Larson & Associates, Inc.
Environmental Consultants

January 14, 2003

VIA FACSIMILE: (505) 393-0720

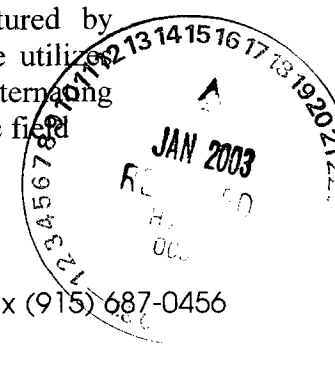
Mr. Paul R. Sheeley
Environmental Engineering Specialist
New Mexico Oil Conservation Division
1625 North French Drive
Hobbs, New Mexico 88240

Re: Investigation Work Plan for Produced Water Spill, LMPSU Tr. No. 4, Well No. 2, Unit Letter K, Section 22, Township 22 South, Range 37 East, Lea County, New Mexico

Dear Mr. Sheeley:
Anadarko Petroleum Corporation (Anadarko) has requested Larson and Associates, Inc. (LA) to prepare a work plan in response to a request by the New Mexico Oil Conservation Division (NMOCD) to investigate a spill involving produced water from an injection line in Unit Letter K (NE/4, SW/4), Section 22, Township 22 South, Range 37 East, Lea County, New Mexico. The spill is located approximately 250 feet west of the above-referenced well, and is shown on Figure 1.

Background
Anadarko discovered the spill on October 29, 2002, and provided verbal notification to the NMOCD. The spill involved approximately 220 barrels (bbl), and about 190 bbl was recovered. Anadarko filed Form C-141 on November 22, 2002. On November 18, 2002, the NMOCD issued a letter requesting submittal of a work plan to delineate the horizontal and vertical extent of the benzene, toluene, ethylbenzene, xylene (BTEX), total petroleum hydrocarbon (TPH) and chloride impact in the soil. The NMOCD granted Anadarko an extension until January 16, 2003, to submit the requested information.

Proposed Investigation Plan
An electromagnetic (EM) terrain conductivity survey will be performed to initially evaluate the extent of the spill. The EM technique is a qualitative method that measures the electrical properties (i.e., conductivity) of soil and rock, as well as the electrical properties of groundwater. The major factor that contributes to the conductivity of soil and rock is the conductivity of the formation water. The conductivity of the formation water depends primarily on the dissolved solids content. The EM survey will be performed using terrain conductivity meters (EM-31 or EM-34) manufactured by Geonics Limited, Missasauga, Ontario, Canada. The EM induction technique utilizes current flow induced in the subsurface materials by a surface transmitter. An alternating electric current produced by the transmitter coil generates an alternating magnetic field



Anadarko - 817
Incident - nPAC0605336515

507 North Marienfeld, Suite 202 ◆ Midland, Texas 79701 ◆ Ph. (915) 687-0901 ◆ Fax (915) 687-0456

Application - pPAC0605336722

that induces current flow through the earth material. The secondary magnetic field sensed by the receiver coil depends on the strength of the primary magnetic field, current frequency, distance between transmitting and receiving coils, and ground conductivity. The primary magnetic field, current frequency, and coil separation can be accounted for, leaving ground conductivity as the only unknown variable to be measured. The ground conductivity is digitally displayed in millimhos per meter (mmhos/m) at the receiver consol.

The EM-31 is a one-person portable instrument that has exploration capabilities from 0 to approximately 8.5 feet below ground surface (BGS) in the horizontal dipole (HD) mode, and from 0 to approximately 19 feet BGS in the vertical dipole (VD) mode. The EM-34-3 is a two-person operation, and has exploration capabilities from 0 to approximately 200 feet BGS depending on the separation of the transmitter and receiver coils (coil separation), and coil orientation (HD or VD). A sample grid measuring approximately 600 x 900 feet will be located using a Nikon Model DP-310 total station system (TSS), and EM measurements will be collected approximately every 50 feet.

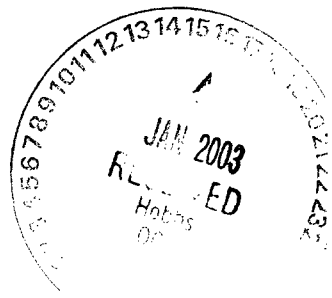
Soil samples will be collected from approximately 4 locations, depending on the EM survey results, for field and laboratory analysis. The soil samples will be obtained at areas of greatest terrain conductivity determined by the EM survey, and will be collected from borings advanced using either direct-push, air rotary or auger drilling methods, depending on equipment availability. The soil samples were collected in laboratory sample jars, labeled, chilled in an ice chest, and delivered to an environmental laboratory under proper chain-of-custody documentation. A duplicate sample will be collected for each laboratory sample, and analyzed for headspace vapors using the ambient temperature headspace (ATH) method. The ATH method involves filling a clean glass sample jar approximately 2/3 full with discreet or composite sample media, sealing the top of the jar with a layer of aluminum foil, and replacing the cap. A photoionization detector (PID) will be used to measure the ionization potential of organic compounds in the headspace vapors by inserting the PID probe through the aluminum foil. The concentration of organic vapors is displayed in parts per million (ppm). The ATH is a qualitative method used to determine the presence of hydrocarbons in soil. The NMOCD allows a PID analysis to be used in lieu of a laboratory analysis for benzene and total BTEX (sum of benzene, toluene, ethylbenzene and xylene) when the PID reading is less than 100 ppm. The PID was calibrated using isobutylene (100 ppm). Samples exhibiting PID readings above 100 ppm will be analyzed by the laboratory for BTEX using method SW-846-8021B. Samples will also be analyzed for TPH using method SW-846-8015 for gasoline-range (GRO) and diesel-range (DRO) organics, and chloride. All sampling equipment will be thoroughly cleaned between samples using laboratory-grade detergent and rinsed with distilled water. The drilling equipment (i.e., rods, bit, etc.) will be cleaned between locations using a high-pressure water sprayer. A geologic log will be prepared for each boring. The laboratory data will be evaluated in accordance with NMOCD guidelines (*"Guidelines for Remediation of Leaks, Spills and Releases, August*

13, 1993"). Please call (915) 687-0901 or e-mail mark@LAenvironmental.com if you have questions.
Sincerely,
Larson and Associates, Inc.

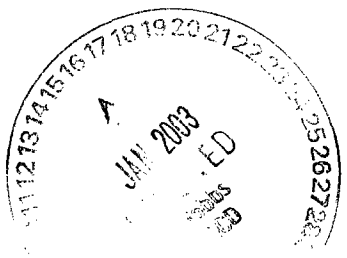
Mark J. Larson, CPG, CGWP
President

Encl.

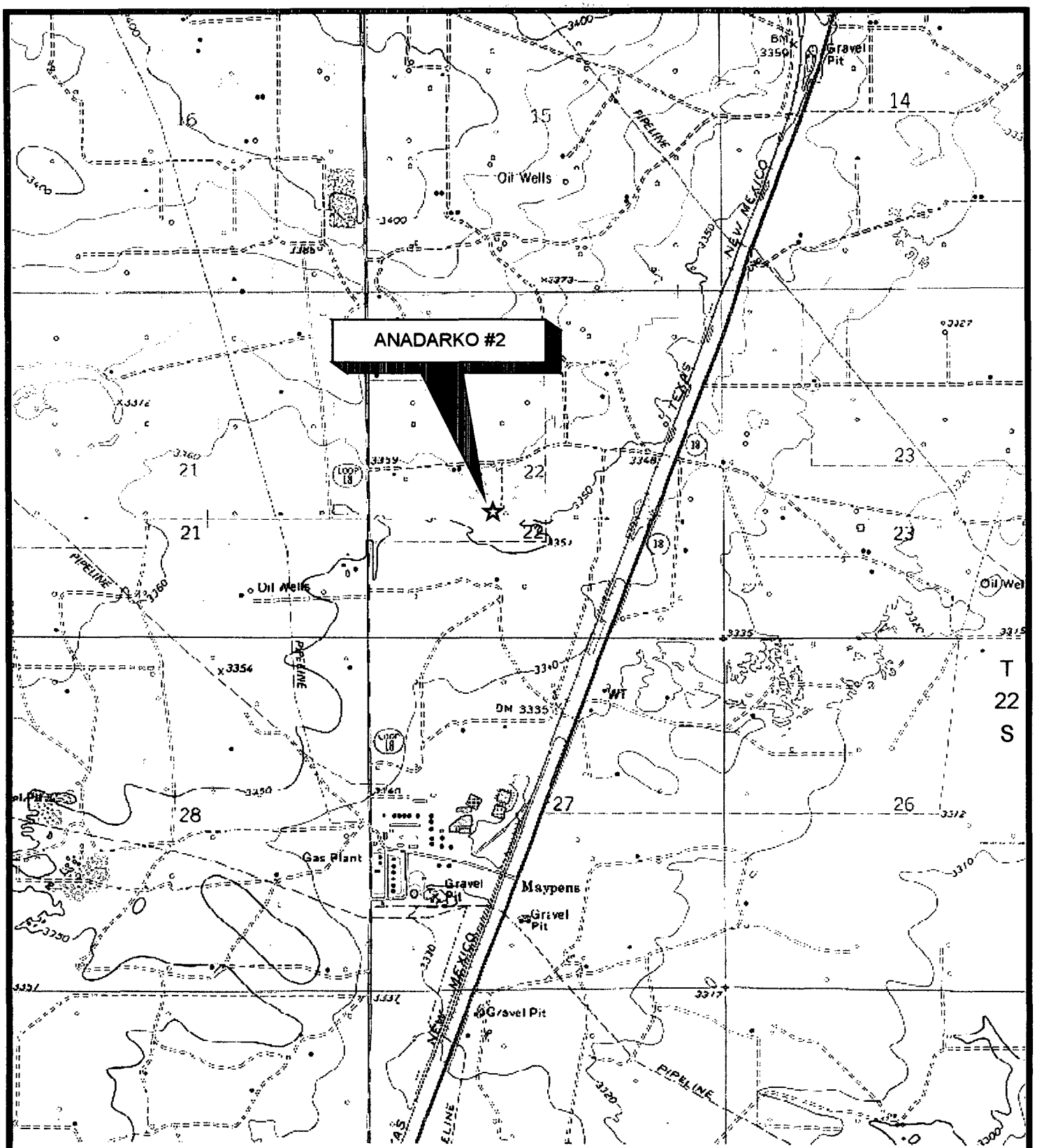
cc: Mike Gray - Anadarko



FIGURES



507 North Marienfeld, Suite 202 ◆ Midland, Texas 79701 ◆ Ph. (915) 687-0901 ◆ Fax (915) 687-0456



TAKEN FROM U.S.G.S.
EUNICE, N & RATTLESNAKE CANYON, N, NEW MEXICO
7.5' QUADRANGLES

SCALE: 1"=2000'

FIGURE #1

LEA COUNTY, NEW MEXICO

ANADARKO PETROLEUM CORP.
LMPSU TR. #4 WELL #2

SITE LOCATION

DATE: 5/21/02
NAME:
FILE: 3-0102

Larson & Associates, Inc.
Environmental Consultants

C-141 IN RESPONSE TO N.O.V.!

L/W. ✓ CLW ✓ DHS

District I
1625 N. French Dr., Hobbs
District II
811 South First, Artesia,
District III
1000 Rio Brazos Road, A
District IV
2040 South Pacheco, San

State of New Mexico
Minerals and Natural Resources
Oil Conservation Division
2040 South Pacheco
Santa Fe, NM 87505

Form C-141
Revised March 17, 1999

Submit 2 Copies to appropriate District Office in accordance with Rule 116 on back side of form

ation and Corrective Action

OPERATOR

☑ Initial Report ☐ Final Report

Name of Company: ANADARKO PET CORP	Contact: MIKE GRAY
Address: P.O. BOX 1923 EUNICE NM 88231	Telephone No.: 915 . 683 . 0540
Facility Name: LMPSW PLANT #3	Facility Type: WATER INJECTION

Surface Owner	Mineral Owner	Lease No.
J.D MARTIN	API # 30025 10418 0000	

LOCATION OF RELEASE

Unit Letter	Section	Township	Range	Feet from the	North/South Line	Feet from the	East/West Line	County
K	22	22S	37E					LEA CO.

NATURE OF RELEASE

Type of Release: PRODUCE WATER	Volume of Release: 220	Volume Recovered: 190
Source of Release: INJECTION LINE	Date and Hour of Occurrence	Date and Hour of Discovery: 10/29/2002 7:50 A.M.
Was Immediate Notice Given? ☒ Yes ☐ No ☐ Not Required	If YES, To Whom? OCD SYLVIA (VOICE MAIL)	
By Whom? KEVIN DAVIDSON	Date and Hour: 10/29/02	
Was a Watercourse Reached? ☐ Yes ☒ No	If YES, Volume Impacting the Watercourse.	

If a Watercourse was Impacted, Describe Fully.*

Describe Cause of Problem and Remedial Action Taken.*
INJECTION LINE COLLOSION. PICKED UP SPILL REMEDIATED ALCA BLENDING IN SAND

Describe Area Affected and Cleanup Action Taken.*
1200' SQUARE FT ALCA PICKED UP PRODUCE WATER REMEDIATED ALCA BLENDING IN SAND. LEAK OCCURED 76 YARDS WEST OF THE ABOVE LOCATION REPORTED.

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to NMOCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the NMOCD marked as "Final Report" does not relieve the operator 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 acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations.

Signature: Kevin Davidson	OIL CONSERVATION DIVISION
Printed Name: KEVIN DAVIDSON	Approved by District Supervisor:
Title: PRODUCTION TECH FAX # 394 3246	Approval Date: / Expiration Date:
Date: 11/22/02 Phone: 915 559-5514	Conditions of Approval: / Attached ☐

* Attach Additional Sheets If Necessary

November 18, 2002

Anadarko Petroleum Corporation
Attn: Mike Gray
P.O. Box 1923
Eunice, New Mexico 88231

USPS Certified Mail
Return Receipt #7099 3220 0002 3948 3410

Re: **NOTICE OF VIOLATION - No Notification Pursuant to Rule 116**
Location is 500' south of UL K -Sec 22-T22S-R37E

Dear Mr. Gray,

Major spills require immediate notification and a C-141 spill report submitted within 15-days. The New Mexico Oil Conservation Division (OCD) did not receive notification as specified and referenced above. In addition, covering up a spill is not an acceptable remediation practice in the State of New Mexico.

The OCD hereby requires Anadarko Petroleum Corporation to submit a remediation plan by December 16, 2001, that includes the following:

1. Anadarko Petroleum Corporation shall provide a copy of all C-141 reports for major spills since October 1, 2001.

2. Anadarko Petroleum Corporation shall perform delineation of the horizontal and vertical extent of TPH, BTEX and Chloride contamination in the soil

3. Anadarko Petroleum Corporation shall demonstrate contaminants will not migrate vertically so as to cause groundwater to exceed New Mexico Water Quality Control Commission (WQCC) standards.

4. The OCD shall be notified at least 48 hours in advance of any sampling event allowing OCD the option to witness activities and/or split samples.

Please be advised that future violations may likely result in an administrative hearing to order compliance with OCD rules including the imposition of civil penalties.

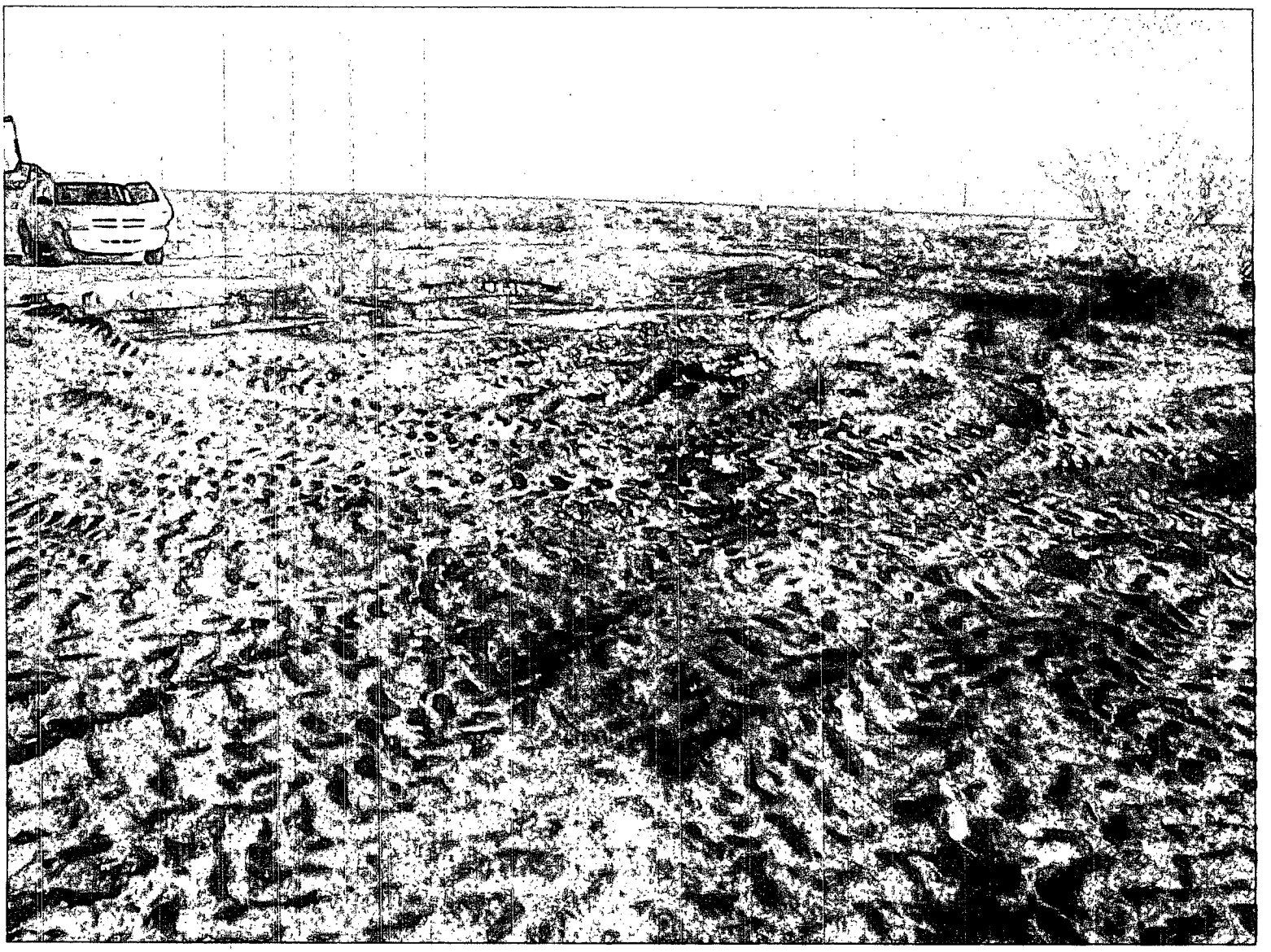
If you have any questions or need assistance please feel free to write or call Paul Sheeley at (505) 393-6161, x113 or email: psheeley@state.nm.us

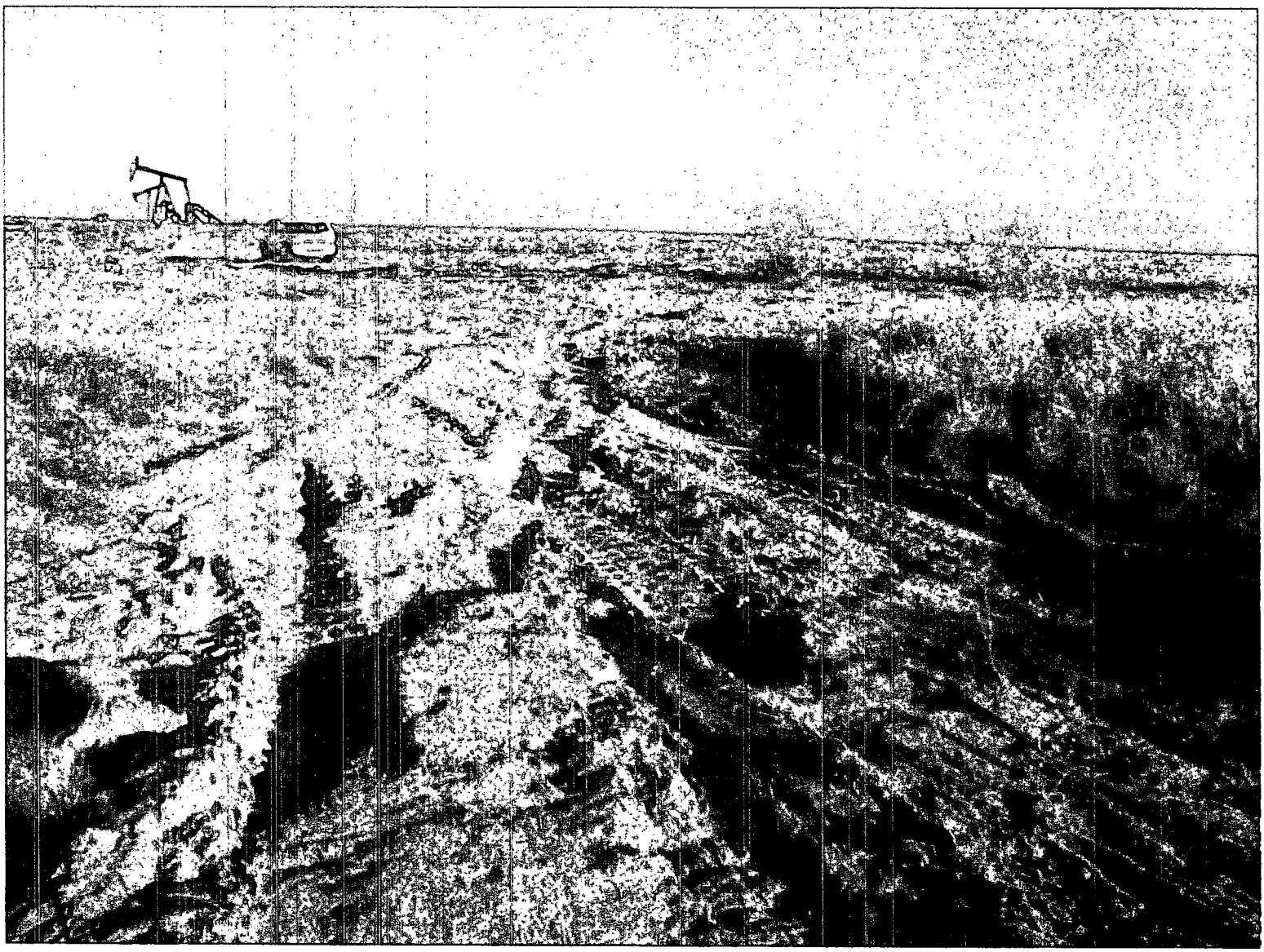
Sincerely,

Chris Williams
District 1 Supervisor

granted deadline extension to 1-17-03
by telephone call from Mike Gray 12-23-02 08:10

ANA DARKO





Date: ______

From the Desk of: Sylvia Dickey

To: ______

more info

Wed 7:41AM - 10/30 -
Ken w/ Anadarko
Leak (29th pm) K-22-22-37
LMPSU 4-2 75 yds W -
260 +- f/up

394-3184
915-559-5514

10/30 9:14AM -
683-5271
George Weigel
old prod ok - 1/02
no water prod.
15-17-34

?

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Mike Gray
Anadarko Petroleum
P.O.B. 1925
~~Eunice~~, NM 88231

2. Article Number (Copy from service label) 7099 3220 0002 3948 3410

PS Form 3811, July 1999 Domestic Return Receipt 102595-00-M-0952

RECEIVED NOV 2002 Hobbs OCD

COMPLETE THIS SECTION ON DELIVERY

A. Received by (Please Print Clearly) B. Date of Delivery

C. Signature [redacted]

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

Kevin Davidson

EUNICE NM NOV 21 2002 USPS

3. Service Type
☐ Certified Mail ☐ Express Mail
☐ Registered ☐ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

U.S. Postal Service
CERTIFIED MAIL RECEIPT
(Domestic Mail Only; No Insurance Coverage Provided)

Article Sent To: Anadarko - Mike Gray

Postage	$
Certified Fee	
Return Receipt Fee (Endorsement Required)	
Restricted Delivery Fee (Endorsement Required)	
Total Postage & Fees	$

Postmark Here: HOBBS NM 88240 NOV 18 2002 USPS

(Please Print Clearly) (To be completed by mailer)
New Mexico Oil Conservation Div.
Street, Apt. No.; or PO Box No.
1625 N. French Dr
City, State, ZIP+4
Hobbs, NM 88240

PS Form 3800, July 1999 See Reverse for Instructions

U.S. Postal Service
CERTIFIED MAIL RECEIPT
(Domestic Mail Only; No Insurance Coverage Provided)

7099 3220 0002 3948 3281

Article Sent To: Anadarko

Postage	$
Certified Fee	
Return Receipt Fee (Endorsement Required)	
Restricted Delivery Fee (Endorsement Required)	
Total Postage & Fees	$

Postmark Here: HOBBS NM 88240 SEP 7 2001 PM

OIL CONSERVATION DIVISION
ATTN: PAUL SHEELEY
1625 N. FRENCH DR.
HOBBS, NEW MEXICO 88240

nPRS0232228408 SP# NONWELL
IPRS0232232029 INSP#

September 4, 2001

Anadarko Petroleum Corporation
Attn: Mike Gray
P.O. Box 1923
Eunice, New Mexico 88231

USPS Certified Mail
Return Receipt #7099 3220 0002 3948 3281

Re: Major Oil Release & Remediation
Anadarko #2
UL K-Sec 21-T22S-R37E

Dear Mr. Gray,

The New Mexico Oil Conservation Division (OCD) inspected a major release of oil from a pipeline near the above referenced site on August 30, 2001. This release was not reported. There is evidence of surface work, grading and manipulation of the topsoil extending nearly a quarter mile. The OCD has not approved any work nor has Anadarko Petroleum Corporation submitted a work-plan. There is evidence of other release(s) in this area that were not reported. Enclosed are photos of the area.

Pursuant to **OCD Rule 116**, *("Release Notification and Corrective Action")*, must be submitted to the OCD district office within 15 days of the release.

The OCD hereby requires Anadarko Petroleum Corporation to submit a remediation plan by September 28, 2001, that includes the following:

1. Anadarko Petroleum Corporation shall submit a completed C-141 form for each release.
2. Anadarko Petroleum Corporation shall perform delineation of the horizontal and vertical extent of the Total Petroleum Hydrocarbons (TPH) and BTEX in the soil.
3. The OCD shall be notified at least 48 hours in advance of any sampling event.

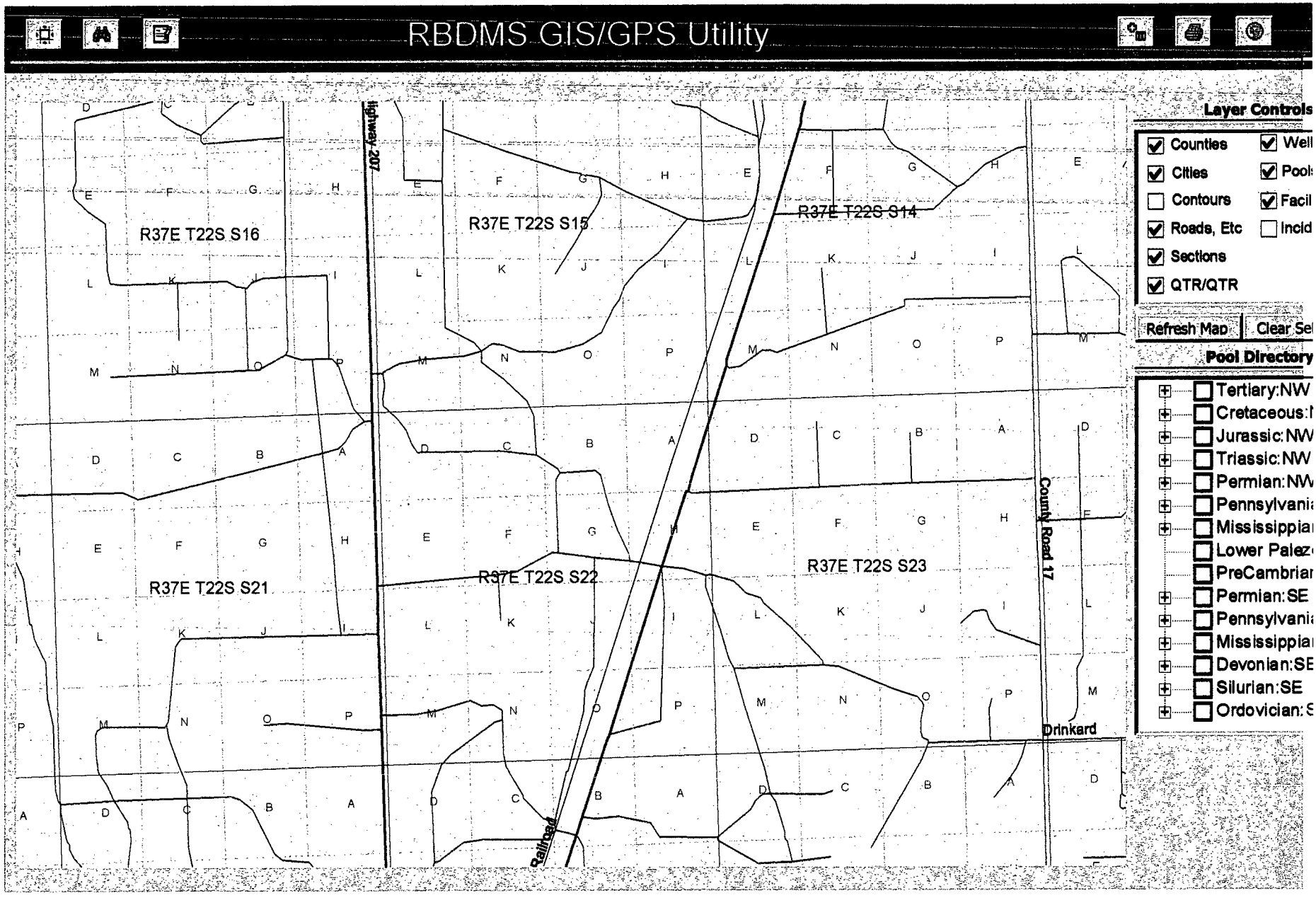
For guidance in this matter see Guidelines for Remediation of Leaks, Spills and Releases, August 13, 1993, on the OCD website:

*www.emnrd.state.nm.us/ocd/bureaus/environemntal/review/spill1.doc

If you have any questions, or need any assistance please write or call (505) 393-6161 x113.

Sincerely,

Paul Sheeley
Environmental Engineer
Cc: Roger Anderson - Environmental Bureau Chief
Chris Williams - District I Supervisor
William Olson - OCD Hydrologist


RBDMS GIS/GPS Utility
R37E T22S S16
R37E T22S S15
R37E T22S S14
R37E T22S S21
R37E T22S S22
R37E T22S S23
Highway 207
County Road 17
Railroad
Drinkard
Layer Controls
Counties
Cities
Contours
Roads, Etc
Sections
QTR/QTR
Refresh Map
Pool Directory
Tertiary:NW
Jurassic:NW
Triassic:NW
Permian:NW
Permian:SE
Devonian:SE
Silurian:SE