CLEANUP ACTION PLAN

Texaco February 22, 1991 Oil Spill
Anacortes, Washington

by

Washington Department of Ecology

May 25, 1993

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INTRODUCTION

1.1 PURPOSE

This document presents the Cleanup Action Plan for the Texaco February 22, 1991 oil spill on-land site. The Cleanup Action Plan documents the site-specific factors and analysis that led to the selection of the cleanup remedy for the site. The upland site is located on March Point at the Texaco refinery approximately three miles east of the city of Anacortes, Washington. The oil spill site resulted from the failure of a booster pump located in the northwest corner of the refinery. The pump failed during the offloading of Alaska North Slope crude oil from an offshore oil tanker. An estimated 210,000 gallons of crude oil were released at the site. Soils were impacted on Texaco property as well as adjacent property owned by Leonard Munks family, and Shell Oil Company. The southern portion of Fidalgo Bay was also affected by the spill. The cleanup decisions in this Cleanup Action Plan are based on data presented in remedial investigation and feasibility studies and interim action studies conducted by K. W. Brown Environmental Services and initial investigations carried out by Texaco Environmental Services. Much of the cleanup was completed as either an emergency action or interim action under an Agreed Order signed by Texaco and the Department of Ecology in July of 1991. Figure one shows areas of the site which still are impacted by the spill.

1.2 APPLICABILITY

This Cleanup Action Plan is applicable only to the Texaco February 22, 1991 on-land site. The cleanup levels and cleanup actions presented in this document have been developed as a result of a remediation process conducted with Department of Ecology oversight. The cleanup levels are site specific. The cleanup actions should not be considered as setting precedent for other similar sites.

Potentiality Liable Persons (PLP's) cleaning up sites independently, without Ecology oversight, may not cite numerical values of cleanup levels specified in this draft document as justification for cleanup levels in other unrelated sites. PLP's that are cleaning up sites under Ecology oversight must base cleanup levels on site specific regulatory considerations and not the numerical values presented in this CAP.

1.3 DECLARATION

The selected remedy will be protective of human health and the environment. Ecology gives preference to permanent solutions to the maximum extent where

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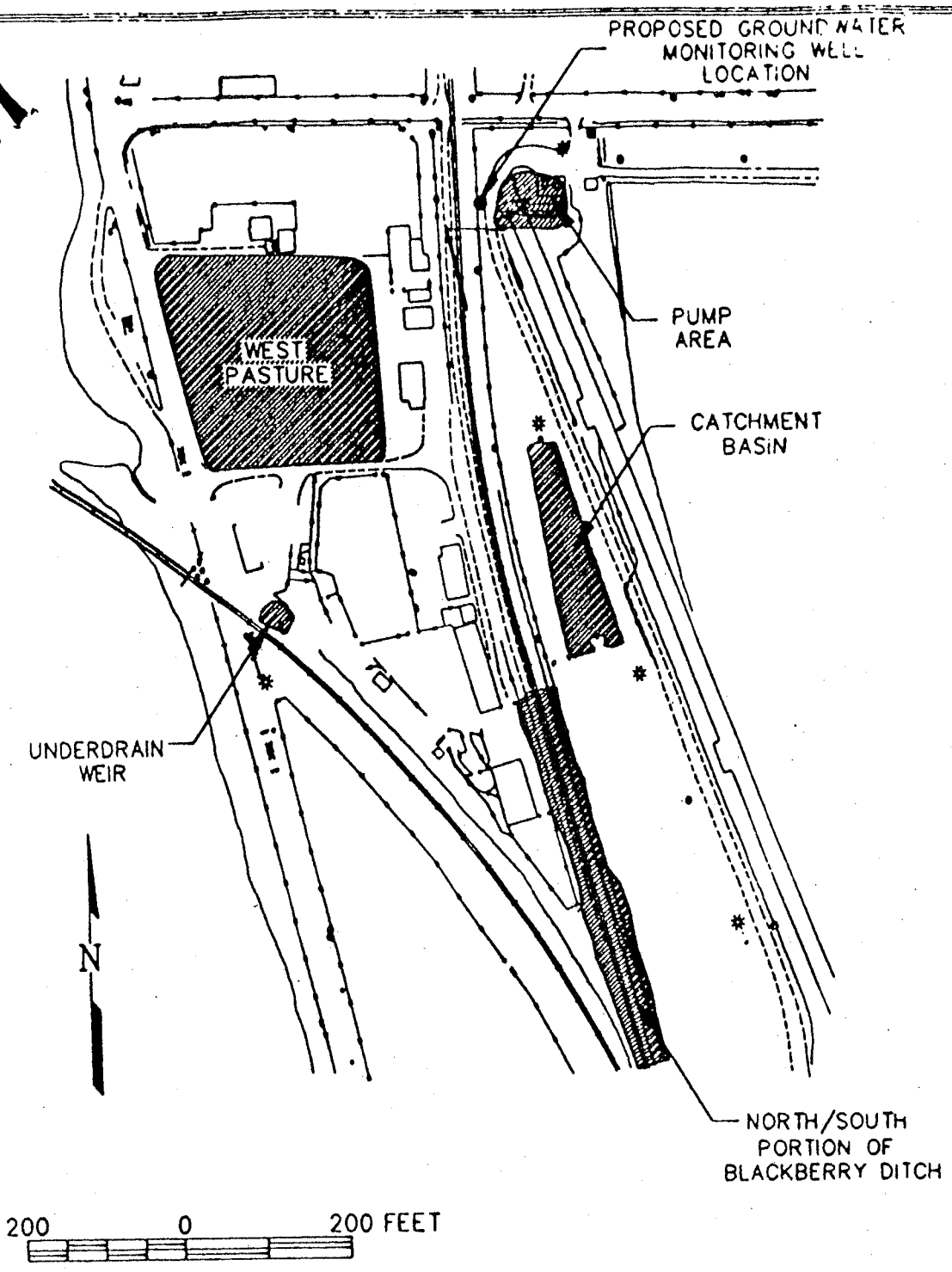

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Oil spill areas of concern.

prepared for:

PROJECT:	701092005-237 (PSPSAMP)		
LOCATION:	ANACORTES, WASHINGTON		
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DATE:	05/21/91	FIGURE:	1

practical. In this cleanup, treatment was examined and used as the primary cleanup technology proposed. Permanent treatment off site of contaminated soils was judged practicable at this site. Institutional controls along with method B cleanup standards are proposed for one small portion of the site. A summary of all cleanup alternatives which were examined during the investigative phase of the feasibility study is given in the cleanup alternative section of this CAP.

SITE DESCRIPTION AND HISTORY

2.1 SITE LOCATION

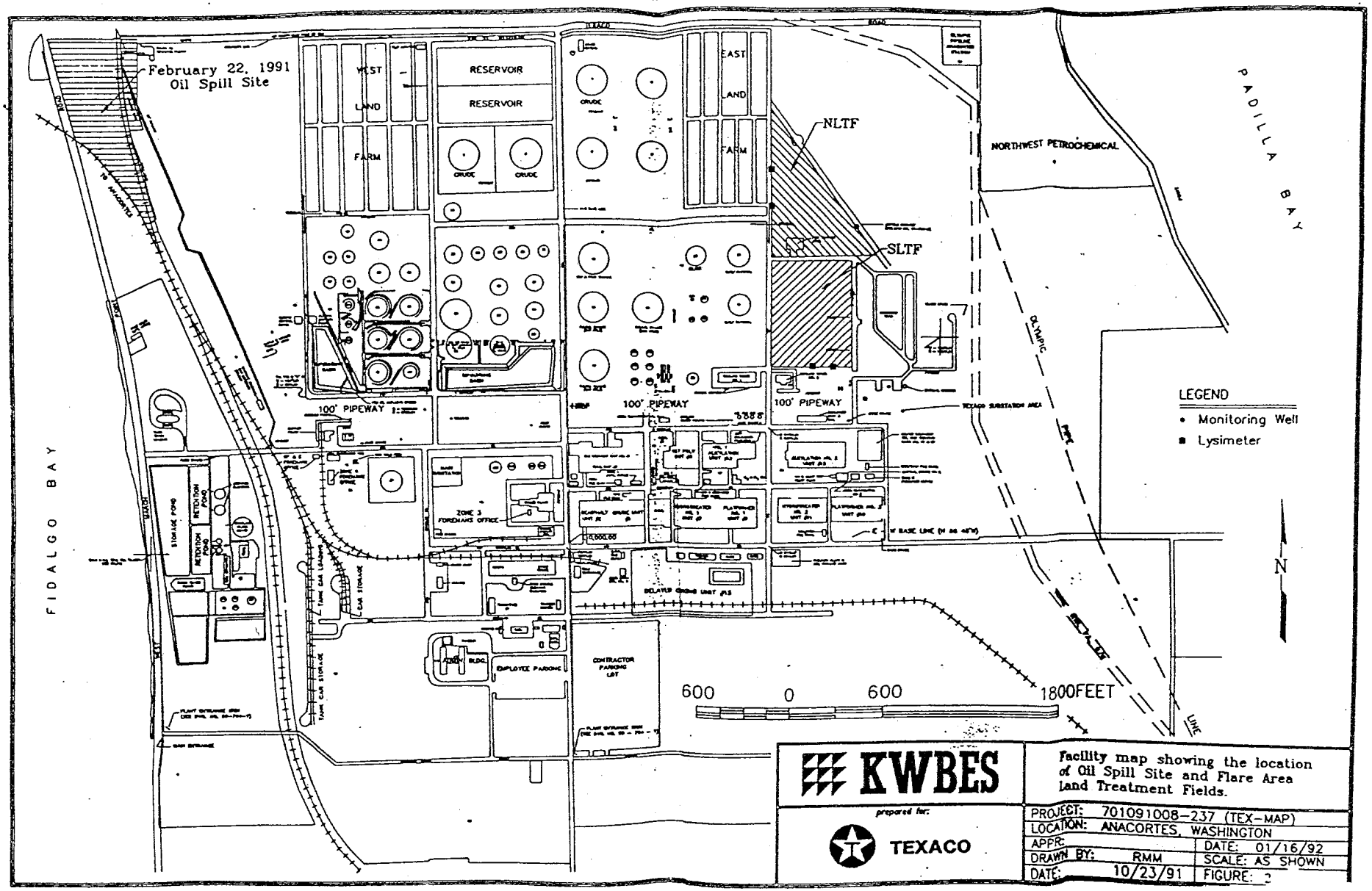
The Texaco February 22, 1991 oil spill site is located in the northwest corner of the Texaco refinery situated on March Point near Anacortes, Washington. The site is approximately 100 to 200 feet from Fidalgo Bay. The area is industrial with two large refineries, Texaco and Shell located along March Point. Figure 2 shows the site location.

2.2 SITE HISTORY

The Texaco refinery began operation in the fall of 1958. The plant operates 24 hours per day and produces a variety of marketable petroleum products. The refinery production capacity is approximately 115,000 barrels of crude oil per day. The oil spill occurred in the evening of February 22, 1991 while Alaskan North Slope crude oil was being off loaded from a tanker in Fidalgo Bay. The spill was a result of a catastrophic failure of a large crude oil litering pump. After pump failure, approximately 210,000 gallons (5000 barrels) of crude oil were released on to the environment. Soils and surface water were impacted on Texaco property as well as adjacent property owned by Mr. Leonard Munks and the Shell Oil Company. Surface drainage pathways transect the site and run directly into Fidalgo Bay. During the spill, crude oil ran from the broken pump westward across the pipeway and railroad right of way to drainage ditches located on the Munks property. The crude oil entered the Fidalgo Bay via two surface water drainage outfalls. The crude oil affected the southern portion of bay. A massive cleanup effort on Fidalgo Bay and the upland pump area was initiated immediately following the release.

Several emergency actions on the site occurred immediately following the spill. Intercepter trenches were excavated in strategic locations on the site to control hydrocarbon migration. Vacuum trucks were utilized to remove free crude oil from the trenches and other low areas on the site. An underdrain weir system was constructed in the drainage ditches surrounding the site to control the movement of crude oil into Fidalgo Bay. Visibly oiled materials from the Munks property, pump area, and service road were removed and stockpiled in a holding area in the refinery. The area was initially investigated by Texaco Environmental Services. Texaco Environmental Services completed a report documenting the impacts of the spill complete with a work plan for the investigation of the site.

In July of 1991, the Washington Department of Ecology and Texaco signed an Agreed Order that directed Texaco to prepare a remedial investigation and feasibility


February 22, 1991
Oil Spill Site
WEST LAND FARM
RESERVOIR
RESERVOIR
CRUDE
CRUDE
CRUDE
EAST LAND FARM
NLTF
SLTF
NORTHWEST PETROCHEMICAL
PADILLA BAY
FIDALGO BAY
100' PIPEWAY
100' PIPEWAY
100' PIPEWAY
OLYMPIC
PIPE LINE
LEGEND
Monitoring Well
Lysimeter
N
600
0
600
1800FEET
ZONE 3 FOREMANS OFFICE
EMPLOYEE PARKING
CONTRACTOR PARKING LOT
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Facility map showing the location of Oil Spill Site and Flare Area Land Treatment Fields.
PROJECT: 701091008-237 (TEX-MAP)
LOCATION: ANACORTES, WASHINGTON
APPR:
DATE: 01/16/92
DRAWN BY: RMM
SCALE: AS SHOWN
DATE: 10/23/91
FIGURE: 2

study on the site and complete the rapid cleanup of the oily soils on the private property of Mr. Munks. Texaco personnel and individuals from K. W. Brown and Associates completed the work directed by the Order. The Order consisted of three parts. The first section was an interim cleanup action which allowed for the rapid cleanup of the Munks residence, the second portion of the Order dealt with the bioremediation of the stockpiled nonhazardous oily soil that was placed in the refinery during the emergency action, and the third section of the Order involved the implementation of a work plan to complete the site assessment of the oil spill area and conduct an RI/FS (remedial action/feasibility study) on the affected areas of the site not remediated under the emergency and interim actions. The RI/FS Order was amended to include the cleanup of the oiled railroad right of way in October of 1991.

2.3 CURRENT STATUS AND FUTURE USE

The site is currently bordered on the east by two refineries and on the west by Fidalgo Bay. Mr. L. Munks owns a private residence on the western portion of the site. Future use of the site is unknown at this time. Mr. Munks does not plan to move his residence.

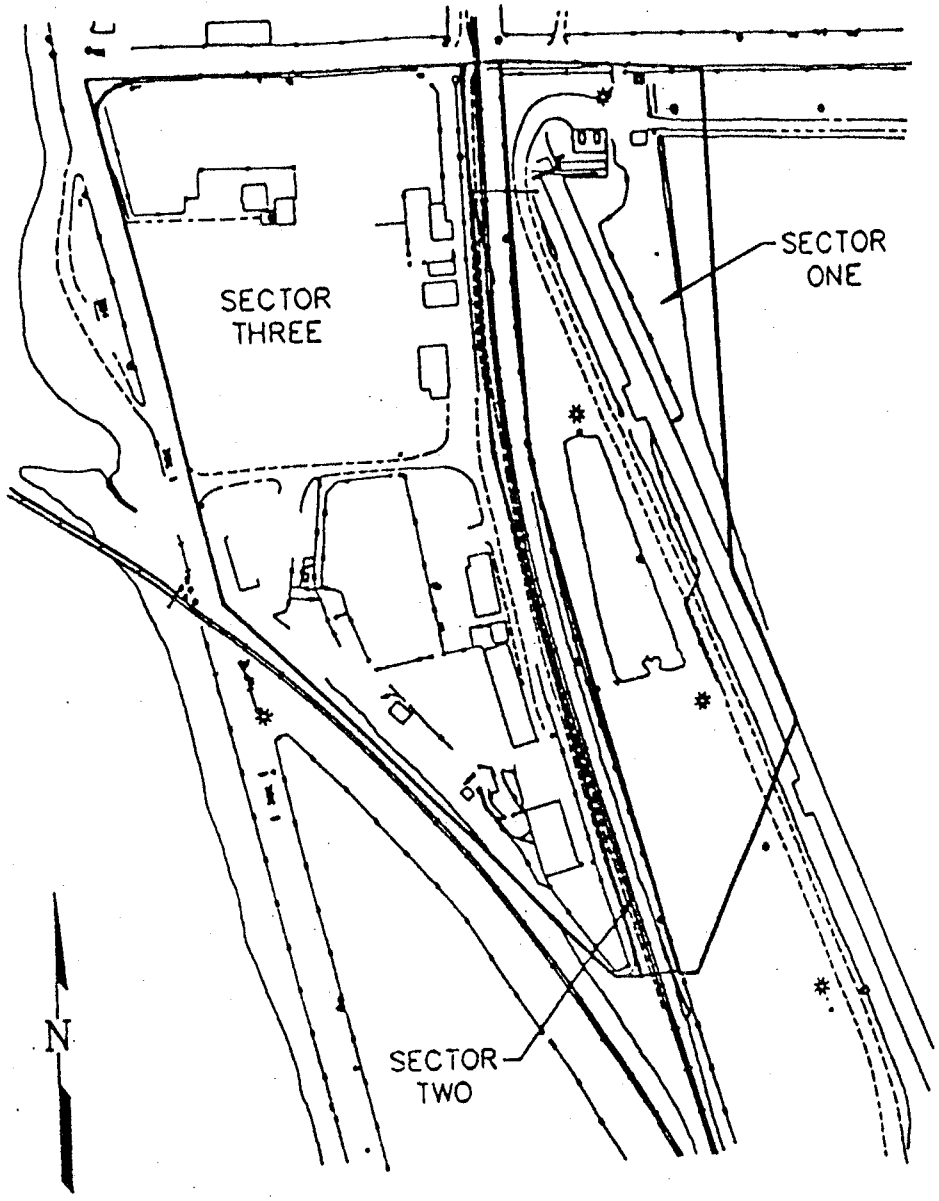
RESULTS OF ENVIRONMENTAL STUDIES AND EMERGENCY/INTERIM ACTIONS

3.1 SITE CHARACTERIZATION

3.1.1 Site Description.

The oil spill site is located on the western flank of March Point approximately 3 miles from Anacortes, Washington. The site is bounded on the north by North Texas Road, a north-south trending Texaco pipeway to the east, West March Point Road to the west, and a railroad spur running northwest-southeast that crosses Fidalgo Bay to the south (Figure 3). For the purpose of cleanup activities, the site was divided into three areas (sectors): Munks property (sector 3), Shell railroad right of way (sector 2), and Texaco property (sector 1). During the interim action the Munks property (sector 3), was divided into six principal areas (Figure 4).

- North Pasture
- South Pasture
- West Pasture
- Area adjacent to Munks north residence
- South house area
- The blackberry ditch - a drainage ditch that parallels the railroad spur



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Sectors in the RI/FS site characterization.

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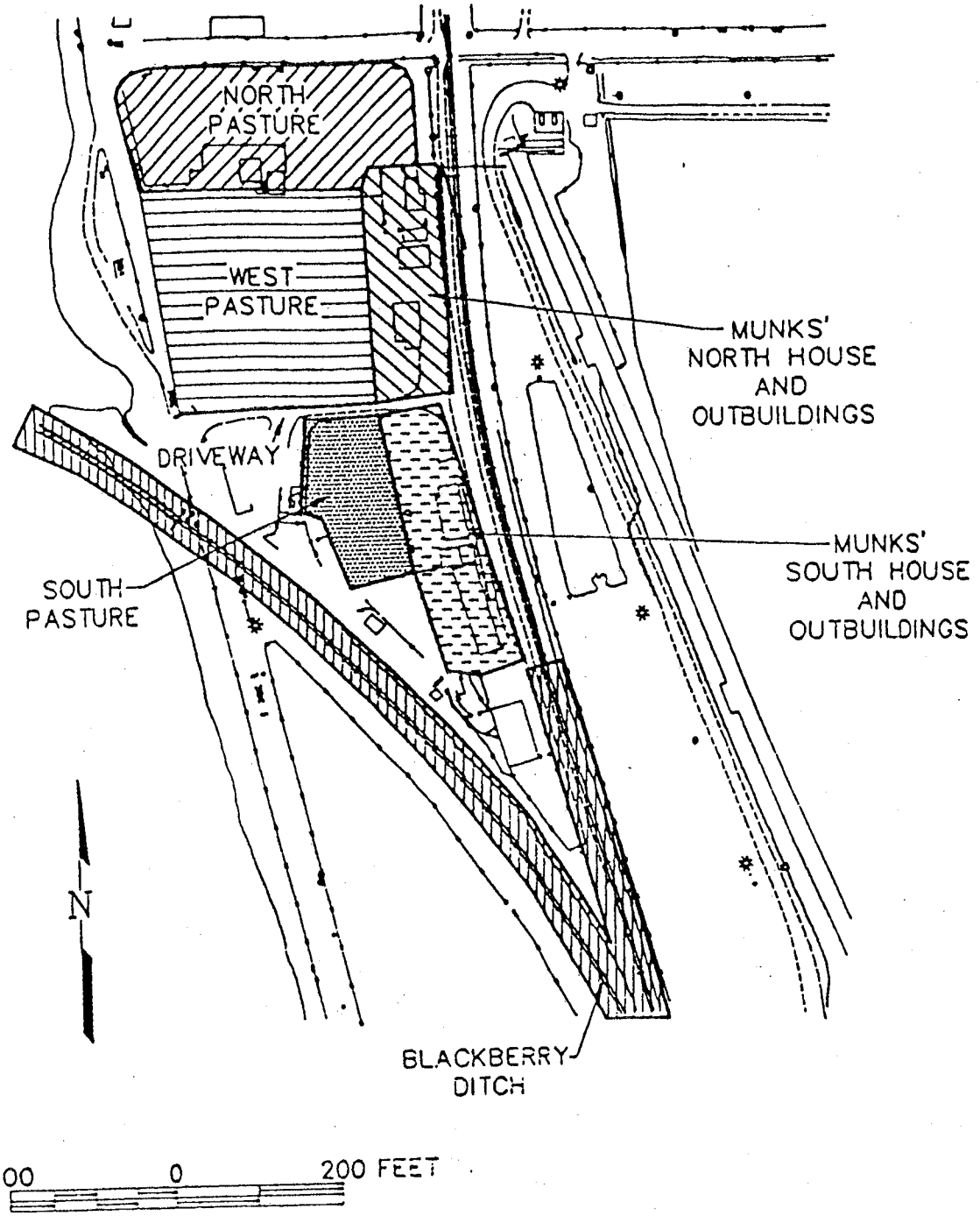
DATE:	05/21/91	FIGURE:	3



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Primary areas within Munks' property.

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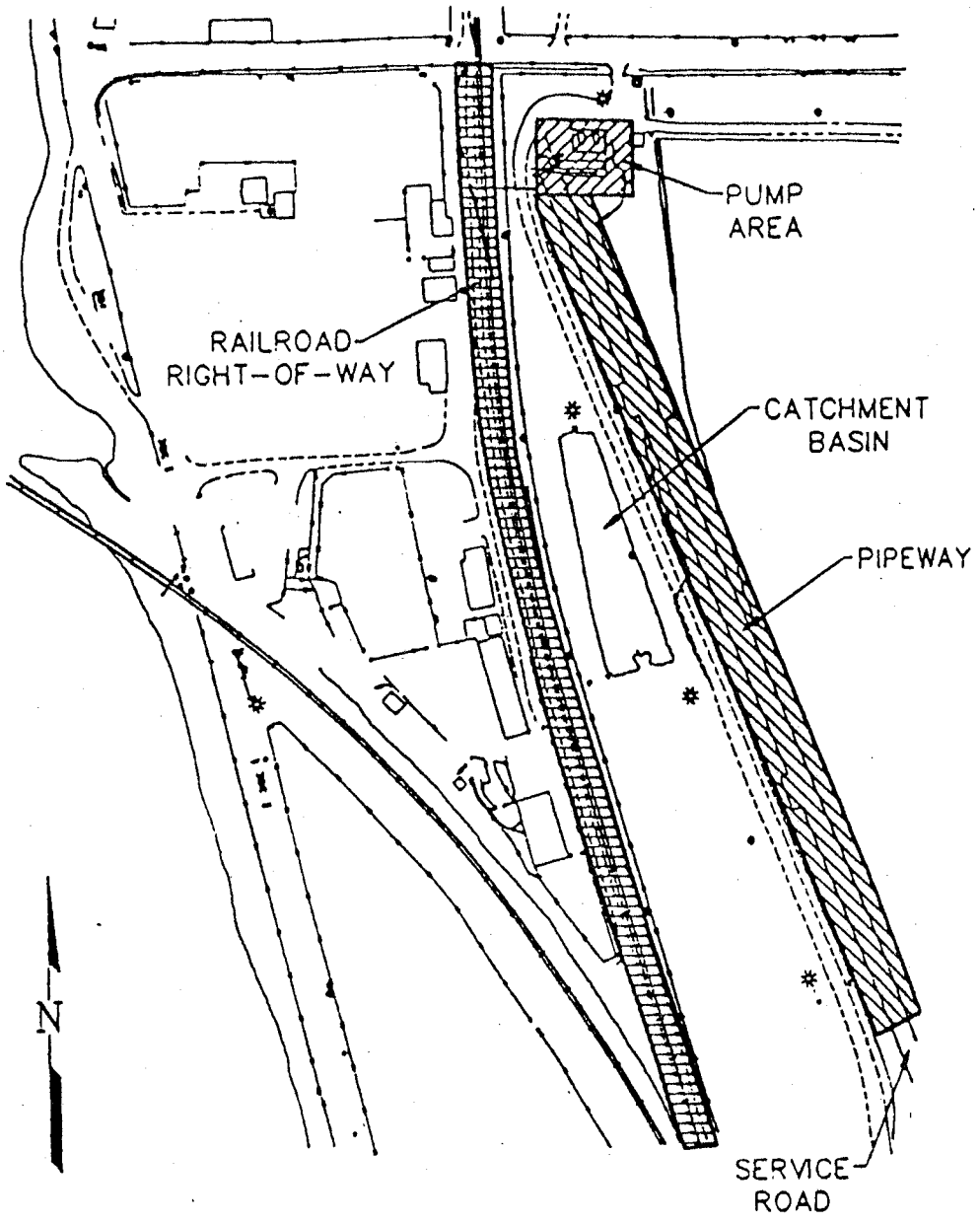
DATE: 05/21/91	FIGURE: 4



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Primary areas within the Texaco property and Shell Oil right-of-way.

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DATE:	05/21/91	FIGURE:	5

The Shell railroad spur is the second area (sector 2) and the Texaco property is the third area (sector 1). Sector one, the Texaco property is divided into four areas (Figure 5).

- o Pump area
- o Catchment basin
- o Pipeway
- o Surface road that parallels the pipeway

3.1.2 Site Geology and Hydrogeology

The geology of the spill site was investigated during the remedial investigation. Geologic descriptions in the remedial investigation were derived from three borings and surface field investigations. The borings were located in Munks' north pasture, west of the pump station, and east of the pump station area. The three drill holes penetrated two units to a total depth of 50 feet.

The two major stratigraphic units are found throughout the three sectors of the site. The first unit is a brown to gray, mottled, fractured silty clay to clayey silt. The unit is continuous throughout the site and ranges from 10 to 15 feet in thickness. The hydraulic conductivity of the unit is 4.1×10^{-8} cm/sec. The unit is covered with fill consisting of rock ballast beneath the railroad right of way and silt and clay beneath the pipeway. The unit comprised the bulk of the contaminated soil removed from the site.

The second unit is a gray, slightly moist to dry silt that grades into interbedded a gray silt with clay and sand lenses. The top portion of the unit is continuous throughout the site and ranges from 15 to 20 feet in thickness. The gray silt has a hydraulic conductivity of 2.9×10^{-7} cm/sec. The lower portion of the unit, which is interbedded with fine sand and clay, was detected in the lower 15 to 20 feet of each bore hole.

The two geologic units in the site form a barrier over the regional aquifer in the area. One water well is found near the site. This well is located approximately 15 feet north of North Texas Road and west of the railroad crossing. It is owned by the Munks family. The depth of the well is 79 feet as measured from the top of the well casing. No records of well construction details are available for this well. The well produces water throughout the summer months and is assumed to be screened in a confined aquifer found deeper than 50 feet. Monitoring wells drilled south of the spill site at the Texaco effluent plant show similar artesian conditions.

Shallow ground water forms a perched water table on the site and is found on top of unit one during the winter and spring wet seasons. The fluid migration within the unit is vertical by fracture flow. Based on oily fractures found in the remedial investigation, it was concluded that the predominant flow direction was downward in the dry season. No analysis of ground water flow direction on Munks property or the railroad right of way has been completed for wet season flow.

The flow direction of the perched water table beneath the pump station is to the west.

3.1.3 Soil and Ground Water investigations

Sector One Sector one consists of oil spill affected portions of the Texaco property located east of the rail road right of way (Figure 5). The area contains the pipeline area, drainage ditch east of the railroad right of way, pump area, and catchment basin. Portions of the sector were cleaned up during the interim actions described in Section 3.2 and have not been characterized.

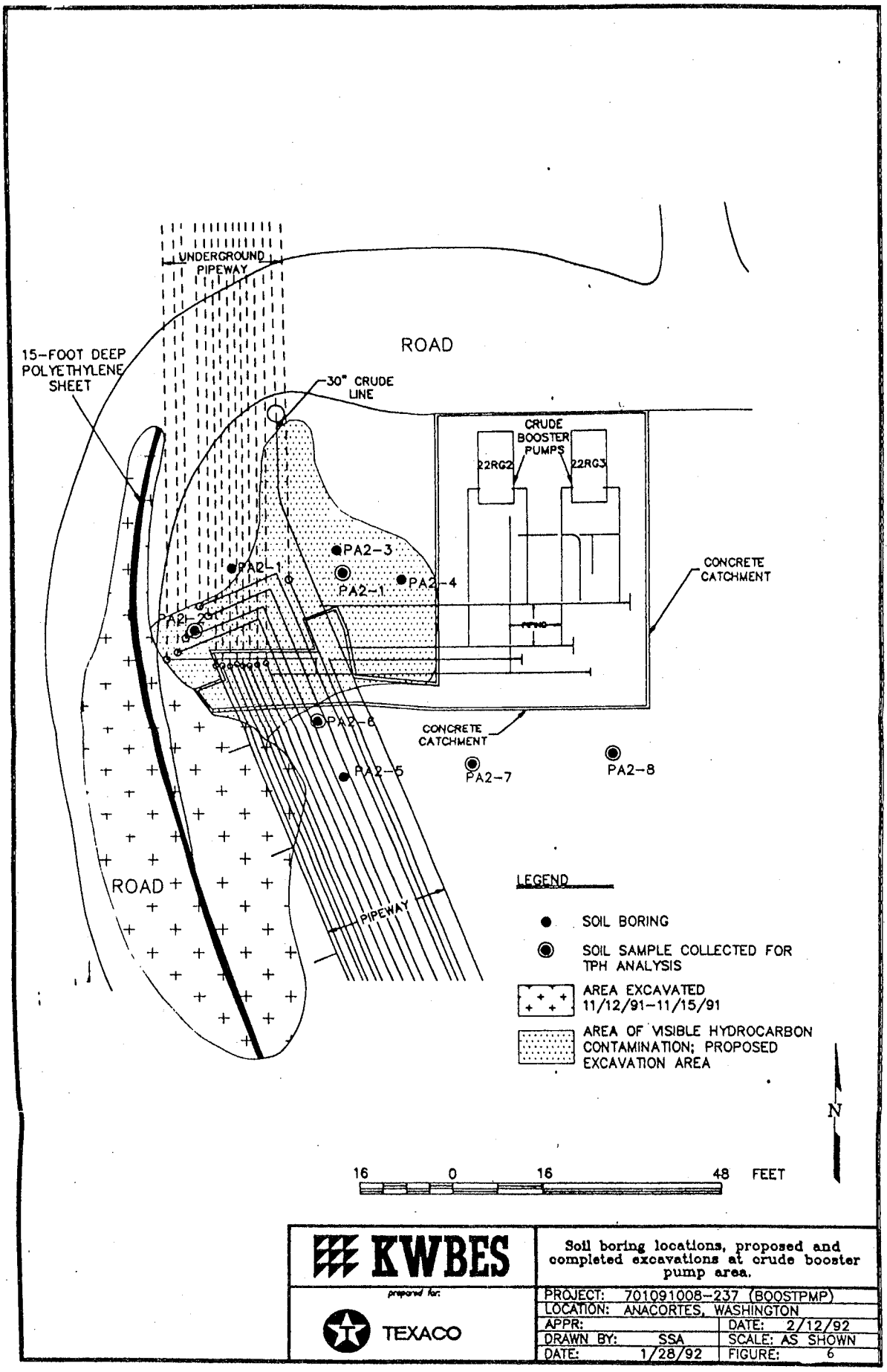
The pipeline area is located south of the pump station. Crude oil ran along the pipeline for approximately 200 feet during the spill. The area was sampled during the emergency action. The surface sample (0-10 inches) collected from a trench containing oil and water showed evidence of oil contamination (16,000 mg/kg). The subsurface sample (10-20 inches) showed less than 5 mg/kg. Samples collected during the RI/FS were below the TPH method detection limit. A portion of the region was excavated during the installation of the impermeable barrier between the pump and service road. No further work is planned along the southern pipeline area.

The ditch east of the railroad right of way was sampled during the RI/FS. The samples yielded TPH results that were below the cleanup standard of 200 mg/kg. Major portions of the ditch were excavated during the replacement of the oiled railroad right of way. No further work is planned in the ditch.

The pump area was heavily oiled during the spill. The oily piping and support structures were pressure washed during the emergency action. The upper 6 inches of oily soil, or approximately 925 cubic yards, were removed near the station and land farmed at the Texaco refinery. Soil removal was not attempted below the pipeway west of the pump station. During the interim action Texaco placed a 120 foot HDPE sheet pile west of the pipeway. The plastic barrier was designed to prevent oil present under the pipeway and buried pipeline from migrating west into the clean railroad ballast bed. Based on analytical results and field observations of soils in the pump area, there appears to still be hydrocarbon contamination in soils directly west of the pump station (Figure 6).

During the oil spill crude oil ran into the containment basin. The majority of the oil was removed by vacuum truck and returned to the refinery. The areas most heavily oiled during the spill are located on the side walls of the basin because the catchment basin contained storm water runoff at the time of the spill. Three soil samples were taken during the RI/FS. One of the samples collected on the side walls of the basin was above MTCA cleanup levels (RP-2 2,139 mg/kg TPH). No sediment was taken from the catchment basin during either the emergency action or interim action.

Sector Two Sector two consists of the Shell Oil railroad right of way. The right of way was heavily oiled during the spill event. Prior to the interim cleanup, the roadbed contained areas of free crude oil and oily ballast. During the interim action, the area along the right of way was cleaned up to MTCA standardsand new clean ballast was placed in the roadbed. The roadbed was


UNDERGROUND PIPEWAY
ROAD
15-FOOT DEEP POLYETHYLENE SHEET
30" CRUDE LINE
CRUDE BOOSTER PUMPS
22RG2
22RG3
CONCRETE CATCHMENT
PA2-3
PA2-1
PA2-4
PA2-2
PA2-6
PA2-5
PA2-7
PA2-8
CONCRETE CATCHMENT
ROAD
PIPEWAY
LEGEND
SOIL BORING
SOIL SAMPLE COLLECTED FOR TPH ANALYSIS
AREA EXCAVATED 11/12/91-11/15/91
AREA OF VISIBLE HYDROCARBON CONTAMINATION; PROPOSED EXCAVATION AREA
N
16 0 16 48 FEET
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TEXACO
Soil boring locations, proposed and completed excavations at crude booster pump area.
PROJECT: 701091008-237 (BOOSTPMP)
LOCATION: ANACORTES, WASHINGTON
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DATE: 2/12/92
DRAWN BY: SSA
SCALE: AS SHOWN
DATE: 1/28/92
FIGURE: 6

cleaned up due to the threat of further oil migration from the pump and pipeway areas through the ballast and onto the Munks property. No further action is planned in sector two.

Sector Three Sector three consists of Munks private property located east of the railroad right of way. Munks west pasture, north residence and a portion of the north pasture received the bulk of the crude oil from the spill. Interim actions removed oily soils from the north residence, north pasture and west pasture. Oil remained above MTCA 200 ppm TPH limits in the west pasture after the soils excavation. The west pasture was landfarmed throughout late 1991 and 1992. In the fall of 1992, hydrocarbon levels had dropped, but the area was still considered contaminated. In late 1992 Texaco removed soil around two hots spots. After the removal of contaminated soil, verification sampling showed no areas in the west pasture out of complience. All areas in sector three are at or below the TPH soil cleanup standard.

3.1.4 Surface and Ground Water Analysis

Surface water in sector three (Munks property) and two (railroad right of way) is collected in ditches and travels through two culverts to Fidalgo Bay (Figure 7). Subsurface drainage from Munks house area is collected from a north south trending drainfield located along the eastern edge of Munks northern house. The drainfield collects water from under the railroad right of way and a portion of the pump station. The drainfield flow is directed into a sump located in the southwest corner of the west pasture. Surface water flow from the pump station is directed into the catchment basin located south of the pump station structure. The surface water is periodically pumped to a ballast line that runs to the Texaco waste water treatment plant.

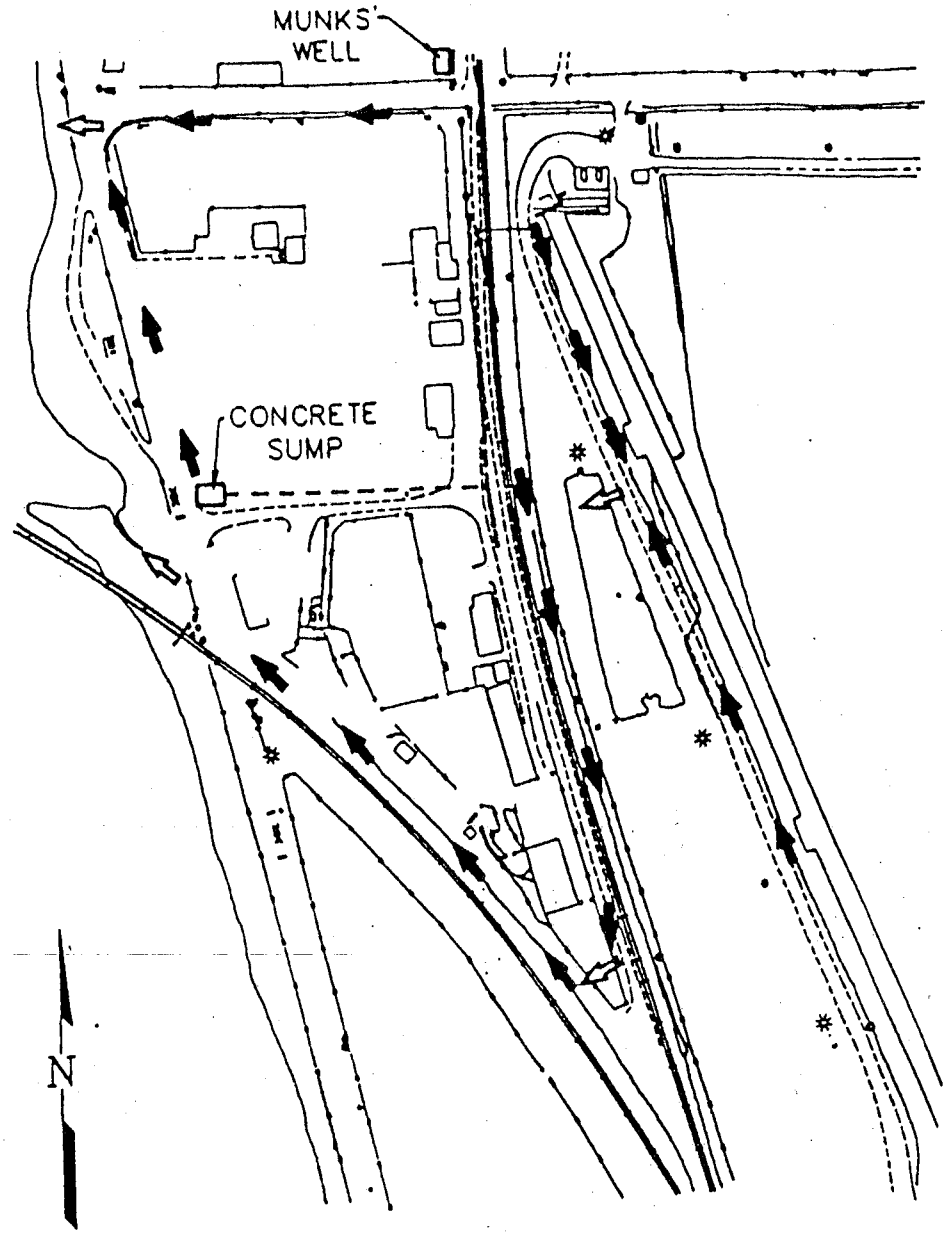
Surface water and water from the perched water table and aquifer has been tested for hydrocarbons and metals. The water from the Munks north house drain field has been tested for metals and hydrocarbons. No detectable hydrocarbons were noted in the samples. Minor amounts of zinc (0.02 mg/kg), nickel (0.01 mg/kg) and copper(0.04 mg/kg) were detected. These levels are below the Method B groundwater cleanup standards. The copper is thought to have originated from the sample pump.

Ground water from the Munks family well was analyzed for TPH, benzene, toluene, ethyl benzene and total xylene. Results of the laboratory testing indicate that no hydrocarbons are present in the water.

During the interim action an intercepter drain was placed west of the pump station. This drain empties into the trench system that ultimately drains to the catchment basin. The catchment basin is pumped into the refinery waste water treatment plant. The water from the drain has not been analyzed.

3.2 EMERGENCY AND INTERIM ACTIONS

Texaco began emergency actions on the on-land portion of the oil spill immediately after the event. These actions continued until July of 1991. In



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Surface water flow directions and location of Munks' drainfield and well.

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LOCATION:	ANACORTES, WASHINGTON		
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DATE:	05/21/91	FIGURE:	7

July, Texaco and the Department of Ecology signed an agreed order that directed Texaco to continue the cleanup of the private residence owned by the Munks family, complete a site assessment of the spill area and prepare an remedial investigation and feasibility study on the affected areas of the spill not remediated under the interim cleanup efforts. The following remedial actions have been completed on the site.

3.2.1 Munks Residence

3.2.1.1 Munks North Pasture.

A preliminary sample (location 7 - Figure 8) indicated hydrocarbon contamination in the center of the pasture (Figure 8). During the remedial investigation three trenches were excavated in the vicinity of the high sample. No oil was observed or measured using photoionization detectors (PID) during the investigation. Total petroleum hydrocarbon (TPH) and benzene analysis did not repeat the high sample results. The analytes were not present above method detection limits.

A buried water line that extends across the north pasture was examined during the remedial investigation. The water line was exposed in one of the emergency intercepter trenches. The soils exposed near the water line were excavated and screened with a PID. No visible hydrocarbons and no organic vapors were detected by the PID.

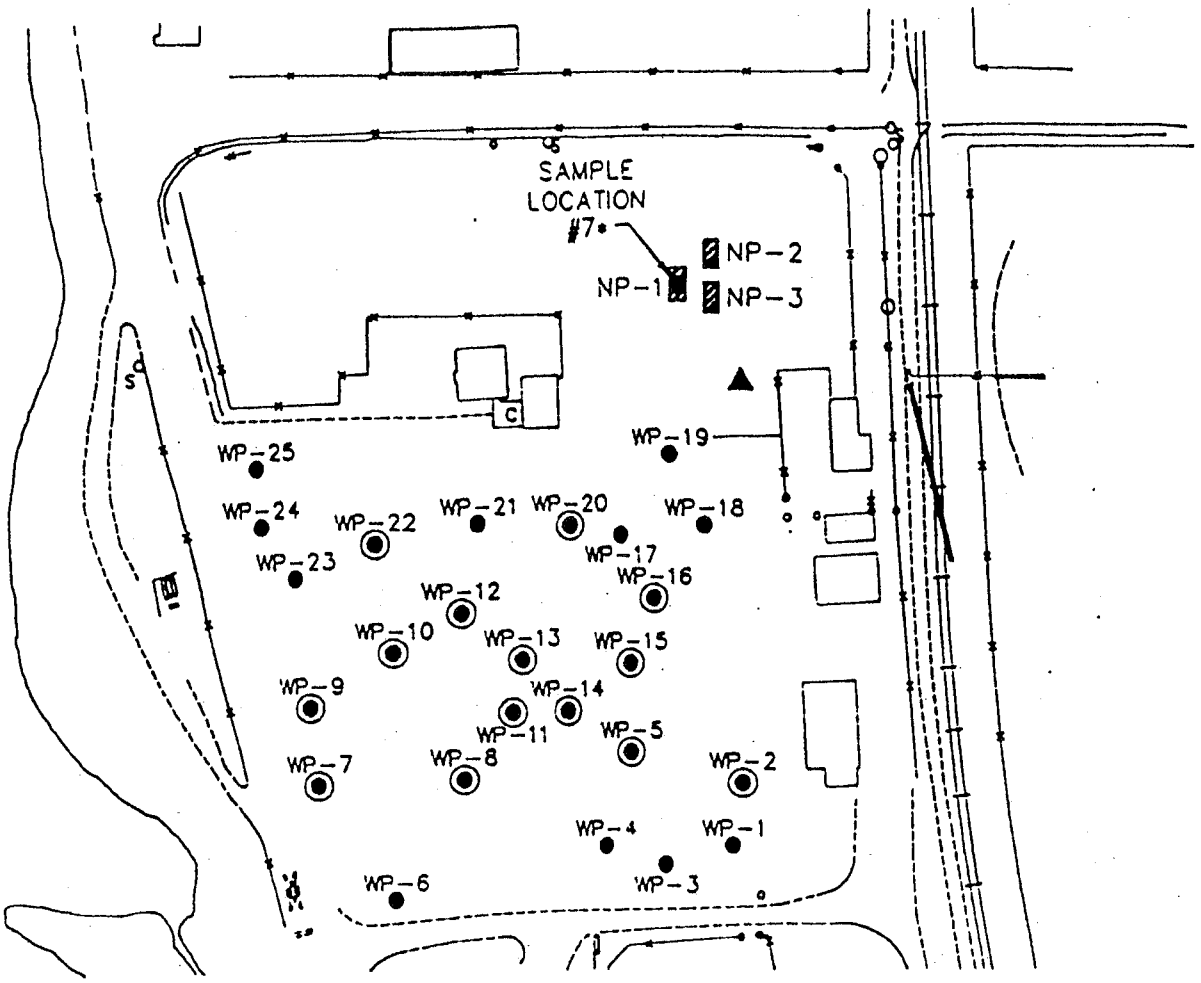
No further work in the north pasture was recommended by the RI/FS. Investigations of the original preliminary high samples did not indicate the presence of hydrocarbons.

3.2.1.2 Munks West Pasture.

Munks west pasture was heavily oiled during the spill. Approximately six inches of topsoil was removed from the pasture in the days immediately following the spill. Soil sampling immediately after the removal of the top soil indicated localized residual hydrocarbon remained in the pasture. A drain tile runs from the Munks house into the west pasture (Figure 8,9).

A second round of sampling was conducted in the pasture in August 1991. The second round of samples consisted of 0 to 10 inch composite samples collected from 25 random sites (Figure 8). Each composite sample was screened using a PID. Eleven samples showed PID responses. Each of these samples, along with three random samples taken from the samples that did not yield any detectable organic vapors, were analyzed for TPH and benzene. Of the 14 samples analyzed for TPH and benzene, five samples contained TPH concentrations in excess of 200 kg/mg.

Texaco began an **in situ** land farming program on Munks west pasture in the fall of 1991. A third sampling event occurred in October of 1991 (Figure 9). Once again TPH concentrations in the west pasture were above the 200 mg/kg cleanup standard. Texaco continued to landfarm the material throughout the winter and spring season. The area was re-sampled in August of 1992. The results of the 1992 sampling indicated that two samples were above the 200 mg/kg MTCA standard and that the oil concentrations in all cases were continuing to degrade. In September of 1992, Texaco choose to re-sample around the two high samples and



LEGEND

- ● SOIL BORING
- ◉ SOIL SAMPLE COLLECTED FOR TPH, BENZENE ANALYSES
- ▮ TRENCH LOCATION, SOIL SAMPLE COLLECTED FOR TPH, BENZENE ANALYSES
- ▲ PORTION OF BURIED WATER LINE EXPOSED IN INTERCEPTOR TRENCH. (FOR LOCATION OF INTERCEPTOR TRENCH SEE FIGURE 2)
- * From Phase II Preliminary Site Assessment and Remedial Action Review Workplan (Texaco, 1991b)

100 0 100 FEET

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Soil sampling locations at the north and and west pastures (WP and NP sampling events).

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LOCATION:	ANACORTES, WASHINGTON
APPR:	DATE: 10/23/91
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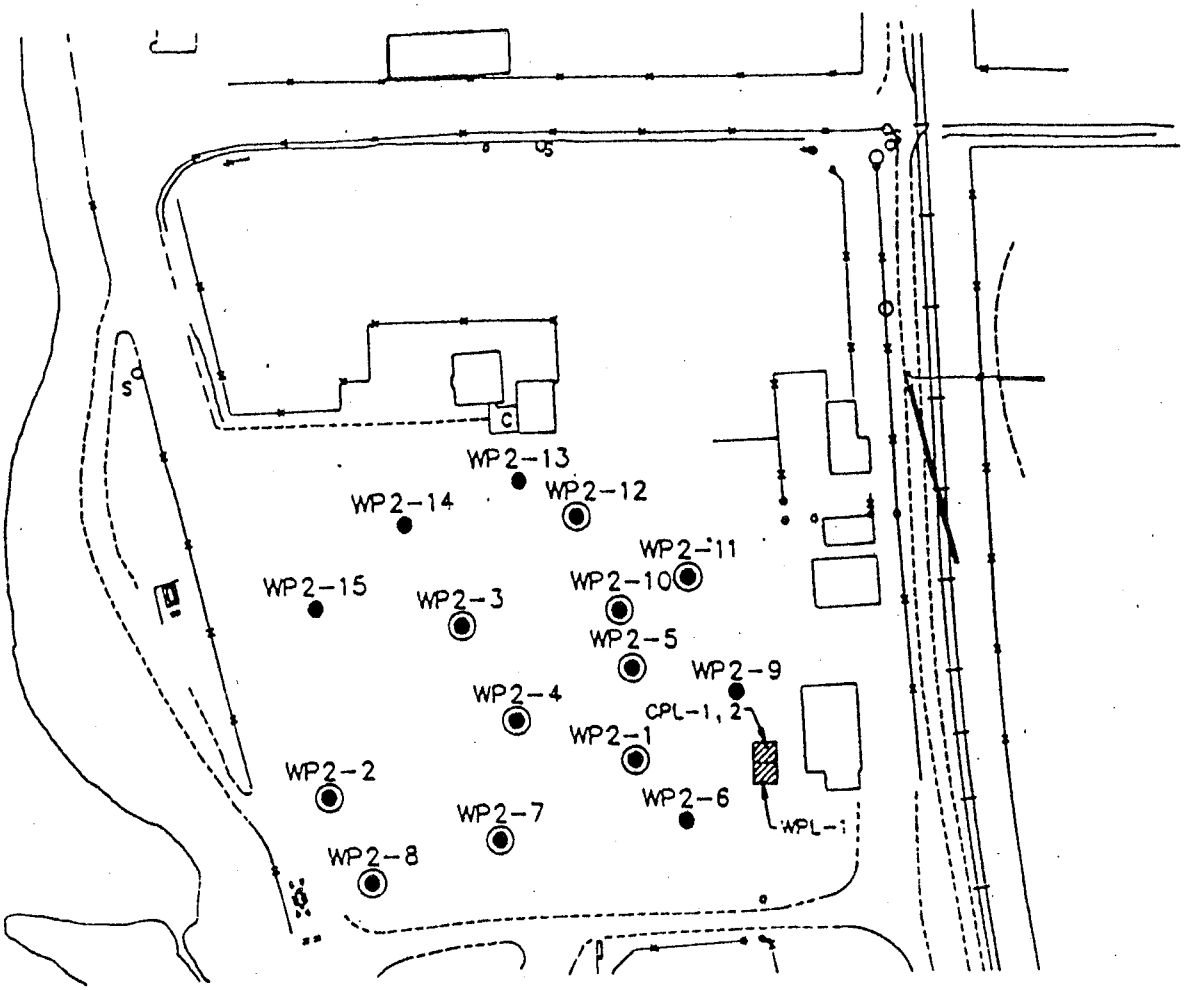
DATE: 10/23/91	FIGURE: 8



LEGEND

- ● SOIL BORING
- ◉ SOIL SAMPLE COLLECTED FOR TPH ANALYSIS
- ▨ TRENCH LOCATION, SOIL SAMPLES COLLECTED FOR TPH, BENZENE ANALYSES

100 0 100 FEET

N

NOTE: WP3 SERIES SAMPLING LOCATIONS SAME AS WP2 LOCATIONS.

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West pasture soil sampling locations (WP2, WP3, sampling events).

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remove soils above the MTCA cleanup standard. Texaco removed soils around the two hot spots using techniques described in Exhibit A of the consent decree. The west pasture was covered with new clean top soil in October of 1992.The area around the drain tile was removed and landfarmed on the refinery site.

3.2.1.3 Munks North House.

Two interim remedial actions for the Munks residences were outlined in the agreed order. One action called for the cleaning of the Munks residences and **in situ** bioremediating of contaminated soils, while the other action called for the destruction of the buildings and removal of contaminated soils. Test pits dug next to the residence indicated that **in situ** cleaning of the building would not be feasible. The decision was made by Texaco, in agreement with the Munks family, to demolish the house, garage, workshop, and barn located in the area. This would facilitate the excavation of the contaminated soil found beneath the structures.

Approximately 11,000 cubic yards of contaminated soil was removed from the area and landfarmed in the Texaco flare landfarms. The deepest contamination was observed beneath the Munks barn where crude oil had pooled under the flooring. This resulted in hydrocarbon contamination to depths of 15 feet in the fractured clay. Soil analysis was completed in the bottom of the pit after removal of contaminated soils. None of the samples from the North house area yielded results above the 200 mg/kg cleanup standard (Figure 10).

The north house area excavation was filled with clean fill and a new residential structure was constructed. The property was restored to the original pre-excavation grade.

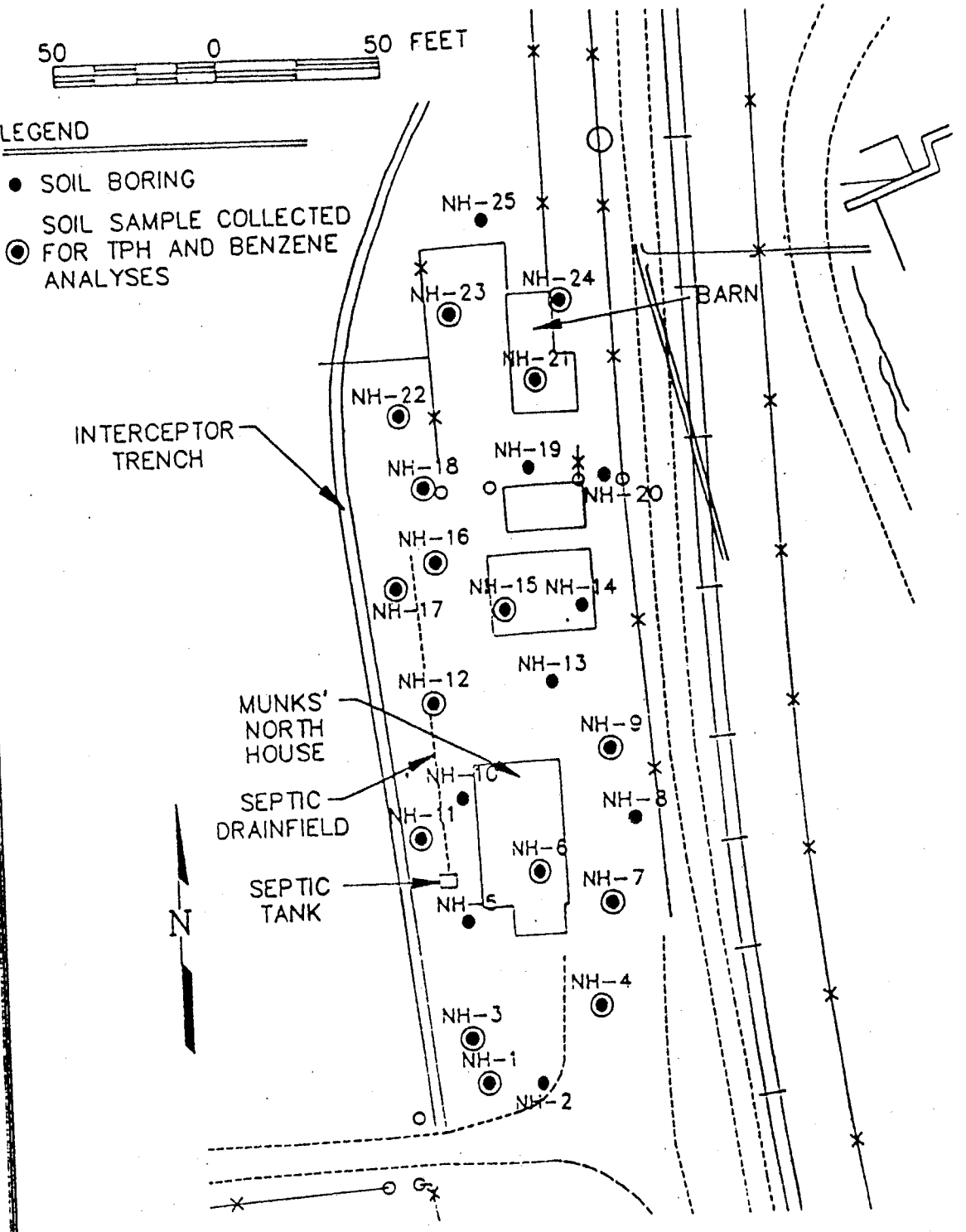
3.2.1.4 Munks South House and Pasture

The soils beneath driveway next to Munks southern house were investigated during the RI/FS. Five borings were completed east of the south house to determine if hydrocarbons migrated from the oiled railroad spur. Samples from the borings were tested with the PID and analyzed for hydrocarbons. The results of the analysis indicated that no samples contained TPH concentrations in excess of the method detection limits (Figure 11).

A northeast-southwest trending drainfield in the southern pasture was investigated as a possible hydrocarbon migration route during the RI/FS. The outfall end of the drain pipe was examined and no hydrocarbons were identified. The drain field was exposed on the eastern edge of the south pasture using an excavator. Soils were screened using a PID. The hole was deepened to six feet where ground water was encountered. No evidence of hydrocarbons was detected in the investigations.

A single boring was completed in the vicinity of the drainfield that serves the Munks' south house septic system. The soil from the hole was screened with a PID. No visible or detectable hydrocarbons were encountered.

Eight random soil samples were collected in the south pasture (Figure 11). The



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TEXACO

Munks' north house and outbuildings soil sampling locations (NH sampling event).

PROJECT: 701091008-237 (PSPSAMPS)	
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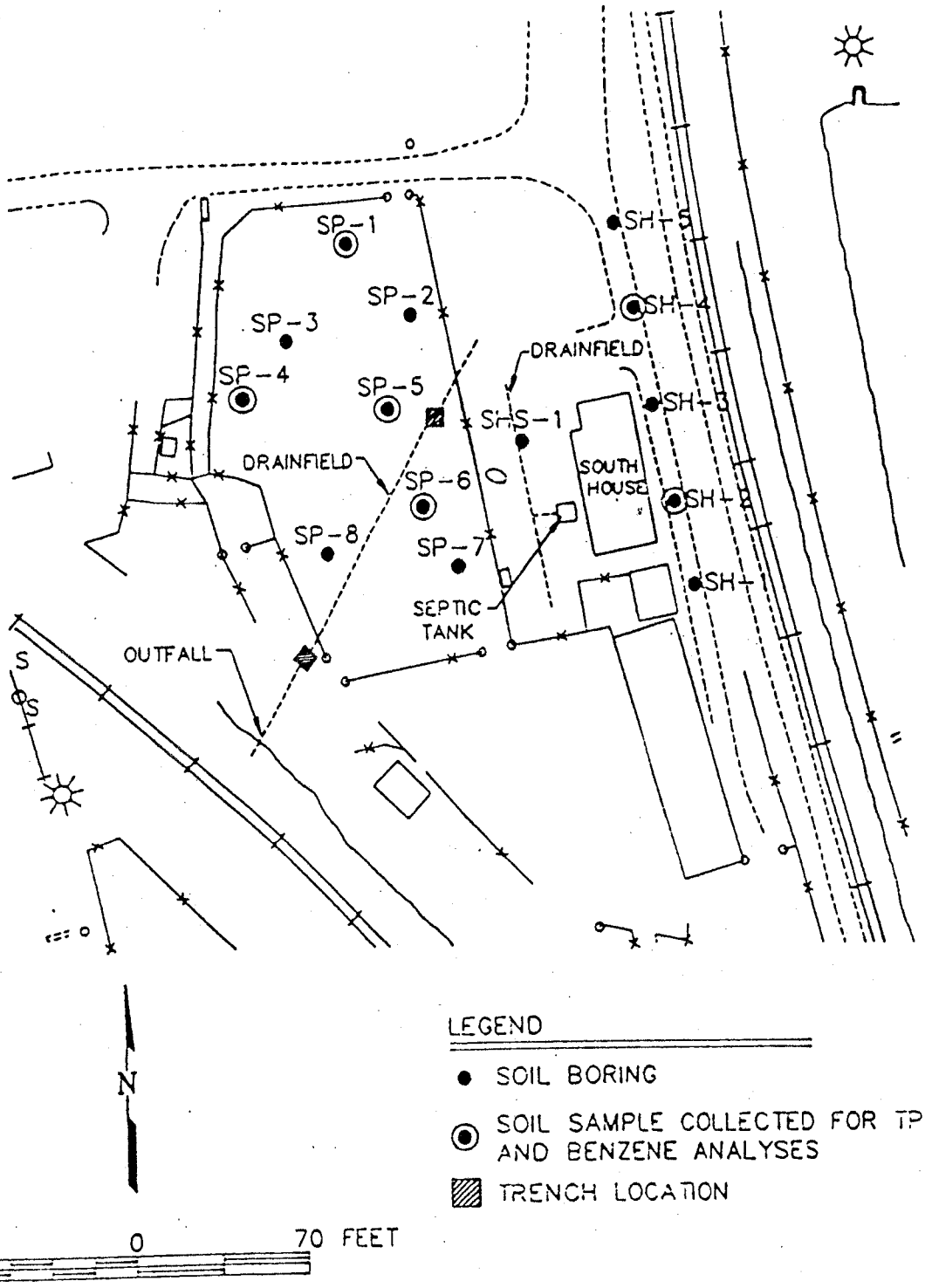
DATE: 01/21/92	FIGURE: 10



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prepared for:

TEXACO

Munks' south house and pasture soil sampling locations.

PROJECT:	701091CC8-237 (PSPSAMP3)
LOCATION:	ANACORTES, WASHINGTON
APPR:	DATE: 10/23/91
DRAWN BY:	RMM SCALE: AS SHOWN
DATE:	10/23/91 FIGURE: 11

samples were screened with a PID. No samples yielded detectable organic vapors. Four of the eight samples were randomly chosen to be analyzed for TPH and benzene. Results of the analysis indicated only one sample with detectable hydrocarbons at the 10 mg/kg level. Visual observations and the sample analysis indicates that no significant release of hydrocarbons occurred in the south pasture.

3.2.1.5 Blackberry Ditch

In the blackberry ditch south of Munks property, and the drainage ditch east of the railroad spur three composite soil samples were collected and analyzed for TPH. Soil TPH analysis indicates that two of the three areas are contaminated with hydrocarbon above MTCA cleanup levels. Visual inspection of the ditch indicated that the contaminated areas are sporadic.

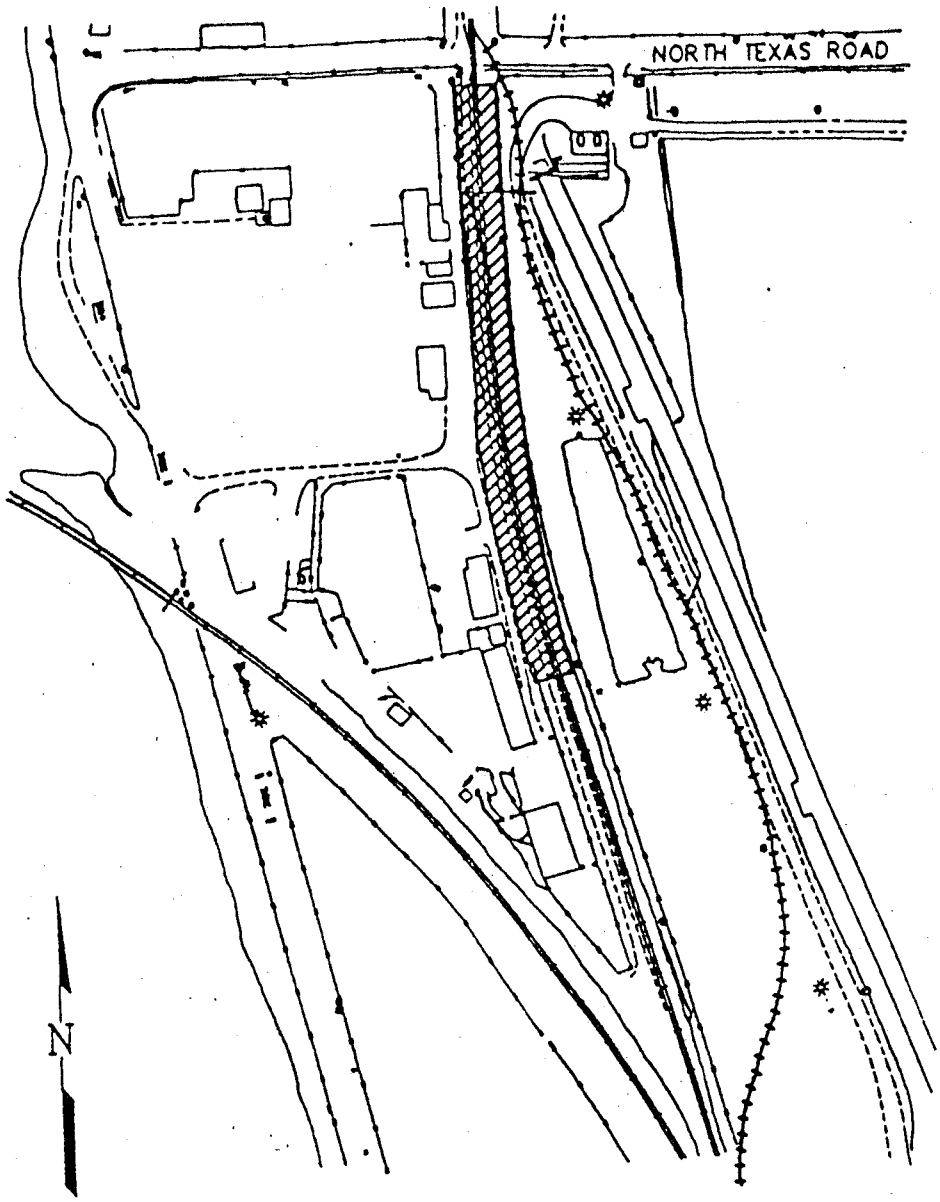
An expanded soil grid in the ditch supports the hypothesis that the oily soils are sporadic in distribution. Only one of the six locations sampled in the second round of sampling yielded TPH concentrations above the 200 mg/kg standard.

3.2.2 Railroad Easement and Temporary Railroad Spur

The July 1991 Agreed Order was amended to include the investigation and cleanup of the railroad spur easement in September 1991 (Figure 12,13). The initial agreed order directed Texaco to conduct the cleanup of the spur under the cleanup consent decree. The agreed order was amended to include the spur cleanup because of the potential of contaminating the clean fill that had been placed down gradient on the Munks property. The railroad spur roadbed contained free crude oil from the spill.

A temporary railroad spur was constructed through the spill site east of the original railroad right of way. The construction of the temporary spur resulted in the excavation of soils and the backfilling of the excavation with ballast to provide a firm roadbed and achieve proper grade. During the excavation the soils in the trench were examined for evidence of hydrocarbon contamination. South of the catchment basin no contaminated soils were observed. Oil was observed north of the basin in the road bed ballast that was found beneath the service road that runs between the catchment basin and pipeline (Figure 13). All oily soils and ballast were removed to the Texaco refinery staging areas. The depth of excavation was directed by visual observation and with the aid of a PID. The nine confirmational samples after the excavation indicated TPH concentrations below the method detection limits (Figure 13). Oily soils were left in place next to the pump area. A 12 foot high, 100 foot long HDPE barrier was placed next to the oily soils found near the pump station (Figure 14). The barrier will prevent oil from moving west through the new fill and into the Munks property.

The excavation of oily materials from the original railroad bed began in the fall of 1991. Approximately 980 cubic yards of ballast was removed and placed in a staging area on Texaco property. Free oil was observed in the ballast and in fractures of the silty clay and sand found beneath the ballast. The deepest hydrocarbon penetration was found immediately west of the pump station. Small



200 0 200 FEET

LEGEND

Excavated portion of railroad roadbed

Temporary railroad spur

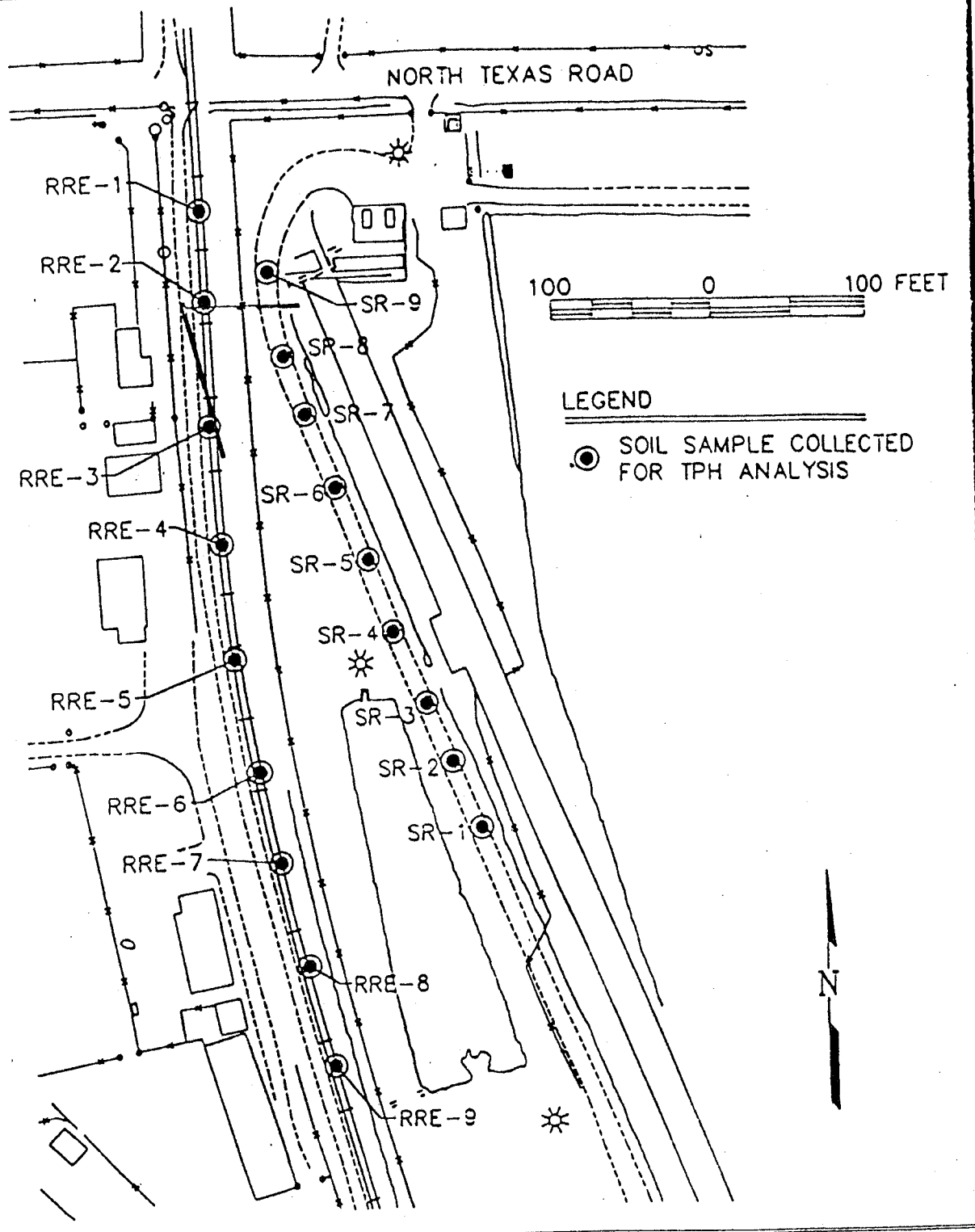
KWBES

prepared for:

TEXACO

Location of temporary railroad spur and excavated portion of railroad roadbed.

PROJECT: 701091008-237 (PSPSAMP)	
LOCATION: ANACORTES, WASHINGTON	
APPR:	DATE: 01/16/92
DRAWN BY: RMC	SCALE: AS SHOWN
DATE: 05/21/91	FIGURE: 12



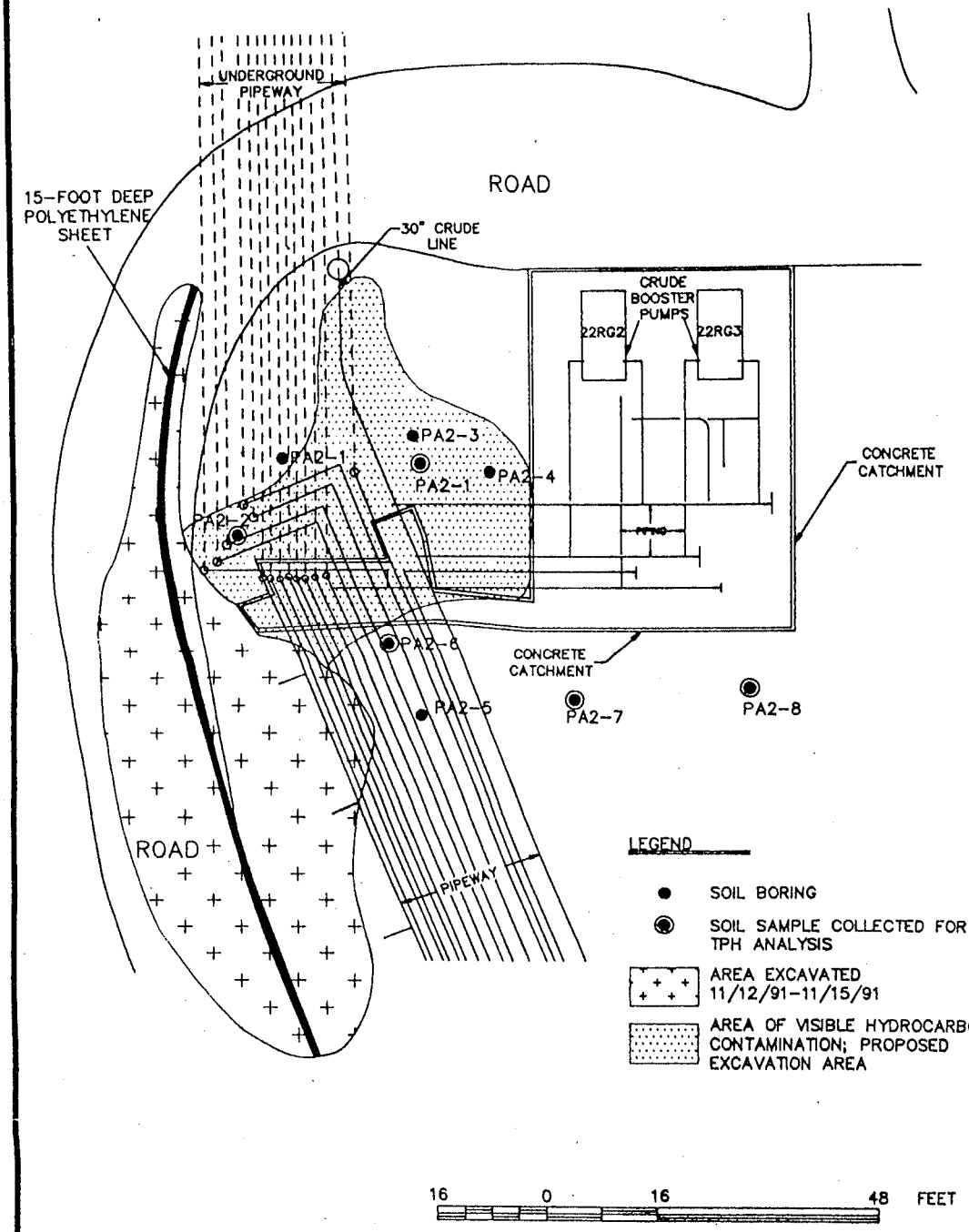
KWBES

Railroad excavation soil sampling locations

prepared for:

TEXACO

PROJECT:	701091008-237 (PSPSAMP4)
LOCATION:	ANACORTES, WASHINGTON
APPR:	DATE: 10/23/91
DRAWN BY: RMM	SCALE: AS SHOWN
DATE: 10/23/91	FIGURE: 13



KWBES	Soil boring locations, proposed and completed excavations at crude booster pump area.	
prepared for: TEXACO	PROJECT: 701091008-237 (BOOSTPMP)	
	LOCATION: ANACORTES, WASHINGTON	
	APPR:	DATE: 2/12/92
	DRAWN BY: SSA	SCALE: AS SHOWN
	DATE: 1/28/92	FIGURE: 14

pockets of oil were found in the ballast at this location. A total of 7,100 cubic yards of soil were removed from the 700 feet of railroad bed that was remediated. Confirmational samples were taken at a depth interval of 0-10 inches, every 75 feet linear feet along the excavation. The analytical results indicated that the TPH concentrations were below method detection limits in all nine samples collected (Figure 13). Backfilling of the area began immediately following the receipt of the analytical results. Clean fill materials were moved by truck from offsite. The railroad bed was reconstructed using clean materials.

3.2.3 Summary of Interim Actions

The following areas in the spill site have been cleaned to below the 200 mg/kg MTCA method A soil cleanup level during the interim/emergency actions or no oil was found during the remedial investigation. The areas are considered clean (Figure 4,5).

- Munks north pasture. Eastern edge of pasture excavated.
- Munks house and outbuildings. Excavated and back filled.
- Munks west pasture. Excavated and land farmed.
- Munks south house and outbuildings. No oil found above MTCA cleanup level.
- Munks south pasture. No oil found in RI/FS sampling
- Shell oil railroad right of way. Excavated and back filled.

The following areas contain contamination from the oil spill and will be addressed in the consent decree (Figure 1).

- Blackberry ditch.
- Texaco catchment basin.
- Pump station area east of the service road.

3.3 MEDIA CLEANUP LEVELS

3.3.1 Selection of Method for Establishing Cleanup Levels

The Model Toxics Control Act Cleanup Regulation provides three methods for determining cleanup levels at a contaminated site. The methods are known as Method A, Method B, and Method C. Method A applies to relatively straight forward sites that involve only a few hazardous substances. The method defines cleanup levels for 25 of the most common hazardous substances. The method also requires that the cleanup meet promulgated federal and state regulations such as

the maximum contaminant levels established by the clean water act. Method B is a standard method that can be used at all sites. The clean up levels are set using a site risk assessment which focuses on site characteristics or concentrations of individual hazardous substances established under applicable state and federal laws. Method C is similar to Method B. The main difference in the two methods is that the life time cancer risk is set at a lower number. The method can be only used when either Method A or Method B are technically impossible, the site is defined as an industrial site, or where attainment of Method A or Method B cleanup levels has the potential for creating a significantly greater overall threat to human health and the environment. In addition, Method C also requires that the person undertaking the action comply with all applicable state and federal laws.

The Texaco site is considered a routine petroleum spill site where Method A can be used. The contaminant of concern is petroleum hydrocarbon. Method C can not be used on the site because the site is not defined as a MTCA industrial site, Method B levels are not technically impossible to achieve on the site, and achieving Method B levels will not cause greater environmental harm than not achieving them. The majority of the site is being cleaned up using Method A soil and water cleanup levels, Method B may be used at the pump station area of the site if contaminated soils are left in place. Cleanup levels are discussed below.

3.3.2 Ground-Water Cleanup Levels

No groundwater at the site has been discovered contaminated. One near surface monitoring well is proposed down gradient of the pump station area contamination. The Method A cleanup standard (WAC 173-340-720) for groundwater will be used at the site. The standard for total petroleum hydrocarbons is 1000 ug/liter. The site cleanup standards (Method A) for individual BTEX chemicals are: benzene 5.0 ug/liter, toluene 40.0 ug/liter, ethylbenezene 30.0 ug/liter, and xylenes 20.0 ug/liter.

3.3.3 Soil Cleanup Levels

The Method A soil cleanup standard (WAC 173-340-740(2)) will be used for the blackberry ditch and catchment basin areas of the cleanup. In these areas site soil standard will be 200 mg/kg total petroleum hydrocarbons.

The pump station area will use the Method A standard for total petroleum hydrocarbons (WAC 173-340-740(2)). If the total petroleum hydrocarbon criterion cannot be met at the pump area, a health based assessment of individual hazardous petroleum constituents can be conducted based on a "worst case" TPH sample. Soil cleanup levels shall be determined using the Method B equations outlined in WAC 173-340-740(3)(iii). The protocol for determining individual hazardous petroleum constituents is being developed by the Department of Ecology. When the protocol for the demonstration as outlined in WAC 173-340-740(3) is developed, a worst case sample may be collected from the location exhibiting the highest TPH concentrations. If the area is found to be below the health based standard, then it will be considered clean.

SUMMARY OF ALTERNATIVE CLEANUP ACTIONS

4.1 INTRODUCTION - FEASIBLITY STUDIES

Texaco has completed extensive emergency and interim remedial actions at the site. These cleanup activities have been described in section 3.2 of this report. The activities concentrated on removal of oiled soils and free crude oil through excavation and treatment through landfarming off site. The results of the remedial investigation indicate that hydrocarbon contamination above the MTCA Method A standard is present in selected areas where complete excavation was not possible. The feasibility study portion of the RI/FS was limited to these contaminated areas: the blackberry ditch, the catchment basin, the pump station, and Munks west pasture (Figure 1).

4.2 SECTOR ONE

4.2.1 Sector One - Catchment Basin

Four cleanup alternatives were examined for cleanup of the catchment basin. The alternatives were: no action, additional sampling using Method B analysis and cleanup levels to limit cleanup areas to hot spots along with additional remedial actions in the highly contaminated areas, *in situ* bioremediation, and excavation with off site bioremediation. Each of the alternatives is discussed below.

No Action. The alternative would allow natural bioremediation to occur. Due to the analytical results of the RI/FS sampling and the location of the basin hydraulically up gradient of the Munks property this alternative was not considered a viable cleanup option.

Additional Soil Sampling. Initial emergency action and RI/FS sampling of the basin indicated that the contamination was sporadic in nature and found in the basin bottom and along the walls. Little visible hydrocarbon staining has been observed on the basin walls. This can be explained by the fact that the basin was partially full of water during the spill and the crude oil release floated on the top of the water filled containment. Further sampling would further define hot spot locations. Along with further expanded sampling, Method B standards would be used to determine areas that need further remediation. Further remediation would consist of treatment (bioremediation) either on site *in situ* or off site at one of the refinery landfarms.

In Situ Bioremediation. *In situ* bioremediation of the basin and side wall sediments is feasible during the warmer months of the year. A program of tillage and nutrient application similar to that used at the refinery landfarms would be used to promote microbial degradation of the hydrocarbon in the soils. This alternative would depend on rainfall in the region since the basin is currently used for storm water control and periodically fills with storm water. The bioremediation program may only be possible during the dry summer months.

Excavation of Soils. Contaminated soils would be removed from the side walls and the basin bottom and treated in the refinery landfarms. Soils would be treated in the flare landfarms on Texaco refinery property. The removal of one foot of soil from the basin floor and side walls would generate 600 cubic yards of material that would require treatment.

The preferred action for the Catchment Basin is *in situ* bioremediation. This alternative requires no removal of material from the basin. The basin is periodically filled with storm water. The bottom of the basin contains saturated sediments that are hard to remove and bioremediate.

4.1.2 Sector One - Pump Station Area.

Five alternatives were examined for the cleanup of the pump station area. The pump station area has a shallow perched water table with visible floating hydrocarbon. During the emergency action and the RI/FS, excavation near the pump station was limited due to the existence of buried crude oil pipes. The results of expanded sampling during the RI/FS limit the contamination to a circular area of less than 60 square yards (Figure 14).

No Further Action. Soils in the vicinity of the pump station have not yielded TPH concentrations that are above the MTCA standard. Free floating product has been observed in soils near the station. The no action alternative is not protective of human health and the environment and is not considered an alternative.

No Action With Additional Sampling. This alternative is no action with the collection of further worst case samples. These samples will be used to determine potential threats posed to human health and the environment. Method B analysis of the dangerous constituents of crude oil would be used to determine cleanup levels rather than the general total petroleum hydrocarbon standard. The contaminated area is located up gradient of the impermeable barrier and drain system placed near the pump station during the interim action. This drain system will likely impede shallow groundwater migration of the floating hydrocarbons. The alternative will require deed restrictions if contaminated soils are left in place.

Additional Excavation of Soil. Excavation of contaminated soils in the vicinity of the pump station. Contaminated soils are in the area of the underground portion of the pipeway. The underground portion of the pipeway is located approximately three feet below grade. Texaco proposes to excavate soils down to the buried pipeway and landfarm the contaminated soils in the refinery. If soils in the area are above the MTCA TPH standard of 200 mg/kg Texaco can elect to use a risk based standard using individual petroleum constituents and the standard described in WAC 173-340-740(3). If contaminated soil is left in place a deed restriction will be placed on that portion of the site.

Hydrocarbon Recovery Wells. This alternative uses a pump and treat system to remove hydrocarbon from the shallow aquifer. This alternative was not considered because of the near surface location of the floating product layer and the complexity of the sedimentary column beneath the pump station. The pump

station is built on several different layers of fill. In the vicinity of the pump station the hydraulic conductivity of the different fill units varies greatly and several buried structures such as the pipeway disturb the flow paths of the perched water table. The fill is also locally compacted. Each of these factors makes the alternative not feasible in this location.

Interceptor Trenches. This alternative uses an intercepter trench located next to the barrier wall. Floating free product is collected in a sump located at the end of the intercepter trench. Flow from the intercepter trench is directed to the Texaco treatment plant via the crude oil ballast line that runs past the pump station. The selection of a passive or active free product collection system will be undertaken following the evolution of the intercepter ditch.

The preferred alternative in the pump station area is further excavation in the vicinity of the contamination. If contaminated soils remain after the excavation, then a Method B cleanup standards can be used in the area. If the soil remains above the Method B standard then a deed restriction will be placed on the pump station area and a ground water monitoring program will be initiated at the site. The monitoring well will be located downgradient from the pump station contamination. The well would also be located on the downgradient side of the barrier wall found on the western side of the pump station contamination.

4.3 SECTOR TWO.

All hydrocarbon contaminated soils were completely excavated from sector two during the interim action. This sector consists of the railroad right of way. The right of way was remediated by excavation of contaminated soils to the Texaco flare landfarm and replacement of soils with clean fill. No additional work is proposed for Sector two.

4.4 SECTOR THREE.

4.4.1 Sector Three - Munks West Pasture

Four cleanup alternatives were examined for the cleanup of the west pasture. These alternatives were: no action, no action with additional sampling and re-evaluation using Method B cleanup standards, continuation of *in situ* bioremediation, and excavation of hot spots after *in situ* bioremediation. In the fall of 1992 the excavation alternative was completed.

Remedial activities in Munks west pasture were begun during the emergency action in 1991. The top six to twelve inches of top soil were removed from the pasture and landfarmed in the flare landfarms. The remaining petroleum contamination was landfarmed *in situ* during 1991 and 1992. The pasture was resampled in the fall of 1991 and still showed isolated hot spots of petroleum contamination. The pasture was resampled in the fall of 1992 and showed two hot spots. In the fall of 1992 using protocol from the draft consent decree, Texaco removed six inches of top soil from the hot spot areas. This soil was landfarmed at the flare landfarms on refinery property. After removal, confirmation sampling showed that

the areas were below the cleanup standard of 200 mg/kg total petroleum hydrocarbons. Six to twelve inches of top soil was replaced on the west pasture to bring the pasture surface up to the original grade.

4.4.2 Sector Three - Blackberry Ditch.

Four cleanup alternatives were examined for the cleanup of the blackberry ditch. The alternatives were: no action with natural bioremediation, no action with resampling and re-evaluation using Method B standards, additional excavation with bioremediation off site, and *in situ* bioremediation.

No Further Action. The first alternative consists of no further action at either the blackberry ditch or railroad spur ditch. The last sampling episode conducted during the RI/FS showed sporadic contamination. One sample contained oil above the TPH standard. No visible hydrocarbons have been noted on the oil/water separator weir located down gradient from the blackberry ditch system. Residue hydrocarbons are probably found sporadically in the ditch sediments.

No Action With Additional Soil Sampling. This alternative consists of a two phased sampling program to determine if the contamination is sporadic in nature. The initial phase consists of the collection of a set of composite samples collected from the ditch wall and floor. Three sample composites consisting of soil from five sample locations would be collected and analyzed for TPH. If TPH levels exceed the 200 mg/kg TPH standard then one sample would be collected for analysis using the Method B cleanup standard involving individual hazardous constituents of crude oil. The single sample would be a worst case sample. If contamination remains above Method B standards natural bioremediation would be used to lower TPH levels.

Additional Excavation of Soils. Excavation of contaminated soils was examined as a potential cleanup alternative but not considered as a preferred option. The soil contamination found in the blackberry ditch is sporadic in nature making determination of hot spots difficult. The soils of the ditch are saturated making excavation difficult. Delineation of the contaminated sediments in the field is very difficult due to limitations of the photoionization detectors when analyzing saturated sediments. Any excavation will require removal and treatment of large amounts of clean sediment. Excavation was not considered a viable cleanup option.

In Situ Remediation. In situ remediation was considered but not recommended because of the following problems with the technology. The ditch channels storm water from the site to Fidalgo Bay. It is periodically flooded during the summer, making the application of nutrients used *in situ* remediation very difficult. Saturated conditions and the small narrow dimensions of the ditch make the proper aeration of the soil though tillage difficult. The *in situ* cleanup option was not recommended.

The preferred cleanup alternative for the black berry ditch is a combination of excavation and *in situ* bioremediation. The sporadic nature of the contamination

and the physical conditions (saturated sediments located in a narrow ditch) of the ditch make cleanup of the area difficult to achieve. The cleanup will consist of the excavation of a "hot spot" located in the north-south portion of the ditch east of the railroad tracks. If it appears that *in situ* bioremediation of ditch sediments is practical, then excavation will be terminated and bioremediation will be used as the cleanup technology. A temporary underdrain weir will be installed downstream of the black berry ditch contamination. The weir will protect Fidalgo Bay from any contamination that results from remediation. The weir will be removed at the end of the remediation.

SELECTED CLEANUP ACTION

5.1 INTRODUCTION

The cleanup strategy proposed by Ecology is to combine treatment of petroleum contaminated soils with containment, monitoring and institutional controls to provide for the protection of human health and the environment. This strategy assumes that the area in the site where contaminated soils are left in place will be used for industrial or commercial purposes for the foreseeable future. The majority of the contamination associated with the February 1991 spill was excavated and treated off site at the Texaco refinery. The proposed cleanup alternatives that were selected for the contamination that remains on site are described in more detail below.

5.2 SELECTED CLEANUP ACTION

The proposed cleanup actions consist of *in situ* bioremediation and/or excavation and off site bioremediation (Figure 15). Specifically:

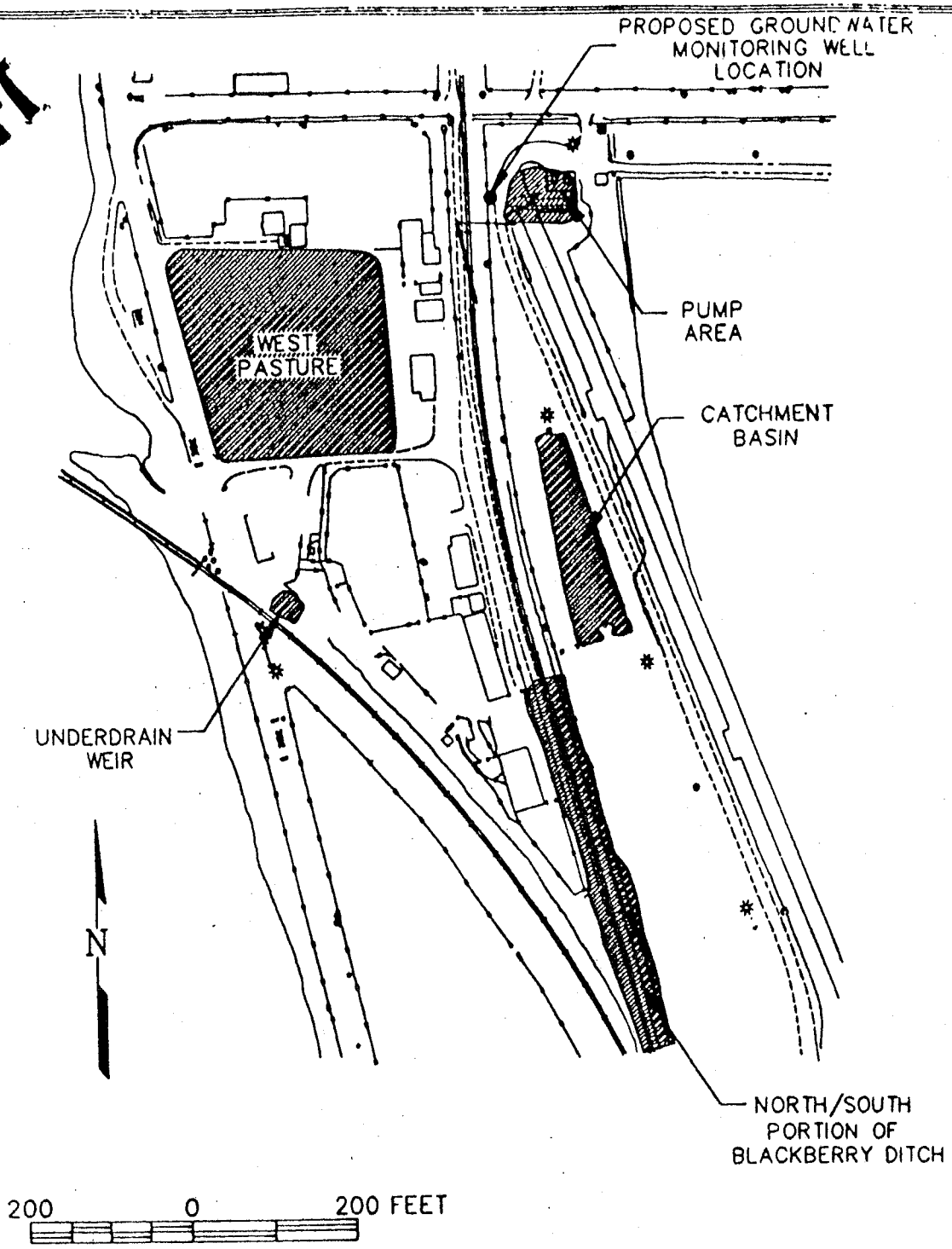
- Sector Three - Blackberry Ditch. Install temporary underdrain weir, excavate or bioremediate "hot spots", verify sampling, and remove temporary underdrain weir.

- Sector Three - Monks West Pasture. Excavation of hot spots complete. Re-vegetation and replacement of top soils was complete in late fall of 1992.

- Sector Two - Railroad Right of Way. Complete. Excavated during interim action and bioremediated at refinery landfarm.

- Sector One - Catchment Basin. *In situ* bioremediation of contaminated side wall and bottom sediments.

- Sector One - Pump Station Area Excavation of contamined soils with bioremediation off site at the Texaco refinery. Use of Method B cleanup levels if contaminated soils are found above the Method A total petroleum hydrocarbon standard. Ground water monitoring and



KWBES

Oil spill areas of concern.

prepared for:

PROJECT: 701092005-237 (PSPSAMP)	
LOCATION: ANACORTES, WASHINGTON	
APPR:	DATE: 06/24/92
DRAWN BY: RMO	SCALE: AS SHOWN
DATE: 05/21/91	FIGURE 15

deed restriction if contaminated soils are left in place after excavation. Continuation of pump station surface water treatment in Texaco waste water treatment plant.

5.3 GROUNDWATER MONITORING

Under one cleanup scenario contaminated soil will be left in place at the pump station site. A confirmational monitoring program for TPH and BTEX will be implemented as part of the cleanup. The proposed monitoring plan consists of quarterly monitoring for the first two years and annual monitoring for the next three years. At the end of the five year period Ecology and Texaco will exchange proposals to amend the consent decree with regard to whether continuation of the monitoring program is necessary and, if so, what constitutes an appropriate schedule. The proposed monitoring program will be evaluated at the end of each five year period until the site is no longer a danger to human health and the environment.

5.4 INSTITUTIONAL CONTROLS

If petroleum hydrocarbons are left in place above Method A or B cleanup standards then Texaco will record a restrictive land use covenant in the property deed of the site to ensure that no ground water is removed for domestic purposes from the area near the pump station and that there is no interference with the cleanup action. The form of this covenant is specified in the Consent Decree. Texaco may remove the covenant when contaminant concentrations in soils fall below either Method A or Method B cleanup levels as specified in this Cleanup Action Plan, and after receiving Ecology's consent.

5.5 SCHEDULE

The proposed cleanup is scheduled to occur in 1993. If approved, the cleanup actions will occur in the winter, spring and summer of 1993. Bioremediation will occur during the 1993 dry season. Groundwater monitoring will begin in 1993 after the completion of the remedial action and will continue for five years. At the end of the five year period Ecology and Texaco will exchange proposals for continued monitoring.