

ATL 01102-2

SODA LAKE

CONFIDENTIALITY NOTICE

"Data contained in pages and figures listed below of this proposal shall not be used or disclosed, except for evaluation purposes, provided that if a contract is awarded to this proposer as a result of or in connection with the submission of this proposal, the Government shall have the right to use or disclose any data to the extent provided in the contract. This restriction does not limit the Government's right to use or disclose any technical data obtained from another source without restriction."

PAGE

4-11 inclusive

14 and 15

Optional Form 60 and attachments B-1, B-2

FIGURE

1 and 2

RFP NO. ET-78-R-08-003
GEOHERMAL RESERVOIR CASE STUDY
NORTHERN BASIN AND RANGE PROVINCE

A. PROPOSER: CHEVRON RESOURCES CO.
320 Market Street
San Francisco, California 94111

B. TECHNICAL PROPOSAL

1. Investigation Area: SODA LAKE, NEVADA

a. Location

The geothermal resource area lies principally in T19 and 20N, R27 and 28E, Churchill County, Nevada.

b. Ownership

The attached map (Figure 1) shows the current geothermal leases. Federal lands administered by the BLM occupy a checkerboard of even-numbered sections through the northern part of the area. The balance of the land is privately owned in tracts ranging in size from 10 acres to a few thousand acres. Chevron holds approximately 13,400 acres.

Accessibility

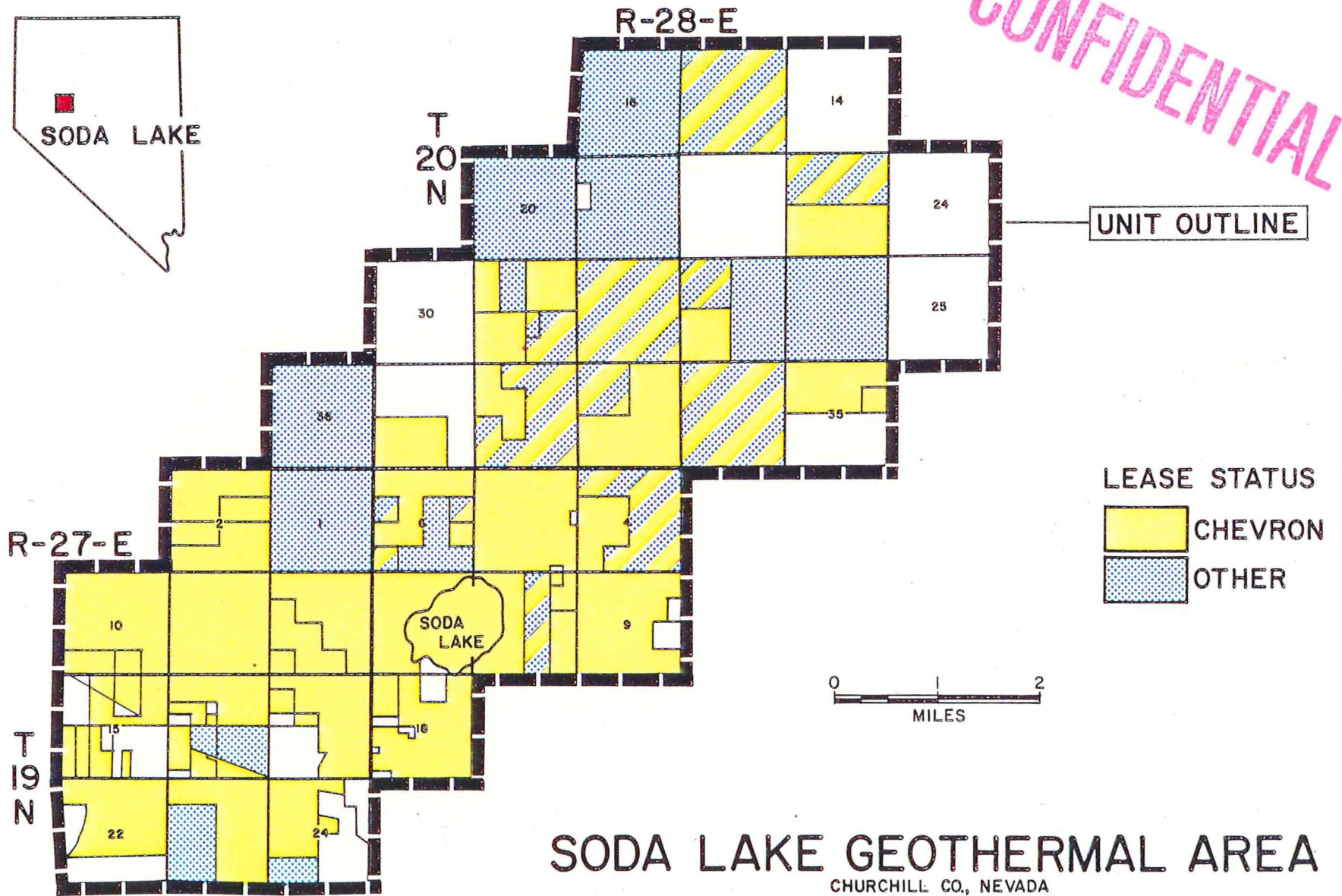
The area is readily accessible by car over paved roads (Highway 50 and Soda Lake Road), northwest of the town of Fallon. The topography is shown on the PROGRAM DATA INDEX map (Figure 2 - a folded map attached).

Unitization

Chevron has formed a Federal Geothermal Unit in the area. The Unit Outline is shown on Figure 1. The Unit area



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SODA LAKE GEOTHERMAL AREA
CHURCHILL CO., NEVADA

FIGURE 1

comprises 38 Sections totaling approximately 24,300 acres. Public domain lands occupy approximately 10,370 acres, State of Nevada lands 160 acres, and the balance is patented land.

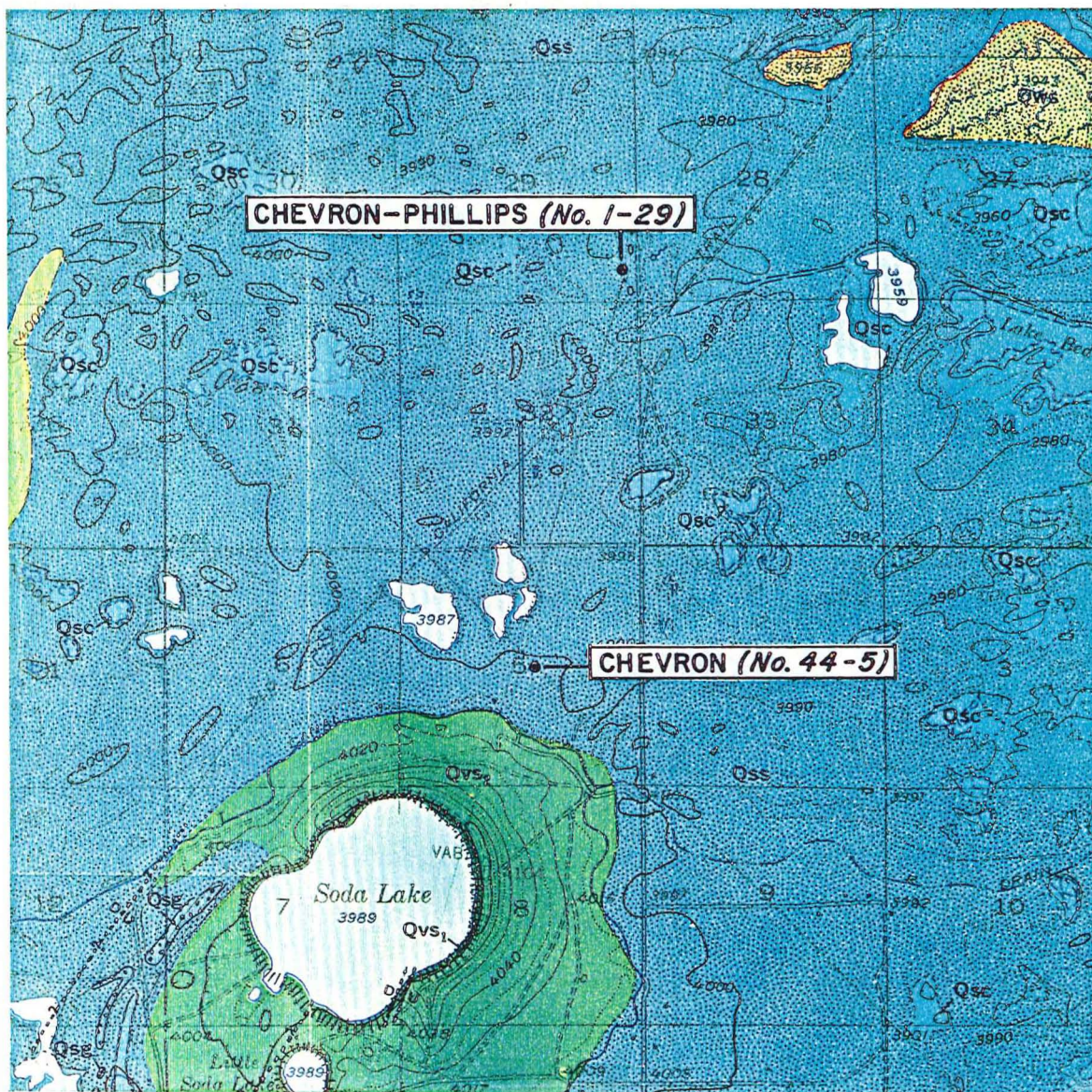
c. Geology

The Soda Lake Area is situated in the Basin and Range province of west-central Nevada, a region of abnormally high heat flow, and locally is within the Stillwater-Soda Lake KGRA. The area near the southwest end of the Carson Desert, a large downdropped fault block bounded by numerous normal faults principally trending north-northeasterly.

Bounding upthrown blocks are comprised of cores of Mesozoic sedimentary, volcanic and intrusive rocks. These are exposed in the Stillwater Range to the east and the West Humboldt Range on the northwest. The southern Stillwater Range and other mountains bounding Carson Sink on the west, southwest and southeast are principally Tertiary volcanic rocks, with some interbedded sediments. (Figure 3)

Of greatest significance to the source of heat for geothermal fluids are the Quaternary volcanic events evidenced by the Soda Lakes craters, Upsal Hogback cones and Rattlesnake Hill crater. Volcanic activity at Soda Lakes was contemporaneous with the existence of Lake Lahontan in the area. The Rattlesnake Hill basalt flows, six miles southeast of the Unit Area, are younger than





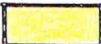
R-28-E



T 20 N

T 19 N

EXPLANATION

-  Qsg - DEEP LAKE SEDIMENTS - GRAVEL
-  Qss - " " " - SAND
-  Qsc - " " " - CLAY
-  Qvs - VOLCANIC EXPLOSION DEBRIS
-  Qws - NON-VOLCANIC SHALLOW LAKE SEDIMENTS

GEOLOGY-SODA LAKE AREA

FROM: GEOLOGIC MAP OF EASTERN SODA LAKE QUAD, NEVADA
MORRISON - 1958

Lake Lahontan.

Near the southwest corner of Section 28, T20N-R28E (approximately 1000' north, and 300' east of the southwest corner) a hot spring formerly flowed at the surface. Some years ago a well was drilled nearby to approximately 60 feet at which depth it encountered steam. Hydrothermal alteration and steaming ground covers almost an acre at this locality. Springs which issue within Soda Lake are reported to have temperatures up to 86°F.

From available geological, geophysical, and well data it appears that the geothermal fluids are principally in relatively shallow lacustrine and volcani-clastic rocks. Hot waters probably rising along northeast-southwest trending faults have saturated permeable sediments.

Two wells, the Chevron-Phillips 1-29 and the Chevron 44-5, and several intermediate temperature holes have been drilled in the area. Information from these wells together with shallow temperature gradient holes and geophysical information shows that the geothermal resource is totally contained within the unit area (Fig 1).

d. Technical Reasons for Site Selection

Locations of the proposed 2000' temperature holes (Figure 2) have been selected on the basis of analysis and interpretation of all the available geologic, geophysical, and well data which suggest that the resource is centered

approximately in the southwest part of Section 28 - T20N R28E. Two of the four locations will be chosen for drilling under terms of this proposal.

2. PROGRAM DATA OFFERED - (See Figure 2)

a. SUBSURFACE

EXISTING WELL DATA

Chevron-Phillips 1-29 and Chevron 44-5 as described in detail below (see 3. PROGRAM DESCRIPTION).

NEW WELL DATA

Two temperature holes located in Section 28, 32, and/or 33 (See Figure 2) are proposed to be drilled to a depth of 2000' to complete reservoir delineation.

b. SURFACE INVESTIGATIONS - EXISTING

Resistivity, MT, and Seismic data offered have been completed and are described in detail below (see 3. PROGRAM DESCRIPTION).

c. RESERVOIR ENGINEERING STUDIES

Test data from the Chevron-Phillips 1-29 is described in 3 - Below.

3. PROGRAM DESCRIPTION

a. Subsurface - Wells (Existing)

CHEVRON PHILLIPS SODA LAKE 1-29

Spudded 12/11/74

Suspended 12/30/74

Total Depth:

4306

Contractor:

Hunnicuttt and Camp Drilling Co
P. O. Box 399
Rio Vista, CA 94571

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- 1) Drilling history
- 2) Drilling fluids used
- 3) Casing and cementing record
- 4) Mud log 1008' - 4306

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Contractor: Exploration Logging, Inc.
 3325 Longview Drive
 Sacramento, CA 95821

- a) Bit data, hole size, penetration rate
- b) Lithology
- c) Continuous mud temperature (in and out)
- d) H₂S gas
- e) Hole deviation

- 5) Cuttings samples 1008' - 4306'
 approximately 30-50 gm. samples at 10'
 intervals will be furnished

- 6) Core Description
 Cored interval

- 7) Electric Logs

Contractor: Schlumberger
 517 Houston Street
 Sacramento, CA

Log Run: 53 - 1025' (12/13/74)
 induction electrical log

Log Run: 1013 - 4305' (12/28/74)
 dual induction laterolog
 compensated neutron log
 compensated sonic log
 formation density and gamma ray logs
 caliper log (3 arm)
 four-arm high resolution dipmeter

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8) Production Tests

Contractor: Haliburton Services
Rio Vista, CA

Intervals Tested:

1008 - 1531 (5/22/75)

791 - 980 (5/24/75)

9) Fluid Chemistry

Contractor: Skyline Labs, Inc.
12090 West 50th Place
Wheat Ridge, CO 80033
Charles E. Thompson, Chief Chemist

Samples recovered from flow tests
5/22-24/75

10) Temperature Surveys

a) Surveys run by Chevron personnel with
maximum reading thermometers:

<u>DATE</u>	<u>DEPTH</u>
12/21/74	2994
12/26/74	4274

b) Surveys at 20' intervals, 20' - 4270

Contractor: Agnew & Sweet
3914 Gilmore Avenue
Bakersfield, CA 93308

1/10/75
1/27/75
2/27/75
4/29/75

CHEVRON SODA LAKE 44-5

Spudded 12/27/77

Suspended 1/15/76

Total Depth:

5070'

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Contractor: Camay Drilling Co.
4250 Wilshire Boulevard
Los Angeles, CA 90010

- 1) Drilling History
- 2) Drilling fluids used
- 3) Casing and cementing record
- 4) Mud log 83' - 5069'
run by Chevron geologists at wellsite
 - a) Bit data, hole size, penetration rate
 - b) Lithology
 - c) Mud temperature (in and out) at 30' intervals
- 5) Cutting samples
Approximately 30-50 gm. samples at 30' intervals
will be furnished
- 6) Electric Logs

Contractor: Schlumberger
517 Houston Street
Sacramento, CA

- Log Run: 500 - 4970 (1/12/78)
- dual induction SFL
compensated formation density and neutro
gamma ray
caliper (three arm and one arm)
four-arm high resolution continuous
dipmeter
long spaced sonic log; temperature log
- 7) Directional Surveys taken by Chevron field foreman
at various intervals

- 8) Subsurface Temperature Surveys

Contractor: Agnew & Sweet
3914 Gilmore Avenue
Bakersfield, CA 93308

Temperature logged at 20' intervals in 2 7/8
tubing 40' - 5016' on following dates:

2/25/78, 3/28/78

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Subsurface - Intermediate temperature gradient hole-
(Existing)

CHEVRON SODA LAKE 36-78

Drilled:	March 1978
Total Depth:	2000'
Contractor:	CXM Drilling Co. Salt Lake City, UT
Data Offered:	Temperature profile (3) 3/17/78 3/24/78 lithologic description drilling history

Subsurface - Intermediate Temperature Gradient Holes - (NEW)

The 2000' temperature gradient holes are proposed
to be drilled at two of the four locations shown on
Figure 2.

The drilling program is contained in Appendix I, and
scheduling and cost figures are shown on Chevron Form
PRO 316-C and attachments.

b. SURFACE DATA - EXISTING

(See Figure 2, PROGRAM DATA INDEX MAP)

(1) GEOPHYSICAL SURVEYS

(a) ELECTRICAL - RESISTIVITY (Dipole - dipole)

Contractor: McPhar Geophysics Inc.
Tucson, AZ (Later became Phoenix Geophysics, Inc.)

Surveyed 1974

63 Miles

a = 2000'

n = 1 to 4

f = 0.125 Hz

Results: Contractors report with apparent resistivity pseudo sections.

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(b) ELECTRICAL - MAGNETO TELLURIC

Contractor: Geotronics Corp.
10317 McKalla Place
Austin, TX 78758

Surveyed 1975

14 stations covering approximately 20 square miles

Technique: Five orthogonal component surface EM field measurements, of micropulsation fields taken @ each station over the frequency range 6.002-250Hz. Data was digitally recorded and reprocessed for a complete MT tensor analysis.

Results: Contractor's report with data and one-dimensional inversion.

(c) SEISMIC - REFLECTION

Contractor: Charles B. Reynolds and Associates
11909 Allison Court NE
Albuquerque, NM 87112

Charles B. Reynolds, Principal Investigator

Grid of 3 E - W and 4 N - S lines

Total 24 miles

Completed 1975

Technique: 300 lb. weight drop source
Single channel engineering
seismograph with filtering
programmable gain and vertical
stacking capabilities.

Results: Contractor's report with stacked
(time) sections (migrated) depth
sections and tertiary event
structure map

(d) SEISMIC REFLECTION

Completed: 1977

Technique: 1 NE-SW and 2 NW-SE lines with
total surface coverage of about
12 line miles
48 channel 1200% CDP dynamite data
results: 3 stacked time sections

(2) TEMPERATURE GRADIENT SURVEY

Contractor: Boyles Brothers Drilling Company

Reno, Nevada

and

Chevron Resources Company

Date Completed: May, 1974

Eleven 500' temperature gradient holes were drilled and stabilized - temperature obtained in each. Results of survey are temperature profiles and cuttings descriptions from each hole.

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4. SCHEDULE

a. 1978 (3rd Quarter)

Temperature gradient holes of the type proposed here are normally drilled in about ten days; therefore, elaborate scheduling charts are not appropriate. The key elements in the program are:

1. Obtain permits for locations
2. Review data to determine which holes will be drilled and in which order.
3. Drill and log holes

All steps will be completed between 4-6 weeks after proposal is accepted. A drilling schedule based on previously drilled holes in similar areas and/or lithologies, is attached to Chevron Form PRO 316-C.

b. Availability of Data

(1) Existing Data

After contract has been signed as soon as data can be reproduced and transmitted but not to exceed 60 days thereafter.

(2) New Data

Well data can be submitted to DOE within 15 days of completion and final report within 30 days of completion. Well data can be released to the public 6 months after completion.

5. ENVIRONMENTAL EVALUATION

The Office of the Area Geothermal Supervisor, U.S.G.S., Menlo Park, has prepared EA#43: "Final Environmental Analysis #43 prepared for five test wells in Soda Lake Unit, Chevron Oil Co., Churchill Co., Nevada." This is a 134 page document including an Environmental Base Line report and the impact evaluation of five proposed well sites, one of which is within 3000' of the area of the 2000' temperature holes proposed herein.

a. Brief description of the environment affected.

Summary description is given in the following paragraph, which is from EA#43, page 3. "The area under consideration is located from four to ten miles (6 to 16 km) northwest of Fallon (population 3000), Churchill County, Nevada. It is situated near the southern end of the Carson Desert (Figure 2). Its terrain for the most part is very flat with local relief being only 20 to 40 feet (6 to 12 m). Elevation averages approximately 4000' (1219 m) but the rim of Soda Lake, in the southern part of the unit area, rises some 100 feet (30 m) above the level of the surrounding land. In addition to the Soda Lakes, several small ponds are in the unit area. The Carson River flows westward across the southern part of the unit area and connects with a system of irrigation ditches in the area. There are several unpaved roads which provide access to the area from Highway 50, the major east-west highway in the area."

b. Analysis of the potential environmental impact.

Attached as APPENDIX III are copies of pages 48-52 of EA #43 in which the "Impact Evaluation and Mitigating Measures" are discussed.

c. Potential for conflicts with existing land use patterns and programs.

Page 51 of EA #43, included in Appendix III, discusses impact on land uses.

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C. COST

1. ESTIMATED TOTAL PROGRAM COST

EXISTING DATA

See attached Optional Form 60 for detailed breakdown of cost elements.

Surface data	\$179,211
(geophysical and temperature hole data)	

Subsurface data	756,331
(wells)	

PROPOSED PROGRAM

Drill two 2000' temperature holes	110,000
(see attached Optional Form 60 and	

Chevron form PRO-316C)	\$1,045,542	TOTAL
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The proposed temperature holes are estimated to cost \$110,000. Our PRO-316C shows breakdown into cost elements. This estimate is based upon our experience in drilling several similar holes, including

one recently at Soda Lake. Because of continually changing prices of material and services, the estimate has not been developed by obtaining current price quotations for each of the multitude of items required to drill such a well. If this proposal is selected within the Competitive Range and specific details of the cost estimate are required they can be developed and submitted at that time.

2. PROPOSED COST TO GOVERNMENT

EXISTING DATA

20% of surface data	\$ 35,842
33 1/3% of subsurface data	\$ 251,858

PROPOSED PROGRAM

Chevron proposes that D.O.E. pay 50% of the actual cost of drilling the two intermediate temperature holes, up to a maximum of 50% of the estimated cost of the holes.

RECAP - PROPOSED COST TO GOVERNMENT

Existing surface data	\$ 35,842
Existing subsurface data	\$251,858
Proposed temperature holes	<u>\$ 55,000</u>
Total Proposed Cost to Government	\$342,700

CONTRACT PRICING PROPOSAL
(RESEARCH AND DEVELOPMENT)

Office of Management and Budget
Approval No. 29-RO184

This form is for use when (i) submission of cost or pricing data (see FPR 1-3.807-3) is required and (ii) substitution for the Optional Form 59 is authorized by the contracting officer.

PAGE NO.

NO. OF PAGES

NAME OF OFFEROR

CHEVRON RESOURCES COMPANY

SUPPLIES AND/OR SERVICES TO BE FURNISHED

Existing geothermal well data
Existing geophysical data
Proposed drilling 2-2000' temp. holes

HOME OFFICE ADDRESS

320 Market Street
San Francisco, CA 94111

DIVISION(S) AND LOCATION(S) WHERE WORK IS TO BE PERFORMED

SODA LAKE, NEVADA

TOTAL AMOUNT OF PROPOSAL

\$ 342,700

GOV'T SOLICITATION NO.

ET-78-R-08-0003

DETAIL DESCRIPTION OF COST ELEMENTS

1. DIRECT MATERIAL (Itemize on Exhibit A)	ESTIMATED COST (\$)	TOTAL EST COST ¹	REFERENCE ²
a. PURCHASED PARTS			
b. SUBCONTRACTED ITEMS			
c. OTHER—(1) RAW MATERIAL			
(2) YOUR STANDARD COMMERCIAL ITEMS			
(3) INTERDIVISIONAL TRANSFERS (At other than cost)			
TOTAL DIRECT MATERIAL			
2. MATERIAL OVERHEAD ³ (Rate %X\$ base=)			
3. DIRECT LABOR (Specify)	ESTIMATED HOURS	RATE/HOUR	EST COST (\$)
TOTAL DIRECT LABOR			
4. LABOR OVERHEAD (Specify Department or Cost Center) ³	O.H. RATE	X BASE =	EST COST (\$)
TOTAL LABOR OVERHEAD			
5. SPECIAL TESTING (Including field work at Government installations)		EST COST (\$)	
TOTAL SPECIAL TESTING			
6. SPECIAL EQUIPMENT (If direct charge) (Itemize on Exhibit A)			
7. TRAVEL (If direct charge) (Give details on attached Schedule)		EST COST (\$)	
a. TRANSPORTATION			
b. PER DIEM OR SUBSISTENCE			
TOTAL TRAVEL			
8. CONSULTANTS (Identify—purpose—rate)		EST COST (\$)	
TOTAL CONSULTANTS			
9. OTHER DIRECT COSTS (Itemize on Exhibit A)			
TOTAL DIRECT COST AND OVERHEAD			1,045,542
10.			
11. GENERAL AND ADMINISTRATIVE EXPENSE (Rate % of cost element Nos.) ³			
12. ROYALTIES ⁴			
13.	TOTAL PROGRAM COST		1,045,542
14. FEE OR PROFIT			
15. PROPOSED COST TO GOVERNMENT			342,700

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Well Name SODA LAKE #1-29

Project # X 20422

Well Costs from inception to 4/30/78

	Chevron Code No.	<u>Amount</u>
Company labor	001-050	26,202
Expense accounts	071-0723	5,968
Motor fuel, lubes and greases	080-081	4,736
Fuels and utilities	090-1091	556
Materials and supplies:		
Drilling fluids	201-203	24,782
Casing and Tubing	206	18,308
Drillpipe, bits, reamers, other tools	222-249	24,158
Other surface equipment	204	5,336
Artificial lift equipment - subsurface	205	-
Subsurface controllable equipment	207	-
Transportation equipment services	267-279	19,324
Rentals, charters and equipment usage	291-2991	9,884
Contract labor	310	21,884
Drilling - contract	381-382	156,042
Drilling - company drilling equipment	383	-
Coring	3831, 825	-
Cementing	385	14,284
Directional tool, survey, and service costs	386	-
Logging and sampling - wire line & drill stem	388	16,472
Logging - mud	389	6,262
Perforating	390	-
Testing	391	12,048
Coring	392	3,218
Other drilling costs	399	1,866
Shops, mechanical services	406-419	124
Technical services	463-4799	6,038
Permits and fees	486-493	-
Telecommunications	505-509	-
Maps, surveys, logs, etc.	712	790
Loaned employee services	735	3,250
Other miscellaneous services & fees	736	-
Services from other operating companies	7387-739	2,276
General and administrative costs	745-748	-

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TOTAL WELL COSTS

383,808

Well Name SODA LAKE #44-5

Project # X 20423

Well Costs from inception to 4/30/78

	Chevron Code No.	Amount
Company labor	001-050	15,168
Expense accounts	071-0723	5,301
Motor fuel, lubes and greases	080-081	-
Fuels and utilities	090-1091	-
Materials and supplies:		
Drilling fluids	201-203	92,922
Casing and Tubing	206	10,248
Drillpipe, bits, reamers, other tools	222-249	44,943
Other surface equipment	204	-
Artificial lift equipment - subsurface	205	1,403
Subsurface controllable equipment	207	-
Transportation equipment services	267-279	9,508
Rentals, charters and equipment usage	291-2991	1,648
Contract labor	310	-
Drilling - contract	381-382	89,144
Drilling - company drilling equipment	383	439
Coring	3831, 825	590
Cementing	385	6,509
Directional tool, survey, and service costs	386	25,762
Logging and sampling - wire line & drill stem	388	22,070
Logging - mud	389	-
Perforating	390	23,940
Testing	391	-
Coring	392	11,473
Other drilling costs	399	-
Shops, mechanical services	406-419	-
Technical services	463-4799	2,052
Permits and fees	486-493	-
Telecommunications	505-509	-
Maps, surveys, logs, etc.	712	229
Loaned employee services	735	-
Other miscellaneous services & fees	736	2,749
Services from other operating companies	7387-739	6,425
General and administrative costs	745-748	-

TOTAL WELL COSTS

372,523

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WELL COST ESTIMATE WORKSHEET Pro-316-C

PROPERTY AND WELL NO. 2000' Temperature Hole AREA _____
 FIELD Soda Lake SEC. _____ T _____ R _____
 ESTIMATED TOTAL DEPTH 2000' ESTIMATED DRILLING DAYS OR TOURS 9

C-946-2 ITEM NO.	DESCRIPTION	EXPLORATORY		DEVELOPMENT
		DRY HOLE	PRODUCER	PRODUCER
1	CONTRACT DRILLING DAY RATE <u>9</u> DAYS @ \$ <u>2700</u> PER DAY			25000
	_____ DAYS @ \$ _____ PER DAY			-
2	CONTRACT DRILLING FOOTAGE _____ FT. @ \$ _____ PER FT.			-
	_____ DAYS @ \$ _____ PER DAY			-
3	COMPANY DRILLING LABOR _____ DAYS @ \$ _____ PER DAY			-
4	COMPANY DRILLING SUPERVISION <u>15</u> DAYS @ \$ <u>350</u> PER DAY			5000
5	COMPANY EQUIPMENT USAGE			-
	DEU _____ DAYS @ \$ _____ PER DAY			-
	DERS _____ DAYS @ \$ _____ PER DAY			-
6	FUEL AND UTILITIES _____ DAYS @ \$ _____ PER DAY			-
7	SUB TOTAL (1 THROUGH 6)	\$	\$	\$ 30000
8	RIG UP AND TEAR OUT/MOVE IN AND OUT <u>20</u>			6000
9	DRILLING FLUIDS <u>100/FT</u>			2000
10	WELL SUPPLIES AND NON-SALVABLE MATERIALS (CEMENT BASKETS, FLOAT EQUIPMENT, CENTRALIZERS-SCRATCHERS).			1000
11	TRANSPORTATION			500
12	CONTRACT SERVICES AND RENTALS			-
	DIRECTIONAL, TOOLS, SURVEYS & SERVICES (MONEL COLLAR, MULTI-SHOT INST., SERVICEMAN, SURVEYS, ETC.)			-
13	DRILL PIPE, BITS, REAMERS & OTHER TOOLS <u>1-9 7/8 @ 800+5-6 1/4 @ 500</u>			3000
	(HOLE OPENERS, STABILIZERS, REAMERS, DRILL PIPE & DRILL COLLAR RENTAL, ETC.)			-
14	OTHER SUB SURFACE CONTRACT RENTALS & SERVICES <u>ROP @ 125%</u> (WIRELINE PERFORATING, FORM, STIMULATION, CASED HOLE LOGS, ETC.)			1500
15	OTHER SUB SURFACE COSTS (SWABBING, WASHING PERFORATIONS, CHANGE OVERS, ETC.)			-
16	SUB TOTAL (1 THROUGH 15)	\$	\$	\$ 44000
20	FORMATION EVALUATION CONTRACT SERVICES			-
	CORING _____ FT. @ \$ _____ PER FT.			-
	SIDEWALL SAMPLES _____ @ \$ _____ PER SAMPLE			-
	CORE ANALYSIS _____			-
21	TESTING _____ TESTS @ \$ _____ PER TEST			-
	_____ WIRELINE TESTS @ \$ _____ PER TEST			-
22	LOGGING WIRE LINE _____ RUNS @ \$ _____ PER RUN			0
23	LOGGING MUD _____ DAYS @ \$ _____ PER DAY <u>Well Site Geologist 5 @ 200</u>			1000
24	TOTAL FORMATION EVALUATION SERVICES (20 THROUGH 23)	\$	\$	\$ 1000
30	CASING, TUBING AND RODS			
	CONDUCTOR _____ FT. @ \$ _____ PER FT.			
	SURFACE <u>200' - 7" - 23#</u> FT. @ \$ <u>10</u> PER FT.			2000
	PROTECTIVE _____ FT. @ \$ _____ PER FT.			
	LINER _____ FT. @ \$ _____ PER FT.			
	OILSTRING _____ FT. @ \$ _____ PER FT.			
	TUBING <u>2000' - 1 1/2</u> FT. @ \$ <u>1</u> PER FT.			2000
	TUBING _____ FT. @ \$ _____ PER FT.			
	RODS _____ FT. @ \$ _____ PER FT.			
	RODS _____ FT. @ \$ _____ PER FT.			
	TOTAL _____			4000

WELL COST ESTIMATE WORKSHEET Pro-316-C

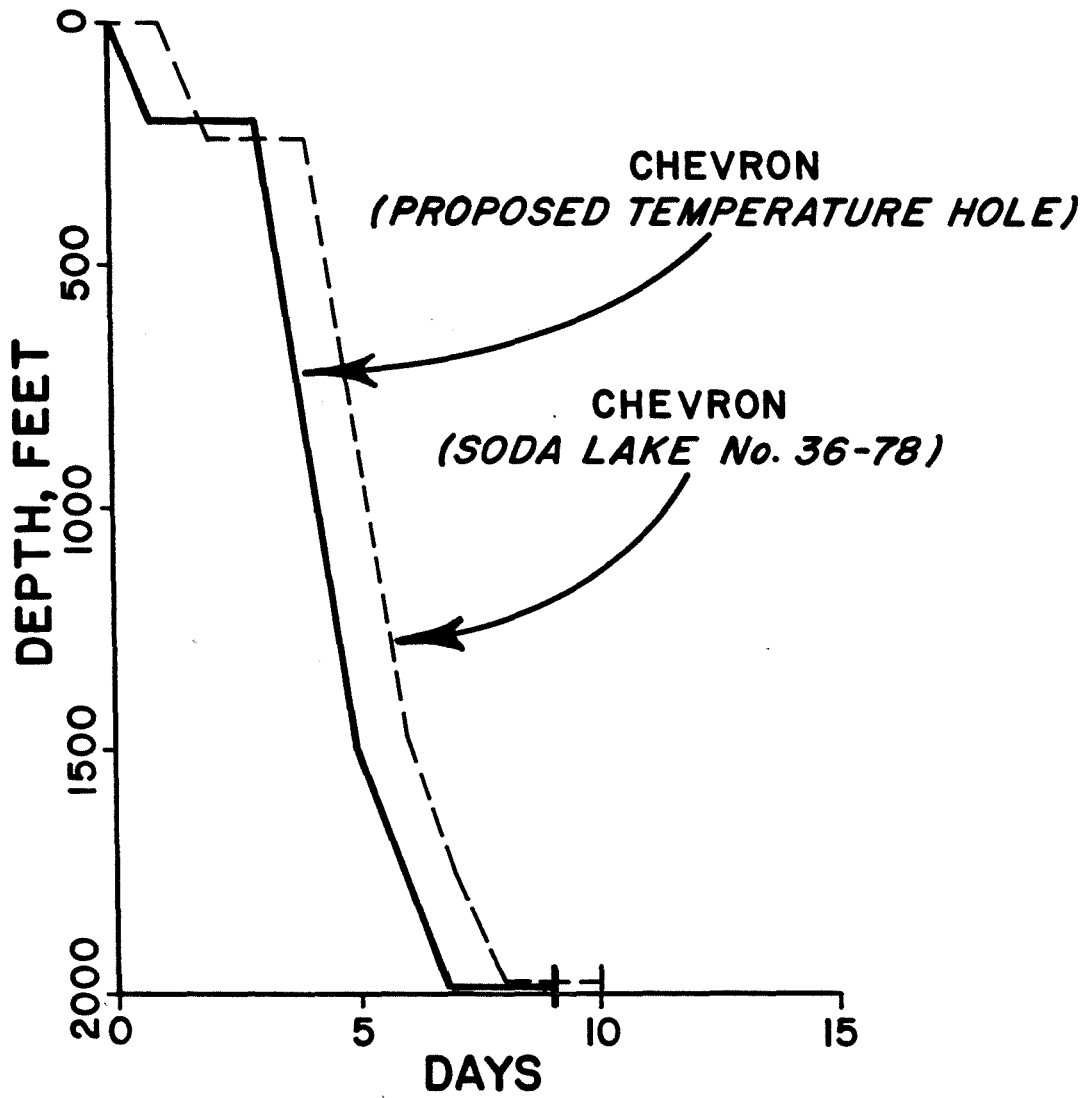
C-946-2 ITEM NO.	DESCRIPTION	EXPLORATORY		DEVELOPMENT PRODUCER
		DRY HOLE	PRODUCER	
31	SUBSURFACE PRODUCING EQUIPMENT CASING HEAD _____, TUBING HEAD _____ CASING SPOOL _____, XMAS TREE <u>200</u> PACKERS _____, WELL PUMP _____ SLIDING SLEEVES, SIDE DOOR CHOKES, ETC. _____			200
32	CONTRACT CEMENTING SERVICES CONDUCTOR _____ YDS. @ \$ _____ PER YD. SURFACE <u>80</u> SACKS \$ <u>100</u> PUMP TRUCK \$ <u>300</u> PROTECTIVE _____ SACKS \$ _____ PUMP TRUCK \$ _____ OIL STRING _____ SACKS \$ _____ PUMP TRUCK \$ _____ LINER _____ SACKS \$ _____ PUMP TRUCK \$ _____ SQUEEZE JOBS _____ SACKS \$ _____ PUMP TRUCK \$ _____ OTHER <u>42</u> SACKS \$ <u>50</u> PUMP TRUCK \$ <u>300</u> CEMENT BOND LOG _____ RUNS @ \$ _____ PER RUN WATER SHUT OFF TESTS _____ TST. @ \$ _____ PER TEST TEMPERATURE SURVEY			800
40	FISHING			50,000
41	TOTAL SUBSURFACE WELL COSTS	\$	\$	\$
51	SURFACE WELL COSTS SITE PREPARATION - LAND LOCATION <u>2000</u> ROAD <u>3000</u>			5,000
52	SITE PREPARATION - WATER			
53	ARTIFICIAL LIFT EQUIPMENT PUMPING UNIT \$ _____ PRIME MOVER \$ _____			-
54	TANKS, TRAPS, CAISSONS & OTHER SURFACE EQUIPMENT TANKS _____ @ \$ _____ EACH SEPARATORS _____ @ \$ _____ EACH FLOW LINES _____ FT. @ \$ _____ FT. ELECTRIC LINES _____ FT. @ \$ _____ FT. GAS LINES _____ FT. @ \$ _____ FT. WATER LINES _____ FT. @ \$ _____ FT. MISCELLANEOUS _____			-
55	TOTAL SURFACE WELL COSTS	\$	\$	\$ 5,000
56	TOTAL DIRECT WELL COSTS	\$	\$	\$ 55,000
61	DISTRICT AND DIVISION EXPENSE			
62	GENERAL AND ADMINISTRATIVE EXPENSE			
63	WELL CONTRIBUTION CREDITS			
64	TOTAL WELL COST			55,000
	TOTAL TANGIBLE (TOTAL OF LINES 30, 31, 53 & 54)	\$	\$	\$
	TOTAL INTANGIBLE (LINE 64 LESS TOTAL TANGIBLE)	\$	\$	\$

Prepared by B. D. GARRETT 5/11/78 District Engineer _____

Area Supervisor _____ District Drilling Supervisor _____

Approved _____ Date _____

District Superintendent



**DRILLING TIME CURVE
SODA LAKE TEMPERATURE HOLE**

5/16/78

B.D.GARRETT

TO ACCOMPANY PRO-316-C

D. BUSINESS AND MANAGEMENT

1. Chevron Resources Company is a division of Chevron Industries, Inc. which is a wholly owned subsidiary of Standard Oil Company of California, domiciled in San Francisco, California.

Chevron initiated exploration for geothermal resources in the western states in 1971 and has actively continued exploration and drilling for geothermal resources to the present. We have identified some 45 prospects in which we hold Federal, State or private geothermal leases or first priority applications for Federal geothermal leases. Chevron holds approximately 210,000 acres under lease.

Chevron has drilled 18 geothermal wells in seven areas, is operator in developing the Heber geothermal field in the Imperial Valley of California and is involved in drilling wells in the promising Brawley field nearby. Chevron conducts exploration and drilling with its staff of professional geologists, geophysicists and engineers. Geophysical surveys and drilling of wells are performed by contractors with consultation from Chevron professional personnel.

Organizations having cognizance over our geothermal activities would be certain other companies active in geothermal exploration and drilling, i.e., our competitors. We have made trades of certain data with Phillips Petroleum Co., Union Oil Company of California, and

Gulf Energy and Minerals Co.

The Source Evaluation Panel may contact the following personnel regarding Chevron's professional qualifications in the geothermal field with the explicit understanding, however, that it will be inappropriate to discuss with them any portion of Chevron's proposal.

Mr. C. W. Berge
Energy Minerals Division
Phillips Petroleum Company
P. O. Box 752
Del Mar, CA 92014

Mr. Carel Otte
Union Geothermal Co.
Union Oil Company of California
P. O. Box 7600
Los Angeles, CA 90017

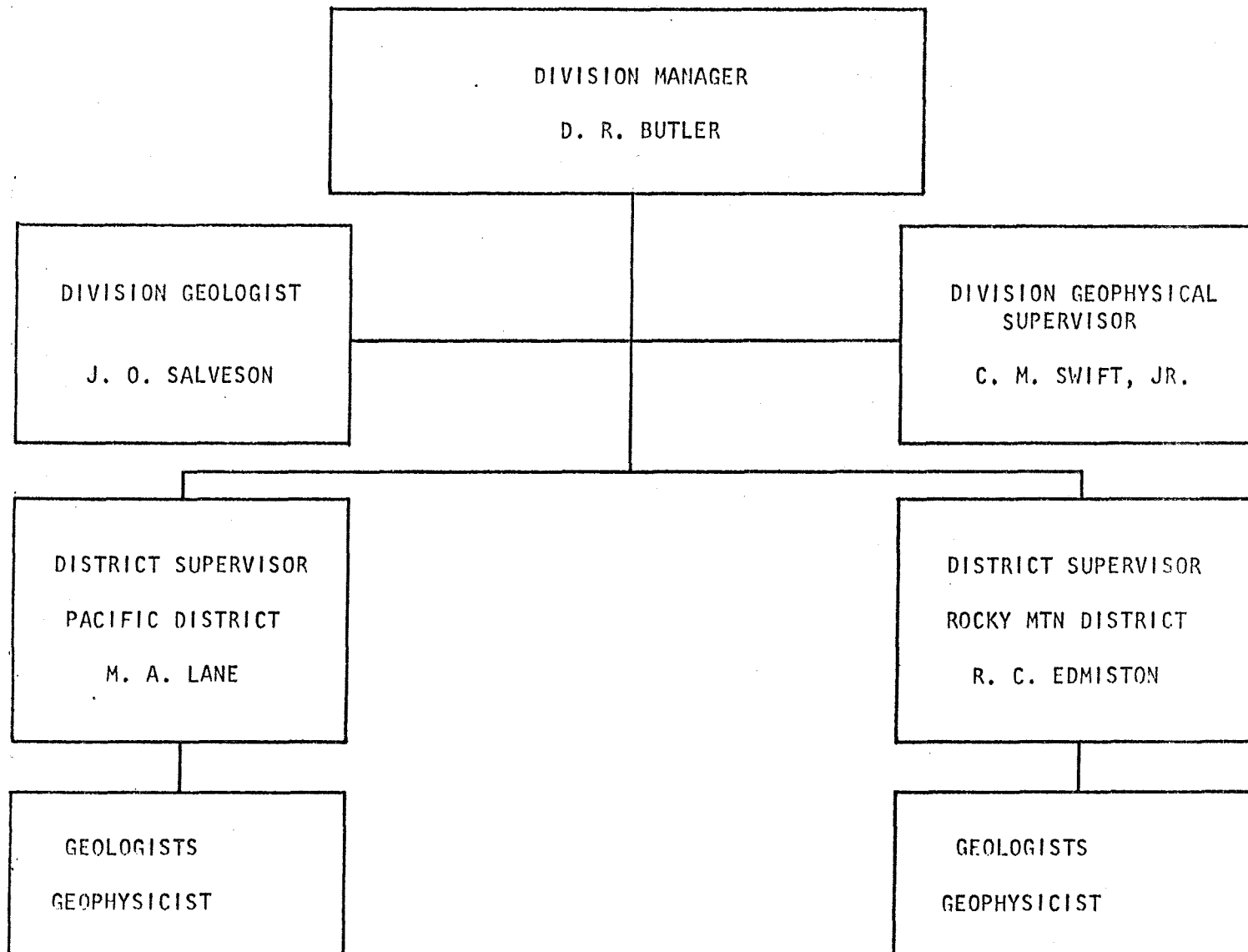
Mr. Glen Campbell
Gulf Energy & Minerals Co.
1780 So. Bellaire Street
Denver, CO 80222

2. PRINCIPAL PROGRAM PERSONNEL

The following personnel were responsible for acquisition of existing surface and well data and resumes for each follow: (See Appendix IV)

Exploration Personnel (See Figure 6 - Organization Chart)

D. R. BUTLER	Division Manager
J. O. SALVESON	Division Geologist
C. M. SWIFT, JR.	Division Geophysical Supervisor
M. A. LANE	District Supervisor
R. C. EDMISTON	District Supervisor
R. W. BUTLER	Geologist
R. J. ALMENDINGER	Geologist



CHEVRON RESOURCES CO.
EXPLORATION DEPARTMENT
GEOTHERMAL DIVISION

FIGURE 6

E. H. HAYNES	Formerly District Supervisor
W. E. MERO	Formerly Senior Geologist

DRILLING PROJECT PERSONNEL

A. M. COOPER	Senior Project Manager
B. D. GARRETT	Operations Supervisor- Geothermal

Certain of the above personnel (see Figure 7 - Project Organization Chart) will be responsible for the drilling of the proposed well and their resumes follow: See Appendix IV

3. MANAGEMENT PLAN

Proposed 2000' temperature holes

- a. Objective: to drill 2 2000' temperature holes, log, run tubing, and obtain stabilized temperature profiles.
- b. Drilling Operations - Responsibilities and Control Procedures:

The Project Organization Chart for the drilling of the temperature holes is shown in Figure 7.

Overall responsibility for drilling the well and accomplishing the objectives of the project lies with the Project Manager working through the Operations Supervisor.

The Operations Supervisor is responsible for preparation of the specific program and its implementation.

PROJECT ORGANIZATION
TEMPERATURE HOLE OPERATIONS
(SODA LAKE)

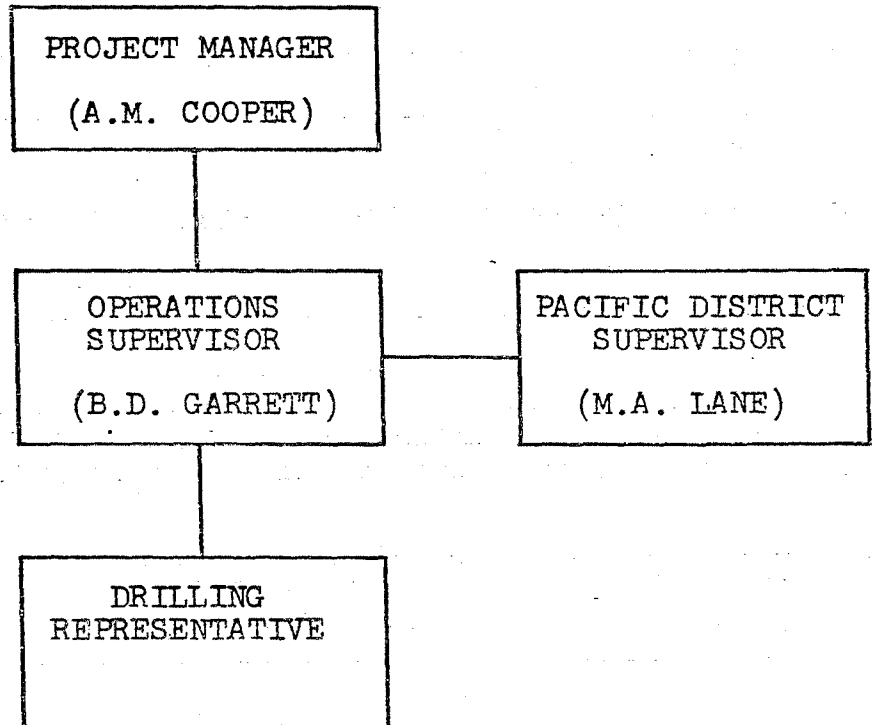


FIGURE 7

The Drilling Superintendent is responsible for the drilling operations including procurement of materials and services required to accomplish the objectives.*

The Drilling Representative, located at the well-site, is responsible for all field work including supervision of the actual drilling operations, logistics of material and services, daily cost control and preparation of daily progress reports.

The Pacific District Supervisor, who is a geologist, is responsible for analysis of data obtained while drilling, logging, and testing to determine that the objectives are being met and to recommend to the Operations Supervisor program changes which may be required to meet those objectives.

Well progress, cumulative costs, lithology, etc. are reported by phone each morning by the Drilling Representative to the Operations Supervisor. Based upon these data, the Operations Supervisor determines that everything reasonable is being done to maintain schedules, cost control, and project objectives. The Pacific District Supervisor is advised daily of the lithology, well conditions, etc. so he may recommend changes in program as required.

*For temperature holes, handled by Drilling Rep.

c) Cost Controls -

- 1) After funds for the well have been approved and appropriated by Management, sealed bids are solicited from reputable drilling contractors who are or have been active in geothermal drilling.
- 2) The Drilling Superintendent studies the bids and normally awards the contract to the lowest bidder, other considerations being equal.*
- 3) Service Orders, containing short form contractual language, are issued to service companies and local contractors by personnel with appropriate authority.
- 4) At the wellsite, the Drilling Representative directly monitors the various contractors and suppliers.
- 5) Invoices submitted by contractors and suppliers are processed in the following manner:
 - (a) Drilling Representative checks invoices to be certain that work charged has been performed. Signs invoices except any which may require changes.
 - (b) Invoices signed by Drilling Representative approved by Drilling Superintendent.
 - (c) Clerk in Drilling Superintendent's office determines that appropriate project number is coded on invoice.

*The Soda Lake Program, if approved, may be drilled by a contractor already under Contract to Chevron.

(d) Invoice clerk under supervision of Accounting Supervisor (San Francisco) compares invoice with contract terms for:

1. accuracy of rates
2. accuracy of invoice calculations
3. approvals have been made by personnel with proper authority

invoice clerk forwards accurate invoices to Accounting Supervisor for payment approval

(e) Invoice forwarded to Corporation Computer Services where:

1. pertinent data is keypunched into storage
2. payment check is printed by computer
3. a monthly tabulation of accumulated costs by project number are printed.

(f) Monthly project cost tabulation forwarded to Accounting Supervisor and appropriate Chevron Resources management for purpose of checking accumulated costs vs. appropriated costs.

4. PRIMARY BUSINESS AND TECHNICAL CONTACTS WHOM DOE MAY CONTACT

In as much as our entire proposal is proprietary except for evaluation purposes, we request that if our proposal is to be discussed with any of the contractors that the following procedure be followed:

- a. Advise Mr. D. R. Butler
Chevron Resources Company
320 Market Street
San Francisco, CA 94111
Phone: (415) 894-3590

b. Mr. Butler will advise the contractor that he may discuss any of the equipment specifications, field procedures, and data quality relating to his work for Chevron with appropriate D.O.E. personnel.

Following is the list of contractors (see also under Program Data Offered), principal supervisory personnel, phone numbers and addresses:

Geotronics Corp.
George Hopkins, President
(512) 837-7564
10317 McKalla Place
Austin, TX 78758

Phoenix Geophysics
Bruce Bell, Vice-President
(303) 373-0332
4690 Ironton Street
Denver, CO 80239

Senturion Sciences, Inc.
John Bailey, President
(918) 836-6746
P. O. Box 15447
Tulsa, OK 74112

Seismic Exploration Inc.
c/o Lewis Katz
(801) 272-1289
P. O. Box 9344
Salt Lake City, UT 84109

United Geophysical Corp.
Gunter Fercho, Regional Manager
(303) 572-8727
1645 Court Place, Suite 300
Denver, CO 80202

Terraphysics
Aldo Maggella, President
(415) 234-8961
815 South 10th Street, Suite 11A
Richmond, CA 94804

Photogravity Co. Inc.
William Scott, President
(713) 780-4911
7000 Regency Sq. Blvd.
Houston, TX 77036

Western Geophysical Co.
C. W. Dick, Vice President
(303) 770-8660
P. O. Box 1638
Denver, CO 80150

Charles B. Reynolds & Associates
Charles B. Reynolds
(505) 294-6971
11909 Allison Court N.E.
Albuquerque, NM 87112

R. B. Montgomery Drilling Co.
R. B. Montgomery

P. O. Box 2508
Bakersfield, CA 93303

Big Chief Drilling Co.
W. A. Glass

P. O. Box 14837
Oklahoma City, OK 73114

5. ACCEPTABILITY OF DRAFT CONTRACT PROVISIONS

The draft contract is generally acceptable as a basis for contract negotiations although we reserve the right to negotiate modifications of some of its provisions. Based on a preliminary review of Appendix B (General Provisions) to the draft contract, a number of provisions appear to be inapplicable to the proposal being made by Chevron Resource Company. Specifically these are:

Clauses	2.1	4.1.2	7.3
	2.4	4.4	7.16
	2.5	4.7	7.18
	2.6	4.8	7.19
	2.9	4.9	7.20
	2.10	4.10	
	3.3	6.6	

Other clauses in Appendix B may be inapplicable if the contract sum fails to exceed specified threshold amounts.

6. The "Program Technical Scope" has been reviewed and any such data offered by Chevron Resources in this proposal which D.O.E. accepts and contracts for may be published by D.O.E.
7. Six copies of the 1977 Annual Report of Standard Oil Company of California are attached (one for each member of the Source Evaluation Panel, per Joseph Fiore, personal communication May 18, 1978).
8. The specific terms and conditions contained in this proposal will remain in effect for 120 days from May 30, 1978; however, should D.O.E. propose any changes in such offered terms or conditions then Chevron shall have the right to reject such modified terms or conditions if they are unacceptable to Chevron.
9. Mr. C. Dahlstrom, Vice-President and General Manager, Chevron Resources Company, has the authority to commit Chevron Resources to the provisions of this proposal per the "Resolution of the Board of Directors of Chevron Industries, Inc. dated April 13, 1977", a certified copy of which is attached as Appendix V.
10. GSA Form 19B "Representations and Certifications" has been completed and is attached to the letter transmitting this proposal."

SODA LAKE TEMPERATURE HOLE
PROPOSED PROGRAM

1. Construct Road and Location
2. Move in Rig
3. Rig Up and Set Conductor
4. Drill 9 7/8" Hole to 200'
5. Cement 7" 23# Casing
6. Install and Test BOPE
7. Drill 6 1/4" Hole to 2000'
Catch 3 Sets Samples at 20' Intervals (D.O.E. Set = 2#±)
8. Using Chevron Equipment, * Run Logs (Resistance, S.P. Gamma,
and Temperature)
9. Run 1 1/2" Tubing to 2000'
10. Cement 7" x 1 1/2" Annulus to 200'
11. Weld 1/2" Plate On 7" x 1 1/2" Annulus
12. Install 1 1/2" Gate Valve and Lock
13. Release Rig, Cleanup Location
14. Run Temperature Surveys with Chevron Equipment.
1 Survey Upon Reaching T.D. (*8 Above)
1 Survey Approximately 30 Days Later
15. Cement inside of 1 1/2" Tubing to 30' and Abandon Well

*MT. SOPRIS Model #2500

APPENDIX III

PAGES 48 - 52

OF

SODA LAKE EA #43

Community Facilities - Community facilities accessible to personnel engaged in geothermal development are primarily in the City.

Facilities of the Churchill County School District, serving grades k through 12, all are located in the City. There are approximately 2,600 students in the school district, with about 60 percent transported from the surrounding rural communities. The School District operates a K6-3-3 program and has participated in Head Start programs, adult education, and extension courses offered by the University of Nevada at Reno.

Other community facilities in the Fallon area include: the 42-bed Churchill County Public Hospital, the 18,000-volume Churchill County Library, the Churchill County Museum, two clinics with four M.D.'s and three dentists, two banks, numerous shopping and service facilities, 15 churches of various denominations, and a variety of sites for recreation. Carson River and Lake Lahontan provide fishing, boating, swimming, water skiing, and picnic grounds. Other recreational opportunities include a 9-hole golf course and rodeos held on the Fourth of July and during the Labor Day weekend.

IMPACT EVALUATION AND MITIGATING MEASURES

Physical Characteristics

Geologic Hazards - Potential impacts and mitigating measures of the plan are discussed with respect to: seismicity induced by production or injection of geothermal fluids; subsidence as a result of the production of geothermal fluids; and blowout of a well.

Seismicity has been induced by high pressure injections of fluids that resulted in shear failure of the host rock (Raleigh, 1972). Where induced seismicity associated with the development of geothermal resources is determined to exist, then the Supervisor may require the lessee to install such monitoring devices as necessary to quantify the effects. If induced seismicity is determined to represent a significant hazard, then the Supervisor may require remedial actions including, but not limited to, reduced production rates, increased injection of waste or other fluids, or suspension of production (Sec. 8, GRO Order No. 4).

No information is available at the present time to form a basis for evaluating the likelihood that subsidence will result from the production of geothermal fluids in the vicinity of the Soda Lakes. If the geothermal reservoir exists in unconsolidated alluvium or ancient lake-deposits then subsidence is likely to occur. On the other hand, should the reservoir exist in volcanic rocks at depth, little or no subsidence should be expected. The ability to assess this hazard will improve as exploration progresses.

Local networks of horizontal and vertical control must be established by the lessee prior to prolonged production of the reservoir to monitor for possible subsidence and lateral surface deformation (Sec. 8, GRO Order No. 4). To minimize the risk of subsidence, injection programs may be initiated to maintain formation pressures in the reservoir. If subsidence is determined by the Supervisor to represent a significant hazard to operations or adjoining land use, then the Supervisor may require remedial action including, but not limited to, reduced production rates, increased injection of waste or other fluids, or a suspension of production (Sec. 8, GRO Order No. 4).

It is possible that the traces of the faults mapped in the rim of the Soda Lake craters may extend, in the subsurface, into the area of the proposed well sites. Blowouts have occurred where improperly equipped drilling operations have encountered faults at depth. Full compliance with the provisions of Sec. 2 of GRO Order No. 3, the review of the Application for Permit to Drill, and on-site blowout prevention equipment inspections should prevent blowouts in the Soda Lake Unit.

Soils - Vegetation will be cleared from the drill sites, therefore, these areas will be more subject to erosion than undisturbed areas. Because the area near the drillsite is flat, erosion by water will not present much of a problem.

The area will, however, be subject to wind erosion. The unit operator will be required to institute a dust abatement program through the use of water which should minimize erosion by wind during operations. Revegetation, which is required on Federal Lands by GRO Order No. 4, would serve to minimize erosion after operations are completed. In this instance, because all proposed wells are on private land, revegetation will be at the option of the land owner.

Water - No discharge of drilling fluids or geothermal fluids into surface water is contemplated. Contamination of ground water by interzonal communication of aquifers is, however, a possibility. The well casing requirements imposed by GRO No. 2, however, should prevent such contamination. If an earthen cuttings tank is used instead of the steel one proposed in the P.o.O. then contamination of shallow ground water might result. If necessary, a properly designed and constructed earthen pit would mitigate this concern.

If an injection and testing program is contemplated, then additional potential impacts on both shallow and deeper ground waters are possible. Prior to initiation of an injection program, the lessee must submit the proposal for approval by the Supervisor. However, if the Office of the Area Geothermal Supervisor determines that additional, significant surface disturbance will result from injection operations, an appropriate P.o.O. will be required of the lessee and an EA on the subject proposal will ensue.

Vegetation - Preparation of each drill site will require clearing and levelling for a drill pad of 2 to 3 acres and, in some cases, an access road (Figure 4). All slash should be piled along the cleared areas for animal habitat. Restoration of each site to the present level of vegetational maturity will require about 50 years. Reseeding with native plants such as greasewood and shadscale would accelerate revegetation and impede invasion of the disturbed areas by Russian thistle and halegoton, a plant which is poisonous to livestock. To insure surface reclamation of Federal lands as required by GRO Order No. 4, it will be recommended as a condition of approval that the unit operator consult the Supervisor and the surface managing agency, Bureau of Reclamation, for the exact method and seed mixture to use in revegetation of disturbed areas. Revegetation of privately owned lands will be at the option of the land owner.

Wildlife - Noise and the presence of human activity at the drill sites could temporarily displace waterfowl and other animals. The magnitude of impact would depend on the extent and duration of exploration activities and the capacity of surrounding habitat to absorb and support the displaced population.

The destruction of vegetation associated with the construction of the well sites will result in a long term loss of habitat. Potential food will be lost and community relationships will be disturbed by animals displaced from the disturbed areas. The greatest impact will be on the smaller, more sedentary, species (i.e. small mammals, rodents, and reptiles) that do not have home ranges. The larger, more specialized animals (i.e. large mammals and birds) may move out of the disturbed area.

Adherence to existing regulations and GRO Orders, particularly Order No. 4, sections 6 and 11 should mitigate impacts of the proposed activity on wildlife populations in the area.

Drought conditions prevailing in the Sierra Nevada of California have significantly reduced the flow of the Truckee and Carson Rivers into the Lahontan Reservoir. Irrigation water allotments have likewise been reduced with the ultimate effect of lowering the water table and decreasing the area of wetlands in the Stillwater National Wildlife Refuge, which obtains its water mostly from irrigation water drainage. Wetland surface area is currently reduced by 65-70% in the Stillwater National Wildlife Refuge and by 90% in the Carson Lake area, the principal waterfowl nesting and production areas in the Carson Desert. The Soda Lakes area only has an estimated loss of 40% of its maximum as of September 1, 1976 (Felix Smith, pers. comm., 1976). Consequently, waterfowl usage is expected to shift more than usual to the Soda Lakes area when migratory waterfowl come to winter in the Area (oral communications, Norman Saake, Nevada Department of Fish and Game, August 6, 1976). The construction of earthen sumps for containment of drilling fluids and other drilling waste could encourage waterfowl to attempt to use them also. Therefore, fencing and netting of the sump, when not in use, may be necessary to prevent bird and other animal entry into the sump.

Although, the endangered bald eagle and American peregrine falcon utilize the Stillwater National Wildlife management area for winter feeding purposes, the proposed geothermal activity is not expected to interfere with the birds feeding practices, therefore no impacts are anticipated.

Land Uses

Recreation - The proposed drilling may have an impact on hunting during the waterfowl hunting season, which runs from early October to early January. The Nevada Department of Fish and Game anticipates heavy waterfowl usage of the Soda Lakes area during the winter of 1976-77. The operation of a large drilling rig, with attendant noise and traffic may frighten waterfowl from nearby ponds and thereby decrease or negate hunting opportunities.

Visual Resources - Impairment of the scenic qualities of the Soda Lakes area would be minor and temporary in nature. Drill pad preparation on this flat terrain requires only clearing of brush and very little movement of the essentially flat desert soils. Scars in the landscape, therefore, will only be evident to those at the sites. The drilling rig, however, will be noticeable to travelers on Route 50 and, of course, to the few local residents living near Soda Lake. Given the number of vertical lines already imposed on the landscape, such as power lines, houses, barns, fences and antennas, the temporary emplacement of a drilling rig should not be significant visual intrusion. Such a determination is, of course, highly subjective. Each drilling operation would probably last one to two months, for a maximum total duration of ten months if all five wells are drilled. Viewing distance from Route 50 would be approximately three miles at the nearest point, but east of the Ragtown site the view would be largely, if not completely, obscured by the volcanic rim north and east of Soda Lake.

Cultural Resources - An archaeological survey was performed by members of the Nevada Archaeological Survey of the five proposed drill sites and proposed access roads (Appendix B). The archaeologists collected two cultural artifacts at one site, though it was not considered significant enough to merit preservation in situ (Figure 15). All of the proposed drill sites and proposed access roads were otherwise devoid of cultural resources.

One portion of the California Emigrants Trail was found to be relatively undisturbed. It is located near enough to proposed site 21-5 that it might be disturbed by vehicles needing to turn around, take a short-cut, or simply wanting to tour the area. A Special Condition prohibiting the usage of this portion of the historic California Trail would help assure preservation of this cultural resource.

Socio-Economic Characteristics

During drilling of the five wells proposed in the P.o.O. as many as 25 people will be employed on the drilling rig. Some of these may be local citizens. The result of this will be a small addition to the revenues of the county. Because Fallon, where the crew will probably stay, is well able to handle large tourist loads, no significant impact is anticipated.

While it is somewhat difficult to project exact future levels of economic activity if full-scale geothermal development should occur, a maximum of 250 persons could be employed. This figure represents the total number of persons employed in all phases of the development of the resource. Perhaps as many as 100 would be employed at one time; this would be during the power plant construction phase. Given that this estimate is accurate and that the required number of employees fluctuates during the various stages of development, the town of Fallon should be able to accommodate and benefit from the slight additions to the Churchill County socio-economic structure. The impact of a full-scale geothermal development can not be adequately evaluated until a Plan of Development is submitted in the future. Any such plan will be the subject of an environmental analysis.

SPECIAL STIPULATIONS AND SPECIAL CONDITIONS

All operations in the unit will be subject to the requirements of Rules and Regulations (30 CFR 270) and Geothermal Resources Operational (GRO) Orders. Operations on Federal leases will also be subject to Standard Lease Terms and Special Stipulations and Conditions associated with the leases. Lease Special Stipulations and Conditions may be found in Appendix H.

Recommended Special Conditions

As a result of the coordination effort and this environmental analysis for this Plan of Operation, the following Special Conditions are recommended as conditions of approval for the Soda Lake Unit Plan of Operation. Environmental protection measures proposed by the unit operator are shown in Appendix A.

1. If an earthen cuttings tank is used while drilling the wells, then the design and construction of the tank must be approved by the Supervisor and the Surface Managing Agency. It is recommended that in drilling operations, when feasible, use be made of the irrigation waters within the canal which flows arcuately between Soda Lake and the proposed drill site areas. And if these waters are utilized without addition of toxic materials, no sump lining will be required. In the case where waters of poor quality are to be utilized in drilling operation, it is suggested that proper analyses be made of the shallow water beneath the proposed sump location. If the water analysis can be demonstrated to the satisfaction of the Supervisor that the shallow water is of the same or worse quality than the drilling fluid to be

APPENDIX IV

R E S U M E S

DAVID R. BUTLER

EDUCATION:

B.S. Geology (honors) - University of Texas, 1955.
M.S. Geology - University of Oklahoma, 1957.
Group I Intercompany Management Development Program, 1977.

OUTSIDE ACTIVITIES:

Member, AAPG, SEG, Sigma Xi.
Registered Geologist, State of California.

PROFESSIONAL EXPERIENCE:

1956-1973 STANDARD OIL CO. OF CALIFORNIA
Area Geologist, Texas and New Mexico (1956-1968)

Prepared and maintained subsurface maps and prospect generation, well log analyses and photogeologic analyses; integrated existing and new seismic data; supervised seismic crew; generated and supervised subsurface geological plays.

Geophysicist/Area Geologist, La Habra, California
(1968-1973)

Reviewed, integrated and interpreted California offshore seismic data; generated and supervised subsurface geological plays.

1973-1977 CHEVRON OIL CO. - MINERALS STAFF - GEOTHERMAL
DIVISION
Senior Exploration Geologist (1973-1975)

Generated and supervised programs for geothermal exploration.

Staff Geologist (1975-1977)

Responsibility for recommending plans, execution and staffing of geological, geophysical, land and base programs for geothermal exploration.

1977- CHEVRON RESOURCES CO. - GEOTHERMAL DIVISION
Present Division Manager, Geothermal Exploration

Plan, review and recommend exploration programs for and direct exploration operations for the purpose of acquiring geothermal reserves which can be developed profitably. Supervise execution of geological, geophysical, land and base programs.

J. O. SALVESON

EDUCATION:

U.S. Naval Electronics Material School, 1947.
B.S. Geology - Massachusetts Institute of Technology, 1951.
Business Administration courses - University of California
Extension, 1958-1961.
Management Development program, 1963.
Formation Evaluation seminar, 1966.
Corporation Structural seminar, 1967.
ACE courses:
Principles of Metallic Ore Deposits, 1972.
Global Tectonics, 1972.
Modern Sedimentation, 1973.
Potential Methods in Exploration, 1973.
Evolution of Sedimentary Basins, 1974.
Corporation Stratigraphic Seminar, 1976.

OUTSIDE ACTIVITIES:

Member, Pacific Coast Section, AAPG.
Member, M.I.T. Club of Southern California.
Member, San Joaquin Geological Society.

PROFESSIONAL EXPERIENCE:

1951-1971 STANDARD OIL COMPANY OF CALIFORNIA - WESTERN
OPERATIONS - EXPLORATION
Geologist (1951-1960)

Reconnaissance and detail field mapping of Tertiary, Mesozoic
and Paleozoic sediments in eastern and southern Nevada.
(1951-1952).

Detailed field mapping and subsurface geology; incorporation
of available gravity, magnetic and seismic information into
analysis of specific projects. (1952-1956).

Training in theory and method of seismic exploration and
application to specific problems in San Joaquin Valley.

Reanalysis of seismic data Four Corners area. Geologic analysis
offshore Santa Barbara Channel area, including reanalysis of
seismic data and coordinating with onshore geology. (1956-1960).

Exploration Geologist (1960-1962)

Responsibility for systematic evaluation of Santa Barbara area.
Planned and recommended programs. Directed projects to carry
out approved programs. Followed activities of competitors
in assigned areas and made recommendations for action.

Senior Exploration Geologist (1962-1964)

Responsibility for Washington-Oregon district involving exploratory evaluation of critical areas. Directed or took part in evaluations or special studies involving integration of exploratory tools and techniques. Assured that all available information and concepts were used in the best manner and developed or stimulated others to develop additional useful evaluation techniques.

District Geologist (1964-1967)

Conducted and supervised exhaustive systematic study of geological conditions, Pacific Northwest, and initiated new exploratory programs in assigned district with purpose of locating new reserves of oil and/or gas.

Division Geologist, Northern California (1967-1971)

Provided creative leadership to technical staff in division to assure effective geological exploration. Took part in training and developing efficient, enthusiastic technical force through constructive, critical analysis of results and insistence on sound imaginative thinking and on use of best technical adviser to Superintendent of the division's operations.

1971-1977 CHEVRON OVERSEAS PETROLEUM, INC.
Senior Staff Geologist

Performed independent geological studies to develop a worldwide framework of regional geology, utilizing principles of plate tectonics, to provide a basis for recognizing favorable basins and trends, and coordinated similar studies being carried on by COFRC and Socal operating companies.

1977- CHEVRON RESOURCES CO. - GEOTHERMAL DIVISION
Present Division Geologist

Primary responsibility for proposing that new geological programs and techniques be employed to more effectively explore for geothermal energy. Once approved, monitor implementation of these new programs and techniques. Responsibility for functional supervision of geologists working in division and for quality of geological output. Coordinate with District Supervisors and advise Division Manager on status and needs of geological programs and quality. Responsibility for geothermal activities outside boundaries of designated operating districts, including foreign.

CHARLES M. SWIFT, JR.

EDUCATION:

A.B. Geology (Magna cum laude) - Princeton University, 1962.
Ph.D. Geophysics (5 years) - Massachusetts Institute of
Technology, 1967.
Digital Signal Processing - ACE, 1976.

OUTSIDE ACTIVITIES:

Adjunct Associate Professor, Department of Geology and
Geophysics, University of Utah.
Lecturer, Engineering Geoscience Group, Department of Materials
Science and Engineering, University of California, Berkeley.
Member, GSA, AGU, Society of Exploration Geophysicists
(Chairman, Geothermal Exploration Committee).

PROFESSIONAL EXPERIENCE:

1967-1976 KENNECOTT COPPER CO.
Geophysicist (1967-1969) and Senior Geophysicist
(1969-1976)

Responsibility for conceiving, conducting, supervising, contract-
ing and/or interpreting geophysical surveys in conjunction with
geologists of Bear Creek Mining Company (the domestic explora-
tion group of Kennecott) in the following mineral exploration
programs:

porphyry copper exploration in Washington, Nevada,
Colorado, Arizona, New Mexico, Idaho, Montana and Utah;

volcanogenic massive sulfide exploration in Alaska,
Wisconsin and Minnesota;

stockwork molybdenum exploration in Colorado, Washing-
ton and British Columbia;

copper skarn exploration in Alaska, Arizona, New
Mexico, Idaho and Montana; and

ultramafic nickel exploration in Minnesota.

As Northwest District Geophysicist, became intimately acquainted
with application of electrical (IP), electromagnetic (Turam and
magnetotellurics), gravity and aeromagnetic techniques. Con-
ducted applied theoretical research in aspects of IP, Turam and
audio-frequency magnetotellurics. (This research was primarily
in (1) computer modeling of the forward electromagnetic boundary
value problem, and (2) interpretive techniques.) Instituted a
research project on the relationship of porphyry copper
mineralization to related plate tectonics and presented an

in-house workshop which included both Prof. Jason Morgan of Princeton and Prof. Peter Coney of the University of Arizona. Made numerous oral presentations and wrote numerous publications.

1976-1977 CHEVRON OIL CO. - MINERALS STAFF - GEOTHERMAL DIVISION
Senior Geophysicist

1977- CHEVRON RESOURCES CO. - GEOTHERMAL DIVISION
Present Geophysical Supervisor

Supervise planning, contracting, execution and interpretation of wide range of geophysical surveys in support of domestic exploration program, e.g., resistivity, magnetotelluric, Curie point analysis of aeromagnetic data, gravity, telluric, reflection seismic, SP and passive microseismicity. Presented paper at November 1977 Intercompany Geophysical Conference (ICGC) "Geophysical Techniques in Geothermal Exploration."

MICHAEL A. LANE

EDUCATION:

A.B. Geology - Hamilton College, 1965.
M.A. Geology - Indiana University, 1967.
Ph.D. Structural Geology (minors: Petrology, Geochemistry) -
Indiana University, 1970.
Supervisory Skills and Knowledge Program, 1976.

OUTSIDE ACTIVITIES:

Member, Pacific Section AAPG, GSA, GRC, AIME, Sierra Club.
Fluent in Spanish, French and German.

PROFESSIONAL EXPERIENCE:

1969-1973 STANDARD OIL OF CALIFORNIA
Geologist, La Habra, California (1969-1971)

Subsurface structural and stratigraphic geology, Hollywood Shelf area, involving E-log interpretation, SCAT interpretation, construction of serial cross-sections and structure contour maps; worked with COFRC in developmental phases of computer programs evaluation for cross-section construction and graphic analysis of three-dimensional data; recommended exploratory drilling.

Geologist (Summer 1971)

Geologic reconnaissance in Western Alaska.

Geologist (1971-1973)

Integrated current plate tectonics ideas with Los Angeles Basin geology.

1973-1977 CHEVRON OIL CO. - MINERALS STAFF - GEOTHERMAL
DIVISION
Geologist (1973-1975)

Delineated prospective geothermal areas in western U.S.; compiled appropriate geological and geophysical data relating to geothermal anomalies; conducted and interpreted temperature surveys; collected and interpreted data on 32 geothermal localities; compiled and studied ERTS photographs. Did geochemical sampling of selected localities in British Columbia. Proposed two-year field exploration program for Indonesia. Assisted in preparation for federal land sales.

Senior Geologist (1975-1977)

Supervised development drilling and sampling program at Panna Maria uranium prospect to determine quality and size of

deposit. Responsibility for establishing Karnes City office, hiring and supervising necessary field personnel. Coordinated field aspects of mine, mill, environmental and metallurgical engineering studies leading to project start-ups. Responsibility for community and landowner public relations.

1977- CHEVRON RESOURCES CO. - GEOTHERMAL DIVISION
Present Senior Geologist and Project Coordinator (1977)

Established and managed San Antonio exploration office. Set up and carried out regional exploration program for south Texas uranium deposits, conducted drilling program and related and contract geological and geophysical studies. Prepared geological and land budgets.

District Supervisor, Pacific District (1978-Present)

Responsibility for generating new geothermal prospects, evaluating current ones and training personnel for all programs in Washington, Oregon, California and Nevada. Involves budget, program planning and execution.

R. C. EDMISTON

EDUCATION:

B.S. Geological Engineering - University of Arizona, 1967.
M.S. Geological Engineering - University of Arizona, 1971.
Graduate study in Geophysics and related engineering and mathematics - University of Utah, 1971-1973.

OUTSIDE ACTIVITIES:

Registered Geophysicist, State of California (No. GP858).
Associate member, AIME and Society of Exploration Geophysicists.
Member, Geothermal Resources Council.

PROFESSIONAL EXPERIENCE:

1967-1969 AMERICAN SMELTING AND REFINING CO.
Silver Bell, Arizona
Resident Mine Geologist

Responsible for development drilling and geologic mapping for two open-pit copper mines.

1973-1975 GEOPHYSICAL SERVICE, INC.
Calgary, Alberta, Canada
Geophysicist

Responsible for interpretation of marine gravity and magnetics data. Formed and supervised marine gravity processing and interpretation crew in Calgary during 1974 and 1975.

1975-1977 CHEVRON OIL COMPANY - MINERALS STAFF - GEOTHERMAL DIVISION
Geophysicist and Senior Geophysicist

As geophysical supervisor of geothermal group, planned geophysical program that was integrated with remainder of exploration program; recommended necessary staffing; supervised execution of approved geophysical program; recommended action based on geophysical results. Did geophysical interpretation and integrated geological and geochemical data into geophysical interpretation. Advised of changes or new developments/ideas and recommended appropriate program modification. Trained new members of geophysical group and maintained geothermal and geophysical expertise.

1977- CHEVRON RESOURCES COMPANY - GEOTHERMAL DIVISION
Present District Supervisor, Rocky Mountain District

Responsible for exploration for geothermal resources in Utah, Arizona, New Mexico, Colorado, Idaho, Montana and Wyoming.
Plan and recommend geological and geophysical exploration

programs. Supervise area staff. Recommend land acquisition, surrender and rental payment. Responsibility for well recommendations and supervision of geological wellsite staff. Responsibility and authority for budget control of exploration programs carried out in district. Responsibility for recommending personnel for continuing programs and meetings. Prepare preliminary yearly budget for submittal to Division Manager each year. Functional areas of expertise include heat flow and electrical geophysical methods.

ROBERT W. BUTLER

EDUCATION:

B.A. Geology/Physical Geography - University of Santa
Barbara, 1972.

M.S. Geology - Colorado School of Mines, 1976.

PROFESSIONAL EXPERIENCE:

1974-1977 CHEVRON OIL CO. - MINERALS STAFF - GEOTHERMAL
DIVISION
Geologist

1977- CHEVRON RESOURCES CO. - GEOTHERMAL DIVISION
Present Geologist

Collect, evaluate and summarize geological and geochemical data on geothermal prospects by reconnaissance field studies and computer modeling and reduction of data. Supervise field, wellsite work, collect data for analysis and evaluation. Write final and summary reports of geothermal prospects. Recommend further action on leased land and new exploration programs.

ROGER J. ALLMENDINGER

EDUCATION:

B.S. Geology - State University of New York, College at New Paltz, 1969.

M.S. Geology (Geohydrology) - New Mexico Institute of Mining & Technology, 1971.

Ph.D. Geochemistry (Aqueous Geochemistry) - New Mexico Institute of Mining & Technology, 1976.

Research Interests: Fluid inclusion, Stable isotopes, Hydrothermal mineralization, Regional groundwater dynamics.

OUTSIDE ACTIVITIES:

All Saints Lutheran Church Council.

Amateur Photographer.

PROFESSIONAL EXPERIENCE:

1974-1976 CHEVRON OIL COMPANY - MINERALS STAFF - GEOTHERMAL
DIVISION
Geologist

General geologic, geochemical and geophysical interpretation of geothermal prospects in the western U.S.

1977- CHEVRON RESOURCES COMPANY - GEOTHERMAL DIVISION
Present Geologist

Act as Lead Geologist for Rocky Mountain District, Geothermal Exploration. Geographic area of responsibility of New Mexico and Colorado. Assist District Supervisor in planning and executing programs to evaluate leased areas and find new prospects. Analyze data on pending lease sales in area of responsibility and make appropriate recommendations. Responsibility for quality control of geochemical sampling and interpretation of geochemical data within district.

EDWARD H. HAYNES (Retired)

EDUCATION:

B.S. Geology - University of Kansas, 1951.

M.S. Geology - University of Kansas, 1952.

OUTSIDE ACTIVITIES:

Member, AAPG, Sigma Gamma Epsilon, Sigma Xi, Pacific Coast AAPG
Registered Geologist, State of California.

PROFESSIONAL EXPERIENCE:

1952-1971 STANDARD OIL CO. OF CALIFORNIA
Development Geologist, Venezuela (1952-1959)

Worked with wildcat wells, surface mapping and geophysical prospects.

Geologist, Denver, Colorado (1959-1962)

Independently performed surface and subsurface mapping in areas of complex geology; supervised less experienced geologists.

Staff Assistant to Manager, Exploration
Denver, Colorado (1962-1963)

Assisted Manager in administration of exploration activities, reviewed proposals, analyzed budget and forecast status of long-range proposals. (This was a training program.)

District Geologist, Plains District
Denver, Colorado (1963-1967)

Performed, participated in and supervised geological/geophysical work and land and lease acquisition in search for new oil and gas reserves. Provided leadership to technical personnel.

Senior Exploration Geologist
Bakersfield, California (1967-1971)

Initiated and recommended geological work programs in California coastal and offshore basins. Appointed to Professional Specialist in recognition of fully demonstrated professional ability.

1971-1977 CHEVRON OIL CO. - MINERALS STAFF - GEOTHERMAL
DIVISION
Senior Geologist (1971-1975)

Generated and supervised exploratory program for coal in western U.S.; generated steam coal evaluation studies and

programs for world excluding U.S. Assigned to geothermal group: generated, supervised and coordinated programs for geothermal exploration.

Staff Geologist (1975-1977)

Responsibility for developing plans for geological and well programs for geothermal exploration. Responsibility for overseas coal project evaluation, including Venezuela, Colombia and Indonesia.

1977 CHEVRON RESOURCES CO. - GEOTHERMAL DIVISION
District Supervisor, Pacific District

Responsibility for exploration for geothermal resources in Washington, Oregon, Nevada and California. Planned geologic and geophysical programs and supervised staff for area. Recommended land acquisition, surrender and rental payment. Responsibility for well recommendations and supervision of geological wellsite staff. Responsibility and authority for budget control in district.

WILLIAM E. MERO (Transferred)

EDUCATION:

B.A. Geology - University of California, Santa Barbara, 1960.

M.A. Geology - University of California, Berkeley, 1962.

OUTSIDE ACTIVITIES:

President, North Orange County Young Republicans, 1966.

Area Precinct Chairman, La Habra, 1966.

Co-campaign Manager, City Council, 1968.

Co-campaign Manager, Elementary School Board, 1969.

Legislative Chairman, North Orange County Young Republicans,
1967-1968.

Orange County Deputy Registrar, 1968.

PROFESSIONAL EXPERIENCE:

1962-1972 STANDARD OIL COMPANY OF CALIFORNIA - WESTERN
OPERATIONS - EXPLORATION - SOUTHERN CALIFORNIA
DIVISION
Geologist

Surface and subsurface structural and stratigraphic studies, both regional and prospect oriented. Economic evaluations of prospects and bid acreage. Geophysical and geological subsurface interpretation, offshore Santa Barbara Channel. Stratigraphic and structural studies leading to drilling recommendations.

Geophysicist

Assigned to geophysics group for experience in all phases of geophysical work. Attended "Basic Chevron Geophysical School."

1972-1977 CHEVRON OIL COMPANY - MINERALS STAFF - GEOTHERMAL
DIVISION
Geologist (1972-1976)

Supervised geophysical programs and evaluated geothermal projects. Evaluated data and made recommendations on land acquisition.

Senior Geologist (1977)

Executed assigned geological and/or geophysical projects in geothermal exploration. Initiated or recommended new projects.

1977 CHEVRON RESOURCES COMPANY - GEOTHERMAL DIVISION
Senior Geologist

As Lead Geologist, responsible for new prospect exploration and leased area exploration in Nevada. Aided District Supervisor in planning and carrying out programs in state. Aided

and advised other geologists in district on geological evaluation of prospects in Washington, Oregon and California. Analyzed KGRA sales in Nevada and recommended appropriate action.

9/1/77 - CHEVRON, U.S.A. - WESTERN REGION
Present Senior Geophysicist

ALBERT M. COOPER

EDUCATION:

B.S. Engineering/Mechanical Specialization (minor:
Thermodynamics) - University of Southern California, 1947.
Interdepartmental Management Development Program, 1962.
Computer School - San Francisco Computer Center, 1962.
Northern Division Geologic Training Course for Engineers,
1966.
Corporation Formation Evaluation Seminar, 1967.
"The Effective Executive Series," 1973.
Management Systems Program, 1977.

OUTSIDE ACTIVITIES:

Past Chairman, Pacific Coast District, API Drilling Prac-
tices Committee.
Past Chairman, Pacific Coast District, API Drilling Sessions.
Past Chairman, Pacific Coast District, API Blowout Preven-
tion Committee.
Member, Pacific Coast District, API Advisory Committee.
Vice-Chairman, API Steering Committee on Drilling and Pro-
duction Practices, 1967 and 1968.
Chairman, API Steering Committee on Drilling and Production
Practices, 1969 and 1970.
Chairman, API Committee on Environmental Protection, Drilling
and Production, 1971-1973.
Vice-Chairman, API Executive Committee on Drilling and Pro-
duction Practices, 1971-1973.

PROFESSIONAL EXPERIENCE:

1947-1971 STANDARD OIL COMPANY OF CALIFORNIA
WESTERN OPERATIONS - PRODUCING DEPARTMENT
Junior Engineer, Professional Training Program
(1947-1949)

Roustabout, pumper, well-puller, engineer, rotary helper,
maintenance engineer.

Maintenance Engineer (1949-1954)

Made specific recommendations as to design, selection, layout,
planning and construction of surface production facilities.
Inspected sites regarding proposed alterations of existing
facilities, plant modernization and waste water disposal plants.
Assisted in development of cost estimates, general layout and
scheduling of surface construction for new well locations.

Lead Engineer (1954-1956)

Planned, supervised and conducted engineering design or solution of engineering problems requiring a high degree of technical competence to achieve effective results, to drill wells, to produce and handle oil and gas, and to maintain surface facilities and equipment.

Job Engineer (1956-1962)

Directed engineering required in developing broad, overall plans for systems, processes, methods and practices necessary to efficient operations concerning well producing, oil gathering, gauging, cleaning and shipping.

Senior Engineer (1962-1967)

Applied sound engineering principles in selection, installation, use, care, operation, alteration and repair of materials and equipment; provided advice on complex mechanical, structural and electrical engineering problems. Provided engineering advice on technical problems such as oil cleaning, waste water handling and corrosion treatment.

Division Organization and Cost Control Supervisor (1967-1969)

Supervised division organization and cost control; furnished functional guidance to management on development, maintenance and improvements of organization structures, staff requirements, functions and obligations of management, position and job evaluation, application of wage and salary structures.

Supervisor, Administrative Staff (1969-1970)

Planned, supervised and coordinated division-wide activities in fields of capital expenditures, profit analysis, training and administration.

Field Superintendent, Northern Division, Elk Hills, USNPR #1 (1970-1971)

Conducted departmental activities, i.e., maintenance, construction, development, production of oil and gas, and conservation considerations, natural gasoline operations, surface and subsurface engineering.

1971-1972 STANDARD OIL COMPANY OF CALIFORNIA
WESTERN OPERATIONS - CORPORATION ENGINEERING
DEPARTMENT
Senior Supervising Engineer

As a member of Project Management Team, directed Engineering

Department designs; served as department design representative in contractor's office. Responsibility for designs of plant costing \$5-\$20 million. Design and construction project manager for \$100+ million Kaybob No. 3 gas plant in Canada.

1972-1977 CHEVRON OIL CO. - MINERALS STAFF - GEOTHERMAL
DIVISION
Senior Project Manager

1977- CHEVRON RESOURCES CO. - GEOTHERMAL DIVISION
Present Senior Project Manager

Plan, supervise and coordinate engineering and operations activities associated with geothermal exploration and development including, but not limited to: drilling and test evaluation, facility design and construction, reservoir analysis, feasibility and process studies of geothermal energy conversion, commercialization planning, generation of project schedules, engineering requirements, operation plan, cost and economics. Responsibility for overall project management, including implementation, staff utilization, costs, contract awards, agency permits and negotiations. Provide technical guidance in engineering and operating aspects of geothermal exploration and development.

BASIL D. GARRETT

EDUCATION:

B.S. Mechanical Engineering/Spec. Hydraulics/Heat Power -
University of California, 1944.
Management Development Program, 1962.
Reservoir Engineering Course - Texas A&M, 1960-1961.
Formation Evaluation Seminar, 1959.
Training courses in Electrical, G&NG, Prod. Operator,
M&C Operator and Supervisor.

OUTSIDE ACTIVITIES:

Past President, Ventura Toastmasters.

PROFESSIONAL EXPERIENCE:

1945-1973 STANDARD OIL COMPANY OF CALIFORNIA
WESTERN OPERATIONS - PRODUCING DEPARTMENT
Pool-Shop Engineer (1945-1949)

Contacted production superintendents and foremen concerning specific problems. Followed up on job to compare cost with estimate and determine reason for overexpenditures, if any. Analyzed larger shop jobs, prepared cost estimates, handled technical phases of job. Made recommendations for shop procedures; analyzed shop costs; followed up on tests of material and equipment and made recommendations for standards.

Production Equipment and Methods Engineer
(1949-1952)

Assisted job engineer on engineering problems arising in connection with selection, installation, use, replacement, repair and maintenance of production equipment and appurtenances used in and at wells, including costs, methods and practices, insofar as equipment was concerned.

Analyst, Production Division (1952-1953)

Did studies on oil cleaning, sampling and gauging, well pumps, production equipment and tools, production stimulation methods and application and other production problems.

Assistant General Shop Foreman (1953-1956)

Responsibility for successful conduct of all activities concerned with efficient and economical operation of general shops and for accomplishment of authorized work in field.

Job Engineer, Drilling (1956-1958)

Responsibility for application of sound engineering principles to selection, installation, use and repair of surface drilling equipment, including complete drill stem.

Engineer, General (1958-1959)

Supervised and performed complex engineering assignments involving construction of shore facilities and lines to and from offshore platform and operation, repair, alteration, etc. of platform, underwater lines and onshore facilities. Provided technical advice to district and division management.

Senior Engineer, Operations (1959-1963)

Planned, supervised and conducted engineering activity for assigned area, provided technical advice to Field Superintendent, represented department at technical meetings.

District Engineer (1963-1965) - title change only

Planned, supervised and conducted engineering activity for assigned area, provided technical advice to Field Superintendent, represented department at technical meetings.

Production Foreman (1965-1966)

Responsibility for successfully conducting activities concerning production, treating, gathering, cleaning, gauging and shipping of oil and gas from assigned area.

Area Supervisor (1966-1973)

Conducted departmental activities within assigned area, including production (oil and gas), maintenance, construction, gas processing (including sale of liquid products and distribution of gas).

1973-1977 CHEVRON OIL CO. - MINERALS STAFF - GEOTHERMAL
DIVISION
Operations Supervisor, Geothermal

1977- CHEVRON RESOURCES CO. - GEOTHERMAL DIVISION
Present Operations Supervisor, Geothermal

Plan, coordinate, direct and have responsibility for field operations and engineering required to conduct geothermal exploration and development well drilling, production test evaluations of new discoveries, surface and subsurface operational requirements of producing and handling geothermal fluids from commercial projects, including associated construction activities.

APPENDIX V

BOARD OF DIRECTORS RESOLUTION

AND

LIST OF OFFICERS

RESOLVED: That the President, a Vice-President, the Treasurer, the Secretary, an Assistant Secretary, an Assistant Treasurer, or a duly appointed Attorney-in-Fact of Chevron Resources Company, a division of this corporation, be and each of them is hereby empowered in such capacity or as Agents or as Attorneys-in-Fact for said division, to execute for and on behalf of said division (without the necessity of affixing the corporate seal) all papers requiring execution in the name of said division, excepting no authority is conferred by this resolution for execution of any of the following:

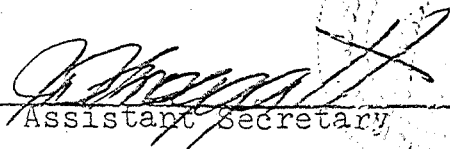
1. leases to others covering oil, gas or other hydrocarbon or non-hydrocarbon minerals underlying fee lands of said division, or deeds or conveyances to others covering fee lands of said division, other than rights of way and similar easements, where either book value or sale price exceeds \$50,000;
2. promissory notes or notes or other documents and agreements in support of any borrowings;
3. documents of agreements establishing bank accounts in the name of said division, or withdrawing of funds or closing of any bank accounts of said division, and be it further

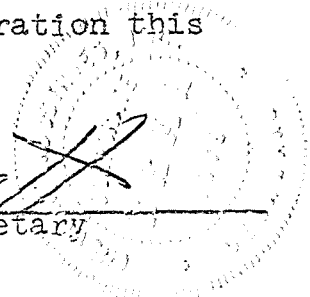
RESOLVED: That each party empowered by this resolution is authorized to affix the seal of this corporation to such papers as require a seal and to acknowledge and deliver any such papers as fully as if special authority were granted in each particular instance; and be it further

RESOLVED: That the President or a Vice-President of said division be and each of them is hereby empowered on behalf of said division to appoint any person or persons whom they or any one of them may deem proper as Attorney or Attorneys-in-Fact of said division for a term not to exceed one year with such powers said persons or any of them may lawfully do by virtue of the authority herein granted to them.

I, J. D. FROGGATT, Assistant Secretary of CHEVRON INDUSTRIES, INC., a Delaware corporation, do hereby certify that the foregoing is a full, true and correct copy of certain resolutions unanimously adopted at a meeting of the Board of Directors of said corporation held at the office of said corporation in San Francisco, California, on April 13, 1977, and that said resolutions are in full force and unrevoked.

WITNESS my hand and the seal of said corporation this 25th day of May, 1978.


Assistant Secretary



CHEVRON RESOURCES COMPANY DIVISION
OF
CHEVRON INDUSTRIES, INC.

Officers

President	R. F. Schlecht
Vice-President	C. Dahlstrom
Secretary	J. D. Froggatt
Treasurer	R. E. Willoughby
Assistant Secretary	Bruce Chalker
Assistant Secretary	Barbara F. Perez
Assistant Treasurer	C. B. Sonne
Assistant Treasurer	J. S. Tate

I, J. D. FROGGATT, Assistant Secretary of CHEVRON INDUSTRIES, INC., a Delaware corporation, do hereby certify that the foregoing is a true and correct list of the names of the officers of the Chevron Resources Company Division of said corporation authorized to execute papers of this corporation pursuant to resolutions adopted by the Board of Directors of said corporation on April 13, 1977, copy of which is attached hereto.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the seal of said corporation this 25th day of May, 1978.


Assistant Secretary

