April 92
WA 6197
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WORKPLAN FOR CONDUCTING SWMU 11 PHASE II RFI ACTIVITIES, TEXACO PUGET SOUND PLANT, ANACORTES, WASHINGTON

prepared for

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RCRA PERMITS SECTION

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1.0 SCOPE OF WORK

The RFI workplan for SWMU 11 (the Shipping Basin) outlines specific objectives to be met during the RFI. The principal objective of the subject RFI is to determine if a release of hazardous waste or hazardous constituents has occurred from the Solid Waste Management Unit referred to as SWMU 11. To meet this objective, Texaco has made use of drilling, soil and groundwater sampling, bail and pump testing, and mapping. At the conclusion of the first round of RFI activities, Texaco has determined that the following conditions exist at SWMU 11:

- groundwater is flowing in a southwesterly direction beneath SWMU 11
- volatile organic compounds (VOCs) have been detected in groundwater monitoring wells located mainly along the south side of the basin — this includes halogenated organics
- semivolatile organic compounds (SVOCs) have been detected in groundwater monitoring wells located along the south and west sides of the basin
- Skinner list trace metals were detected in virtually every monitoring well at SWMU 11
- floating immiscible layers (FILs) have been detected in three groundwater monitoring wells located along the south and west sides of the basin: W-59, -63, and -64

As a result of a post-Phase I meeting between EPA and Texaco, a number of RFI data deficiencies were identified. Issues deemed to be unresolved at the conclusion of the meeting included:

1. Further defining deeper flow paths in the subsurface.
2. Completing the SWMU 11 bail/slug test database by conducting tests on all 60- and 90-series monitoring wells.
3. As part of an Interim Measures action, installing a free-phase hydrocarbon-recovery system in wells W-59 and W-64.

Texaco has prepared this workplan in response to these agreed-upon data deficiencies. Specific objectives of the Phase II investigation include the following:

- install a deep well to a depth not to exceed 200 ft
- evaluate data collected from the deep well installation exercise to evaluate the optimal number and placement of additional wells for further deep subsurface characterization
- conduct bail/slug tests on the 60-series wells, and on the 90-series groundwater monitoring wells that were installed in 1991
- install a dual-pump hydrocarbon-recovery system in wells W-59 and W-64 and begin hydrocarbon-recovery operations

2.0 ACTIVITIES

The field program includes the following activities: (1) drill and install a deep well to a depth not to exceed 200 ft, (2) conduct bail tests on each 60- and 90-series groundwater monitoring well, and (3) install a dual-pump hydrocarbon-recovery system in wells W-59 and W-64. The number and placement of additional wells will be assessed following evaluation of the data collected during the first deep boring and subsequent sampling activities. Each of these tasks is discussed in detail in the following sections.

2.1 TASK 1 — DEEP WELL INSTALLATION

The principal goals of installing the deep well are the collection of stratigraphic information with depth, and the collection of data pertaining to contaminated soil/rock or groundwater.

The proposed drilling location for the deep well is shown in Figure 1. This location was chosen based on EPA concerns regarding contaminant concentrations in groundwater samples collected from wells along the south margin of the basin. Since groundwater flows in a west-southwest direction beneath SWMU 11, and since the majority of the groundwater contamination is located on the south and west sides of the basin, this location has been chosen to maximize the potential for intercepting the most likely flow path of the plume.

The air-rotary drilling technique will be used to drill and install the deep well. This methodology is entirely analogous to the mud-rotary technique with the exception that, instead of drilling mud, compressed air is forced down through the drill pipe and up inside the annulus (i.e., the region between the borehole walls and the drill pipe). Thus, the air-rotary method removes cuttings from the hole by entraining them in an air stream that is lifted to the surface.

The air-rotary technique is preferred over hollow-stem augering and mud-rotary due to its speed and depth capabilities, and to the fact that it is possible to discern areas of saturation by evaluating recovered core samples. With hollow-stem augering, the practical depth limit is 100 ft. Although the mud-rotary technique can be used to drill holes to comparable depths as the air-rotary technique, its main disadvantage is that the mud inside the borehole masks the effects of soil saturation, and it is very difficult to determine if a saturated length of core is a result of drilling mud invasion or naturally occurring groundwater.

A steel or PVC casing may have to be inserted into the borehole concurrent with drilling. This step may be necessary to ensure that the hole does not collapse upon removal of the drill string.

A double completion will be necessary as a result of the documented contamination in the subsurface. To avoid introducing contaminants to a clean portion of the underlying aquifer, a large-diameter drilling bit will be used to advance the borehole through the known layer of contamination, and a casing will be grouted in place. Once the grout has cured for a sufficiently long period of time, the hole will be re-entered with a smaller-diameter bit and one that is small enough to permit entry into the newly installed casing.

Core samples will be collected using a 3-inch-diameter core barrel. A typical core barrel can be used to recover a core sample of rock and/or soil in 10-ft lengths. Texaco anticipates collecting a number of these 10-ft cores from the deep well. In the event that a core barrel is unavailable or cannot be used, alternative sampling methods aimed at providing the same data, such as split-spoon sampling, will be employed.

If a core barrel cannot be used, rather than collect continuous samples, which is a very time-consuming process, the sampling scheme will probably consist of collecting samples every 2.5 ft. The on-site hydrogeologist may increase the sampling frequency depending on progress and field conditions. Based on knowledge of surrounding geology, it is possible that the drilling rig may encounter bedrock prior to reaching 200 ft. However, the most appropriate zone in which to terminate drilling and begin completion of the well will be selected by evaluating the recovered cores/samples. Particular attention will be paid to zones of apparent increased or decreased hydraulic conductivity relative to that of the typical strata encountered during boring.

Recovered samples will be screened in the field with a photoionization detector (PID) for the presence of organic vapors. Samples that are found to have a PID reading of greater than or equal to 1 part per million (ppm) above ambient conditions will be immediately placed into sample containers for possible submission to an analytical laboratory for chemical analysis. Additionally, samples that are noted to be heavily stained or laden with free-phase hydrocarbons will be placed into containers for potential laboratory analysis. The sample containing the highest recorded PID reading will be returned to a laboratory for analysis. The analytical suite will consist of the following:

- Skinner list volatiles plus 1,1,1-trichloroethane and trichloroethene (EPA method 8240)
- Skinner list semivolatiles (EPA method 8270)
- Skinner list metals, including manganese

- total petroleum hydrocarbons (TPH)

In the event that the air-rotary drilling rig has difficulty in penetrating particularly troublesome layers, such as coarse-grained gravel or cobbles, the on-site hydrogeologist will make a determination in the field regarding proceeding with the drilling exercise. If difficult drilling conditions are encountered, the first remedial action to be undertaken will be to abandon the hole and move the rig to a nearby location and resume drilling; the abandoned hole will be pressure-grouted to the surface. If it appears that a given area continues to exhibit exceedingly difficult drilling conditions, the on-site hydrogeologist may opt to discontinue drilling in the area. This decision will be made only after Texaco consults with the drilling contractor. Texaco may recommend the deployment of a different type of rig such as a cable-tool rig if conditions warrant such an action.

The well will be completed using 2-inch I.D. schedule 40 PVC well casing and screen. After the well has been completed and developed properly, a groundwater sample will be collected and returned to a laboratory where it will be analyzed according to the following analytical specifications:

- Skinner list volatiles plus 1,1,1-trichloroethane and trichloroethene (EPA method 8240)
- Skinner list semivolatiles (EPA method 8270)
- Skinner list metals, including manganese
- total petroleum hydrocarbons (TPH)

Quality control samples will be submitted to the laboratory in the form of a duplicate sample, as well as a trip blank to be analyzed for Skinner list volatiles only.

Additionally, a geochemical investigation of cation/anion ratios will be undertaken. Ionic concentrations in groundwater collected from the deep well will be compared with samples collected from the 60- and 90-series wells during the next RFI sampling exercise.

A schedule for implementation of this drilling plan is presented in Figure 2.

2.2 TASK 2 — BAIL TESTING

Texaco has performed bail and/or slug tests on all pre-90-series monitoring wells at SWMU 11. These tests were conducted using an electronic depth-to-water meter and a stop watch. Texaco proposes using pressure transducers and data loggers to monitor groundwater levels in each 90-series well to accurately record water level changes during a bail test. A bail test is conducted when one removes a volume of water from a well and monitors the resulting water level recovery with time. The converse of the bail test is the slug test, which is performed when water (or a solid object) is added to a well. To ensure uniformity in data sets, Texaco will retest each 60-series well using pressure transducers and data loggers. By having bail tests that were conducted using identical equipment, comparisons of hydraulic conductivity between wells will be much more unambiguous and less subject to misinterpretation on the basis of false data.

The end result of this task will be a table of hydraulic conductivity values for the geologic materials opposite each 60- and 90-series well screen. All data obtained from the tests will be presented to EPA in the form of graphs and tables of the raw and processed data. These data could prove useful in evaluating the potential migration of hazardous constituents from the Shipping Basin as hydraulic conductivity is a key component of groundwater velocity.

2.3 TASK 3 — EVALUATION OF DEEP WELL DATA

EPA is concerned about the potential for migration of dense, nonaqueous phase liquids (DNAPLs). EPA bases its concern on the observance of detections of chlorinated hydrocarbons in soil and groundwater samples in and around the Shipping Basin; these compounds consist of 1,1,1-trichloroethane (TCA), 1,2-dichloroethane (DCA), and trichloroethene (TCE). Texaco believes that the potential for existence of DNAPLs at depth below the impoundment is low for the following reasons:

- the concentrations of chlorinated hydrocarbons in soil and groundwater samples are low, in the parts per billion range
- the solubility limit of the detected chlorinated hydrocarbons is very low in comparison with the concentration levels
- if chlorinated solvents were present in free-phase conditions, one would expect to see aqueous concentrations much closer to the solubility limit
- if free-phase solvents were present, it would not be unreasonable to see residual saturation of these substances in soil samples collected from the basin floor
- the only recorded chlorinated hydrocarbon detected in basin floor soil samples (trichloroethene) was detected below the detection limit, and was a result of the TCLP.

The objective of this task is to provide EPA with a higher level of confidence in Texaco's assessment of the nature and extent of contamination associated with SWMU 11. In Texaco's opinion, this can best be accomplished by installing a deep well, collecting a groundwater sample from the well (Task 1), and making an evaluation of the optimal placement and number of wells necessary to define deeper flow paths.

It is anticipated that three deep wells, completed in the same saturated zone, will be necessary to delineate the flow direction of groundwater at depth. Texaco will notify EPA before drilling the second and third deep wells to discuss proposed well locations. Groundwater samples will be collected from each of the three wells before assessing the need for additional wells or borings. Bail tests will be conducted on the wells as outlined under Task 2 to determine the hydraulic conductivity in the vicinity of each installation.

Texaco believes that if no significant contamination is detected in the groundwater samples, and the flow direction of groundwater indicates that the wells are situated downgradient of SWMU 11, additional wells will not be necessary to characterize deeper flowpaths. In the event that the analytical results indicate that groundwater has been impacted at depth, the placement and number of additional wells will be negotiated with EPA.

2.4 TASK 4 — INSTALLATION OF INTERIM MEASURES HYDROCARBON-RECOVERY SYSTEM

Texaco has prepared a preliminary design of a dual-pump hydrocarbon-recovery system for SWMU 11. This design consists of a water-table depression pump overlain by a low-flow hydrocarbon-skimming pump. Both of these devices operate using compressed air. The action of inducing drawdown inside the well serves to induce free-phase hydrocarbon to pool inside the cone-of-depression surrounding the well, thereby making skimming of the product an easier exercise. Preliminary design drawings for the system are included in Appendix A, as well as product literature for the proposed equipment.

It is envisioned that both the water and recovered hydrocarbon will be piped to Texaco's Oily-Water Sewer (OWS) for conveyance to the Effluent Treatment Plant (ETP) for treatment/oil recovery.

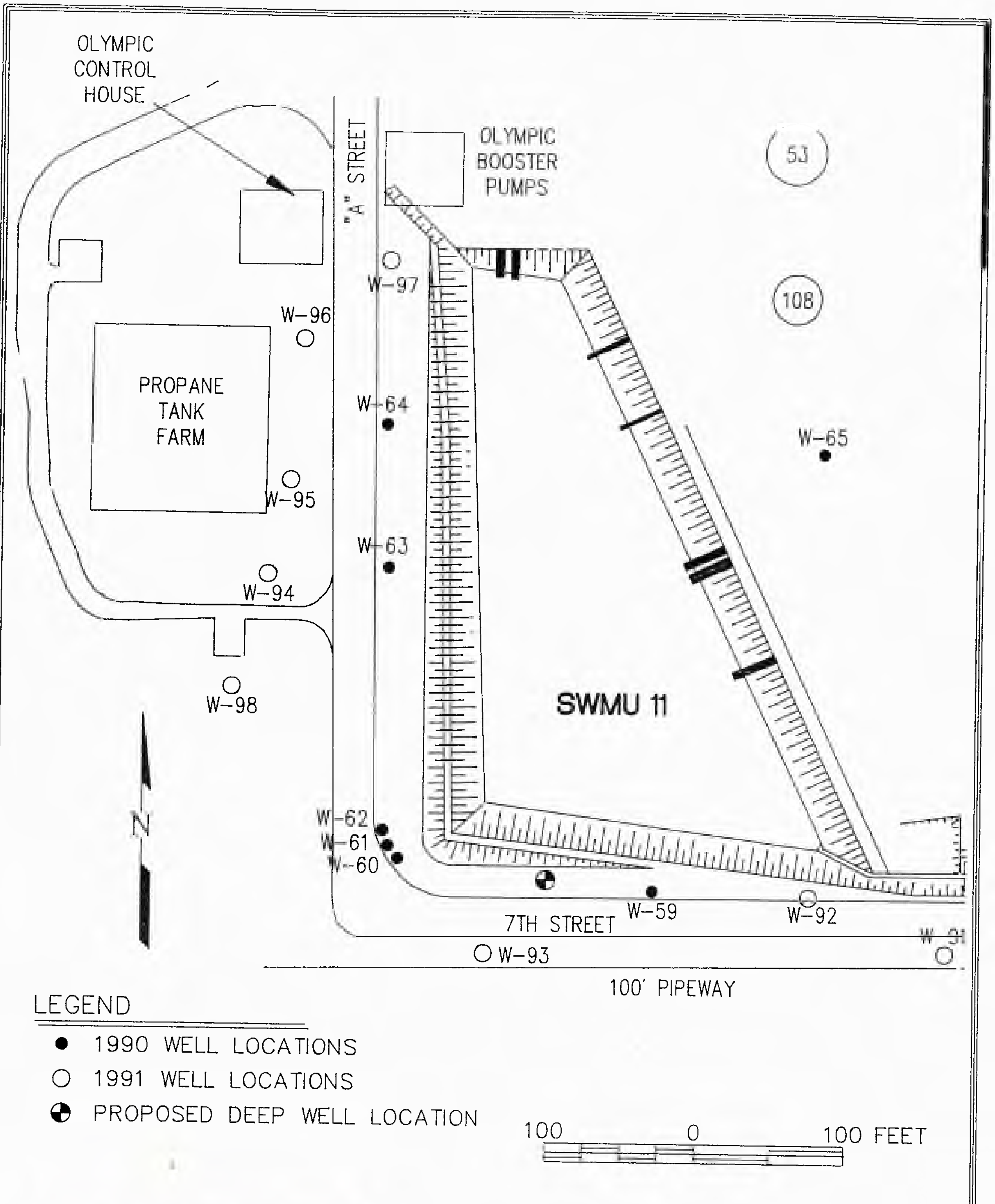
Once installed, Texaco will adjust the system for maximum recovery of hydrocarbon with a minimum of drawdown (which in turn minimizes the volume of groundwater that must be discharged to the ETP). Texaco will also develop as-built drawings of the system for their files, and will prepare an Implementation of Interim Measures report. This document will contain the following information per EPA's Corrective Action Plan (CAP):

- objectives of the interim measures — how the measure is mitigating potential threat to human health and the environment and/or is consistent with and integrated into any long-term solution at the facility
- design, construction, and maintenance requirements
- schedules for design, construction, and monitoring
- schedule for progress reports

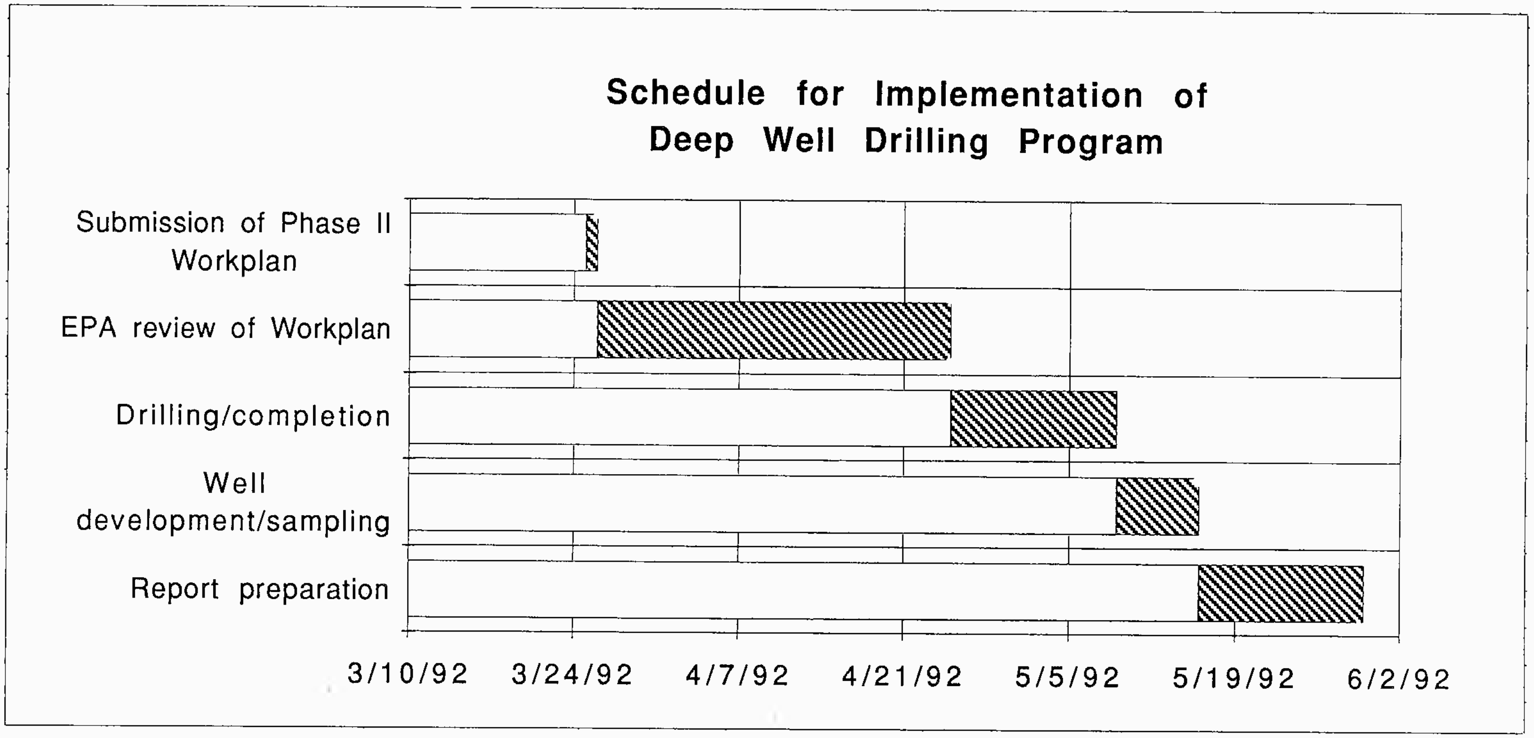
Additionally, during the initial period of operation, Texaco anticipates monitoring the system every two weeks and making adjustments if necessary for optimum performance. Finally, once the system has been adjusted and is operating consistently, Texaco will make monthly readings of the totalizing flow meters and maintain a database of cumulative volume pumped (for both oil and water) versus time. Additional performance monitoring criteria will include water levels in adjacent monitoring wells, and analytical data from quarterly RFI sampling activities. These data will be used in the preparation of quarterly Interim Measures progress reports for submission to EPA.

A schedule for installation and start-up of the hydrocarbon recovery system is presented in Figure 3.

FIGURES

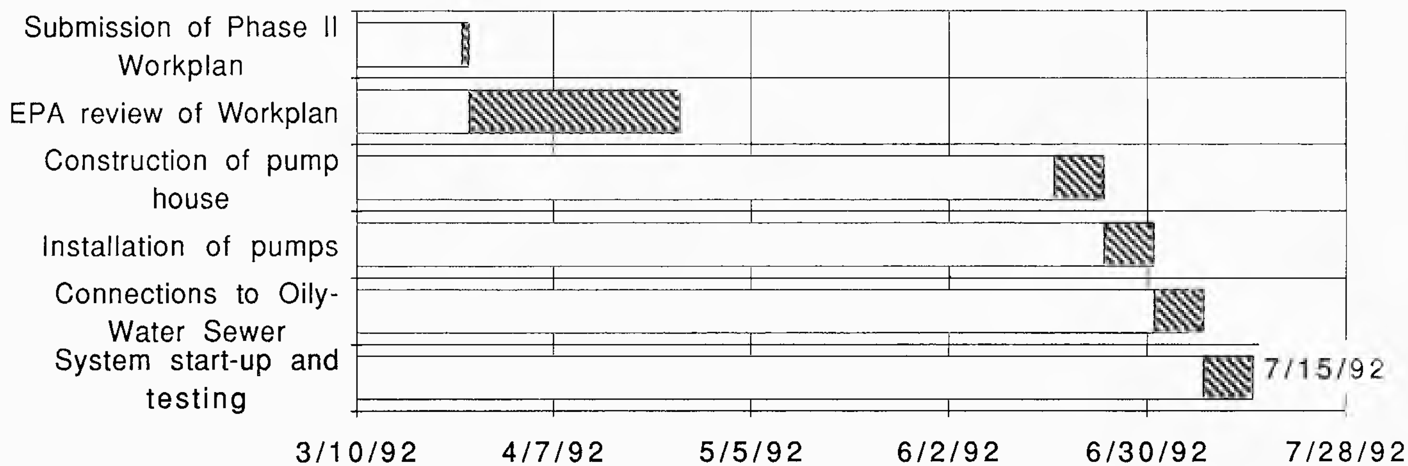


KWBES	Proposed deep well locations.
prepared for: TEXACO	PROJECT: 701091004-273 (SM110BSE)
	LOCATION: ANACORTES, WASHINGTON
	APPR: — DATE: 03/30/92
	DRAWN BY: RMM — SCALE: AS SHOWN
	DATE: 04/15/91 — FIGURE: 1



KWBES	Proposed schedule for implementation of deep well drilling program.	
prepared for: TEXACO	PROJECT: 701091004-237	
	LOCATION: ANACORTES, WASHINGTON	
	APPR:	DATE: 4/2/92
	DRAWN BY: SSA	SCALE: AS SHOWN
	DATE: 4/2/92	FIGURE: 2

Schedule for Implementation of Interim Measures Hydrocarbon Recovery System



KWBES

prepared for:

TEXACO

Proposed schedule for implementation of interim measures hydrocarbon recovery system.

PROJECT:	701091004-237		
LOCATION:	ANACORTES, WASHINGTON		
APPR:		DATE:	4/2/92
DRAWN BY:	SSA	SCALE:	AS SHOWN
DATE:	4/2/92	FIGURE:	3

APPENDIX A

APPENDIX A

Proposed hydrocarbon-recovery system design

(b) (4)

KWBES

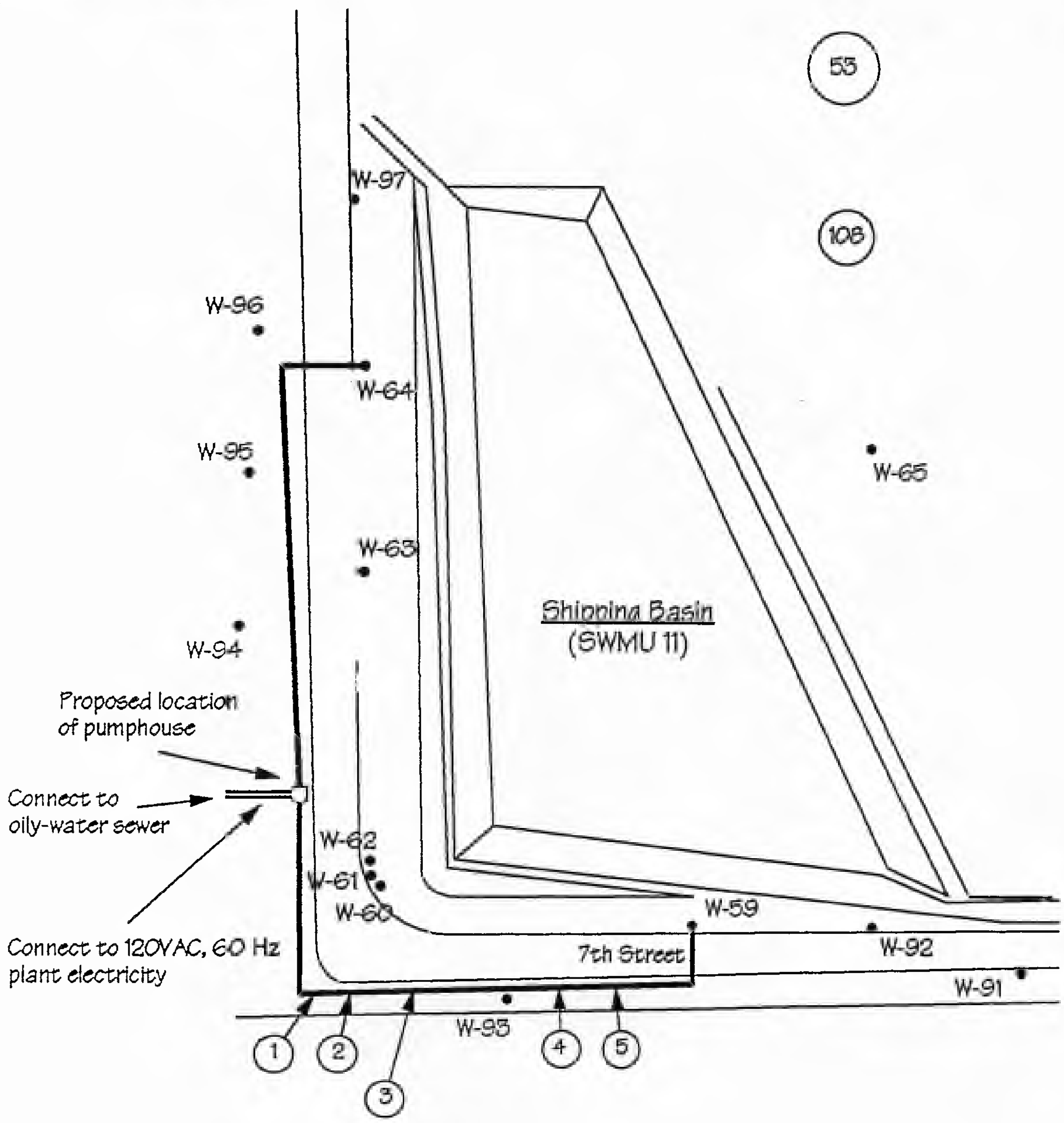
SWMU 11 typical
hydrocarbon-recovery well.

prepared for:

TEXACO

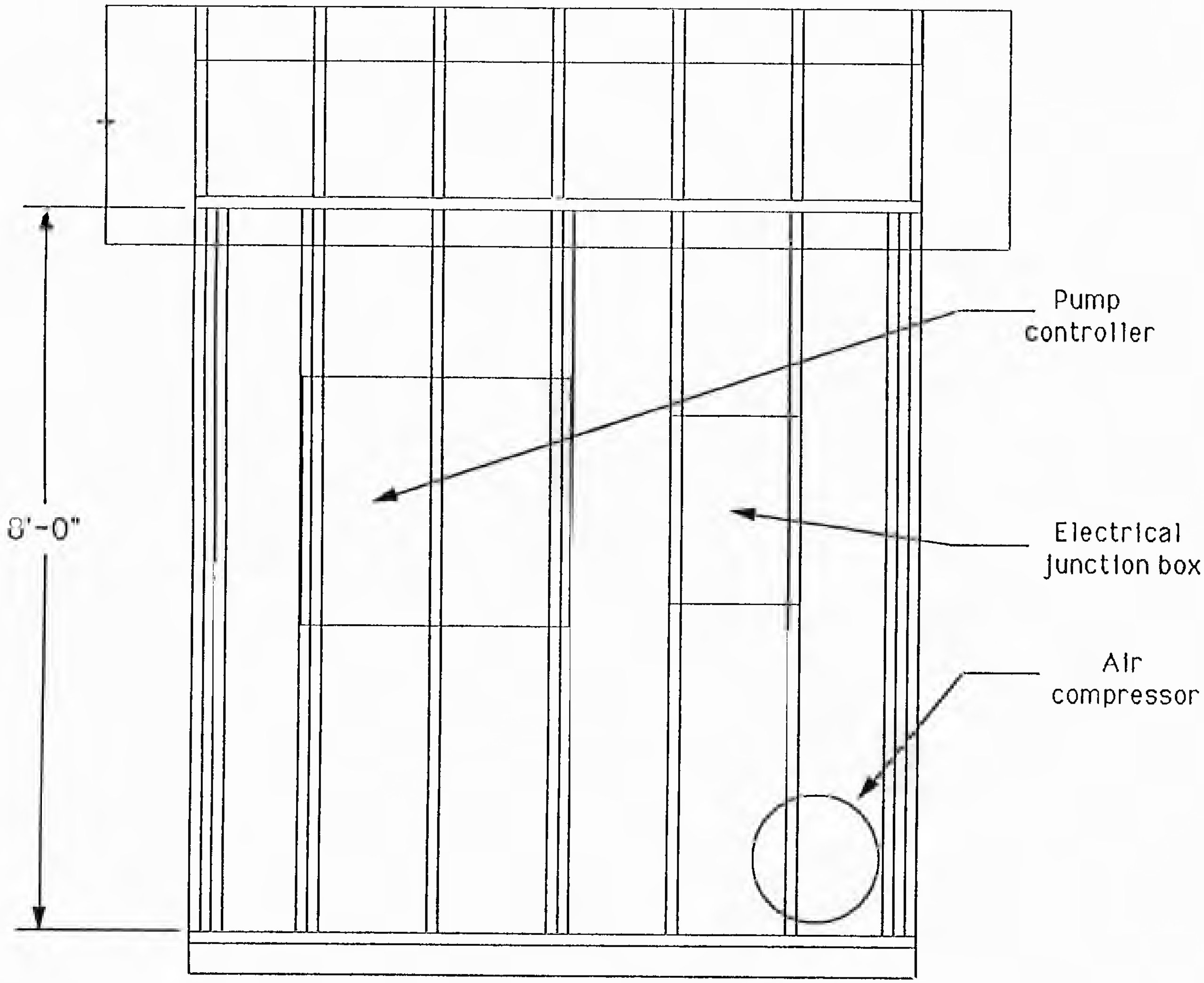
PROJECT: 701091005-237 (RECOV)	
LOCATION: ANACORTES, WASHINGTON	
APPR:	DATE: 02/12/92
DRAWN BY: RMO	SCALE: AS SHOWN
DATE: 01/29/92	FIGURE:

5	1/2" Ortac hydrocarbon discharge tubing
4	1/2" Ortac water discharge tubing
3	Teflon sensor cable
2	3/8" Nylon dual air tubing
1	3/8" Polyethylene dual air tubing
No.	Description
STOCK LIST	



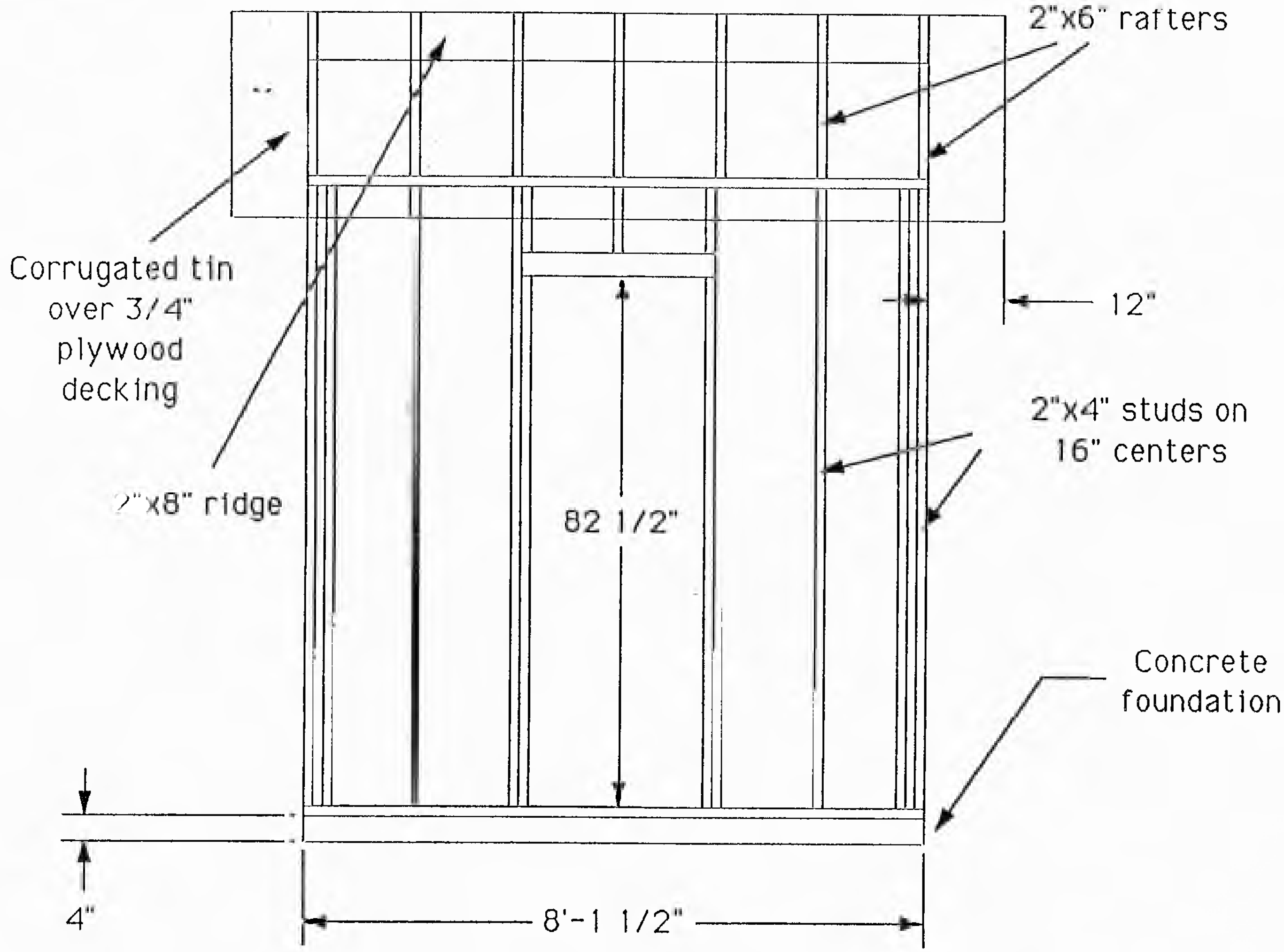
TEXACO REFINING & MARKETING, INC. Puget Sound Plant	SWMU 11 Hydrocarbon Recovery Area

PROJECT: 701091004, 271			LOCATION: ANACORTES, WASHINGTON		
K.W. BROWN ENVIRONMENTAL SERVICES					DATE: 12-13-91
APPR:			DRAWN BY:	RCS	SCALE: 1" = 100'
DATE:			DATE:		FIGURE:

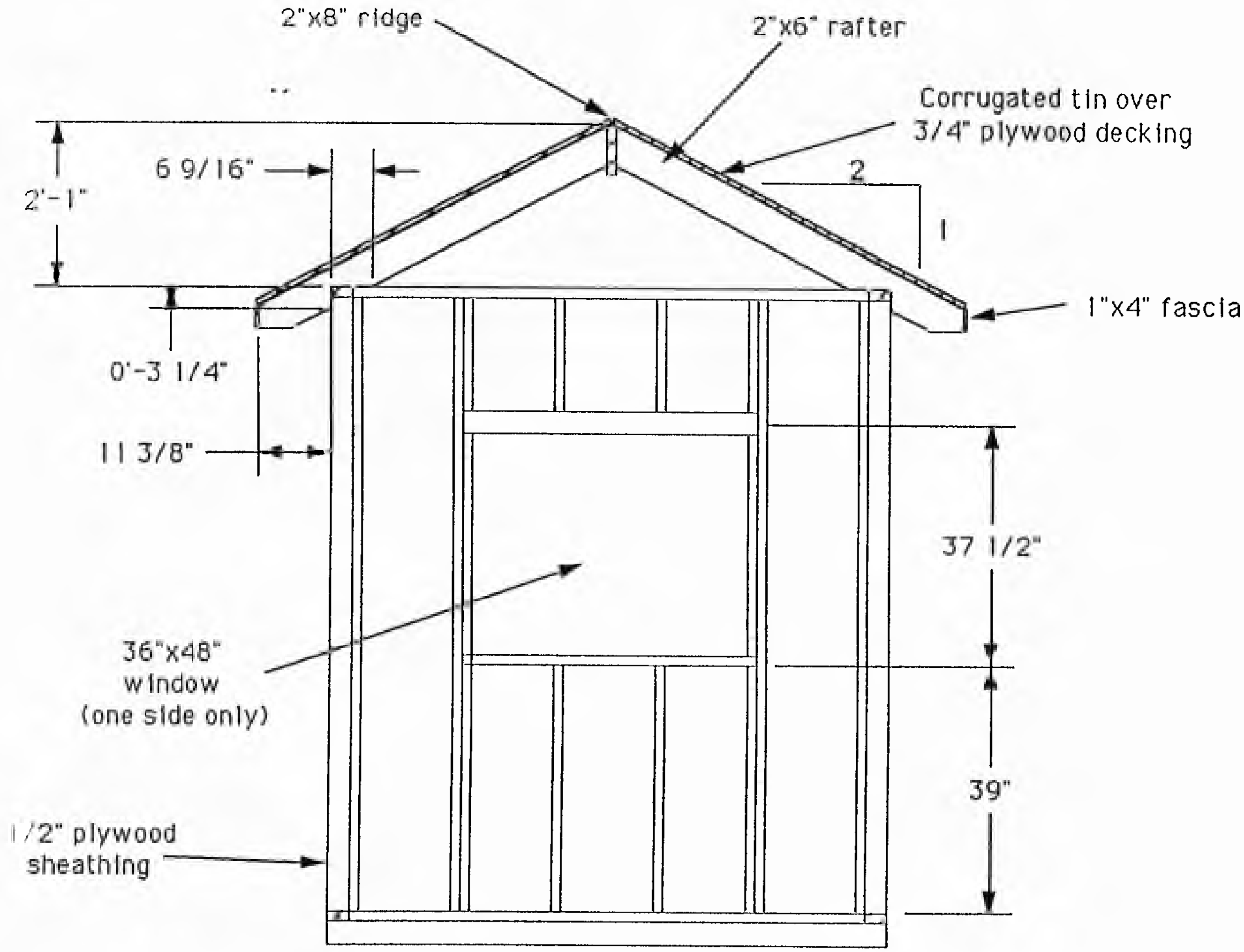


TEXACO REFINING & MARKETING, INC. Puget Sound Plant	Back View of SWMU 11 Pump House

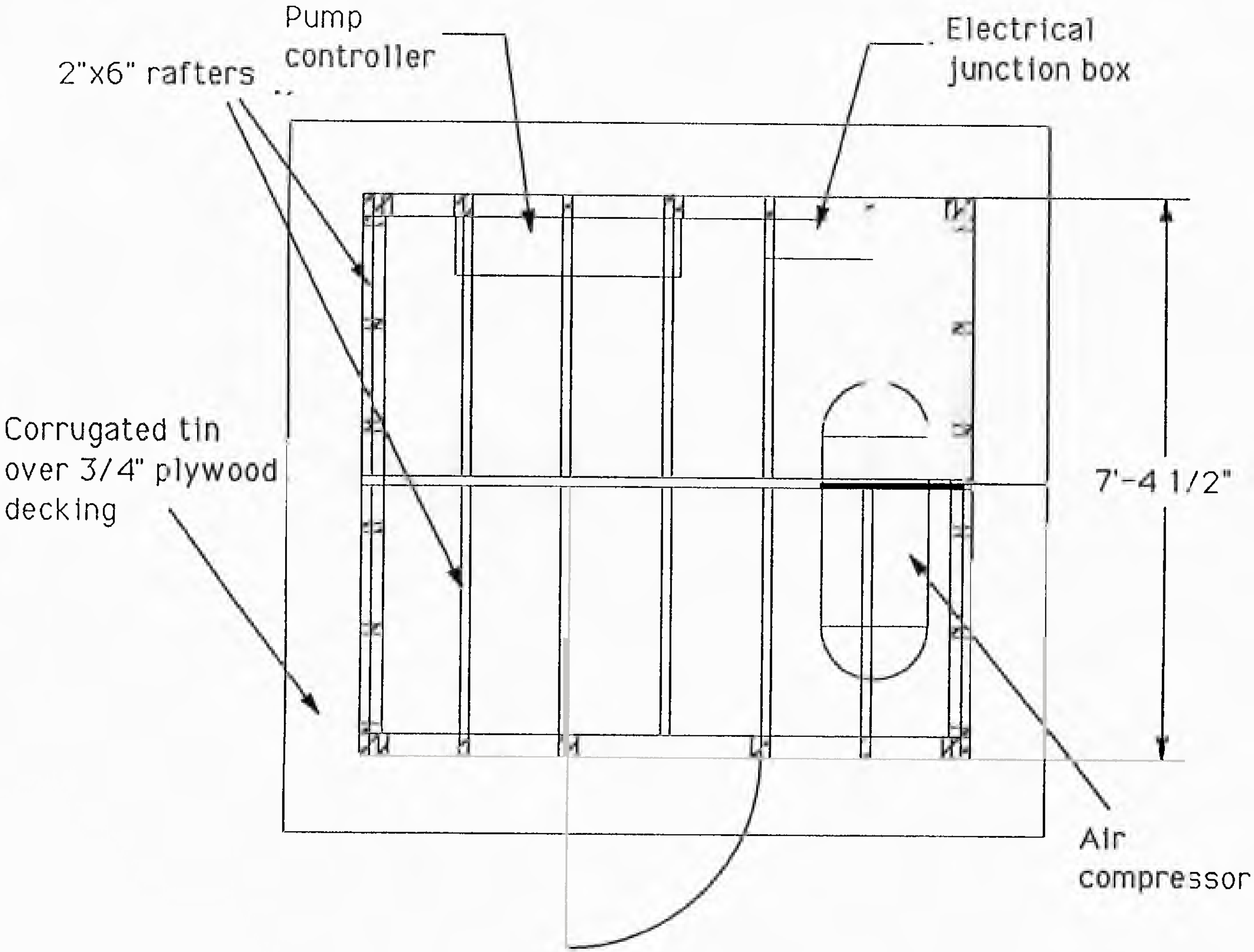
PROJECT: 701091005, 271			LOCATION: ANACORTES, WASHINGTON		
K.W. BROWN ENVIRONMENTAL SERVICES					DATE: 11-25-91
APPR:			DRAWN BY:	RCS	SCALE: 1" = 24"
DATE:			DATE:	12-12-91	FIGURE:



TEXACO REFINING & MARKETING, INC. Puget Sound Plant		Front View of SWMU 11 Pump House		
PROJECT: 701091005, 271			LOCATION: ANACORTES, WASHINGTON	
K.W. BROWN ENVIRONMENTAL SERVICES				DATE: 11-25-91
APPR:		DRAWN BY:	RCS	SCALE: 1" = 28"
DATE:		DATE:		FIGURE:



TEXACO REFINING & MARKETING, INC. Puget Sound Plant			Side View of SWMU 11 Pump House		
PROJECT: 701091005, 271			LOCATION: ANACORTES, WASHINGTON		
K.W. BROWN ENVIRONMENTAL SERVICES					DATE: 11-25-91
APPR:			DRAWN BY:	RCS	SCALE: 1" = 28"
DATE:			DATE:		FIGURE:



TEXACO REFINING & MARKETING, INC. Puget Sound Plant	Top View of SWMU 11 Pump House

PROJECT: 701091005, 271			LOCATION: ANACORTES, WASHINGTON		
K.W. BROWN ENVIRONMENTAL SERVICES					DATE: 11-25-91
APPR:			DRAWN BY:	RCS	SCALE: 1" = 28"
DATE:			DATE:		FIGURE:

THE WRIGHT MODULAR RECOVERY SYSTEM

PNEUMATIC PISTON PUMP MODEL #2020-02-DA

(b) (4)

r.e. wright associates, inc.

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SERIES 2020-2-DA PNEUMATIC CARSON PUMP FOR FLOATING HYDROCARBON RECOVERY

Specifications

(b) (4)

[redacted]

THE WRIGHT MODULAR RECOVERY SYSTEM

PNEUMATIC PISTON PUMP MODEL #2040-06-DC

(b) (4)

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SERIES 2040-06-DC PNEUMATIC CARSON PUMP FOR LOW FLOW GROUNDWATER RECOVERY

Specifications

(b) (4)

[redacted]

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Specifications

(b) (4)

THE WRIGHT MODULAR RECOVERY SYSTEM

CONTROLLER MODEL #4001-02-F

(b) (4)

[redacted]

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Specifications

(b) (4)

THE WRIGHT MODULAR RECOVERY SYSTEM

CONTROLLER MODEL #4002-04-F

(b) (4)

[redacted]

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