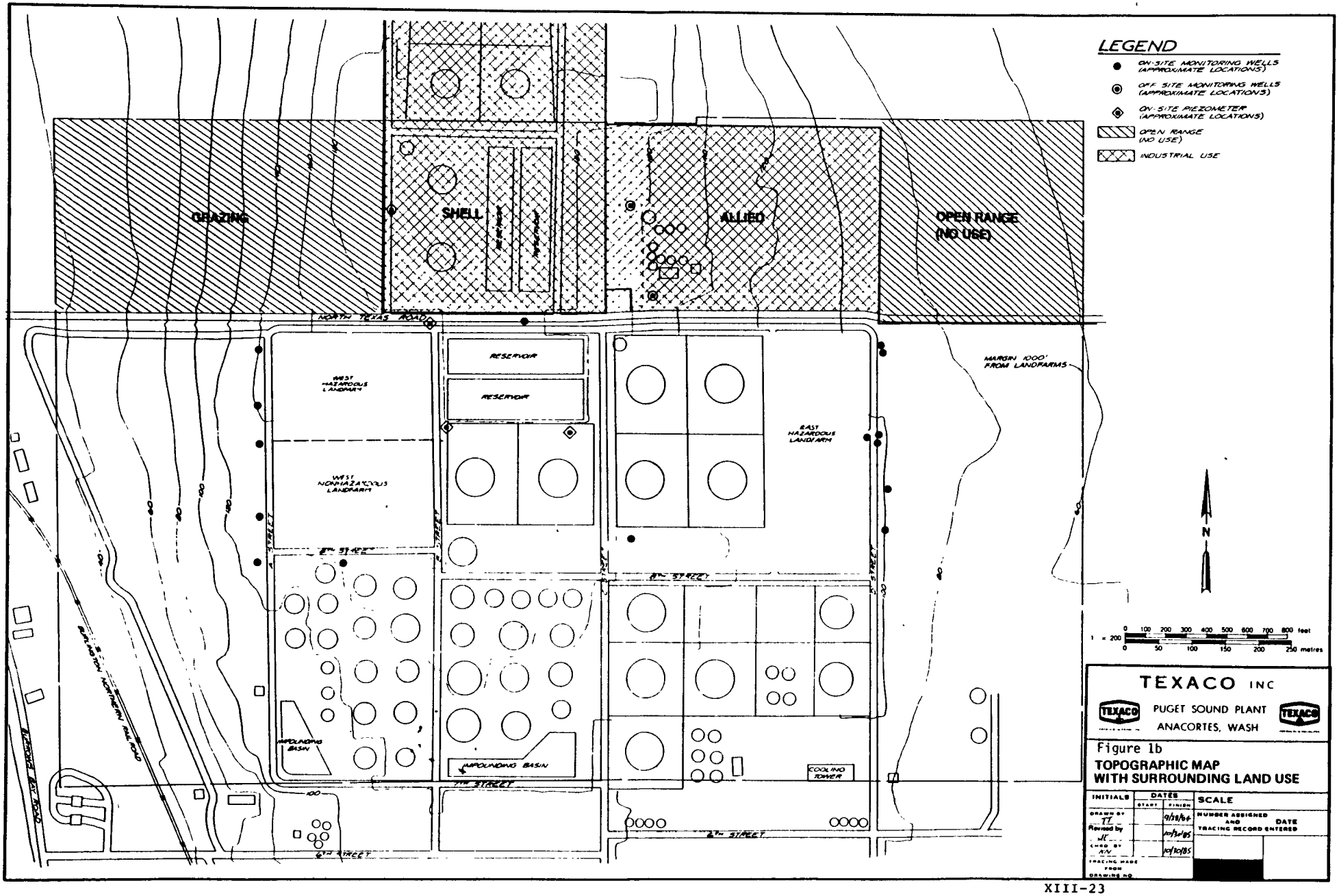
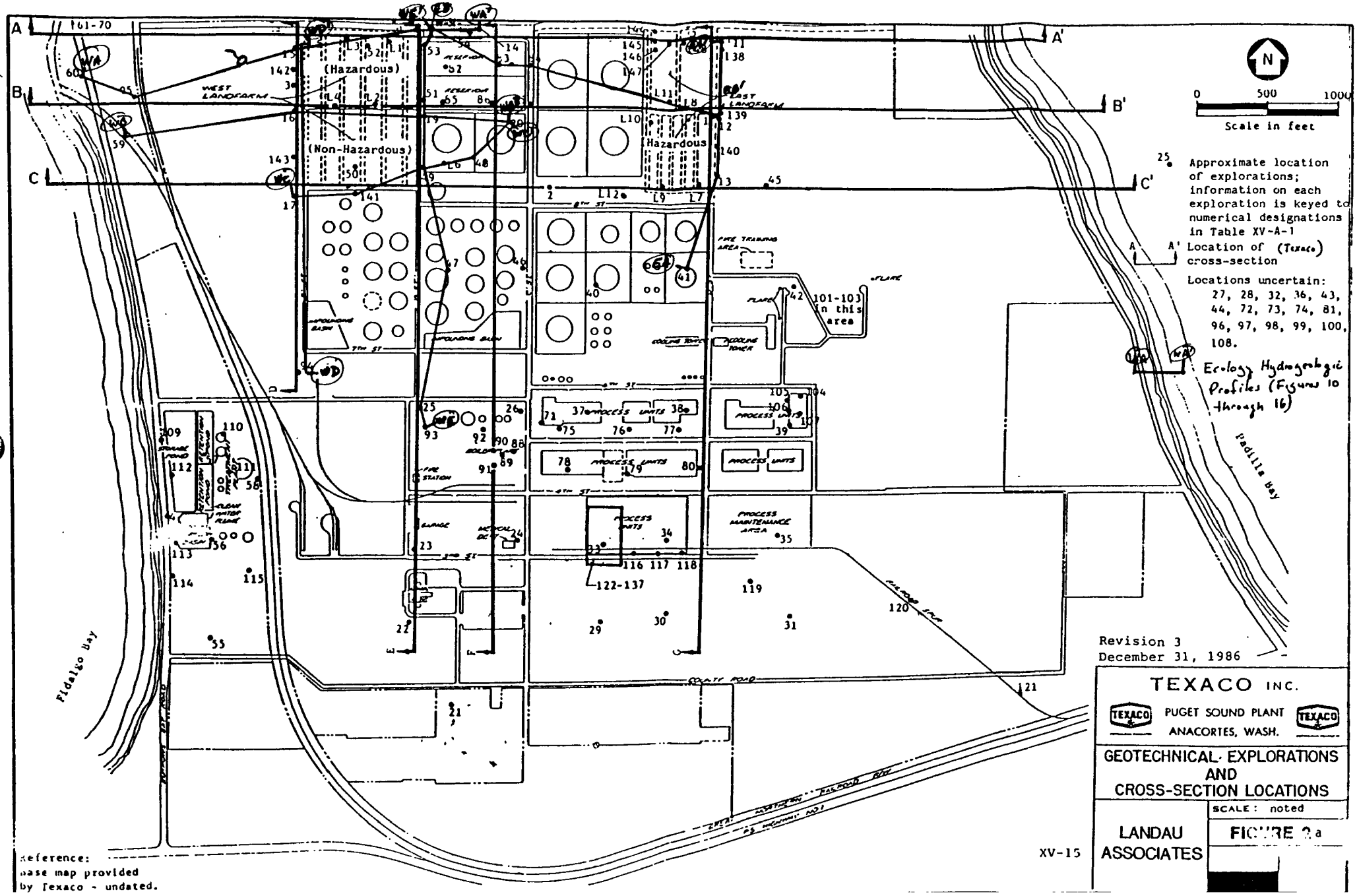


Figure 1a
USGS MAP--- ANACORTES SOUTH


LEGEND
ON-SITE MONITORING WELLS (APPROXIMATE LOCATIONS)
OFF SITE MONITORING WELLS (APPROXIMATE LOCATIONS)
ON-SITE PIEZOMETER (APPROXIMATE LOCATIONS)
OPEN RANGE (NO USE)
INDUSTRIAL USE
GRAZING
SHELL
ALLIED
OPEN RANGE (NO USE)
NORTH TEXAS ROAD
RESERVOIR
RESERVOIR
WEST HAZARDOUS LANDFARM
WEST NONHAZARDOUS LANDFARM
EAST HAZARDOUS LANDFARM
MARGIN 1000' FROM LANDFARMS
A STREET
B STREET
C STREET
6TH STREET
7TH STREET
8TH STREET
IMPOUNDING BASIN
IMPOUNDING BASIN
COOLING TOWER
BURLINGTON NORTHERN RAILROAD
N
0 100 200 300 400 500 600 700 800 feet
1 : 200
0 50 100 150 200 250 metres
TEXACO INC
PUGET SOUND PLANT
ANACORTES, WASH
Figure 1b
TOPOGRAPHIC MAP WITH SURROUNDING LAND USE
INITIALS
DATES
START
FINISH
SCALE
DRAWN BY TT 9/28/84
Revised by JC 10/30/85
CHKD BY AK 10/30/85
TRACING MADE FROM DRAWING NO.
NUMBER ASSIGNED AND TRACING RECORD ENTERED DATE


A
B
C
A'
B'
C'
(Hazardous)
(Non-Hazardous)
Hazardous
WEST LANDFORM
EAST LANDFORM
FIRE TRAINING AREA
PROCESS UNITS
PROCESS MAINTENANCE AREA
101-103 In this area
Padilla Bay
Fidalgo Bay
0 500 1000
Scale in feet
Approximate location of explorations; information on each exploration is keyed to numerical designations in Table XV-A-1
Location of (Texaco) cross-section
Locations uncertain: 27, 28, 32, 36, 43, 44, 72, 73, 74, 81, 96, 97, 98, 99, 100, 108.
Ecology Hydrogeologic Profiles (Figures 10 through 16)
Revision 3
December 31, 1986
TEXACO INC.
PUGET SOUND PLANT
ANACORTES, WASH.
GEOTECHNICAL EXPLORATIONS AND CROSS-SECTION LOCATIONS
SCALE: noted
LANDAU ASSOCIATES
FIGURE 2a
Reference:
Base map provided by Texaco - undated.

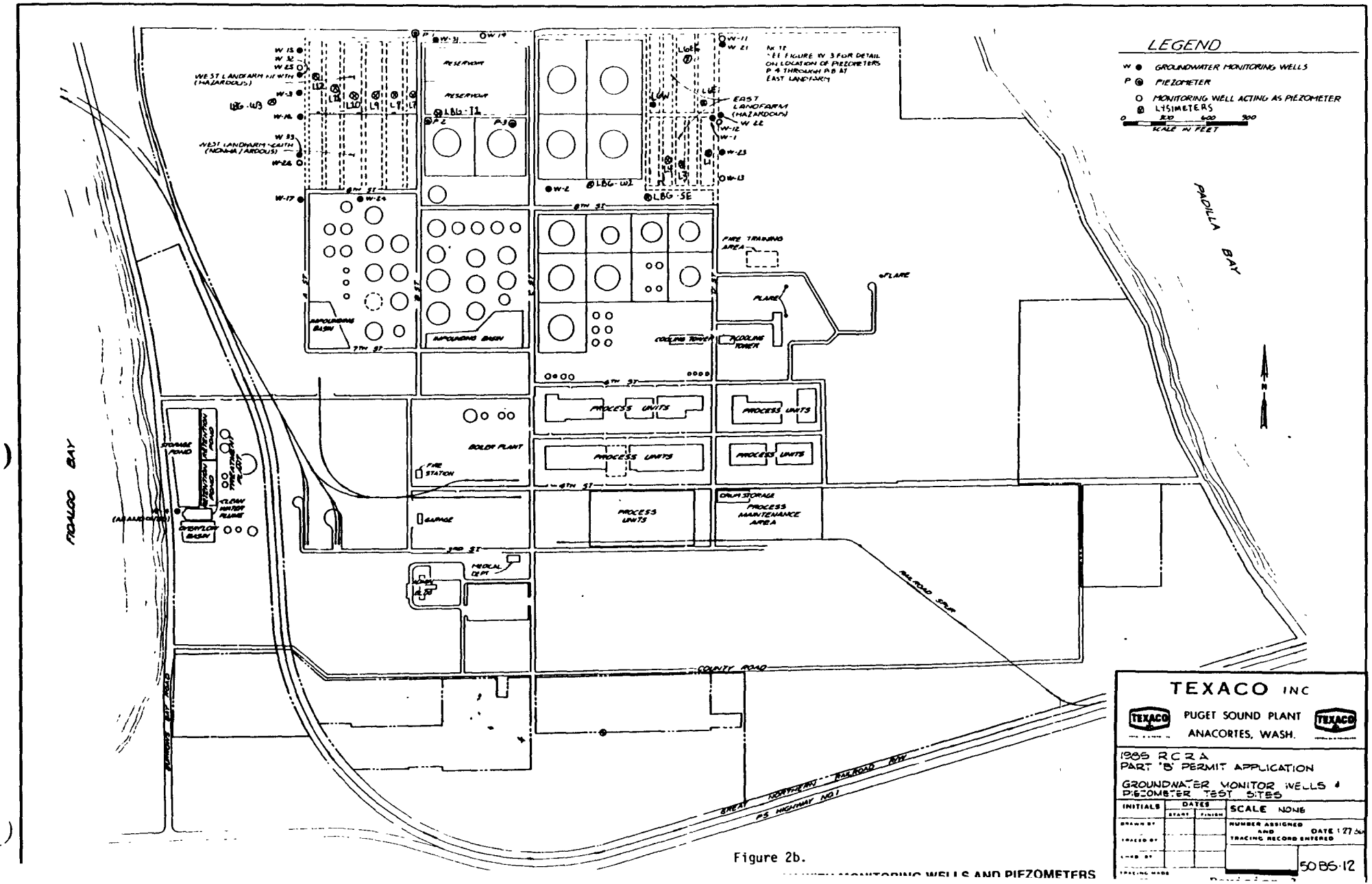

LEGEND
GROUNDWATER MONITORING WELLS
PIEZOMETER
MONITORING WELL ACTING AS PIEZOMETER
LYSIMETERS
SCALE IN FEET
FIDALGO BAY
PADILLA BAY
WEST LANDFARM WITH (HAZARDOUS)
WEST LANDFARM WITH (NONHAZARDOUS)
EAST LANDFARM (HAZARDOUS)
RESERVOIR
LBG-1
LBG-2
LBG-3
LBG-SE
FIRE TRAINING AREA
FLARE
COOLING TOWER
BOILER PLANT
FIRE STATION
GARAGE
MEDICAL DEPT
PROCESS UNITS
DRUM STORAGE
PROCESS MAINTENANCE AREA
STORAGE POND
CLEAN WATER PLANT
OVERFLOW BASIN
RAILROAD SPUR
COUNTY ROAD
GREAT NORTHERN RAILROAD R/W
#5 HIGHWAY NO.1
TEXACO INC
PUGET SOUND PLANT
ANACORTES, WASH.
1985 RCRA
PART 'B' PERMIT APPLICATION
GROUNDWATER MONITOR WELLS & PIEZOMETER TEST SITES
SCALE NONE
50 B6-12

Figure 2b.

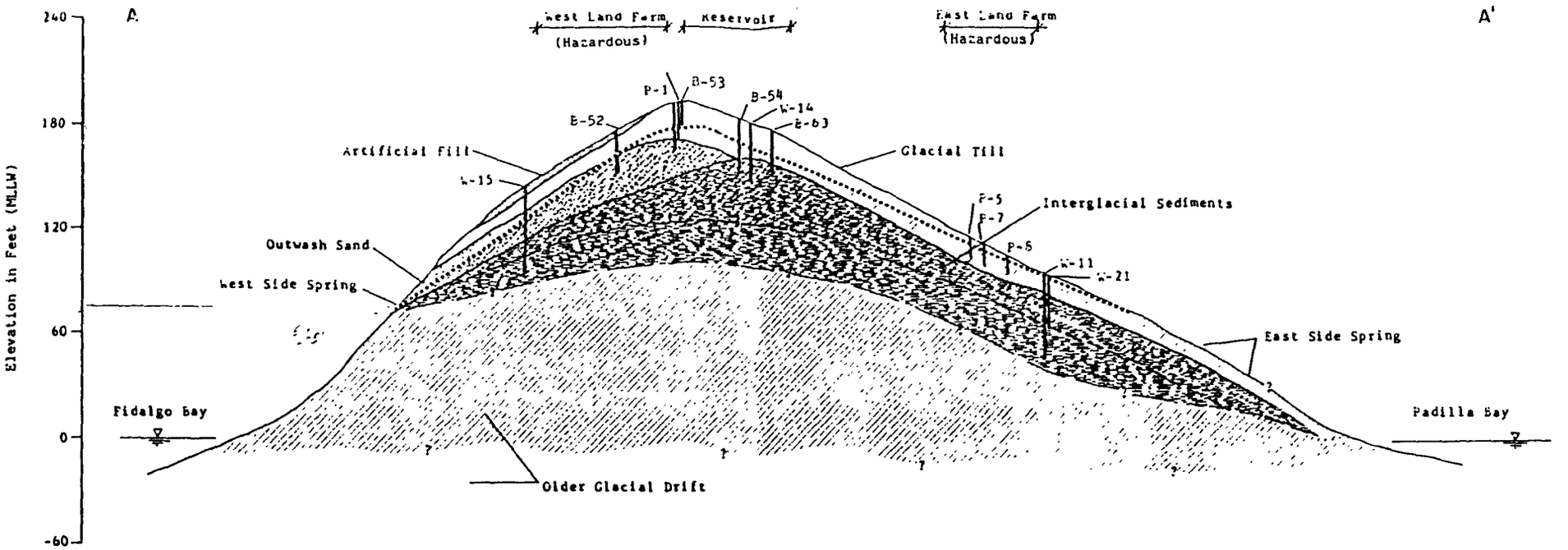
cross-sections, Figures 3 through 9, from Texaco's Part B application. The distribution and properties of the units are described below.

Glacial Till and/or Glaciomarine Drift (Diamicton)

The till or glaciomarine drift consists of a dense, compact mixture of boulders, cobbles, gravel, sand, silt and clay. The unit is characterized by poor sorting and low hydraulic conductivity. It appears to be continuous beneath most of the facility and ranges up to 30 feet in thickness. It is significant to the site hydrogeology because its low hydraulic conductivity limits the amount of recharge to underlying water-bearing zones. At the east land treatment unit, weathered portions of this unit have been defined as the uppermost water-bearing zone by Texaco.

Outwash Sand

The outwash sand consists of medium to coarse-grained sand with occasional lenses of gravel, silt and clay. The outwash is continuous beneath the west land treatment unit, but its extent beneath the east land treatment unit is not well defined. The outwash unit ranges up to 30 feet thick, and is significant because it represents the uppermost aquifer beneath the west land treatment unit and may exist at depth beneath the east land treatment unit.



Legend

Upper and lower water-bearing zones.

..... Water level in upper water-bearing zone on 26 July 1985.

Horizontal Scale 1" = 600'
Vertical Scale 1" = 60'
Vertical Exaggeration - 10x

(MLLW) = Mean Lower Low Water Datum

Notes:

1. Reference to the text of the submittal is necessary for a proper understanding of subsurface conditions.
2. Soil investigations did not always utilize the same classification systems; therefore some interpretation was necessary.
3. Cross-Sections Location depicted on Figures XV-2 and XV-4.

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TEXACO INC.
PUGET SOUND PLANT
ANACORTES, WASH.

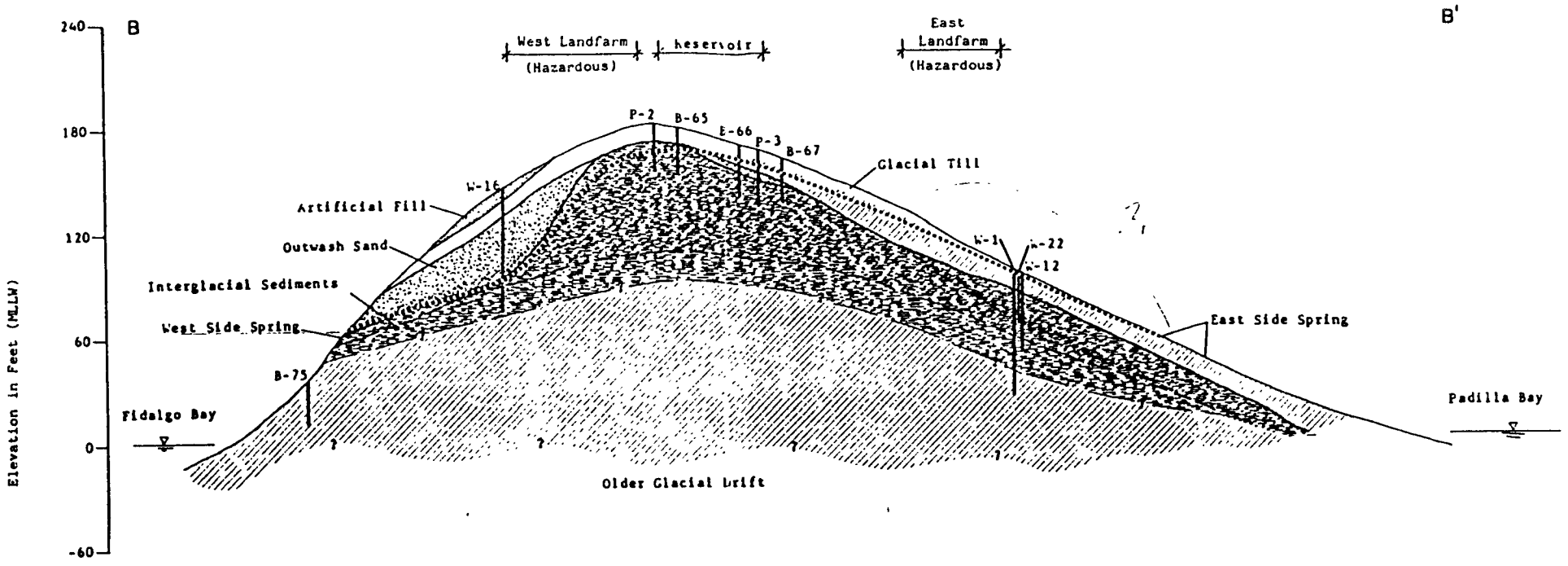
CROSS-SECTION A-A'

LANDAU ASSOCIATES

SCALE Noted

FIGURE 3

XV-19



Legend

Upper and lower water-bearing zones.

..... Water level in upper water-bearing zone on 26 July 1985.

Horizontal Scale 1" = 600'
Vertical Scale 1" = 60'
Vertical Exaggeration - 10x

(MLLW) = Mean Lower Low Water Datum

Notes:

1. Reference to the text of the submittal is necessary for a proper understanding of subsurface conditions.
2. Soil investigations did not always utilize the same classifications systems; therefore, some interpretation was necessary.
3. Cross-section locations depicted on Figures XV-2 and XV-4.

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December 31, 1986

TEXACO INC.
PUGET SOUND PLANT
ANACORTES, WASH.

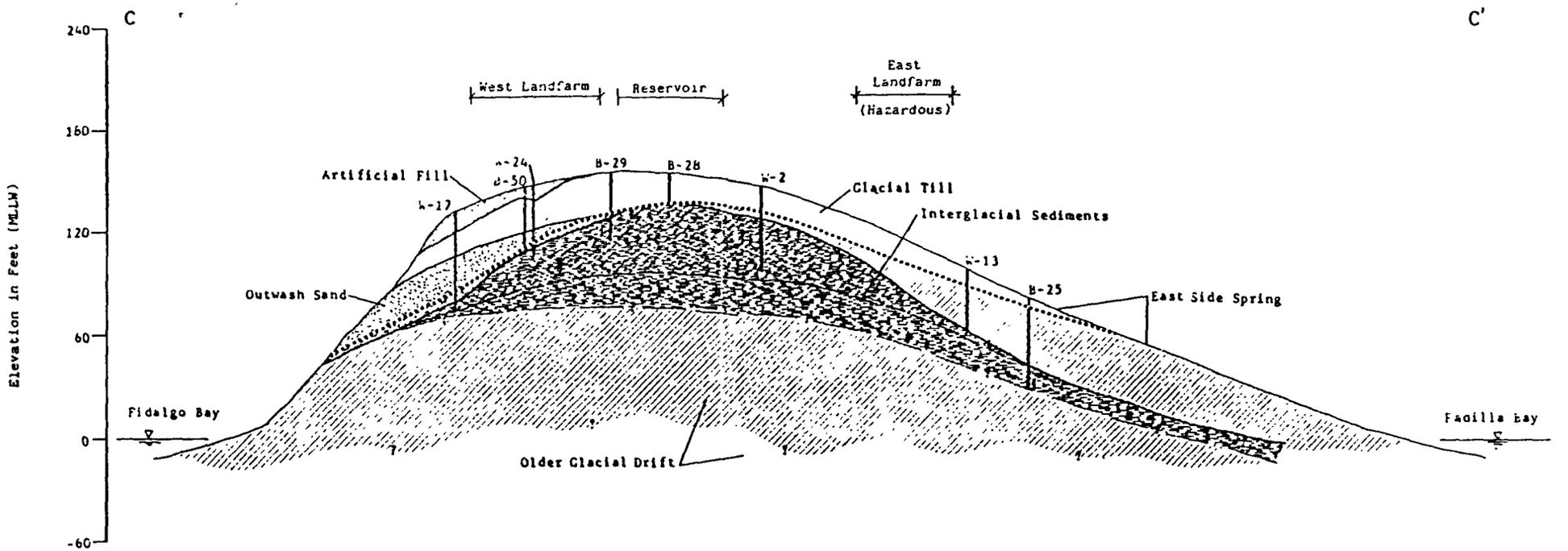
CROSS-SECTION B-B'

SCALE Noted

LANDAU ASSOCIATES

FIGURE 4

XV-21



Legend

Upper and lower water-bearing zone.

..... Water level in upper water-bearing zone on 2o July 1955.

Horizontal Scale 1" = 600'
Vertical Scale 1" = 60'
Vertical Exaggeration - 10x

(MLLW) = Mean Lower Low Water Datum

Notes:

1. Reference to the text of the submittal is necessary for a proper understanding of subsurface conditions.
2. Soil investigations did not always utilize the same classification systems; therefore, some interpretation was necessary.
3. Cross-section locations depicted on Figures XV-2 and XV-4.

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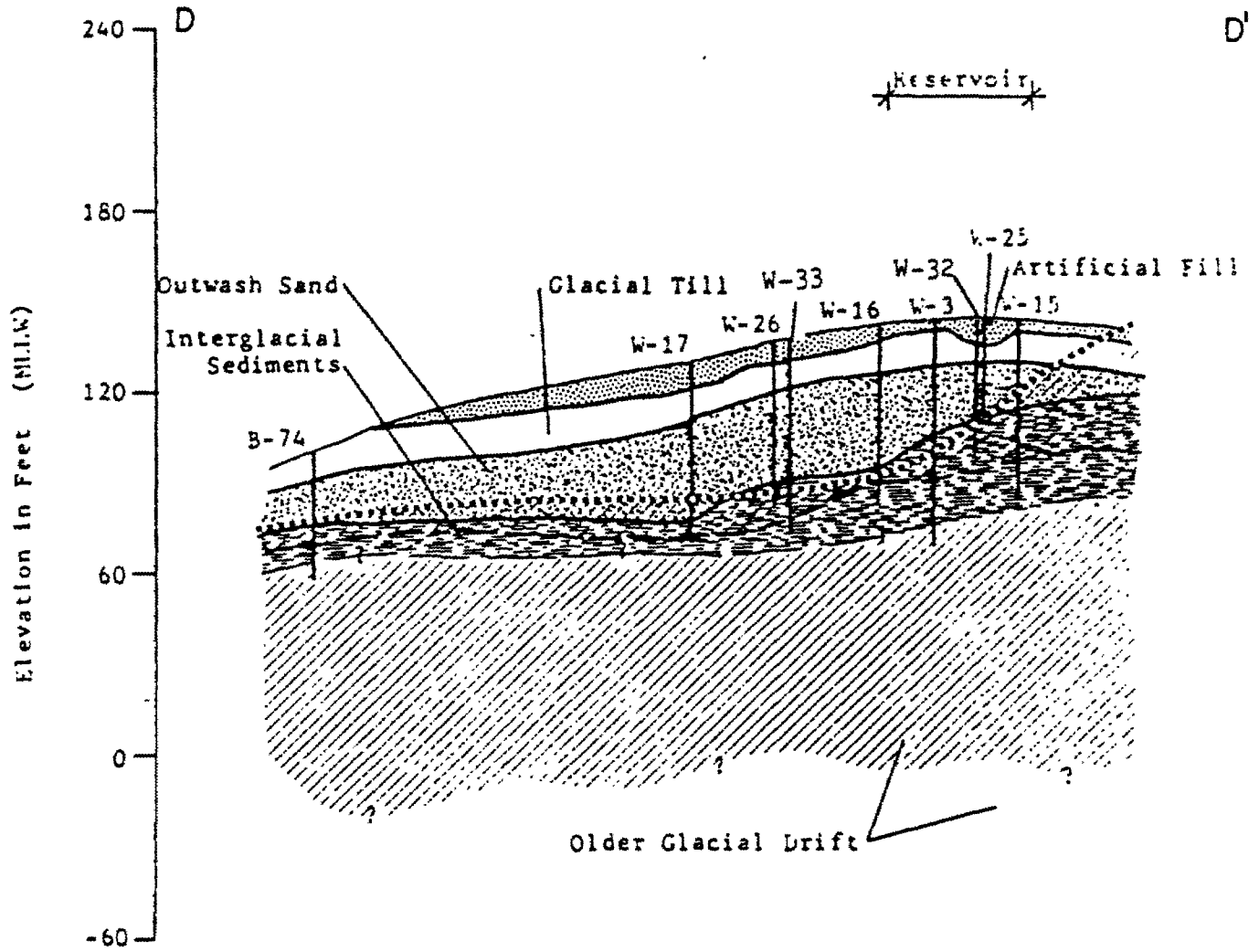
TEXACO INC.
PUGET SOUND PLANT
ANACORTES, WASH.

CROSS-SECTION C-C'

SCALE Noted

LANDAU ASSOCIATES

FIGURE 5



Legend

Upper and lower water-bearing zones.

Water level in upper water-bearing zone on 26 July 1985.

Horizontal Scale 1" = 600'
Vertical Scale 1" = 60'
Vertical Exaggeration - 10x

(MLLW) = Mean Lower Low Water Datum

Notes:

1. Reference to the text of the submittal is necessary for a proper understanding of subsurface conditions.
2. Soil investigations did not always utilize the same classification systems; therefore, some interpretation was necessary.
3. Cross-section locations depicted on Figures XV-2 and XV-4.

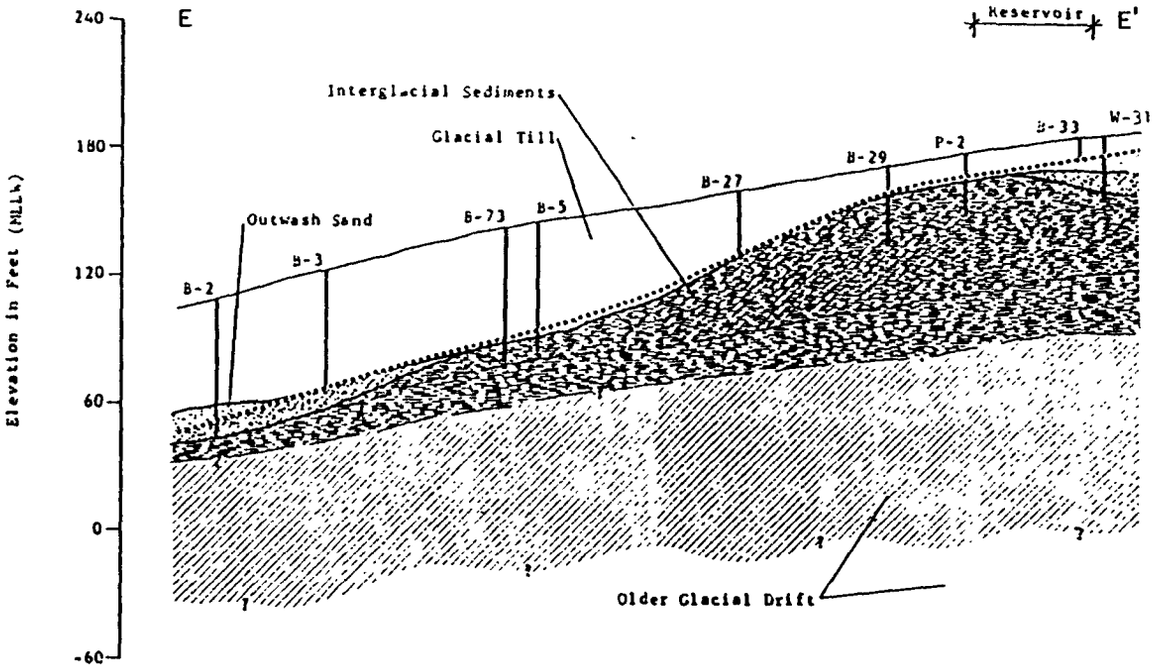
TEXACO INC.

PUGET SOUND PLANT
ANACORTES, WASH.

CROSS-SECTION D-D'
FIGURE 6

LANDAU ASSOCIATES

SCALE None
Revision 3
December 31, 1986



Legend

Upper and lower water-bearing zones.

Water level in upper water-bearing zone on 26 July 1985.

Horizontal Scale 1" = 600'
Vertical Scale 1" = 60'
Vertical Exaggeration - 10x

(MLLW) = Mean Lower Low Water Datum

Notes:

1. Reference to the text of the submittal is necessary for a proper understanding of subsurface conditions.
2. Soil investigations did not always utilize the same classification systems; therefore some interpretation was necessary.
3. Cross-section locations depicted on Figures XV-2 and XV-4.

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TEXACO INC.
PUGET SOUND PLANT
ANACORTES, WASH.

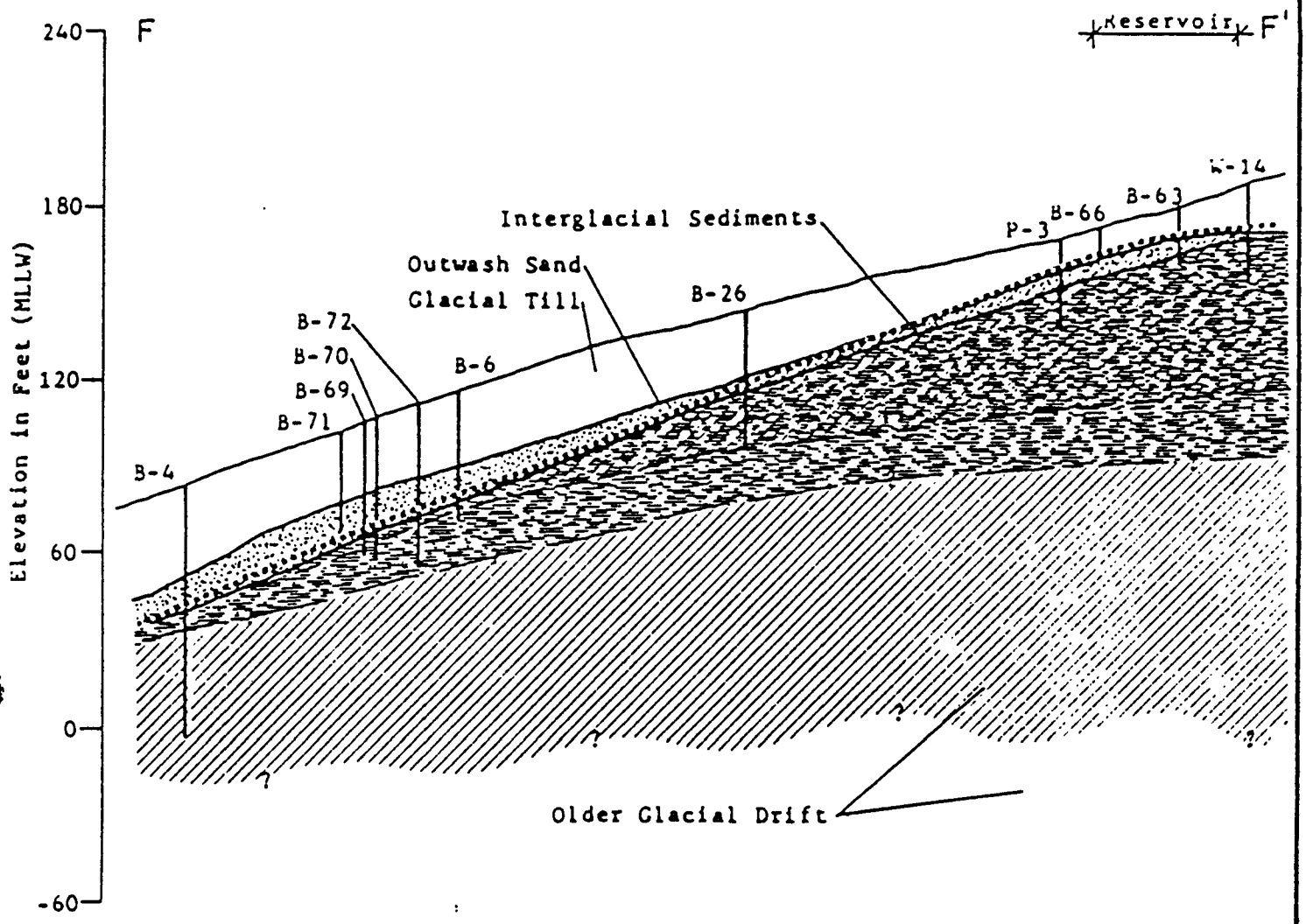
CROSS-SECTION E-E'

SCALE Noted

LANDAU ASSOCIATES

FIGURE 7

XV-27



Legend

Upper and lower water-bearing zone.

..... Water level in upper water-bearing zone on 26 July 1985.

Horizontal Scale 1" = 600'
Vertical Scale 1" = 60'
Vertical Exaggeration - 10x
(MLLW) = Mean Lower Low Water Datum

Notes:

1. Reference to the text of the submittal is necessary for a proper understanding of subsurface conditions.
2. Soil investigations did not always utilize the same classification systems; therefore some interpretation was necessary.
3. Cross-section locations depicted on Figures XV-2 and XV-4.

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PUGET SOUND PLANT
ANACORTES, WASH.

CROSS-SECTION F-F'
FIGURE 8

LANDAU ASSOCIATES

SCALE Noted

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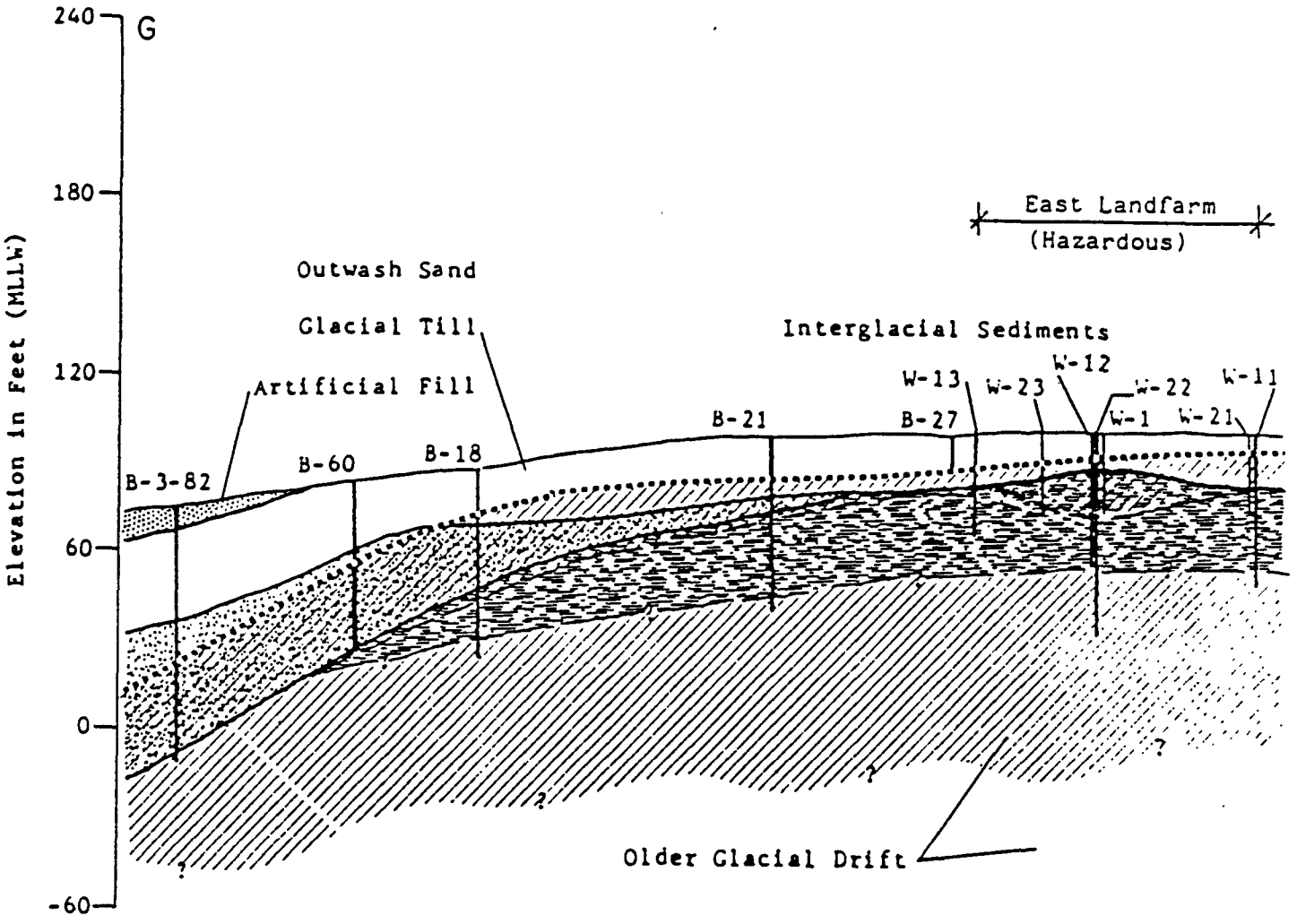

Legend

Upper and lower water-bearing zones.

..... Water level in upper water-bearing zone on 26 July 1985.

Horizontal Scale 1" = 600'
Vertical Scale 1" = 60'
Vertical Exaggeration - 10x

(MLLW) = Mean Lower Low Water Datum

Notes:

1. Reference to the text of the submittal is necessary for a proper understanding of subsurface conditions.
2. Soil investigations did not always utilize the same classification systems; therefore, some interpretation was necessary.
3. Cross-section locations depicted on Figures XV-2 and XV-4.

TEXACO INC.

PUGET SOUND PLANT
ANACORTES, WASH.

CROSS-SECTION G-G'
FIGURE 9

LANDAU ASSOCIATES

SCALE Noted
Revision 3
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Interglacial Sediments

The interglacial sediments consist of hard, thinly-bedded clay, silt, and fine sand with occasional layers of peat and gravel. They underlie the outwash sand, or if the outwash sand is not present, they underlie the till or glaciomarine drift. There is no reliable information available to estimate the distribution or thickness of this unit. Only the upper portion of this unit is saturated according to Texaco, and it represents part of the uppermost aquifer beneath the land treatment units.

Older Glacial Drift

The older glacial drift consists of undifferentiated glacial deposits, a dense, heterogeneous mixture of gravel, sand, and silt. No wells or borings penetrate the entire unit, and consequently its thickness is unknown. The permeability is probably highly variable, considering the wide variation of texture in the unit. The older glacial drift is significant because it has been designated as a water-bearing zone that underlies the uppermost aquifer by Texaco. The degree of hydraulic interconnection between this zone and the uppermost aquifer has not been defined by Texaco.

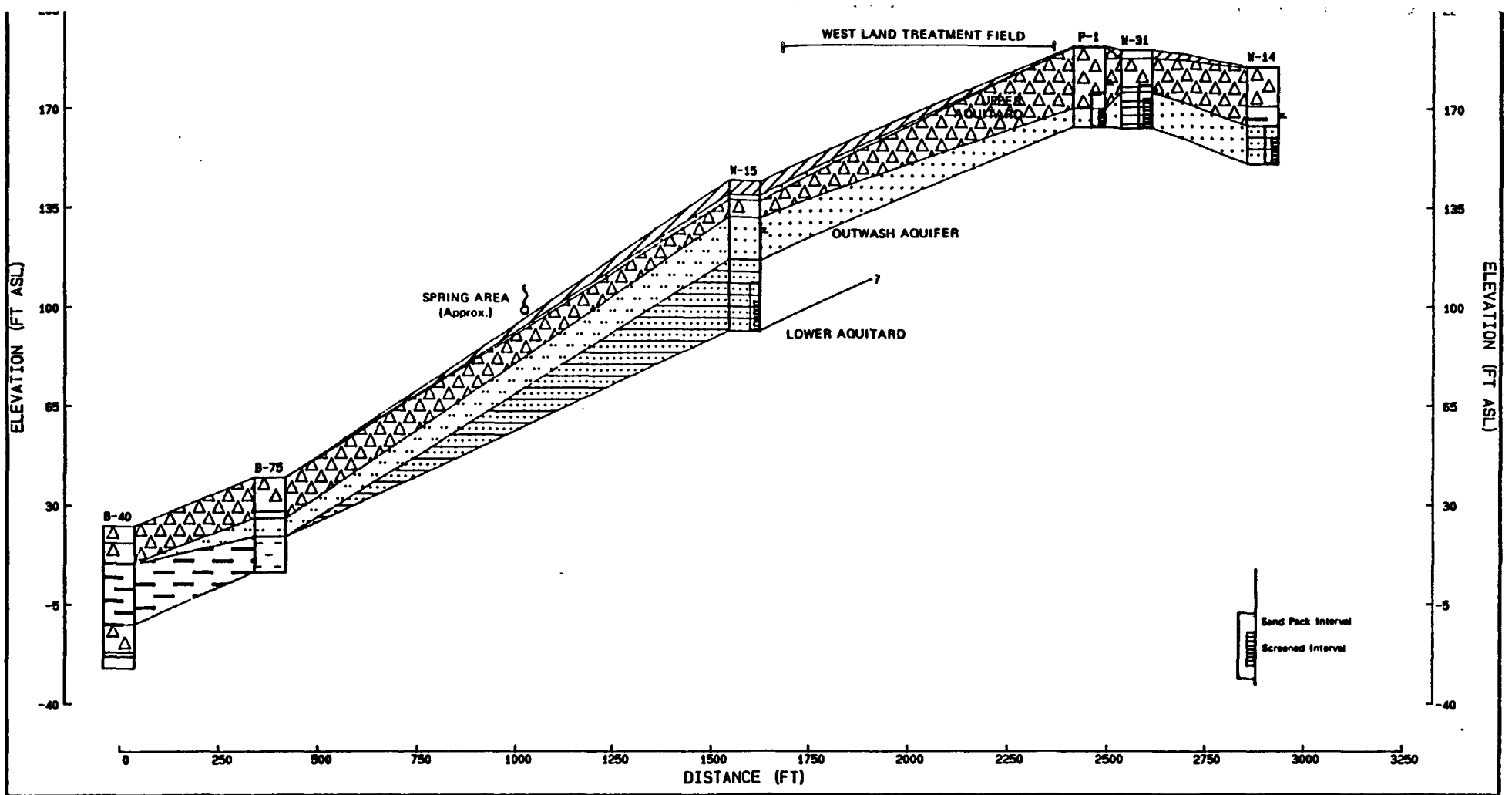
SITE HYDROGEOLOGY

Because Texaco's interpretation of the existing hydrogeologic information was judged to be incomplete, a thorough evaluation of the existing information was conducted by EPA and Ecology. Included in this evaluation

were the geotechnical boring logs which had not been provided in a detailed form until this inspection. Based on this review, four hydrogeologic units have been identified that, for discussion purposes, are designated as follows: the Shallow Zone, the Upper Aquitard, the Outwash Aquifer, and the Lower Aquitard. The subsurface relationship of these units is shown in seven hydrogeologic profiles (Figures 10 through 16). The locations of the profiles in relations to the site are shown in Figure 2a. The distribution and the hydrogeologic properties of the units are discussed below.

Shallow Zone

The Shallow Zone consists of either artificial fill or deposits formed as recessional outwash or beach deposits. The fill consists of a wide variety of mixtures of gravel, sand, silt and clay. The recessional outwash/beach deposits consist of sand and gravel. The Shallow Zone is thin and discontinuous across the site. The maximum observed thickness is about 10 feet (well W-17). The lateral extent of this unit has not been defined and saturation of this unit has not been reported. No wells or piezometers have been completed in the Shallow Zone. The unit is of potential significance because where saturated it could serve as a source of recharge to underlying water-bearing zones and may transmit contaminants laterally. The Shallow Zone, which has not been addressed by Texaco, may be contributing to the seeps on the slopes of the peninsula.



LEGEND x SWL

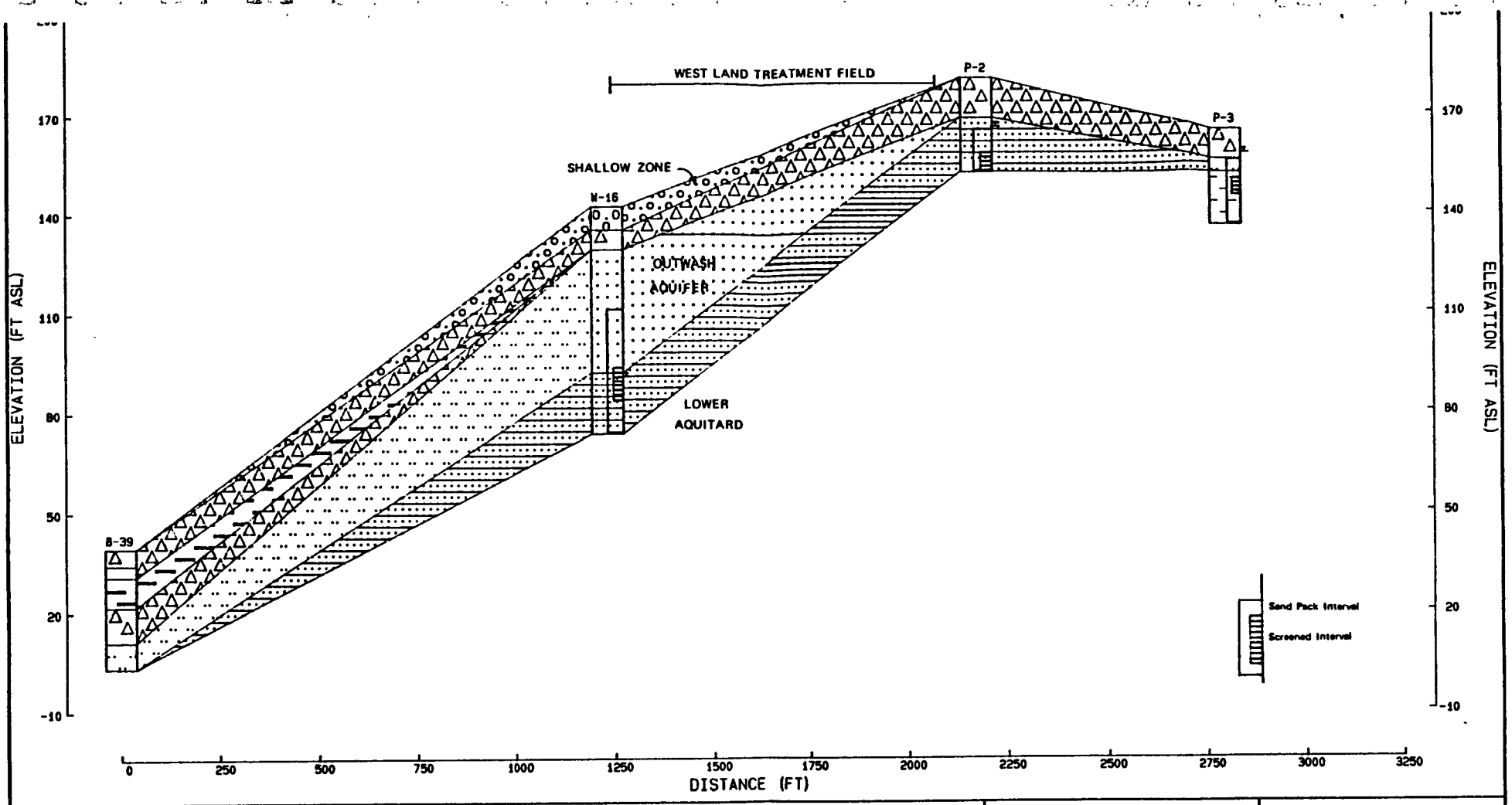
FILL	SILTY SAND	SAND/GRAVEL	--	DIAMICTON
PEAT	SAND-FINE	GRAVEL	--	--
TILL	SAND FN-MED	SILT-CLAY	--	--
SILT	SAND MED-CR	SILT/SAND L	--	--

PROJECT: TEXACO
FILE: WAD009276197
LOCATION: ANACORTES

FIGURE: 10

GEOLOGIC CROSS SECTION
WA-WA'

WASHINGTON DEPT. OF ECOLOGY



LEGEND ▲ SWL

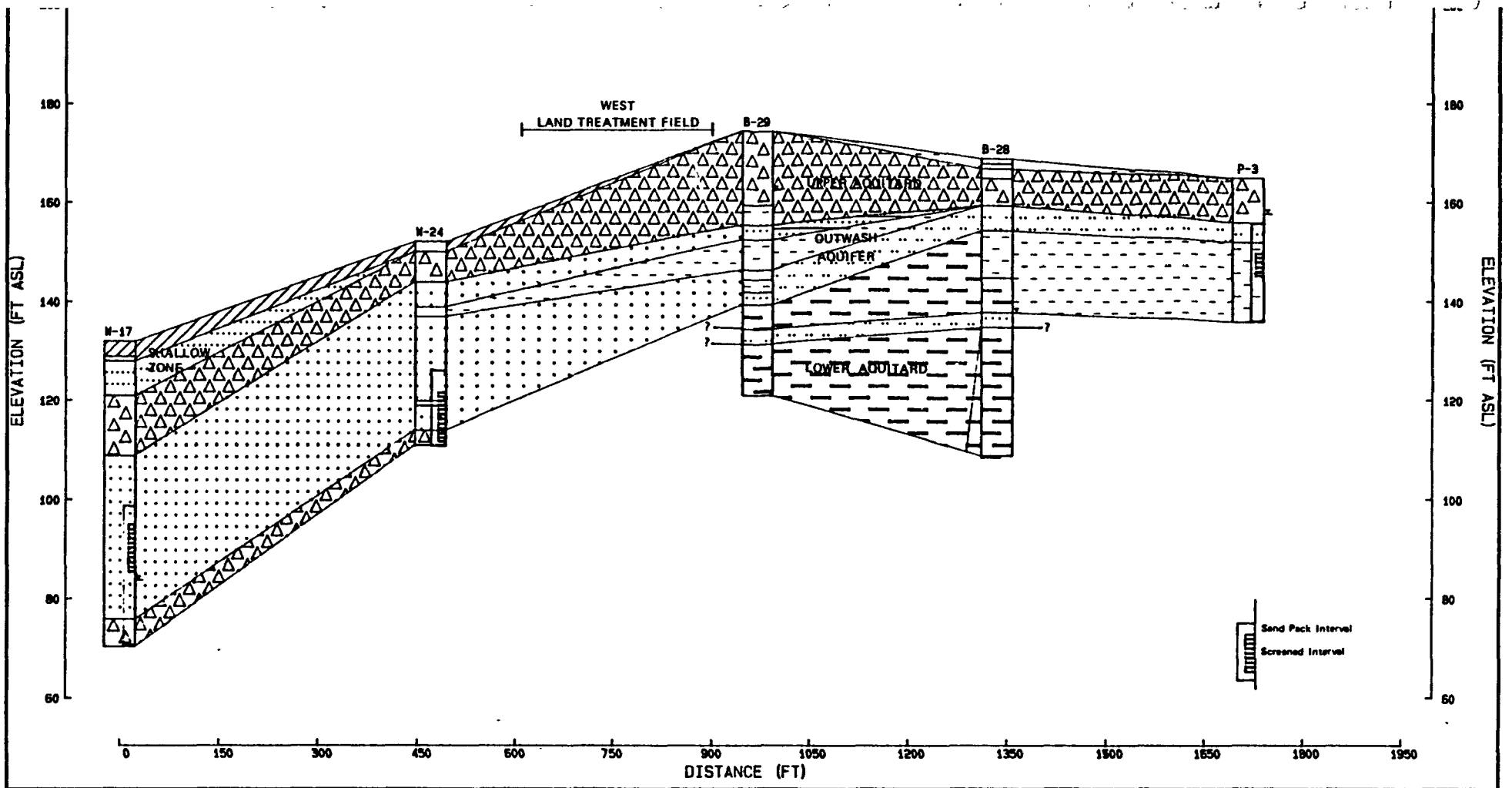
FILL	SILTY SAND	SAND/GRAVEL	--	DIAMICTON
PEAT	SAND-FINE	GRAVEL	--	--
TILL	SAND FN-MED	SILT-CLAY	--	--
SILT	SAND MED-CR	SILT/SAND L	--	--

PROJECT: TEXACO
FILE: WAD009276197
LOCATION: ANACORTES

FIGURE:11

GEOLOGIC CROSS SECTION
WBWB'

WASHINGTON DEPT. OF ECOLOGY



LEGEND ± SWL

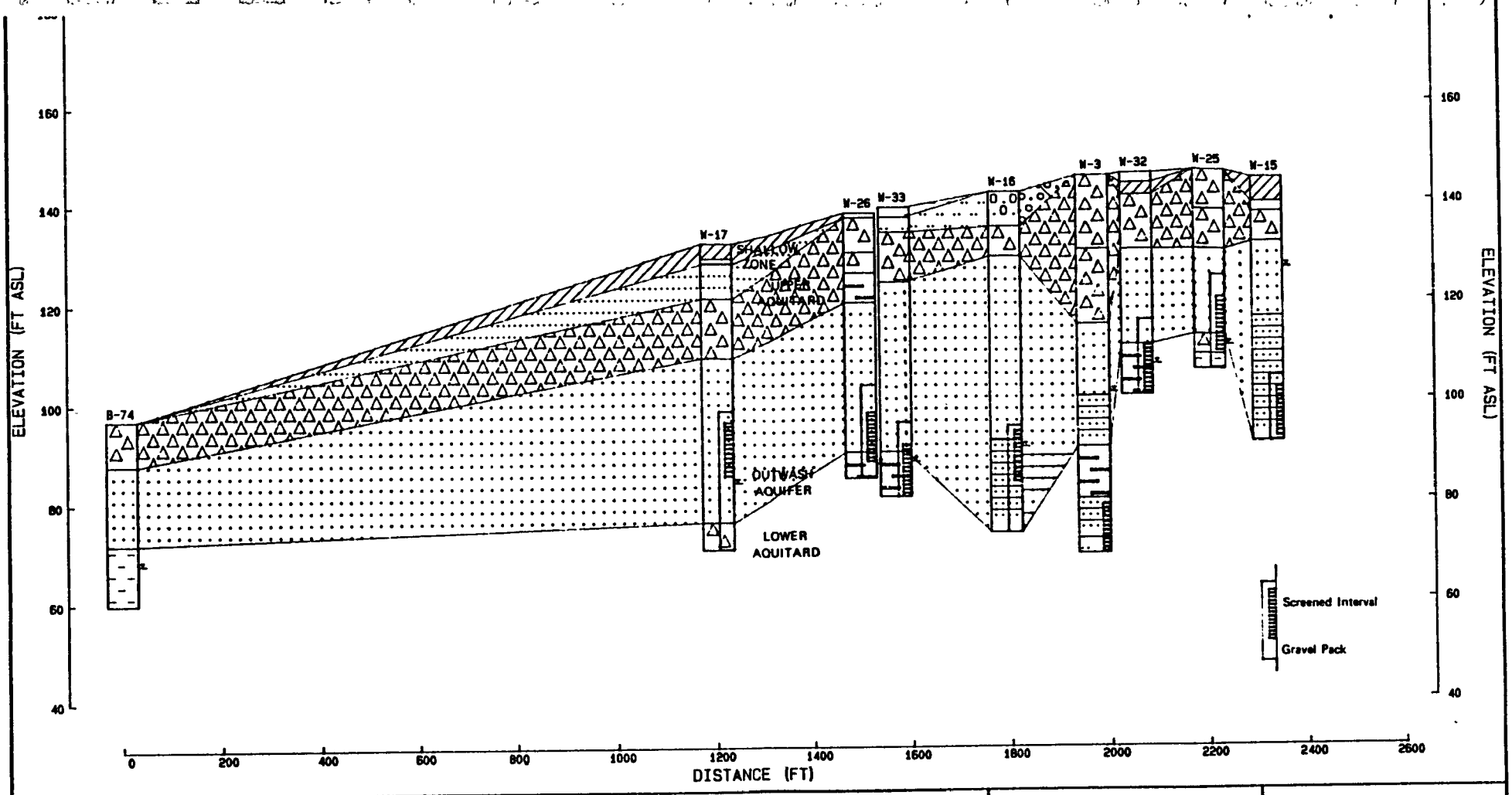
FILL	SILTY SAND	SAND/GRAVEL	--	DIAMICTON
PEAT	SAND-FINE	GRAVEL	--	--
TILL	SAND FN-MED	SILT-CLAY	--	--
SILT	SAND MED-CR	SILT/SAND L	--	--

PROJECT: TEXACO
FILE: WAD009276197
LOCATION: ANACORTES

FIGURE: 12

GEOLOGIC CROSS SECTION
WC-WC'

WASHINGTON DEPT. OF ECOLOGY



LEGEND ⊥ SWL

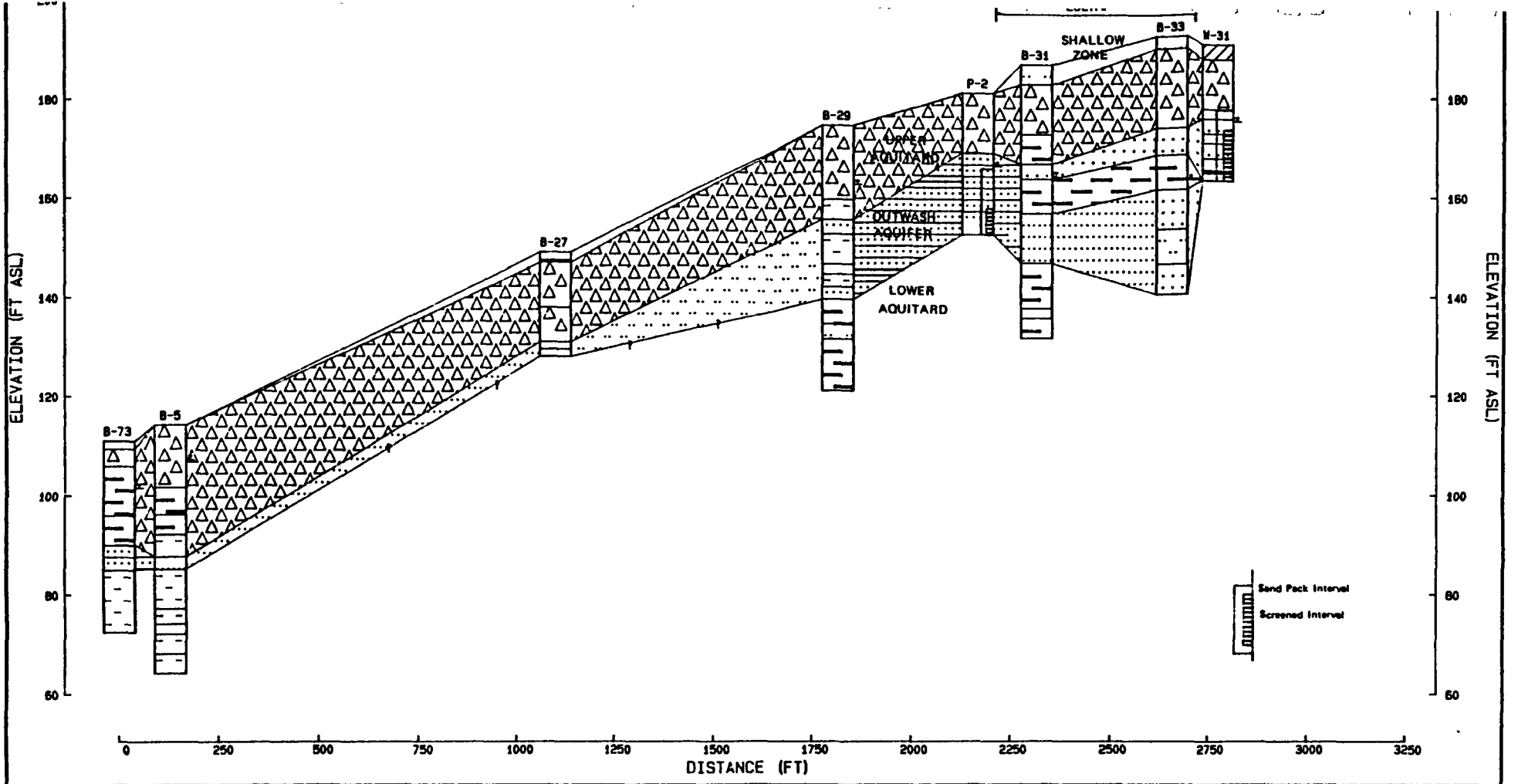
FILL	SILTY SAND	SAND/GRAVEL	--	DIAMICTON
PEAT	SAND-FINE	GRAVEL	--	--
TILL	SAND FN-MED	SILT-CLAY	--	--
SILT	SAND MED-CR	SILT/SAND L	--	--

PROJECT: TEXACO
FILE: WAD009276197
LOCATION: ANACORTES

FIGURE: 13

GEOLOGIC CROSS SECTION
WD-WD'

WASHINGTON DEPT. OF ECOLOGY



LEGEND ± SWL

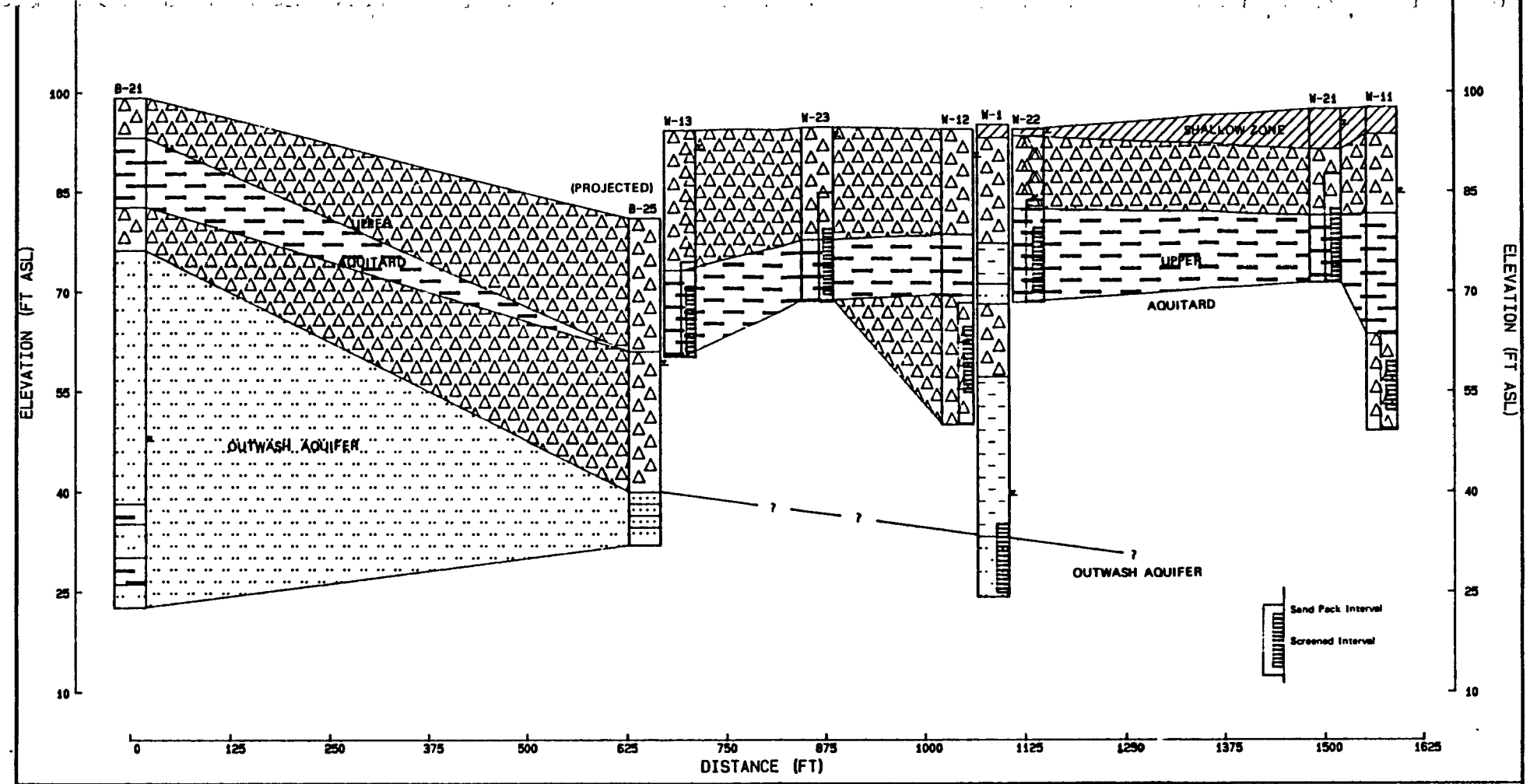
FILL	SILTY SAND	SAND/GRAVEL	--	DIAMICTON
PEAT	SAND-FINE	GRAVEL	--	--
TILL	SAND FN-MED	SILT-CLAY	--	--
SILT	SAND MED-CR	SILT/SAND L	--	--

PROJECT: TEXACO
FILE: WAD009276197
LOCATION: ANACORTES

FIGURE: 14

GEOLOGIC CROSS SECTION
WE-WE'

WASHINGTON DEPT. OF ECOLOGY



LEGEND ▼ SWL

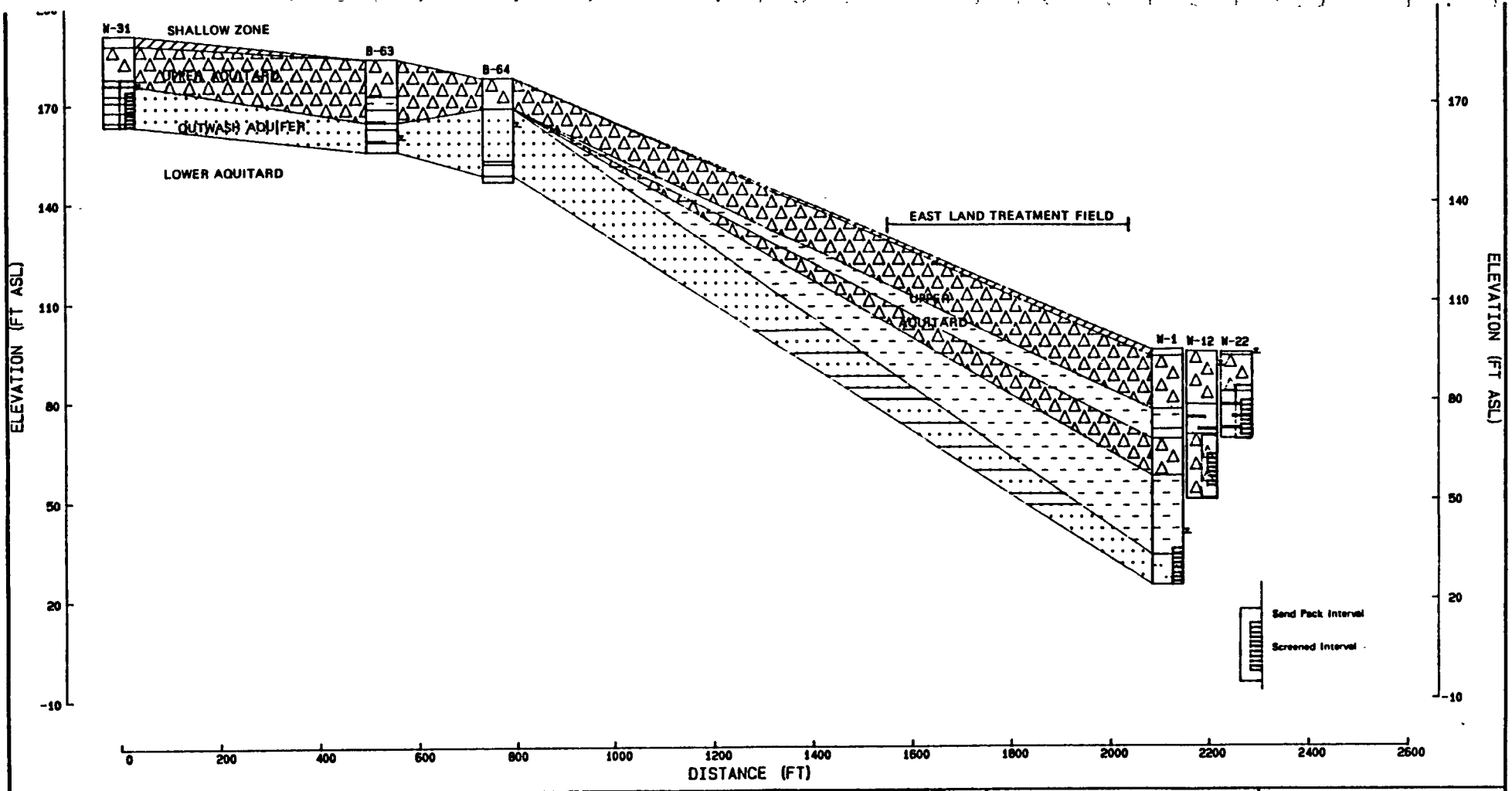
FILL	SILTY SAND	SAND/GRAVEL	--	DIAMICTON
PEAT	SAND-FINE	GRAVEL	--	--
TILL	SAND FN-MED	SILT-CLAY	--	--
SILT	SAND MED-CR	SILT/SAND L	--	--

PROJECT: TEXACO
FILE: WAD009276197
LOCATION: ANACORTES

FIGURE:15

GEOLOGIC CROSS SECTION
EA-EA'

WASHINGTON DEPT. OF ECOLOGY



LEGEND ▽ SWL

FILL	SILTY SAND	SAND/GRAVEL	--	DIAMICTON
PEAT	SAND-FINE	GRAVEL	--	--
TILL	SAND FN-MED	SILT-CLAY	--	--
SILT	SAND MED-CR	SILT/SAND L	--	--

PROJECT: TEXACO
FILE: WAD009276197
LOCATION: ANACORTES

FIGURE: 16

GEOLOGIC CROSS SECTION
EB-EB'

WASHINGTON DEPT. OF ECOLOGY

Upper Aquitard

The Upper Aquitard consists of diamicton (a dense unsorted mixture of gravel, sand, silt, and clay) and interlayered silt and clay. This unit corresponds to the glacial till/glaciomarine drift unit described by Texaco, but also includes silt and clay layers that are interlayered with the till/glaciomarine drift. The unit appears to be continuous over the site and ranges in thickness from about 10 to 60 feet. The unit thickens toward the east on the east slope of the peninsula. This thickening accounts for the more gradual slope of the topography on the east side. Beneath the west land treatment unit, the Upper Aquitard is unsaturated and acts as a partial barrier to the downward migration of infiltrating water. On the east side, the upper portions of the Upper Aquitard are reported to be saturated and have been designated as the uppermost water-bearing zone beneath the east land treatment unit. Fracturing and weathering of the upper portions of this unit were observed in borings and in the excavation of an 18-foot-deep french drain immediately west and north of the east land treatment unit. The purpose of the french drain is to lower the seasonal high water-table beneath the east land treatment unit to satisfy regulatory requirements. Strong vertical downward hydraulic gradients exist in the Upper Aquitard as shown by water levels in the W-1/W-12/W-22 well cluster. The downward hydraulic gradient was calculated from well W-1 and W-22 to be about 1.2 feet/foot.

Outwash Aquifer

The Outwash Aquifer consists of the saturated portions of the advance outwash. The Outwash Aquifer underlies the Upper Aquitard and appears to be continuous. It consists of two facies. The first facies consists of fine-to-coarse sand with occasional gravel. The second facies consists of fine sand interlayered with silt or clayey silt. The second facies may coincide with the interglacial sediments unit designated by Texaco. In general, the coarser, sandy facies overlies the second facies, but at some locations it is absent. When the more permeable coarser facies is saturated, it represents the preferred pathway of migration for the two facies. Beneath the west land treatment unit, a number of wells have penetrated the Outwash Aquifer and the hydrogeology is fairly well defined. On the east side, however, only one monitoring well, W-1, is believed to extend into the Outwash Aquifer. At most locations, the Outwash Aquifer is unconfined, but at W-1 it appears to be confined as shown in Figures 15 and 16.

The direction of ground-water flow in the Outwash Aquifer is controlled by a number of factors that include the location and rates of recharge, the variation of hydraulic conductivity within the aquifer, and the surface expression of the top of the underlying Lower Aquitard. A water-table contour map, based on water levels in piezometers and wells screened in the Outwash Aquifer, is shown in Figure 17. This figure shows that the direction of ground-water flow in the Outwash Aquifer mimics the topographic expression of the peninsula and flows radially from the center of the peninsula. At the west land treatment unit, the flow is toward the west and southwest. The

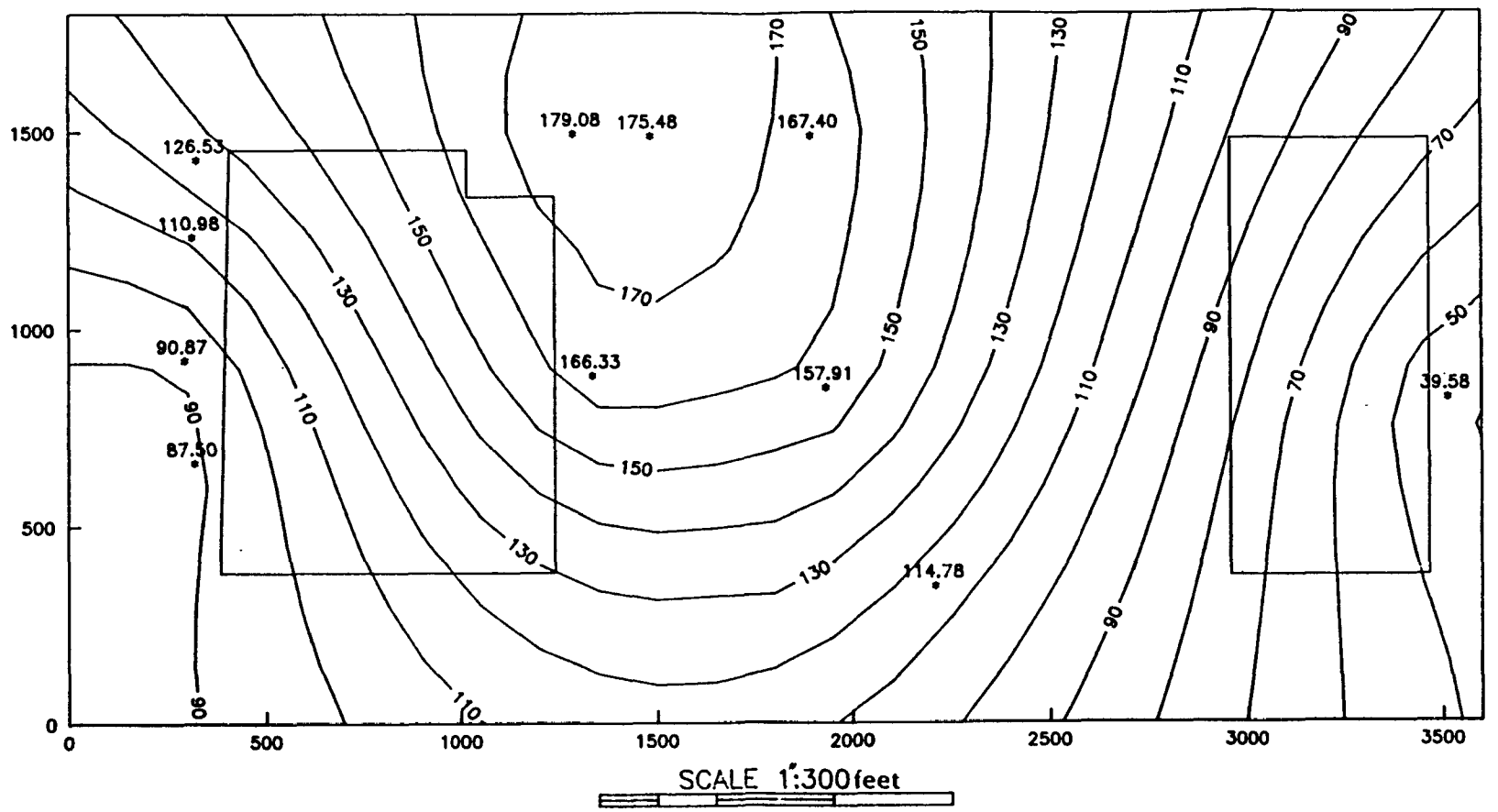


FIGURE 17
WATER-TABLE CONTOUR
MAP

ground-water flow beneath the east land treatment unit is toward the east and southeast.

Seep activity that occurs downslope from the west land treatment unit has been attributed by Texaco to represent an outcrop of the outwash sand. However, it is likely that the seeps are only local discharge areas for the Shallow Zone. Investigations by Texaco to define the hydrogeology of the seeps were too shallow to be conclusive. However, the investigations did encounter diamicton rather than advance outwash, which supports the interpretation that the seeps are related to the Shallow Zone.

Recharge to the Outwash Aquifer occurs as infiltration of precipitation and leakage from the city reservoirs located near the center of the peninsula (Figures 2a and 2b). Texaco, in the past, had estimated the leakage rate from the reservoirs to be 50 gallons per minute, but revised this estimate to 10 gallons per minute based on water balance calculations. The infiltration rate from precipitation has been estimated by Texaco to be about five inches per year.

Lower Aquitard

The Lower Aquitard underlies the Outwash Aquifer and consists of interlayered diamicton, silty sand, silt and clayey silt. The unit probably corresponds to the lower portion of the interglacial sediments designated by Texaco; however, the thickness and hydrogeologic properties have not been defined in detail. At boring B-28 the Lower Aquitard appears to be greater than 45 feet thick.

HYDROGEOLOGIC CHARACTERIZATION DEFICIENCIES

Based on the review of existing data, a number of deficiencies have been identified in the characterization of the hydrogeology at Texaco. These deficiencies are listed as follows:

1. The hydrogeologic units designated by Texaco are based on stratigraphic boundaries rather than similarity of lithology and hydrogeologic properties. The stratigraphic boundaries at Texaco do not coincide with hydrogeologic unit boundaries. As a result, preferred ground water and contaminant pathways are not adequately defined. In addition, the stratigraphic boundaries for interglacial deposits and older glacial drift have poor geologic control and are, for the most part, speculative. Also, the basis for defining the locations of the unsaturated zones in the interglacial deposits has not been provided by Texaco.

2. Significant sand layers (Outwash Aquifer) are identified at depth in geotechnical soil borings located west of the east land treatment unit. These sand layers may extend beneath the east land treatment unit, may significantly influence the ground water flow pattern, and may be the preferred location for ground water monitoring for portions of the east land treatment unit. The extent, thickness, and hydrogeologic properties of these hydrogeologic units must be defined in detail, as well as vertical and horizontal hydraulic gradients. Extensive field investigations are needed, both

upgradient and downgradient of the east land treatment unit. The drilling program should be designed to penetrate the entire thickness of the Outwash Aquifer. Well completions at multiple depths will be necessary to define the vertical gradients. Quantitative flow nets must be prepared to identify preferred pathways for ground water and contaminant migration.

3. Additional exploration is needed to define the entire thickness of the Outwash Aquifer and the hydrogeologic characteristics of the Lower Aquitard beneath the west land treatment unit.

4. Evidence exists that suggests that the Outwash Aquifer beneath the west land treatment unit may out-crop at Fidalgo Bay rather than discharging at springs west of the west land treatment unit as interpreted by Texaco. Additional deep exploration of the seep area is needed to verify the hydrogeology. The responses of selected wells known to show air flow reversals should be monitored over tidal cycles.

5. Texaco's presentation of the hydrogeology in its Part B application is inadequate. Detailed hydrogeologic profiles should be prepared that show hydrogeologic units based on lithologic and textural variations rather than stratigraphic boundaries. Also, the profiles should show well construction details such as screened intervals, gravel pack, and seal locations.

GROUND WATER MONITORING NETWORK

At the time of the inspection, 20 monitoring wells and 8 piezometers had been installed at Texaco (Figure 2b). A well construction summary is shown in Table 3 which has been updated from Table XV-B-1 in the Part B application. Logs and as-built drawings for all wells and soil borings used in this report are shown in Appendix C.

Although it is not possible to fully evaluate the adequacy of the ground water monitoring network until the hydrogeology of the site has been adequately characterized, some deficiencies in the existing monitoring network have been identified. These deficiencies are described as follows:

1. The sand pack interval was not measured during the installation of wells W-1, W-2, W-3, and W-4. It is necessary to know the detailed monitoring well construction to interpret the water quality and water level data obtained from the wells. Lengths of sand pack intervals in some wells are excessive compared with respective screen lengths.

2. Wells W-11, W-12, W-13 and W-14 were contaminated with cement grout during well installation and are unsuitable for ground water sampling because of high pH in the samples.

3. Well W-16 reportedly had a broken casing, and as a result, cement grout entered the well during the well installation. Portions of this grout had to be drilled out. A 2-inch PVC well casing was

TABLE 3.

SUMMARY OF WELL/PIEZOMETER INSTALLATIONS

	Well	Total Depth of Well (ft) (b)	Elevations (ft)(a) Ground Surface	Top of Outer Casing *	Top of Sandpack	Top of Screen	Bottom of Screen	Bottom of Sandpack	Remarks
d	W-1	71.97	95.28	~~97.25~~ 97.56	--(c)	35.28	25.28	--	Unknown Top of Gravel Pack
d	W-2 u	47.85	143.81	~~145.86~~ 145.37	--	108.81	98.81	--	" " " "
d	W-3	76.72	145.44	~~147.16~~ 146.70	--	88.44	78.44	--	" " " "
	W-4	47.23	17.18	~~19.33~~ 45'd	--	-17.98	-27.98	--	Abandoned
	W-11	53.14	97.74	99.74	68.6	56.6	46.6	46.1	Grout, pH elevated
	W-12	61.81	96.61	96.31	69.1	65.1	55.1	58.6	" "
	W-13	31.98	96.26	96.18	77.2	74.2	64.2	63.2	" "
	W-14	34.95	185.33	187.25	164.3	162.3	152.3	150.8	" "
d	W-15	53.87	144.73	~~146.77~~ 146.96	107.9	102.9	92.9	91.9	" "
d	W-16	68.96	142.13	~~143.46~~ 143.76	97.5	94.5	84.5	74.8	Screened too low
d	W-17	62.83	131.98	~~133.23~~ 134.01	98.9	95.9	85.9	78.4	Grout, Broken Casing!
									Screened too high
d	W-21	27.17	97.49	~~99.66~~ 99.77	88.8	82.5	72.5	71.5	
d	W-22	27.88	94.61	~~96.69~~ 97.00	84.1	79.6	69.6	67.6	
d	W-23	27.25	94.79	~~97.84~~ 96.65	84.8	79.8	69.8	68.8	
d	W-24	42.67	151.95	~~154.62~~ 154.29	126.9	121.9	111.9	110.9	
	W-25	37.92	146.12	148.84	125.1	120.1	110.1	106.1	
	W-26	51.25	137.92	139.17	103.9	97.9	87.9	84.7	
	P-1	28.82	192.59	~~193.42~~ 193.15	176.6	169.6	164.6	164.1	
	P-2	29.48	188.98	~~182.48~~ 182.27	166.8	158.8	153.8	152.5	
	P-3	21.56	165.89	~~166.36~~ 165.37	156.2	150.2	145.2	136.2	
	P-4	14.67	119.11	120.78	111.1	109.1	106.1	106.1	
	P-5	15.17	119.76	121.93	111.8	109.8	106.8	106.8	
	P-6	14.58	120.28	121.86	112.3	110.3	107.3	107.3	
	P-7	15.33	116.12	118.45	108.1	106.1	103.1	103.1	
	P-8	14.83	111.14	112.97	103.1	101.1	98.1	98.1	
					Depth	Depth	Depth	Depth	
d	W-31 u		190.98	192.80	12.5	17.0	27.5	28.0	
d	W-32		145.89	147.79	29.0	39.2	44.7	44.7	
d	W-33		139.92	141.30	42.5	47.5	58.0	58.0	

(a) Elevations refer to Mean Lower Low Water Datum
(b) From top of outer casing to bottom of PVC screen or riser (if present below screen)
(c) "--" = Unknown

* Changes based on Texaco's water level reporting sheets.

"d" proposed Detection Monitoring Well

"u" upgradient " " "

installed inside the 4-inch PVC casing to attempt to reduce the amount of fines entering this well. Water quality results from this well remain questionable due to the grout installation problem.

4. As-built drawings for all wells that have been modified should be submitted to Ecology and EPA. Wells W-1 through W-3 and W-4 through W-17 were modified with 2-inch casing inserts. As-built drawings for only W-16 and W-17 have been submitted.

5. Well W-15 is screened only in the lower portion of the Outwash Aquifer. Another potential pathway for contaminant movement is through the upper portion of the Outwash Aquifer.

6. Well W-17 is screened too high. The well should be screened about 8 to 10 feet lower in a saturated portion of the Outwash Aquifer. Water levels from W-17 have been reported that are lower than the screened interval. This information is unreliable, as are all water quality results from this well when the water level was below the screen.

7. There are no monitoring wells upgradient of the east land treatment unit. Upgradient monitoring wells must be installed closer to the regulated unit to characterize the detailed hydrogeology, to define vertical and horizontal gradients, and to define the quality of water that is moving beneath the facility. Furthermore, the east and west land treatment units should be represented individually by separate

upgradient wells for statistical comparison purposes, since the two units are likely distinct geochemically, based on the different lithologies which have been observed, and would not be expected to demonstrate comparable water quality characteristics.

8. The locations of wells that are suitable for water quality monitoring are shown in Figure 18. Considering the complexity of the hydrogeology, this spacing of wells is not sufficient to adequately monitor the release of contaminants from either regulated unit.

9. The screening intervals for wells at the east land treatment unit cannot be evaluated until the hydrogeologic characterization is completed. Preliminary data indicate that monitoring wells will probably be needed in the upper portion of the Upper Aquitard and in the Outwash Aquifer if it is found to exist beneath the east land treatment unit. This determination should be based on the identification of preferred pathways for contaminant migration.

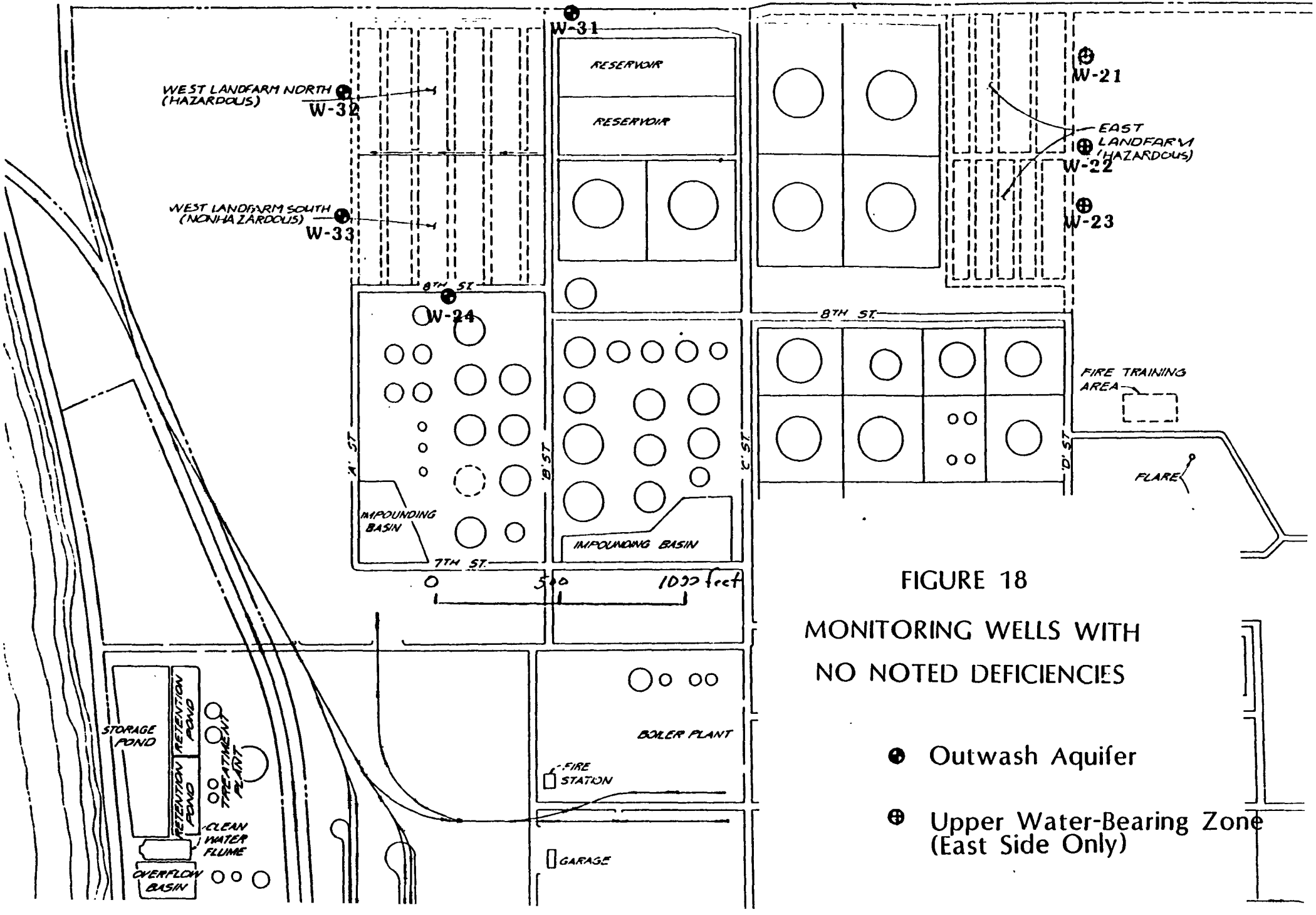


FIGURE 18

MONITORING WELLS WITH NO NOTED DEFICIENCIES

- Outwash Aquifer
- Upper Water-Bearing Zone (East Side Only)

GROUND WATER SAMPLING AUDIT

INTRODUCTION

A ground water sampling audit was conducted at Texaco on December 17, 1986, as part of the Hazardous Waste Ground Water Task Force inspection. The ground water sampling audit team consisted of Will Abercrombie (Ecology) and Marcia Bailey (EPA). The following tasks were accomplished as part of the sampling audit:

1. Review of the groundwater Sampling and Analysis Plan.

2. Observation of well purging, sampling, and field analysis techniques at wells W-3, W-15, W-16, W-31, and W-33. Sampling at well W-16 was not completed during the audit due to low well yield.

3. A review of Texaco's sample handling and chain-of-custody procedures.

4. An exit interview with Ken Brown, Vern Stevens, and Mike Meeuwsen, representing Texaco.

SAMPLING AND ANALYSIS PLAN REVIEW

The interim status Sampling and Analysis Plan reviewed for this audit was not available prior to conducting the inspection. It was received from Texaco on December 18, 1986, and is titled "Detailed Well Sampling Procedures, December 1986, Texaco Puget Sound Plant."

The Sampling and Analysis Plan lacks sufficient detail. The plan should be a stand-alone document with enough detail to allow an individual who is unfamiliar with the procedures to sample the wells in a manner that is consistent with previous sampling exercises. The plan needs to be rewritten in a format that allows it to be used as a field tool and guide. Certain areas of the plan need clarification, and in some cases the plan lacks specific elements. The following documents areas in the plan where modifications are required:

1. Quality control/quality assurance procedures for sampling, field analysis, and contract laboratory analysis should be identified and followed.

2. Analytical methods should be included in the plan. This information is found in the Part B submittal, but it should also be part of the interim status Sampling and Analysis Plan in order to make it a stand-alone document, as well as to reflect current practices.

3. Pump and well maintenance procedures and schedules should be part of the plan. This is especially important due to past problems with some wells and the use of dedicated pumps.

4. Table 1 (Sample Containers) on page 2 of the Plan is confusing and needs clarification.

5. The Plan does not detail procedures for obtaining water levels from piezometers and wells which do not have dedicated pumps.

6. Inaccurate well coordinates listed on the map located on page 6 should be corrected.

7. Table 4 on page 7 should be modified as follows:

   - The order of collection should be modified. Samples for total organic carbon (TOC) and total organic halogen (TOX) should be collected immediately after those for volatile organic compounds (VOCs). Pesticide samples should be collected along with other base, neutral, and acid extractables (i.e., semi-volatile organics).

   - The derivation of subsample numbers listed in the first column ("subsample number") needs to be clarified in the text.

   - Not all samples are listed as requiring ice as a preservative. All samples, including laboratory pH and specific conductance samples, require ice as a preservative. Field pH and specific conductance samples do not require ice if analyzed immediately upon collection.

   - The asterisk next to the volume for subsamples B and E needs to be explained.

- Sample containers requiring septa, teflon liners, etc. should be identified on the Table to aid in verifying sample containers prior to sampling.

- The parameter identified as "others" should be clarified and the appropriate columns need to be filled in.

8. The method of sealing containers and ice chests in order to detect tampering should be specified.

9. Information required in the field notebook should be compiled into a list so the sampler can easily ensure that all required information has been recorded.

10. The example of the chain-of-custody form on page 9 of the Plan appears to indicate that a maximum/minimum thermometer is used to record sample temperatures during shipment. If this is correct, it should be so indicated in the text of the Plan.

11. On page 12, a statement is made that dedicated pumps must be removed from the well before measuring the total depth of the well. These procedures need to be identified in the Plan and a schedule for measuring well depths should be part of the well maintenance program.

12. Table 6 on page 14 is a handy reference guide, but it should not be used to determine pore volumes for purging. Pore volumes should be

calculated using accurate depth-to-water measurements each time the well is sampled. The recharge rates listed in the last column of the Table does not represent the time it takes to recharge to static levels.

13. The following items refer to section E, titled "Well Sampling", located on pages 15 through 18 in the Sampling and Analysis Plan:

- This section should include procedures for addressing problems that are known to occur or are likely to occur during sampling, such as leaks in the sample tubing while taking dissolved metals samples with in-line filters, what to do if a sample container is not full when the well goes dry (i.e., discard or fill later), how to obtain water levels if the depth-to-water is below the pump, etc.

- Provisions need to describe where to obtain spare sample containers if one breaks or becomes contaminated.

- The purge rate needs to be slow enough to prevent aeration of water as it cascades down the inside of the well screen. Ideally, the purge rate should not exceed the recharge rate of the well. Some wells at Texaco will go dry even if purged very slowly. The Plan needs to take the foregoing into account and include appropriate purge rates for each well being sampled.

- The plan recommends that volatile organics be sampled at a rate of less than 100 ml/min. The flow rate must be low and the same at each well to prevent error induced due to variable sampling rates. The sampler should not be given an option in this matter. This also applies to other aeration-sensitive samples.

- Procedures for checking the accuracy of the thermometer used for measuring sample temperatures should be provided.

- The Plan should caution against touching or otherwise contaminating the inside of containers, septa, and cap liners. Procedures should be provided describing what to do if this occurs.

- The plan states that an extra volatile organics sample is collected and will be analyzed, if needed, to guard against false positive results due to analytical error. False negative results are just as likely, yet this possibility is not addressed, nor are acceptable holding times prior to extraction of the extra sample.

- The plan should alert the sampler not to overfill containers which contain preservatives and should describe what to do if this should occur.

14. Sample holding times need to be identified in the Plan and the method for ensuring that holding times are not exceeded should be described. This is to include a method for ensuring the contract laboratory does not exceed holding times. Procedures to be followed should holding times be exceeded should also be noted.

OBSERVATION OF FIELD PROCEDURES

This section documents discrepancies between the Sampling and Analysis Plan procedures and observed field procedures noted during the sampling audit. Any other inappropriate sampling activity that was observed is also listed. The following items all require correction.

1. Temperature, pH, and specific conductance are determined in the field. Additional samples are obtained and analyzed for pH, specific conductance, and turbidity in the Texaco laboratory. Laboratory values for specific conductance and pH are used by Texaco for the statistical tests required at 40 CFR § 265.93(b). Texaco claims that laboratory values are used because they are more reliable due to the nature of the field equipment used. It was observed that the pH and specific conductance meter appears to go out of calibration during well sampling. Although calibration frequencies are adequate, it appeared that the meter was not operating properly or is not accurate enough for ground water monitoring purposes. Texaco should procure equipment that allows for accurate and reliable field measurements so that these can be used in statistical tests. This is particularly critical for pH, which can change rapidly once exposed to air.

2. The Sampling and Analysis Plan states that laboratory pH and specific conductance samples are to be delivered to the Texaco laboratory for analysis immediately after being collected. During the audit many of the pH and specific conductance samples were not taken to the lab until the end of the day.

3. On at least two occasions, sample containers with preservatives were overfilled. These samples should have been discarded or additional preservative should have been added.

4. Well purge volumes were those listed in Table 6 of the Plan. Purge volumes should be based on water level measurements obtained immediately prior to commencement of purging activities.

5. In some cases, low-yielding wells were not sampled immediately after purging. Samples should be obtained as soon as enough volume is available to fill a container and in accordance with the sampling hierarchy.

WASTE ANALYSIS PLANS

Four waste analysis plans developed by Texaco were obtained during the inspection and subsequently reviewed. These plans, which pertain to waste stream characterization, were reviewed for compliance with regulatory requirements in 40 CFR Part 265. The plans reviewed include the original, dated March 1984, and three successive revisions: October 1984, November 1985, and December 1986. The two latest revisions of the waste analysis plan are virtually identical.

Regulations relating to waste analysis for all interim status hazardous waste facilities are set forth in 40 CFR § 265.13. This section requires that a detailed chemical and physical analysis of a representative sample from all hazardous wate streams be conducted, and that a written waste analysis plan be developed. Waste analysis requirements specific to owners and operators of land treatment facilities are described in 40 CFR § 265.273.

GENERAL COMMENTS

Compliance checklists for the individual waste analysis plans were completed for reference and are presented in Appendix D. The following comments apply to all four plans and address sections of the plans where it is not clear whether the applicable requirements are being met.

Each plan should contain the results of the comprehensive waste analysis required by 40 CFR § 265.13(a), but these results are found only in the most

recent revision (December 1986). The original plan and the first two revisions were taken from Texaco's RCRA Part B application that did not include the comprehensive waste analysis found in a different section of the RCRA Part B application.

One of the requirements of the comprehensive waste analysis is that "it must contain all the information which must be known to treat, store, or dispose of the waste ..." [40 CFR 265.13(a)(1)]. All four plans should provide this information, but they contain little on what is necessary to determine whether a waste can be landfarmed. This lack of information is particularly true of the first two plans (March and October 1984). Although the two most recent revisions briefly discuss "rate limiting constituents" and "capacity limiting constituents," little or no specific criteria are included.

All of the plans call for a "fingerprint" analysis of all hazardous wastes to be contained in Texaco's land treatment units. This fingerprint analysis includes selected parameters that are intended to characterize the waste. The only organic parameter is total oil content, which may not be sufficient to characterize the waste for treatment purposes. In addition, the fingerprinting analysis may not satisfy 40 CFR § 265.273(b), which requires that "the concentration of any substances which caused the waste to be listed as a hazardous waste" be determined.

Texaco's annual hazardous waste reports for the most recent three years were reviewed. Considerable variations in the composition of wastes was found. Therefore, comprehensive waste analysis, especially for organic

compounds, should be performed more often. This frequency would provide better data on what organic compounds are being applied to the land treatment units at Texaco's Puget Sound Plant.

MARCH 1984 WASTE ANALYSIS PLAN

The March 1984 plan is the least complete of the four. While it calls for detailed chemical and physical analyses of the wastes, the list of parameters provided is not complete and excludes many of the organic compounds typically found in oil refinery wastes. Also, the plan does not provide the necessary information on the treatment, storage, or disposal of the refinery wastes in accordance with 40 CFR Part 265. Other apparent areas of non-compliance are listed below:

- Sampling methods are not provided. SW 846 (U.S. EPA 1986) sampling methods are referenced but should be described in the report.

- The frequency of repetition for the initial comprehensive analysis is included but is vague. A specific minimum number of years should be given.

- Routine analysis for compounds that exceed the maximum concentrations (EP toxicity) given in Table 1 of 40 CFR § 261.24 is not addressed for all wastes. This table includes heavy metals and pesticides.

OCTOBER 1984 WASTE ANALYSIS PLAN

The first revision of October 1984 is a considerable improvement on the original waste analysis plan. Only two areas of non-compliance were noted. First, the plan does not provide guidelines for dealing with wastes generated off-site that are to be disposed at the Texaco land treatment units. (Texaco infrequently received waste from off-site generators and reportedly has not done so since 1984.) Second, substances that caused the waste to be listed in 40 CFR Part 261 Subpart D are not routinely analyzed for in all cases. Certain oily wastes are listed because of elevated levels of polyaromatic hydrocarbons, but this parameter is excluded from the list for routine analysis.

NOVEMBER 1985 AND DECEMBER 1986 WASTE ANALYSIS PLANS

The two most recent revisions appear to meet the 40 CFR Part 265 requirements. Although provisions for the evaluation of hazardous waste received from off-site generators is still absent, as long as Texaco does not accept off-site hazardous wastes, this is not an area of non-compliance.

WASTE TRACKING AND CHARACTERIZATION

During the inspection, certain waste tracking reports and chemical analyses of hazardous wastes were obtained and subsequently reviewed. The review included identifying and quantifying the types of hazardous waste and hazardous waste constituents disposed on-site since 1984. In the following narrative, the Texaco refinery's landfarm system, information sources, and reliability of the data are discussed.

WASTE TRACKING

Texaco's Anacortes refinery operates three land treatment units (see Figure 2). Two of the land treatment units are designated for hazardous waste, while the third receives non-hazardous waste. Each land treatment unit is subdivided into individual landfarms or plots. The two hazardous waste land treatment units consist of 16 landfarms totaling approximately 13 acres. The non-hazardous waste land treatment unit consists of 7 landfarms totaling approximately 7 acres.

According to Texaco records and procedures, when a waste is applied to one of the land treatment units, a pollution control form (Texaco Form R-500, see Figure 19) must be completed. Form R-500 is the basis of Texaco's waste tracking system. Information from these forms is summarized in Texaco's annual hazardous waste report. The annual hazardous waste reports contain information concerning date, quantity, and location of waste application, and data on waste composition. It was assumed for the purposes of this review

FIGURE 19

Form R-500 (1-82) RE

POLLUTION CONTROL FORM

SUBMIT REQUEST PROMPTLY TO POLLUTION COORDINATOR

UNIT OR AREA: ALKY 2 OWS BASIN (EAST OF COMP. HOUSE)

TYPE AND STRENGTH OF MATERIAL: WATER - DIRT

ESTIMATED QUANTITY: 200 GALS. WATER / 500# DIRT

REQUEST DISPOSAL TO: LAND FARM WITH WATER & DIRT
LANDFARM #5

PROPOSED DATE OF DISPOSAL: 1-27-84

*START OF RELEASE, TIME AND DATE: 0800 - 1-27-84

*COMPLETION OF RELEASE, TIME AND DATE: 1200 - 1-27-84

REMARKS: WILL SEND SAMPLE TO LAB FROM OWS BASIN

SUPERVISOR O.F. Beasley

RECOMMENDATIONS:

K R Browne
POLLUTION COORDINATOR

APPROVED C R Rice ASSISTANT PLANT MANAGER

*In case of upset or operating with uncontrolled or unusual release of pollutants, Waste Treating Plant Supervisor must be alerted immediately, and this form filed to confirmation.

Refinery Daily Waste

Jan ... 4-5-84

RCRA 5-84

Texaco Form R-500, Pollution Control Form.

that all hazardous wastes applied to the land treatment units since 1984 have been identified in Texaco's annual hazardous waste reports.

For this report, a summary table was prepared for each of the 23 landfarm plots, using Texaco's annual hazardous waste reports (Tables 4-26). The total estimated quantity of each constituent applied since 1984 is noted. Source of the constituent and calendar year it was applied are also shown. The constituents listed in the summary tables were selected on the basis of availability of analytical data. All analytical data used were assumed to be accurate [e.g., correct analytical metod was used, adequate quality assurance/quality control (QA/QC) was performed].

Constituents originated from one or more of the following categories of refinery waste (called "source" in the tables):

- API = American Petroleum Institute (API) separator sludge (K051) or other wastes generated at the API separator
- SOES = Slop oil emulsion solid and other related wastes generated from Tanks 61 and 62
- RS = Refinery scale, including any waste identified as a tank or roof scale
- ROW Refinery oily wastes, including miscellaneous oily waste such as tank bottoms and certain spent catalysts

TABLE 4. HAZARDOUS CONSTITUENTS APPLIED TO LANDFARM 1

Constituent	Source	Years Applied	Total Quantity Applied (lb)
	METALS		
Arsenic	API, SOES	1984, 1985	1
Barium	API, SOES	1984, 1985	147
Cadmium	ROW	1985	<1
Chromium (total)	API, RS, SOES, MS	1984, 1985	304
Lead	API, RS, SOES, MS	1984, 1985	60
Mercury	API, SOES	1984, 1985	14
Nickel	API, SOES, RS	1984, 1985	125
Selenium	API, SOES	1984, 1985	1
	ORGANICS		
PAH (total)	SOES	1985	1,860
Anthracene	SOES	1985	203
Benz(a)anthracene	API, SOES	1984, 1985	18
Chrysene	API	1984	36
Naphthalene	API, SOES	1984, 1985	187
Phenanthrene	API, SOES	1984, 1985	125
Pyrene	API, SOES	1984, 1985	38
Benzene	SOES	1985	46
Toluene	SOES	1985	329
Methyl ethyl ketone	API	1984	103
Cresols	SOES	1985	4

TABLE 5. HAZARDOUS CONSTITUENTS APPLIED TO LANDFARM 2

Constituent	Source	Years Applied	Total Quantity Applied (lb)
		METALS	
Arsenic	MS	1984	<1
Barium	MS	1984	3
Cadmium	ND	---	--
Chromium (total)	MS, RS	1984	2
Lead	MS, RS	1984	23
Mercury	MS	1984	<1
Nickel	MS	1984	1
Selenium	ND	---	--
		ORGANICS	
PAH (total)	MS	1984	103
Anthracene	ND	---	--
Benz(a)anthracene	ND	---	--
Chrysene	ND	---	--
Naphthalene	ND	---	--
Phenanthrene	ND	---	--
Pyrene	ND	---	--
Benzene	ND	---	--
Toluene	ND	---	--
Methyl ethyl ketone	ND	---	--
Cresols	ND	---	--

TABLE 6. HAZARDOUS CONSTITUENTS APPLIED TO LANDFARM 3

Constituent	Source	Years Applied	Total Quantity Applied (lb)
		METALS	
Arsenic	RS	1984	<1
Barium	RS	1984	<1
Cadmium	ND	---	--
Chromium (total)	MS, SOES, RS	1984, 1985	86
Lead	MS, SOES, RS	1984, 1985	25
Mercury	RS	1984	<1
Nickel	RS	1984	<1
Selenium	RS	1984	<1
		ORGANICS	
PAH (total)	SOES	1984	1,100
Anthracene	SOES	1984	168
Benz(a)anthracene	SOES	1984	3
Chrysene	ND	---	--
Naphthalene	SOES	1984	81
Phenanthrene	SOES	1984	42
Pyrene	SOES	1984	6
Benzene	SOES	1984	37
Toluene	SOES	1984	271
Methyl ethyl ketone	ND	---	--
Cresols	SOES	1984	3

TABLE 7. HAZARDOUS CONSTITUENTS APPLIED TO LANDFARM 4

Constituent	Source	Years Applied	Total Quantity Applied (lb)
	METALS		
Arsenic	API	1984	<1
Barium	API	1984	6
Cadmium	ND	---	--
Chromium (total)	API, SOES, MS	1984	81
Lead	API, SOES, MS	1984	37
Mercury	API	1984	<1
Nickel	API	1984	5
Selenium	API	1984	<1
	ORGANICS		
PAH (total)	API, SOES	1984	8,980
Anthracene	SOES	1984	545
Benz(a)anthracene	API, SOES	1984	9
Chrysene	API	1984	2
Naphthalene	API, SOES	1984	267
Phenanthrene	API, SOES	1984	141
Pyrene	API, SOES	1984	21
Benzene	SOES	1984	122
Toluene	SOES	1984	883
Methyl ethyl ketone	API	1984	6
Cresols	SOES	1984	11

TABLE 8. HAZARDOUS CONSTITUENTS APPLIED TO LANDFARM 5

Constituent	Source	Years Applied	Total Quantity Applied (lb)
	METALS		
Arsenic	API	1984, 1985	<1
Barium	API, RS	1984, 1985	117
Cadmium	API	1984	<1
Chromium (total)	API, RS, MS	1984, 1985	183
Lead	API, RS	1984, 1985	37
Mercury	API, RS	1984, 1985	11
Nickel	API, RS	1984	100
Selenium	API	1984	1
	ORGANICS		
PAH (total)	API, MS	1984, 1985	6,800
Anthracene	NONE	---	--
Benz(a)anthracene	API	1984, 1985	17
Chrysene	API	1984, 1985	43
Naphthalene	API	1984, 1985	107
Phenanthrene	API	1984, 1985	89
Pyrene	API	1984, 1985	38
Benzene	NONE	---	--
Toluene	NONE	---	--
Methyl ethyl ketone	API	1984, 1985	125
Cresols	NONE	---	--

TABLE 9. HAZARDOUS CONSTITUENTS APPLIED TO LANDFARM 6E

Constituent	Source	Years Applied	Total Quantity Applied (lb)
		METALS	
Arsenic	ND	---	--
Barium	ND	---	--
Cadmium	ND	---	--
Chromium (total)	API	1985	61
Lead	API	1985	7
Mercury	ND	---	--
Nickel	ND	---	--
Selenium	ND	---	--
Vanadium	ND	---	--
		ORGANICS	
PAH (total)	ND	---	--
Anthracene	ND	---	--
Benz(a)anthracene	API	1985	10
Chrysene	API	1985	24
Naphthalene	API	1985	60
Phenanthrene	API	1985	50
Pyrene	API	1985	21
Benzene	ND	---	--
Toluene	ND	---	--
Methyl ethyl ketone	API	1985	70
Cresols	ND	---	--

TABLE 10. HAZARDOUS CONSTITUENTS APPLIED TO LANDFARM 6W

Constituent	Source	Years Applied	Total Quantity Applied (lb)
		METALS	
Arsenic	ND	---	--
Barium	ND	---	--
Cadmium	ND	---	--
Chromium (total)	API	1985	53
Lead	API	1985	6
Mercury	ND	---	--
Nickel	ND	---	--
Selenium	ND	---	--
Vanadium	ND	---	--
		ORGANICS	
PAH (total)	ND	---	--
Anthracene	ND	---	--
Benz(a)anthracene	API	1985	8
Chrysene	API	1985	21
Naphthalene	API	1985	51
Phenanthrene	API	1985	43
Pyrene	API	1985	18
Benzene	ND	---	--
Toluene	ND	---	--
Methyl ethyl ketone	API	1985	59
Cresols	ND	---	--

TABLE 11. HAZARDOUS CONSTITUENTS APPLIED TO LANDFARM 6WC

Constituent	Source	Years Applied	Total Quantity Applied (lb)
	METALS		
Arsenic	NO WASTE APPLIED SINCE 1984		
Barium			
Cadmium			
Chromium (total)			
Lead			
Mercury			
Nickel			
Selenium			
	ORGANICS		
PAH (total)	NO WASTE APPLIED SINCE 1984		
Anthracene			
Benz(a)anthracene			
Chrysene			
Naphthalene			
Phenanthrene			
Pyrene			
Benzene			
Toluene			
Methyl ethyl ketone			
Cresols			

TABLE 12. HAZARDOUS CONSTITUENTS APPLIED TO LANDFARM 6W

Constituent	Source	Years Applied	Total Quantity Applied (lb)
		METALS	
Arsenic	ND	---	--
Barium	ND	---	--
Cadmium	ND	---	--
Chromium (total)	MS	1985	65
Lead	MS	1985	18
Mercury	ND	---	--
Nickel	ND	---	--
Selenium	ND	---	--
Vanadium	ND	---	--
		ORGANICS	
PAH (total)	ND	---	--
Anthracene	ND	---	--
Benz(a)anthracene	ND	---	--
Chrysene	ND	---	--
Naphthalene	ND	---	--
Phenanthrene	ND	---	--
Pyrene	ND	---	--
Benzene	ND	---	--
Toluene	ND	---	--
Methyl ethyl ketone	ND	---	--
Cresols	ND	---	--

TABLE 13. HAZARDOUS CONSTITUENTS APPLIED TO LANDFARM 7

Constituent	Source	Years Applied	Total Quantity Applied (lb)
	METALS		
Arsenic	SOES, MS	1984, 1986	1
Barium	MS	1984	2
Cadmium	ND	---	--
Chromium (total)	API, SOES, MS	1984, 1985, 1986	952
Lead	API, SOES, MS	1984, 1985, 1986	33
Mercury	SOES, MS	1984, 1986	23
Nickel	SOES, MS	1984, 1986	23
Selenium	SOES, MS	1984, 1986	3
	ORGANICS		
PAH (total)	SOES	1985, 1986	29,000
Anthracene	SOES	1985, 1986	1,520
Benz(a)anthracene	SOES, API	1985, 1986	28
Chrysene	API	1985	4
Naphthalene	SOES, API	1985, 1986	743
Phenanthrene	SOES, API	1985, 1986	390
Pyrene	SOES, API	1985, 1986	55
Benzene	SOES	1985, 1986	341
Toluene	SOES	1985, 1986	2,460
Methyl ethyl ketone	API	1985	11
Cresols	SOES	1985, 1986	29

TABLE 14. HAZARDOUS CONSTITUENTS APPLIED TO LANDFARM 8

Constituent	Source	Years Applied	Total Quantity Applied (lb)
	METALS		
Arsenic	SOES, MS	1984, 1986	2
Barium	ND	---	--
Cadmium	ND	---	--
Chromium (total)	SOES, API, MS	1984, 1985, 1986	815
Lead	SOES, API, MS	1984, 1985, 1986	80
Mercury	SOES, MS	1984, 1986	16
Nickel	SOES, API	1986	32
Selenium	SOES, MS	1984, 1986	3
	ORGANICS		
PAH (total)	SOES	1986	42,300
Anthracene	SOES	1985, 1986	2,300
Benz(a)anthracene	SOES, API	1985, 1986	56
Chrysene	API	1985, 1986	43
Naphthalene	SOES, API	1985, 1986	1,200
Phenanthrene	SOES, API	1985, 1986	660
Pyrene	SOES, API	1985, 1986	120
Benzene	SOES	1985, 1986	510
Toluene	SOES	1985, 1986	3,700
Methyl ethyl ketone	API	1985, 1986	120
Cresols	SOES	1985, 1986	44

TABLE 15. HAZARDOUS CONSTITUENTS APPLIED TO LANDFARM 9

Constituent	Source	Years Applied	Total Quantity Applied (lb)
	METALS		
Arsenic	SOES, API, MS	1984, 1985, 1986	1
Barium	ND	---	—
Cadmium	SOES	1985	<1
Chromium (total)	SOES, API, MS	1984, 1985, 1986	820
Lead	SOES, API	1985, 1986	32
Mercury	SOES, API, MS	1984, 1985, 1986	14
Nickel	SOES, API	1985, 1986	215
Selenium	SOES, API, MS	1984, 1985, 1986	1
	ORGANICS		
PAH (total)	SOES, API	1985, 1986	23,400
Anthracene	SOES	1985, 1986	1,300
Benz(a)anthracene	SOES, API	1985, 1986	35
Chrysene	API	1986	33
Naphthalene	SOES, API	1985, 1986	710
Phenanthrene	SOES, API	1985, 1986	400
Pyrene	SOES, API	1985, 1986	74
Benzene	SOES	1985, 1986	290
Toluene	SOES	1985, 1986	2,100
Methyl ethyl ketone	API	1986	96
Cresols	SOES	1985, 1986	25

TABLE 16. HAZARDOUS CONSTITUENTS APPLIED TO LANDFARM 10E

Constituent	Source	Years Applied	Total Quantity Applied (lb)
	METALS		
Arsenic	SOES, API	1984, 1985, 1986	2
Barium	API	1984	12
Cadmium	SOES	1985	<1
Chromium (total)	SOES, API, MS	1984, 1985, 1986	441
Lead	SOES, API, MS	1984, 1985, 1986	41
Mercury	SOES, API	1984, 1985, 1986	8
Nickel	SOES, API, MS	1984, 1985, 1986	333
Selenium	SOES, API, MS	1984, 1985, 1986	1
	ORGANICS		
PAH (total)	SOES, API	1984, 1985, 1986	23,890
Anthracene	SOES	1985, 1986	1,920
Benz(a)anthracene	SOES, API	1984, 1985, 1986	35
Chrysene	API	1984	8
Naphthalene	SOES, API	1984, 1985, 1986	946
Phenanthrene	SOES, API	1984, 1985, 1986	500
Pyrene	SOES, API	1984, 1985, 1986	73
Benzene	SOES	1985, 1986	430
Toluene	SOES	1985, 1986	3,110
Methyl ethyl ketone	API	1984	23
Cresols	SOES	1985, 1986	37

TABLE 17. HAZARDOUS CONSTITUENTS APPLIED TO LANDFARM 10W

Constituent	Source	Years Applied	Total Quantity Applied (lb)
	METALS		
Arsenic	SOES, API	1984, 1985, 1986	1
Barium	API	1984	12
Cadmium	SOES	1985, 1986	<1
Chromium (total)	SOES, API, MS	1984, 1985, 1986	416
Lead	SOES, API, MS	1984, 1985, 1986	37
Mercury	SOES, API	1984, 1985, 1986	7
Nickel	SOES, API, MS	1984, 1985, 1986	317
Selenium	SOES, API, MS	1984, 1985, 1986	1
	ORGANICS		
PAH (total)	SOES, API	1984, 1985, 1986	26,590
Anthracene	SOES	1985, 1986	1,590
Benz(a)anthracene	SOES, API	1984, 1985, 1986	30
Chrysene	API	1984	8
Naphthalene	SOES, API	1984, 1985, 1986	786
Phenanthrene	SOES, API	1984, 1985, 1986	416
Pyrene	SOES, API	1984, 1985, 1986	72
Benzene	SOES	1985, 1986	355
Toluene	SOES	1985, 1986	2,570
Methyl ethyl ketone	API	1984	23
Cresols	SOES	1985, 1986	31

TABLE 18. HAZARDOUS CONSTITUENTS APPLIED TO LANDFARM 11

Constituent	Source	Years Applied	Total Quantity Applied (lb)
	METALS		
Arsenic	SOES, RS	1985, 1986	1
Barium	ND	---	--
Cadmium	ND	---	--
Chromium (total)	SOES, API, RS, MS	1984, 1985, 1986	406
Lead	SOES, API, RS, MS	1984, 1985, 1986	51
Mercury	SOES	1986	3
Nickel	SOES, API, RS, MS	1984, 1985, 1986	171
Selenium	SOES, API, RS, MS	1984, 1985, 1986	1
	ORGANICS		
PAH (total)	SOES, API	1985, 1986	33,500
Anthracene	SOES	1985, 1986	1,570
Benz(a)anthracene	SOES, API	1985, 1986	53
Chrysene	API	1985, 1986	66
Naphthalene	SOES, API	1985, 1986	910
Phenanthrene	SOES, API	1985, 1986	533
Pyrene	SOES, API	1985, 1986	110
Benzene	SOES	1985, 1986	350
Toluene	SOES	1985, 1986	2,550
Methyl ethyl ketone	API	1985, 1986	190
Cresols	SOES	1985, 1986	30

TABLE 19. HAZARDOUS CONSTITUENTS APPLIED TO LANDFARM 12

Constituent	Source	Years Applied	Total Quantity Applied (lb)
	METALS		
Arsenic	SOES, API, MS	1985, 1986	1
Barium	SOES, RS	1984, 1985, 1986	4
Cadmium	SOES, API, MS, RS	1984, 1985, 1986	<1
Chromium (total)	SOES, API, MS, RS	1984, 1985, 1986	360
Lead	SOES, API, MS, RS	1984, 1985, 1986	31
Mercury	SOES	1986	2
Nickel	SOES, API, RS, MS	1984, 1985, 1986	160
Selenium	SOES, API	1985, 1986	1
	ORGANICS		
PAH (total)	SOES, API	1985, 1986	17,900
Anthracene	SOES	1985, 1986	800
Benz(a)anthracene	SOES, API	1985, 1986	34
Chrysene	API	1985, 1986	50
Naphthalene	SOES, API, MS	1985, 1986	546
Phenanthrene	SOES, API	1985, 1986	128
Pyrene	SOES, API	1985, 1986	70
Benzene	SOES	1985, 1986	180
Toluene	SOES	1985, 1986	1,300
Methyl ethyl ketone	API	1985, 1986	140
Cresols	SOES	1985, 1986	18
Xylenes	MS	1985	40

TABLE 20. HAZARDOUS CONSTITUENTS APPLIED TO LANDFARM 13

Constituent	Source	Years Applied	Total Quantity Applied (lb)
	METALS		
Arsenic	MS	1984	<1
Barium	ND	---	--
Cadmium	ND	---	--
Chromium (total)	MS, RS	1984, 1985, 1986	693
Lead	MS, RS	1985, 1986	17
Mercury	MS	1984	11
Nickel	MS	1985, 1986	37
Selenium	ND	---	--
	ORGANICS		
PAH (total)	NONE REPORTED	---	--
Anthracene	NONE REPORTED	---	--
Benz(a)anthracene	NONE REPORTED	---	--
Chrysene	NONE REPORTED	---	--
Naphthalene	NONE REPORTED	---	--
Phenanthrene	NONE REPORTED	---	--
Pyrene	NONE REPORTED	---	--
Benzene	NONE REPORTED	---	--
Toluene	NONE REPORTED	---	--
Methyl ethyl ketone	NONE REPORTED	---	--
Cresols	NONE REPORTED	---	--

TABLE 21. HAZARDOUS CONSTITUENTS APPLIED TO LANDFARM 14

Constituent	Source	Years Applied	Total Quantity Applied (lb)
	METALS		
Arsenic	MS	1984, 1985	12
Barium	MS	1985	74
Cadmium	MS	1985	2
Chromium (total)	MS, ROW	1984, 1985, 1986	5,260
Lead	MS	1985, 1986	150
Mercury	MS	1984	1
Nickel	MS	1984, 1985, 1986	420
Selenium	MS	1986	<1
	ORGANICS		
PAH (total)	NONE REPORTED	---	--
Anthracene	NONE REPORTED	---	--
Benz(a)anthracene	NONE REPORTED	---	--
Chrysene	NONE REPORTED	---	--
Naphthalene	NONE REPORTED	---	--
Phenanthrene	NONE REPORTED	---	--
Pyrene	NONE REPORTED	---	--
Benzene	NONE REPORTED	---	--
Toluene	NONE REPORTED	---	--
Methyl ethyl ketone	NONE REPORTED	---	--
Cresols	NONE REPORTED	---	--

TABLE 22. HAZARDOUS CONSTITUENTS APPLIED TO LANDFARM 15

Constituent	Source	Years Applied	Total Quantity Applied (lb)
	METALS		
Arsenic	ND	---	--
Barium	ND	---	--
Cadmium	ND	---	--
Chromium (total)	MS	1984, 1985, 1986	2,060
Lead	MS	1985, 1986	95.6
Mercury	MS	1984	1
Nickel	MS	1986	72
Selenium	MS	1984	2
	ORGANICS		
PAH (total)	NONE REPORTED	---	--
Anthracene	NONE REPORTED	---	--
Benz(a)anthracene	NONE REPORTED	---	--
Chrysene	NONE REPORTED	---	--
Naphthalene	NONE REPORTED	---	--
Phenanthrene	NONE REPORTED	---	--
Pyrene	NONE REPORTED	---	--
Benzene	NONE REPORTED	---	--
Toluene	NONE REPORTED	---	--
Methyl ethyl ketone	NONE REPORTED	---	--
Cresols	NONE REPORTED	---	--

TABLE 23. HAZARDOUS CONSTITUENTS APPLIED TO LANDFARM 16E

Constituent	Source	Years Applied	Total Quantity Applied (lb)
	METALS		
Arsenic	ND	---	--
Barium	ND	---	--
Cadmium	ND	---	--
Chromium (total)	MS, RS	1985, 1986	1,440
Lead	MS, RS	1986	138
Mercury	ND	---	--
Nickel	MS, RS	1986	178
Selenium	ND	---	--
	ORGANICS		
PAH (total)	NONE REPORTED	---	--
Anthracene	NONE REPORTED	---	--
Benz(a)anthracene	NONE REPORTED	---	--
Chrysene	NONE REPORTED	---	--
Naphthalene	NONE REPORTED	---	--
Phenanthrene	NONE REPORTED	---	--
Pyrene	NONE REPORTED	---	--
Benzene	NONE REPORTED	---	--
Toluene	NONE REPORTED	---	--
Methyl ethyl ketone	NONE REPORTED	---	--
Cresols	NONE REPORTED	---	--

TABLE 24. HAZARDOUS CONSTITUENTS APPLIED TO LANDFARM 16W

Constituent	Source	Years Applied	Total Quantity Applied (lb)
	METALS		
Arsenic	ND	---	--
Barium	ND	---	--
Cadmium	ND	---	--
Chromium (total)	MS, RS	1985, 1986	1,600
Lead	MS, RS	1986	39
Mercury	ND	---	--
Nickel	MS, RS	1986	150
Selenium	ND	---	--
	ORGANICS		
PAH (total)	NONE REPORTED	---	--
Anthracene	NONE REPORTED	---	--
Benz(a)anthracene	NONE REPORTED	---	--
Chrysene	NONE REPORTED	---	--
Naphthalene	NONE REPORTED	---	--
Phenanthrene	NONE REPORTED	---	--
Pyrene	NONE REPORTED	---	--
Benzene	NONE REPORTED	---	--
Toluene	NONE REPORTED	---	--
Methyl ethyl ketone	NONE REPORTED	---	--
Cresols	NONE REPORTED	---	--

TABLE 25. HAZARDOUS CONSTITUENTS APPLIED TO LANDFARM 17

Constituent	Source	Years Applied	Total Quantity Applied (lb)
	METALS		
Arsenic	ND	---	---
Barium	ND	---	---
Cadmium	ND	---	---
Chromium (total)	MS, RS	1985, 1986	2,100
Lead	MS, RS	1985, 1986	60
Mercury	ND	---	---
Nickel	MS, RS	1986	120
Selenium	ND	---	---
	ORGANICS		
PAH (total)	NONE REPORTED	---	---
Anthracene	NONE REPORTED	---	---
Benz(a)anthracene	NONE REPORTED	---	---
Chrysene	NONE REPORTED	---	---
Naphthalene	NONE REPORTED	---	---
Phenanthrene	NONE REPORTED	---	---
Pyrene	NONE REPORTED	---	---
Benzene	NONE REPORTED	---	---
Toluene	NONE REPORTED	---	---
Methyl ethyl ketone	NONE REPORTED	---	---
Cresols	NONE REPORTED	---	---

TABLE 25. HAZARDOUS CONSTITUENTS APPLIED TO LANDFARM 17

Constituent	Source	Years Applied	Total Quantity Applied (lb)
	METALS		
Arsenic	ND	---	--
Barium	ND	---	--
Cadmium	ND	---	--
Chromium (total)	MS, RS	1985, 1986	2,100
Lead	MS, RS	1985, 1986	60
Mercury	ND	---	--
Nickel	MS, RS	1986	120
Selenium	ND	---	--
	ORGANICS		
PAH (total)	NONE REPORTED	---	--
Anthracene	NONE REPORTED	---	--
Benz(a)anthracene	NONE REPORTED	---	--
Chrysene	NONE REPORTED	---	--
Naphthalene	NONE REPORTED	---	--
Phenanthrene	NONE REPORTED	---	--
Pyrene	NONE REPORTED	---	--
Benzene	NONE REPORTED	---	--
Toluene	NONE REPORTED	---	--
Methyl ethyl ketone	NONE REPORTED	---	--
Cresols	NONE REPORTED	---	--

TABLE 26. HAZARDOUS CONSTITUENTS APPLIED TO LANDFARM 18

Constituent	Source	Years Applied	Total Quantity Applied (lb)
	METALS		
Arsenic	ND	---	--
Barium	ND	---	--
Cadmium	ND	---	--
Chromium (total)	MS	1985, 1986	825
Lead	MS	1985, 1986	67
Mercury	ND	---	--
Nickel	MS	1985, 1986	290
Selenium	ND	---	--
	ORGANICS		
PAH (total)	NONE REPORTED	---	--
Anthracene	NONE REPORTED	---	--
Benz(a)anthracene	NONE REPORTED	---	--
Chrysene	NONE REPORTED	---	--
Naphthalene	NONE REPORTED	---	--
Phenanthrene	NONE REPORTED	---	--
Pyrene	NONE REPORTED	---	--
Benzene	NONE REPORTED	---	--
Toluene	NONE REPORTED	---	--
Methyl ethyl ketone	NONE REPORTED	---	--
Cresols	NONE REPORTED	---	--

- MS = Miscellaneous wastes, including filter materials, spent catalysts, contaminated soild, and various sludges.

Where "ND" appears in the "Source" column of the tables, calculated quantity of waste constituent in the plot was less than 0.1 lb.

Metals

The quantities of metals reported in the summary tables were calculated using only data from the annual hazardous waste reports. Tables in the 1984 report provided the concentration of each constituent in each application of waste, and weight of the application. Total mass of the constituent was not provided. Total mass of the constituent was calculated by multiplying concentration times total weight of waste, after making the necessary unit corrections. For example, if a 50-ton batch of separator sludge contained 500 mg/kg of chromium, the concentration would be converted to lb/ton (500 mg/kg = 1 lb/ton) and multiplied by 50 tons for a total chromium mass of 50 lb in the batch.

Tables in the 1985 and 1986 reports include total mass of each constituent for each waste application. Several of these calculated mass values were recalculated using other data in the reports and found to be accurate.

The metals quantities reported in the summary tables are considered to be reasonably accurate for those metals which were analyzed. Almost all wastes generated since 1984 have been analyzed for chromium and lead, commonly found

in significant concentrations in refinery wastes. Reportedly, when a waste was suspected of containing high levels of nickel or vanadium, it was also analyzed for these constituents. Materials that typically contain high levels of nickel and vanadium include catalyst wastes, specifically from the fluidized catalytic cracker unit (FCCU). Waste samples were infrequently analyzed for the remainder of metals (25-35 percent of the time).

Vanadium is not included in the summary tables because it was not an analyte in 1984 and only infrequently an analyte in 1985 and 1986. Most vanadium applied to the land treatment units reportedly is contained in FCCU waste, which has not been applied to the hazardous land treatment units since 1985. However, waste characterization information provided in Texaco's Part B permit application indicate that vanadium is present to some extent in most of the hazardous waste streams applied to the land treatment units.

Organics

The quantities of organic constituents reported in the summary tables were calculated using data from the comprehensive waste characterization performed by Texaco in 1985 and from the annual hazardous waste reports. The annual reports contain limited data on organic constituents found in wastes. Only total polynuclear aromatic hydrocarbons (PAH) were analyzed, and this only 10-20 percent of the time.

To estimate the amount of organic compounds that has been applied since 1984, data from Texaco's comprehensive waste characterization was needed.

This characterization included an analysis of waste for "Skinner list" compounds. The Skinner list (Table 27) is an EPA index of constituents considered likely to be found in petroleum refinery wastes. The only wastes generated at the Texaco refinery that showed significant concentrations of organic compounds were API separator sludge and slop oil emulsion solids. The concentrations of compounds identified in these wastes are shown in Table 28. Total quantities of organic constituents applied to land treatment units in waste were calculated using the same procedure described for metals.

Quantities of organic compounds reported in the summary tables may not be reliable, because it is not clear whether the profiles shown in Table 28 are representative of all API and SOES wastes. The total PAH levels reported for SOES waste varied from 0 to 7.3 percent. Concentrations of other organic compounds are also unlikely to remain constant. The values shown in the summary tables should be considered rough estimates. The actual values for organic compounds are probably higher because most wastes that contain organic compounds were probably not analyzed for them regularly.

CONCLUSIONS

From available Texaco records, it is possible to discern to varying degrees of accuracy and precision the quantities and identities of constituents which have been disposed in the hazardous waste landfarms in the past few years. Since the facility has operated since 1958, and since hazardous as well as non-hazardous refinery wastes were placed together in the units until 1985, it is of course not possible to determine in a meaningful

Table 27. Constituents of Petroleum Refining Wastes

1. Metals

Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Cobalt
Lead
Mercury
Nickel
Selenium
Vanadium

2. Volatiles

Benzene
Carbon disulfide
Chlorobenzene
Chloroform
1,2-Dichloroethane
1,4-Dioxane
Ethyl benzene
Ethylene dibromide
Methyl ethyl ketone
Styrene
Toluene
Xylene

3. Semivolatile Base/Neutral Extractable Compounds

Anthracene
Benzo(a)anthracene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(a)pyrene
Bis(2-ethylhexyl) phthalate
Butyl benzyl phthalate
Chrysene
Dibenz(a,h)acridine
Dibenz(a,h)anthracene
Dichlorobenzenes
Diethyl phthalate
7,12-Dimethylbenz(a)anthracene
Dimethyl phthalate
Di(n)butyl phthalate
Di(n)octyl phthalate
Fluoranthene
Indene
Methyl chrysene
1-Methyl naphthalene
Naphthalene
Phenanthrene
Pyrene
Pyridine
Quinoline

4. Semivolatile Acid-Extractable Compounds

Benzenethiol
Cresols
2,4-Dimethylphenol
2,4-Dinitrophenol
4-Nitrophenol
Phenol

TABLE 28. HAZARDOUS WASTE PROFILE

SLOP OIL EMULSION SOLIDS

Compound	Concentration (mg/kg)
Benzene	650
Toluene	4,700
Anthracene	2,900
Naphthalene	1,400
Benz(a)anthracene	49
Phenanthrene	730
Pyrene	100
Cresols	56

Also contains trace levels (0.05 - 0.07 mg/kg) of volatile sulfur compounds.

API SEPARATOR SLUDGE

Compound	Concentration (mg/kg)
Methyl ethyl ketone	430
Benz(a)anthracene	60
Chrysene	150
Naphthalene	370
Phenanthrene	310
Pyrene	130

Also contains trace levels (0.1-0.4 mg/kg) of volatile sulfur compounds.

way the total quantities of constituents which have been disposed. Prior to the implementation of RCRA regulations beginning in 1980, records of such disposal were not required of Texaco.

Soil core samples obtained as part of Texaco's land treatment demonstration provide a better understanding of the nature of the inorganic constituents which have been placed in the units and which are present within and below the zone of incorporation. In 1985, Texaco conducted a reconnaissance sampling effort to assess soil conditions at the land treatment units, both hazardous and nonhazardous. Soil cores were collected at 26 randomly chosen locations in the east and west land treatment units and in the background areas. Seven depth intervals were sampled at each location: 0-15 cm, 15-45 cm, 45-90 cm, 90-150 cm, 200-250 cm and 250-305 cm. One result of the study (Table 29) was a demonstration of values of the following waste constituents to be above background levels at various discrete depths: antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, lead, mercury, nickel and vanadium. While it should be noted that most of the metals had decreased to background levels at the deepest measured depths, all values greater than background serve as an indication of the identity of inorganic constituents which have been treated in these units. Since organic constituents are biodegraded, rather than immobilized, in the land treatment process, it is not possible to draw similar conclusions from core samples analyzed for organic constituents.

Table 29

D7a-18. Metal Concentrations by Depth That Exceed Background Values for the Texaco LT Unit (1985).

Parameter	Antimony				Arsenic				Barium			
Depth, cm	0-45	45-150	150-200	200-305	0-45	45-150	150-200	200-305	0-45	45-150	150-200	200-305
Sample Number												
Hazardous Units												
East-1,2	200				18	10		10				
East-3,4	150				17							
East-5,6	84				18							
West North-1,2	22				18			8				
West North-3,4					12		9	8				
West North-5,6					16	23	20	22		88		
Nonhazardous Units												
West South-1,2					12	12						
West South-3,4					15							
West South-5,6												

Parameter	Beryllium				Cadmium				Chromium			
Depth	0-45	45-150	150-200	200-305	0-45	45-150	150-200	200-305	0-45	45-150	150-200	200-305
Sample Number												
Hazardous Units												
East-1,2	0.75						1.5		158	53		46
East-3,4	1								248	66		69
East-5,6	0.84	0.49							164	56		
North-1,2	0.71	0.46					1.6		276		39	
West North-3,4	0.83								325	89		
West North-5,6	0.59	0.49							376	80		43
Nonhazardous Units												
West South-1,2					4		1.6		229		39	
West South-3,4					2				493			
West South-5,6									109			

Parameter	Cobalt				Lead				Mercury			
Depth	0-45	45-150	150-200	200-305	0-45	45-150	150-200	200-305	0-45	45-150	150-200	200-305
Sample Number												
Hazardous Units												
East-1,2	26	16			38	10			1.1	0.25		
East-3,4	27	15			39	11			1.7	0.35	0.1	
East-5,6	18	14			47	12					0.1	
West North-1,2	23	16			49	11			1.4		0.1	
West North-3,4	25	15			50	16			1.1	0.35		
West North-5,6	20	19			52	13		11	9.1	0.45	0.1	
Nonhazardous Units												
West South-1,2	31				79	10			0.45			
West South-3,4					99				0.95			
West South-5,6												

-- Continued --

Table D7a-18. Continued.

Parameter	Nickel				Selenium				Silver			
Depth	0-45	45-150	150-200	200-305	0-45	45-150	150-200	200-305	0-45	45-150	150-200	200-3
Sample Number												
Hazardous Units												
East-1,2	270	62										
East-3,4	283											
East-5,6	161											
West North-1,2	141			72								
West North-3,4	180	72										
West North-5,6	134	55	60	58								
Nonhazardous Units												
West South-1,2	115			57					1.7			
West South-3,4	108											
West South-5,6												

Parameter	Vanadium			
Depth	0-45	45-150	150-200	200-305
Sample Number				
Hazardous Units				
East-1,2	238	75		
East-3,4	253			
East-5,6	212			
West North-1,2	174			
West North-3,4	167	74		
West North-5,6	129			
Nonhazardous Units				
West South-1,2				
West South-3,4				
West South-5,6				

SAMPLE DATA RESULTS

INSPECTION DATA

The analytical results obtained from ground water, lysimeter and surface water samples during this inspection are summarized in Appendix E. The organics samples obtained from lysimeter L-11 were not received by the analytical laboratory. A summary of the usability of the data is reproduced in Appendix F. Most of the results reported for metals, volatiles and semi-volatiles were judged to be quantitative. Results for arsenic, cadmium, antimony, lead and total magnesium and aluminum were judged to be semi-quantitative, while total barium was rated as qualitative. TOX was judged to be quantitative, while TOC was semi-quantitative.

The results for organic compounds were largely unremarkable, as were those for indicator parameters, except for TOX values of 248 ug/l in well W-15 and 91 ug/l in well W-17. Trichlorofluoromethane was reported in W-15 at an estimated value of 1 ug/l, and the sample from W-17 reportedly contained 1,1,1-trichloroethane at an estimated value of 2 ug/l. Neither of the constituents was reported at a level that would account for the TOX values. Various phthalate compounds were reported in several wells, and are also on the Skinner list of refinery waste constituents. Although such compounds are commonly found in samples from wells which have been constructed of PVC, as are the Texaco wells, it is recommended that, in order to demonstrate that a release has not occurred, future wells installed at Texaco be constructed of stainless steel, at least in the saturated zone.

Skinner List constituents (Table 27) which were reported above detection limits in the samples obtained at Texaco are presented in Table 30. Both of the west side lysimeters that were sampled showed the presence of cobalt above detection levels, whereas the west side background lysimeter showed none. Cobalt, nickel, mercury, vanadium, and lead were detected in the surface water run-off sample from the west land treatment unit, while none of those constituents were found in either west side background well W-31 or in east side background well W-2. Downgradient west side wells which showed the presence of some or all of the Skinner list constituents found in the run-off sample include W-32 (lead) and W-17 (nickel and cobalt). On the east side, lysimeters L-6E and L-1 were reported to contain lead, chromium, nickel and cobalt, none of which were found above detection levels in background lysimeter L-BGT1. Lysimeter L-1 additionally showed the presence of antimony, arsenic and vanadium, not found above detection limits in the background lysimeter. East side downgradient wells which showed Skinner list constituents not found in background wells (but present in the landfarm runoff sample) include W-22 (cobalt); W-23 (cadmium); W-1 (lead, nickel, cobalt and vanadium); and W-21 (lead, nickel, cobalt and vanadium). The east side curtain drain accepts fresh water in a cutoff system before the east land treatment unit, as part of the effort to dewater that unit. The analytical results from that sample were unremarkable, as would be expected.

Of the inorganic constituents noted above, only cadmium is present, in W-23, at a level exceeding the ground water protection standard, which for cadmium is 10 ug/l. While the levels of the other constituents noted do not necessarily represent an environmental threat, they are constituents of the

TABLE 30
SKINNER LIST CONSTITUENTS FOUND ABOVE DETECTION
LIMITS DURING THE GWTF INSPECTION AT TEXACO*

detection limits	Barium DL=3	Lead DL=5	Antimony DL=3	Arsenic DL=10	Chromium DL=6	Nickel DL=23	Cobalt DL=7	Vanadium DL=8	Cadmium DL=5
West Landfarm Wells									
W-31 (background)	170/57	---	11/--	14/10.8	12/--	---	---	---	---
W-32	144/96	--/2.5	---	---	---	---	---	---	---
W-17	26/82	---	---	---	9/--	67/--	--/9	---	---
W-16	110/63	---	---	---	---	---	---	---	---
W-33	107/66	---	---	---	7/--	---	---	---	---
W-24	196/46	---	---	---	---	---	---	---	---
W-15	147/90	---	---	---	6/--	---	---	---	---
Surface Water Run-off from west land treatment units	86/63	4.9/21.6	62/26.7	---	20/7	89/58	8/18	27/18	---
West Landfarm Lysimeters									
L-11	127/93	---	---	---	11/--	---	--/19	---	---
L-12	174/89	---	7.8/11.7	---	6/--	---	--/16	---	---
L-BG-SE (background)	158/65	--/17.4	11/--	---	16/--	---	---	---	---

* Values are shown as Total/Dissolved, all in ug/l. Blanks indicate below detection limit.

TABLE 30, continued
SKINNER LIST CONSTITUENTS FOUND ABOVE DETECTION
LIMITS DURING THE GWTF INSPECTION AT TEXACO*

detection limits	Barium DL=3	Lead DL=5	Antimony DL=3	Arsenic DL=10	Chromium DL=6	Nickel DL=23	Cobalt DL=7	Vanadium DL=8	Cadmium DL=5
QA Samples									
Field Blank	46/15	---	---	---	---	---	---	---	---
Trip Blank	27/--	---	---	---	---	---	---	---	---
East Landfarm Wells									
W-2 (Background)	52/13	---	---	---	12/--	---	---	---	---
W-22	77/27	---	---	---	15/--	---	--/12	---	---
W-22 (Duplicate)	138/28	---	---	---	15/--	---	---	8/--	---
W-23	41/4	---	---	---	---	---	---	---	18/44.1
W-1	79/--	4.9/--	---	---	23/--	33/--	--/8	33/--	---
W-21	128/--	5.3/--	---	---	25/--	23/--	--/8	28/--	---
East Curtain Drain Surface Water	63/40	---	---	---	6/--	--/7	---	---	---
East Landfarm Lysimeters									
L-BGT1 (background)	69/70	---	---	---	---	---	---	---	---
L - 6E	132/75	0/29.7	---	---	10/--	26/--	9/--	---	---
L -1	182/111	--/38.4	21/--	9.1/--	21/--	63/--	33/17	12/--	---

hazardous (and non-hazardous) wastes Texaco has disposed in its land treatment units, according to the waste characterization information presented in Texaco's Part B permit application. As such, and since background conditions (as represented by this sampling event) do not indicate the presence of those constituents, a preliminary assessment would indicate that they may be present in downgradient wells as a result of a release or releases from the land treatment units. To confirm or deny this, additional analyses with appropriately low detection limits should be obtained for the constituents in question. This is further discussed below.

Texaco has informed EPA and Ecology since the inspection that the newest set of lysimeters, which were installed 5.5 feet below ground surface in 1986, has since been determined to be within, rather than below, the treatment zone. The soil pore water sample data generated from these lysimeters therefore is not useful in demonstrating the efficacy of land treatment at Texaco. Since the lysimeters do not collect soil pore water immediately beneath the land treatment zone, they do not meet the unsaturated zone monitoring requirements of WAC 173-303-655(6)(d). Consequently, a new set of lysimeters must be installed pursuant to the permitting process.

REVIEW OF GROUND WATER DATA GENERATED BY TEXACO

Indicator Parameters

On June 24, 1986, Texaco informed Ecology and EPA in writing that required statistical analyses indicated that specific conductance values for W-23,

downgradient of the east land treatment unit, were significantly higher than background values found in wells P-3 (west side) and W-2 (east side). Texaco proposed a ground water quality assessment program to investigate that phenomenon. Texaco later concluded that no ground water contamination had occurred, based on monitoring quarterly for a list of refinery waste constituents; and on information from a new background well, W-2. By virtue of W-2 showing relatively high specific conductance values (and additional statistical tests incorporating such values), Texaco concluded that the values observed in W-23 were in fact not statistically significant, and were therefore not indicative of a release of contamination to ground water.

Because of the new background monitoring well, which replaced P-3, Texaco compiled four quarters of new background data for statistical comparison purposes. Background values now used are from wells W-31 and W-2, obtained during the months of August 1986; October 1986; December 1986; and April 1987. In December 1987, and upon request, Texaco submitted ground water data which had been generated since the Task Force inspection. These data include ground water results from April and September 1987 (reproduced as received in Appendix G), conducted in accordance with the semi-annual monitoring requirements of 40 CFR § 265.93(d)(2). Statistical comparisons of indicator parameter results were made using the averaged-replicate t-test. Texaco combined the results from both background wells for comparison with individual downgradient wells in both land treatment units. No statistically significant differences were found, except TOX in September, in wells W-3, W-15, W-17, W-24 and W-2 and W-31 (the latter two being background wells). Additional t-tests incorporating current background data into the background data set

(that is, using five quarters of background data instead of four) showed no statistically significant differences. Subsequent sampling in October 1987 demonstrated that all wells contained less than 10 ug/l TOX, with no statistically significant differences existing, using the original four quarters of background data for comparison.

Because the two background wells actually represent individual units, that is, either the east or the west land treatment unit, statistical tests were performed for this report using Texaco's background data from only W-31 for comparison with west land treatment unit downgradient wells and from only W-2 for comparison with east land treatment unit downgradient wells. The results of the averaged replicate t-tests using this method indicate statistical differences exist (at the 0.99 confidence level) in the following instances:

April 1987: pH, W-1 (east side); W-3, W-15, W-16, W-17, W-24 and W-33 (west side).
Conductance, W-22 (east side); W-17 (west side).

Sept. 1987: pH, W-22 (east side); wells W-3, W-15, W-17, and W-24 (west side).
Conductance, W-22 (east side).

In the case of pH, all values which were significantly different were higher than background, except in the case of W-24, which showed pH lower than background. It is of interest to note that pH values obtained by Texaco's lab appear to be consistently higher than those obtained in the field. The same

phenomenon exists for specific conductance. Although both values are provided in Texaco's submittals, only laboratory values were used (by Texaco and for this report) in the required statistical tests. In any case, W-22, which caused Texaco to temporarily engage in assessment monitoring in 1986, continues to demonstrate specific conductance values out of proportion to any other east side well.

It is difficult to interpret these results. Having background results from only one well for comparision with downgradient wells places the facility at a greater risk of encountering false positives, that is, having indicator parameter values which demonstrate statistical significance when in fact no contamination exists. However, this fact does not justify combining values from background wells which represent two geologically and hydraulically distinct units. Rather, Texaco should install more than one background well truly representative of each unit, and use values from those wells in the comparisons with wells downgradient of each respective unit. The need for more appropriate background wells is described in this report in the section "Ground Water Monitoring Network."

Waste Constituents

Texaco's analytical results for organic constituents, including volatile organics and certain Skinner list compounds, historically have been unremarkable. This was also the case for results from the Task Force inspection. However, as described above, results from this inspection effort indicate the possible presence of several inorganic refinery waste

constituents in some downgradient wells where they are not also present in background wells. These constituents are lead, nickel, cobalt, cadmium and vanadium. In 1985 and 1986, Texaco tested ground water samples quarterly for several metals, including cadmium, lead, vanadium and nickel. The detection limits for vanadium and nickel during those sampling events were high: 500 ug/l for nickel and 500-1000 ug/l for vanadium. Detection limits for lead were 50 ug/l and 10 ug/l for cadmium. None of these constituents were detected in upgradient or downgradient wells. In August 1986, detection limits were lower, and vanadium was reported in W-1 at 50 ug/l; W-2 (background) at 40 ug/l; W-24 at 10 ug/l; and W-33 at 10 ug/l. The detection limit was 10 ug/l. Nickel was reported at low levels in many wells but was also found at a relatively high level of 40 ug/l in the trip blank, obviating the value of the well sample results. Lead was reported in W-1 at 1 ug/l and in W-32 at 1 ug/l, the detection limit. The only other metals tested at all wells were chromium, found in all wells at low levels, and antimony, found in no wells. In April 1987, Texaco sampled lysimeter water and found nickel and cobalt to be present in some lysimeters, including three background lysimeters.

In Texaco's two routine 1987 sampling events (Appendix G), vanadium was not an analyte. Nickel, chromium and lead (as well as iron, zinc and manganese, not of concern in this discussion) were tested. Chromium again was ubiquitous at low levels. Lead was also present in many wells including background wells, all at low levels. Nickel was reported in all wells at levels between 1 ug/l and 38 ug/l, except for W-17, which showed a level of 203 ug/l in the April sampling event and 518 ug/l in the September sampling event.

CONCLUSIONS

The historical analytical results for inorganic constituents indicate that vanadium may be a natural constituent in ground water upgradient from the land treatment units; however, Texaco's single sampling event in 1986 with appropriately low detection levels is insufficient to draw such a conclusion with confidence, given the results of the Task Force inspection, which found vanadium in downgradient wells only. It is recommended that vanadium be an analyte in one or more future sampling events. While nickel appears to be a natural constituent in upgradient ground water, Texaco's results for the most recent two quarters (April and September 1987) show W-17 to contain high levels of nickel relative to all other wells. (According to Texaco's land treatment demonstration document, nickel is the single constituent which may present a concern at unit closure because it is present in the treatment zone at levels which could potentially cause a phytotoxic reaction in the cover crop at closure.) The presence of nickel at the levels observed in the last two quarters in W-17 may indicate a release from the west land treatment unit.

No conclusions can be drawn from the presence of cobalt and cadmium above detection limits in certain downgradient wells during the Task Force inspection, since cobalt has never been a Texaco analyte, and cadmium has not recently been one. Cadmium should be an analyte, at least in W-23, where it was reported in the Task Force inspection results. Cobalt and vanadium are also constituents of Texaco's refinery wastes, and as such could potentially provide important information regarding the release of constituents from the land treatment units. Once an improved ground water monitoring system is

installed at each of Texaco's land treatment units, appropriate analytical studies should be made to determine definitively the nature of the occurrence of these metal constituents, that is, whether they represent natural phenomena or are sourced in Texaco's land-treated wastes.

APPENDIX A

FIELD PARAMETERS AND WELL DEPTH MEASUREMENTS

Appendix A

Field Parameters
Ground Water Task Force Inspection
Texaco

	Trial 1	Trial 2	Trial 3	Trial 4
Well 1				
Temperature, °C	10.8	11.2	9.8	10.5
Specific Conductance, umhos/cm	617	543	705	691
pH	7.9	8.1	8.5	8.0
Well 2				
Temperature, °C	10.1	10.7	10.7	
Specific Conductance, umhos/cm	699	688	688	
pH	8.0	7.7	7.8	
Well 15				
Temperature, °C	10.6	10.6	10.4	
Specific Conductance, umhos/cm	552	552	555	
pH	7.7	7.3	7.1	
Well 16				
Temperature, °C	11.0	11.0	11.0	
Specific Conductance, umhos/cm	505	423	450	
pH	7.4	8.6	8.6	
Well 17				
Temperature, °C	10.8	10.8	--	
Specific Conductance, umhos/cm	1098	1372	--	
pH	7.2	7.2	--	
Well 21				
Temperature, °C	10.8	11.0	10.7	
Specific Conductance, umhos/cm	823	819	825	
pH	7.1	7.0	7.2	
Well 22				
Temperature, °C	10.7	11.1	11.6	
Specific Conductance, umhos/cm	1753	1736	1747	
pH	6.9	7.1	7.2	

Appendix A, continued

	Trial 1	Trial 2	Trial 3	Trial 4
Well 23				
Temperature, °C	10.2	10.3	10.2	
Specific Conductance, umhos/cm	906	938	836	
pH	7.4	7.1	7.2	
Well 24				
Temperature, °C	10.3	11.3	--	
Specific Conductance, umhos/cm	1599	813	--	
pH	6.4	6.0	6.0	
Well 31				
Temperature, °C	12.2	12.3	12.1	
Specific Conductance, umhos/cm	926	1056	1061	
pH	6.9	7.0	7.0	
Well 32				
Temperature, °C	9.5	--	--	
Specific Conductance, umhos/cm	653	--	--	
pH	7.0	--	--	
Well 33				
Temperature, °C	10.4	10.3	10.0	9.7
Specific Conductance, umhos/cm	555	556	561	565
pH	7.4	7.0	7.0	7.1
Surface Water - West Ditch				
Temperature, °C	4.1	--	--	
Specific Conductance, umhos/cm	999	--	--	
pH	7.7	--	--	
Surface Water - East Curtain Drain				
Temperature, °C	7.4	--	--	
Specific Conductance, umhos/cm	602	--	--	
pH	7.3	--	--	

MEASURED DEPTHS OF WELLS & PIEZOMETERS COMPARED
WITH DEPTHS REPORTED IN TEXACO LOGS

Location	Reported Depths, Ft.	Measured Depth, Ft.
P-1	28.82	22.6
W-26	51.25	52.1
P-2	29.48	24.75
P-3	21.56	19.35
W-14	34.95	34.14
P-4	14.67	14.80
P-5	15.17	14.87
P-6	14.58	14.92
P-7	15.33	14.87
P-8	14.83	14.90
W-11	53.14	49.6

APPENDIX B

ANALYTICAL PARAMETERS FOR TASK FORCE SAMPLES OBTAINED AT TEXACO

ATTACHMENT D
ANALYTICAL PARAMETER LIST

APPENDIX IX -- GROUND-WATER MONITORING LIST

Systematic Name	CAS RN	Common Name
Acenaphthylene	208-96-8	Acenaphthalene
Acenaphthylene, 1,2-dihydro-	83-32-9	Acenaphthene
Acetamide, N-(4-ethoxyphenyl)-	62-44-2	Phenacetin
Acetamide, N-9H-fluoren-2-yl-	53-96-3	2-Acetylaminofluorene
Acetic acid ethenyl ester	108-05-4	Vinyl acetate
Acetic acid, (2,4,5-trichlorophenoxy)-	93-76-5	2,4,5-T
Acetic acid, (2,4-dichlorophenoxy)-	94-75-7	2,4-Dichlorophenoxyacetic acid
Acetonitrile	75-05-8	Acetonitrile
Aluminum	7429-90-5	Aluminum (total)
Anthracene	120-12-7	Anthracene
Antimony	7440-36-0	Antimony (total)
Aroclor 1016	12674-11-2	Aroclor 1016
Aroclor 1221	11104-28-2	Aroclor 1221
Aroclor 1232	11141-16-5	Aroclor 1232
Aroclor 1242	53469-21-9	Aroclor 1242
Aroclor 1248	12672-29-6	Aroclor 1248

APPENDIX IX -- GROUND-WATER MONITORING LIST

Systematic Name	CAS RN	Common Name
Aroclor 1254	11097-69-1	Aroclor 1254
Aroclor 1260	11096-82-5	Aroclor 1260
Arsenic	7440-38-2	Arsenic (total)
Barium	7440-39-3	Barium (total)
Benz[a]anthracene, 7,12-dimethyl-	57-97-6	7,12-Dimethylbenz[a]anthracene
Benz[j]aceanthrylene, 1,2-dihydro-3-methyl-	56-49-5	3-Methylcholanthrene
Benz[e]acephenanthrylene	205-99-2	Benzo[b]fluoranthene
Benzamide, 3,5-dichloro-N-(1,1-dimethyl-2-propynyl)-	23950-58-5	Pronamide
Benz[a]anthracene	56-55-3	Benz[a]anthracene
Benzenamine	62-53-3	Aniline
Benzenamine, 2-methyl-5-nitro-	99-55-8	5-Nitro-o-toluidine
Benzenamine, 2-nitro-	88-74-4	2-Nitroaniline
Benzenamine, 3-nitro-	99-09-2	3-Nitroaniline
Benzenamine, 4-chloro-	106-47-8	p-Chloroaniline
Benzenamine, 4-nitro-	100-01-6	p-Nitroaniline
Benzenamine, 4,4'-methylenebis[2-chloro-	101-14-4	4,4'-Methylenebis(2-chloroaniline)

APPENDIX IX -- GROUND-WATER MONITORING LIST

Systematic Name	CAS RN	Common Name
Benzenamine, N-nitroso-N-phenyl-	86-30-6	N-Nitrosodiphenylamine
Benzenamine, N-phenyl-	122-39-4	Diphenylamine
Benzenamine, N,N-dimethyl-4-(phenylazo)-	60-11-7	p-Dimethylaminoazobenzene
Benzene	71-43-2	Benzene
Benzene, 1-bromo-4-phenoxy-	101-55-3	4-Bromophenyl phenyl ether
Benzene, 1-chloro-4-phenoxy-	7005-72-3	4-Chlorophenyl phenyl ether
Benzene, 1-methyl-2,4-dinitro-	121-14-2	2,4-Dinitrotoluene
Benzene, 1,1'-(2,2,2-trichloroethylidene)bis[4-chloro-	50-29-3	DDT
Benzene, 1,1'-(2,2,2-trichloroethylidene)bis[4-methoxy-	72-43-5	Methoxychlor
Benzene, 1,1'-(2,2-dichloroethylidene)bis[4-chloro-	72-54-8	DDD
Benzene, 1,1'-(dichloroethenylidene)bis[4-chloro-	72-55-9	DDE
Benzene, 1,2-dichloro-	95-50-1	o-Dichlorobenzene
Benzene, 1,2,4-trichloro-	120-82-1	1,2,4-Trichlorobenzene
Benzene, 1,2,4,5-tetrachloro-	95-94-3	1,2,4,5-Tetrachlorobenzene
Benzene, 1,3-dichloro-	541-73-1	m-Dichlorobenzene
Benzene, 1,4-dichloro-	106-46-7	p-Dichlorobenzene

APPENDIX IX -- GROUND-WATER MONITORING LIST

Systematic Name	CAS RN	Common Name
Benzene, 1,4-dinitro-	100-25-4	meta-Dinitrobenzene
Benzene, 2-methyl-1,3-dinitro-	606-20-2	2,6-Dinitrotoluene
Benzene, chloro-	108-90-7	Chlorobenzene
Benzene, dimethyl-	1330-20-7	Xylene (total)
Benzene, ethenyl-	100-42-5	Styrene
Benzene, ethyl-	100-41-4	Ethyl benzene
Benzene, hexachloro-	118-74-1	Hexachlorobenzene
Benzene, methyl-	108-88-3	Toluene
Benzene, nitro-	98-95-3	Nitrobenzene
Benzene, pentachloro-	608-93-5	Pentachlorobenzene
Benzene, pentachloronitro-	82-68-8	Pentachloronitrobenzene
Benzeneacetic acid, 4-chloro-α-(4-chlorophenyl)-α-hydroxy-, ethyl ester	510-15-6	Chlorobenzilate
1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester	117-81-7	Bis(2-ethylhexyl) phthalate
1,2-Benzenedicarboxylic acid, butyl phenylmethyl ester	85-68-7	Butyl benzyl phthalate
1,2-Benzenedicarboxylic acid, dibutyl ester	84-74-2	Di-n-butyl phthalate

APPENDIX IX -- GROUND-WATER MONITORING LIST

Systematic Name	CAS RN	Common Name
1,2-Benzenedicarboxylic acid, diethyl ester	84-66-2	Diethyl phthalate
1,2-Benzenedicarboxylic acid, dimethyl ester	131-11-3	Dimethyl phthalate
1,2-Benzenedicarboxylic acid, dioctyl ester	117-84-0	Di-n-octyl phthalate
1,3-Benzenediol	108-46-3	Resorcinol
Benzeneethanamine, α,α-dimethyl-	122-09-8	alpha,alpha-Dimethylphenethylamine
Benzenemethanol	100-51-6	Benzyl alcohol
Benzenethiol	108-98-5	Benzenethiol
1,3-Benzodioxole, 5-(1-propenyl)-	120-58-1	Isosafrole
1,3-Benzodioxole, 5-(2-propenyl)-	94-59-7	Safrole
Benzo[k]fluoranthene	207-08-9	Benzo(k)fluoranthene
Benzoic acid	65-85-0	Benzoic acid
Benzo[rst]pentaphene	189-55-9	Dibenzo[a,i]pyrene
Benzo[ghi]perylene	191-24-2	Benzo(ghi)perylene
Benzo[a]pyrene	50-32-8	Benzo[a]pyrene
Beryllium	7440-41-7	Beryllium (total)
[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dichloro-	91-94-1	3,3'-Dichlorobenzidine

APPENDIX IX -- GROUND-WATER MONITORING LIST

Systematic Name	CAS RN	Common Name
[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethoxy-	119-90-4	3,3'-Dimethoxybenzidine
[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethyl-	119-93-7	3,3'-Dimethylbenzidine
[1,1'-Biphenyl]-4-amine	92-67-1	4-Aminobiphenyl
[1,1'-Biphenyl]-4,4'-diamine	92-87-5	Benzidine
1,3-Butadiene, 1,1,2,3,4,4-hexachloro-	87-68-3	Hexachlorobutadiene
1,3-Butadiene, 2-chloro-	126-99-8	2-Chloro-1,3-butadiene
1-Butanamine, N-butyl-N-nitroso-	924-16-3	N-Nitrosodi-n-butylamine
2-Butanone	78-93-3	Methyl ethyl ketone
2-Butene, 1,4-dichloro-, (E)-	110-57-6	trans-1,4-Dichloro-2-butene
Cadmium	7440-43-9	Cadmium (total)
Calcium	7440-70-2	Calcium (total)
Carbon disulfide	75-15-0	Carbon disulfide
Chromium	7440-47-3	Chromium (total)
Chrysene	218-01-9	Chrysene
Cobalt	7440-48-4	Cobalt (total)
Copper	7440-50-8	Copper (total)

APPENDIX IX -- GROUND-WATER MONITORING LIST

Systematic Name	CAS RN	Common Name
Cyanide	57-12-5	Cyanide
2,5-Cyclohexadiene-1,4-dione	106-51-4	p-Benzoquinone
Cyclohexane, 1,2,3,4,5,6-hexachloro-, (1α,2α,3β,4α,5β,6β)-	319-84-6	alpha-BHC
Cyclohexane, 1,2,3,4,5,6-hexachloro-, (1α,2β,3α,4β,5α,6β)-	319-85-7	beta-BHC
Cyclohexane, 1,2,3,4,5,6-hexachloro-, (1α,2α,3α,4β,5α,6β)-	319-86-8	delta-BHC
Cyclohexane, 1,2,3,4,5,6-hexachloro-, (1α,2α,3β,4α,5α,6β)-	58-89-9	gamma-BHC
2-Cyclohexen-1-one, 3,5,5-trimethyl-	78-59-1	Isophorone
1,3-Cyclopentadiene, 1,2,3,4,5,5-hexachloro-	77-47-4	Hexachlorocyclopentadiene
Dibenz[a,h]anthracene	53-70-3	Dibenz[a,h]anthracene
Dibenzo[b,e][1,4]dioxin, 2,3,7,8-tetrachloro-	1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin
		Hexachlorodibenzo-p-dioxins
		Pentachlorodibenzo-p-dioxins
		Tetrachlorodibenzo-p-dioxins
Dibenzo[b,def]chrysene	189-64-0	Dibenzo[a,h]pyrene
Dibenzofuran	132-64-9	Dibenzofuran
		Hexachlorodibenzofurans

APPENDIX IX -- GROUND-WATER MONITORING LIST

Systematic Name	CAS RN	Common Name
		Pentachlorodibenzofurans
		Tetrachlorodibenzofurans
2,7:3,6-Dimethanonaphth[2,3-b]oxirene, 3,4,5,6,9,9-hexachloro-1a, 2,2a,3,6,6a,7,7a-octahydro-, (1aα,2β,2aα,3β,6β,6aα, 7β,7aα)-	60-57-1	Dieldrin
2,7:3,6-Dimethanonaphth[2,3-b]oxirene, 3,4,5,6,9,9-hexachloro-1a, 2,2a,3,6,6a,7,7a-octahydro-, (1aα,2β,2aβ,3α,6α,6aβ, 7β,7aα)-	72-20-8	Endrin
1,4:5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexachloro-1,4,4a,5,8, 8a-hexahydro-, (1α,4α,4aβ,5α,8α,8aβ)-	309-00-2	Aldrin
1,4:5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexachloro-1,4,4a,5,8, 8a-hexahydro-, (1α,4α,4aβ,5β,8β,8aβ)-	465-73-6	Isodrin
1,4-Dioxane	123-91-1	1,4-Dioxane
Ethanamine, N-ethyl-N-nitroso-	55-18-5	N-Nitrosodiethylamine
Ethanamine, N-methyl-N-nitroso-	10595-95-6	N-Nitrosomethylethylamine
Ethane, 1,1-dichloro-	75-34-3	1,1-Dichloroethane
Ethane, 1,1'-[methylenebis(oxy)]bis[2-chloro-	111-91-1	Bis(2-chloroethoxy)methane
Ethane, 1,1'-oxybis[2-chloro-	111-44-4	Bis(2-chloroethyl) ether
Ethane, 1,1,1-trichloro-	71-55-6	1,1,1-Trichloroethane
Ethane, 1,1,1,2-tetrachloro-	630-20-6	1,1,1,2-Tetrachloroethane

APPENDIX IX -- GROUND-WATER MONITORING LIST

Systematic Name	CAS RN	Common Name
Ethane, 1,1,2-trichloro-	79-00-5	1,1,2-Trichloroethane
Ethane, 1,1,2,2-tetrachloro-	79-34-5	1,1,2,2-Tetrachloroethane
Ethane, 1,2-dibromo-	106-93-4	1,2-Dibromoethane
Ethane, 1,2-dichloro-	107-06-2	1,2-Dichloroethane
Ethane, chloro-	75-00-3	Chloroethane
Ethane, hexachloro-	67-72-1	Hexachloroethane
Ethane, pentachloro-	76-01-7	Pentachloroethane
1,2-Ethanediamine, N,N-dimethyl-N'-2-pyridinyl-N'-(2-thienylmethyl)-	91-80-5	Methapyrilene
Ethanone, 1-phenyl-	98-86-2	Acetophenone
Ethene, (2-chloroethoxy)-	110-75-8	2-Chloroethyl vinyl ether
Ethene, 1,1-dichloro-	75-35-4	1,1-Dichloroethylene
Ethene, 1,2-dichloro-, (E)-	156-60-5	trans-1,2-Dichloroethene
Ethene, chloro-	75-01-4	Vinyl chloride
Ethene, tetrachloro-	127-18-4	Tetrachloroethene
Ethene, trichloro-	79-01-6	Trichloroethene
Fluoranthene	206-44-0	Fluoranthene

APPENDIX IX -- GROUND-WATER MONITORING LIST

Systematic Name	CAS RN	Common Name
Fluoride	16984-48-8	Fluoride
9H-Fluorene	86-73-7	Fluorene
2-Hexanone	591-78-6	2-Hexanone
Hydrazine, 1,2-diphenyl-	122-66-7	1,2-Diphenylhydrazine
Indeno[1,2,3-cd]pyrene	193-39-5	Indeno(1,2,3-cd)pyrene
Iron	7439-89-6	Iron (total)
Lead	7439-92-1	Lead (total)
Magnesium	7439-95-4	Magnesium (total)
Manganese	7439-96-5	Manganese (total)
Mercury	7439-97-6	Mercury (total)
Methanamine, N-methyl-N-nitroso-	62-75-9	N-Nitrosodimethylamine
Methane, bromo-	74-83-9	Bromomethane
Methane, bromodichloro-	75-27-4	Bromodichloromethane
Methane, chloro-	74-87-3	Chloromethane
Methane, dibromo-	74-95-3	Dibromomethane
Methane, dibromochloro-	124-48-1	Chlorodibromomethane

APPENDIX IX -- GROUND-WATER MONITORING LIST

Systematic Name	CAS RN	Common Name
Methane, dichloro-	75-09-2	Dichloromethane
Methane, dichlorodifluoro-	75-71-8	Dichlorodifluoromethane
Methane, iodo-	74-88-4	Iodomethane
Methane, tetrachloro-	56-23-5	Carbon tetrachloride
Methane, tribromo-	75-25-2	Tribromomethane
Methane, trichloro-	67-66-3	Chloroform
Methane, trichlorofluoro-	75-69-4	Trichloromonofluoromethane
Methanesulfonic acid, methyl ester	66-27-3	Methyl methanesulfonate
Methanethiol, trichloro-	75-70-7	Trichloromethanethiol
4,7-Methano-1H-indene, 1,2,4,5,6,7,8,8-octachloro-2,3,3a,4,7,7a-hexahydro-	57-74-9	Chlordane
4,7-Methano-1H-indene, 1,4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-	76-44-8	Heptachlor
2,5-Methano-2H-indeno[1,2-b]oxirene, 2,3,4,5,6,7,7-heptachloro-1a,1b,5,5a,6,6a-hexahydro-, (1aα,1bβ,2α,5α,5aβ,6β,6aα)-	1024-57-3	Heptachlor epoxide
6,9-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-, 3-oxide, (3α,5aβ,6α,9α,9aβ)-	959-98-8	Endosulfan I
6,9-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-, 3-oxide, (3α,5aα,6β,9β,9aα)-	33213-65-9	Endosulfan II

APPENDIX IX -- GROUND-WATER MONITORING LIST

Systematic Name	CAS RN	Common Name
1,3,4-Metheno-2H-cyclobuta[cd]pentalen-2-one, 1,1a,3,3a,4,5,5,5a, 5b,6-decachlorooctahydro-	143-50-0	Kepone
1,2,4-Methenocyclopenta[cd]pentalene-5-carboxaldehyde, 2,2a,3,3,4, 7-hexachlorodecahydro-, (1α,2β,2aβ,4β,4aβ,5β,6aβ,6bβ, 7R*)-	7421-93-4	Endrin aldehyde
Morpholine, 4-nitroso-	59-89-2	N-Nitrosomorpholine
1-Naphthalenamine	134-32-7	1-Naphthylamine
2-Naphthalenamine	91-59-8	2-Naphthylamine
Naphthalene	91-20-3	Naphthalene
Naphthalene, 2-chloro-	91-58-7	2-Chloronaphthalene
Naphthalene, 2-methyl-	91-57-6	2-Methylnaphthalene
1,4-Naphthalenedione	130-15-4	1,4-Naphthoquinone
Naphtho[1,2,3,4-def]chrysene	192-65-4	Dibenzo[a,e]pyrene
Nickel	7440-02-0	Nickel (total)
Osmium	7440-04-2	Osmium (total)
Oxirane	75-21-8	Ethylene oxide
2-Pentanone, 4-methyl-	108-10-1	4-Methyl-2-pentanone
Phenanthrene	85-01-8	Phenanthrene

APPENDIX IX -- GROUND-WATER MONITORING LIST

Systematic Name	CAS RN	Common Name
Phenol	108-95-2	Phenol
Phenol, 2-(1-methylpropyl)-4,6-dinitro-	88-85-7	2-sec-Butyl-4,6-dinitrophenol
Phenol, 2-chloro-	95-57-8	2-Chlorophenol
Phenol, 2-methyl-	95-48-7	ortho-Cresol
Phenol, 2-methyl-4,6-dinitro-	534-52-1	4,6-Dinitro-o-cresol
Phenol, 2-nitro-	88-75-5	2-Nitrophenol
Phenol, 2,2'-methylenebis[3,4,6-trichloro-	70-30-4	Hexachlorophene
Phenol, 2,3,4,6-tetrachloro-	58-90-2	2,3,4,6-Tetrachlorophenol
Phenol, 2,4-dichloro-	120-83-2	2,4-Dichlorophenol
Phenol, 2,4-dimethyl-	105-67-9	2,4-Dimethylphenol
Phenol, 2,4-dimethyl-	105-67-9	2,4-Dimethylphenol
Phenol, 2,4-dinitro-	51-28-5	2,4-Dinitrophenol
Phenol, 2,4,5-trichloro-	95-95-4	2,4,5-Trichlorophenol
Phenol, 2,4,6-trichloro-	88-06-2	2,4,6-Trichlorophenol
Phenol, 2,6-dichloro-	87-65-0	2,6-Dichlorophenol
Phenol, 4-chloro-3-methyl-	59-50-7	p-Chloro-m-cresol

APPENDIX IX -- GROUND-WATER MONITORING LIST

Systematic Name	CAS RN	Common Name
Phenol, 4-methyl-	106-44-5	para-Cresol
Phenol, 4-nitro-	100-02-7	4-Nitrophenol
Phenol, pentachloro-	87-86-5	Pentachlorophenol
Phosphorodithioic acid, O,O-diethyl S-[(ethylthio)methyl] ester	298-02-2	Phorate
Phosphorodithioic acid, O,O-diethyl S-[2-(ethylthio)ethyl] ester	298-04-4	Disulfoton
Phosphorothioic acid, O-[4-[(dimethylamino)sulfonyl]phenyl] O,O-dimethyl ester	52-85-7	Famphur
Phosphorothioic acid, O,O-diethyl O-(4-nitrophenyl) ester	56-38-2	Parathion
Phosphorothioic acid, O,O-diethyl O-pyrazinyl ester	297-97-2	O,O-Diethyl O-2-pyrazinyl phosphorothioate
Phosphorothioic acid, O,O-dimethyl O-(4-nitrophenyl) ester	298-00-0	Methyl parathion
Piperidine, 1-nitroso-	100-75-4	N-Nitrosopiperidine
Potassium	7440-09-7	Potassium (total)
1-Propanamine, N-nitroso-N-propyl-	621-64-7	Di-n-propylnitrosamine
Propane, 1,2-dibromo-3-chloro-	96-12-8	1,2-Dibromo-3-chloropropane
Propane, 1,2-dichloro-	78-87-5	1,2-Dichloropropane
Propane, 1,2,3-trichloro-	96-18-4	1,2,3-Trichloropropane

APPENDIX IX -- GROUND-WATER MONITORING LIST

Systematic Name	CAS RN	Common Name
Propane, 2,2'-oxybis(1-chloro-	108-60-1	Bis(2-chloroisopropyl) ether
Propanedinitrile	109-77-3	Malononitrile
Propanenitrile	107-12-0	Ethyl cyanide
Propanenitrile, 3-chloro-	542-76-7	3-Chloropropionitrile
Propanoic acid, 2-(2,4,5-trichlorophenoxy)-	93-72-1	Silvex
1-Propanol, 2,3-dibromo-, phosphate (3:1)	126-72-7	Tris(2,3-dibromopropyl) phosphate
1-Propanol, 2-methyl-	78-83-1	Isobutyl alcohol
2-Propanone	67-64-1	Acetone
2-Propenal	107-02-8	Acrolein
1-Propene, 1,1,2,3,3,3-hexachloro-	1888-71-7	Hexachloropropene
1-Propene, 1,3-dichloro-, (E)-	10061-02-6	trans-1,3-Dichloropropene
1-Propene, 1,3-dichloro-, (Z)-	10061-01-5	cis-1,3-Dichloropropene
1-Propene, 3-chloro-	107-05-1	3-Chloropropene
2-Propenenitrile, 2-methyl-	126-98-7	Methacrylonitrile
2-Propenenitrile	107-13-1	Acrylonitrile
2-Propenoic acid, 2-methyl-, ethyl ester	97-63-2	Ethyl methacrylate

APPENDIX IX -- GROUND-WATER MONITORING LIST

Systematic Name	CAS RN	Common Name
2-Propenoic acid, 2-methyl-, methyl ester	80-62-6	Methyl methacrylate
2-Propen-1-ol	107-18-6	Allyl alcohol
2-Propyn-1-ol	107-19-7	2-Propyn-1-ol
Pyrene	129-00-0	Pyrene
Pyridine	110-86-1	Pyridine
Pyridine, 2-methyl-	109-06-8	2-Picoline
Pyrrolidine, 1-nitroso-	930-55-2	N-Nitrosopyrrolidine
Selenium	7782-49-2	Selenium (total)
Silver	7440-22-4	Silver (total)
Sodium	7440-23-5	Sodium (total)
Sulfide	18496-25-8	Sulfide
Sulfurous acid, 2-chloroethyl 2-[4-(1,1-dimethylethyl)phenoxy]-1-methylethyl ester	140-57-8	Aramite
Thallium	7440-28-0	Thallium (total)
Thiodiphosphoric acid ([(HO)$_2$P(S)]$_2$O), tetraethyl ester	3689-24-5	Tetraethyldithiopyrophosphate
Tin	7440-31-5	Tin (total)

APPENDIX IX -- GROUND-WATER MONITORING LIST

Systematic Name	CAS RN	Common Name
Toxaphene	8001-35-2	Toxaphene
Vanadium	7440-62-2	Vanadium (total)
Zinc	7440-66-6	Zinc (total)

TABLE I

Comparison of CLP and SW-846 Analytical Methods

Legend:

IN-ORG:	Inorganic or organic method
PROCEDURE:	Type of procedure
	Sample prep[aration]
	Determ[inative]
METHOD:	Description of method
ANALYTE:	Analyzed for (if appropriate)
CLP-No:	Unique identifier for CLP method
SW-846:	Unique identifier for SW-846 method

##	IN_ORG	PROCEDURE	METHOD	ANALYTE	CLP_NO	SOLVENT	METH_SRCE	SOURCE_NO	SW_846
1	I	sample prep.	digestion for waters_furnace	*	(S-1)	HNO3/H2O2	*	*	*
2	I	sample prep.	digestion for waters_ICP_flame	*	(S-2)	HNO3/HCl	*	*	3005
3	I	sample prep.	digestion of sed._sludges_soils	*	(S-3)	HNO3/H2O2/HNO3	SW-846	3050	3050
4	I	determ.	furnace aa	Sb	204.2 CLP-M	*	Meth. M&W	204.2	7041
5	I	determ.	furnace aa	As	206.2 CLP-M	*	Meth. M&W	206.2	7060
6	I	determ.	furnace aa	Be	210.2 CLP-M	*	Meth. M&W	210.2	7091
7	I	determ.	furnace aa	Cd	213.2 CLP-M	*	Meth. M&W	213.2	7131
8	I	determ.	furnace aa	Cr	218.2 CLP-M	*	Meth. M&W	218.2	7191
9	I	determ.	furnace aa	Pb	239.2 CLP-M	*	Meth. M&W	239.2	7421
10	I	determ.	furnace aa	Se	270.2 CLP-M	*	Meth. M&W	270.2	7740
11	I	determ.	furnace aa	Ag	272.2 CLP-M	*	Meth. M&W	272.2	7761
12	I	determ.	furnace aa	Tl	279.2 CLP-M	*	Meth. M&W	279.2	7841
13	I	determ.	ICP	25 metals	200.7 CLP-M	*	Meth. M&W	200.7	6010
14	I	determ.	flame aa	Ca	215.1 CLP-M	*	Meth. M&W	215.1	7140
15	I	determ.	flame aa	Mg	242.1 CLP-M	*	Meth. M&W	242.1	7450
16	I	determ.	flame aa	K	258.1 CLP-M	*	Meth. M&W	258.1	7610
17	I	determ.	flame aa	Na	273.1 CLP-M	*	Meth. M&W	273.1	7770
18	I	determ.	cold vapor aa, manual, in waters	Hg	245.1 CLP-M	*	Meth. M&W	245.1	7470
19	I	determ.	cold vapor aa, auto., in waters	Hg	245.2 CLP-M	*	Meth. M&W	245.2	*
20	I	determ.	cold vapor aa, manual, in sedim.	Hg	245.5 CLP-M	*	Meth. M&W	245.5	7471
21	I	determ.	titrimetric	CN	335.2 CLP-M	*	Meth. M&W	335.2	*
22	I	determ.	manual spectrophotometric	CN	335.2 CLP-M	*	Meth. M&W	335.2	9010+
23	I	determ.	semi-auto. spectophotometric	CN	335.2 CLP-M	*	Meth. M&W	335.3	9012+
24	I	determ.	titrimetric	CN	335.2 Sed.	*	Meth. M&W	335.2	*
25	I	determ.	manual spectrophotometric	CN	335.2 Sed.	*	Meth. M&W	335.2	9010
26	I	determ.	semi-auto. spectrophotometric	CN	335.2 Sed.	*	Meth. M&W	335.3	9012+
27	I	determ.	% solids	solids	335.2 Sed.	*	Meth. M&W	160.3	*
1	I	sample prep.	digestion, acid, for flame aa	*	*	HNO3/HCl	*	*	3010
29	I	sample prep.	digestion, acid, for furnace aa	*	*	HNO3	*	*	3020
30	I	sample prep.	dissolution, oils, gr., waxes	*	*	organic	*	*	3040
31	I	determ.	atomic absorption, general	metals	*	*	Meth. M&W	Metal	7000
32	I	determ.	flame aa	Al	*	*	Meth M&W	202.1	7020
33	I	determ.	flame aa	Sb	*	*	Meth. M&W	204.1	7040
34	I	determ.	gaseous hydride aa	As	*	*	Meth. M&W	206.3	7061
35	I	determ.	flame aa	Ba	*	*	Meth. M&W	208.1	7080
36	I	determ.	flame aa	Be	*	*	Meth. M&W	210.1	7090
37	I	determ.	flame aa	Cd	*	*	Meth. M&W	213.1	7130
38	I	determ.	flame aa	Cr	*	*	Meth. M&W	218.1	7190
39	I	determ.	Coprecipitation	Cr VI	*	*	Meth. M&W	218.5	7195
40	I	determ.	Colorimetric	Cr VI	*	*	*	*	7196
41	I	determ.	Chelation-Extraction	Cr VI	*	*	Meth. M&W	218.3	7197
42	I	determ.	Differential Pulse Polarog.	Cr VI	*	*	*	*	7198
43	I	determ.	flame aa	Co	*	*	Meth. M&W	219.1	7200
44	I	determ.	furnace aa	Co	*	*	Meth. M&W	219.2	7201
45	I	determ.	flame aa	Cu	*	*	Meth. M&W	220.1	7210
46	I	determ.	flame aa	Fe	*	*	Meth. M&W	236.1	7380
47	I	determ.	flame aa	Pb	*	*	Meth. M&W	239.1	7420
48	I	determ.	flame aa	Mn	*	*	Meth. M&W	243.1	7460
49	I	determ.	flame aa	Mo	*	*	Meth. M&W	246.1	7480
50	I	determ.	furnace aa	Mo	*	*	Meth. M&W	246.2	7481
51	I	determ.	flame aa	Ni	*	*	Meth. M&W	249.1	7520
52	I	determ.	flame aa	Os	*	*	Meth. M&W	252.1	7550
3	I	determ.	aa, gaseous hydride	Se	*	*	Meth. M&W	270.3	7741
4	I	determ.	flame aa	Ag	*	*	Meth. M&W	272.1	7760
55	I	determ.	flame aa	Tl	*	*	Meth. M&W	279.1	7840
56	I	determ.	flame aa	Sn	*	*	Meth. M&W	282.1	7870

57	I	determ.	flame aa	V	*	*	Meth.W&W	286.1	7910
58	I	determ.	furnace aa	V	*	*	Meth.W&W	286.2	7911
59	I	determ.	flame aa	Zn	*	*	Meth.W&W	289.1	7950
60	0	extraction	extraction & sample prep.	*	*	?	?	?	3500
61	0	extraction	sep. funnel liq-liq	*	(P-11a,-12a)	various	40CFR136	625	3510
62	0	extraction	continuous liq-liq	*	(P-11b,-12b)	various	40CFR136	625	3520
63	0	extraction	acid/base cleanup	*	*	?	?	?	3530
64	0	extraction	Soxhlet	*	*	various	?	?	3540
65	0	extraction	sonication	*	(P-13a,-14a)	various	EPA 600-4-84	027	3550
66	0	extraction	column cleanup of petroleum waste	*	*	?	?	?	3570
67	0	extraction	VOST Purge-and-Trap Sample Prep.	*	*	(	cf	?	3720
68	0	extraction	headspace	*	*	*	cf	?	5020
69	0	extraction	purge-and-trap	*	(D-3a)	H20/MeOH	40CFR136	624	5030
70	0	extraction	direct injection	*	*	H20	?	?	5040
71	0	extraction	solvent dilution	*	*	methyleneCl/hexane	?	?	5050
72	0	cleanup	cleanup, gen	*	*	*	SW-846	3600	3600
73	0	cleanup	alumina column	*	P11c,13b,14b	various	40CFR136	?	3610
74	0	cleanup	alumina column, petrol wastes	*	*	various	40CFR136	?	3611
75	0	cleanup	Florisil column	*	*	various	40CFR136	?	3620
76	0	cleanup	silica gel	*	*	various	40CFR136	?	3630
77	0	cleanup	gel-permeation	*	(P-14c)	methylene Cl	MERL-Ci	?	3640
78	0	cleanup	acid-base partition	*	*	various	?	?	3650
79	0	cleanup	sulfur	*	P11d,13c,14d	?	?	?	3660
80	0	determ.	gc, gen.	*	(D-2) ?	*	40CFR136	601+	8000
81	0	determ.	gc, halogenated volatile organic	RX	X	*	40CFR136	601	8010
82	0	determ.	gc, nonhalogenated vol. organics	R	*	*	cf	?	8015
83	0	determ.	gc, aromatic vol. organics	Ar/ArCl	*	*	cf	?	8020
84	0	determ.	gc, acrolein, acryl-, acetonitril	Acr	*	*	40CFR136	603	8030
85	0	determ.	gc. hexadecane ext-scr, purgeables	?	(P-15,D-1)	*	?	?	8035
86	0	determ.	gc, phenols	ArOH	*	*	40CFR136	604	8040
87	0	determ.	gc, phthalate esters	phtn.	*	*	40CFR136	606	8060
88	0	determ.	gc, organo-Cl pesticides & PCBs	RCl/PCBs	(D-5)	*	40CFR136	608	8080
89	0	determ.	gc, nitroarom. & cyclic ketones	nitr/ket	*	*	40CFR136	609	8090
90	0	determ.	gc, polynucl. aromat. hydrocarbon	PAHs	*	*	40CFR136	610	8100
91	0	determ.	gc, chlorinated hydrocarbons	RCl/Ar/Cl	*	*	40CFR136	612	8120
92	0	determ.	gc, organophosphorus pesticides	RP	*	*	cf	?	8140
93	0	determ.	gc, chlorinated herbicides	RCl	*	*	cf	?	8150
94	0	determ.	gc/ms, volatile organics	vol. org.	(D-3b)	*	40CFR136	624	8240
95	0	determ.	gc/ms, packed col., semivolatiles	s-vol. org	*	*	40CFR136	625	8250
96	0	determ.	gc/ms, capillary col., semivolat.	s-vol. org	(D-4)	*	40CFR136	625	8270
97	0	determ/extrn	gc/ms, capillary col.	2378-TCDD	(D-6)	hexane/MeOH	CLP	(D-6)	*
98	0	determ.	HPLC, polynuc. arom. hydrocarb.	PAHs	*	*	40CFR136	610	8310
99		determ.	adsorp., microcoulometry	RX (TOX)	*	*	EMSL-Ci	?	9020
100		determ.	adsorp., anetron activation	RX (TOX)	*	*	?	?	9022
101		determ.	titrimetric, iodine	S—	*	*	APHA	427+	9030
102		determ.	colorim., auto., chloranilate	SO4	*	*	Meth.W&W	375.1	9035
103		determ.	colorim., auto., methylthymolblue	SO4	*	*	Meth.W&W	375.2	9036
104		determ.	turbidimetric	SO4	*	*	Meth.W&W	375.4	9038
105		determ.	combustion or oxidation	C (TOC)	*	*	Meth.W&W	415.1	9060
106		determ.	spectrophot., manual, 4-AAP/dist.	phenols	*	*	Meth.W&W	420.1	9065
107		determ.	colorim., auto., 4-AAP/dist.	phenols	*	*	Meth.W&W	420.2	9066
108		determ.	spectrophot., MBTH/dist.	phenols	*	*	Meth.W&W	420.3	9067
109		determ.	gravim., sep. funnel extr'n.	oil/gr liq	*	*	Meth.W&W	413.1	9070
110		determ.	grav/. Soxhlet extr'n.	oil/gr sol	*	*	S.M.E.W&W	502A	9071
111		determ.	multiple tube fermentation	coliform-t	*	*	M.M.M.E.	?	9131
112		determ.	membrane filter	coliform-t	*	*	M.M.M.E.	?	9132
113		determ.	colorim., manual, brucine	NO3	*	*	Meth.W&W	352.1	9200
		determ.	colorim., auto., Fe(CN)6, AAI	Cl	*	*	Meth.W&W	325.1	9250

115	determ.	colorim., auto., Fe(CN)6, AAII	Cl	*	*		Meth.W&W	325.2	9251
116	determ.	titrimetric, mercuric nitrate	Cl	*	*		Meth.W&W	325.3	9252
117	determ.	radio.	Ra-228	*	*		S.M.E.W&W	707	9320
118	determ.	electrometric	pH	*	*		Meth.W&W	150.1	9040
119	determ.	pH paper	pH	*	*		?	?	9041
120	determ.	electrometric	pH in soil	*	*		?	?	9045
121	determ.	specific conductance	conductanc	*	*		S.M.E.W&W	205	9050
122	determ.	ammonium acetate displacement	cat.ex.cap	*	*		M.S.A.	p.891	9080
123	determ.	sodium acetate displacement	cat.ex.cap	*	*		M.S.A.	p.891	9081
124	determ.	immersion test, membrane liners	liners	*	*		?	?	9090
125	determ.	paint filter test	filters	*	*		?	?	9095
126	determ.	sat'd. hydraul. cond.& permeabil.	*	*	*		SW-846	9100	9100
127	determ.	radio., evaporation	alpha&beta	*	*		?	?	9310
128	determ.	radio., precipitation	alpha Ra	*	*		S.M.E.W&W	705 ?	9315
129	extraction	multiple, acid rain	*	*	HOAc/H2SO4/HNO3		?	?	1320
130	extraction	oily wastes, Soxhlet	*	*	THF/toluene/HOAc		?	?	1330
131	ignitability	Pensky-Martin closed cup	*	*	*		ASTM STD	D-93+	1010
132	ignitability	Setaflash closed-cup	*	*	*		ASTM STD	D3278	1020
133	corrosivity	weight loss	steel	*	*		NACE-TM-	01-69	1110
134	toxicity	extr'n procedure(EP)toxicity	*	*	HOAc		?	?	1310
135	sampling	sampling train, modified	*	*	*		40CFR60 ?	5	0010
136	sampling	source assessment	organics	*	*		40CFR60	?	0020
137	sampling	vol. org. sampling train	POHCs	*	*		?	?	0030

TABLE II

Appendix IX, 5/15/86

Proposed for groundwater monitoring in 51FR 26632

Legend:

SYST-NAME:	Systematic name in Appendix IX
CLP-NAME:	Name in CERCLA CLP Invitation for Bid (IFB)
Q-Anal:	Analytical feasibility questioned in 51FR26632
CAS-RN:	Chemical Abstracts Service number
MS:	Mass Spectrum in latest EPA/NIH Data Base? (True or False)
HSL:	CERCLA "Hazardous Substance List" identifier from ITD "list-of-lists". An entry in this column indicates that the substance is listed on a current IFB. Z indicates metal Number indicates organic compound Xi added for this data base
CRDL-CLP:	Contract Required Detection Limit under CLP IFB

ID	SYST_NAME	CLP_NAME	Q_ANAL	CAS_RN	MS	HSL	CRDL_CLP
1	Acenaphthylene	Acenaphthylene		208-96-8	.T.	540	10.00
2	Acenaphthylene, 1,2-dihydro-	Acenaphthene		83-32-9	.T.	550	10.00
3	Acetamide, N-(4-ethoxyphenyl)-	Phenacetin		62-44-2	.T.		0.00
4	Acetamide, N-9H-fluoren-2-yl	2-Acetylaminofluorene	YES	53-96-3	.T.		0.00
5	Acetic acid ethenyl ester	Vinyl acetate		108-05-4	.T.	125	10.00
6	Acetic acid, (2,4,5-trichlorophenoxy)-	2,4,5-T		93-76-5	.T.		0.00
7	Acetic acid, (2,4-dichlorophenoxy)-	2,4-Dichlorophenoxyacetic acid	YES	94-75-7	.T.		0.00
8	Acetonitrile	Acetonitrile	YES	75-05-8	.T.		0.00
9	Aluminum	Aluminum(total)		7429-90-5	.F.	Z13	200.00
10	Anthracene	Anthracene		120-12-7	.T.	645	10.00
11	Antimony	Antimony (total)		7440-36-0	.F.	Z51	60.00
12	Aroclor 1016	Aroclor 1016		12674-11-2	.T.	925	0.50
13	Aroclor 1221	Aroclor 1221		11104-28-2	.T.	930	0.50
14	Aroclor 1232	Aroclor 1232		11141-16-5	.T.	935	0.50
15	Aroclor 1242	Aroclor 1242		53469-21-9	.T.	940	0.50
16	Aroclor 1248	Aroclor 1248		12672-29-6	.T.	945	0.50
17	Aroclor 1254	Aroclor 1254		11097-69-1	.T.	950	1.00
18	Aroclor 1260	Aroclor 1260		11096-82-5	.T.	955	1.00
19	Arsenic	Arsenic (total)		7440-38-2	.F.	Z33	10.00
20	Barium	Barium(total)		7440-39-3	.F.	Z56	200.00
21	Benz[a]anthracene, 7,12-dimethyl-	7,12-Dimethylbenz[a]anthracene		57-97-6	.T.		0.00
22	Benz[j]aceanthrylene, 1,2-dihydro-3-methyl-	3-Methylcholanthrene		56-49-5	.T.		0.00
23	Benz[e]acephenanthrylene	Benzo[b]fluoranthene		205-99-2	.T.	765	10.00
24	Benzamide, 3,5-dichloro-N-(1,1-dimethyl-2-propynyl	Pronamide		23950-58-5	.T.		0.00
25	Benz[a]anthracene	Benzo[a]anthracene		56-55-3	.T.	730	10.00
26	Benzenamine	Aniline	YES	62-53-3	.T.		0.00
27	Benzenamine, 2-methyl-5-nitro	5-Nitro-o-toluidine		99-55-8	.T.		0.00
1	Benzenamine, 2-nitro	2-Nitoraniline		88-74-4	.T.	530	50.00
29	Benzenamine, 3-nitro-	3-Nitroaniline		99-09-2	.T.	545	50.00
30	Benzenamine, 4-chloro	4-Chloroaniline		106-47-8	.T.	455	10.00
31	Benzenamine, 4-nitro-	4-Nitroaniline		100-01-6	.T.	595	50.00
32	Benzenamine, 4,4'-methylenebis[2-chloro-	4,4'-Methylenebis(2-chloroaniline)		101-14-4	.T.		0.00
33	Benzeneamine, N-nitroso-N-phenyl-	N-Nitrosodiphenylamine		86-30-6	.T.	615	10.00
34	Benzenamine, N-phenyl-	Diphenylamine	YES	122-39-4	.T.		0.00
35	Benzenamine, N,N-dimethyl-4-(phenylazo)-	p-Dimethylaminoazobenzene		60-11-7	.T.		0.00
36	Benzene	Benzene		71-43-2	.T.	165	5.00
37	Benzene, 1-bromo-4-phenoxy-	4-Bromophenyl phenyl ether		101-55-3	.T.	625	10.00
38	Benzene, 1-chloro-4-phenoxy-	4-Chlorophenyl phenyl ether		7005-72-3	.T.	585	10.00
39	Benzene, 1-methyl-2,4-dinitro-	2,4-Dinitrotoluene		121-14-2	.T.	570	10.00
40	Benzene, 1,1'-(2,2,2-trichloroethylidene)bis[4etc1	4,4'-DDT		50-29-3	.T.	885	0.10
41	Benzene, 1,1'-(2,2,2-trichloroethylidene)bis[4etc2	Methoxychlor		72-43-5	.T.	910	0.50
42	Benzene, 1,1'-(2,2-dichloroethylidene)bis[4-chloro	4,4'-DDD		72-54-8	.T.	870	0.10
43	Benzene, 1,1'-(dichloroethenylidene)bis[4-chloro-	4,4'-DDE		72-55-9	.T.	855	0.10
44	Benzene, 1,2-dichloro-	1,2-Dichlorobenzene		95-50-1	.T.	350	10.00
45	Benzene, 1,2,4-trichloro-	1,2,4-Trichlorobenzene		120-82-1	.T.	445	10.00
46	Benzene, 1,2,4,5-tetrachloro-	1,2,4,5-Tetrachlorobenzene		95-94-3	.T.		0.00
47	Benzene, 1,3-dichloro-	1,3-Dichlorobenzene		541-73-1	.T.	335	10.00
48	Benzene, 1,4-dichloro-	1,4-Dichlorobenzene		106-46-7	.T.	340	10.00
49	Benzene, 1,3-dinitro-	meta-Dinitrobenzene		100-25-4	.T.		0.00
50	Benzene, 2-methyl-1,3-dinitro-	2,6-Dinitrotoluene		606-20-2	.T.	575	10.00
51	Benzene, chloro-	Chlorobenzene		108-90-7	.T.	235	5.00
52	Benzene, dimethyl-	Xylenes(total)		1330-20-7	.T.	250	5.00
1	Benzene, ethenyl-	Styrene		100-42-5	.T.	245	5.00
1	Benzene, ethyl-	Ethyl benzene		100-41-4	.T.	240	5.00
55	Benzene, hexachloro-	Hexachlorobenzene		118-74-1	.T.	630	10.00

56	Benzene, methyl-	Toluene		108-88-3	.T.	230	5.00
57	Benzene, nitro-	Nitrobenzene		98-95-3	.T.	410	10.00
58	Benzene, pentachloro-	Pentachlorobenzene		608-93-5	.T.		0.00
59	Benzene, pentachloronitro-	Pentachloronitrobenzene		82-68-8	.T.		0.00
60	Benzeneacetic acid, 4-chloro-alpha-(4-chloro etc	Chlorobenzilate		510-15-6	.T.		0.00
	1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) etc	Bis(2-ethylhexyl) phthalate		117-81-7	.T.	735	10.00
62	1,2-Benzenedicarboxylic acid, butylphenylmethy etc	Butyl benzyl phthalate		85-68-7	.T.	720	10.00
63	1,2-Benzenedicarboxylic acid, dibutyl ester	Di-n-butyl phthlate		84-74-2	.T.	650	10.00
64	1,2-Benzenedicarboxylic acid, diethyl ester	Diethylphthlate		84-66-2	.T.	580	10.00
65	1,2-Benzenedicarboxylic acid, dimethyl ester	Dimethyl phthlate		131-11-3	.T.	535	10.00
66	1,2-Benzenedicarboxylic acid, dioctyl ester	Di-n-octyl phthalate		117-84-0	.T.	760	10.00
67	1,3-Benzenediol	Resorcinol	YES	108-46-3	.T.		0.00
68	Benzeneethanamine, alpha,alpha-dimethyl-	Alpha,alpha-dimethylphenethylamine	YES	122-09-8	.T.		0.00
69	Benzeneethanol	Benzyl alcohol		100-51-6	.T.	345	10.00
70	Benzenethiol	Benzenethiol	YES	108-98-5	.T.		0.00
71	1,3-Benzodioxole, 5-(1-propenyl)-	Isosafrole	YES	120-58-1	.T.		0.00
72	1,3-Benzodioxole, 5-(2-propenyl)-	Safrole		94-59-7	.T.		0.00
73	Benzo[k]fluoranthene	Benzo(k)fluoranthene		207-08-9	.T.	770	10.00
74	Benzoic acid	Benzoic acid		65-85-0	.T.	430	50.00
75	Benzo[rst]pentaphene	Dibenzo[a,i]pyrene	YES	189-55-9	.F.		0.00
76	Benzo[ghi]perylene	Benzo(ghi)perylene		191-24-2	.T.	790	10.00
77	Benzo[a]pyrene	Benzo[a]pyrene		50-32-8	.T.	775	10.00
78	Beryllium	Beryllium (total)		7440-41-7	.F.	Z04	5.00
79	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dichloro-	3,3'-Dichlorobenzidine		91-94-1	.T.	725	20.00
80	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethoxy-	3,3'-Dimethoxybenzidine		119-90-4	.T.		0.00
81	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethyl-	3,3'-Dimethylbenzidine		119-93-7	.T.		0.00
82	[1,1'-Biphenyl]-4-amine	4-Aminobiphenyl		92-67-1	.T.		0.00
83	[1,1'-Biphenyl]-4,4'-diamine	Benzidine	YES	92-87-5	.T.		0.00
84	1,3-Butadiene, 1,1,2,3,4,4-hexachloro-	Hexachlorobutadiene		87-68-3	.T.	460	10.00
85	1,3-Butadiene, 2-chloro-	2-Chloro-1,3-butadiene	YES	126-99-8	.T.		0.00
86	1-Butanamine, N-butyl-N-nitroso-	N-Nitrosodi-n-butylamine		924-16-3	.T.		0.00
	2-Butanone	2-Butanone		78-93-3	.T.	110	10.00
88	2-Butene, 1,4-dichloro-, (E)-	trans-1,4-Dichloro-2-butene		110-57-6	.T.		0.00
89	Cadmium	Cadmium(total)		7440-43-9	.F.	Z48	5.00
90	Calcium	Calcium (total)		7440-70-2	.F.	Z20	5000.00
91	Carbon disulfide	Carbon disulfide		75-15-0	.F.	040	5.00
92	Chromium	Chromium (total)		7440-47-3	.F.	Z24	10.00
93	Chrysene	Chrysene		218-01-9	.T.	740	10.00
94	Cobalt	Cobalt (total)		7440-48-4	.F.	Z27	50.00
95	Copper	Copper (total)		7440-50-8	.F.	Z29	25.00
96	Cyanide	Cyanide		57-12-5	.F.	X1	10.00
97	2,5-Cyclohexadiene-1,4-dione	p-Benzoquinone	YES	106-51-4	.T.		0.00
98	Cyclohexane, 1,2,3,4,5,6-hexachloro- etc1	alpha-BHC		319-84-6	.T.	810	0.05
99	Cyclohexane, 1,2,3,4,5,6-hexachloro- etc2	beta-BHC		319-85-7	.T.	815	0.05
100	Cyclohexane, 1,2,3,4,5,6-hexachloro- etc3	delta-BHC		319-86-8	.T.	820	0.05
101	Cyclohexane, 1,2,3,4,5,6-hexachloro- etc4	Lindane		58-89-9	.T.	825	0.05
102	2-Cyclohexen-1-one, 3,5,5-trimethyl-	Isophorone		78-59-1	.T.	415	10.00
103	1,3-Cyclopentadiene, 1,2,3,4,5,5-hexachloro-	Hexachlorocyclopentadiene		77-47-4	.T.	510	10.00
104	Dibenz[a,h]anthracene	Dibenz[a,h]anthracene		53-70-3	.T.	785	10.00
105	Dibenzo[b,e][1,4]dioxin, 2,3,7,8-tetrachloro-	2,3,7,8-Tetrachlorodibenzo-p-dioxin		1746-01-6	.T.	X2	1.00
106		Hexachlorodibenzo-p-dioxins			.F.		0.00
107		Pentochlorodibenzo-p-dioxins			.F.		0.00
108		Tetrachlorodibenzp-p-dioxins			.F.		0.00
109	Dibenzo[b,def]chrysene	Dibenzo[a,h]pyrene	YES	189-64-0	.F.		0.00
110	Dibenzofuran	Dibenzofuran		132-64-9	.T.	565	10.00

11		Hexachlorodibenzofurans			.F.		0.00
12		Pentachlorodibenzofurans			.F.		0.00
13		Tetrachlorodibenzofurans			.F.		0.00
14	2,7:3,6-Dimethanonaphth[2,3-b]oxirene, etc1	Dieldrin		60-57-1	.T.	850	0.10
5	2,7:3,6-Dimethanonaphth[2,3-b]oxirene, etc2	Endrin		72-20-8	.T.	860	0.10
6	1,4:5,8-Dimethanonaphthalene, 1,2,3,4,10,10-etc1	Aldrin		309-00-2	.T.	835	0.05
17	1,4:5,8-Dimethanonaphthalene, 1,2,3,4,10,10-etc2	Isodrin	YES	465-73-6	.T.		0.00
18	1,4-Dioxane	1,4-Dioxane	YES	123-91-1	.T.		0.00
19	Ethanamine, N-ethyl-N-nitroso	N-Nitrosodiethylamine		55-18-5	.T.		0.00
20	Ethanamine, N-methyl-N-nitroso-	N-Nitrosomethylethylamine	YES	10595-95-6	.T.		0.00
21	Ethane, 1,1-dichloro-	1,1-Dichloroethane		75-34-3	.T.	050	5.00
22	Ethane, 1,1'-[methylenebis(oxy)]bis[2-chloro-	Bis(2-chloroethoxy)methane		111-91-1	.T.	435	10.00
23	Ethane, 1,1'-oxybis[2-chloro-	Bis(2-chloroethyl) ether		111-44-4	.T.	325	10.00
24	Ethane, 1,1,1-trichloro-	1,1,1-Trichloroethane		71-55-6	.T.	115	5.00
25	Ethane, 1,1,1,2-tetrachloro-	1,1,1,2-Tetrachloroethane		630-20-6	.T.		0.00
26	Ethane, 1,1,2-trichloro-	1,1,2-Trichloroethane		79-00-5	.T.	160	5.00
27	Ethane, 1,1,2,2-tetrachloro-	1,1,2,2-Tetrachloroethane		79-34-5	.T.	225	5.00
28	Ethane, 1,2-dibromo-	1,2-Dibromoethane		106-93-4	.T.		0.00
29	Ethane, 1,2-dichloro-	1,2-Dichloroethane		107-06-2	.T.	065	5.00
30	Ethane, chloro-	Chloroethane		75-00-3	.T.	025	10.00
31	Ethane, hexachloro-	Hexachloroethane		67-72-1	.T.	375	10.00
32	Ethane, pentachloro-	Pentachloroethane		76-01-7	.T.		0.00
33	1,2-Ethanediamine, N,N-dimethyl-N'-etc	Methapyrilene		91-80-5	.T.		0.00
34	Ethanone, 1-phenyl	Acetophenone		98-86-2	.T.		0.00
35	Ethene, (2-chloroethoxy)-	2-Chloroethyl vinyl ether		110-75-8	.T.	175	10.00
36	Ethene, 1,1-dichloro-	1,1-Dichloroethene		75-35-4	.T.	045	5.00
37	Ethene, 1,2-dichloro-, (E)-	trans-1,2-Dichloroethene		156-60-5	.T.	055	5.00
38	Ethene, chloro-	Vinyl chloride		75-01-4	.T.	020	10.00
39	Ethene, tetrachloro-	Tetrachloroethene		127-18-4	.T.	220	5.00
40	Ethene, trichloro-	Trichloroethene		79-01-6	.T.	150	5.00
1	Fluoranthene	Fluoranthene		206-44-0	.T.	655	10.00
2	Fluoride	Fluoride		16984-48-8	.F.		0.00
43	9H-Fluorene	Fluorene		86-73-7	.T.	590	10.00
44	2-Hexanone	2-Hexanone		591-78-6	.T.	210	10.00
45	Hydrazine, 1,2-diphenyl-	1,2-Diphenylhydrazine		122-66-7	.T.		0.00
46	Indeno[1,2,3-cd]pyrene	Indeno(1,2,3-cd)pyrene		193-39-5	.T.	780	10.00
47	Iron	Iron (total)		7439-89-6	.F.	Z26	100.00
48	Lead	Lead (total)		7439-92-1	.F.	Z82	5.00
49	Magnesium	Magnesium (total)		7439-95-4	.F.	Z12	5000.00
50	Manganese	Manganese (total)		7439-96-5	.F.	Z25	15.00
51	Mercury	Mercury (total)		7439-97-6	.F.	Z86	0.20
52	Methanamine, N-methyl-N-nitroso-	N-Nitrosodimethylamine	YES	62-75-9	.T.		0.00
53	Methane-bromo	Bromomethane		74-83-9	.T.	015	10.00
54	Methane, bromodichloro-	Bromodichloromethane		75-27-4	.T.	130	5.00
55	Methane, chloro-	Chloromethane		74-87-3	.T.	010	10.00
56	Methane, dibromo-	Dibromomethane	YES	74-95-3	.T.		0.00
57	Methane, dibromochloro-	Dibromochloromethane		124-48-1	.T.	155	5.00
58	Methane, dichloro-	Methylene chloride		75-09-2	.T.	030	5.00
59	Methane, dichlorodifluoro-	Dichlorodifluoromethane	YES	75-71-8	.T.		0.00
60	Methane, iodo-	Iodomethane	YES	74-88-4	.T.		0.00
61	Methane, tetrachloro-	Carbon tetrachloride		56-23-5	.T.	120	5.00
62	Methane, tribromo-	Bromoform		75-25-2	.T.	180	5.00
63	Methane, trichloro-	Chloroform		67-66-3	.T.	060	5.00
64	Methane, trichlorofluoro-	Trichloromonofluoromethane		75-69-4	.T.		0.00
65	Methanesulfonic acid, methyl ester	Methyl methanesulfonate		66-27-3	.T.		0.00

166	Methanethiol, trichloro-	Trichloromethanethiol		75-70-7	.F.		0.00
167	4,7-Methano-1H-indene, 1,2,4,5,6,7,8,8- etc	Chlordane		57-74-9	.T.	915	0.50
	4,7-Methano-1H-indene, 1,4,5,6,7,8,8- etc	Heptachlor		76-44-8	.T.	830	0.05
169	2,5-Methano-2H-indeno[1,2-b]oxirene, etc	Heptachlor epoxide		1024-57-3	.T.	840	0.05
170	6,9-Methano-2,4,3-benzodioxathiepin, etc1	Endosulfan I		959-98-8	.T.	845	0.05
171	6,9-Methano-2,4,3-benzodioxathiepin, etc2	Endosulfan II		33213-65-9	.T.	865	0.10
172	1,3,4-Metheno-2H-cyclobuta[cd]pentalen- etc	Kepone	YES	143-50-0	.T.		0.00
173	1,2,4-Metheneocyclopenta[cd]pentalene- etc	Endrin aldehyde		7421-93-4	.T.		0.00
174	Morpholine, 4-nitroso-	N-Nitrosomorpholine		59-89-2	.T.		0.00
175	1-Naphthalenamine	1-Naphthylamine		134-32-7	.T.		0.00
176	2-Naphthalenamine	2-Naphthylamine		91-59-8	.T.		0.00
177	Naphthalene	Naphthalene		91-20-3	.T.	450	10.00
178	Naphthalene, 2-chloro	2-Chloronaphthalene		91-58-7	.T.	525	10.00
179	Naphthalene, 2-methyl-	2-Methylnaphthalene		91-57-6	.T.	470	10.00
180	1,4-Naphthalenedione	1,4-Naphthoquinone		130-15-4	.T.		0.00
181	Naphtho[1,2,3,4-def]chrysene	Dibenzo[a,e]pyrene	YES	192-65-4	.T.		0.00
182	Nickel	Nickel (total)		7440-02-0	.F.	Z28	40.00
183	Osmium	Osmium (total)		7440-04-2	.F.		0.00
184	Oxirane	Ethylene oxide	YES	75-21-8	.T.		0.00
185	2-Pentanone, 4-methyl-	4-Methyl-2-pentanone		108-10-1	.T.	215	10.00
186	Phenanthrene	Phenanthrene		85-01-8	.T.	640	10.00
187	Phenol	Phenol		108-95-2	.T.	315	10.00
188	Phenol, 2-(1-methylpropyl)-4,6-dinitro-	2-sec-Butyl-4,6-dinitrophenol	YES	88-85-7	.T.		0.00
189	Phenol, 2-chloro-	2-Chlorophenol		95-57-8	.T.	330	10.00
190	Phenol, 2-methyl-	2-Methylphenol		95-48-7	.T.	355	10.00
191	Phenol, 2-methyl-4,6-dinitro-	4,6-Dinitro-2-methylphenol		534-52-1	.T.	X3	50.00
192	Phenol, 2-nitro-	2-Nitrophenol		88-75-5	.T.	420	10.00
193	Phenol, 2,2'-methylenebis[3,4,6-trichloro-	Hexachlorophene		70-34-4	.T.		0.00
	Phenol, 2,3,4,6-tetrachloro-	2,3,4,6-Tetrachlorophenol		58-90-2	.T.		0.00
	Phenol, 2,4-dichloro	2,4-Dichlorophenol		120-83-2	.T.	440	10.00
196	Phenol, 2,4-dimethyl-	2,4-Dimethylphenol		105-67-9	.T.	425	10.00
197	Phenol, 2,4-dinitro-	2,4-Dinitrophenol		51-28-5	.T.	555	50.00
198	Phenol, 2,4,5-trichloro-	2,4,5-Trichlorophenol		95-95-4	.T.	520	50.00
199	Phenol, 2,4,6-trichloro-	2,4,6-Trichlorophenol		88-06-2	.T.	515	10.00
200	Phenol, 2,6-dichloro-	2,6-Dichlorophenol		87-65-0	.T.		0.00
201	Phenol, 4-chloro-3-methyl-	4-Chloro-3-methylphenol		59-50-7	.T.	465	10.00
202	Phenol, 4-methyl-	4-Methylphenol		106-44-5	.T.	365	10.00
203	Phenol-4-nitro-	4-Nitrophenol		100-02-7	.T.	560	50.00
204	Phenol, pentachloro-	Pentachlorophenol		87-86-5	.T.	635	50.00
205	Phosphorodithioic acid, O,O-diethyl S- etc1	Phorate		298-02-2	.T.		0.00
206	Phosphorodithioic acid, O,O-diethyl S- etc2	Disulfoton		298-04-4	.T.		0.00
207	Phosphorothioic acid, O-[4-[etc	Famphur		52-85-7	.T.		0.00
208	Phosphorothioic acid, O,O-diethyl O- etc1	Parathion		56-38-2	.T.		0.00
209	Phosphorothioic acid, O,O-diethyl O- etc2	O,O-Diethyl-O-2-pyrazinyl phosp etc		297-97-2	.T.		0.00
210	Phosphorothioic acid, O,O-dimethyl O- etc	Methyl parathion		298-00-0	.T.		0.00
211	Piperidine, 1-nitroso-	N-Nitrosopiperidine		100-75-4	.T.		0.00
212	Potassium	Potassium (total)		7440-09-7	.F.	Z19	5000.00
213	1-Propanamine, N-nitroso-N-propyl-	N-Nitrosodipropylamine		621-64-7	.T.	370	10.00
214	Propane, 1,2-dibromo-3-chloro-	1,2-Dibromo-3-chloropropane		96-12-8	.T.		0.00
215	Propane, 1,2-dichloro-	1,2-Dichloropropane		78-87-5	.T.	140	5.00
216	Propane, 1,2,3-trichloro-	1,2,3-Trichloropropane		96-18-4	.T.		0.00
217	Propane, 2,2'-oxybis[1-chloro-	Bis(2-chloroisopropyl) ether		108-60-1	.T.	360	10.00
218	Propanedinitrile	Malononitrile	YES	109-77-3	.T.		0.00
7	Propanenitrile	Ethyl cyanide	YES	107-12-0	.T.		0.00
	Propanenitrile, 3-chloro-	3-Chloropropionitrile	YES	542-76-7	.T.		0.00

221	Propanoic acid, 2-(2,4,5-trichlorophenoxy)-	Silvex		93-72-1	.T.		0.00
22	1-Propanol, 2,3-dibromo-, phosphate (3:1)	Tris(2,3-dibromopropyl) phosphate	YES	126-72-7	.T.		0.00
23	1-Propanol, 2-methyl-	Isobutyl alcohol	YES	78-83-1	.T.		0.00
	2-Propanone	Acetone		67-64-1	.T.	035	10.00
25	2-Propenal	Acrolein		107-02-8	.T.		0.00
26	1-Propene, 1,1,2,3,3,3-hexachloro-	Hexachloropropene	YES	1888-71-7	.T.		0.00
227	1-Propene, 1,3-dichloro-, (E)-	trans-1,3-Dichloropropene		10061-02-6	.T.	145	5.00
228	1,Propene, 1,3-dichloro-, (Z)-	cis-1,3-Dichloropropene		10061-01-5	.T.	170	5.00
29	1-Propene, 3-chloro-	3-Chloropropene	YES	107-05-1	.T.		0.00
30	2-Propenenitrile, 2-methyl-	Methacrylonitrile	YES	126-98-7	.T.		0.00
231	2-Propenenitrile	Acrylonitrile		107-13-1	.T.		0.00
32	2-Propenoic acid, 2-methyl-, ethyl ester	Ethyl methacrylate		97-63-2	.T.		0.00
33	2-Propenoic acid, 2-methyl-, methyl ester	Methyl methacrylate	YES	80-62-6	.T.		0.00
234	2-Propen-1-ol	Allyl alcohol	YES	107-18-6	.T.		0.00
235	2-Propyn-1-ol	2-Propyn-1-ol	YES	107-19-7	.T.		0.00
36	Pyrene	Pyrene		129-00-0	.T.	715	10.00
237	Pyridine	Pyridine		110-86-1	.T.		0.00
238	Pyridine, 2-methyl-	2-Picoline	YES	109-06-8	.T.		0.00
39	Pyrrolidine, 1-nitroso-	N-Nitrosopyrrolidine		930-55-2	.T.		0.00
40	Selenium	Selenium (total)		7782-49-2	.F.	Z34	5.00
241	Silver	Silver (total)		7440-22-4	.F.	Z47	10.00
42	Sodium	Sodium (total)		7440-23-5	.F.	Z11	5000.00
43	Sulfide	Sulfide		18496-25-8	.F.		0.00
244	Sulfurous acid, 2-chloroethyl 2- etc	Aramite		140-57-8	.T.		0.00
245	Thallium	Thallium (total)		7440-28-0	.F.	Z81	10.00
46	Thiodiphosphoric acid(...), tetraethyl ester	Tetraethyldithiopyrophosphate	YES	3689-24-5	.T.		0.00
247	Tin	Tin (total)		7440-31-5	.F.		0.00
248	Toxaphene	Toxaphene		8001-35-2	.T.	920	1.00
49	Vanadium	Vanadium (total)		7440-62-2	.F.	Z23	50.00
	Zinc	Zinc (total)		7440-66-6	.F.	Z30	20.00

1. SPECIFIC REQUIREMENTS

SAS No. 1653-HQ
Case Nos. 4581, 4582, 4583, 4586 & 4587

1.	Effective Date:	June 27, 1985
2.	Type of Agreement:	Firm, fixed, per-unit price, with penalties assessed as stated herein for late receipt of data.
3.	Data Turnaround:	Hardcopy data is due within thirty (30) days from the latest date of receipt of samples at LAB per Case. LAB shall employ all procedures, including air express if necessary, to ensure that all Program Principals receive the data by the required deliverable date.
4.	Adjustment/ Penalty Schedule:	One percent (1%) of the SAS per-sample bid price for each day late.
5.	Scheduled Sample Description:	LAB shall analyze up to forty-five (45) low concentration aqueous samples, including QC.
6.	Matrix Spike & Duplicate Frequency:	One (1) matrix spike sample and one (1) matrix spike duplicate sample per Case per twenty (20) samples of similar matrix and concentration per week.
7.	Shipment Schedule to LAB:	Shipment during the week of July 15. Lab shall immediately return the shipping coolers.
8.	Analytical Requirements:	Analyze for Total and Dissolved Metals, Cyanide, TOC, TOX, Chloride, Total Phenols, Sulfate, Nitrate, Ammonia, POX, and POC.
9.	Protocol/Method:	Total Metals, CN - IFB WA 84-J092 Dissolved Metals - IFB WA84-J092 without the digestion TOC - SW846 Method 9060 TOX - SW846 Method 9020 Chloride - SW846 Method 9252 Total Phenols - SW846 Method 9066 Sulfate - SW846 Method 9036 or 9038 Nitrate - SW846 Method 9200 Ammonia - "Methods for Chemical Analyses of Water and Wastes," (MCAWW), USEPA EMSL/Cinn, 3/83, Method 350.1 or 350.3 POX - EPA 600/4-84-008 previously sent to the LAB. POC - Groundwater, Vol. 22, p. 18-23, 1984, using Dohrman equipment, previously sent to the LAB. LAB shall contact the designated SMO and Regional Technical Officer(s) if any modifications to the referenced methods are required. LAB shall report and document any modifications to the protocol/method, in the Data Package.

Viar & company

10. **Detection Limit Requirements:** As specified in the protocol(s)/method(s) listed in Item 9. More speciically,

TOC - 1mg/L	TOX - 5ug/L
Chloride - 1mg/L	Phenols - 10ug/L
Sulfate - 1mg/L	Nitrate - 300ug/L
Ammonia - 100ug/L	POX - 5ug/L
POC - 10ug/L	

Report and document actual detection limits attained in the Data Package.

11. **IFB Reference:** WA 84-J092 for document control, sample handling and chain-of-custody procedures, and all applicable IFB requirements. See item 9. for specific methods.

12. **Technical Officers:** Headquarters Paul Friedman 202/382-4796

13. Data Package/Number of Copies and Distribution:

A. Client/Region - One Copy

USEPA
Office of Solid Waste and Emergency Response
401 M Street, SW
Mail Stop WH-562-A
Washington, DC 20460
Attn: Greg Marion

B. Sample Management Office - One Copy

Sample Management Office
300 North Lee Street, Suite 200
Alexandria, Virginia 22314
Attn: Linda Haas Boynton

C. EMSL/LV - One Copy

USEPA EMSL/LV
Executive Center, Room 226
944 East Harmon Avenue
Las Vegas, Nevada 89109
Attn: Data Audit Staff

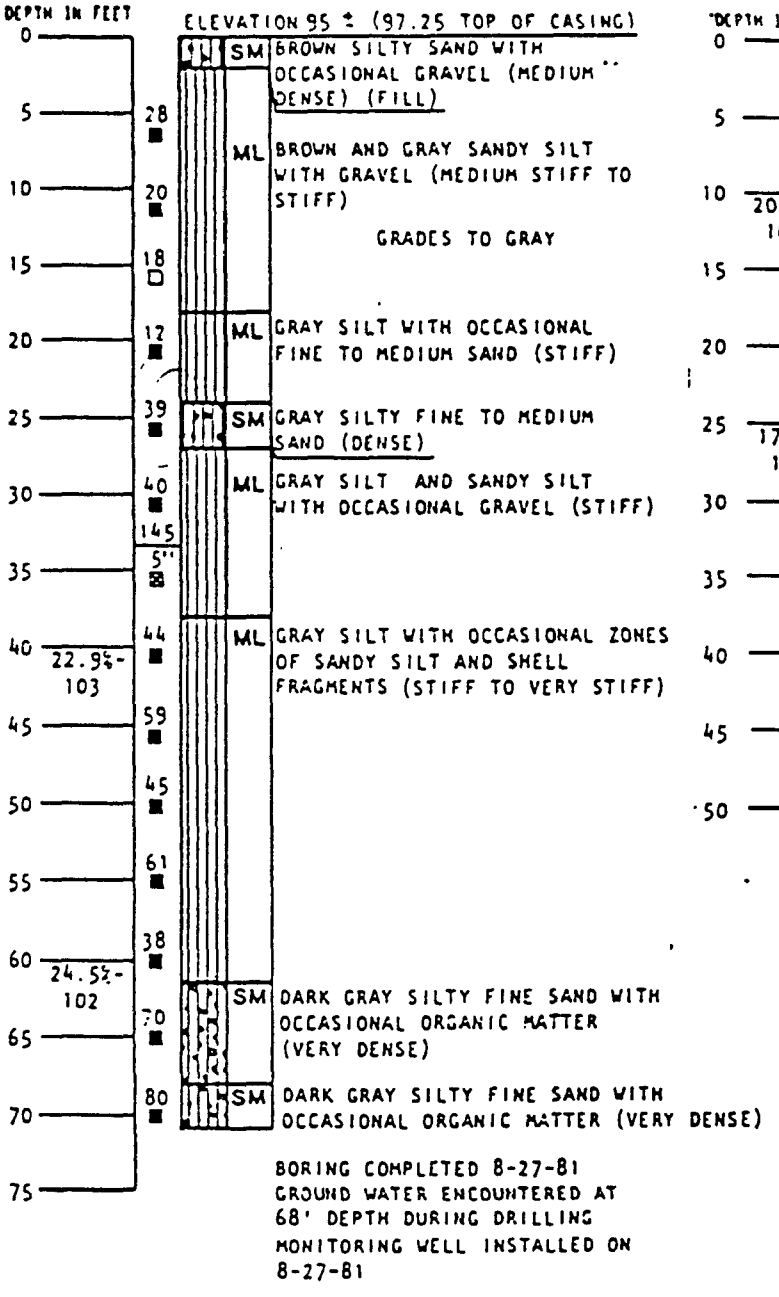
D. Life Systems - One Copy

Life Systems
24755 Highpoint Road
Cleveland, Ohio 444122
Attn: Tim Owens

APPENDIX C

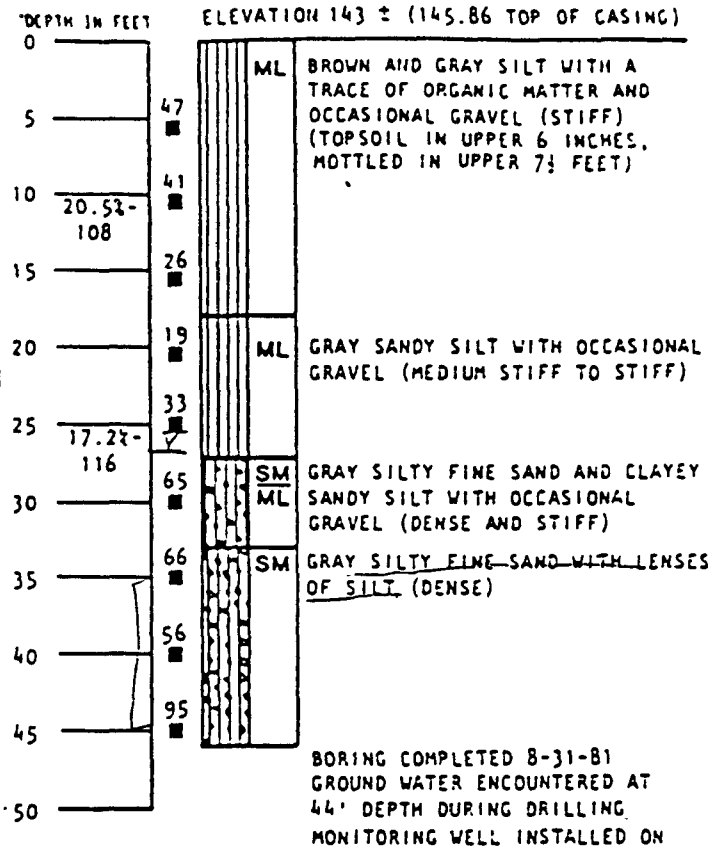
TEXACO WELL LOGS AND AS-BUILT DIAGRAMS

Boring W-1



BORING COMPLETED 8-27-81
GROUND WATER ENCOUNTERED AT 68' DEPTH DURING DRILLING
MONITORING WELL INSTALLED ON 8-27-81

Boring W-2



BORING COMPLETED 8-31-81
GROUND WATER ENCOUNTERED AT 44' DEPTH DURING DRILLING
MONITORING WELL INSTALLED ON 8-31-81

Note:
Elevation = Mean Lower Low Water Datum

Adapted from Dames & Moore report entitled As-Built Conditions, Ground Water Monitoring Wells and Lysimeters, Texaco March Point Refinery, Anacortes, Washington, for Texaco, Inc., dated November 18, 1981.

TEXACO INC.

PUGET SOUND PLANT
ANACORTES, WASH.

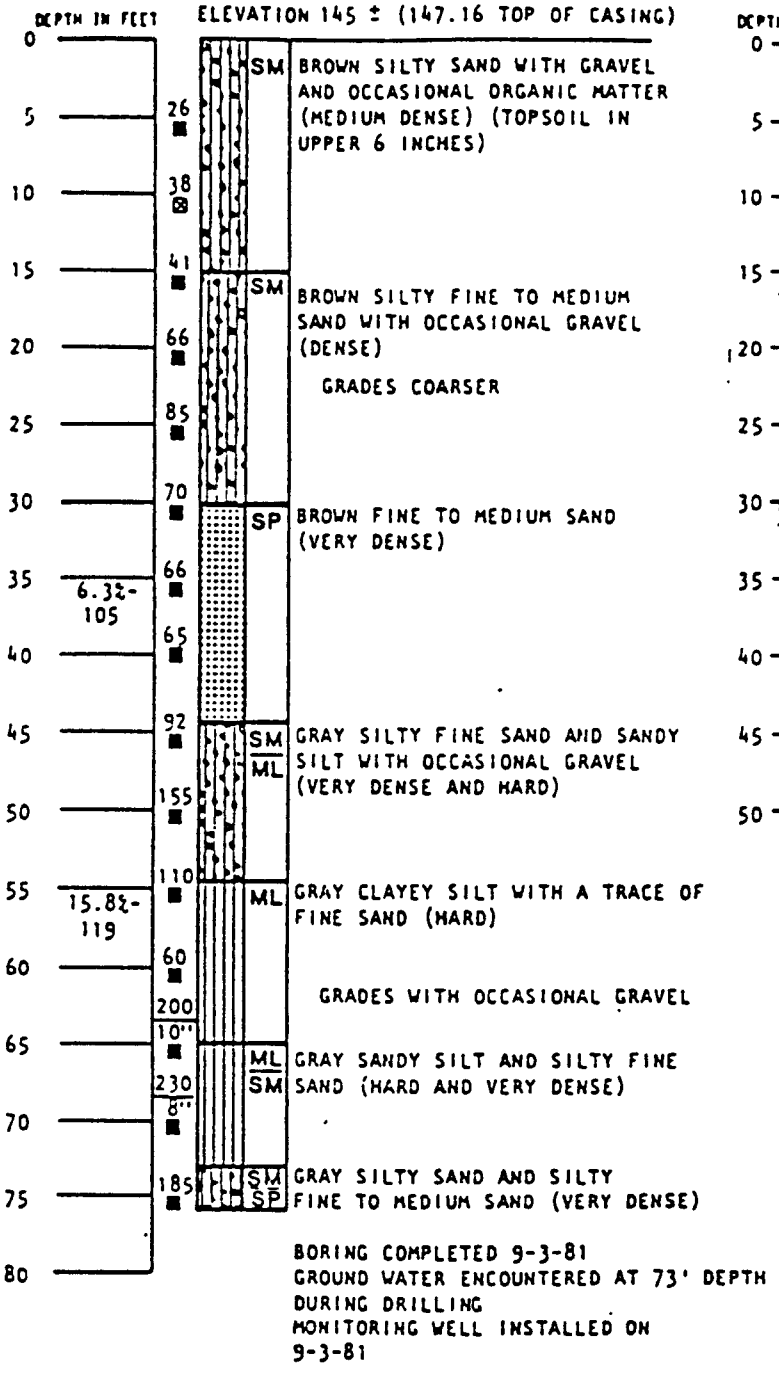
LOGS OF WELLS W-1 THROUGH W-2

LANDAU ASSOCIATES

SCALE 1" = 10'

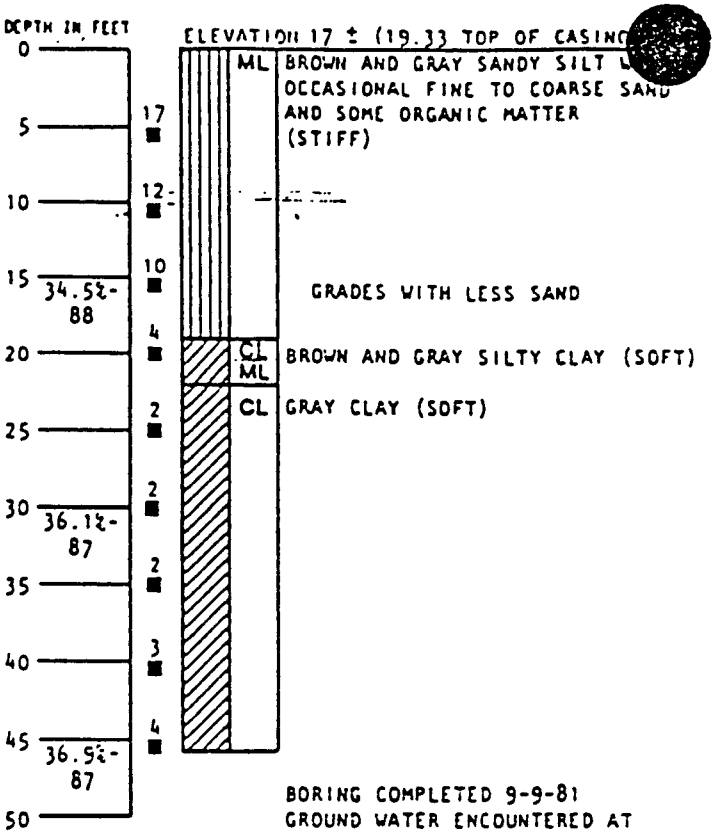
Revision 2
November 8, 1985

Boring W-3



BORING COMPLETED 9-3-81
GROUND WATER ENCOUNTERED AT 73' DEPTH DURING DRILLING
MONITORING WELL INSTALLED ON 9-3-81

Boring W-4



BORING COMPLETED 9-9-81
GROUND WATER ENCOUNTERED AT 42'.DEPTH DURING DRILLING (SEE DISCUSSION IN TEXT OF REPORT)
MONITORING WELL INSTALLED ON 9-9-81

Note:
Elevation = Mean Lower Low Water Datum

Adapted from Dames & Moore report entitled As-Built Conditions, Ground Water Monitoring Wells and Lysimeters, Texaco March Point Refinery, Anacortes, Washington, for Texaco, Inc., dated November 18, 1981.

TEXACO INC.

PUGET SOUND PLANT
ANACORTES, WASH.

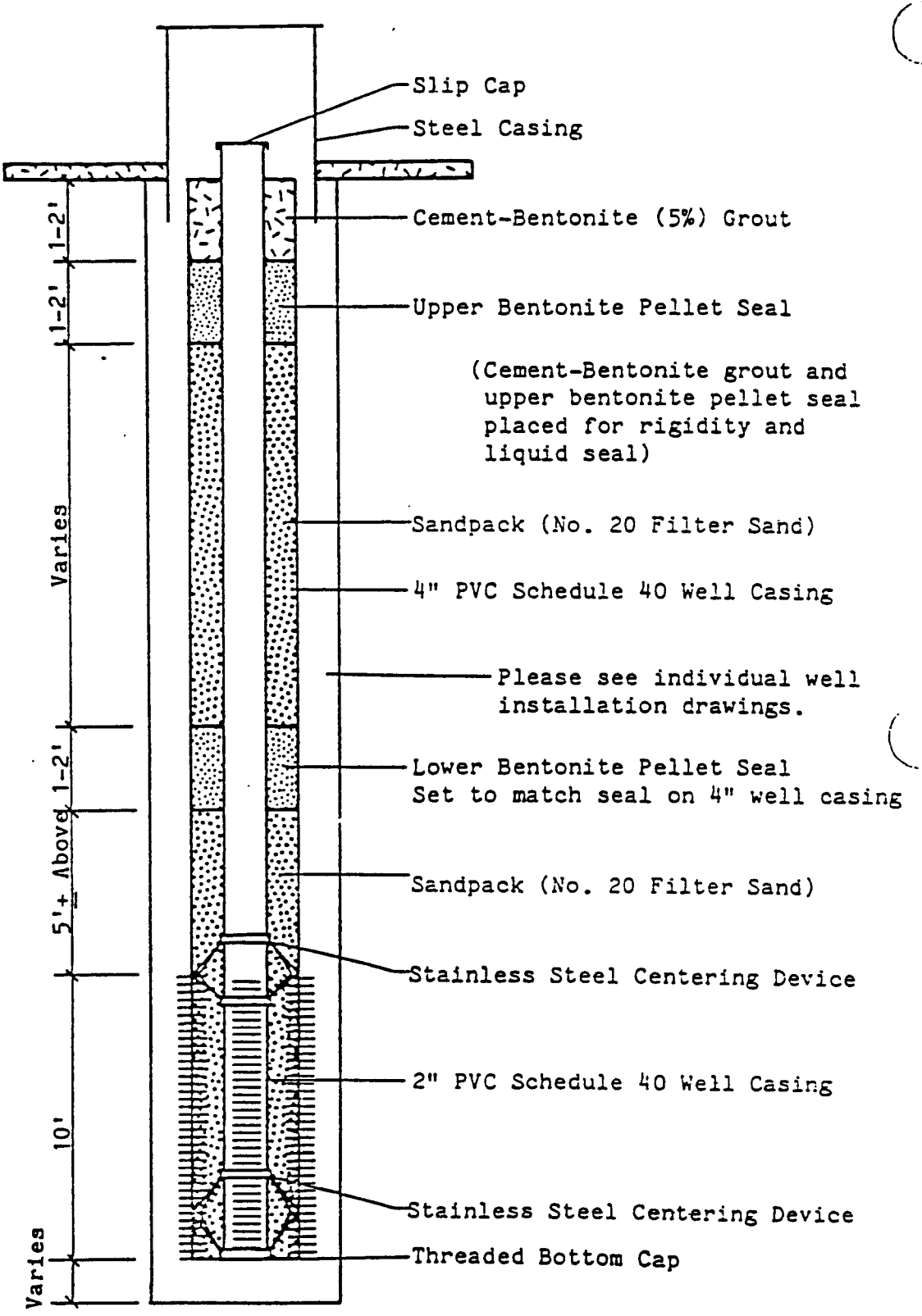
LOGS OF WELLS
W-3 THROUGH W-4

LANDAU ASSOCIATES

SCALE 1" = 1[illegible]
Revision 2
November 8, 1985

Figure XV-B-[illegible]

Wells W-1, W-2, W
W-14, and W-



XV-B-62

Revision 3
December 31, 1986

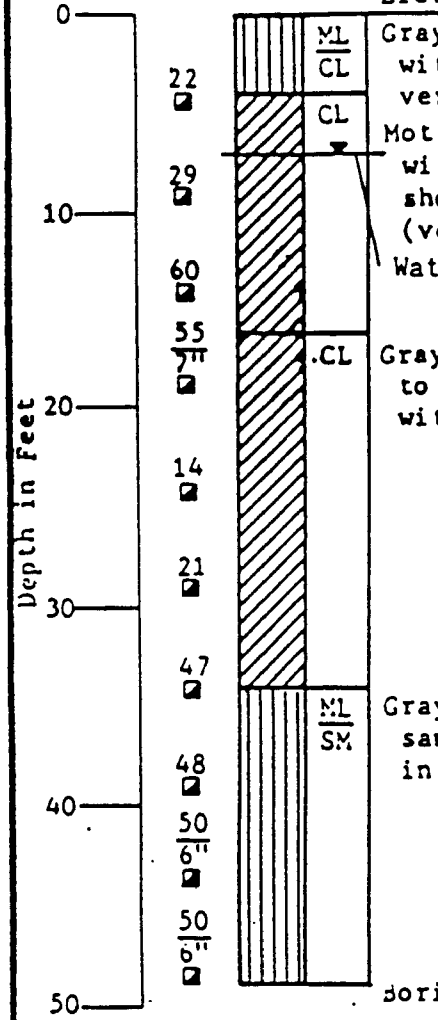
Not to scale

TEXACO INC.
PUGET SOUND PLANT
ANACORTES, WASH.

LANDAU ASSOCIATES, INC.

Two-Inch Well Casing Insert Design

WELL W-11



Elevation 96.65 (MLLW)

Grayisn-brown silt and clay with trace gravel (stiff to very stiff) (fill)

Mottled gray-brown silty clay with trace sand and gravel; shows laminations in places (very stiff to hard)

Water Level 6 June 1984

Gray silty clay with some fine to medium sand; grades to silt with depth (hard to stiff)

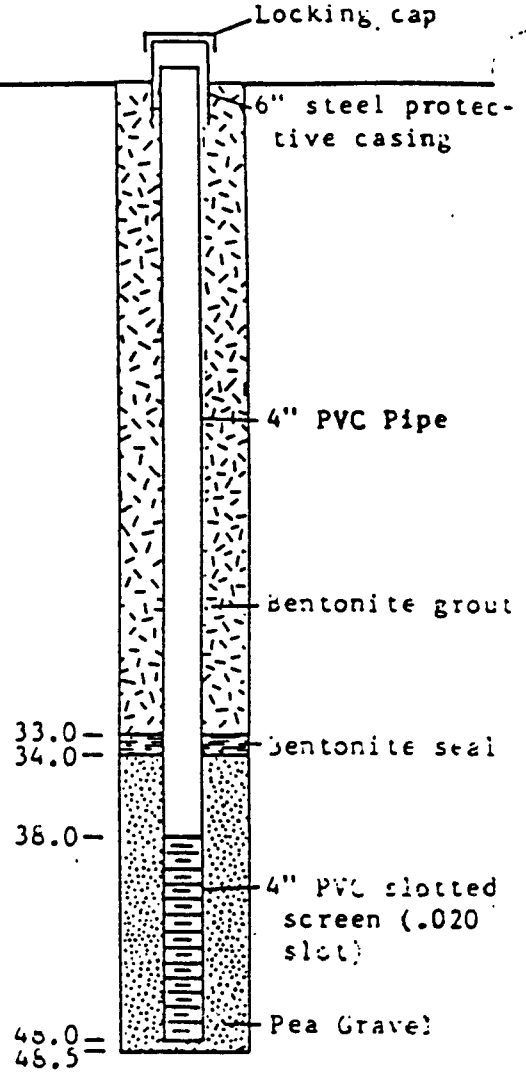
Gray sandy silt and gray silty sand; contains clay and gravel in places (till-like)

Boring completed May 25, 1984

Note:
Water level encountered during drilling was 38' below ground surface on 25 May 1984.

(MLLW) = Mean Lower Low Water Datum

AS BUILT



TEXACO INC.

PUGET SOUND PLANT
ANACORTES, WASH.

LOG OF WELL W-11

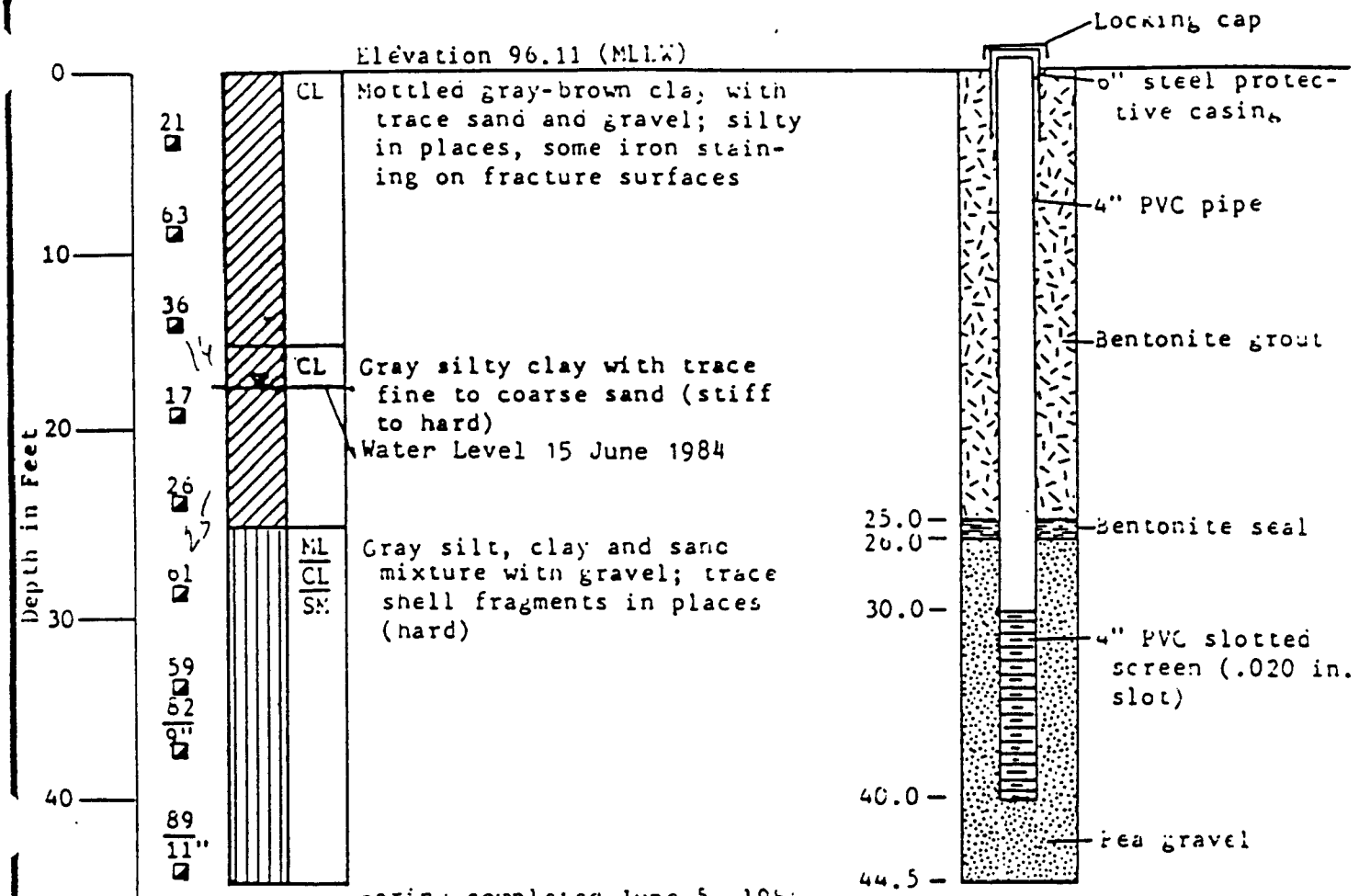
LANDAU ASSOCIATES

SCALE 1" = 1

Revision 2
November 8, 1985

WELL W-12

AS BUILT



Boring completed June 5, 1984

Note:
Water level encountered during drilling was 15' below ground surface on 5 June 1984.

(MLLW) = Mean Lower Low Water Datum

TEXACO INC.

PUGET SOUND PLANT
ANACORTES, WASH.

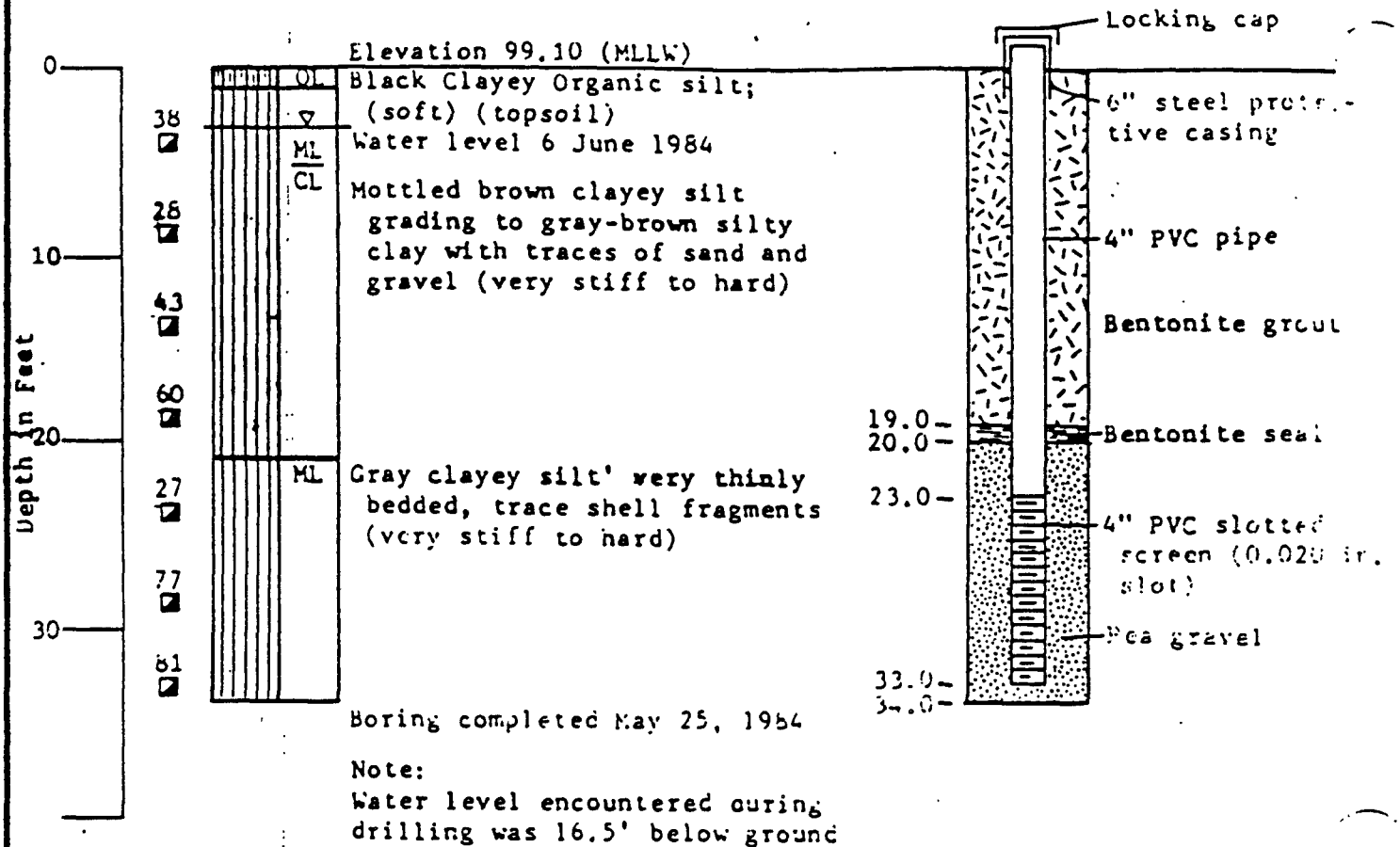
LOG OF WELL W-12

LANDAU ASSOCIATES

SCALE 1" = 10'
Revision 2
November 8, 1985

WELL W-13

AS BUILT



Boring completed May 25, 1984

Note:
Water level encountered during drilling was 16.5' below ground surface on 25 May 1984.

(MLLW) = Mean Lower Low Water Datum

TEXACO INC.

PUGET SOUND PLANT
ANACORTES, WASH.

LOG OF WELL W-13

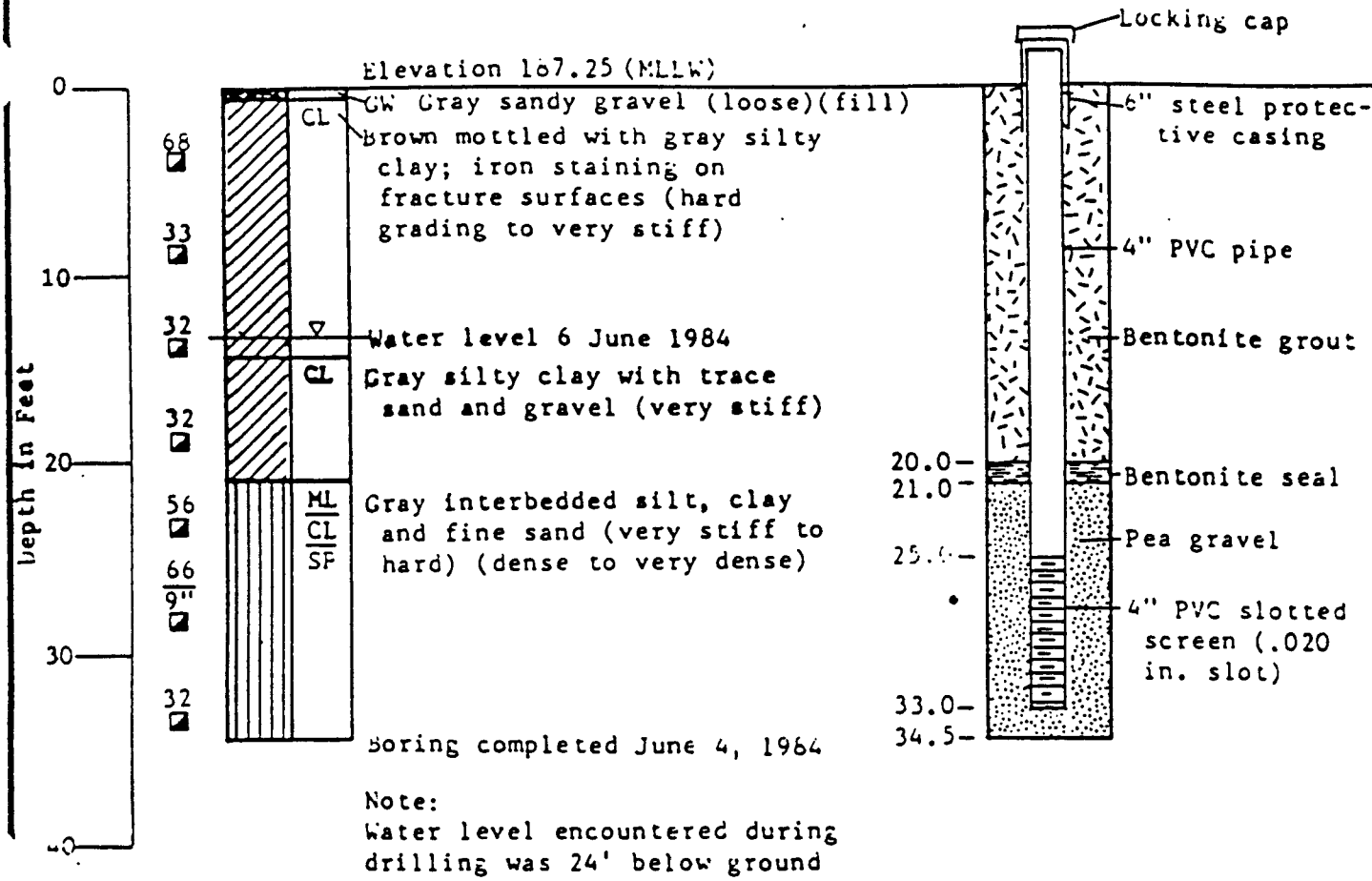
LANDAU ASSOCIATES

SCALE 1" = 1'

Revision 2
November 8, 1985

WELL W-14

AS BUILT



Note:
Water level encountered during drilling was 24' below ground surface on 4 June 1984.

(MLLW) = Mean Lower Low Water Datum

See As-built Modification after ~~W-15~~

TEXACO INC.

PUGET SOUND PLANT
ANACORTES, WASH.

LOG OF WELL W-14

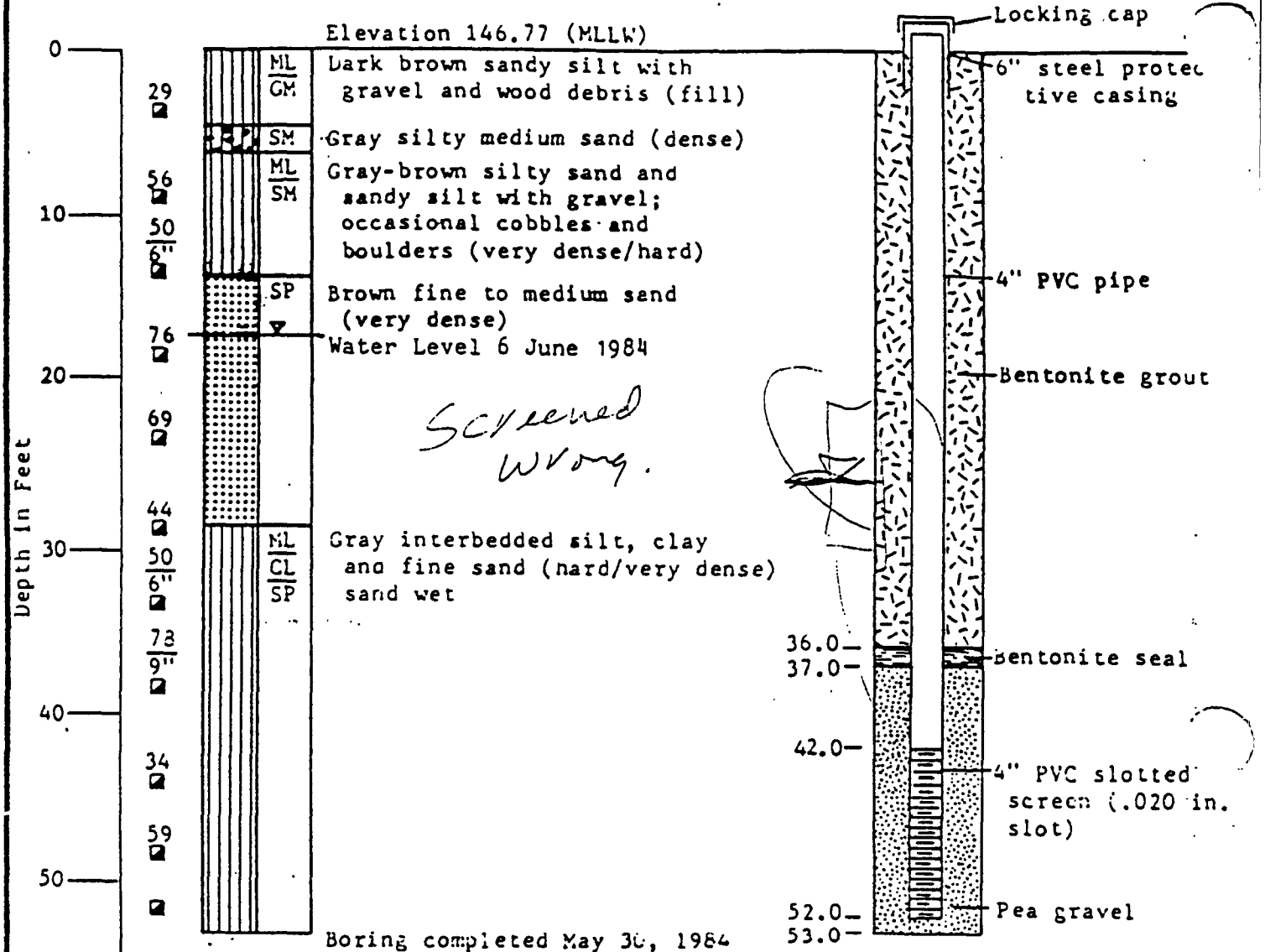
LANDAU ASSOCIATES

SCALE 1" = 10'

Revision 2
November 8, 1985

WELL W-15

AS BUILT



Note:
Water level encountered during drilling was 27' below ground surface on 30 May 1984.

(MLLW) = Mean Lower Low Water Datum

See As-built modifications Next Page

TEXACO INC.

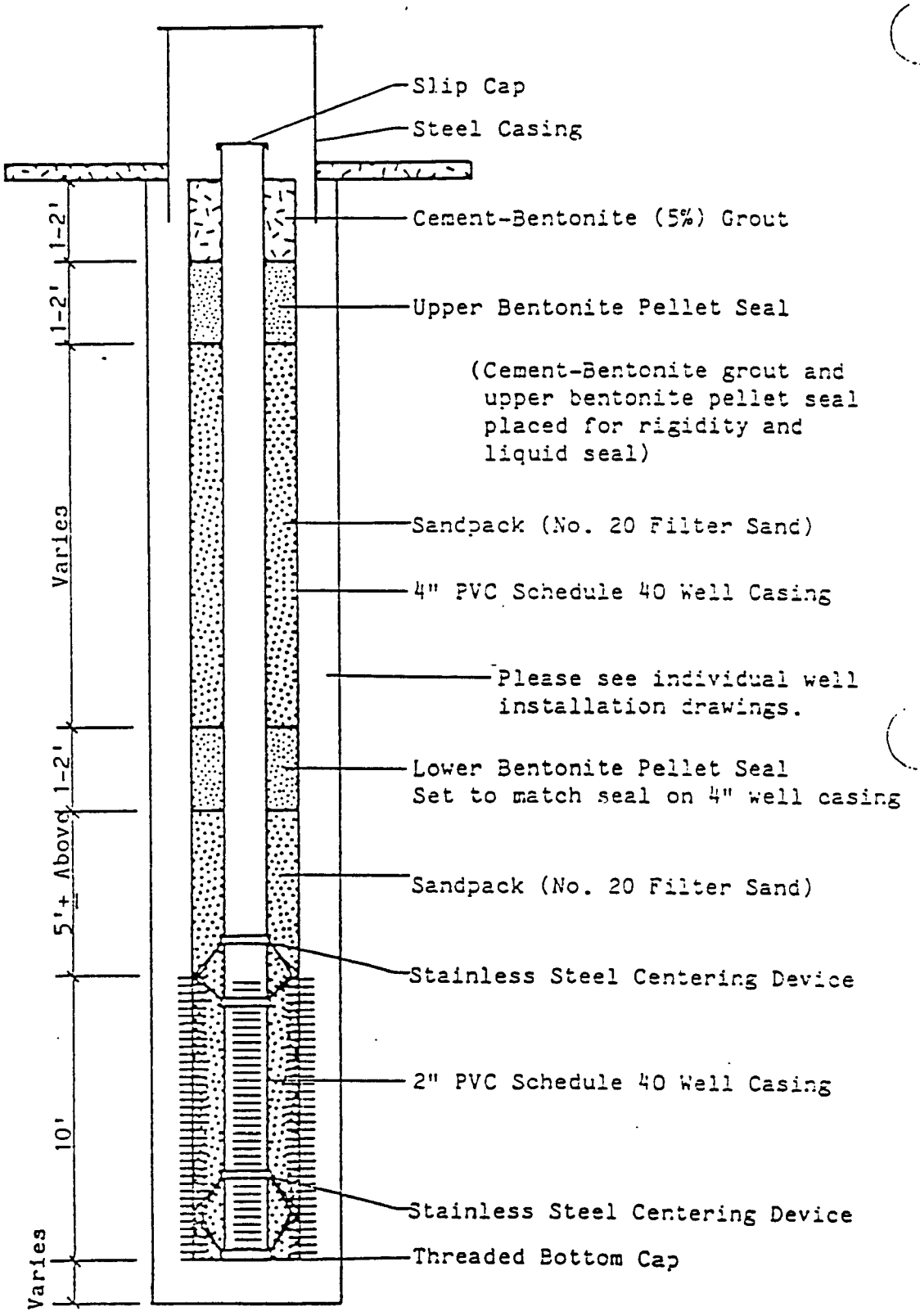
PUGET SOUND PLANT
ANACORTES, WASH.

LOG OF WELL W-15

LANDAU ASSOCIATES

SCALE 1" = 10'
Revision 2
November 8, 1985

Wells W-1, W-2, W-
W-14, and W-1



XV-B-62

Revision 3
December 31, 1986

TEXACO INC.
PUGET SOUND PLANT
ANACORTES, WASH.

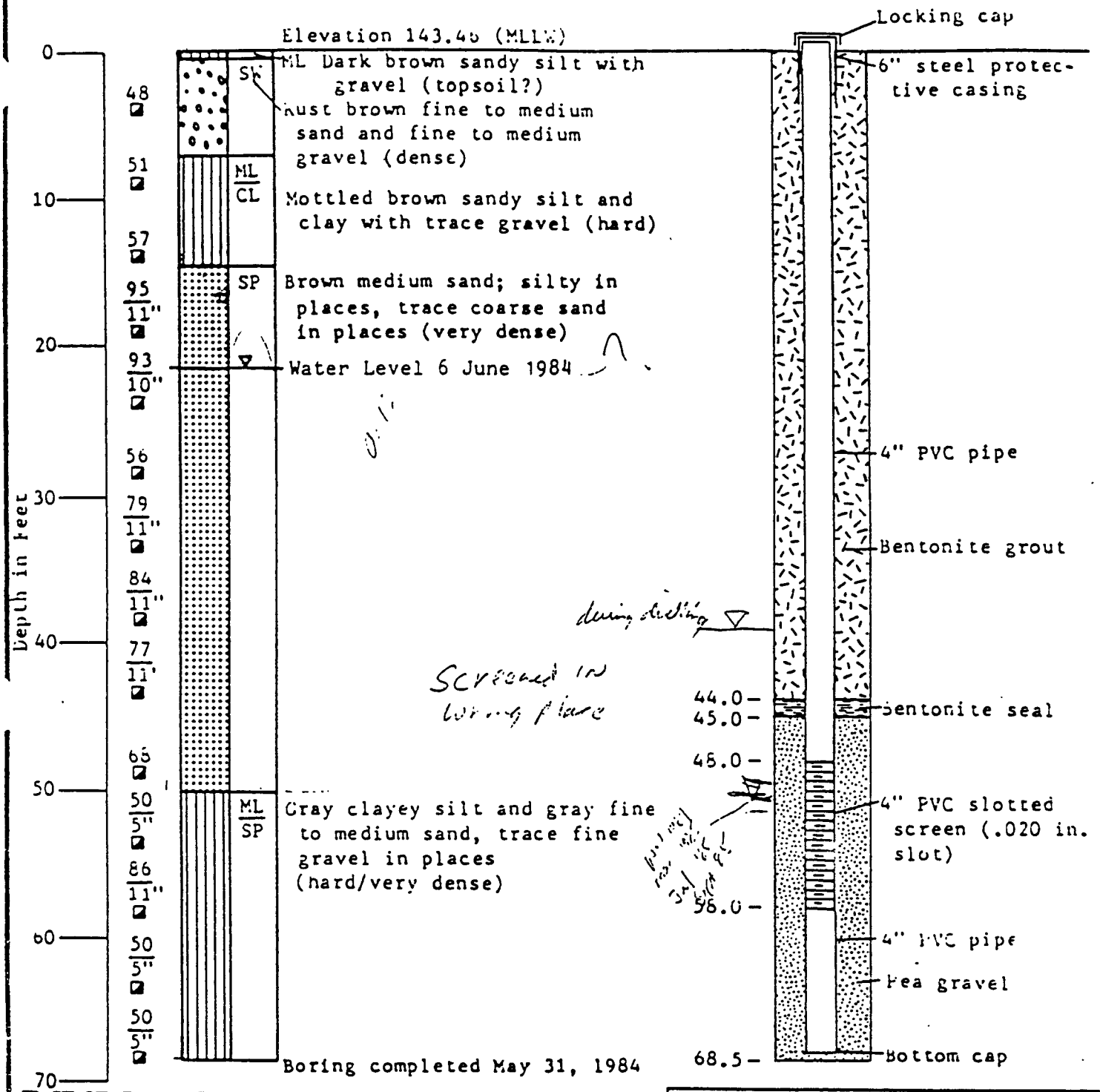
Not to scale

LANDAU ASSOCIATES, INC.

Two-Inch Well Casing Insert Design

WELL W-16

AS BUILT



Note:
Water level encountered during drilling was 38' below ground surface on 31 May 1984.

(MLLW) = Mean Lower Low Water Datum

See As-built Modifications Next Page

TEXACO INC.

PUGET SOUND PLANT
ANACORTES, WASH.

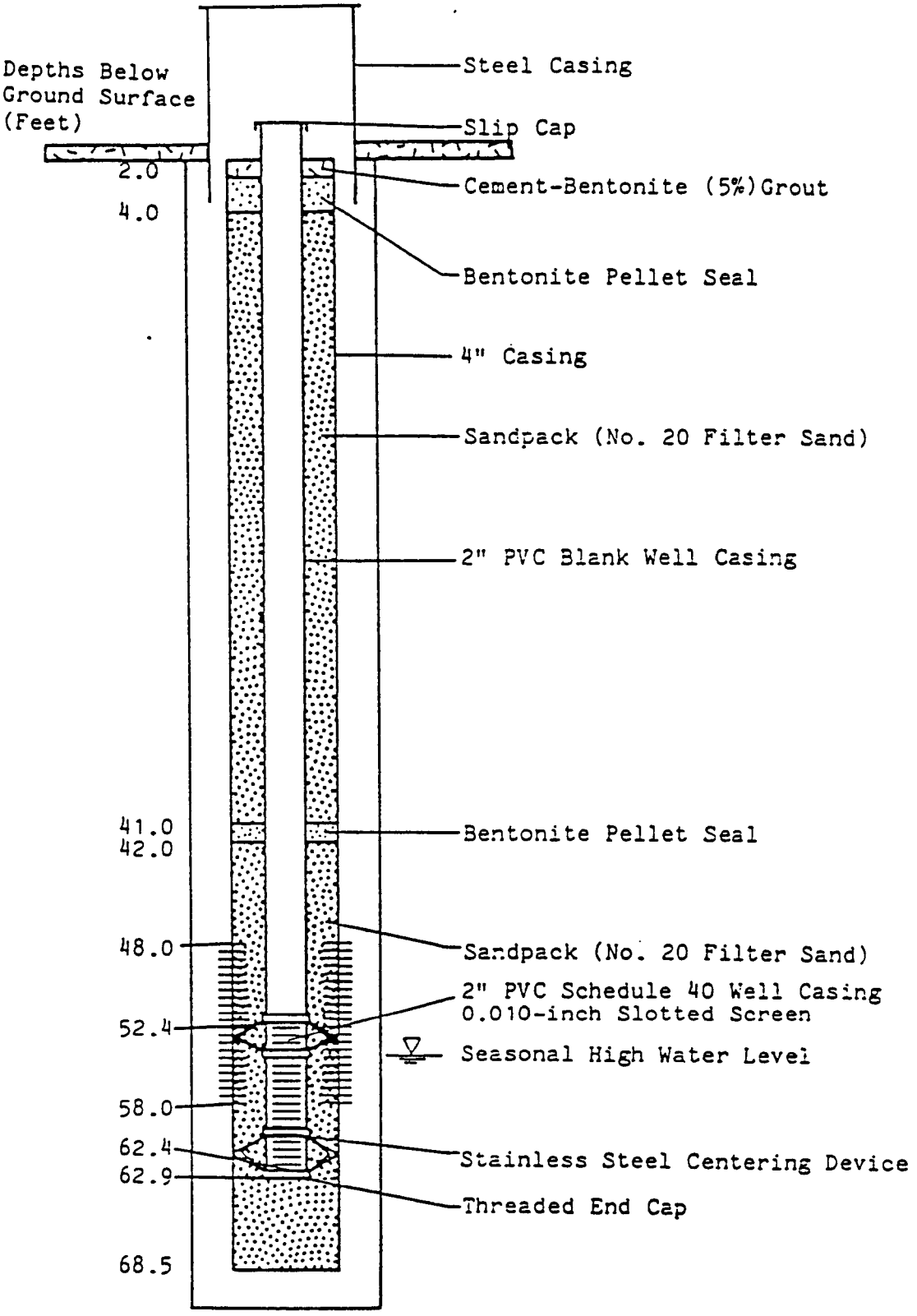
LOG OF WELL W-16

LANDAU ASSOCIATES

SCALE 1" = 10'

Revision 2
November 8, 1985

Figure XV-B-1



XV-B-63

Revision 3
December 31, 1986

Not to scale

TEXACO INC.

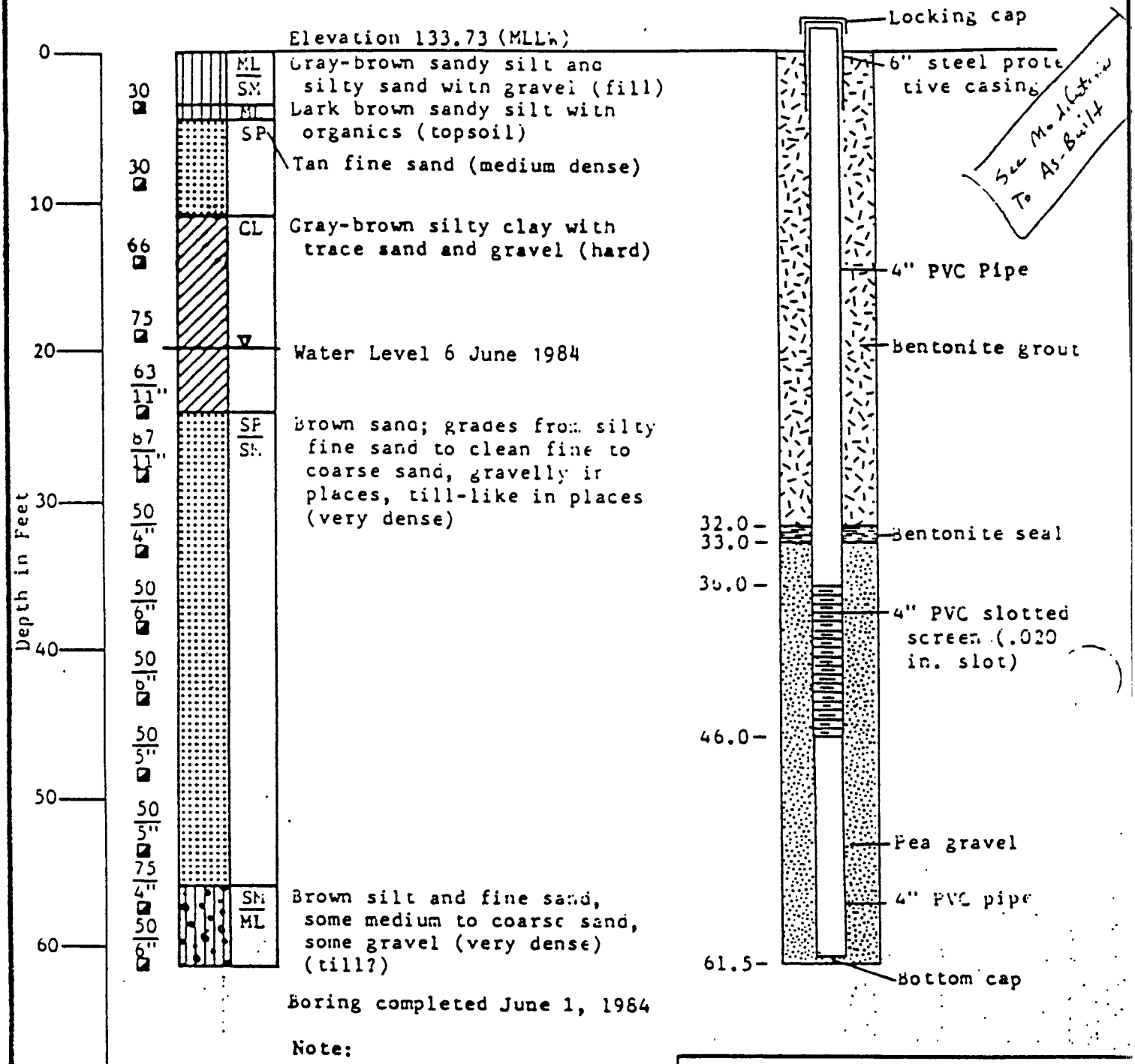
PUGET SOUND PLANT
ANACORTES, WASH.

LANDAU ASSOCIATES, INC.

W-16: Two-Inch Casing Insert Installation Drawing (July 19

WELL W-17

AS BUILT



TEXACO INC.

PUGET SOUND PLANT

ANACORTES, WASH.

LOG OF WELL W-17

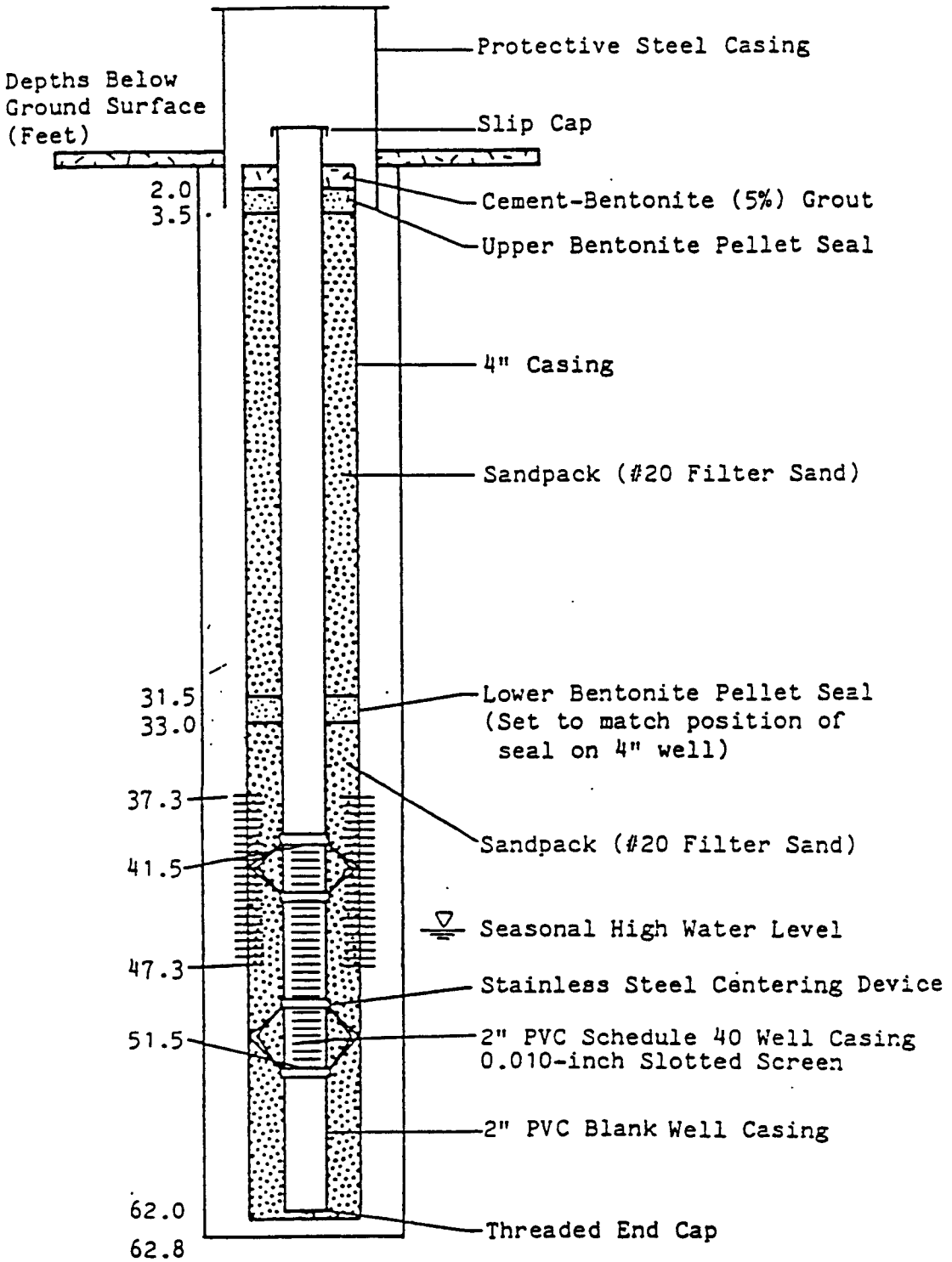
SCALE 1" = 10'

Revision 2

November 8, 1985

LANDAU ASSOCIATES

Figure XV-B-12



XV-B-64

Revision 3
December 31, 1986

Not to scale

TEXACO INC

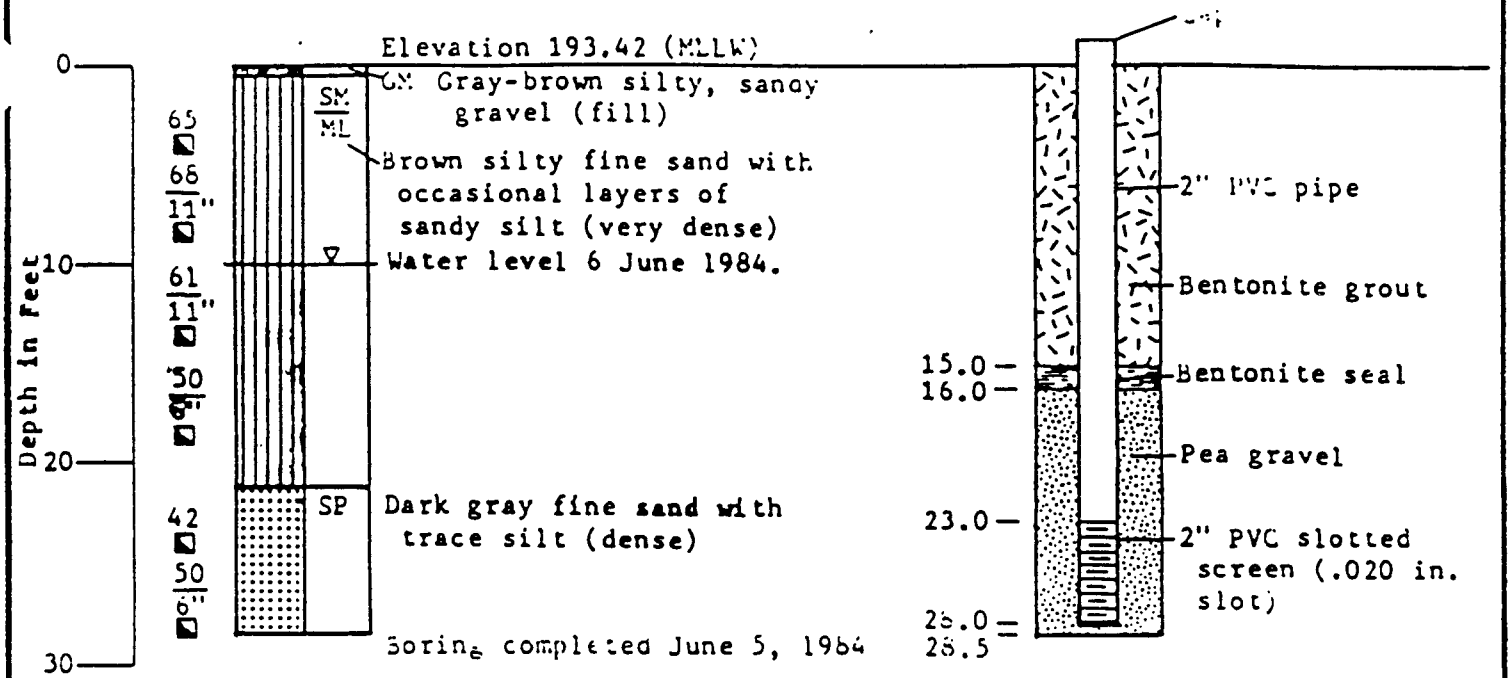
PUGET SOUND PLANT
ANACORTES, WASH.

LANDAU ASSOCIATES, INC.

W-17: Two-Inch Casing Insert Installation Drawing (July 19

PIEZOMETER PI

AS BUILT



Note:
Water level encountered during drilling was 17.5' below ground surface on 5 June 1984.

(MLLW) = Mean Lower Low Water Datum

TEXACO INC.

PUGET SOUND PLANT
ANACORTES, WASH.

LOG OF PIEZOMETER P-1

LANDAU ASSOCIATES

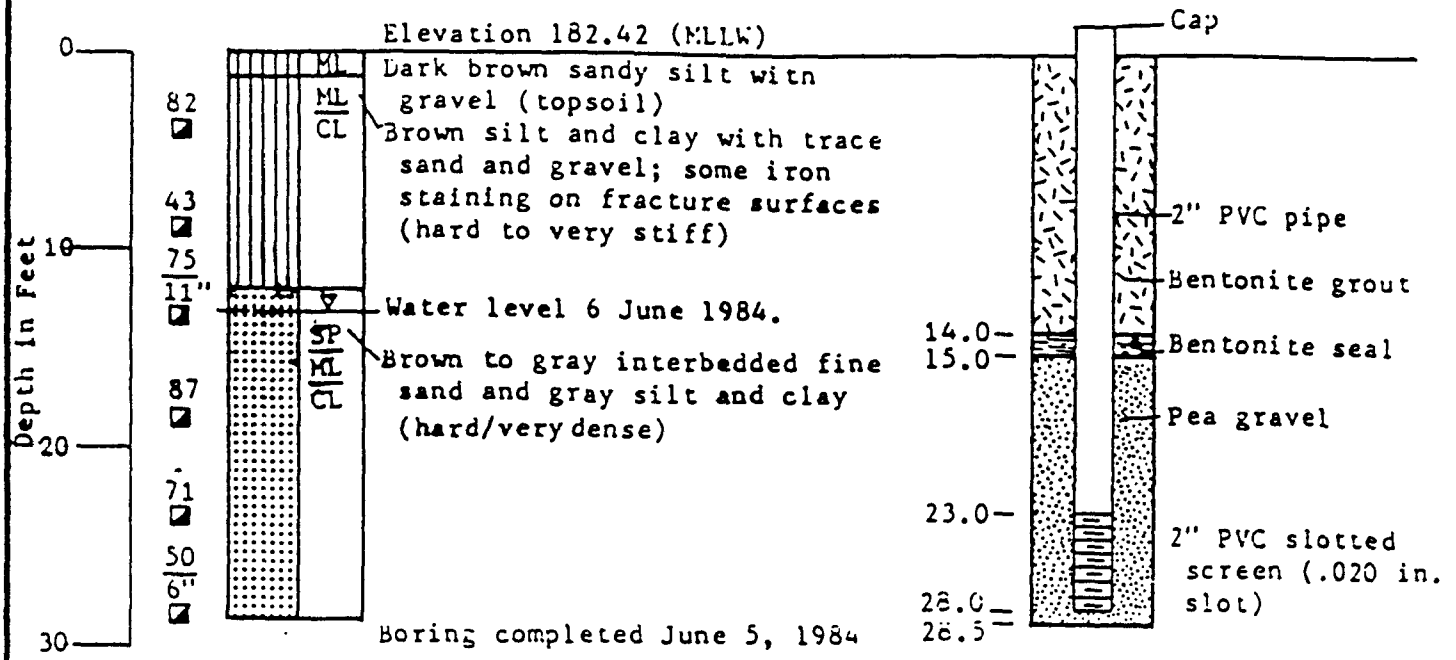
SCALE 1" = 10'

Revision 2
November 8, 1985

Figure XV-B-13

PIEZOMETER P2

AS BUILT.



Note:
Water level encountered during drilling was 13.3' below ground surface on 5 June 1984.

(MLLW) = Mean Lower Low Water Datum

TEXACO INC.

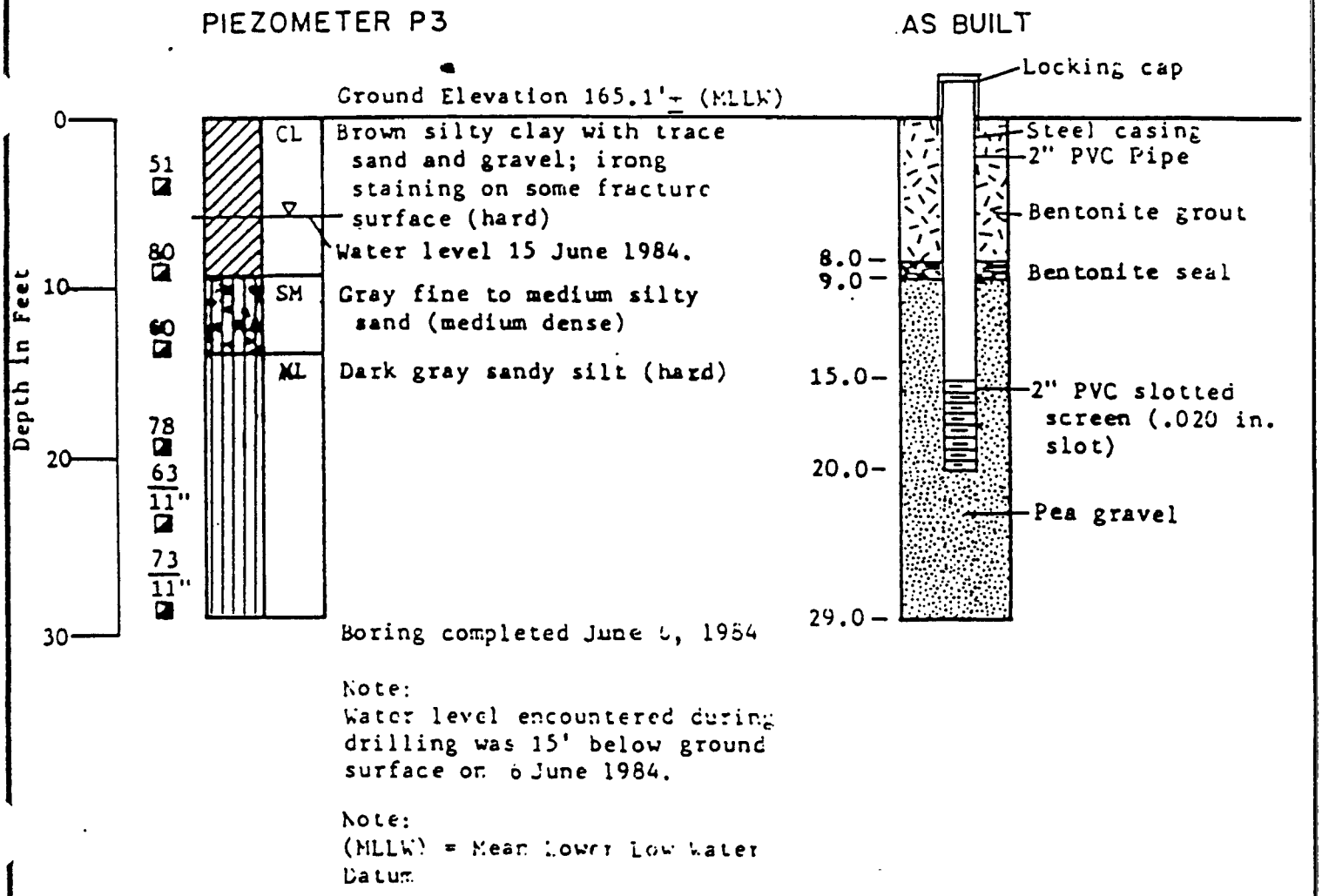
PUGET SOUND PLANT
ANACORTES, WASH.

LOG OF PIEZOMETER P-2

LANDAU ASSOCIATES

SCALE 1" = 1

Revision 2
November 8, 1985



TEXACO INC.

PUGET SOUND PLANT
ANACORTES, WASH.

LOG OF PIEZOMETER P-3

LANDAU ASSOCIATES

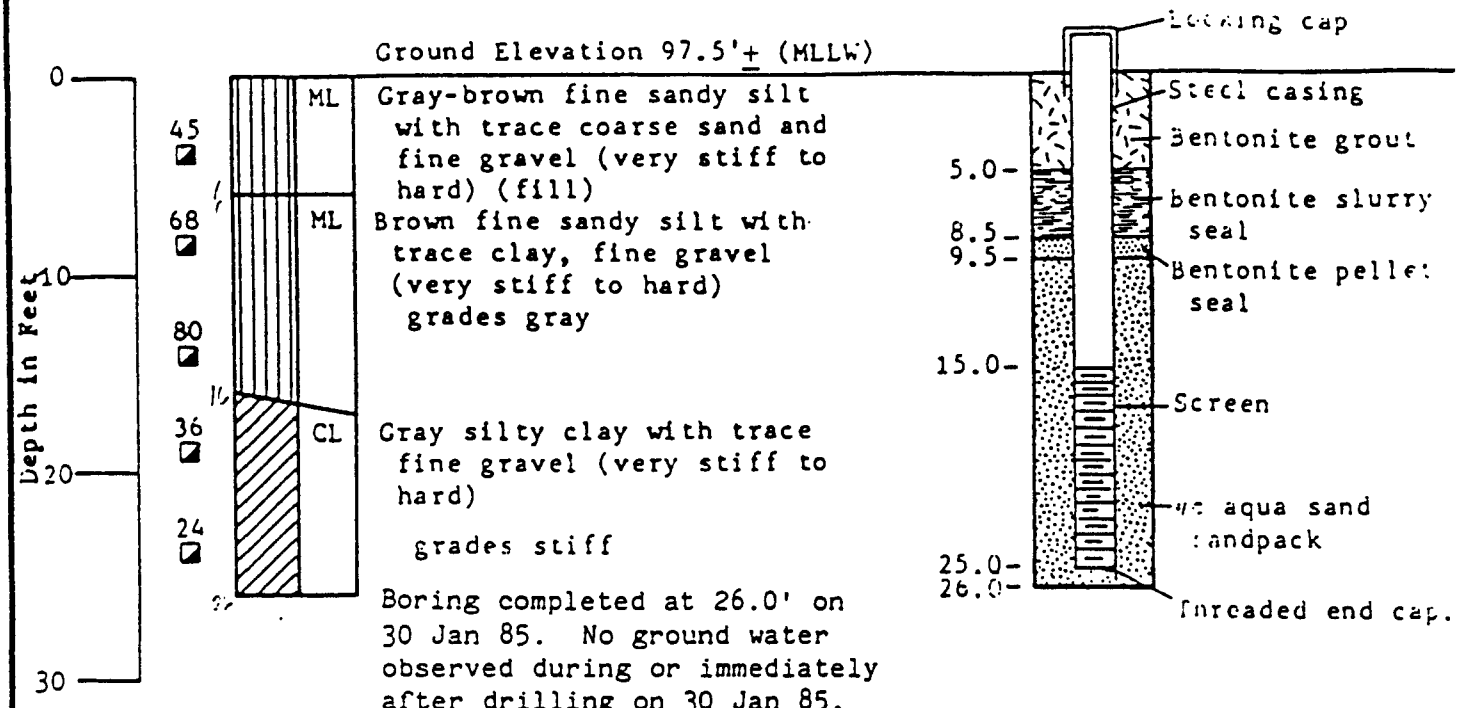
SCALE 1" = 10'

Revision 2
November 8, 1985

Figure XV-B-1

WELL W-21

AS BUILT



TEXACO INC.

PUGET SOUND PLANT
ANACORTES, WASH.

LOG OF WELL W-21

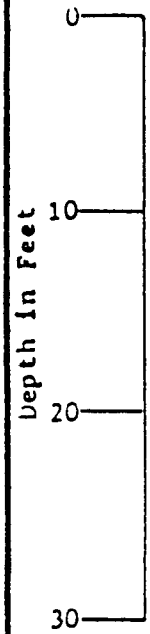
LANDAU ASSOCIATES

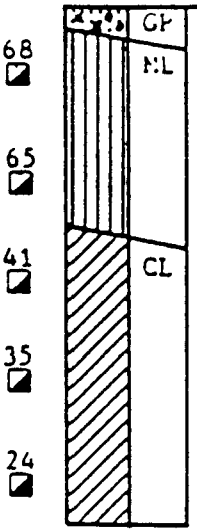
SCALE 1" = 10

Revision 2
November 8, 1985

Figure XV-B-1

WELL W-22





Ground Elevation 94.6'± (MLLW)

Dark gray angular gravel (dense) (fill)

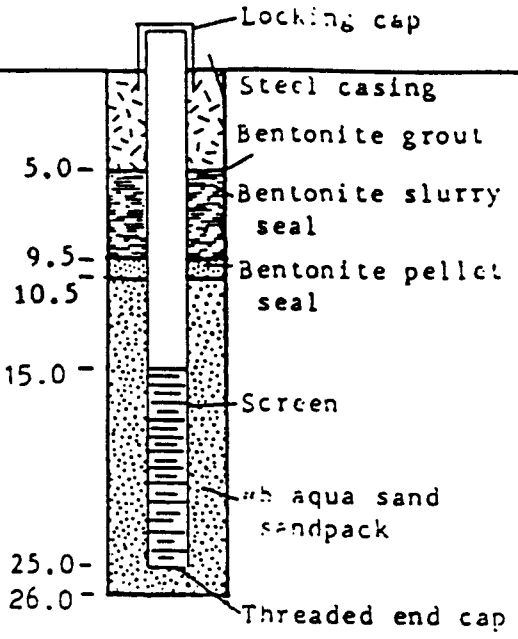
Gray-brown fine sandy silt with trace gravel (very stiff-hard)

Gray silty clay with trace gravel (very stiff to hard)

grades medium stiff to stiff

Boring completed at 26.0' on 30 Jan 85. No ground water observed during or immediately after drilling on 30 Jan 85. ground water measured at 0.6' below ground surface on 4 Feb 85 after open hole caved.
(MLLW) = Mean Lower Low Water

AS BUILT



TEXACO INC.

PUGET SOUND PLANT
ANACORTES, WASH.

LOG OF WELL W-22

LANDAU ASSOCIATES

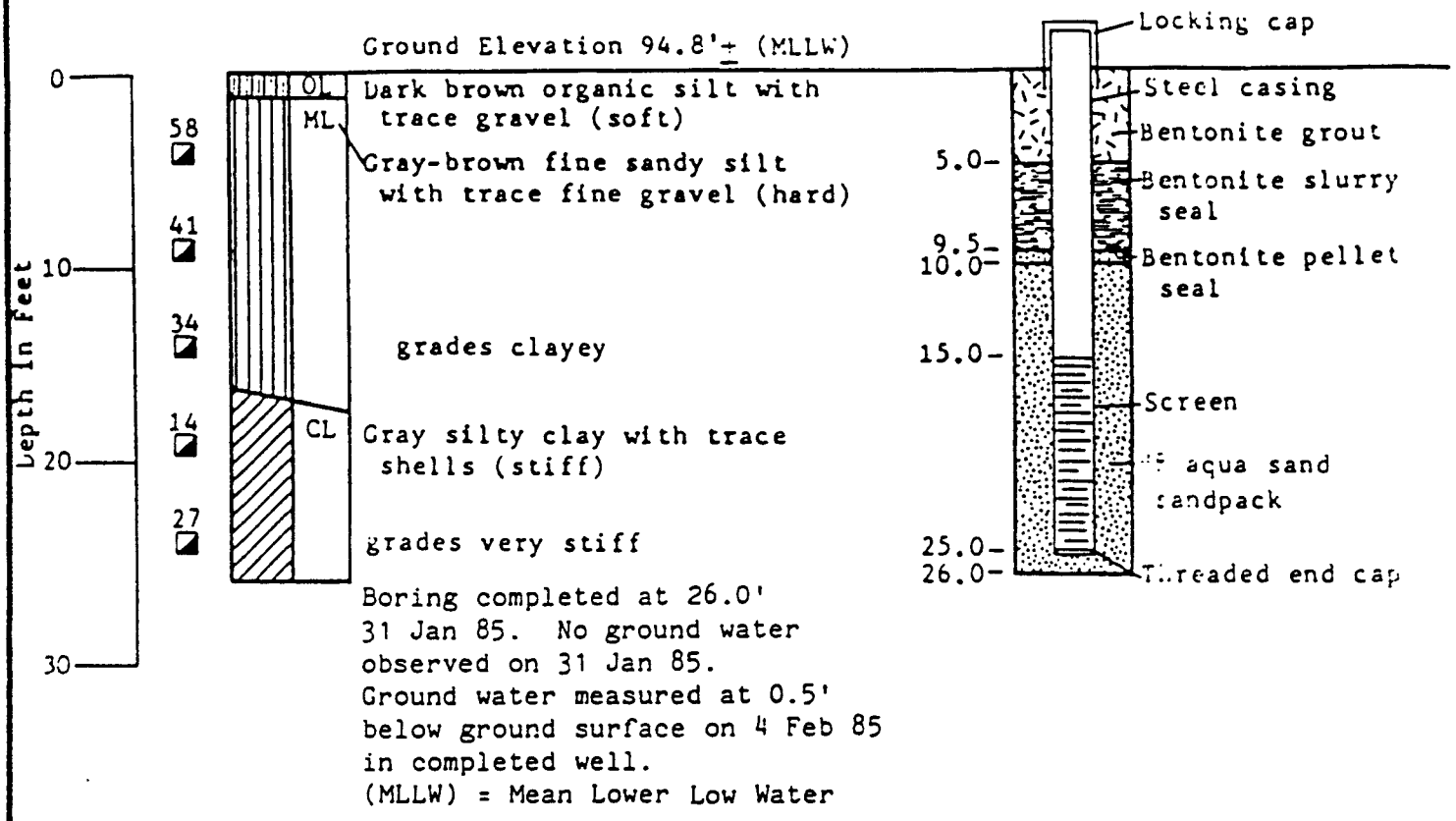
SCALE 1" = 10'

Revision 2
November 8, 1985

Figure XV-B-

WELL W-23

AS BUILT



TEXACO INC.

PUGET SOUND PLANT
ANACORTES, WASH.

LOG OF WELL W-23

LANDAU ASSOCIATES

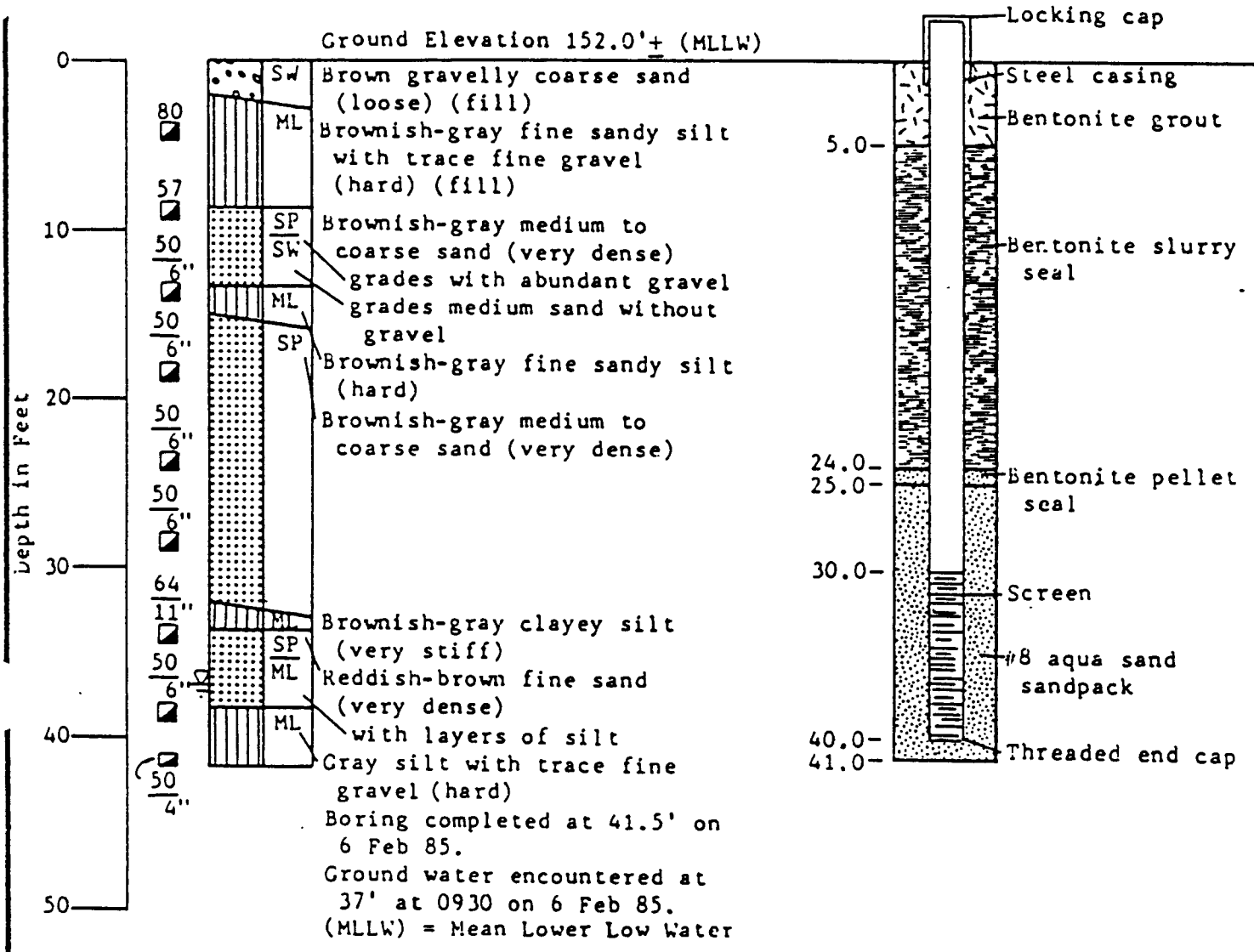
SCALE 1" = 1'

Revision 2
November 8, 1985

Figure XV-B-2(

WELL W-24

AS BUILT



TEXACO INC.

PUGET SOUND PLANT
ANACORTES, WASH.

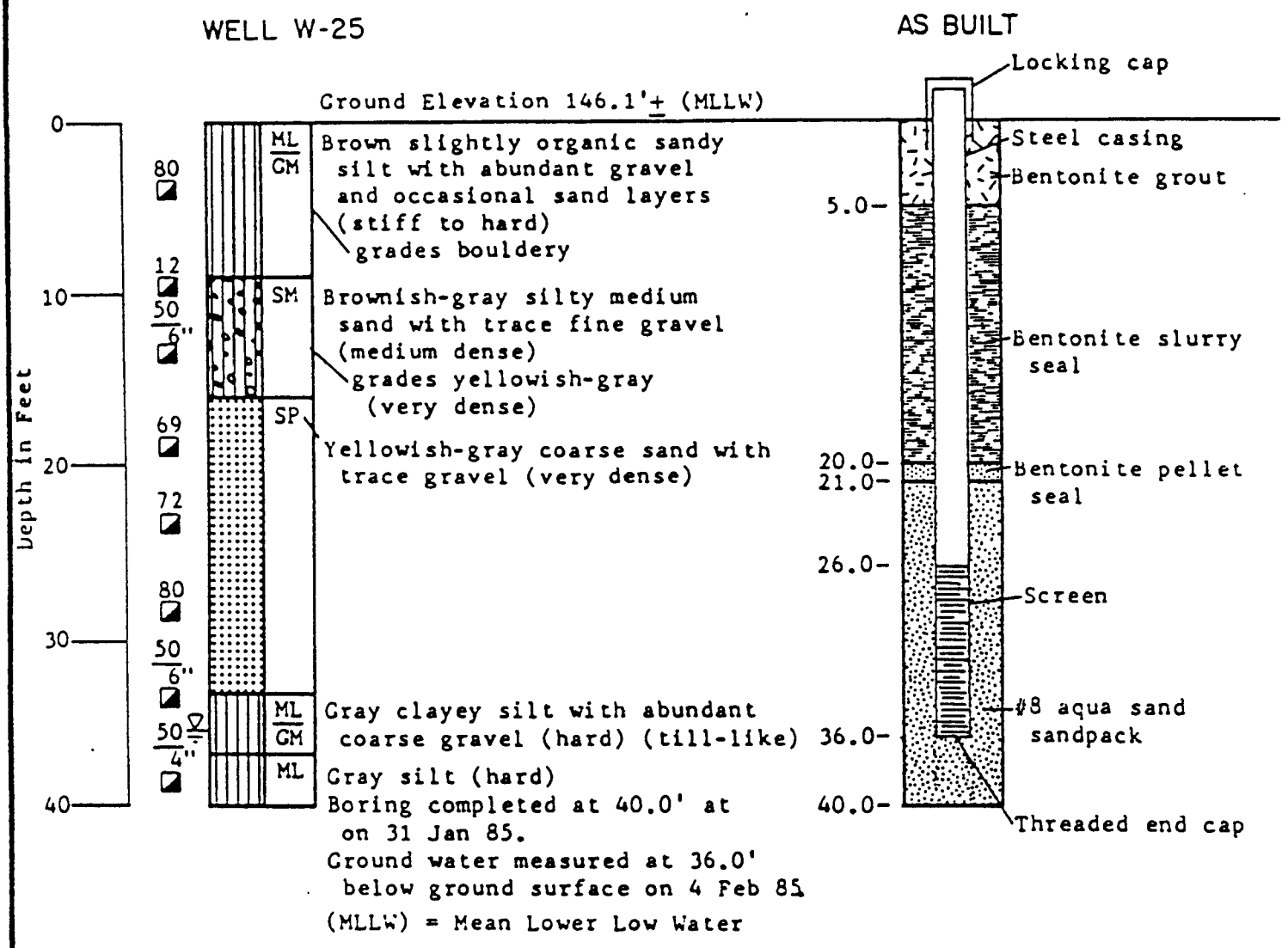
LOG OF WELL W-24

LANDAU ASSOCIATES

SCALE 1" = 10'

Revision 2
November 8, 1985

Figure XV-B-2



TEXACO INC.

PUGET SOUND PLANT
ANACORTES, WASH.

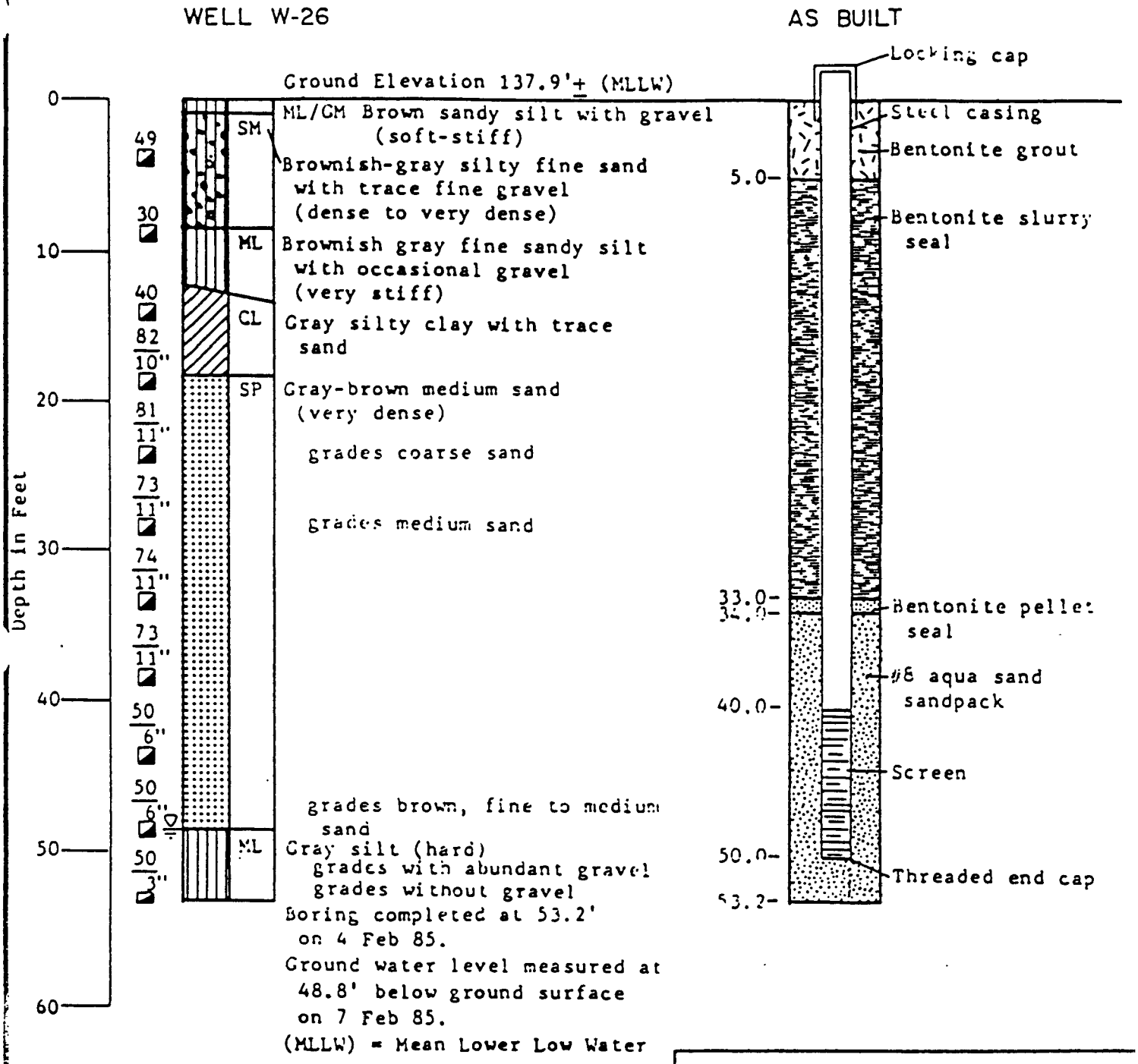
LOG OF WELL W-25

LANDAU ASSOCIATES

SCALE 1" = 10'

Revision 2
November 8, 1985

Figure XV-B-22



TEXACO INC.

PUGET SOUND PLANT
ANACORTES, WASH.

LOG OF WELL W-26

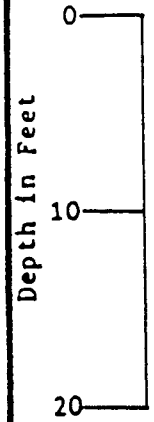
LANDAU ASSOCIATES

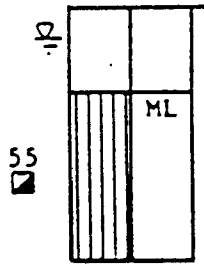
SCALE 1" = 10'

Revision 2
November 8, 1985

P-4

Ground Elevation 119.1'± (MLLW)



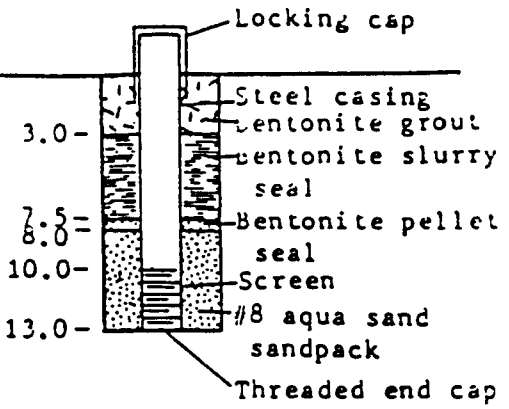


Backfill soil

Brownish-gray silt with trace clay, fine gravel (hard)

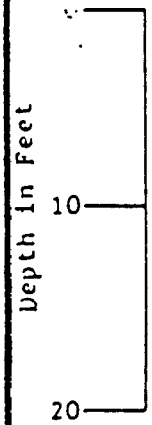
Boring completed at 13.0' on 6 Feb 85
Ground water measured at 1.04' below ground surface on 7 Feb 85.

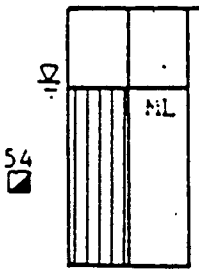
AS BUILT



P-5

Ground Elevation 119.8'± (MLLW)



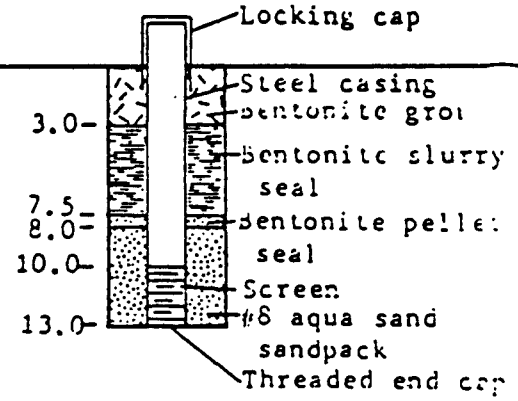


Backfill soil

brownish-gray silt with trace clay, fine gravel (hard)

Boring completed at 13.0' on 6 Feb 85.
Ground water measured at 3.4' below ground surface on 7 Feb 85.

AS BUILT



(MLLW) = Mean Lower Low Water

TEXACO INC.

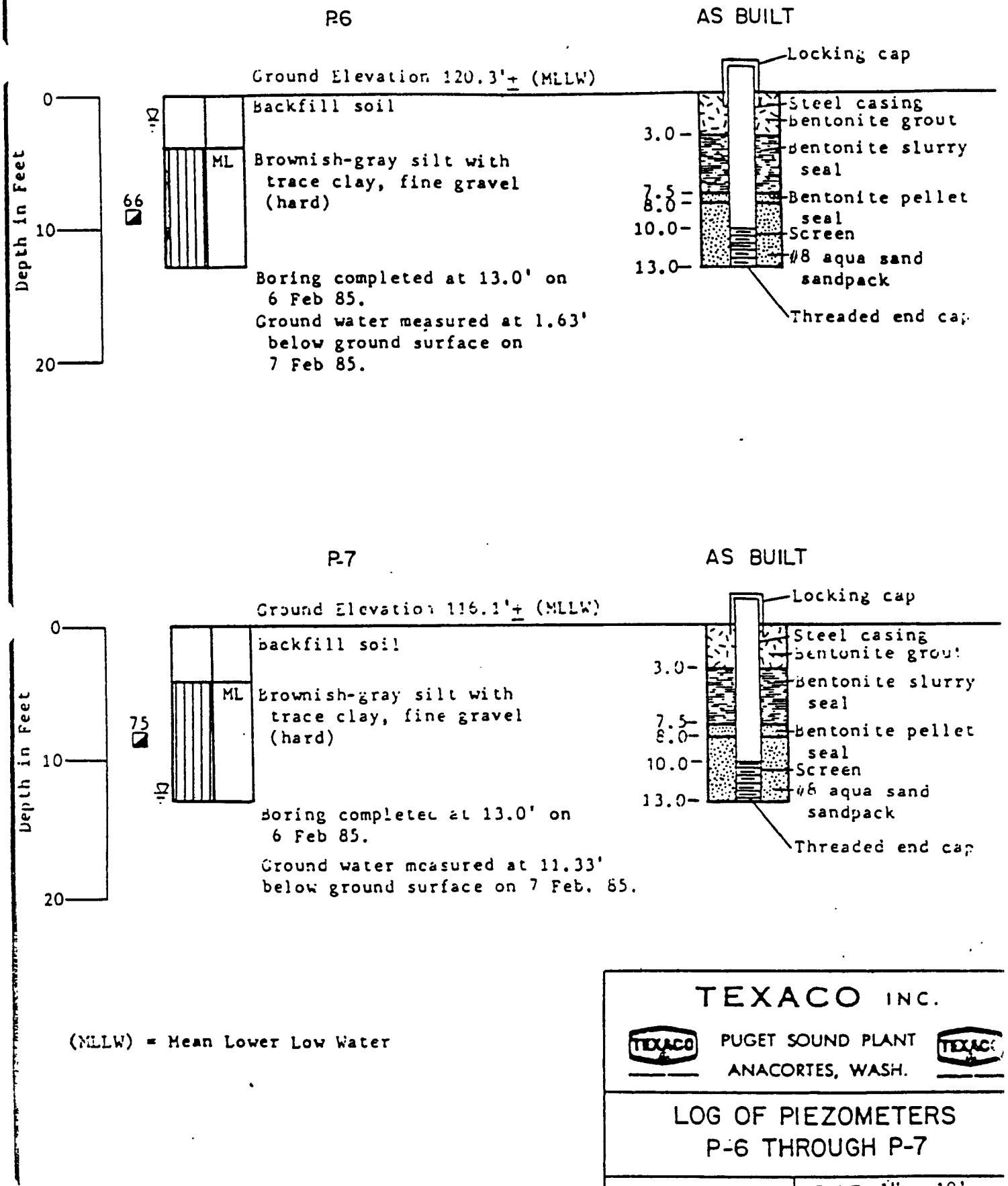
PUGET SOUND PLANT
ANACORTES, WASH.

LOG OF PIEZOMETERS
P-4 THROUGH P-5

LANDAU ASSOCIATES

SCALE 1" = 1

Revision 2
November 8, 1985



(MLLW) = Mean Lower Low Water

TEXACO INC.

PUGET SOUND PLANT
ANACORTES, WASH.

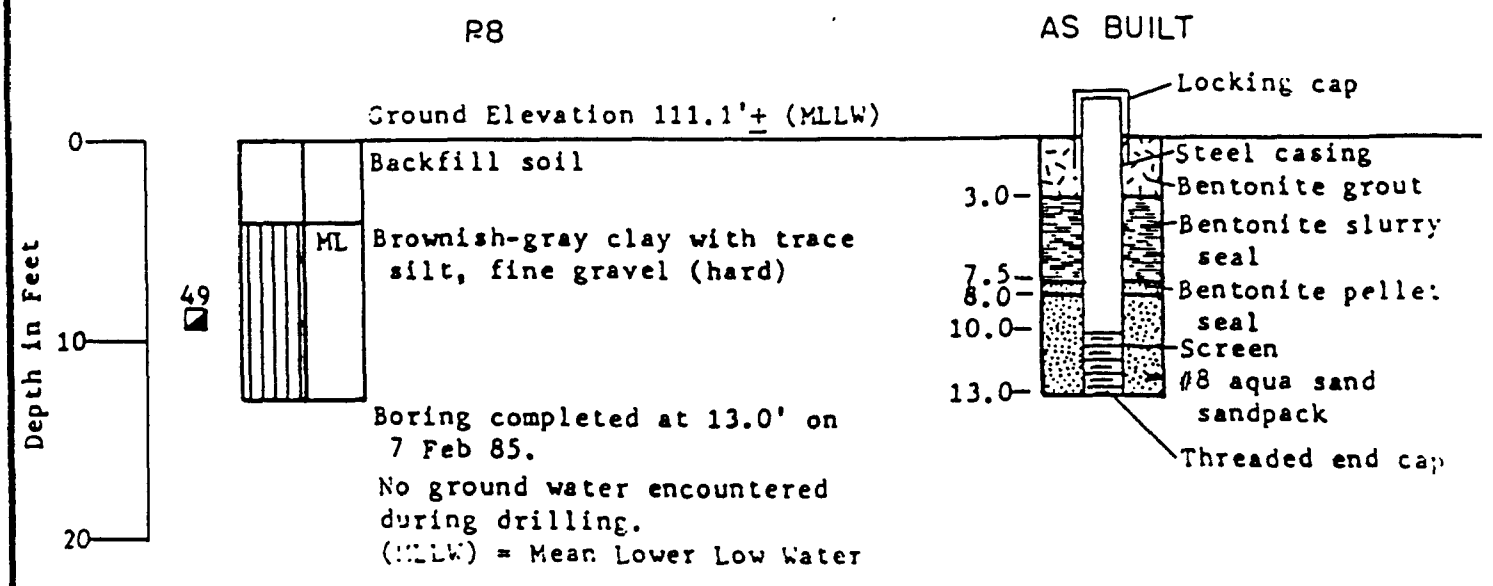
LOG OF PIEZOMETERS
P-6 THROUGH P-7

LANDAU ASSOCIATES

SCALE 1" = 10'

Revision 2
November 8, 1985

Figure XV-B-2



TEXACO INC.

PUGET SOUND PLANT
ANACORTES, WASH.

LOG OF PIEZOMETER P-8

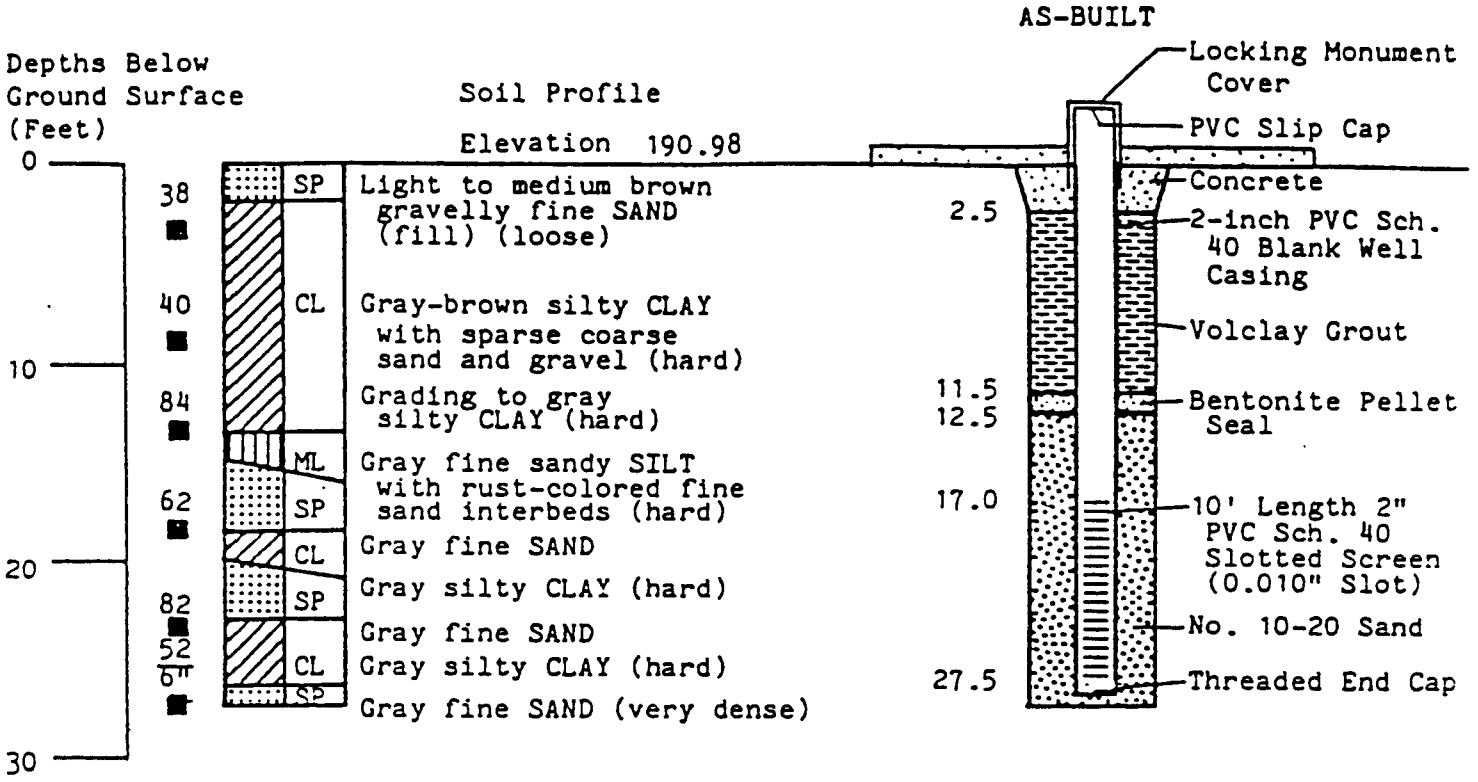
LANDAU ASSOCIATES

SCALE 1" = 10

Revision 2
November 8, 1985

Figure XV-B-26

WELL W-31



Boring completed at 27.5 feet on 12 June 1986.

Ground water level measured during drilling at 13.5 feet.

TEXACO INC.

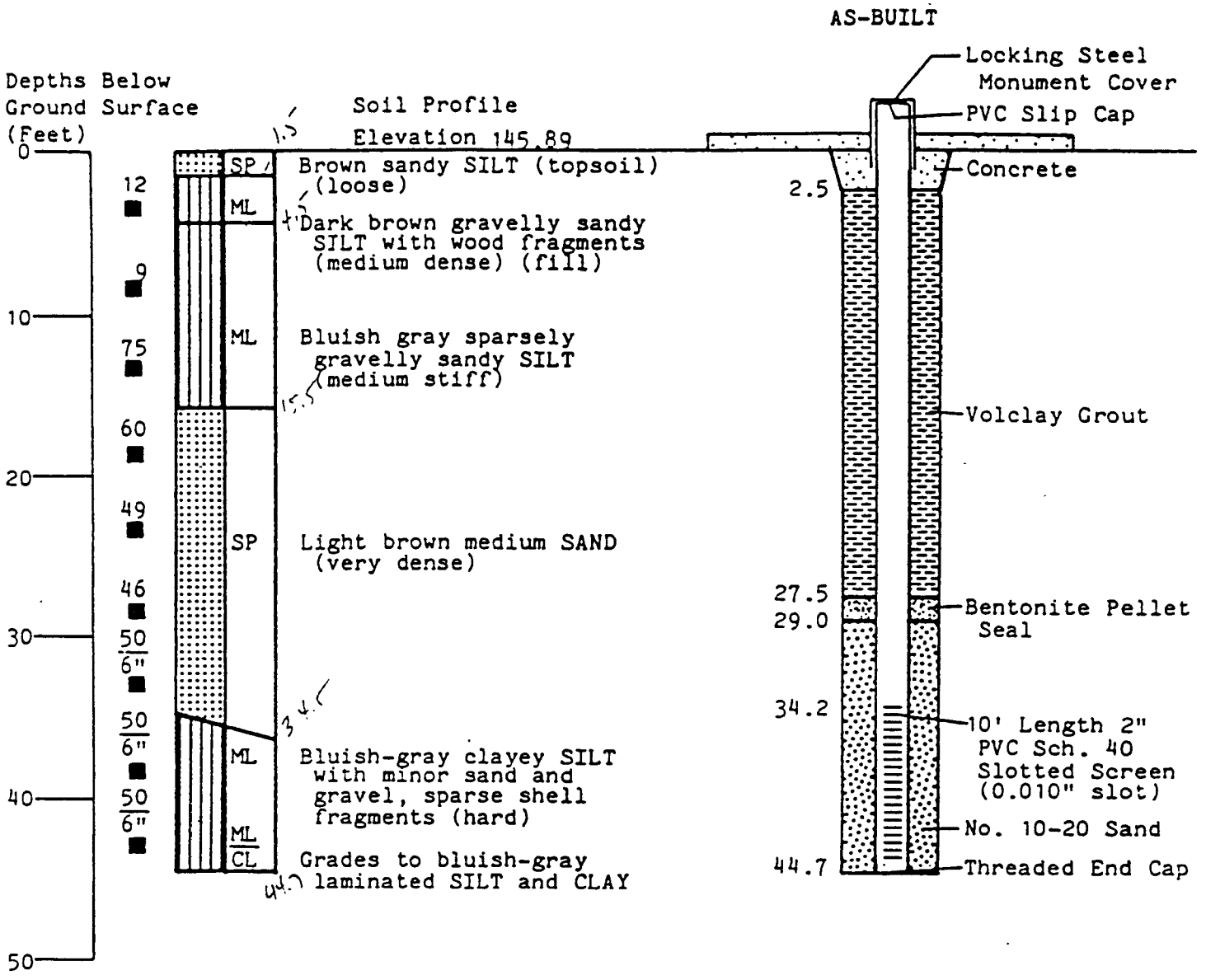
PUGET SOUND PLANT
ANACORTES, WASH.

LOG OF WELL W-31

SCALE

LANDAU ASSOCIATES

WELL W-32



Boring completed at 44.7 feet on 6 June 1986.

Ground water not encountered during drilling.

TEXACO INC.

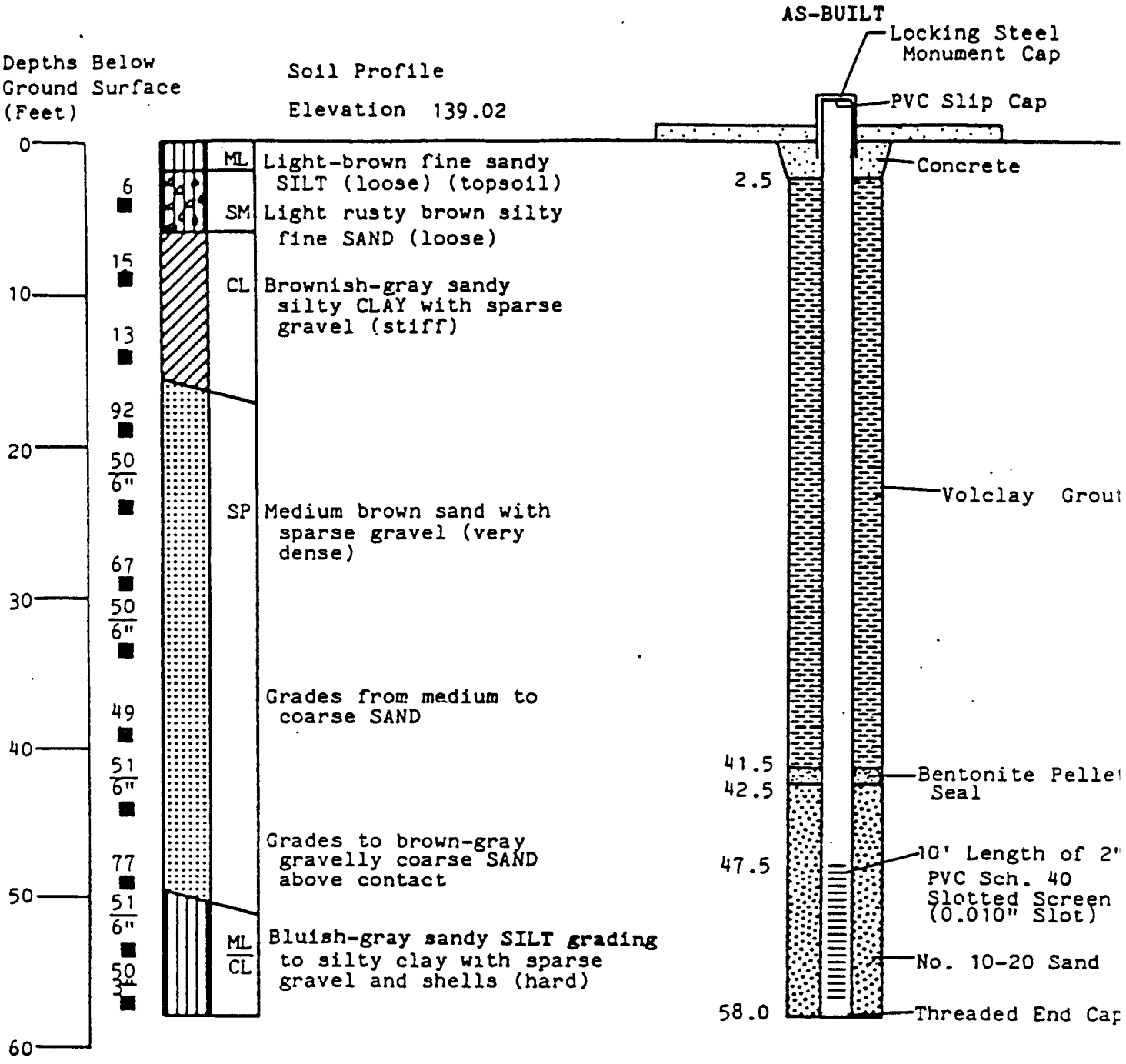
PUGET SOUND PLANT
ANACORTES, WASH.

LOG OF WELL W-32

SCALE

LANDAU ASSOCIATES

WELL W-33



Boring completed at 58.0 feet on 12 June 1986.

Ground water level measured at 49.0 below surface during drilling.

TEXACO INC.

PUGET SOUND PLANT
ANACORTES, WASH.

LOG OF WELL W-33

SCALE

LANDAU ASSOCIATES

Figure 4

APPENDIX D

WASTE ANALYSIS PLAN EVALUATION CHECKLISTS

COMPLIANCE CHECKLIST FOR RCRA
WASTE ANALYSIS PLAN

Prepared by Texaco Oil Company
Dated March 1984

		Yes	No
1.	Does the plan include a detailed chemical and physical analysis of a representative sample of all hazardous wastes? [265.13(a)(1)]	____	X
2.	Does the detailed analysis of the waste provide all information needed to treat, store, or dispose of the waste? [265.13(a)(1)]	____	X
3.	Will the detailed analysis be repeated whenever:		
	a. The operation or process generating the waste changes? [265.13(a)(3)(i)]	X	____
	b. When wastes received from offsite do not match the accompanying manifests? [265.13(1)(3)(ii)]	X	____
4.	Does the plan require the inspection of each hazardous waste received at the facility from offsite sources to see that it matches the accompanying manifest? [265.13(c)]	X	____

5. Does the waste analysis plan specify:

a. The parameters for which each hazardous waste will be analyzed? [265.13(b)(1)]	X	____
b. The rationale for each parameter? [265.13(b)(1)]	X	____
c. The analytical methods used to test for these parameters? [265.13(b)(2)]	X	____
d. The sampling method used to obtain a representative sample of each waste? [265.13(b)(3)]	____	X
e. The frequency of repetition for the initial analysis of the waste to ensure it is up to date? [265.13(b)(4)]	____	X

6. For wastes that will be applied to land treatment units, has:

a. The concentration of substances that exceed the maximum concentrations in Table I of 40 CFR 261.21 been determined? [265.273(a)]	____	X
b. The concentrations of any substances that caused the waste to be listed as a hazardous waste been determined? [265.273(b)]	X	____

COMPLIANCE CHECKLIST FOR RCRA
WASTE ANALYSIS PLAN

Prepared by Texaco Oil Company
Dated October 1984

		Yes	No
1.	Does the plan include a detailed chemical and physical analysis of a representative sample of all hazardous wastes? [265.13(a)(1)]	X	___
2.	Does the detailed analysis of the waste provide all information needed to treat, store, or dispose of the waste? [265.13(a)(1)]	X	___
3.	Will the detailed analysis be repeated whenever:		
	a. The operation or process generating the waste changes? [265.13(a)(3)(i)]	X	___
	b. When wastes received from offsite do not match the accompanying manifests? [265.13(1)(3)(ii)]	___	X
4.	Does the plan require the inspection of each hazardous waste received at the facility from offsite sources to see that it matches the accompanying manifest? [265.13(c)]	___	X

5. Does the waste analysis plan specify:

a.	The parameters for which each hazardous waste will be analyzed? [265.13(b)(1)]	X	____
b.	The rationale for each parameter? [265.13(b)(1)]	X	____
c.	The analytical methods used to test for these parameters? [265.13(b)(2)]	X	____
d.	The sampling method used to obtain a representative sample of each waste? [265.13(b)(3)]	X	____
e.	The frequency of repetition for the initial analysis of the waste to ensure it is up to date? [265.13(b)(4)]	X	____

6. For wastes that will be applied to land treatment units, has:

a.	The concentration of substances that exceed the maximum concentrations in Table I of 40 CFR 261.21 been determined? [265.273(a)]	X	____
b.	The concentrations of any substances that caused the waste to be listed as a hazardous waste been determined? [265.273(b)]	____	X

COMPLIANCE CHECKLIST FOR RCRA
WASTE ANALYSIS PLAN

Prepared by Texaco Oil Company
Dated November 1985

	Yes	No
1. Does the plan include a detailed chemical and physical analysis of a representative sample of all hazardous wastes? [265.13(a)(1)]	X	____
2. Does the detailed analysis of the waste provide all information needed to treat, store, or dispose of the waste? [265.13(a)(1)]	X	____
3. Will the detailed analysis be repeated whenever:		
a. The operation or process generating the waste changes? [265.13(a)(3)(i)]	X	____
b. When wastes received from offsite do not match the accompanying manifests? [265.13(1)(3)(ii)]	____	X
4. Does the plan require the inspection of each hazardous waste received at the facility from offsite sources to see that it matches the accompanying manifest? [265.13(c)]	____	X

5. Does the waste analysis plan specify:

a. The parameters for which each hazardous waste will be analyzed? [265.13(b)(1)]	X	____
b. The rationale for each parameter? [265.13(b)(1)]	X	____
c. The analytical methods used to test for these parameters? [265.13(b)(2)]	X	____
d. The sampling method used to obtain a representative sample of each waste? [265.13(b)(3)]	X	____
e. The frequency of repetition for the intital analysis of the waste to ensure it is up to date? [265.13(b)(4)]	X	____

6. For wastes that will be applied to land treatment units, has:

a. The concentration of substances that exceed the maximum concentrations in Table I of 40 CFR 261.21 been determined? [265.273(a)]	X	____
b. The concentrations of any substances that caused the waste to be listed as a hazardous waste been determined? [265.273(b)]	X	____

COMPLIANCE CHECKLIST FOR RCRA
WASTE ANALYSIS PLAN

Prepared by Texaco Oil Company
Dated December 1986

		Yes	No
1.	Does the plan include a detailed chemical and physical analysis of a representative sample of all hazardous wastes? [265.13(a)(1)]	X	____
2.	Does the detailed analysis of the waste provide all information needed to treat, store, or dispose of the waste? [265.13(a)(1)]	X	____
3.	Will the detailed analysis be repeated whenever:		
	a. The operation or process generating the waste changes? [265.13(a)(3)(i)]	X	____
	b. When wastes received from offsite do not match the accompanying manifests? [265.13(1)(3)(ii)]	____	X
4.	Does the plan require the inspection of each hazardous waste received at the facility from offsite sources to see that it matches the accompanying manifest? [265.13(c)]	____	X

5. Does the waste analysis plan specify:

a.	The parameters for which each hazardous waste will be analyzed? [265.13(b)(1)]	X	____
b.	The rationale for each parameter? [265.13(b)(1)]	X	____
c.	The analytical methods used to test for these parameters? [265.13(b)(2)]	X	____
d.	The sampling method used to obtain a representative sample of each waste? [265.13(b)(3)]	X	____
e.	The frequency of repetition for the initial analysis of the waste to ensure it is up to date? [265.13(b)(4)]	X	____

6. For wastes that will be applied to land treatment units, has:

a.	The concentration of substances that exceed the maximum concentrations in Table I of 40 CFR 261.21 been determined? [265.273(a)]	X	____
b.	The concentrations of any substances that caused the waste to be listed as a hazardous waste been determined? [265.273(b)]	X	____

APPENDIX E

SUMMARY OF CONCENTRATIONS FOR SUBSTANCES REPORTED IN SAMPLES OBTAINED DURING THE TASK FORCE INSPECTION AT TEXACO

APPENDIX 1

Contract Required Detection Limits and Instrument Detection Limits for Metals, Inorganic, and Indicator Parameters

TABLE A1-1

CONTRACT REQUIRED DETECTION LIMITS AND INSTRUMENT
DETECTION LIMITS FOR METALS, INORGANIC, AND INDICATOR PARAMETERS

Parameter	CRDL	IDL
Metals		
Aluminum	200	94
Antimony	60	5
Arsenic	10	6
Barium	200	3
Beryllium	5	2
Cadmium	5	0.5
Calcium	5000	67
Chromium	10	6
Cobalt	50	7
Copper	25	18
Iron	100	23
Lead	5	2
Magnesium	5000	84
Manganese	15	4
Mercury	0.2	0.2
Nickel	40	23
Potassium	5000	486
Selenium	5	4
Silver	10	5
Sodium	5000	163
Tin	50	72
Thallium	10	6
Vanadium	50	8
Zinc	20	20
Inorganic and Indicators		
Bromide	1000	50
Chloride	1000	1000
Cyanide	10	
Fluoride	1000	1000
Nitrate-nitrogen	300	300
Nitrite-nitrogen	300	50
POC	10	20
POX	5	5
Sulfate	1000	500
Sulfide	1000	1000
TOC	1000	1000
TOX	5	5
Total Phenols	50	10

concentrations are in µg/l

APPENDIX 2

SUMMARY OF CONCENTRATIONS FOR COMPOUNDS FOUND IN GROUND-WATER AND SAMPLING BLANK SAMPLES AT SITE 43, TEXACO, WA

The following table lists the concentrations for compounds analyzed for and found in samples at the site. Table A2-1 is generated by listing all compounds detected and all tentatively identified compounds reported on the organic Form I, Part B. All tentatively identified compounds with a spectral purity greater than 850 are identified by name and purity in the table. Those with a purity of less than 850 are labeled, unknown. The scan number written next to the "unknown" TICs are approximate values. The MS library searches are compared to see if the same unknown is detected in the samples.

Sample numbers are designated by the inorganic and corresponding organic sample number. Inorganic sample numbers are preceded by the prefix "MQA" organic sample numbers are preceded by the prefix "Q."

TABLE KEY

A value without a flag indicates a result above the contract required detection limit (CRDL).

J Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicated the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero. If the limit of detection is 10 µg and a concentration of 3 µg is calculated, then report as 3J.

B This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

GW = ground-water
SW = surface-water
low and medium are indicators of concentration.

SITE: 43 TEXACO, WA
CASE NO: 9-23631HQ

SAMPLE NO:		MQA975/01575	MQA992/01592	MQA970/01570	MQA973/01573	MQA965/01565	MQA966/01566
SAMPLE LOCATION:		FIELD BLANK	TRIP BLANK	WELL 22	WELL 22	WELL 2	WELL 32
SAMPLE TYPE:		GW-LOW	GW-LOW	GW-LOW DUP	GW-LOW DUP	GW-LOW	GW-LOW
VOA	2-BUTANONE						
	METHYLENE CHLORIDE	6 B	5 B	12 B	9 B	6 B	4 JB
	1,1,1-TRICHLOROETHANE						
AD-VOA	TRICHLOROFLUOROMETHANE	2 J		1 J			
SEMI-VOA	PHENOL	4 J	2 J				
	BIS(2-ETHYLHEXYL)PHTHALATE	4 J	5 JB		4 J	76	
	4-METHYLPHENOL						
PEST/PCB	NO HITS						
HERB	2,4,5-TP						
	2,4,5-T						
	CHLOROBENZILATE						
TIC-SEMI-VOA	BUTYROLACTONE					IPUR 952 10 J	
	TRICHLOROPROPENE						
	UNKNOWN AMIDE (scan 1866)	10 J			10 J		
	BICYCLOHEPTANE, DICHLORO						
	UNKNOWN (scan 484)	10 J	60 J				30 J
	UNKNOWN (scan 648)	9 J	10 J	20 J			
	UNKNOWN (scan 811)			9 J			
	UNKNOWN				9 J		
TOTAL METALS	ALUMINUM			3020	3800	3010	256
	ANTIMONY						
	ARSENIC						
	BARIUM	46	27	77	138	52	144
	BERYLLIUM						
	CADMIUM						
	CALCIUM	477	791	18700	190000	59500	78200
	CHROMIUM			15	15	12	
	COBALT						
	COPPER						
	IRON	23	34	3180	3780	3430	590
	LEAD						
	MAGNESIUM	133	326	151000	151000	60800	44200
	MANGANESE			72	107	145	23
	MERCURY						
	NICKEL						
	POTASSIUM			13800	14200	7830	6480
	SELENIUM						
	SILVER						
	SODIUM	749	1080	61900	61600	30200	20800
	THALLIUM						

SITE: 43 TEXACO, WA
CASE NO: 8-2363HQ

SAMPLE NO:		MQA975/Q1575	MQA992/Q1592	MQA970/Q1570	MQA973/Q1573	MQA965/Q1565	MQA966/Q1566
SAMPLE LOCATION:		FIELD BLANK	TRIP BLANK	WELL 22	WELL 22	WELL 2	WELL 32
SAMPLE TYPE:		GW-LOW	GW-LOW	GW-LOW DUP	GW-LOW DUP	GW-LOW	GW-LOW
	TIN			60	64	97	47
	VANADIUM				8		
	ZINC				31		
DIS	ALUMINUM			98	120		
METALS	ANTIMONY						
	ARSENIC						
	BARIUM	15		27	28	13	96
	BERYLLIUM						
	CADMIUM						
	CALCIUM	113	69	187000	187000	56900	77400
	CHROMIUM						
	COBALT			12			
	COPPER						
	IRON					115	25
	LEAD						2.5
	MAGNESIUM			151000	157000	61000	47600
	MANGANESE					85	7
	MERCURY	<					
	NICKEL						
	POTASSIUM			14000	14100	7270	6380
	SELENIUM						
	SILVER						
	SODIUM	401	249	65400	66300	30400	21400
	THALLIUM						
	TIN			36	45	56	
	VANADIUM						
	ZINC						
INORG.	BROMIDE						NR
INDIC.	BICARBONATE			275000	305000	415000	NR
	CARBONATE						NR
	CHLORIDE			17000	34000	18000	NR
	FLUORIDE						NR
	NITRATE NITROGEN						NR
	NITRITE NITROGEN						NR
	POC	11		11		22	18
	POX						
	SULFATE			908000	908000	10000	NR
	SULFIDE						
	TOC			4700	4400	1100	2800
	TOTAL PHENOLS						NR
	TOX			18	19		6.9

SITE: 43 TEXACO, WA
CASE NO: 8-23638HO

SAMPLE NO:		MDA967/01567	MDA968/01568	MDA969/01569	MDA972/01572	MDA976/01576	MDA978/01578
SAMPLE LOCATION:		WELL 31	WELL 17	WELL 16	WELL 33	WELL 23	EAST DITCH
SAMPLE TYPE:		GW-LOW	GW-LOW	GW-LOW	GW-LOW	GW-LOW	SW-LOW
VOA	2-BUTANONE	1 J					
	METHYLENE CHLORIDE	24 B	5 B	7 B	4 JB	5 B	15 B
	1,1,1-TRICHLOROETHANE						
AD-VOA	TRICHLOROFLUOROMETHANE		1 J		2 J	3 J	
SEMI-VOA	PHENOL						
	BIS(2-ETHYLHEXYL)PHTHALATE						5 J
	4-METHYLPHENOL		30 B				
PEST/PCB	NO HITS						
HERB	2,4,5-TP						0.5
	2,4,5-T						0.3
	CHLOROBENZILATE						
TIC-SEMI-VOA	BUTYROLACTONE			PUR 950 9 J			
	TRICHLOROPROPENE	10 J					
	UNKNOWN AMIDE (scan 1866)						20 J
	BICYCLOHEPTANE, DICHLORO						
	UNKNOWN (scan 484)	9 J	10 J			30 J	
	UNKNOWN (scan 448)		30 J			9 J	
	UNKNOWN (scan 811)						
	UNKNOWN						
TOTAL METALS	ALUMINUM	853			942	388	821
	ANTIMONY	11					
	ARSENIC	14					
	BARIUM	170	26	110	107	41	43
	BERYLLIUM						
	CADMIUM					19	
	CALCIUM	129000	82500	47800	58600	94900	41800
	CHROMIUM	12	9		7		6
	COBALT						
	COPPER						
	IRON	3390	117	78	1120	444	886
	LEAD						
	MAGNESIUM	77700	67300	32400	43500	70100	31900
	MANGANESE	512	309	84	77	14	306
	MERCURY						
	NICKEL		67				
	POTASSIUM	12900	5200	9200	6980	8050	3400
	SELENIUM						
	SILVER			5			
	SODIUM	46600	26900	25500	20800	40500	22600
	THALLIUM						

SITE: 43 TEXACO: WA
CASE NO: 9-2363H0

		SAMPLE NO:	MQA967/01567	MQA968/01568	MQA969/01569	MQA972/01572	MQA974/01574	MQA979/01579
		SAMPLE LOCATION:	WELL 31	WELL 17	WELL 16	WELL 33	WELL 23	EAST DITCH
		SAMPLE TYPE:	GW-LOW	GW-LOW	GW-LOW	GW-LOW	GW-LOW	SW-LOW
	TIN		43			53		
	VANADIUM							
	ZINC		22		23			
DIS	ALUMINUM							
METALS	ANTIMONY							
	ARSENIC		10.8					
	BARIUM		57	82	43	66	4	40
	BERYLLIUM							
	CADMIUM						44:1	
	CALCIUM		128000	77500	47200	58400	90100	43500
	CHROMIUM							
	COBALT			9				7
	COPPER							
	IRON		1860	189				
	LEAD							
	MAGNESIUM		79100	42000	32900	43900	74100	33200
	MANGANESE		526	261	79	20		297
	MERCURY							
	NICKEL							
	POTASSIUM		12600	5720	9660	7450	8469	3460
	SELENIUM							
	SILVER							
	SODIUM		46600	24800	26600	21700	42300	25000
	THALLIUM							
	TIN		43					
	VANADIUM							
	ZINC							
INORG.	BROMIDE							
INDIC.	BICARBONATE		450000	285000	195000	210000	425000	210000
	CARBONATE				20000			
	CHLORIDE		40000	64000	16000	23000	30000	8800
	FLUORIDE							
	NITRATE NITROGEN							410
	NITRITE NITROGEN							
	POC		28	15	16	15	18	13
	POX							
	SULFATE		128000	122000	30000	96000	134000	45000
	SULFIDE							
	TOC		1800	4200	1300	2400	6300	6200
	TOTAL PHENOLS							
	TOX		10	91			15	25

SITE: 43 TEXACO, WA
CASE NO: 9-23627MD

		SAMPLE NO:	MQA979/Q1579	MQA990/Q1580	MQA991/Q1581	MQA992/Q1582	MQA993/Q1583	MQA994/Q1584
		SAMPLE LOCATION:	WELL 24	WELL 15	WELL 1	L-11	L-12	L-BG TANK 1
		SAMPLE TYPE:	GW-LOW	GW-LOW	GW-LOW	GW-LOW	GW-LOW	GW-LOW
VOA	2-BUTANONE					ORGANICS		
	METHYLENE CHLORIDE		4 JB	5 B		SAMPLE	5 B	5 B
	1,1,1-TRICHLOROETHANE			2 J	4 JB	NOT		
						RECEIVED		
AD-VOA	TRICHLOROFLUOROMETHANE					BY		2 J
						LAB		
SEMI-VOA	PHENOL							
	BIS(2-ETHYLHEXYL)PHTHALATE		4 JB					
	4-METHYLPHENOL							
PEST/PCB	NO HITS							
HERB	2,4,5-TP							
	2,4,5-T							
	CHLOROBENZILATE							
TIC-SEMI-VOA	BUTYROLACTONE							
	TRICHLOROPROPENE							
	UNKNOWN AMIDE (scan 1866)							
	BICYCLOHEPTANE, DICHLORO				PUR 837 10 J			
	UNKNOWN (scan 494)		40 J	30 J	30 J			
	UNKNOWN (scan 648)		7 J	20 J	10 J			
	UNKNOWN (scan 911)							
	UNKNOWN							
TOTAL METALS	ALUMINUM		759		8740			
	ANTIMONY						7.8	
	ARSENIC							
	BARIUM		196	147	79	127	174	69
	BERYLLIUM							
	CADMIUM							
	CALCIUM		76600	77300	8180	147000	72400	43000
	CHROMIUM			6	23	11	6	
	COBALT							
	COPPER				35			
	IRON		1140	235	10500	1210	73	24
	LEAD				4.9			
	MAGNESIUM		42000	42000	7470	130000	44600	42800
	MANGANESE		149	251	163	2450	629	73
	MERCURY							
	NICKEL				33			
	POTASSIUM		4080	4310	6450	2720	2070	
	SELENIUM							
	SILVER						6	
	SODIUM		19700	24200	169000	74200	90000	104000
	THALLIUM							

SITE: 43 TEXACO, WA
CASE NO: 8-33633HO

SAMPLE NO:		MQ4979/Q1579	MQ4980/Q1580	MQ4981/Q1581	MQ4982/Q1582	MQ4983/Q1583	MQ4984/Q1584
SAMPLE LOCATION:		WELL 24	WELL 15	WELL 1	L-11	L-12	L-86 TANK 1
SAMPLE TYPE:		GW-LOW	GW-LOW	GW-LOW	GW-LOW	GW-LOW	GW-LOW
	TIN	45	50	45	46		
	VANADIUM			33			
	ZINC			49		36	32
DIS METALS	ALUMINUM			105			
	ANTIMONY					11.7	
	ARSENIC						
	BARIUM	46	90		93	89	70
	BERYLLIUM						
	CADMIUM						
	CALCIUM	74700	74200	4910	150000	69500	36700
	CHROMIUM						
	COBALT			8	19	16	
	COPPER						
	IRON		179	71	208		
	LEAD						
	MAGNESIUM	67000	43800	3200	146000	46900	40000
	MANGANESE	128	250	10	2580	643	41
	MERCURY						
	NICKEL						
	POTASSIUM	3790	5460	5790	2390	1890	
	SELENIUM						
	SILVER						
	SODIUM	20800	24500	172000	87800	103000	121000
	THALLIUM						
	TIN				60		
	VANADIUM						
	ZINC				22	24	37
INORG.	BROMIDE				NR	NR	NR
INDIC.	BICARBONATE	255000	310000	315000	NR	NR	NR
	CARBONATE			10000	NR	NR	NR
	CHLORIDE	71000	22000	22000	NR	NR	NR
	FLUORIDE				NR	NR	NR
	NITRATE NITROGEN	320		1500	NR	NR	NR
	NITRITE NITROGEN			1200	NR	NR	NR
	POC	31	21	12	NR	19	
	POX				NR		
	SULFATE	159000	48000	20000	NR	NR	NR
	SULFIDE				NR	NR	NR
	TOC	7400	1300	2900	NR	104000	NR
	TOTAL PHENOLS				NR	NR	NR
	TOX	21	248	18	NR	NR	NR

SITE: 43 TEXACO, WA
CASE NO: 8-23638

SAMPLE NO:		MQA995/01585	MQA996/01586	MQA998/01588	MQA999/01589	MQA990/01590	MQA991/01591
SAMPLE LOCATION:		L-4E	L-1	L-BOSE	SURFACE WEST	WELL 21	
SAMPLE TYPE:		GW-LOW	GW-LOW	GW-LOW	SW-LOW	GW-LOW	
VOA	2-BUTANONE						
	METHYLENE CHLORIDE	4 JB	5 B	5 B	8 B	4 JB	
	1,1,1-TRICHLOROETHANE						
AT-VOA	TRICHLOROFLUOROMETHANE	1 J	2 J				
SEMI-	PHENOL						
VOA	BIS(2-ETHYLHEXYL)PHTHALATE	4 JB	14 B		3 J		
	4-METHYLPHENOL						
PEST/	NO HITS						
PCB							
HERB	2,4,5-TP						
	2,4,5-T				2,6		
	CHLOROBENZILATE				6		
TIC-	BUTYROLACTONE						
SEMI-	TRICHLOROPROPENE						
VOA	UNKNOWN AMIDE (scan 1866)				10 J		
	BICYCLOHEPTANE, DICHLORO						
	UNKNOWN (scan 484)	80 J				20 J	
	UNKNOWN (scan 648)	10 J	20 J		20 J	10 J	
	UNKNOWN (scan 811)		400 J				
	UNKNOWN						
TOTAL	ALUMINUM				955	9620	
METALS	ANTIMONY		21	11	62		
	ARSENIC		9,1				
	BARIUM	132	182	158	86	128	
	BERYLLIUM						
	CADMIUM						
	CALCIUM	100000	254000	56400	141000	70300	
	CHROMIUM	10	21	16	20	25	
	COBALT	9	33		8		
	COPPER				54	23	
	IRON	331	2780	126	1560	10400	
	LEAD				4,9	5,3	
	MAGNESIUM	78000	184000	45700	42000	59300	
	MANGANESE	872	5980	125	1760	223	
	MERCURY				0,2		
	NICKEL	26	63		89	23	
	POTASSIUM	1440	3140	956	11800	10200	
	SELENIUM						
	SILVER						
	SODIUM	51000	94000	41800	49100	45700	
	THALLIUM						

SITE: 47 TEXACO- MA
CASE NO: 9-23A7MO

SAMPLE NO:		MQA995/01585	MQA996/01586	MQA998/01588	MQA999/01589	MQA991/01591
SAMPLE LOCATION:		L-4E	L-1	L-BASE	SURFACE WEST	WELL 21
SAMPLE TYPE:		GW-LOW	GW-LOW	GW-LOW	GW-LOW	GW-LOW
	TIN	71	124	42	65	61
	VANADIUM		12		27	28
	ZINC		23	28	159	31
DIS METALS	ALUMINUM		134		167	404
	ANTIMONY				24.7	
	ARSENIC					
	BARIUM	75	111	45	63	11
	BERYLLIUM					
	CADMIUM					
	CALCIUM	91200	233000	53100	133000	64900
	CHROMIUM				7	
	COBALT		17		19	9
	COPPER				22	
	IRON	92	1720		313	579
	LEAD	29.7	38.4	17.4	21.6	
	MAGNESIUM	77000	184000	46600	41000	60000
	MANGANESE	803	5770	127	1700	17
	MERCURY					
	NICKEL				58	
	POTASSIUM		590		11400	9490
	SELENIUM					
	SILVER					
	SODIUM	48400	86700	40900	47900	66600
	THALLIUM					
	TIN	41	74			
	VANADIUM				18	
	ZINC	26	62	57	131	
INORG. INDIC.	BROMIDE	NR	NR	NR		
	BICARBONATE	NR	NR	NR	90000	380000
	CARBONATE	NR	NR	NR		
	CHLORIDE	NR	NR	NR	55000	38000
	FLUORIDE	NR	NR	NR		
	NITRATE NITROGEN	NR	NR	NR		
	NITRITE NITROGEN	NR	NR	NR		
	POC	148	222	12		14
	POX					
	SULFATE	NR	NR	NR	396000	72000
	SULFIDE	NR	NR	NR		
	TOC	4600	129000	11000	127000	3900
	TOTAL PHENOLS		83		50	
	TOX	NR	NR	NR	34	26

APPENDIX F

SUMMARY OF DATA USABILITY

WP-1338C

INORGANIC DATA USABILITY AUDIT REPORT

Laboratory: Centec Analytical Services | Total Number of Samples: 23

Case: B-2363 | Contract Number: SAS 2363

Data User: GWMTF | Region: 10 | Site Number: 43

QC Number: 108 | Site: Texaco, WA

Date Received at EMSL/LV: 2 / 12 / 87 | Date Audited: 3 / 3 / 87

Date Submitted by Lab: 2 / 10 / 87 | Date Reviewed: 4 / 8 / 87

DATA QUALITY SUMMARY

A. Graphite Furnace AA Analysis: Sb(T) with exceptions, Pb(T), Se(T,D), and Tl (T,D) are quantitative. As(T,D), Cd(T,D), Sb(D), and Pb(D) are semi-quantitative.

B. ICP Analysis: Total and dissolved results for Be, Ca, Cr, Co, Cu, Fe, Mn, Ni, K, Ag, Na, V, and Zn are quantitative. The dissolved results for Ba, Al, and Mg are quantitative. The Mg(T) and Al(T) results are semi-quantitative. Ba(T) is qualitative.

C. Hg Analysis: Quantitative

D. IC Analysis: Br^-, F^-, Cl^-, and SO_4 are quantitative. NO_3 and NO_2 are quantitative with exceptions.

E. Phenol Analysis: Quantitative with reservations

F. TOC Analysis: Quantitative with reservations

G. POC Analysis: Suspect

H. TOX Analysis: Quantitative

I. POX Analysis: Quantitative

J. Sulfide Analysis: Quantitative

K. Bicarbonate Analysis: Semi-quantitative

L. Carbonate Analysis: Semi-quantitative

NOTE: Usability is determined from guidelines laid out in the "Inorganic Data Validation SOP" written by D.K. White, May 14, 1985.

Initial Audit by:

M.E. Balogh
Senior Scientist

Gail Gibson
Data Audit Technician

Reviewed by:

Keith A. Aleckson
Senior Scientist

DRAFT

11 1987

Laboratory Performance Monitoring Group
Lockheed Engineering and Management Services Co.
P.O. Box 15027
Las Vegas, Nevada 89114
Tel: (702) 798-3143 (FTS) 545-3143

WP-1353C

ORGANIC DATA USABILITY AUDIT REPORT

Laboratory: EMSI Total Number of Samples 32

Case: B-2363HQ Site: 43 Texaco, WA Contract Number: SAS/2363HQ

Data User: GWMTF Region: 10 Date Audited: April 4, 6-9, 1987

Date Received at EMSL/LV: 4-3-87 Date Reviewed: 4-10-87

REPORT SUMMARY

The following is the auditors assessment of Data Quality of this case pertaining to:

A. Volatiles and Appendix 9 Volatiles by Purge and Trap:	Quantitative
B. Semivolatiles and Appendix 9 Semivolatiles:	Quantitative Unusable for the TICs detected at scans ~ 473 and ~ 648; unusable for the analysis of 4-methylphenol in Q1568; unusable for analytes quantified using perylene-D12 (IS) in Q1592.
C. Pesticides and Appendix 9 Pesticides:	Quantitative Suspect for the heptachlor analyses due to MB contamination. Unusable for the kepone analysis.
D. Herbicides:	Qualitative for organophoso-herbicides due to lack of surr. data, confirmation analysis, and linearity verification. Suspect for chloro-herbicides. Unusable for Chlorobenzilate

Initial Audit by:

D.L. Bogen
Senior Associate Scientist

E.S. Moore
Scientist

Reviewed by:

D.C. Pudvah
Senior Scientist

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DRAFT

APR 13 1987

APPENDIX G

1987 SEMIANNUAL GROUND WATER ANALYTICAL DATA SUBMITTED BY TEXACO

WELL WATER , APRIL 1987

Water Elevations (ft) 04-07-87

Well Number	Well Type	Feet to Water	Reference (MLLW)	Water (MLLW)
1	East Down	56.89	97.5	40.61
2	Up	31.46	145.9	114.44
3	West Down	44.51	146.7	102.19
15	West Down	19.55	146.4	126.85
16	West Down	52.62	143.7	91.08
17	West Down	49.38	133.9	84.52
21	East Down	5.26	99.8	94.54
22	East Down	3.08	97.0	93.92
23	East down	3.35	96.7	93.35
24	South Down	37.75	154.2	116.45
31	Up	16.15	192.7	176.55
32	West Down	39.70	147.7	108.00
33	West Down	53.20	140.3	87.10
P-1		12.69	193.1	180.41
P-2		14.90	182.3	167.40
P-3		7.58	166.6	159.02
P-4		8.98	120.7	111.72
P-5		10.50	121.9	111.40
P-6		11.29	121.8	110.51
P-7		8.36	118.4	110.04
P-8		5.28	112.9	107.62
KWB 6EC		6.55	111.00	104.45
11		13.87	99.7	85.83
12		5.95	96.1	90.15
13		5.65	96.1	90.45
14		19.47	187.0	167.53
25		36.80	147.5	110.70
26		51.48	138.6	87.12

WELL WATER , APRIL 1987

pH, Lab Data 04-07-87

Well Number	Sample Number	pH	Up-gradiant	t	Sig. (1)
1	A1	8.79			
	A2	8.77			
	A3	8.81			
	A4	8.90			
	Mean	8.82	7.53	2.67	NA
	S.D.	0.06	0.45		
	n	4	8		
2	A1	8.01			
	A2	8.02			
	A3	8.04			
	A4	8.00			
	Mean	8.02	7.53	1.01	NA
	S.D.	0.02	0.45		
	n	4	8		
3	A1	7.88			
	A2	8.13			
	A3	8.07			
	A4	8.02			
	Mean	8.02	7.53	1.02	NA
	S.D.	0.11	0.45		
	n	4	8		
15	A1	7.89			
	A2	7.86			
	A3	7.85			
	A4	7.85			
	Mean	7.86	7.53	0.69	NA
	S.D.	0.02	0.45		
	n	4	8		
16	A1	9.09			
	A2	8.32			
	A3	8.74			
	A4	9.15			
	Mean	8.82	7.53	2.68	NA
	S.D.	0.38	0.45		
	n	4	8		
17	A1	7.43			
	A2	7.57			
	A3	[illegible].64			
	A4	[illegible].58			
	Mean	7.55	7.53	0.05	NA
	S.D.	0.09	0.45		
	n	4	8		

(1) Based on two-tailed test,
7 degrees of freedom @ 0.99 and 13 wells; t = 5.714

WELL WATER , APRIL 1987

pH, Lab Data 04-07-87

Well Number	Sample Number	pH	Up-gradiant	t	Sig.
18*	A1	7.84			
15 Dup.	A2	7.85			
	A3	7.87			
	A4	7.85			
	Mean	7.85	7.53	0.66	NA
	S.D.	0.01	0.45		
	n	4	8		
19*	A1	7.90			
Res.	A2	7.89			
	A3	8.03			
	A4	7.92			
	Mean	7.93	7.53	0.84	NA
	S.D.	0.06	0.45		
	n	4	8		
21	A1	7.58			
	A2	7.55			
	A3	7.59			
	A4	7.54			
	Mean	7.56	7.53	0.07	NA
	S.D.	0.02	0.45		
	n	4	8		
22	A1	7.29			
	A2	7.29			
	A3	7.29			
	A4	7.22			
	Mean	7.27	7.53	0.54	NA
	S.D.	0.03	0.45		
	n	4	8		
23	A1	7.47			
	A2	7.41			
	A3	7.48			
	A4	7.45			
	Mean	7.45	7.53	0.17	NA
	S.D.	0.03	0.45		
	n	4	8		
24	A1	6.65			
	A2	6.68			
	A3	6.74			
	A4	6.69			
	Mean	6.69	7.53	1.75	NA
	S.D.	0.04	0.45		
	n	4	8		

WELL WATER , APRIL 1987

pH, Lab Data 04-07-87

Well Number	Sample Number	pH	Up-gradiant	t	Sig.
31	A1	7.13			
	A2	7.17			
	A3	7.15			
	A4	7.17			
	Mean	7.15	7.53	0.78	NA
	S.D.	0.02	0.45		
	n	4	8		
32	A1	7.43			
	A2	7.47			
	A3				
	A4				
	Mean	7.45	7.53	0.17	NA
	S.D.	0.03	0.45		
	n	2	8		
33	A1	7.67			
	A2	7.47			
	A3	7.55			
	A4	7.53			
	Mean	7.55	7.53	0.05	NA
	S.D.	0.08	0.45		
	n	4	8		

Up-gradiant, Well 2 and 31

Mean	7.59
S.D.	0.46
n	8

* Results for Well 18 are duplicate samples obtained from Well 15.
Results for Well 19 are for the Reservoir water.

20	A1	9.12			
	A2	8.21		Apr S.D.	0.06
					0.02
Year Upgradiant Results			pH		0.11
	Aug 86, Well 2		7.82		0.02
	Aug 86, Well 31		7.07		0.38
	Oct 86, Well 2		7.96		0.09
	Oct 86, Well 31		7.08		0.02
	Dec 86, Well 2		8.01		0.03
	Dec 86, Well 31		7.15		0.03
	Apr 87, Well 2		8.02		0.04
	Apr 87, Well 31		7.15		0.02
					0.03
	Year Mean		7.53		0.08
	Year S.D.		0.45		
	Year n		8	Avg	0.07

WELL WATER , APRIL 1987
Conductivity, Lab Data (uMHO@25)04-07-87

Well Number	Sample Number	Cond. Up-gradiant		t	Sig. (1)
1	A1	700			
	A2	703			
	A3	717			
	A4	694			
	Mean	704	953	-0.98	NA
	S.D.	10	240		
	n	4	8		
2	A1	814			
	A2	803			
	A3	806			
	A4	808			
	Mean	808	953	-0.57	NA
	S.D.	5	240		
	n	4	8		
3	A1	715			
	A2	714			
	A3	718			
	A4	716			
	Mean	716	953	-0.93	NA
	S.D.	2	240		
	n	4	8		
15	A1	679			
	A2	679			
	A3	683			
	A4	683			
	Mean	681	953	-1.07	NA
	S.D.	2	240		
	n	4	8		
16	A1	451			
	A2	557			
	A3	515			
	A4	451			
	Mean	494	953	-1.80	NA
	S.D.	52	240		
	n	4	8		
17	A1	2730			
	A2	2420			
	A3	2283			
	A4	1280			
	Mean	2178	953	4.82	NA
	S.D.	627	240		
	n	4	8		

(1) Based on one-tailed test,
7 degrees of freedom @ 0.99 and 13 wells; t = 5.276

WELL WATER , APRIL 1987
Conductivity, Lab Data (uMHO@25)04-07-87

Well Number	Sample Number	Cond.	Up-gradiant	t	Sig.
18*	A1	690			
15 Dup.	A2	683			
	A3	688			
	A4	686			
	Mean	687	953	-1.04	NA
	S.D.	3	240		
	n	4	8		
19*	A1	77			
Res.	A2	73			
	A3	77			
	A4	76			
	Mean	76	953	-3.45	NA
	S.D.	2	240		
	n	4	8		
21	A1	889			
	A2	868			
	A3	857			
	A4	856			
	Mean	868	953	-0.33	NA
	S.D.	15	240		
	n	4	8		
22	A1	1844			
	A2	1814			
	A3	1840			
	A4	1892			
	Mean	1848	953	3.52	NA
	S.D.	33	240		
	n	4	8		
23	A1	1014			
	A2	1002			
	A3	1006			
	A4	1004			
	Mean	1007	953	0.21	NA
	S.D.	5	240		
	n	4	8		
24	A1	820			
	A2	817			
	A3	934			
	A4	930			
	Mean	875	953	-0.30	NA
	S.D.	66	240		
	n	4	8		

WELL WATER , APRIL 1987
Conductivity, Lab Data (uMHO@25)04-07-87

Well Number	Sample Number	Cond.	Up-gradiant	t	Sig.
31	A1	1220			
	A2	1202			
	A3	1205			
	A4	1206			
	Mean	1208	953	1.01	NA
	S.D.	8	240		
	n	4	8		
32	A1	648			
	A2	600			
	A3				
	A4				
	Mean	624	953	-1.29	NA
	S.D.	34	240		
	n	2	8		
33	A1	669			
	A2	659			
	A3	609			
	A4	655			
	Mean	648	953	-1.20	NA
	S.D.	27	240		
	n	4	8		

Up-gradiant, Well 2 and 31

Mean	1008
S.D.	213
n	8

* Results for Well 18 are duplicate samples obtained from Well 15.
Results for Well 19 are for the Reservoir water.

20	A1	8.82
	A2	3.27

Year Upgradiant Results

	uMHO
Aug 86, Well 2	708
Aug 86, Well 31	1230
Oct 86, Well 2	699
Oct 86, Well 31	1099
Dec 86, Well 2	718
Dec 86, Well 31	1150
Apr 87, Well 2	808
Apr 87, Well 31	1208
Year Mean	952.50
Year S.D.	239.84
Year n	8

Apr S.D.		9.75
		4.65
		1.71
		2.31
		51.98
		627.35
		15.33
		32.51
		5.26
		65.56
		8.02
		33.94
		26.66
	Avg	68.08

WELL WATER , APRIL 1987
Turbidity, Lab Data (NTU) 04-07-87

Well Number	Sample Number	NTU	Up-gradiant	t	Sig. (1)
1	A1	64.00			
	A2	250.00			
	A3	225.00			
	A4	302.00			
	Mean	210.25	71.73	5.73	0.99
	S.D.	102.64	39.51		
	n	4	8		
2	A1	9.50			
	A2	44.00			
	A3	76.00			
	A4	29.00			
	Mean	39.63	71.73	-1.33	NA
	S.D.	28.06	39.51		
	n	4	8		
3	A1	0.30			
	A2	0.10			
	A3	11.10			
	A4	13.00			
	Mean	6.12	71.73	-2.71	NA
	S.D.	6.89	39.51		
	n	4	8		
15	A1	0.60			
	A2	0.70			
	A3	0.80			
	A4	0.50			
	Mean	0.65	71.73	-2.94	NA
	S.D.	0.13	39.51		
	n	4	8		
16	A1	0.30			
	A2	0.00			
	A3	0.00			
	A4	0.00			
	Mean	0.07	71.73	-2.96	NA
	S.D.	0.15	39.51		
	n	4	8		
17	A1	15.40			
	A2	4.90			
	A3	3.60			
	A4	1.50			
	Mean	6.35	71.73	-2.70	NA
	S.D.	6.19	39.51		
	n	4	8		

(1) Based on one-tailed test,
7 degrees of freedom @ 0.99 and 13 wells; t = 5.276

WELL WATER , APRIL 1987
Turbidity, Lab Data (NTU) 04-07-87

Well Number	Sample Number	NTU	Up-gradiant	t	Sig.
18*	A1	0.40			
15 Dup.	A2	0.30			
	A3	0.30			
	A4	0.60			
	Mean	0.40	71.73	-2.95	NA
	S.D.	0.14	39.51		
	n	4	8		
19*	A1	0.00			
Res.	A2	0.00			
	A3	0.10			
	A4	0.00			
	Mean	0.02	71.73	-2.96	NA
	S.D.	0.05	39.51		
	n	4	8		
21	A1	12.00			
	A2	19.40			
	A3	16.60			
	A4	4.60			
	Mean	13.15	71.73	-2.42	NA
	S.D.	6.47	39.51		
	n	4	8		
22	A1	1.60			
	A2	0.70			
	A3	0.70			
	A4	0.80			
	Mean	0.95	71.73	-2.93	NA
	S.D.	0.44	39.51		
	n	4	8		
23	A1	4.40			
	A2	1.20			
	A3	2.50			
	A4	3.50			
	Mean	2.90	71.73	-2.84	NA
	S.D.	1.37	39.51		
	n	4	8		
24	A1	68.30			
	A2	60.70			
	A3	60.00			
	A4	14.50			
	Mean	50.87	71.73	-0.86	NA
	S.D.	24.54	39.51		
	n	4	8		

WELL WATER , APRIL 1987

Turbidity, Lab Data (NTU) 04-07-87

Well Number	Sample Number	NTU	Up-gradiant	t	Sig.
31	A1	58.00			
	A2	62.00			
	A3	56.30			
	A4	77.10			
	Mean	63.35	71.73	-0.35	NA
	S.D.	9.47	39.51		
	n	4	8		
32	A1	3.10			
	A2	1.40			
	A3				
	A4				
	Mean	2.25	71.73	-2.22	NA
	S.D.	1.20	39.51		
	n	2	8		
33	A1	4.30			
	A2	29.00			
	A3	23.80			
	A4	26.50			
	Mean	20.90	71.73	-2.10	NA
	S.D.	11.27	39.51		
	n	4	8		

Up-gradiant, Well 2 and 31

Mean	51.49
S.D.	17.22
n	8

* Results for Well 18 are duplicate samples obtained from Well 15.
Results for Well 19 are for the Reservoir water.

20	A1	0.50
	A2	0.20

Year Upgradiant Results

	NTU
Aug 86, Well 2	137.20
Aug 86, Well 31	43.42
Oct 86, Well 2	122.44
Oct 86, Well 31	40.27
Dec 86, Well 2	86.67
Dec 86, Well 31	40.85
Apr 87, Well 2	39.63
Apr 87, Well 31	63.35
Year Mean	71.73
Year S.D.	39.51
Year n	8

Apr S.D.	102.64
	28.06
	6.89
	0.13
	0.15
	6.19
	6.47
	0.44
	1.37
	24.54
	9.47
	1.20
	11.27
	15.29

WELL WATER , APRIL 1987

TOH, AM-Test Data (ug/l) 04-07-87

Well Number	Sample Number	TOH	Up-gradiant	t	Sig. (1)
1	A1	17.2			
	A2	5.0			
	A3	63.2			
	A4	11.4			
	Mean	24.2	9.3	2.13	NA
	S.D.	26.5	11.4		
	n	4	8		
2	A1	5.0			
	A2	5.0			
	A3	31.6			
	A4	5.0			
	Mean	11.6	9.3	0.34	NA
	S.D.	13.3	11.4		
	n	4.0	8.0		
3	A1	27.0			
	A2	17.4			
	A3	5.0			
	A4	28.6			
	Mean	19.5	9.3	1.46	NA
	S.D.	10.9	11.4		
	n	4	8		
15	A1	5.0			
	A2	5.0			
	A3	5.0			
	A4	5.0			
	Mean	5.0	9.3	-0.61	NA
	S.D.	0.0	11.4		
	n	4	8		
16	A1	5.0			
	A2	5.0			
	A3	50.4			
	A4	5.0			
	Mean	16.3	9.3	1.01	NA
	S.D.	22.7	11.4		
	n	4	8		
17	A1	34.2			
	A2	18.0			
	A3	14.8			
	A4	24.8			
	Mean	22.9	9.3	1.95	NA
	S.D.	8.6	11.4		
	n	4	8		

(1) Transfer blank = 37 ug/l
(2) Based on one-tailed test,
7 degrees of freedom @ 0.99 and 13 wells; t = 5.276
(3) Detection limit = 10 ug/l

WELL WATER , OCTOBER 1986
TOH, AM-Test Data (ug/l) 04-07-87

Well Number	Sample Number	TOH	Up-gradiant	t	Sig.
18*	A1	5.0			
15 Dup.	A2	5.0			
	A3	5.0			
	A4	16.8			
	Mean	7.9	9.3	-0.19	NA
	S.D.	5.9	11.4		
	n	4	8		
19*	A1	43.4			
Res.	A2	42.0			
	A3	57.8			
	A4	5.0			
	Mean	37.0	9.3	3.96	NA
	S.D.	22.5	11.4		
	n	4.0	8.0		
21	A1	25.8			
	A2	33.0			
	A3	36.0			
	A4	13.8			
	Mean	27.1	9.3	2.55	NA
	S.D.	9.9	11.4		
	n	4	8		
22	A1	16.4			
	A2	14.2			
	A3	5.0			
	A4	5.0			
	Mean	10.1	9.3	0.12	NA
	S.D.	6.0	11.4		
	n	4	8		
23	A1	11.2			
	A2	5.0			
	A3	23.0			
	A4	5.0			
	Mean	11.0	9.3	0.25	NA
	S.D.	8.5	11.4		
	n	4	8		
24	A1	5.0			
	A2	30.4			
	A3	28.2			
	A4	52.0			
	Mean	28.9	9.3	2.80	NA
	S.D.	19.2	11.4		
	n	4	8		

WELL WATER , OCTOBER 1986
TOH, AM-Test Data (ug/l) 04-07-87

Well Number	Sample Number	TOH	Up-gradiant	t	Sig.
31	A1	5.0			
	A2	11.6			
	A3	5.0			
	A4	5.0			
	Mean	6.6	9.3	-0.37	NA
	S.D.	3.3	11.4		
	n	4	8		
32	A1	5.0			
	A2	19.0			
	A3	50.4			
	A4	13.0			
	Mean	21.8	9.3	1.80	NA
	S.D.	19.9	11.4		
	n	4	8		
33	A1	5.0			
	A2	5.0			
	A3	5.0			
	A4	5.0			
	Mean	5.0	9.3	-0.61	NA
	S.D.	0.0	11.4		
	n	4	8		

Up-gradiant, Well 2 and 31	
Mean	9.1
S.D.	9.1
n	8.0

* Results for Well 18 are duplicate samples obtained from Well 15.
Results for Well 19 are for the Reservoir water.

Year Upgradiant Results	TOH		
Aug 86, Well 2		14.00	
Aug 86, Well 31		13.00	
Oct 86, Well 2		11.00	
Oct 86, Well 31		5.00	
Dec 86, Well 2		5.00	
Dec 86, Well 31		8.00	
Apr 87, Well 2		11.6	
Apr 87, Well 31		6.6	
Year Mean		9.27	
Year S.D.	3.58	11.44	
Year n		8	
Average of April S.D.		11.44	

Apr S.D.	26.47
	13.30
	10.86
	0.00
	22.70
	8.58
	9.88
	6.01
	8.49
	19.21
	3.30
	19.88
	0.00

WELL WATER , APRIL 1987
TOC, Texaco-Test Data (mg/l) 04-07-87

Well Number	Sample Number	TOC	Up-gradiant	t	Sig. (1)
1	D1	9.8			
	D2	5.4			
	D3	5.1			
	D4	4.8			
	Mean	6.3	5.9	0.11	NA
	S.D.	2.4	4.3		
	n	4	6		
2	D1	5.6			
	D2	3.6			
	D3	8.7			
	D4	3.7			
	Mean	5.4	5.9	-0.20	NA
	S.D.	2.4	4.3		
	n	4	6		
3	D1	4.9			
	D2	7.4			
	D3	1.3			
	D4	14.7			
	Mean	7.1	5.9	0.41	NA
	S.D.	5.6	4.3		
	n	4	6		
15	D1	5.4			
	D2	6.4			
	D3	7.7			
	D4	5.1			
	Mean	6.1	5.9	0.07	NA
	S.D.	1.2	4.3		
	n	4	6		
16	D1	10.6			
	D2	5.2			
	D3	5.1			
	D4	2.2			
	Mean	5.8	5.9	-0.06	NA
	S.D.	3.5	4.3		
	n	4	6		
17	D1	7.4			
	D2	6.8			
	D3	7.8			
	D4	6.8			
	Mean	7.2	5.9	0.46	NA
	S.D.	0.5	4.3		
	n	4	6		

(1) Transfer blank = none
(2) Based on one-tailed test,
7 degrees of freedom @ 0.99 and 13 wells; t = 5.28
(3) Detection limit = 1.0 mg/l

WELL WATER , APRIL 1987
TOC, Texaco-Test Data (mg/l) 04-07-87

Well Number	Sample Number	TOC	Up-gradiant	t	Sig.
18*	D1	6.4			
15 Dup.	D2	4.7			
	D3	4.8			
	D4	4.2			
	Mean	5.0	5.9	-0.34	NA
	S.D.	1.0	4.3		
	n	4	6		
19*	D1	1.0			
Res.	D2	1.1			
	D3	1.2			
	D4	1.1			
	Mean	1.1	5.9	-1.75	NA
	S.D.	0.1	4.3		
	n	4	6		
21	D1	12.2			
	D2	12.4			
	D3	6.5			
	D4	6.7			
	Mean	9.4	5.9	1.26	NA
	S.D.	3.3	4.3		
	n	4	6		
22	D1	5.9			
	D2	5.2			
	D3	5.4			
	D4	5.8			
	Mean	5.6	5.9	-0.14	NA
	S.D.	0.3	4.3		
	n	4	6		
23	D1	5.6			
	D2	8.1			
	D3	6.5			
	D4	4.8			
	Mean	6.3	5.9	0.11	NA
	S.D.	1.4	4.3		
	n	4	6		
24	D1	11.8			
	D2	10.4			
	D3	11.8			
	D4	13.3			
	Mean	11.8	5.9	2.13	NA
	S.D.	1.2	4.3		
	n	4	6		

WELL WATER , APRIL 1987

TOC, Texaco-Test Data (mg/l) 04-07-87

Well Number	Sample Number	TOC	Up-gradiant	t	Sig.
31	D1	8.3			
	D2	6.7			
	D3	8.0			
	D4	8.3			
	Mean	7.8	5.9	0.67	NA
	S.D.	0.7	4.3		
	n	4	6		
32	D1	8.1			
	D2	7.1			
	D3	5.4			
	D4	2.3			
	Mean	5.7	5.9	-0.08	NA
	S.D.	2.5	4.3		
	n	4	6		
33	D1	5.7			
	D2	6.1			
	D3	1.8			
	D4	7.4			
	Mean	5.2	5.9	-0.26	NA
	S.D.	2.4	4.3		
	n	4	6		

Up-gradiant, Well 2 and 31

Mean	6.6
S.D.	2.0
n	8

* Results for Well 18 are duplicate samples obtained from Well 15.
Results for Well 19 are for the Reservoir water.

Year Upgradiant Results

	TOC
Aug 86, Well 2	
Aug 86, Well 31	
Oct 86, Well 2	1.60
Oct 86, Well 31	1.60
Dec 86, Well 2	6.30
Dec 86, Well 31	13.00
Apr 87, Well 2	5.4
Apr 87, Well 31	7.8
Year Mean	5.95
Year S.D.	4.28
Year n	6

	Apr S.D.	2.37
		2.38
		5.64
		1.17
		3.48
		0.46
		3.29
		0.35
		1.44
		1.18
		0.72
		2.53
		2.42
	Avg	2.11

20	D1	0.5
	D2	0.5
	D3	0.6
	D4	0.5

WELL WATER , APRIL 1987

pH, Field Data 04-07-87

Well Number	Sample Number	pH	Up-gradiant	t	Sig. (1)
1	A1	8.76			
	A2	8.62			
	A3				
	A4				
	Mean	8.69	7.11	3.0567	NA
	S.D.	0.10	0.65		
	n	2	8		
2	A1	7.79			
	A2	7.75			
	A3	7.72			
	A4	7.69			
	Mean	7.74	7.11	1.57	NA
	S.D.	0.04	0.65		
	n	4	8		
3	A1	8.33			
	A2	8.60			
	A3	8.62			
	A4	8.56			
	Mean	8.53	7.11	3.54	0.99
	S.D.	0.13	0.65		
	n	4	8		
15	A1	7.61			
	A2	7.73			
	A3	7.79			
	A4	7.81			
	Mean	7.73	7.11	1.56	NA
	S.D.	0.09	0.65		
	n	4	8		
16	A1	9.57			
	A2	8.85			
	A3	9.07			
	A4	9.63			
	Mean	9.28	7.11	5.42	0.99
	S.D.	0.38	0.65		
	n	4	8		
17	A1	7.70			
	A2	7.92			
	A3	7.29			
	A4	7.34			
	Mean	7.56	7.11	1.13	NA
	S.D.	0.30	0.65		
	n	4	8		

(1) Based on two-tailed test,
10 degrees of freedom @ 0.99 = t of 3.17

WELL WATER , APRIL 1987

pH, Field Data 04-07-87

Well Number	Sample Number	pH	Up-gradiant	t	Sig.
18*	A1	7.64			
15 Dup.	A2	7.73			
	A3	7.79			
	A4	7.81			
	Mean	7.74	7.11	1.58	NA
	S.D.	0.08	0.65		
	n	4	8		
19*	A1	7.59			
Res.	A2				
	A3				
	A4				
	Mean	7.59	7.11	0.69	NA
	S.D.	ERR	0.65		
	n	1	8		
21	A1	7.53			
	A2	7.51			
	A3	7.52			
	A4	7.51			
	Mean	7.52	7.11	1.02	NA
	S.D.	0.01	0.65		
	n	4	8		
22	A1	7.09			
	A2	7.13			
	A3	7.22			
	A4	7.22			
	Mean	7.16	7.11	0.14	NA
	S.D.	0.07	0.65		
	n	4	8		
23	A1	6.94			
	A2	7.09			
	A3	7.14			
	A4	7.20			
	Mean	7.09	7.11	0.04	NA
	S.D.	0.11	0.65		
	n	4	8		
24	A1	6.70			
	A2	6.76			
	A3	6.29			
	A4	6.25			
	Mean	6.50	7.11	1.52	NA
	S.D.	0.27	0.65		
	n	4	8		

WELL WATER , APRIL 1987

pH, Field Data 04-07-87

Well Number	Sample Number	pH	Up-gradiant	t	Sig.
31	A1	6.39			
	A2	6.44			
	A3	6.52			
	A4	6.57			
	Mean	6.48	7.11	1.57	NA
	S.D.	0.08	0.65		
	n	4	8		
32	A1	7.97			
	A2	7.98			
	A3				
	A4				
	Mean	7.97	7.11	1.67	NA
	S.D.	0.01	0.65		
	n	2	8		
33	A1	8.07			
	A2	7.87			
	A3	7.90			
	A4	7.39			
	Mean	7.81	7.11	1.75	NA
	S.D.	0.29	0.65		
	n	4	8		
Up-gradiant, Well 2 and 31					
	Mean	7.11			
	S.D.	0.65			
	n	8			

* Results for Well 18 are duplicate samples obtained from Well 15.
Results for Well 19 are for the Reservoir water.

WELL WATER , APRIL 1987
Conductivity, Field Data (uMHO) 04-07-87

Well Number	Sample Number	Cond.	Up-gradiant	t	Sig. (1)
1	A1	546			
	A2	561			
	A3				
	A4				
	Mean	554	789	-1.72	NA
	S.D.	11	173		
	n	2	8		
2	A1	633			
	A2	626			
	A3	627			
	A4	628			
	Mean	629	789	-1.51	NA
	S.D.	3	173		
	n	4	8		
3	A1	569			
	A2	591			
	A3	587			
	A4	582			
	Mean	582	789	-1.95	NA
	S.D.	10	173		
	n	4	8		
15	A1	580			
	A2	580			
	A3	578			
	A4	579			
	Mean	579	789	-1.98	NA
	S.D.	1	173		
	n	4	8		
16	A1	389			
	A2	445			
	A3	420			
	A4	380			
	Mean	409	789	-3.59	NA
	S.D.	30	173		
	n	4	8		
17	A1	2170			
	A2	2040			
	A3	1788			
	A4	1048			
	Mean	1762	789	9.16	0.99
	S.D.	501	173		
	n	4	8		

(1) Based on one-tailed test,
10 degrees of freedom @ 0.99 = t of 2.76

WELL WATER , APRIL 1987
Conductivity, Fieli Data (uMHO) 04-07-87

Well Number	Sample Number	Cond.	Up-gradiant	t	Sig.
18*	A1	580			
15 Dup.	A2	580			
	A3	578			
	A4	579			
	Mean	579	789	-1.98	NA
	S.D.	1	173		
	n	4	8		
19*	A1	67.8			
Res.	A2				
	A3				
	A4				
	Mean	68	789	-3.92	NA
	S.D.	ERR	173		
	n	1	8		
21	A1	712			
	A2	707			
	A3	700			
	A4	697			
	Mean	704	789	-0.80	NA
	S.D.	7	173		
	n	4	8		
22	A1	1455			
	A2	1510			
	A3	1506			
	A4	1515			
	Mean	1497	789	6.66	0.99
	S.D.	28	173		
	n	4	8		
23	A1	823			
	A2	790			
	A3	789			
	A4	791			
	Mean	798	789	0.08	NA
	S.D.	17	173		
	n	4	8		
24	A1	535			
	A2	728			
	A3	727			
	A4	733			
	Mean	681	789	-1.02	NA
	S.D.	97	173		
	n	4	8		

WELL WATER , APRIL 1987
Conductivity, Fieli Data (uMHO) 04-07-87

Well Number	Sample Number	Cond.	Up-gradiant	t	Sig.
31	A1	946			
	A2	965			
	A3	929			
	A4	960			
	Mean	950	789	1.51	NA
	S.D.	16	173		
	n	4	8		
32	A1	530			
	A2	531			
	A3				
	A4				
	Mean	531	789	-1.89	NA
	S.D.	1	173		
	n	2	8		
33	A1	592			
	A2	531			
	A3	531			
	A4	528			
	Mean	546	789	-2.30	NA
	S.D.	31	173		
	n	4	8		

Up-gradiant, Well 2 and 31	
Mean	789
S.D.	173
n	8

* Results for Well 18 are duplicate samples obtained from Well 15.
Results for Well 19 are for the Reservoir water.

WELL WATER , APRIL 1987
Temperature, Field Data (deg. F)04-07-87

Well Number	Sample Number	Deg	Up-gradiant	t	Sig. (1)
1	A1	52			
	A2	52			
	A3				
	A4				
	Mean	52	53	-1.24	NA
	S.D.	0	1		
	n	2	8		
2	A1	53			
	A2	52			
	A3	52			
	A4	52			
	Mean	52	53	-1.14	NA
	S.D.	1	1		
	n	4	8		
3	A1	52			
	A2	52			
	A3	52			
	A4	52			
	Mean	52	53	-1.60	NA
	S.D.	0	1		
	n	4	8		
15	A1	52			
	A2	52			
	A3	53			
	A4	52			
	Mean	52	53	-1.14	NA
	S.D.	1	1		
	n	4	8		
16	A1	53			
	A2	52			
	A3	52			
	A4	52			
	Mean	52	53	-1.14	NA
	S.D.	1	1		
	n	4	8		
17	A1	53			
	A2	53			
	A3	53			
	A4	53			
	Mean	53	53	0.23	NA
	S.D.	0	1		
	n	4	8		

(1) Based on one-tailed test,
10 degrees of freedom @ 0.99 = t of 2.76

WELL WATER , APRIL 1987
Temperature, Field Data (deg. F)04-07-87

Well Number	Sample Number	deg.	Up-gradiant	t	Sig.
18*	A1	52			
15 Dup.	A2	52			
	A3	53			
	A4	52			
	Mean	52	53	-1.14	NA
	S.D.	1	1		
	n	4	8		
19*	A1	51			
Res.	A2				
	A3				
	A4				
	Mean	51	53	-1.97	NA
	S.D.	ERR	1		
	n	1	8		
21	A1	51			
	A2	51			
	A3	51			
	A4	51			
	Mean	51	53	-3.42	NA
	S.D.	0	1		
	n	4	8		
22	A1	52			
	A2	52			
	A3	51			
	A4	51			
	Mean	52	53	-2.51	NA
	S.D.	1	1		
	n	4	8		
23	A1	52			
	A2	53			
	A3	51			
	A4	51			
	Mean	52	53	-2.05	NA
	S.D.	1	1		
	n	4	8		
24	A1	53			
	A2	53			
	A3	54			
	A4	52			
	Mean	53	53	0.23	NA
	S.D.	1	1		
	n	4	8		

WELL WATER , APRIL 1987
Temperature, Field Data (deg. F)04-07-87

Well Number	Sample Number	deg.	Up-gradiant	t	Sig.
31	A1	53			
	A2	54			
	A3	53			
	A4	54			
	Mean	54	53	1.14	NA
	S.D.	1	1		
	n	4	8		
32	A1	52			
	A2	52			
	A3				
	A4				
	Mean	52	53	-1.24	NA
	S.D.	0	1		
	n	2	8		
33	A1	52			
	A2	52			
	A3	52			
	A4	52			
	Mean	52	53	-1.60	NA
	S.D.	0	1		
	n	4	8		

Up-gradiant, Well 2 and 31

Mean	53
S.D.	1
n	8

* Results for Well 18 are duplicate samples obtained from Well 15.
Results for Well 19 are for the Reservoir water.

WELL WATER , APRIL 1987

Purgeable Aromatics (ug/l) 04-07-87

Well Number	Benzene	Toluene	Ethyl Benzene	Xylenes m,p	Xylenes o
1	ND	ND	ND	ND	ND
2	ND	ND	ND	ND	ND
3	ND	ND	ND	ND	ND
15	ND	ND	ND	ND	ND
16	ND	ND	ND	ND	ND
	ND	ND	ND	ND	ND
17	ND	ND	ND	ND	ND
21	ND	ND	ND	ND	ND
22	ND	ND	ND	ND	ND
23					
24	ND	ND	ND	ND	ND
31	ND	ND	ND	ND	ND
32	ND	ND	ND	ND	ND
	ND	ND	ND	ND	ND
33	ND	ND	ND	ND	ND
18* (Dup. of 15)	ND	ND	ND	ND	ND
19* (Res.)	ND	ND	ND	ND	ND
Trip Blank	ND	ND	ND	ND	ND
Detection Limit	0.5	0.5	0.5		0.5

* Results for Well 18 are duplicate samples obtained from Well 15.
Results for Well 19 are for the Reservoir water.

WELL WATER , APRIL 1987

Dissolved Metals (ug/l) 04-07-87

Well Number	Cr	Pb	Ni	Fe	Mg	Mn	Ca
1	0.0030	<0.001	0.002	0.14	2.2	0.025	6.0
2	0.0010	<0.001	0.002	<.05	29.0	0.087	15.0
3	0.0008	<0.001	<0.001	0.25	27.0	0.099	35.0
15	0.0016	<0.001	<0.001	0.23	23.0	0.270	39.0
16	<.0005	<0.001	0.006	<.05	18.0	0.074	32.0
	<.0005	<0.001	0.003	<.05	19.0	0.061	35.0
17	0.0021	<0.001	0.203	0.17	67.0	0.240	103.0
							102.0
21	0.0016	<0.001	0.002	0.08	3.4	<.010	31.0
22	0.0024	<0.001	0.001	0.08	51.0	<.010	120.0
23	0.0008	<0.001	0.001	0.06	17.0	<.010	74.0
24	0.0105	0.005	0.008	<.05	29.0	0.260	36.0
			0.007		30.0	0.260	
31	0.0038	<0.001	<0.001	1.70	35.0	0.460	20.0
32	0.0024	<0.001	0.001	0.06	21.0	<.010	35.0
33	0.0019	<0.001	0.002	0.08	23.0	<.010	38.0
				0.08	21.0		
18*	0.0070	<0.001	0.002	0.20	15.0	0.250	38.0
(Dup. of 15)				0.21			
19*	0.0027	0.007	0.002	<.05	1.6	<.010	6.9
(Res.)							
Trip Blank	0.0016	<0.001	0.003	<.05	0.05	<.010	0.1
Detection Limit	0.0005	0.001	0.001	0.01	0.003	0.01	0.10

* Results for Well 18 are duplicate samples obtained from Well 15.
Results for Well 19 are for the Reservoir water.

WELL WATER , APRIL 1987

Dissolved Metals (ng/l) 04-07-87

Well Number	Na	Zn
1	115.0	0.033
2	27.0	0.033
3	18.0	0.050
15	22.0	0.028
16	24.0	0.020
		0.015
17	92.0	0.020
21	47.0	0.037
22	46.0	0.037
23	22.0	0.024
24	16.0	0.033
	17.0	
31	36.0	0.024
32	14.0	0.020
33	18.0	0.033
	15.0	
18* (Dup. of 19* (Res.)	21.0	0.028
Trip Blank	0.4	0.042
Detection Limit	0.10	0.001

* Results for Well 18 are duplicate samples obtained from Well 15.
Results for Well 19 are for the Reservoir water.

WELL WATER , APRIL 1987

Dissolved Metals (ng/l) 04-07-87

Well Number	As	Ba	Cd	Hg	Se	Ag
1						
2						
3						
15						
16						
17						
21						
22						
23						
24						
31	0.019	<0.25	<.0005	0.0004	0.009	<.0003
				0.0004		
32	0.010	<0.25	<.00051	<.0002	0.007	<.0003
33	0.008	<0.25	<.00051	0.0004	0.011	<.0003
18* (Dup. of 15)						
19* (Res.)						
Trip Blank						
Detection Limit	0.003	0.25	0.0001	0.0002	0.0002	0.0003

* Results for Well 18 are duplicate samples obtained from Well 15.
Results for Well 19 are for the Reservoir water.

WELL WATER , APRIL 1987

Radiation (pci/l) 04-07-87

Well Number	Gross Alpha	Gross Beta
1		
2		
3		
15		
16		
17		
21		
22		
23		
24		
31	-0.225	11.900
32	3.070	6.300
33	0.697	6.310
18* (Dup. of 15)		
19* (Res.)		
Trip Blank		
Detection Limit		

* Results for Well 18 are duplicate samples obtained from Well 15.
Results for Well 19 are for the Reservoir water.

WELL WATER , DECEMBER 1986

Non-Metals (mg/l) 04-07-87

Well Number	Phenol	Chloride	Ammonia	Sulfate	Nitrate+ Nitrite
1	<.008	27.0 26.0	2.62	15.0	0.530
2	<.008	21.0	0.37	4.9	0.109
3	<.008	1.8	1.22	45.0	0.078 0.077
15	<.008	8.9	0.39	40.0	0.080
16	<.008	18.0	1.00	31.0	0.058
17	<.008	230.0	0.08	120.0 140.0	0.215
21	<.008	36.0	0.02	81.0	0.239
22	<.008	36.0	0.01 0.01	800.0	0.098
23	<.008	31.0	0.01	130.0	0.140
24	<.008	73.0	0.03	160.0	0.547
31	<.008	45.0	0.15	130.0	<.010 <.010
32		12.0	0.04	110.0 100.0	1.590
33	<.008	23.0 24.0	0.04	91.0	0.294
18* (Dup. of 15)	<.008	19.0	0.38	40.0	0.093
19* (Res.)	<.008	2.3	0.02	7.1	0.072
Trip Blank	<.008	<1.0	0.01	<1.0	0.054
Detection Limit	0.008	1.0	0.01	1.0	0.01

* Results for Well 18 are duplicate samples obtained from Well 15.
Results for Well 19 are for the Reservoir water.

WELL WATER , DECEMBER 1986

Herbicides (mg/l) 04-07-87

Well Number	2,4-D	2,4,5-TP Silvex
1		
2		
3		
15		
16		
17		
21		
22		
23		
24		
31	ND	ND
32	ND	ND
33	ND	ND
18* (Dup. of 15)		
19* (Res.)		
Trip Blank		
Detection Limit	0.001	0.0001

* Results for Well 18 are duplicate samples obtained from Well 15.
Results for Well 19 are for the Reservoir water.

WELL WATER , DECEMBER 1986

Pesticides (mg/l) 04-07-87

Well Number	Lindane	Methoxychlor	Endrin	Toxaphene
1				
2				
3				
15				
16				
17				
21				
22				
23				
24				
31	ND	ND	ND	ND
32	ND	ND	ND	ND
33	ND	ND	ND	ND
18* (Dup. of 15)				
19* (Res.)				
Trip Blank				
Detection Limit	0.00002	0.0005	0.00002	0.0004

* Results for Well 18 are duplicate samples obtained from Well 15.
Results for Well 19 are for the Reservoir water.

WELL WATER , SEPTEMBER 1987
Conductivity, Field Data (uMHO) 09-02-87

Well Number	Sample Number	Cond.	Up-gradiant	t	Sig.
31	A1	839			
	A2	839			
	A3	846			
	A4	847			
	Mean	843	706	1.52	NA
	S.D.	4	147		
	n	4	8		
32	A1	481			
	A2	484			
	A3				
	A4				
	Mean	483	706	-1.93	NA
	S.D.	2	147		
	n	2	8		
33	A1	486			
	A2	471			
	A3	476			
	A4	487			
	Mean	480	706	-2.52	NA
	S.D.	8	147		
	n	4	8		

Up-gradiant, Well 2 and 31

Mean	706
S.D.	147
n	8

* Results for Well 18 are duplicate samples obtained from Well 15.
Results for Well 19 are for the Reservoir water.

WELL WATER , SEPTEMBER 1987

Water Elevations (ft) 08-28-87

Well Number	Well Type	Feet to Water	Reference (MLLW)	Water (MLLW)
1	East Down	57.92	97.5	39.58
2	Up	32.55	145.9	113.35
3	West Down	45.43	146.7	101.27
15	West Down	21.10	146.4	125.30
16	West Down	52.85	143.7	90.85
17	West Down	50.83	133.9	83.07
21	East Down	7.32	99.8	92.48
22	East Down	6.02	97.0	90.98
23	East down	8.35	96.7	88.35
24	South Down	37.80	154.2	116.40
31	Up	19.97	192.7	172.73
32	West Down	40.54	147.7	107.16
33	West Down	53.72	140.3	86.58
P-1		17.30	193.1	175.80
P-2		16.77	182.3	165.53
P-3		7.88	166.6	158.72
P-4		10.87	120.7	109.83
P-5		11.31	121.9	110.59
P-6		11.75	121.8	110.05
P-7		9.60	118.4	108.80
P-8		6.97	112.9	105.93
KWB 6EC		8.59	111.00	102.41
11		16.28	99.7	83.42
12		10.46	96.1	85.64
13		11.33	96.1	84.77
14		21.53	187.0	165.47
25		37.10	147.5	110.40
26		52.10	138.6	86.50

2nd Quarter Well Results Sept 1987

WELL WATER , SEPTEMBER 1987

pH, Field Data 09-02-87

Well Number	Sample Number	pH	Up-gradiant	t	Sig. (1)
1	A1	8.84			
	A2	8.86			
	A3	8.90			
	A4	8.68			
	Mean	8.82	7.78	6.21	0.99
	S.D.	0.10	0.27		
	n	4	8		
2	A1	7.73			
	A2	7.99			
	A3	8.15			
	A4	8.22			
	Mean	8.02	7.78	1.43NA	
	S.D.	0.22	0.27		
	n	4	8		
3	A1	8.78			
	A2	8.80			
	A3	8.88			
	A4	8.89			
	Mean	8.84	7.78	6.32	0.99
	S.D.	0.06	0.27		
	n	4	8		
15	A1	7.67			
	A2	7.77			
	A3	8.02			
	A4	8.14			
	Mean	7.90	7.78	0.70NA	
	S.D.	0.22	0.27		
	n	4	8		
16	A1	9.42			
	A2	9.59			
	A3	9.83			
	A4	9.08			
	Mean	9.48	7.78	10.17	0.99
	S.D.	0.32	0.27		
	n	4	8		
17	A1	8.41			
	A2	8.70			
	A3	7.50			
	A4	7.77			
	Mean	8.10	7.78	1.87NA	
	S.D.	0.56	0.27		
	n	4	8		

(1) Based on two-tailed test,
10 degrees of freedom @ 0.99 = t of 3.17

WELL WATER , SEPTEMBER 1987

pH, Field Data 09-02-87

Well Number	Sample Number	pH	Up-gradiant	t	Sig.
18*	A1	7.67			
15 Dup.	A2	7.77			
	A3	8.02			
	A4	8.14			
	Mean	7.90	7.78	0.70NA	
	S.D.	0.22	0.27		
	n	4	8		
19*	A1	9.32			
Res.	A2	8.68			
	A3				
	A4				
	Mean	9.00	7.78	5.65	0.99
	S.D.	0.45	0.27		
	n	2	8		
21	A1	7.50			
	A2	7.54			
	A3	7.63			
	A4	7.70			
	Mean	7.59	7.78	1.15NA	
	S.D.	0.09	0.27		
	n	4	8		
22	A1	7.34			
	A2	7.44			
	A3	7.46			
	A4	7.48			
	Mean	7.43	7.78	2.12NA	
	S.D.	0.06	0.27		
	n	4	8		
23	A1	6.85			
	A2	7.45			
	A3	7.60			
	A4	7.65			
	Mean	7.39	7.78	2.38NA	
	S.D.	0.37	0.27		
	n	4	8		
24	A1	7.87			
	A2	7.22			
	A3	6.78			
	A4	6.79			
	Mean	7.17	7.78	3.71	0.99
	S.D.	0.51	0.27		
	n	4	8		

WELL WATER , SEPTEMBER 1987

pH, Field Data 09-02-87

Well Number	Sample Number	pH	Up-gradiant	t	Sig.
31	A1	7.28			
	A2	7.58			
	A3	7.61			
	A4	7.71			
	Mean	7.55	7.78	1.43NA	
	S.D.	0.19	0.27		
	n	4	8		
32	A1	7.59			
	A2	7.46			
	A3				
	A4				
	Mean	7.53	7.78	1.20NA	
	S.D.	0.09	0.27		
	n	2	8		
33	A1	8.59			
	A2	8.31			
	A3	8.33			
	A4	8.47			
	Mean	8.43	7.78	3.84	0.99
	S.D.	0.13	0.27		
	n	4	8		

Up-gradiant, Well 2 and 31

Mean	7.78
S.D.	0.27
	8

* Results for Well 18 are duplicate samples obtained from Well 15.
Results for Well 19 are for the Reservoir water.

WELL W^TER , SEPTEMBER 1987
Conductivity, Fie d Data (uMHO) 09-02-87

Well Number	Sample Number	Cond.	Up-gradiant	t	Sig. (1)
1	A1	491			
	A2	486			
	A3	490			
	A4	491			
	Mean	490	706	-2.41	NA
	S.D.	2	147		
	n	4	8		
2	A1	575			
	A2	569			
	A3	569			
	A4	567			
	Mean	570	706	-1.52	NA
	S.D.	3	147		
	n	4	8		
3	A1	535			
	A2	538			
	A3	539			
	A4	532			
	Mean	536	706	-1.89	NA
	S.D.	3	147		
	n	4	8		
15	A1	565			
	A2	536			
	A3	543			
	A4	546			
	Mean	548	706	-1.77	NA
	S.D.	12	147		
	n	4	8		
16	A1	373			
	A2	352			
	A3	339			
	A4	393			
	Mean	364	706	-3.80	NA
	S.D.	24	147		
	n	4	8		
17	A1	995			
	A2	932			
	A3	768			
	A4	712			
	Mean	852	706	1.62	NA
	S.D.	134	147		
	n	4	8		

(1) Based on one-tailed test,
10 degrees of freedom @ 0.99 = t of 2.76

WELL WATER , SEPTEMBER 1987
Conductivity, Field Data (uMHO) 09-02-87

Well Number	Sample Number	Cond.	Up-gradiant	t	Sig.
18*	A1	565			
15 Dup.	A2	536			
	A3	543			
	A4	546			
	Mean	548	706	-1.77NA	
	S.D.	12	147		
	n	4	8		
19*	A1	59.3			
Res.	A2	53.3			
	A3				
	A4				
	Mean	56	706	-5.59NA	
	S.D.	4	147		
	n	2	8		
21	A1	643			
	A2	648			
	A3	637			
	A4	634			
	Mean	641	706	-0.73NA	
	S.D.	6	147		
	n	4	8		
22	A1	1328			
	A2	1370			
	A3	1387			
	A4	1389			
	Mean	1369	706	7.36	0.99
	S.D.	28	147		
	n	4	8		
23	A1	720			
	A2	734			
	A3	706			
	A4	703			
	Mean	716	706	0.10NA	
	S.D.	14	147		
	n	4	8		
24	A1	725			
	A2	683			
	A3	663			
	A4	666			
	Mean	684	706	-0.25NA	
	S.D.	29	147		
	n	4	8		

WELL W'TER , SEPTEMBER 1987
Temperature, Fiel(Data (deg. F)09-02-87

Well Number	Sample Number	Deg	Up-gradiant	t	Sig. (1)
1	A1	57			
	A2	54			
	A3	53			
	A4	54			
	Mean	55	56	-1.00	NA
	S.D.	2	2		
	n	4	8		
2	A1	57			
	A2	54			
	A3	53			
	A4	53			
	Mean	54	56	-1.25	NA
	S.D.	2	2		
	n	4	8		
3	A1	58			
	A2	55			
	A3	55			
	A4	53			
	Mean	55	56	-0.25	NA
	S.D.	2	2		
	n	4	8		
15	A1	58			
	A2	54			
	A3	54			
	A4	54			
	Mean	55	56	-0.50	NA
	S.D.	2	2		
	n	4	8		
16	A1	54			
	A2	54			
	A3	54			
	A4	55			
	Mean	54	56	-1.25	NA
	S.D.	1	2		
	n	4	8		
17	A1	59			
	A2				
	A3	54			
	A4	54			
	Mean	56	56	0.15	NA
	S.D.	3	2		
	n	3	8		

(1) Based on one-tailed test,
10 degrees of freedom @ 0.99 = t of 2.76

WELL WATER , SEPTEMBER 1987
Temperature, Field Data (deg. F)09-02-87

Well Number	Sample Number	deg.	Up-gradiant	t	Sig.
18*	A1	58			
15 Dup.	A2	54			
	A3	54			
	A4	54			
	Mean	55	56	-0.50NA	
	S.D.	2	2		
	n	4	8		
19*	A1	65			
Res.	A2	66			
	A3				
	A4				
	Mean	66	56	7.75	0.99
	S.D.	1	2		
	n	2	8		
21	A1	56			
	A2	56			
	A3	55			
	A4	55			
	Mean	56	56	0.00NA	
	S.D.	1	2		
	n	4	8		
22	A1	55			
	A2	56			
	A3	56			
	A4	56			
	Mean	56	56	0.25NA	
	S.D.	1	2		
	n	4	8		
23	A1	58			
	A2	55			
	A3	54			
	A4	54			
	Mean	55	56	-0.25NA	
	S.D.	2	2		
	n	4	8		
24	A1	67			
	A2	58			
	A3	55			
	A4	55			
	Mean	59	56	3.25	0.99
	S.D.	6	2		
	n	4	8		

WELL WATER , SEPTEMBER 1987
Temperature, Field Data (deg. F)09-02-87

Well Number	Sample Number	deg.	Up-gradiant	t	Sig.
31	A1	58			
	A2	57			
	A3	56			
	A4	56			
	Mean	57	56	1.25NA	
	S.D.	1	2		
	n	4	8		
32	A1				
	A2	52			
	A3				
	A4				
	Mean	52	56	-2.02NA	
	S.D.		2		
	n	1	8		
33	A1	59			
	A2	56			
	A3	55			
	A4	54			
	Mean	56	56	0.50NA	
	S.D.	2	2		
	n	4	8		

Up-gradiant, Well 2 and 31		
Mean	56	
S.D.	2	
n	8	

* Results for Well 18 are duplicate samples obtained from Well 15.
Results for Well 19 are for the Reservoir water.

WELL W.TER , SEPTEMBER 1987

pH, Lab Data 09-02-87

Well Number	Sample Number	pH	Up-gradiant	t	Sig. (1)
1	A1	8.70			
	A2	8.61			
	A3	8.56			
	A4	8.40			
	Mean	8.57	7.53	2.15	NA
	S.D.	0.13	0.45		
	n	4	8		
2	A1	7.96			
	A2	7.92			
	A3	7.94			
	A4	7.92			
	Mean	7.94	7.53	0.84	NA
	S.D.	0.02	0.45		
	n	4	8		
3	A1	7.90			
	A2	7.97			
	A3	7.92			
	A4	7.94			
	Mean	7.93	7.53	0.83	NA
	S.D.	0.03	0.45		
	n	4	8		
15	A1	7.75			
	A2	7.73			
	A3	7.67			
	A4	7.71			
	Mean	7.72	7.53	0.38	NA
	S.D.	0.03	0.45		
	n	4	8		
16	A1	8.05			
	A2	9.02			
	A3	9.08			
	A4	8.82			
	Mean	8.74	7.53	2.51	NA
	S.D.	0.47	0.45		
	n	4	8		
17	A1	7.66			
	A2	7.71			
	A3	7.61			
	A4	7.65			
	Mean	7.66	7.53	0.26	NA
	S.D.	0.04	0.45		
	n	4	8		

(1) Based on two-tailed test,
7 degrees of freedom @ 0.99 and 13 wells; t = 5.714

WELL WATER , SEPTEMBER 1987

pH, Lab Data 09-02-87

Well Number	Sample Number	pH	Up-gradiant	t	Sig.
18*	A1	7.72			
15 Dup.	A2	7.70			
	A3	7.76			
	A4	7.70			
	Mean	7.72	7.53	0.39	NA
	S.D.	0.03	0.45		
	n	4	8		
19*	A1	7.65			
Res.	A2	7.61			
	A3	7.50			
	A4	7.60			
	Mean	7.59	7.53	0.12	NA
	S.D.	0.06	0.45		
	n	4	8		
21	A1	7.51			
	A2	7.46			
	A3	7.43			
	A4	7.48			
	Mean	7.47	7.53	0.13	NA
	S.D.	0.03	0.45		
	n	4	8		
22	A1	7.26			
	A2	7.21			
	A3	7.19			
	A4	7.17			
	Mean	7.21	7.53	0.68	NA
	S.D.	0.04	0.45		
	n	4	8		
23	A1	7.28			
	A2	7.37			
	A3	7.42			
	A4	7.48			
	Mean	7.	7.53	0.30	NA
	S.D.	0.	0.45		
	n	4	8		
24	A1	6.58			
	A2	6.58			
	A3	6.55			
	A4	6.58			
	Mean	6.57	7.53	1.99	NA
	S.D.	0.02	0.45		
	n	4	8		

WELL WATER , SEPTEMBER 1987

pH, Lab Data 09-02-87

Well Number	Sample Number	pH	Up-gradiant	t	Sig.
31	A1	7.05			
	A2	7.02			
	A3	7.05			
	A4	7.06			
	Mean	7.05	7.53	1.01	NA
	S.D.	0.02	0.45		
	n	4	8		
32	A1	7.38			
	A2	7.25			
	A3	7.51			
	A4				
	Mean	7.38	7.53	0.32	NA
	S.D.	0.13	0.45		
	n	3	8		
33	A1	7.48			
	A2	7.40			
	A3	7.35			
	A4	7.45			
	Mean	7.42	7.53	0.23	NA
	S.D.	0.06	0.45		
	n	4	8		

Up-gradiant, Well 2 and 31

	Mean	7.49			
	S.D.	0.47			
	n	8			
13	A1				
	A2	8.15			
	A3	8.22			
	A4	8.21			
	Mean	8.19	7.53	1.37	NA
	S.D.	0.04	0.45	Sept S.D.	0.13
	n	3	8		0.02

Year Upgradiant Results	pH		
Aug 86, Well 2	7.82		0.03
Aug 86, Well 31	7.07		0.47
Oct 86, Well 2	7.96		0.04
Oct 86, Well 31	7.08		0.03
Dec 86, Well 2	8.01		0.04
Dec 86, Well 31	7.15		0.08
Apr 87, Well 2	8.02		0.02
Apr 87, Well 31	7.15		0.02
			0.13
Year Mean	7.53		0.06
Year S.D.	0.45	Avg	0.087
Year n	8		

* Results for Well 18 are duplicate samples obtained from Well 15.
Results for Well 19 are for the Reservoir water.

WELL WATER , SEPTEMBER 1987

pH, Lab Data 09-02-87

Well Number	Sample Number	pH	Up-gradiant	t	Sig.
11	A1	11.77			
	A2	11.80			
12	A1	11.56			
	A2	10.91			
14	A1	11.52			

WELL W'TER , SEPTEMBER 1987
Conductivity, Lab Data (uMHO@25)09-02-87

Well Number	Sample Number	Cond.	Up-gradiant	t	Sig. (1)
1	A1	675			
	A2	628			
	A3	680			
	A4	669			
	Mean	663	953	-1.14	NA
	S.D.	24	240		
	n	4	8		
2	A1	748			
	A2	752			
	A3	728			
	A4	739			
	Mean	742	953	-0.83	NA
	S.D.	11	240		
	n	4	8		
3	A1	672			
	A2	676			
	A3	730			
	A4	726			
	Mean	701	953	-0.99	NA
	S.D.	31	240		
	n	4	8		
15	A1	668			
	A2	731			
	A3	674			
	A4	720			
	Mean	698	953	-1.00	NA
	S.D.	32	240		
	n	4	8		
16	A1	589			
	A2	434			
	A3	455			
	A4	459			
	Mean	484	953	-1.84	NA
	S.D.	71	240		
	n	4	8		
17	A1	1355			
	A2	1216			
	A3	1019			
	A4	958			
	Mean	1137	953	0.73	NA
	S.D.	182	240		
	n	4	8		

(1) Based on one-tailed test,
7 degrees of freedom @ 0.99 and 13 wells; t = 5.276

WELL WATER SEPTEMBER 1987
Conductivity, Lab Data (uMHO@25)09-02-87

Well Number	Sample Number	Cond.	Up-gradiant	t	Sig.
18*	A1	707			
15 Dup.	A2	722			
	A3	725			
	A4	651			
	Mean	701	953	-0.99	NA
	S.D.	34	240		
	n	4	8		
19*	A1	71			
Res.	A2	70			
	A3	75			
	A4	91			
	Mean	77	953	-3.44	NA
	S.D.	10	240		
	n	4	8		
21	A1	865			
	A2	813			
	A3	835			
	A4	834			
	Mean	837	953	-0.46	NA
	S.D.	21	240		
	n	4	8		
22	A1	1709			
	A2	1774			
	A3	1777			
	A4	1763			
	Mean	1756	953	3.16	NA
	S.D.	32	240		
	n	4	8		
23	A1	997			
	A2	988			
	A3	942			
	A4	934			
	Mean	965	953	0.05	NA
	S.D.	32	240		
	n	4	8		
24	A1	941			
	A2	870			
	A3	826			
	A4	857			
	Mean	874	953	-0.31	NA
	S.D.	49	240		
	n	4	8		

WELL W.TER , SEPTEMBER 1987
Conductivity, Lab Data (uMHO@25)09-02-87

Well Number	Sample Number	Cond.	Up-gradiant	t	Sig.
31	A1	1212			
	A2	1224			
	A3	1165			
	A4	1187			
	Mean	1197	953	0.96	NA
	S.D.	26	240		
	n	4	8		
32	A1	668			
	A2	630			
	A3	664			
	A4				
	Mean	654	953	-1.17	NA
	S.D.	21	240		
	n	3	8		
33	A1	697			
	A2	678			
	A3	672			
	A4	675			
	Mean	681	953	-1.07	NA
	S.D.	11	240		
	n	4	8		

Up-gradiant, Well 2 and 31

	Mean	969			
	S.D.	243			
	n	8			
13	A1				
	A2	827			
	A3	839			
	A4	826			
	Mean	831	953	-0.48	NA
	S.D.	7	240	SeptS.D.	23.76
	n	3	8		10.66
			uMHO		31.26
	Aug 86, Well 2		708		31.88
	Aug 86, Well 31		1230		70.69
	Oct 86; Well 2		699		182.33
	Oct 86, Well 31		1099		21.39
	Dec 86, Well 2		718		31.74
	Dec 86, Well 31		1150		31.85
	Apr 87, Well 2		808		48.64
	Apr 87, Well 31		1208		26.32
					20.88
	Year Mean		952.50		11.27
	Year S.D.		239.84		
	Year n		8	Avg	41.74

* Results for Well 18 are duplicate samples obtained from Well 15.
Results for Well 19 are for the Reservoir water.

WELL W.TER , SEPTEMBER 1987
Conductivity, Lab Data (uMHO@25)09-02-87

Well Number	Sample Number	Cond.	Up-gradiant	t	Sig.
11	A1	4590			
	A2	4310			
12	A1	3660			
	A2	1370			
14	A1	3700			

WELL WATER , SEPTEMBER 1987
Turbidity, Lab Data (NTU) 09-02-87

Well Number	Sample Number	NTU	Up-gradiant		t	Sig. (1)
1	A1	167.50				
	A2	175.50				
	A3	159.70				
	A4	206.00				
	Mean	177.18	71.73		4.76	NA
	S.D.	20.27	39.51			
	n	4	8			
2	A1	45.00				
	A2	52.90				
	A3	30.30				
	A4	42.90				
	Mean	42.78	71.73		-1.20	NA
	S.D.	9.36	39.51			
	n	4	8			
3	A1	2.10				
	A2	0.80				
	A3	4.30				
	A4	6.50				
	Mean	3.43	71.73		-2.82	NA
	S.D.	2.51	39.51			
	n	4	8			
15	A1	1.00				
	A2	1.00				
	A3	1.20				
	A4	1.20				
	Mean	1.10	71.73		-2.92	NA
	S.D.	0.12	39.51			
	n	4	8			
16	A1	2.40				
	A2	0.70				
	A3	0.80				
	A4	1.20				
	Mean	1.28	71.73		-2.91	NA
	S.D.	0.78	39.51			
	n	4	8			
17	A1	1.10				
	A2	2.90				
	A3	2.80				
	A4	1.70				
	Mean	2.13	71.73		-2.88	NA
	S.D.	0.87	39.51			
	n	4	8			

(1) Based on one-tailed test,
7 degrees of freedom @ 0.99 and 13 wells; t = 5.276

WELL WATER , SEPTEMBER 1987

Turbidity, Lab Data (NTU) 09-02-87

Well Number	Sample Number	NTU	Up-gradiant	t	Sig.
18*	A1	1.20			
15 Dup.	A2	1.00			
	A3	1.00			
	A4	1.30			
	Mean	1.13	71.73	-2.92	NA
	S.D.	0.15	39.51		
	n	4	8		
19*	A1	0.50			
Res.	A2	1.40			
	A3	0.60			
	A4	0.50			
	Mean	0.75	71.73	-2.93	NA
	S.D.	0.44	39.51		
	n	4	8		
21	A1	23.00			
	A2	24.60			
	A3	24.10			
	A4	10.30			
	Mean	20.50	71.73	-2.12	NA
	S.D.	6.83	39.51		
	n	4	8		
22	A1	8.30			
	A2	3.20			
	A3	1.20			
	A4	1.00			
	Mean	3.43	71.73	-2.82	NA
	S.D.	3.40	39.51		
	n	4	8		
23	A1	4.80			
	A2	6.10			
	A3	4.80			
	A4	6.30			
	Mean	5.50	71.73	-2.74	NA
	S.D.	0.81	39.51		
	n	4	8		
24	A1	22.00			
	A2	9.00			
	A3	5.80			
	A4	16.40			
	Mean	13.30	71.73	-2.42	NA
	S.D.	7.30	39.51		
	n	4	8		

WELL WATER , SEPTEMBER 1987

Turbidity, Lab Data (NTU) 09-02-87

Well Number	Sample Number	NTU	Up-gradiant	t	Sig.
31	A1	59.60			
	A2	54.60			
	A3	58.70			
	A4	74.00			
	Mean	61.73	71.73	-0.41	NA
	S.D.	8.47	39.51		
	n	4	8		
32	A1	2.50			
	A2	2.00			
	A3	3.00			
	A4				
	Mean	2.50	71.73	-2.59	NA
	S.D.	0.50	39.51		
	n	3	8		
33	A1	13.90			
	A2	15.90			
	A3	10.70			
	A4	9.60			
	Mean	12.53	71.73	-2.45	NA
	S.D.	2.90	39.51		
	n	4	8		

Up-gradiant, Well 2 and 31					
	Mean	52.25			
	S.D.	13.47			
	n	8			
13	A1				
	A2	37.20			
	A3	81.20			
	A4	38.10			
	Mean	52.17	71.73	-0.73	NA
	S.D.	25.15	39.51	SeptS.D.	20.27
	n	3	8		9.36
			NTU		2.51
	Aug 86, Well 2		137.20		0.12
	Aug 86, Well 31		43.42		0.78
	Oct 86, Well 2		122.44		0.87
	Oct 86, Well 31		40.27		6.83
	Dec 86, Well 2		86.67		3.40
	Dec 86, Well 31		40.85		0.81
	Apr 87, Well 2		39.63		7.30
	Apr 87, Well 31		63.35		8.47
					0.50
	Year Mean		71.73		2.90
	Year S.D.		39.51		
	Year n		8		4.93

* Results for Well 18 are duplicate samples obtained from Well 15.
Results for Well 19 are for the Reservoir water.

WELL WATER , SEPTEMBER 1987
TOC, Texaco-Test Data (mg/l) 09-02-87

Well Number	Sample Number	TOC	Up-gradiant	t	Sig. (1)
1	D1	4.9			
	D2	3.0			
	D3	4.1			
	D4	9.5			
	Mean	5.4	6.0	-0.21	NA
	S.D.	2.8	4.3		
	n	4	6		
2	D1	1.7			
	D2	0.9			
	D3	7.0			
	D4	1.2			
	Mean	2.7	6.0	-1.18	NA
	S.D.	2.9	4.3		
	n	4	6		
3	D1	1.4			
	D2	1.4			
	D3	1.3			
	D4	1.8			
	Mean	1.5	6.0	-1.62	NA
	S.D.	0.2	4.3		
	n	4	6		
15	D1	1.1			
	D2	1.2			
	D3	1.8			
	D4	1.9			
	Mean	1.5	6.0	-1.62	NA
	S.D.	0.4	4.3		
	n	4	6		
16	D1	1.3			
	D2	1.4			
	D3	.5			
	D4	1.5			
	Mean	1.4	6.0	-1.64	NA
	S.D.	0.1	4.3		
	n	4	6		
17	D1	3.7			
	D2	3.9			
	D3	3.6			
	D4	4.4			
	Mean	3.9	6.0	-0.74	NA
	S.D.	0.4	4.3		
	n	4	6		

(1) Transfer blank = none
(2) Based on one-tailed test,
7 degrees of freedom @ 0.99 and 13 wells; t = 5.276
(3) Detection limit = 1.0 mg/l

WELL W'.TER , SEPTEMBER 1987
TOC, Texaco-Test Data (mg/l) 09-02-87

Well Number	Sample Number	TOC	Up-gradiant	t	Sig.
18*	D1	1.7			
15 Dup.	D2	1.7			
	D3	1.1			
	D4	2.4			
	Mean	1.7	6.0	-1.53	NA
	S.D.	0.5	4.3		
	n	4	6		
19*	D1	2.5			
Res.	D2	1.8			
	D3	1.4			
	D4	2.0			
	Mean	1.9	6.0	-1.46	NA
	S.D.	0.5	4.3		
	n	4	6		
21	D1	2.4			
	D2	2.1			
	D3	2.3			
	D4	2.3			
	Mean	2.3	6.0	-1.33	NA
	S.D.	0.1	4.3		
	n	4	6		
22	D1	3.6			
	D2	3.4			
	D3	3.5			
	D4	3.4			
	Mean	3.5	6.0	-0.90	NA
	S.D.	0.1	4.3		
	n	4	6		
23	D1	2.0			
	D2	2.7			
	D3	2.0			
	D4	2.1			
	Mean	2.2	6.0	-1.36	NA
	S.D.	0.4	4.3		
	n	4	6		
24	D1	7.6			
	D2	8.1			
	D3	7.0			
	D4	6.1			
	Mean	7.2	6.0	0.46	NA
	S.D.	0.9	4.3		
	n	4	6		

WELL WATER , SEPTEMBER 1987

TOC, Texaco-Test Data (mg/l) 09-02-87

Well Number	Sample Number	TOC	Up-gradiant	t	Sig.
31	D1	1.8			
	D2	1.7			
	D3	1.9			
	D4	2.3			
	Mean	1.9	6.0	-1.47	NA
	S.D.	0.3	4.3		
	n	4	6		
32	D1	3.3			
	D2	2.2			
	D3	2.7			
	D4	2.3			
	Mean	2.6	6.0	-1.21	NA
	S.D.	0.5	4.3		
	n	4	6		
33	D1	1.3			
	D2	2.1			
	D3	1.7			
	D4	1.9			
	Mean	1.8	6.0	-1.51	NA
	S.D.	0.3	4.3		
	n	4	6		

Up-gradiant, Well 2 and 31

	Mean	2.3			
	S.D.	1.9			
	n	8			
13	A1	4.22			
	A2	4.26			
	A3	3.83			
	A4	4.40			
	Mean	4.18	6.0	-0.38	NA
		0.2	4.3	Apr S.D.	2.82
Year Upgradiant Results			6		2.87
			TOC		0.23
	Aug 86, Well 2				0.39
	Aug 86, Well 31				0.08
	Oct 86, Well 2		1.60		0.36
	Oct 86, Well 31		1.60		0.11
	Dec 86, Well 2		6.30		0.11
	Dec 86, Well 31		13.00		0.36
	Apr 87, Well 2		5.4		0.86
	Apr 87, Well 31		7.8		0.26
					0.49
	Year Mean		5.95		0.34
	Year S.D.		4.28		0.24
	Year n		6	Avg	0.68
20	D1	0.4			
	D2	0.3			
	D3	0.3			
	D4	0.6			

WELL WATER , SEPTEMBER 1987
TOH, AM-Test Data (ug/l) 09-02-87

Well Number	Sample Number	TOH	Up-gradiant	t	Sig. (1)
1	A1	5.0			
	A2	12.6			
	A3	5.0			
	A4	15.0			
	Mean	9.4	9.3	0.03	NA
	S.D.	5.2	6.2		
	n	4	8		
2	A1	53.4			
	A2	62.0			
	A3	67.6			
	A4	56.8			
	Mean	60.0	9.3	13.33	0.99
	S.D.	6.2	6.2		
	n	4.0	8.0		
3	A1	46.4			
	A2	66.6			
	A3	46.1			
	A4	40.0			
	Mean	49.8	9.3	10.65	0.99
	S.D.	11.6	6.2		
	n	4	8		
15	A1	48.8			
	A2	40.8			
	A3	47.2			
	A4	54.0			
	Mean	47.7	9.3	10.10	0.99
	S.D.	5.4	6.2		
	n	4	8		
16	A1	21.4			
	A2	5.0			
	A3	5.0			
	A4	18.4			
	Mean	12.5	9.3	0.83	NA
	S.D.	8.7	6.2		
	n	4	8		
17	A1	46.4			
	A2	29.4			
	A3	39.0			
	A4	32.8			
	Mean	36.9	9.3	7.26	0.99
	S.D.	7.5	6.2		
	n	4	8		

(1) Transfer blank = 37 ug/l
(2) Based on one-tailed test,
7 degrees of freedom @ 0.99 and 13 wells; t = 5.276
(3) Detection limit = 10 ug/l

WELL WATER , SEPTEMBER 1987
TOH, AM-Test Data (ug/l) 09-02-87

Well Number	Sample Number	TOH	Up-gradiant	t	Sig.
18*	A1	26.0			
15 Dup.	A2	24.2			
	A3	20.4			
	A4	30.2			
	Mean	25.2	9.3	4.19NA	
	S.D.	4.1	6.2		
	n	4	8		
19*	A1	50.2			
Res.	A2	30.6			
	A3	21.6			
	A4	26.2			
	Mean	32.2	9.3	6.02	0.99
	S.D.	12.6	6.2		
	n	4.0	8.0		
21	A1	19.6			
	A2	22.0			
	A3	16.0			
	A4	16.8			
	Mean	18.6	9.3	2.45NA	
	S.D.	2.7	6.2		
	n	4	8		
22	A1	26.4			
	A2	22.6			
	A3	14.8			
	A4	20.0			
	Mean	21.5	9.3	3.20NA	
	S.D.	5.7	6.2		
	n	4	8		
23	A1	14.2			
	A2	11.2			
	A3	14.0			
	A4	5.0			
	Mean	11.1	9.3	0.48NA	
	S.D.	4.3	6.2		
	n	4	8		
24	A1	41.8			
	A2	34.0			
	A3	25.4			
	A4	23.6			
	Mean	31.2	9.3	5.77	0.99
	S.D.	8.4	6.2		
	n	4	8		

WELL W.TER , SEPTEMBER 1987
TOH, AM-Test Dat.. (ug/l) 09-02-87

Well Number	Sample Number	TOH	Up-gradiant	t	Sig.
31	A1	35.6			
	A2	34.8			
	A3	32.2			
	A4	21.6			
	Mean	31.1	9.3	5.73	0.99
	S.D.	6.5	6.2		
	n	4	8		
32	A1	19.6			
	A2	10.6			
	A3	16.0			
	A4	20.4			
	Mean	16.7	9.3	1.94NA	
	S.D.	4.5	6.2		
	n	4	8		
33	A1	13.2			
	A2	[illegible].0			
	A3	[illegible].0			
	A4	5.0			
	Mean	7.1	9.3	-[illegible].59NA	
	S.D.	4.1	6.2		
	n	4	8		

Up-gradiant, Well 2 and 31					
	Mean	45.5			
	S.D.	17.6			
	n	8.0			
13	A1	13.2			
	A2	5.0			
	A3	5.0			
	A4	5.0			
	Mean	7.1	9.3	-0.25NA	
	S.D.	4.1	6.2		

Year Upgradiant Results	TOH	Sep S.D.
		5.17
		6.21
		11.60
Aug 86, Well 2	14.00	5.44
Aug 86, Well 31	13.00	8.69
Oct 86; Well 2	11.00	7.48
Oct 86, Well 31	5.00	2.74
Dec 86, Well 2	5.00	5.66
Dec 86, Well 31	8.00	4.29
Apr 87, Well 2	11.6	8.40
Apr 87, Well 31	6.6	6.47
		4.46
Year Mean	9.28	4.10
Year S.D. 3.58	6.21	
Year n	8	
Average of Sept. S.D.	6.21	

* Results for Well 18 are duplicate samples obtained from Well 15.

WELL WATER , SEPTEMBER 1987

TOH, AM-Test Data (ug/l) 09-02-87

Well Number	Sample Number	TOH	Up-gradiant	t	Sig. (1)
1	A1	5.0			
	A2	12.0			
	A3	5.0			
	A4	15.0			
	Mean	9.4	16.5	-0.71	NA
	S.D.	5.2	17.0		
	n	4	10		
2	A1	53.4			
	A2	62.0			
	A3	67.6			
	A4	56.8			
	Mean	60.0	16.5	4.31	NA
	S.D.	6.2	17.0		
	n	4.0	10		
3	A1	46.4			
	A2	66.6			
	A3	46.1			
	A4	40.0			
	Mean	49.8	16.5	3.30	NA
	S.D.	11.6	17.0		
	n	4	10		
15	A1	48.8			
	A2	40.8			
	A3	47.2			
	A4	54.0			
	Mean	47.7	16.5	3.09	NA
	S.D.	5.4	17.0		
	n	4	10		
16	A1	21.4			
	A2	5.0			
	A3	5.0			
	A4	18.4			
	Mean	12.5	16.5	-0.40	NA
	S.D.	8.7	17.0		
	n	4	10		
17	A1	46.4			
	A2	29.4			
	A3	39.0			
	A4	32.8			
	Mean	36.9	16.5	2.02	NA
	S.D.	7.5	17.0		
	n	4	10		

(1) Transfer blank = 37 ug/l
(2) Based on one-tailed test,
7 degrees of freedom @ 0.99 and 13 wells; t = 5.276
(3) Detection limit = 10 ug/l

WELL WATER , SEPTEMBER 1987
TOH, AM-Test Data (ug/l) 09-02-87

Well Number	Sample Number	TOH	Up-gradiant	t	Sig.
18*	A1	26.0			
15 Dup.	A2	24.2			
	A3	20.4			
	A4	30.2			
	Mean	25.2	16.5		0.86NA
	S.D.	4.1	17.0		
	n	4	10		
19*	A1	50.2			
Res.	A2	30.6			
	A3	21.6			
	A4	26.2			
	Mean	32.2	16.5		1.55NA
	S.D.	12.6	17.0		
	n	4.0	10		
21	A1	19.6			
	A2	22.0			
	A3	16.0			
	A4	16.8			
	Mean	18.6	16.5		0.21NA
	S.D.	2.7	17.0		
	n	4	10		
22	A1	28.4			
	A2	22.6			
	A3	14.8			
	A4	20.0			
	Mean	21.5	16.5		0.49NA
	S.D.	5.7	17.0		
	n	4	10		
23	A1	14.2			
	A2	11.2			
	A3	14.0			
	A4	5.0			
	Mean	11.1	16.5		-0.54NA
	S.D.	4.3	17.0		
	n	4	10		
24	A1	41.8			
	A2	34.0			
	A3	25.4			
	A4	23.6			
	Mean	31.2	16.5		1.46NA
	S.D.	8.4	17.0		
	n	4	10		

WELL W.TER , SEPTEMBER 1987

TOH, AM-Test Dati. (ug/l) 09-02-87

Well Number	Sample Number	TOH	Up-gradiant	t	Sig.
31	A1	35.6			
	A2	34.8			
	A3	32.2			
	A4	21.6			
	Mean	31.1	16.5	1.44	NA
	S.D.	6.5	17.0		
	n	4	10		
32	A1	19.6			
	A2	10.6			
	A3	16.0			
	A4	20.4			
	Mean	16.7	16.5	0.01	NA
	S.D.	4.5	17.0		
	n	4	10		
33	A1	13.2			
	A2	5.0			
	A3	5.0			
	A4	5.0			
	Mean	7.1	16.5	-0.94	NA
	S.D.	4.1	17.0		
	n	4	10		

Up-gradiant, Well 2 and 31

	Mean	45.5			
	S.D.	17.6			
	n	8.0			
13	A1	13.2			
	A2	5.0			
	A3	5.0			
	A4	5.0			
	Mean	7.1	16.5	-0.53	NA
	S.D.	4.1	17.0		
			10	Sep S.D.	5.17
	Sep 87, Well 2		60.00		6.21
	Sep 87, Well 31		31.10		11.60
	Aug 86, Well 2		14.00		5.44
	Aug 86, Well 31		13.00		8.69
	Oct 86, Well 2		11.00		7.48
	Oct 86, Well 31		5.00		2.74
	Dec 86, Well 2		5.00		5.66
	Dec 86, Well 31		8.00		4.29
	Apr 87, Well 2		11.60		8.40
	Apr 87, Well 31		6.60		6.47
					4.46
	Year Mean		16.53		4.10
	Year S.D.	17.04	17.04		
	Year n		10		

Average of Sept. S.D. 6.21

* Results for Well 18 are duplicate samples obtained from Well 15.

WELL WATER , SEPTEMBER 1987

Purgeable Aromatics (ug/l) 09-02-87

Well Number	Benzene	Toluene	Ethyl Benzene	Xylenes m,p	Xylenes o
1	ND	ND	ND	ND	ND
2	ND	ND	ND	ND	ND
3	ND	ND	ND	ND	ND
15	ND	ND	ND	ND	ND
16	ND	ND	ND	ND	ND
17	ND	ND	ND	ND	ND
21	ND	ND	ND	ND	ND
22	ND	ND	ND	ND	ND
23	ND	ND	ND	ND	ND
24	ND	ND	ND	ND	ND
31	ND	ND	ND	ND	ND
32	ND	ND	ND	ND	ND
33	ND	ND	ND	ND	ND
18* (Dup. of 15)	ND	ND	ND	ND	ND
19* (Res.)	ND	ND	ND	ND	ND
Trip Blank	ND	ND	ND	ND	ND
13	ND	ND	ND	ND	ND
Detection Limit	0.01	0.01	0.01	0.01	0.01

* Results for Well 18 are duplicate samples obtained from Well 15.
Results for Well 19 are for the Reservoir water.

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Dissolved Metals (mg/l) 09-02-87

Well Number	Cr	Pb	Ni	Fe	Zn	Mn
1	0.0222	0.002	0.015	0.24	0.023	<0.030
2	0.0030	0.003	0.008	0.39	0.040	0.080
3	0.0030	0.003	0.004	<0.05	0.015	0.080
15	0.0019	0.001	0.001	0.20	0.023	0.240
16	0.0016	<0.001	0.004	0.10	0.015	0.042
17	0.0056	0.007	0.518	0.08	0.032	0.061
21	0.0030	0.011	0.009	0.01	0.023	<0.03
	0.0036				0.026	<0.03
22	0.0062	<0.001	0.007	0.10	0.320	<0.03
23	0.0067	0.004	0.001	0.16	0.043	<0.03
24	0.0400	0.001	0.038	0.31	0.034	0.200
31	0.0100	0.003	0.013	2.64	0.032	0.460
32	0.0010	0.002	0.007	0.08	0.035	<0.03
33	0.0028	0.002	0.009	0.14	0.035	<0.03
18* (Dup. of 15)	0.0102	0.021	0.004	0.78	0.066	0.240
19* (Res.)	0.0042	.002	0.001	0.12	0.017	<0.03
Trip Blank	0.0013	0.003	0.007	0.10	0.040	<0.03
13	0.0030	0.003	0.004	<0.05	0.049	0.042
Detection Limit	0.0005	0.001	0.001	0.05	0.003	0.03

* Results for Well 18 are duplicate samples obtained from Well 15.
Results for Well 19 are for the Reservoir water.

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Non-Metals (mg/l) 09-02-87

Well Number	Phenol	Ammonia	Sulfate	Nitrate + Nitrite	Nitrite
1	<.008	2.000	19.7	2.240	0.765
2	<.008	0.363	6.9	0.023	0.006
	<.008				
3	<.008	1.240	52.8	0.026	0.007
				0.026	
15	<.008	4.340	47.6	<0.010	<0.010
					<0.010
16	<.008	1.030	30.8	0.036	0.016
17	<.008	0.060	147.0	0.290	0.009
		0.059			
21	<.008	0.015	69.3	0.124	0.004
22	<.008	<0.005	847.0	0.052	<0.001
		<0.005			
23	<.008	<0.005	132.0	0.019	<0.001
					<0.001
24	<.008	0.007	168.0	0.439	0.004
				0.443	
31	<.008	0.109	156.0	<0.010	0.003
32	<.008	<0.005	119.0	0.966	0.003
			123.0		
33	<.008	0.033	102.0	0.232	0.004
18* (Dup. of 15)	<.008	0.412	47.0	<.010	<0.001
19* (Res.)	<.008	0.034	6.6	0.075	<0.001
Trip Blank	<.008	0.026	<1.0	<.010	<0.001
13	<.008	0.064	206.0	0.19	0.015
Detection Limit	0.008	0.005	1.0	0.010	0.001

* Results for Well 18 are duplicate samples obtained from Well 15.
Results for Well 19 are for the Reservoir wat