1R - 279

GENERAL CORRESPONDENCE

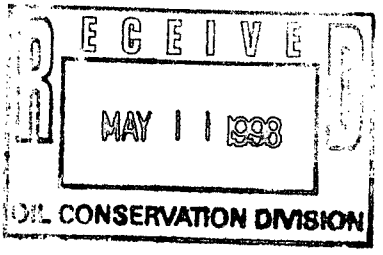
YEAR(S):

1998 - 1986

Highlander Environmental Corp.

Midland, Texas

May 8, 1998



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

Re: Groundwater Monitoring Report, Texaco Exploration and Production, Inc., Vacuum Field Unit, Buckeye, Lea County, New Mexico

Dear Mr. Olson,

On behalf of Texaco Exploration and Production, Inc. (Texaco), please find enclosed one copy of the above-referenced report. The report details the groundwater monitoring conducted by Highlander Environmental Corp. (Highlander) at the Vacuum Unit, Buckeye, New Mexico.

Please call if you have any questions.

Sincerely,
Highlander Environmental Corp.

Ike Tavarez
Project Manager/Geologist

cc: Mr. Rodney Bailey, Texaco Exploration and Production, Inc.
Mr. Robert Browning, Texaco Exploration and Production, Inc
Mr. Wayne Price, OCD-Hobbs District

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

HOBBS DISTRICT OFFICE

OIL CONSERVATION DIVISION
RECEIVED
'93 JUN 21 AM 10 31

BRUCE KING
GOVERNOR

June 17, 1993

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

Sage Energy Company
P. O. Drawer 3068
Midland, Texas 79702

Re: NVANU "14" #3-E, Sec 12, T17S, R34E

Gentlemen:

The Oil Conservation Division recently witnessed bradenhead test on the wells in your North Vacuum Abo North Unit.

The above referenced producing well failed to meet mechanical integrity standards, with the information available indicating a casing leak.

We request that you take immediate steps to locate and repair the problem.

We are enclosing a copy of the test sheet for your information.

We request 24 hours prior to the repair in order to witness the operation.

Very truly yours

OIL CONSERVATION DIVISION

Jerry Sexton
Supervisor, District I

JS:bp

cc: William J. LeMay
File

Enclosure

New Mexico DRUG FREE It's a State of Mind!

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION
HOBBS DISTRICT OFFICE

OIL CONSERVATION DIVISION
RECEIVED
'93 JUN 21 AM 10 33

June 16, 1993

BRUCE KING
GOVERNOR

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

Texaco Exploration & Production Inc.
P. O. Box 730
Hobbs, New Mexico 88241-0730

Re: Test Results on Wells in Vacuum Pools

Gentlemen:

The Oil Conservation Division recently witnessed annulus pressure and/or bradenhead tests on the active wells in the Vacuum area.

The following problems were noted:

The Central Vacuum Unit Well No. 25 located in Unit K of Section 25, Township 17 South, Range 34 East, was injecting at a pressure of 1050 psi. The approved pressure limit for this well is 907 psi. We request that you curtail the pressure to conform to the approved limits.

The Central Vacuum Unit Well No. 150 located in Unit B of Section 30, Township 17 South, Range 35 East, failed to demonstrate mechanical integrity, with the information indicating a possible tubing or packer leak.

The West Vacuum Unit Well No. 9 located in Unit A of Section 33, Township 17 South, Range 34 East, failed to meet mechanical integrity standards, with the information available indicating a possible casing leak.

As required by the EPA, we request that these 2 wells be shut in until such time as repairs are made and approved.

We are enclosing copies of the test sheets for your information.

We request 24 hours notice prior to repairs in order to witness the operation and the pressure test upon completion of repairs.

Very truly yours

OIL CONSERVATION DIVISION

Jerry Sexton
Supervisor, District I

JS:bp

cc: William J. LeMay
File

Enclosure

New Mexico DRUG FREE It's a State of Mind!

OIL CONSERVATION DIVISION
RECEIVED
'91 AUG 19 AM 9 44

TEXACO USA

August 13, 1991

NMOCD
P.O. Box 1980
Hobbs, NM 88240

Attn: Mr. Jerry Sexton

Dear Mr. Sexton:

Attached is the second quarter 1991 supplement to the original report.

Yours very truly,

Russell S. Pool
Vacuum Field Waterflow
Technicial Committee Chairman

Attachments

cc: Management Committee Members
Technical Committee Members
Geological-Geophysical Committee Members
(Address Lists Attached)

VACUUM FIELD

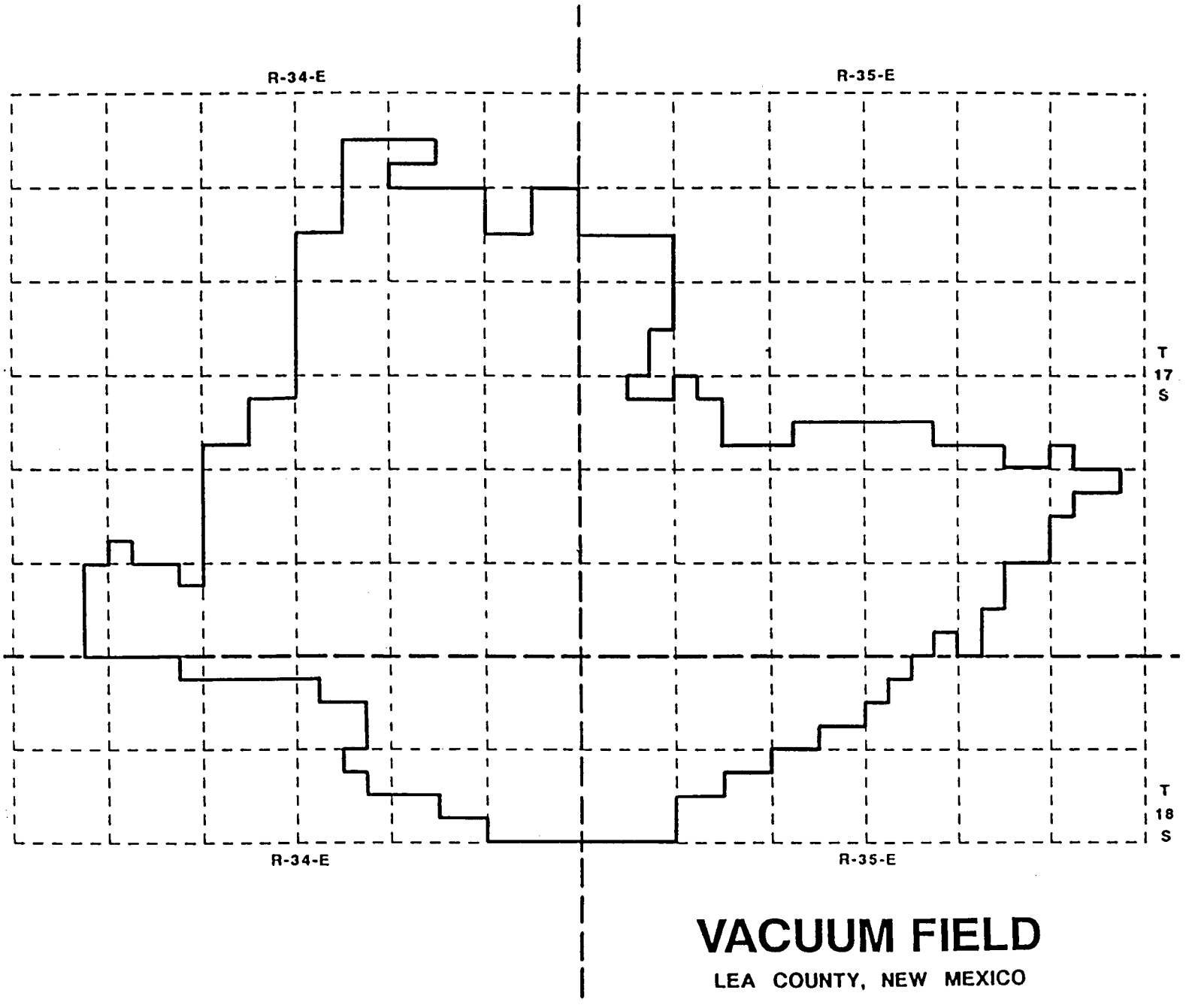
WATERFLOW

QUARTERLY

REPORT

VACUUM FIELD

WATERFLOW



VACUUM FIELD

LEA COUNTY, NEW MEXICO

Quarterly Report

VACUUM FIELD WATERFLOW TECHNICAL COMMITTEE QUARTERLY REPORT
SECOND QUARTER 1991

The Vacuum Field Waterflow Technical Committee has compiled the following summary for the second quarter of 1991. Companies actively participating in this work are Arco, Conoco, Marathon, Mobil, Phillips and Texaco.

Target wells evaluated by operator are as follows:

WELL SURVEYS - SECOND QUARTER 1991

OPERATOR	WELLS EXAMINED	FALLOFFS	STEP RATES	PROFILES TEMPERATURE	DECAY TEMPERATURE	TDT
ARCO	0	0	0	0	0	0
CONOCO	0	0	0	0	0	0
MARATHON	0	0	0	0	0	0
MOBIL	0	0	0	0	0	0
PHILLIPS	0	0	0	0	0	0
TEXACO	0	0	0	0	0	0

Pressure in the salt section is now being monitored by three wells.

Five production wells were drilled on Texaco acreage in the Vacuum Field in the second quarter of 1991. One well was plugged and abandoned in the New Mexico "AE" State lease.

Mobil is continuing to depressurize the San Andres formation underlying the Bridges State lease by backflowing the Bridges State Nos. 37, 56, 62, 64 and 167 WIW's. The total withdrawal rate for the 5 wells in June, 1991 was 638 BWPD. Mobil has temporarily discontinued water injection into the San Andres. Surface tubing pressure has dropped from 2350 in April to 1300 in June. During the second quarter, four wells in the Bridges State lease were plugged and abandoned.

The NVAW #304 water supply well was drilled on Mobil acreage in the Vacuum Field in the second quarter of 1991.

VACUUM FIELD FRESH WATER WELLS

LEA COUNTY, NEW MEXICO

CHLORIDE CONTENT (PPM)

I.D.	WELL DESCRIPTION	1989 FIRST QUARTER	1989 SECOND QUARTER	1989 THIRD QUARTER	1989 FOURTH QUARTER	1990 FIRST QUARTER	1990 SECOND QUARTER	1990 THIRD QUARTER	1990 FOURTH QUARTER	1991 FIRST QUARTER	1991 SECOND QUARTER
1	TEXACO VGSAU SUPPLY WELL NO.1		196	213	270	244	260	120	302	296	220
2	TEXACO VGSAU SUPPLY WELL NO.2									82	*
3	TEXACO VGSAU SUPPLY WELL NO.3									*	*
4	TEXACO VGSAU SUPPLY WELL NO.4	320	44	35	36	40	40	36	35	44	50
5	TEXACO CVU SUPPLY WELL NO.1	840	544		404		210	477	639	500	460
6	TEXACO CVU SUPPLY WELL NO.2	200	192	99	32	150	160	140	99	55	98
7	TEXACO CVU SUPPLY WELL NO.3	360	114	1598	2000	SI	1630	62		*	*
8	TEXACO BUCKEYE OFFICE WELL	166	122	124	108	112	120	104	94	88	94
9	TEXACO GAS PLANT WATER WELL	400	116	102	112	108	115	90		134	110
10	BUCKEYE STORE WATER WELL	72	52	38	36	36	50	110	33	44	55
11	FORKLIFT ENT. BUCKEYE STATION									1500	2100
12	RANCH WINDMILL	84		34	40	30	20	10	34	28	30
13	RANCH WINDMILL	66	36	37	32	48	54	30	31	34	30
14	N. M. POTASH CORP. WELL NO.1	136		101	108	100	100	166	155	134	114
15	N. M. POTASH CORP. WELL NO.5	92	88	78	88	82	95	47	67	96	105
16	N. M. POTASH CORP. WELL NO.6									*	*
17	N. M. POTASH CORP. WELL NO.7	58	48	55	42			29		*	*
18	N. M. POTASH CORP. WELL NO.8	312	286	277	290	290	250		275	268	190
19	AMAX WATER WELL	120	100	72						*	*
20	WESTERN AG MINERALS WELL NO.1	82	78	62	76	80	85	25	70	76	90
21	WESTERN AG MINERALS WELL NO.4	58	42	37	40	40	55	25	31	28	35
22	WESTERN AG MINERALS WELL NO.5	90		27	88	92	105	30	81	80	80
23	WESTERN AG MINERALS WELL NO.6		48		48	40	45	27	43	42	40
24	WESTERN AG MINERALS WELL NO.7	70			34	32	55	28	31	36	40
25	NATL. POTASH WATERWELL NO.7									*	*
26	NATL. POTASH WATERWELL NO.2									*	*
27	RANCH WINDMILLA	40	40	60	80	35	31	32	120	41	54
28	WESTERN AG MINERALS WELL NO.9	66	68	70	110	60	64	60	68	60	69
29	NVAU NO.100	164	166	180	230	169	150	151	150	156	166
30	NVAU NO.101	144	140	140	180	122	125	138	180	140	129
31	BRIDGES STATE NO. 179	54	44	60	90	41	45	43	43	43	55
32	BRIDGES STATE NO. 94	84	88	85	190	80	88	90	90	90	90
33	RANCH WINDMILL	40	38	40	130	31	32	30	36	31	39
34	AMAX NO. 7	60	58	70	120	59	56	56	68	58	*
35	AMAX NO. 6	60	62	60	90	55	61	53	58	59	76
36	MOBIL OFFICE WATER WELL	50	50	60	110	60	45	42	42	40	49
37	N.M. POTASH WATER WELL NO. 9	40	44	49	90	60	65	56	84	62	69
38	NO NAME NO PUMP									*	*
39	RANCH WINDMILL	40	36	40	28	39	37	40	42	31	42
40	NO NAME NO PUMP									*	*
41	RANCH WINDMILL									*	*

* INACTIVE

VACUUM FIELD FRESH WATER WELLS

LEA COUNTY, NEW MEXICO

CHLORIDE CONTENT (PPM)

I.D.	WELL DESCRIPTION	1989 FIRST QUARTER	1989 SECOND QUARTER	1989 THIRD QUARTER	1989 FOURTH QUARTER	1990 FIRST QUARTER	1990 SECOND QUARTER	1990 THIRD QUARTER	1990 FOURTH QUARTER	1991 FIRST QUARTER	1991 SECOND QUARTER
42	RANCH WELL									*	*
43	RANCH WELL									*	*
44	RANCH WELL									*	*
45	LEE PLANT SUPPLY WELL NO. 1	62	30	60	60		74	78	80	86	74
46	LEE PLANT SUPPLY WELL NO. 2									*	*
47	LEE PLANT SUPPLY WELL NO. 3	200	206	168	200	160				240	180
48	LEE PLANT SUPPLY WELL NO. 4		117				240	136		*	90
49	LEE PLANT MONITOR WELL NO. 1									*	*
50	LEE PLANT MONITOR WELL NO. 2									*	*
51	LEE PLANT MONITOR WELL NO. 3									*	*
52	LEE PLANT MONITOR WELL NO. 4									*	*
53	HALE MABLE SUPPLY WELL NO. SO-1	44	22	34	34	44	30	36	35	36	36
54	HALE MABLE SUPPLY WELL NO. SO-2	80	47	66	72	56	64	72	62	72	60
55	RANCH WINDMILL						30	34	30	38	34
56	RANCH WINDMILL						24	25	25	32	30
57	EVGSAU SUPPLY WELL NO. 2721-S04	64	32	60	52	40	48	54	45	58	56
58	EVGSAU SUPPLY WELL NO. 2941-S05									*	*
59	EVGSAU SUPPLY WELL NO. 3366-S06	76	58	64	74	50	52	54	59	56	54
60	EVGSAU SUPPLY WELL NO. 3202-S07	60	30	64	44	48	38	48	40	50	50
61	EVGSAU SUPPLY WELL NO. 2060-S01	60	46	44	40	42	50	50	54	74	58
62	EVGSAU SUPPLY WELL NO. 2865-S02	64	56	60	44	38	22	44	43	46	68
63	MOBIL SUPPLY WELL NO. S08									*	*
64	MOBIL SUPPLY WELL NO. S09									*	*
65	RANCH WINDMILL	44	38	48		40	58	39	59	76	74
66	RANCH WINDMILL									*	*
67	RANCH WINDMILL	42	24		36	36	36	38	32	44	40
68	WATER WELL									*	*
69	CHEVRON DOGHOUSE	28	8	20	30	40	20	24	23	34	30
70	EXXON DOGHOUSE									*	*
71	RANCH WINDMILL	18	20	11	14		13		20	24	23
72	STATE OBSERVATION WELL NO. 1	57	57							*	*
73	STATE OBSERVATION WELL NO. 4									*	*
74	STATE OBSERVATION WELL NO. 5	71	28							*	*
75	SW PUBLIC SERVICE WELL NO. 26			36		27	29	28	25	26	*
76	SW PUBLIC SERVICE WELL NO. 27			37		33	32	35	31	30	*
77	SW PUBLIC SERVICE WELL NO. 28	269	184	199	128	190	142	196	167	124	*
78	PHILLIPS MONITOR WELL #2	220		1420	753	482				*	*
79	PHILLIPS MONITOR WELL #4A	103		142	128	99	142	142		*	*
80	TEXACO RECOVERY WELL #1					69000	35000	29000	28000	24000	5200
81	TEXACO RECOVERY WELL #2					79000	25000	21000	21000	27000	2300
82	NVAW #304										39

* INACTIVE

SECOND QUARTER 1991

DRILLING ACTIVITY

VACUUM FIELD

LEA COUNTY, NEW MEXICO

			LEAK-OFF TEST RESULTS			
OPERATOR	WELL NAME	WELL LOCATION	SURFACE PRESSURE	BOTTOM HOLE PRESSURE	CASING DEPTH	ACTUAL TESTS TO LEAKOFF
TEXACO	NM 'L' ST #10	280' FNL & 2080' FEL, 1-18S-34E	1000	1612	1550	NO
TEXACO	NM 'L' ST #11	604' FNL & 856' FEL, 1-18S-34E	1000	1644	1550	NO
TEXACO	CVU #345	1310' FSL & 1850' FWL, 31-17S-35E	1000	1604	1550	NO
TEXACO	CVU #291	660' FSL & 1330' FWL, 36-17S-34E	1000	1583	1530	NO
TEXACO	CVU #290	670' FSL & 2630' FWL, 36-17S-34E	1000	1596	1550	NO

VACUUM FIELD MONITOR WELLS

QUARTERLY PRESSURE REPORT

OPERATOR	WELL NAME	WELL LOCATION	SURFACE PRESSURE (PSIG) 1990 FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER	SURFACE PRESSURE (PSIG) 1991 FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER
ARCO	COLE DARDEN HALE STATE #1	660' FNL, 660' FEL 31-17-34	-----	-----	-----	-----	-----	-----		
MOBIL	BRIDGES STATE #6	1980' FSL, 660' FWL 26-17-34	780	770	800	850	860	860		
TEXACO	CENTRAL VACUUM UNIT MONITOR WELL #1	960' FNL, 284' FWL 6-18-35	-----	-----	-----	-----	-----	-----		
	CENTRAL VACUUM UNIT WELL #91	660' FSL, 1980' FWL 36-17-34	875	900	900	800	900	800		
	STATE "P" WELL #1	1980' FSL, 1980' FEL 7-18-35	0	0	0	0	0	0		

TELEPHONE LIST

	OFFICE	HOME
ARCO		
1. S. D. Smith	505-392-3551	505-392-1175
2. J. A. Nicholson	915-688-5324	915-686-1809
3. H. W. Johnson	915-688-5411	915-685-4151
CONOCO		
1. Mike Colburn	505-397-5947	
2. Frank Patton	505-397-5890	
3. Michael Morrison	505-397-5800	
MOBIL		
1. Darrel Werley	505-393-3315	505-392-8287
2. Danny Phipps	505-393-3315	NA
3. Bob Pratt	915-524-1800	NA
PHILLIPS		
1. D. T. Thorp	505-397-5592	505-397-1662
2. S. H. Oden	505-397-8287	505-392-1159
3. R. M. Sulak	915-368-1650	915-520-3408
TEXACO		
1. P. W. Minchew	505-393-4031	505-392-5703
2. J. A. Head	505-393-7191	505-392-2961
3. R. S. Pool	505-393-7191	505-392-4642

VACUUM FIELD WATERFLOW
MANAGEMENT COMMITTEE

ARCO Oil & Gas Company
H. W. Johnson
P. O. Box 1610
Midland, Texas 79702

Conoco, Inc.
Jerry Hoover
10 Desta Drive West
Midland, Texas 79705

Mobil Exploration and Producing U.S. Inc
Guy Miller
P. O. Box 633
Midland, Texas 79702

Phillips Petroleum Company
Bill Mueller
4001 Penbrook
Odessa, Texas 79762

Texaco Exploration and Production Inc.
James Head
P. O. Box 730
Hobbs, New Mexico 88240

VACUUM FIELD WATERFLOW
TECHNICAL COMMITTEE

ARCO Oil and Gas Company
David Newell
P. O. Box 1610
Midland, Texas 79702

Conoco, Inc.
Jim Allen
10 Desta Drive West
Midland, Texas 79705

Marathon Oil Company
Robin Tracy
P. O. Box 552
Midland, Texas 79702

Mobil Exploration and Producing U.S. Inc.
Suzie Boyd
P. O. Box 633
Midland, Texas 79707

Phillips Petroleum Company
Susan Courtright
4001 Penbrook
Odessa, Texas 79762

Texaco Exploration and Production Inc.
Darlene de Aragao
Todd Lackey
Russell Pool
P. O. Box 730
Hobbs, New Mexico 88240

Texaco Exploration and Production Inc.
HRC (Brian Park)
George Kokolis
P. O. Box 770070
Houston, Texas 77215-0070

VACUUM FIELD WATERFLOW
GEOLOGICAL-GEOPHYSICAL COMMITTEE

ARCO Oil and Gas Company
David Entzinger
P. O. Box 1610
Midland, Texas 79702

Mobil Exploration and Producing U.S. Inc.
Dan Burnham
P. O. Box 633
Midland, Texas 79702

Phillips Petroleum Company
David White
4001 Penbrook
Odessa, Texas 79762

Texaco Exploration and Production Inc.
Julie Gibbs
P. O. Box 3109
Midland, Texas 79702

PHILLIPS PETROLEUM COMPANY
ODESSA, TEXAS 79762
4001 PENBROOK

EXPLORATION AND PRODUCTION GROUP
Permian Basin Region

February 3, 1989

RECEIVED
FEB - 8 1989
OIL CONSERVATION DIVISION
SANTA FE

Mr. William J. LeMay
NMOCD Director
P. O. Box 2088
Santa Fe, New Mexico 87504

Dear Mr. LeMay;

Enclosed please find the Vacuum Field Waterflow Committee's 1988 Technical Report and 1989 Contingency Plan. This report also includes the individual companies' 1988 activity summaries. Five (5) copies are enclosed for distribution to your staff.

Sincerely,

William J. Mueller, Chairman
Vacuum Field Waterflow
Management Committee

SGC:jj

Enclosures

cc: Mr. Jerry Sexton (5)
NMOCD Hobbs District Supervisor
P. O. Box 1980
Hobbs, New Mexico 88240

Texaco USA

PO Box 728
Hobbs NM 88240
505 393 7191

RECEIVED
AUG 18 1988
OIL CONSERVATION DIVISION

August 17, 1988

Mr. William J. Lemay, Director
New Mexico Oil Conservation Division
P. O. Box 2088
Santa Fe, New Mexico 87504-2088

Dear Mr. Lemay,

Attached is the second quarter report for addition to the original.

Yours very truly,

David C. Cain

David C. Cain
Chairman Vacuum Field
Waterflow Technical Committee

DCC/tlc

Attachments

cc: Attached List

VACUUM FIELD WATERFLOW TECHNICAL COMMITTEE QUARTERLY REPORT

SECOND QUARTER 1988

The Vacuum Field Waterflow Technical Committee's summary of the second quarter, 1988 follows. Companies actively participating in the work include Arco, Mobil, Phillips and Texaco.

Chloride analysis have been compiled on all active fresh water wells. There have been no significant changes from the wells tested since the last quarter of 1987.

Target wells examined by operator are as follows:

WELL SURVEYS SECOND QUARTER 1988

OPERATOR	WELLS EXAMINED	FALLOFFS	PROFILES TEMPERATURE	DECAY TEMPERATURE	TDT
Arco	0	0	0	0	0
Mobil	0	0	0	0	0
Phillips	0	0	0	0	0
Texaco	13	13	0	0	0

Presently five wells monitor pressure in the salt section. There have been no significant changes in pressure in any of the monitor wells.

Quarterly drilling activity included six wells. None of these wells encountered a waterflow from the salt section.

VACUUM FIELD FRESH WATER WELLS

LEA COUNTY, NEW MEXICO

CHLORIDE CONTENT (PPM)

I.D.	WELL DESCRIPTION	1987 FOURTH QUARTER	1988 FIRST QUARTER	1988 SECOND QUARTER	1988 THIRD QUARTER	1988 FOURTH QUARTER
1	TEXACO VGSAU SUPPLY WELL NO.1	173	156	156		
2	TEXACO VGSAU SUPPLY WELL NO.2					
3	TEXACO VGSAU SUPPLY WELL NO.3	145	153	170		
4	TEXACO VGSAU SUPPLY WELL NO.4	42	44	45		
5	TEXACO CVU SUPPLY WELL NO.1		554	280		
6	TEXACO CVU SUPPLY WELL NO.2	99	94	99		
7	TEXACO CVU SUPPLY WELL NO.3		87	79		
8	TEXACO BUCKEYE OFFICE WELL	183	186	139		
9	TEXACO GAS PLANT WATER WELL					
10	BUCKEYE STORE WATER WELL	71	70	57		
11	FORKLIFT ENT. BUCKEYE STATION					
12	RANCH WINDMILL	40	42	38		
13	RANCH WINDMILL	36	37	33		
14	N. M. POTASH CORP. WELL NO.1					
15	N. M. POTASH CORP. WELL NO.5	103				
16	N. M. POTASH CORP. WELL NO.6	47				
17	N. M. POTASH CORP. WELL NO.7	45				
18	N. M. POTASH CORP. WELL NO.8	277	277	291		
19	AMAX WATER WELL	83				
20	WESTERN AG MINERALS WELL NO.1	93				
21	WESTERN AG MINERALS WELL NO.4	48				
22	WESTERN AG MINERALS WELL NO.5					
23	WESTERN AG MINERALS WELL NO.6	51				
24	WESTERN AG MINERALS WELL NO.7	46				
25	NATL. POTASH WATERWELL NO.7	244				
26	NATL. POTASH WATERWELL NO.2					
27	RANCH WINDMILLA	59	60	40		
28	WESTERN AG MINERALS WELL NO.9	62	62	65		
29	NVAU NO.100	152	146	160		
30	NVAU NO.101	100	152	150		
31	BRIDGES STATE NO. 179	64	56	60		
32	BRIDGES STATE NO. 94	88	80	85		
33	RANCH WINDMILL	39	38	45		
34	AMAX NO. 7	57	64	62		
35	AMAX NO. 6	53	62	55		
36	MOBIL OFFICE WATER WELL	45	46	46		
37	N.M. POTASH WATER WELL NO. 9	47	42	42		
38	NO NAME NO PUMP					
39	RANCH WINDMILL	38	38	40		
40	NO NAME NO PUMP					
41	RANCH WINDMILL					
42	RANCH WELL					
43	RANCH WELL					

VACUUM FIELD FRESH WATER WELLS

LEA COUNTY, NEW MEXICO

CHLORIDE CONTENT (PPM)

I.D.	WELL DESCRIPTION	1987 FOURTH QUARTER	1988 FIRST QUARTER	1988 SECOND QUARTER	1988 THIRD QUARTER	1988 FOURTH QUARTER
44	RANCH WELL					
45	LEE PLANT SUPPLY WELL NO. 1	79	48			
46	LEE PLANT SUPPLY WELL NO. 2					
47	LEE PLANT SUPPLY WELL NO. 3	250				
48	LEE PLANT SUPPLY WELL NO. 4	190	156	170		
49	LEE PLANT MONITOR WELL NO. 1	113				
50	LEE PLANT MONITOR WELL NO. 2	248				
51	LEE PLANT MONITOR WELL NO. 3	85				
52	LEE PLANT MONITOR WELL NO. 4	99				
53	HALE MABLE SUPPLY WELL NO. SO-1	43	36	80		
54	HALE MABLE SUPPLY WELL NO. SO-2	71	76	90		
55	RANCH WINDMILL	47				
56	RANCH WINDMILL	38				
57	EVGSAU SUPPLY WELL NO. 2721-S04	115	40	50		
58	EVGSAU SUPPLY WELL NO. 2941-S05					
59	EVGSAU SUPPLY WELL NO. 3366-S06	59	42	37		
60	EVGSAU SUPPLY WELL NO. 3202-S07	59	28	32		
61	EVGSAU SUPPLY WELL NO. 2060-S01	78	40	46		
62	EVGSAU SUPPLY WELL NO. 2865-S02	61	36	80		
63	MOBIL SUPPLY WELL NO. S08					
64	MOBIL SUPPLY WELL NO. S09					
65	RANCH WINDMILL	54	36	90		
66	RANCH WINDMILL					
67	RANCH WINDMILL	42	20	50		
68	WATER WELL					
69	CHEVRON DOGHOUSE			70		
70	EXXON DOGHOUSE					
71	RANCH WINDMILL	27	18	20		

VACUUM FIELD MONITOR WELLS

QUARTERLY PRESSURE REPORT

OPERATOR	WELL NAME	WELL LOCATION	SURFACE PRESSURE (PSIG) 1988 FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER
ARCO	COLE DARDEN HALE STATE #1	660' FNL, 660' FEL 31-17-34	500	500		
MOBIL	BRIDGES STATE #6	1980' FSL, 660' FWL 26-17-34	800	825		
TEXACO	CENTRAL VACUUM UNIT MONITOR WELL #1	960' FNL, 284' FWL 6-18-35	860	850		
	CENTRAL VACUUM UNIT WELL #91	660' FSL, 1980' FWL 36-17-34	930	940		
	STATE "P" WELL #1	1980' FSL, 1980' FEL 7-18-35	0	0		

SECOND QUARTER 1988

DRILLING ACTIVITY

VACUUM FIELD

LEA COUNTY, NEW MEXICO

OPERATOR	WELL NAME	WELL LOCATION	LEAK-OFF TEST RESULTS SURFACE PRESSURE	BOTTOM HOLE PRESSURE	CASING DEPTH	ACTUAL TEST TO LEAKOFF
ARCO						
MOBIL						
PHILLIPS	EVGSAU 3202-018	2560' FNL, 680' FEL 32-17-35	2000	2809	1545	NO
	EVGSAU 3374-004	1950' FSL, 210' FWL 33-17-35	2000	2803	1534	NO
	EVGSAU 3229-012	2630' FSL, 569' FWL 32-17-35	2000	2802	1533	NO
	EVGSAU 3127-009	1175' FSL, 740' FEL 31-17-35	2000	2796	1521	NO
	PHILMEX 30	660' FSL, 1880' FWL 26-17-33	2000	2790	1510	NO
	PHILMEX 31	1980' FSL, 2105' FEL 26-17-33			1480	NO
TEXACO						

July, 1988

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MOBIL		
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2. A.J. Alcott	505-393-9186	505-392-5340
3. G.P. Dalton	915-688-2249	915-687-5247
PHILLIPS		
1. D.T. Thorp	505-397-5592	505-397-1662
2. D.J. Fisher	505-397-5539	505-397-2420
3. W.B. Berry	915-367-1204	915-368-7305
TEXACO		
1. A. Gernandt	505-393-4031	505-396-3429
2. J.A. Schaffer	505-393-7191	505-392-8387
3. J.E. King	505-393-7191	505-392-2585

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VACUUM FIELD WATERFLOW TECHNICAL COMMITTEE QUARTERLY REPORT

SECOND QUARTER 1988

The Vacuum Field Waterflow Technical Committee's summary of the second quarter, 1988 follows. Companies actively participating in the work include Arco, Mobil, Phillips and Texaco.

Chloride analysis have been compiled on all active fresh water wells. There have been no significant changes from the wells tested since the last quarter of 1987.

Target wells examined by operator are as follows:

WELL SURVEYS SECOND QUARTER 1988

OPERATOR	WELLS EXAMINED	FALLOFFS	PROFILES TEMPERATURE	DECAY TEMPERATURE	TDT
Arco	0	0	0	0	0
Mobil	0	0	0	0	0
Phillips	0	0	0	0	0
Texaco	13	13	0	0	0

Presently five wells monitor pressure in the salt section. There have been no significant changes in pressure in any of the monitor wells.

Quarterly drilling activity included six wells. None of these wells encountered a waterflow from the salt section.

VACUUM FIELD FRESH WATER WELLS

LEA COUNTY, NEW MEXICO

CHLORIDE CONTENT (PPM)

I.D.	WELL DESCRIPTION	1987 FOURTH QUARTER	1988 FIRST QUARTER	1988 SECOND QUARTER	1988 THIRD QUARTER	1988 FOURTH QUARTER
1	TEXACO VGSAU SUPPLY WELL NO.1	173	156	156		
2	TEXACO VGSAU SUPPLY WELL NO.2					
3	TEXACO VGSAU SUPPLY WELL NO.3	145	153	170		
4	TEXACO VGSAU SUPPLY WELL NO.4	42	44	45		
5	TEXACO CVU SUPPLY WELL NO.1		554	280		
6	TEXACO CVU SUPPLY WELL NO.2	99	94	99		
7	TEXACO CVU SUPPLY WELL NO.3		87	79		
8	TEXACO BUCKEYE OFFICE WELL	183	186	139		
9	TEXACO GAS PLANT WATER WELL					
10	BUCKEYE STORE WATER WELL	71	70	57		
11	FORKLIFT ENT. BUCKEYE STATION					
12	RANCH WINDMILL	40	42	38		
13	RANCH WINDMILL	36	37	33		
14	N. M. POTASH CORP. WELL NO.1					
15	N. M. POTASH CORP. WELL NO.5	103				
16	N. M. POTASH CORP. WELL NO.6	47				
17	N. M. POTASH CORP. WELL NO.7	45				
18	N. M. POTASH CORP. WELL NO.8	277	277	291		
19	AMAX WATER WELL	83				
20	WESTERN AG MINERALS WELL NO.1	93				
21	WESTERN AG MINERALS WELL NO.4	48				
22	WESTERN AG MINERALS WELL NO.5					
23	WESTERN AG MINERALS WELL NO.6	51				
24	WESTERN AG MINERALS WELL NO.7	46				
25	NATL. POTASH WATERWELL NO.7	244				
26	NATL. POTASH WATERWELL NO.2					
27	RANCH WINDMILLA	59	60	40		
28	WESTERN AG MINERALS WELL NO.9	62	62	65		
29	NVAU NO.100	152	146	160		
30	NVAU NO.101	100	152	150		
31	BRIDGES STATE NO. 179	64	56	60		
32	BRIDGES STATE NO. 94	88	80	85		
33	RANCH WINDMILL	39	38	45		
34	AMAX NO. 7	57	64	62		
35	AMAX NO. 6	53	62	55		
36	MOBIL OFFICE WATER WELL	45	46	46		
37	N.M. POTASH WATER WELL NO. 9	47	42	42		
38	NO NAME NO PUMP					
39	RANCH WINDMILL	38	38	40		
40	NO NAME NO PUMP					
41	RANCH WINDMILL					
42	RANCH WELL					
43	RANCH WELL					

VACUUM FIELD FRESH WATER WELLS

LEA COUNTY, NEW MEXICO

CHLORIDE CONTENT (PPM)

I.D.	WELL DESCRIPTION	1987 FOURTH QUARTER	1988 FIRST QUARTER	1988 SECOND QUARTER	1988 THIRD QUARTER	1988 FOURTH QUARTER
44	RANCH WELL					
45	LEE PLANT SUPPLY WELL NO. 1	79	48			
46	LEE PLANT SUPPLY WELL NO. 2					
47	LEE PLANT SUPPLY WELL NO. 3	250				
48	LEE PLANT SUPPLY WELL NO. 4	190	156	170		
49	LEE PLANT MONITOR WELL NO. 1	113				
50	LEE PLANT MONITOR WELL NO. 2	248				
51	LEE PLANT MONITOR WELL NO. 3	85				
52	LEE PLANT MONITOR WELL NO. 4	99				
53	HALE MABLE SUPPLY WELL NO. SO-1	43	36	80		
54	HALE MABLE SUPPLY WELL NO. SO-2	71	76	90		
55	RANCH WINDMILL	47				
56	RANCH WINDMILL	38				
57	EVGSAU SUPPLY WELL NO. 2721-S04	115	40	50		
58	EVGSAU SUPPLY WELL NO. 2941-S05					
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TEXACO	CENTRAL VACUUM UNIT MONITOR WELL #1	960' FNL, 284' FWL 6-18-35	860	850		
	CENTRAL VACUUM UNIT WELL #91	660' FSL, 1980' FWL 36-17-34	930	940		
	STATE "P" WELL #1	1980' FSL, 1980' FEL 7-18-35	0	0		

SECOND QUARTER 1988

DRILLING ACTIVITY

VACUUM FIELD

LEA COUNTY, NEW MEXICO

			LEAK-OFF TEST RESULTS			
OPERATOR	WELL NAME	WELL LOCATION	SURFACE PRESSURE	BOTTOM HOLE PRESSURE	CASING DEPTH	ACTUAL TEST TO LEAKOFF
ARCO						
MOBIL						
PHILLIPS	EVGSAU 3202-018	2560' FNL, 680' FEL 32-17-35	2000	2809	1545	NO
	EVGSAU 3374-004	1950' FSL, 210' FWL 33-17-35	2000	2803	1534	NO
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	PHILMEX 30	660' FSL, 1880' FWL 26-17-33	2000	2790	1510	NO
	PHILMEX 31	1980' FSL, 2105' FEL 26-17-33			1480	NO
TEXACO						

July, 1988

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VACUUM FIELD WATERFLOW COMMITTEES
MEETING WITH
NEW MEXICO OIL CONSERVATION DIVISION
TUESDAY, JANUARY 12, 1988
SANTA FE, NEW MEXICO

Time: 9:00 A.M. MST

Place: Oil Conservation Division Conference Room (No. 205)
State Land Office Building

AGENDA

1. Call to order - Bill Mueller, Phillips
2. Introductory Remarks - Bill Lemay and Jerry Sexton, NMOCD
3. Geological - Geophysical Committee's Report and Discussion - Bill Hermance, Mobil
4. Technical Committee's Report and Discussion - David Cain, Texaco
5. Individual Company Reports
   A. Arco
   B. Mobil
   C. Phillips
   D. Texaco
6. Contingency Plan for Subsurface Environment Protection - Bill Mueller
7. Discussion and Comments
8. Closing - Bill Lemay

12 JANUARY 88

NEW MEXICO OIL CONSERVATION DIVISION MEETING

NAME	COMPANY
BILL MUELLER	PHILLIPS PETROLEUM COMPANY
ARLENE POLLIN	PHILLIPS PETROLEUM COMPANY
R Danny Campbell	ARCO
Jim Nicholson	ARCO
DAVID McGEE	ARCO
John Schuller	Texaco
David Cain	Texaco
George Kokolis	Texaco
PAT McCELVEY	STANDARD OIL
T. L. Hill	MOBIL Expl. + Prod. Inc USA Midland Tx.
W. Perry Pearce	Mobil Expl. & Prod. US Santa Fe
MATTHEW SWEENEY	MOBIL MIDLAND TX
JAMI BAILEY	OCD
DAVID A. HOWELL	Mobil, Hobbs N.M
LOUIS F. MARCZYNSKI	MOBIL, MIDLAND
C. JACK HAMNER	Mobil, Midland
W. E. Hermance	Mobil, Midland
V. T. LYON	OCD

VACUUM FIELD SALT WATER FLOW
GEOLOGICAL COMMITTEE
1987 REPORT

The Vacuum Field Salt Water Flow Geological Committee has, to date, completed the geological description and characterization of the evaporite section across the field. The overlying red beds have also been described. The following is a review of the critical aspects of the Committee's study.

MAPPING

Structure maps have been completed on the Top Rustler, Top Salt, Top Cowden Anhydrite, and on the Base Salt. An Isopach of the "Salt" has also been generated. Each of these markers is continuous across the field, and can be picked on the 600 logs used as a data base .

GEOLOGY

The entire section of interest was cored in a cooperative effort at the Mobil Bridges State #507, sec. 26, T17S, R34E. A total of 1424 feet of core from the interval 1253-2677 feet was taken with 100% recovery. The formations cored included the Triassic Dockum Group, Permian Dewey Lake, Rustler, Salado, and the top of the Tansil.

The core was described in detail by the Geological Committee during April of this year. Since that time the Committee has completed the correlation of the core description to the open hole logs of the interval. This combined data set was then used as a base log for the entire field.

DISCUSSION

The detailed description of the Bridges State #507 core, and the correlation of that well data across the field has provided a clear understanding of how fluid flow through the evaporite section has been facilitated.

All wells with known waterflow encounters at known depths were tied to the logs of the Bridges State #507. A total of 48 discrete flows from different wells were correlated to, and plotted on the 507 logs. In every case individual flows can be related to distinct horizons within the Salado. Geologically, fluid flow would be facilitated along horizontal underclay/evaporite weaknesses such as those provided at clastic-evaporite interfaces. In the Salado, these evaporites include halite, anhydrite, polyhalite, and other minor salts. All of the flows identified to date in Vacuum Field can be correlated or assigned to one of these interfaces. None of the flows originates from within a thick halite unit.

If fluid flow were to occur along planes within the Salado, then we should find flows from several wells occurring at the same level. The log correlations discussed above show this to be the situation in the field. Indeed,

several planes yielded flows in several different wells.

Once fluid reaches the evaporite section, movement of the fluid into the section and flow of the fluid in and along the type of horizons discussed above can be facilitated by both chemical dissolution of bounding salts and horizontal mechanical fracturing. This type of fluid movement enables large volumes of fluid to be transported over large areas. This process will also result in large volumes being stored without the formation of large vertical solution cavities. As an example; a total combined parting of 1 foot divided between several flow zones will provide storage for 4.96 million barrels of water over 640 acres.

This flow and storage scenario is supported by field experience. None of the wells which have encountered flows have experienced bit drops, and the frequency with which flows are encountered at the crest of the structure indicates that pressured fluid is not being stored in a randomly distributed cavern and pipe system.

Waterflow zones (underclays) can be correlated from well to well across the field. These correlations are most reliable when modern log suites are used. Figure 1 is a structural cross section which illustrates how these zones can be traced across the field. The seven flow zone examples on the section have all produced flows from wells in this line of section, as well as from other wells in the field. It is apparent that the structural configuration of these flow zones is the same as the Permian structure seen in the 1986 mapping. The structure of the field, combined with the fluid flow mechanism outlined above has resulted in the highest concentration of waterflows occurring at the crest of the structure.

Porosity and permeability data were obtained from four of the red bed sands cored in the 507;

Depth	Kmd	Porosity %
1264	88	12.8
1311	103	22.5
1340	247	24.0
1396	34	18.6

This data clearly indicates that there are many sands above the Dewey Lake which have sufficient porosity and permeability to act as a reservoir should they come in contact with pressured water. In the unlikely event that fluid were to escape the evaporite section, it would have to

bypass more than 1000 feet of clastics with fluid bearing capacity before it could possibly endanger fresh water aquifers. Additionally, the existence of swelling and sloughing clays interbedded in these sands often causes drilling problems, and it can be expected that these clays and sand might act in a similar manner to seal any vertical channels capable of carrying fluid upward from the evaporite section.

All of the above scenarios would first require water from the evaporite section to either fracture or bypass the massive anhydrites within the Rustler. To understand the mechanical behavior of the anhydrites, preliminary rock property data was obtained from four samples (table 1). This data is currently being studied to determine the exact pressure required to fracture the Rustler anhydrite, and what the resultant fracture pattern might be. Recent leak-off tests within the Rustler anhydrite, below casing shoes in newly drilled wells indicate no leakage at surface pressures of 1000 psi.

ULTRASONIC VELOCITY AND DYNAMIC MODULI AS A FUNCTION OF PRESSURE

SAMPLE I.D.	PNET (psi)	COMP.VEL. (ft./s)	SHEAR VEL. (ft./s)	POISSON'S RATIO	SHEAR MOD. (1E6 psi)	BULK MOD. (1E6 psi)	YOUNG'S MOD. (1E6 psi)
5V	1000	20320	10672	0.30954	4.38810	10.0570	11.4928
6V	1000	20780	10604	0.32396	4.30150	10.7839	11.3901
7V	1000	20014	10180	0.32551	4.00630	10.1448	10.6208
8V	1000	19795	10052	0.32626	3.93338	10.0096	10.4344

VACUUM FIELD SALT WATER FLOW
GEOLOGICAL COMMITTEE
1987 REPORT

CONCLUSIONS

The following are the Geological Committee's conclusions based upon the work completed to date.

1. Fluid flow within the evaporite section in the Vacuum field area occurs along underclays within the evaporite section. These underclays can be identified on modern open-hole logs.

2. Large volumes of fluid can be stored in and along underclays and underclay-evaporite interfaces without the formation of large vertical solution cavities.

3. Fluid movement along flow zones will be towards the crest of the structure at that level. Fluid will migrate up structure where the largest volumes may be stored. This appears to be the situation in Vacuum field.

4. Dissolution of the more soluble evaporite minerals will occur on the largest scale as the fluid initially enters the evaporite section. The fluid stored in the bedding planes will be saturated with respect to "salt".

5. The Rustler anhydrite should act as a cap to the evaporite section. The anhydrite will provide mechanical strength. Neither the core nor the logs show any evidence of fracturing within the anhydrite, thus the anhydrite may serve as an effective vertical permeability barrier to fluids under pressures currently exhibited in the evaporite section.

6. The extensive red bed sequences of the Dewey Lake and Dockum Group will provide further protection for the fresh water system in the area. These red beds have an abundance of clays which swell and slough when in contact with water. Additionally, the core has shown several permeable sands within the red bed section which would serve as reservoir rock for vertically moving, pressured water.

The Geologic Committee acknowledges the seriousness of the waterflow situation in Vacuum field and will continue to work with the Technical Committee as needed. The work completed to date places solid geological constraints upon waterflow occurrences within the field. Remaining to be defined is the specific source or sources for delivery of pressured fluid to the evaporite section, and it seems apparent that the vertical weaknesses which can act to deliver this fluid are not functions of geology.

Vacuum Field Waterflow

1987 Activity and Status Report
ARCO Oil and Gas Company
December 15, 1987

ARCO's involvement in addressing the Vacuum waterflow problem is primarily as a nonoperating working interest owner. However, ARCO does operate the State Vacuum Unit and the Sinclair Vacuum salt water disposal well. The State Vacuum Unit is a small 800 acre waterflood on the western edge of the field and the Sinclair disposal well is on the southern edge. ARCO has operated a monitor well, the Cole Darden Hale State #1, on the State Vacuum Unit since 1977. The monitoring well has not encountered significant water flows or pressure changes in the evaporite section during this period. ARCO continues to implement the field testing program to verify the integrity of our injectors on the State Vacuum Unit. During 1987, ARCO performed five radioactive tracer/temperature surveys and two falloff tests. A summary of these tests is shown in Figure 1, well locations are shown in Figure 2, and the falloff data from each test is attached.

ARCO ceased injection into the State Vacuum Unit No. 1 and No. 2, two offset injectors to our monitor well, on August 4, 1987 at the request of Jerry Sexton of the NMOCD (see attached letter dated August 3, 1987). The Cole Darden Hale State #1 will be monitored for one year with the offset injectors shut-in. If no change is seen in the Hale State #1 well, ARCO plans to request approval to plug and abandon the Hale State #1. ARCO is convinced that the Hale State #1 is open in more than just the evaporite section and is therefore not an acceptable monitoring well.

ARCO Oil and Gas Company fully supports the work of the Vacuum Waterflow Committees in their efforts to solve the waterflow problem. ARCO will also continue to implement the field testing program in 1988 to verify the integrity of the injectors in the State Vacuum Unit.

Figure 1

Vacuum Field Waterflow
ARCO's 1987 Activity Report

Sinclair Salt Water Disposal Well - Current Injection Pressure (11/87) 1850 psi

State Vacuum Unit

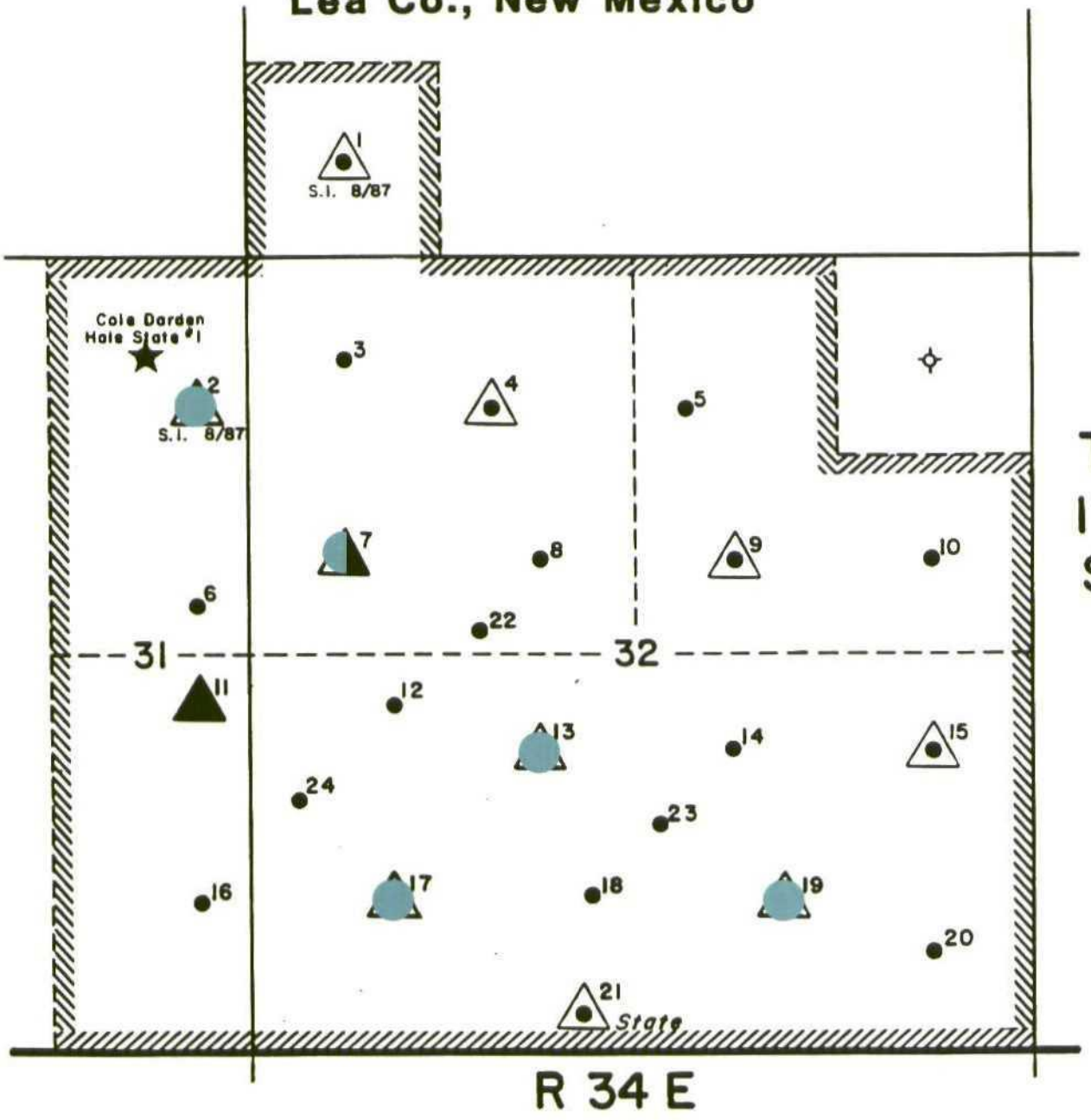
Well No.	Injection Pressure 11/87	Falloff Test	Tracer Survey
#1	SI 8/87 0 psi SITP		
#2	SI 8/87 30 psi SITP		2/23/87
#4	1150 psi		
#7	1150 psi	2/3/87	2/24/87
#9	1150 psi		
#11	1150 psi	1/29/87	
#13	1150 psi		2/26/87
#15	1150 psi		
#17	1150 psi		3/02/87
#19	1150 psi		3/03/87
#21	1150 psi		

Cole Darden Hale State No. 1 (Monitor Well) - Current Pressure (11/87) 460 psi

Figure 2

STATE VACUUM UNIT

Lea Co., New Mexico



1987 ACTIVITY

Tracer Survey

Falloff Test

ARCO Oil and Gas Company
Permian District - West Area
P.O. Box 1710
Hobbs, New Mexico 88240
Telephone 505 392 3551

August 3, 1987

Mr. Jerry Sexton
New Mexico Oil Conservation Commission
P.O. Box 1980
Hobbs, New Mexico 88240

Re: Cole Darden Hale State #1
Vacuum Field Observation Well

Dear Mr. Sexton:

In response to our meeting July 29, 1987, concerning the Cole Darden Hale State #1 Vacuum field observation well, this letter is to confirm our intentions and plans.

Effective Tuesday, August 4, 1987, ARCO Oil and Gas Company will cease injection on the State Vacuum Unit injectors #1 and #2. We will begin flowing down the Sate Vacuum Unit wells #1 and #2 as soon as the facilities can be modified. We will also begin, on August 4, 1987, monitoring daily the wellhead pressure on the Cole Darden Hale State #1.

Based on our results from flowing back the State Vacuum Unit wells #1 and #2, we may at a future date place these wells on pump.

After monitoring the Cole Darden Hale State #1 for one year, we would appreciate your reevaluation of the need to maintain it as a monitor well and reconsider allowing the permanent plug and abandonment of the well.

As soon as the State Vacuum Unit facilities are modified to enable back flow of wells #1 and #2, we will notify your office by submitting the required sundry notices for change of status.

Respectfully,

Steven D. Smith

Steven D. Smith
Area Prod. Supt.

SDS:knc

cc: Dave Hartman - MIO 354

ARCO's
State Vacuum Unit
Fall-Off Test

Well No. 7

Test Date: 2/3/87
Rate: 215 BWPD
Last Shut-in: 120 Days
Perf's: 4671-4718'

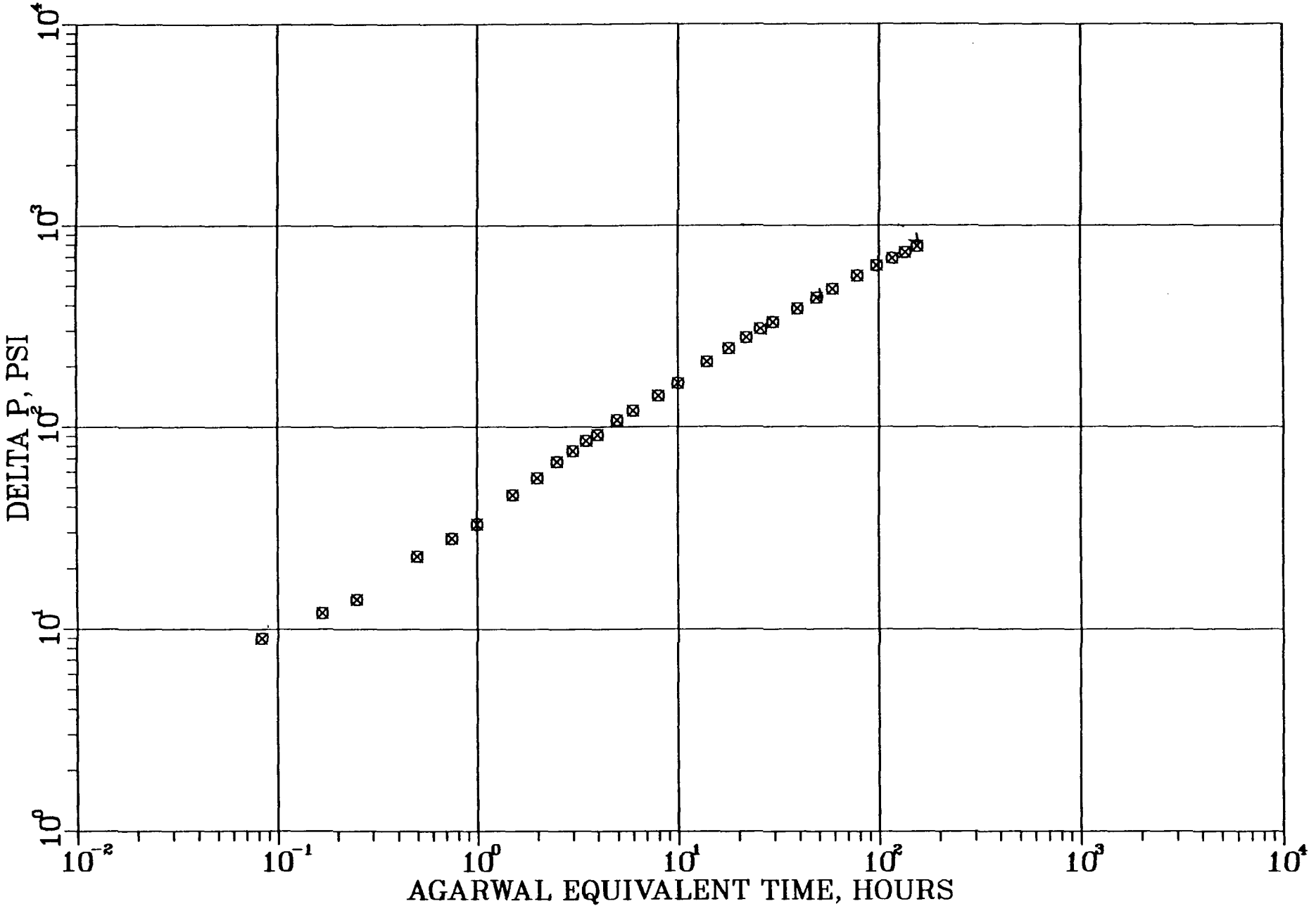
Time Hrs	Pressure @4382'
0	3463
0.083	3454.00
0.167	3451.00
0.250	3449.00
0.500	3440.00
0.750	3435.00
1.000	3430.00
1.500	3417.00
2.000	3407.00
2.500	3396.00
3.000	3387.00
3.500	3378.00
4.000	3372.00
5.000	3355.00
6.000	3343.00
8.000	3321.00
10.000	3298.00
14.000	3252.00
18.000	3217.00
22.000	3185.00
26.000	3157.00
30.000	3131.00
40.000	3077.00
50.000	3025.00
60.000	2980.00
80.000	2902.00
100.000	2832.00
120.000	2775.00
140.000	2724.00
162.000	2675.00

Well No. 11

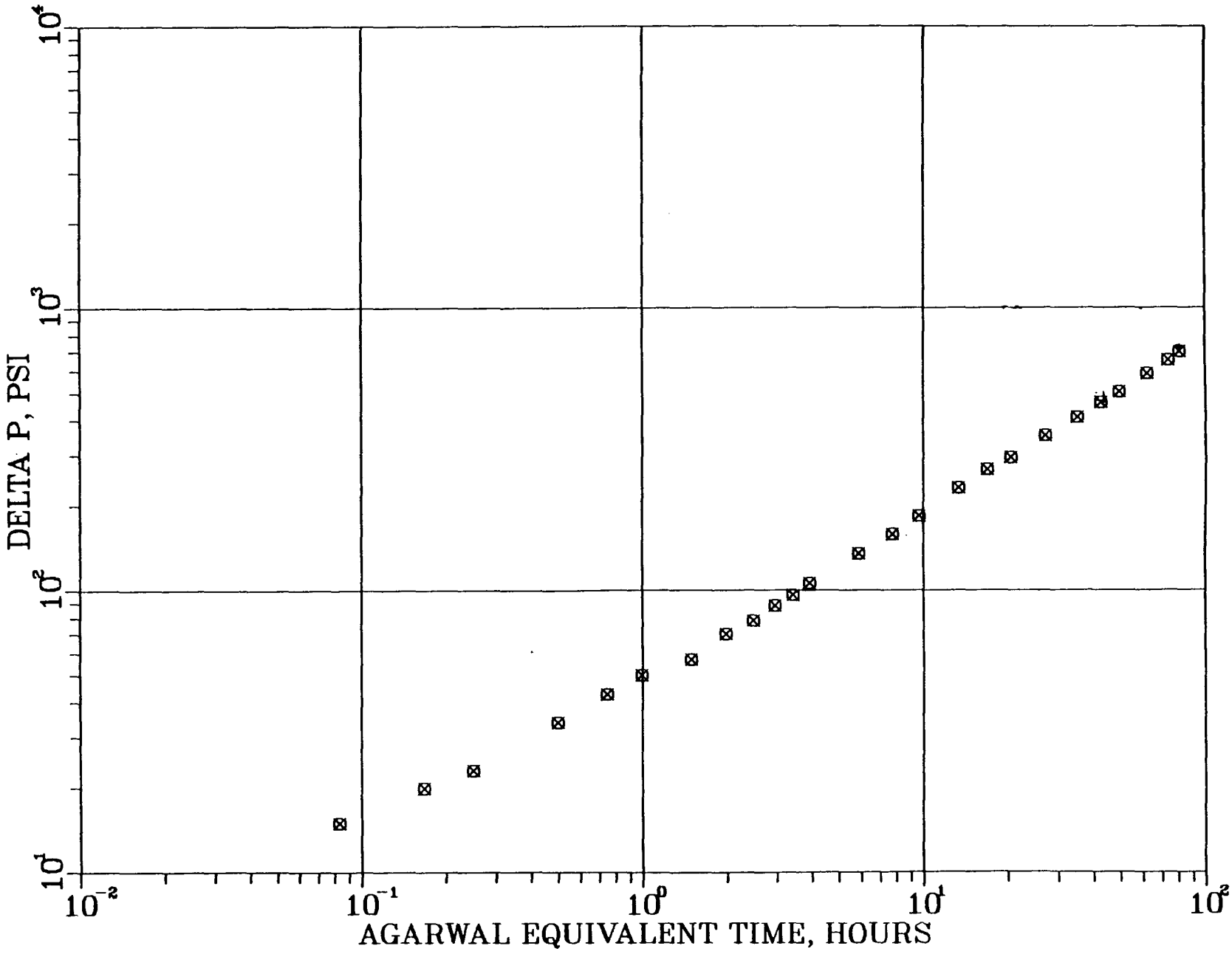
Test Date: 1/29/87
Rate: 270 BWPD
Last Shut-in: 12 Days
Perf's: 4693-4753'

Time Hrs	Pressure @4200'
0	3306
0.083	3291.00
0.167	3286.00
0.250	3283.00
0.500	3272.00
0.750	3263.00
1.000	3256.00
1.500	3249.00
2.000	3236.00
2.500	3228.00
3.000	3218.00
3.500	3210.00
4.000	3200.00
6.000	3171.00
8.000	3148.00
10.000	3123.00
14.000	3075.00
18.000	3039.00
22.000	3011.00
30.000	2954.00
40.000	2896.00
50.000	2844.00
60.000	2803.00
80.000	2719.00
100.000	2653.00
113.000	2607.00

STATE VACUUM # 7 2/3/87
RE83 LOG LOG PLOT



STATE VACUUM # 11 1/29/87
RE83 LOG LOG PLOT



Mobil Exploration and Producing U.S. Inc.

December 3, 1987

P.O. BOX 633
MIDLAND, TEXAS 79702

MIDLAND DIVISION

New Mexico Oil Conservation Division
P. O. Box 2088
Santa Fe, New Mexico

Attention: Mr. W. J. LeMay

STATUS AND FUTURE PLANS
VACUUM WATERFLOW STUDY
VACUUM FIELD
LEA COUNTY, NEW MEXICO

Dear Mr. LeMay:

In anticipation of the meeting on this subject on December 15th in Santa Fe, we wish to submit the following summary of Mobil's activities during the last year and its plans for the future. We plan to make a more detailed presentation in Santa Fe.

Accompanying this letter is a report by the Geological Committee. It is not entirely complete, as we are waiting on some data from Core Lab. The Committee plans to make a full report in Santa Fe.

I. WORK ACCOMPLISHED

Establishment of a Salado Formation Monitor Well: The San Andres interval in Mobil Bridges State #6 was isolated by a bridge plug. The well was perforated in the salt section (2240'-2300' and 2540'-2620'). Only a small flow was observed from the perforated intervals. The well was then equipped for continuous pressure monitoring (Attachments I & III).

The pressure monitored at the wellhead has remained constant at 800 psi since the initial completion in February, 1987. This indicates that the conditions in the salt section have not changed and that the continued injection in the offset wells has not influenced the pressure conditions in the salt section of this well.

Falloff Tests: A falloff test was run in Bridges State #43 in order to determine wellbore storage. Type-curve matching technique used to calculate the wellbore storage showed storage to be insignificant. Following this, pressure tests were run in an additional twenty wells. The pressure behavior in these wells paralleled that of Bridges State #43 and it was concluded that the wells tested had no significant wellbore storage. Presence of any solution cavities in communication with the tested wellbores was thus ruled out (Attachment I).

Tracer-Temperature Surveys: Radioactive tracer and temperature logs in combination were run in 14 San Andres and 20 Abo water injection wells. None of the 34 wells (Attachments I & II), showed evidence of injection out of the intended zone.

Core Study: Core study of the evaporite section in the Mobil Bridges State #507 correlated with the waterflow intervals observed in the field by Texaco and Phillips indicates only horizontal bedding plane type weaknesses within the Salado formation. These conclusions are detailed in the Geological Committee report.

Fresh Water Analysis: A program of monitoring the fresh water from the four active water supply wells on a quarterly basis was initiated. Water samples are being collected from WSW Nos. 94, 100, 101, and 179 located on Bridges State lease. These wells are the wells that we currently produce for our fresh water requirements in the Vacuum field. Results of the last two analyses are attached. The analyses to-date are found to be consistent and show no deterioration in the water quality (Attachments IV & V). Eight other fresh water wells on the Bridges State lease have also been sampled. All of the analyses show low chloride content.

II. FUTURE PLANS

Mobil plans to continue its efforts toward resolving the waterflow problem. To this end, we will:

1. Reduce water injection in Mobil's Grayburg-San Andres waterflood on the Bridges State lease. Plans are to reduce injection to a volume no greater than the volume of water produced. It is estimated that it will take about 6 months preparation to bring about this reduction. This is due to the lack of current water disposal capacity for produced water from the North Vacuum Abo Unit, which is being injected into the Bridges State San Andres zone. Mobil is presently implementing plans to develop the produced water disposal capability that will allow the reduced injection. Earlier efforts to develop the North Vacuum Abo Unit Well Number 95 as a Devonian disposal well were a failure, as was the Mobil Bridges State No. 511 as a lower San Andres disposal well. Several alternatives for offlease disposal of produced water have been considered, with disposal in the South Vacuum Field now being the most likely alternative.

2. Continue to monitor the pressure in the salt section in the Bridges State #6. If warranted, further testing of this well and possible other completions in the Salado formation will be considered for pressure monitoring.

3. Continue analysis of water samples from the fresh water supply wells for any indication of degradation in water quality.

4. Continue to investigate the application of other techniques and run appropriate tests.

We look forward to the meeting on December 15th.

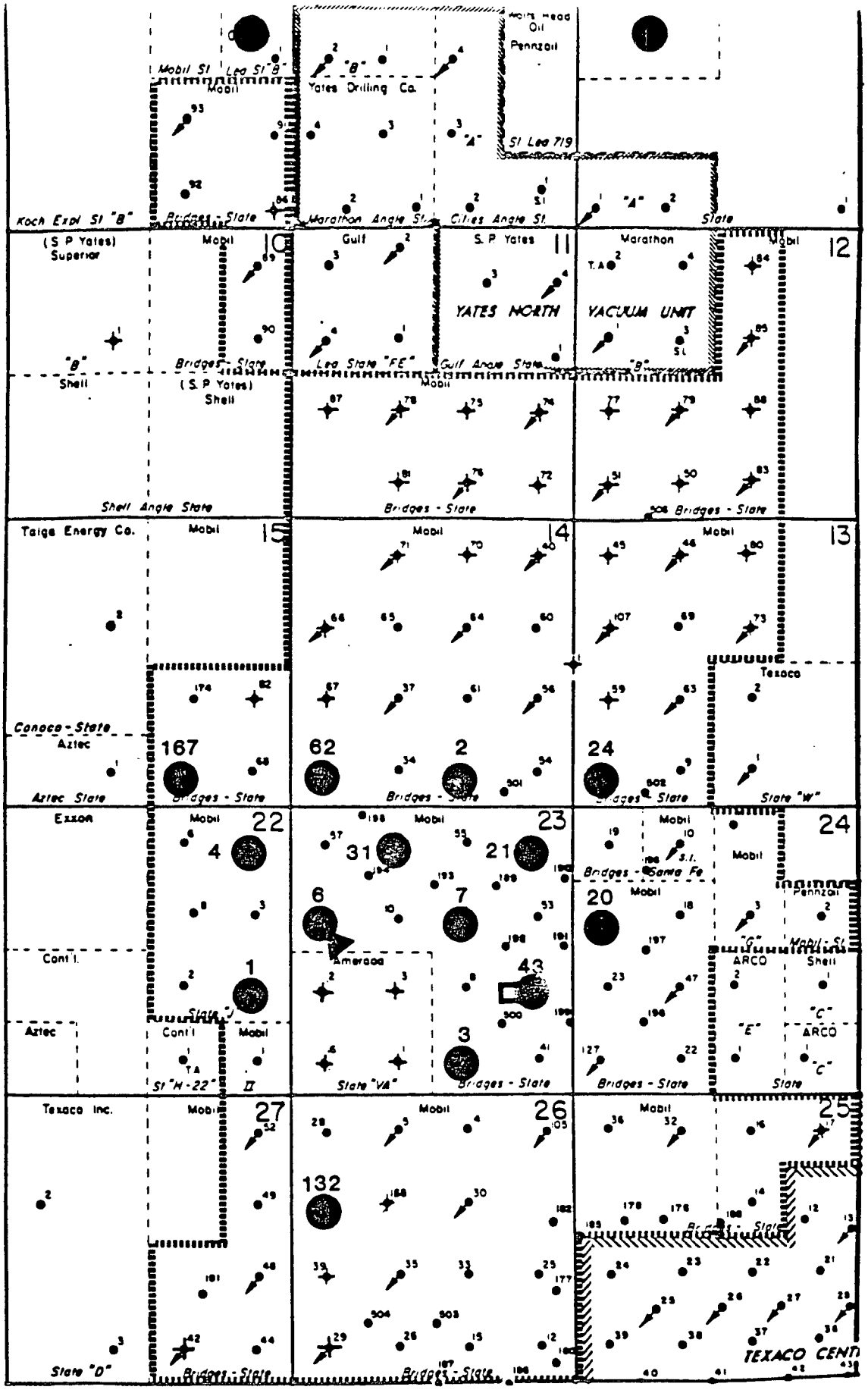
Sincerely,

M. E. Sweeney
Environmental & Regulatory Manager

MES/KKS/hjw
Attachments (4)

A:M733769A.MES

ATTACHMENT I



▶ PRESS MONITOR SALT SECTION

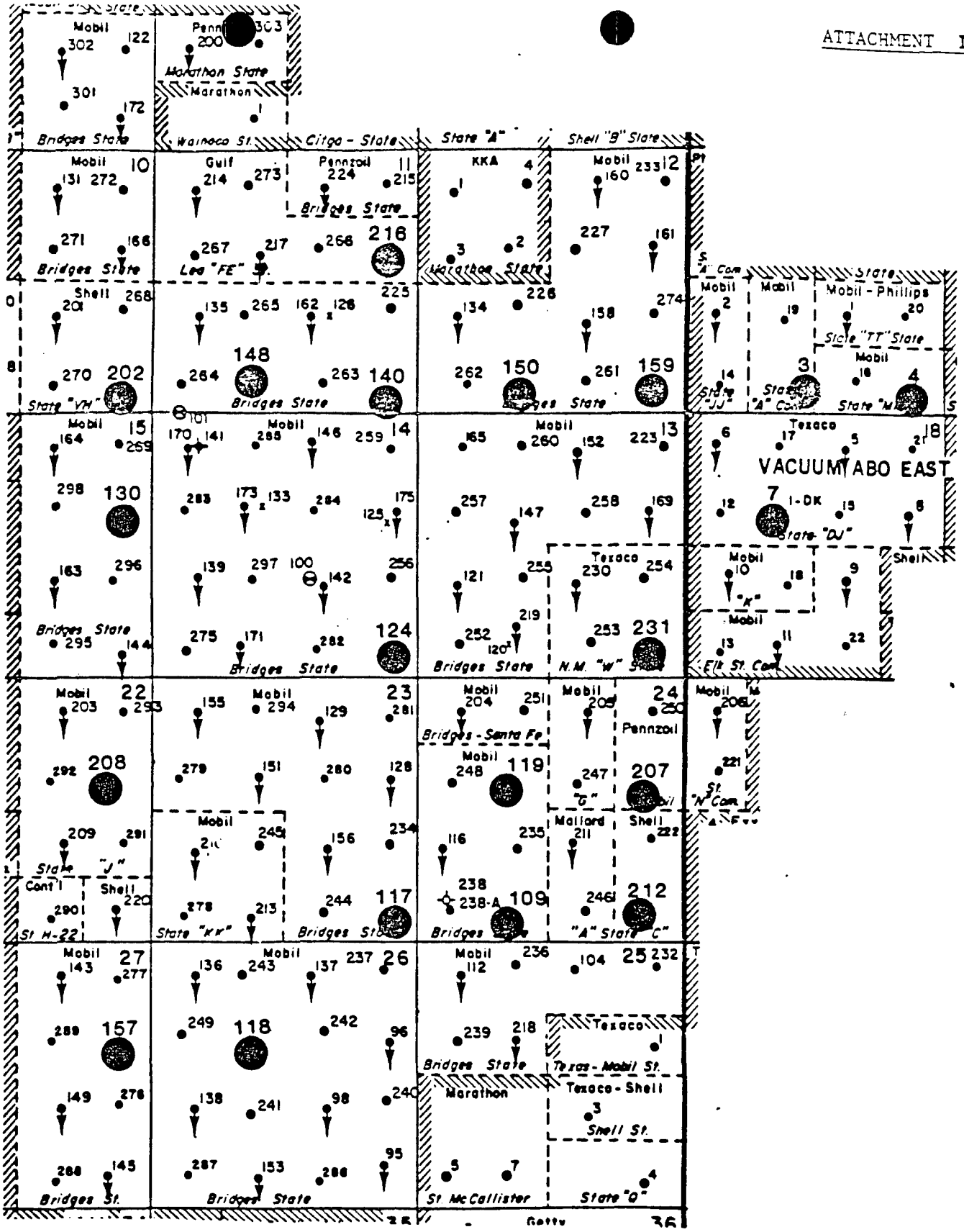
● TRACER/TEMP SURVEY

□ PRESS FALLOFF TEST

MOBIL OIL

SAN ANDRES WATERFLOOD
BRIDGES STATE LEASE
VACUUM (SAN ANDRES) FIELD
LEA COUNTY, NEW MEXICO

ATTACHMENT II

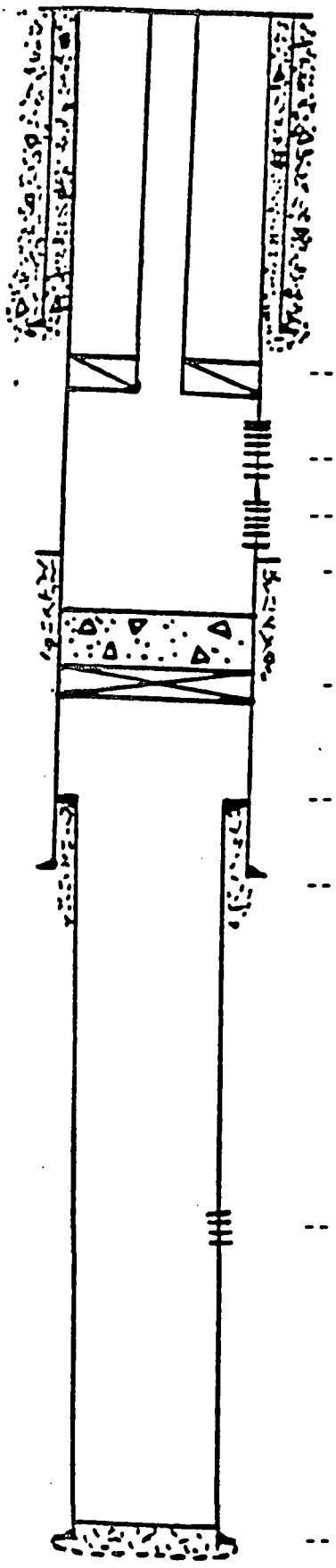


TRACER/TEMP SURVEY

MOBIL OIL

NORTH VACUUM ABO UNIT
NORTH VACUUM ABO EAST UNIT
VACUUM (Abo) FIELD
LEA COUNTY, NEW MEXICO

SALADO PRESSURE MONITOR WELL
BRIDGES STATE No. 6



LOCATION 660'FWL 1980' FNL E23-17S-34E
FIELD VACUUM (San Andres)
OPERATOR MOBIL OIL

-- Bradenhead Sq. w/200 sx class C cmt

-- 10 3/4", L.W. Line Pipe Set @ 776' w/220 sx cmt cir
-- 7" Pkr set @ 2148'

-- Salado Formation Perf. (2240'-2300') w/1JS/2'
-- Salado Formation Perf. (2540'-2620') w/1JS/2'
72 holes

- Calc. TOC @ 2678'

- 7" CIBP, capped w/35' cement set @ 4100'

-- Top of liner @ 4180'

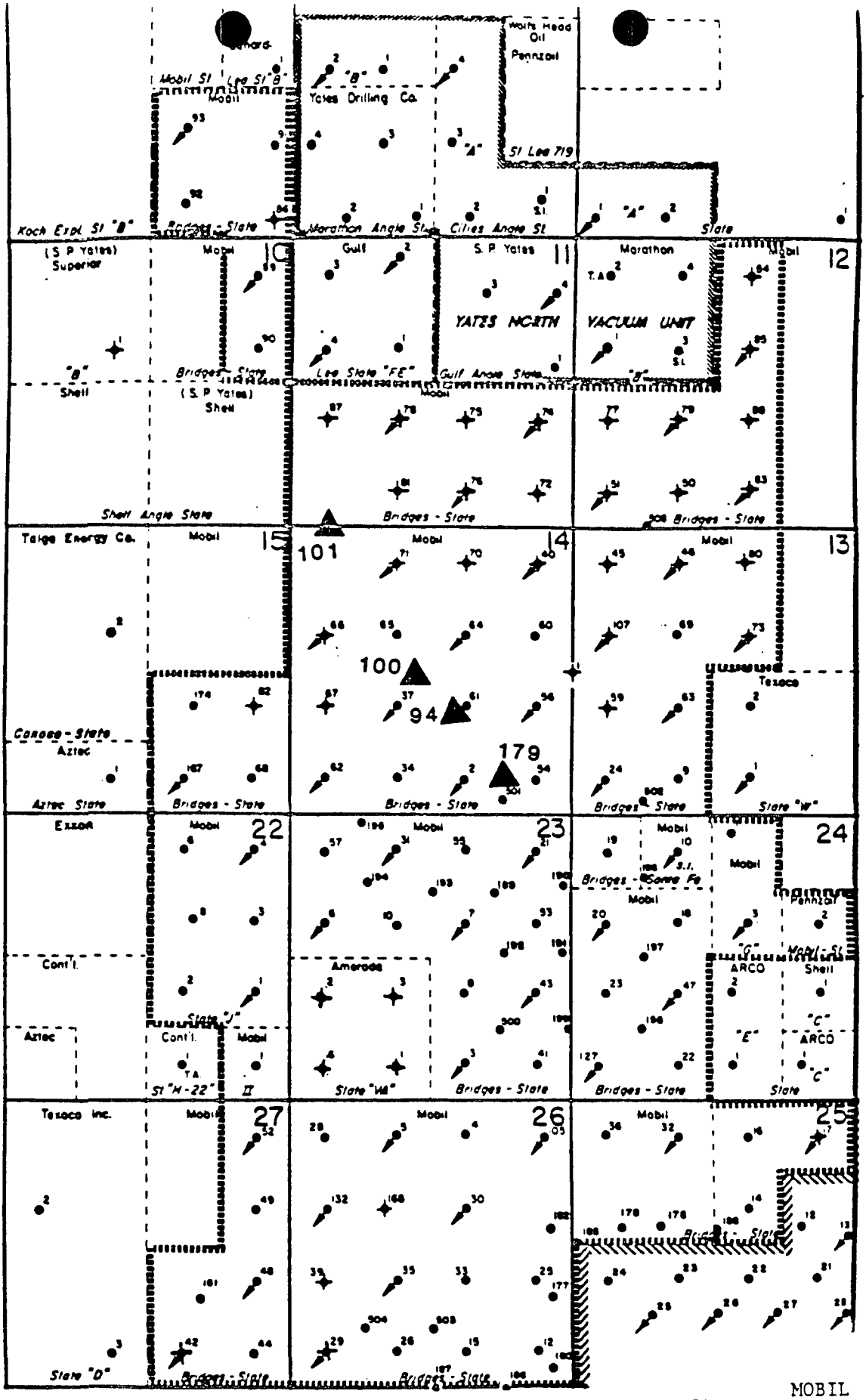
-- 7" 24# Csg set @ 4364' w/240 sx cmt

-- G/SA Perfs: 4602, 03, 04, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 38, 44, 46, 48, 50, 56, 58, & 60 w/1JSPF (24 holes)

-- 5", 15# liner set @ 4754' w/200 sx class C w/0.3% D65 200 sx class C w/0.3% D65 + 1/5# celloflakes/sx. Sqz top of liner w/200 sx class C cmt

TD @ 4755'

ATTACHMENT



▲ FRESH WATER SUPPLY WELLS

MOBIL OIL
SAN ANDRES WATERFLOOD
BRIDGES STATE LEASE
VACUUM (SAN ANDRES) FIELD
LEA COUNTY, NEW MEXICO

Unichem International

707 North Leech P.O.Box 1499

Hobbs, New Mexico 88240

Company : Mobil Producing Texas & NM
Date : 10-16-1987
Location: Bridges State - #94 (on 10-08-1987)

	Sample 1
Specific Gravity:	1.000
Total Dissolved Solids:	436
pH:	6.96
IONIC STRENGTH:	0.009

CATIONS:		me/liter	mg/liter
Calcium	(Ca^{+2})	3.42	68.4
Magnesium	(Mg^{+2})	1.10	13.4
Sodium	(Na^{+1})	1.75	40.3
Iron (total)	(Fe^{+2})	0.025	0.700
Barium	(Ba^{+2})	0.006	0.420
ANIONS:			
Bicarbonate	(HCO_3^{-1})	3.08	188
Carbonate	(CO_3^{-2})	0	0
Hydroxide	(OH^{-1})	0	0
Sulfate	(SO_4^{-2})	1.02	49.0
Chloride	(Cl^{-1})	2.17	77.0
DISSOLVED GASES			
Carbon Dioxide	(CO_2)		0

SCALING INDEX (positive value indicates scale)

Temperature		Calcium Carbonate	Calcium Sulfate
86°F	30°C	-0.42	-18

Unichem International

707 North Leech P.O.Box 1499

Hobbs, New Mexico 88240

Company : Mobil Producing Texas & NM
Date : 10-16-1987
Location: Bridges State - Well #100 (on 10-08-1987)

	Sample 1
Specific Gravity:	1.000
Total Dissolved Solids:	462
pH:	7.06
IONIC STRENGTH:	0.010

CATIONS:		me/liter	mg/liter
Calcium	(Ca^{+2})	3.44	68.8
Magnesium	(Mg^{+2})	1.20	14.6
Sodium	(Na^{+1})	2.12	48.9
Iron (total)	(Fe^{+2})	0.029	0.800
Barium	(Ba^{+2})	0.003	0.240
ANIONS:			
Bicarbonate	(HCO_3^{-1})	3.04	185
Carbonate	(CO_3^{-2})	0	0
Hydroxide	(OH^{-1})	0	0
Sulfate	(SO_4^{-2})	0.989	47.5
Chloride	(Cl^{-1})	2.74	97.0
DISSOLVED GASES			
Carbon Dioxide	(CO_2)		0

SCALING INDEX (positive value indicates scale)

Temperature		Calcium Carbonate	Calcium Sulfate
86°F	30°C	-0.33	-18

Unichem International

707 North Leech P.O.Box 1499

Hobbs, New Mexico 88240

Company : Mobil Producing Texas & NM
Date : 10-16-1987
Location: Bridges State - #101 (on 10-08-1987)

	Sample 1
Specific Gravity:	1.000
Total Dissolved Solids:	550
pH:	6.97
IONIC STRENGTH:	0.012

CATIONS:		me/liter	mg/liter
Calcium	(Ca^{+2})	4.28	85.6
Magnesium	(Mg^{+2})	1.24	15.1
Sodium	(Na^{+1})	2.78	63.9
Iron (total)	(Fe^{+2})	0.025	0.700
Barium	(Ba^{+2})	0.002	0.120
ANIONS:			
Bicarbonate	(HCO_3^{-1})	3.08	188
Carbonate	(CO_3^{-2})	0	0
Hydroxide	(OH^{-1})	0	0
Sulfate	(SO_4^{-2})	0.989	47.5
Chloride	(Cl^{-1})	4.23	150
DISSOLVED GASES			
Carbon Dioxide	(CO_2)		0

SCALING INDEX (positive value indicates scale)

Temperature		Calcium Carbonate	Calcium Sulfate
86°F	30°C	-0.33	-17

Unichem International

707 North Leech P.O.Box 1499

Hobbs, New Mexico 88240

Company : Mobil Producing Texas & NM
Date : 10-16-1987
Location: Bridges State - #179 (on 10-08-1987)

	Sample 1
Specific Gravity:	1.000
Total Dissolved Solids:	390
pH:	7.03
IONIC STRENGTH:	0.008

CATIONS:		me/liter	mg/liter
Calcium	(Ca^{+2})	2.92	58.4
Magnesium	(Mg^{+2})	1.04	12.6
Sodium	(Na^{+1})	1.51	34.6
Iron (total)	(Fe^{+2})	0.014	0.400
Barium	(Ba^{+2})	0.003	0.240
ANIONS:			
Bicarbonate	(HCO_3^{-1})	3.08	188
Carbonate	(CO_3^{-2})	0	0
Hydroxide	(OH^{-1})	0	0
Sulfate	(SO_4^{-2})	0.947	45.5
Chloride	(Cl^{-1})	1.44	51.0
DISSOLVED GASES			
Carbon Dioxide	(CO_2)		0

SCALING INDEX (positive value indicates scale)

Temperature		Calcium Carbonate	Calcium Sulfate
86°F	30°C	-0.42	-18

Vacuum Field Waterflow Committee
1987 Status Report for Phillips Petroleum Company
December 15, 1987

The work done by Phillips Petroleum Company in the interest of the Vacuum Field Waterflow Committee during 1987 is concentrated in three major areas. These are injection well pressure falloff testing, injection well surveying, and monitoring drilling wells.

Injection Well Pressure Falloff Testing. Falloff tests run in twenty-three injection wells on the East Vacuum Unit have been analyzed. A summary report from Dr. Arlene G. Pollin, Staff Director, Reservoir Simulation & Enhanced Oil Recovery, is attached. Three of the wells showed moderately high storage (5500 to 11,000 bbls.). Injection profile surveys run on two of these wells indicated that the injection fluid was not moving up out of the injection interval. All other wells showed normal storage. Fifteen additional falloff tests have been run and are being analyzed. A list of all wells tested is attached.

Injection Well Profile Surveying. Surveys have been run in 50 wells on the East Vacuum Unit and Hale and Mable leases this year. None have shown evidence of fluid travelling up out of the injection interval. During the running of these injection surveys, temperature surveys were run through the Salado in five wells. None showed any indication of fluid travelling into, out of, or through the Salado. A list of all wells surveyed is attached.

New Well Drilling Activity. Five wells were drilled on the East Vacuum Unit this year. A map and locations of the wells are attached. Only one of these had a waterflow in the Salado. Tract 3229, Well No. 010 flowed water at a rate of 43 BPH from 2509'. Because of the low flow rate, we were unable to get a water sample for analysis.

Seven new wells were drilled by Phillips in the western portion of the field. The Lea No. 34 encountered a 34 BPH waterflow in the Salado. The Philmex No. 20 encountered a 39 BPH waterflow in the Queen formation at 3905'. A summary of waterflows from the Queen formation in the western Vacuum area is attached.

A hole was found in the casing in one East Vacuum well. Tract 3229, Well No. 001 had a hole in the casing between 938' and 968'. (Its location is shown on the attached map.) Cement was circulated to surface between the 7" and the 9-5/8" casing. Cement was also squeezed into the hole. The well was returned to production with no adverse results.

Vacuum Field Waterflow Committee
1987 Status Report for Phillips Petroleum Company
December 15, 1987

List of Attachments

1. List of Wells Tested
2. List of Newly Drilled Well Locations
3. Map of East Vacumm Unit Showing Wells Tested and New Wells
4. Map of the Hale and Mable Leases Showing Wells Tested
5. Engineering Report - Analysis of East Vacuum Unit Water Injection Falloff Tests
6. Review of Queen Formation Waterflows
7. Map of Western Vacuum Field Showing Queen Waterflows and New Wells

Attachment 1

Vacuum Field Waterflow Committee
1987 Status Report for Phillips Petroleum Company
December 15, 1987

List of Wells Tested

East Vacuum Grayburg-San Andres Unit

Tract-Well	Tests Run	Tract-Well	Tests Run
0524-001	P	0524-006	P
2622-004	P T	2622-006	P F T
2717-003	P	2717-005	P F
2717-007	P F	2720-006	P F T
2721-001	P F	2721-002	P F
2738-007	P F T	2738-008	P F T
2801-005	P F	2801-006	P F
2801-007	P F	2801-012	P F
2801-015	P F	2865-001	P
2913-007	P	2913-008	P
2941-001	P	2947-001	P
2963-004	P	3127-004	F
3127-006	F	3127-007	F
3202-008	P	3202-010	P F
3202-011	P	3202-013	P F
3229-006	P	3229-007	P
3229-008	P	3236-006	P
3236-008	F	3315-006	P F
3315-008	P	3328-003	P F
3332-001	P F	3333-005	P
3333-006	P	3373-001	P
3374-002	P	3456-006	P
3456-007	P	3456-009	P
0524-005	F		

M. E. Hale and Mable Leases

Hale #14	P F	Hale #15	P F
Hale #16	P F	Hale #17	P F
Hale #18	P F	Hale #19	P F
Mable #4	P F	Mable #5	P F

Types of Tests Run

P - Injection profile surveys
F - Pressure falloff tests
T - Temperature survey through the Salado

Attachment 2

PHILLIPS PETROLEUM COMPANY
NEWLY DRILLED WELL LOCATIONS

Lease	Well #	Location	Section	Township	Range
EVGSAU	3374-003	2630' FSL & 400' FWL	33	17S	35E
	3202-017	2000' FNL & 120' FEL	32	17S	35E
	3236-009	2510' FNL & 1850' FWL	32	17S	35E
	3229-010	1980' FSL & 10' FWL	32	17S	35E
	3202-019	2065' FNL & 2540' FEL	32	17S	35E
Lea	34	935' FSL & 1980' FWL	30	17S	34E
Philmex	19	1980' FNL & 560' FEL	35	17S	33E
	20	660' FNL & 660' FWL	36	17S	33E
	21	1980' FNL & 1980' FEL	35	17S	33E
	24	660' FNL & 1980' FEL	35	17S	33E
	25	1980' FNL & 1980' FWL	35	17S	33E
	28	1980' FNL & 660' FEL	26	17S	33E

R-34-E

R-35-E

T 17 S

PHILLIPS EAST VACUUM UNIT

LEE PLANT

TEXACO CENTRAL VACUUM UNIT

CO_2 PLANT

CTB

T 18 S

R-34-E

R-35-E

October, 1987 Production & Injection

9,819 BOPD	47,548 BWIPD
4,174 MCFPD	29,869 MCFIPD
29,771 BWPD	

SATELLITE AREAS

EAST VACUUM GRAYBURG – SAN ANDRES UNIT
VACUUM GRAYBURG – SAN ANDRES FIELD
LEA COUNTY, NEW MEXICO

SCALE

0 2000' 4000' 6000'

(3333) Tract Numbers

(3) Production Satellite Locations

CTB Central Tank Battery

Water Injection Well

Water Supply Well

CO_2 Wag Injection Well

Injection Profile Survey
Pressure Falloff Test
Temperature Survey

1987 Drilled Wells

Casing Problems

PHILLIPS HALE-MABLE LEASES

CO-OPERATIVE POLYMER EOR INJECTION PROJECT

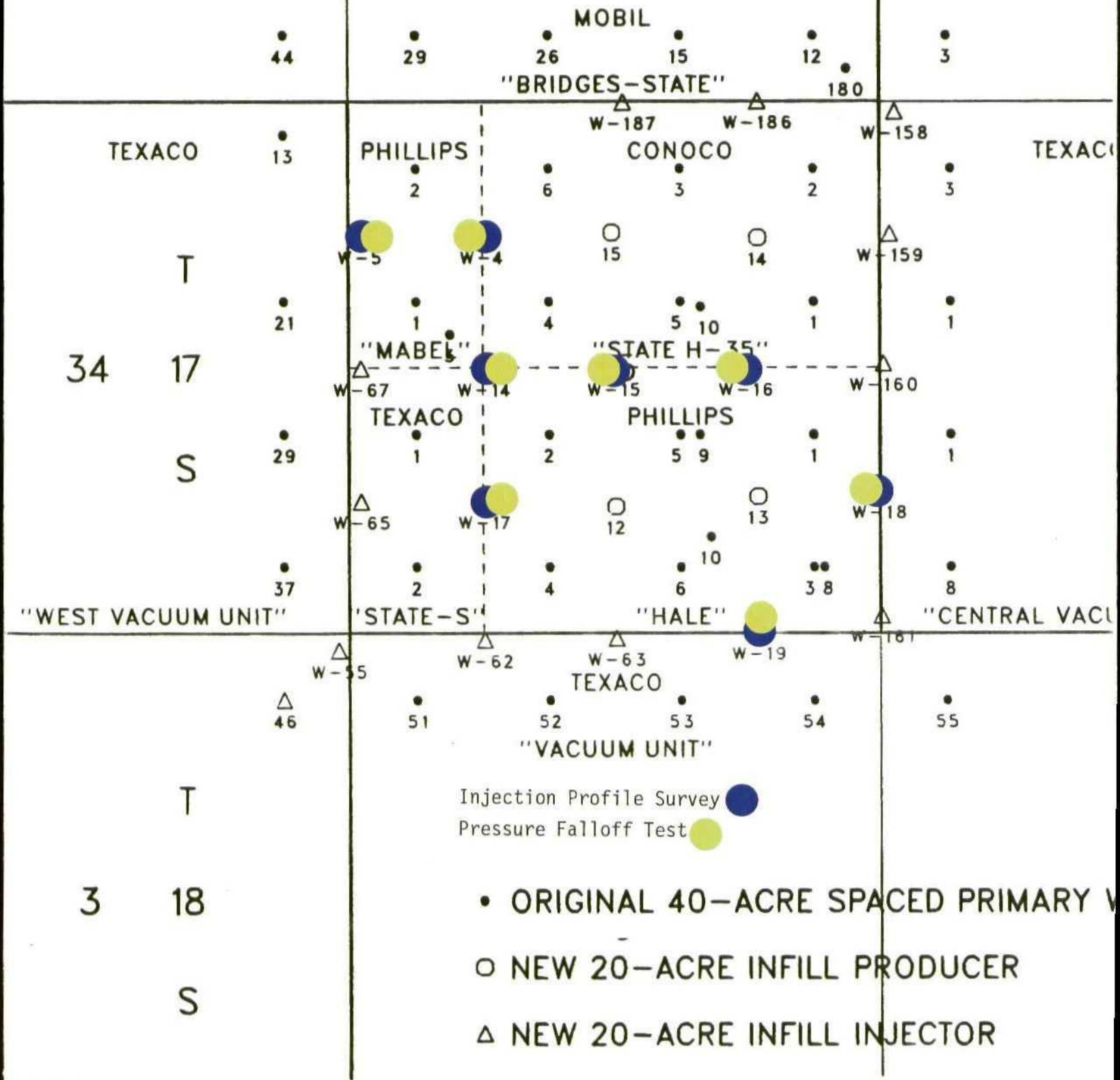
LEA COUNTY, NEW MEXICO

ATTACHMENT 4

October, 1987 Production & Injection
1,361 BOPD 13,171 BWIPD
436 MCFPD
4,345 BWPD

R-34-E

27



Attachment 5

Engineering Report

Vacuum Field Waterflow Problem

Analysis of East Vacuum Grayburg San Andres Unit Water Injection Falloff Tests

A. G. Pollin

OBJECTIVE

Determine whether the water injection falloff tests run on East Vacuum Grayburg San Andres Unit (EVGSAU) through March 1987 identify any wells which have large storage volumes and which may have reservoir injection intervals in communication with salt zone caverns.

CONCLUSIONS

1. None of the 23 wells tested exhibit storage volumes large enough to classify them as suspect in the Vacuum Field Waterflow problem.

2. Three wells (0524-005, 2801-007, and 2801-005) show moderately high storage (5000-11,000 BBL) and should be considered as possibly suspect. Interpretation of the test on 2801-005 (11,000 BBL storage) is particularly ambiguous, and storage in this well may be significantly lower.

3. Twenty wells show either essentially zero or low (< 3500 BBL) storage and should be considered non-suspect at this time.

RECOMMENDATIONS

1. Run logs and rerun falloff tests on wells 0524-005, 2801-007, and 2801-005.

2. Run the next series of water injection falloff tests on wells in Sections 5 and 32 situated between 2801-007 and 0524-005.

3. Compare storage volumes for EVGSAU with those for other units in the Vacuum Field.

DISCUSSION

Water injection falloff tests on 23 EVGSAU wells have been examined for storage using the techniques described in the Engineering Report "Vacuum Field Waterflow Problem -- Analysis of Water Injection Falloff Tests", supplemented by the detailed example interpretations and additional typecurves described in the 24 February 87 letter from A. G. Pollin to G. R. Smith. All but three of the tests contain early time data beginning one minute after shut-in (data for the three exceptions begin at five minutes) and are well suited for use in storage analysis. None of the tests shows a unit slope.

Results of the tests are summarized in Table 1, along with several of the parameters used in the storage value computation. Computed storage is directly proportional to the water injection rate assumed prior to shut-in. Injection rates were generally not measured directly prior to shut-in and can vary by as much as a factor of two between monthly tests. Only one test shows changing liquid level storage rather than compressive storage at early time. Reservoir parameters calculated from the typecurve matches and typecurve match points are listed in Table 2.

Nineteen of the wells tested show bilinear flow behavior, including the three which show moderately high values of storage. Tests on wells which have bilinear flow were matched to Finite Conductivity Vertical Fracture (FCVF) typecurves. Fracture capacity sometimes appeared to change during a test; matched fracture capacity ratios varied from $\pi/10$ (a very long and/or very poorly conductive fracture) to 100π (approaching an infinite conductivity fracture). Wells with high fracture capacity ratios could sometimes also be matched to Vertical Fracture with Storage typecurves. Significant storage during the bilinear flow period is indicated by an approach to the FCVF typecurve from below and was quantified by a separate match during the bilinear flow period to a Finite Conductivity Fracture with Storage and Skin (FCFWSS) typecurve. Matches (even with the aid of the pressure derivative) were frequently somewhat ambiguous, both on the FCVF and on the FCFWSS typecurves, and a fairly large uncertainty should be associated with all derived parameters. Radial flow (semilog straight line) was not reached in many of the tests. The upper limit of storage was computed for the high storage wells (and therefore the approximate magnitude of computed storage confirmed) by assuming that the first measured falloff point was the last point on an assumed unit slope.

Three of the wells show linear flow behavior without a preceding period of bilinear flow and were matched to Vertical Fracture with Storage (Uniform Flux and Infinite Conductivity) [VFWS(UF) and (IC)] typecurves. All show very low values of storage.

The one remaining well shows no distinct evidence of linear or bilinear flow and was matched to Flopetrol's Wellbore Storage and Skin (WSS) typecurve. The well appears to encounter a pressure

maintenance boundary and shows a low value of storage. Because data points past the boundary need to be discarded, the match to the WSS typecurve is not unique, and an alternate match on a VFWS typecurve is possible.

Values of storage in moderate excess of tubing dimensions (about 30 BBLs for EVGSAU injectors) are frequently computed for highly stimulated and/or fractured systems and should not be unexpected in the very vuggy and somewhat naturally fractured San Andres formation.

TABLE 1

STORAGE COMPUTATION RESULTS

WELL	q (BBLs)	ϕ	h (ft)	STORAGE VOLUME (BBLs)	
0524-005	548	0.060	150	6600	Possibly suspect
2622-006	400	0.060	160	2800	--
2717-005	1115	0.083	171	0	--
2717-007	1000	0.068	182	0	--
2720-006	900	0.055	160	3100	--
2721-001	200	0.080	160	0	--
2721-002	1000	0.070	180	2800	--
2738-007	900	0.080	160	*	--
2738-008	372	0.065	120	1300	--
2801-005	1069	0.090	70	11000	Possibly suspect
2801-006	472	0.080	110	2200	--
2801-007	1300	0.090	160	5500	Possibly suspect
2801-012	80	0.060	120	1100	--
2801-015	543	0.090	140	0	--
3127-004	1578	0.090	333	0	--
3127-006	576	0.085	330	500	--
3127-007	952	0.080	300	900	--
3202-010	1377	0.090	204	1300	--
3202-013	3000	0.090	240	0	--
3236-008	1638	0.080	300	0	--
3315-006	1706	0.070	189	0	--
3328-003	1670	0.075	140	0	--
3332-001	1361	0.080	140	0	--

* Changing liquid level storage = 0.010 BBL/ft

TABLE 2 (continued)

WELL	k/μ (md/cp)	X_f (ft)	TYPECURVE	MATCH POINT	
2738-008	0.3	848	FCVF	$P_{wD}K_{fD}W_{fD} = 10$ $t_{DX}(K_{fD}W_{fD})^2 = 0.1$ $K_{fD}W_{fD} = 10\pi$	$\Delta P = 490$ $\Delta t = 0.54$
			FCFWSS	$F_1 = 1$ $F_2 = 10$ $F_4 = 0$	$\Delta P = 6$ $\Delta t = 0.015$
2801-005	0.6	1286	FCVF	$P_{wD}K_{fD}W_{fD} = 10$ $t_{DX}(K_{fD}W_{fD})^2 = 1$ $K_{fD}W_{fD} = 100\pi$	$\Delta P = 120$ $\Delta t = 0.086$
			FCFWSS	$F_1 = 1$ $F_2 = 10$ $F_4 = 0$	$\Delta P = 7.4$ $\Delta t = 0.052$
2801-006	0.3	806	FCVF	$P_{wD}K_{fD}W_{fD} = 10$ $t_{DX}(K_{fD}W_{fD})^2 = 0.1$ $K_{fD}W_{fD} = 20\pi$	$\Delta P = 360$ $\Delta t = 0.15$
			FCFWSS	$F_1 = 1$ $F_2 = 10$	$\Delta P = 6.6$ $\Delta t = 0.022$
2801-007	1.1	538	FCVF	$P_{wD}K_{fD}W_{fD} = 10$ $t_{DX}(K_{fD}W_{fD})^2 = 0.1$ $K_{fD}W_{fD} = 10\pi$	$\Delta P = 340$ $\Delta t = 0.082$
			FCFWSS	$F_1 = 1$ $F_2 = 10$ $F_4 = 0$	$\Delta P = 6.9$ $\Delta t = 0.021$
2801-012	0.1	310	FCVF	$P_{wD}K_{fD}W_{fD} = 100$ $t_{DX}(K_{fD}W_{fD})^2 = 10$ $K_{fD}W_{fD} = 50\pi$	$\Delta P = 750$ $\Delta t = 0.15$
			FCFWSS	$F_1 = 10$ $F_2 = 1$ $F_4 = 0$	$\Delta P = 130$ $\Delta t = 0.013$
2801-015	0.5	265	FCVF	$P_{wD}K_{fD}W_{fD} = 100$ $t_{DX}(K_{fD}W_{fD})^2 = 10$ $K_{fD}W_{fD} = 100\pi$	$\Delta P = 340$ $\Delta t = 0.044$
3127-004	0.2	7	VFWS(UF)	$P_D = 10$ $t_{DXf} = 1$ $C_{DXf} = 0$	$\Delta P = 4500$ $\Delta t = 1.1$

TABLE 2 (continued)

WELL	k/μ (md/cp)	X_f (ft)	TYPECURVE	MATCH POINT	
3127-006	0.7	23	VFWS(IC)	$P_D = 0.1$ $t_{DXf} = 0.1$ $C_{Df} = 0.01$	$\Delta P = 38$ $\Delta t = 0.22$
3127-007	1.5	180	FCVF	$P_{wD}K_{fD}W_{fD} = 10$ $t_{DX}(K_{fD}W_{fD})^2 = 0.01$ $K_{fD}W_{fD} = \pi/10$	$\Delta P = 9400$ $\Delta t = 6$
			FCFWSS	$F_1 = 1$ $F_2 = 10$ $F_4 = 5$	$\Delta P = 35$ $\Delta t = 0.024$
3202-010	1.5	351	FCVF	$P_{wD}K_{fD}W_{fD} = 1$ $t_{DX}(K_{fD}W_{fD})^2 = 0.01$ $K_{fD}W_{fD} = \pi/5$	$\Delta P = 1050$ $\Delta t = 6.4$
			FCFWSS	$F_1 = 1$ $F_2 = 10$ $F_4 = 0$	$\Delta P = 40$ $\Delta t = 0.027$
3202-013	4.5	144	FCVF	$P_{wD}K_{fD}W_{fD} = 10$ $t_{DX}(K_{fD}W_{fD})^2 = 0.01$ $K_{fD}W_{fD} = \pi/5$	$\Delta P = 6200$ $\Delta t = 0.32$
3236-008	1.8	66	FCVF	$P_{wD}K_{fD}W_{fD} = 100$ $t_{DX}(K_{fD}W_{fD})^2 = 10$ $K_{fD}W_{fD} = 5\pi$	$\Delta P = 2800$ $\Delta t = 0.27$
3315-006	1.6	178	FCVF	$P_{wD}K_{fD}W_{fD} = 1000$ $t_{DX}(K_{fD}W_{fD})^2 = 10000$ $K_{fD}W_{fD} = 100\pi$	$\Delta P = 2500$ $\Delta t = 4.9$
3328-003	3.4	265	VFWS(IC)	$P_D = 10$ $t_D = 0.01$ $C_{Df} = 0$	$\Delta P = 4900$ $\Delta t = 0.53$
3332-001	0.6	888	FCVF	$P_{wD}K_{fD}W_{fD} = 100$ $T_{DX}(K_{fD}W_{fD})^2 = 1$ $K_{fD}W_{fD} = 20\pi$	$\Delta P = 3800$ $\Delta t = 0.91$

TABLE 2

RESERVOIR PARAMETERS AND MATCH POINTS

WELL	k/μ(md/cp)	X_f (ft)	TYPECURVE	MATCH POINT	
0524-005	0.5	751	FCVF	$P_{wD}K_{fD}W_{fD} = 0.08$ $t_{DX}(K_{fD}W_{fD})^2 = 61$ $K_{fD}W_{fD} = 20\pi$	$\Delta P = 1.3$ $\Delta t = 35$
			FCFWSS	$F_1 = 1$ $F_2 = 100$ $F_4 = 0$	$\Delta P = 5.8$ $\Delta t = 0.5$
2622-006	0.3	354	FCVF	$P_{wD}K_{fD}W_{fD} = 10$ $t_{DX}(K_{fD}W_{fD})^2 = 1$ $K_{fD}W_{fD} = 20\pi$	$\Delta P = 220$ $\Delta t = 0.25$
			FCFWSS	$F_1 = 1$ $F_2 = 10$ $F_4 = 0$	$\Delta P = 7.8$ $\Delta t = 0.039$
2717-005	1.6	258	FCVF	$P_{wD}K_{fD}W_{fD} = 100$ $t_{DX}(K_{fD}W_{fD})^2 = 10$ $K_{fD}W_{fD} = 50\pi$	$\Delta P = 360$ $\Delta t = 0.048$
2717-007	1.2	306	FCVF	$P_{wD}K_{fD}W_{fD} = 10$ $t_{DX}(K_{fD}W_{fD})^2 = 1$ $K_{fD}W_{fD} = 10\pi$	$\Delta P = 200$ $\Delta t = 0.185$
2720-006	2.3	--	WSS	$P_D = 1$ $t_D/C_D = 1$ $C_De^{2s} = 0.3$	$\Delta P = 350$ $\Delta t = 0.086$
2721-001	0.4	99	FCVF	$P_{wD}K_{fD}W_{fD} = 100$ $t_{DX}(K_{fD}W_{fD})^2 = 10$ $K_{fD}W_{fD} = 20\pi$	$\Delta P = 650$ $\Delta t = 0.17$
2721-002	0.9	371	FCVF	$P_{wD}K_{fD}W_{fD} = 10$ $t_{DX}(K_{fD}W_{fD})^2 = 1$ $K_{fD}W_{fD} = 10\pi$	$\Delta P = 280$ $\Delta t = 0.37$
			FCFWSS	$F_1 = 1$ $F_2 = 10$ $F_4 = 0$	$\Delta P = 7$ $\Delta t = 0.014$
2738-007	1.9	480	FCVF	$P_{wD}K_{fD}W_{fD} = 10$ $t_{DX}(K_{fD}W_{fD})^2 = 0.01$ $K_{fD}W_{fD} = 2\pi$	$\Delta P = 680$ $\Delta t = 0.084$
			FCFWSS	$F_1 = 10$ $F_2 = 10$ $F_4 = 5$	$\Delta P = 105$ $\Delta t = 0.065$

Review of Queen Formation Waterflows
Eastern Maljamar and Western Vacuum Pools
Lea County, New Mexico
November 19, 1987

Phillips Petroleum has encountered waterflows from the Queen Formation in six wells located in Section 30-17S-34E (Vacuum Pool), Section 25-17S-33 (Maljamar Pool), and Section 36-17S-33E (Vacuum Pool) as shown on the attached map. Details of the waterflow in each well are as follows:

1) Lea Well No. 32, SE-SW Section 30-17S-34E:

Encountered 14 BPM water flow on 12/11/83 at 3722' while drilling well. On 12/14/84 water was flowing out of production casing. Found holes in casing 3300'-3600', squeezed holes with 300 sx Class C, drilled out, and pressure tested casing to 1000 psi. Put well back on production and casing immediately collapsed at 3800'; when well was shut in, surface pressure built to 1750 psi. Collapse was milled out 3860'-3872', well was cemented TD-4178' to plug Grayburg and San Andres, set packer on tubing at 3192' and left well as monitor well per N.M.O.C.D. request. Shut in pressure as high as 2100 psi has been observed in this well. Well is currently shut in and believed to be plugged with carbonate and sulfate scale.

2) Lea Well No. 18, SE-SE Section 30-17S-34E:

Open hole completion with 6-5/8" & 5-1/2" casing set to 4325', TD = 4760' in 10/47. On 2/15/85 first observed water flowing from inside and outside of production casing; found casing collapsed 3000'-3015'. Shut in surface pressure was 800 psi prior to repairs. Perforated at 910' and circulated cement to surface to shut off water, then milled out and realigned casing 2990'-3020'. Cemented TD-3850' to plug Grayburg and San Andres. Set packer on tubing at 2869' and left well as monitor well per N.M.O.C.D. request.

3) Lea Well No. 33, NW-SW Section 30-17S-34E:

Encountered 34 GPM water flow at 4360' on 11/20/85 while drilling well. Well was cemented in two stages with DV tool at 3800' and external casing packer at 3804'. Water flow was not shut off by cementing. Cement bond log indicated no cement above 3800'. Well was squeezed 1/86 through perfs at 3775'. Through 11/87 no further problems have been encountered.

4) Leamex Well No. 38, SE-NE Section 25-17S-33E:

Encountered 15 GPM water flow at 4240' on 11/29/85 while drilling well. Cemented well in one stage; no water flow after cementing. Cement Evaluation Log indicated no cement 3740'-3790' with evidence of channeling above 3740'. Well was squeezed 4/86 through perfs at 3775'. Through 11/87 no further problems have been encountered.

5) Leamex Well No. 37, NW-NE Section 25-17S-33E:

Encountered 5 GPM water flow below 4200' on 12/20/85 while drilling well. Open hole temperature and mud resistivity logs showed water flow at 3796'. Well was cemented in a single stage which not not stop the water flow. Cement Evaluation Log indicated no cement 3710'-3790' with evidence of channeling above 3710'. Well was squeezed 3/86 through perfs at 3770' and 1300'. Through 11/87 no further problems have been encountered.

6) Philmex Well No. 20, NW-NW Section 36-17S-33E:

Encountered 39 BPH water flow at 3905' on 6/30/87 while drilling well. Well was cemented in a single stage; water flow stopped while cementing. Cement bond log indicated no cement 3570'-3780' and 3865'-4020'. Well was squeezed through perfs at 3950'. Through 11/87 no further problems have been encountered.

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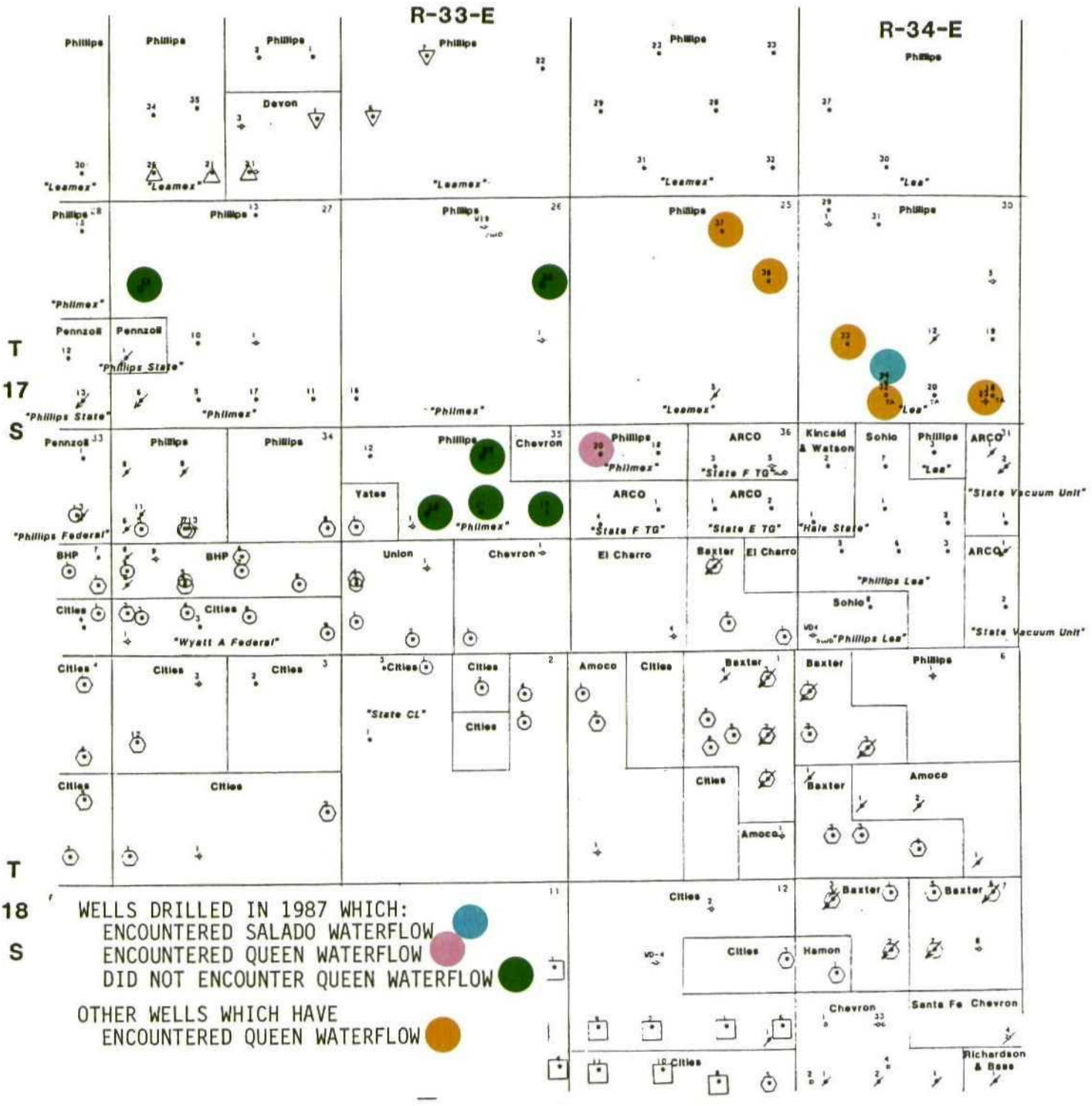


WELL SYMBOL

- Well Location
- Injection Well
- P&A
- SWD
- D&A

COMPLETION ZONE

- Queen and/or Yates
- Grayburg/San Andres
- Paddock
- Bone Springs
- Abo
- Penn

PHILLIPS PETROLEUM

PHILMEX LEASE
VACUUM (GRAYBURG/SAN ANDRES) POOL
LEA COUNTY, NEW MEXICO

DATE: 11/8/87

0 2.000 4.000
SCALE (FEET)

1987 STATUS REPORT
VACUUM FIELD WATERFLOW
TEXACO INC.
DECEMBER 15, 1987

Texaco operates four waterflood projects in the Vacuum Field. Production from the Central Vacuum Unit, Vacuum Grayburg San Andres Unit, West Vacuum Unit and North Vacuum Abo Unit plus primary production totals over 12,000 barrels of oil per day. Plats of the units and production/injection rates are shown on Attachments 3-6.

During 1987 Texaco has attempted to use several methods to investigate the origin of the water contained in the salt section in the Vacuum Field. Techniques used to identify the source of the problem include falloff tests, tracer and temperature surveys and the monitoring of pressure and flows from the salt section. Testing of fresh water wells on a quarterly basis has begun to detect any contamination that may occur in the future.

Injection well pressure falloff testing:
Falloff tests have been run and analyzed in thirty-two (32) of the seventy-eight (78) target wells identified by Texaco. Three wells have been identified as having high storage. All of these are in the same general vicinity. Vacuum Grayburg San Andres Unit (VGSAU) No. 49 has been identified as having high storage (100,000 bbls) and confirmed with a subsequent falloff. Central Vacuum Unit Well Nos. 81 and 141 were identified as having high storage on initial falloffs but significantly lower storage than VGSAU No. 49. The falloff tests have not been confirmed on the CVU wells. These wells encountered flows when drilled, and therefore, cannot be considered as contributing to the original problem. Four additional Central Vacuum Unit Wells (Nos. 58, 60, 72 and 73) have been identified as having anomalous storage volumes and possibly suspect. These volumes calculate an order of magnitude less than the high storage volume wells and are therefore deemed less critical. Again, the original waterflow problem existed when these wells were drilled meaning they could not be the original source. Interestingly, these wells are located fairly close to one another. All of the wells tested are mapped on Attachment 8. None of the pressure falloff analysis to date has established any connection between the injection interval and the salt section.

Radioactive tracer surveys:
Tracer and temperature surveys have been run in thirty (30) of the target wells. In addition, a thermal decay time log has been run on VGSAU No. 49. None of the surveys detected fluid communicating between the injection interval and the salt section.

Texaco has drilled six wells in the Vacuum Field during 1987.

These ranged from 4800' San Andres to a 12,000' wildcat all penetrating the evaporite section. Four of these wells encountered waterflows which were anticipated. None of these flows were outside the boundaries of the existing problem area.

Texaco continues to monitor the pressure in the salt section through three separate wellbores. These consist of Central Vacuum Unit Monitor Well No. 1, Central Vacuum Unit Well No. 91 and New Mexico State P Well No. 1. Location of these wells are shown on Attachment 7. No appreciable pressure changes have been measured in these wells. An interference test was run between the Central Vacuum Unit Monitor Well No. 1 and N.M. "O" State NCT-1 Well No. 27. Results of the interference test are being analyzed. No wells operated by Texaco experienced bradenhead pressure or casing leaks during 1987.

LIST OF ATTACHMENTS

1. List of wells tested.
2. Summary of Pressure Falloff Tests.
3. Map of Central Vacuum Unit.
4. Map of Vacuum Grayburg San Andres Unit.
5. Map of West Vacuum Unit.
6. Map of North Vacuum Abo West Unit.
7. Map of 1987 Drilling Activity.
8. Map of Injection Wells tested.
9. Engineering report - Analysis of Injection Well Falloff Tests.

ATTACHMENT 1

1987 STATUS REPORT
VACUUM FIELD WATERFLOW
TEXACO INC.
DECEMBER 15, 1987

LIST OF WELLS TESTED

Central Vacuum Unit

Well No.	Tests Run		Well No.	Tests Run	
15	F		100	F	P
25	F		113	F	P
27		P	120	F	P
31	F		121		P
41	F		122	F	
45		P	134	F	
56		P	135	F	
57	F		138	F	P
58	F		140	F	
60	F		141	F	
72	F		144	F	
73	F		145	F	P
81	F		156	F	
82	F		157	F	

Vacuum Grayburg San Andres Unit

14		P	33	F	P
15	F		35	F	P
17	F	P	45		P
29		P	47		P
31		P	49	F	P

West Vacuum Unit

18		P	34		P
20		P	36		P
23	F	P	42		P
25		P	48	F	P
27		P	55		P
32		P			

North Vacuum Abo West Unit

17	F	P

Types of Tests:

F = Pressure Falloff Tests
P = Injection Profile/Temperature Surveys

ATTACHMENT 2

TEXACO SUMMARY OF WELLBORE STORAGE ANALYSIS RESULTS

Falloff tests have been performed and analyzed on thirty-two Texaco operated water injection wells.

These wells have been categorized below according to the wellbore storage volumes calculated from the falloff tests:

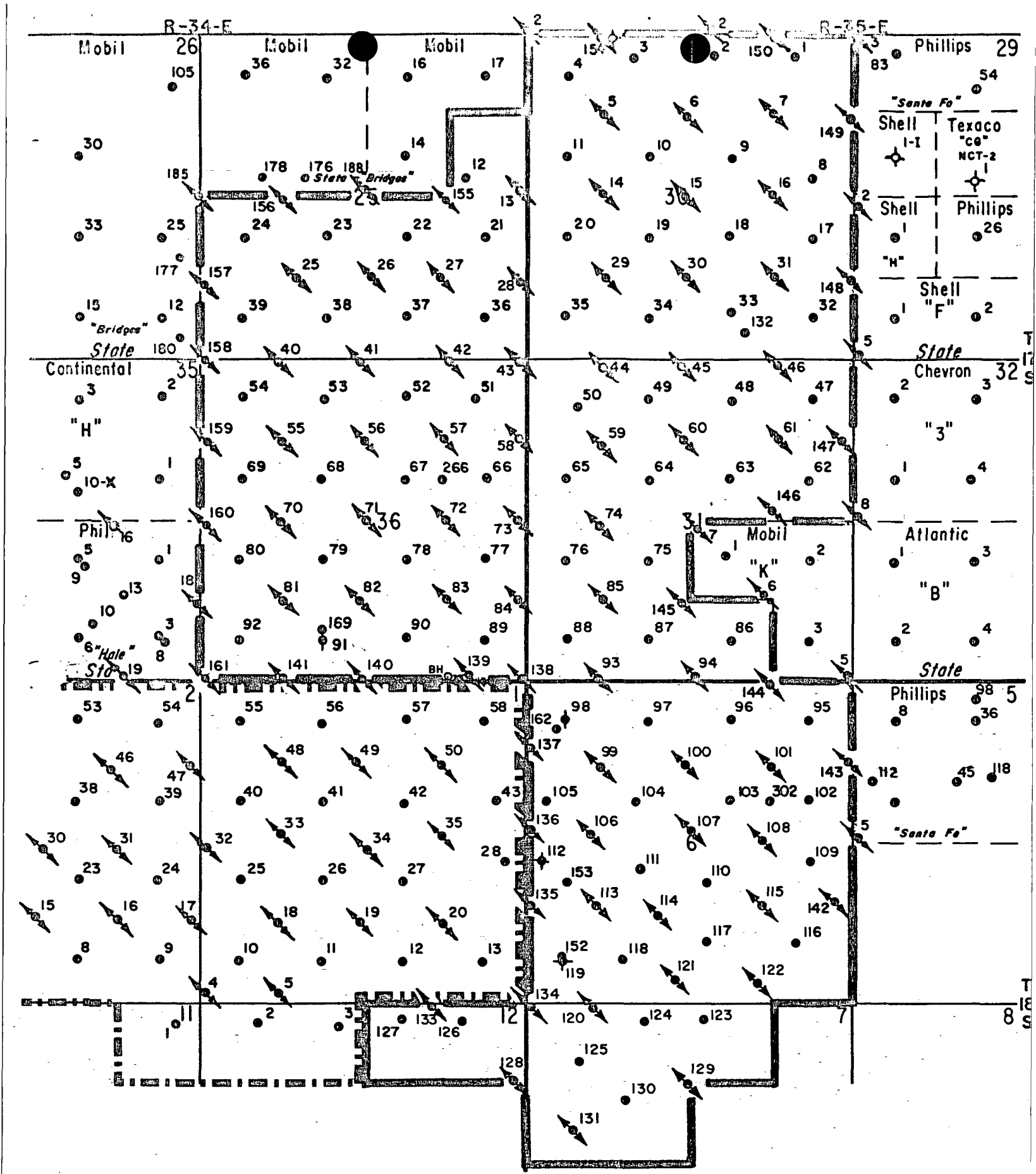
INSIGNIFICANT STORAGE	LOW STORAGE	MEDIUM STORAGE	HIGH STORAGE	BAD TEST
<1000 bbl	>1000 bbl & <5000 bbl	>5000 bbl & <10000 bbl	>10000 bbl	
CVU 15	CVU 41	CVU 58*	VGSAU 49*	CVU 82
CVU 25	CVU 113	CVU 60	CVU 81	CVU 122
CVU 31	CVU 120	CVU 72	CVU 141	VGSAU 33
CVU 57	CVU 134	CVU 73		WVU 23
CVU 100	CVU 135			WVU 48
VGSAU 17	CVU 138			
	CVU 140			
	CVU 144			
	CVU 145			
	CVU 156			
	CVU 157			
	NVAWU 17			
	VGSAU 15			
	VGSAU 35			
6	14	4	3	5

NOTES:

* after well number indicates that MEDIUM or HIGH storage volume has been confirmed on these wells by repeat testing using high accuracy/high sample rate electronic surface pressure gauges.

Injection rates and storage volumes for wells with indicated high wellbore storage are:

VGSAU 49 - 2,100 BPD water injection - ~100,000 bbl storage
CVU 81 - 1,280 BPD water injection - ~ 23,000 bbl storage
CVU 141 - 1,127 BPD water injection - ~ 11,000 bbl storage



- PRODUCING WELL
- INJECTION WELL
- SHUT-IN WELL

OIL --- 6200 BOPD

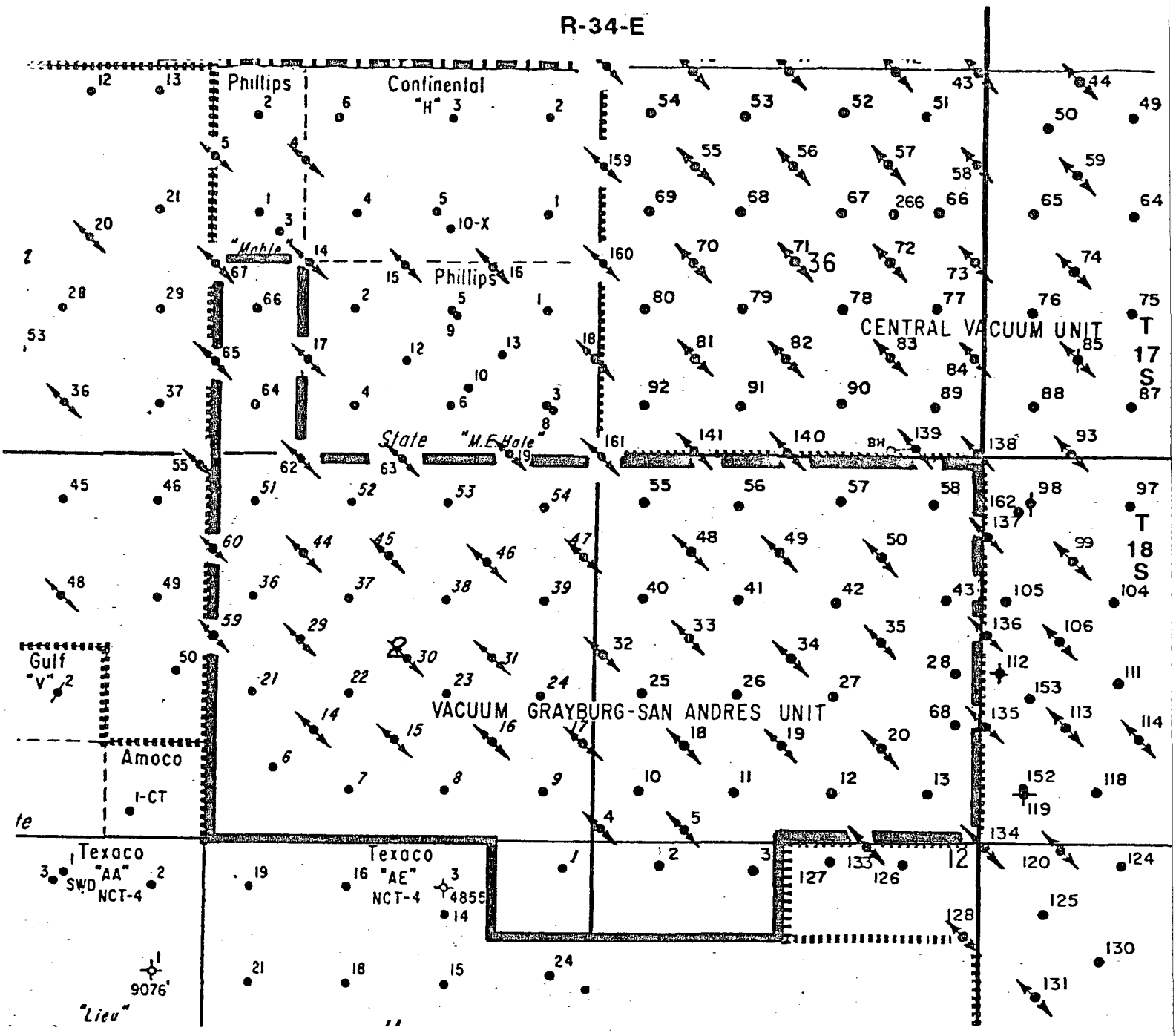
WTR 35000 BWPD

INJ --- 45000 BWPD

TEXACO Inc.

CENTRAL VACUUM UNIT
VACUUM G-SA FIELD
LEA COUNTY, NEW MEXICO

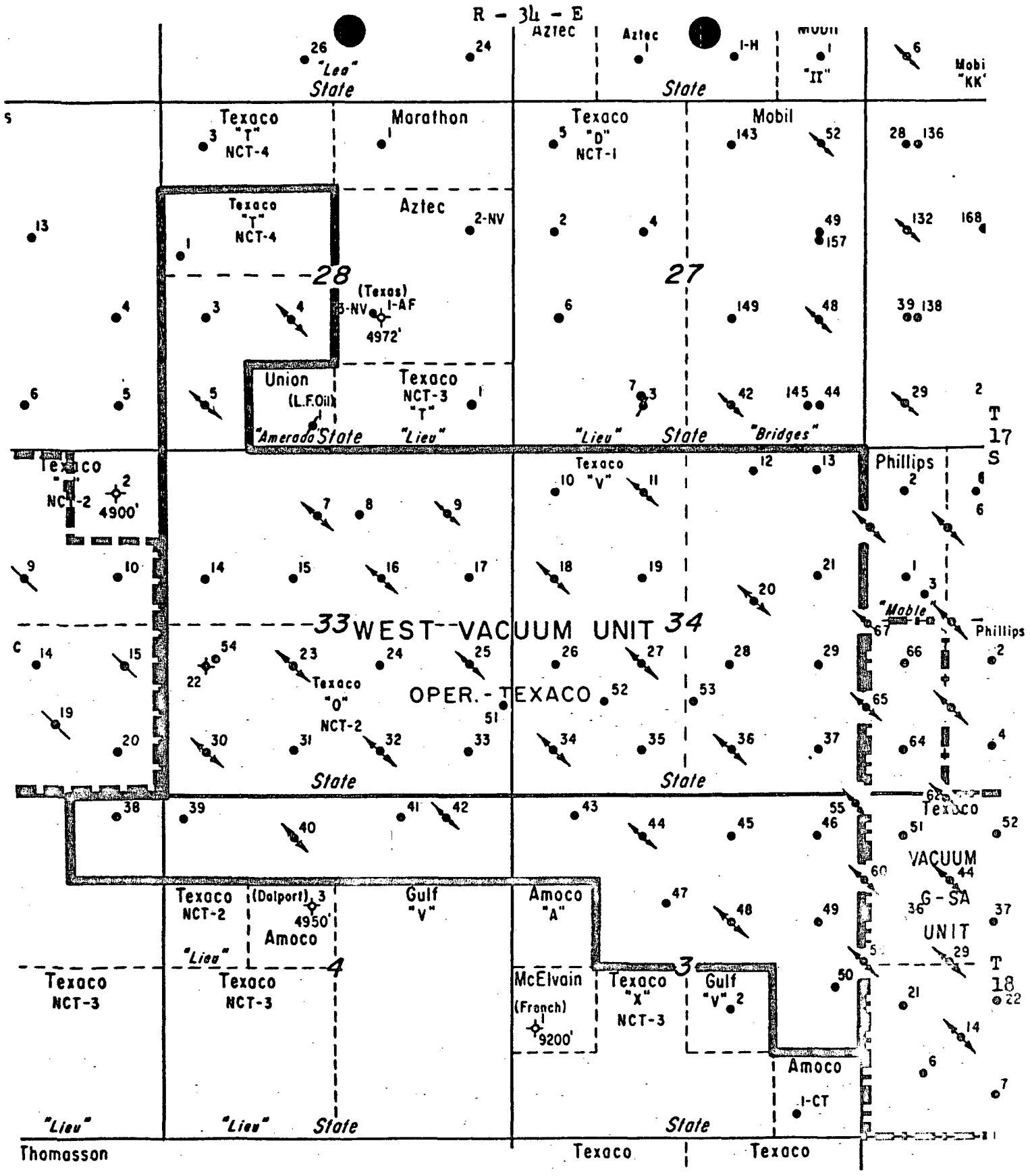
ATTACHMENT 3

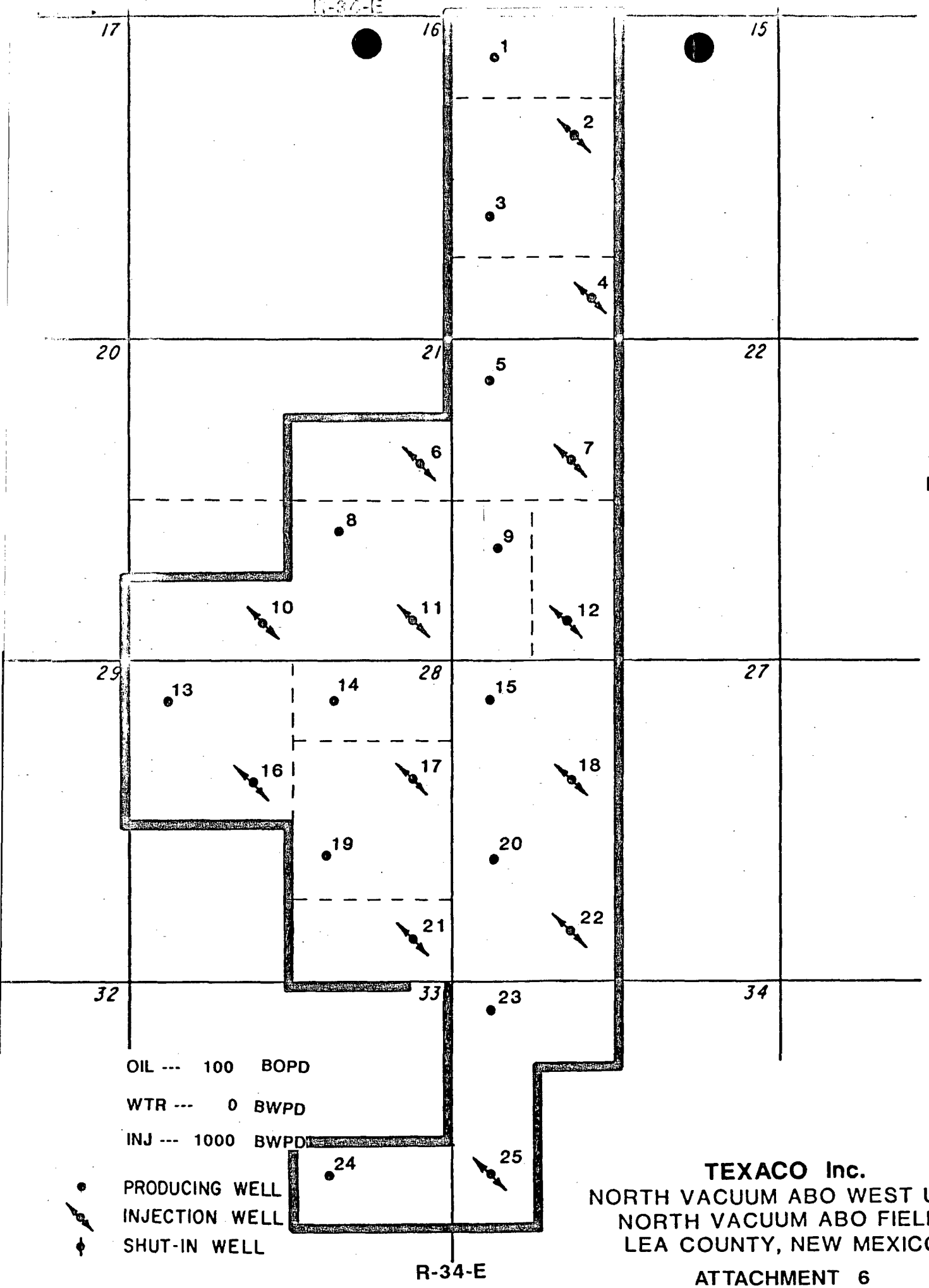


PRODUCING WELL
INJECTION WELL
SHUT-IN WELL

OIL --- 3450 BOPD
WTR -- 6000 BWPD
INJ --- 17000 BWPD

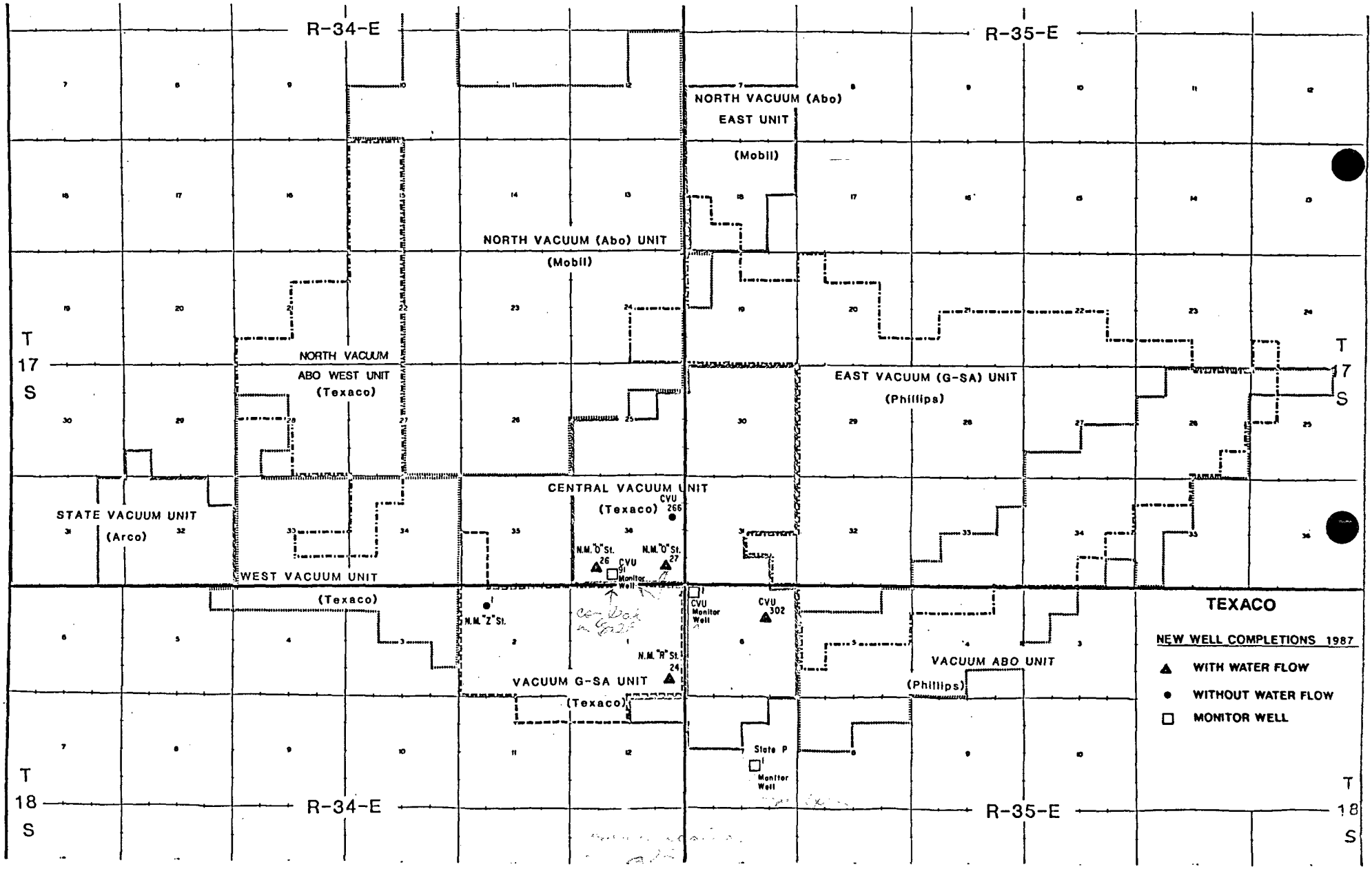
TEXACO Inc.
VACUUM G-SA UNIT
VACUUM G-SA FIELD
LEA COUNTY, NEW MEXICO
ATTACHMENT 4


R - 34 - E
T 17 S
T 18
WEST VACUUM UNIT
OPER. - TEXACO
VACUUM G-SA UNIT
Texaco "T" NCT-4
Marathon
Texaco "D" NCT-1
Mobil
Aztec
Union (L.F.Oil)
Texaco NCT-3 "T"
Texaco "V"
Phillips
Texaco "O" NCT-2
Texaco NCT-2
Texaco NCT-3
Gulf "V"
Amoco "A"
McElvain (French) 1 9200'
Texaco "X" NCT-3
Gulf "V" 2
Amoco I-CT
Thomasson
"Lea" State
"Amerada" State
"Lieu"
"Bridges"
"Mable"
28
27
33
34
4
3
PRODUCING WELL
INJECTION WELL
SHUT-IN WELL
OIL --- 350 BOPD
WTR -- 3000 BWPD
INJ --- 3000 BWPD
TEXACO Inc.
WEST VACUUM UNIT
VACUUM G-SA FIELD
LEA COUNTY, NEW MEXICO
ATTACHMENT 5

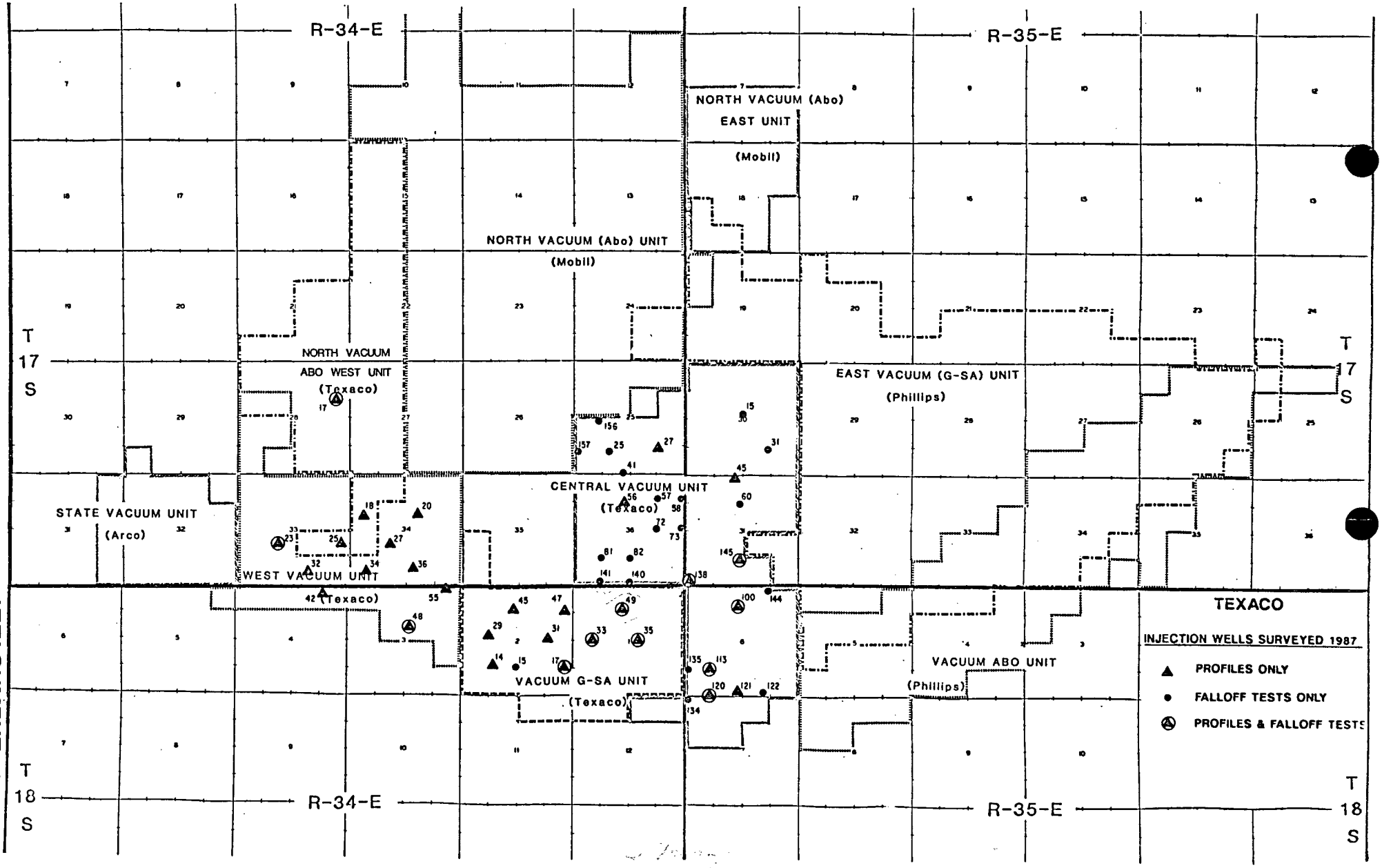


TEXACO Inc.
NORTH VACUUM ABO WEST UNIT
NORTH VACUUM ABO FIELD
LEA COUNTY, NEW MEXICO

ATTACHMENT 6



ATTACHMENT 7



ATTACHMENT 8

Copies to: VIC
cReturn
WJL
David C.
Mike
Jami
Prentiss

PHILLIPS PETROLEUM COMPANY
ODESSA, TEXAS 79762
4001 PENBROOK

EXPLORATION AND PRODUCTION GROUP
Permian Basin Region

December 31, 1987

Vacuum Field Waterflow Committees
Joint Meeting with NMOCD Staff
Tuesday, January 12, 1988

William J. Lemay, Director
State of New Mexico
Oil Conservation Division
P. O. Box 2088
Santa Fe, New Mexico 87504-2088

Dear Bill:

This is to confirm the rescheduling of our joint meeting to Tuesday, January 12, 1988. An agenda is attached.

The presentations will require the use of a slide projector, an overhead projector, and a screen.

Very truly yours,

W. J. Mueller, Chairman
Management Committee

WJM/lsw
RE12.5/vacuum

Attachment

cc: J. T. Sexton, Supervisor
NMOCD District I
P. O. Box 1980
Hobbs, New Mexico 88240
Management Committee Members
Technical Committee Members
Geological-Geophysical Committee Members

VACUUM FIELD WATERFLOW COMMITTEES
MEETING WITH
NEW MEXICO OIL CONSERVATION DIVISION
TUESDAY, JANUARY 12, 1988
SANTA FE, NEW MEXICO

Time: 9:00 A.M. MST

Place: Oil Conservation Division Conference Room (No. 205)
State Land Office Building

AGENDA

1. Call to order - Bill Mueller, Phillips
2. Introductory Remarks - Bill Lemay and Jerry Sexton, NMOCD
3. Geological - Geophysical Committee's Report and Discussion - Bill Hermance, Mobil
4. Technical Committee's Report and Discussion - David Cain, Texaco
5. Individual Company Reports
   A. Arco
   B. Mobil
   C. Phillips
   D. Texaco
6. Contingency Plan for Subsurface Environment Protection - Bill Mueller
7. Discussion and Comments
8. Closing - Bill Lemay

December, 1987

VACUUM FIELD WATERFLOW
MANAGEMENT COMMITTEE MEMBERS

ARCO Oil & Gas Company
Mr. David McGee
P. O. Box 1610
Midland, Texas 79702

Conoco, Inc.
Mr. Hugh Ingram
P. O. Box 460
Hobbs, New Mexico 88240

Mobil Producing Texas and New Mexico, Inc.
Mr. Matt Sweeney
P. O. Box 633
Midland, Texas 79702

Phillips Petroleum Company
Mr. Bill Mueller
4001 Penbrook
Odessa, Texas 79762

Texaco, Inc.
Mr. John Schaffer
P. O. Box 728
Hobbs, New Mexico 88240

December, 1987

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Phillips Petroleum Company
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Odessa, Texas 79762

Phillips Petroleum Company
Ms. Arlene Pollin
1300 B Plaza Oil Building
Bartlesville, Oklahoma 74004

Standard Oil Production Company
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P. O. Box 4587
Houston, Texas 77210

Texaco Inc.
Mr. David Cain
P. O. Box 728
Hobbs, New Mexico 88240

December, 1987

VACUUM FIELD WATERFLOW
GEOLOGICAL-GEOPHYSICAL COMMITTEE MEMBERS

ARCO Oil and Gas Company
Mr. Tim Verseput
P. O. Box 1610
Midland, Texas 79702

Mobil Producing Texas and New Mexico
Mr. William Hermance
P. O. Box 633
Midland, Texas 79702

Phillips Petroleum Company
Mr. David White
4001 Penbrook
Odessa, Texas 79762

Texaco Inc.
Mr. Ed Horvath
P. O. Box 3109
Midland, Texas 79702

1987 STATUS REPORT
VACUUM FIELD WATERFLOW TECHNICAL COMMITTEE
DECEMBER 15, 1987

The efforts of the Vacuum Waterflow Technical Committee during the past 12 months concentrated towards implementation of the measures adopted in 1986 to identify and solve the causes of the waterflow problem. The most viable techniques identified are as follows:

1) Pressure falloff tests evaluating storage volumes.
   Pressure falloffs are a standard industry method of evaluating injection wells. One variable which is calculated from early time data is wellbore storage. Any injection wells communicating with the salt section whether through a direct channel or other wellbores, should exhibit significantly larger storage. This anomalous behavior will provide a means of screening wells for communication.

2) Radioactive tracer surveys using scintillation detectors.
   Radioactive material released into the injection well fluids is traced by a detector and if channeling is present will be sensed.

3) Nuclear decay time logs.
   This method traces fluid movement behind casing by activating the oxygen in water as it passes by the tool thus creating the tracer material. Measures velocity of fluid channeling.

4) Texaco neutron activation tool.
   Works similar to the nuclear decay time logs. Design of this tool allows measurement of volumes channeling. Major disadvantage of this tool is the size prohibits running through tubing.

5) Radial differential temperature surveys.
   Sensitive temperature measuring device with extending probes which contact casing wall and read differences in temperature thus detecting channeling (+0.01 degrees Farenheit).

Field wide, 263 wells were identified as target wells. This classification consisted of wells injecting above 900 psi. These

are broken down by operator as follows:

ARCO	12
MOBIL	88
PHILLIPS	85
TEXACO	78

Examination of 146 target wells by one or more of the various techniques adopted by the committee failed to establish communication between the injection interval and salt section. This includes 192 surveys of one type or another as shown in the following table:

WELL SURVEYS AS OF 12/01/87

OPERATOR	WELLS EXAMINED	FALLOFFS	PROFILES	TEMPERATURE	TDT	TOTAL SURVEYS
Arco	6	2	5	0	0	7
Mobil	35	1	34	0	0	35
Phillips	55	31	51	5	0	87
Texaco	50	32	30	0	1	63

Falloff tests conducted on 66 wells identified ten wells as possibly in some way contributing to the waterflow problem. This could be either through direct channeling or communication through other wellbores. A wellbore storage volume greater than 5000 bbls is being used as a cutoff to identify questionable areas where additional investigation is necessary.

The ten wells identified are:

Central Vacuum Unit Well Nos.: 58, 60 72, 73, 81 and 141.

Vacuum Grayburg San Andres Unit Well No. 49**.

East Vacuum Grayburg San Andres Unit Well Nos.: 0524-005, 2801-007*, 2801-005*.

Further investigation of these areas is underway.

*Radioactive tracer surveys run on these wells did not identify communication with salt section.

**Radioactive tracer survey and thermal decay time log did not identify communication with salt section.

Radioactive tracer and temperature surveys run on 125 of the targeted wells did not identify any wells communicating with the salt section.

Field drilling activity for the year included 39 wells penetrating the salt section. Waterflows from the salt section occurred in 6 wells. One additional waterflow occurred from the Queen formation. This along with wells identified by the OCD as experiencing bradenhead pressures through their annual surveys have been mapped. Eight wells experienced bradenhead pressure or casing leaks.

A list of wells drilled and those experiencing troubles in 1987 is attached. Bradenhead/casing leaks tabulated for the history of the Vacuum Field follows:

SUMMARY OF BRADENHEAD/CASING LEAK FOR THE VACUUM FIELD

YEAR	LEAKS
1987	8
1986	1
1985	2
1984	9
1983	8
1982	24
1981	23
1980	59
Prior to 1980	91

Seven wells currently monitor pressure across the salt section with Mobil's Bridges State No. 6 being completed in 1987. No significant pressure changes occurred during the past year on any of the monitor wells.

1987 Drilling Activity/Water Flows/Bradenhead Pressure or Casing Leak
Vacuum Field
Lea County, New Mexico

12/15/87

Well Name	Well Location	Wells Drilled During 1987 Which Encountered: No Wtr Flow	Salado Wtr Flow	Queen Wtr Flow	Flow Rate	Existing Wells With Bradenhead Press or Casing Leak in Salt
Phillips Philmex #28	1980' FNL & 660' FEL Sec 26-17S-33E	X				
Phillips Philmex #19	1980' FNL & 560' FEL Sec 35-17S-33E	X				
Phillips Philmex #21	1980' FNL & 1980' FEL Sec 35-17S-33E	X				
Phillips Philmex #24	660' FNL & 1980' FEL Sec 35-17S-33E	X				
Phillips Philmex #25	1980' FNL & 1980' FWL Sec 35-17S-33E	X				
Phillips Philmex #20	660' FNL & 660' FWL Sec 36-17S-33E			X	39 BPH	
JFG Mobil State #1	1980' FNL & 1980' FWL Sec 07-17S-34E	X				
SW Royalties Mobil State #1	600' FSL & 1971' FWL Sec 07-17S-34E	X				
D. R. Ormand Amoco State #1	660' FNL & 1980' FWL Sec 18-17S-34E	X				
Mobil State N #3	800' FNL & 2010' FWL Sec 10-17S-34E	X				
Mobil State N #4	1918' FNL & 850' FWL Sec 10-17S-34E	X				
Mobil Bridges State #512	470' FSL & 1850' FEL Sec 11-17S-34E	X				
Mobil Bridges State #507	1150' FSL & 1200' FEL Sec 26-17S-34E	X				
Mobil Bridges State #49	1980' FNL & 660' FEL Sec 27-17S-34E					X
Mobil Bridges State #89	660' FNL & 660' FEL Sec 10-17S-34E					X
Mobil Bridges State #63	1980' FSL & 1980' FWL Sec 13-17S-34E					X
Arco Hale State #1	660' FNL & 660' FEL Sec 31-17S-34E					X
Yates Angle State #1	660' FNL & 1980' FWL Sec 09-17S-34E					X
Samedan State GS16 #1	660' FSL & 660' FEL Sec 16-17S-34E					X
Texaco N.M. O State #26	990' FSL & 990' FWL Sec 36-17S-34E		X		1200 BPH	
Texaco N.M. O State #27	990' FSL & 990' FEL Sec 36-17S-34E		X		3000 BPH	
Texaco CVU #266	1971' FNL & 1310' FEL Sec 36-17S-34E	X				
Phillips Lea #14	935' FNL & 1980' FWL Sec 30-17S-34E		X		34 BPH	
Mobil State JJ #3	544' FSL & 760' FWL Sec 07-17S-35E	X				
Marathon State Com #1	1980' FNL & 1980' FWL Sec 17-17S-35E	X				
Lynx Pet State 20 #1	1980' FSL & 660' FEL Sec 20-17S-35E	X				
Sun Shoe Bar State Com #1	660' FSL & 2030' FWL Sec 15-17S-35E	X				
Arco Shoe Bar 23 State Com #1	1980' FNL & 660' FWL Sec 23-17S-35E	X				
BTA Oil Buckeye B #3	330' FNL & 1650' FWL Sec 36-17S-35E	X				
BTA Oil Buckeye C #1	1750' FNL & 1650' FWL Sec 36-17S-35E	X				
Phillips EVGSAU #3374-003	2630' FSL & 400' FWL Sec 33-17S-35E	X				
Phillips EVGSAU #3202-017	2000' FNL & 120' FEL Sec 32-17S-35E	X				
Phillips EVGSAU #3236-009	2510' FNL & 1850' FWL Sec 32-17S-35E	X				
Phillips EVGSAU #3229-010	1980' FSL & 10' FWL Sec 32-17S-35E		X		43 BPH	
Phillips EVGSAU #3202-019	2065' FNL & 2540' FEL Sec 32-17S-35E	X				
Phillips EVGSAU #3229-001	1980' FSL & 660' FWL Sec 32-17S-35E					X
Phillips EVGSAU #2054-001	330' FSL & 660' FWL Sec 20-17S-35E					X
Sun N.M. Federal C #1	2080' FNL & 600' FEL Sec 24-18S-34E	X				
Phillips Airstrip State A #1	1931' FSL & 1980' FWL Sec 15-18S-34E	X				
Southland Tonto 15 State #2	1880' FNL & 550' FEL Sec 15-18S-34E	X				
Southland Tonto 14 State #3	1980' FNL & 660' FWL Sec 14-18S-34E	X				
Texaco N.M. Z State NCT 5 #1	1850' FSL & 2110' FEL Sec 14-18S-34E	X				
Texaco N.M. R State #24	860' FSL & 660' FEL Sec 01-18S-34E		X		110 BPH	
Texaco N.M. Z State TN Com #1	660' FNL & 2200' FWL Sec 02-18S-34E	X				
Texaco CVU #302	2030' FNL & 1310' FEL Sec 06-18S-35E		X		2000 BPH	
Sun State AP #2	330' FSL & 2130' FEL Sec 08-18S-35E	X				
Yates Shining Star AEA #1	1650' FSL & 2310' FEL Sec 11-18S-35E	X				

PHILLIPS PETROLEUM COMPANY
OREGON LOCAL 7762
4001 PENBROOK
EXPLORATION AND PRODUCTION GROUP

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OIL CONSERVATION DIVISION
SANTA FE

December 7, 1987

Vacuum Field Waterflow Committees
Joint Meeting with NMOCD Staff
Tuesday, December 15, 1987

William J. Lemay, Director
State of New Mexico
Oil Conservation Division
P. O. Box 2088
Santa Fe, New Mexico 87504-2088

Dear Bill:

Attached is a proposed agenda for the subject meeting, and a preliminary copy of our proposed Contingency Plan for Subsurface Environment Protection.

Very truly yours,

W. J. Mueller, Chairman
Management Committee

WJM/lsw
RE12.5/vacuum

Attachments

cc: J. T. Sexton, Supervisor
NMOCD District I
P. O. Box 1980
Hobbs, New Mexico 88240

Copies to:
Vic
David C.
Jami

Vacuum Field Waterflow Committees
Meeting with
New Mexico Oil Conservation Division
Tuesday, December 15, 1987
Santa Fe, New Mexico

Time: 9:00 A.M. MST
Place: Oil Conservation Division Conference Room (No. 205)
State Land Office Building

AGENDA

1. Call to order - Bill Mueller, Phillips

2. Introductory Remarks - Bill Lemay and Jerry Sexton, NMOCD

3. Geological - Geophysical Committee's Report and Discussion - Bill Hermance, Mobil

4. Technical Committee's Report and Discussion - David Cain, Texaco

5. Individual Company Reports
   A. Arco
   B. Mobil
   C. Phillips
   D. Texaco

6. Contingency Plan for Subsurface Environment Protection - Bill Mueller

7. Discussion and Comments

8. Closing - Bill Lemay

WJM/lsw
RE12/vacuum9

VACUUM FIELD

LEA COUNTY, NEW MEXICO

CONTINGENCY PLAN

FOR

SUBSURFACE ENVIRONMENT PROTECTION

INJECTION PROJECT OPERATORS:

ARCO OIL AND GAS COMPANY
MOBIL PRODUCING TEXAS AND NEW MEXICO
PHILLIPS PETROLEUM COMPANY
STANDARD OIL PRODUCTION COMPANY
TEXACO, INC

RE1/Contingency

VACUUM FIELD
LEA COUNTY, NEW MEXICO

CONTINGENCY PLAN FOR SUBSURFACE ENVIRONMENT PROTECTION

PREFACE

To protect the subsurface environment of the Vacuum Field from possible degradation caused by pressured water in the Salado formation, the water injection project operators in the field plan to monitor the integrity of the Ogallala formation water. This monitoring program will serve to identify any subsurface problems as soon as they occur.

Geological investigations, as well as NMOCD regulated well completion techniques, give evidence that there is minimal likelihood of contamination of the Ogallala formation by the water in the Salado. However, in the unlikely event that the pressured water escapes from the Salado formation, the plan also lays out active steps to confine the problem area, identify and rectify the cause, and for restoration of the area.

VACUUM FIELD
LEA COUNTY, NEW MEXICO

CONTINGENCY PLAN FOR SUBSURFACE ENVIRONMENT PROTECTION

II. ACTION

If a fresh water sample shows an abnormal increase in chlorides, the following actions are to be taken:

A. Notify OCD and all Field Project Operators.

B. Begin producing contaminated water at maximum rate and retest for verification.

C. Sample and shut in all uncontaminated offset fresh water wells.

D. Reduce surface fluid injection pressures on all injection wells within a half-mile radius to 0 psi.

E. Begin testing the areal extent of the contamination and searching for the source.

Options available:

1. Perforate existing nearby wellbores opposite Ogallala.

2. Drill test well.

F. Identify source and repair.

G. Deplete area of all contaminated water:

1. Produce to surface with following disposal options:

a. Existing disposal wells and systems.

b. Current injection projects.

c. Perforate existing wellbores in the lower San Andres for additional disposal capacity.

2. Subsurface depletion and disposal by simultaneous completions in common wellbores of the Ogallala, Santa Rosa, Dewey Lake and/or Salado with the lower San Andres disposal zone.

H. Increase fresh water well sampling frequency in and around the contaminated area.

VACUUM FIELD INJECTION PROJECT OPERATORS

TELEPHONE LIST

ARCO	OFFICE	HOME
1. S. D. Smith	505-392-3551	505-392-1175
2. J. A. Nicholson	915-688-5324	915-686-1809
3. David McGee	915-688-5683	915-697-8705
MOBIL		
1. D. R. Seale	505-393-3315	505-393-1466
2. A. J. Alcott	505-393-9186	505-392-5340
3. G. P. Dalton	915-688-2249	915-687-5247
PHILLIPS		
1. D. T. Thorp	505-397-5592	505-397-1662
2. D. J. Fisher	505-397-5539	505-397-2420
3. W. B. Berry	915-367-1204	915-368-7305
SOHIO		
1.		
2.		
3.		
TEXACO		
1. A. Gernandt	505-393-4031	505-396-3429
2. J. A. Schaffer	505-393-7191	505-392-8387
3. J. E. King	505-393-7191	505-392-2585

RE1/Contingency3

December, 1987

VACUUM FIELD
LEA COUNTY, NEW MEXICO

CONTINGENCY PLAN FOR SUBSURFACE ENVIRONMENT PROTECTION

I. MONITOR

A. Sample and analyze all active and accessible fresh water wells to obtain a base chloride content reference.

B. Quarterly sample and analyze fresh water wells.

1. Wells will be produced prior to sampling to insure a representative sample is obtained.

2. Analysis will be performed by an independent lab or chemical company.

C. Conduct monthly surface pressure checks of monitor wells completed in the Salado Section.

D. Report drilling activity quarterly, specifically as to the existence or nonexistence of waterflows and their shut-in surface pressure.

E. All data to be submitted to the technical committee for compilation and comparison. A quarterly report will be sent to the Hobbs District Supervisor of the OCD and the Management Committee members.

Mobil Exploration and Producing U.S. Inc.

P.O. BOX 633
MIDLAND, TEXAS 79702

MIDLAND DIVISION

December 3, 1987

New Mexico Oil Conservation Division
P. O. Box 2088
Santa Fe, New Mexico 87504-2088

Attention: Mr. W. J. LeMay

VACUUM FIELD WATER FLOW
GEOLOGICAL COMMITTEE REPORT

Dear Mr. LeMay:

Attached you will find a Summary of the Committee's 1987 Geologic Report outlining the work that we have completed and our conclusions. I will review this project in detail at our December 15th meeting with your staff in Santa Fe.

Sincerely,

William E. Hermance.

William E. Hermance, Chairman
Geological Committee

WEH/hjw

A:M733769C.MES

VACUUM FIELD WATER FLOW
GEOLOGICAL COMMITTEE
REPORT SUMMARY

The Vacuum Field Salt Water Flow Geological Committee has, to-date, completed the geological description and characterization of the evaporite section across the field. The overlying red beds have also been described. The following is a summary of the Committee's work and conclusions.

MAPPING

Structure maps have been completed on the Top Rustler, Top Salt, Top Cowden Anhydrite, and on the Base Salt. An Isopach of the "Salt" has also been generated. Each of these markers is continuous across the field, and can be picked on the 600 logs used as a data base.

GEOLOGY

The entire section of interest was cored in a cooperative effort at the Mobil Bridges State #507, Sec. 26, T17S, R34E. A total of 1424 feet of core from the interval 1253-2677 feet was taken with 100% recovery. The formations cored included the Triassic Dockum Group, Permian Dewey Lake, Rustler, Salado, and the top of the Tansil.

The core was described in detail by the Geological Committee during April of this year. Since that time the Committee has completed the correlation of the core description to the open hole logs of the interval. This combined data set was then used as a base log for the entire field.

RESULTS

The detailed description of the Bridges State #507 core, and the correlation of that well data across the field has provided a clear understanding of how fluid flow through the evaporite section has been facilitated.

All wells with known waterflow encounters at known depths were tied to the logs of the Bridges State #507. A total of 48 discrete flows from different wells were correlated to, and plotted on the 507 logs. In every case individual flows can be related to distinct horizons within the Salado. Geologically, fluid flow would be facilitated along horizontal bedding-plane type weaknesses such as those provided at clastic-evaporite interfaces. In the Salado, these evaporites include halite, anhydrite, polyhalite, and other minor salts. All of the flows identified to-date in Vacuum Field can be correlated or assigned to one of these interfaces. None of the flows originates from within a thick halite unit.

If fluid flow were to occur along planes within the Salado, then we should find flows from several wells occurring at the same level. The log correlations discussed above show this to be the situation in the field. Indeed, several planes yielded flows in several different wells.

A:M733769B.MES

VACUUM FIELD WATER FLOW
GEOLOGICAL COMMITTEE
REPORT SUMMARY

CONCLUSIONS

The following are the Geological Committee's conclusions based upon the work completed to-date.

1. Fluid flow within the evaporite section in the Vacuum field area occurs along bedding planes within the evaporite section. These bedding planes can be identified on modern open-hole logs.

2. Fluid movement along bedding planes will be towards the crest of the structure at that level. Fluid will migrate up structure where the largest volumes may be stored. This appears to be the situation in Vacuum field.

3. Large volumes of fluid can be stored in and along bedding planes without the formation of large vertical solution cavities, thus the physical requirements for solution collapse do not exist.

4. Dissolution of the more soluble evaporite minerals will only occur as the fluid initially enters the evaporite section. The fluid stored in the bedding planes will be saturated with respect to "salt".

5. The Rustler anhydrite may act as a cap to the evaporite section. The anhydrite will provide mechanical strength. Neither the core nor the logs show any evidence of fracturing within the anhydrite and mapping shows the Rustler in the field to be unfaulted, thus the anhydrite may serve as an effective vertical permeability barrier.

6. The extensive red bed sequences of the Dewey Lake and Dockum Group may provide some further protection for the fresh water system in the area. These red beds have an abundance of clays which swell and slough when in contact with water. Additionally, the core has shown several permeable sands within the red bed section. These geologic conditions may serve as additional barriers to vertical fluid movement.

William E. Hermance

William E. Hermance
Chairman
Geological Committee

A:M733769B.MES

Mobil Exploration and Producing U.S. Inc.

December 3, 1987

P.O. BOX 633
MIDLAND, TEXAS 79702

MIDLAND DIVISION

New Mexico Oil Conservation Division
P. O. Box 2088
Santa Fe, New Mexico

Attention: Mr. W. J. LeMay

STATUS AND FUTURE PLANS
VACUUM WATERFLOW STUDY
VACUUM FIELD
LEA COUNTY, NEW MEXICO

Dear Mr. LeMay:

In anticipation of the meeting on this subject on December 15th in Santa Fe, we wish to submit the following summary of Mobil's activities during the last year and its plans for the future. We plan to make a more detailed presentation in Santa Fe.

Accompanying this letter is a report by the Geological Committee. It is not entirely complete, as we are waiting on some data from Core Lab. The Committee plans to make a full report in Santa Fe.

I. WORK ACCOMPLISHED

Establishment of a Salado Formation Monitor Well: The San Andres interval in Mobil Bridges State #6 was isolated by a bridge plug. The well was perforated in the salt section (2240'-2300' and 2540'-2620'). Only a small flow was observed from the perforated intervals. The well was then equipped for continuous pressure monitoring (Attachments I & III).

The pressure monitored at the wellhead has remained constant at 800 psi since the initial completion in February, 1987. This indicates that the conditions in the salt section have not changed and that the continued injection in the offset wells has not influenced the pressure conditions in the salt section of this well.

Falloff Tests: A falloff test was run in Bridges State #43 in order to determine wellbore storage. Type-curve matching technique used to calculate the wellbore storage showed storage to be insignificant. Following this, pressure tests were run in an additional twenty wells. The pressure behavior in these wells paralleled that of Bridges State #43 and it was concluded that the wells tested had no significant wellbore storage. Presence of any solution cavities in communication with the tested wellbores was thus ruled out (Attachment I).

Tracer-Temperature Surveys: Radioactive tracer and temperature logs in combination were run in 14 San Andres and 20 Abo water injection wells. None of the 34 wells (Attachments I & II), showed evidence of injection out of the intended zone.

Core Study: Core study of the evaporite section in the Mobil Bridges State #507 correlated with the waterflow intervals observed in the field by Texaco and Phillips indicates only horizontal bedding plane type weaknesses within the Salado formation. These conclusions are detailed in the Geological Committee report.

Fresh Water Analysis: A program of monitoring the fresh water from the four active water supply wells on a quarterly basis was initiated. Water samples are being collected from WSW Nos. 94, 100, 101, and 179 located on Bridges State lease. These wells are the wells that we currently produce for our fresh water requirements in the Vacuum field. Results of the last two analyses are attached. The analyses to-date are found to be consistent and show no deterioration in the water quality (Attachments IV & V). Eight other fresh water wells on the Bridges State lease have also been sampled. All of the analyses show low chloride content.

II. FUTURE PLANS

Mobil plans to continue its efforts toward resolving the waterflow problem. To this end, we will:

1. Reduce water injection in Mobil's Grayburg-San Andres waterflood on the Bridges State lease. Plans are to reduce injection to a volume no greater than the volume of water produced. It is estimated that it will take about 6 months preparation to bring about this reduction. This is due to the lack of current water disposal capacity for produced water from the North Vacuum Abo Unit, which is being injected into the Bridges State San Andres zone. Mobil is presently implementing plans to develop the produced water disposal capability that will allow the reduced injection. Earlier efforts to develop the North Vacuum Abo Unit Well Number 95 as a Devonian disposal well were a failure, as was the Mobil Bridges State No. 511 as a lower San Andres disposal well. Several alternatives for offlease disposal of produced water have been considered, with disposal in the South Vacuum Field now being the most likely alternative.

2. Continue to monitor the pressure in the salt section in the Bridges State #6. If warranted, further testing of this well and possible other completions in the Salado formation will be considered for pressure monitoring.

3. Continue analysis of water samples from the fresh water supply wells for any indication of degradation in water quality.

4. Continue to investigate the application of other techniques and run appropriate tests.

We look forward to the meeting on December 15th.

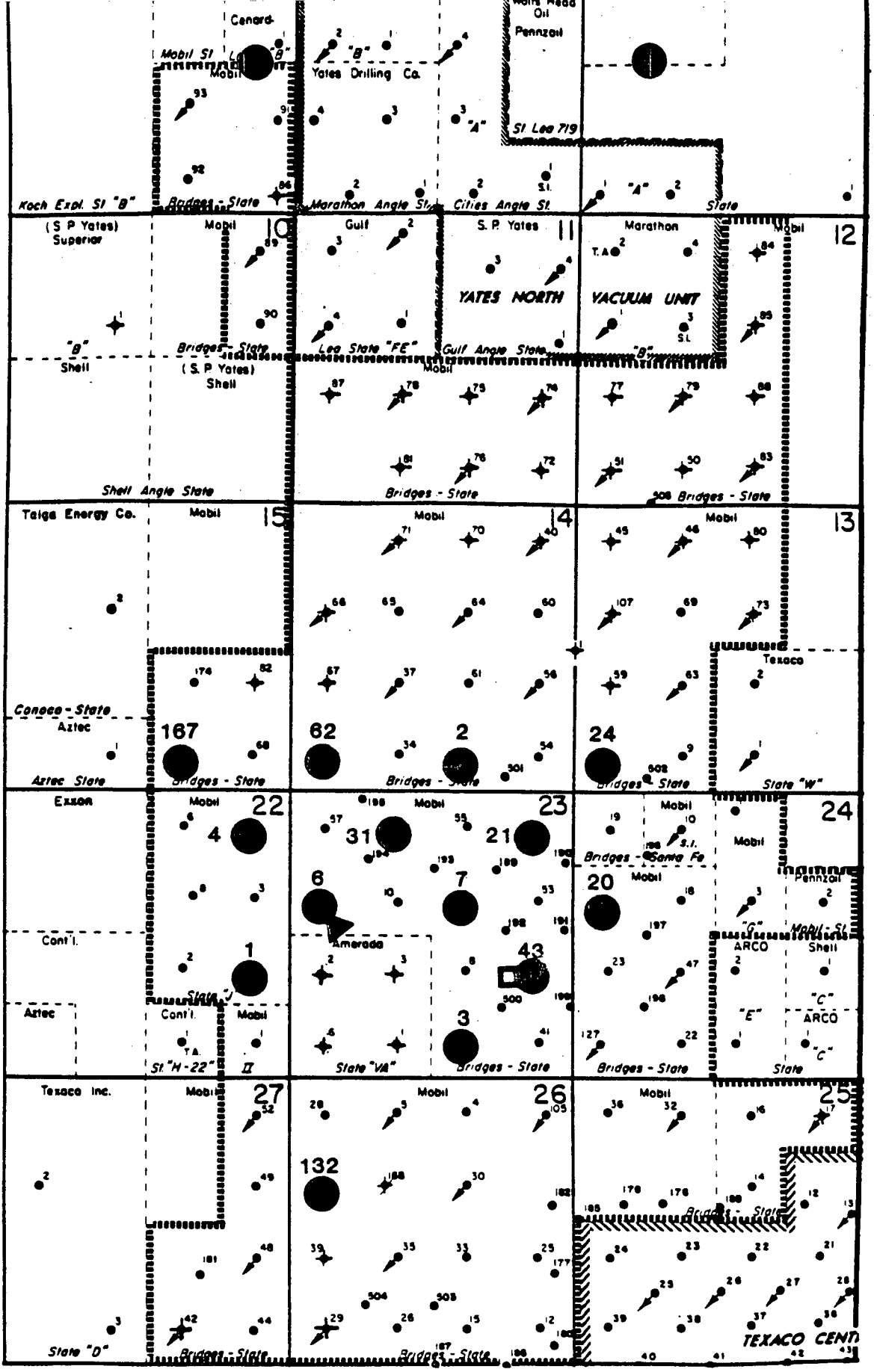
Sincerely,

M. E. Sweeney
Environmental & Regulatory Manager

MES/KKS/hjw
Attachments (4)

A:M733769A.MES

ATTACHMENT I



▶ PRESS MONITOR SALT SECTION

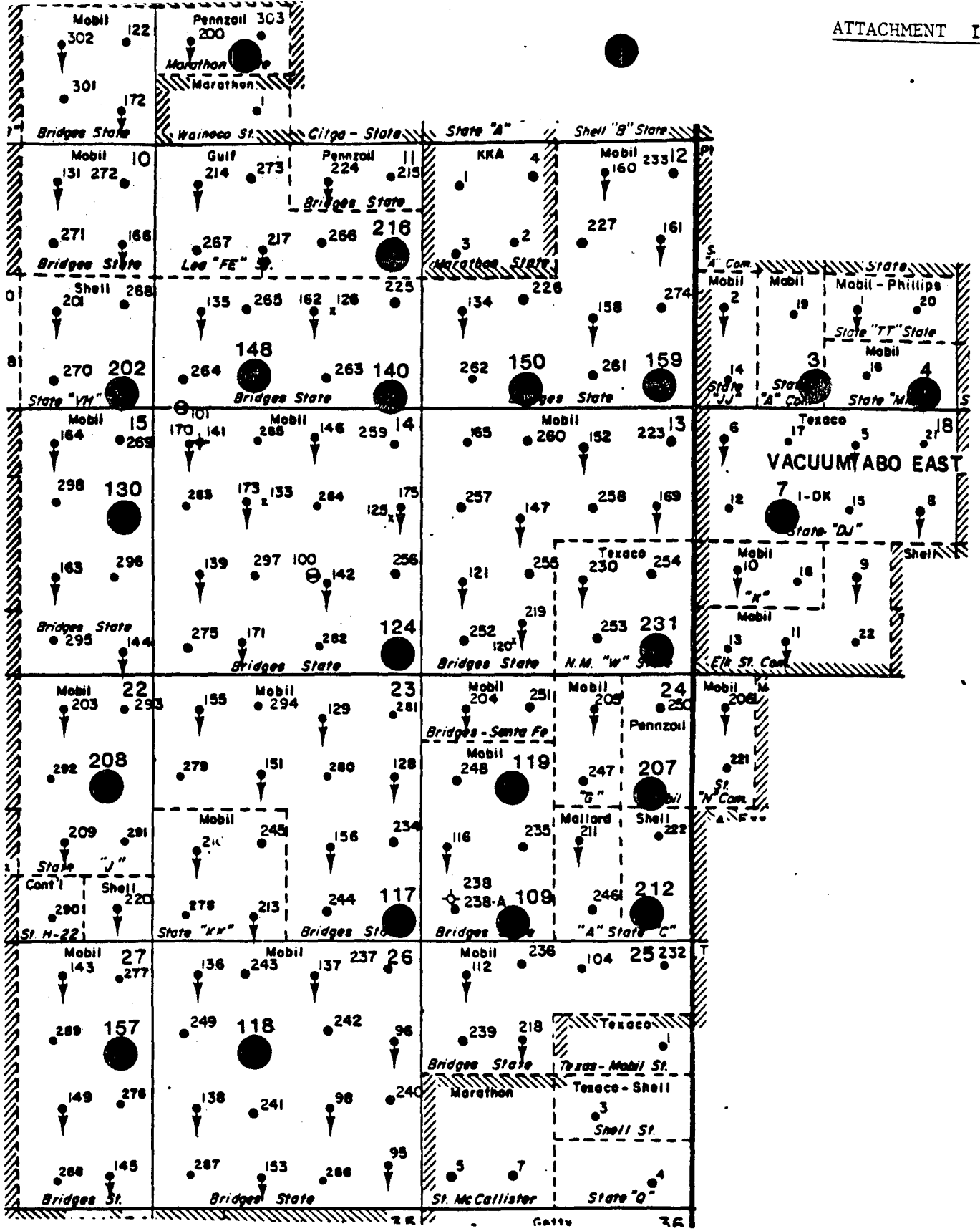
● TRACER/TEMP SURVEY

□ PRESS FALLOFF TEST

MOBIL OIL

SAN ANDRES WATERFLOOD
BRIDGES STATE LEASE
VACUUM (SAN ANDRES) FIELD
LEA COUNTY, NEW MEXICO

ATTACHMENT II

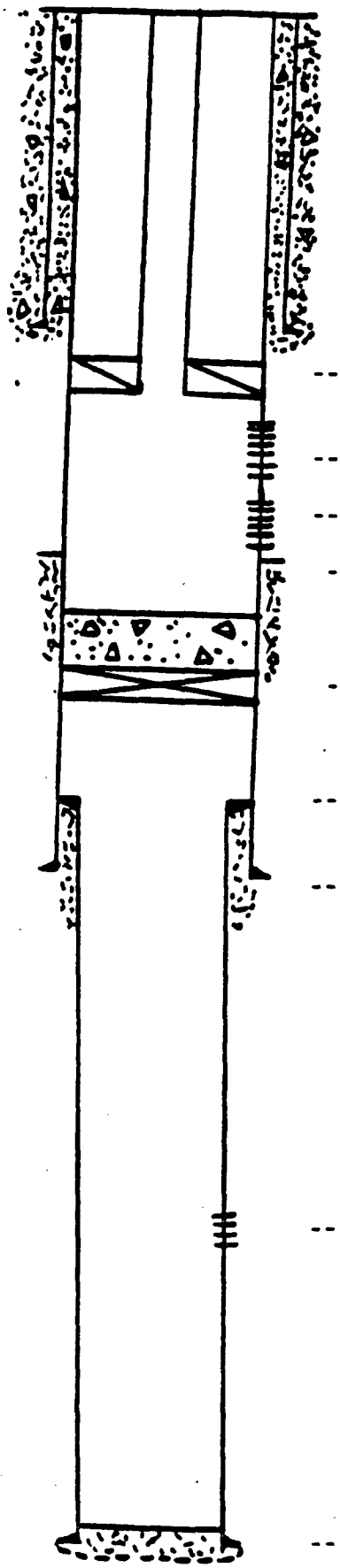


TRACER/TEMP SURVEY

MOBIL OIL

NORTH VACUUM ABO UNIT
NORTH VACUUM ABO EAST UNIT
VACUUM (Abo) FIELD
LEA COUNTY, NEW MEXICO

SALADO PRESSURE MONITOR WELL
BRIDGES STATE No. 6



LOCATION 660'FWL 1980' FNL
E23-17S-34E
FIELD VACUUM (San Andres)
OPERATOR MOBIL OIL

-- Bradenhead Sq. w/200 sx class C cmt

-- 10 3/4", L.W. Line Pipe Set @ 776' w/220 sx cmt cir

-- 7" Pkr set @ 2148'

-- Salado Formation Perf. (2240'-2300') w/1JS/2'
-- Salado Formation Perf. (2540'-2620') w/1JS/2'
72 holes

- Calc. TOC @ 2678'

- 7" CIBP, capped w/35' cement set @ 4100'

-- Top of liner @ 4180'

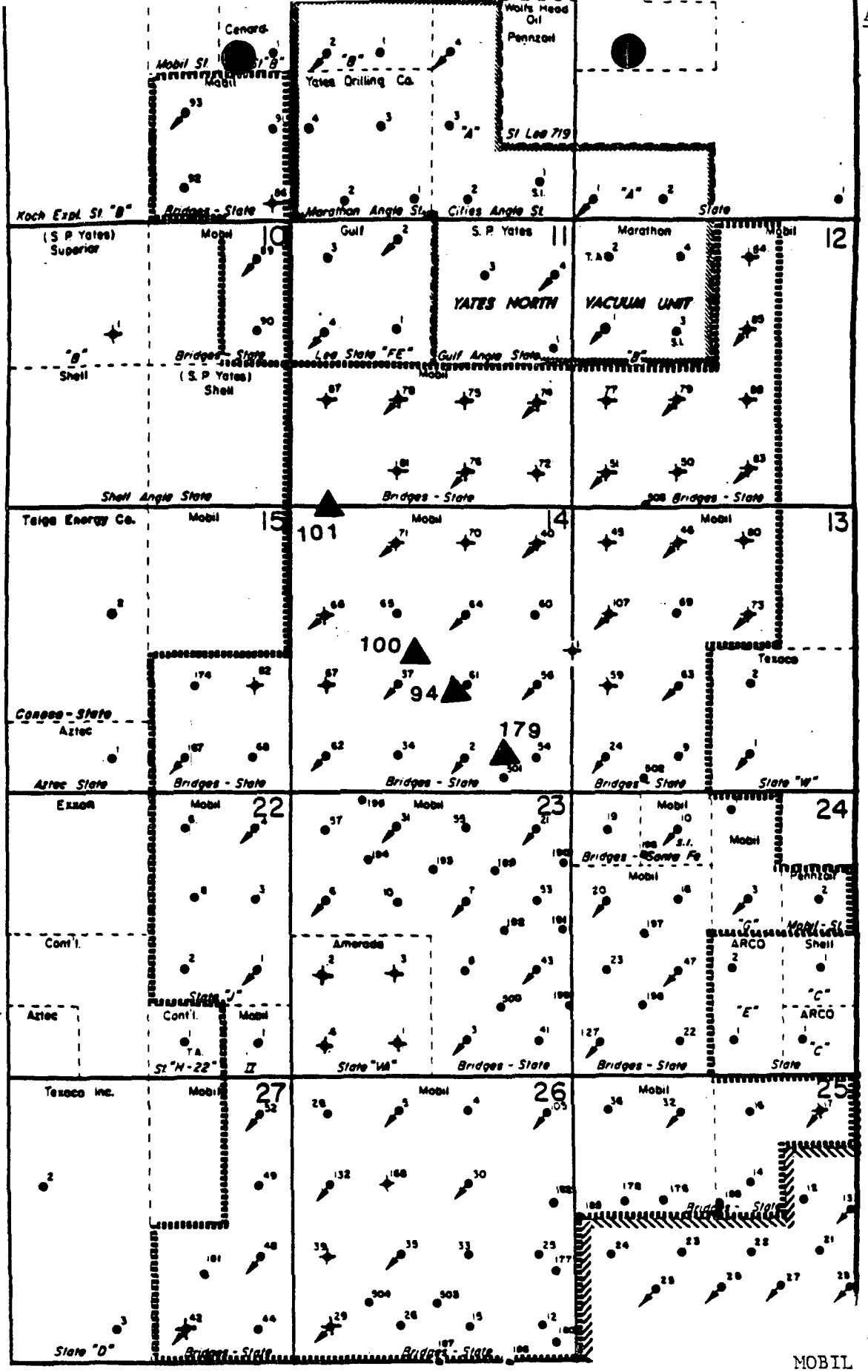
-- 7" 24# Csg set @ 4364' w/240 sx cmt

-- G/SA Perfs: 4602, 03, 04, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 38, 44, 46, 48, 50, 56, 58, & 60 w/1JSPF (24 holes)

-- 5", 15# liner set @ 4754' w/200 sx class C w/0.3% D65 200 sx class C w/0.3% D65 + 1/5# celloflakes/sx. Sqz top of liner w/200 sx class C cmt

TD @ 4755'
PBTD @ 4681'

ATTACHMENT I



▲ FRESH WATER SUPPLY WELLS

MOBIL OIL
SAN ANDRES WATERFLOOD
BRIDGES STATE LEASE
VACUUM (SAN ANDRES) FIELD
LEA COUNTY, NEW MEXICO

Unichem International

707 North Leech P.O.Box 1499

Hobbs, New Mexico 88240

Company : Mobil Producing Texas & NM
Date : 10-16-1987
Location: Bridges State - #94 (on 10-08-1987)

	Sample 1
Specific Gravity:	1.000
Total Dissolved Solids:	436
pH:	6.96
IONIC STRENGTH:	0.009

CATIONS:		me/liter	mg/liter
Calcium	(Ca^{+2})	3.42	68.4
Magnesium	(Mg^{+2})	1.10	13.4
Sodium	(Na^{+1})	1.75	40.3
Iron (total)	(Fe^{+2})	0.025	0.700
Barium	(Ba^{+2})	0.006	0.420
ANIONS:			
Bicarbonate	(HCO_3^{-1})	3.08	188
Carbonate	(CO_3^{-2})	0	0
Hydroxide	(OH^{-1})	0	0
Sulfate	(SO_4^{-2})	1.02	49.0
Chloride	(Cl^{-1})	2.17	77.0
DISSOLVED GASES			
Carbon Dioxide	(CO_2)		0

SCALING INDEX (positive value indicates scale)

Temperature		Calcium Carbonate	Calcium Sulfate
86°F	30°C	-0.42	-18

Unichem International

707 North Leech P.O.Box 1499

Hobbs, New Mexico 88240

Company : Mobil Producing Texas & NM
Date : 10-16-1987
Location: Bridges State - Well #100 (on 10-08-1987)

	Sample 1
Specific Gravity:	1.000
Total Dissolved Solids:	462
pH:	7.06
IONIC STRENGTH:	0.010

		me/liter	mg/liter
CATIONS:			
Calcium	(Ca^{+2})	3.44	68.8
Magnesium	(Mg^{+2})	1.20	14.6
Sodium	(Na^{+1})	2.12	48.9
Iron (total)	(Fe^{+2})	0.029	0.800
Barium	(Ba^{+2})	0.003	0.240
ANIONS:			
Bicarbonate	(HCO_3^{-1})	3.04	185
Carbonate	(CO_3^{-2})	0	0
Hydroxide	(OH^{-1})	0	0
Sulfate	(SO_4^{-2})	0.989	47.5
Chloride	(Cl^{-1})	2.74	97.0
DISSOLVED GASES			
Carbon Dioxide	(CO_2)		0

SCALING INDEX (positive value indicates scale)

Temperature		Calcium Carbonate	Calcium Sulfate
86°F	30°C	-0.33	-18

Unichem International

707 North Leech P.O.Box 1499

Hobbs, New Mexico 88240

Company : Mobil Producing Texas & NM
Date : 10-16-1987
Location: Bridges State - #101 (on 10-08-1987)

	Sample 1
Specific Gravity:	1.000
Total Dissolved Solids:	550
pH:	6.97
IONIC STRENGTH:	0.012

		me/liter	mg/liter
CATIONS:			
Calcium	(Ca^{+2})	4.28	85.6
Magnesium	(Mg^{+2})	1.24	15.1
Sodium	(Na^{+1})	2.78	63.9
Iron (total)	(Fe^{+2})	0.025	0.700
Barium	(Ba^{+2})	0.002	0.120
ANIONS:			
Bicarbonate	(HCO_3^{-1})	3.08	188
Carbonate	(CO_3^{-2})	0	0
Hydroxide	(OH^{-1})	0	0
Sulfate	(SO_4^{-2})	0.989	47.5
Chloride	(Cl^{-1})	4.23	150
DISSOLVED GASES			
Carbon Dioxide	(CO_2)		0

SCALING INDEX (positive value indicates scale)

Temperature		Calcium Carbonate	Calcium Sulfate
86°F	30°C	-0.33	-17

Unichem International

707 North Leech P.O.Box 1499

Hobbs, New Mexico 88240

Company : Mobil Producing Texas & NM
Date : 10-16-1987
Location: Bridges State - #179 (on 10-08-1987)

	Sample 1
Specific Gravity:	1.000
Total Dissolved Solids:	390
pH:	7.03
IONIC STRENGTH:	0.008

CATIONS:		me/liter	mg/liter
Calcium	(Ca^{+2})	2.92	58.4
Magnesium	(Mg^{+2})	1.04	12.6
Sodium	(Na^{+1})	1.51	34.6
Iron (total)	(Fe^{+2})	0.014	0.400
Barium	(Ba^{+2})	0.003	0.240
ANIONS:			
Bicarbonate	(HCO_3^{-1})	3.08	188
Carbonate	(CO_3^{-2})	0	0
Hydroxide	(OH^{-1})	0	0
Sulfate	(SO_4^{-2})	0.947	45.5
Chloride	(Cl^{-1})	1.44	51.0
DISSOLVED GASES			
Carbon Dioxide	(CO_2)		0

SCALING INDEX (positive value indicates scale)

Temperature		Calcium Carbonate	Calcium Sulfate
86°F	30°C	-0.42	-18

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

GARREY CARRUTHERS
GOVERNOR

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87504
(505) 827-5800

M E M O R A N D U M

TO: William J. LeMay, Director

FROM: Jami Bailey, Geologist

SUBJECT: Vacuum Field Waterflow

DATE: October 5, 1987

A review of geologic data presented by the Vacuum Field Waterflow Technical Committee indicates that although a great deal of work has been performed, the source of high pressure water which is flowing through the salt section (Salado Formation) has not been identified.

In 1986, geochemical analyses of injected waters and salt flow waters were made, and results were presented by Phillips Petroleum Company in the "Origin of Vacuum Field Waterflow Brines: Status Report." The conclusions presented in the Status Report were:

"1. The Vacuum Field salt section waterflow brines from the two wells sampled are not naturally occurring connate waters formed by the evaporation of Permian seawater.

2. The waters presently found in the Salado, San Andres, and Devonian formations have fresh water (meteoric) origins.

3. Waterflow brines can be correlated with specific injection or disposal waters based on their isotopic composition.

4. The dissolved salts in the waterflow brines are determined by the dissolution of evaporite minerals from the Salado Formation and are not related to the original components in the source water."

The report presented convincing evidence through geochemical analyses that the salt section waterflow brines are introduced waters that dissolve evaporite minerals from the rock during circulation through the section. Similar dissolution by introduced water has been studied elsewhere in the area.

Deep-seated dissolution in the salt section described by Anderson (1981) has occurred around the margin of the Delaware Basin where the Capitan limestone is in contact with Permian evaporites and within the Basin where selective dissolution in the lower Salado has undercut the overlying salt beds of the middle and upper Salado. Figure 1 shows the relationship of the Vacuum Field to the Delaware Basin and results of this deep-seated dissolution in the form of sinks and playa lakes.

Although the Vacuum Field is not within the margins of the basin, Anderson presented various models for the communication needed to initiate a dissolution cycle. Anderson, et al.(1978) describe dissolution controls which may be applicable in the apparently increasing salt section waterflow. I do not necessarily mean to imply that the Vacuum Field waterflow is strictly a naturally occurring phenomenon, but that the principles for development and growth of salt dissolution basins through brine flows in the salt section have been identified in the southeastern part of the state.

The Waterflow Technical Committee submitted land plats identifying bradenhead flows for 1980-1985. Although these plats indicate a decrease in the number of new bradenhead flows each year, and a general shifting of the locations of new flows from the East Vacuum Unit to the Central Unit, we do not have any comparative information on the number and locations of injection wells that were operating during the respective years, or prior to 1980, that may be contributing to the natural process.

The December 8, 1986 Status Report of the Geological-Geophysical Committee, presented by Mobil, indicated that the most likely pathway of fluid flow within the evaporite section occurs along bedding planes and not through a pipe system within the halite. As seen on the electric log for the Texaco CVU Well No. 81 on Cross Section A-A', the evaporite section is comprised of interbedded anhrydrite, halite, polyhalite, clays, shales, and some dolomite. These bedding planes would provide higher permeability pathways for fluid movement than would be present for vertical movement of fluids, except along fractures.

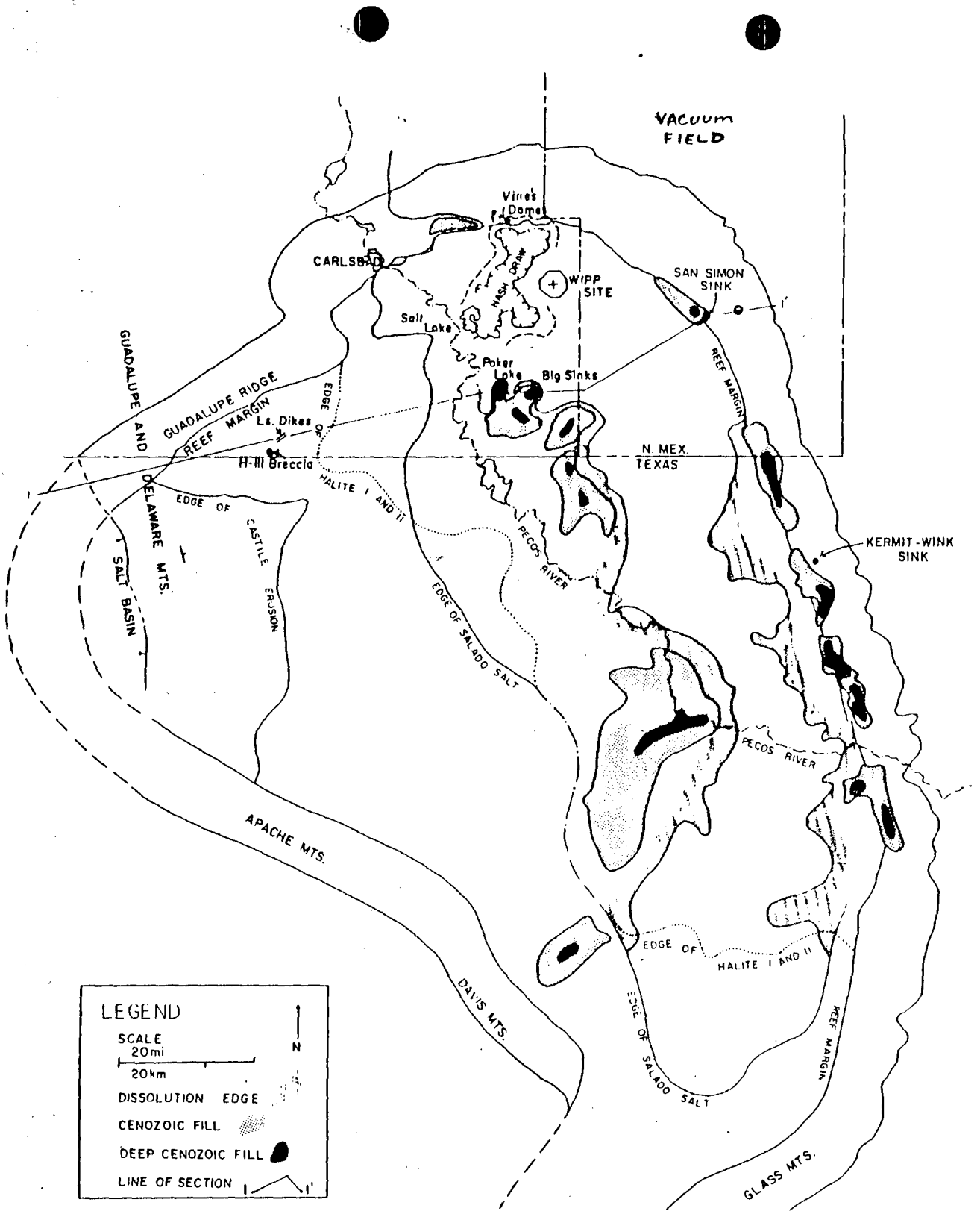


Figure 1. Map of Delaware Basin showing location of Capitan reef, major dissolution depressions, and western dissolution edge of evaporites and of major salt units. (FROM ANDERSON, 1981)

However, the structure of the Vacuum Field anticline can not be ignored and is analogous to other anticlines expressed also in the Castile-Salado evaporite sequence in the northern Delaware Basin. In these possible analogs to the Vacuum Field, extreme extensional fracturing has been observed in the salt section where competent beds are "pulled apart" during the flow of less competent, enclosing materials. Anticlinal structures tend to develop in evaporites where two or more types of materials are interlayered and subjected to stresses perpendicular to the bedding. (Anderson and Powers, 1978)

Cross-section A-A' and B-B' were drawn through the central portion of the Vacuum Field and indicate that waterflows encountered during drilling of the wells may be correlatable through the Vacuum structure. Five of the wells were drilled within a 3-month time span in 1979, and one well was drilled 30 years earlier. The well logs were hung on the top of the Rustler datum and indicate that several distinct waterflows can be identified. It is most interesting to note that not only is the water flow found in the Texaco CVU No. 1 definitely correlatable with the later wells, but also was present many years prior to start-up of waterflood operations in the field.

The Vacuum Field Geological-Geophysical Committee proposed continuing examination of the waterflow problem in the following areas:

1. Finalize all maps created to date.

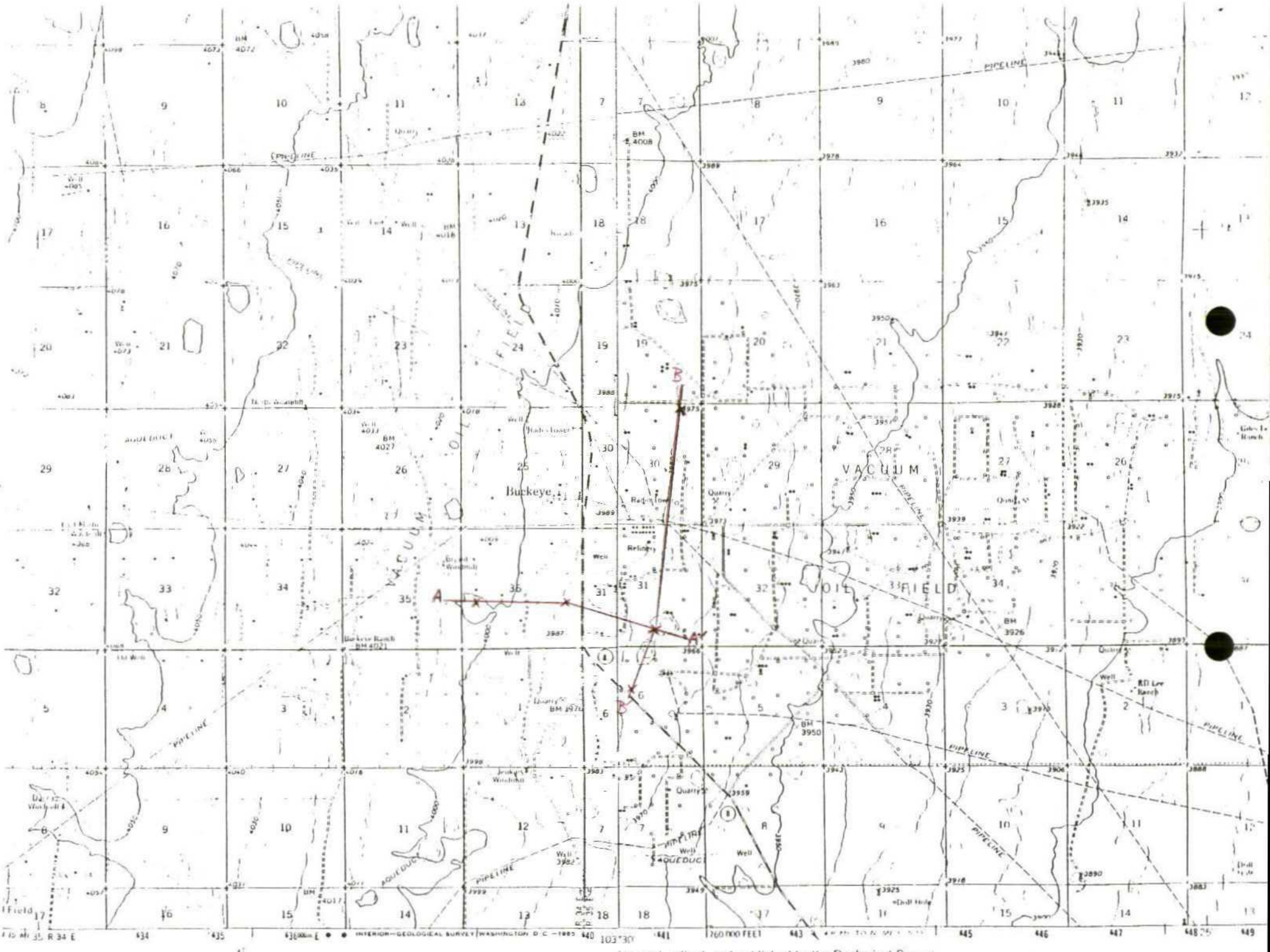
2. Attempt to identify specific intervals in the evaporite section through which fluid may be moving.

3. Review subsidence monitoring for areas where large volumes of fluid and rock may have been removed.

4. Determine the composition, continuity, and sealing characteristics of the interval from the surface to the top of the salt to define the constraints upon fluid movement upwards from the evaporite.

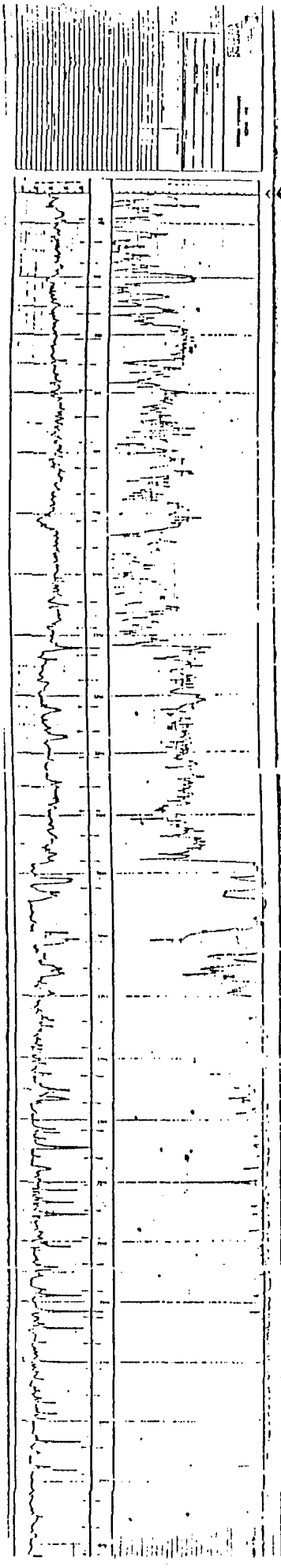
I agree that these priorities should continue, but I also recommend:

1. Construction of maps indicating bradenhead flows and waterflows for the purpose of tracing the direction and history of water movement through specific intervals.



Mapped, edited, and published by the Geological Survey

CROSS-SECTION A-A'



TEXACO CENTRAL VACUUM No. 81
L-36-17S-34E 3998'
3/79

← BOTTOM OGALLALA ~350

← TOP RUSTLER 1483

← TOP SALT 1617

← WATER FLOW 1928

← BOTTOM SALT 2518

INJECTION INTERVAL 4322-4705

A

TEXACO CENTRAL VACUUM
No. 84 I-36-17S-34E
2/79 3985'

← BOTTOM OGALLALA ~335

← TOP RUSTLER 1467

← TOP SALT 1598

← WATER FLOW 1795

← WATER FLOW 1977

INJECTION INTERVAL 4350-4682

← BOTTOM SALT 2756

TEXACO CENTRAL VACUUM
No. 94 O-31-17S-35E
3/79 3969'

← BOTTOM OGALLALA ~320

← TOP RUSTLER 1452

← TOP SALT 1585

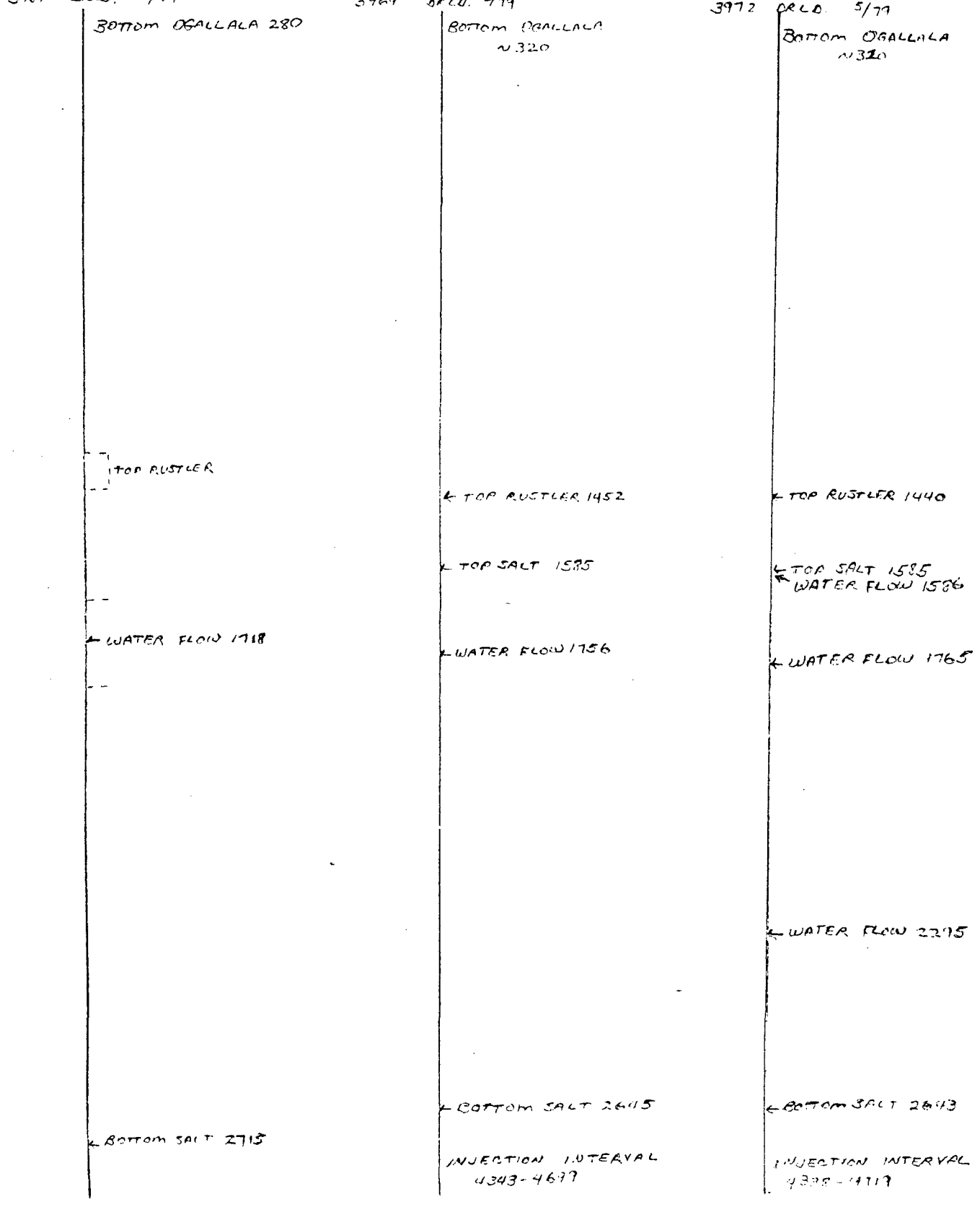
← WATER FLOW 1756

← BOTTOM SALT 2645

INJECTION INTERVAL 4343-4677

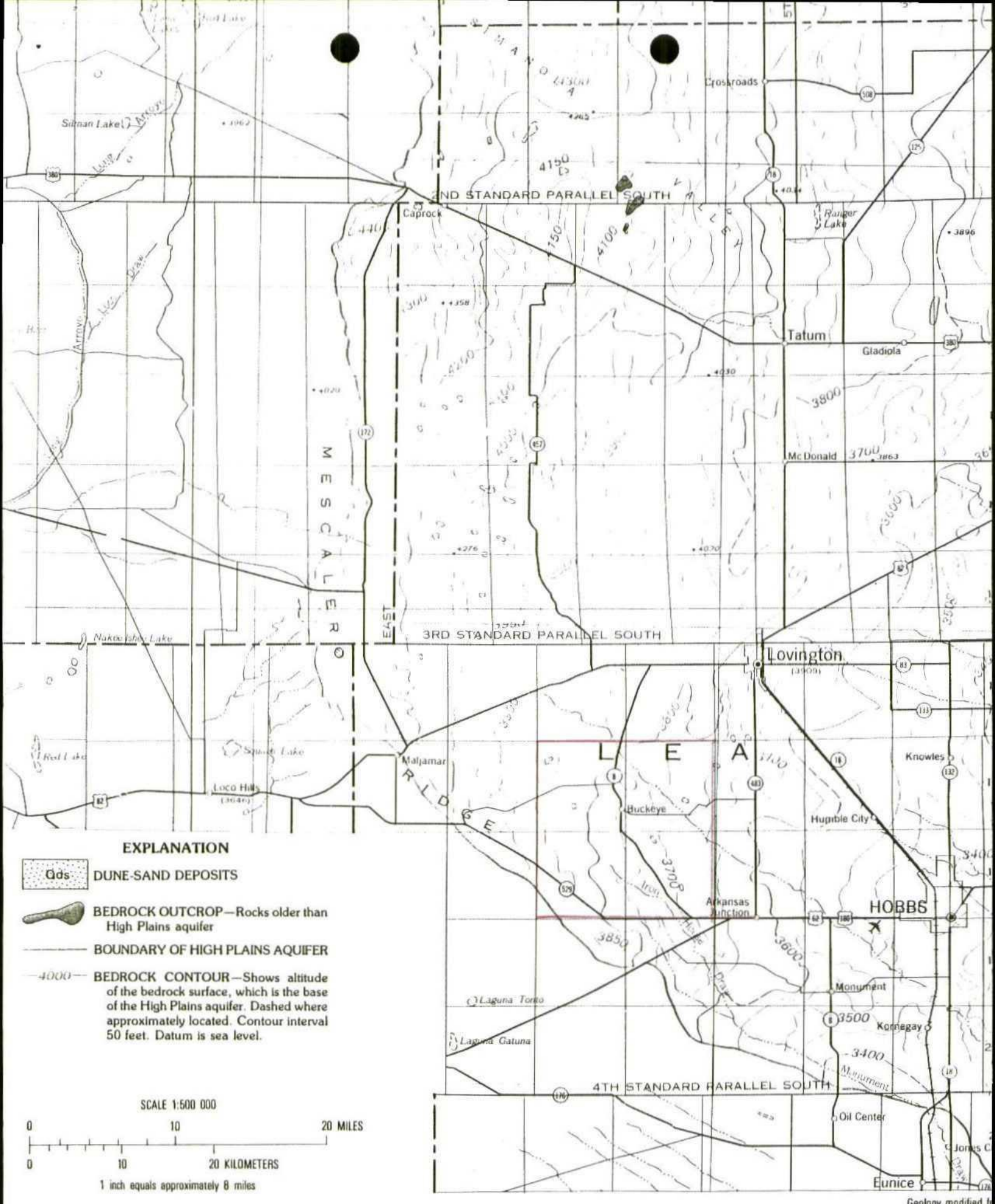
A'

CROSS-SECTION B-B'



2. Land plats comparative to the 1980-1985 bradenhead flow plats, indicating which wells were injecting fluids at that time, and at what pressure. This information is necessary for years previous to 1980 also. These plats in conjunction with the maps may help identify areas for further study and determine those conditions and practices that may aggravate natural processes evident in the area.

cc: David Boyer



EXPLANATION

Qds — DUNE-SAND DEPOSITS

BEDROCK OUTCROP—Rocks older than High Plains aquifer

BOUNDARY OF HIGH PLAINS AQUIFER

4000 — BEDROCK CONTOUR—Shows altitude of the bedrock surface, which is the base of the High Plains aquifer. Dashed where approximately located. Contour interval 50 feet. Datum is sea level.

SCALE 1:500 000

0 10 20 MILES

0 10 20 KILOMETERS

1 inch equals approximately 8 miles

Geology modified from Cronin (1969)

MAP SHOWING ALTITUDE OF THE BEDROCK SURFACE, WHICH IS THE BASE OF THE HIGH PLAINS AQUIFER (OGALLALA)

(HART, 1985)

REFERENCES

Anderson, R.Y., 1981, Deep-Seated Salt Dissolution in the Delaware Basin, Texas and New Mexico: New Mexico Geological Society Special Publication 10, p. 135-145.

Anderson, R.Y., Kietzke, K.K. and Rhodes, D.J., 1978, Development of dissolution breccias, northern Delaware basin, New Mexico and Texas: New Mexico Bureau of Mines and Mineral Resources Circular 159, p. 47-52.

Anderson, R.Y. and Powers, D.W., 1978, Salt anticlines in the Castile-Salado evaporite sequence, northern Delaware basin, New Mexico: New Mexico Bureau of Mines and Mineral Resources Circular 159, p. 79-83.

Hart, D.L. and McAda, D.P., 1985, Geohydrology of the High Plains aquifer in southeastern New Mexico: U.S. Geological Survey Hydrologic Investigations Atlas 679.

Hess, W.L., 1976, Structure of the Permian Ochoan Rustler Formation, southeast New Mexico and west Texas: New Mexico Bureau of Mines and Mineral Resources Map 7.

Roger, Jami File

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

TONEY ANAYA
GOVERNOR

December 23, 1986

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87501-2088
(505) 827-5800

W. J. Mueller, Chairman
Vacuum Pool Management Committee
c/o Phillips Petroleum Company
4001 Penbrook
Odessa, Texas 79762

Dear Mr. Mueller:

This letter is a followup on our meeting of December 11, 1986.

First, I want to thank you and all the other members of the various Vacuum Pool committees for the work conducted to date. It is clear to me from the reports received that the participating companies have committed substantial resources and quality manpower to the effort to find the source of the problem in the pool. Nevertheless, it is distressing that solid evidence as to the source or sources of the waterflows is not in hand or even clearly on the horizon. I would hope for some improvement in this area when we meet in late March or early April.

As I have suggested to you from time to time, this problem cannot be studied forever. At some time some mitigating action will need to be taken. One possible course of action might be a phased reduction in injection pressure. Under such a plan, injection at pressures over 900 psi might have to be stepped down over a set period of time such as 12 to 18 months. Any pressure over 900 psi would be reduced by a one-twelfth or one-eighteenth part, as appropriate, until no injection above 900 psi was occurring in the pool.

If hard evidence is not available by next summer, I would have to seriously consider implementation of such a plan or a variation thereon.

Sincerely,

R. L. STAMETS
Director

RLS/fd

cc: Jerry Sexton

FORM G-157

Vacuum Field Waterflow Committee Meeting w/ NMOCD Dec. 11, 1986

Name	Company	Location	Phone
Bill Mullin	Phillips	Odessa	915/ 367-1313
Bill Hermance	Mobil	Midland	915/ 688-2191
Bob Orlando Asst.	ARCO	Dallas	214-754-4368
John Roam	ARCO	Midland	915-688-5269
Mike Brownlee	Phillips	Odessa	(915) 367-1413
David Cain	Texaco	Hobbs	505-393-7191
Arlene Rollin	Phillips	Bartlesville	918-661-3483
Kris Singh	Mobil	Midland	915-688-2189
David Douglas	ARCO	Midland	915-688-5563
Ron Rogers	ARCO	Midland	915-688-5579
Roy Johnson	OCD	Santa Fe	—
Michael E. Stogner	OCD	Santa Fe	505-827-5811
David Catanach	OCD	S.F.	827-5807
Tom Kellahin	Mobil	Midland	688 2064
[illegible]	Phillips	Odessa	(915)367-1407
Jami Bailey	OCD	Santa Fe	827-5884
Roger Anderson	OCD	" "	827-5885
Bret Rowland	Mobil	Midland	688-2458

STATUS REPORT

December 11, 1986

The following is a report on the accomplishments to date by the Vacuum Field Waterflow Technical Committee since the August, 1986 meeting. The goals of this committee are:

1.) Find avenue(s) allowing water into evaporite section.

2.) Correct communication.

3.) Develop a method to verify the problem is dissipating.

Two written reports have been presented listing targeted wells, critiquing industry techniques available to detect channeling and future uses of monitor wells.

To obtain a better handle on the extent of waterflows, bradenhead maps have been compiled, updated and reproduced by computer for future reference of known flows. In conjunction with updating of the bradenhead flows, all wellheads have been inspected and their mechanical integrity has been verified. This has been mapped for convenience. The only recorded casing failure in the salt section this year occurred in the Central Vacuum Unit Well No. 91. This well had a history of casing failures. Oxygen 18 Isotope analysis of samples from this well compare with previous analysis of water flows. Common mixtures of injected fluids in the field hamper this procedure in pinpointing the exact source of contamination. Approximately 35 water samples field wide have been analyzed.

Lists of all injection and disposal wells operating above 900 psi have been compiled and defined as target wells. This represents over 250 wells field wide. Every well surveying technique available both commercially and experimental has been evaluated. Phillips' Research Department evaluated logging tools and the Technical Committee adopted the following as a preliminary order of preference:

1.) Radioactive tracer surveys using scintillation detectors in combination with temperature surveys.

2.) Nuclear decay logs.

3.) Texaco neutron activation tool.

4.) Radial differential temperature survey.

Pressure falloff testing has been the conventional industry method for determining wellbore storage. Phillips' Research Department recommended and the committee has accepted the use of this technique to search for unusually large storage possibly indicating channeling. The large number of target wells makes it infeasible to use all of the above techniques on every well. Combinations of these techniques are being implemented to check their validity. Over 120 wells have been or plan to be surveyed by one or more of the above methods initially. Ultimately all 250 wells will be surveyed if necessary. Maps of wells surveys are being prepared to indicate areal coverage. After evaluating the results of these initial surveys, a standard procedure will be adopted to survey the remaining wells.

Locations for monitor wells have been proposed throughout the field. These wells will have a three fold purpose. Initially, these wells will serve to define the areal extent of the flows and establish communication within the evaporite section. Finally, these wells will serve to monitor the salt section to determine if the pressure is actually dissipating once the problems have been corrected.

Vacuum Field Waterflow Problem
ARCO Oil and Gas Company Plan of Action

ARCO Oil and Gas Company fully supports the implementation of a field-wide program to locate the source or sources of fluid entry into the evaporite section. Given below is a general description of how AOGC believes a field-wide program should be implemented as well as specifics as to the work completed and planned on AOGC operated properties.

AOGC recommends that the extent of the pressurized evaporite section be determined through the drilling and/or recompletion of monitor wells in the evaporite section in known or suspected "Hot Spot" locations. These monitor wells should be used to monitor pressure and only be produced to facilitate interference or tracer testing. This will minimize the potential for subsidence. Where production from the evaporite zone is necessary, a localized subsidence monitoring program should be implemented. Where waterflows are encountered, interference testing between monitor wells should be pursued to determine the extent of communication within the evaporite section and provide information to determine the flow characteristics in this section. Also, the merits of a RA tracer program and pressure tests between offsetting injection wells and monitor wells with waterflows should be examined.

Concurrent with the above program, bradenhead and annular pressure surveys should be performed on all injection wells and testing initiated on target wells. Target wells are defined as wells injecting at wellhead pressures of 900 PSI or greater. Testing should include falloff tests and radioactive tracer surveys (using tools with multiple scintillation detectors) run in conjunction with a continuous reading temperature tool. Falloff testing could potentially detect wells with abnormally high storage volumes which could indicate possible dissolution of the evaporite section. Radioactive tracer surveys should detect any behind-pipe movement of injected fluids from the perforated interval to the evaporite section. Other tools if proven more effective or if needed for verification should also be used. Due to the large number of target wells, testing priority should be given to wells around known evaporite section flows, to wells with high cumulative injection volumes and/or historically high injection pressures, and to wells with past injection profiles indicating upward channelling.

AOGC believes a better understanding of the geologic nature of the evaporite section is needed. Mapping of the various substrata within the section should provide some clues as to where and how fluid movement is likely to occur. Also, the potential for subsidence resulting from salt dissolution should be researched.

AOGC's involvement in addressing the Vacuum waterflow problem is primarily as a nonoperating working interest owner. However, AOGC does operate the State Vacuum Unit and the Sinclair Vacuum salt water disposal well. The State Vacuum Unit is a small waterflood on the western edge of the Field. AOGC has operated a monitor well on the State Vacuum Unit since 1977. The monitor well has not encountered any significant water flows or pressure changes in the evaporite section during this period. This data indicates

that the waterflow problem does not exist on the State Vacuum Unit. Nevertheless, AOGC will implement the field testing program to verify the integrity of the injectors on the State Vacuum Unit.

Following the outline of the field program described above, AOGC has initiated work on the properties it operates. AOGC has completed bradenhead and annular pressure surveys on all wells in the State Vacuum Unit. AOGC also has completed radioactive tracer surveys and temperature surveys on the State Vacuum Unit Nos. 9, 11, 15 and the Sinclair Vacuum salt water disposal well. These surveys did not detect any channelling or fluid movement to the evaporite section. The Sinclair Vacuum SWD has been surveyed three times in the last two years, and the surveys consistently show that no channel to the evaporite section exists. AOGC plans additional work within this program as described below:

1. AOGC plans to re-enter the Lea 403 State No. 6 (660' FNL and 1980' FEL, Section 17-T18S-R35E) and complete it as a monitor well. This recompletion will confirm the existence of a pressurized evaporite section in the vicinity of AOGC's SWD well. The scheduling for the recompletion of AOGC's monitor well is to be coordinated with other monitor well completions so that interference tests can be run.

2. AOGC concurs with the interference test procedure as proposed by Phillips. If a waterflow is encountered in AOGC's monitor well, interference tests between monitor wells and/or the monitor well and offset injectors will be pursued. If interference tests establish that communication exists, then the merits of a RA tracer program for confirmation will be evaluated.

3. AOGC plans radioactive tracer and temperature surveys for all target wells. Other tools if proven more effective or if needed for verification will be used.

4. AOGC is participating in the Vacuum Field Geologic Committee. This committee is preparing structure and isopach maps for various intervals above and below the evaporite section. The committee also is addressing the problem of salt dissolution and potential subsidence.

5. AOGC will continue to monitor the evaporite section for pressure changes or fluid movement in the monitor well on the State Vacuum Unit.

ARCO Oil and Gas Company fully supports the work of the Management, Geologic, and Technical Committees in their efforts to solve the waterflow problem. As an operator and working interest owner in the Vacuum Field, AOGC will take all necessary and appropriate steps to solve the waterflow problem.