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UNITED STATES  
DEPARTMENT OF THE INTERIOR

GL03133

GEOLOGICAL SURVEY  
Area Geothermal Supervisor's Office  
Conservation Division, MS 92  
345 Middlefield Road  
Menlo Park, CA 94025

JUN 1 1979

Memorandum

To: Interested Parties

From: Area Geothermal Supervisor

Subject: Plan of Operation, Aminoil USA, Inc., Federal Lease CA-1862,  
Geysers-Calistoga KGRA, Lake and Sonoma Counties, CA.

Aminoil USA, Inc. has submitted a Plan of Operation for Exploration in accordance with CFR 270.34 to construct one multiple well drill pad site and to drill one or more exploratory wells on Federal Lease CA-1862, Geysers-Calistoga KGRA, Lake and Sonoma Counties, CA. A copy of the Plan of Operation is attached for your review and files.

An Environmental Analysis (EA#130-9) will be prepared by the Office of the Area Geothermal Supervisor for the proposed action.

You are invited to participate in a field inspection being led by Ted Hudson, Santa Rosa District Geothermal Supervisor, USGS, on June 14, 1979. Participants are asked to meet at the Chevron Service Station in Middletown, California, at 9 a.m., June 14, 1979.

All comments concerning the proposed actions should be received no later than June 24, 1979, by:

**UNIVERSITY OF UTAH  
RESEARCH INSTITUTE  
EARTH SCIENCE LAB.**

Area Geothermal Supervisor  
US Geological Survey - Conservation Division  
345 Middlefield Road - MS 92  
Menlo Park, CA. 94025

Tel: (415) 323-8111, Ext. 2848 (FTS: 467-2848)

We urge you to send written commentary and will appreciate hearing from you even if you are of the opinion that the existing regulations, lease terms, and operational orders provide adequate environmental protection.

Further, we solicit your comments and suggestions on the proposed action. All comments will be given serious consideration in the preparation of the Environmental Analysis and any subsequent conditions of approval.

The Area Geothermal Supervisor's Office will not send a draft Environmental Analysis to interested parties for review for the proposed action. Certain parties, however, such as the surface managing agency, the lessee, GEAP and USFWS will receive a copy of the completed EA. Other interested parties will not receive a copy of the final EA unless such parties comment on the proposed action in writing or request a copy of the particular EA pursuant to the Freedom of Information Act. Copies of the Environmental Analyses are available for inspection during normal business hours at the Area Geothermal Supervisor's Office, the Santa Rosa District Geothermal Supervisor's Office, and the Ukiah BLM District Manager's Offices.

A handwritten signature in cursive script, appearing to read "R. A. Storer".

Attachment

Principal, Department of  
Plan and Exploration

Principal, Department of  
Plan and Exploration

District Geothermal Supervisor  
USGS, Conservation Division  
Post Office Box 354  
Santa Rosa, California 95402  
\*FIS: 438-4326 Cor: 707-525-2726

Conservation Manager, Eastern Region  
ATTN: Environmental Staff  
USGS, Conservation Division  
545 Linderoth Rd., US 80  
Santa Rosa, California 95425  
\*Tel: 707-525-2726 Cor: 415-523-0111

Mr. Henry Collins  
Area Geologist, Traffic Dept  
USGS-Conservation Division  
545 Linderoth Rd., Santa Rosa  
Santa Rosa, California 95425  
\*FIS: 437-2007 Cor: 415-523-0111

Geological Science Research  
ATTN: Bruce L. Tassev  
Federal Building, Rm. 1252A  
270 Cottage Way  
Sacramento, California 95825  
\*FIS: 468-4728

Dr. R. W. Robinson, Principal  
Geothermal Environmental Geology  
Panel  
545 Linderoth Rd., Santa Rosa  
Santa Rosa, California 95425  
\*FIS: 437-2071 Cor: 415-523-0111 X0871

U.S. Bureau of Land Management  
Geothermal Specialist  
ATTN: Theodore L. Holland  
Western Int. Center, R. 50 (0-310)  
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California State Director  
Bureau of Land Management  
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2800 Cottage Way  
Sacramento, California 95825  
\*FIS: 468-4676 Cor: (916) 468-4676

District Manager  
Bureau of Land Management  
545 Leslie Street  
 Ukiah, California 95428  
\*Cor: 707-462-3973

U.S. Fish and Wildlife Service  
ATTN: Field Supervisory Serv  
2800 Cottage Way  
Sacramento, California 95825  
\*FIS: 468-4516 Cor: 916-484-4516

U. S. Fish and Wildlife Service  
ATTN: Gail Sobeditich  
Endangered Species Office  
2800 Cottage Way, Room E-2720  
Sacramento, California 95825  
\*FIS: 468-4516 Cor: 916-484-4516

Department of Energy, Division of  
Geothermal Resource Management  
ATTN: Mr. Fred S. Abel, Program  
20 Massachusetts Avenue, NW  
Washington, D.C. 20545

Department of Energy, Geothermal  
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\*FIS: 376-1690 Cor: 202-376-1690

California Division of Oil & Gas  
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2904 Alcide Lane  
Santa Rosa, California 95401  
\*Cor: 707-525-2472

California Department of Fish & Game  
ATTN: Don Lalloek  
1616 Ninth Street  
Sacramento, California 95814  
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State of California  
Department of Parks & Recreation  
ATTN: Knox Kellan, P. O.  
P.O. Box 2390  
Sacramento, California 95811

Regional Water Quality Control Board  
ATTN: David Snetsinger  
1400 Lodi Town Center  
Santa Rosa, California 95401  
\*Tel: 707-468-2620

INTERESTED PARTIES for EA #130-9

Governor's Office of Planning and  
 Research - State Clearing House  
 ATTN: Bill Kirkham and Susan Brown  
 1400 Tenth Street  
 Sacramento, California 95814

State of California  
 Water Resources Control Board  
 ATTN: Alvin Franks  
 P.O. Box 100  
 Sacramento, California 95801  
 \*Comm: 916-445-2774

John Emio  
 California Department of Fish and  
 Game  
 P.O. Box 47  
 Yountville, California 94599

Native American Heritage Committee  
 ATTN: Stephen Rios  
 1400 10th Street  
 Sacramento, CA 95814  
 \*916-322-7791

State of California  
 Public Utilities Commission  
 ATTN: Mr. William M. Foley  
 350 McAllister Street, Room 5069  
 San Francisco, California 94102

Mr. Tom Cordill  
 Sonoma County Planning Director  
 County Admin. Building, Rm. 105A  
 2555 Mendocino Avenue  
 Santa Rosa, California 95401  
 \*Tel: 707-527-2412

Don Johnson  
 Lake County Planning Director  
 255 N. Forbes Street  
 Lakeport, California 95453  
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Sonoma State College  
 ATTN: Dr. David A. Fredrickson  
 Anthropology Laboratory  
 1801 East Cotati Avenue  
 Rohnert Park, California 94928  
 \*Comm: 707-564-2381

Earth Science Laboratory  
 Univ of Utah Research Institute  
 ATTN: Phillip M. Wright  
 420 Chipeta Way, Suite 120  
 Salt Lake City, Utah 84108  
 \*Tel (801) 581-5283

Geothermal Resources Council  
 Attn: Mr. David Anderson  
 P.O. Box 98  
 Davis, CA 95616  
 \*Comm: 916-758-2360

Mr. Mike Eaton  
 Sierra Club  
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 \*916-444-9132

Mr. John Kramer  
 for the Sierra Club  
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 Santa Rosa, California 95406  
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Anadarko Production Company  
 ATTN: Mr. John D. Syntak  
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 Houston, Texas 77001  
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Occidental Geothermal, Inc.  
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 5000 Stockdale Highway  
 Bakersfield, California 93309  
 \*Tel: (805) 327-7351

Republic Geothermal, Incorporated  
Northern California Office  
ATTN: J. L. Schneidenger  
2544 Cleaveland Avenue  
Santa Rosa, California 95401  
\*Comm: 707-527-7755

CER Corporation  
ATTN: Joy Hyde  
Post Office Box 15090  
Las Vegas, Nevada 89114  
\*Comm: 702-735-7136

Union Oil Company of California  
Geothermal Division  
ATTN: Neil Stefanides  
Union Oil Center, Box 7600  
Los Angeles, California 90051  
\*213-486-7740

Union Oil Company  
ATTN: Don Ash  
Post Office Box 6854  
Santa Rosa, California 95406

New Albion Resources Company  
ATTN: J. M. Nugent  
Post Office Box 168  
San Diego, California 92112

Mr. Warren M. Woodward  
125 Drew Drive  
Reno, Nevada 89502  
\*FTS 470-5911 702-825-3079

SAYARIGHT Corporation  
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Fairfield, California 94533  
\*Tel: 707-429-5777

Shell Oil Company  
ATTN: Mr. F.W. Nantker  
Post Office Box 92047  
Worldway Center  
Los Angeles, California 90009  
\*Tel: (805) 648-2751

Union Oil Company of California  
ATTN: Mr. Joseph L. Wilson  
Post Office Box 7600  
Los Angeles, California 90051  
\*DIRECT 8-213-486-6492

Environmental Science Associates, J  
ATTN: Paul Zigman  
1291 E. Hillscale Blvd.  
Foster City, CA 94404  
\*415-573-8500

Mr. Jack McNamara  
10850 Wilshire Blvd, Suite 790  
Los Angeles, California 90024  
\*Tel: (213) 475-4933

Plan of Operation - Exploration  
Lease Unit 7 CA1862  
Supplement III  
23 April, 1979

Sections 21, 27, 28 and 29, T11N, R8W  
Geysers Area KGRA  
Lake & Sonoma Counties, California

Aminoil USA, Inc.  
Geothermal Resources Division  
P. O. Box 11279  
Santa Rosa, California 95406  
(707) 527-5332

Plan proposes the construction of one multiple well drill pad site and the drilling of one or more geothermal resource wells to evaluate the potential for geothermal resource reserves.

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## Introduction

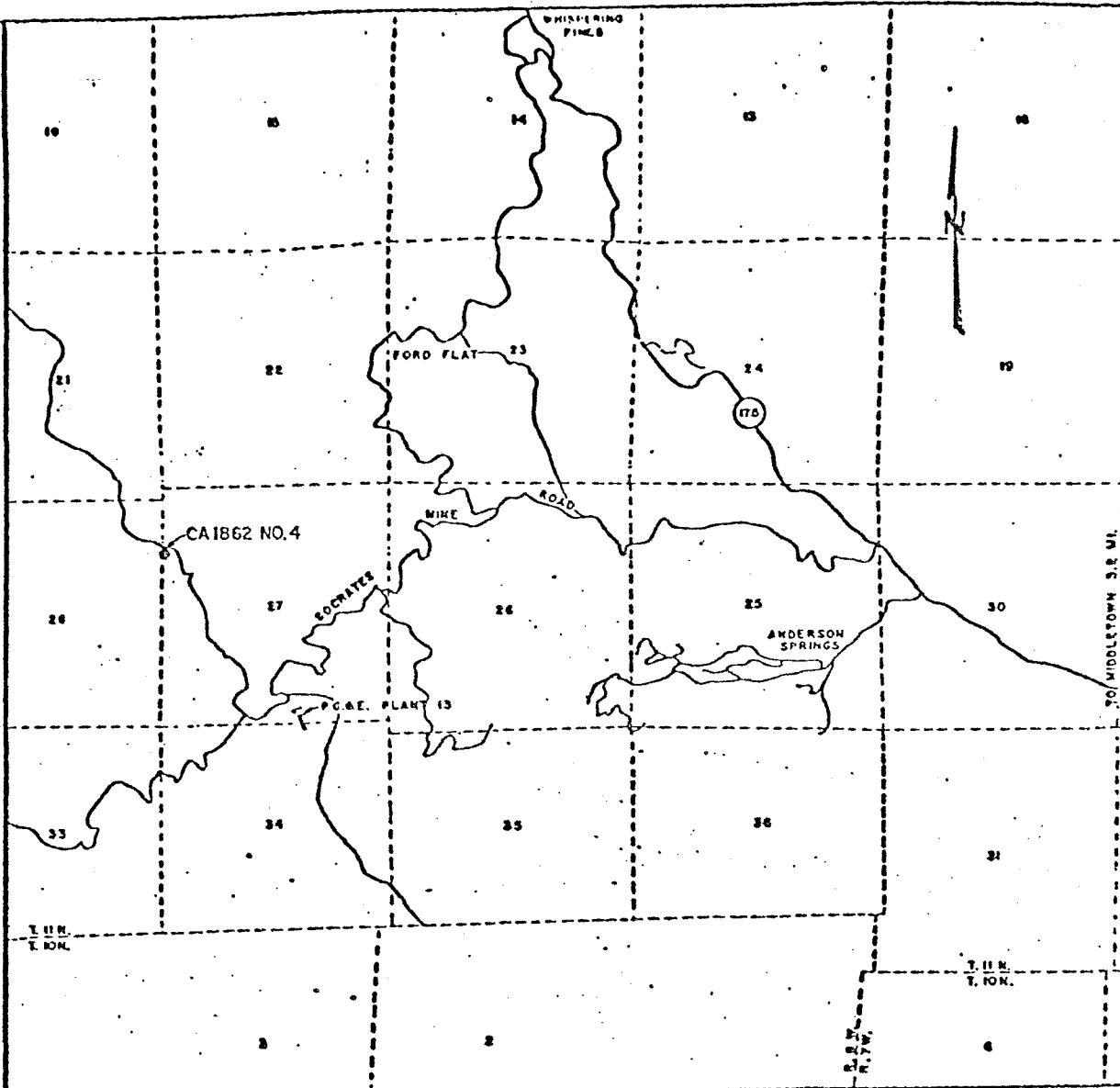
Pursuant to 30 CFR 270.34, Aminoil USA, Inc. (formerly Burmah Oil and Gas Company) hereby supplements its Plan of Operation Lease Unit 7 CA1862, Geysers Area KGRA, Lake and Sonoma Counties, California, submitted May 14, 1975 and approved July 7, 1975.

The USGS Environmental Analysis, Geothermal Lease, CA1862, Burmah Oil and Gas Company (now Aminoil USA, Inc.), The Geysers Calistoga KGRA, California, July 7, 1979 is hereby referenced and made a part of this Supplement.

Aminoil USA, Inc. now proposes to construct a multiple well drill pad site and drill one or more geothermal resource wells to a depth of + 2440 meters (8000') on the westerly parcel of Lease Unit 7 CA1862 in Section 28, T11N, R8W, Geysers KGRA, Lake and Sonoma Counties, California.

One well, CA1862 26-27, was completed on the easterly parcel of Lease Unit 7 in the SW-1/4 of Section 27, October 3, 1975. A second well CA1862 37-21 was completed on the westerly parcel of Lease Unit 7 in the SW-1/4 of Section 21 July 13, 1976. A third well is currently being directionally drilled from an adjacent private lease into the easterly parcel of Lease Unit 7 to a bottom hole location in the SE-1/4 of Section 27, T11N, R8W.

The project defined by this Plan is proposed to help evaluate the potential for adequate geothermal resource reserves on the westerly parcel of Lease Unit 7 CA1862 in Sections 21, 28 and 29, T11N, R8W to supply steam for operation of a 55 MW electric generation facility for up to 30 years. It is expected that one additional access road, drill pad site and the drilling of one additional well in the NE-1/4 of Section 29, T11N, R8W will be required before resource reserves are adequately confirmed within the parcel. A Plan of Operation for that well will be filed under separate cover following completion of required geotechnical studies.



VICINITY MAP

1" = 2000'

## I Project Location

Aminoil USA, Inc., Geothermal Resources Division proposes to construct a multiple well drill pad site along an existing improved access road and drill one or more geothermal resource wells to a depth of + 2440 meters (8000') to evaluate the geothermal resource reserves underlying the westerly parcel of Federal Lease Unit 7 CA1862, Sections 21, 28 and 29, T11N, R8W, MDB & M, Lake and Sonoma Counties, California.

The multiple well drill pad site is to be constructed on the east side and adjacent to the existing improved access road for the Lease Unit 7 CA1862 37-21 well at a location being approximately 343 meters (1125') south and 1487 meters (4875') east of the NW Corner of Section 28, T11N, R8W, MDB & M.

## II Project Access

Access to the project site is from highway 175 via Socrates Mine Road and the State Forest Service Road previously improved for access to the CA1862 37-21 well.

The proposed drill pad site lies immediately adjacent to the existing improved access road and no additional road construction with the exception of minor modification where the road accesses the drill pad site is expected.

## III Site Construction

The proposed location for the drill pad site is on a relatively small ridge at an elevation of approximately 1031 meters (3380') and was selected because of its stability and advantageous topographic features which will minimize grading operations and other potential environmental impacts.

The existing access road was constructed in 1975 and to date no failures have occurred along its entire length. The roadbed itself appears to be in excellent condition.

The rock formations underlying the proposed pad site will provide adequate stability for well pad construction. A small landslide and some rock debris extend from the ridgeline to the proposed pad site. The landslide debris appears to be relatively shallow and is not expected to effect the stability of the proposed site. Other landslides identified northeast of the proposed project should have no effect on construction of the pad site other than to require careful planning for pad site drainage (Geologic Analysis, Mary K. Twichell, April, 1979).

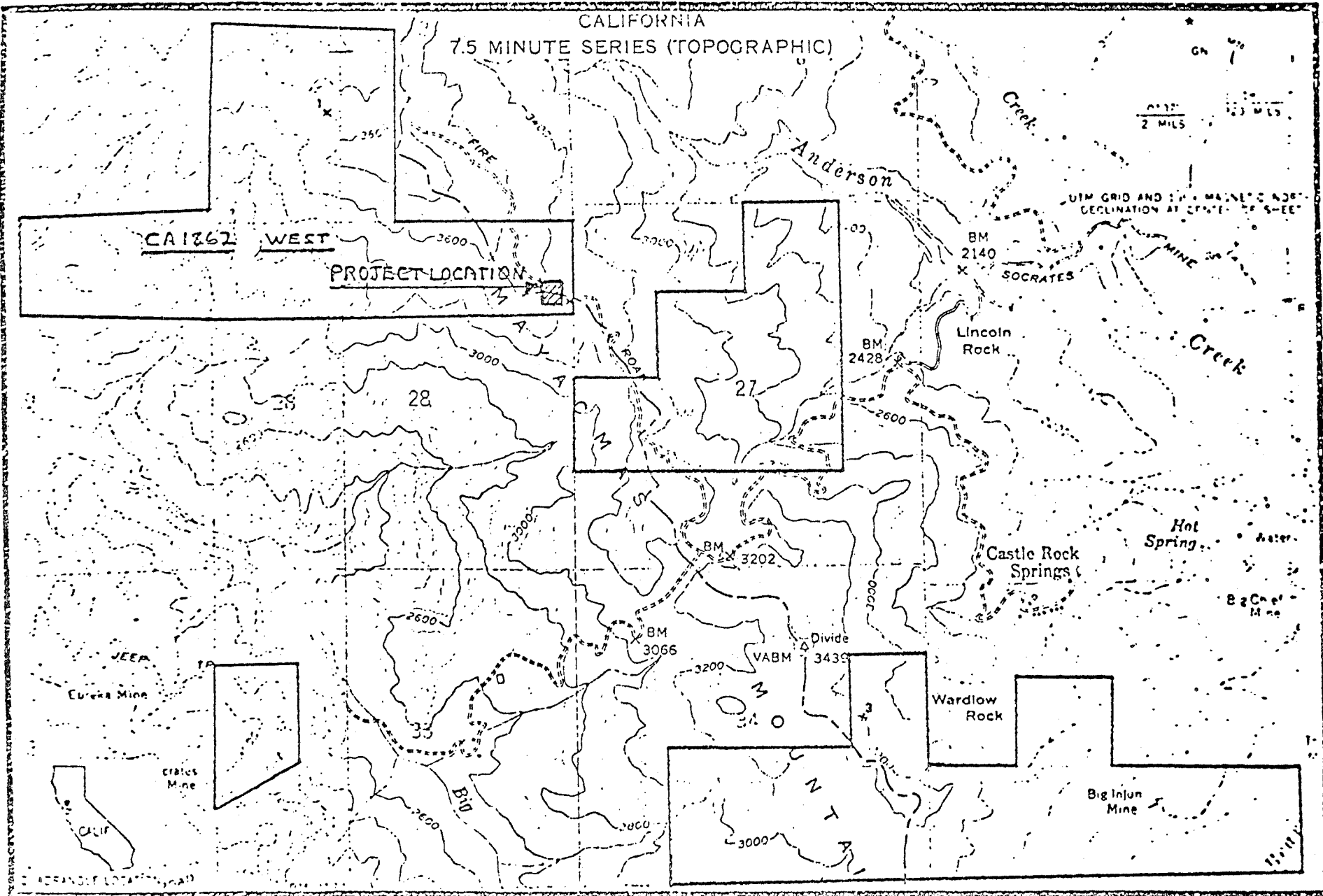
The construction of the pad site and temporary waste discharge pit will require the clearing and grading of + .8 ha (2 acres) of ground surface area. The surface area will be cleared of all vegetation and graded to drain toward drainage ditches and structures pursuant to drawings and specifications as provided by Hawke Engineers, San Francisco, California. All proposed earth movement associated with the project will be engineered to provide for balanced cuts and fills. The construction area will be stripped of all topsoil and debris and the topsoil stockpiled for later use on cut and fill slopes. All brush will be chipped and spread over exposed soil areas. All stumps, boulders and other such debris will be buried at locations outside of the limits of engineered fills and as specified by the Supervising Engineer. Trees and tree branches over 6 inches in diameter will be cut for firewood and stockpiled at an offsite location.

THE GEYSERS QUADRANGLE

WHISPERING PINES

CALIFORNIA

7.5 MINUTE SERIES (TOPOGRAPHIC)



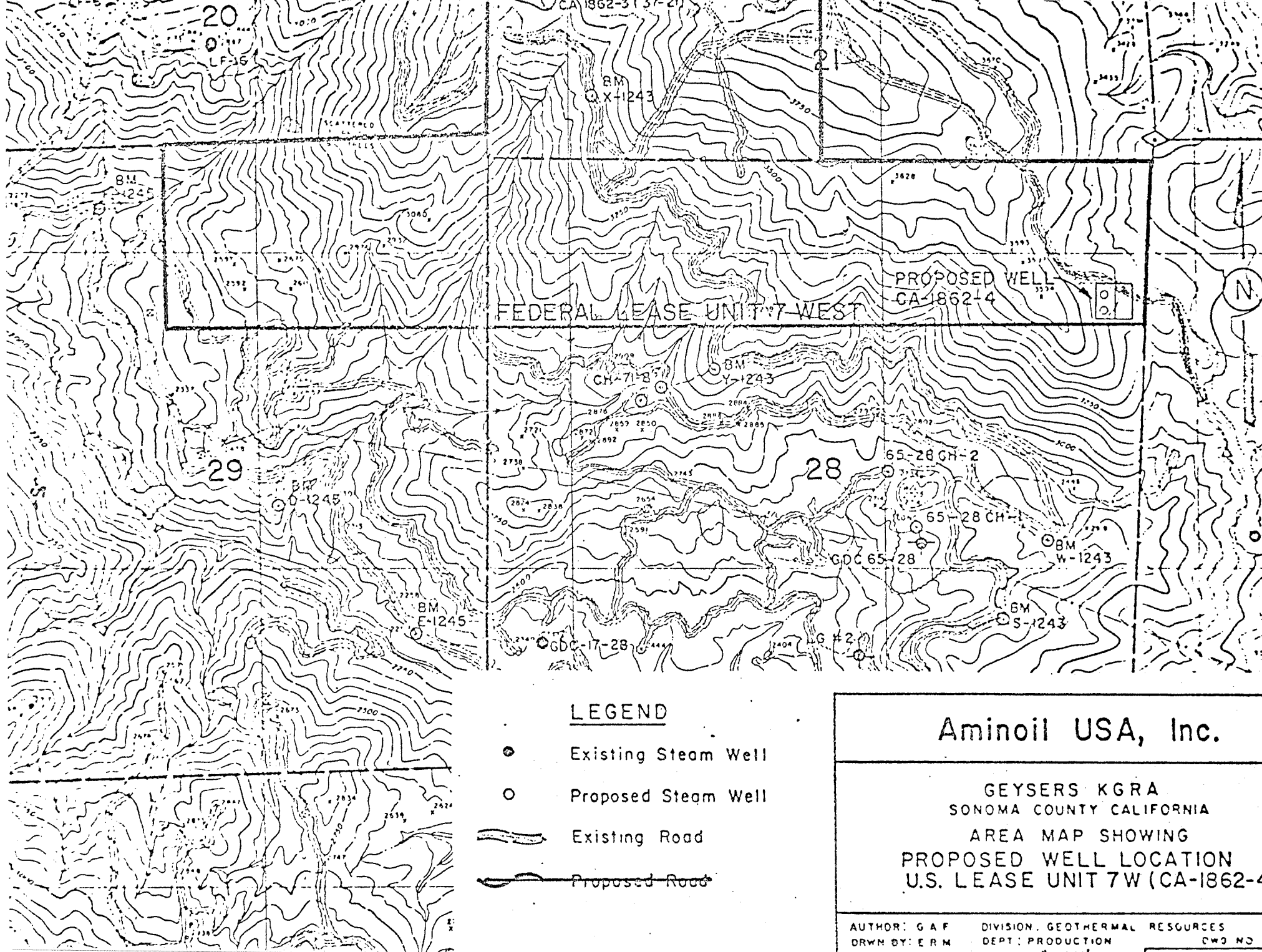
CA 1262 WEST

PROJECT LOCATION

UTM GRID AND 1983 MAGNETIC ANGLE DECLINATION AT CENTER OF SHEET

Map made, edited, and published by the Geological Survey  
 CONTOUR INTERVAL 40 FEET SCALE 1:24,000  
 DATUM IS MEAN SEA LEVEL

1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000



FEDERAL LEASE UNIT 7 WEST

PROPOSED WELL  
CA-186214

LEGEND

- ⊙ Existing Steam Well
- Proposed Steam Well
- Existing Road
- Proposed Road

**Aminoil USA, Inc.**

GEYSERS KGRA  
SONOMA COUNTY CALIFORNIA  
AREA MAP SHOWING  
PROPOSED WELL LOCATION  
U.S. LEASE UNIT 7W (CA-1862-4)

AUTHOR: G A F DIVISION: GEOTHERMAL RESOURCES  
DRWN BY: E R M DEPT: PRODUCTION  
SCALE: 1" = 1000'

GEOLOGIC ANALYSIS OF PROPOSED WELL LOCATION AND EXISTING ACCESS ROAD  
U.S. LEASE UNIT 7 WEST, GEYSERS KGRA, LAKE AND SONOMA COUNTIES

The proposed well site is located in the southeastern corner of U.S. Lease Unit 7 West. The pad will be constructed on a relatively small ridge at an approximate elevation of 3380 feet. There is an existing road which leaves the Socrates Mine Road south of Aminoil's CA 1862-1 well and tranverses northwest across a portion of U.S. Lease Unit 7 West to Aminoil's CA 1862-3 well. This road would provide access to the pad site. The area was examined to determine the existence of any potential geologic hazards.

The road to be used as the access road was constructed in 1975. No failures have occurred along its entire length. The roadbed itself is in excellent condition.

The well pad will be constructed on a small ridge underlain by serpentized ultramafic rock (Sp) and graywacke melange (fsr). Even though these rock types have variable rock strengths, the area is considered stable for well pad construction. Part of this ridge is covered by talus from the graywacke melange and a small landslide (see geologic map). The landslide does not appear to be very thick or extensive where it originates on the ridge. The rest of the landslide deposit occupies a depression between the main ridge to the west of the site and the ridge on which the pad will be built. Depending on the extent of this landslide, it will either be cleared away or stabilized before construction of the pad. Other landslides in the area have been identified (see geologic map). Their positions do not affect the stability of the pad site. Drainage ditches from the pad will avoid these hazards.

In summary, an existing road, in excellent condition, will provide access to the pad site. The rock types underlying the pad site offer no stability problems. The only geologic hazards in the area are landslides. These hazards will either be cleared away, stabilized, or avoided entirely.

*Mary K. Twichell*

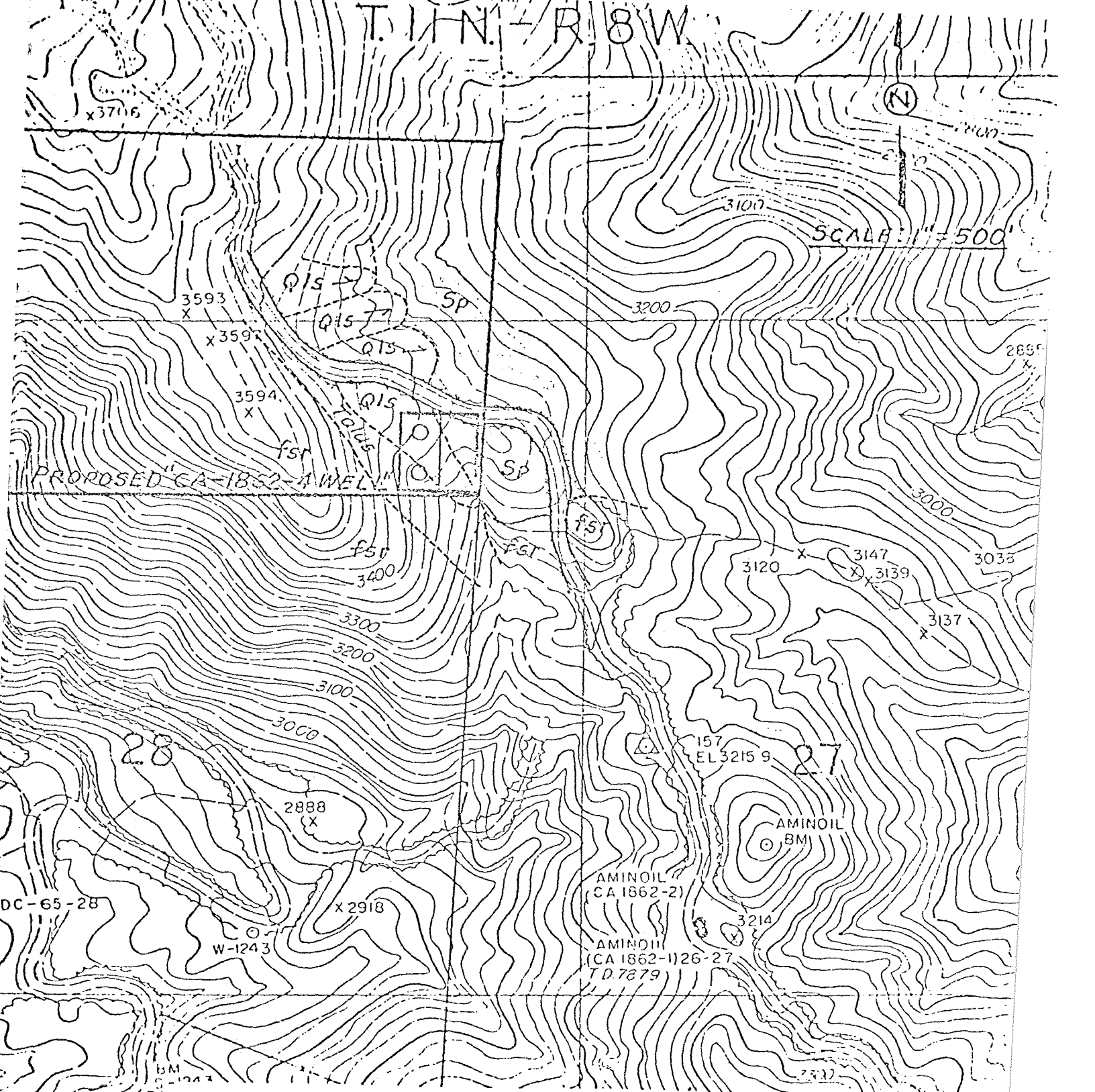
Mary K. Twichell, Geologist  
Aminoil USA, Inc.

MKT/lp  
Attachments

T. 11 N. - R. 8 W.



SCALE: 1" = 500'



EXPLANATION

- Q1s Landslide Deposit
- Talus
- Road Fill
- Sp Serpentinized Ultramafic
- fsl Melange Undifferentiated

DC-65-28

W-1243

AMINOIL  
(CA 1862-2)

AMINOIL  
(CA 1862-1) 26-27  
T.D. 7679

AMINOIL  
BM

Cut slopes will not be steeper than 1 horizontal to 1 vertical except at locations where sound and durable rock is encountered. Fill slopes are to be keyed into undisturbed ground areas with relative compaction of 95% pursuant to specifications to be prepared by Hawke Engineers and based on ASTM method D-1557-70, "Moisture Density Relations Test for Soils". Outer fill slopes will not be steeper than 1-1/2 horizontal to 1 vertical and will be dressed or compacted by rollers or by "walking" with a crawler tractor. A minimum of two percent slope will be provided on all graded surface areas to assure adequate drainage. The drill pad surface will be covered with approximately six inches of rock surfacing spread and moistened as required and compacted by tamping rollers or other compacting equipment to 90% of ASTM D-1557-70.

Waste materials generated during drilling activities will be disposed of within the waste disposal pit (sump) which will be constructed adjacent to the drilling pad and lined with an impervious two foot thick clay liner. The impervious liner will be constructed and compacted in six inch lifts and provide a maximum permeability of  $1 \times 10^{-6}$  cm/sec.

Erosion at the project site will be controlled by a series of drainage ditches and culverts placed at locations pursuant to drawings and specifications to be provided by Hawke Engineers.

The outer limits of the entire area to be disturbed by construction will be staked prior to commencement of any construction activity to provide for a joint USGS, Santa Rosa and BLM, Ukiah field inspection tour of the proposed project site location.

#### IV Proposed Well

On completion of site construction, Aminoil proposes to drill one geothermal resource well to a depth of + 2440 meters (8000') to evaluate the potential geothermal resource reserves underlying the CA1862 lease. The proposed well, CA1862 82-28, is to be drilled at a location being approximately 343 meters (1125') south and 1487 meters (4875') east of the NW Corner of Section 28, T11N, R8W, MDB & M, Lake County, California. Pursuant to 30 CFR 270.71, the Application for a Permit to Drill (form 9-331c) appended with a drilling program summary and appropriate reference and a plat showing the proposed surface and subsurface well locations will be forwarded under separate cover. Aminoil has scheduled the CA1862 82-28 well for commencement of drilling operations on or about October 1, 1979.

#### V Water Supply and Construction Material

During construction activities and for well drilling operations, substantial amounts of water will be required. Aminoil proposes that the water supply for both construction and drilling operations associated with the project will be purchased from a source or sources located off Aminoil's Federal leased lands and imported to the site by pipeline or tank vehicle. If necessary, water will be stored in close proximity to the project operations in a container of sufficient capacity to provide for continuous uninterrupted operations.

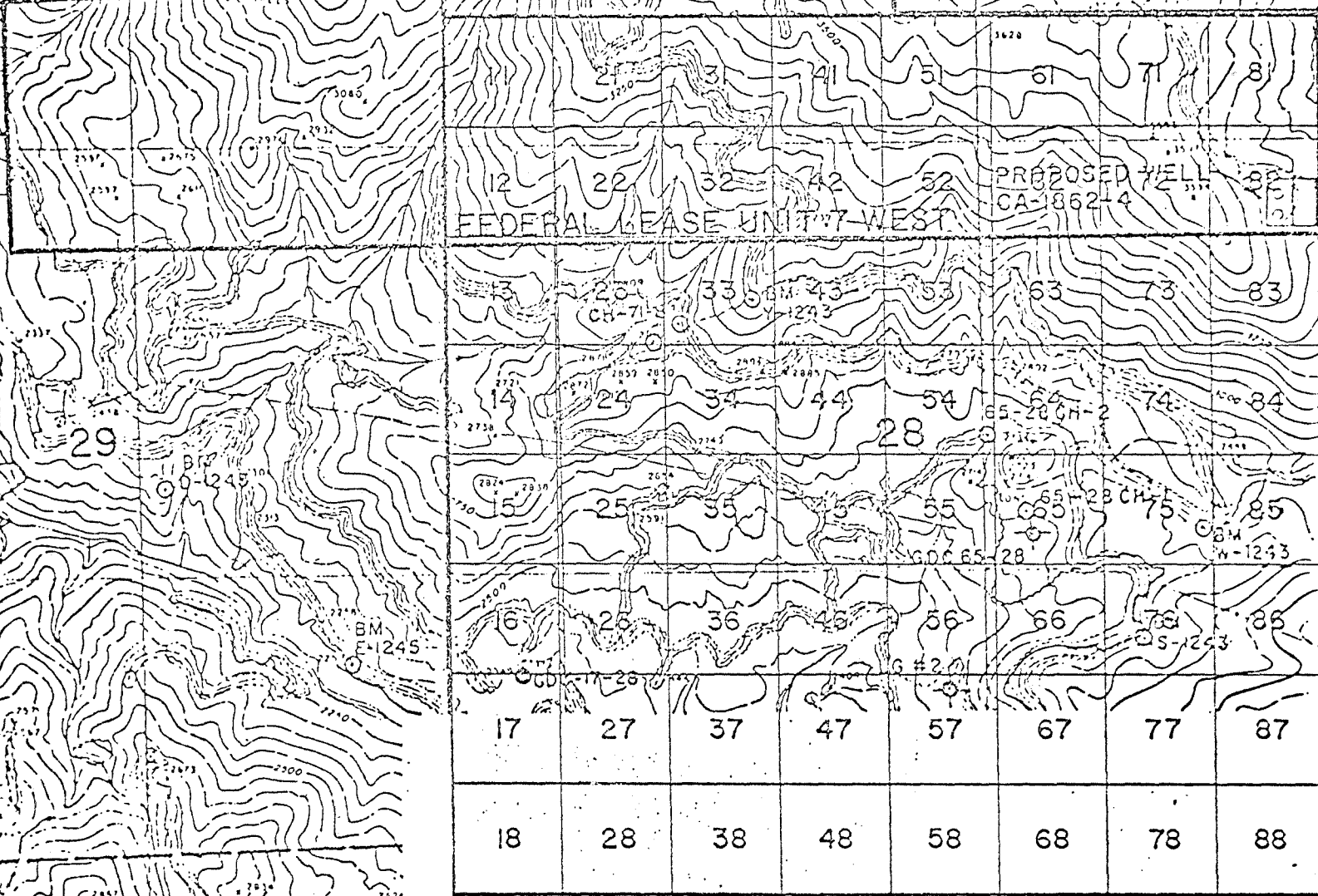
Construction of surface facilities for the project will not require soils to be imported or deported. Rock required for surfacing of the drill pad site will be provided from an existing borrow pit on Aminoil's fee lease in the SE-1/4 of Section 35, T11N, R8W, MDB & M, Lake County.



T11N R8W

AMINOIL  
CA 1862-3 (37-2)

NUMBERING SYSTEM  
U.S.S.



TYPICAL SECTION  
SCALE: 1" = 1000'

All earth movement associated with the project will be done pursuant to any U. S. Geological Survey, Menlo Park, or Bureau of Land Management, Ukiah District Office recommendations.

#### VI Camp Sites Air Strips and Other Support Facilities

Completion of the project as proposed by this plan does not alter Aminoil's plan to utilize its existing geothermal operations support facilities which are located on adjacent private lands.

No campsites, crew housing, air strips or other supporting facilities will be constructed on Federal lands by reason of this project.

#### VII Other Potential Surface Disturbance

No surface area other than the + .8 ha (2 acres) area required for construction of the drill pad site and waste disposal sump will be significantly disturbed as a result of completion of the proposed project.

#### VIII Topographic Features and Drainage Patterns

The area to be disturbed by the proposed project lies on the easterly slope of a small ridgeline at elevations from approximately 1025 meters (3360') to 1049 meters (3440'). The ridgeline is oriented in a northwest to southeast direction with an elevation of approximately 1096 meters (3595') at its southeastern tip rising to an elevation of approximately 1204 meters (3947') at its summit 915 meters (3000') northwest from the project site.

The construction area is bisected by the drainage divide which also provides the boundary between the County of Lake and the County of Sonoma. Drainage to the north and east of the access road and drill pad site flows into Anderson Creek and ultimately into Putah Creek which forms a part of the watershed basin for Lake Berryessa. Drainage to the south and west of the project site flows into unnamed tributaries and ultimately reaches Big Sulphur Creek.

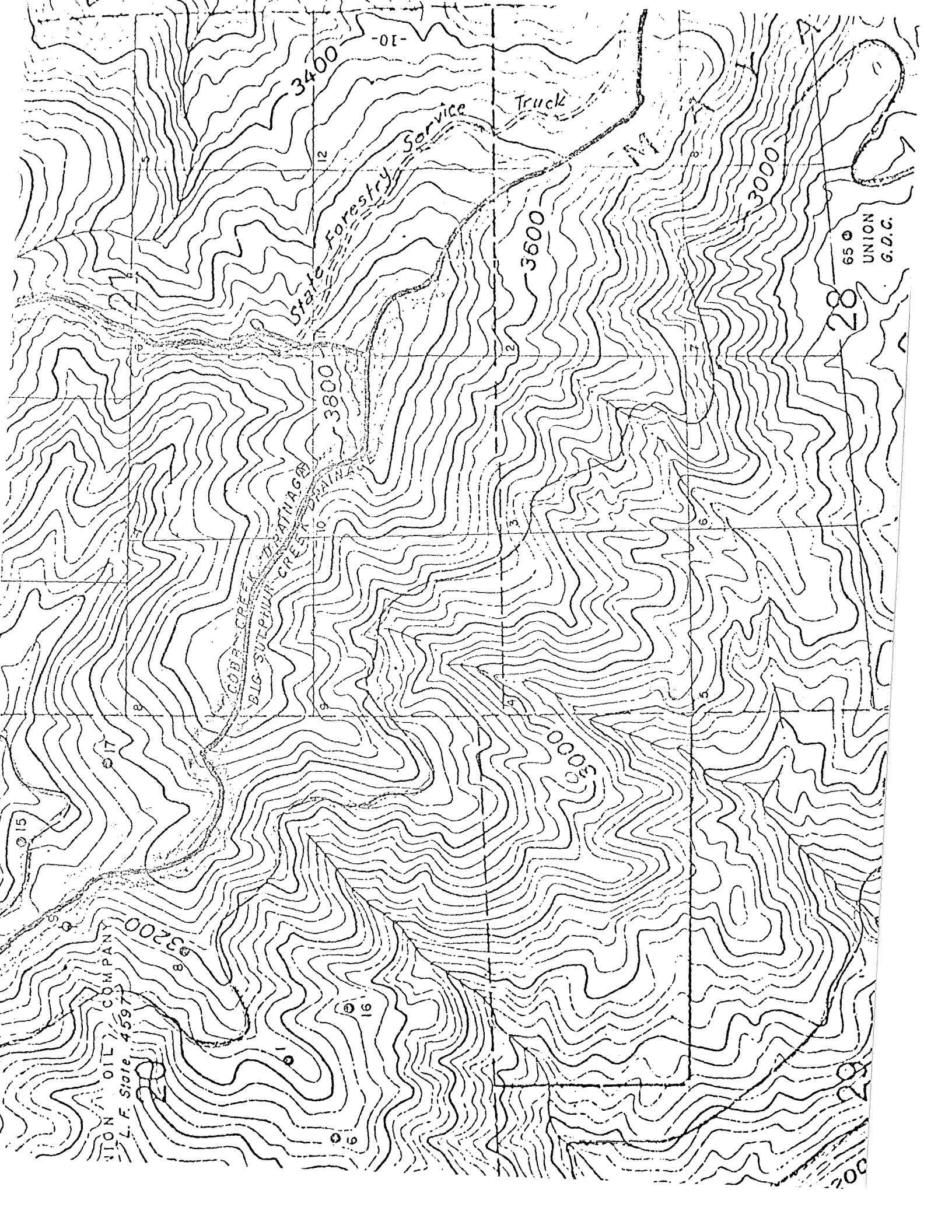
#### IX Methods for Disposal of Waste Materials

On completion of construction, the project site will be cleared of all waste materials and construction debris pursuant to specifications as contained in the Contract Book for Access Road and Geothermal Well Location CA1862 #4 (82-28) to be prepared by Hawke Engineers, San Francisco, California.

All brush, trees, limbs and stumps generated during clearing and construction operations will be chipped and spread on exposed surface soils, cut for firewood or buried pursuant to specifications prescribed by the Supervising Engineer.

Waste materials generated during drilling operations will be directed to a waste discharge sump constructed pursuant to specifications of Hawke Engineers and retained until the well is completed.

Waste materials (oil and grease) accidentally spilled around the base of operating equipment will be contained by earthen berms and directed to the waste disposal sump.



ION OIL COMPANY  
L.F. State 4597

COBB CREEK DRAINAGE  
BIG SUTPHUN CREEK DRAINAGE

State Forestry Service  
Truck

65 UNION G.D.C.

28

Following completion of drilling operations, the sump will be dewatered by evaporation which can be accelerated by placing steam lines into the sump and/or decantation. The remaining non-toxic drill mud and drilled cuttings are thoroughly mixed with native earth and the sump is closed over and compacted and graded to conform as nearly as possible to original contours. Potential erosion is controlled by careful attention to surrounding drainage patterns during regrading operations and by the revegetation of fill slopes prior to the succeeding wet season.

Further waste disposal methods specific to the site location will be pursuant to Orders for Waste Discharge Requirements issued to Aminoil USA upon application to the North Coast Regional Water Quality Control Board.

Portable sanitary facilities will be provided at the project site for employee use.

## X Protection of the Environment

### A. Fire Control Procedure

The Counties of Sonoma and Lake and the State Department of Forestry require the geothermal operator to prepare and file with the Department of Forestry an Emergency Fire Plan. The Plan is updated annually by the operator and submitted to the Department of Forestry for approval. The emergency fire plan, "Aminoil USA, Inc., Emergency Fire Control Procedure, Castle Rock Springs Field Lake County, West Sonoma Geysers, Sonoma County", as updated April 10, 1979, would be applicable for this project and is on file with the Office of the Geothermal Supervisor, Menlo Park, California.

### B. Soil Erosion

The Environmental Impact Analysis "The Geothermal Leasehold of Union Oil Company at the Geysers, Sonoma County, California", Ekoview, 1975, overlaps the westerly parcel of Federal Lease Unit 7 CA1862 and the proposed project site. Subsurface geology at the project site is identified by the Ekoview Report as Franciscan greywacke. Soils in the immediate vicinity of the project site are identified as the Josephine and Los Gatos Series. Both the Josephine Series and the Los Gatos Series are referenced by the USDA Soil Conservation Service, 1972, as having high permeability, good drainage, high susceptibility to erosion and fair to poor suitability for vegetation.

Care will be taken at the project site to minimize the potential for erosion and disturbance to natural drainage. The outer limits of the entire area to be disturbed will be staked for field inspection prior to commencement of any construction activities. Vegetation will be cleared and earthwork and installation of culverts and drainage ditches will be done pursuant to specifications as provided by Hawke Engineers, San Francisco, California. On completion of construction all outer fill slopes will be dressed and compacted by rollers or by walking with a crawler tractor. Vegetation will be reestablished on all fill slopes and appropriate cut slopes pursuant to recommendations of a qualified vegetation consultant acceptable to the USGS, Menlo Park, and BLM, Ukiah District Office. Revegetation will take place prior to the wet season immediately following completion of construction activities.

### C. Surface and Ground Water

Significant ground water resources are not known to exist on or in the vicinity of the project site. All construction, however, will be completed pursuant to specifications for protection of ground water resources. The waste discharge sump will be constructed with a two foot thick impervious clay liner compacted to insure a maximum permeability of  $1 \times 10^{-6}$  cm/sec. Subsurface ground waters will be further protected by casing and cementing procedures proposed in the Application to Drill (form 9-331c) filed pursuant to 30 CFR 270.71 and approved by the Office of the Geothermal Supervisor, Menlo Park.

The proposed project area is divided by Big Sulphur Creek Drainage to the south and west and Anderson Creek Drainage to the north and east. The potential for stream pollution will be minimized by construction of earthen berms at appropriate locations along the drill pad site which will direct any accidental spillage of oil and grease from operating facilities into the waste disposal sump. The waste disposal sump will be constructed with a capacity to accommodate all of the liquid waste from drilling operations plus the maximum precipitation which could be expected to fall within its area. The sump will be operated with a minimum 3 feet of freeboard above the liquid level at all times.

### D. Vegetation

Vegetation in the vicinity of the proposed project is identified in the Environmental Impact Analysis "The Geothermal Leasehold of Union Oil Company at the Geysers, Sonoma County, California", Ekoview, February 1975, as predominantly live oak, buck brush and manzanitas. "The Geysers Wildlife Study, Interim Report", Pacific Gas and Electric Company, et al, October 1977, identifies the vegetation at the project site as predominantly mixed chaparral with some serpentine chaparral. Chamise appears to be the dominant species at the project site (personal observation, T. Box, April, 1979).

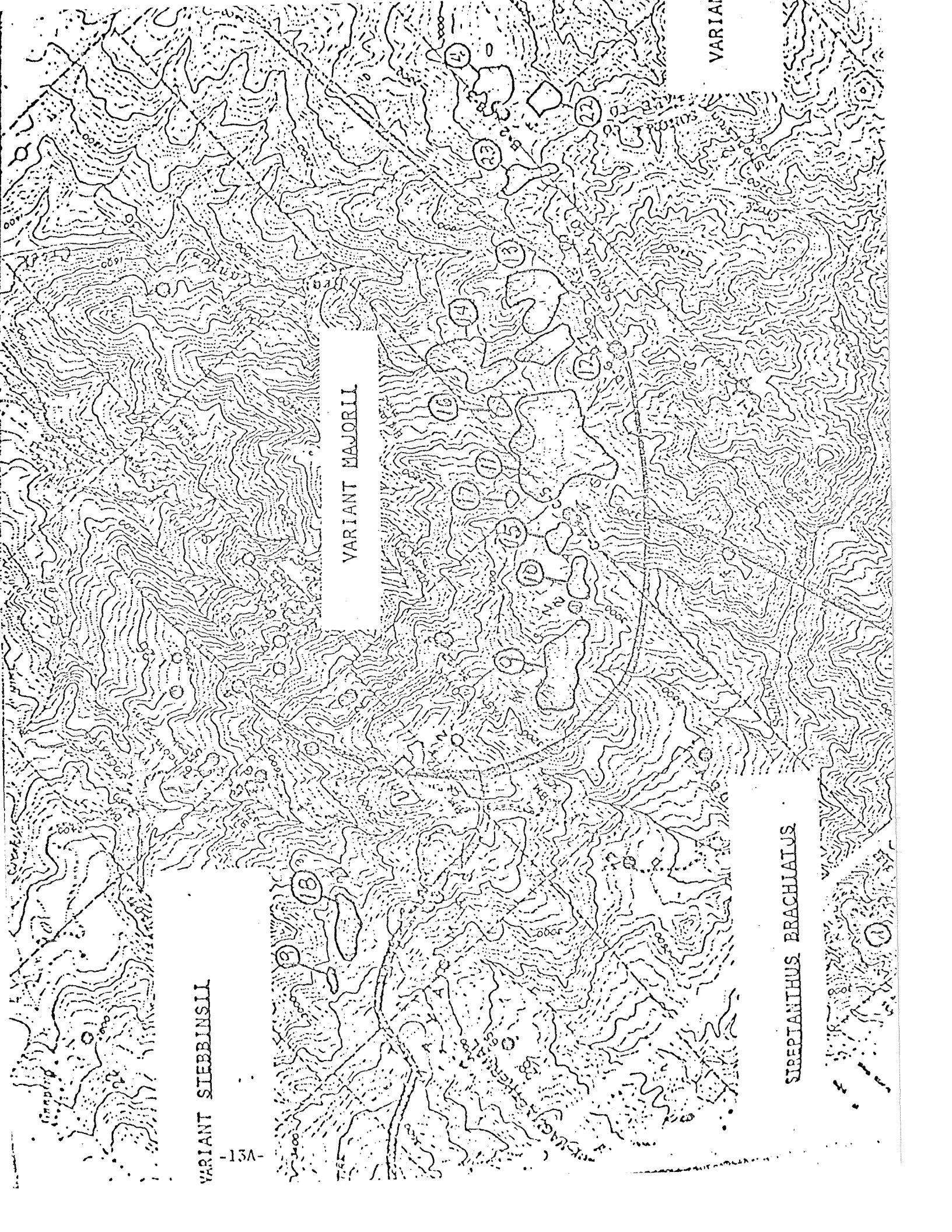
Approximately 1 ha (2.5 acres) of chamise and mixed chaparral will be permanently removed from site during construction. Topsoil will be stockpiled and used to improve later revegetation efforts. Reestablishment of vegetation on all disturbed areas except those essential to normal geothermal operations and maintenance will take place prior to commencement of the next wet season immediately following the completion of construction.

No rare or endangered species are known to exist in the area to be disturbed by construction. Two small populations of the Streptanthus Variant, Stebbinsii were identified approximately 534 meters (1750') east of the project location in the NW-1/4 of Section 27, T11N, R8W. The populations were identified in the report to Shell Oil Company "Observations on Populations of the Streptanthus Morrisonii Complex in the Central and Southern Mayacmas Mts., Lake, Sonoma and Napa Counties, California" prepared by James A. Neilson Ph.D., May 15, 1977. The larger population numbered +176 plants and the smaller population 6.

A rare and endangered plant survey for the entire area of Lease Unit 7 CA1862 is to be completed in May or June, 1979 when the various species are expected to be in flower and can readily be identified. Upon completion, copies of the survey will be forwarded under separate cover to the

TABLE 1. Location of *Streptanthus morrisonii* complex population in the central and southern Mayacma Mountains. Population location numbers are correlated to the distribution map (Figure 1). The letter E after population size indicates that the total number is estimated.

Site #	Streptanthus Variant	Number In Population*	Elev.	Township & Range	Section Number
1. Socrates Mine	brachiatus	35	3200	T11-R8	SW $\frac{1}{4}$ of 2W $\frac{1}{4}$ of 33
2. Socrate Mine	brachiatus	84	3280	T11-R8	SW $\frac{1}{4}$ of SE $\frac{1}{4}$ -32
3. Lunar Point	?	16	3452	T11-R8	NE $\frac{1}{4}$ of NE $\frac{1}{4}$ -10
4. Well Site "B"	kruckebergii	1000E	3200	R10-R8	SW $\frac{1}{4}$ of NW $\frac{1}{4}$ -1
5. Shell Control Pt	kruckebergii	47+		T10-R8	SW $\frac{1}{4}$ of NE $\frac{1}{4}$ -1
6. Shell Ridge	kruckebergii	71+	2920	T10-R8	SW $\frac{1}{4}$ of NE $\frac{1}{4}$ -1
7. Shell Ridge	kruckebergii	350E	2880	T10-R8	NE $\frac{1}{4}$ of SE $\frac{1}{4}$ -1
8. Shell Ridge	kruckebergii	500E	3000	T10-R8	SE $\frac{1}{4}$ of NE $\frac{1}{4}$ -1
9. Aminoil Ridge (North)	?	15 incompl.	3400	T11-R8	NW $\frac{1}{4}$ of SE $\frac{1}{4}$ -34
10. Aminoil Ridge (South)	majorii	57	3080	T11-R8	SW $\frac{1}{4}$ of SE $\frac{1}{4}$ -34
11. Bear Creek Canyon (North)	majorii	550+E	2880	T10-R8	NW $\frac{1}{4}$ of NW $\frac{1}{4}$ -2
12. Bear Creek Canyon (West)	mixed	450+E	2880	T10-R8	NE $\frac{1}{4}$ of NW $\frac{1}{4}$ -2
13. Bear Creek Canyon (West)	mixed	300+E	3000	T10-R8	NE $\frac{1}{4}$ of NW $\frac{1}{4}$ -2
14. Bear Creek Canyon (East)	majorii	250+E	2600	T10-R8	NE $\frac{1}{4}$ of NW $\frac{1}{4}$ -2
15. Aminoil Ridge (South)	majorii	27	2860	T11-R8	SW $\frac{1}{4}$ of SE $\frac{1}{4}$ -34
16. Bear Creek Canyon	majorii	50+E	2600	T10-R8	NE $\frac{1}{4}$ of NW $\frac{1}{4}$ -2
17. Aminoil Gate	?	No 1977 Plants	3120	T11-R8	SW $\frac{1}{4}$ of SW $\frac{1}{4}$ -35
18. Anderson Creek	stebbinsii	176+	3120	T11-R8	SE $\frac{1}{4}$ of NW $\frac{1}{4}$ -27
19. Anderson Creek	stebbinsii	6	3120	T11-R8	NW $\frac{1}{4}$ of NW $\frac{1}{4}$ -27
20. Pine Mountain	kruckebergii	12	3200	T10-R8	SE $\frac{1}{4}$ of NE $\frac{1}{4}$ -11
21. Pine Mountain	kruckebergii	6	3400	T10-R8	SW $\frac{1}{4}$ of NE $\frac{1}{4}$ -11
22. Shell Ridge	kruckebergii	?	2920	T10-R8	SW $\frac{1}{4}$ of NW $\frac{1}{4}$ -1
23. Shell Ridge	kruckebergii	?	3120	T10-R8	SE $\frac{1}{4}$ of NW $\frac{1}{4}$ -2
24. Shell Ridge	kruckebergii	?	2880	T10-R8	SE $\frac{1}{4}$ of NW $\frac{1}{4}$ -1
25. Apple Tree Creek	kruckebergii	60+E	2400	T10-R8	NW $\frac{1}{4}$ of NW $\frac{1}{4}$ -7
26. Apple Tree Creek	?	180+E	2200	T10-R8	NE $\frac{1}{4}$ of NW $\frac{1}{4}$ -7
27. Apple Tree Creek	?	200+E	2180	T10-R8	SW $\frac{1}{4}$ of NE $\frac{1}{4}$ -7
28. White Point	elatus	258	2280	T10-R6	SW $\frac{1}{4}$ of SW $\frac{1}{4}$ -30
29. Three Peaks	elatus	2500+E	2200	T10-R6	SW $\frac{1}{4}$ - 19
30. Wall Street Mine	kruckebergii	300+E	2600	T10-R8	SE $\frac{1}{4}$ of SE $\frac{1}{4}$ -1
31. Wall Street Mine	kruckebergii	70	2400	T10-R8	SE $\frac{1}{4}$ of SE $\frac{1}{4}$ -1
32. Dry Creek Tributary	kruckebergii	9	2600	T10-R8	SE $\frac{1}{4}$ of SE $\frac{1}{4}$ -1
33. Helen Mine	kruckebergii	?	2600	T10-R8	SW $\frac{1}{4}$ of SW $\frac{1}{4}$ -1



VARIAN

VARIANT MAJORII

VARIANT SIEBBINSII

SIREPIANTHUS BRACHIATUS



USGS, Office of the Geothermal Supervisor, Menlo Park and BLM, Ukiah District office.

#### E. Wildlife

The Environmental Impact Report "The Geothermal Leasehold of Union Oil Company at The Geysers, Sonoma County, California" Ekoview, February 1975, overlaps and includes the area of Federal Lease Unit 7, CA1862 within its baseline data collection boundary. That report identifies two amphibian species, ten reptile species, thirty bird species, and twenty-one mammal species as recurring within the chaparral habitat similar to that of the project area. Construction of the drill pad site will result in the permanent loss of + 1 ha (2.5 acres) of chamise chaparral habitat. Wildlife species most likely to be directly impacted are expected to be the smaller more sedentary species such as lizards, small rodents, and small birds. Habitat for a relatively few individuals of these or other common and widespread species could be permanently lost to the population. Revegetation of cut and fill slopes and other disturbed areas will provide some offsetting benefit from addition of browse and seed for deer and some species of songbirds. Care will be taken that no wildlife habitat will be disturbed beyond the outer limits of that required for construction of the drill pad site and waste disposal sump.

The only threatened or endangered wildlife species known to exist in the vicinity of the project area is the peregrine falcon (*Falco peregrinus*). The peregrine falcon has been observed flying in the vicinity of the project area on several occasions. The "Report of Survey to Determine the Status of the Peregrine Falcon (*Falco peregrinus anatum*) in The Geysers area (Cobb Mountain) of Sonoma and Lake Counties", Dr. Kenneth E. Stager, PhD. April 25, 1977, failed to disclose any indication of the presence of the American peregrine falcon from February 2, 1977 through March 31, 1977 and concluded that "Geothermal development in the Cobb Mountain area is exerting no detrimental impact upon the welfare of the endangered American peregrine falcon".

Additional quantitative studies related to the wildlife habitat of Federal Lease Unit 7 will be completed prior to submission of a plan for production and pursuant to 30 CFR 270.34 (k).

#### F. Cultural Resources

The "Archeological Assessment of Cultural Resources on Geothermal Leaseholds in Lake and Sonoma Counties, California, Burmah Oil and Gas Company" (now Aminoil USA), Ann S. Peak, Consulting Archeologist, October 1974, included the portions of Section 21, 27, 28 and 29, T11N, R8W, MDB & M which are a part of Federal Lease Unit 7 CA1862. Results of that survey concluded that no archeological sites were located within the boundaries of Federal Lease Unit 7 and that no impact on cultural resources would be expected by construction of geothermal facilities. The report was completed under Federal Antiquities Permit No. 74-EM-016 October 1974 and is on file with the Office of the Geothermal Supervisor, Menlo Park, California.

The Environmental Impact Report "The Geothermal Leasehold of Union Oil Company at The Geysers, Sonoma County, California" Ekoview, February 1975, overlaps and includes within the boundaries of its baseline data collection area the portion of Sections 21, 28 and 29 which form the westerly



parcel of Lease Unit 7. The archeological section of that report was completed by David A. Fredrickson, Department of Anthropology, Sonoma State University and failed to locate any archeological or historical sites within the proposed project area.

An ethnographic and historical cultural resource study which would include a native American study was not a part of either of the two referenced studies. A study to correct this omission will be completed and forwarded under separate cover to the USGS Office of the Geothermal Supervisor, Menlo Park and the BLM, Ukiah District Office.

#### G. Air Quality

Ambient air quality within the vicinity of the project area can, in general, be considered very good. The potential impacts from the proposed project would be increased suspended particulates from construction activities and air drilling operations and hydrogen sulfide emissions during drilling and testing operations. Natural vegetation minimizes particulate concentrations from dust even during high winds. Construction of the drill pad site will cause approximately 1 ha (2.5 acres) of natural vegetation to be permanently removed. Impacts from surface dust exposure during construction activities will be minimized by the use of water. Particulates brought to the surface during air drilling operations will be controlled by the use of a tangential separator connected to the blooie line into which water is injected to increase its efficiency.

Steam from geothermal wells contains an average of + 0.03 percent non-condensable gases. The major source for potential air quality impact comes from the hydrogen sulfide content of these non-condensable gases. Hydrogen sulfide concentrations (ppm) in the steam produced from geothermal wells within the vicinity of the project site have been measured at lesser ppm than average concentrations for the total Geysers area. Potential impacts from hydrogen sulfide emissions produced by the proposed project will be mitigated pursuant to conditions of approval as provided in the Authority to Construct and Permit to Operate to be issued by the Lake County Air Pollution Control District.

#### H. Noise

The proposed project site is at a relative remote location being approximately 3.2 kilometers (2 miles) from the nearest residential community, Anderson Springs. Consultants in Acoustics were employed by Aminoil USA in 1977 to monitor noise levels associated with well drilling and completion operations and recommend steps for further control. As a result, muffler systems have been modified and noise levels from air and steam escaping during drilling operations and steam escaping from well bleed lines have been substantially reduced. Noise levels during worst case conditions when steam is escaping to the atmosphere during drilling operations have been monitored and a sound level reduction from 70 dBA to 52 dBA measured at 305 meters (1000') from the source has been accomplished. Noise levels associated with the proposed project are expected to be within acceptable limits at the nearest receptor locations and in compliance with State and Federal occupational noise exposure levels and local county Ordinances applicable to geothermal activities.

I. Public Health and Safety

Project operations will be conducted in a manner which provides the maximum protection to the overall environment. Necessary precautions will be taken and public access will be restricted in areas where required to protect the public health and safety. Warning signs, fencing, barricades or other safety measures will be taken when and where deemed necessary.

Employees will be provided with portable sanitary facilities, bottled drinking water, sound pressure protective devices, a first aid facility and hard hats will be worn by all construction and drilling personnel while on location. Radio and telephone communications will be provided for emergency situations.

J. Environmental Data

A substantial amount of environmental baseline data now exists which would be applicable to the project area. A data review will be made and where necessary monitor programs will be initiated and additional baseline data will be collected and submitted with the subsequent Plan of Production pursuant to 30 CFR 270.34 (k).

XI Schedule for Operations

Commencement of Construction	September 1, 1979
Commencement of Drilling Operations	October 1, 1979