Authorization to Inject APPLICATION

UIC-CL1-008

ENVIROCORP®

APPLICATION FOR AUTHORIZATION TO INJECT PER OIL CONSERVATION DIVISION FORM C-108

NAVAJO REFINING COMPANY
Artesia, New Mexico

Envirocorp Project No. 60A4305

February 1998

Prepared By:

ENVIROCORP SERVICES & TECHNOLOGY, INC.
Houston, Texas

ENVIROCORP SERVICES & TECHNOLOGY, INC.

7020 PORTWEST DRIVE, #100 HOUSTON, TEXAS 77024 713/880-4640 FAX 713/880-3248

DATE IN	SUSPENSE	ENGINEER	LOGGED BY	TYPE

ABOVE THIS LINE FOR DIVISION USE ONLY

NEW MEXICO OIL CONSERVATION DIVISION

- Engineering Bureau -

ADMINISTRATIVE APPLICATION COVER SHEET

THIS COVERSHEET IS MANDATORY FOR ALL ADMINISTRATIVE APPLICATIONS FOR EXCEPTIONS TO DIVISION RULES AND REGULATIONS

Application Acronyms:

[NSP-Non-Standard Proration Unit] [NSL-Non-Standard Location]
[DD-Directional Drilling] [SD-Simultaneous Dedication]
[DHC-Downhole Commingling] [CTB-Lease Commingling] [PLC-Pool/Lease Commingling]
[PC-Pool Commingling] [OLS - Off-Lease Storage] [OLM-Off-Lease Measurement]
[WFX-Waterflood Expansion] [PMX-Pressure Maintenance Expansion]
[SWD-Salt Water Disposal] [IPI-Injection Pressure Increase]
[EOR-Qualified Enhanced Oil Recovery Certification] [PPR-Positive Production Response]

[1] **TYPE OF APPLICATION** - Check Those Which Apply for [A]

[A] Location - Spacing Unit - Directional Drilling

❑ NSL ❑ NSP ❑ DD ❑ SD

Check One Only for [B] and [C]

[B] Commingling - Storage - Measurement

❑ DHC ❑ CTB ❑ PLC ❑ PC ❑ OLS ❑ OLM

[C] Injection - Disposal - Pressure Increase - Enhanced Oil Recovery

❑ WFX ❑ PMX ☒ SWD ❑ IPI ❑ EOR ❑ PPR

[2] **NOTIFICATION REQUIRED TO:** - Check Those Which Apply, or ❑ Does Not Apply

[A] ❑ Working, Royalty or Overriding Royalty Interest Owners

[B] ☒ Offset Operators, Leaseholders or Surface Owner

[C] ☒ Application is One Which Requires Published Legal Notice

[D] ❑ Notification and/or Concurrent Approval by BLM or SLO
U.S. Bureau of Land Management - Commissioner of Public Lands, State Land Office

[E] ☒ For all of the above, Proof of Notification or Publication is Attached, and/or,

[F] ❑ Waivers are Attached

[3] **INFORMATION / DATA SUBMITTED IS COMPLETE** - Statement of Understanding

I hereby certify that I, or personnel under my supervision, have read and complied with all applicable Rules and Regulations of the Oil Conservation Division. Further, I assert that the attached application for administrative approval is accurate and complete to the best of my knowledge and where applicable, verify that all interest (WI, RI, ORRI) is common. I understand that any omission of data (including API numbers, pool codes, etc.), pertinent information and any required notification is cause to have the application package returned with no action taken.

Note: Statement must be completed by an individual with supervisory capacity.

Darrell Moore	Darrell Moore	Env. Mgr. for Water & Waste	2/26/98
Print or Type Name	Signature	Title	Date

District I
PO Box 1980, Hobbs, NM 88241-1980
District II
811 South First, Artesia, NM 88210
District III
1000 Rio Brazos Rd., Aztec, NM 87410
District IV
2040 South Pacheco, Santa Fe, NM 87505

State of New Mexico
Energy, Minerals & Natural Resources Department

OIL CONSERVATION DIVISION
2040 South Pacheco
Santa Fe, NM 87505

Form C-101
Revised October 18, 1994
Instructions on back
Submit to Appropriate District Office
State Lease - 6 Copies
Fee Lease - 5 Copies

☐ AMENDED REPORT

APPLICATION FOR PERMIT TO DRILL, RE-ENTER, DEEPEN, PLUGBACK, OR ADD A ZONE

[1] Operator Name and Address	[2] OGRID Number
Navajo Refining Company Post Office Box 159 Artesia, New Mexico 88211	[3] API Number 30 - 0 15-27592-0001

[4] Property Code	[5] Property Name	[6] Well No.
	WDW-1	

[7] Surface Location

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
O	31	17S	28E		660	South	2310	East	Eddy

[8] Proposed Bottom Hole Location If Different From Surface

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County

[9] Proposed Pool 1	[10] Proposed Pool 2
Wolfcamp, Cisco, and Canyon Injection Zone	

[11] Work Type Code	[12] Well Type Code	[13] Cable/Rotary	[14] Lease Type Code	[15] Ground Level Elevation
Re-enter	WDW	Rotary		3678 feet
[16] Multiple	**[17] Proposed Depth**	**[18] Formation**	**[19] Contractor**	**[20] Spud Date**
	9624 Feet	Wolfcamp/Cisco/ Canyon		

[21] Proposed Casing and Cement Program

Hole Size	Casing Size	Casing weight/foot	Setting Depth	Sacks of Cement	Estimated TOC
17-1/2	13-3/8	48	390	525	surface
12-1/4	9-5/8	36	2555	1000	surface
8-1/2	7	26	9600	*	surface

[22] Describe the proposed program. If this application is to DEEPEN or PLUG BACK give the data on the present productive zone and proposed new productive zone. Describe the blowout prevention program, if any. Use additional sheets if necessary.

Re-enter plugged and abandoned Mewbourne Oil Company Chalk Bluff 31 State No. 1. With drilling rig, wash out hole and drill out cement plugs to 9624 feet (original total depth was 10,200 feet). Log hole. Set straddle packers and run injectivity test or if required by hole condition, set 7 inch casing at 9600 feet and cement to surface; run injectivity tests.

*Sacks of cement for 7 inch casing to be determined from calipered hole volume, plus 20%.
NOTE: See accompanying Form C-108 for additional information.

[23] I hereby certify that the information given above is true and complete to the best of my knowledge and belief.

Signature: Darrell Moore

Printed name: Darrell Moore

Title: Env. Mgr. for Water & Waste

Date: 2/26/98

Phone: 505-748-3311

OIL CONSERVATION DIVISION

Approved by:

Title:

Approval Date: Expiration Date:

Conditions of Approval Attached ☐

District I
PO Box 1980, Hobbs, NM 88241-1980
District II
811 South First, Artesia, NM 88210
District III
1000 Rio Brazos Rd., Aztec, NM 87410
District IV
2040 South Pacheco, Santa Fe, NM 87505

State of New Mexico
Energy, Minerals & Natural Resources Department

OIL CONSERVATION DIVISION
2040 South Pacheco
Santa Fe, NM 87505

Form C-102
Revised October 18, 1994
Instructions on back
Submit to Appropriate District Office
State Lease - 4 Copies
Fee Lease - 3 Copies

☐ AMENDED REPORT

WELL LOCATION AND ACREAGE DEDICATION PLAT

[1] API Number	[2] Pool Code	[3] Pool Name
30-015-27592-0001		Wolfcamp, Cisco, and Canyon Injection Zone

[4] Property Code	[5] Property Name	[6] Well Number
	WDW-1	

[7] OGRID No.	[8] Operator Name	[9] Elevation
	Navajo Refining Company	3678 Feet GL

[10] Surface Location

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
-O-	31	17S	28E		660	South	2310	East	Eddy

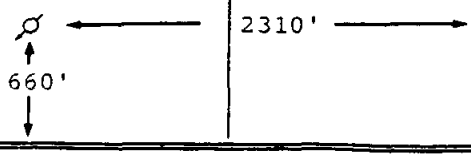
[11] Bottom Hole Location If Different From Surface

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County

[12] Dedicated Acres	[13] Joint or Infill	[14] Consolidation Code	[15] Order No.

NO ALLOWABLE WILL BE ASSIGNED TO THIS COMPLETION UNTIL ALL INTERESTS HAVE BEEN CONSOLIDATED OR A NON-STANDARD UNIT HAS BEEN APPROVED BY THE DIVISION

16



[17] OPERATOR CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief

Darrell Moore
Signature
Darrell Moore
Printed Name
Env. Mgr. for Water & Waste
Title
2/28/98
Date

[18] SURVEYOR CERTIFICATION

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my belief.

Date of Survey

Signature and Seal of Professional Surveyor

Certificate Number

See attached survey plat

SECTION 31, TOWNSHIP 17 SOUTH, RANGE 28 EAST, N.M.P.M.,
EDDY COUNTY NEW MEXICO

◎ DENOTES: SET 1/2" IRON ROD W/ PVC CAP MARKED "PS 3239 PS 12641"

JOHN W. WEST ENGINEERING COMPANY
CONSULTING ENGINEERS & SURVEYORS – HOBBS, NEW MEXICO

NAVAJO REFINING COMPANY

CHALK BLUFF 31 STATE #1 LOCATED 660 FEET FROM THE SOUTH LINE AND 2310 FEET FROM THE EAST LINE SECTION 31, TOWNSHIP 17 SOUTH, RANGE 28 EAST, N.M.P.M., EDDY COUNTY, NEW MEXICO.

Survey Date: 11/24/97		Sheet 1 of 1 Sheets	
W.O. Number: 97-11-1922		Drawn By: CDG	
Date: 12/1/97	DISK: NAVAJO	NAV1922	

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ATTACHMENTS

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I. PURPOSE

Navajo Refining Company (Navajo) submits this permit application for a Class II well for approval to re-enter a plugged and abandoned well to conduct injection testing. Navajo proposes to re-enter the Mewbourne Oil Company Chalk Bluff 31 No. 1 well, which is located in Section 31, T17S, R28E, Unit Letter O, approximately 11 miles east-southeast of Artesia, in Eddy County, New Mexico. The Mewbourne Oil Company Chalk Bluff 31 No. 1 well was drilled through the Morrow Formation to 10,200 feet in 1993 and was plugged and abandoned. The zones to be tested for injection are porous intervals in the Wolfcamp, Cisco, and Canyon Formations between 6890 feet and 9016 feet below kelly bushing in the Mewbourne Oil Company Chalk Bluff 31 No. 1 well.

II. OPERATOR

Operator Name and Mailing Address:

Navajo Refining Company
Post Office Box 159
Artesia, New Mexico 88211

Street Address:

Navajo Refining Company
Highway 82 East
Artesia, New Mexico 88211

Operator Contacts and Telephone:

Darrell Moore
Environmental Manager of Water and Waste
Navajo Refining Company
Post Office Box 159
Artesia, New Mexico 88211
505-748-3311

George Walbert, Geologist
Holly Petroleum, Inc.
100 Crescent Court, Suite 1600
Dallas, Texas 75201-6927
214-871-3555

III. WELL DATA

The well data form for the proposed Class II well is provided as Attachment III-1. A well schematic that shows the proposed injection well, the Mewbourne Oil Company Chalk Bluff 31 State No. 1 well, in its current condition, is included as Attachment III-2. Attachment III-3 shows the condition of the well after the existing cement plugs have been drilled out. Attachment III-4 shows the configuration of the proposed injection well.

Navajo proposes to re-enter the well with a drilling rig and wash out the hole, drilling out the existing cement plugs, to approximately 9624 feet. The well will be logged as described in Section X. The well will be tested using one or both of the following methods: (1) setting open-hole packers and testing through the work string or (2) setting 7 inch casing cemented to surface per Class I well standards and perforating. Navajo will retrieve a sample of the native fluid in the injection formations and conduct injectivity testing in porous intervals, as described in Section X.

IV. EXISTING PROJECT

The proposed injection well is not part of an existing project.

V. AREA OF REVIEW

A map that shows all non-freshwater wells within 2 miles of the proposed Class II well is provided as Attachment V-1. Also shown on Attachment V-1 is the area of review (AOR), which consists of the area within 1/2 mile of the proposed Class II well. The wells within the AOR are marked with Map ID numbers that are keyed to the list of wells in Attachment VI-1.

The names and addresses of the leasehold operators of the active non-freshwater wells within 1/2 mile of the proposed Class II well are provided in Attachment XIII-1. The leasehold operators were obtained from the Form C-104 (Request for Allowable and Authorization) that is on file with the Oil Conservation Division (OCD) for each active well within the 1/2-mile AOR.

All freshwater wells within 2 miles of the proposed injection wells are shown in Attachment V-3. The freshwater wells are keyed to the list of wells in Attachment XI-1.

VI. WELLS THAT PENETRATE THE INJECTION ZONE

No wells have penetrated the injection zone within the 1/2-mile AOR of the proposed Class II well, with the exception of the Mewbourne Oil Company Chalk Bluff 31 No. 1 (Map ID No. 59), the proposed Class II well for which this application is being submitted. Attachment VI-1 is a list of all of the wells drilled in the AOR, with total depth and date drilled. The Map ID numbers for wells in Attachment VI-1 are keyed to the map in Attachment V-1.

Information was available from the OCD files on every well in the AOR that is shown on the commercial oil and gas base map except for Map ID No. 173, for which a scout ticket was available from Petroleum Information Dwights LLC. Except for the Mewbourne well, the deepest well in the AOR, Map ID No. 92, was drilled to 6380 feet, which is within the upper portion of the Abo Formation, described in Section VIII.B.

VII. PROPOSED OPERATIONS

1. Proposed Injection Rate and Volume

The proposed maximum injection rate is 300 gallons per minute (gpm). The proposed maximum daily injection volume is 432,000 gallons, which is equivalent to 10,286 barrels per day. The proposed maximum injection volume in any given month is that volume calculated by multiplying 300 gpm by 60 minutes per hour by 24 hours per day by the number of days in the month.

2. Whether the System Is Open or Closed

The operations for the proposed Class II well will be restricted to injection testing from a closed system. Fluids to be injected will be trucked to the site.

3. Proposed Injection Pressure

The maximum injection pressure may vary, depending on the depth of the injection formation. For example, if the top of the injection formation coincides with the top of the Wolfcamp Formation at 6890 feet, then the requested maximum injection pressure is 1378 psi, as calculated below:

Maximum Injection Pressure at the Top of the Wolfcamp Formation

= Top of the Wolfcamp Formation x 0.2 psi/ft
= 6890 feet x 0.2 psi/ft
= 1378 psi

If the top of the injection formation coincides with the top of the Cisco or Canyon Formations, both of which are deeper than the Wolfcamp Formation, then the proposed injection pressure will be higher. The proposed injection pressure for each injection formation is summarized in the following table:

PROPOSED INJECTION PRESSURE

Injection Formation	Top of Injection Formation	Maximum Injection Pressure Gradient	Proposed Injection Pressure
Wolfcamp	6890 feet	0.2 psi/ft	1378 psi
Cisco	7816 feet	0.2 psi/ft	1563 psi
Canyon	8475 feet	0.2 psi/ft	1695 psi

4. Wastestream Information and Compatibility with the Injection Zone

Navajo is requesting a Class II permit for the purpose of conducting injection tests in the Wolfcamp, Cisco, and Canyon Formations. The fluids to be injected during the tests will be fresh water or brine. Acids may be injected to clean and stimulate the perforated intervals, as discussed in Section IX.

The fluid to be injected during the injection tests will be chosen to be compatible with the injection zone limestones, dolomites, and shales and with the native formation brine.

5. Injection Zone Fluid Analysis

The composition of the native formation fluid in the proposed Wolfcamp, Cisco, and Canyon injection zone is expected to be similar to that in these formations in other parts of southeastern New Mexico. The salinity of Wolfcamp, Cisco, and Canyon formation brines from hydrocarbon producing areas in northern Lea County, to the east of Eddy County, was reported by Meyer (1966, Table 4). Attachment VII-1 summarizes the salinity data reported by Meyer (1966, Table 4) for Wolfcamp, Cisco, and Canyon formation brines from limestones that were deposited in a shelf environment similar to that of the proposed injection site. The salinity of the formation brines range from 67,098 to 119,909 parts per million (ppm). The formation brines were produced from intervals that occur between 9001 feet and 10742 feet below ground. Also listed in Attachment VII-1 are data from Strawn limestones that were deposited in a platform environment and that occur at 7700 feet below ground; the salinity of the Strawn formation brine is 39,374 ppm.

Navajo will attempt to retrieve a sample of formation brine during the proposed well testing operations. As discussed above, the salinity of the formation brine in the Wolfcamp, Cisco, and Canyon injection zone is expected to be between 40,000 and 120,000 ppm.

VIII. GEOLOGY

VIII.A Injection Zone Lithology, Depth, Thickness, Porosity, and Permeability

The proposed injection zones are porous limestones of the Wolfcamp, Cisco, and Canyon Formations. These formations occur in the proposed injection well between 6890 feet (top of the Wolfcamp) and 9016 feet (base of the Canyon). The proposed injection zone is shown on the logs of the proposed injection well in Attachments VIII-1 and VIII-2.

The Wolfcamp Formation (Permian - Wolfcampian age) consists of light brown to tan, fine- to medium-grained, fossiliferous limestones with variegated shale interbeds (Meyer, 1966, page 69). The top of the Wolfcamp was picked for this study at 6890 feet, at the base of the massive, dense dolomites of the overlying Abo Formation. The base of the Wolfcamp coincides with the top of the Cisco Formation at 7812 feet. The Wolfcamp is 922 feet thick in the proposed injection well. The total thickness of intervals with log porosity greater than 5% is approximately 88 feet. The total thickness with log porosity greater than 10% is approximately 26 feet. Attachment VIII-3 shows that the thickness of the porous intervals in the Wolfcamp ranges from 0 feet to 295 feet in a band 3 miles wide that trends northeast-southwest across the study area. The Wolfcamp Formation serves as the injection zone in an active Class II saltwater disposal well, the I&W, Inc., Walter Solt State SWD No. 1 well, located 4600 feet southeast of the proposed injection well in the NW/4, SW4 Section 5, T18S-R28E.

The Cisco Formation (Pennsylvanian - Virgilian age) of the Northwest Shelf is described by Meyer (1966, page 59) as consisting of uniform, light-colored, chalky, fossiliferous limestones interbedded with variegated shales. Meyer (1966, page 59) also describes the Cisco at the edge of the Permian Basin as consisting of biohermal (mound) reefs composed of thick, porous, coarse-grained dolomites. In the proposed injection well, the Cisco consists of dolomite extending from 7816 feet to the top of the limestones of the Canyon Formation at 8475 feet. The Cisco is 659 feet thick in the proposed injection well. The total thickness of intervals with log porosity greater than 5% is approximately 310 feet. The total thickness with log porosity greater than 10% is approximately 100 feet. Attachment VIII-4 shows that the thickness of the porous intervals in the Cisco ranges from 0 feet in the northwestern part of the study area to nearly 700 feet in a band 3 miles wide that trends northeast-southwest.

The Canyon Formation (Pennsylvanian - Missourian age) consists of white to tan to light brown fine-grained, chalky, fossiliferous limestone with gray and red shale interbeds (Meyer, 1966, page 53). In the proposed injection well, the Canyon occurs between 8475 feet, the base of the Cisco dolomites, and 9015 feet, the top of the Strawn Formation of Pennsylvanian (Desmoinesian) age. The Canyon is 540 feet thick in the proposed injection well. The total thickness of intervals with log porosity greater than 5% is 34 feet. No intervals appear to have log porosity greater than 10%.

Permeable zones in the proposed Wolfcamp, Cisco, and Canyon injection zone are expected to be encountered in porous intervals and in intervals that are naturally fractured. Drilling records for the proposed injection well indicate that returns of drilling mud and cuttings were lost at 8418 feet in the Cisco, in a porous interval that also may be naturally fractured. Permeability measurements from hydrocarbon-producing intervals in the Wolfcamp, Cisco, and Canyon are available from Meyer (1966, Table 4). These permeability data are summarized in Attachment VIII-5. Meyer reported permeabilities in the Cisco of up to 114 millidarcies (md), up to 38 md in the Canyon, and up to 200 md in the Wolfcamp. This range of permeabilities is expected in the Wolfcamp, Cisco, and Canyon injection zone in the proposed injection well.

VIII.B Confining Zone

The confining zone extends from 4000 feet to 6890 feet in the proposed injection well. The confining zone includes massive low-porosity carbonate beds and layers of shale that will confine the injected fluids to the proposed injection zone (Wolfcamp, Cisco, and Canyon Formations). The formations that comprise the confining zone are described below.

The proposed injection zone is directly overlain by the confining layers of the lower portion of the Abo Formation. The Abo extends from 5500 feet to 6890 feet in the proposed injection well, with a total thickness of 1390 feet. Although the Abo is well known as a major oil producer in the AOR, the producing intervals lie in the upper Abo and the B Reef of the Abo, whose equivalents are above 6100 feet in the proposed injection well. The deepest Abo well in the AOR, Map ID No. 92, located 1970 feet south (downdip) of the proposed injection well, was drilled to 6380 feet. No Abo production in the AOR has been established below 6264 feet, the producing interval in Map ID No. 104, located 2400 feet south of the proposed

injection well. The base of the producing interval within the Abo Formation in the AOR, therefore, is over 700 feet above the top of the proposed injection zone. The lower 700 feet of the Abo Formation, consisting primarily of dolomite with average porosity less than 5% and interbedded shale, will serve as the primary confining layer above the proposed injection zone.

The Yeso Formation, which will provide additional confining capabilities, directly overlies the Abo Formation. The top of the Yeso is not clearly identified in the AOR, according to reports submitted to the OCD and scout tickets available from Petroleum Information Dwights LLC. However, the top of the confining zone can be considered to extend to 4000 feet in the proposed injection well, which coincides with the top of the low-porosity limestone interval below the higher-porosity dolomites below the Glorieta Member of the San Andres Formation. The Yeso consists of low-porosity carbonates and clastic beds. The Tubb shale, a shale interval up to 150 feet thick in some wells in the study area, occurs between 4380 feet and 4500 feet in the proposed disposal well. Although no faults are known to exist in the confining zone within the AOR, the Tubb shale will serve to prevent movement of fluids through a hypothetical unknown fault.

VIII.C Structure

The proposed injection well is located on the Artesia-Vacuum anticline (also called the Vacuum Arch), which trends east-west across the study area. The Vacuum Arch is shown clearly on Attachment VIII-6, a structure map drawn on the Rio Bonito member of the San Andres Formation. The top of the Rio Bonito member occurs at approximately 2260 feet in the proposed injection well, or 300 feet below the top of the San Andres Formation, and 4630 feet above the top of the proposed injection interval (Wolfcamp, Cisco, and Canyon Formations). The general structure of the injection zone is shown on Attachment VIII-7, a structure map of the Strawn Formation, drawn on a horizon that is 370 feet below the top of the Strawn (base of the proposed injection zone), as it is recognized in records and scout tickets for wells in the study area. The top of the proposed injection zone is conformable with the Strawn Formation. Attachment VIII-7 shows the trend of the Vacuum arch, as well as the southeasterly dip of the beds at 85 feet per mile in the vicinity of the proposed injection well. No faults exist in the study area, and faulting occurs no closer than 17 miles to the proposed injection well. The nearest fault is the K-M fault, which is located 6 miles northwest of Artesia and trends northeast-southwest, as shown on Attachment VIII-6.

VIII.D Underground Sources of Drinking Water (USDWs)

The base of the USDWs, in which the total dissolved solids (TDS) concentration of the formation water is less than 10,000 milligrams/liter (mg/l) or the equivalent, 10 g/l, occurs at approximately 3200 feet above sea level in the study area, as shown on Attachment VIII-8. In the proposed injection well, the base of the USDWs occurs at a measured depth of 493 feet below kelly bushing (KB; 493' KB = 3693' - 3200', where 3693' is the elevation of the kelly bushing of the proposed injection well), or the base of the Tansill Formation (Permian - Guadalupean age). In the eastern part of the study area, at depth, the Tansill Formation is overlain by the Salado Formation (Permian - Ochoan age). The Salado consists of halite, polyhalite, anhydrite, and potassium salts, which are soluble. The Salado is overlain by the Rustler Formation (Permian - Ochoan age). In the AOR, which straddles the outcrop area of the Salado and, to the east, the Salado has been removed by solution by ground water flowing through the Rustler.

To the east, where the Rustler is present, the Rustler is the USDW. To the west, where the Rustler has been removed by erosion and the Salado has been removed by solution, the Tansill is the USDW. The Tansill Formation and the underlying Yates Formation comprise the Three Twins Member of the Chalk Bluff Formation known in outcrops in the region (Hendrickson and Jones, 1952, page 20), and listed as a freshwater-producing interval in Attachment XI-1. The proposed injection zone (Wolfcamp, Cisco, and Canyon Formations) is separated from the USDWs by 6397 feet of carbonates, siltstones, and shales in the proposed injection well.

IX. PROPOSED STIMULATION PROGRAM

The proposed stimulation program will be limited to acidizing, as described below:

1. Acid wash perforations with selective perforation wash tool.

2. Isolate desired zone with treating packer and retrievable plugs, as necessary.

3. Acidize selected perforations with approximately 100 gallons per foot of perforations with additives diverting with perf balls, as needed.

X. LOGGING AND WELL TEST DATA

A formation fluid sample will be retrieved from the proposed injection zone. Navajo will conduct injectivity testing in permeable intervals.

The proposed logging program is described below:

OPEN-HOLE LOGS

Run the following logs from total depth to the base of the 9-5/8 inch casing at 2555 feet:

- dual induction log
- gamma ray (from total depth to surface)
- microlog
- caliper
- density
- neutron (from total depth to surface)
- long-spaced sonic
- fracture identification log

CASED-HOLE LOGS

1. Cement bond log on 9-5/8 inch casing from 2555 feet to the surface.

2. Cement bond log on 7 inch casing from total depth to the surface.

3. Gamma ray from total depth to 5000 feet.

4. Casing collar from total depth to 5000 feet.

XI. FRESHWATER CHEMISTRY

The files of the State Engineer Office in Roswell, New Mexico were searched for records of water wells in the AOR. No records of water wells drilled in the AOR were found. According to the State Engineer Office personnel, records are not required to be filed on water wells that are not drilled in declared underground water basins. The western portion of the study area, which lies in T17S-R27E and T18S-R27E, as shown on Attachment V-3, has been part of the Roswell Underground Water Basin since August 21, 1946 (New Mexico State Engineer, 1995, pages 140-141); therefore, records for any water wells drilled in these townships after August 21, 1946, should be on file. The eastern part of the study area, in T17S-R28E and T18S-R28E, however, was declared part of the Roswell Underground Water Basin on February 8, 1993 (New Mexico State Engineer, 1995, page 142). Records for any water wells drilled in these townships after February 8, 1993, should be on file; however, no records were found.

Although no records for wells in the AOR are available from the State Engineer Office, several water wells have been drilled within the study area, according to Hendrickson and Jones (1952, Table 1) and as shown as windmills on the topographic map in Attachment V-3. Water wells indicated by these two sources are listed in Attachment XI-1 and shown on Attachment V-3.

TDS and chloride concentrations from a water well located 2 miles south of the proposed injection well are presented in Attachment XI-2. Attachment XI-2 is a letter report from the New Mexico State Engineer Office that lists the analyses of three samples taken from Water Well ID No. 18.28.7.430 in 1985, 1988, and 1994. Water Well ID No. 18.28.7.430 is located in the SW/4 SE/4 of Section 7, T18S-R28E. The TDS concentrations in water samples from this well ranged from 1535 to 2209 mg/l.

XII. FAULTING AND OTHER HYDRAULIC CONNECTIONS BETWEEN THE INJECTION ZONE AND THE USDWS

No evidence has been found of open faults or other hydraulic connection between the injection zone and any USDWs. No other wells penetrate the injection zone within the AOR of the proposed injection well; therefore, no hydraulic connection through an improperly constructed wellbore exists. With the exception of the K-M fault located 17 miles northwest of the proposed injection well, no faulting is indicated on structure maps of the study area (Attachments VIII-6 and VIII-7); therefore, no faults are believed to exist in the study area. Natural fractures in the proposed injection zone are confined to thin intervals and do not extend between the injection zone and the USDWs. The interval between the injection zone and the USDWs contains at least one interval, the Abo and Yeso Formations described in Section VIII.B, that serves as a confining zone that is free of known open faults and fractures in the AOR.

XIII. PROOF OF NOTICE

A copy of the application has been furnished, by registered mail, to each leasehold operator within 1/2 mile of the proposed injection well. The names and addresses of leasehold operators within 1/2 mile of the proposed injection well are listed in Attachment XIII-1. Copies of the registered mail receipts are included as Attachment XIII-2. Navajo is the owner of the surface of the land on which the proposed injection well is to be located.

XIV. CERTIFICATION

I hereby certify that the information submitted with this application is true and correct to the best of my knowledge and belief.

NAME: Darrell Moore

TITLE: Env. Mgr. for Water & Waste

SIGNATURE: Darrell Moore

DATE: 2/26/98

REFERENCES

Hendrickson, G. E., and R. S. Jones, 1952, Geology and Ground-Water Resources of Eddy County, New Mexico, Ground Water Report 3: New Mexico Bureau of Mines and Mineral Resources, Socorro, New Mexico, 169 pages.

Kelley, Vincent C., 1971, Geology of the Pecos Country, Southeastern New Mexico, Memoir 24: New Mexico Bureau of Mines and Mineral Resources, Socorro, New Mexico, 78 pages.

Kelly, T. E., 1974, Reconnaissance Investigation of Ground Water in the Rio Grande Drainage Basin - with Special Emphasis on Saline Ground-Water Resources, Hydrologic Investigations Atlas HA-510: U. S. Geological Survey, Washington, D. C., 4 sheets.

Meyer, Richard F., 1966, Geology of Pennsylvanian and Wolfcampian Rocks in Southeast New Mexico, Memoir 17: New Mexico Bureau of Mines and Mineral Resources, Socorro, New Mexico, 123 pages.

New Mexico State Engineer, 1995, Rules and Regulations Governing Drilling of Wells and Appropriation and Use of Ground Water in New Mexico: State Engineer Office, Santa Fe, New Mexico, 166 pages.

U. S. Geological Survey, 1965, Mineral and Water Resources of New Mexico, Bulletin 87: New Mexico Bureau of Mines and Mineral Resources, Socorro, New Mexico, printed 1982, 437 pages.

ATTACHMENTS

ATTACHMENT III-1

INJECTION WELL DATA SHEET

ATTACHMENT III-1

INJECTION WELL DATA SHEET

OPERATOR: Navajo Refining Company

LEASE: WDW-1 (formerly Mewbourne Oil Company Chalk Bluff 31 State No. 1)

660' FSL, 2310' FEL — 31-T17SR28E

Footage Location — Section — Township — Range

WELL CONSTRUCTION DATA

Surface Casing

Size 13-3/8" Cemented with 525 sx

TOC Surface feet determined by Circulated 86 sx to surface

Hole Size 17-1/2" Set at 390 feet

Intermediate Casing

Size 9-5/8" Cemented with 1000 sx

TOC Surface feet determined by Circulated 133 sx to surface

Hole Size 12-1/4" Set at 2555 feet

Long String (Proposed)

Size 7" Cemented with not available sx

TOC Surface feet determined by Temperature log if cement does not reach surface

Hole Size 8-1/2" Set at 9600 feet (proposed)

Total Depth 10,200', Plugged back to 9624'

Injection Interval

6890 feet to 9016 feet, perforated

(perforated or open-hole; indicate which)

Tubing size 3-1/2 lined with not lined* set in a retrievable full bore packer at approximately 6000** feet. Other type of tubing/casing seal if applicable latch-in seal assembly

OTHER DATA

1. Is this a new well drilled for injection? ___ Yes _X_ No

   If no, for what purpose was the well originally drilled? The well was drilled in 1993 as an exploratory well. The well was plugged and abandoned in 1993.

2. Name of the injection formation: Wolfcamp, Cisco, and Canyon Formations

3. Name of Field or Pool (if applicable): Not applicable

4. Has the well ever been perforated in any other zones(s)? List all such perforated intervals and give plugging detail, i.e., sacks of cement or plug(s) used. No

5. Give the names and depths of any over or underlying oil or gas zones (pools) in the area:

Within the AOR: · Seven Rivers (600 feet), Queen (1400 feet), Grayburg (1700 feet and 1900 feet), and Abo (5800 feet to 6200 feet)

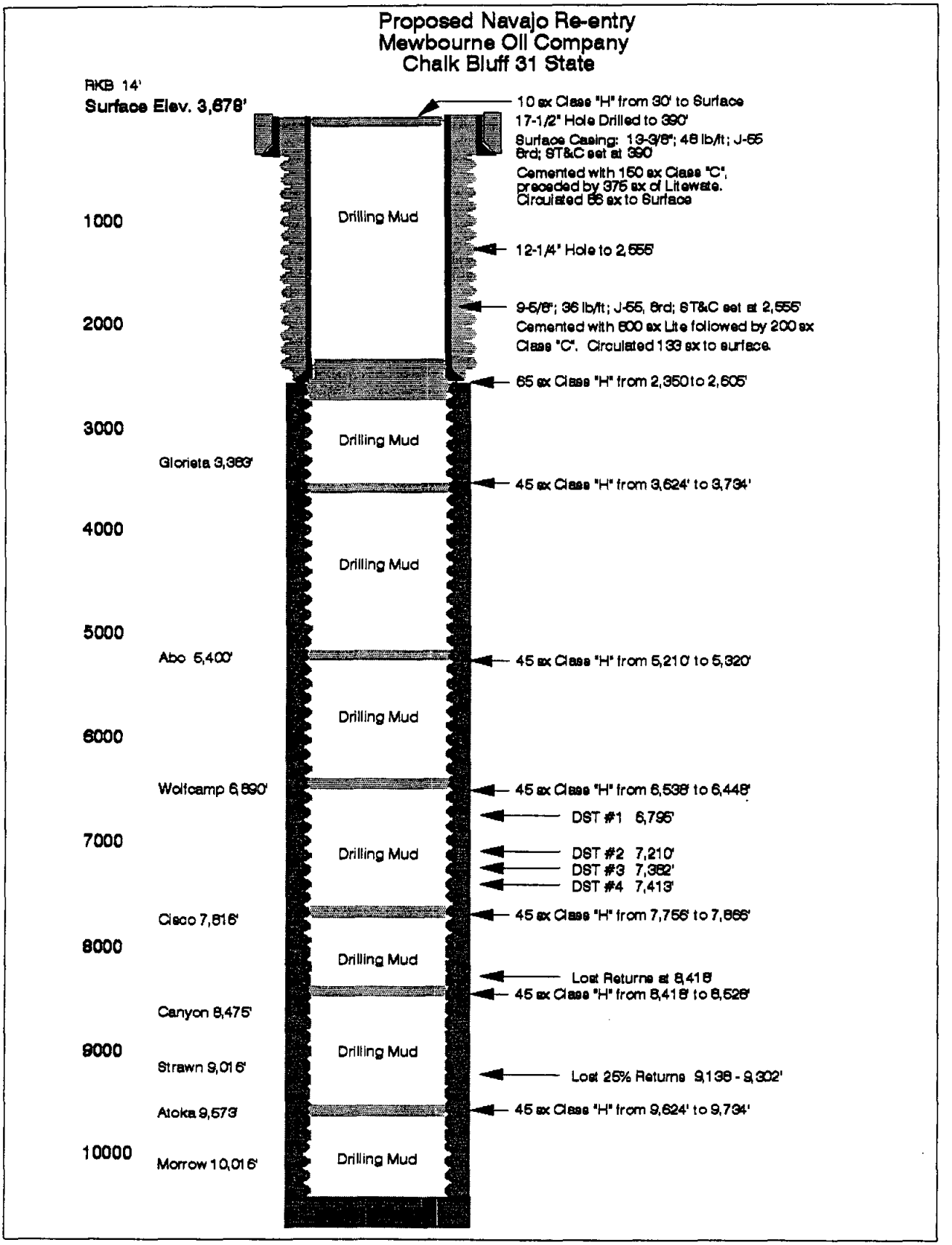
Within one mile: Yates (500 feet), Seven Rivers (600 feet), Grayburg (1600 feet to 1900 feet), San Andres (2000 feet), Abo (5800 feet to 6200 feet), and Morrow (9900 feet)

* Waiting on fluid analysis to determine corrosivity. Tubing or lining will be adjusted to address corrosion problems.

** Depends on injection interval selected.

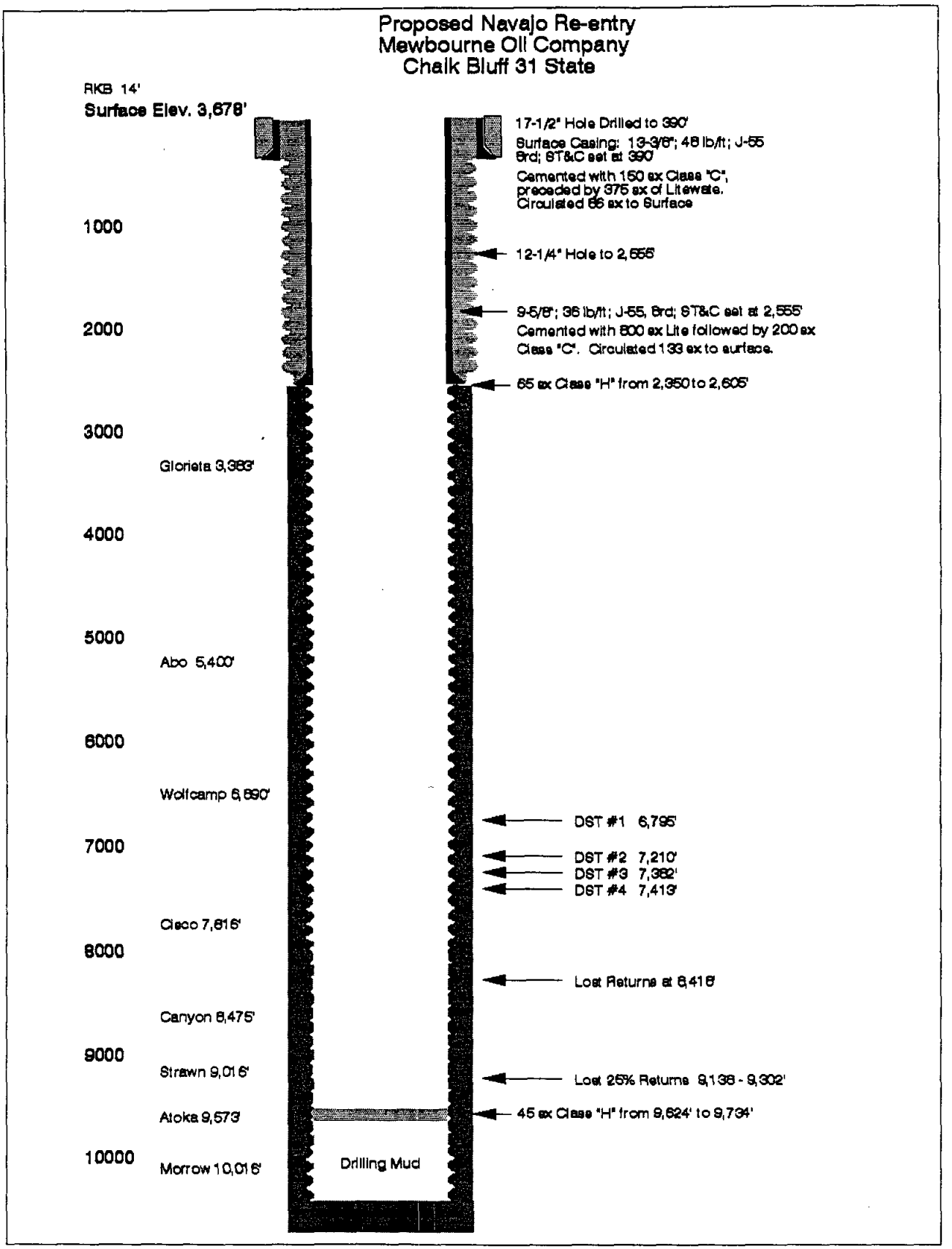
ATTACHMENT III-2

WELL SCHEMATIC (Current Condition)


Proposed Navajo Re-entry
Mewbourne Oil Company
Chalk Bluff 31 State
RKB 14'
Surface Elev. 3,678'
10 sx Class "H" from 30' to Surface
17-1/2" Hole Drilled to 390'
Surface Casing: 13-3/8"; 48 lb/ft; J-55 8rd; ST&C set at 390
Cemented with 150 sx Class "C", preceded by 375 sx of Litewate. Circulated 66 sx to Surface
Drilling Mud
12-1/4" Hole to 2,555'
9-5/8"; 36 lb/ft; J-55, 8rd; ST&C set at 2,555'
Cemented with 600 sx Lite followed by 200 sx Class "C". Circulated 133 sx to surface.
65 sx Class "H" from 2,350 to 2,605'
Drilling Mud
Glorieta 3,369'
45 sx Class "H" from 3,624' to 3,734'
Drilling Mud
Drilling Mud
Abo 5,400'
45 sx Class "H" from 5,210' to 5,320'
Drilling Mud
Wolfcamp 6,590'
45 sx Class "H" from 6,538' to 6,448'
DST #1 6,795'
Drilling Mud
DST #2 7,210'
DST #3 7,362'
DST #4 7,413'
Cisco 7,816'
45 sx Class "H" from 7,756' to 7,866'
Drilling Mud
Lost Returns at 8,418'
45 sx Class "H" from 8,418' to 8,528'
Canyon 8,475'
Drilling Mud
Strawn 9,016'
Lost 25% Returns 9,138 - 9,302'
Atoka 9,573'
45 sx Class "H" from 9,624' to 9,734'
Morrow 10,016'
Drilling Mud
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000

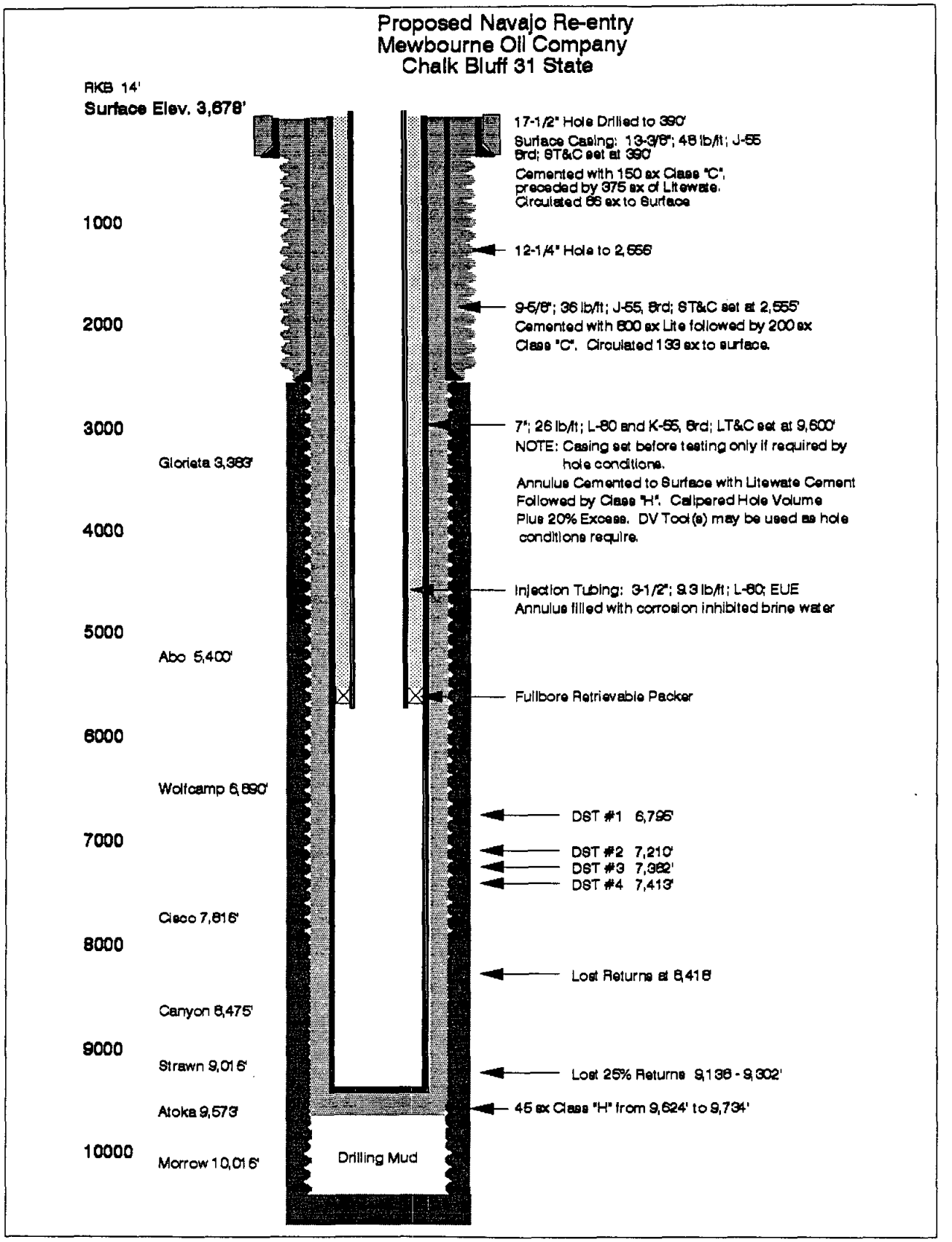
ATTACHMENT III-3

WELL SCHEMATIC (After Drilling Out Plugs)


Proposed Navajo Re-entry
Mewbourne Oil Company
Chalk Bluff 31 State
RKB 14'
Surface Elev. 3,678'
17-1/2" Hole Drilled to 390'
Surface Casing: 13-3/8"; 48 lb/ft; J-55 Brd; ST&C set at 390'
Cemented with 150 ex Class "C", preceded by 375 ex of Litewate. Circulated 66 ex to Surface
12-1/4" Hole to 2,555'
9-5/8"; 36 lb/ft; J-55, Brd; ST&C set at 2,555'
Cemented with 800 ex Lite followed by 200 ex Class "C". Circulated 133 ex to surface.
65 ex Class "H" from 2,350 to 2,605'
1000
2000
3000
Glorieta 3,363'
4000
5000
Abo 5,400'
6000
Wolfcamp 6,890'
7000
Cisco 7,616'
8000
Canyon 8,475'
9000
Strawn 9,016'
Atoka 9,573'
10000
Morrow 10,016'
DST #1 6,795'
DST #2 7,210'
DST #3 7,362'
DST #4 7,413'
Lost Returns at 8,416'
Lost 25% Returns 9,138 - 9,302'
45 ex Class "H" from 9,624' to 9,734'
Drilling Mud

ATTACHMENT III-4

WELL SCHEMATIC (Proposed Injection Well)


Proposed Navajo Re-entry
Mewbourne Oil Company
Chalk Bluff 31 State
RKB 14'
Surface Elev. 3,678'
1000
2000
3000
Glorieta 3,383'
4000
5000
Abo 5,400'
6000
Wolfcamp 6,890'
7000
Cisco 7,816'
8000
Canyon 8,475'
9000
Strawn 9,016'
Atoka 9,573'
10000
Morrow 10,016'
Drilling Mud
17-1/2" Hole Drilled to 390'
Surface Casing: 13-3/8"; 48 lb/ft; J-55 8rd; ST&C set at 390'
Cemented with 150 sx Class "C", preceded by 375 sx of Litewate. Circulated 66 sx to Surface
12-1/4" Hole to 2,555'
9-5/8"; 36 lb/ft; J-55, 8rd; ST&C set at 2,555'
Cemented with 600 sx Lite followed by 200 sx Class "C". Circulated 133 sx to surface.
7"; 26 lb/ft; L-80 and K-55, 8rd; LT&C set at 9,600'
NOTE: Casing set before testing only if required by hole conditions.
Annulus Cemented to Surface with Litewate Cement Followed by Class "H". Caliper Hole Volume Plus 20% Excess. DV Tool(s) may be used as hole conditions require.
Injection Tubing: 3-1/2"; 9.3 lb/ft; L-80; EUE
Annulus filled with corrosion inhibited brine water
Fullbore Retrievable Packer
DST #1 6,795'
DST #2 7,210'
DST #3 7,362'
DST #4 7,413'
Lost Returns at 8,418'
Lost 25% Returns 9,136 - 9,302'
45 sx Class "H" from 9,624' to 9,734'

ATTACHMENT V-1

NON-FRESHWATER WELLS WITHIN 2 MILES OF THE PROPOSED INJECTION WELL (Map)

ATTACHMENT V-3

FRESHWATER WELLS IN THE VICINITY OF THE PROPOSED INJECTION WELL (Map)

ATTACHMENT VI-1

NON-FRESHWATER WELLS WITHIN THE 1/2-MILE AREA OF REVIEW (Table)

ATTACHMENT VI-1

NON-FRESHWATER WELLS WITHIN THE 1/2-MILE AREA OF REVIEW

ID NO.	OPERATOR/LEASE	TYPE	TOTAL DEPTH (ft)	DATE COMPLETED OR PLUGGED
42	Franklin, Aston & Fair, Inc. State F No. 1 31-17S-28E Unit F	Active Oil	5971	6/7/60
43	Aston & Fair State No. Y-1 31-17S-28E Unit F	Active Oil	1926	5/8/48
44	J. E. Bedingfield Malco State No. 1 31-17S-28E Unit G	Active Shut In	1852	10/12/53
45	Pan American Petroleum Corp. State of New Mexico CC No. 1 31-17S-28E Unit G	Active Oil	6025	8/10/60
47	DEPCO, Inc. State 647 No. 213 31-17S-28E Unit I	Active Oil	1945	6/17/66
48	Hondo-Western-Yates State A No. 9 31-17S-28E Unit I	Active Inj. Gas	6106	4/29/60
49	Franklin, Aston & Fair, Inc. State AG No. 1 31-17S-28E Unit J	Active Oil	1937	12/23/62
50	Pan American Petroleum Corp. State of New Mexico BJ No. 2 31-17S-28E Unit J	Active Oil	6094	3/13/60
51	Pan American Petroleum Corp. State BM No. 1 31-17S-28E Unit K	Active Inj. Gas	6046	4/10/60
53	Pan American Petroleum Corp. State BE No. 2 31-17S-28E Unit L	Active Oil	5971	4/29/60
54	Barney Cockburn Ramapo-State No. 1 31-17S-28E Unit M	Active Oil	1975	5/1/48
55	Pan American Petroleum Corp. State BE No. 1 31-17S-28E Unit M	Active Inj. Gas	6006	1/31/60

ATTACHMENT VI-1 (Continued)

NON-FRESHWATER WELLS WITHIN THE 1/2-MILE AREA OF REVIEW

ID NO.	OPERATOR/LEASE	TYPE	TOTAL DEPTH (ft)	DATE COMPLETED OR PLUGGED
56	Pan American Petroleum Corp. State BD No. 1 31-17S-28E Unit N	Active Oil	6050	1/22/60
57	Franklin, Aston & Fair, Inc. State AD No. 1 31-17S-28E Unit N	Active Oil	1938	3/1/63
58	Otis A. Roberts Parker-State No. 1 31-17S-28E Unit O	P&A Dry	742	1/18/42
59	Mewbourne Oil Company Chalk Bluff 31 State No. 1 Illinois Camp Morrow North Field 31-17S-28E Unit O	P&A Dry	10200	9/9/93 9/10/93 P&A
60	Pan American Petroleum Corp. State BJ No. 1 31-17S-28E Unit O	Active Oil	6094	2/24/60
61	DEPCO, Inc. State 647 No. 219 31-17S-28E Unit P	Active SWD	2012	5/8/67
62	Hondo-Western-Yates State A No. 5 31-17S-28E Unit P	Active Oil	6122	3/12/60
79	Atlantic Richfield Co. Empire Abo Unit I No. 251 5-18S-28E Unit D	Active Oil	6250	1/12/79
87	DEPCO, Inc. State 647 No. 216 6-18S-28E Unit A	Active Oil	3280	3/14/67
88	Hondo-Western-Yates State A No. 2 6-18S-28E Unit A	Active Oil	6241	2/29/60
89	Resler and Sheldon State No. 1 6-18S-28E Unit B	Active Inj. Gas	6194	12/21/59
90	Atlantic Richfield Co. Empire Abo Unit I No. 231 6-18S-28E Unit B	Active Oil	6250	11/1/75

ATTACHMENT VI-1 (Continued)

NON-FRESHWATER WELLS WITHIN THE 1/2-MILE AREA OF REVIEW

ID NO.	OPERATOR/LEASE	TYPE	TOTAL DEPTH (ft)	DATE COMPLETED OR PLUGGED
91	Pan American Petroleum Corp. State BB No. 3 6-18S-28E Unit C	Active Oil	6033	12/29/59
92	Atlantic Richfield Co. Empire Abo Unit J No. 231 6-18S-28E Unit G	Active Oil	6380	10/22/75
93	Hondo Oil & Gas Co. State EA No. 1 6-18S-28E Unit D	Active Oil	6119	12/30/59
98	Atlantic Richfield Co. Empire Abo Unit J No. 222 6-18S-28E Unit F	Active Oil	6303	3/13/77
99	David C. Saikin & Henry F. Oliver State No. 1 6-18S-28E Unit F	P&A Dry	705	2/21/42
100	Franklin, Aston & Fair, Inc. State AB No. 1 6-18S-28E Unit F	Active Oil	1985	8/8/63
101	Pan American Petroleum Corp. State BB No. 2 6-18S-28E Unit F	Active Oil	6206	11/26/59
104	ARCO Oil and Gas Co. Empire Abo Unit J No. 235 6-18S-28E Unit G	Active Oil	6300	7/8/79
105	Atlantic Richfield Co. Empire Abo Unit J No. 234 6-18S-28E Unit G	Active Oil	6260	8/27/78
106	Hondo-Western-Yates State A No. 1 6-18S-28E Unit G	Active Oil	6242	1/26/60
110	Hondo-Western-Yates State A No. 6 6-18S-28E Unit H	Active Oil	6253	3/24/60
173	J. B. Adamson Ramapo No. 2 31-17S-28E Unit L	Unknown	1996	8/1/55

ATTACHMENT VII-1

SALINITY OF FORMATION BRINES FROM HYDROCARBON-PRODUCING INTERVALS IN THE WOLFCAMP, CISCO, CANYON, AND STRAWN FORMATIONS

ATTACHMENT VII-1

SALINITY OF FORMATION BRINES
FROM HYDROCARBON-PRODUCING INTERVALS
IN THE WOLFCAMP, CISCO, CANYON, AND STRAWN FORMATIONS

FIELD	COUNTY	FORMATION	DEPOSITIONAL ENVIRONMENT	LITHOLOGY	DEPTH	BRINE SALINITY ppm
Allison Penn	Lea	Wolfcamp	shelf	limestone	9673	119447
Bagley Penn	Lea	Cisco	shelf	limestone	9001	67098
Bough Permo Penn	Lea	Wolfcamp	shelf	limestone	9615	109594
Cass Penn	Lea	Strawn	platform	limestone	7700	39374
Crossroads Penn	Lea	Cisco	shelf	limestone	9750	119909
Denton Wolfcamp	Lea	Wolfcamp	shelf	limestone	9395	103705
Eidson Penn	Lea	Wolfcamp	shelf	limestone	10705	90559
Kemnitz Wolfcamp	Lea	Cisco	shelf	limestone	10742	81382
King Penn	Lea	Canyon	shelf	limestone	10708	118521
King Wolfcamp	Lea	Cisco	shelf	limestone	10125	108410
Lazy J Penn	Lea	Cisco	shelf	limestone	9580	105741
Saunders Permo Penn	Lea	Cisco	shelf	limestone	9908	75728

Source: Meyer, 1966, Table 4.

ATTACHMENT VIII-1

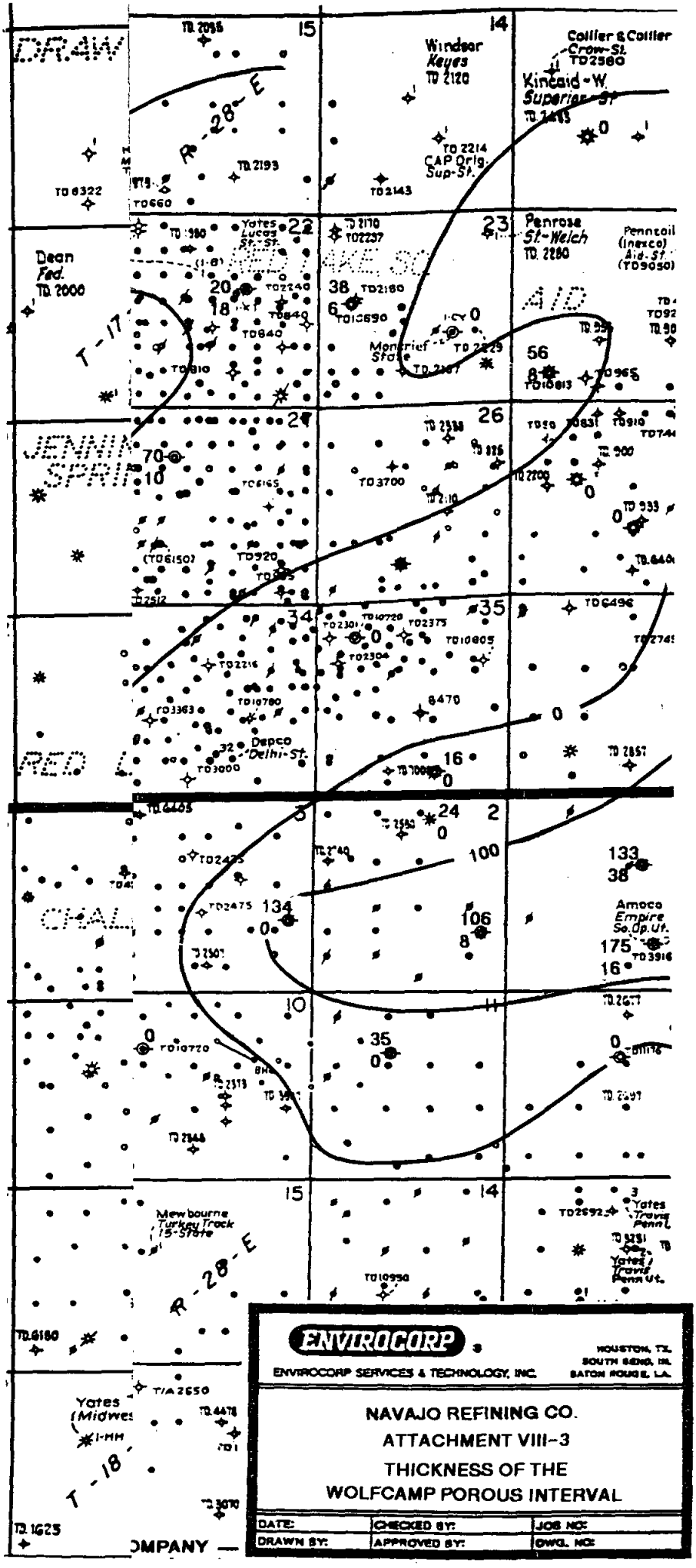
RESISTIVITY LOG OF THE PROPOSED INJECTION WELL

ATTACHMENT VIII-2

POROSITY LOG OF THE PROPOSED INJECTION WELL

ATTACHMENT VIII-3

THICKNESS OF THE WOLFCAMP POROUS INTERVAL



380 FEET WITH POROSITY OVER 5%
78 FEET WITH POROSITY OVER 10%

CONTOUR INTERVAL
100 FEET WITH POROSITY OVER 5%

ENVIROCORP

ENVIROCORP SERVICES & TECHNOLOGY, INC.

HOUSTON, TX.
SOUTH BEND, IN.
BATON ROUGE, LA.

NAVAJO REFINING CO.

ATTACHMENT VIII-3

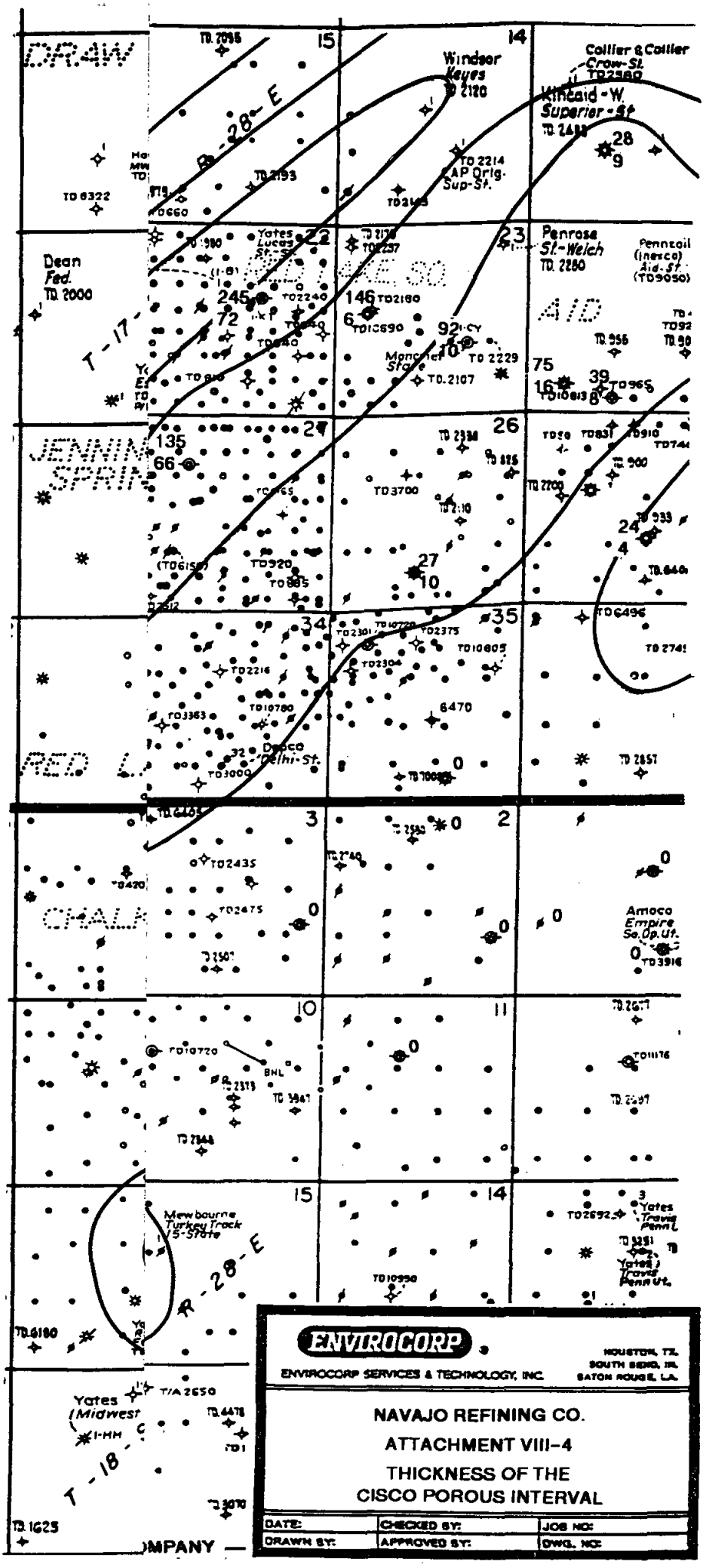
THICKNESS OF THE
WOLFCAMP POROUS INTERVAL

DATE:	CHECKED BY:	JOB NO:
DRAWN BY:	APPROVED BY:	DWG. NO:

OMPANY —

ATTACHMENT VIII-4

THICKNESS OF THE CISCO POROUS INTERVAL



380 FEET WITH POROSITY OVER 5%
78 FEET WITH POROSITY OVER 10%

CONTOUR INTERVAL
100 FEET WITH POROSITY OVER 5%

ENVIROCORP

ENVIROCORP SERVICES & TECHNOLOGY, INC.

HOUSTON, TX.
SOUTH BEND, IN.
BATON ROUGE, LA.

NAVAJO REFINING CO.

ATTACHMENT VIII-4

THICKNESS OF THE
CISCO POROUS INTERVAL

DATE:	CHECKED BY:	JOB NO:
DRAWN BY:	APPROVED BY:	DWG. NO:

ATTACHMENT VIII-5

PERMEABILITY, POROSITY, AND THICKNESS OF HYDROCARBON-PRODUCING INTERVALS IN THE WOLFCAMP, CISCO, AND CANYON FORMATIONS IN EDDY AND LEA COUNTIES

ATTACHMENT VIII-5

PERMEABILITY, POROSITY, AND THICKNESS OF HYDROCARBON-PRODUCING INTERVALS IN THE WOLFCAMP, CISCO, AND CANYON FORMATIONS IN SOUTHEASTERN NEW MEXICO

FIELD	COUNTY	DEPOSTIONAL PROVINCE*	LITHOLOGY	DEPTH feet	THICKNESS feet	POROSITY %	PERMEABILITY md
WOLFCAMP FORMATION							
Allison Penn	Lea	shelf	limestone	9673	17	9	200
Apache Springs Wolfcamp	Chaves	shelf	limestone	4929	7	8	1
Bagley East Wolfcamp	Lea	shelf	limestone	9994	17	8	1
Bluitt Wolfcamp	Roosevelt	shelf	limestone	8022	50	8	5
Bough Permo Penn	Lea	shelf	limestone	9615	20	13	30
Caudill Wolfcamp	Lea	shelf	limestone	10292	22	8	1
Chambers Wolfcamp	Lea	shelf	limestone	10581	34	6	36
Denton Wolfcamp	Lea	shelf	limestone	9395	53	10	13
Eidson Penn	Lea	shelf	limestone	10705	35	9	20
Jenkins Wolfcamp	Lea	shelf	limestone	9604	15	7	20
Mescalero Wolfcamp North	Lea	shelf	limestone	8350	15	9	13
Milnesand Penn	Roosevelt	shelf	limestone	9202	14	4	10
Prarie Penn South	Roosevelt	shelf	limestone	9653	7	4	194
Shell Henshaw 1	Eddy	transition	limestone	8500	10	6	17
Tatum Wolfcamp	Lea	shelf	limestone	10285	19	10	12
Townsand Wolfcamp	Lea	shelf	limestone	10410	36	8	38
CISCO FORMATION							
Anderson Ranch Penn East	Lea	shelf	limestone	10960	24	4	1
Anderson Ranch Wolfcamp	Lea	shelf	limestone	9664	50	10	114
Bagley Penn	Lea	shelf	limestone	9001	45	7	1
Bronco Wolfcamp	Lea	shelf	limestone	9600	25	13	45
Four Lakes Penn	Lea	shelf	limestone	10277	16	10	60
Kemnitz Wolfcamp	Lea	shelf	limestone	10742	32	9	9
Lane Penn	Lea	shelf	limestone	9802	18	3	9
Lane Wolfcamp	Lea	shelf	limestone	9648	13	11	100
Lazy J Penn	Lea	shelf	limestone	9580	20	6	8
Mescalero Permo Penn	Lea	shelf	limestone	8390	16	8	18
Ranger Lake Penn	Lea	shelf	limestone	10312	33	10	28
Saunders Permo Penn Sou	Lea	shelf	limestone	10587	22	8	1
Shell Henshaw 2	Eddy	transition	limestone	9124	18	7	20
Shell Henshaw 3	Eddy	transition	limestone	8711	30	7	2
CANYON FORMATION							
Kemnitz Cisco	Lea	shelf	dolomite	11446	30	8	16
King Penn	Lea	shelf	limestone	10708	25	4	38

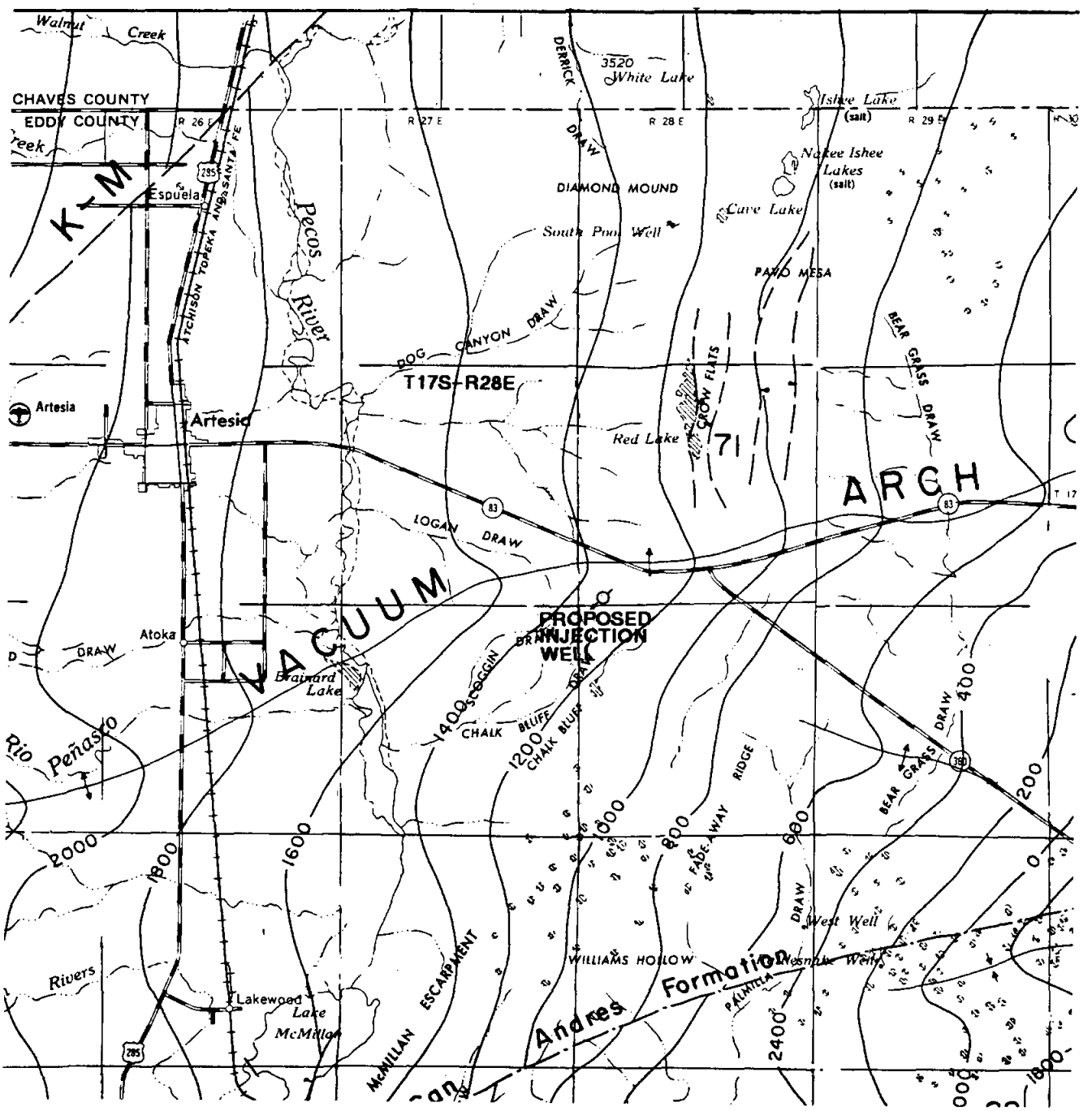
* "transition" denotes area between shelf and basin

Source: Meyer, 1966, Table 4.

NLN\c:\qpw\navajo\poroperm.wb1

ATTACHMENT VIII-6

STRUCTURE MAP OF THE TOP OF THE RIO BONITO MEMBER OF THE SAN ANDRES FORMATION



0 6 miles

SCALE

N

SOURCE: KELLEY, 1971, PLATE 5S

ENVIROCORP

ENVIROCORP SERVICES & TECHNOLOGY, INC.

HOUSTON, TX.
SOUTH BEND, IN.
BATON ROUGE, LA.

NAVAJO REFINING CO.

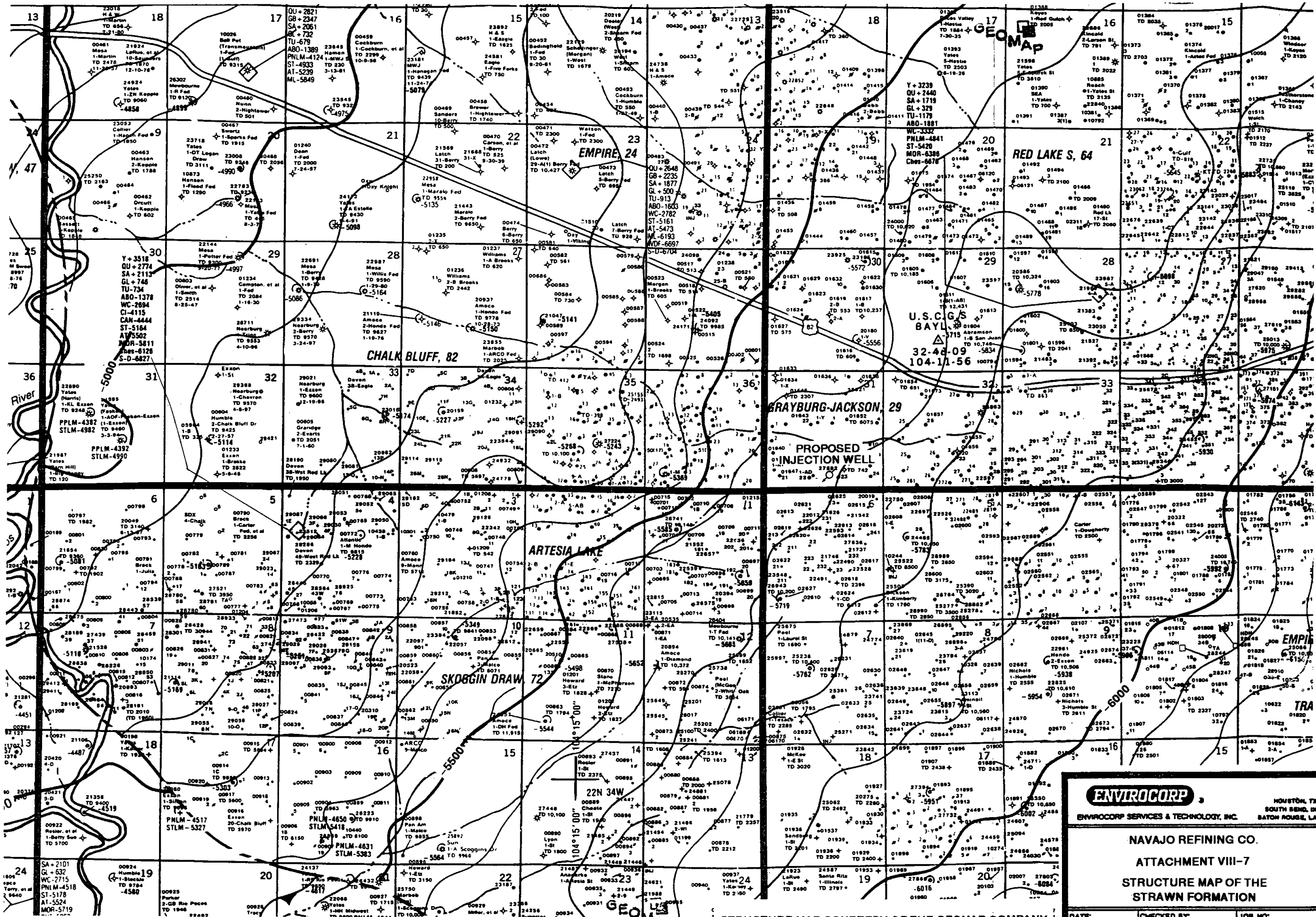
ATTACHMENT VIII-6

STRUCTURE OF THE RIO BONITO MEMBER OF THE SAN ANDRES FM.

DATE:	CHECKED BY:	JOB NO:
DRAWN BY:	APPROVED BY:	DWG. NO:

ATTACHMENT VIII-7

STRUCTURE MAP OF THE STRAWN FORMATION



STRUCTURE MAP COURTESY OF THE GEOMAP COMPANY
Posted July 1997

ENVIROCORP
ENVIROCORP SERVICES & TECHNOLOGY, INC.
HOUSTON, TX.
SOUTH BEND, IN.
BATON ROUGE, LA.

NAVAJO REFINING CO.

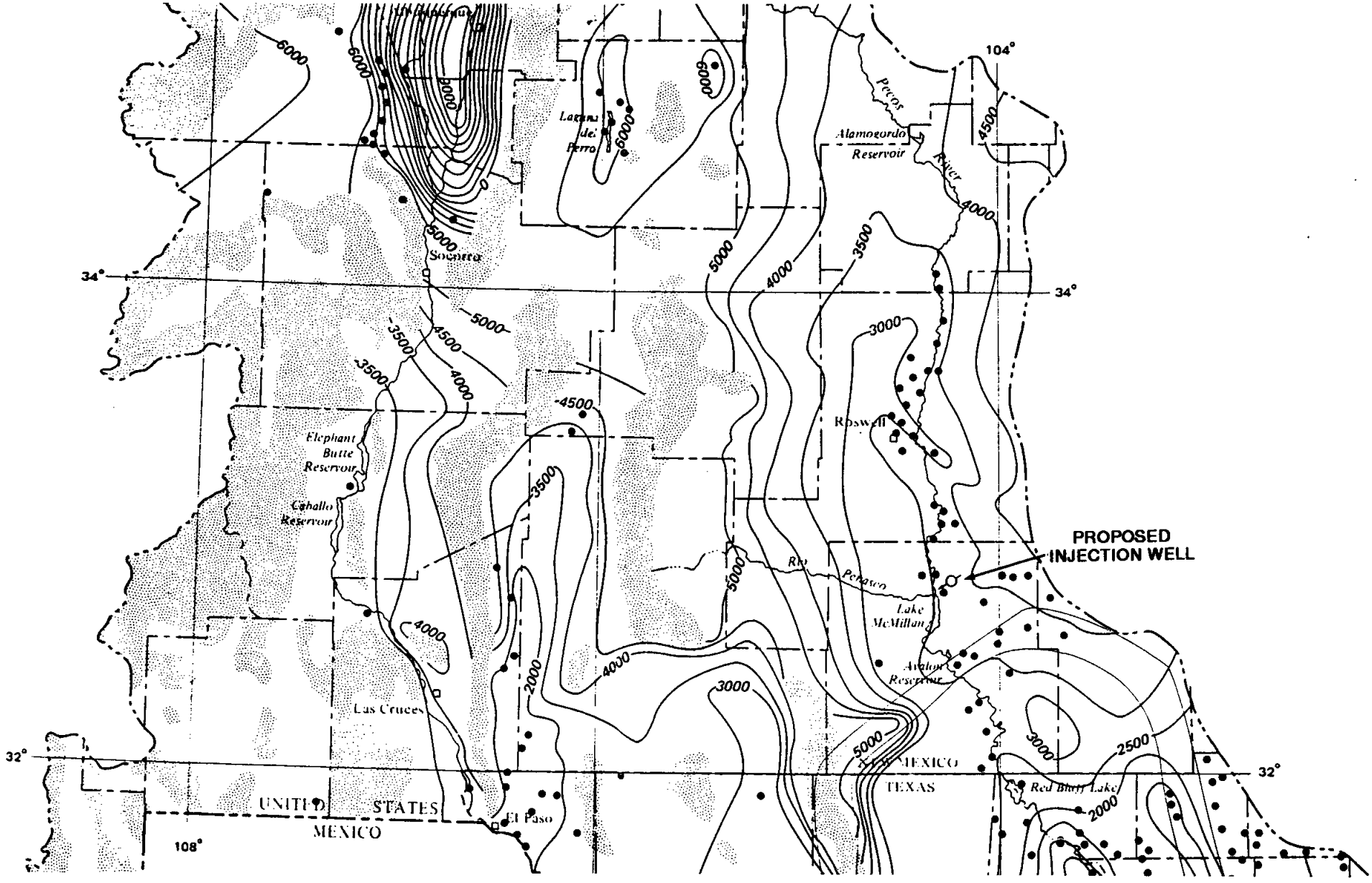
ATTACHMENT VIII-7

STRUCTURE MAP OF THE STRAWN FORMATION

DATE:	CHECKED BY:	JOB NO:
DRAWN BY:	APPROVED BY:	DWG. NO:

ATTACHMENT VIII-8

MAP SHOWING THE ALTITUDE OF THE 10-g/l ISOSALINE SURFACE



SCALE 1:2 500 000

50 0 50 100 150 MILES

50 0 50 100 150 KILOMETERS

MAP SHOWING ALTITUDE OF THE
10-GRAM PER LITER ISOSALINE SURFACE

Modified from Kelly, 1974, Sheet 3.

ATTACHMENT VIII–8

ATTACHMENT XI-1

FRESHWATER WELLS IN THE VICINITY OF THE PROPOSED INJECTION WELL (Table)

ATTACHMENT XI-1

FRESHWATER WELLS IN THE VICINITY OF THE PROPOSED INJECTION WELL

WATER WELL ID NO.	OWNER	PRINCIPAL WATER-BEARING BED		LIFT METHOD	USE OF WELL
		LITHOLOGY	FORMATION		
17.28.19.200	Hal Bogle	redbeds, gypsum	Chalk Bluff or Rustler	Windmill	Stock
17.28.22.230	Unknown	redbeds	Dockum	None	Abandoned stock well
18.28.7.330	Unknown	redbeds, gypsum, limestone?	Chalk Bluff or Rustler	Windmill	Stock
18.28.7.430*	Unknown	Unknown	Unknown	Windmill	Unknown
18.28.8.330**	Unknown	Unknown	Unknown	Windmill	Unknown

Source: Hendrickson and Jones (1952, Table 1).

* Attachment XI-2 and topographic map data.

** Topographic map data only.

ATTACHMENT XI-2

CHEMICAL ANALYSIS OF SAMPLES FROM THE WATER WELL IN SECTION 7, T18S, R28E

ATTACHMENT XI-2

WATER WELL ID NO. 18.28.7.430
WATER ANALYSES

STATE OF NEW MEXICO
STATE ENGINEER OFFICE
ROSWELL

THOMAS C. TURNEY
State Engineer

DISTRICT II
1900 West Second St.
Roswell, New Mexico 88201
(505) 622-6521

January 16, 1998

Nancy Nieman
Enviro Corp.
7020 Portwest, Ste. 100
Houston, Texas 77024

Greetings:

Enclosed is the information that you requested. Please call if you have any further questions. If you find a driller who has a well record, please send our office a copy.

Well is located in the NW¼NW¼SW¼NW¼SW¼SE¼ of Section 7, Township 18 South, Range 28 East, N.M.P.M.; 900 feet FSL, 2600 feet FEL.

DATE SAMPLED	CHLORIDES	TOTAL DISSOLVED SOLIDS
October 8, 1985	255	1535
November 20, 1988	280	2209
March 9, 1994	208	2010

The well is shown on 7 ½ minute topographic map as a windmill, on map named Red Lake, New Mexico.

Sincerely,

Sheldon Dorman
Water Resource Specialist

SD/tmi

ATTACHMENT XIII-1

LEASEHOLD OPERATORS WITHIN 1/2 MILE OF THE PROPOSED INJECTION WELL

ATTACHMENT XIII-1

LEASEHOLD OPERATORS WITHIN 1/2 MILE OF THE PROPOSED INJECTION WELL

Map ID Nos. 42, 48, 50, 51, 53, 55, 56, 60, 62, 79, 88, 89, 90, 91, 92, 93, 98, 101, 104, 105, 106, 110

ARCO Permian
A Unit of Atlantic Richfield Co.
P. O. Box 1710
Hobbs, NM 88240

Map ID No. 43

Baber Well Servicing Company
P. O. Box 1772
Hobbs, NM 88241

Map ID Nos. 45, 47, 61, 87

Kersey & Company
P. O. Box 316
Artesia, NM 88211-0316

Map ID Nos. 49, 54, 57, 100

Mack Energy Corporation
P. O. Box 276
Artesia, NM 88210

Map ID No. 44

Pronghorn Management Corporation
P. O. Box 1772
Hobbs, NM 88241

Map ID Nos. 58, 59, 99

P&A

Map ID No. 173

Leaseholder Unknown

Other Interested Party

Mewbourne Oil Company
Post Office Box 5270
Hobbs, New Mexico 88241

ATTACHMENT XIII-2

REGISTERED MAIL RECEIPTS

TELEPH...
(505) ...

EASYLINK
62905278

FAX
(505) 746-6410

... NEW MEXICO 88210

ACCOUNTS ... 505/748-3310 MARKETING ... 505/746-6155

... ENGINEERING: 505/748-9077 PIPELINE DIV... 505/746-4438

PLEASE DELIVER 3 PAGES, INCLUDING THIS COVER ...

TO: Ben Stone PHONE:

COMPANY/DEPARTMENT:

MESSAGE: Here are the notification certifications for Navajo's Class II UIC Permit. Call me if there are any questions.

FROM: D. Moore DATE: 3/10/98

If you do not receive all pages, please call ... at 505/748-.... ext. ...

An Independent Refinery Serving NEW MEXICO ○ ARIZONA ○ WEST TEXAS

ARCO Permian
Unit of Atlantic Richfield Co.
P.O. Box 1710
Hobbs, NM 88240

No Insurance Coverage Provided.
NM OCD
2040 South Pacheco
Santa Fe, NM 87505

Receipt for Certified Mail
No Insurance Coverage Provided.
Do not use for International Mail (See reverse)
Kersey & Company

Mail