1R - 204

GENERAL CORRESPONDENCE

YEAR(S):

2000 → 1987

NEW MEXICO ENERGY, MINERALS and
NATURAL RESOURCES DEPARTMENT

GARY E. JOHNSON
Governor
Jennifer A. Salisbury
Cabinet Secretary

Lori Wrotenbery
Director
Oil Conservation Division

May 26, 2000

CERTIFIED MAIL
RETURN RECEIPT NO. 5051-3259

Mr. John Pride
Pride Energy Company
P.O. Box 701602
Tulsa, Oklahoma 74170

RE: GROUND WATER REMEDIATION AND MONITORING
SOUTH FOUR LAKES UNIT

Dear Mr. Pride:

The New Mexico Oil Conservation Division (OCD) has recently been informed that Pride Energy Company (Pride) has purchased the South Four Lakes Unit from Phillips Petroleum Company (Phillips). As you are aware, Phillips was conducting soil and ground water remedial actions at the site as required by the OCD. The OCD's July 14, 1997 approval of the site remediation and monitoring actions required the submission of annual reports by July 1 of each year. The OCD has not received an annual report for the 1998 calendar year which was due on July 1, 1999. In order to correct this deficiency, the OCD requires that Pride submit the required 1998 annual report to the OCD Santa Fe Office by July 1, 2000 with a copy provided to the OCD Hobbs District Office. The report shall contain all remediation and monitoring information required as part of the OCD's July 14, 1997 approval.

In addition, the OCD's files contain a December 31, 1997 notification from Phillips regarding the discovery of ground water contamination from an injection line leak on the South Four Lakes Unit adjacent to the above remediation project. This correspondence committed to provide the OCD with a formal report on the incident and a remediation plan by February 27, 1998. The OCD has no record of receiving these documents. Please submit these documents to the OCD by July 1, 2000.

Please be aware that the South Four Lakes annual remediation and monitoring report for the 1999 calendar year is also due on July 1, 2000.

If you have any questions, please call me at (505) 827-7154.

Sincerely,

William C. Olson
Hydrologist
Environmental Bureau

xc: Chris Williams, OCD Hobbs District Supervisor

NEW MEXICO ENERGY, MINERALS and NATURAL RESOURCES DEPARTMENT

GARY E. JOHNSON
Governor
Jennifer A. Salisbury
Cabinet Secretary

Lori Wrotenbery
Director
Oil Conservation Division

May 26, 2000

CERTIFIED MAIL
RETURN RECEIPT NO. 5051-3242

Mr. J.S. de Albuquerque
Phillips Petroleum Company
13D Phillips Bldg.
Bartlesville, Oklahoma 74004

RE: GROUND WATER REMEDIATION AND MONITORING
SOUTH FOUR LAKES UNIT

Dear Mr. de Albuquerque:

The New Mexico Oil Conservation Division (OCD) has reviewed Phillips Petroleum Company's (Phillips) March 13, 2000 correspondence titled "GROUNDWATER REMEDIATION & MONITORING, SOUTH FOUR LAKES UNIT". This document contains the results of Phillips' ground water remediation and monitoring activities at the South Four Lakes Unit Site during the 1997 calendar year. The document also informs the OCD that Phillips has sold the South Four Lakes Unit to the Pride Energy Company (Pride) and requests that the OCD acknowledge the document as Phillips' final action for the location.

The results of Phillips's ground water monitoring shows that the site has ongoing ground water remedial actions that have not been completed. Therefore, the above referenced request is denied. Since Pride has contractually accepted responsibility for remediation of the site from Phillips, the OCD will be working with Pride to continue the site remedial actions. However, please be advised that a contractual arrangement between Phillips and Pride does not relieve Phillips of liability or responsibility for remediation of contaminated soils and ground water.

If you have any questions, please call me at (505) 827-7154.

Sincerely,

William C. Olson
Hydrologist
Environmental Bureau

xc: Chris Williams, OCD Hobbs District Supervisor

PHILLIPS PETROLEUM COMPANY
BARTLESVILLE, OKLAHOMA 74004 918 661-6600

HEALTH, ENVIRONMENT AND SAFETY

March 13, 2000

Mr. William C. Olson - Hydrologist
New Mexico Oil Conservation Division
Environmental Bureau
2040 South Pacheco
Santa Fe, New Mexico 87505

RE: Groundwater Remediation & Monitoring
South Four Lakes Unit

Dear Mr. Olson:

The purpose of this letter is to respond to your 15 February 2000 letter to Mr. Sam Christy concerning the South Four Lakes Unit groundwater remediation and monitoring effort that Phillips Petroleum Company (Phillips) initiated in 1994.

Please be advised that Phillips sold the South Four Lakes Unit to Pride Energy Company (Pride) of Tulsa, Oklahoma, in October 1998. Pride can be reached at:

Pride Energy Company
Attention: Mr. John or Matt Pride
P.O. Box 701602
Tulsa, Oklahoma 74170
Phone: 918-524-9200
Facsimile: 918-524-9292

As described in the enclosed letter dated 01 December 1998 from Phillips to Pride, Pride assumed responsibility and liability for the groundwater remediation that Phillip initiated in 1997. Pride also assumed responsibility and liability for the 31 December 1997 injection line leak referenced in your 15 February 2000 letter to Mr. Christy.

Enclosed is the 1997 Annual Remediation and Monitoring Report for the South Four Lakes Unit. Also enclosed are the groundwater analytical results from ILMW-1 (injection line monitor well #1) that was installed to determine groundwater impacts from the 1997 injection line leak. A comparison of ILMW-1 data to up gradient, side-gradient, and down gradient groundwater quality from the pre-existing monitor well network suggests that groundwater was impacted by the injection line leak.

Phillips submittal of the enclosed information serves as our final action for this location. We also respectfully request that the OCD acknowledge, in writing, this letter as Phillips' final action for this site.

Should you have questions or require additional information concerning pre-10/98 site assessment, monitoring, or remediation activities, please feel free to contact me at (918) 661-7283 or Mr. Chris Parks, Safety & Environmental Specialist in Odessa, Texas at (915) 368-1620. Please contact Pride Energy Company for information pertaining to post-10/98 South Four Lake Unit environmental activities and/or conditions.

Sincerely,

J.S. de Albuquerque
Sr. Environmental Specialist

JSA:sfluocd5.doc

cc: Pride Energy Company w/attachments
M. W. Tompkins
J. B. Morgan
D. T. Thorp
H. O. Platt
(r) S. C. Parks
L. D. Nash

PHILLIPS PETROLEUM COMPANY
HOUSTON, TEXAS 77251-1967
BOX 1967

AMERICAS DIVISION

BELLAIRE, TEXAS
6330 WEST LOOP SOUTH
PHILLIPS BUILDING

December 1. 1998

Mr. John Pride
Pride Energy Company
2250 East 73rd Street
Suite 550
Tulsa, Oklahoma 74136

Post-it® Fax Note 7671	Date 3/1/00	# of pages ▶ 2
To JS de Albuquerque	From Chris Parks	
Co./Dept. PPCo	Co. PPCo	
Phone #	Phone # 1620	
Fax # 661-5664	Fax # 1507	

RE: Transmittal of South Four Lakes Unit Groundwater Remediation Project Information

Dear Mr. Pride:

Enclosed for your information and files are the pertinent documents concerning the South Four Lakes Unit groundwater monitoring and remediation project. The following reports are enclosed:

1. Original Soil & Groundwater Assessment: 03/13/95;
2. Subsequent Soil & Groundwater Assessment: 11/28/95;
3. Pit Closure Report: 12/95;
4. Recovery Well Installation: 01/29/96;
5. Hydrocarbon Recovery System Installation: 01/30/96;
6. Demonstration of Intrinsic Bioremediation of Dissolved Hydrocarbons & Annual Groundwater Monitoring Report – 1996: 03/96; and
7. Demonstration of Intrinsic Bioremediation of Dissolved Hydrocarbons & Annual Groundwater Monitoring Report – 1997: 04/97.

Also enclosed are three correspondence packets concerning:

1. The annual groundwater remediation and monitoring requirements as required by the New Mexico Oil Conservation Division (OCD);
2. Information on the water development easement for the withdrawal of groundwater (remediation and monitoring) that Phillips was required to execute with the New Mexico State Land Office; and
3. Spill reporting documentation for a 1997 produced water release.

The OCD letter dated July 14, 1997 is the most important agency correspondence and includes the present and future groundwater monitoring and remediation requirements. Phillips is in the process of finalizing the 1998 monitoring and

remediation report for submission to the OCD. Once the report is finalized, Phillips will send Pride Energy a copy of the subject report for Pride's files and also submit a copy of the report to the OCD as Phillips' final action for this location. It is assumed by Phillips that all subsequent agency communication concerning the South Four Lakes Unit groundwater remediation and monitoring will be between Pride Energy and the OCD.

Should Pride Energy have questions or require additional information concerning the enclosed documentation or present/future site environmental requirements, please feel free to contact me at (713) 669-3748 or Mr. Sam Christy, Safety & Environmental Analyst in Odessa, TX, at (915) 368-1620.

Sincerely,

J. Stephen de Albuquerque
Sr. Environmental Specialist

cc: R. A. Bradford w/o attch
J. E. Herndon w/o attch
S. E. Christy w/o attch

NAPD-E & P - SWR
SAFETY

DEC 0 4 1998

RECEIVED

Groundwater Data

Injection Line Leak

CERTIFICATE OF ANALYSIS

Service Location	Received	Project	Lab ID
HERITAGE ENVIRONMENTAL SERVICES, INC. COMMERCIAL LABORATORY OPERATIONS 7901 W. MORRIS ST. INDIANAPOLIS, IN 46231 (317)243-8304	05-DEC-97	3892	A427822
	Complete	PO Number	
	15-DEC-97	VERBAL*	
	Printed	Sampled	
	16-DEC-97	04-DEC-97 11:45	

Report To	Bill To
JAKE GALLEGOS CH2M HILL 100 INVERNESS TERRACE EAST ENGLEWOOD, CO 80112-5304	STEVE DE ALBUQUERQUE PHILLIPS PETROLEUM; HOUSTON 6330 WEST LOOP SOUTH BELLAIRE, TX 77401

Sample Description

CLIENT ID: ILMW-1
LOCATION: SOUTH 4 LAKES

PURGEABLE AROMATICS BY GC/PID SW846-8020A

Analyst: S. STRUEWING Analysis Date: 08-DEC-97 16:21 Instrument: GC/PID ELCD Test: 0460.2.0

Parameter	Result	Det. Limit	Units
BENZENE	BDL	1	ug/L
TOLUENE	BDL	1	ug/L
ETHYL BENZENE	BDL	1	ug/L
M/P-XYLENE	BDL	1	ug/L
O-XYLENE	BDL	1	ug/L
NAPHTHALENE	5.8	1	ug/L
...			
SURROGATE RECOVERY			

FLUOROBENZENE	101.0		% Rec
CHLOROFLUOROBENZENE	95.5		% Rec

ALKALINITY TOTAL EPA 310.1

Analyst: R. PIERCE Analysis Date: 09-DEC-97 22:00 Test: 0605.2.0

Parameter	Result	Det. Limit	Units
ALKALINITY	430	1.0	mg/L

ALKALINITY (CARBONATE) EPA 310.1

Analyst: R. PIERCE Analysis Date: 09-DEC-97 22:00 Test: 0611.2.0

Parameter	Result	Det. Limit	Units
ALKALINITY	BDL	1.0	mg/L

ALKALINITY (BICARBONATE) EPA 310.1

Analyst: R. PIERCE Analysis Date: 09-DEC-97 22:00 Test: 0610.2.0

Parameter	Result	Det. Limit	Units
ALKALINITY	430	1.0	mg/L

SULFATE BY ION CHROMATOGRAPHY EPA 300.0

Analyst: M. ADKINS Analysis Date: 05-DEC-97 21:10 Instrument: IC Test: 0300.2.0

Parameter	Result	Det. Limit	Units
SULFATE	7.5	0.25	mg/L

HERITAGE ENVIRONMENTAL SERVICES, INC. **Sample ID: A427822 ILMW-1**

CHLORIDE BY ION CHROMATOGRAPHY EPA 300.0
Analyst: M. ADKINS Analysis Date: 05-DEC-97 21:42 Instrument: IC Test: G300.2-0

Parameter	Result	Det. Limit	Units
CHLORIDE	5400	100	mg/L

1:400 DILUTION

DISSOLVED SOLIDS EPA-160.1
Analyst: J. ZAVELA Analysis Date: 10-DEC-97 14:55 Test: G402.7-0

Parameter	Result	Det. Limit	Units
DISSOLVED SOLIDS	9400	10	mg/L

SPECIAL SERVICES FOR GC/FID/PID/ELCD SAS
Analyst: B. BELL Analysis Date: 05-DEC-97 13:56 Instrument: GC/FID Test: X106.0-0

Parameter	Result	Det. Limit	Units
METHANE	13	8.0	ug/L

TOTAL ORGANIC CARBON EPA 415.1
Analyst: JC STALOWICZ Analysis Date: 08-DEC-97 08:10 Instrument: TOC Test: G401.1-0

Parameter	Result	Det. Limit	Units
TOTAL ORGANIC CARBON (TOC)	13	1.0	mg/L

SULFIDE (TITRIMETRIC IODINE) EPA 376.1
Analyst: M. BORDS Analysis Date: 09-DEC-97 23:00 Test: G130.3-0

Parameter	Result	Det. Limit	Units
SULFIDE	BDL	1.0	mg/L

PHOSPHORUS, TOTAL (AUTOMATED) EPA 365.1
Analyst: C. PEREGRINE Analysis Date: 09-DEC-97 10:14 Instrument: AUTO ANALYZER Test: G207.2-0

Parameter	Result	Det. Limit	Units
PHOSPHORUS	BDL	0.03	mg/L

NITRATE-NITROGEN BY ION CHROMATOGRAPHY EPA 300.0
Analyst: M. ADKINS Analysis Date: 05-DEC-97 21:10 Instrument: IC Test: G300.5-0

Parameter	Result	Det. Limit	Units
NITROGEN, NITRATE	BDL	0.05	mg/L

NITRITE-NITROGEN BY ION CHROMATOGRAPHY EPA 300.0
Analyst: M. ADKINS Analysis Date: 05-DEC-97 21:42 Instrument: IC Test: G300.3-0

Parameter	Result	Det. Limit	Units
NITROGEN, NITRITE	BDL	20	mg/L

1:400 DILUTION
Unable to analyze sample at lower dilution due to high concentration of non-target compounds.

FIELD FILTRATION SAS
Analyst: Analysis Date: Instrument: FIELD Test: P150.0-0

FAA OR ICP ACID DIGESTION (DISSOLVED METALS) EPA 200.0
Analyst: R. DALAL Analysis Date: 11-DEC-97 12:00 Instrument: PREP Test: P152.2-0
Prep: FIELD FILTRATION SAS P150.0-0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	50		mL
FINAL VOLUME	50		mL

HERITAGE ENVIRONMENTAL SERVICES, INC.

Sample ID: A427822 ILMW-1

CALCIUM ICP EPA 200.7

Analyst: A. STOCKBURGER Analysis Date: 12-DEC-97 05:41 Instrument: ICP Test: M409 3.0
Prep: FAA OR ICP ACID DIGESTION (DISSOLVED METALS) EPA 200.0 P132 2.0
Prep: FIELD FILTRATION SAS P110 0.0

Parameter	Result	Det. Limit	Units
CALCIUM	700	0.20	mg/L

IRON ICP EPA 200.7

Analyst: A. STOCKBURGER Analysis Date: 12-DEC-97 05:41 Instrument: ICP Test: M415 3.0
Prep: FAA OR ICP ACID DIGESTION (DISSOLVED METALS) EPA 200.0 P132 2.0
Prep: FIELD FILTRATION SAS P110 0.0

Parameter	Result	Det. Limit	Units
IRON	BDL	0.025	mg/L

MAGNESIUM ICP EPA 200.7

Analyst: A. STOCKBURGER Analysis Date: 12-DEC-97 05:41 Instrument: ICP Test: M418 3.0
Prep: FAA OR ICP ACID DIGESTION (DISSOLVED METALS) EPA 200.0 P132 2.0
Prep: FIELD FILTRATION SAS P110 0.0

Parameter	Result	Det. Limit	Units
MAGNESIUM	140	0.20	mg/L

MANGANESE ICP EPA 200.7

Analyst: A. STOCKBURGER Analysis Date: 12-DEC-97 05:41 Instrument: ICP Test: M419 3.0
Prep: FAA OR ICP ACID DIGESTION (DISSOLVED METALS) EPA 200.0 P132 2.0
Prep: FIELD FILTRATION SAS P110 0.0

Parameter	Result	Det. Limit	Units
MANGANESE	0.91	0.010	mg/L

POTASSIUM ICP EPA 200.7

Analyst: A. STOCKBURGER Analysis Date: 12-DEC-97 05:41 Instrument: ICP Test: M426 3.0
Prep: FAA OR ICP ACID DIGESTION (DISSOLVED METALS) EPA 200.0 P132 2.0
Prep: FIELD FILTRATION SAS P110 0.0

Parameter	Result	Det. Limit	Units
POTASSIUM	30.	0.20	mg/L

SODIUM ICP EPA 200.7

Analyst: A. STOCKBURGER Analysis Date: 12-DEC-97 21:55 Instrument: ICP Test: M431 3.0
Prep: FAA OR ICP ACID DIGESTION (DISSOLVED METALS) EPA 200.0 P132 2.0
Prep: FIELD FILTRATION SAS P110 0.0

Parameter	Result	Det. Limit	Units
SODIUM	2500	20.	mg/L

DILUTION 1:100

Sample Comments

BDL Below Detection Limit

Sample chain of custody number 66007.

Additional copies of this report sent to:
STEVE DE ALBUQUERQUE, PHILLIPS PETROLEUM COMPANY

HERITAGE ENVIRONMENTAL SERVICES, INC. **Sample ID: A427822 ILMW-1**

Sample Comments

6330 WEST LOOP SOUTH, BELLAIRE, TX 77401

JAKE GALLEGOS, THE BEST WESTERN - EL RANCHO
2205 N MAIN STREET (SHIPPING ADDRESS), ROSWELL, NM 88201

Approved : P.K. Spence

ENVIRONMENTAL LAB OF TEXAS, INC.

"Don't Treat Your Soil Like Dirt!"

SOIL DATA
INJECTION LINES
LEAK

PHILLIPS PETROLEUM COMPANY
ATTN: MR. SAM E. CHRISTY
4001 PENBROOK
ODESSA, TEXAS 79762
FAX: 915-368-1507

Receiving Date: 10/03/97
Sample Type: SOIL
Project Name: SOUTH FOUR LAKES INJ. LINE
Project Location: SOUTH FOUR LAKES UNIT

Analysis Date: 10/03/97
Sampling Date: 10/01/97,10/02/97
Sample Condition: Intact/Iced

ELT#	FIELD CODE	TPH mg/kg	Chloride mg/kg
12716	SFLU #1	170	2,552
12717	SFLU #2	420	2,340
12718	SFLU #3	<10	3,403
12719	SFLU #4	<10	3,403
	QUALITY CONTROL	537	9,891
	TRUE VALUE	537	10,000
	% PRECISION	100	99

Methods: EPA 418.1,SW 846-9252

Michael R. Fowler

Michael R. Fowler

10-7-97
Date

ENVIRONMENTAL LAB OF , INC.

"Don't Treat Your Soil Like Dirt!"

PHILLIPS PETROLEUM CO.
ATTN: MR. SAM CHRISTY
4001 PENBROOK
ODESSA, TEXAS 79762
FAX: 915-368-1507

Receiving Date: 10/03/97
Sample Type: SOIL
Project Nmae: SOUTH FOUR LAKES INJ. LINE
Project Location: SOUTH FOUR LAKES UNIT

Analysis Date: 10/06/97
Sampling Date: 10/01/97, 10/02/97
Sample Condition: Intact/Iced

ELT#	FIELD CODE	BENZENE (mg/Kg)	TOLUENE (mg/Kg)	ETHYLBENZENE (mg/Kg)	m,p-XYLENE (mg/Kg)	o-XYLENE (mg/Kg)
12716	SFLU #1	0.325	0.581	0.165	0.686	0.654
12717	SFLU #2	0.136	<0.100	<0.100	<0.100	<0.100
12718	SFLU #3	<0.100	<0.100	<0.100	<0.100	<0.100
12719	SFLU #4	<0.100	<0.100	<0.100	<0.100	<0.100
% IA		91	93	94	90	94
% EA		88	87	91	87	86
BLANK		<0.001	<0.001	<0.001	<0.001	<0.001

METHODS: SW 846-8020,5030

Michael R. Fowler
Michael R. Fowler

10-7-97
Date

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION
2040 S. PACHECO
SANTA FE, NEW MEXICO 87505
(505) 827-7131

February 15, 2000

CERTIFIED MAIL
RETURN RECEIPT NO. Z-559-572-905

Mr. Sam E. Christy
Phillips Petroleum Company
4001 Penbrook
Odessa, Texas 79762

RE: GROUND WATER REMEDIATION AND MONITORING
SOUTH FOUR LAKES UNIT

Dear Mr. Christy:

A review of the New Mexico Oil Conservation Division (OCD) files has shown that the OCD has no record of receiving any reports from Phillips Petroleum Company (Phillips) on the ground water remediation and monitoring activities at the South Four Lakes Unit Site since May 6, 1997. The OCD's July 14, 1997 approval of the site remediation and monitoring actions required that Phillips submit annual reports to the OCD by July 1 of each year. In order to correct this deficiency, the OCD requires that Phillips submit the required annual reports to the OCD by March 17, 2000.

In addition, the OCD's files contain a December 31, 1997 notification from you regarding the discovery of ground water contamination from an injection line leak on the South Four Lakes Unit adjacent to the above remediation project. This correspondence committed to provide the OCD with a formal report on the incident and a remediation plan by February 27, 1998. The OCD has no record of receiving these documents. Please submit these documents to the OCD by March 17, 2000.

If you have any questions, please call me at (505) 827-7154.

Sincerely,

William C. Olson
Hydrologist
Environmental Bureau

xc: Chris Williams, OCD Hobbs District Supervisor

PHILLIPS PETROLEUM COMPANY
4001 PENBROOK
ODESSA, TEXAS 79762

EXPLORATION AND PRODUCTION
Permian Profit Center

December 31, 1997

State of New Mexico
Oil Conservation Division
Attention: Roger Anderson
2040 South Pacheco Street
Santa Fe, New Mexico 87505

Re: Release Notification/Groundwater Impact
South Four Lakes Unit
Lea County, New Mexico

Dear Mr. Anderson:

Pursuant to our telephone conversation of December 19, 1997 enclosed you will find the formal written notification of groundwater impact of the injection line leak at the South Four Lakes Unit in Lea County, New Mexico. I have also attached for your files copies of correspondence between myself and Wayne Price of the NMOCD office in Hobbs.

As stated in the report this office proposes to submit to the NMOCD a formal report on the sampling and analysis from the monitor well associated with this release on or before February 27, 1998. At the same time Phillips will submit an action proposal based on the release and the apparent impact to the groundwater at the site.

If you have any questions or comments, please do not hesitate to contact me at this office at **915-368-1620**.

Sincerely,

Sam E. Christy
Safety & Environmental Analyst

enclosure

cc. Chris Williams (NMOCD/Hobbs, NM)
Wayne Price (NMOCD/Hobbs, NM)
H. E. Chesley
D. T. Thorp, Jr.
J. S. de Albuquerque

District I - (505) 393-6161
P. O. Box 1980
Hobbs, NM 88241-1980
District II - (505) 748-1283
811 South First
Artesia, NM 88210
District III - (505) 334-6178
1000 Rio Brazos Road
Aztec, NM 87410
District IV - (505) 827-7131

State of New Mexico
Energy Minerals and Natural Resources Department
Oil Conservation Division
2040 South Pacheco Street
Santa Fe, New Mexico 87505
(505) 827-7131

Form C- 141
Originated 2/13/97

Submit 2 copies to Appropriate District Office in accordance with Rule 116 on back side of form

Release Notification and Corrective Action
OPERATOR

FOLLOW UP REPORT ☐ Initial Report ☐ Final Report

Name	Contact
PHILLIPS PETROLEUM COMPANY	D. T. THORP, JR.
Address	**Telephone No.**
4001 PENBROOK, ODESSA, TX 79762	505-391-5314
Facility Name	**Facility Type**
SOUTH FOUR LAKES UNIT	OIL & GAS PRODUCTION LEASE

Surface Owner	Mineral Owner	Lease No.
State of NM	State of NM	E-2064

LOCATION OF RELEASE

Unit Letter	Section	Township	Range	Feet from the	North/South Line	Feet from the	East/West Line	County
I	2	12S	34E	@2,000	South	@1,035	East	Lea

NATURE OF RELEASE

Type of Release	Volume of Release	Volume Recovered
Produced water release	@200 bbl	@10 bbl
Source of Release	**Date and Hour of Occurrence**	**Date and Hour of Discovery**
Injection line leak	07/14/97 (am)	07/14/97 (am)
Was Immediate Notice Given? ☒ Yes ☐ No ☐ Not Required	**If YES, To Whom?** NMOCD, Hobbs, NM	
By Whom? D. T. Thorp, Jr.	**Date and Hour** 07/14/97	
Was a Watercourse Reached? ☒ Yes ☐ No	**If YES, Volume Impacting the Watercourse.** See attached page	

If a Watercourse was Impacted, Describe Fully.*

See attached page

Describe Cause of Problem and Remedial Action Taken.*

See attached page

Describe Area Affected and Cleanup Action Taken.*

See attached page

Describe General Conditions Prevailing (Temperature, Precipitation, etc.).*

Sunny to partly cloudy, hot (85° to 95°)

I hereby certify that the information given above is true and complete to the best of my knowledge and belief.
Signature: Sam E. Christy

Printed Name: Sam E. Christy
Title: Safety & Environmental Analyst
Date: 12/31/97 Phone 915-368-1620

OIL CONSERVATION DIVISION

Approved by District Supervisor:
Approval Date: Expiration Date:
Conditions of Approval: Attached ☐

* Attach Additional Sheets If Necessary

ATTACHMENT
FORM C-141
RELEASE NOTIFICATION AND CORRECTIVE ACTION
SOUTH FOUR LAKES UNIT
LEA COUNTY, NEW MEXICO

DECEMBER 31, 1997

On or about July 14, 1997, 1997 Phillips Petroleum Company discovered a leak on the injection line running from the South Four Lakes Unit Tank Battery to the South Four Lakes Unit Disposal Well No. 6. This well is located 1980 FSL and 660 FEL of Section 2, T-12-S, R-34-E, Lea County, NM. The leak occurred approximately 375 feet to the WNW from the disposal well and is estimated to have lost approximately 200 bbl. of produced water. The injection line and is buried approximately 2 to 3 feet below the surface. No produced water was recovered.

During the week of September 29, 1997 Phillips excavated the site in order to replace the injection line. On October 1 & 2, 1997 Phillips conducted further excavations at the leak site to help determine the extent of the contamination from the leak. Soil sample were taken at the leak site to a depth of approximately 14 feet. Additional soil samples were taken at another leak site on the old line approximately 210 feet WNW of the disposal well to a depth of approximately 4 feet. Wayne Price of the NMOCD (Hobbs, NM) was present on October 1, 1997 to inspect the site and witness some of the sampling activity. *(See a copy of the attached October 14, 1997 letter and sampling results from Sam E. Christy to Mr. Price which has also been attached.)*

By his letter dated, October 21, 1997 Mr. Price further requested Phillips to determine of the groundwater at the site had been impacted by the leak on the subject injection line. He strongly recommended that a monitor well be installed and samples taken to assist with this request. *(A copy of this letter has also been attached.)* On December 3, 1997 Phillips installed the requested monitor well approximately 10 to 15 feet to the SE of the of the injection line leak site and sampled the same per Sam E. Christy's letter to Mr. Price on November 24, 1997. *(A copy of this letter has also been attached.)*

On December 18, 1997 this office received the results from this sampling and reported the high Chloride levels in the groundwater to both Wayne Price and Roger Anderson (NMOCD/Santa Fe, NM) on December 19, 1997. This analysis showed the Chloride levels to be 5400.00 MG/L and the BETX to be below the non-detectable level.

From the letter dated November 24, 1997 from Sam E. Christy to Wayne Price, Phillips proposed to submit a formal groundwater report concerning this sampling to the NMOCD on or before February 27, 1998. Phillips plans to submit this report under the same proposed timetable and will also submit a proposal to the NMOCD concerning actions to be taken by Phillips as a result of the analytical findings.

PHILLIPS PETROLEUM COMPANY

4001 PENBROOK
ODESSA, TEXAS 79762

EXPLORATION AND PRODUCTION
Permian Profit Center

November 24, 1997

State of New Mexico
Oil Conservation Division
Attention: Wayne Price
P. O. Box 1980
Hobbs, New Mexico 88241-1980

Re: South Four Lakes Unit
Lea County, New Mexico

Dear Mr. Price:

The purpose of this letter is to advise the New Mexico Oil Conservation Division of the Phillips Petroleum Company's plan to investigate the elevated soil chloride (Cl-) levels associated with recent produced water injection line leak at the South Four Lake Unit.

Phillips proposes to install one (1) groundwater monitor well slightly down gradient of the area of concern addressed by your letter of October 21, 1997. From this well Phillips will analyze groundwater for the list of constituents previously agreed to by Mr. William C. Olson of the NMOCD in Santa Fe. (Please see the enclosed copy my letter, dated May 6, 1997 to William C. Olson, a copy of the April 1997 Quantification of Natural Attenuation of Petroleum Hydrocarbons in Groundwater Report, and the copy of Mr. Olson's letter, dated July 14, 1997.)

As you are aware, Phillips is presently monitoring groundwater at the South Four Lake Unit on a yearly schedule, with each year's sampling and analysis being completed during the fourth quarter of each year. From the letters and report referenced above, please note the list of constituents which presently includes Cl- and BTEX, but not TPH. Phillips does not agree that TPH is a meaningful groundwater indicator parameter, and therefore, respectfully proposes not sampling or analyzing for such levels in this monitor well. This philosophy would be consistent with the previously proposed and completed work at the site and approved by the NMOCD.

This office has scheduled and arranged for the annual groundwater sampling referenced above for December 2 - 4, 1997. This office has further arranged for the monitor well to be installed on December 3, 1997 so we can include this additional sampling and analysis with this regularly scheduled work. From this sampling and subsequent analysis Phillips proposes to supply the NMOCD with a report summarizing the groundwater quality of the proposed monitor well on or before February 27, 1997. This report will be in addition to the verbal and written notification of groundwater contamination if and when such contamination is discovered.

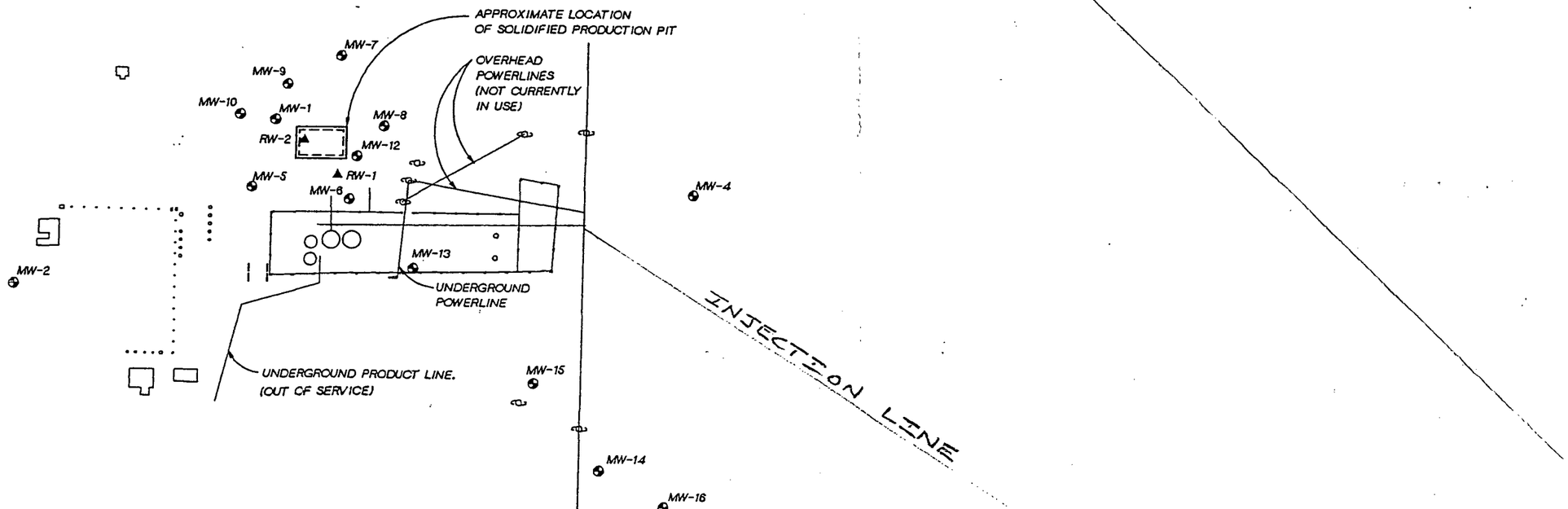
Should you have any questions or require any additional information, please feel free to contact me at **915-368-1620**.

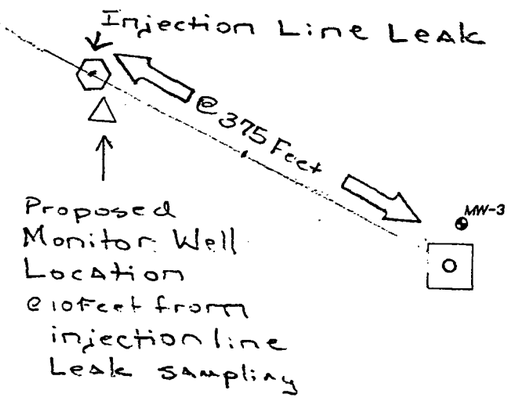
Sincerely,

Sam E. Christy
Safety & Environmental Analyst

enclosure

cc. J. S. de Albuquerque
H. E. Chesley





LEGEND

- Power Pole
- Monitoring Well
- RW-1 and RW-2 Recovery Well Clusters
- MW-8 Location has been plugged and abandoned.

Note: Underground product line and powerline locations infered based on best available information.

0 150 300 450

SCALE 1"=150'

Phillips Petroleum Company
South Four Lakes Unit
Tatum, New Mexico

Production Lease Tank Battery Layout and Monitor Well Locations

Figure 1-2

PHILLIPS PETROLEUM COMPANY

4001 PENBROOK
ODESSA, TEXAS 79762

EXPLORATION AND PRODUCTION
Permian Profit Center

May 6, 1997

Mr. William C. Olson
Environmental Bureau
New Mexico Oil Conservation Division
2040 South Pacheco
Santa Fe, New Mexico 87505

RE: South Four Lakes Unit
Quantification of Natural Attenuation
& Future Groundwater Monitoring Program

Dear Mr. Olson:

Enclosed is a report entitled *"Quantification of Natural Attenuation of Petroleum Hydrocarbons in Groundwater - South Four Lakes Unit, Lea County, NM"* prepared on behalf of Phillips Petroleum Company (Phillips) by CH_2M HILL, Inc. of Denver, CO.

The report summarizes four quarters of groundwater monitoring results and specifically documents natural bioattenuation, and containment of the dissolved petroleum hydrocarbon plume by bioattenuation, at the site. Furthermore, it is Phillips' belief based on the data analyzed to date that our source elimination / control program (pit solidification / free-product removal) implemented over the past 1.5 years in combination with the natural bioattenuation occurring at the site, is responsible for the reduction in dissolved toluene, ethylbenzene, and xylenes, and the disappearance of benzene, documented in MW-15 (Page 2-6 of the enclosed report).

At this point in our monitoring program, Phillips respectfully requests that monitor wells MW-2, MW-3, and MW-4 be eliminated from future groundwater monitoring events and be plugged and abandoned in accordance with applicable NM rules and regulations. Also, Phillips requests that the metals (Ag, Ar, Ba, Cd, Cr, Pb, Hg, and Se) be eliminated from the suite of groundwater parameters sampled in future monitoring events. Now that the site is well-documented and we understand the groundwater system, Phillips further recommends groundwater monitoring on a once-per-year basis as opposed to the quarterly basis completed previously. Further explanation for these requests is summarized below.

As you can see from the figures in the enclosed report, MW-2, MW-3, and MW-4 are located outside the area of concern, and to date, have yielded no detections of constituents that exceeded NM Water Quality Control Commission (WQCC) standards as specified in

20 NMAC 6.2(J) (3103)(A). Phillips has adequate upgradient site coverage in MW-5, MW-7, MW-9, and MW-10. Monitor wells 13, 14, 15, and 16 are located within the apex of the dissolved hydrocarbon plume, and therefore, provide adequate downgradient plume coverage. Should the NMOCD concur that these monitor wells no longer add value to the groundwater monitoring program, Phillips will proceed with the plugging and abandonment of these three wells.

Phillips has now completed three quarters of groundwater monitoring for metals (2nd, 3rd, and 4th quarters - 1996). You will note that barium was detected at varying levels upgradient, downgradient, and within the plume. Also, chromium was detected in upgradient MW-10 at 0.63, 0.58, and 0.46 mg/L (April-July-October 1996). Since the groundwater data does not suggest a metals groundwater problem resulting from the closed production pit, Phillips requests that the metals suite be eliminated from future sampling and monitoring events.

Through the last 1.5 years of assessment and corrective action activities, Phillips has gained a thorough understanding of the groundwater system at the South Four Lakes Unit. Furthermore, we have analytically quantified the natural and intrinsic biological processes at work in groundwater beneath and adjacent to the Unit. These natural attenuation processes, with the emphasis on bioattenuation, are responsible for the containment, and to a degree, reduction of the dissolved hydrocarbon plume size and relative concentration at the Unit. Phillips now proposes a natural attenuation-monitoring only long-term groundwater management strategy for the Unit. We propose to monitor the monitor well network on a once-per-year basis begining in the fourth quarter of 1997. Please note that Phillips will continue to operate the windmill-driven free-product recovery system as part of the long-term site strategy since we have demonstrated a benefit in the continued operation of the system.

Should you need additional information or have questions, please call me at (915) 368-1620.

Sincerely,

Sam E. Christy
Safety & Environmental Analyst

cc: Jerry Sexton, NMOCD/Hobbs, NM
L. A. Takla
H. E. Chesley
J. S. de Albuquerque

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION
2040 S. PACHECO
SANTA FE, NEW MEXICO 87505
(505) 827-7131

July 14, 1997

CERTIFIED MAIL
RETURN RECEIPT NO. P-410-431-193

Mr. Sam E. Christy
Phillips Petroleum Company
4001 Penbrook
Odessa, Texas 79762

RE: GROUND WATER REMEDIATION AND MONITORING
SOUTH FOUR LAKES UNIT

Dear Mr. Christy:

The New Mexico Oil Conservation Division has reviewed Phillips Petroleum Company's (Phillips) May 6, 1997 "SOUTH FOUR LAKES UNIT QUANTIFICATION OF NATURAL ATTENUATION & FUTURE GROUNDWATER MONITORING PROGRAM ". This document contains the results of Phillips's recent ground water remediation and monitoring activities. The document also contains recommendations to plug and abandon 3 site monitoring wells and modify the long term ground water monitoring plan.

Phillips's proposals as contained in the above referenced document are approved with the following conditions:

1. In addition to the proposed sampling parameters, Phillips will continue to sample and analyze ground water from all monitor wells for concentrations of iron and manganese using EPA approved methods and quality assurance/quality control (QA/QC).

2. Annual remediation and monitoring reports will be submitted to the OCD by July 1 of each year. The annual reports will contain:

   a. A description of the monitoring and remediation activities which occurred during the year including conclusions and recommendations.

   b. Summary tables listing past and present laboratory analytic results of all water quality sampling for each monitoring point and plots of concentration vs. time for contaminants of concern from each monitoring point. Copies of the most recent years laboratory, data sheets and associated QA/QC data will also be submitted.

c. A water table elevation map using the water table elevation of the ground water in all monitor wells.

d. Plots of water table elevation vs. time for each ground water monitoring point.

e. A product thickness map based on the thickness of free phase product on ground water in all refinery monitor wells.

f. The volume of product and water recovered in the remediation system during each year and the total recovered to date.

3. All wastes generated will be disposed of at an OCD approved facility or in an OCD approved manner.

4. Phillips will notify the OCD at least one week in advance of all scheduled activities such that the OCD has the opportunity to witness the events and/or split samples.

5. All documents will be submitted to the OCD Santa Fe Office with copies provided to the OCD Hobbs District Office.

Please be advised that OCD approval does not relieve Phillips of liability should the remediation and monitoring program fail to adequately monitor or remediate contamination related to Phillips's operations. In addition, OCD approval does not relieve Phillips of responsibility for compliance with any other federal, state, or local laws and/or regulations.

If you have any questions, please call me at (505) 827-7154.

Sincerely,

William C. Olson
Hydrogeologist
Environmental Bureau

xc: Chris Williams, OCD Hobbs District Supervisor
Wayne Price, OCD Hobbs Office
David Deardorff, New Mexico State Land Office

NEW MEXICO ENERGY, MINERALS
& NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION
DISTRICT I HOBBS
PO BOX 1980, Hobbs, NM 88241
(505) 393-6161
FAX (505) 393-0720

Jennifer A. Salisbury
CABINET SECRETARY

October 21, 1997

Mr. Sam Christy-S&EA
Phillips Petroleum Company (PPC)
4001 Penbrook
Odessa, Texas 79762

Re: South Four Lakes Unit
Lea County, New Mexico
NE/4 SE/4 Sec 2-Ts12s-R34e.

New Mexico Oil Conservation Division (NMOCD) is in receipt of the project report and plan dated October 14, 1997 for the above referenced site. **The plan is hereby approved subject to the following conditions:**

A. All berms constructed shall at a minimum contain a capacity one-third larger than the capacity of the enclosed tank or tanks.

B. Due to the shallow depth to ground water at this site (25-30 feet) , all remedaited soils shall met the minimum numerical standards;

TPH < 100 ppm, Benzene < 10 ppm, Total BTEX < 50 ppm, Chlorides < 250 ppm; or, PPC will be allowed to demonstrate, by using a known and proven risk assessment method, that any contaminated soils above the numerical levels listed above, will not adversely impact the environment in the foreseeable future.

C. Site SFLU #(1 & 2) was noted to have elevated chlorides at a depth of 4 feet below ground surface. PPC will be required to determine the vertical extent of this contamination.

D. Site SFLU # (3 & 4) indicated high chlorides levels (3403 ppm) at a depth of 14 feet below the surface. Since ground water in the immediate area is around 25 to 30 feet below ground surface, PPC will be required to submit to the NMOCD for approval a site investigation plan to determine if ground water has been impacted.

The NMOCD recommends initially installing one exploratory monitor well down gradient and adjacent to the original leak site SFLU (# 3&4). PPC shall initially run TPH, BTEX, and general chemistry including chlorides on the ground water. Depending upon these initial results, NMOCD defers commit on future work required at this time.

PPC is hereby required to submit to the NMOCD District I office for approval the site investigation plan as mentioned in items C. & D. above within 45 days of receipt of this letter.

Please be advised that NMOCD approval of this plan at this time does not relieve PPC of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to ground water, surface water, human health or the environment. In addition, NMOCD approval does not relieve PPC of responsibility for compliance with any other federal, state, or local laws and/or regulations.

In addition, PPC should be aware of NMOCD's policy that upon discovery of ground water contamination PPC must within 24 hours notify both the NMOCD District office and the NMOCD Environmental Bureau (505-827-7152), also submit written notification within 15 days.

If you require any further information or assistance please do not hesitate to call (505-393-6161) or write this office.

Sincerely Yours,

Wayne Price-Environmental Engineer

cc: Chris Williams-NMOCD District I Supervisor
NM State Land Office-Hobbs

attachments- PPC report & analysis

PHILLIPS 66

PHILLIPS PETROLEUM COMPANY

4001 PENBROOK
ODESSA, TEXAS 79762

EXPLORATION AND PRODUCTION
Permian Profit Center

October 14, 1997

State of New Mexico
Oil Conservation Division
Attention: Wayne Price
P. O. Box 1980
Hobbs, New Mexico 88241

Re: South Four Lakes Unit
Lea County, New Mexico

Dear Mr. Price:

Pursuant to our telephone conversations and Phillips soil sampling at the South Four Lakes Unit attached you will find copies of the laboratory analysis from the bottom hole samples taken on October 1 & 2, 1997. The locations and depths of the samples are as follows:

- **SFLU #1:** approximately 210 feet west of the South Four Lakes Unit Injection Well No. D-6 at a depth of approximately 4 feet below the surface.
- **SFLU #2:** the same as SFLU #1.
- **SFLU #3:** approximately 375 feet west of the South Four Lakes Unit Injection Well No. D-6 at a depth of approximately 14 feet below the surface.
- **SFLU #4:** the same as SFLU #3.

Please be advised of the following action plan which Phillips Petroleum Company proposes to undertake concerning the contaminated soil at the South Four Lakes Unit:

- The contaminated soil from the sampled sites will be taken to the tank battery area of the South Four Lakes Unit and mixed with clean make-up soil and a dike/berm will be constructed around the subject tank battery. TPH & BTEX analysis will be conducted on the mixture during this process and the results will be sent to the NMOCD in Hobbs, NM.
- The excavated contaminated soil will be replaced with clean make-up soil.

Phillips Petroleum Company plans to begin this project within the next 2 to 3 weeks. If you have any questions or comments, please feel free to contact me at **915-368-1620**.

Sincerely,

Sam E. Christy
Safety & Environmental Analyst

enclosure

ENVIRONMENTAL LAB OF , INC.

"Don't Treat Your Soil Like Dirt!"

PHILLIPS PETROLEUM COMPANY
ATTN: MR. SAM E. CHRISTY
4001 PENBROOK
ODESSA, TEXAS 79762
FAX: 915-368-1507

Receiving Date: 10/03/97
Sample Type: SOIL
Project Name: SOUTH FOUR LAKES INJ. LINE
Project Location: SOUTH FOUR LAKES UNIT

Analysis Date: 10/03/97
Sampling Date: 10/01/97,10/02/97
Sample Condition: Intact/Iced

ELT#	FIELD CODE	TPH mg/kg	Chloride mg/kg
12716	SFLU #1	170	2,552
12717	SFLU #2	420	2,340
12718	SFLU #3	<10	3,403
12719	SFLU #4	<10	3,403
	QUALITY CONTROL	537	9,891
	TRUE VALUE	537	10,000
	% PRECISION	100	99

Methods: EPA 418.1,SW 846-9252

Michael R. Fowler

10-7-97
Date

12600 West I-20 East • Odessa, Texas 79765 • (915) 563-1800 • Fax (915) 563-1713

Bill Olson

From: Price, Wayne
Sent: Friday, December 19, 1997 1:26 PM
To: Roger Anderson; Bill Olson
Cc: Chris Williams
Subject: Phillips S. 4-lakes Inj line leak-

Sam Christy has made a verbal notification that they have a groundwater impact. They will follow-up with written notification.

PHILLIPS PETROLEUM COMPANY

4001 PENBROOK
ODESSA, TEXAS 79762

EXPLORATION AND PRODUCTION
Permian Profit Center

November 20, 1997

State of New Mexico
Oil Conservation Division
Attention: William C. Olson
2040 South Pacheco
Santa Fe, New Mexico 87505

Re: Annual Groundwater Sampling
South Four Lakes Unit
Lea County, New Mexico

Dear Mr. Olson:

By this letter, please be advised that Phillips Petroleum Company has scheduled the annual groundwater sampling at the South Four Lakes Unit for December 2 - 4, 1997.

If you have any questions, please feel free to contact me at **915-368-1620**.

Sincerely,

Sam E. Christy
Safety & Environmental Analyst

cc: Chris Williams (NMOCD/Hobbs, NM)
H. E. Chesley (PPCo/Team NM)
D. T. Thorp (PPCo/Team NM)
J. S. de Albuquerque (PPCo/NAPD)

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION
2040 S. PACHECO
SANTA FE, NEW MEXICO 87505
(505) 827-7131

July 14, 1997

CERTIFIED MAIL
RETURN RECEIPT NO. P-410-431-193

Mr. Sam E. Christy
Phillips Petroleum Company
4001 Penbrook
Odessa, Texas 79762

RE: GROUND WATER REMEDIATION AND MONITORING
SOUTH FOUR LAKES UNIT

Dear Mr. Christy:

The New Mexico Oil Conservation Division has reviewed Phillips Petroleum Company's (Phillips) May 6, 1997 "SOUTH FOUR LAKES UNIT QUANTIFICATION OF NATURAL ATTENUATION & FUTURE GROUNDWATER MONITORING PROGRAM ". This document contains the results of Phillips's recent ground water remediation and monitoring activities. The document also contains recommendations to plug and abandon 3 site monitoring wells and modify the long term ground water monitoring plan.

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If you have any questions, please call me at (505) 827-7154.

Sincerely,

William C. Olson
Hydrogeologist
Environmental Bureau

xc: Chris Williams, OCD Hobbs District Supervisor
Wayne Price, OCD Hobbs Office
David Deardorff, New Mexico State Land Office

PHILLIPS PETROLEUM COMPANY
4001 PENBROOK
ODESSA, TEXAS 79762

EXPLORATION AND PRODUCTION
Permian Profit Center

May 6, 1997

Mr. William C. Olson
Environmental Bureau
New Mexico Oil Conservation Division
2040 South Pacheco
Santa Fe, New Mexico 87505

RE: South Four Lakes Unit
Quantification of Natural Attenuation
& Future Groundwater Monitoring Program

Dear Mr. Olson:

Enclosed is a report entitled *"Quantification of Natural Attenuation of Petroleum Hydrocarbons in Groundwater - South Four Lakes Unit, Lea County, NM"* prepared on behalf of Phillips Petroleum Company (Phillips) by CH_2M HILL, Inc. of Denver, CO.

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Should you need additional information or have questions, please call me at (915) 368-1620.

Sincerely,

Sam E. Christy
Safety & Environmental Analyst

cc: Jerry Sexton, NMOCD/Hobbs, NM
L. A. Takla
H. E. Chesley
J. S. de Albuquerque

PHILLIPS PETROLEUM COMPANY
ODESSA, TEXAS 79762
4001 PENBROOK

EXPLORATION AND PRODUCTION GROUP
Permian Basin Region

July 3, 1996

State of New Mexico
Oil Conservation Division
Attention: William C. Olson
2040 South Pacheco
Santa Fe, New Mexico 87505

Re: 3rd Quarter Groundwater Sampling
South Four Lakes Unit
Lea County, New Mexico

Dear Mr. Olson:

Please be advised that Phillips will begin the 3rd quarter groundwater sampling at the South Four Lakes Unit beginning Tuesday, July 9, 1996. As with the sampling done in the first two quarters of 1996, representatives from CH_2M HILL, Inc. from Denver, Colorado will be doing the actual sampling on behalf of Phillips Petroleum Company.

If you have any questions, please contact me at **915-368-1620**.

Sincerely,

Sam E. Christy
Safety & Environmental Analyst

cc: Jerry Sexton/OCD Hobbs District
Wayne Price/OCD Hobbs District
J. S. de Albuquerque/PPCo NAPD

PHILLIPS 66 *From the desk of . . .*

6/4/96

Steve de Albuquerque

Bill,

Attached are copies of our overheads from our South Four Lakes meeting April 24, 1996.

It occured to me that I may have forgotten to send these to you as I promised. If I did send them earlier, well now you have two copies.

Regards,

Steve

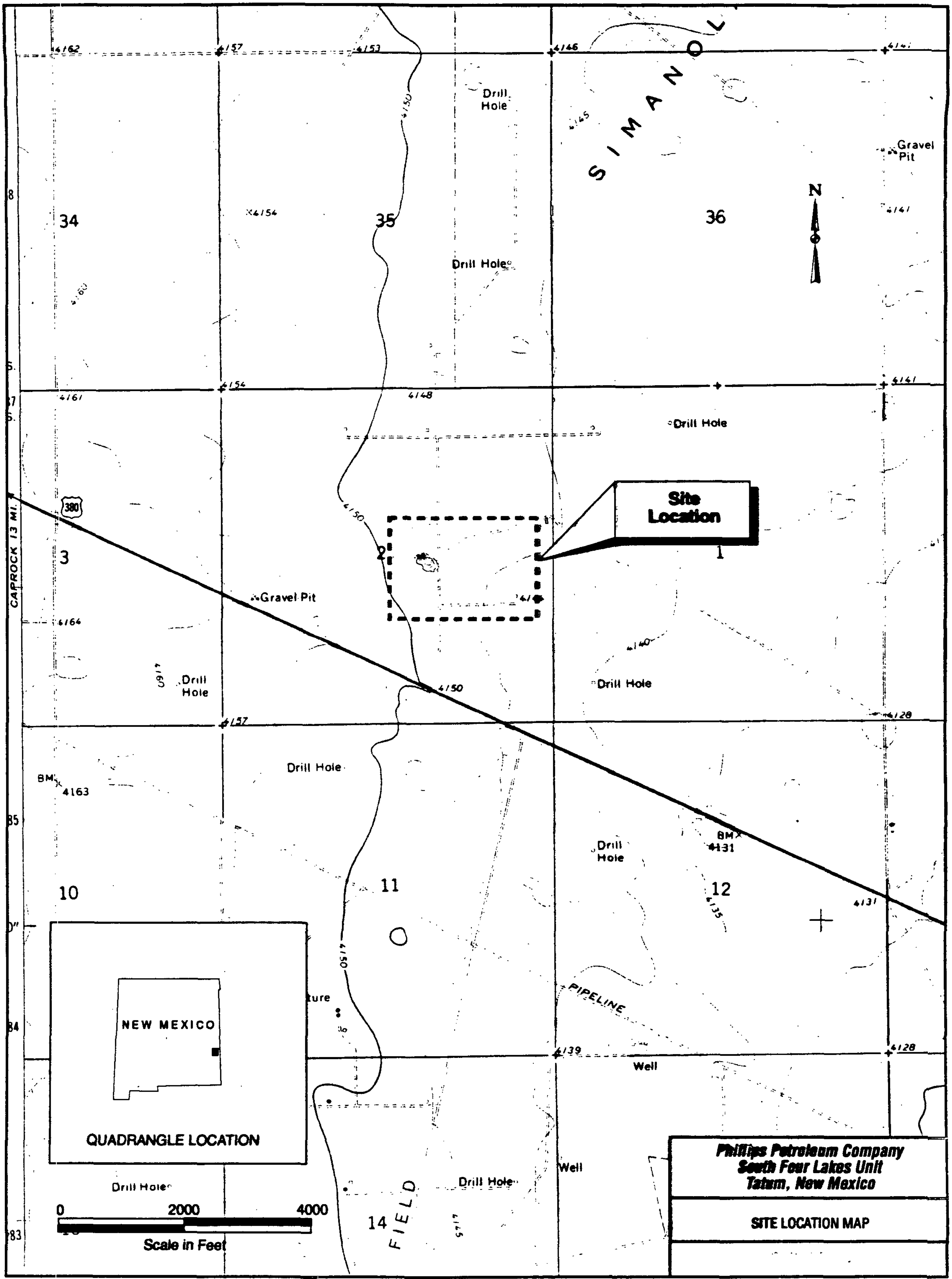
Objective

Cost Effective Assessment ...

Risk Management ...

Closure ...

- Site History and Description
- Natural Attenuation Processes
- Site Specific Natural Bioattenuation


Phillips Petroleum Company
South Four Lakes Unit
Tatum, New Mexico
SITE LOCATION MAP
Site Location
QUADRANGLE LOCATION
NEW MEXICO
0
2000
4000
Scale in Feet
N
34
35
36
3
2
1
10
11
12
14
SIMANOL
FIELD
CAPROCK 13 MI.
380
Drill Hole
Gravel Pit
Well
PIPELINE
BM 4163
BM 4131
4150

PRODUCTION HISTORY

SOUTH FOUR LAKES UNIT

- STATE OIL & GAS LEASE # E-2064
- 40 YEARS OF OIL & GAS ACTIVITY
- 1956 - 1970 = HUMBLE OIL & REFINING
  1970 - 1990 = EXXON
  1990 - 1996 = PHILLIPS PETROLEUM CO.

ENVIRONMENTAL ASSESSMENT CHRONOLOGY

SOUTH FOUR LAKES UNIT

10/90: PHASE I/II SITE ASSESSMENT
- 4 MONITOR WELLS
  SOIL & GROUNDWATER SAMPLING
- T-E-X DETECTED; BELOW NMWQCC
  STANDARDS

09/94: PHASE I/II SITE ASSESSMENT
- FREE PRODUCT DISCOVERED IN MW-1

ENVIRONMENTAL ASSESSMENT CHRONOLOGY

SOUTH FOUR LAKES UNIT

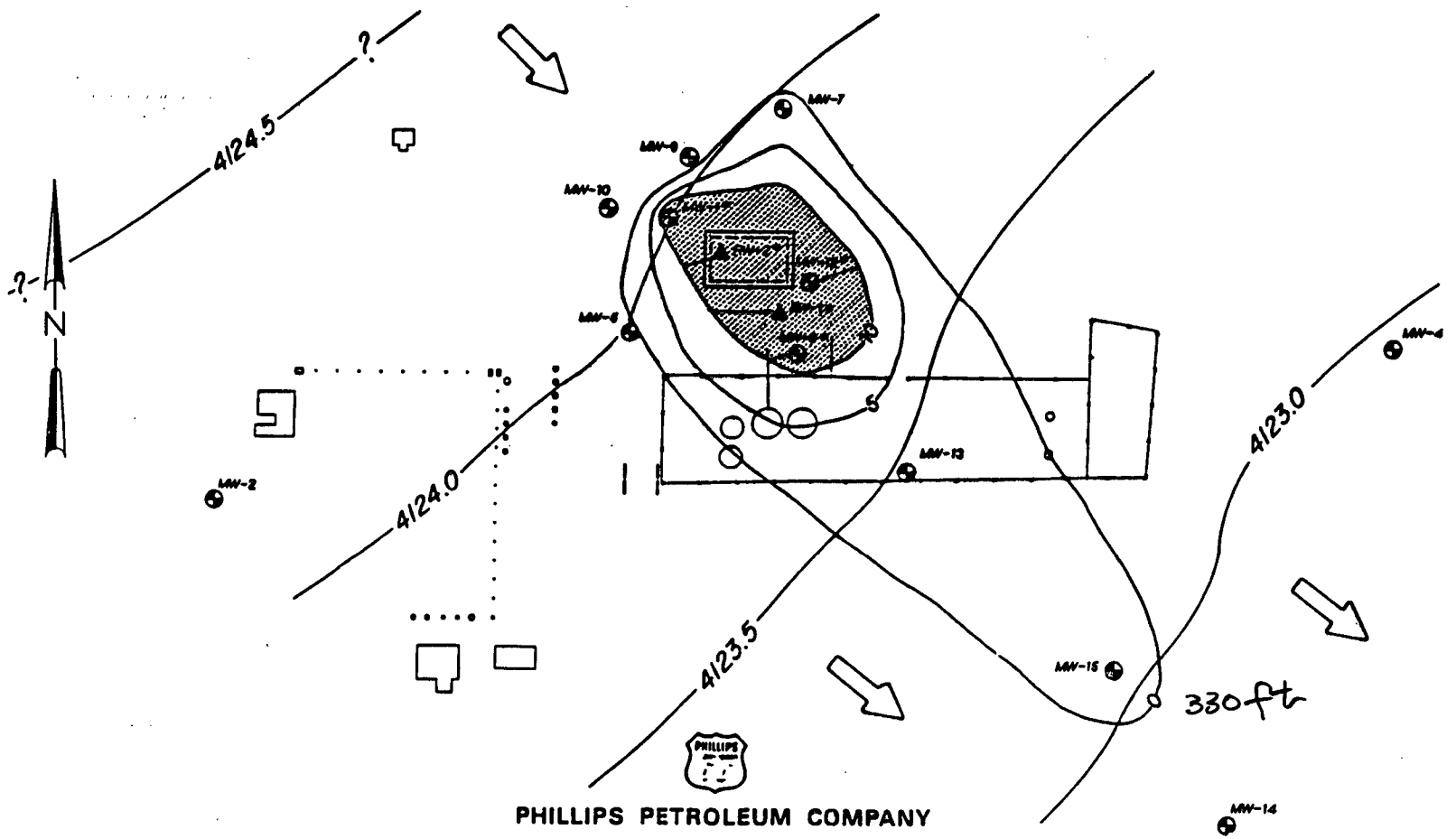
12/94: EXPANDED SITE ASSESSMENT
- 9 ADDITIONAL MONITOR WELLS
- IDENTIFIED SOURCE
- DEFINED EXTENT OF FREE PRODUCT & DISSOLVED HYDROCARBONS

7/95 REMEDIAL ACTION PLAN
- SOURCE ELIMINATION
- MASS REMOVAL
- DOWN-GRADIENT ASSESSMENT

ENVIRONMENTAL ASSESSMENT CHRONOLOGY

SOUTH FOUR LAKES UNIT

- 10/95: DOWN-GRADIENT ASSESSMENT
  - 3 ADDITIONAL MONITOR WELLS
- 11/95: SOURCE ELIMINATION
  - SOLIDIFIED 1,835 YARDS OF PIT MATERIAL
- 1/96: MASS REMOVAL
  - 2 RECOVERY WELL CLUSTERS
  - 1 WINDMILL SYSTEM
  - INTRINSIC BIOATTENUATION STUDY



PHILLIPS PETROLEUM COMPANY

SURFICIAL AQUIFER - POTENTIOMETRIC SURFACE
SOUTH FOUR LAKES UNIT
JANUARY - 1996

LEGEND

- Monitoring Well
- RW-1 and RW-2 Recovery Well Clusters
- Inferred Extent of FPPH

NOTE: HYDRAULIC GRADIENT (i) = 0.002 FT./FT.
GROUND WATER FLOW VELOCITY ≈ 4 FT./YR.
(CONSERVATIVE ESTIMATE)

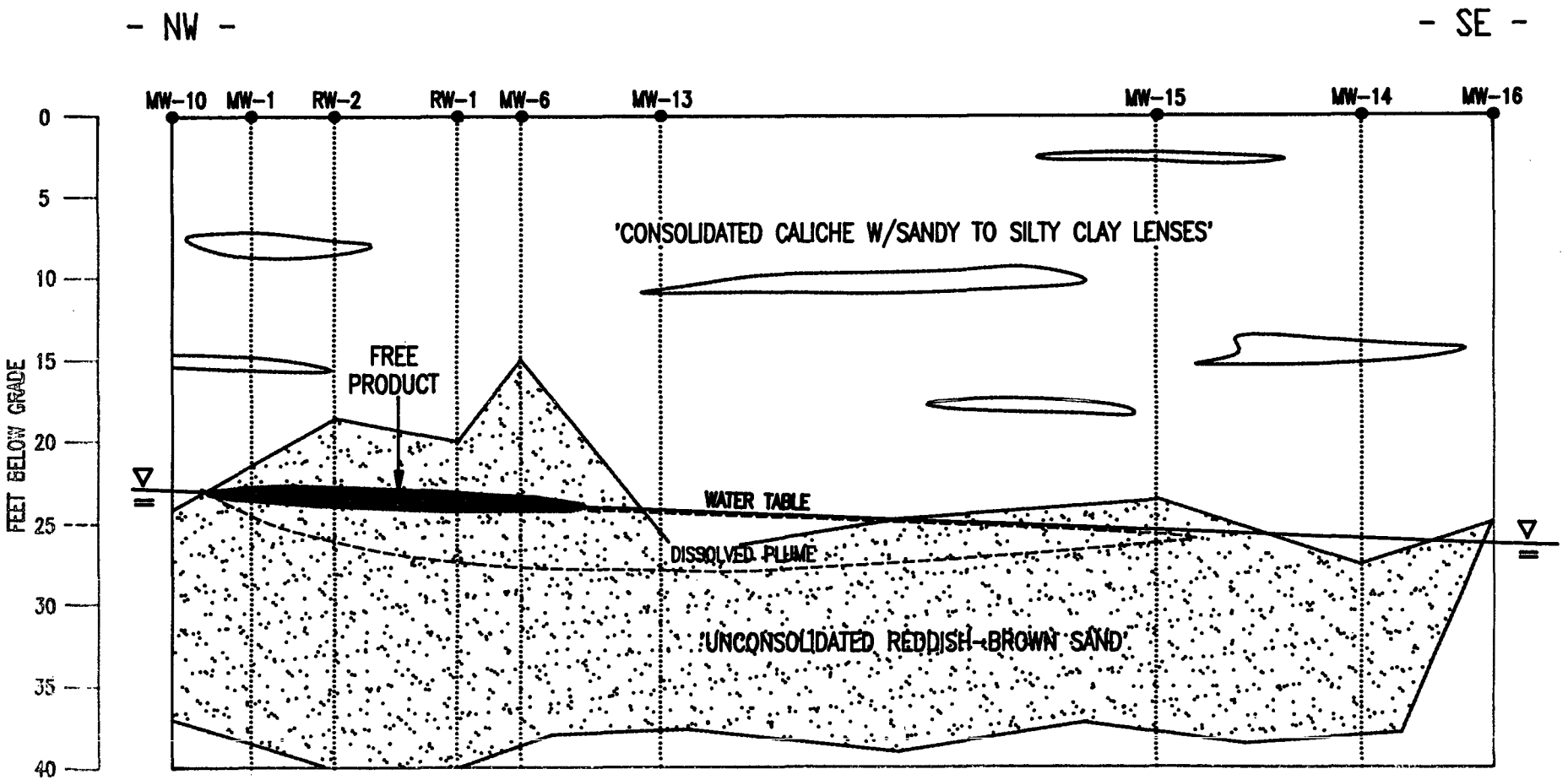
0 100 200 300

800ft.

PHILLIPS PETROLEUM COMPANY

- GENERALIZED GEOLOGIC CROSS-SECTION -
OF
SOUTH FORK LAKES UNIT

TATUM, NEW MEXICO



- Site History and Description
- Natural Attenuation Processes
- Site Specific Natural Bioattenuation

Natural Attenuation Processes

- Dilution
- Adsorption
- Volatilization
- Biodegradation
- Abiotic Oxidation
- Hydrolysis

STOICHIOMETRY

Aerobic Degradation

$$C_6H_5\text{-}CH_3 + 9O_2 \longrightarrow 7CO_2 + 4H_2O$$

Denitrification

$$C_6H_5\text{-}CH_3 + 6\,NO_3^- \longrightarrow 7CO_2 + 4H_2O + 3N_2$$

Sulfate Reduction

$$C_6H_5\text{-}CH_3 + 4.5\,SO_4^{2-} + 3H_2O \longrightarrow + 2.25\,H_2S + 2.25HS^- + 7HCO_3^- + 0.25H^+$$

Methanogenesis

$$C_6H_5\text{-}CH_3 + 5\,H_2O \longrightarrow 2.5\,CO_2 + 4.5\,CH_4$$

Iron III Reduction

$$C_6H_5\text{-}CH_3 + 36Fe(OH)_3 \longrightarrow 7CO_2 + 22H_2O + 36Fe^{2+} + 72\,OH^-$$

Stoichiometry

Electron Acceptors	Key By-Products
O_2	CO_2
NO_3^-	CO_2
SO_4^{2-}	HCO_3^-
Fe^{3+}	CO_2, Fe^{2+}
CO_2	CO_2, CH_4

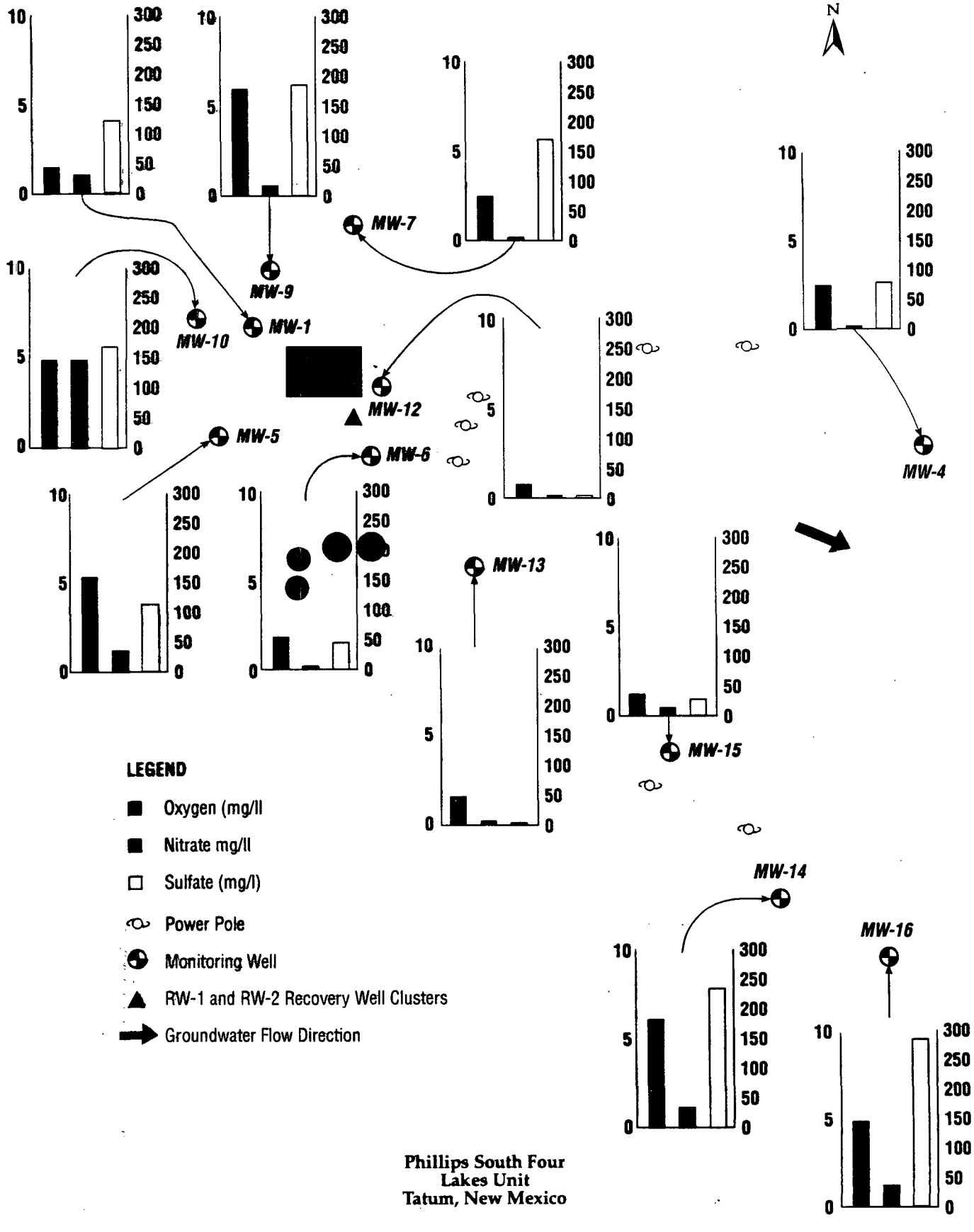
- Site History and Description
- Natural Attenuation Processes
- Site Specific Natural Bioattenuation

PREDICTED BTEX MIGRATION WITH NO BIODEGRADATION

SOUTH FOUR LAKES UNIT

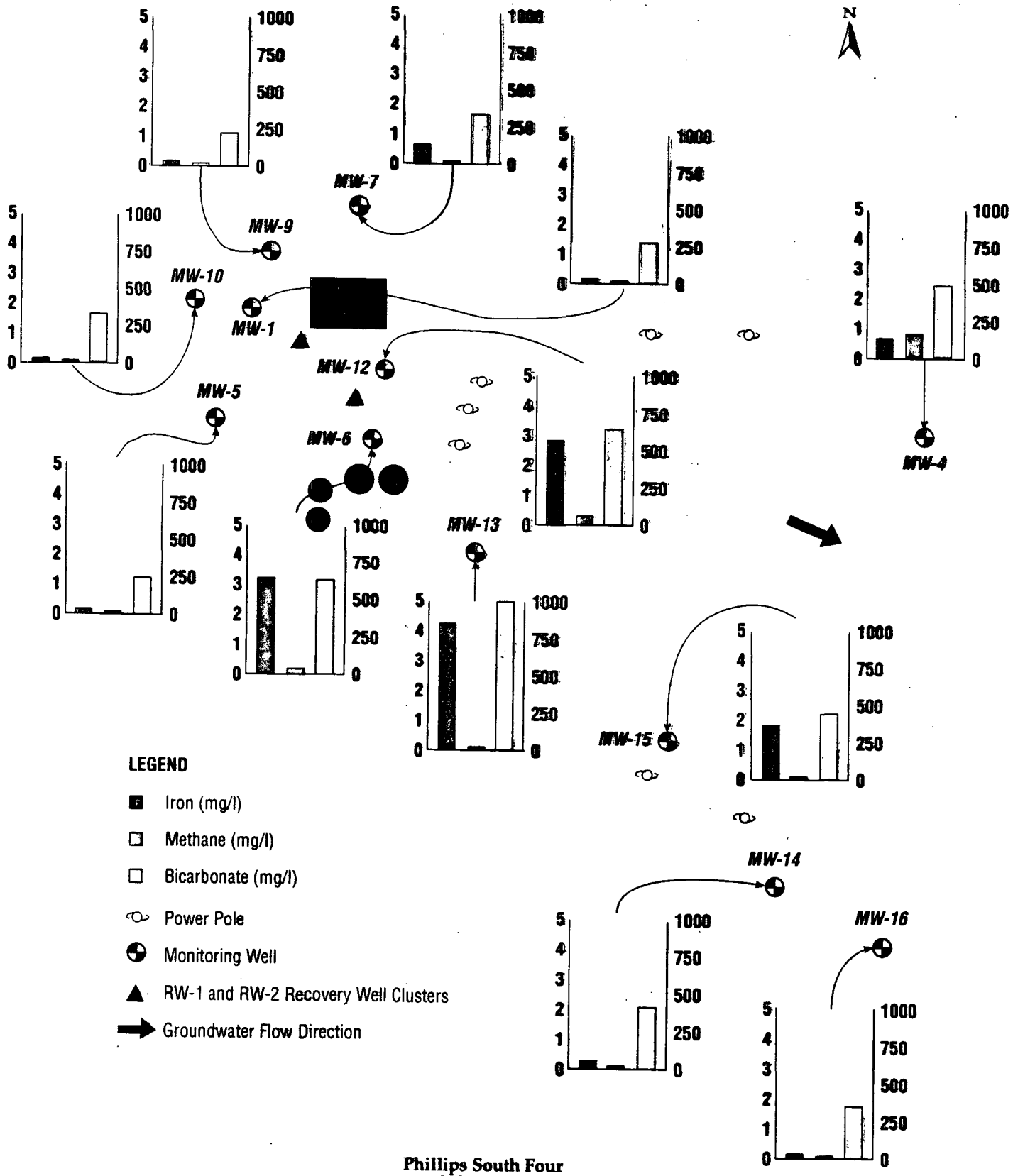
Parameter	Koc (ml/g)	Kd (ml/g)	Retardation Factor	Travel Distance (feet)
Conservative Tracer	- -	- -	1	1040
Benzene	83	0.21	2.3	455
Toluene	300	0.75	5.7	184
Ethylbenzene	1100	2.8	18.1	58
Xylenes	240	0.6	4.7	220

Electron Acceptors



Phillips South Four Lakes Unit
Tatum, New Mexico

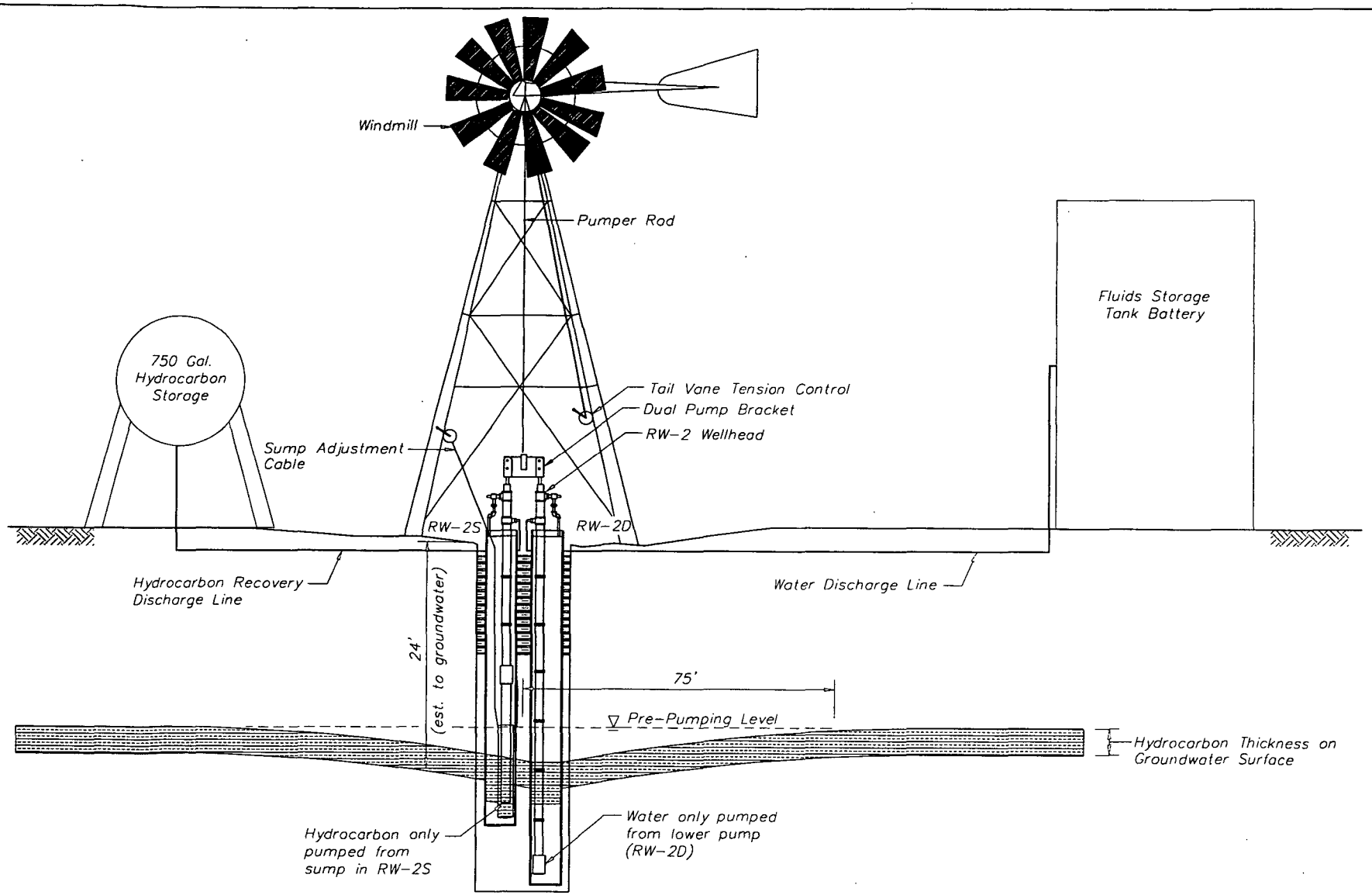
Biodegradation Byproducts



Phillips South Four Lakes Unit
Tatum, New Mexico

Natural Attenuation Site Considerations

- Land Use & Time Constraints
- Available Electron Acceptors
- Regulatory Agency Acceptance



NOT TO SCALE

DATE	ISSUE	DATE	ISSUE

PHILLIPS 66

PHILLIPS PETROLEUM COMPANY
SOUTH FOUR LAKES UNIT
HYDROCARBON RECOVERY SYSTEM LOGIC

DRAWN	CHECKED	APPROVED	DATE
			1-29-96
FILENAME: D:\PP124\CARTOON.DWG		REFERENCE FILES: NONE	FIGURE 6

OIL CONSERVATION DIVISION RECEIVED '96 APR 15 AM 8 52

PHILLIPS PETROLEUM COMPANY

HOUSTON, TEXAS 77251-1967
BOX 1967

NORTH AMERICA
PRODUCTION DIVISION

BELLAIRE, TEXAS
6330 WEST LOOP SOUTH
PHILLIPS BUILDING

09 April 1996

Fax received on 4/9/96 Will Olson

Mr. William C. Olson
New Mexico Oil Conservation Division
Environmental Bureau
2040 South Pacheco
Santa Fe, New Mexico 87505

RE: South Four Lakes Unit
Quarterly Groundwater Sampling Event - 2nd QTR 1996

Dear Bill:

As you requested in your 22 March 1996 letter to Mr. Sam Christy of Phillips Petroleum Company (Phillips), this letter is to notify the New Mexico Oil Conservation Division (OCD) that Phillips will be sampling the South Four Lakes monitor well network beginning on Tuesday morning, 16 April 1996.

This sampling event is the second quarter sampling event for 1996. CH_2M HILL, Inc. of Denver, Colorado, will be completing the sampling on behalf of Phillips. The sampling should take three days to complete.

Should you have questions or require additional information, please feel free to contact me at (713) 669-3748 or Mr. Sam Christy at (915) 368-1620.

Sincerely,

Steve de Albuquerque

J. Stephen de Albuquerque
Sr. Environmental & Regulatory
Representative

JSA:sfluocd3.doc

cc: Jerry Sexton - OCD Hobbs District Supervisor
Wayne Price - OCD Hobbs
S. E. Christy

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION
2040 S. PACHECO
SANTA FE, NEW MEXICO 87505
(505) 827-7131

March 22, 1996

CERTIFIED MAIL
RETURN RECEIPT NO: P-269-269-131

Mr. Sam E. Christy
Phillips Petroleum Company
4001 Penbrook
Odessa, Texas 79762

RE: INVESTIGATION AND REMEDIATION REPORTS
SOUTH FOUR LAKES UNIT

Dear Mr. Christy:

The New Mexico Oil Conservation Division (OCD) has completed a review of the following Phillips Petroleum Company (PPC) documents:

- January 31, 1996 "SOUTH FOUR LAKES UNIT, LEA COUNTY, NEW MEXICO, REMEDIAL ACTION PLAN COMPLETION REPORTS".

- January 29, 1996 "RECOVERY WELL INSTALLATION AT THE SOUTH FOUR LAKES TANK BATTERY".

- January 1996 "FREE PHASE HYDROCARBON RECOVERY SYSTEM INSTALLATION REPORT, SOUTH FOUR LAKES UNIT, LEA COUNTY, NEW MEXICO".

- December 1995 "FINAL CLOSURE REPORT, UNLINED SURFACE IMPOUNDMENT CLOSURE, PHILLIPS PETROLEUM COMPANY, SOUTH FOUR LAKES IMPOUNDMENT, SECTION 2, TOWNSHIP 12 SOUTH, RANGE 34 EAST, LEA COUNTY, NEW MEXICO".

- November 28, 1995 "SUPPLEMENTAL ENVIRONMENTAL INVESTIGATION OF THE SOUTH FOUR LAKES TANK BATTERY".

These documents contain the results of PPC's recent soil and ground water investigation/remedial actions related to PPC's South Four Lakes Unit in Lea County, New Mexico. The documents also contain a proposed ground water monitoring plan for the site.

The soil and ground water remedial actions taken to date are satisfactory and the long term monitoring plan is approved with the following conditions:

1. PPC will sample ground water on a quarterly basis from all monitor wells which do not contain free phase products. The ground water will be sampled and analyzed for concentrations of aromatic volatile organics, total dissolved solids (TDS), major cations and anions, heavy metals, polynuclear aromatic hydrocarbons (PAH) and dissolved oxygen using EPA approved methods.

2. On February 2 of each respective year PPC will submit an annual ground water monitoring report which will contain:

   a. A description of all activities which occurred during the past year, conclusions and recommendations.

   b. A summary of all quarterly laboratory analytic results of ground water quality monitoring and the laboratory analyses. The summary will include tables for each monitor well and will list all past and present sampling results.

   c. Ground water isoconcentration maps for contaminants of concern for each quarter (ie. TDS, chloride, benzene, metals, Pah's, etc.).

   d. A water table elevation map for each quarter using the water table elevation of ground water in all monitor wells.

   e. The volume of water and free phase product recovered each quarter and the cumulative volumes recovered since pumping began.

3. PPC will notify the OCD at least one week in advance of scheduled sampling activities such that the OCD has the opportunity to witness the events and/or split samples.

4. All documents will be submitted to the OCD Santa Fe Office with copies provided to the OCD Hobbs District Office.

The OCD would like to commend PPC for their initiative and innovative ideas in developing risk based low tech, cost effective approaches for remediating soils and ground water at the South Four Lakes Unit.

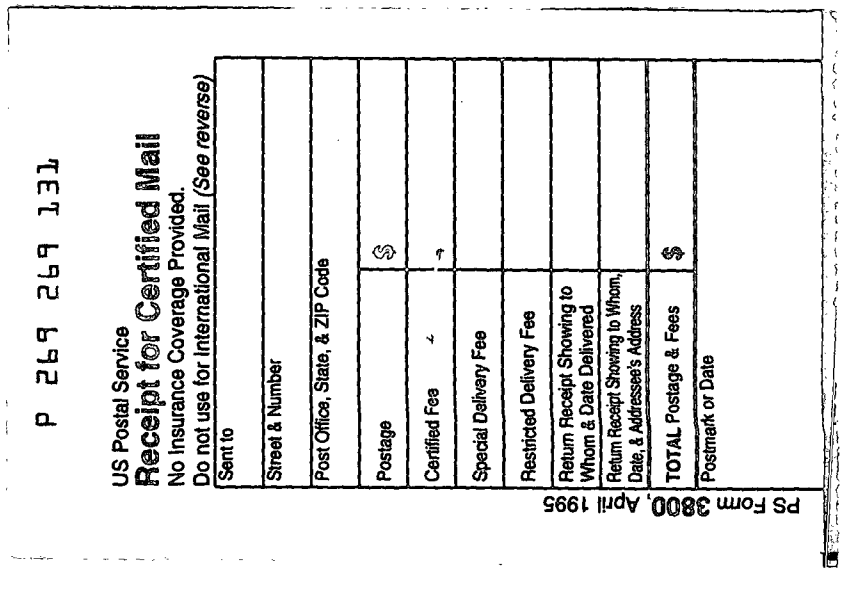
Please be advised that OCD approval does not relieve PPC of liability should contamination exist which is beyond the scope of the work plan or if the activities fail to adequately remediate or monitor contamination related to PPC's activities In addition, OCD approval does not relieve PPC of responsibility for compliance with any other federal, state or local laws and/or regulations.

If you have any questions, please call me at (505) 827-7154.

Sincerely,

William C. Olson
Hydrogeologist
Environmental Bureau

xc: Jerry Sexton, OCD Hobbs District Supervisor
Wayne Price , OCD Hobbs Office
J. Stephen de Albuquerque, Phillips Petroleum



PHILLIPS PETROLEUM COMPANY
4001 PENBROOK
ODESSA, TEXAS 79762

EXPLORATION AND PRODUCTION
Permian Basin Region

January 31, 1996

Mr. William C. Olson
New Mexico Oil Conservation Division
Environmental Bureau
2040 South Pacheco
Santa Fe, New Mexico 87505

RE: South Four Lakes Unit
Lea County, New Mexico
Remedial Action Plan Completion Reports

Dear Bill:

Enclosed, for your review and approval, are four reports which summarize work completed to date at the Phillips Petroleum Company (Phillips) South Four Lakes Unit located approximately 10 miles northwest of Tatum, NM.

The four submittals include:

1.) Final Closure Report - Unlined Surface Impoundment Closure prepared by Ritter Environmental & Geotechnical Services (December, 1995);

2.) Supplemental Environmental Investigation - Downgradient Assessment Report prepared by SECOR International, Inc. (November 1995);

3.) Recovery Well Installation Report prepared by SECOR International, Inc. (January 1995);

4.) Free-Product Recovery System Installation Report prepared by BASCOR Environmental, Inc. (January 1995).

One final Remedial Action Plan (RAP) task, quantification of natural bioattenuation of the dissolved hydrocarbon plume, is in progress. The first quarter groundwater sampling event for the monitor well network was completed the week of January 8, 1996. The first quarter groundwater report will be submitted to your office on or before March 15, 1996. Therefore, our quarterly groundwater monitoring schedule is January (complete), April, July, and October for 1996.

Results will be reported during March (in preparation), June, September, and December. Pending the quantification of natural bioattenuation of the dissolved hydrocarbon plume, Phillips anticipates sampling the monitor well network at a less frequent interval in subsequent years.

As you will see in the BASCOR report referenced above, the windmill-driven free-product recovery system has been installed. The recovery system is in the process of being piped to the lease production system. The recovered groundwater will be piped directly to the lease saltwater tanks for disposal in the lease injection well. The recovered free-product will be stored on site in a 750 gallon tank and sold periodically as product.

Phillips will be testing the recovery system (determining optimal flow rates, etc.) the week of February 5, 1995. Flow rates and recovered fluid volumes will be reported to the OCD quarterly or the first year of operation along with the groundwater monitoring report.

Should you have questions or require additional information, please feel free to contact me at (915) 368-1620.

Sincerely,

Sam E. Christy
Safety & Environmental
Analyst

SEC:sft
sfluocd2.ltr

cc: L.A. Takla
D. T. Thorp
H. E. Chesley
J. S. de Albuquerque

CC: BILL OLSON
NMOCD

OIL CONSERVATION DIVISION
RECEIVED
'96 FEB ... PM 8 52

NEW MEXICO OIL CONSERVATION COMMISSION
FIELD TRIP REPORT

INSPECTION	CLASSIFICATION	FACILITY	HOURS	QUARTER HOURS

Name WAYNE PRICE Date 2/13/96 Miles ______ District I

Time of Departure 7 AM Time of Return 4 PM Car No. G 0472

In the space below indicate the purpose of the trip and the duties performed, listing wells or leases visited and any action taken.

Signature Wayne Price

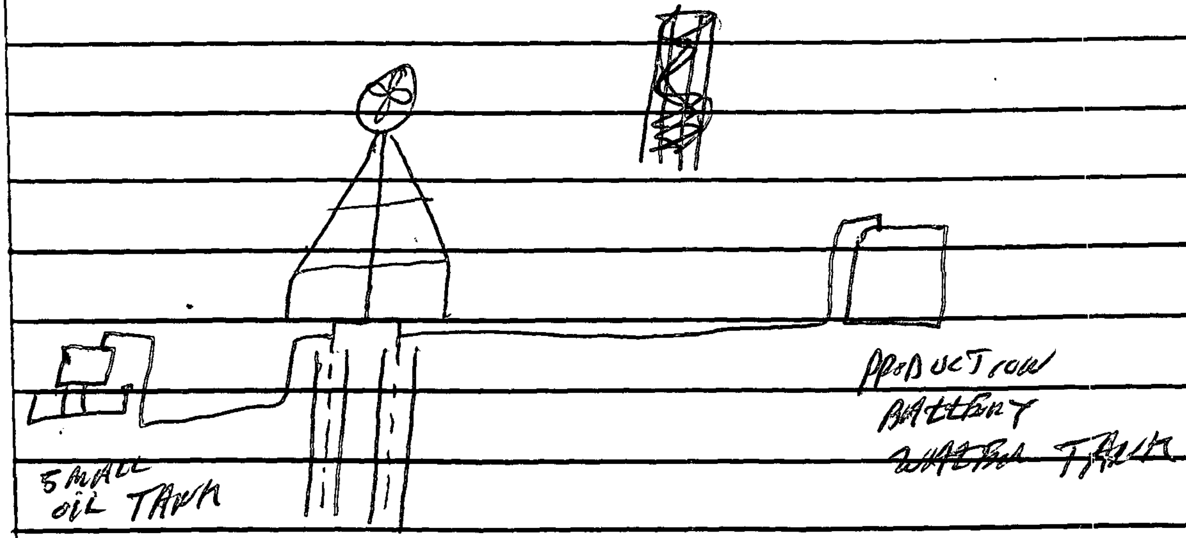
PHILLIPS SOUTH FOUR LAKES

GROUND WATER REMEDIATION RECOVERY WELL

SEC-2- T12S- R34E

TOOK PICTURE OF WINDMILL "RECOVERY SYSTEM"

DUEL CASING SINGLE DRIVE BY WINDMILL



NOTE: BILL I NEVER REC THEIR WORK PLAN!

Mileage		Per Diem		Hours	
UIC		UIC		UIC	
RFA		RFA		RFA	
Other		Other		Other	

TYPE INSPECTION PERFORMED

H = Housekeeping
P = Plugging
C = Plugging Cleanup
T = Well Test
R = Repair/Workover
F = Waterflow
M = Mishap or Spill
W = Water Contamination
O = Other

INSPECTION CLASSIFICATION

U = Underground Injection Control - Any inspection of or related to injection project, facility, or well or resulting from injection into any well. (SWD, 2ndry injection and production wells, water flows or pressure tests, surface injection equipment, plugging, etc.)

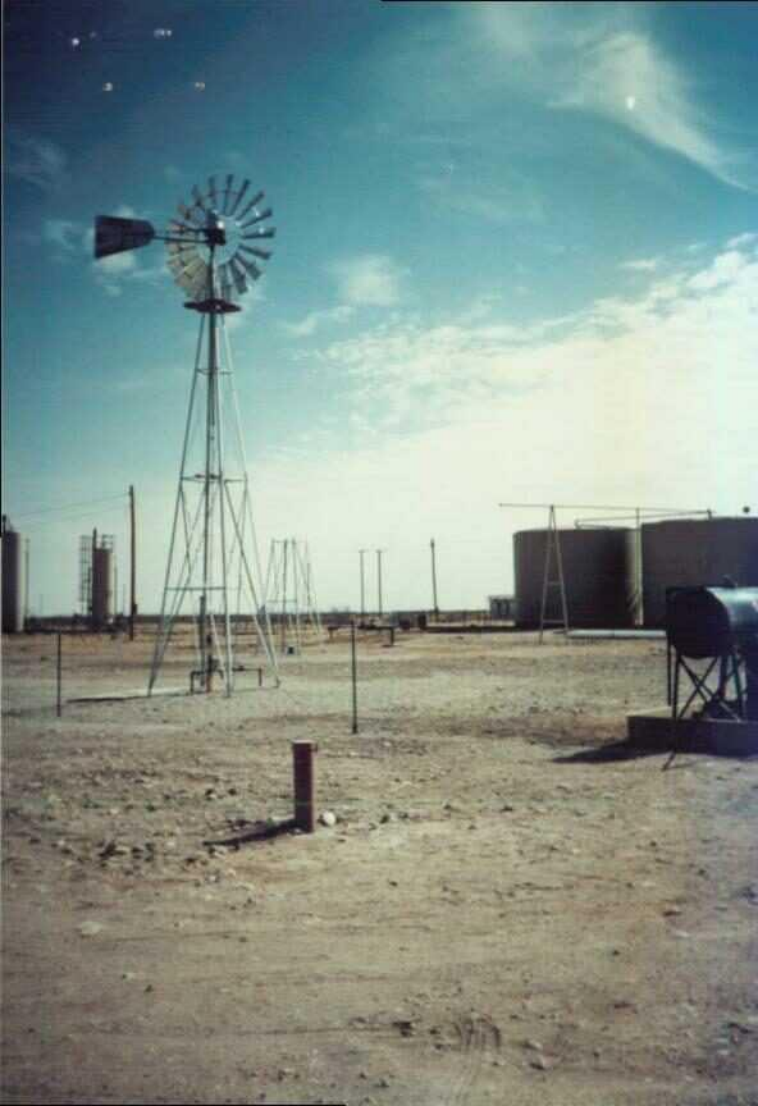
R = Inspections relating to Reclamation Fund Activity

O = Other - Inspections not related to injection or The Reclamation Fund

E = Indicates some form of enforcement action taken in the field (show immediately below the letter U, R or O)

NATURE OF SPECIFIC WELL OR FACILITY INSPECTED

D = Drilling
P = Production
I = Injection
C = Combined prod. inj. operations
S = SWD
U = Underground Storage
G = General Operation
F = Facility or location
M = Meeting
O = Other



PHILLIPS - SOUTH FORK LAKES
SEC 2 - T12S, R.39E.

BY WAYNE PRICE
FEB 13, 1996

LOOKING S.E.

"RECOVERY WELL"

RITTER ENVIRONMENTAL & GEOTECHNICAL SERVICES
2900 N. Big Spring, Midland, Texas 79705
Bus: (915) 682-7404 • Metro: (915) 570-6007 • Fax: (915) 682-7440

November 13, 1995

Certified Return Receipt

Mr. William C. Olsen
Environmental Bureau
New Mexico Oil Conservation Division
Energy, Minerals and Natural Resources Department
2040 S. Pacheco St.
Santa Fe, New Mexico 87505

Re: Phillips Petroleum Company - South Four Lakes Remediation Project-
Section 2, T-12-S, R-34-E, Lea County, New Mexico

Dear Mr. Olsen:

This letter will serve as notification to the NMOCD of the implementation of the Remedial Action Plan and Unlined Surface Impoundment Closure of the South Four Lakes project. The remediation project will follow the previously filed plan which was submitted to the NMOCD in July of 1995.

We anticipate start of this project on the 27th of November 1995. The project will run approximately one to two weeks in duration, weather permitting. The NMOCD is welcome to visit the project and witness any phase that may take place.

Thank you for your time and assistance on this project.

Sincerely,

Mitchell Ritter

cc: Jerry Sexton - NMOCD - Hobbs

Sam Christie - Phillips Petroleum - Odessa

SO4LSTAR.LTR

NEW MEXICO ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION
2040 S. Pacheco
Santa Fe, New Mexico 87505

October 26, 1995

CERTIFIED MAIL
RETURN RECEIPT NO: Z-765-962-498

Mr. Sam E. Christy
Phillips Petroleum Company
4001 Penbrook
Odessa, Texas 79762

RE: INVESTIGATION AND REMEDIATION REPORT
SOUTH FOUR LAKES UNIT

Dear Mr. Christy:

The New Mexico Oil Conservation Division (OCD) has reviewed Phillips Petroleum Company's (PPC) October 4, 1995 "SOUTH FOUR LAKES UNIT, LEA COUNTY, NEW MEXICO, REQUEST FOR EXTENSION". This document contains PPC's request for an extension of the timetable for submission of a report on additional definition of the extent of contamination related to PPC's South Four Lakes Unit in Lea County, New Mexico. PPC requests approval to change the report submission date from November 17, 1995 to February 2, 1995.

The above referenced request is approved.

If you have any questions, please call me at (505) 827-7154.

Sincerely,

William C. Olson
Hydrogeologist
Environmental Bureau

xc: Jerry Sexton, OCD Hobbs District Supervisor
Wayne Price, OCD Hobbs District Office

Z 765 962 498

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PS Form 3800, March 1993

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PHILLIPS PETROLEUM COMPANY
4001 PENBROOK
ODESSA, TEXAS 79762

EXPLORATION AND PRODUCTION
Permian Basin Region

4 October 1995

Mr. William Olson
New Mexico Oil Conservation Division
Environmental Bureau
2040 South Pacheco
Santa Fe, New Mexico 87505

RE: South Four Lakes Unit
Lea County, New Mexico
Request for Extension

Dear Bill:

As you discussed with Mr. Steve de Albuquerque of Phillips Petroleum Company (Phillips) on Monday, 2 October 1995, the purpose of this letter is to respectfully request a time extension for the submittal of the South Four Lakes Unit report summarizing the downgradient groundwater investigation, pit closure, and free product recovery system installation and startup. Instead of submitting the report on Friday, 17 November 1995, Phillips would like to submit the report on Friday, 2 February 1996.

As I think you may be aware, Phillips is negotiating the sale of the South Four Lakes Unit to Riverhill Energy Corporation (Riverhill) of Midland, Texas. As part of the environmental due diligence effort for this sale, Phillips has agreed to install the three proposed monitor wells to delineate the downgradient edge of the dissolved plume discussed in the July-1995 Remedial Action Plan (RAP). This task will be accomplished early next week (9 October 1995).

Please note that at this time, groundwater within these three new monitor wells will only be sampled for BTEX (benzene, toluene, ethybenzene, and total xylenes). Groundwater within the three new monitor wells will be sampled for the suite of USEPA Method 8260 constituents, as specified in the RAP, at a later date. As for the remaining RAP tasks (e.g. abandoned pit closure; free product recovery system; and quantification of natural bioattenuation), these will be completed by either Phillips or Riverhill late in fourth quarter, 1995.

Should you have questions or require additional information, please feel free to contact me at (915) 368-1620.

Sincerely,

Sam E. Christy
Safety & Environmental Analyst

SEC:sft;sflu-ocd.ltr

cc: Gary L. Trotter
Riverhill Energy Corporation
1716 Briarcrest Dr., Suite 400
Bryan, Texas 77802

L. A. Takla
C. Y. Vanderbrouk
J. S. de Albuquerque
Mr. Jerry Sexton (NM/OCD)

NEW MEXICO ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION
2040 S. Pacheco
Santa Fe, New Mexico 87505

August 18, 1995

CERTIFIED MAIL
RETURN RECEIPT NO: Z-765-962-398

Mr. Sam E. Christy
Phillips Petroleum Company
4001 Penbrook
Odessa, Texas 79762

RE: INVESTIGATION AND REMEDIATION WORK PLAN
SOUTH FOUR LAKES UNIT

Dear Mr. Christy:

The New Mexico Oil Conservation Division (OCD) has completed a review of Phillips Petroleum Company's (PPC) July 27, 1995 "GROUND WATER CONTAMINATION, SOUTH FOUR LAKES UNIT, LEA COUNTY, NEW MEXICO and July 1995 "REMEDIAL ACTION PLAN, SOUTH FOUR LAKES UNIT, LEA COUNTY, NEW MEXICO". These documents contain PPC's work plan for investigation and remediation of soil and ground water contamination related to PPC's South Four Lakes Unit in Lea County, New Mexico.

The above referenced work plan is approved with the following conditions:

1. Site surface reclamation of the pit area will include mounding the soils at the surface such that rainfall will not accumulate over the former pit location.

2. All monitor wells and recovery wells will be constructed with a minimum of 15 feet of well screen and will be installed with at least 10 feet of well screen below the water table and 5 feet of well screen above the water table.

3. All underground piping for collection of fluids from the recovery wells will be pressure tested for integrity prior to operation. The piping will be pressured to 3 psi above operating pressure and shall maintain pressure for a 4 hour time period.

4. PPC will submit a report on the investigation and pit closure actions to the OCD by November 17, 1995. The report will contain:

   a. A description of all activities which occurred during the investigation, conclusions and recommendations.

   b. A summary of the laboratory analytic results of soil, pit closure and water quality sampling.

   c. A water table elevation map using the water table elevation of the ground water in all monitor wells.

   d. A geologic log for each borehole and monitor well and as built well completion diagrams for each monitor well.

   e. A schedule for future quarterly sampling events.

5. PPC will notify the OCD at least 48 hours in advance of all scheduled activities such that the OCD has the opportunity to witness the events and/or split samples.

6. All original documents submitted for approval will be submitted to the OCD Santa Fe Office with copies provided to the OCD Hobbs District Office.

Please be advised that OCD approval does not relieve PPC of liability should the investigation activities determine that contamination exists which is beyond the scope of the work plan, or, if the activities fail to adequately determine the extent of contamination related to PPC's activities. In addition, OCD approval does not relieve PPC of responsibility for compliance with any other federal, state or local laws and/or regulations.

If you have any questions, please call me at (505) 827-7154.

Sincerely,

William C. Olson
Hydrogeologist
Environmental Bureau

xc: Jerry Sexton, OCD Hobbs District Supervisor
Wayne Price, OCD Hobbs District Office

Z 765 962 398

Receipt for Certified Mail

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PS Form 3800, March 1993

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PHILLIPS PETROLEUM COMPANY
4001 PENBROOK
ODESSA, TEXAS 79762

EXPLORATION AND PRODUCTION
Permian Basin Region

July 27, 1995

State of New Mexico
Oil Conservation Division
Attention: William C. Olson
2040 S. Pacheco
Santa Fe, New Mexico 87505

Re: Ground Water Contamination
South Four Lakes Unit
Lea County, New Mexico

Dear Mr. Olson:

Pursuant to your letter, dated May 15, 1995, enclosed you will find Phillips Petroleum Company's **Remedial Action Plan** for the South Four Lakes Unit, located in Lea County, New Mexico. This plan covers the additional request of the Oil Conservation Division of:

1. **A soil and ground water remediation work plan.**

2. **A work plan to completely define the extent of dissolved phase ground water contamination at the site.**

This plan is now submitted for review and approval by the Oil Conservation Division.

If you have any questions, comments, or concerns, please contact me at this office (915)368-1620.

Sincerely,

Sam E. Christy
Safety & Environmental Analyst

Remedial Action Plan
South Four Lakes Unit
Lea County, New Mexico

Phillips Petroleum Company
North America Production
Permian Profit Center
4001 Penbrook
Odessa, Texas 79762

July 1995

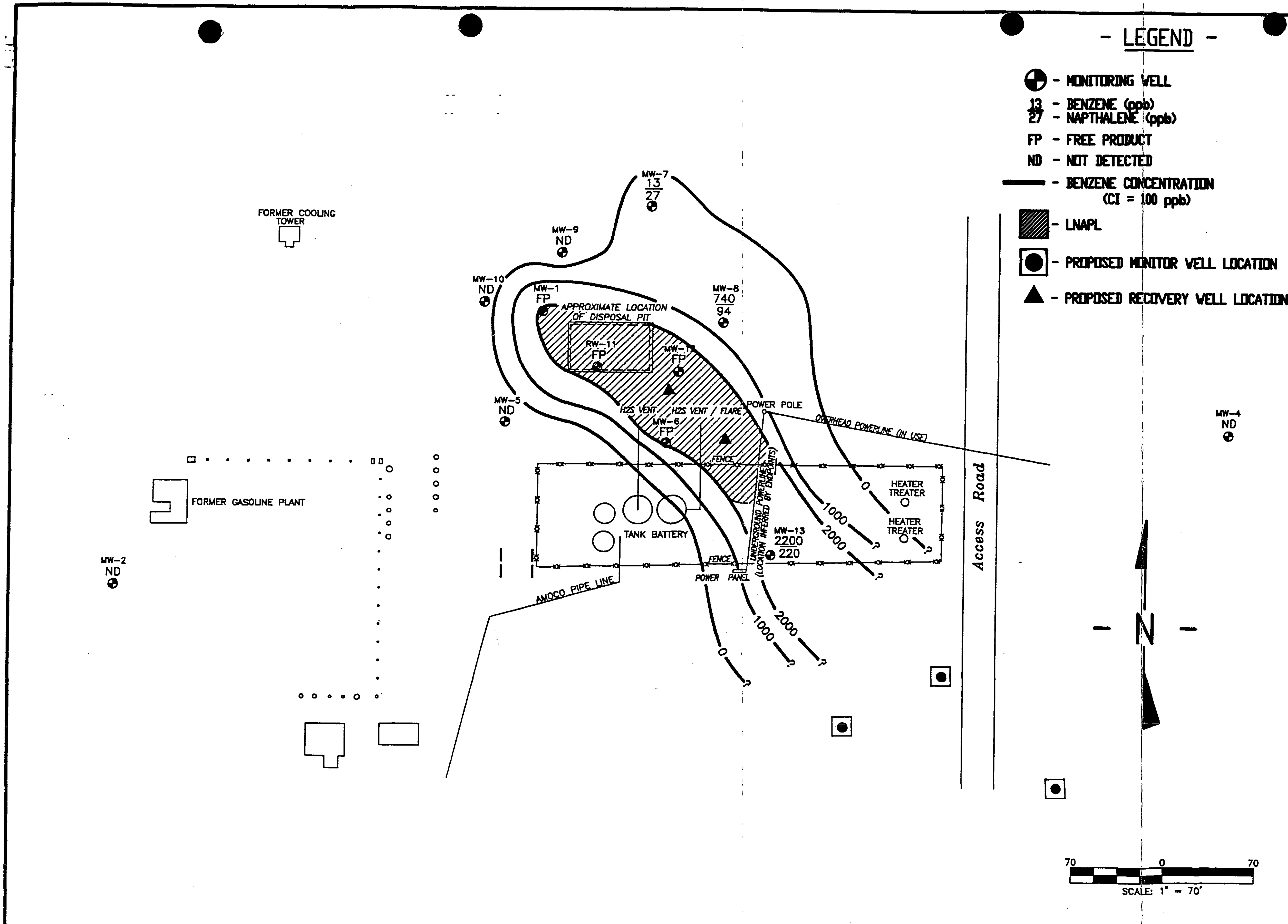
Table of Contents

1.0 Introduction

This Remedial Action Plan (RAP) presents the tasks for the additional assessment and remediation activities at the Phillips Petroleum Company (Phillips) South Four Lakes Unit (the Unit) located in Lea County, NM, approximately 12 miles northwest of the City of Tatum (Figure 1). Conceptually the work can be categorized as: 1) source elimination; 2) mass removal; 3) downgradient dissolved plume delineation; and 4) demonstration of natural bioattenuation of the dissolved plume.

Source elimination of the mobile free-phase petroleum hydrocarbon (free product) will be accomplished by solidification of the abandoned production pit. Total-fluid recovery wells will be installed to recover free-product (mass removal) present outside the area of the abandoned production pit after solidification of the pit is complete. Concurrent with the installation of the total-fluid recovery wells, additional monitor wells will be installed to define the downgradient edge of the dissolved plume.

The final component of this RAP is the quantification of natural bioattenuation of the dissolved plume. Recognizing that biological processes may be the primary factor limiting the migration of dissolved petroleum hydrocarbons in groundwater, an assessment of the natural bioattenuation component of natural attenuation (i.e. dilution, retardation, volatilization, biodegradation, abiotic oxidation, and hydrolysis) will be completed through one year of quarterly groundwater monitoring. Intrinsic bioremediation will also be evaluated as part of a final remedial strategy for the Unit. Intrinsic bioremediation is a risk-based management option that relies on natural biological processes to eliminate the spread of contamination from hydrocarbon releases.



NO.	DATE	INIT.	REVISION

NO.	DATE	INIT.	REVISION

NOTES/COMMENTS:

SIGNATURE	DATE
REVIEW ENGR:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

PHILLIPS 66

PHILLIPS PETROLEUM COMPANY

NORTH AMERICA PRODUCTION PERMIAN BASIN REGION

SOUTH FOUR LAKES UNIT
LEA COUNTY, NEW MEXICO

DESIGNED BY:	DETAILED BY: SDP	CHECKED BY:
DATE:	ACAD FILE: 11178106	
PROJECT NO.: 80106-001-01	PLOT SCALE: 1" = 1'	

2.0 Soil and Groundwater Remediation

The soil and groundwater remediation effort at the Unit will focus on source elimination through solidification of the abandoned production pit and mass removal of the free product using groundwater recovery wells. The work sequence will begin with pit solidification activities followed by recovery well installation.

2.1 Abandoned Pit Closure

Phillips proposes to close the abandoned production pit using on-site solidification techniques. This pit closure technique has been successfully used by Phillips to close similar pits in the Permian Basin region of New Mexico.

Application of a cement-based pozzolanic material (mixture of cement and kiln dust) will be used to bind the abandoned production pit soils into a hardened, monolithic block of concrete-like material. Solidification processes are designed to: 1) improve the handling and physical characteristics of pit material; 2) limit the solubility of compounds contained in the pit material; and 3) decrease the surface area across which transfer and loss of pit material constituents can occur. Bench-scale testing of the abandoned production pit soils indicates that the organic compounds present in the pit material will fixate to the cement thereby reducing the potential for leaching of organics from the solidified pit material. The following tasks will be completed during pit solidification:

a) Preliminary Site Evaluation:

A preliminary site evaluation has been completed. The preliminary evaluation included a visual inspection and sampling of the pit to determine the physical/chemical properties and treatability of the pit materials. Site-specific conditions (soil types and depths, depth

to groundwater, and proximity to water wells and surface waters) were also noted.

b) Site Preparation:

Site preparation will include the excavation of three to four mixing cells adjacent to the abandoned production pit. These mixing cells will be used for the mixing of the pit materials with the solidification materials. The clean soils generated during the excavation of the mixing cells will be used to backfill the abandoned production pit once it is excavated. Unfortunately two to three existing monitor wells may be destroyed during the site preparation process. It is likely that monitor wells MW-1, RW-11, and possibly MW-12 will be removed during the abandoned pit excavation and the construction of the mixing cells. Every effort by the contractor will be made to ensure that only minimal disturbance occurs to the existing monitor well network. The need to replace destroyed monitor wells will be determined after solidification and site restoration is complete.

c) Treatment/Solidification:

Upon completion of site preparation, the abandoned production pit will be excavated and the solidification process begins. As the pit is excavated, solidification materials will be added to the mixing cells. Excavated pit materials will then be added to the mixing cells with water for solidification. A volume increase of approximately 1.5 times original volume is expected during the mixing and solidification process. The contractor will physically add the appropriate solidifying agents in the proportions defined as a result of the bench-scale testing of the abandoned pit material. Mechanical mixing methods will be used in the mixing cells to

thoroughly blend the pit material with the solidifying agents and fresh water. Upon completion of mixing, the resultant material is allowed to cure for 24 to 48 hours. Post mixing samples will be collected from the solidified material and will be analyzed to determine leachability of volatile organic compounds using the USEPA Toxicity Characteristic Leaching Procedure (TCLP) Method (SW-846 Method 1311). The extract will also be analyzed for TPH (Total Petroleum Hydrocarbons). Pit excavation will continue until either: 1) groundwater is encountered (approximately 23 to 24 feet below grade); or 2) the New Mexico Oil Conservation Division (OCD) Unlined Surface Impoundment Closure Guidelines (February, 1993) are achieved. Headspace soil screening, using an organic vapor analyzer (flame or photoionization detector) as well as visual methods, will be used to guide pit excavation activities.

d) Site Surface Reclamation:

The backfilled abandoned pit area and the adjacent solidified mixing cells will be recontoured to original grade after solidification is complete.

e) Reporting & Documentation:

Results and photodocumentation of the abandon pit solidification effort (inclusive of post-solidification sampling and analyses) and site reclamation will be included in a pit closure report and will be submitted to the OCD.

2.2 Free Product Recovery

Mass removal of the free product present outside the immediate area of the abandoned production pit will be accomplished using total-fluid recovery system. The total-fluid recovery system will include two recovery wells located

within the free-product plume and associated piping connected to the existing lease production tank battery. The recovery system will have a design capacity of approximately five gallons per minute per recovery well (10 gpm total). The fluids recovered (e.g. groundwater and free-product) will be pumped to, and separated at, the existing lease tank battery.

The total-fluids recovery wells will be installed using a 10.5-inch hollow stem auger. All borings will be sampled continuously to approximately 40 feet below grade using a five-foot split-spoon sampler. All recovery well installation activities, inclusive of soil sampling and soil types encountered, will be photodocumented by the site hydrogeologist. Each foot of the soil column encountered will be lithologically logged and screened with a photoionization detector (PID) for total volatile organic vapors. Information collected during the drilling of each soil boring and the installation of each recovery well will be recorded and summarized on a separate boring log.

Each recovery well will be completed with four-inch, flush-coupled/square-threaded, Schedule 40 PVC consisting of 15 feet of mill-slotted well screen (0.020 slot) and 20 feet of casing. A sand pack consisting of 10/20 sand will be installed in the annulus around the well screen to approximately one foot above the screen. The remainder of the annulus will be sealed using a bentonite-grout mixture. Each recovery well will then be developed by bailing five or more casing volumes. Each recovery well will contain a pneumatic total fluids extraction pump. Pitless adapters will be used at each recovery well location.

Approximately 400 linear feet of underground conveyance piping will be installed to pump the recovered fluids to the existing production heater treater located at the tank battery. The oil separated from the recovered fluids will be pumped to the existing oil stock tanks and sold as product. The groundwater

separated from the total fluids will be pumped to the saltwater storage tanks and will be disposed of along with the produced water from the lease in the Class II disposal well present on the Unit.

All drilling, soil sampling and analyses, and recovery well installation will be completed in accordance with the OCD Guidelines for Remediation of Leaks, Spills and Releases (August, 1993).

3.0 Delineation of the Downgradient Edge of the Dissolved Plume

The existing South Four Lakes Unit monitor well network is composed of thirteen monitor wells and defines the extent of the free-product and dissolved hydrocarbon plumes in the upgradient and side gradient directions (Figure 1). Although the downgradient edge (e.g. southeastern) of the dissolved plume can be inferred from established equations based on groundwater flow velocities and attenuation rates, the monitor well network does not provide adequate coverage to the southeast of the tank battery. Therefore, the OCD requested that Phillips define the downgradient edge of the dissolved plume in their 15 May 1995 letter to Phillips. Two or three additional monitor wells will be needed to accomplish this task.

The additional two-inch PVC monitor wells will be installed using hollow stem auger drilling methods. All borings will be sampled continuously to approximately 35 feet below grade using a five-foot split-spoon sampler. All monitor well installation activities, inclusive of soil sampling and soil types encountered, will be photodocumented by the site hydrogeologist. Each foot of the soil column encountered will be lithologically logged and screened with a photoionization detector (PID) for total volatile organic vapors. Information collected during the drilling of each soil boring and the installation of each monitor well will be recorded and summarized on a separate boring log.

The sample from each soil boring exhibiting the highest PID reading will be submitted to a laboratory for Benzene, Toluene, Ethylbenzene, and Total Xylene (BTEX) analyses using USEPA SW-846 Method 8020 and for Total Volatile Petroleum Hydrocarbon (TPH) using Modified USEPA SW-846 Method 8015. Each monitor well will be completed with two-inch, flush-coupled/square-threaded, Schedule 40 PVC consisting of 15 feet of mill-slotted well screen (0.020 slot) and 25 feet of casing. A sand pack consisting of 10/20 sand will be installed in the annulus around the well screen to approximately one foot above the screen. The remainder of the annulus will be sealed using a bentonite-grout mixture. A locking protective cover will be placed on each monitor wellhead. Each monitor well will then be developed by bailing five or more casing volumes.

Groundwater samples will be collected only from the new monitor wells that do not contain free product. This sampling effort will be included as part of the first quarterly groundwater sampling of the entire monitor well network. The two to three new monitor wells will be sampled and analyzed for volatile and semivolatile organic compounds using USEPA Method 8260. Other wells in the monitor well network will be sampled and analyzed for the list of constituents summarized in Table 1.

All drilling, soil sampling and analyses, and monitor well installation will be completed in accordance with the OCD Guidelines for Remediation of Leaks, Spills and Releases (August, 1993).

4.0 Quantification of Natural Bioattenuation

Where petroleum hydrocarbons are released to the environment, they often percolate through soil to the interval of groundwater saturation. Once at the water table, individual compounds present within petroleum partition into

groundwater. Field data collected over the last decade indicate that the migration of petroleum hydrocarbons typically is far slower than groundwater flow velocities. Recognizing that biological processes may be the primary factor limiting migration of dissolved petroleum hydrocarbons in groundwater, an assessment of the natural biodegradation (bioattenuation) component of natural attenuation will be completed. Intrinsic bioremediation will also be evaluated as part of a larger, overall remedial strategy. Intrinsic bioremediation is a risk management option that relies on natural biological processes to contain the spread of contamination from spills [1].

Natural bioattenuation recognizes that petroleum hydrocarbons are readily biodegradable where nutrients and electron acceptors are present in sufficient concentrations. Furthermore, because of this biodegradability significant migration of dissolved hydrocarbons often will not occur.

4.1 Overview of Natural Attenuation Principals

Natural attenuation is the process in which contaminant concentrations are passively, but continually, reduced by various naturally occurring *in-situ* mechanisms, without active remedial actions [2]. Contaminant attenuation processes include the following:

- Nondestructive Processes:
  - Dilution resulting from diffusion and/or hydrodynamic dispersion;
  - Depletion resulting from volatilization; and
  - Retardation resulting from contaminant adsorption to the aquifer matrix.
- Destructive Processes:
  - Biodegradation;
  - Abiotic contaminant oxidation; and
  - Hydrolysis.

At sites where natural attenuation is well documented, biodegradation of BTEX by indigenous, subsurface microbes appears to be the primary mechanism [2]. Furthermore, recent work by Wilson et al. (1993) [3] indicates that natural biological attenuation, or bioattenuation, of aromatic hydrocarbons can occur under either aerobic or anaerobic conditions.

Biodegradation of hydrocarbons is the result of the metabolic activity of microorganisms. Metabolism is a term that embraces the diverse reactions by which a microorganism processes food materials to obtain energy and the compounds from which cell components are made. Biodegradation typically relies on heterotrophic microorganisms; that is, microorganisms that require carbon in the form of relatively complex, reduced organic compounds (e.g. petroleum hydrocarbons). These microbes rely on the oxidation of these reduced organics in exothermic degradation reaction sequences that yield energy and the "building blocks" of biosynthesis. Energy is produced through the oxidation of the reduced organic compound in a reaction involving the loss of hydrogen atoms that contain electrons. These electrons are then passed through an electron-transport system to a terminal electron acceptor. The electron-transport system is a series of electron carriers arranged such that the energy liberated in the oxidation of the organic is retained in a useable form by the microorganism.

Because oxygen is an efficient electron acceptor, organic contaminants are most readily biodegraded under aerobic conditions. Therefore, the most common applications of *in-situ* bioremediation involve stimulation of the contaminant biodegradation activity of soil microorganisms under aerobic conditions. In aerobic biodegradation, the organic contaminant exerts a stoichiometric oxygen demand. To biodegrade a given quantity of organic contaminant, a corresponding quantity of oxygen is required. In soils, the presence of sufficient oxygen is often the factor that limits the rate of

contaminant biodegradation. However, certain organic contaminants can be biodegraded by bacteria that use other electron acceptors. When oxygen is not present in sufficient amounts, nitrate, sulfate, ferrous iron, and/or carbon dioxide may be used as electron acceptors.

4.2 Characterization of Natural Bioattenuation at the South Four Lakes Unit

To assess the significance of natural bioattenuation of the dissolved hydrocarbon plume, the parameters presented in Table 1 will be measured quarterly for a period of one year. These parameters are classified as:

- Electron Acceptors: used to take up the electrons generated through biological oxidation of the hydrocarbons;
- Reaction By-Products: produced by biological oxidation of hydrocarbons; and
- Major Anions and Cations: major cation/anion chemistry provides a useful tool in identifying upgradient, interior, and downgradient wells and reflects mixing of water associated with the plume.

Specifically, the following biodegradation processes will be evaluated over the one year period:

PROCESS	ELECTRON ACCEPTORS	BY-PRODUCTS
Aerobic Degradation	O_2	CO_2
Denitrification	NO_3^-	CO_2
Sulfate Reduction	SO_4^{2-}	HCO_3^-
Methanogenesis	CO_2	CO_2, CH_4
Iron III Reduction	Fe^{3+}	Fe^{2+}, CO_2

Table 1 Parameters and Analytical Methods				
Parameter	**Objective**	**Lab or Field**	**Method**	**Detection Limit**
Organics				
BTEX	Contaminants of concern	Lab	8020 Mod.	5.0 µg/L
TOC	Total organic loading in groundwater	Lab	415.2	0.4 mg/L
Volatile Fatty Acids (VFA)	Intermediates in contaminant mineralization	Lab	Phillips R&D GC/FID	1.0 mg/L
Electron Acceptors				
Dissolved Oxygen	Preferred electron acceptor	Field	Winkler Titration	0.2 mg/L
Nitrate	Electron acceptor	Lab	300.0	0.1 mg/L
Nitrite	Potential intermediate in reduction of NO_3 to N_2	Lab	354.1	0.1 mg/L
Sulfate	Electron acceptor	Lab	300.0	1.0 mg/L
General Water Chemistry				
Carbonate Species - CO_3, HCO_3, and Alkalinity	Insight into water chemistry (buffering capacity) and microbial activity (CO_2 generation)	Lab	310.1	1.0 mg/L
Major Cations - sodium, calcium, potassium, magnesium, manganese, and phosphorus	For ion balance	Lab	200.7	0.05 to 0.5 mg/L
Chloride	For ion balance	Lab	300.0	1.0 mg/L
Sulfide	Indicator of low redox conditions	Lab	376.1	1.0 mg/L
TDS	General water quality parameter	Lab	160.1	4.0 mg/L

A sampling protocol for natural bioattenuation characterizations is included as Appendix A.

REFERENCES

1. Wilson, J.T., F.M. Pfeffer, J.W. Weaver and D.H. Kampbell: "Intrinsic Bioremediation of JP-4 Jet Fuel," Symposium on Intrinsic Bioremediation of Ground Water, USEPA 540/R-94/515, Washington, D.C.(1994).

2. McAllister, P.M. and C.Y. Chiang: "A Practical Approach to Evaluating Natural Attenuation of Contaminants in Groundwater" *Groundwater Monitoring and Remediation* (Spring 1994), Volume XIV Number 2, Groundwater Publishing Company, Dublin, Ohio, 161-174.

3. Wilson, J.T., D.H. Kampbell, and J. Armstrong: "Natural Bioreclamation of Alkylbenzenes (BTEX) From a Gasoline Spill in Methanogenic Ground Water," *In: Hydrocarbon Bioremediation*, Lewis Publishers, Ann Arbor, Michigan (1994).

APPENDIX A

STANDARD OPERATING PROCEDURE FOR INTRINSIC BIOREMEDIATION CHARACTERIZATION

CH2M HILL

CH2M HILL Standard Operation Procedure

Groundwater Sampling for Intrinsic Bioremediation Characterizations

4/3/95 Version

Section 1. Introduction

This document presents a protocol for measurements and groundwater sampling in support of intrinsic bioremediation characterizations. This protocol was developed because of the potential adverse effects of commonly employed groundwater sampling methodology on the quality of intrinsic bioremediation data.

Naturally occurring contaminant biodegradation can result in groundwater that is in dramatic non-equilibrium with the atmosphere. Commonly employed sampling collection techniques include use of bailers and excessive rates of groundwater purging. These practices may result in exposure of the groundwater to the atmosphere and will often produce groundwater samples with a geochemistry that is different than formation groundwater. Parameters for characterization of intrinsic bioremediation are listed in Table 1. The potential adverse effects of poor groundwater sampling on data quality for select intrinsic bioremediation parameters is summarized in Table 2. The specific mechanisms in which the geochemistry of groundwater sample can be altered through sample collection technique include the following:

- Excessively lowering the water level in the well by purging at high flow rates. During recharge, exposure of water trickling into the well to the atmosphere can result in aeration of the groundwater sample, resulting in loss of volatiles, introduction of oxygen, and elevation of the sample Eh.

- Sample aeration caused by sample collection with a bailer and/or excessive exposure of the groundwater to the atmosphere during field measurements or filling of sample containers.

- Increased turbidity caused by bailing the well, or purging the well at high flow rates creating high entrance velocities through the well screen and mobilizing sediment in the well, sand pack, and formation.

- De-pressurization of samples of deep groundwater can result in super-saturation of the groundwater with certain constituents and de-gassing

of the constituents from the sample. (However, this should not be a significant problem at LNAPL sites, where the groundwater zone of interest is typically the uppermost saturated interval.)

The "minimal aeration method" described in this protocol will enable collection of representative groundwater samples for characterization of intrinsic bioremediation, except at those sites of very low permeability. Considerations for very low permeability settings are discussed.

Section 2. Standard Operating Procedure

The minimal aeration method described herein has been adapted from the protocols specified by EPA in their most recent groundwater monitoring guidance (EPA, 1992), and demonstrated by Barcelona for providing consistent monitoring results for volatile constituents (Barcelona, 1994). The method is illustrated in Figure 1, and described below.

2.1 Equipment Requirements

Equipment needed for sample collection are provided in the attached checklist (Attachment A).

2.2 General Pre-sampling Procedure

Prior to purging and groundwater sampling, the routine procedures listed in the attached check list (Attachment B) should be conducted.

2.3 Monitoring Well Purging

The objective of purging the monitoring well is to collect groundwater samples representative of the formation groundwater. At most petroleum hydrocarbon sites, the groundwater near the water table surface will have the highest constituent concentrations, and monitoring wells are therefore screened across the water table. In these wells, the pump intake should be placed approximately 1 foot below the water level. If the well has a discreet screen length that is entirely submerged, the pump intake should be placed within the screened interval approximately 1 foot below the top of the screen.

To collect intrinsic bioremediation parameter samples, monitoring wells should be purged at a rate that does not lower the water level significantly (i.e., less than 10 percent of the screen length). The purging rate should be controlled as needed using the pump's variable speed flow controller and/or the gate valve in the discharge line.

Collect water level measurements frequently during purging to ensure that the water level has not dropped lower than desired. Monitoring wells should be purged until the field parameters have stabilized to within the ranges presented in Table 3. If an electric submersible pump is used, temperature may increase rather than stabilize during low flow rate purging.

Table 3
Criteria for Stabilization
of Indicator Parameters During Purging

Field Parameter	Stabilization Criterion
Dissolved Oxygen	0.10 mg/L
Electrical Conductivity	3% Full Scale Range
pH	0.10 pH unit
Temperature	0.2° C

The method described above is recommended as an alternative to the conventional "three well volume" purging protocol. Purging until the parameters in Table 3 have stabilized is a technically sound method for obtaining groundwater samples that are representative of formation groundwater. Most regulatory agencies accept this newer method based on it's technical merits. However, some regulatory agencies may still require the older "three well volume" method. For wells completed in very transmissive zones, it may not be practical to purge at a slow rate with minimal water table depression while still achieving the required purge volume. In these cases, a higher purge rate may be acceptable initially, but purging rates should be decreased as the required purge volume is approached, with the objective of producing groundwater samples that are not turbid and have not been artificially aerated.

2.4 Field Indicator Parameter Measurement

During purging, continuously measure dissolved oxygen, electrical conductance, pH, Eh, and temperature with the flow cell or container (e.g., large beaker or bucket). If using the container for measuring the field indicator parameters, direct the discharge into the bottom of the container and allow the bucket to continuously overflow during measurements to minimize aeration. Allowing the discharge to pour into the container will aerate the water and result in nonrepresentative results for critical intrinsic bioremediation parameters.

Record indicator parameter and water level measurements in a field notebook or onto well development logs at approximately 1/4 well volume increments. Purging is complete once the parameters have stabilized to within the ranges presented in Table 3 regardless of the number of well volumes.

If using the electric submersible pump (i.e., Redi-Flo 2) care must be taken to prevent flow interruption. If the flow is interrupted for any reason (e.g., loss of power), entry of air into the tubing usually occurs, with the potential result of artificially aerating the groundwater sample. In addition, restarting the pump may cause a surge in flow that will suspend particulate matter in the well.

2.5 Groundwater Sample Collection

When purging is complete, collect aliquots for the analytical parameters listed in Table 1. To ensure the most consistent, comparable results, individual samples/measurements from all wells should be collected in the same order. The order used in this protocol is based on the approximate order of susceptibility to artificial aeration: volatile organics, total organic carbon (TOC), methane, iron, sulfide, alkalinity, and sulfate.

Reduce the pumping rate and/or use the 3-way valve to collect the methane, volatile and TOC samples. Direct the discharge toward the inside wall of the jar to minimize volatilization, and fill to overflowing. Filter the discharge prior to filling the ferrous iron sample jar using an in-line 0.45 micron filter. Filtration is recommended to eliminate bias introduced with particulates. In-line filtration is recommended to prevent artificial aeration of the sample.

If additional samples are collected for dissolved oxygen analysis using field kits (i.e. Hach or Winkler), submerge the sample jar into the bottom of the large container, continue to fill the container to overflowing, and allow the sample jar to fill without aeration.

Preserve and analyze the samples as described in the sampling and analysis plan.

2.6 Quality Control Check for Field Measurements

Field checks should be performed to ensure that representative measurements are being made. At a minimum, Eh and D.O. readings should be in agreement. D.O. readings should be near-zero when the Eh is negative. If this is not the case, one or the other measurement is in error. When additional geochemical parameters are measured in the field, additional checks can be made. For example, ferrous iron should be present in elevated concentrations only when D.O. is zero and the Eh is negative. When all measurements are not in agreement, measurements should be repeated until agreement is reached. In this process of achieving consistent results, there may be merit in trying alternative measurement techniques; for example, use of a Hach field kit for D.O. rather than a D.O. measurement probe.

Another check for representative results can be made by comparing the D.O. and Eh of well water before and after purging. In almost all cases, the D.O./Eh measurements taken from the well water prior to purging should be equal to or higher

than the D.O./Eh of the formation groundwater. Increase in the D.O. and Eh as a result of purging is an indication of artificial aeration of the water.

In many cases, generation of valid field measurements for these parameters is not a trivial matter. Consideration should be given to including an analytical chemist on the field sampling crew. If this is not practical, the field crew should have familiarity with the problems that may arise in obtaining valid measurements and/or have access to an analytical chemist during the sampling effort to assist in resolution of measurement difficulties and apparent anomalies.

Section 3.
Considerations for Very Low Permeability Settings

Monitoring wells screened across very low permeability materials (silts, clays, etc.) typically purge dry then are allowed to recharge prior to sampling. However, recharge into a dewatered well results in increased exposure of the water entering the well to the air present at the water table interface and in the well, potentially altering the groundwater geochemistry as summarized in Table 2. To attempt to minimize these effects, the pump intake should be placed 2-3 feet below the water level and operated at as low a rate as is achievable, ideally equal to the recovery rate. In this manner, water drawn into the pump would be primarily from the formation and sand pack pore spaces. Close monitoring of the indicator parameter measurements is necessary since stabilization should occur prior to one bore-hole volume.

In some cases, a well may recharge so slowly that it may be impractical or even impossible to collect a groundwater sample that is truly representative of formation groundwater with respect to key geochemical parameters. If there is a need to collect samples/measurements for intrinsic bioremediation parameters in such cases, slowly purge the well dry and collect the groundwater samples as soon as the necessary volume has recharged into the well. As previously described in Section 2.6, the D.O. and Eh should be measured prior to, during, and after purging. An increase in D.O. or Eh is an indication of artificial aeration of the water, and results should be qualified accordingly.

References

United States Environmental Protection Agency. 1992. *RCRA Ground-Water Monitoring: Draft Technical Guidance.* EPA/530-R-93-001.

Kearl, P.M., et. al. 1994. *Field Comparison of Micropurging vs. Traditional Ground Water Sampling.* Ground Water Monitoring and Remediation. Fall, 1994 pp. 183-190.

Barcelona, M.J., et. al. 1994. *Reproducible Well-Purging Procedures and VOC Stabilization Criteria for Ground-Water Sampling.* Ground Water. Vol 32, No. 1. pp. 12-22.

Walton-Day, K., et. al. 1990. *Field Methods for Measurement of Ground Water Redox Chemical Parameters.* Groundwater Monitoring and Remediation. Fall, 1990, pp. 81-89.

Attachment A Equipment Checklist	
___	monitoring well construction details (geologic log, screened interval, well depth, bore-hole diameter, etc.).
___	water level indicator
___	submersible positive displacement pump and controller or bladder pump (e.g. Grundfos Redi-Flo, QED Well Wizard, etc.)
___	PTFE lined polyethylene tubing in sufficient quantity to use new tubing for each well. Note: Teflon is quite permeable to certain gasses.
___	Throttling valves and 3-way flow-tee sampling valve (See Figure 1)
___	field meters for pH, Eh, dissolved oxygen, temperature, electrical conductance (including instrument manuals and calibration materials)
___	calibrated bucket or beaker
___	flow cell with ports for each of the field meter probes (optional)
___	field note book and/or well purging log forms
___	sample containers, preservatives, ice and cooler(s)
___	decontamination supplies
___	personal protective equipment

Attachment B Pre-Purging Checklist	
____	Decontaminate submersible pump (if not a dedicated pump).
____	Decontaminate or replace discharge tubing (if not a dedicated pump).
____	Calibrate field meters (pH, Eh, specific conductance, dissolved oxygen, HNu, etc.)
____	Decontaminate water level indicator probe and tape.
____	Unlock the monitoring well and measure vapor concentrations in accordance with the site specific Health and Safety Plan.
____	Measure depth to water.
____	Evaluate whether water table surface is above or within the screened interval.
____	Calculate the volume of water in the well and borehole filter sand pack pore space (borehole volume).
____	Insert dissolved oxygen probe into the monitoring well and measure the dissolved oxygen in the water column. If practical, also measure Eh of water in well.
____	Install submersible pump into the well slowly to minimize aeration, placing the pump intake within the screened interval or approximately 1 foot below the water level.
____	If gasoline or diesel powered generators or compressors are used to operate the pump, take precautions to prevent the exhaust from contaminating the samples.
____	Configure the discharge tubing with a gate valve and 3-way valve, with discharge directed through the 3-way valve and flow cell (optional), and into a calibrated decontaminated bucket (See Figure 1).

KRP/IR/SOP.WP5

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION
2040 S. PACHECO
SANTA FE, NEW MEXICO 87505
(505) 827-7131

May 31, 1995

Mr. Clave Jones
West Star Route
Tatum, New Mexico 88267

RE: WINDMILL WATER SAMPLES

Dear Mr. Jones:

On March 15, 1995, the New Mexico Oil Conservation Division (OCD) collected a ground water sample from a windmill on property which you lease from the State of New Mexico. The OCD sampled this windmill in response to your concern that petroleum contaminated ground water at the adjacent Phillips South Four Lakes Unit tank battery had impacted the windmill.

Water from the pond was analyzed for aromatic and halogenated volatile organics which are constituents of petroleum products. The samples were also analyzed for heavy metals and major cations and anions. Enclosed you will find the results of the analysis. No aromatic or halogenated volatile organics related to petroleum contaminants were present in the sample. In addition, the heavy metals and cations/anions analyses show that the water is of a high quality and meets New Mexico Water Quality Control Commission drinking water standards.

I will keep you informed of future actions taken to investigate and remediate ground water at Phillips' South Four Lakes Unit.

If you have any questions please contact me at 827-7154.

Sincerely,

William C. Olson
Hydrogeologist
Environmental Bureau

Enclosure

xc w/enclosure: Jerry Sexton, OCD Hobbs District Supervisor
Wayne Price OCD Hobbs District
Jeff Carlson, Phillips Petroleum
Ray Powell Jr., NM State Land Commissioner

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

ATI # 503354

LABORATORY SAMPLE RECORD

PROJ. NO.	PROJECT NAME	NO. OF CONTAINERS	8010/8020	Cations/Anions	Heavy Metals	602			REMARKS
	Phillips Lee Gas Plant								
SAMPLERS: (Signature) Olson									
DATE TIME	STATION LOCATION								
01 950315 1300	Clave Jones Windmill	4	2	1	1				Al, Antimony, As, Ba, Be,
02 950316 0845	MW-12	2				2			cd, Ca, Cr, Co, Cu, Fe, Pb,
03 " 0930	MW-11	2				2			Mg, Mn, Hg, Ni, K, Se, ~~Si~~ Ag,
04 " 1030	MW-13	2				2			Na, Tl, Va, Zn
05 " 1300	MW-15	2				2			
06 " 1310	MW-6	2				2			Fl, Br, Alk, Cl, SO4, TDS,
07 " 1400	MW-19	2				2			pH, EC
08 "	MW-17	2				2			
09									

Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Will Olson	3/17/95 1450	D. Cutler
Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)

SEALS INTACT ☐ YES ☐ NO

: (Signature)

: (Signature)

Date / Time

Remarks

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

ANALYSIS REQUEST FORM

Contract Lab Analytical Technology Contract No. 95-521.07-040

OCD Sample No. 9503151300

Collection Date	Collection Time	Collected by—Person/Agency
3/15/95	1300	Olson / Price /OCD

SITE INFORMATION

Sample location: Phillips South Four Lakes Clare Jones Windmill

Collection Site Description: Discharge pipe to stock tank

Township, Range, Section, Tract: | | | + | | + | + | | |

SEND FINAL REPORT TO

ENVIRONMENTAL BUREAU
NM OIL CONSERVATION DIVISION
PO Box 2088
Santa Fe, NM 87504-2088

SAMPLE FIELD TREATMENT — *Check proper boxes*

No. of samples submitted: 2

- [X] **NF:** Whole sample (Non-filtered)
- [ ] **F:** Filtered in field with 0.45 μ membrane filter
- [ ] **PF:** Pre-filtered w/45 μ membrane filter

- [ ] **NA:** No acid added
- [ ] **A:** HCL
- [ ] **A:** 2ml H_2SO_4/L added
- [ ] **A:** 5ml conc. HNO_3 added
- [ ] **A:** 4ml fuming HNO_3 added
- [X] HgCl

FIELD COMMENTS:

SAMPLING CONDITIONS

- [ ] Bailed
- [X] Pump
- [ ] Dipped
- [ ] Tap

Water level:

Discharge:

Sample type: grab

pH(00400): 7.25

Conductivity (Uncorrected): 975 μmho

Water Temp. (00010): 16 °C

Conductivity at 25° C: μmho

LAB ANALYSIS REQUESTED:

ITEM	DESC	METHOD	ITEM	DESC	METHOD	ITEM	DESC	METHOD
☐ 001	VOA	8020	☐ 013	PHENOL	604	☐ 026	Cd	7130
☐ 002	VOA	602	☐ 014	VOC	8240	☐ 027	Pb	7421
☐ 003	VOH	8010	☐ 015	VOC	624	☐ 028	Hg(L)	7470
☐ 004	VOH	601	☐ 016	SVOC	8250	☐ 031	Se	7740
☒ 005	SUITE	8010-8020	☐ 017	SVOC	625	☐ 032	ICAP	6010
☐ 006	SUITE	601-602	☐ 018	VOC	8260	☐ 033	CATIONS/ANIONS	
☐ 007	HEADSPACE		☐ 019	SVOC	8270	☐ 034	N SUITE	
☐ 008	PAH	8100	☐ 020	O&G	9070	☐ 035	NITRATE	
☐ 009	PAH	610	☐ 022	AS	7060	☐ 036	NITRITE	
☐ 010	PCB	8080	☐ 023	Ba	7080	☐ 037	AMMONIA	
☐ 011	PCB	608	☐ 024	Cr	7190	☐ 038	TKN	
☐ 012	PHENOL	8040	☐ 025	Cr6	7198	☐	OTHER	

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

ANALYSIS REQUEST FORM

Contract Lab Analytical Technology Contract No. 95-521.07-040

OCD Sample No. 9503151300

Collection Date	Collection Time	Collected by—Person/Agency
3/15/95	1300	Olson / Price /OCD

SITE INFORMATION

Sample location: Phillips South Four Lakes Clave Jones Windmill

Collection Site Description: Discharge pipe to stock tank

Township, Range, Section, Tract: | | + | | + | + | | |

SEND FINAL REPORT TO

ENVIRONMENTAL BUREAU
NM OIL CONSERVATION DIVISION
PO Box 2088
Santa Fe, NM 87504-2088

SAMPLING CONDITIONS

☐ Bailed ☒ Pump
☐ Dipped ☐ Tap

pH(00400) 7.25

Water Temp. (00010) 16 °C

Water level

Discharge

Sample type grab

Conductivity (Uncorrected) 975 µmho

Conductivity at 25° C µmho

SAMPLE FIELD TREATMENT — *Check proper boxes*

No. of samples submitted: 2

☒ **NF:** Whole sample (Non-filtered)
☐ **F:** Filtered in field with 0.45 µ membrane filter
☐ **PF:** Pre-filtered w/45 µ membrane filter

☒ **NA:** No acid added
☐ **A:** HCL
☐ **A:** 2ml H_2SO_4/L added
☐ **A:** 5ml conc. HNO_3 added
☐ **A:** 4ml fuming HNO_3 added

FIELD COMMENTS:

LAB ANALYSIS REQUESTED:

ITEM	DESC	METHOD	ITEM	DESC	METHOD	ITEM	DESC	METHOD
☐ 001	VOA	8020	☐ 013	PHENOL	604	☐ 026	Cd	7130
☐ 002	VOA	602	☐ 014	VOC	8240	☐ 027	Pb	7421
☐ 003	VOH	8010	☐ 015	VOC	624	☒ 028	Hg(L)	7470
☐ 004	VOH	601	☐ 016	SVOC	8250	☒ 031	Se	7740
☐ 005	SUITE	8010-8020	☐ 017	SVOC	625	☒ 032	ICAP	6010
☐ 006	SUITE	601-602	☐ 018	VOC	8260	☒ 033	CATIONS/ANIONS	
☐ 007	HEADSPACE		☐ 019	SVOC	8270	☐ 034	N SUITE	
☐ 008	PAH	8100	☐ 020	O&G	9070	☐ 035	NITRATE	
☐ 009	PAH	610	☐ 022	AS	7060	☐ 036	NITRITE	
☐ 010	PCB	8080	☐ 023	Ba	7080	☐ 037	AMMONIA	
☐ 011	PCB	608	☐ 024	Cr	7190	☐ 038	TKN	
☐ 012	PHENOL	8040	☐ 025	Cr6	7198	☐	OTHER	

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : PURGEABLE HALOCARBONS/AROMATICS (EPA 8010/8020)
CLIENT : NM OIL CONSERVATION DIV. ATI I.D.: 503354
PROJECT # : (NONE)
PROJECT NAME : ~~PHILLIPS LEE GAS PLANT~~

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	CLAVE JONES WINDMILL	AQUEOUS	03/15/95	NA	03/20/95	1

PARAMETER	UNITS	01
BENZENE	UG/L	<0.5
BROMODICHLOROMETHANE	UG/L	<0.2
BROMOFORM	UG/L	<0.5
BROMOMETHANE	UG/L	<1.0
CARBON TETRACHLORIDE	UG/L	<0.2
CHLOROBENZENE	UG/L	<0.5
CHLOROETHANE	UG/L	<0.5
CHLOROFORM	UG/L	<0.5
CHLOROMETHANE	UG/L	<1.0
DIBROMOCHLOROMETHANE	UG/L	<0.2
1,2-DIBROMOETHANE (EDB)	UG/L	<0.2
1,2-DICHLOROBENZENE	UG/L	<0.5
1,3-DICHLOROBENZENE	UG/L	<0.5
1,4-DICHLOROBENZENE	UG/L	<0.5
1,1-DICHLOROETHANE	UG/L	<0.2
1,2-DICHLOROETHANE (EDC)	UG/L	<0.5
1,1-DICHLOROETHENE	UG/L	<0.2
CIS-1,2-DICHLOROETHENE	UG/L	<0.2
TRANS-1,2-DICHLOROETHENE	UG/L	<1.0
1,2-DICHLOROPROPANE	UG/L	<0.2
CIS-1,3-DICHLOROPROPENE	UG/L	<0.2
TRANS-1,3-DICHLOROPROPENE	UG/L	<0.2
ETHYLBENZENE	UG/L	<0.5
METHYL-t-BUTYL ETHER	UG/L	<2.5
METHYLENE CHLORIDE	UG/L	<2.0
1,1,2,2-TETRACHLOROETHANE	UG/L	<0.2
TETRACHLOROETHENE	UG/L	<0.5
TOLUENE	UG/L	<0.5
1,1,1-TRICHLOROETHANE	UG/L	<1.0
1,1,2-TRICHLOROETHANE	UG/L	<0.2
TRICHLOROETHENE	UG/L	<0.2
TRICHLOROFLUOROMETHANE	UG/L	<0.2
VINYL CHLORIDE	UG/L	<0.5
TOTAL XYLENES	UG/L	<0.5
SURROGATES:		
BROMOCHLOROMETHANE (%)		95
TRIFLUOROTOLUENE (%)		99

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 503354

CLIENT : ENERGY,MINERALS & RESOURCES DEPT.
PROJECT # : (NONE)
PROJECT NAME : ~~PHILLIPS LEE GAS PLANT~~

DATE RECEIVED : 03/17/95
REPORT DATE : 04/10/95

PARAMETER	UNITS	01 Clave Jones Windmill
CARBONATE (CACO3)	MG/L	<1
BICARBONATE (CACO3)	MG/L	189
HYDROXIDE (CACO3)	MG/L	<1
TOTAL ALKALINITY (AS CACO3)	MG/L	189
BROMIDE (EPA 300.0)	MG/L	0.8
CHLORIDE (EPA 325.2)	MG/L	160
CONDUCTIVITY, (UMHOS/CM)		1160
FLUORIDE (EPA 340.2)	MG/L	1.04
PH (EPA 150.1)	UNITS	7.5
SULFATE (EPA 375.2)	MG/L	170
T. DISSOLVED SOLIDS (160.1)	MG/L	740

Analytical Technologies, Inc.

METALS RESULTS

ATI I.D. : 503354

CLIENT : ENERGY,MINERALS & RESOURCES DEPT. DATE RECEIVED : 03/17/95
PROJECT # : (NONE)
PROJECT NAME : ~~PHILLIPS LEE GAS PLANT~~ REPORT DATE : 04/10/95

PARAMETER	UNITS	01 Clave Jones Windmill
SILVER (EPA 200.7/6010)	MG/L	<0.010
ALUMINUM (EPA 200.7/6010)	MG/L	<0.05
ARSENIC (EPA 206.2/7060)	MG/L	<0.005
BARIUM (EPA 200.7/6010)	MG/L	0.059
BERYLLIUM (EPA 200.7/6010)	MG/L	<0.004
CALCIUM (EPA 200.7/6010)	MG/L	145
CADMIUM (EPA 213.2/7131)	MG/L	<0.0005
COBALT (EPA 200.7/6010)	MG/L	<0.010
CHROMIUM (EPA 200.7/6010)	MG/L	<0.010
COPPER (EPA 200.7/6010)	MG/L	<0.010
IRON (EPA 200.7/6010)	MG/L	0.052
MERCURY (EPA 245.1/7470)	MG/L	<0.0002
POTASSIUM (EPA 200.7/6010)	MG/L	3.3
MAGNESIUM (EPA 200.7/6010)	MG/L	24.5
MANGANESE (EPA 200.7/6010)	MG/L	<0.010
SODIUM (EPA 200.7/6010)	MG/L	98.6
NICKEL (EPA 200.7/6010)	MG/L	<0.020
LEAD (EPA 239.2/7421)	MG/L	<0.002
ANTIMONY (EPA 200.7/6010)	MG/L	<0.05
SELENIUM (EPA 270.2/7740)	MG/L	<0.005
THALLIUM (EPA 279.2/7841)	MG/L	<0.005
VANADIUM (EPA 200.7/6010)	MG/L	0.029
ZINC (EPA 200.7/6010)	MG/L	<0.050

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - QUALITY CONTROL

MSMSD

TEST	: PURGEABLE HALOCARBONS/AROMATICS (EPA 8010/8020)		
MSMSD #	: 50335401	ATI I.D.	: 503354
CLIENT	: NM OIL CONSERVATION DIV.	DATE EXTRACTED	: NA
PROJECT #	: (NONE)	DATE ANALYZED	: 03/20/95
PROJECT NAME	: ~~PHILLIPS LEE GAS PLANT~~	SAMPLE MATRIX	: AQUEOUS
REF. I.D.	: 50335401	UNITS	: UG/L

PARAMETER	SAMPLE RESULT	CONC SPIKE	SPIKED SAMPLE	% REC	DUP SPIKE	DUP % REC	RPD
BENZENE	<0.5	10	11	110	10	100	10
CHLOROBENZENE	<0.5	10	11	110	10	100	10
1,1-DICHLOROETHENE	<0.2	10	8.5	85	7.9	79	7
TOLUENE	<0.5	10	12	120	10	100	18
TRICHLOROETHENE	<0.2	10	11	110	11	110	0

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative Percent Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS - QUALITY CONTROL

REAGENT BLANK

TEST	: EPA 8010/8020	ATI I.D.	: 503354
BLANK I.D.	: 032095	MATRIX	: AQUEOUS
CLIENT	: NM OIL CONSERVATION DIV.	DATE EXTRACTED	: NA
PROJECT #	: (NONE)	DATE ANALYZED	: 03/20/95
PROJECT NAME	: ~~PHILLIPS LEE GAS PLANT~~	DIL. FACTOR	: 1

PARAMETER	UNITS	
BENZENE	UG/L	<0.5
BROMODICHLOROMETHANE	UG/L	<0.2
BROMOFORM	UG/L	<0.5
BROMOMETHANE	UG/L	<1.0
CARBON TETRACHLORIDE	UG/L	<0.2
CHLOROBENZENE	UG/L	<0.5
CHLOROETHANE	UG/L	<0.5
CHLOROFORM	UG/L	<0.5
CHLOROMETHANE	UG/L	<1.0
DIBROMOCHLOROMETHANE	UG/L	<0.2
1,2-DIBROMOETHANE (EDB)	UG/L	<0.2
1,2-DICHLOROBENZENE	UG/L	<0.5
1,3-DICHLOROBENZENE	UG/L	<0.5
1,4-DICHLOROBENZENE	UG/L	<0.5
1,1-DICHLOROETHANE	UG/L	<0.2
1,2-DICHLOROETHANE (EDC)	UG/L	<0.5
1,1-DICHLOROETHENE	UG/L	<0.2
CIS-1,2-DICHLOROETHENE	UG/L	<0.2
TRANS-1,2-DICHLOROETHENE	UG/L	<1.0
1,2-DICHLOROPROPANE	UG/L	<0.2
CIS-1,3-DICHLOROPROPENE	UG/L	<0.2
TRANS-1,3-DICHLOROPROPENE	UG/L	<0.2
ETHYLBENZENE	UG/L	<0.5
METHYL-t-BUTYL ETHER	UG/L	<2.5
METHYLENE CHLORIDE	UG/L	<2.0
1,1,2,2-TETRACHLOROETHANE	UG/L	<0.2
TETRACHLOROETHENE	UG/L	<0.2
TOLUENE	UG/L	<0.5
1,1,1-TRICHLOROETHANE	UG/L	<1.0
1,1,2-TRICHLOROETHANE	UG/L	<0.2
TRICHLOROETHENE	UG/L	<0.2
TRICHLOROFLUOROMETHANE	UG/L	<0.2
VINYL CHLORIDE	UG/L	<0.5
TOTAL XYLENES	UG/L	<0.5
SURROGATES:		
BROMOCHLOROMETHANE (%)		104
TRIFLUOROTOLUENE (%)		100

Analytical Technologies, Inc.

GENERAL CHEMISTRY - QUALITY CONTROL

CLIENT : ENERGY,MINERALS & RESOURCES DEPT.
PROJECT # : (NONE)
PROJECT NAME : ~~PHILLIPS LEE GAS PLANT~~ ATI I.D. : 503354

PARAMETER	UNITS	ATI I.D.	SAMPLE RESULT	DUP. RESULT	RPD	SPIKED SAMPLE	SPIKE CONC	% REC
CARBONATE	MG/L	50375203	<1	<1	NA	NA	NA	NA
BICARBONATE	MG/L		157	161	3	NA	NA	NA
HYDROXIDE	MG/L		<1	<1	NA	NA	NA	NA
TOTAL ALKALINITY	MG/L		157	161	3	NA	NA	NA
BROMIDE	MG/L	50335401	0.8	0.8	0	2.9	2.0	105
CHLORIDE	MG/L	50336001	42	43	2	90	50	96
CONDUCTIVITY(UMHOS/CM)		50379509	222	229	3	NA	NA	NA
FLUORIDE	MG/L	50335401	1.04	1.06	2	2.03	1.00	99
PH	UNITS	50379801	8.0	8.0	0	NA	NA	NA
SULFATE	MG/L	50378004	35	37	6	53	20	90
TOTAL DISSOLVED SOLIDS	MG/L	50334120	1300	1400	7	NA	NA	NA

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative Percent Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Analytical Technologies, Inc.

METALS - QUALITY CONTROL

CLIENT : ENERGY,MINERALS & RESOURCES DEPT.
PROJECT # : (NONE)
PROJECT NAME : ~~PHILLIPS LEE GAS PLANT~~ ATI I.D. : 503354

PARAMETER	UNITS	ATI I.D.	SAMPLE RESULT	DUP. RESULT	RPD	SPIKED SAMPLE	SPIKE CONC	% REC
SILVER	MG/L	50376001	<0.010	<0.010	NA	1.00	1.00	100
ALUMINUM	MG/L	50349903	<0.05	<0.05	NA	1.05	1.00	105
ARSENIC	MG/L	50335401	<0.005	<0.005	NA	0.056	0.050	112
BARIUM	MG/L	50376601	0.095	0.098	3	1.03	1.00	94
BERYLLIUM	MG/L	50349903	<0.004	<0.004	NA	0.985	1.00	98
CALCIUM	MG/L	50334703	521	514	1	1020	500	100
CADMIUM	MG/L	50378007	<0.0005	<0.0005	NA	0.0052	0.0050	104
COBALT	MG/L	50349910	<0.010	<0.010	NA	1.05	1.00	105
CHROMIUM	MG/L	50376601	<0.010	<0.010	NA	0.958	1.00	96
COPPER	MG/L	50376601	<0.010	<0.010	NA	0.484	0.500	97
IRON	MG/L	50335401	0.052	0.057	9	1.13	1.00	108
MERCURY	MG/L	50336002	<0.0002	<0.0002	NA	0.0049	0.0050	98
POTASSIUM	MG/L	50334703	107	105	2	204	100	97
MAGNESIUM	MG/L	50334703	101	103	2	356	250	102
MANGANESE	MG/L	50376601	0.017	0.018	6	0.975	1.00	96
SODIUM	MG/L	50334703	2080	2110	1	2540	500	92
NICKEL	MG/L	50376001	<0.020	<0.020	NA	1.01	1.00	101
LEAD	MG/L	50379501	<0.002	<0.002	NA	0.050	0.050	100
ANTIMONY	MG/L	50349903	<0.05	<0.05	NA	1.04	1.00	104
SELENIUM	MG/L	50379501	<0.005	<0.005	NA	0.045	0.050	90
THALLIUM	MG/L	50375212	<0.002	<0.002	NA	0.045	0.050	90
VANADIUM	MG/L	50349903	<0.010	<0.010	NA	1.05	1.00	105
ZINC	MG/L	50376601	<0.050	<0.050	NA	0.523	0.500	105

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative Percent Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION
2040 S. PACHECO
SANTA FE, NEW MEXICO 87505
(505) 827-7131

May 15, 1995

CERTIFIED MAIL
RETURN RECEIPT NO: P-667-242-260

Mr. J.A. Carlson
Phillips Petroleum Company
4001 Penbrook
Odessa, Texas 79762

RE: GROUND WATER CONTAMINATION
SOUTH FOUR LAKES UNIT

Dear Mr. Carlson:

The New Mexico Oil Conservation Division (OCD) has completed a review of Phillips Petroleum Company's (PPC) March 27, 1995 CORRESPONDENCE and March 13, 1995 "SOIL AND GROUND WATER ASSESSMENT, PHILLIPS PETROLEUM COMPANY, SOUTH FOUR LAKES UNIT, LEA COUNTY, NEW MEXICO, SECOR PROJECT NO. B0106-001-01". This document contains the results of PPC's investigation of soil and ground water contamination related to the South Four Lakes Unit in Lea County, New Mexico.

The investigation actions taken to date are satisfactory. However, the report does not include recommendations for remediation of contaminated soils and ground water nor a plan for determining the complete extent of dissolved phase ground water contamination at the site. Therefore, the OCD requires that PPC submit, by July 28, 1995:

1. A soil and ground water remediation work plan.

2. A work plan to completely define the extent of dissolved phase ground water contamination at the site.

If you have any questions, please call me at (505) 827-7154.

Sincerely,

William C. Olson
Hydrogeologist
Environmental Bureau

xc: Jerry Sexton, OCD Hobbs District Supervisor
Wayne Price, OCD Hobbs District Office

P 667 242 260

Certified Mail Receipt

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PS Form **3800**, June 1990

Fold at line over top of envelope to the right of the return address.

Bill Olson

From: Bill Olson
To: Jerry Sexton
Cc: Wayne Price
Subject: Phillips South Four Lakes Unit
Date: Wednesday, May 10, 1995 4:17PM
Priority: High

Attached is a draft letter reviewing Phillips' investigation of soil and ground water contamination at the South Four Lakes Unit and requesting submission of a ground water remediation work plan. Please provide me with any comments by 4:15pm on 5/12/95. Thanks!

<<File Attachment: REMEDY1.REQ>>

Bill Olson

From: Jerry Sexton
Date sent: Thursday, May 11, 1995 10:31AM
To: Bill Olson
Subject: Registered: Jerry Sexton

Your message
To: Jerry Sexton
Subject: Phillips South Four Lakes Unit
Date: Wednesday, May 10, 1995 4:17PM
was accessed on
Date: Thursday, May 11, 1995 10:31AM

Bill Olson

From: POSTOFFICE
To: Bill Olson
Subject: Registered: Wayne Price
Date: Thursday, May 11, 1995 10:58AM

[013] ***** CONFIRMATION OF REGISTERED MAIL *****
Your message:

TO: Wayne Price DATE: 05-11-95
SUBJECT: Phillips South Four Lakes Unit TIME: 09:41

Was accessed on 05-11-95 10:58

PHILLIPS PETROLEUM COMPANY
4001 PENBROOK
ODESSA, TEXAS 79762

EXPLORATION AND PRODUCTION
Permian Basin Region

March 27, 1995

Mr. Roger Anderson
Environmental Bureau Chief
New Mexico Oil Conservation Division
2040 South Pacheco Street
Santa Fe, New Mexico 87505

RE: Phillips Petroleum Company
South Four Lakes Unit
Soil & Groundwater Assessment Report

Dear Mr. Anderson:

Enclosed is a copy of a report entitled "Soil and Groundwater Assessment, South Four Lakes Unit, Lea County, New Mexico" prepared for Phillips Petroleum Company (Phillips) by SECOR International, Inc.

Phillips looks forward to our meeting on 03 April 1995 to discuss the enclosed assessment report and our remedial approach.

Should you have questions or require additional information concerning the enclosed report, please contact me at (915) 368-1229 or Steve de Albuquerque at (713) 669-3748.

Sincerely,

J. A. Carlson

J. A. Carlson

JAC:sft

cc: Jerry Sexton - OCD District 1
L. A. Takla

AGENDA

Phillips Petroleum Company
South Four Lakes Unit
Groundwater Assessment & Remediation Strategy
03 April 1995

A) SUMMARY OF FINDINGS:

- Source Identification
- Extent of Free Product & Dissolved Hydrocarbons

B) CLOSURE ISSUES:

- Ultimate Property Disposition
- Short Term vs. Long Term Solutions
- Cost Effective Liability Management

C) REMEDIATION STRATEGY:

- Source Elimination
- Mass Removal
- Demonstration of Natural Bioattenuation of Dissolved Plume
- Risk-Based Corrective Action

D) SCHEDULE

SOUTH FOUR LAKES
APPROACH TO ASSESS
DEGREE OF NATURAL ATTENUATION

A) Natural Attenuation Site Considerations:

- Land Use & Time Constraints
- Available Electron Acceptors

B) Natural Attenuation Processes:

- Dilution
- Adsorption
- Volatilization
- Biodegradation
- Abiotic Oxidation
- Hydrolysis

C) Natural Biodegradation:

Process	E.A.s	By-Products
• Aerobic Degradation	O_2	CO_2
• Denitrification	NO_3^-	CO_2
• Sulfate Reduction	SO_4^{2-}	HCO_3^-
• Methanogenesis	CO_2	CO_2, CH_4
• Iron III Reduction	Fe^{3+}	Fe^{2+}, CO_2

SOUTH FOUR LAKES
ASSESSMENT FINDINGS

- Abandoned Pit = Source
- Surface Spills Appear Not to Contributed to Subsurface Plume
- Free Product Plume Defined
- Dissolved Plume Not Fully Defined Downgradient; Intuitively Estimated
- No Hydrocarbon Impacts to Windmill

State of New Mexico
ENERGY, MINERALS and NATURAL RESOURCES DEPARTMENT
Santa Fe, New Mexico 87505

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

MEMORANDUM OF MEETING OR CONVERSATION

☑ Telephone ☐ Personal	Time 1010 hrs	Date 3/9/95
Originating Party		**Other Parties**
Clave Jones 398-6577		Bill Olson - Envir. Bureau

Subject

South Four Lakes Tank Battery - Phillips Petroleum

Discussion

Believes stock well may be contaminated.
Recently had - 2 cows abort fetus
2 calves born deformed
2 calves scouring

Stock well is located short distance from Phillips South Four Lakes Unit tank Battery.
Drive to mile marker 217, go thru double gate on North side of road.
1/2 mile to battery, ranch road east of battery goes to stock well

Conclusions or Agreements

I will sample next week. Will call him about time next week

Distribution
file
Jerry Sexton - OCD Hobbs
Wayne Price - OCD Hobbs.

Signed Bill Olson

State of New Mexico
ENERGY, MINERALS and NATURAL RESOURCES DEPARTMENT
Santa Fe, New Mexico 87505

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

MEMORANDUM OF MEETING OR CONVERSATION

☑ Telephone ☐ Personal	Time 0940 hrs.	Date 3/9/95
Originating Party		**Other Parties**
Al Hopkay - NMED Roswell 624-6046		Bill Olson - Envir. Bureau

Subject

Clave Jones Stock Well

Discussion

Clave Jones (398-6577) reported that his cows are aborting fetus's. He believes it may be that his stock well is contaminated from oilfield activities. He is located 10 miles west of Tatum. The stock well is approximately 3/8 mile east of a Phillips tank battery on state land

I will be area @ next week and can take sample.

Conclusions or Agreements

I will contact Mr. Jones and arrange to sample stock well

Distribution

file
Jerry Sexton - OCD Hobbs
~~Wayne Price - OCD Hobbs~~

Signed Bill Olson

PHILLIPS PETROLEUM COMPANY
HOUSTON, TEXAS 77251-1967
BOX 1967

NORTH AMERICA
EXPLORATION AND PRODUCTION

BELLAIRE, TEXAS
6330 WEST LOOP SOUTH
PHILLIPS BUILDING

19 January 1995

Mr. Bill Olson
New Mexico Oil Conservation Division
2040 South Pacheco Street
Santa Fe, New Mexico 87505

RE: Phillips Petroleum Company
South Four Lakes Unit-1990 Preliminary Site Assessment Data

Dear Mr. Olson:

As you requested during our 03 January 1995 telephone conversation, enclosed are Figures 3 and 4, the soil and groundwater analytical data, soil boring logs, and the monitor well completion reports from the October-1990 Law Environmental report. This report was prepared for Phillips Petroleum Company (Phillips) as part of a prepurchase environmental due diligence effort for the South Four Lakes Unit located approximately 12 miles northwest of Tatum, NM (Sec. 2, T12S R34E).

Please note that monitor wells 1, 2, 3, and 4 are soil borings 1, 2, 3, and 4, respectively. Please also note that the tank battery layout depicted on Figure 4 is no longer accurate. Once Phillips purchased the lease from Exxon, Phillips decommissioned the old Exxon tank battery and replaced it with a new facility. The new tank battery layout will be depicted correctly in our site assessment report which is now in preparation. Upon completion of the assessment report, Phillips looks forward to discussing the findings of this phase of work with the NM Oil Conservation Division in late February, 1995.

Should you have questions or require additional information concerning this project or the enclosed information, please call me at (713) 669-3748 or Jeff Carlson, Environmental Analyst, at (915) 368-1229.

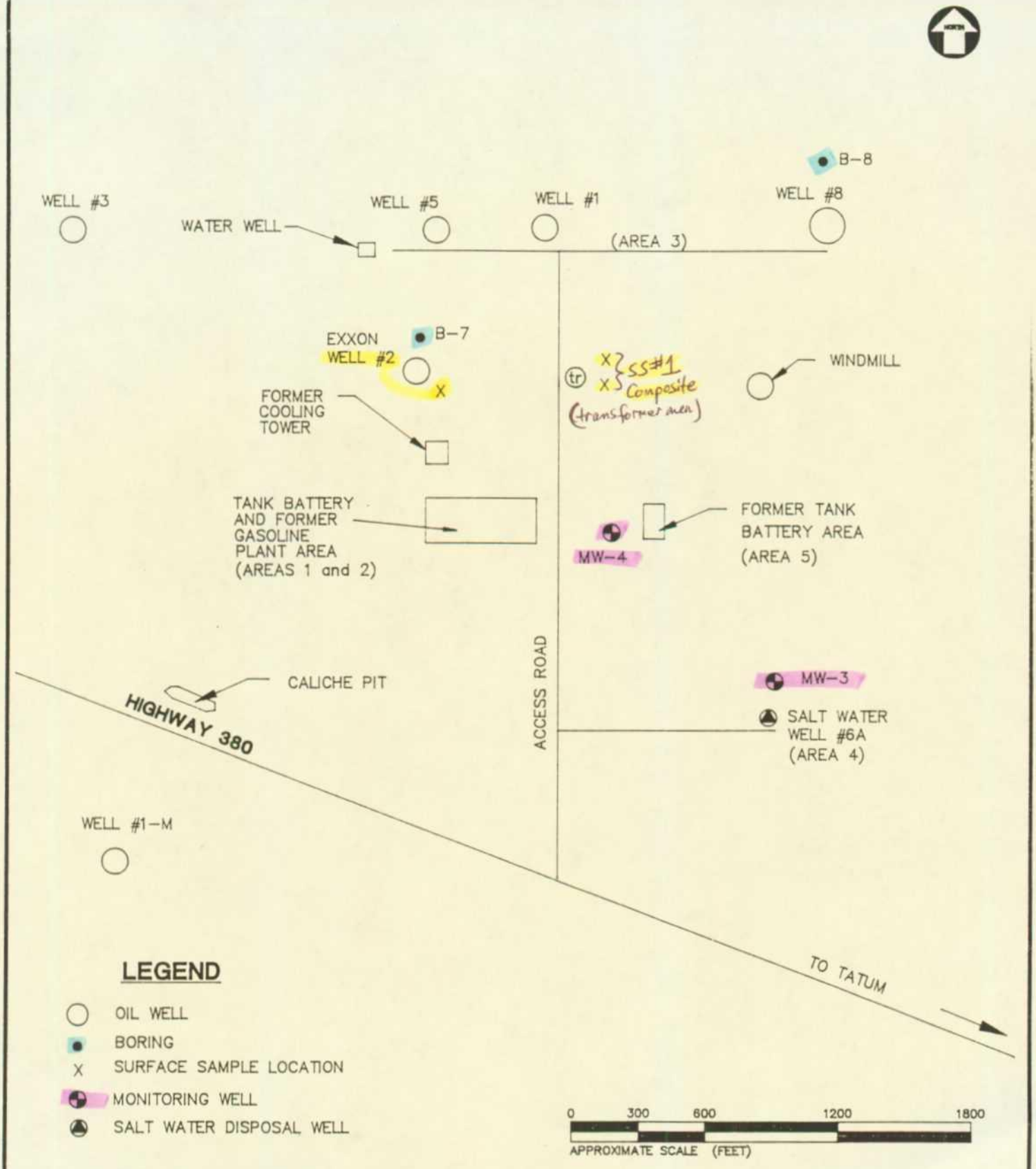
Sincerely,

J. Stephen de Albuquerque, P.G.
Environmental & Regulatory Representative

JSA:sfl-ocd2.ltr

JSA:sfl-ocd2.ltr

cc: J. E. Stark
J. A. Carlson



DRAWN BY	DRAWING NO.
CA	06060023
CHECKED BY	SCALE
	1" = 600'
APPROVED BY DATE	REVISION

LAW ENVIRONMENTAL

PHILLIPS PETROLEUM COMPANY
SOUTH FOUR LAKES UNIT
SECTION 2, T12S, R34E
LEA COUNTY, NEW MEXICO

FIGURE 3
SITE MAP
71-0606 TASK 02

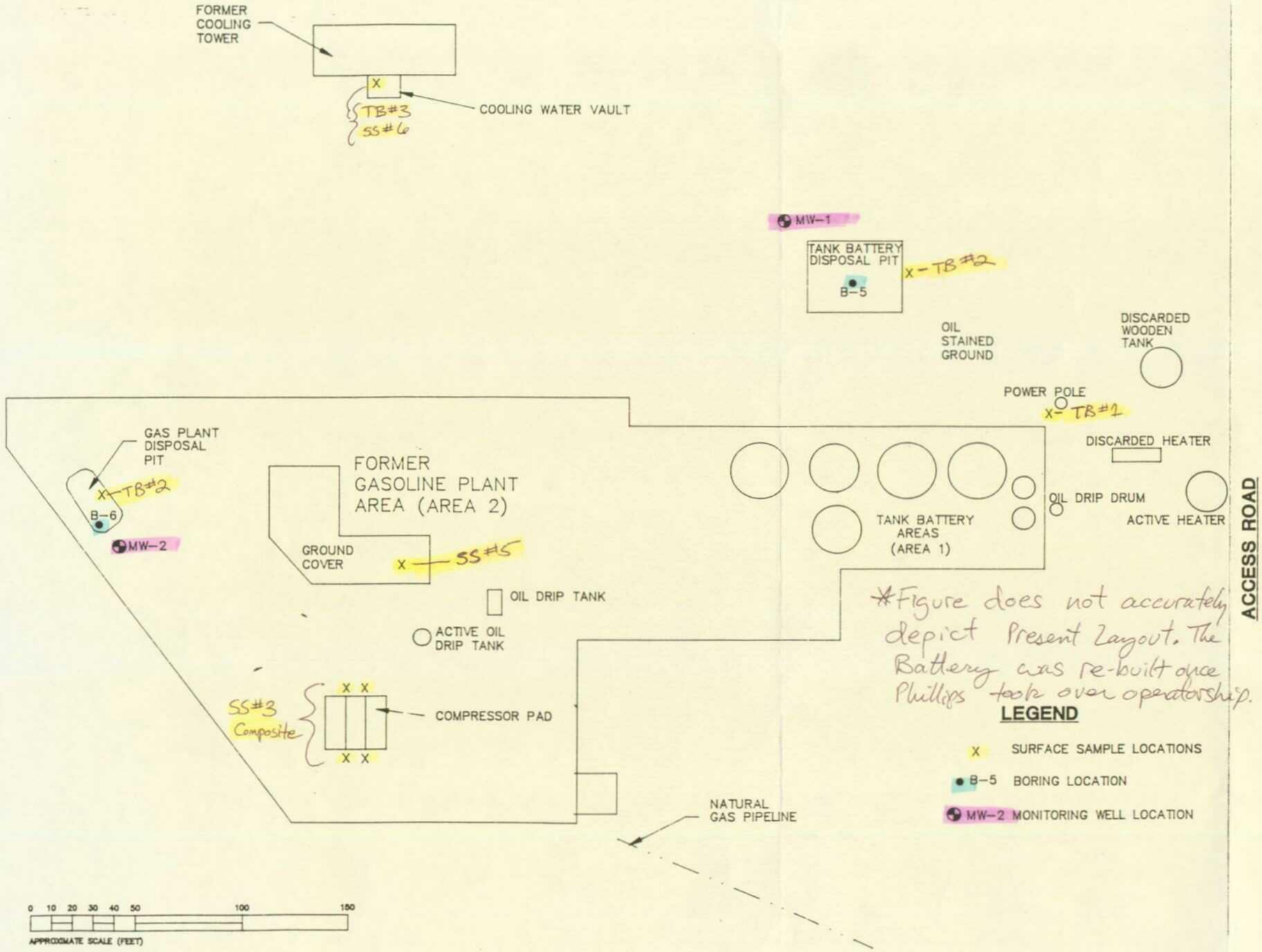


*Figure does not accurately depict Present Layout. The Battery was re-built once Phillips took over operatorship.

LEGEND

- X — SURFACE SAMPLE LOCATIONS
- B-5 — BORING LOCATION
- MW-2 — MONITORING WELL LOCATION

LAW ENVIRONMENTAL
HOUSTON, TEXAS

NO.	DESCRIPTION	DATE

REVISIONS

PHILLIPS PETROLEUM

SOUTH FOUR LAKES UNIT
TANK BATTERY AREA
LEA COUNTY, NEW MEXICO
FIGURE 4
SITE PLAN
71-0606 TASK 02

DRAWN BY	SHEET NO.
CA	OF
CHECKED BY	SCALE
	1" = 50'
APPROVED BY	DATE
DRAWING NO.	
06060024	

LAW ENVIRONMENTAL

The following is a list of the surficial soil samples taken, the areas from which they were obtained, their corresponding sample identification numbers, and the laboratory analyses selected for testing. Soil samples beginning with a TB prefix were obtained on September 19, 1990. Soil sample beginning with a SS prefix were obtained the week of October 8, 1990.

TB-1	NE corner of the tank battery near a power pole	TPH, BTEX, PCB
TB-2	Tank battery disposal pit	TPH, BTEX, TCLP metals
TB-3	Cooling tower vault sludge	TPH, BTEX TCLP metals
TB-4	Gasoline plant disposal pit	TPH, BTEX, TCLP metals
Well # 2	Exxon Well # 2	TPH, BTEX
SS #1	Composite sample from transformer area	PCBs
SS #2	Background sample	TPH, BTEX, TCLP metals
SS #3	Composite sample compressor pad, gas plant	TPH, PCBs
SS #5	Former tank battery/gasoline plant structure	BTEX, TPH
SS #6	Cooling Tower Wood sample	TCLP metals

The results of the laboratory analyses of surficial soil samples is presented in Table 2. The results for BTEX constituents are reported in micrograms per kilogram (μg/kg), TPH and PCBs are reported in milligrams per kilogram (mg/kg), and TCLP metals are reported in milligrams per liter (mg/l).

TABLE 2
LABORATORY ANALYSES OF SURFICIAL SOIL SAMPLES
SOUTH FOUR LAKES UNIT
PHILLIPS PETROLEUM COMPANY
OCTOBER, 1990

Sample Number	Benzene µg/kg	Toluene µg/kg	Ethylbenzene µg/kg	Xylene µg/kg	TPH mg/kg	Total PCBs mg/kg	TCLP Metals							
							Silver mg/l	Arsenic mg/l	Barium mg/l	Cadmium mg/l	Chromium mg/l	Mercury mg/l	Lead mg/l	Selenium mg/l
TB-1	210	510	< 100	340	50,000	ND	–	–	–	–	–	–	–	–
TB-2	< 2,000	25,000	< 2,000	210,000	55,000	–	ND	ND	0.5	ND	ND	ND	ND	ND
TB-3	< 2,000	4,900	3,100	63,000	58,000	–	ND	ND	0.2	0.01	1.50	ND	ND	ND
TB-4	< 2	< 2	< 2	< 2	52	–	ND	ND	0.5	ND	ND	ND	ND	ND
Well #2	< 1,000	< 1,000	< 1,000	< 1,000	210,000	–	–	–	–	–	–	–	–	–
SS #1	–	–	–	–	–	ND	–	–	–	–	–	–	–	–
SS #2	< 2	< 2	< 2	< 2	36	–	ND	ND	0.6	0.02	0.06	ND	0.10	ND
SS #3	–	–	–	–	180	ND	–	–	–	–	–	–	–	–
SS #4	< 2	< 2	< 2	< 2	22	ND	–	–	–	–	–	–	–	–
SS #5	< 10	86	< 10	45	19,000	–	–	–	–	–	–	–	–	–
SS #6	–	–	–	–	–	–	ND	ND	0.5	0.02	3.44	ND	0.46	ND

ND = Not detected

< 2 = Less than detection limits - detection limits vary for BTEX constituents due to varying degrees of dilution necessary for laboratory analyses

– = Not tested for

TCLP = Toxicity Characteristic Leaching Procedure

TABLE 3
LABORATORY ANALYSES OF SURFICIAL SOIL SAMPLES OBTAINED FROM BORINGS
SOUTH FOUR LAKES UNIT
PHILLIPS PETROLEUM COMPANY
OCTOBER, 1990

Sample Number	Depth feet	Benzene µg/kg	Toluene µg/kg	Ethylbenzene µg/kg	Xylene µg/kg	TPH mg/kg	TCLP Metals							
							Silver mg/l	Arsenic mg/l	Barium mg/l	Cadmium mg/l	Chromium mg/l	Mercury mg/l	Lead mg/l	Selenium mg/l
B-1	21	< 1,000	< 1,000	1,500	14,000	2,700	ND	ND	2.5	0.01	0.07	ND	0.09	ND
B-2	24-25	< 2	< 2	< 2	< 2	< 10	ND	ND	1.7	ND	ND	ND	ND	ND
B-4	22	< 2	< 2	< 2	< 2	39	ND	ND	0.8	0.01	ND	ND	ND	ND
B-5	0-2	< 2	< 2	< 2	< 2	1,500	ND	ND	1.7	0.02	0.10	ND	0.08	ND
B-5	4-6	4,000	4,100	4,800	68,000	97,000	ND	ND	1.4	0.04	0.13	ND	0.11	ND
B-5	8-10	2,200	1,800	4,300	39,000	24,000	ND	ND	0.3	ND	ND	ND	ND	ND
B-6	0-2	< 2	< 2	< 2	< 2	34	ND	ND	0.2	0.01	ND	ND	0.10	ND
B-6	4-6	< 2	< 2	< 2	< 2	37	ND	ND	0.7	0.01	ND	ND	ND	ND
B-6	8-10	< 2	< 2	< 2	< 2	62	ND	ND	0.7	0.02	ND	ND	0.08	ND
B-7	0-2	–	–	–	–	–	ND	ND	ND	0.02	0.23	ND	ND	ND
B-7	4-6	–	–	–	–	–	ND	ND	0.3	0.01	ND	ND	0.08	ND
B-7	8-10	–	–	–	–	–	ND	ND	0.8	ND	ND	ND	ND	ND
B-8	0-2	–	–	–	–	–	ND	ND	0.2	0.02	ND	ND	0.09	ND
B-8	4-6	–	–	–	–	–	ND	ND	0.3	0.01	ND	ND	ND	ND
B-8	8-10	–	–	–	–	–	ND	ND	0.7	ND	ND	ND	ND	ND

MW-1 =
MW-2 =

ND = Not detected

< 2 = Less than detection limits - detection limits vary for BTEX constituents due to varying degrees of dilution necessary for laboratory analyses

– = Not tested for

TABLE 4
LABORATORY ANALYSES OF WATER SAMPLES
SOUTH FOUR LAKES UNIT
PHILLIPS PETROLEUM COMPANY
OCTOBER, 1990

Sample Number	Benzene µg/l	Toluene µg/l	Ethylbenzene µg/l	Xylene µg/l	TPH mg/l	Total Metals							
						Silver mg/l	Arsenic mg/l	Barium mg/l	Cadmium mg/l	Chromium mg/l	Mercury mg/l	Lead mg/l	Selenium mg/l
B-1 = MW-1	< 10	39	100	390	7.7	ND	ND	0.5	ND	ND	ND	ND	ND
B-2 = MW-2	< 1	< 1	< 1	< 1	1.5	ND	0.01	0.7	0.02	ND	ND	0.07	ND
MW-3	< 1	< 1	< 1	< 1	1.3	ND	ND	0.4	ND	ND	0.005	ND	ND
MW-4	< 1	< 1	< 1	< 1	0.7	ND	ND	0.7	0.01	ND	ND	0.05	ND
Cooling Tower	< 1	< 1	< 1	< 1	5.0	ND	ND	ND	ND	0.78	ND	ND	ND
Trip Blank	< 1	< 1	< 1	< 1	< 1	ND	ND	–	–	–	–	–	–

ND = Not detected

– = Not tested for

< 1 = Less than detection limits - detection limits vary due to varying degrees of dilution necessary for laboratory testing.

BORING LOGS

SOIL TEST BORING RECORD MW-1

LAW ENGINEERING, INC.
HOUSTON, TEXAS

BORING NUMBER: B-1 | SHEET 1 OF 1

EQUIPMENT & METHODS:
SPLIT SPOON SAMPLING, PUSHED, NOT DRIVEN
AIR DRILLING

LOCATION:
TANK BATTERY DISPOSAL PIT
SOUTH FOUR LAKES UNIT, LEA CO., NEW MEXICO

CLIENT/OWNER: PHILLIPS PETROLEUM CO.

GROUND LEVEL: EST. 4150 FT. MSL

COORDINATES:

DATE: OCT 1990

DESCRIPTION	LEGEND	DEPTH (ft)	ELEVATION	SAMPLES / TESTS: DEPTH (ft)	SAMPLE: TYPE	SAMPLE: NO.	TEST: dd	TEST: pf
Soft Brown Soil with Roots, No Odor, OVM = 1		.0	4150.0					
		2.0	4148.0	1.3		1		
Hard White Sandy CALICHE, No Odor, OVM = 1				3.5		2		
				7.5		3		
Soft Red Sandy SILT		8.0	4142.0					
		10.0	4140.0	11.3		4		
Soft, White Sandy CALICHE, Moist, No Odor, OVM = 1								
-no odor, OVM = 1				17.5		5		
		20.0	4130.0	21.3		6		
Soft Red Sandy SILT, Strong Hydrocarbon Odor, OVM = 517								
-OVM = 124				25.5		7		
		28.0	4122.0					
Soft White Sandy CALICHE, OVM = 11				30.3		8		
		31.0	4119.0					
Boring Terminated at 31.0 ft.								

PL (%) NM (%) LL (%)
COHESION (100 psf)
PENETRATION (bpf)
RQD
CORE RECOVERY
10 20 30 40 50 60 70 80 90

REMARKS:
Legend for samples:
X = samples from cuttings
Z = split-spoon

DRILLED BY: HI PLAINS

DATE STARTED: 10/9/90

LOGGED BY: MAP

DATE COMPLETED: 10/9/90

CHECKED BY: MAP

JOB NUMBER: 71-0606-T02

MW-2

SOIL TEST BORING RECORD

LAW ENGINEERING, INC. HOUSTON, TEXAS	BORING NUMBER: B-2	SHEET 1 OF 1

EQUIPMENT & METHODS:	LOCATION:
SPLIT-SPOON SAMPLING, PUSHED, NOT DRIVEN AIR DRILLING	FORMER GASOLINE PLANT DISPOSAL PIT SOUTH FOUR LAKES UNIT, LEA CO., NEW MEXICO

CLIENT/OWNER:	GROUND LEVEL:	COORDINATES:	DATE:
PHILLIPS PETROLEUM CO.	EST. 4150 FT. MSL		OCT 1990

DESCRIPTION	LEGEND	DEPTH (ft)	ELEVATION	SAMPLES / TESTS: DEPTH (ft)	SAMPLE TYPE	SAMPLE NO.	TEST dd	TEST pf
Brown Soil with Roots		0	4150.0	1.3		1		
Hard White CALICHE				3.3		2		
-becomes sandy				6.0		3		
				9.3		4		
-few sand stringers				12.5		5		
				17.5		6		
-high sand content, moist		20.0	4130.0					
Soft, Brown Silty SAND		23.0	4127.0	23.3		7		
Hard White Sandy CALICHE		27.0	4123.0	27.0		8		
Boring Terminated at 33.0 ft.		33.0	4117.0					

PL (%) NM (%) LL (%)

△⊗⊕ COHESION (100 psf)
● PENETRATION (bpf)
□ ROD
◇ CORE RECOVERY

10 20 30 40 50 60 70 80 90

REMARKS:	DRILLED BY:	DATE STARTED:
Legend for samples: X = samples from cuttings Z = split-spoon No odor and OVM = 0 in all samples.	HI PLAINS	10/9/90
	LOGGED BY: MAP	DATE COMPLETED: 10/9/90
	CHECKED BY: MAP	JOB NUMBER: 71-0606-702

MW-3

SOIL TEST BORING RECORD

LAW ENGINEERING, INC.
HOUSTON, TEXAS

BORING NUMBER: B-3 | SHEET 1 OF 1

EQUIPMENT & METHODS:
SPLIT-SPOON SAMPLING, PUSHED, NOT DRIVEN
AIR DRILLING

LOCATION:
SOUTH FOUR LAKES UNIT
LEA COUNTY, NEW MEXICO

CLIENT/OWNER: PHILLIPS PETROLEUM CO.

GROUND LEVEL: EST. 4145 FT. MSL

COORDINATES:

DATE: OCT 1990

DESCRIPTION	LEGEND	DEPTH (ft)	ELEVATION	SAMPLES / TESTS: DEPTH (ft)	SAMPLE: TYPE	SAMPLE: NO.	TEST: dd	TEST: pf
9" Brown Soil Hard White CALICHE, No Odor, OVM = 2		.0	4145.0	1.3		1		
				3.5		2		
-becomes sandy, no odor, OVM = 0				7.5		3		
				12.5		4		
-no odor, OVM = 1				17.5		5		
-no odor, OVM = 1								
-moist, near water table, no odor, OVM = 0				22.3		6		
Boring Terminated at 32.0 ft.		32.0	4113.0					

PL (%) NM (%) LL (%)
COHESION (100 psf)
PENETRATION (bpf)
RQD
CORE RECOVERY
10 20 30 40 50 60 70 80 90

REMARKS:
Legend for samples:
X = samples from cuttings
Z = split-spoon

DRILLED BY: HI PLAINS

DATE STARTED: 10/9/90

LOGGED BY: MAP

DATE COMPLETED: 10/9/90

CHECKED BY: MAP

JOB NUMBER: 71-0606-T02

MW-4

SOIL TEST BORING RECORD

LAW ENGINEERING, INC.
HOUSTON, TEXAS

BORING NUMBER: B-4 | SHEET 1 OF 1

EQUIPMENT & METHODS:
SPLIT-SPOON SAMPLING, PUSHED, NOT DRIVEN
AIR DRILLING

LOCATION:
FORMER TANK BATTERY AREA
SOUTH FOUR LAKES UNIT, LEA CO., NEW MEXICO

CLIENT/OWNER: PHILLIPS PETROLEUM CO.

GROUND LEVEL: EST. 4160 FT. MSL

COORDINATES:

DATE: OCT 1990

DESCRIPTION	LEGEND	DEPTH (ft)	ELEVATION	SAMPLES / TESTS: DEPTH (ft)	SAMPLE: TYPE	SAMPLE: NO.	TEST: qu	TEST: pf
Soft Brown Clayey SILT, No Odor, OVM = 2		.0	4150.0	1.3		1		
				3.3		2		
				5.3		3		
-moist, no odor, OVM = 1		7.0	4143.0	7.3		4		
White Sandy CALICHE, Dry, No Odor, OVM = 1				9.3		5		
-no odor, OVM = 0				12.5		6		
				17.5		7		
-hydrocarbon stained sand stringer, slight odor, moist				22.3		8		
				26.5		9		
-with few brown sandy silt stringers, wet		32.0	4118.0					
Boring Terminated at 32.0 ft.								

PL (%) NM (%) LL (%)
△⊗⊕ COHESION (100 psf)
● PENETRATION (tsf)
□ RQD
◇ CORE RECOVERY
10 20 30 40 50 60 70 80 90

REMARKS:
Legend for samples:
X = samples from cuttings
Z = split-spoon

DRILLED BY: HI PLAINS

DATE STARTED: 10/10/90

LOGGED BY: MAP

DATE COMPLETED: 10/10/90

CHECKED BY: MAP

JOB NUMBER: 71-0606-T02

SOIL TEST BORING RECORD

LAW ENGINEERING, INC. HOUSTON, TEXAS	BORING NUMBER: B-5	SHEET 1 OF 1

EQUIPMENT & METHODS:	LOCATION:
SPLIT SPOON SAMPLING TUBES PUSHED, NOT DRIVEN	TANK BATTERY DISPOSAL PIT SOUTH FOUR LAKES UNIT, LEA CO., NEW MEXICO

CLIENT/OWNER:	GROUND LEVEL:	COORDINATES:	DATE:
PHILLIPS PETROLEUM CO.	EST. 4150 FT. MSL		OCT 1990

DESCRIPTION	LEGEND	DEPTH (ft)	ELEVATION	SAMPLES / TESTS: DEPTH (ft)	SAMPLE: TYPE	SAMPLE: NO.	TEST: dd	TEST: pf
Soft, Brown Clayey SILT with Caliche Cobbles, OVM = 22		.0	4150.0	1.3		1		
-black oil saturated, OVM = 245				3.3		2		
-bottom pit at 5 feet, OVM = 411		5.0	4145.0	5.3		3		
Soft, Black Stained Sandy CALICHE				7.3		4		
-staining decreases, OVM = 392				9.3		5		
-decreasing hydrocarbon staining, OVM = 531				11.3		6		
-staining reduced but not absent, OVM = 205		15.0	4135.0					
Boring Terminated at 15.0 ft.								

PL (%) NM (%) LL (%)
△⊗⊕ COHESION (100 psf)
● PENETRATION (bpf)
□ RQD
◇ CORE RECOVERY
10 20 30 40 50 60 70 80 90

REMARKS:	DRILLED BY:	DATE STARTED:
Legend for samples: Z = split-spoon	HI PLAINS	10/10/90
	LOGGED BY: MAP	DATE COMPLETED: 10/10/90
	CHECKED BY: MAP	JOB NUMBER: 71-0606-T02

SOIL TEST BORING RECORD

LAW ENGINEERING, INC. HOUSTON, TEXAS	BORING NUMBER: B-6	SHEET 1 OF 1

EQUIPMENT & METHODS:	LOCATION:
SPLIT SPOON SAMPLING TUBES PUSHED, NOT DRIVEN	GASOLINE PLANT DISPOSAL PIT SOUTH FOUR LAKES UNIT, LEA CO., NEW MEXICO

CLIENT/OWNER:	GROUND LEVEL:	COORDINATES:	DATE:
PHILLIPS PETROLEUM CO.	EST. 4150 FT. MSL		OCT 1990

PL (%) — NM (%) — LL (%)

△⊗⊕ COHESION (100 psf)
● PENETRATION (bpf)
□ RQD
◇ CORE RECOVERY

10 20 30 40 50 60 70 80 90

DESCRIPTION	LEGEND	DEPTH (ft)	ELEVATION	SAMPLES / TESTS: DEPTH (ft)	SAMPLE: TYPE	SAMPLE: NO.	TEST: dd	TEST: pf
Very Hard, Dark Brown CLAY, Cobbles		.0	4150.0	1.3		1		
-bottom of pit at 3.5 feet		3.5	4146.5	3.3		2		
Hard White CALICHE				5.3		3		
				7.3		4		
				9.3		5		
		10.0	4140.0					
Boring Terminated at 10.0 ft.								

REMARKS:	DRILLED BY:	DATE STARTED:
Legend for samples: Z = split-spoon No odor and OVM = 0 in all samples.	HI PLAINS	10/10/90
	LOGGED BY: MAP	DATE COMPLETED: 10/10/90
	CHECKED BY: MAP	JOB NUMBER: 71-0606-T02

SOIL TEST BORING RECORD

LAW ENGINEERING, INC. HOUSTON, TEXAS	BORING NUMBER: B-7	SHEET 1 OF 1

EQUIPMENT & METHODS:	LOCATION:
SPLIT-SPOON SAMPLING TUBES PUSHED, NOT DRIVEN	OIL WELL #2, SOUTH FOUR LAKES UNIT LEA COUNTY, NEW MEXICO

CLIENT/OWNER:	GROUND LEVEL:	COORDINATES:	DATE:
PHILLIPS PETROLEUM CO.	EST. 4150 FT. MSL		OCT 1990

DESCRIPTION	LEGEND	DEPTH (ft)	ELEVATION	SAMPLES / TESTS: DEPTH (ft)	SAMPLE: TYPE	SAMPLE: NO.	TEST: dd	TEST: pf
Soft Brown Silty CLAY, Slight Odor, OVM = 10		.0	4150.0	1.3		1		
				3.3		2		
-bottom of pit at 4.0 feet		4.0	4146.0	5.3		3		
Hard White Sandy CALICHE, OVM = 1								
				9.3		4		
Boring Terminated at 10.0 ft.		10.0	4140.0					

PL (%) NM (%) LL (%)
COHESION (100 psf)
PENETRATION (bpf)
RQD
CORE RECOVERY
10 20 30 40 50 60 70 80 90

REMARKS:	DRILLED BY:	DATE STARTED:
Legend for samples: Z = split-spoon	HI PLAINS	10/10/90
	LOGGED BY: MAP	DATE COMPLETED: 10/10/90
	CHECKED BY: MAP	JOB NUMBER: 71-0606-T02

SOIL TEST BORING RECORD

LAW ENGINEERING, INC. HOUSTON, TEXAS	BORING NUMBER: B-8	SHEET 1 OF 1

EQUIPMENT & METHODS:	LOCATION:
SPLIT-SPOON SAMPLING TUBES PUSHED, NOT DRIVEN	OIL WELL #8, SOUTH FOUR LAKES UNIT LEA COUNTY, NEW MEXICO

CLIENT/OWNER:	GROUND LEVEL:	COORDINATES:	DATE:
PHILLIPS PETROLEUM CO.	EST. 4145 FT. MSL		OCT 1990

DESCRIPTION	LEGEND	DEPTH (ft)	ELEVATION	SAMPLES / TESTS: DEPTH (ft)	SAMPLE: TYPE	SAMPLE: NO.	TEST: dd	TEST: pf
Hard Brown CLAY, Moderate Odor, OVM = 164		.0	4145.0	1.3	Z	1		
		2.0	4143.0	3.3	Z	2		
Stiff Black Silty CLAY with Cobbles, Moderate Odor, OVM = 42 -OVM = 32, moderate odor -bottom of pit at 5.0 feet		5.0	4140.0	5.3	Z	3		
				7.3	Z	4		
Hard, Mottled CALICHE with Brown Staining -no odor, OVM = 9		10.0	4135.0	9.3	Z	5		
Boring Terminated at 10.0 ft.								

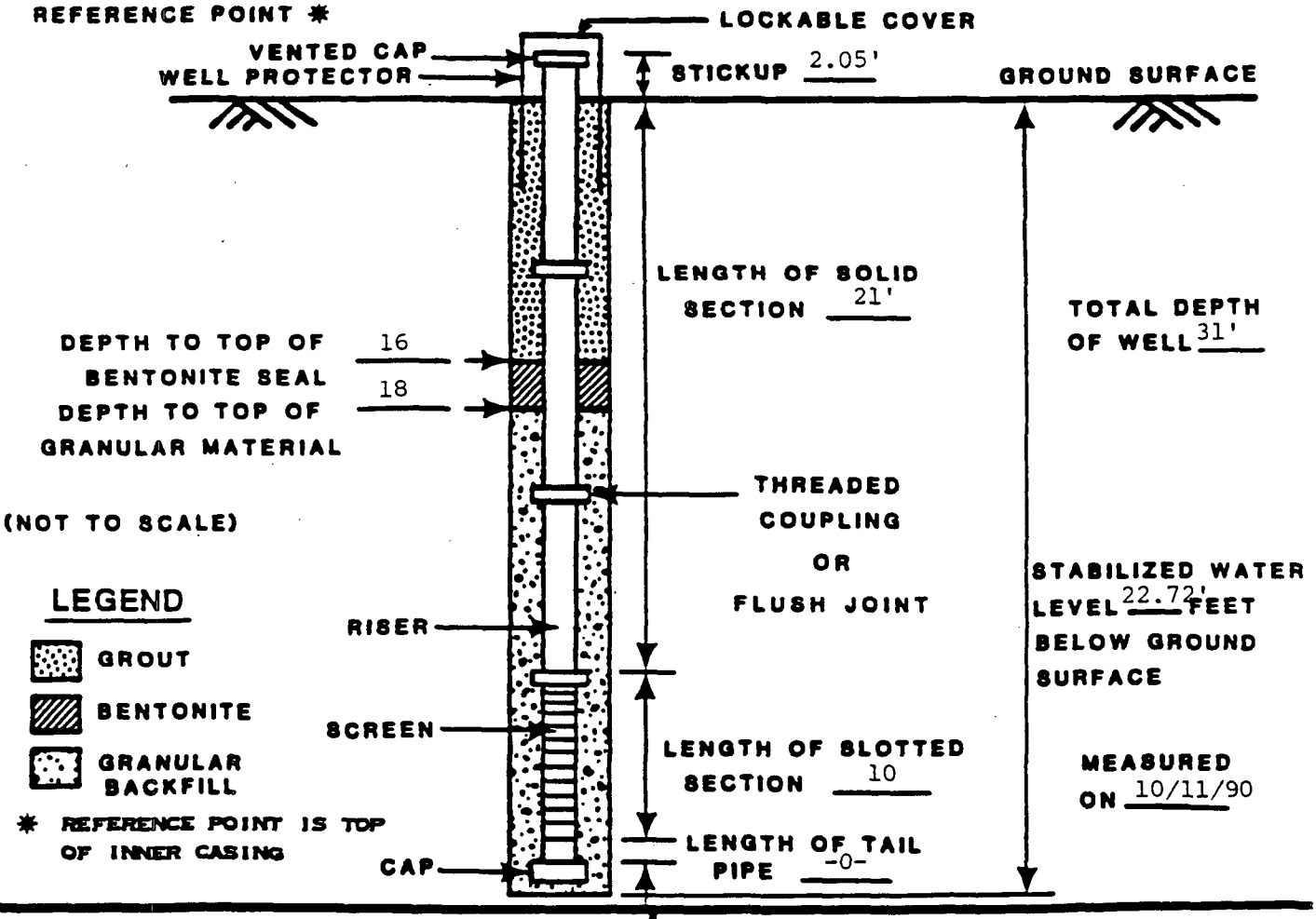
PL (%) NM (%) LL (%)
△⊗⊕ COHESION (100 psf)
● PENETRATION (bpf)
□ RQD
◇ CORE RECOVERY
10 20 30 40 50 60 70 80 90

REMARKS:	DRILLED BY:	DATE STARTED:
Legend for samples: Z = split-spoon	HI PLAINS	10/10/90
	LOGGED BY: MAP	DATE COMPLETED: 10/10/90
	CHECKED BY: MAP	JOB NUMBER: 71-0606-T02

MONITORING WELL INSTALLATION RECORDS

TYPE II MONITORING WELL INSTALLATION RECORD

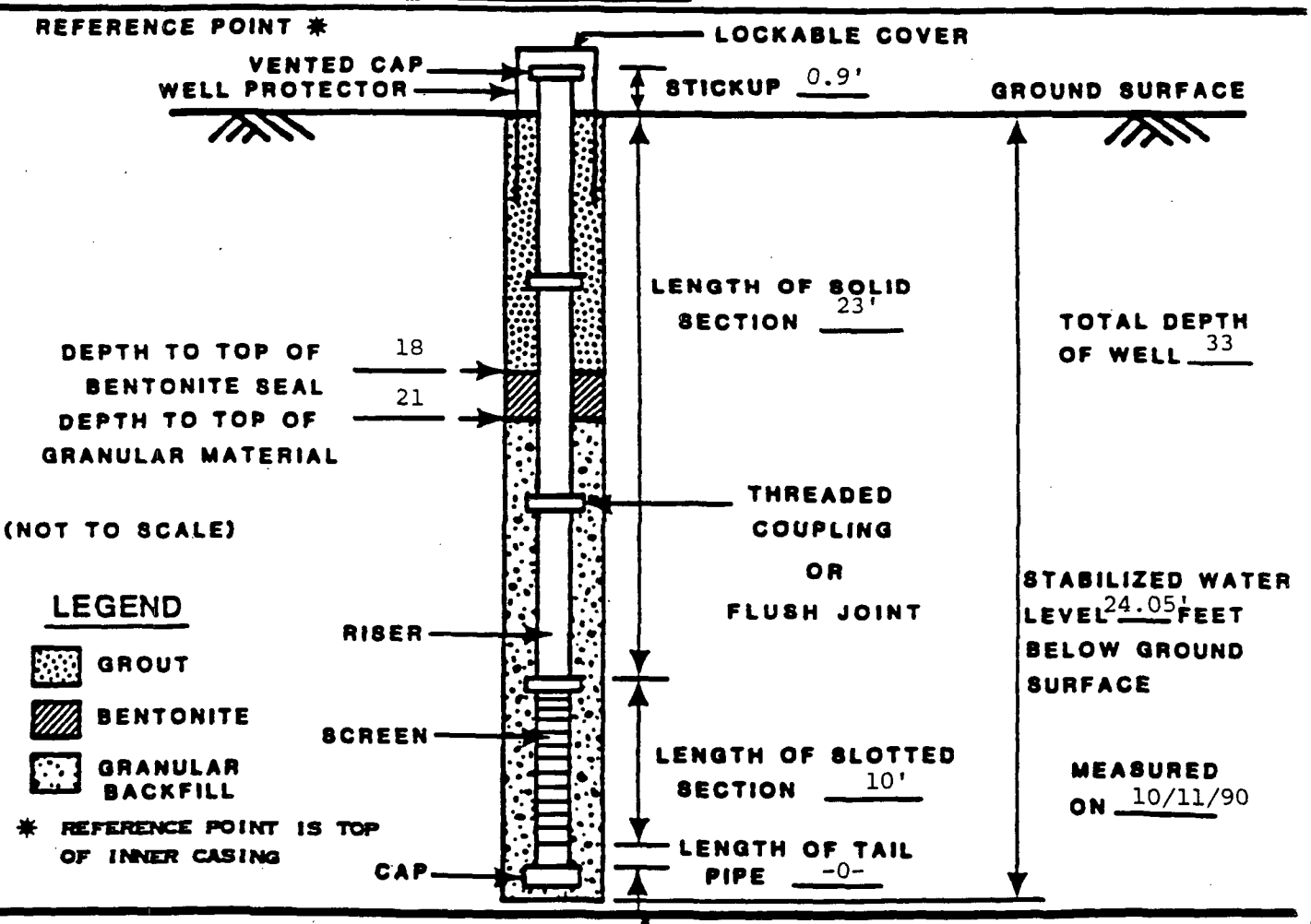
JOB NAME Phillips Petroleum Company
JOB NUMBER 71-0606 Task 02
WELL NUMBER MW-1
INSTALLATION DATE 10/09/90
LOCATION Tank Battery Disposal Pit
GROUND SURFACE ELEVATION 99.3'
REFERENCE POINT ELEVATION 100'
GRANULAR BACKFILL MATERIAL Texblast #1
SLOT SIZE .020 inch
SCREEN MATERIAL Schedule 40 PVC
SCREEN DIAMETER 2 inch
RISER MATERIAL Schedule 40 PVC
RISER DIAMETER 2 inch
DRILLING TECHNIQUE Air Drill
DRILLING CONTRACTOR Hi Plains
BOREHOLE DIAMETER 6 inch
LAW FIELD REPRESENTATIVE MAP
LOCK BRAND Dolphin
SIZE/MODEL
KEY CODE/COMBINATION Key



LAW ENVIRONMENTAL, INC.
13105 NORTHWEST FREEWAY
SUITE 800
HOUSTON, TX 77040
(713) 462-7275

TYPE II MONITORING WELL INSTALLATION RECORD

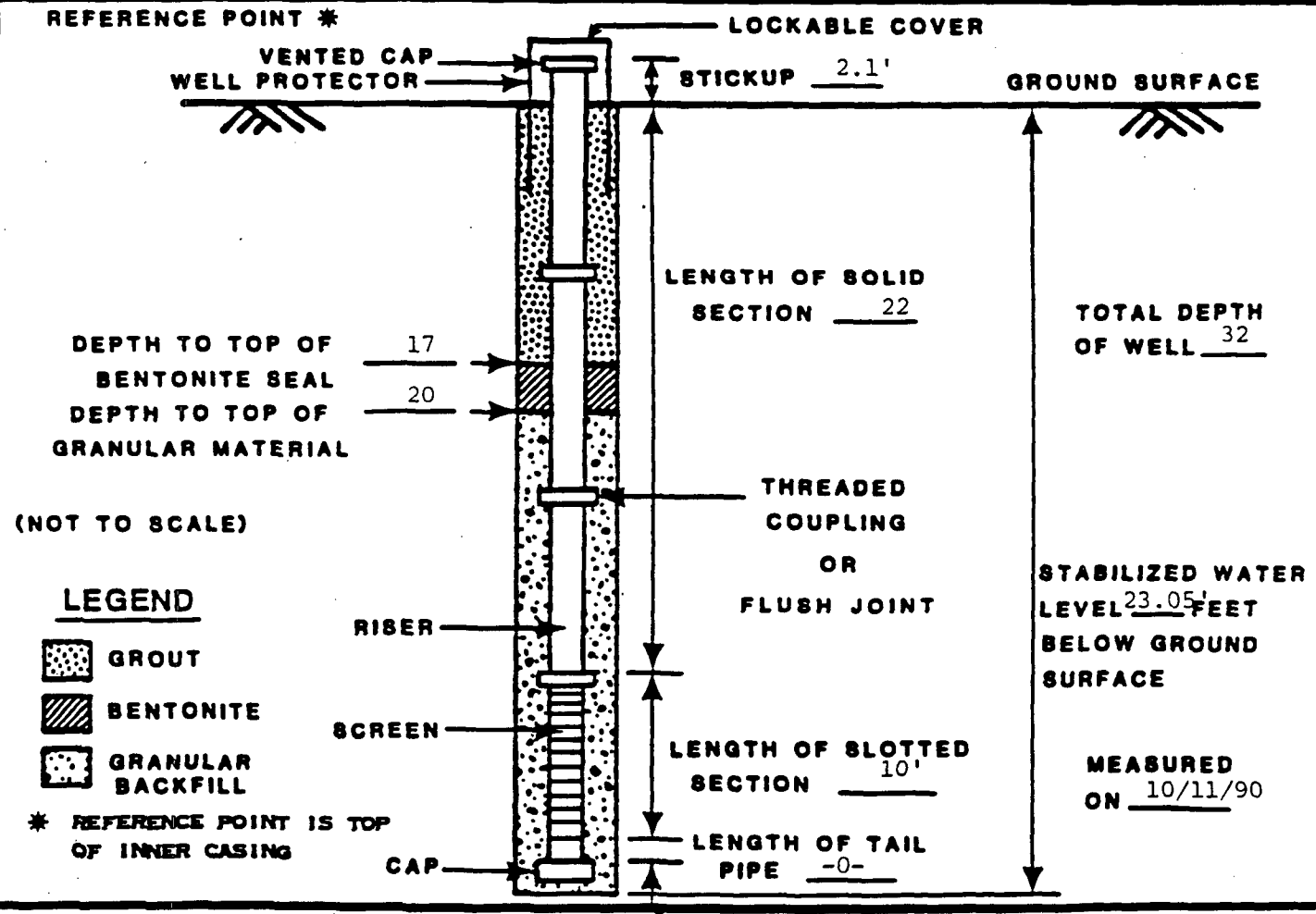
JOB NAME Phillips Petroleum Company
JOB NUMBER 71-0606 Task 02
WELL NUMBER MW-2
INSTALLATION DATE 10/09/90
LOCATION Former Gasoline Plant Disposal Pit
GROUND SURFACE ELEVATION 102.3'
REFERENCE POINT ELEVATION 100'
GRANULAR BACKFILL MATERIAL Texblast #1
SLOT SIZE .020 inch
SCREEN MATERIAL Schedule 40 PVC
SCREEN DIAMETER 2 inch
RISER MATERIAL Schedule 40 PVC
RISER DIAMETER 2 inch
DRILLING TECHNIQUE Air Drill
DRILLING CONTRACTOR Hi Plains
BOREHOLE DIAMETER 6 inch
LAW FIELD REPRESENTATIVE MAP
LOCK BRAND Dolphin
SIZE/MODEL
KEY CODE/COMBINATION Key



LAW ENVIRONMENTAL, INC.
13105 NORTHWEST FREEWAY
SUITE 800
HOUSTON, TX 77040
(713) 462-7275

TYPE II MONITORING WELL INSTALLATION RECORD

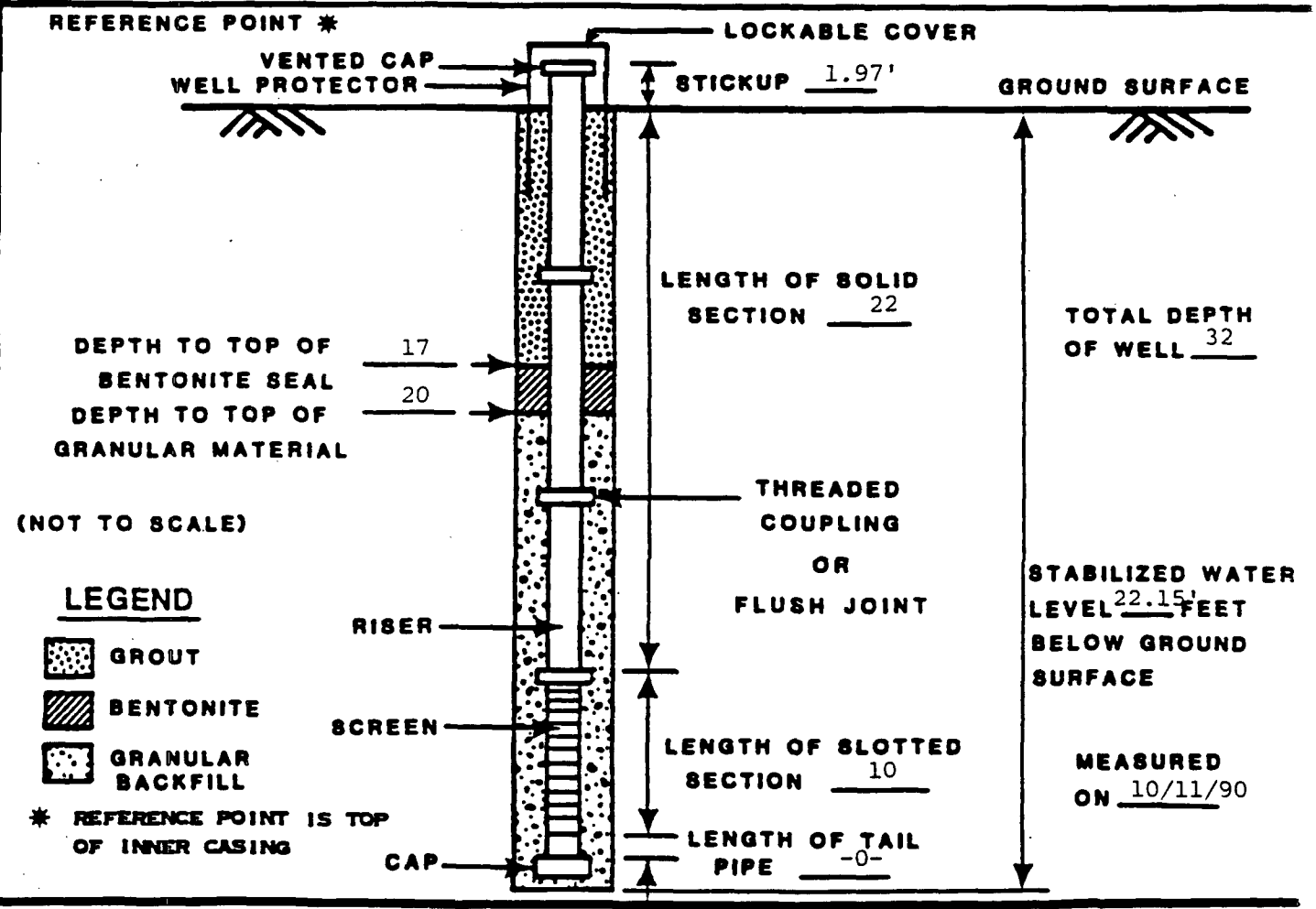
JOB NAME	Phillips Petroleum Company	JOB NUMBER	71-0606 Task 02
WELL NUMBER	MW-3	INSTALLATION DATE	10/09/90
LOCATION	Salt Water Disposal Well		
GROUND SURFACE ELEVATION	96.18 '	REFERENCE POINT ELEVATION	100 '
GRANULAR BACKFILL MATERIAL	Texblast #1	SLOT SIZE	.020 inch
SCREEN MATERIAL	Schedule 40 PVC	SCREEN DIAMETER	2 inch
RISER MATERIAL	Schedule 40 PVC	RISER DIAMETER	2 inch
DRILLING TECHNIQUE	Air Drill	DRILLING CONTRACTOR	Hi Plains
BOREHOLE DIAMETER	6 inch	LAW FIELD REPRESENTATIVE	MAP
LOCK BRAND	Dolphin	SIZE/MODEL	
KEY CODE/COMBINATION	Key		



LAW ENVIRONMENTAL, INC.
13105 NORTHWEST FREEWAY
SUITE 800
HOUSTON, TX 77040
(713) 462-7275

TYPE II MONITORING WELL INSTALLATION RECORD

JOB NAME	Phillips Petroleum Company	**JOB NUMBER**	71-0606 Task 02
WELL NUMBER	MW-4	**INSTALLATION DATE**	10/10/90
LOCATION	Former Tank Battery		
GROUND SURFACE ELEVATION	98.95'	**REFERENCE POINT ELEVATION**	100'
GRANULAR BACKFILL MATERIAL	Texblast #1	**SLOT SIZE**	.020 inch
SCREEN MATERIAL	Schedule 40 PVC	**SCREEN DIAMETER**	2 inch
RISER MATERIAL	Schedule 40 PVC	**RISER DIAMETER**	2 inch
DRILLING TECHNIQUE	Air Drill	**DRILLING CONTRACTOR**	Hi Plains
BOREHOLE DIAMETER	6 inch	**LAW FIELD REPRESENTATIVE**	MAP
LOCK BRAND	Dolphin	**SIZE/MODEL**	
KEY CODE/COMBINATION	Key		



LAW ENVIRONMENTAL, INC.
13105 NORTHWEST FREEWAY
SUITE 800
HOUSTON, TX 77040
(713) 462-7275

State of New Mexico
ENERGY, MINERALS and NATURAL RESOURCES DEPARTMENT
Santa Fe, New Mexico 87505

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

MEMORANDUM OF MEETING OR CONVERSATION

☑ Telephone ☐ Personal	Time 1125	Date 1/3/95

Originating Party	Other Parties
Bill Olson - Envir. Bureau	Steve de Albuquerque - Phillips (713) 669-3748

Subject

Phillips South Four Lakes Unit Ground Water Investigation

Discussion

Called about 12/15/94, work plan
Workplan already implemented

Told him ground water doesn't need to be sampled for TPH but need PAHs, cations/anions, metals.

Requested figures 3 + 4 which were missing from the workplan and all past data on the site (ie. LATU investigation results)

Conclusions or Agreements

He will include requested info in report expected to be submitted to OCD by March 1995.

Distribution

File
Jerry Sexton - OCD Hobbs District Supervisor
Wayne Price - OCD Hobbs office

Signed Bill Olson

PHILLIPS PETROLEUM COMPANY
ODESSA, TEXAS 79762
4001 PENBROOK

EXPLORATION AND PRODUCTION GROUP
Permian Basin Region

15 December 1994

Mr. Roger Anderson
Environmental Bureau Chief
New Mexico Oil Conservation Division
2040 South Pacheco Street
Santa Fe, New Mexico 87505

RE: Soil & Groundwater Assessment
Phillips Petroleum Company
South Four Lakes Unit
Lea County, New Mexico

Dear Mr. Anderson:

The purpose of this letter is to provide notification to the New Mexico Oil Conservation Division Environmental Bureau (OCD) of a soil and groundwater assessment underway at the Phillips Petroleum Company (Phillips) South Four Lakes Unit located approximately 12 miles northwest of Tatum, NM (Sec. 2, T12S R34E). This assessment was initiated as a result of the recent discovery of phase-separated petroleum hydrocarbons (e.g. free product) within a monitor well present at the lease.

Phillips acquired the South Four Lakes Unit from Exxon in November, 1990. At that time Phillips completed a Phase I and II environmental assessment of the lease. The South Four Lakes Unit includes producing wells, a saltwater disposal well, tank battery and associated equipment, and an abandoned gas plant. Four monitor wells were installed in October, 1990, and were sampled for BTEX (Benzene, Toluene, Ethylbenzene and Xylene). Three of the four wells detected no BTEX. However, one well located adjacent to a closed pit just north of the lease tank battery detected levels of Toluene, Ethylbenzene, and Xylene below drinking water standards.

As part of a lease divestiture environmental due diligence effort, the potential buyer resampled the four monitor wells during the Fall of 1994. At the time of sampling, 2.5 feet of free product was discovered within MW-1. Phillips is now in the process trying to identify the source of the free product in MW-1.

Initially, three potential sources were identified: 1) the abandoned pit just north of the tank battery; 2) the crude oil storage tanks; and 3) a crude oil pipeline south of the tank battery. Phillips is also in the process of completing a comparative

analysis of the oil from MW-1 and the crude oil present in the commingled battery as well as each of the producing wells.

The two crude oil storage tanks were taken out of service, inspected, and found not to be leaking. The crude oil pipeline was excavated to a point approximately 200 feet south of the tank battery and found not to be leaking. Phillips is now in the process of completing a site assessment in the area of the closed pit to evaluate the horizontal and vertical extent of the free-phase and dissolved hydrocarbon in groundwater. SECOR Environmental, Inc. of Denver, CO, is completing the assessment (scope of work attached). We are in the process of installing 11 to 12 monitor wells in the surficial (water table) aquifer. Upon completion of this phase of work, Phillips hopes to know the nature and extent of hydrocarbon. Upon completion of the assessment report, Phillips looks forward to discussing the findings of this phase of work with the OCD in early February, 1995.

Prior to starting the assessment work, Phillips met with Mr. Jerry Sexton of the OCD District 1 office on 12 December 1994. Mr. Wayne Price of OCD District 1 was notified verbally of the project on 07 December 1994.

As always, Phillips appreciates your assistance. Should you have questions or require additional information concerning this project, please call me at (915) 368-1229 or Steve de Albuquerque, Environmental & Regulatory Representative, at (713) 669-3748.

Sincerely,

J. A. Carlson

J. A. Carlson
Environmental Analyst

JAC:jsa:ocd-sfl.ltr

cc: Jerry Sexton - OCD District 1
L. A. Takla

November 8, 1994

SECOR
Science & Engineering Analysis Corporation
Environmental Engineering

Phillips Petroleum Company
Box 1967
Houston, TX 77251-1967

Attn: Mr. J. Stephen de Albuquerque
Environmental & Regulatory Representative

RE: PROPOSAL FOR GROUNDWATER ASSESSMENT
PHILLIPS PETROLEUM COMPANY
SOUTH FOUR LAKES TANK BATTERY
LEA COUNTY, NEW MEXICO
***SECOR* PROPOSAL NO. P94-172-I13**

Dear Mr. Albuquerque:

SECOR International Incorporated (*SECOR*) is pleased to present this proposal in response to your Request For Proposal (RFP), dated 21 October 1994, for the further assessment of impacted groundwater at your site in Lea County, New Mexico (Figures 1 & 2). As requested, we have prepared a proposal that provides Phillips with an effective and innovative approach to the project. This proposal is intended to respond to your emphasis on cost control, efficiency and creativity. Accordingly, the costs and services provided reflect *SECOR's* commitment to efficient operation and cost avoidance/containment. This letter proposal provides an executive overview of the key elements of *SECOR's* proposed scope of work.

SECOR proposes to complete the work described in the Scope of Work for a total estimated time and materials not to exceed a cost of [redacted] The basis for this estimated cost is presented in Table 1. The total cost as presented does not include laboratory analysis. We understand that these costs will be directly paid by Phillips using your designated contract laboratory.

SCOPE OF WORK

The approach and subsequent scope of work developed by *SECOR* is based upon information provided by Phillips. Although this information base is somewhat limited, it is *SECOR's* belief that the work scope and cost are responsive to Philips's requirements.

Overview

The proposed approach focuses on Philips's primary objective of definition of the vertical and horizontal extent of phase separated and dissolved phase petroleum hydrocarbons in the soil and groundwater. Information including groundwater flow direction, gradient, velocity and phase separated recovery will also be collected in the proposed approach. *SECOR* has also included an optional cost for the completion of the proposed monitoring wells as remediation wells should the respective locations exhibit significant impacts during drilling. The following presents an overview of the project and *SECOR's* approach to the work scope.

There are presently four monitoring wells in place at the South Four Lakes Unit. These wells are designed to monitor groundwater at different locations and to provide information about "background" concentrations of constituents of concern. In the Request for Proposal (RFP), it

355 Union Boulevard, Suite 200, Lakewood, [illegible]

stated that one of the four site monitor wells (MW-1) recently measured approximately 2.5 feet of separate phase petroleum hydrocarbon atop the groundwater. The approach developed for assessment of petroleum impacted soil and groundwater at this site has been divided into seven tasks as summarized below:

- Task 1 - Drill and Sample Seven soil borings
- Task 2 - Install and Sample Seven Piezometers
- Task 3 - Drill and Install One 2" Soil Vapor Extraction (SVE) Well
- Task 4 - Test Aquifer Parameters
- Task 5 - Perform Soil Vapor Extraction (SVE) Fluid Recovery Pilot Test
- Task 6 - Land Survey Tank Battery Features (Tanks, Separators/Treaters, Abandoned Pit, Pumps, LACT, etc.)
- Task 7 - Project Management and Reporting

We believe that *SECOR's* approach to staffing and completing the work in these defined tasks will provide Phillips with the required support in the most cost-effective, technically sound manner possible. The specific approach proposed to complete each task is outlined in more detail below.

Task 1 - Drill and Sample Seven Soil Borings

Based on the work performed by Law Environmental (LAW), the area of concern is the Tank Battery Disposal Pit shown on Figure 4. This area is detailed in LAW's report dated October, 1990, "Report of Preliminary Environmental Liability Assessment". Due to geologic conditions at the site, a variety of drillings procedures will be required in order to complete the borings and obtain soil samples. *SECOR* proposes to locate an additional seven soil borings to identify the vertical and horizontal extent of the separate phase hydrocarbon plume (Figure 3). The seven borings will be installed using a hollow-stem auger truck mounted rig, with air rotary capabilities, and continuously sampled using a split spoon sampler, when possible, to a total depth of 35 feet below ground surface (bgs). The borings will be chronologically drilled to identify the areas of impact. PZ-1 will evaluate any migration on to the site from the up gradient position, PZ-2 will define the lateral extent. PZ-6 will provide downgradient extent and if no impact is observed then PZ-7 will not be necessary. The soil samples will be photographed (in color) on site, described and recorded on the boring log A headspace reading will be taken with a Photo Ionization Detector (PID). The cores will also be subjected to an Ultra-Violet Light scan to identify the soils for unrefined products.

The sample from each boring which exhibits the highest reading (or saturation) will be submitted for analytical analysis using EPA Methods 8020 (BTEX), EPA Method 8015 modified for volatile (TVPH) and EPA Method 8015 modified for extractable (TEPH).

Task 2 - Install And Sample Seven Piezometers

After each boring has been drilled to a depth of 35 feet bgs, a 2" Schedule 40 PVC piezometer will be installed. Fifteen feet of 0.040 inch mill slotted screen, 22 feet of blank riser, the appropriate amounts of sand and bentonite, and a two foot well protector with locking cap will be used to complete the piezometers.

The piezometers will be developed by removing five casing volumes and gaged. Groundwater samples will be collected in all monitoring wells and piezometers that do not exhibit light nonaqueous phase petroleum and analyzed for BTEX (by 8020), TVPH (by 8015 mod) and TEPH (by 8015 mod).

Task 3 - Drill and Install One 2" SVE Well

As a result of the volatile/biodegradable nature of the petroleum constituents of concern at this site, *SECOR* proposes performance of a soil vapor extraction pilot test further described in Task 5. One two-inch SVE well proximal to three piezometers (Figure 3) will be installed for completion of this test.

Task 4 - Test Aquifer Parameters

Due to the low water table in the area of concern, three in-situ permeability (hydraulic conductivity) tests will be performed by the use of Shelby tube whole sample extraction. The samples will be sent to PNP Laboratory in Michigan. The test method will provide moisture content, density, total porosity, pore fluid saturations, native effective hydraulic conductivity and effective air conductivity using ASTM D2216, API RP40, and EPA 9100 methodology.

Task 5 - Soil Vapor Extraction (SVE) Fluid Recovery Pilot Test

As previously presented, a SVE pilot test is proposed to be performed to evaluate the effectiveness of this technology for removing volatile petroleum hydrocarbons adsorbed to the soil above the groundwater table. Due to the minimal saturated water thickness apparent at this site, air sparging may not be an applicable technology and therefore this type of testing has not been proposed at this time. SVE technology, if applicable, would be the most cost effective and efficient technology for removing volatile petroleum hydrocarbons. The test would entail the use of a vacuum blower connected to the test well while monitoring air flow and offgas concentrations (ppmV, CO_2, and temperature). The offset monitoring well/piezometers would be monitored for vacuum and water levels.

Subsequent to the SVE test, a pump test, using the same well, will be performed to provide potential product recovery data. The offset wells will be monitored for draw down while the pump is operated at a constant discharge rate. The water will be pumped into a poly-tank and allowed to evaporate to the atmosphere. These data will be used in the design of a remedial system.

Task 6 - Survey Tank Battery Features (Tanks, Separators/Treaters, Abandoned Pit, Pumps, LACT, etc.)

Once all field work has been completed, all tank battery features will be surveyed to a common elevation point tied to a National Geodetic Vertical Datum of 1929 using the USGS 7.5 Minute topographic map of Simanola Valley, New Mexico dated 1970. The survey will be conducted by a registered land surveyor in the State of New Mexico. This data will be provided electronically on disc using the Auto CAD format. Data collected during completion of this task will be used to graphically display all analytical results and provide a correct base map.

Task 7 - Project Management and Reporting

This task will include the project management and reporting requirements specified in the RFP. This will involve preparation of a Project Health and Safety Plan. Other task activities completed within this task will include finalization and management of the project scheduling, subcontractor arrangements, and project financial monitoring and control. Reporting activities will include delivery of a final report addressing the concerns outlined in the RFP.

Project Staffing

SECOR has assembled a focused team of experienced professionals to complete the work described. Figure 5 presents a project organization chart with names of assigned staff and an indication of their reporting relationship.

The Project Team will be assembled from *SECOR* staff in the Denver, Colorado office. The work will be under the overall direction of Mr. James M. Kerr, Jr. P. G., who will serve as Principal-in-Charge. Mr. Kerr is manager of the Denver office's Geoscience Department and is an experienced geologist with a background in both petroleum geology and environmental consulting. Mr. Kerr worked for over seven years in the petroleum industry including assignments in Texas, Louisiana, Alabama, Florida and California. He currently serves as Project Manager on numerous RCRA projects, and serves as the project geologist providing characterization for the migration of petroleum constituents in the highly complex geology at the Phillips East St. Louis Terminal for Mr. Jack Williams. Mr. Kerr will be responsible ensuring the overall performance of the team, technical, cost and schedule performance, ensuring that all client requirements are met, and for performing final review of all project plans and deliverables.

Day-to-day management of the work will be performed by Mr. Thomas R. Stotler, P. G. Mr. Stotler has over 17 years experience as a professional geologist, 15 of it in the petroleum industry including assignments in Colorado, Kansas, New Mexico, Texas, California, Oklahoma, Mississippi, Utah, Wyoming, Montana, and two in the environmental consulting field. He currently assists Mr. Kerr on the Phillips East St. Louis Terminal for Mr. Jack Williams and as Project Manager at the Former Phillips Fractionator Facility in Oklahoma City for Mr. Russell Robinson.

All field work will be performed by the field team consisting of Mr. Brian X. Walsh and Mr. Jamie Bethell, E. I. T., from *SECOR's* Denver office. Mr. Walsh is a geologist with over 5 years field experience and has worked at the Phillips East St. Louis Terminal installing monitoring wells and soil cores. He will be responsible for all well installation, water sampling and soil

descriptions at the Four Lakes Unit. He will also assist Mr. Bethell in the aquifer test and pilot test operations.

Mr. Bethell is an experienced field engineer with six years of professional experience in the environmental consulting field. Mr. Bethell has performed numerous soil vapor extraction pilot tests and aquifer tests. Engineering oversight and subsequent review of pilot test data and development of applicable remedial approach, if required, will be provided by Mr. Scott D. Andrews, P. E., of the *SECOR* Denver office.

Resumes for each of the staff proposed for the project are included in Appendix A.

SECOR staff are prepared to begin work on the project as soon as notice to proceed is received from Phillips. We have the staff available and we are prepared to be on-site during the week of November 28, 1994, to carry out the scope of work described above. It is anticipated that lab results will be available by December 10 and the Final Report delivered to Phillips on December 16. An overall project timeline showing task duration and reporting milestones is presented on Figure 4.

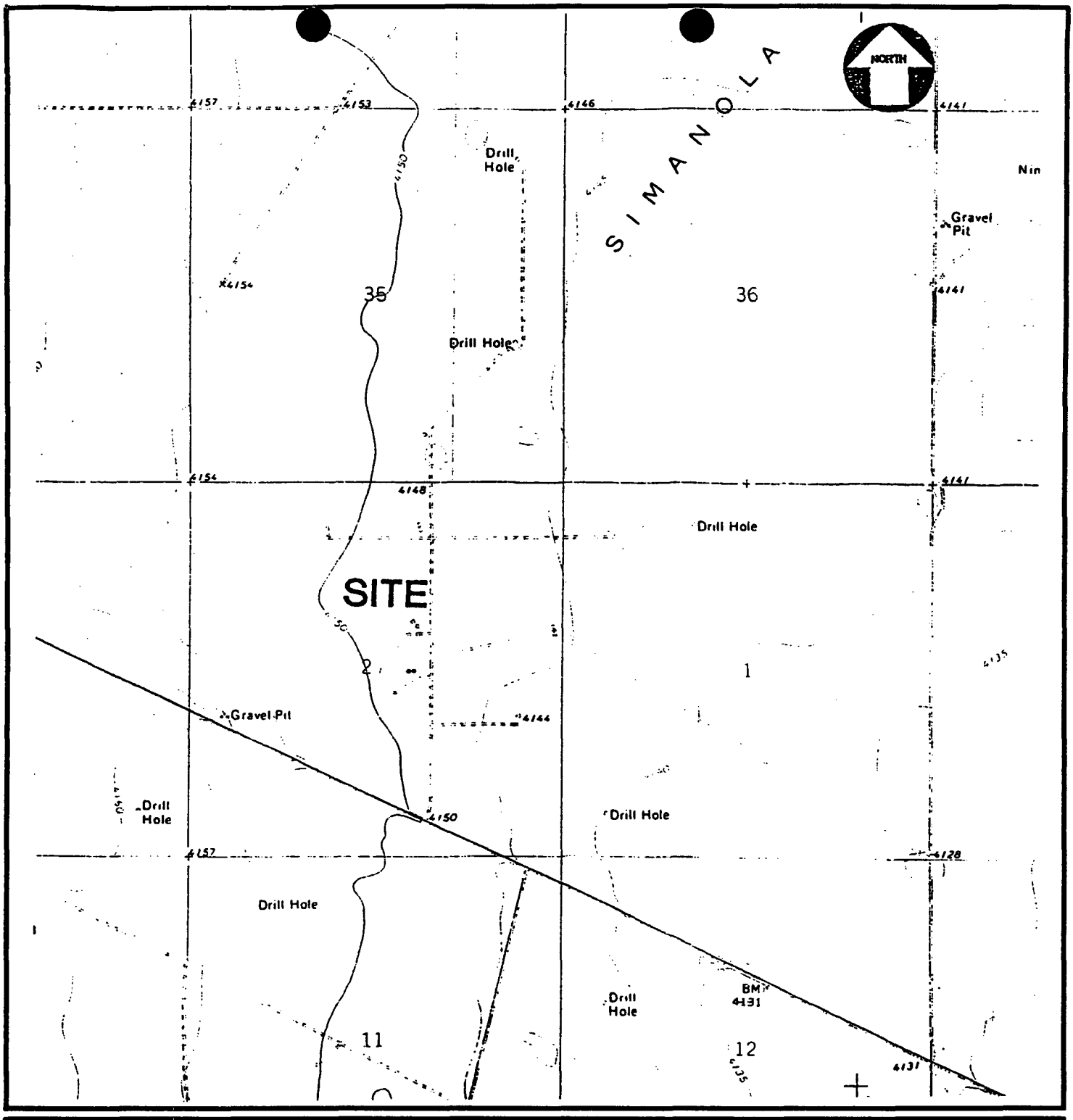
Should you have any questions concerning this proposal, please telephone Jim Kerr or me at (303) 763-8800.

Sincerely,
Science & Engineering Analysis Corporation

Thomas R. Stotler, P. G.
Staff Geologist

TRS/tbm

Attachments:
Figure 1 - Site Location Map
Figure 2 - Site Vicinity Map
Figure 3 - Site Map
Figure 4 - South Four Lakes Unit Project Timeline
Table 1 - Estimated Project Cost Summary
Appendix A - Resumes



NEW MEXICO

QUADRANGLE LOCATION

U.S.G.S. 7.5 MINUTE SERIES (TOPOGRAPHIC)

SIMANOLA VALLEY QUADRANGLE
NEW MEXICO

2,000 0 2,000

SCALE: 1" = 2,000'
CONTOUR INTERVAL: 10 FEET
DATED: 1970

N

Figure 1 *Site Location Map*	PHILLIPS PETROLEUM COMPANY South Four Lakes Unit Lea County, New Mexico	SECOR 355 Union Boulevard Suite 200 Lakewood, Colorado 80228	DWN SDP APPR DATE November 1994 JOB NO. P94-172-113

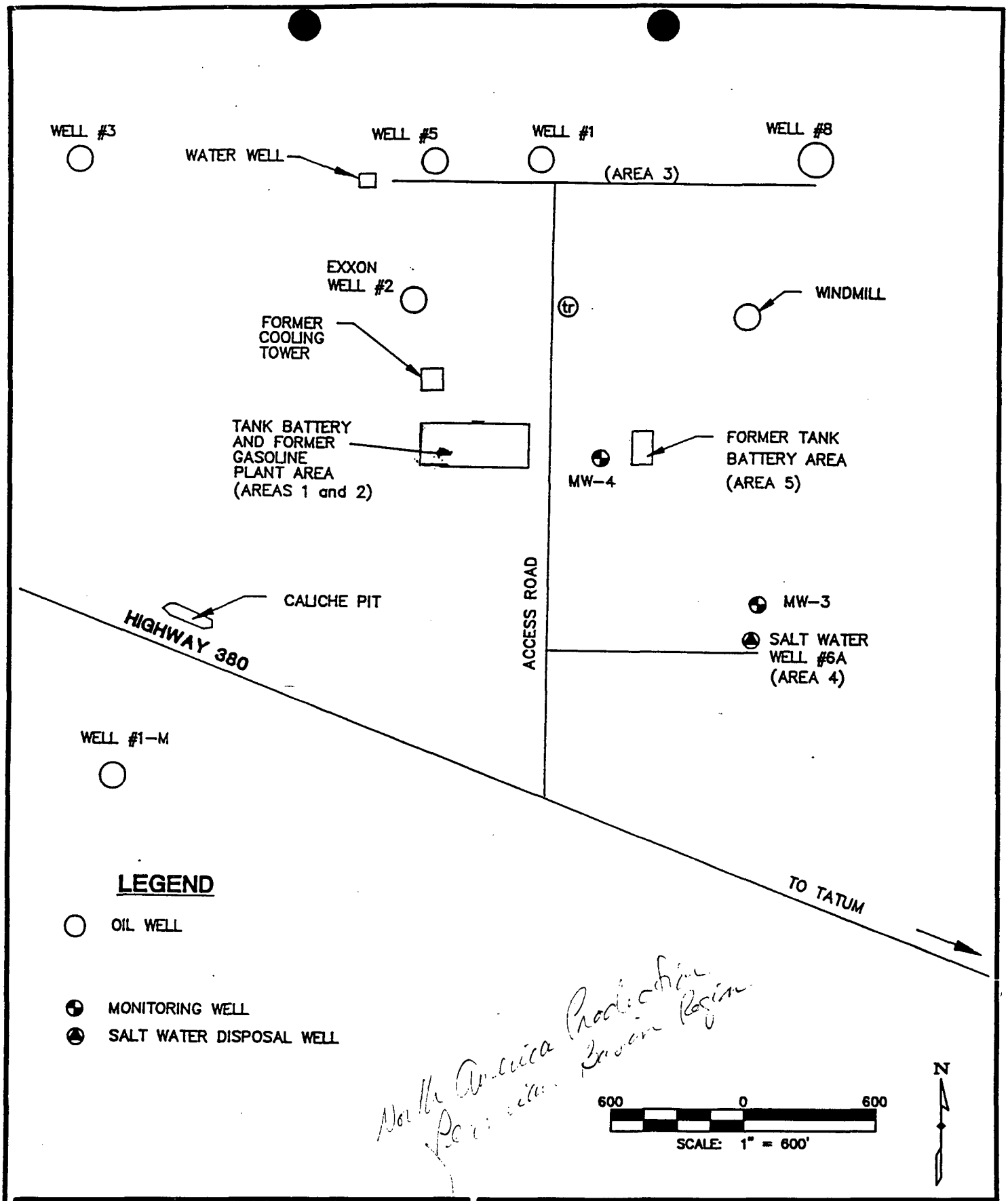


Figure 2 *Site Vicinity Map*	PHILLIPS PETROLEUM COMPANY South Four Lakes Unit Lea County, New Mexico	**SEACOR** 355 Union Boulevard Suite 200 Lakewood, Colorado 80228	DWN SDP APPR DATE November 1994 JOB NO. P94-172-113

November 10, 1994

SECOR

Phillips Petroleum Company
Box 1967
Houston, TX 77251-1967

ATTN: Mr. J. Stephen de Albuquerque
Environmental & Regulatory Representative

RE: PROPOSAL ADDENDUM FOR GROUNDWATER ASSESSMENT
PHILLIPS PETROLEUM COMPANY
SOUTH FOUR LAKES TANK BATTERY
LEA COUNTY, NEW MEXICO
***SECOR* PROPOSAL NO. P94-172-I13**

Dear Mr. Albuquerque:

SECOR International Incorporated (*SECOR*) is pleased to present this proposal addendum in response to our conversation yesterday.

During our telephone conversation you had requested the following changes to the information presented in our November 8, 1994 proposal:

1) Inclusion of the analytical costs in our proposal for soil and groundwater samples collected in association with the proposed assessment activities; and

2) An estimated cost for the completion of additional boring/monitor wells.

In developing the work scope presented in the proposal, *SECOR* anticipated collecting of a soil sample from each boring location for analysis of Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) by Method 8020, Total Volatile Petroleum Hydrocarbons (TVPH) by Method 8020/8015 Modified and Total Extractable Hydrocarbons (TEH) by Method 8015. In addition, each monitor well location was to be developed and samples collected and also analyzed for BTEX, TVPH, and TEH. *SECOR* also proposed collection of Shelby Tubes from three of the seven proposed well locations for analysis of soil grain size, moisture content, air permeability, air conductivity and hydraulic conductivity as presented in our proposal, *SECOR* originally proposed these associated analytical costs be direct billed to Phillips. Based upon your request, *SECOR* has presented the respective cost of these analyses below:

Analytical Costs

Soil Sample Analysis For BTEX by Method 8020, TVPH By Method 8020/8015 .. [redacted]
Modified And TEH by Method 8015 Per Boring Location

Cost For Seven Locations .... [redacted]

proposal\p94-172.add

Groundwater Sample Analysis For BTEX by Method 8020, TVPH By Method 8020/8015 Modified And TEH by Method 8015 Per Monitor Well Location .... $[redacted]

Costs for Eleven Locations (7 new wells; 4 existing monitor wells) ..... $[redacted]

Shelby Tube Soil Sample Analysis for soil grain size, moisture content, air permeability, air conductivity and hydraulic conductivity ..... $[redacted]

Costs for Three Locations ..... $[redacted]

Total Analytical Costs $[redacted]

You also requested that we provide costs associated with the installation of additional borings and associated monitor wells. The cost presented below was developed based upon the boring, oversight, sampling and monitor well completion work scope presented in Task 1 and 2. This cost also includes the collection and analysis of one soil and one groundwater sample from each additional location.

Cost for an additional well ..... $[redacted]

Please feel free to call me at any time if you have any questions regarding the information presented in this proposal addendum or to discuss any other aspects of our interest or capabilities regarding this project. *SECOR* appreciates the opportunity to provide this addendum to our November 8, 1994 proposal and would welcome the chance to demonstrate our attentiveness to our clients and their projects and our wealth of experience in the remediation of petroleum impacted soil and groundwater.

Sincerely,

***SECOR* International Incorporated**

Scott D. Andrews, P.E.
Principal Engineer

SDA/sg

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION
HOBBS DISTRICT OFFICE

BRUCE KING
GOVERNOR

POST OFFICE BOX 1980
HOBBS, NEW MEXICO 88241-1980
(505) 393-6161

DATE: 12/15/94

To ROGER ANDERSON 827-8177
NMOCD - REF PHILLIPS - 5 GAMES UNIT

From
WAYNE PRICE - ENVIRONMENTAL ENGR. - NMOCD DISTRICT I

Energy & Minerals Department

Telephone Number 505-393-6161 FAX # 505-393-0720

- ☐ For Your Files
- ☐ Prepare a Reply for My Signature
- ☐ For Your Review and Return
- ☑ For Your Information
- ☐ For Your Handling
- ☐ For Your Approval
- ☐ As Per Your Request
- ☐ For Your Signature
- ☐ Please Advise
- ☐ For Your Attention

5 Pages

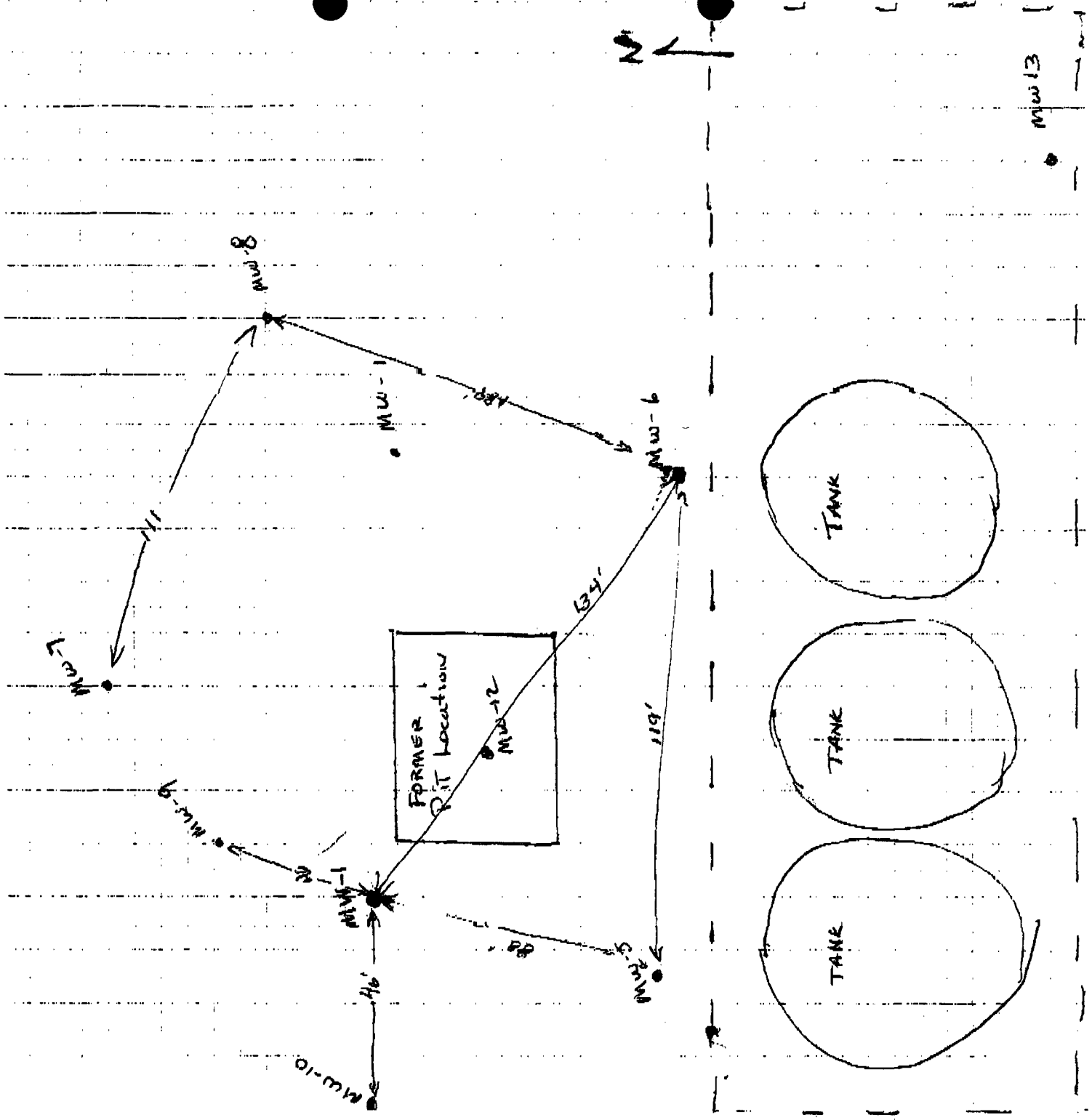
JERRY SEXTON REQUESTED I FAX THIS INFO TO YOU.

Wayne

827-8177

Drilling on numerical order
Jennie #10 - Should finish #11
today, Should finish Tomorrow

12-15-94 SB



MW5-13
installed
12-13-14, 1994
by
Brown for
Phillips Petroleum
Company.

	TD	DTW	Completion	PID
MW-7	34.0'	22.77	2" SCH 40 PVC 15' 0.020 Slot Screen 20' Blank Riser 8.5 Bags of 10/20 SAND 6.5 Bags of MED. Bentonite Chips. TO 2' Finished off W/ Locking CAP And 2' of Concrete.	0.0 PP
MW-8	34.0	24.01	15' 0.02 Slot Screen 20' Blank Riser 9 Bags of 10/20 TO 17.5 Feet 6 Bags of Bentonite Chips TO 2 Finished of W/ Locking Cap and 2' Concrete.	23.5-463
MW-9	34.0'	24.45	15' Screen 0.020 Slot 20' Blank Riser 9.5 Bags of 10/20 SAND TO 17' 6 Bags Bentonite Chips TO 2' Finished off W/ Locking Cap And 2' concrete	0.0 ppm
MW 10	34.0'	24.0'	15' SCREEN 0.020 SLOTS 20' BLANK RISER 9.5 BAGS of 10/20 SAND TO 17' 6 BAGS BENTONITE CHIPS TO 2' FINISHED W/ LOCKING CAP & 2' of CONCRETE	0.0 PPM

EXXON COMPANY, U.S.A.
POST OFFICE BOX 1600 • MIDLAND, TEXAS 79702-1600

PRODUCTION DEPARTMENT
SOUTHWESTERN DIVISION

November 13, 1987

Spill Notification

Ms. Evelyn Downs
New Mexico Oil Conservation Division
District 1
P. O. Box 1980
Hobbs, NM 88240

Dear Ms. Downs:

Per Rule 116 of the New Mexico Oil Conservation Division, Exxon submits the following as notification of an oil spill which occured on Exxon's South Four Lakes lease on November 3, 1987.

LOCATION:	SW 1/4 of NE 1/4, Section 2, T-11-S R-34-E
COUNTY:	Lea
NEAREST TOWN:	10 miles west of Tatum
BBLS OIL SPILLED	825
BBLS OIL RECOVERED:	225 (600)
CAUSE:	Line ruptured and tank siphoned onto ground.
TEMPERATURE:	70°
SOIL CONDITIONS:	Sandy range land.
PRECIPITATION:	1/2 inch in previous 24 hours.
REMEDIAL ACTION:	Tank battery to be redesigned, old buried piping will be replaced with new, above-ground piping.

Please contact Kathy Wells at (915) 686-4111 if you have any additional questions.

James D. Howell

KDW