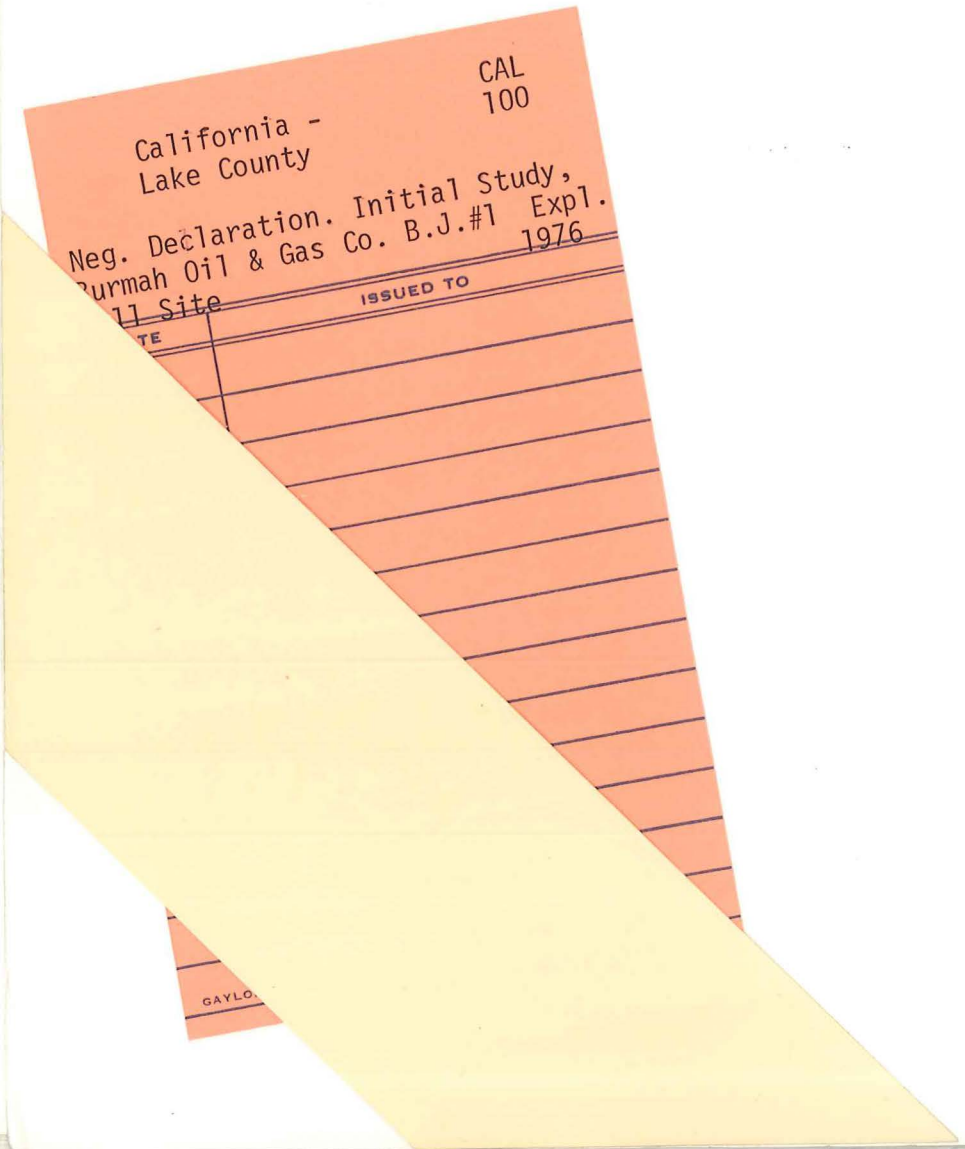
NEGATIVE DECLARATION
Initial Study
BURMAH OIL and GAS COMPANY
B.J. #1 EXPLORATORY WELL SITE
COUNTY OF LAKE

JONES & STOKES ASSOCIATES, INC. / 455 CAPITOL MALL, SUITE 835 / SACRAMENTO, CA. 95814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Well Site
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NEGATIVE DECLARATION
Initial Study
BURMAH OIL and GAS COMPANY
B.J. #1 EXPLORATORY WELL SITE
COUNTY OF LAKE

JANUARY 22,1976

Prepared by:

Lake County Planning Department
Courthouse, 255 N. Forbes St.
Lakeport, California

INITIAL STUDY

PROJECT: Drilling One Exploratory Geothermal Well
Approximately 4 miles southeast of Middletown

CONTENTS

FILED
With The Board of Supervisors
Of The County of Lake
Date MAR 5 1976
LOIS R. [illegible]
CO. CLERK
BY [signature]
Deputy County Clerk

Lake County Planning Commission
255 N. Forbes Street
Lakeport, California 95453

NOTICE OF DETERMINATION

Applicant BURMAH OIL & GAS COMPANY

Application Date NOVEMBER 29, 1975

General Description of the Proposed Project: Drilling of one exploratory geothermal steam well known as B & J Well #1

Location of the Project: Section 13, Township 10 North, Range 8 West

After due consideration, the following findings have been made by:

_____ BOARD OF SUPERVISORS

__x__ PLANNING COMMISSION

_____ SUBDIVISION COMMITTEE

_____ OTHER AGENCY _____

__x__ NO SIGNIFICANT IMPACT WILL RESULT TO THE ENVIRONMENT

_____ SIGNIFICANT IMPACT IS LIKELY TO OCCUR

The project is therefore ordered: __x__ APPROVED

_____ DENIED

_____ An Environmental Impact Report has been prepared.

_x_ An Environmental Impact Report has not been prepared.

March 5, 1976
DATE

[signature]
CHAIRMAN and/or SECRETARY

Draft
Environmental Impact Report

County of Lake
Burmah Oil and Gas Company
B.J. #1 Exploratory Well Site

November 14, 1975

Jones & Stokes Associates, Inc.
455 Capitol Mall, Suite 835
Sacramento, CA 95814

JONES & STOKES ASSOCIATES, INC. / 455 CAPITOL MALL, SUITE 835 / SACRAMENTO, CA. 95814 916/444-5638

November 14, 1975

Donald F. Johnson, Director
Lake County Planning Commission
255 North Forbes Street
Lakeport, CA 95453

Dear Mr. Johnson:

We are transmitting fifty copies of the Draft Environmental Impact Report entitled "Burmah Oil and Gas Company, B.J. #1 Exploratory Well Site". This EIR has been prepared in accordance with the Lake County guidelines for implementation of the California Environmental Quality Act.

The report deals primarily with the drilling and testing of one geothermal exploratory well. The possible impacts of development and operation of a geothermal production unit were not evaluated, but the sensitivity of the surrounding area was assessed relative to several of the major impacts of geothermal energy production.

The project site is outside the boundaries of the Geysers KGRA, and there are no successful geothermal wells in the immediate vicinity. The Burmah geologists expect the energy resource to be dry steam, but since there is a remote possibility that hot water will be found, the EIR considers that possibility.

The project does not pose any serious adverse environmental impacts if the recommended mitigations are applied.

Jones & Stokes Associates, Inc. has enjoyed working on this project. We were aided by the project sponsor's detailed descriptions and explanations of their drilling techniques and their opinions on the feasibility of mitigation alternatives. We look forward to future work in the field of geothermal development.

Respectfully submitted,

James D. Stokes

James D. Stokes

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INTRODUCTION

This environmental impact report has been prepared for Lake County as an assessment of environmental impacts associated with the drilling of one deep well by Burmah Oil and Gas Company in search of a commercial source of geothermal energy 4 miles southeast of Middletown. Impacts on the site itself, such as surface disturbance, as well as impacts extending to some distance from the site, such as noise and visual modifications, are considered. The report also evaluates major sensitivity factors of the area adjacent to the exploratory well.

Previous EIR's prepared for Lake County have been used as a source of information whenever possible. When this has been done, the source is identified. In some instances, the information has been updated to reflect the present technology.

Exploitable geothermal energy resources are believed to exist throughout much of the western United States. The development of these resources uses much technology adopted from standard oil and gas resource development procedures. However, the geothermal resource is quite different from gas and oil, and exploratory techniques and estimation of production potential are not nearly as advanced. To date the only real assurance of a commercially exploitable resource comes from production testing of a well.

The proposed drill sites are located outside the boundaries of the Geysers Known Geothermal Resource Area (KGRA) as designated by the Secretary of the Department of the Interior (U. S. Department of the Interior, 1973). There is no assurance that a commercially exploitable resource underlays the proposed site, although the perimeter of the Geysers commercial steam field is approximately 6 miles away.

Dry steam is the expected resource, but this report considers the possibility of encountering a liquid resource.

In view of the uncertainties involved in the proposed operation, Jones & Stokes Associates, Inc. considers the project objectives to be exploratory in nature. The capital investment may be high (from $500,000 to $1,000,000 per well), but if a resource is not proven, there will be no further development. The proposed project is therefore treated as being individual in nature rather than phased.

It must be recognized by all parties concerned that should a resource be proven, any subsequent activities would no longer be of an exploratory nature. They would clearly fall under the classification of a phased project (CEQA Guidelines, California Resources Agency, 1974), and time and effort would have to be allocated to produce an environmental analysis covering the entire production unit that would result from field development.

PROJECT DESCRIPTION

Location

The proposed exploratory well sites are approximately 4 miles southeast of Middletown, Lake County. The sites and the haul road grade are in Sections 18 and 19, T10N, R6W, MDBM. Figure 1 shows the regional location, and Figure 2 identifies the well sites and the haul road on a USGS 7.5' quadrangle.

Objectives

The objective of the project is to determine the magnitude of geothermal energy resources in the McGuire Peak vicinity. The lower level objective is to drill one exploratory well and evaluate its energy output.

General Description

The project is the drilling of one exploratory geothermal well in an untested area outside of the Geysers KGRA.

Exploratory Wells

Exploratory drilling has been well described in previous Lake County EIR's (Enviros, 1974):

Site Preparation. Exploratory drilling involves the use of heavy duty oil well drilling equipment for a period of about 3-4 weeks. A flat pad, approximately 100' x 200' is required

FIGURE I: LOCATION MAP

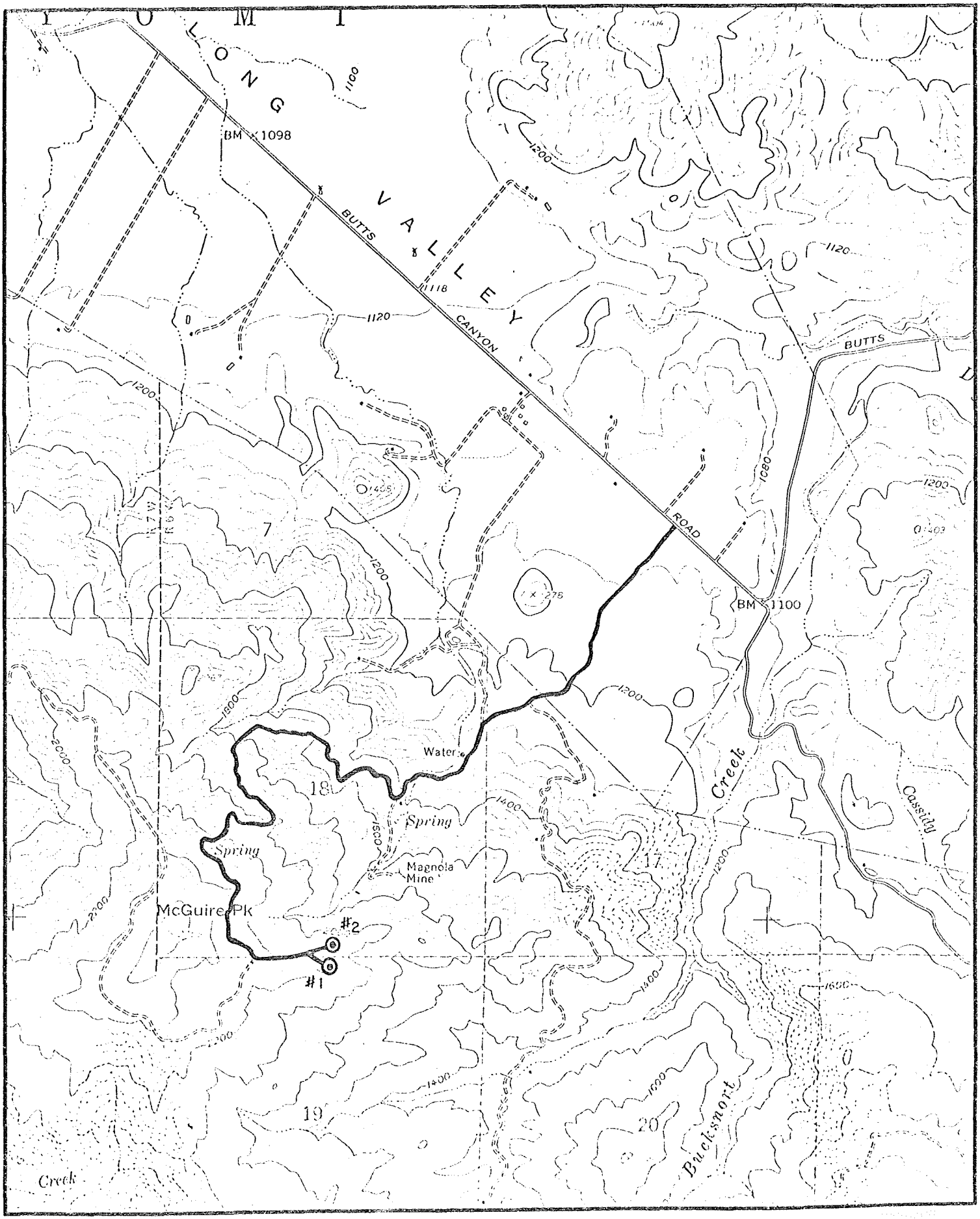


FIGURE 2: SITE MAP

DETERT RESERVOIR QUADRANGLE, 7.5 Min.

◎ Exploratory Well Site

~ Haul Road

to physically accommodate the drill and supporting equipment. Drilling wastes are held in a sump of about 125' x 150', and 15 to 20 feet deep.

Drill Procedure. Based on experience in the field, a typical hole going down to approximately 10,000 feet will probably tend to drift in direction according to rocks encountered, temperature, etc.; this drift can be controlled within reasonable limits.

The hole is drilled in a succession of operations; mud is used as a circulating medium until drilling has reached 2,500 to 3,500 feet; then air is used. Usually steam is encountered within 1,000 to 1,500 feet below this level. At the point when steam is encountered, live steam, together with compressed air forced down the hole, blow rock materials to the surface. These materials are directionally diverted by a well cap device called the "banjo box", into a horizontal pipe (blooie line) which discharges through a separator and muffler. Rock fragments are slowed down and dropped out by the separator and steam is vented to the atmosphere. A water mist is injected to trap dust and drop it with the rock. This part of the operation may take up to three weeks. When the steam reservoir or bearing fracture is penetrated, the well is tested for production potential.

In order to keep wells productive, steam must be continuously vented through a 1/2-inch diameter pipe until the well can be connected to the generator.

At present, estimates for the life of a generator supply field approaches 30 years; however, the field could possibly be productive for 100 years, depending on its quality.

Casing strings are designed to afford maximum safety and performance standards. Maximum tension, collapse and burst pressures are calculated and casing is selected that will provide safety factors of 1.8, 1.125 and 1.0, respectively. These safety factors are approved by California Division of Oil and Gas.

Special Procedures. Drill muds, used to lubricate the bit, provide a medium to remove rock fragments resulting from the action of the bit, and seal off cracks, pores and holes encountered in the rock. These drill muds consist of bentonite (a montmorillinite clay with a fairly high potash content). To this aqueous slurry an organic material (lignin) may be added to maintain the colloidal nature of the bentonite in its most plastic form under the high temperatures encountered in drilling. Spent drill muds will be held in a sump where they will be dried and buried at the termination of drilling.

Drilling is a continuous operation. Three crews of five men each will work 8-hour shifts. All workers will live off-site and drive in and out daily.

Haul Road

The haul road will be made by improving an existing road that goes from the Butts Canyon Road to McGuire Peak. Where necessary the road will be widened to 16 feet, except for some short stretches where a 12-foot width and turnouts every 500 feet may be used. The road grade will not exceed 15 percent. The radius of some turns will be increased to accommodate the long equipment. The road will be surfaced with gravel and sprinkled with water to control dust and maintain the surface. Culverts will be installed in all drainages and where needed to dispose of road surface runoff.

Blowout Potential

Liquids and gases of high enthalpy (total energy content) which are encountered in geothermal operations produce pressure stresses which on occasion have led to failure of the wells to contain the resource. Such a failure is called a blowout. Many diverse factors can lead to blowouts: the unexpected penetration of a high pressure zone, well casing failure, land slippages or seismic action across the well bore, etc. Improvements in technology such as well head blowout protection equipment, increased casing strengths through new metal alloys, and more careful monitoring of potential danger signs have greatly reduced the risk of blowouts. However, the potential for blowouts with attendant locally disastrous results still exists.

Blowout protection equipment is required by the California Division of Oil and Gas (DOG) whose personnel conduct an operational inspection of the equipment prior to the commencement of drilling activity.

Well Testing

After completion, the well must undergo a number of tests to determine its productive potential. The nature of the resource determines the type of testing required.

Dry Steam. The steam is allowed to vent to the atmosphere through mufflers for four periods of about 8 hours during which time measurements are made on a number of properties of the resource, such as well head pressure, enthalpy, mass flow, rates of changes of mass flow, total constituent analyses, etc.

Liquid. If the resource is a liquid-dominated geothermal field, a stream of liquid must either be pumped from the well or a mixture of steam and water will flow under its own pressure from the well head. In either case the fluid flows into a flash chamber where steam is separated from the liquid. Approximately 15 to 20 percent of the resources mass is thus flashed to steam and is discharged to the atmosphere. The remaining 80 to 85 percent remains in liquid form and is discharged into the mud sump for storage.

If a liquid resource is encountered, flow rates are expected to range between 1,000 to 1,500 gallons/minute.

Eighty percent of this flow would be discharged into the sump as a fluid at a rate of 800 to 1,200 gallons/minute. Allowing for 3 feet freeboard space, the sump's capacity is 800,000 gallons. The maximum amount of liquid resulting from the proposed test which may last from 6 to 10 hours would be 720,000 gallons.

These tests are of a preliminary nature and are not the full-scale production tests needed to fully assess the production potential of the geothermal resource. If the proposed preliminary tests are favorable, subsequent detailed production tests will be part of a plan for full field development and will not be conducted until the plan has been approved by appropriate local and state agencies.

Shut Down or Abandonment

After production testing is completed, a determination of the well's productive capacity will lead to several possible courses of action:

1. Successful vapor resource -- The well would be shut down to a small bleeding level of vapor flow necessary to prevent condensation in the well bore. It would remain at this level until the field is developed at which time it would become part of the production unit.

2. Successful liquid resource -- The well will be entirely shut down, pending further drilling operations which lead to the development of a producing geothermal field. At that time it would be reopened as part of the production unit.
3. Unsuccessful -- In the event the well does not encounter a geothermal resource, it will be used for several types of geothermal investigations of temperature gradient, etc., and then filled with cement according to California Division of Oil and Gas regulations, and abandoned.

Site Operations Subsequent to Drilling

After drilling has been completed, several operations occur with respect to either subsequent area use or site abandonment. These include regrading of excavated surfaces, removal or covering of sump material, and the construction of drainage systems to mitigate future erosion. Such operations take place whether or not the site is to be used for future production.

ALTERNATIVES

The technically feasible alternatives to the proposed operations are discussed in this section.

Alternative A (No Project)

Under this alternative none of the adverse impacts associated with the project would occur.

No specific prohibitions to geothermal drilling such as zoning restrictions exist for the proposed site. No critical environmental concerns have been identified on or in close proximity to the site. Therefore, no substantive cause of a specific nature favors the election of the "no project" alternative.

However, several fundamental questions arise involving society's needs for energy resources -- the potential role of geothermal energy in meeting these needs, regional plans for energy resource development, etc. These questions are of a far-reaching nature and beyond the province of a drill site EIR. A programmatic EIS prepared for the Geysers area has dealt with these questions to some extent with the conclusion that the area in general can absorb geothermal resource development without undue environmental degradation (U. S. Department of Interior, 1973).

The alternative to no action is to proceed with the search for geothermal energy. No significantly different techniques are known. Exploratory wells are drilled following a geological investigation indicating the presence of a geothermal resource.

In this project one well is to be drilled. There are, however, two possible sites for the well. Both sites have been evaluated environmentally and found to have no significant differences in sensitivity to the proposed project. The final choice of sites will be based on technical geothermal exploration factors.

The two well sites are the action alternatives:

- Alternative B - Drill the exploratory geothermal well at site #1.
- Alternative C - Drill the exploratory geothermal well at site #2.

LEGAL, REGULATORY AND INSTITUTIONAL CONSTRAINTS

Introduction

A checklist of local, state and federal legal, regulatory and institutional constraints has been prepared to aid in understanding the scope of governmental and public agency responsibilities in monitoring development of the proposed project. The plans, policies and concerns of all of these agencies must be fully understood and given due consideration not only in preparing the EIR, but also in planning and implementing the project.

Federal

U. S. Environmental Protection Agency

The Environmental Protection Agency (EPA) is charged with administering both the Federal Water Pollution Control Act and the Federal Clean Air Act. Under terms in the Water Pollution Control Act, EPA was required to prepare and enforce minimum water quality standards for the nation. The 1972 amendments to this act established the National Pollution Discharge Elimination System which allows EPA to require a permit for any discharge of waste materials to a waterway; this includes both point and non-point discharges. Because California has an equivalent to the Water Pollution Control Act (Porter-Cologne

Act), EPA acts jointly with California's state and regional water quality control boards in enforcing the national standards.

In administering the Federal Clean Air Act, EPA has established national ambient air quality standards (see Table 1). Any project that creates local air pollution conditions in excess of these standards can be halted by EPA. "Indirect sources" of pollutants are also reviewed by EPA; this includes highways, sports stadiums and other fixed facilities that do not emit pollutants but stimulate automobile traffic.

State

California Department of Fish and Game

Section 5650 of the California Fish and Game Code states that it is unlawful to deposit, permit to pass into, or place where it can pass into the waters of the state, any substance or material deleterious to fish, plant life or bird life. The Department of Fish and Game is charged with enforcing this provision of the code. In addition, any modifications of stream flow, banks or channels conducted as part of the proposed project will require a permit from the Department of Fish and Game (Fish and Game Code, Sections 1601 and 1602).

California State Water Resources Control Board (SWRCB)

The SWRCB is responsible for administering both the Federal Water Pollution Control Act and California's Porter-Cologne Act. Under conditions of these acts, the SWRCB has required the Central Valley Regional Water Quality Control Board (RWQCB) to prepare a basin plan for maintenance of water quality in the Clear Lake area. The basin plan and its water quality objectives must be approved by the SWRCB.

California Air Resources Board (ARB)

ARB has no permit requirements that affect the project. However, they will review the adequacy of the air quality sections of the EIR as part of the normal State Clearinghouse review process. State ambient air quality standards have been established by ARB in response to the Federal Clean Air Act. Any project that would create pollution levels in excess of the state standard could be halted by ARB. Their chief concern is with mobile pollution sources (e.g., autos). Special attention is also given to the air quality implications of the growth accommodating or inducing aspects of projects.

Regional

Central Valley Regional Water Quality Control Board (RWQCB)

The RWQCB is responsible for preparing a basin plan for maintenance and enhancement of water quality in the Central

Valley basin, of which Lake County is a part. The plan will establish water quality objectives and standards for the waters of the project area.

Lake County/City Area Planning Council (LCCAPC)

LCCAPC is the officially-recognized regional planning body for Lake County. They do not issue permits as such but will review the proposed project and its EIR and will make recommendations to the county planning commission as to the report's acceptability.

Local

Lake County Planning Commission

The Planning Commission must act on any zoning changes or use permits needed as part of the project. They have primary jurisdiction over construction of projects in the county. In addition, they are charged with preparing and maintaining a general plan for the county.

The Lake County Board of Supervisors is the chief county governing body and has final authority to review decisions or actions of the Planning Commission.

Lake County Health Department

The County Health Department has the authority to halt violations of the California Health and Safety Code. This includes contamination of domestic or recreational water sources or creation of hazardous vector populations.

Lake County Department of Public Works

The County Department of Public Works will issue all building permits for the project. The county building inspector insures that all structures comply with the Uniform Building Code and specific county regulations. In addition, any construction on or modification of county roads will be subject to Department of Public Works traffic control and safety regulations.

Lake County Air Pollution Control District (APCD)

The APCD is responsible for monitoring and control of stationary sources of air pollution in the county, including enforcement of county noise ordinances, point source generation of noxious odors, and the issuance of permits for construction.

ENVIRONMENTAL SETTING

Terrain

From Middletown in the Collayomi Valley, a long ridge trends southeasterly between St. Helena Creek and Long Valley. The crest of this ridge ascends gradually and is characterized by occasional knobs rising several hundred feet above the ridgeline. The well sites are on a short spur ridge that descends from the southeast base of McGuire Peak, the second major knob on the main ridge. The spur ridge descends gradually for approximately 1,500 feet then drops steeply toward Long Valley. On its south side, the spur ridge drains into the headwaters of Bucksnort Creek above Detert Reservoir. On the north side, the drainage is to a 7M Ranch Reservoir in the Long Valley drainage. A low divide separates the Bucksnort drainage from Long Valley, but both drainages are tributary to Putah Creek and Lake Berryessa. The well sites are at an elevation of approximately 2,000 feet, which is 1,000 feet higher than Long Valley.

The haul road to the well sites follows an existing road which winds down the northeast slope of the main ridge to Long Valley. The road alignment stays within the Long Valley drainage.

Geology and Geotechnical Factors

The rocks underlying the project are shales and graywackes of the Franciscan formation, Sonoma formation basalt, alluvium and colluvium, and a gneiss associated with the Franciscan.

The Franciscan formation is Cretaceous-Jurassic age and consists of moderately-well bedded to massive, fine to medium-grained, dark brown graywacke and hard brown shale. Both rock types are moderately-well indurated and fractured. Due to soil cover (variably 1-8 feet thick) and the weathered rock surface, rock outcrops are not common. However, minor road cuts (as much as 8-10 feet deep) and previous exploration trenches expose the subsurface rock for visual inspection. These exposures reveal a rock which is complexly folded and contorted and which has been intruded on a minor scale as evidenced by quartz veins. Occasional thin chert beds were also found. A gneiss body was observed along the proposed haul road. This rock is well indurated and its precise extent is not known due to inadequate outcrops.

Soil generated by the Franciscan rocks consists of a gray silt and clayey silt with numerous rock fragments which grade into the parent material. The soil is considered to have low permeability and moderately high resistance to erosion stresses.

The Sonoma volcanics unconformably overlie the Franciscan and consist primarily of dark gray, very fine-grained basalt

with numerous olivine inclusions. The rock is moderately-well fractured and forms steep slopes at its edges. The rock is found at the higher elevation ridges -- a survivor of past erosion cycles. The basalt occurs as isolated patches on McGuire Peak and along the haul road.

Soil thickness varies from a few inches at the topographic highs to as much as 8 feet on the slopes. The soil consists of a red-brown silt with numerous rock fragments grading from gravel to small boulders in size. The soil is expected to have low permeability (due to its silty matrix) and moderately high resistance to erosion stresses.

Alluvium and colluvium occur in the Long Valley portion of the haul road and as veneers in the steep-sided and narrow stream channels throughout the area.

A few springs occur within the Franciscan, especially near the Sonoma volcanic contact. Four such springs were found about 1,000 feet from the drill site area and adjacent to the haul road (see figures in Appendix A).

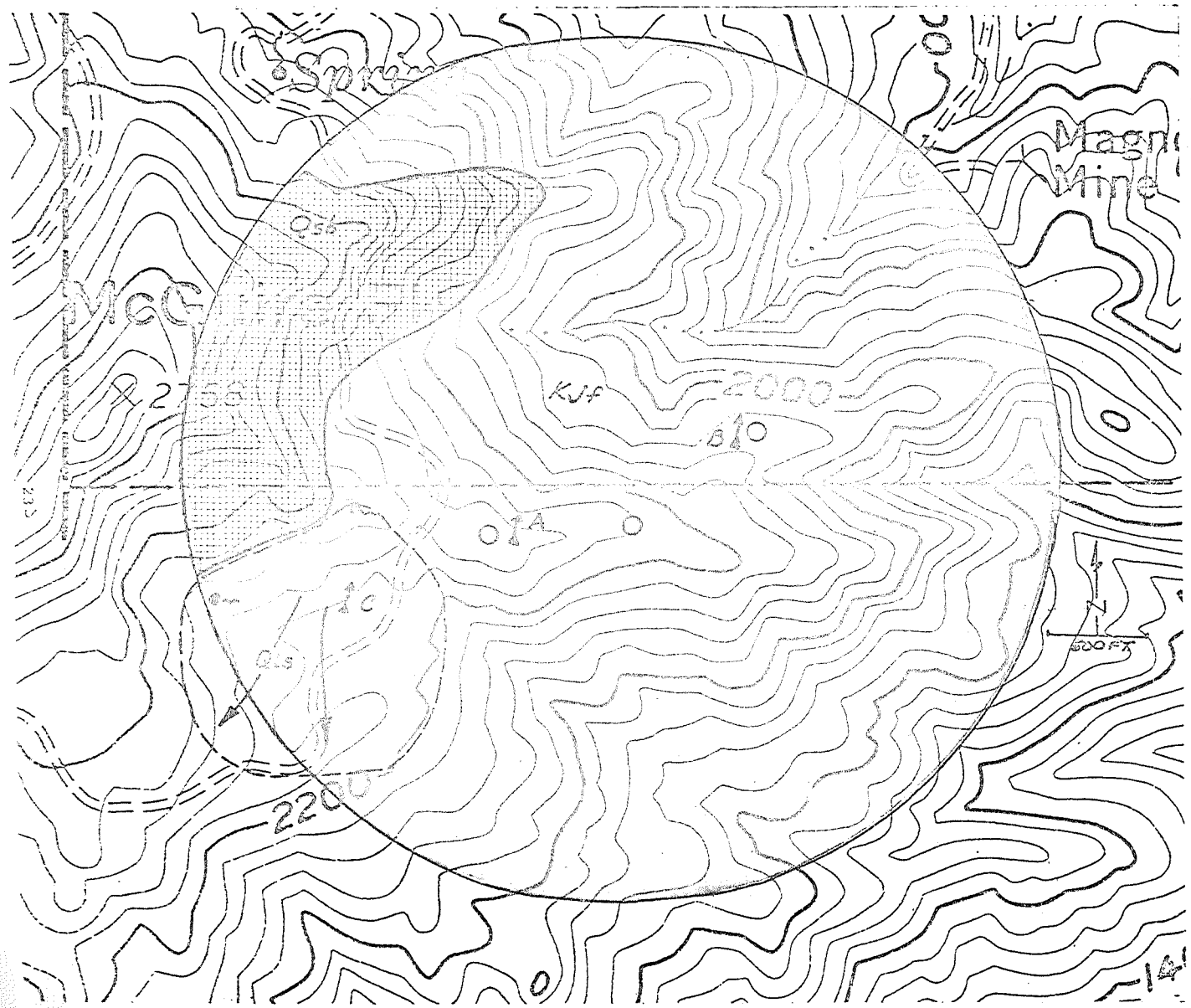
Slope

The slopes in the project area are consistent with the topography of the Mayacmas Mountains in general; that is, flat to low-sloping ridge crests, moderate sloping secondary spurs and steep ridge and spur sides. The steepest slopes in the

project area and along the haul road are on the order of 50-60 percent. The drill sites are on a spur crest which has a slope ranging from 0-20 percent. The steeper slopes are generally associated with resistant Franciscan rocks and the abrupt edges of the Sonoma volcanics. Figure 1 in Appendix A notes slopes found within the area of the proposed drill sites.

Stability

Seismic refraction traverses "A" and "B" were conducted in the immediate area of the drill sites and traverse "C" was located in a flat area at the base of McGuire Peak. Traverses "A" and "B" indicate sound Franciscan rock at a depth of approximately 6 feet, which has a seismic velocity of 5,000 feet/second. Above this material is soil and weathered and fractured rock with a velocity of 1,000 feet/second. Traverse "C" indicates soil of 1,000 feet/second to a depth of 4 feet overlying 2,000 feet/second material to a depth of 13 feet which overlies 3,500 feet/second material to 26 feet which, in turn, overlies 6,000 feet/second materials. From this velocity profile and from topographic expressions and spring activity, it is "possible" an ancient slide exists just downslope from the spring area and may extend to a depth of as much as 30 feet as indicated by the seismic traverse. As indicated by traverses "A" and "B" and topography, this "possible" slide does not appear to extend to the drill sites (see Figure 3). The boundary of the "possible" slide area is 1,200 feet southwest of site #1.



LEGEND

- Qls - Possible Ancient Slide
- Qsb - Sonoma Volcanics, Basalt
- Kjf - Franciscan Fm. Greywacke, Shale
- Spring
- Seismic Traverse
- Potential Drill Site

FIGURE 3

Site Geologic Map

PROJECT 188 JULY 1975

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SCALE IN FEET

No significant unstable or possibly unstable areas were noted near the drill sites or along the proposed haul road. Shallow slip-outs occasionally occur in oversteepened areas, but these are minor in number and magnitude.

The springs which occur along the haul road should be cleaned out and controlled during road construction to prevent possible local instability.

Erosion Potential

The soils in the area have a fine-grained matrix and exhibit a moderately high resistance to erosion stresses as indicated by lack of prominent gullying or rilling. A 10-foot deep exploratory trench in Franciscan rock adjacent to the drill site area shows no significant erosion or slope failure. In the Three Peaks area south of the project, barren Franciscan rock shows only minor erosion, and this is limited to the very steep dirt roads. Ten to 12-foot deep exploratory trenches in this area excavated several years ago by the Monsanto Corporation (Mr. Morris, pers. comm.) show essentially no erosion or slope failure.

Seismic History

At present, the historic record of earthquake activity is the best indicator of future occurrences but the record is only slightly more than 100 years in length, and recent

efforts to monitor tectonic activity in northern California have been concentrated in the San Francisco Bay area and along the San Andreas fault. Nonetheless, some very general seismic mapping has included the study area.

The California Division of Mines and Geology (1972) earthquake intensities map estimated that 6 to 10 quakes with Modified Mercalli (MM) intensities of VI to VIII have occurred in the southern half of Lake County between 1810 and 1969. Quakes of this intensity range are generally felt by everyone in the area and result in some sort of moderate or severe structural damage, depending on location in relation to epicenter and type of construction. The preliminary earthquake epicenters map of the state prepared by the California Division of Mines and Geology (1972a) locates three quakes in the 4.0-4.9 magnitude (Richter) range in Lake County between 1934 and 1971.

The geologic structure of the study area also shows evidence of numerous tectonic events in recent geologic time. The State Preliminary Fault and Geologic Map of Northern California prepared by the California Division of Mines and Geology in 1973 (Jennings, et.al., 1973) locates Quaternary (past 2 million years) fault displacements in lower Long Valley and along the east side of the McGuire Peak main ridge.

Flora

The well sites are on the lower edge of a mixed conifer-hardwood forest. Vegetation changes abruptly in relation to slope exposure.

At the head of the spur ridge, there are some small glades of annual grasses and forbs surrounded by black oaks and yellow pines. A hillside spring just above one glade supports a wild-grape thicket and several large pedestals of bracken fern.

The ridge crests are partially cleared as jeep trails with a border of chaparral and trees. There is a mixture of species as the vegetative type changes from woodland at the ridge head to chaparral at the nose. Ponderosa pine, digger pine, douglas fir, madrone, black oak, canyon live oak and big leaf maple represent the trees. Chaparral species include manzanita, toyon, poison oak and chamise. The trees are small to medium sized, ranging from 20 to 30 feet in height. The south slope of the ridge is chaparral, but the north slopes are wooded with douglas fir as the dominant tree. The haul road stays within this northern exposure woodland type until it descends to approximately 1,400 feet elevation about one-half mile from Long Valley. At this point the vegetation changes to a woodland grass type which extends to the Butts Canyon Road, the haul road's end.

The Lake County rare and endangered plant list was studied to determine if any listed species were known to be in the site vicinity. The majority of the listed species cannot be identified in the field in mid-summer when the site was visited. Table 1 lists the rare and endangered plants, their habitats and the likelihood of their being in the site vicinity.

Fauna

The well site vicinity rates high in quality as a wildlife habitat and supports a wide variety of species. The habitat quality is due to the presence and mixture of two productive types -- pine-fir-chaparral and chaparral; the presence of both natural and man-made edge; increased productivity caused by the logging of adjacent woodlands; availability of water at a near-by spring, and light human use. The majority of wildlife species associated with the two habitat types are probably found in the vicinity during the span of a year. The abundance of wildlife was evidenced in one night by the tracks of mammals, birds, insects and reptiles in dusty road stretches. In some places, the tracks of animals completely obliterated the wheel marks of two vehicles that made a round trip over the road the previous day.

The well site vicinity is not, however, a key area. Similar habitat extends approximately 3 miles along the main ridge edge.

Table 1

RARE AND ENDANGERED PLANTS
KNOWN TO OCCUR IN LAKE COUNTY

Species	Habitat	Status Codes R	E	V	D
Astragalus clarianus Clara Hunt's rattleweed	Grassy hillsides and foothill woodlands	2	2	2	3
* Brodiaea coronaria Indian Valley brodiaea	Varied - below 5,000 feet	3	3	1	3
Carex albida White sedge	Open marshy places below 300 feet, mixed evergreen forest	3	2	?	3
Cuscuta howelliana Bogg's Lake dodder		3	3	?	3
Epilobium nivium Snow Mt. willow-herb	Dry talus slopes 6,000-8,000 feet	3	1	1	3
Eriastrum brandegeae A flax	Volcanic soils, chaparral, Lake County mountains	2	1	1	3
Fritillaria pluriflora Adobe lily	Interior foothills with adobe soils	1	2	2	3
Gratiola heterosepala Bogg's Lake hedge-hyssop	Shore of Bogg's Lake	3	2	1	3
Helianthus exilis Serpentine sunflower	Serpentine outcrops in foothills	2	2	?	3
Hesperolinon adenophyllum Glandular dwarf flax	Dry hills, serpentine	2	1	1	3
Hesperolinon bicarpellatum Two carpel flax	Chaparral foothills	2	1	1	3
Hesperolinon didymocarpum Lake County dwarf flax	Dry slopes	3	2	2	3
Hesperolinon drymarioides Drymaria dwarf flax	Dry slopes	2	1	1	3
Juglans hindsii Northern California black walnut	Old Indian campsites	2	2	2	3
Lasthenia burkei Burke's baeria	Wet meadowy places	3	2	2	3
Legenere limosa Legenere	Dry beds of vernal pools	3	3	?	3
** Lupinus sericatus Cobb Mt. lupine	Yellow pine forest	2	1	1	3
Navarretia pauciflora Few-flowered navarretia	Vernal pools in volcanic rubble	2	2	2	3
Navarretia plieantha Many-flowered navarretia	Peaty margin of Bogg's Lake	3	3	2	3
Orcuttia tenuis Slender orcuttia	Vernal pools	3	3	2	3
Panicum thermale Hot spring panicum	Wet, saline margin of hot springs	3	2	2	3

Species	Habitat	Status Codes R	E	V	D
Parvisedum leiocarpum Lake County stonecrop	Dry rocky places, vernal pools	2	2	1	3
Penstemon filiformis Thread-leaved penstemon	Open dry stony places	2	1	1	3
Pityopus californicus Pityopus	Deep forest shade	2	2	2	1
Pogogyne douglasii Douglas' pogogyne	Dry beds of winter, pools	2	2	2	3
Sidalcea oregana Oregon sidalcea	Sagebrush scrub, meadows along streams	2	1	1	3
* Streptanthus morrisonii St. Helena streptanthus	Chaparral	3	1	1	3
Tracyina rostrata Tracyina	Dry grassy slopes	3	1	1	3

DEFINITION OF STATUS CODES:

Rarity (R)
1. Rare, of limited distribution, but distributed widely enough that potential for extinction or extirpation is apparently low at present.
2. Occurrence confined to several populations or one extended population.
3. Occurs in such small numbers that it is seldom reported; or occurs in one or very few highly restricted populations.

PE Possibly extinct or extirpated.

Endangerment (E)
1. Not endangered.
2. Endangered in part.
3. Totally endangered.

Vigor or Population Trend (V)
1. Stable or increasing.
2. Declining.
3. Approaching extinction or extirpation.

General Distribution (D)
1. Not rare outside California.
2. Rare outside California.
3. Endemic to California

* Habitat similar to that at site.

** Listed in the project vicinity.

Sources: California Native Plant Society, 1974.
Munz and Keck, 1959.
Munz, 1968.

The haul road will follow the alignment of an existing dirt road. The road traverses pine-fir-chaparral and woodland grass habitats. Because they form a habitat edge, roads tend to concentrate wildlife species of the adjacent habitat. Mammalian predators commonly travel back-country dirt roads because they are both good hunting areas and an easy means of travel. Deer find roadside browse easily available, and they often can crop the upper twigs of browse plants that would otherwise be out of their reach. In woodland-grass area, the road is not as attractive to wildlife as in the more dense vegetative types.

Sport fishes, probably black bass, green sunfish and bluegills, are present in Detert Reservoir and the 7M Ranch Reservoir. These two artificial bodies of water occur in the drainages from the south and north slopes of the well site ridge.

Two birds represent the only wildlife species listed as either endangered or rare that are known in the site vicinity. The southern bald eagle, an endangered species, has been reported from an area southeast of Detert Reservoir. A bald eagle might fly over the well site but it would not hunt such an area. The peregrine falcon, an endangered species, nests on Cobb Mt. and Mt. St. Helena. Restricted areas that the California Department of Fish and Game proposes for the protection of these two aerie sites do not reach the well site or haul road vicinity.

Table 2 lists wildlife species representative of the habitat types. Table 3 lists the total acreage of the several habitat types in Lake County and the adjoining Counties of Sonoma and Napa.

Land Use

The well site is on the edge of a stand of commercial timber that was selectively cut several years ago and could not support another harvest operation for a decade. The haul road slope is wooded, but could not support a commercial logging operation. The area serves as a watershed and scenic background and is used for private recreation, mainly in the form of deer hunting.

Off-site there are two very different land uses. Long Valley, to the east, is primarily pastoral agriculture. The population is low and residences are widely dispersed. Along St. Helena Creek, on the west, there are 40 to 60 residences and some small acreages of orchard and vineyard strung continuously along the creek and State Highway 29. The land parcels are primarily residential rather than income producing.

Climate

Precipitation and wind patterns are the primary climatological factors of potential significance in the study area. During the 30-year period, 1941-70, precipitation at Middletown, 4-1/2 miles from the proposed test well, averaged 45.46 inches per year with a high of 76.98 inches in 1955-56 and a

Table 2

HABITAT TYPES AT WELL SITES AND
BORDERING THE HAUL ROAD

Scientific Name	Common Name
Pine-Fir-Chaparral	
Flora	
Pinus ponderosa	Yellow pine
Pseudotsuga menziesii	Douglas fir
Quercus kelloggii	Black oak
Acer macrophyllum	Bigleaf maple
Arbutus menziesii	Madrone
Fauna	
Odocoileus hemionus columbianus	Blacktail deer
Canis latrans	Coyote
Sciurus griseus	Western gray squirrel
Oreortyx pictus	Mountain quail
Columba fasciata	Band-tailed pigeon
Melanerpes formicivorus	Acorn woodpecker
Lampropeltis zonata	California mountain kingsnake
Chaparral	
Flora	
Arctostaphyles sp.	Manzanita
Adenostoma fasciculatum	Chamise
Rhus diversiloba	Poison oak
Heteromeles arbutifolia	Toyon
Ceanothus cuneatus	Buck brush
Fauna	
Odocoileus hemionus columbianus	Blacktail deer
Urocyon cinereoargenteus	Gray fox
Neotoma fuscipes	Dusky-footed woodrat
Toxostoma redivivum	California thrasher
Accipiter striatus	Sharp-shinned hawk
Aphelocoma coerulescens	Scrub jay
Gerrhontus multicarinatus	Southern alligator lizard
Woodland-Grass	
Flora	
Quercus douglasii	Blue oak
Pinus sabiniana	Digger pine
Avena fatua	Wild oat
Bromus mollis	Soft chess
Eremocarpus setigerus	Turkey mullein
Erodium sp.	Filaree
Fauna	
Lepus californicus	Blacktailed jack rabbit
Citellus beecheyi	California ground squirrel
Buteo jamaicensis	Red-tailed hawk
Tyrannus verticalis	Western kingbird
Sturnella neglecta	Meadowlark
Pituophis melanoleucus	Gopher snake

Table 3

TOTAL ACREAGE OF VARIOUS WILDLIFE HABITATS
IN LAKE, NAPA AND SONOMA COUNTIES

	Lake	Napa	Sonoma
Pine-Fir-Chaparral	207,773		
Chaparral	244,373	131,200	83,000
Woodland-Grass	94,150	158,350	197,000

Source: California Fish and Wildlife Plan, 1965.

low in 1963-64 of 27.21 inches (J. B. Gilbert & Associates, 1975). It is presumed that a similar historical rainfall pattern exists for the study area, since both Middletown and the study area are located between the same isohyetal lines; that is, lines of equal mean seasonal precipitation. Almost all of the precipitation occurs between the months of November and April, and cyclonic storms producing 2 to 3 inches of rain in a 24-hour period are not uncommon during this period. Precipitation usually falls as rain, although light snowfalls occur occasionally.

Wind data recorded at Middletown between 1962 and 1970 are given in Table 4 and Figure 4. Although the wind pattern is typical of the regional situation, extrapolation to the study area remains uncertain because of the unpredictable effects of hilly terrain. The wind roses indicate that southerly winds are predominant during all four seasons of the year, and during the summer derive almost exclusively from the south. On the other hand, the winter wind pattern is more bidirectional due to the passage of winter cyclonic storms which bring northerly and northeasterly winds behind the cold front. Maximum wind velocities of 25 to 30 miles per hour are usually associated with these winter storms.

Table 4

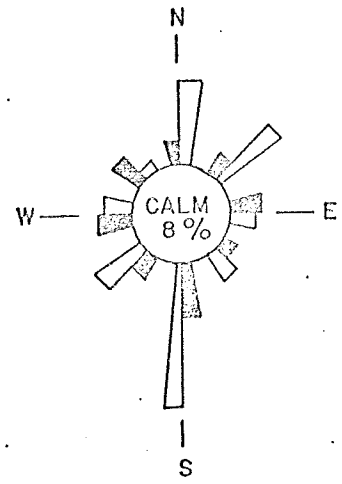
WIND DATA

	January	April	July	October	Annual
Calm	8%	2.6%	0%	5.5%	4.6%
N	17.3% 5.7 mph	10.6% 6.5 mph	.9% 8 mph	17% 7.3 mph	9.9% 7.3 mph
NE	16% 4.6 mph	5.3% 7.5 mph	1.8% 8.3 mph	12% 6.7 mph	7.9% 6.0 mph
E	6% 7.3 mph	2.6% 9.3 mph	1.8% 8.8 mph	5% 3.3 mph	4.4% 5.7 mph
SE	4% 3.2 mph	1.3% 10.5 mph	3.7% 11.1 mph	3.5% 8.3 mph	2.7% 7.1 mph
S	29.3% 11.7 mph	45% 10.5 mph	64.1% 13.1 mph	32.5% 9.8 mph	41.4% 11.5 mph
SW	11.3% 4.9 mph	17.9% 10.6 mph	23% 11.7 mph	15.5% 10.4 mph	19.7% 9.7 mph
W	6% 7.8 mph	12.6% 10.9 mph	4.6% 12.7 mph	8% 7.9 mph	8.3% 7.4 mph
NW	2% 7.7 mph	2% 8.7 mph	0% 0 mph	1% 4.5 mph	1% 8.4 mph

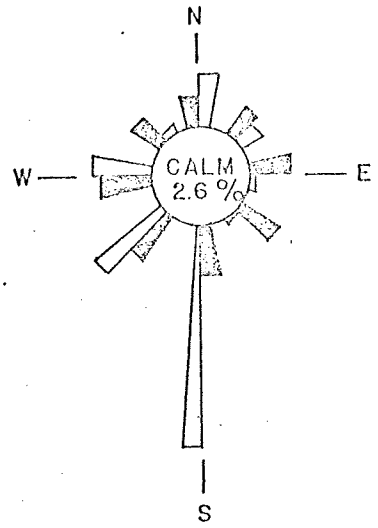
Source: J. B. Gilbert & Associates, 1975.

Figure 4

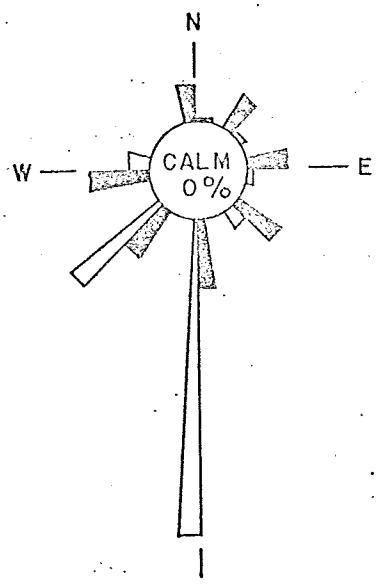
WIND ROSES*



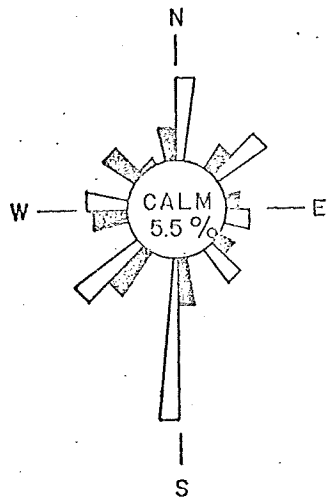
JANUARY



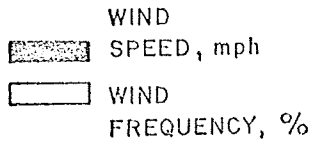
APRIL

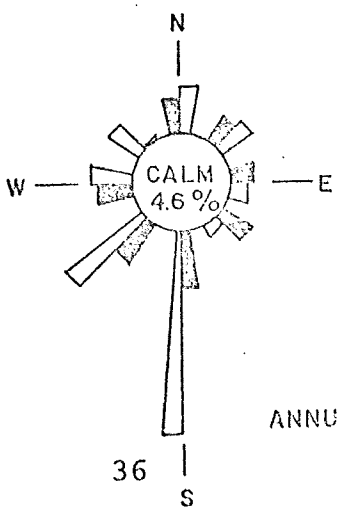


JULY

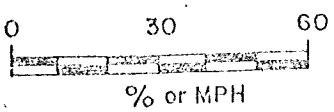


OCTOBER





ANNUAL



* Based on afternoon averages.

Source: J. B. Gilbert & Associates, 1975.

Air Quality

The air quality at the well site has not been measured, but for several reasons it is reasonable to believe it to be in a near natural state. There are no emissions in the site vicinity except when a motor vehicle uses the dirt road -- a relatively rare occurrence. The site is on a ridge crest in a well-ventilated position. Major off-site pollution sources are in the lower Napa Valley and the San Francisco Bay. These sources are from 30 to 50 miles distant and are separated from the site by the Mayacmas Mountains.

Noise

The well site and the haul road vicinity is quiet. The major unnatural noise comes from airplanes and this source is not common. Although the Butts Canyon Road is within hearing range, the traffic load is light and trucks are not shifting gears since there is no grade.

Historic or Archeological Resources

There are no archeological sites or historic features within the impact zones of the project. One small surface site near a small spring was located on the slopes of McGuire Peak southwest of the drill sites. Two areas of sporadic flake scatter were observed near the road above Butts Canyon Road, but these were discontinuous in artifact distribution and had no associated tools or midden.

Prehistoric use of the area appears to have been minimal and probably incidental to the occupation of the nearby valleys. Previous surveys done in the valleys located several villages with housepits and well-developed midden deposits (Johnson, 1975). The archeological record appears to support the ethnographic literature which suggests that the mountain areas formed a resource base for the valley dwellers who utilized the areas during the seasonal harvesting of wild foods (Kroeber, 1925).

For a complete report on the archeological survey conducted in connection with this project, the reader is referred to Appendix B.

Visibility and Scenic Aspect

Terrain features and trees screen the well site and the haul road from most public road vistas. From the three-quarter mile stretch of the Butts Canyon Road north of Cassidy Creek junction, south-bound traffic can see the well site ridge and some of the slopes traversed by the haul road. Trees completely hide the existing dirt road that will be improved for the haul road. The airline distance from the Butts Canyon Road to the well site and the haul road slope is approximately 2 miles.

The well site and haul road slope will be exposed to view from the 7M Ranch and the Circle D Ranch headquarters. The distance is approximately 1 3/4 miles to the well site and

just over a mile from the 7M Ranch to a mid-point on the haul road slope. The Circle D Ranch is over 2 miles from the haul road slope.

The only point of observation from the west is from the Mt. St. Helena radio relay station access road, a distance of 4 airline miles. Only the well site is visible from this point.

In its present state, the ridge and its slopes as viewed from Butts Canyon Road have the appearance of undeveloped wild land. Existing roads are screened by trees; the logged area along the ridge crest was a selective cut, and its marks are obscured by forest regeneration.

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Introduction

This section of the report is designed to identify and discuss the environmental, social and economic impacts of the proposed project and its alternatives. Attention is given to both short-term and long-term effects. The impacts covered include not only direct effects -- the immediate results of an action -- but also indirect effects -- the consequences of the direct effects. Emphasis is placed on describing the nature of the effect, its general magnitude and the associated indirect effects. Measures which could mitigate (reduce in magnitude) or prevent the adverse aspects of an impact are also identified.

The impacts associated with the project alternatives are similar in kind to those of the proposed project. For this reason only, the impacts of the proposed project are discussed in detail.

Construction activities can cause a number of adverse impacts unless certain precautions are taken. The threatened impacts and corrective mitigation measures are similar at different sites. In order to avoid unnecessary repetition, a standard list of construction procedures is proposed in Table 5. When special emphasis is needed or when an impact is peculiar to one type of construction, specific impacts and mitigations will be proposed.

Table 5

STANDARD PROCEDURES FOR MITIGATION OF CONSTRUCTION IMPACTS

Noise Impacts. Muffled motorized equipment. Construction activities limited to normal work week days and daylight hours.

Dust Impacts. Sprinkling of unsurfaced areas. Careful handling of fine, dry materials such as cement or bentonite.

Smoke Impacts. Burn brush on official "burn days" designated by the State Air Resources Board.

Litter Impacts. Maintain litter containers and regularly pick up construction waste materials.

Fire Impacts. In high fire hazard areas have spark arrestors on motorized equipment, use noninflamatory explosives, restrict smoking to designated areas, no open fires, maintain fire extinguishers on all equipment. Maintain standby fire fighting equipment and personnel in remote areas with a high hazard rating. Shutdown operation during periods of extreme fire hazard.

Public Safety Impacts. Maintain signs, lights and guard rails or fences at excavations or other danger areas. Place warning signs when arc welding. Post watchmen at equipment yarding areas and other attractive dangerous sites.

Visual Impacts. Park equipment and store materials in an orderly manner. Perform work in a continuous sequence, progressively if possible.

Destruction of Vegetation

The exploratory well will require approximately 3 acres of cleared space.

Both chaparral and trees will be removed. The two vegetative types, which join at the well sites, are present in very large amounts in the general area. No rare or endangered plants are known to be present. The trees are not of commercial size.

Loss of surface vegetation need not be permanent. Initially the sites will be completely denuded by grading activities and a surrounding area cleared of underbrush as a fire prevention measure. Slopes of overburden can be revegetated with grass and forbs during the first growing season after construction. If the exploratory well is a non-producer, the site can be reclaimed. If a productive field is found, the exploratory well will be incorporated with production wells and operated for an estimated 30-50 years, then the area could be reclaimed. In either case, the reclamation process will require a span of time. Site preparation would require one summer followed by the growth of grass and forbs in one season and the reestablishment of chaparral and trees over a period of years -- relating to the growth characteristics of various species.

Improvement of an existing road to attain a satisfactory haul road will require some widening of the road bed. An estimated 3 acres of tree and chaparral vegetation will be destroyed. This loss will probably be permanent as the improved road may be retained for access to the ridge top, regardless of the success of the geothermal development.

Wherever cuts and fills are required for road improvement, there will be a short-term loss of vegetative cover until a slope revegetation program is initiated.

Mitigations

- Do not remove any trees beyond the area cleared for the well pad and sump and the haul road.
- Stockpile topsoils removed for construction of well pads so that they may be replaced on termination of the project.
- Revegetate all road cuts and fill slopes and the out slopes of the drill pads. When the existing topsoils are too thin to recover the exposed areas, import soil, sod or fertilized mulches.

Destruction and Disturbance of Wildlife

Most of the small rodents and reptiles that occupy the well sites will be destroyed by the earth-moving equipment during site preparation. This loss is not practically preventable with the exception that some reptiles, notably the mountain kingsnake, if observed could be captured and released off-site.

The well site preparation and use will change viable chaparral and pine-fir-chaparral habitats to a sterile industrial type. Some of the lost area will be regained when the slope revegetation program becomes productive. The revegetated slopes will not initially be a similar habitat to that which was lost, but will help to support some of the wildlife species occupying adjacent cover. During the life of the project, however, there will be less wildlife habitat in the area and correspondingly less wildlife.

The presence of people and the noise and motion of the drilling operation will cause some shy wildlife species to leave or avoid the area. The majority of the wildlife species will adjust to the new situation, provided they are not pursued or hunted by the operational personnel.

Mitigations

- Brief workers on value of all wildlife, urge careful driving and equipment operation to avoid road kills, and prohibit deliberate harassment.
- A spring surrounded by wild grapes, ferns and other riparian growth is located at the southeast base of McGuire Peak 1,100 feet from the proposed well sites. The spring and the area around it must not be disturbed because it is an important wildlife waterhole.

Air Pollution

Air pollutants will be produced by stationary and vehicular internal combustion engines, and by the wells, if steam is found.

The drill rigs are powered by stationary diesel motors that will run continuously during the 40-60 day drilling operation.

Road building and site preparation will be done by diesel-powered earth-moving equipment. Equipment and supply trucks will be diesel-powered. During the drilling period, supply trucks will go in and out on a less than daily rate.

Personnel will live off-site and make round trips daily. The drilling crews plus supervisory personnel equal about 18 men per day. Their vehicle trips could range from 6 to 18 daily, depending upon the amount of ride sharing.

Steam may be emitted during the final stages of drilling and during clean out in substantial quantities (150,000 pounds of steam/hour) but will be reduced to a minimal amount while venting (4,000 pounds of steam/hour). The steam will add moisture and possible gaseous contaminants to the atmosphere.

During the clean-out phase, 266 pounds of hydrogen sulfide can be expected per well per day if the steam is of similar analysis as the Geysers. During the stand-by venting phase, about 10 pounds of hydrogen sulfide can be expected per well per day.

If a liquid geothermal resource is found, there may be a volatilization of gaseous components.

Olfactory impacts will vary in magnitude depending on the type of resource encountered. The primary offending constituent is H_2S.

In a liquid resource, the amount contained in the limited amount of geothermal fluid which mixes with the drilling muds or may be discharged during testing would cause only very local and insignificant impacts.

Table 6

ESTIMATED EMISSIONS OF AIR POLLUTANTS

Automobiles (12-18 vehicles/day; 12 miles/round trip)

	Emissions (pounds/day)		
	Hydrocarbons	NOx	CO
Low estimate 144 VMT	1.43	1.00	11.78
High estimate 216 VMT	2.15	1.50	17.67

Diesel Truck Emission Factors

	Pounds/1,000 Gallons of Fuel	Pounds/Mile @ 5 mpg
Particulates	13	0.00265
SOx	27	0.00529
CO	225	0.0450
Hydrocarbons	37	0.0075
NOx	370	0.0750

The testing of both the liquid and dry steam resources will be of such a short duration that the H_2S impact will not become a nuisance factor.

Mitigation

- If a dry steam resource is encountered, the steam should be analyzed prior to testing to determine the concentrations of its components. If a danger of toxicity exists, a contingency plan for cessation of testing operations during periods of local inversions, tied to the Lake County Air Pollution Control District agricultural burn day requirements, should be developed.

Noise

Sources of noise associated with geothermal development are several:

1. From road building equipment.
2. From drilling equipment.
3. From steam during and after a well is brought in.
4. From vehicular traffic.

Table 7 provides information on the predicted project related noise.

Although noise intensity will be low at Butts Canyon Road, it will be audible since it will be introduced to a nearly noiseless area. The most noticeable noise will come from the supply trucks which will move mostly during daylight hours but will occasionally go in to the well site at night when cement is needed in the drilling process. The trucks will produce the most noise at the foot of the haul road grade, where they will shift into lower gears. It is approximately 8/10 of a mile

Table 7

PREDICTED PROJECT RELATED NOISE AT 50 FEET

Activity	Noise Level (dBA)[1] at 50 Feet
Road building equipment	80-90
Drilling rig (air)	102
Steam exiting a blooie with muffler	90
Steam well venting - standby	60 (at source)
Truck traffic bringing equipment and supplies	100

[1] Decibel A scale: A decibel is the universally adopted unit for measuring sound intensity. One decibel change in sound is approximately the smallest difference in sound intensity that the human ear can detect.

Source: Enviros, 1974.

from Butts Canyon Road to this point. As they continue up the grade, the heavy roadside border of trees will have some muffling effect and reduce the intensity of truck noise. Noises at the well site will be attenuated by distance and to a degree muffled by vegetation.

Mitigations

- Muffle the exhausts of all motors.
- Muffle the blooie line.
- To the extent possible, schedule supply and equipment trucks during the day time.
- Encourage the pooling of worker transportation.

Scenic Degradation

Scenic impacts were considered relative to visibility from public roads, private residences, private and public wildlands and from the air. The scenic impacts are all changes in the vista, none are obstructions of view. A relatively natural vista will be marred by road scars and the intrusion of industrial equipment.

The vista from the Butts Canyon Road, the only project-related public road, and from Long Valley residences is similar, although travelers south bound on the road will view the site from only a short duration of time.

The well pads will be screened from view by trees and terrain features. The upper portion of the drill rig derrick will be visible on the skyline above the trees. If steam is discovered, its venting will produce periodic visible plumes.

The haul road will be hidden by trees over most of its alignment. There may be some visible cuts and fills following widening and improving turns. Such cuts and fills would appear as raw earth scars until revegetated, which would require one growing season or four to twelve months following construction.

Most of the wildlands from which the well pad can be seen are private and are traversed by only a few jeep roads. Terrain features block the view from the north and west. From the south the ridge jeep road attains a superior elevation on Three Peaks approximately 1-1/4 miles distant. The radio relay station road on Mt. St. Helena overlooks the well site at a distance of approximately 4 miles. The haul road grade will only be visible from the east at ranges of 2 or more miles.

The well site is not on any regular airlane and is only occasionally overflown by private aircraft. Commercial jets usually fly farther to the west and are at cruising altitudes of 30,000-35,000 feet. Although clearly visible from the air, the incidence of observation will be very low.

Mitigations

- Revegetate all cuts and fills.

HAZARDS

A well-planned project should provide for the prevention or reduction of adverse impacts resulting accidentally as well as for those inherent in the operation. The following discussion deals with the hazards associated with exploratory well drilling.

Blow Out

Geothermal wells have blown out in the Geysers area. These accidents have been the result of unstable geology or inadequate well casings and pipe. The frequency of blow outs has not been increasing.

The geological reconnaissance of the well sites indicates that the underlying structures are stable.

Blowouts can be subdivided into: a) well-head blowouts and b) blowouts through or around the well casing below the well head. Well-head blowouts are relatively easy to contain and therefore would not have significant impacts.

After a well is completed, the situation surrounding the possibilities and resulting impacts of a blowout lower in the well bore is uncertain. Such a blowout with a dry steam resource may result in the full discharge of steam and non-condensible gases into the atmosphere for an indefinite period of time, probably several weeks to several months. However,

impacts resulting from the discharge of one uncontrolled well would not be expected to have long-term significant impacts. The physical damage associated with the occurrence itself which may be an explosion of considerable power can be very severe in the several acres surrounding the site. Such a blowout in the Geysers steam field destroyed much of the vegetation and probably the associated small animal life on a 4 to 7-acre parcel.

The effects of a blowout by a liquid-dominated resource are even more speculative. A discharge of geothermal fluid at rates of 1,000 to 1,500 gallons per minute (about 3 cfs) is possible. Damage to the landscape adjacent to the occurrence would probably be similar to that described above for the steam blowout. Effects in downslope drainages would depend on rates of flow, soil permeabilities, and the quality and temperature of the geothermal fluids. The potential exists for extensive environmental degradation at a considerable distance from the site.

Past experience has indicated that the likelihood of such an occurrence with a liquid-dominated resource is very small. The depth of the resource coupled with the lower pressures relative to the steam resource serve to maintain tight control of the resource.

Well blowouts are adverse economic impacts on the project developer as well as adverse environmental impacts on the public. For this reason alone, the developers can be expected to use the safest and most reliable techniques and equipment.

Mitigations

The favorable site characteristics of drainage to intermittent waterways offer the most powerful mitigating influences. The results of any disastrous occurrence can be contained and cleaned up with a minimum of damage to the environment.

The improbability of occurrence decreases the potential danger of down-hole blowouts.

- A plan for emergency action should be required of the operator to include provisions for:
  - Heavy equipment for emergency sump construction and cleanup operations.
  - Backup personnel with experience in controlling blowouts.
  - Cement and/or water for killing the well.

Loss of Drill Muds

Drill muds have washed into natural drainages and living streams when the sumps containing them failed.

The soils at the well site have a moderately high resistance to erosion. The terrain allows for construction of sumps on ridge crests where there is no danger of uncontrolled runoff from higher elevations. The sumps can be built on a undisturbed foundation.

Mitigations

- Locate the drill pads and sumps on the north slope of the ridge crest so that any soil erosion or drill mud loss that could occur would drain toward Long Valley. This would prevent the possibility of damaging both the Long Valley and the Bucksnort Creek drainages. The length and slopes of Long Valley would make it much easier to control a pollution threat there than in Bucksnort Creek.

- Adopt the standard site preparation specifications prepared for Burmah's Castle Rock Springs project (see Appendix C).

Erosion

Soil erosion and downstream siltation have been caused by inadequately drained well pads and haul roads. This hazard relates directly to the soil stability and erosion resistance at well sites and along haul road alignments. The geological reconnaissance shows soils with a moderately high resistance to erosion both at the well sites and along the haul road.

Mitigations

- Construct project during the dry season.

- Adopt standard site preparation specifications (see Appendix C).

Wildfire

The risk of fires in rural or wildland areas increases whenever human activities increase in these areas. The well sites and the haul road alignment are extreme fire hazard areas whenever the fire weather is rated critical. The critical fire

weather frequency class for the area is III, the highest rating. The fire hazard rating at the well sites and along the haul road will range from high to extreme during the summer.

To date no wildfires in the Geysers area have been attributed to geothermal operations. Wildfires could damage valuable equipment and if caused by the operation, would result in damage claims. It is to the operator's advantage to be careful regarding fire.

Mitigations

- The California Division of Forestry will inspect the site and specify the fire prevention equipment and techniques for this project.

Traffic

A crew of about 20 to 24 men run the drill rig. The operation is continuous and the crew is divided into three shifts of 5 men each. These men usually stay in motels or other temporary accommodations in the area (within 30 miles). Car pooling is often practiced and three cars per shift may travel to and from the site. On occasion (every other day) supplies such as cement, parts for repair, diesel fuel, etc., are brought to the drill site by truck.

The impacts of these increased traffic loads are not expected to be significant since the present traffic load on the Butts Canyon Road is light.

Utility Demands

Geothermal resource drilling operations require no electrical transmission facilities. Diesel-powered generators on the site supply electrical energy. Diesel fuel is trucked in as needed (see Public Services).

Water needs are about 21,000 gallons per day. This will either be supplied from a water well drilled near the site or purchased from the owners of private wells or reservoirs nearby.

Human waste generated on-site will be contained in portable toilets and conveyed to approved disposal sites.

Public Services

The impacts on public services will primarily be those of lodging the work crews. This will produce no strain on the capacity of the local community. It is possible that diesel fuel may be purchased locally for use in the drilling operation. The amounts used may be quite substantial (up to 1,500 gallons/day) and if purchased locally would, under most circumstances, act as a stimulant to the local economy.

Conflicts with Existing Land Uses

Land uses at the site and along the access road are of light intensity or intermittent. There will be a slight restriction of the available private deer hunting space.

Mitigations

- The improved access road will make it easier for deer hunters to reach their hunting areas.

GROWTH INDUCING IMPACTS

There will be no growth inducing impacts associated with the proposed project. If the exploration proves successful and a producing geothermal field is developed, there will be a minor direct growth impact of operational personnel. Growth inducing impacts at the point of the electrical energy utilization are dealt with elsewhere (U. S. Department of Interior, 1973) and are beyond the scope of this report.

ENERGY CONSUMPTION

The project will consume energy primarily in the form of fossil fuels. If the project is successful, it will develop energy resources many times greater than the exploratory consumption. The economics of geothermal exploration encourage efficient equipment and procedures to reduce both energy consumption and overall costs.

SENSITIVITY OF THE McGUIRE PEAK VICINITY TO GEOTHERMAL ENERGY PRODUCTION

A geothermal energy production unit requires from 400 to 600 acres of land, an access road and an electric transmission line right-of-way.

Since it is not known whether the proposed exploratory wells would be centrally or peripherally located in the production unit, the sensitivity of an area 2 miles in diameter centered on the exploratory well sites was considered. Terrain features, drainages and vegetative cover types separate the potential project area into three portions designated "west slope", "Bucksnort drainage" and "Long Valley slope" (Figure 5). The sensitivity of these three sub-areas differs.

Sensitivity is determined by considering the force of possible adverse impacts related to the resistance or resiliency of the environment at specific points. The number of people affected helps determine the significance of the adverse impact.

This sensitivity assessment can only deal broadly with the area and the possible impacts of a production unit. An EIR will be needed to evaluate and mitigate problems such as erosion, vegetative destruction, and transmission line alignment that become specific during project design. This assessment can identify the area's relative sensitivity to several possible significant adverse impacts.

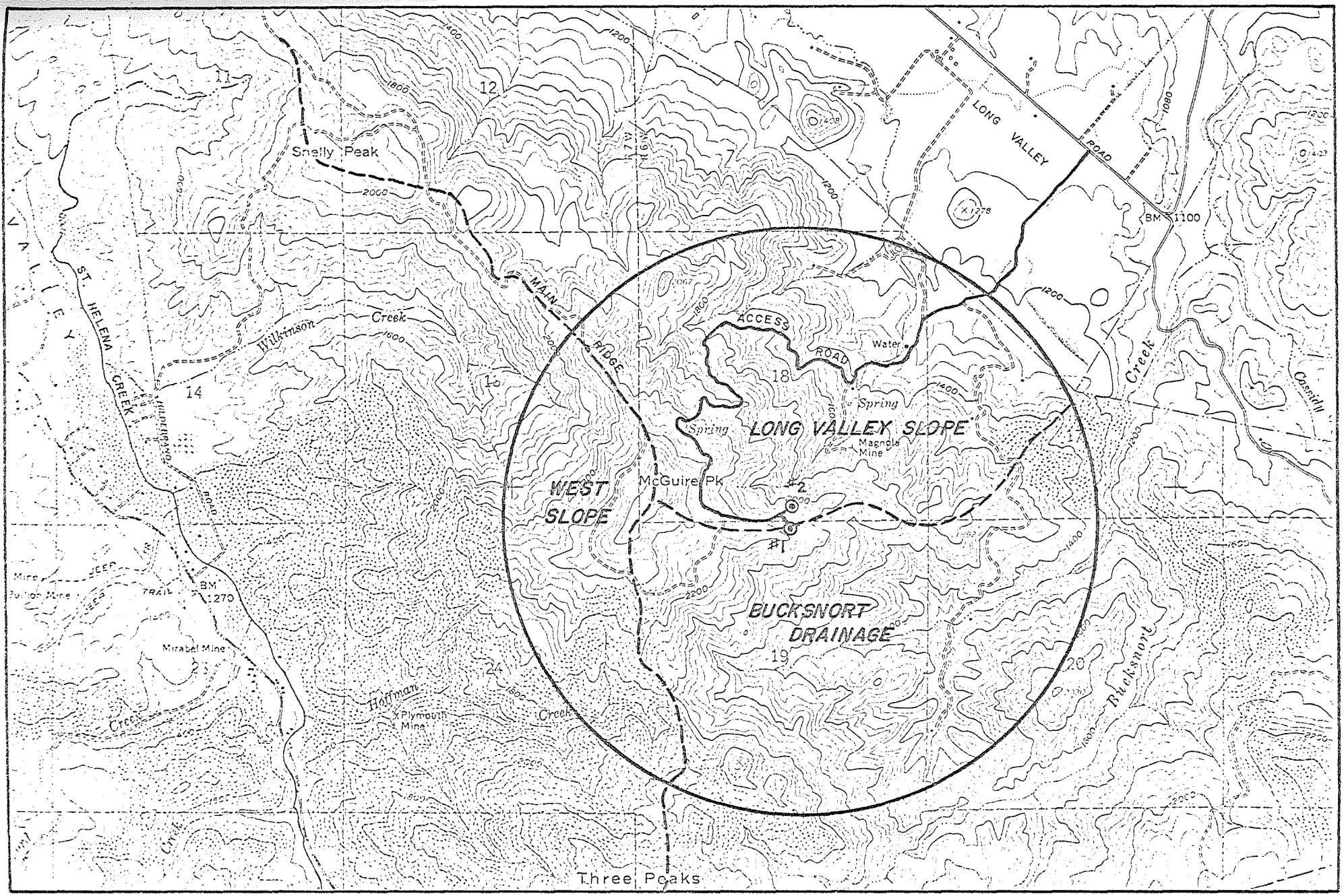


FIGURE 5

McGUIRE PEAK POTENTIAL GEOTHERMAL PROJECT AREA

DETERT RESERVOIR QUADRANGLE
7.5 Minute

The following possible adverse impacts related to the development and operation of a production unit were considered:

Air Pollution

There are no known differences in air quality or susceptibility to air pollution within the production area. More people reside on the west side of the main ridge, but the ridge is approximately parallel to the dominant wind direction and would not form a barrier to the movement of air pollutants. Further study will be required to determine whether air pollutants generated in the project area would settle into St. Helena Creek or Long Valley.

Water Pollution

The only surface water within the project area is in springs found in the Long Valley slope portion. The major concern regarding water quality relates to the possibility of off-site pollution. The "west slope" portion drains to St. Helena Creek, a perennial stream tributary to Putah Creek and Lake Berryessa. On the eastern side of the main ridge, all the streams are intermittent. The "Bucksnort drainage" portion flows to Detert Reservoir and eventually enters Putah Creek. The "Long Valley slope" portion drains to Long Valley which drains on a very low gradient to St. Helena Creek. Based on distance and flow time to perennial

waters, the relative sensitivity of the area sub-sections in descending order is: west slope, Bucksnort drainage and Long Valley slope.

Noise

The impact of noise must be related to people. The number of people to whom the noise will be audible and their occupation must be considered. Workers usually will tolerate higher noise levels at their work site than will residents at their homes. Within the project area, the people subjected to project noise will be the workers.

Off-site to the west, there are 40 to 60 residences along St. Helena Creek, 1 to 2 miles from the project boundary. Middletown, 3 miles to the north, has a population of 1,236. In Long Valley, to the east, there are approximately 16 widely scattered residences at 3/4 to 1-1/2 miles distance. There are no residences to the south on the forward slopes of the mountain range.

Within the project area, the main ridge and trees will act as sound barriers or mufflers to a small degree.

Based on the number of people involved, the range and the effect of vegetation and terrain, the most sensitive area is the west slope, the Long Valley slope is next, and the Bucksnort drainage is the least.

Wildlife and Wildlife Habitat Destruction

Within the project area, all wildlife is terrestrial and although the habitat varies, there is no significant difference in wildlife values. The most vulnerable wildlife resources are the off-site aquatic resources in St. Helena Creek and Detert Reservoir. St. Helena Creek supports a spawning run of trout from Berryessa Reservoir and is a public resource. The west slope drains to St. Helena Creek and is the most sensitive portion of the area. Bucksnort drainage, in the southeast portion of the area, drains to Detert Reservoir which supports a private fishery and is the second-most sensitive portion. The Long Valley slope is the least sensitive.

Scenic Degradation

As a scenic landscape, the project area is divided into two portions -- the west and the east slope. Within the project area, the susceptibility to scenic damage relates to the density and height of vegetative cover and the complexity of the landform. The west slope is most sensitive, the Bucksnort drainage next, and the Long Valley slope the least.

When considered as a view landscape for off-site viewers, the ratings depend on the visibility from public areas such as roads and public lands, private areas such as residences and resorts, and the numbers of people occupying the various viewpoints. The west slope is most sensitive since it can

be seen from a 2-mile stretch of State Highway 29 and from the 40 to 60 residences that lie on either side of the highway. The Bucksnort drainage is less sensitive since it can only be seen from a short stretch of the Butts Canyon Road and from 6 to 8 residences in upper Long Valley. The Long Valley slope is least sensitive as trees screen Butts Canyon Road and terrain features screen a large portion of the slope. Two ranch headquarters will have a direct view of this portion. Although there are presently very few residences in Long Valley, the Guenoc Ranch development plan proposes home sites and condominium villages between the confluence of Bucksnort and Cassidy Creeks and both north and south of Detert Reservoir. Both of these proposed developments will view large parts of the eastern slope of the main ridge.

Consideration of several possible on- and off-site adverse impacts related to the development and operation of a geothermal production unit indicates that the Long Valley slope portion of the project area is the least sensitive. A sensitivity matrix (Table 8) summarizes this evaluation.

Further study will be required to fully assess the impacts of a production unit.

Table 8

SENSITIVITY MATRIX

	Air Pollution		Water Pollution		Noise		Wildlife and Habitat Destruction		Scenic Degradation	
	On-Site	Off-Site	On-Site	Off-Site	On-Site	Off-Site	On-Site	Off-Site	On-Site	Off-Site
West Slope	1	?		3	1	3	1	3	3	3
Bucksnort Drainage	1	?		2	1	1	1	2	2	2
Long Valley Slope	1	?	1	1	1	2	1	1	1	1

3 = high sensitivity
2 = medium sensitivity
1 = low sensitivity
? = not known

UNAVOIDABLE ADVERSE IMPACTS

It will not be possible to prevent all adverse impacts but there are none that are not reduceable by the application of precautionary or mitigation measures. The following Table 9 lists the unavoidable impacts, quantifies them and rates their significance. No degrees of significance were considered. The project impacts are either acceptable therefore not significant or not acceptable therefore significant. Any significant adverse impacts would make the project unacceptable until reduced or eliminated.

Existing laws, regulations and policies were considered. None of the adverse impacts exceeded listed limits.

It is the consultant's opinion that none of the adverse impacts are significant if the recommended mitigations are incorporated in the project.

Table 9

UNAVOIDABLE ADVERSE IMPACTS

Unavoidable Adverse Impacts	Magnitude	Intensity or Relativity	Significant	Not Significant
DESTRUCTION OF VEGETATION	6 acres cleared	No rare and endangered plants known at sites. Over 500,000 acres of similar vegetation in Lake County. No merchantable timber destroyed.		X
DESTRUCTION AND DISTURBANCE OF WILDLIFE	A few small rodents and reptiles killed by earth-moving equipment.	No rare and endangered species dependent on site. Outside of peregrine falcon, nesting area protective zone.		X
	Shy wildlife species leave area.	Shy wildlife will adjust to noise and activity.		
	6 acres of habitat destroyed.	No key habitats affected. Large amounts (over 1 million acres) of similar habitats in general area.		
AIR POLLUTION	1 well.	266 lbs. hydrogen sulfide/well for 7-21 days drilling.		X
	10 to 18 gasoline-powered vehicles per day.	12 lbs. hydrogen sulfide/day when stand-by venting.		
	Heavy diesel trucks, less than daily.	1.5 lbs. NO_x/day from gasoline vehicles.		
	4 to 6 stationary diesels operating continuously 40 to 60 days.	.9 lbs. NO_x/trip from diesel trucks.		
UNNATURAL NOISE	Road building equipment - 100 dBA at source. 6 to 8 pieces of equipment operating for 10 days.	65 dBA maximum at Butts Canyon Road when equipment is on slope.		X
	Well drilling - 102 dBA at site 30 days.	58.5 dBA maximum at Butts Canyon Road.		
	Venting of steam - continuous after well is in	13.5 dBA maximum at Butts Canyon Road.		
	Personnel vehicles - 3 shifts/day.	45 dBA maximum at Butts Canyon Road when vehicles start up grade.		
SCENIC DEGRADATION	1 well pad.	Visible from wildlands from 1-1/4 to 4 mile distances and from aircraft.		x
	Drilling rig with 60-foot derrick. Steam plumes.	Visible from Butts Canyon Road by south-bound traffic for 50 seconds at 55 mph 2 miles distant. Visible from Long Valley residences 2 miles distant.		
	Haul road cut and fill.	Visible from Long Valley residences 2 miles distant until revegetated (approximately one year).		
EROSION	Vegetation removed from 6 acres. Haul road subjected to increased traffic.	Light soil loss from well pads and road surface will be partially held on ridge. No measurable increase in siltation in St. Helena Creek at the confluence of Long Valley Creek.		x

RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

Currently there are no short-term uses of the area. Although intermittent or seasonal, both timber harvest and hunting are long-time uses based on renewable resources.

Long-term productivity (over a period of 30 years) will not be affected by the project if the exploratory result is unfavorable. If favorable, however, the well would ultimately become a part of a producing geothermal resource field; and as a result, other uses of the area such as timber harvest, wildlife utilization, etc., would be curtailed but not eliminated by physical preemption or modification of the land and because of the noise and movement associated with the geothermal activities. Field development would take from 5 to 10 years, and the lifespan of the resource may range from 30 to 100 years. Upon depletion of the resource, the surface area utilized could be revegetated and would ultimately return to its natural state.

IRREVERSIBLE ENVIRONMENTAL CHANGES

The main haul road will in all probability be permanent. Although the well pads can be revegetated, their construction will leave minor landform changes.

Fuels, mainly diesel oil, will be consumed by the project.

INDIVIDUALS CONTACTED REGARDING THIS PROJECT

Burmah Oil & Gas Company

- W. T. Box
- C. E. Woods
- G. A. Frye

California Department of Conservation

- Don Jackson

California Department of Fish and Game

- Phil Baker
- Jack Fraser
- Bob Mallette

California Division of Forestry

- Art Jaseau

Magma Energy, Inc.

- Richard Foss

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Nimbus Instruments
technical Services
2791 Del Monte St. • West Sacramento, Ca. 95691 • (916) 372-3800

Introduction

This report presents the geology and attendant geotechnical factors related to three potential geothermal drill sites and associated Haul Road. Drill Site geology was examined within a 1500 ft. radius of the proposed borings and inspection of the Haul Road geology was limited to the existing road.

The project is located in the northwest trending Mayacmas Mountains, four miles southeast of the town of Middletown, Lake County, California. The drill sites are within 1200 feet of each other and are situated on a ridge adjacent to McGuire Peak.

At present, the project area serves no commercial use. The higher elevations were logged several years ago and the Magnola Mine (Mercury) located to the northeast of the drill sites is inactive.

The proposed Haul Road enters the project from the northeast, through the Morris Ranch. A southerly route, through the Livermore Ranch is also available. Both routes are unimproved, steep and require a four-wheel drive vehicle. The westerly access, through the Silva Ranch, is obstructed by fencing.

For project location see the "Area Geologic Map".

* To avoid repetition, figures prepared by Nimbus Instruments and included in the text of the EIR are not duplicated in this appendix.

Geology

The rocks underlying the project are shales and graywackes of the Franciscan formation, Sonoma formation basalt, alluvium and colluvium and a gneiss associated with the Franciscan.

The Franciscan formation is Cretaceous-Jurassic age and consists of moderately-well bedded to massive, fine to medium-grained, dark brown graywacke and hard brown shale. Both rock types are moderately-well indurated and fractured. Due to soil cover (variably 1-8 ft thick) and the weathered rock surface, rock outcrops are not common. However, minor road cuts (as much as 8-10 ft deep) and previous exploration trenches expose the subsurface rock for visual inspection. These exposures reveal a rock which is complexly folded and contorted and which has been intruded on a minor scale as evidenced by quartz veins. Occasional thin chert beds were also found. A gneiss body was observed along the proposed Haul Road. This rock is well indurated and its precise extent is not known due to inadequate outcrops.

Soil generated by the Franciscan rocks consists of a gray silt and clayey silt with numerous rock fragments which grade into the parent material. The soil is considered to have low permeability and moderately high resistance to erosion stresses.

The Sonoma volcanics unconformably overly the

Franciscan and consist primarily of dark gray, very fine-grained basalt with numerous olivine inclusions. The rock is moderately-well fractured and forms steep slopes at its edges. The rock is found at the higher elevation ridges--a survivor of past erosion cycles. The basalt occurs as isolated patches on McGuire Peak and along the Haul Road.

Soil thickness varies from a few inches at the topographic highs to as much as 8 ft. on the slopes. The soil consists of a red-brown silt with numerous rock fragments grading from gravel to small boulders in size. The soil is expected to have low permeability (due to its silty matrix) and moderately high resistance to erosion stresses.

Alluvium and Colluvium occurs in the Long Valley portion of the Haul Road and as veneers in the steep-sided and narrow stream channels throughout the area.

A few Springs were observed to occur within the Franciscan, especially near the Sonoma volcanic contact. Four such springs were found adjacent to the drill site area and Haul Road and are shown on the accompanying geologic maps.

Slope

The slopes in the project area are consistent with the topography of the Mayacmas Mountains in general. That is, flat to low sloping ridge crests, moderate sloping secondary spurs and steep ridge and spur sides. The

steepest slopes in the project area and along the Haul Road are on the order of 50-60%. The drill sites are on a spur crest which has a slope ranging from 0-20%. The steeper slopes are generally associated with resistant Franciscan rocks and the abrupt edges of the Sonoma volcanics. Figure 1 depicts the slopes found within the area of the proposed drill sites.

Stability

Seismic refraction traverses "A" and "B" were conducted in the immediate area of the drill sites and traverse "C" was located in a flat area at the base of McGuire Peak. Traverses "A" and "B" indicate sound Franciscan rock at a depth of approximately 6 ft which has a seismic velocity of 5000 ft./sec. Above this material is soil and weathered and fractured rock with a velocity of 1000 ft./sec. Traverse "C" indicates soil of 1000 ft./sec. to a depth of 4 ft. overlying 2000 ft./sec. material to depth of 13 ft. which overlies 3500 ft./sec. material to 26 ft. which, in turn, overlies 6000 ft./sec. materials. From this velocity profile and from topographic expressions and spring activity, it is "possible" an ancient slide exists just downslope from the spring area and may extend to a depth of as much as 30 ft. as indicated by the seismic traverse. Also, as indicated by traverses "A" and "B" and topography, this "possible" slide does not appear to extend to the drill sites. For details of the

survey see Figures 2 and 3.

Other than the aforementioned "possible" slide, no significant unstable or possibly unstable areas were noted at the drill sites or along the proposed Haul Road. Shallow slip-outs occasionally occur in oversteepened areas, but these are minor in number and magnitude.

Of interest, however, are the springs which occur along the Haul Road. These should be cleaned out and controlled during road construction to prevent possible local instability.

Erosion Potential

The soils in the area have a fine-grained matrix and exhibit a moderately high resistance to erosion stresses as indicated by lack of prominent gullying or erosion. A 10 ft. deep exploratory trench in Franciscan rock adjacent to the drill site area shows no significant erosion or slope failure. In the Three Peaks area south of the project, barren Franciscan rock shows only minor erosion and this is limited to the very steep dirt roads. Ten to twelve ft. deep exploratory trenches in this area excavated several years ago by the Monsanto Corporation (personal communication, Mr. Morris) show essentially no erosion or slope failure.

Conclusions and Recommendations

1. Erosion potential of the soil and rock types is considered low.

2. No apparent gross instability was found on the proposed drill sites or along the proposed Haul Road.

3. An ancient landslide may exist westerly of the proposed drill sites, however, this "possible" slide will be outside the area of drill pad construction.

4. Springs encountered during construction of the Haul Road should be cleaned-out and controlled by pipe or culvert to reduce erosion and instability hazards.

5. From field observations it appears cut slopes 1:1 or less should be suitable.

Respectfully submitted,

Allen D. Bailey
Certified Engineering
Geologist No. 762

ADB/md

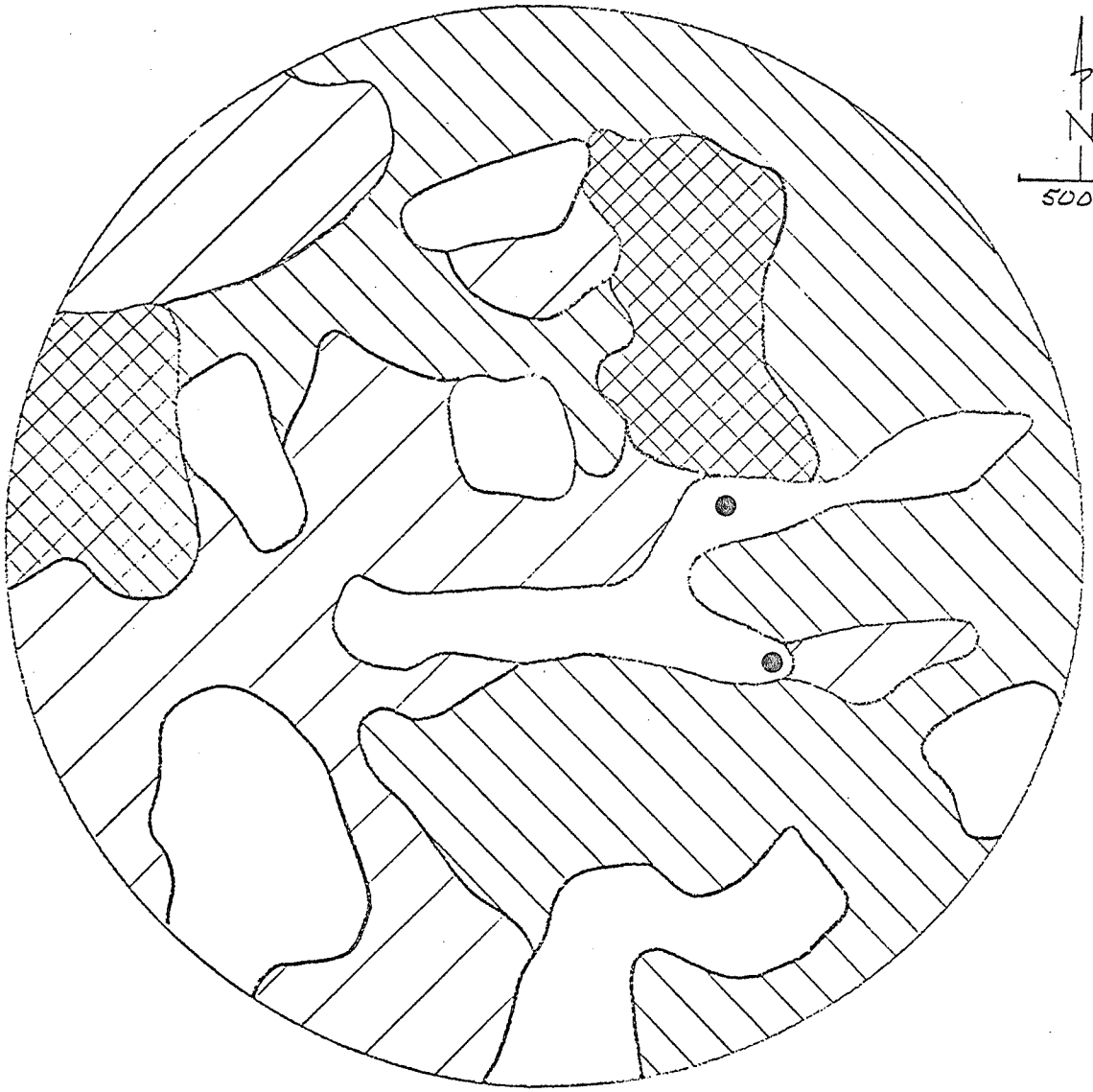
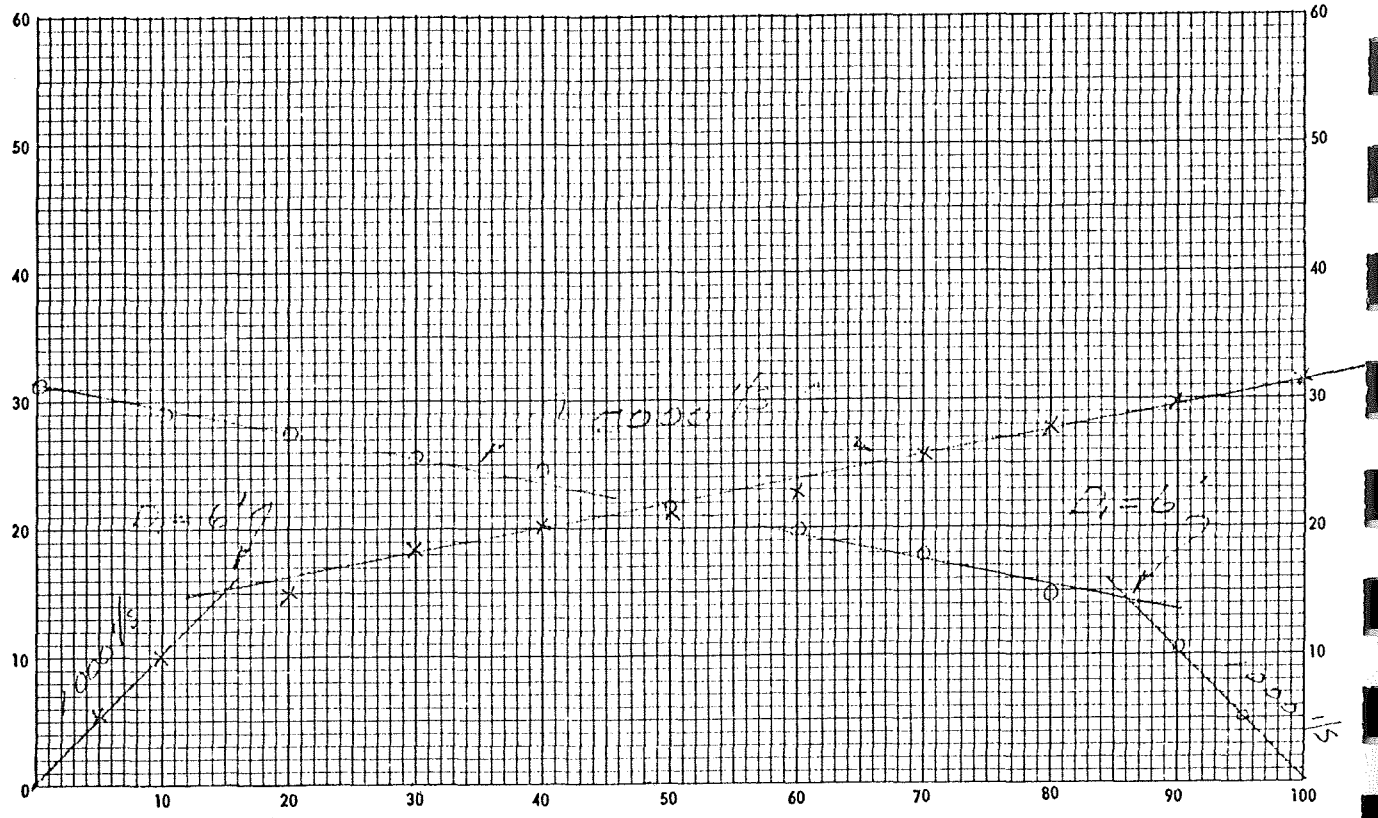


Figure 1
SITE SLOPE MAP

PROJECT 188 JULY 1975



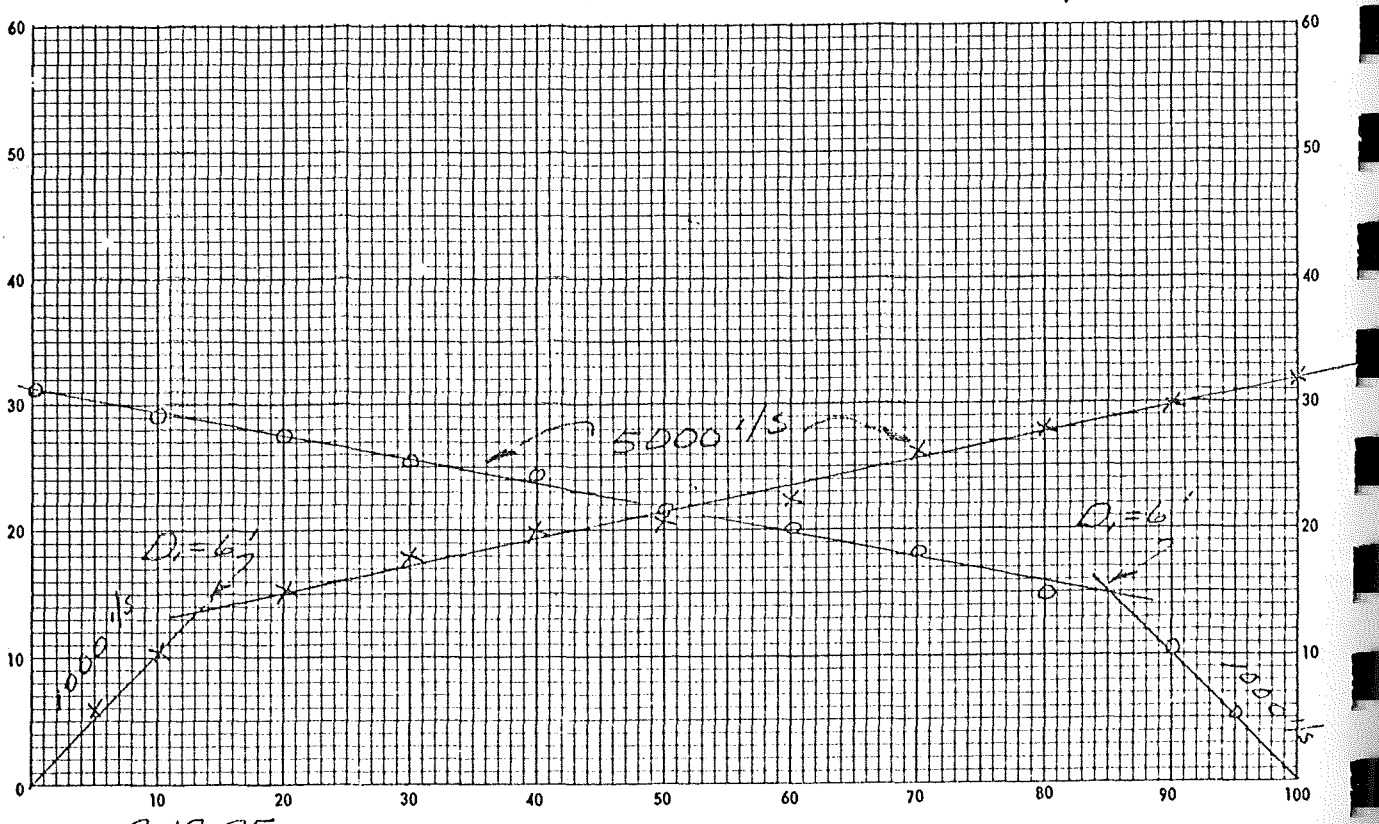
DATE 7-17-75

LOCATION McGUIRE PEAK

JOB 188

"A"

NIMBUS INSTRUMENTS



DATE 7-17-75

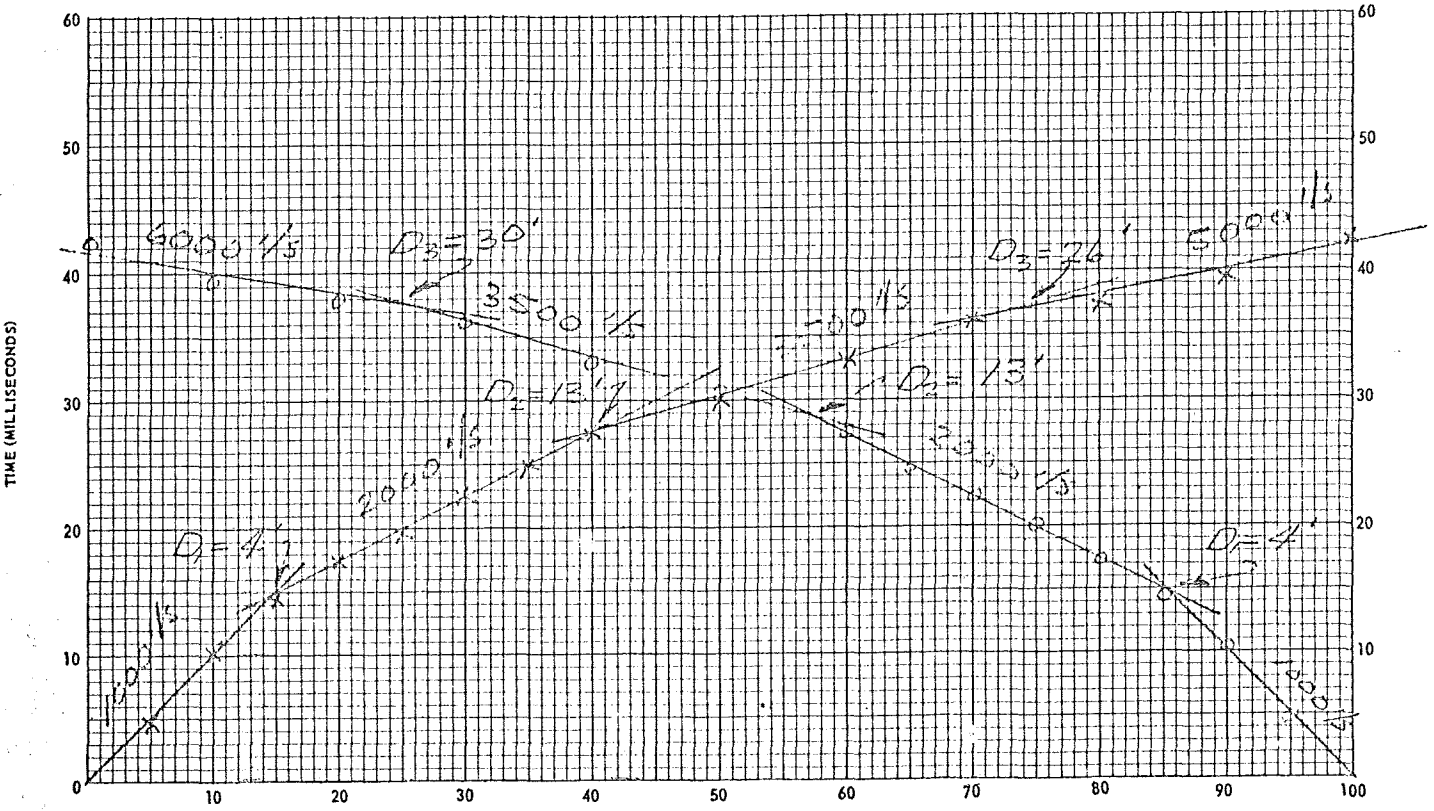
LOCATION McGUIRE PEAK

JOB 188

"B"

NIMBUS INSTRUMENTS

FIG. 2



DATE 7-17-75

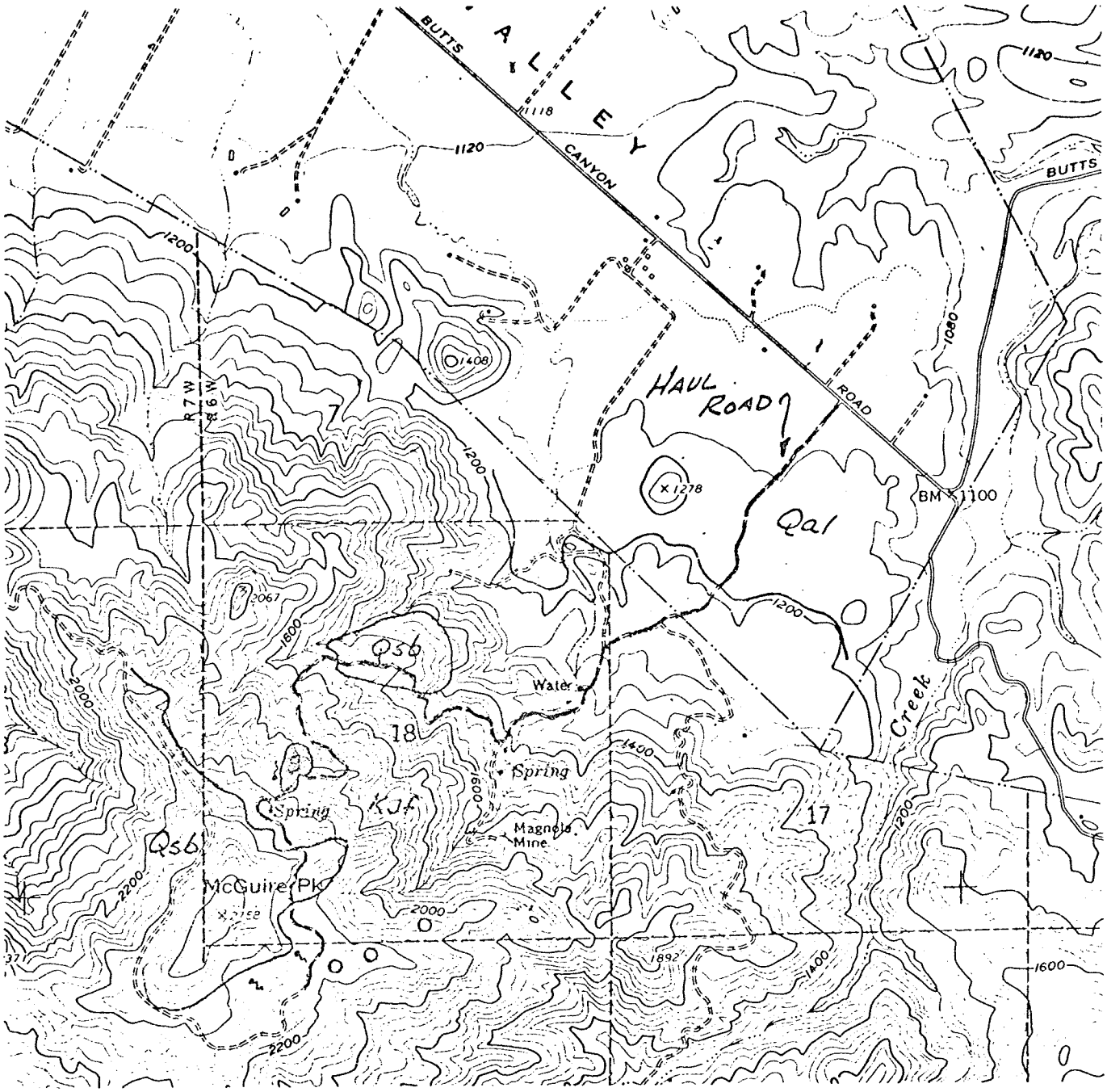
LOCATION McGUIRE PEAK

JOB 188

"C"

NIMBUS INSTRUMENTS

FIG. 3



1" = 2000'

LEGEND

- Qal - Alluvium, Colluvium
- Qsb - Sonoma Volcanics, Basalt
- KJf - Franciscan Fm.
- g - Gneiss
- o Drill Site
- Spring

Area Geologic Map

Scale: 1" = 2000' Project No. 188 Date: July 1975

APPENDIX B

CULTURAL RESOURCE ASSESSMENT OF THE FERNANDES NO. 1 GEOTHERMAL LEASEHOLD, BURMAH OIL AND GAS COMPANY. LAKE COUNTY, CALIFORNIA

By

Ann S. Peak

Consulting Archeologist

For

JONES AND STOKES ASSOCIATES

July 17, 1975

INTRODUCTION

The proposed project is the drilling of one, and possibly three, geothermal exploration wells along a ridge east of McGuire Peak in Lake County. The existing dirt access road from Butts Canyon Road will be improved to permit passage of equipment to the sites. Location of the project is in portions of sections 17, 18, and 19 T1ON R6W on the U.S.G.S. 7.5' Topographic Map Detert Reservoir, California.

The terrain is generally rugged with steeply inclined hillslopes. The infrequent streams have developed deep, narrow walled canyons which open into the broader valleys of the more substantial drainages. Vegetation varies markedly within the project boundaries. Variation is dependent upon elevation, exposure, and available moisture.

The drill sites are situated on a long east trending ridge which is east of McGuire Peak. The arboreal growth is dominated by black oak, Douglas fir, madrone, and yellow pine. Where moisture is deficient or soils inadequate, trees are replaced by often dense stands of brush. As elevation decreases, buckeye, manzanita, and digger pine appear. The lower elevations are dominated by blue oak and digger pine interspersed with open grasslands.

Territorial boundaries of the Indian groups at time of European contact are not well established and information is often vague or contradictory. The project area has been ascribed by ethnographers to both Wappo and Lake Miwok tribal groupings. Kroeber and Barrett place the study area within territorial boundaries of the Yukian-speaking Wappo (Kroeber 1925; Barrett 1908), while Merriam clearly emphasizes these lands as controlled by members of the Tu'leyo'me peoples of Newan stock (Merriam 1955). Regardless of tribal affinities, cultural adaptations were similar between the groups. Economic subsistence was based on the acorn with the diet augmented by gathering of a wide variety of wild vegetable foods. Game animals, small mammals, and fish were taken to supply protein.

Major villages were in the valleys where water supplies were reliable and sufficient to support a permanent settlement. The mountainous environs were seasonally exploited by the valley inhabitants as resource bases.

RESEARCH

Prior to the field survey, records and files of known archeological sites were reviewed at Cultural Resources Section, California Department of Parks and Recreation. Historical record search included the National Register of Historic Places, California Historical Landmarks, and California Points of Historic Interest.

RESEARCH RESULTS

There were no identified cultural resources within the proposed project boundaries. A letter confirming these findings has been requested from Historic Preservation Section, California Department of Parks and Recreation (Appendix 1).

FIELD SURVEY

The areas of the three drill sites were traversed on foot by a two-person team. Ground surfaces were carefully examined for evidence of prior human use/occupation. The existing dirt road was walked and all adjacent flats and gentle slopes were examined. Areas around springs were given a more intensive investigation as these are known in other areas to have associated camp or village sites (Johnson 1975; Peak 1973).

SURVEY RESULTS

There are no archeological sites or historic features within the impact zones of the project. One small surface site near a small spring, was located on the slopes of McGuire Peak southwest of the drill sites. Two areas of sporadic flake scatter were observed near the road above Butts Canyon Road, but these were discontinuous in artifact distribution and had no associated tools or midden.

CONCLUSIONS

Prehistoric use of the area appears to have been minimal and probably incidental to the occupation of the nearby valleys. Previous surveys done in the valleys located several villages with housepits and well-developed midden deposits (Johnson 1975). The archeological record appears to support the ethnographic literature which suggests that the mountain areas formed a resource base for the valley dwellers who utilized the areas during the seasonal harvesting of wild foods (Kroeber 1925).

IMPACTS

There will be no impact on significant cultural resources by road improvements or installation of drill pads for the geothermal wells.

RECOMMENDATIONS

No further archeological work is required in the immediate impact zones.

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RECORDS CONSULTED

California Historical Landmarks
California Points of Historic Interest
National Register of Historic Places
Cultural Resource Section, California Department of Parks and Recreation

APPENDIX 1

Communication with California Department of Parks and Recreation

OF CALIFORNIA—THE RESOURCES AGENCY EDMUND G. BROWN JR., Governor

ARTMENT OF PARKS AND RECREATION
OX 2390
AMENTO 95811
-2358

July 21, 1975

Jones and Stokes Associates
455 Capitol Mall, Suite 835
Sacramento, California 95814

Gentlemen:

I have received Ms. Ann Peak's letter of July 14, 1975 regarding the proposed geothermal project located in the vicinity of Detert Reservoir in Lake County.

As the State Historic Preservation Officer for California, I have determined that there are no California State Historical Landmarks, State Points of Historical Interst, or sites on the National Register of Historic Places currently listed within the well construction area. However, this does not preclude the possibility of significant cultural resources existing in the project area.

As consideration should be given to identifying and safeguarding cultural resources in the project area, I am pleased to acknowledge that an archaeological survey has been conducted by Ms. Peak, consulting archaeologist.

Although the results of Ms. Peak's archaeological survey indicate that no cultural resources were recorded in the vicinity of the geothermal well pads and along the existing dirt road from Butts Canyon Road, I suggest consulting a qualified professional if artifacts are discovered during construction activities.

Thank you for the opportunity to provide comments regarding this matter. Please do not hesitate to contact this office should you require further assistance.

Sincerely,

Herbert Rhodes
State Historic Preservation Officer

0-3/5

Fernandes No. 1, Geothermal Exploration, Lake County

Paleontology

By
Ann S. Peak
Consulting Archeologist

July 23, 1975

During the recent archeological survey, attention was paid to the possible occurrence of paleontological specimens within the study area. However, there was no evidence observed which indicated presence of fossil remains.

APPENDIX C*

Standard Specifications for Geothermal Wells and Access Roads

Introduction

The following specifications and attachments shall be adhered to for geothermal drilling sites and access road construction throughout the Castle Rock Springs Geothermal Project. The specifications are of a general nature and may require special engineering attention and construction techniques on separate and unique situations.

Cases involving special consideration and construction techniques are enumerated in Section 8 of these specifications and are entitled under "Special Conditions".

Drill Site Locations

Drill site locations shall be selected utilizing natural topographic features such as ridges, benches, shoulders and valleys which provide relatively flat areas of sufficient size to accommodate the drilling facility.

Where cuts and fills are required, the site shall have sufficient catch points for the fill to rest on safely.

The site shall be engineered to balance cuts and fills, thereby minimizing changes in natural contours, excavation operations, and disturbance of vegetation.

Areas of past landslides are to be avoided, or stabilized during construction.

* Source: Enviros, 1974.

Road Locations

Access roads shall follow existing trails where possible, in keeping with good design and construction practices.

Road widths will be limited to the width required for safe equipment operation. In general, road widths shall be designed to safely accommodate heavy drilling equipment.

Turnouts shall be provided at strategic locations.

Roads shall follow natural contours of the land, with grades limited to 18%.

Balanced cut and fills shall be utilized.

Construction Techniques

Construction areas will be stripped of vegetation and topsoil. The vegetation will be stockpiled and burned, or buried in spoil areas. The topsoil will be stockpiled for later spreading over cut and fill areas to enhance revegetation.

Engineered Fills

All fill areas will be benched and keyed into undisturbed ground. Beginning at the base of the slope, excavate a substantial key into sound, undisturbed original soil or rock.

Embankments will be placed in 6" to 8" lifts, moistened as required, and compacted by tamping rollers or other approved compacting equipment to 95% of ASTM D- 1557-70, "Moisture Density Relations Test for Soils".

Compacted outer-fill slopes less than 30' in height shall not exceed 1 vertical on 1.75 horizontal and slopes over 30' in height should not exceed 1 vertical on 2.0 horizontal and shall be benched. Height between benches shall not exceed 25'.

At the top of all fill slopes, construct a 3' high beam of compacted soil to prevent any surface water slope wash.

Seed or plant all slopes, to stabilize the soils, control erosion and restore aesthetic value of property.

Along access roads, construct a similar compacted berm to prevent slope wash and to direct all surface flow towards roadway ditches.

At the drill locations slope surface to drains and provide a system of ditches with culverts under access roads so that all water entering the drill location will be conducted to a culvert system.

Maintain flat gradients in ditches to prevent surface erosion. If necessary, along the roadway ditches, provide drop structures to reduce velocities.

Engineered Cuts

Cut slopes less than 15' in height shall not exceed 1 vertical on 1.5 horizontal. Slopes with heights greater than 15' should not exceed 1 vertical on 1.75 horizontal. Cut slopes higher than 30' shall be benched. Steeper slopes may be employed on a case-by-case basis where sound and durable rock is encountered.

The top portion of the cut shall be rounded to eliminate a sharp break between the cut and the existing vegetation. The face of the cut shall be roughened or benched to enhance revegetation.

The above requirements are general. Flatter slopes may be required where soil or rock conditions indicate. (For example, in certain locations where cuts are directly made on weak-weathered serpentine rock, the slopes should be made flatter, to compensate for the easy weathering and eroding rock.)

Drainage and Erosion Controls

Road and location surfaces shall be sloped so as to direct drainage to the inside or up-slope direction. (The slope shall be approximately two feet per hundred feet.)

A drainage system designed in accordance with the Design Standards of the State of California, Division of Highways, shall be provided to adequately carry away water collected on the surface of the roads or drilling locations, as well as, water intercepted from upper slopes and natural drainage systems.

The above drainage system shall consist of ditches on the up-slope side of roads and on the perimeter of drilling locations. These ditches shall be sloped to drain on a gentle gradient and sand/cement filled bags shall be installed as energy breakers where required to prevent erosion. The drainage ditches shall be conducted to culverts; sized, designed and installed in accordance with the above standards.

Culverts shall be installed with sand/cement filled sand bag headwalls at the entrance, stilling basins at the exit, and will be extended to existing natural drainage areas.

Road Locations

Access roads shall follow existing trails where possible, in keeping with good design and construction practices.

Road widths will be limited to the width required for safe equipment operation. In general, road widths shall be designed to safely accommodate heavy drilling equipment.

Turnouts shall be provided at strategic locations.

Roads shall follow natural contours of the land, with grades limited to 18%.

Balanced cut and fills shall be utilized.

Construction Techniques

Construction areas will be stripped of vegetation and topsoil. The vegetation will be stockpiled and burned, or buried in spoil areas. The topsoil will be stockpiled for later spreading over cut and fill areas to enhance revegetation.

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All fill areas will be benched and keyed into undisturbed ground. Beginning at the base of the slope, excavate a substantial key into sound, undisturbed original soil or rock.

Embankments will be placed in 6" to 8" lifts, moistened as required, and compacted by tamping rollers or other approved compacting equipment to 95% of ASTM D- 1557-70, "Moisture Density Relations Test for Soils".

Compacted outer-fill slopes less than 30' in height shall not exceed 1 vertical on 1.75 horizontal and slopes over 30' in height should not exceed 1 vertical on 2.0 horizontal and shall be benched. Height between benches shall not exceed 25'.

At the top of all fill slopes, construct a 3' high beam of compacted soil to prevent any surface water slope wash.

Seed or plant all slopes, to stabilize the soils, control erosion and restore aesthetic value of property.

Along access roads, construct a similar compacted berm to prevent slope wash and to direct all surface flow towards roadway ditches.

Concurrently, with the placing and compacting of backfill on drill locations, corrugated culvert drainage structures shall be installed in accordance with the above standards. The discharge point of these culverts shall be carried well below the zone of existing erosion. At the discharge point, erosion shall be prevented by constructing a headwall around the end of the culvert using sand/cement filled sand bags. The bags shall be laid single fashion to form an attractive and durable structure. Approximately 10' downstream from the discharge point, a low headwall shall be constructed of sand/cement filled sand bags laid single fashion to serve as a stilling basin. The discharge velocity over the low wier thus constructed, would be no greater than the original channel velocity.

Drill Site Pad and Road Surfaces

Drill site pads and road surfaces shall be stabilized to improve trafficability and reduce soil loss during rainfall runoff.

A 2' surface depth shall be provided and compacted in six to eight inch lifts. The material shall be moistened as required, and compacted by tamping trollers or other approved compacting equipment to 95% of ASTM D- 1557-70, "Moisture Density Relations Test for Soils".

Moisture contents in excess of allowable working limits may be hydrated using approximately 10% by volume or 0.2 cubic feet per square foot surface area of either pozmix cement or quicklime.

The surface shall be finished by grading and intensive rolling with a smooth steel or rubber tired roller.

Drill Site Disposal Areas (Sumps)

The disposal site is required to handle drilling wastes which are generated from drilling geothermal steam wells adjacent to the location.

The drilling waste disposal areas (sumps) will be provided with an impervious lining which will preclude the seepage or migration of any of the materials contained therein into the surrounding soil, down gradient surface water, or ground water.

A minimum free board of 3' shall be maintained in the waste sump.

Surface discharge from tributary areas shall not be discharged to the waste sump.

The sumps shall be constructed with baffles and clarifying ponds so as to allow for recycling of free water.

Good mud may be salvaged and used in other wells, to reduce the amount of mud in the waste sump.

Disposal areas are to be graded away from the drilling locations, so that the only rainwater that can accumulate in the sump, is that which falls directly on it.

The top of the sump shall be graded to prevent runoff induced erosion of the downhill face of the dike.

Water confinement barriers shall be protected and maintained to ensure their effectiveness.

There shall be no overflow from the waste sump, normally, the pump will have sufficient freeboard to accommodate increase due to rainfall. If the sump appears to be in jeopardy of overflowing, the water will be hauled to other disposal sumps in the area which have the capacity to hold water, or will be otherwise properly disposed of in an injection well, or by hauling to a qualified disposal area.

It is suggested that high pH, if present, can be reduced by not backfilling the sump immediately after the completion of the well. By exposing the sump to the atmosphere, evaporation will occur, consolidating the mud at the same time permitting it to react with the carbon dioxide of the air to form sodium carbonate which will result in a neutral pH.

Three alternative types of membrane liners are recommended for the sumps, depending on weather conditions and the availability of materials. The slopes of these disposal areas should not exceed 1 on 1.75, and the bottom width should not be less than 5 feet, regardless of which type of lining is employed.

Impervious Soil Lining

The preferred type of lining, if weather conditions permit, is an impervious clay lining.

The advantages of the impervious clay lining are that it conforms to the sump shape; it is self healing; and it is not subject to accidental rupture should pipe, tool, drill rods, be accidentally dropped into the sump, or should earthquake movements occur.

The sump location shall be thoroughly compacted to 95% of ASTM D- 1557-70.

A 2' clay lining shall then be applied. The clay lining shall be placed in six inch layers; the soil should be moistened to optimum moisture content and compacted to at least 95% of ASTM D- 1557-70. Tamping rollers or rubber-tired rollers may be used on the first three layers. The final six inch layer should be compacted by means of rubber-tired or smooth wheel rollers.

The permeability of the lining as placed shall not exceed $1x10^{-6}$ cm/sec. (Assuming that the average time to complete a well is 60 days, only a percolation depth of 0.17" would be accomplished, which is well within the 2' impervious depth.)

Soil Cement or Lime Cement Lining

When soil moisture content is in excess of allowable working limits a soil cement or lime cement lining may be employed.

Quick lime or pozmix cement in the amount of approximately 10% by volume shall be added and thoroughly mixed into selected soils having a suitable clay content. The mixed material shall then be spread throughout the sump area in six inch layers and compacted to at least 95% of ASTM D- 1557-70. This procedure should be repeated four times until a two foot thick minimum impervious lining is created. Tamping rollers or rubber-tired rollers may be used on the first three layers. The final six inch layer should be compacted by means of rubber-tired or smooth wheel rollers.

The permeability of the lining as placed shall not exceed $1x10^{-6}$ cm/sec.

Vinyl (PVC) Membrane Lining

The sump area must be carefully compacted to present a smooth surface. Rocks, rock fragments, and other materials which might puncture the membrane must be removed.

A light sand or sand/cement fill, one to three inches in thickness may be applied to assist in proficing (sic) a smooth surface.

A vinyl membrane not less than 20 mils in thickness may be applied to assist in proficing (sic) a smooth surface. A vinyl membrane not less than 20 mils in thickness shall be applied. The vinyl will be prefabricated to meet the requirements of the individual ponds and will be packaged so that it may be unfolded into place without the necessity of pulling or dragging the membrane. The membrane shall be laid with sufficient slack to accommodate temperature changes.

A ditch approximately 12 inches deep shall be excavated at the perimeter of the sump.

After placement of the vinyl lining, a light earth fill, approximately 12 inches in thickness and composed of fine sand, silt and clay, free from coarse sand and rock fragments, shall be placed to hold the lining in place and to protect it.

To prevent damage to the lining during drilling operations, it is recommended that supports be provided for suction and discharge lines. After filling the sump, the edges of the lining shall be buried in the 12 inch deep perimeter ditch and the ditch backfilled.

NEGATIVE DECLARATION
COUNTY OF LAKE
BURMAH OIL and GAS COMPANY
B.J. #1 EXPLORATORY WELL SITE
MAGNOLA MINE ALTERNATIVE WELL SITE

JANUARY 22,1976

Supplemental Report

Draft EIR
County of Lake
Burmah Oil and Gas Company
B.J. #1 Exploratory Well Site
* * *
Magnola Mine Alternative Well Site

December 30, 1975

Jones & Stokes Associates, Inc.
455 Capitol Mall, Suite 835
Sacramento, CA 95814

INTRODUCTION

This report is an evaluation of an alternative well site not considered in the Draft Environmental Impact Report dated November 14, 1975. The well site and the haul road were inspected prior to the evaluation. The report compares the environmental impacts of this new alternative with those of the McGuire Peak sites.

EXISTING ENVIRONMENT AT MAGNOLA MINE AND ACCESS ROAD

Terrain

The site is on the north-facing slope of one of the main ridges that extends from McGuire Peak to the floor of Long Valley. Its elevation is approximately 1,750 feet, which is 600 feet higher than the valley. Drainage is to an intermittent stream that flows to the 7M Reservoir and then to Long Valley. Site slopes are steep, but the spur ridge top is gently rounded and slopes moderately.

The mine road, which would be the haul road, goes through a gently sloping, grassy glade, crosses the intermittent stream and then traverses a steep slope to the mine site. A boxed spring lies below the road at the top of the opening. There are small perennial pools in the stream at the road crossing. The road terminates at the base of the mine workings.

Geology and Geophysics

The geology and geophysics of the well site were evaluated by Nimbus Instruments. Their report was used in the overall impact assessment of the well site, and a copy of the full report is included in this document as Appendix A.

Flora

The well site is in a moderately open mixed conifer-hardwood forest. Black oaks are the dominant hardwood, but there are also a few canyon live oaks and some small madrone trees. Douglas fir and ponderosa pine, mostly smaller than 0 inches diameter at breast height, are the conifers at the ite. Manzanita and poison oak represent the understory shrubs. alifornia brome occurs in scattered clumps throughout the rea.

The mine workings are mostly bare earth, but Douglas fir eedlings are establishing themselves and range from 3 to 12 eet in height.

At its lower end, the mine road crosses a glade covered ith annual grasses and bordered by small valley oaks. The oundation of an old house at the upper end of the glade is overed with periwinkles, and a walnut and fig tree are growing earby. Above the glade the road crosses shady slopes domi-ted by canyon live oak and Douglas fir trees.

None of the listed Lake County rare and endangered plants re found near the road or at the site.

Fauna

The habitat in the area is good quality and undoubtedly supports a representative fauna. Deer, gray squirrels, quail and robins were seen during the inspection. Although good, this is not a key wildlife area.

Air Quality

The air quality is good and is similar to that at the other sites.

Noise

The site is generally quiet, but it is within the sound range of Butts Canyon Road.

Visibility and Scenic Aspects

Although the Magnola Mine exposed more than one surface acre of red earth, it is not visible from the Butts Canyon Road. Terrain and trees screen the site on all but the north side. The access road is completely hidden from outside view.

IMPACTS ASSOCIATED WITH THE MAGNOLA MINE ALTERNATIVE WELL SITE

Destruction of Vegetation

Trees and some chaparral will be destroyed by road improvement and site clearing. Most of the trees that must be removed are small black oaks and Douglas fir. An estimated acre of

land was denuded by the Magnola Mine workings and is presently bare except for a scattering of Douglas fir seedlings. The well site is entirely within a forest area.

The well site will require the clearing of approximately 4 acres which will include the estimated 1 acre of mine workings. The haul road will require widening of the existing mine road. An estimated 2 acres of forest type will be cleared to accommodate the widened road. Very few (less than 25) of the conifers are of merchantable size. The oaks are potential firewood.

Mitigations

- Do not remove any trees beyond the area cleared for the well pad and sump and the haul road.
- Stockpile topsoils removed for construction of well pads so that they may be replaced on termination of the project.
- Revegetate all road cuts and fill slopes and the out slopes of the drill pads. When the existing topsoils are too thin to recover the exposed areas, import soil, sod or fertilized mulches.
- Salvage all timber with potential value as saw logs or firewood.
- Locate haul road along the west side of the glade at the road junction and stay above the spring.

estruction and Disturbance of Wildlife

No significant problems are related to development of his site.

Mitigations

- Brief workers on value of all wildlife, urge careful driving and equipment operation to avoid road kills, and prohibit deliberate harassment.

Air Pollution

No significant problems are foreseen. This site is deep within the Long Valley basin and could only affect that vicinity. Emissions from vehicles going to the site will be reduced since the haul road to this site is 1.5 miles -- one half the length of the route to the other alternative sites.

Noise

Construction phase noise will be reduced because there is less road to be built. The site however, is closer to the Long Valley residences. 7M houses are within .7 mile. It is 1.3 mile to the Butts Canyon Road. The highest intensity noises at the site (approximately 100 dBA) would be between 55 and 60 dBA at Butts Canyon Road.

Mitigations

- Muffle the exhausts of all motors.
- Muffle the blooie line.
- To the extent possible, schedule supply and equipment trucks during the day time.
- Encourage the pooling of worker transportation.

Scenic Degradation

Vegetation and terrain features will screen the haul road and the drill pad from view from most directions. The pad and some road cuts will be visible from a sector extending approximately 15°W to 15°E of N. Four to six residences lie within

this sector at ranges of 3 to 4 miles. The drill rig derrick will be visible from most of Long Valley.

Mitigations

- Revegetate all cuts and fills.
- Preserve screening vegetation wherever possible.

ENERGY CONSUMPTION

The Magnola Mine site will require less transportation energy due to the shortened haul road.

IMPACT COMPARISON

	Well site where impact has greatest magnitude
Erosion	Sites 1 and 2 - longer haul road
Destruction of vegetation	Sites 1 and 2 - longer haul road
Disturbance of wildlife	Same at all sites
Air pollution	Same at all sites
Noise	Magnola Mine site - closer to Butts Canyon Road
Scenic degradation	Sites 1 and 2 - longer haul road
Energy consumption	Sites 1 and 2 - longer haul road

APPENDIX A

[illegible] Eathreads
2791 Del Monte St. • West Sacramento, Ca. 95691 • (916) 372-3800
nical Services

December 29, 1975

Mr. James Stokes
JONES & STOKES
455 Capitol Mall
Sacramento, California 95814

Re: Magnola Mine Geothermal
Drill Site-Burmah Oil Co.

Dear Mr. Stokes:

Pursuant to your request, a geologic reconnaissance has been made of a proposed drill pad at the Magnola Mine and the connection Haul Road. It is assumed the new Haul Road will be located essentially along the same alignment as the existing mine road. The proposed drill pad area is assumed to be in the range of 3-4 acres and located at the mine site.

eology & Geophysics

The geology along the proposed road and at the drill site consists of a contorted, fractured and slightly metamorphosed, iltstone and very fine grained sandstone. A surficial mantle soil and thoroughly weathered rock has formed to a general pth of a few feet and as much as 20 ft. in places.

As shown on the "Site Geologic Map," three seismic fraction traverses were conducted in the proposed drill d area to determine the nature of the subsurface materials. ese traverses are labeled "C". "D", and "E" following

'A" and "B" of the initial investigation for the proposed
IcGuire Peak drill sites.

Haul Road

The proposed Haul Road alignment (Magnola Mine Road) follows a low grade along the hillside. From field estimates it appears a one-lane rural standard road would not produce more than 10-12 ft. cuts anywhere along the alignment. Cuts along the existing road are on the order of 4-5 ft. maximum and are standing near-vertical.

A spring, as noted on the accompanying "Area Geologic Map", is located at the beginning of the Haul Road alignment and is presently being used for a water supply. There is ample area for the Haul Road to pass above the spring, thus preserving it.

The road intersects an intermittent stream (the only prominent drainage in the area) and should be crossed by the use of a pipe or culvert.

There is no surface evidence of widespread or severe erosion or gross instability along the alignment. Surficial forest litter and a mantle of soil and weathered rock have resisted pronounced erosion such as gullying, rilling, and general mass wasting. An occasional surficial and small slipout occurs along an oversteepened slope, but this is minor in extent and magnitude.

ill Site

The proposed drill site is located at the Magnola
ne, very near the top of a low sloping ridge spur, as
own on the "Area Geologic Map". Several exploration
enches (as much as 15 ft. (±) deep with near-vertical sides)
e located on the site and show no significant erosion or
istability.

The three seismic traverses were conducted at the site
) determine the nature of the subsurface materials. Line
:" was located near the up-hill edge of the field-estimated
rill pad and reveals a few feet of soil and thoroughly
eathered rock overlying 2500 ft./sec. weathered rock.
ine "D" was located in a 10-12 ft. deep exploration trench
nd shows 7-8 ft. of mine spoil and weathered rock which
verlies slightly weathered, highly competent bedrock of
000 ft./sec. velocity. Line "E" also located in the bottom
f a 10-12 ft. trench, reveals 4000 ft./sec. rock comparable
o the 5000 ft./sec. materials encountered in Line "D".
or details of the survey see the accompanying seismic graphs.

From the exposed geology and the geophysics the soil
nd thoroughly weathered rock layer varies in thickness from
few feet to as much as 20 ft. Below this depth lies
eathered to moderately weathered rock of 2500 to 5000 ft./sec.

ocity. From the geologic reconnaissance and geophysical vey no evidence of gross instability of the upper l/weathered rock layer or the underlying slightly weathered rock was found.

mary and Recommendations

1- The geologic reconnaissance and seismic survey revealed no gross instability or erosion at the drill site or along the road alignment.

2- The Haul Road should cross the intermittent drainage by a culvert or pipe.

3- The Haul Road should be routed above the spring located at the beginning of the road in order to preserve this water supply source.

4- Cuts should be built no steeper than 1:1. If cuts exceed 20 ft. height, a bench at least 6 ft. wide should be constructed at each 20 ft. interval. If cuts exceed 20 ft., but are less than 40 ft., the bench should be installed at the mid-point.

5- It is recommended that an engineering geologist inspect the cuts during construction to determine their condition and to make

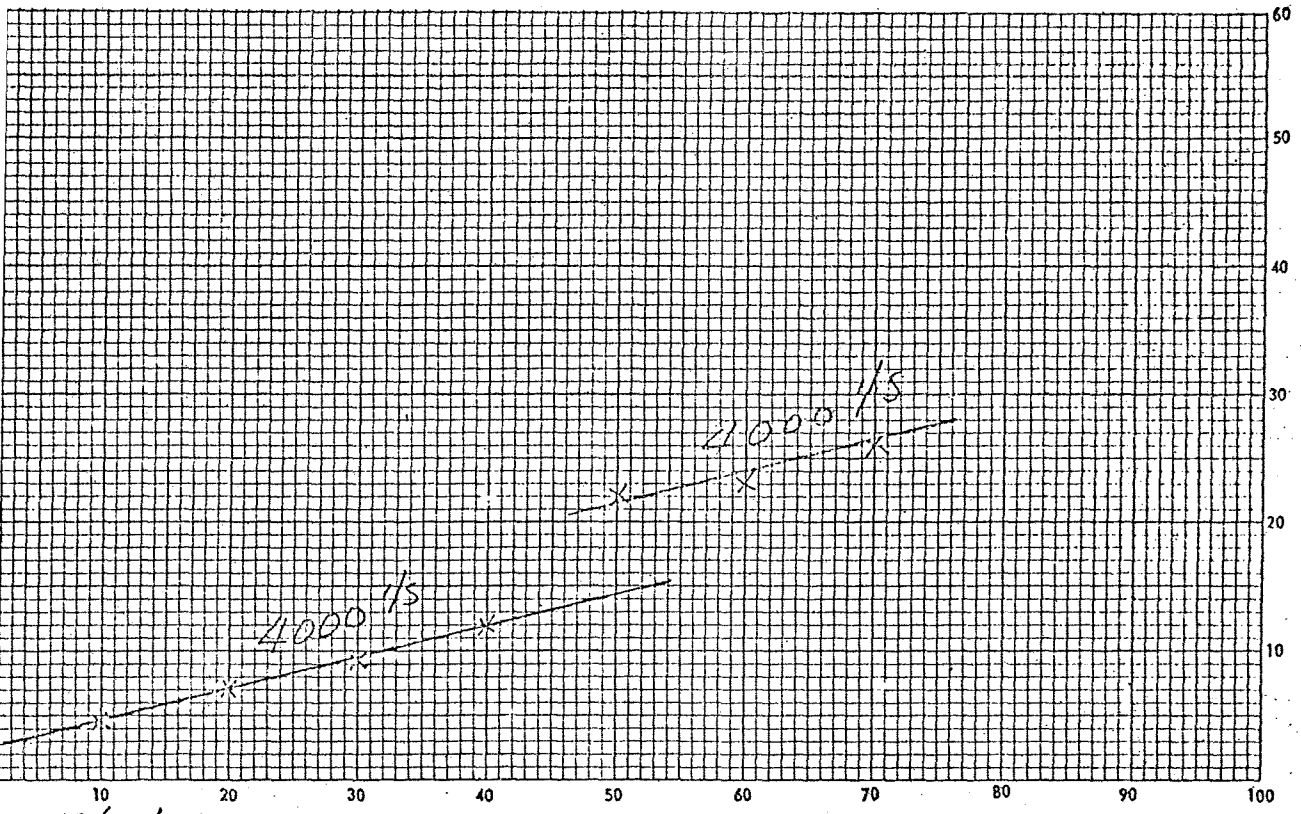
recommendations should remedial action be necessary.

It has been a pleasure to assist you on this oject. Should there be questions, or if we may assist further, please feel free to contact our office.

Sincerely,

Allen D. Bailey
Certified Engineering Geologist
#762

/cj
1.



TE 12/23/75

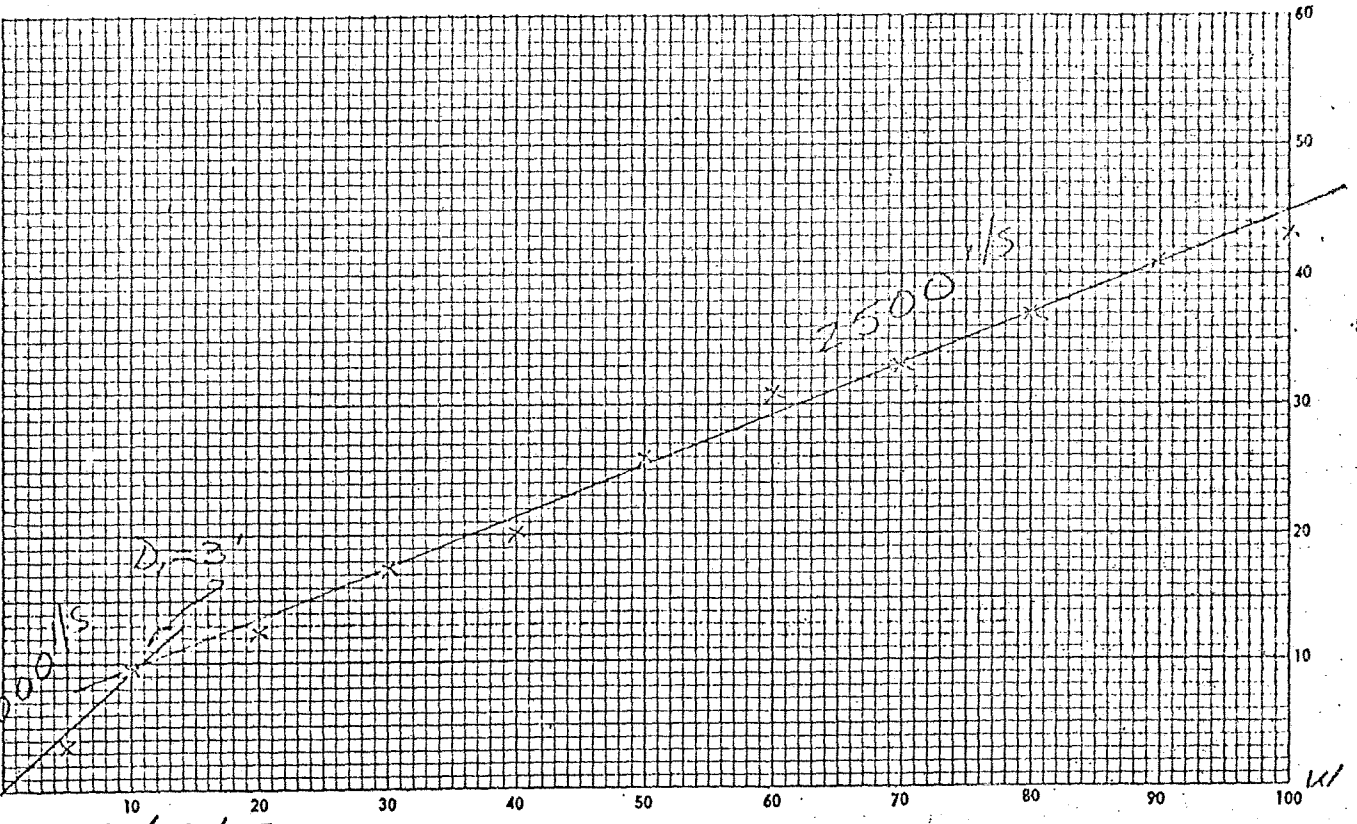
CATION MAGNOLA MINE

188

DISTANCE (FEET)

"E"

NIMBUS INSTRUMENTS

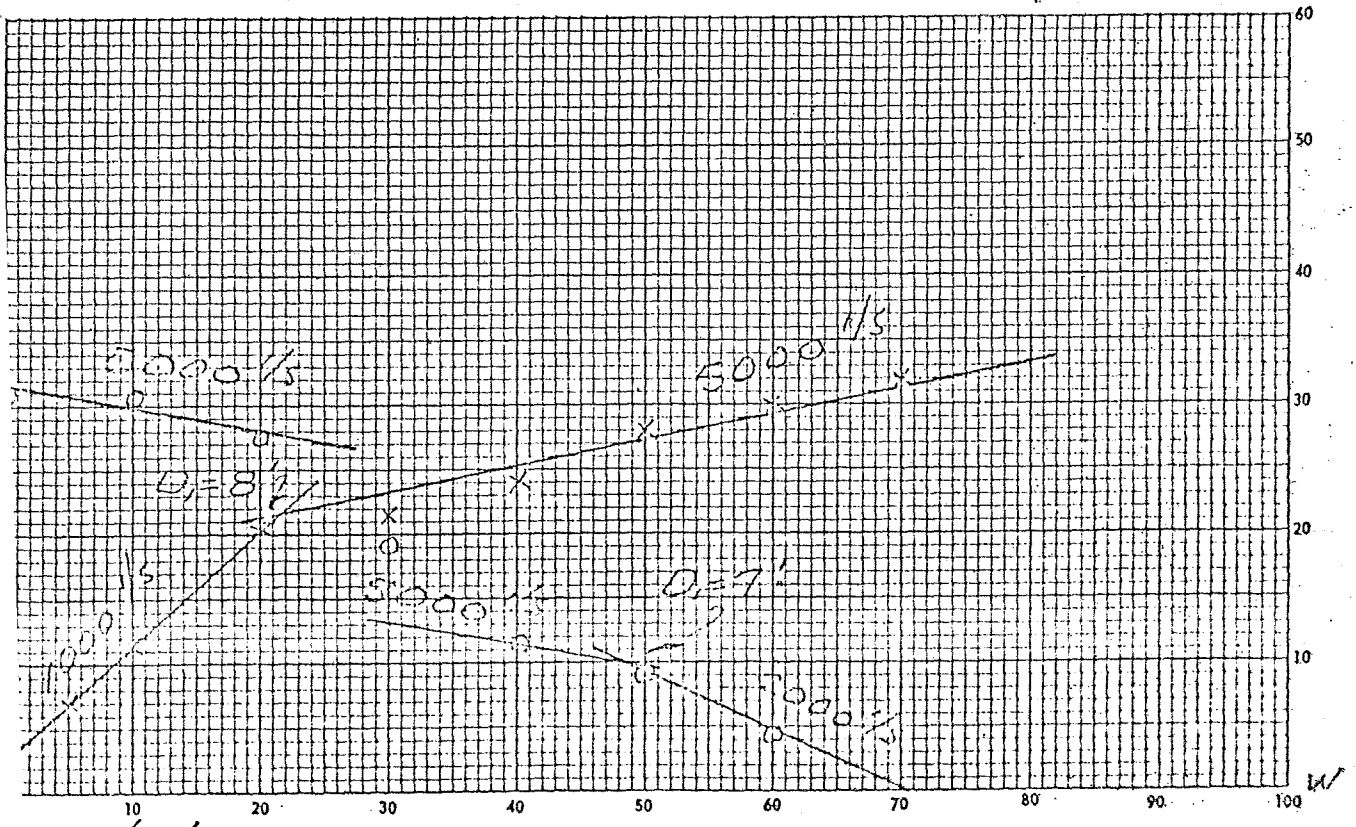


DATE 12/23/75
LOCATION MAGNOLA MINE
JOB 188

DISTANCE (FEET)

"C"

NIMBUS INSTRUMENTS

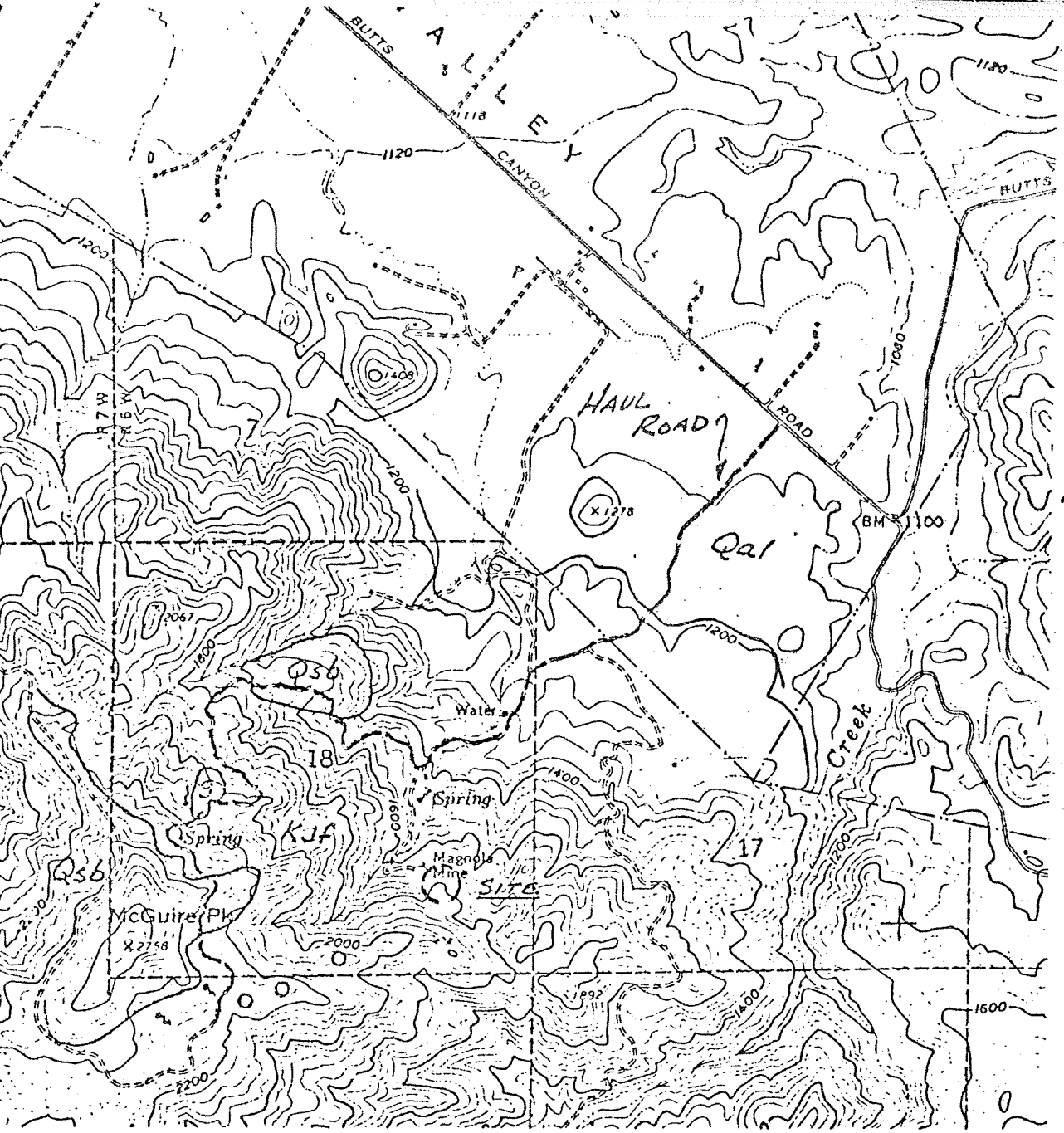


TE 12/23/75
CATION MAGNOLA MINE
B 188

DISTANCE (FEET)

"D"

NIMBUS INSTRUMENTS

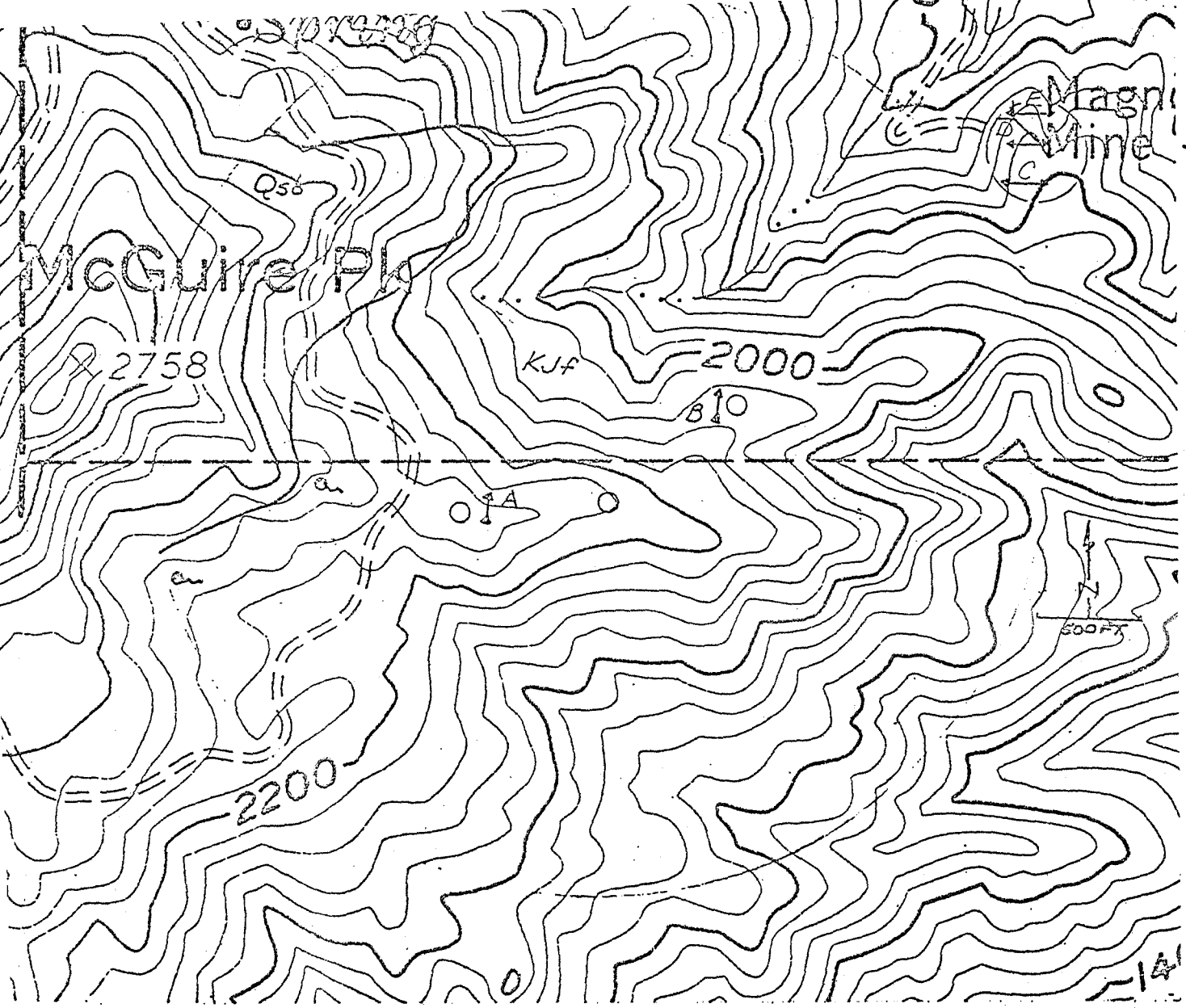


LEGEND

- Qal - Alluvium, Colluvium
- Qsb - Sonoma Volcanics, Basalt
- KJf - Franciscan Fm.
- g - Gneiss
- o Drill Site
- Spring

Area Geologic Map

Scale: 1" = 2000' Project No. 188 Date: July 1975



LEGEND

- Qsb - Sonoma Volcanics, Basalt
- KJf - Franciscan Fm. Greywacke, Shale
- Spring
- Seismic Traverse
- Potential Drill Site

Site Geologic Map

Project 188 July 1975

1"=500'

LAKE COUNTY PLANNING DEPARTMENT
255 N. Forbes Street
Lakeport, California 95453

NEGATIVE DECLARATION OF ENVIRONMENTAL IMPACT

APPLICANT: BURMAH OIL AND GAS COMPANY

DATE OF APPLICATION: NOVEMBER 20,1975 DATE OF FINDING: JANUARY 22,1976

General description of proposed project: Drilling of one geothermal exploratory well

FILED
With The Board of Supervisors
Of The County of Lake
Date JAN 30 1976
LOIS R. HESTERBERG
CO. CLERK
BY NORMA T. THRASHER
Deputy County Clerk

Location of proposed project: Section 18, Township 10 North, Range 6 West

The proposed project has been evaluated by the:

	Board of Supervisors	X	Planning Commission
	Subdivision Committee		Other agency

FINDING: NO SIGNIFICANT IMPACT WILL RESULT TO THE ENVIRONMENT FROM THE PROPOSED PROJECT.

Reasons for finding: 1)Worse case condition without mufflers would not exceed ambient air standards

) Nearest residential use is 2 to 2½ miles away from project site.

) Proposed operation will not create a significant effect on the environment.

) Project is found to have a potentially beneficial effect on the energy crisis.

tudy prepared by: Lake County Planning Department

ocation of study for review: Courthouse, 255 N. Forbes Street
Lakeport, California

ATE January 30, 1976

CHAIRMAN and/or SECRETARY

20/75 jh

Lake County Planning Commission
December 18, 1975

10:30 a.m.-Discussion RE: INITIAL STUDY for BURMAH OIL COMPANY for Geothermal Drilling of Exploratory Well on property located east of Middletown, in the McGuire Peak Area known as B.J.#1 was held at this time. Director Johnson gave the staff report including comments received from the Environmental Assessment Committee indicating there is question of concern on access road, the prime watershed, St.Helena Creek shows possible conflict with the Guenoc Ranch Development; the proposed site is outside the KGRA area; the area is steep which will require extensive filling and cutting for road and pad site; the Committee feels the probability of future expansion is very slight; The Air Pollution Control District feels the area is the most advantageous location for geothermal drilling due to air and wind patterns; the impact on the air would be insignificant; the initial study is comprehensive and not very detailed; the most detrimental environmental issue is the terrain.

Chairman Stolesen called for proponents and responding was Bill Woods of Burmah Oil who said they have submitted application for one exploratory well, and they feel there will be no significant impact on the environment; if a steam source is found they understand a full E.I.R. would be required for further drilling; requested this sight and the initial study be accepted as a Negative Declaration.

Commissioner Moorhead questioned why the applicant did not choose to drill near the Magnola Mine site and Mr. Woods responded that there were title problems, but should the Commission wish them to consider that site, they would be glad to submit a supplemental report and change the drill site.

Mr. Woods in responding to question by Commissioner Sampson, said the water to be used for drilling would come from a private lake existing on the property. He said this project involves Burmah, Natomas and Gulf Oil who all have leases within the area. Burmah has done 9 or more probe holes in the area. He said they would use approximately 12,000 gallons of water per day, not 21,000 as the report indicates; he said that was a typographical error.

BURMAH OIL INITIAL STUDY BJ #1 CONTINUED

Sheldon Bell said to log the trees they remove requires a permit from the Forestry Service and it gets very envolved. However, when they cut enough trees for a truck load they are removed from the site. You are allowed to cut down trees up to 3 acres without a permit.

Mr. Wood said that should this exploratory well show potential for a geothermal resource they would most likely request to drill a second exploratory well to be sure of the resource.

Chairman Stolesen questioned the table 7 on page 48 as to whether testing at cleanout was included under"Steam exiting a blooie with muffler" referencing noise level or was it omitted? James Stokes, preparer of the E.I.R. or Initial Study said he understood the decimal levels would go through muffler, same as when venting.

Chairman Stolesen said that if the area within the circle on page 60, Figure 5 were included as an amendment to the assessment, then the idea of slant drilling from the Magnola Mine area would be included. Mr. Woods said it was his understanding that the report did take into consideration the sensitivities of that total area, but there would need to be a site specific supplement to the initial study, for that particular site location.

Commissioner Moorhead suggested that about 1½ miles of road could be eliminated if they would slant drill from the Magnola Mine area, and would eliminate extensive cuts and fills; he would suggest this be done particularly because of the wildcat operation.

Jim Whalon of Burmah Oil said that to the best of their knowledge the mine has never been operated, or at least that is what their geologists have determined.

12:00 Recessed for lunch and reconvened at 2:00 p.m.

2:00 p.m.-Continued DISCUSSION re: BURMAH OIL COMPANY INITIAL STUDY B J #1.

Chairman Stolesen questioned how Mr. Stokes could justify no rare or endangered plants are present, since the study was done in the summer. Mr.Stokes responded that none are known to be there, the absence can never be proven, only their presence, some of the plants on the endangered list cannot be found except for very short periods of time during the year, and some cannot be found in July, when the study was done.

Chairman Stolesen questioned if the pile of rocks or boulders located near the airport could be identified, that is where did they come from, and Mr. Woods responded that he could only theorize that they came from the area of the airport when it was constructed, although he had no official proof of that.

She also questioned if this exploratory well would fall under the requirements of the new Rule A.

Director Johnson responded that in view of the APCD requirements the worse case condition without mufflers it would not violate the air ambient standards for this one well, but it is subject

to the rule.
Chairman Stolesen asked if the Commission feels a relocation of the pad site is in order would the seismic refraction tests hold true. Mr. Stokes, said no, near the mine a new survey would have to be made.
Mike Heffernan questioned 12 lbs. per day H_2S as being not significant. Mr. Stokes responded that was the amount taken from tests from other wells; actually on this site they do not know for sure until a resource is found, they can only use data they have obtained to date. Bill Woods said from the tests they have taken it usually averages from 7-10 lbs per day.
Director Johnson read questions submitted by Fayne Tucker of the Air Pollution Control who could not be at the hearing, one was what impacts would occur if hot water were hit, Mr. Stokes responded an entirely different plan and less hazardous plan would have to be followed; actually there would be less chances of environmental damage if they should hit hot water than with steam.
What is the likelyhood of hitting water versus steam?
Bill Woods responded very little, lessor impacts if they do, and they would have to go back to the drawing board; in the meantime it would be less impact because it wouldn't bleed.
Director Johnson introduced Dave Anderson from the State Division of Oil and Gas who was in the audience and welcomed him to the meeting.
Chairman Stolesen questioned if it would be possible to have water and steam in the same area, or as much of one as the other and Mr. Anderson responded that you seldom find steam and hot water in the same area, usually one or the other but not both.
Mr. Woods responded to a question from the audience that the closest house to the site is 2 to 2½ miles away.
Chairman Stolesen suggested the consultant consider an alternate site within the Magnola Mine area both from the standpoint of road construction and slang drilling.
Mr. Woods said they would submit additional information and provide a site specific plan and requested the Commission continue this discussion until January 8, in order that they could obtain that information.
Jean Talbot suggested that she felt there were to many discrepencies in the proposed assessment.
Commissioner Jones moved to continue this discussion until January 8, 1976 at 1:30 p.m., seconded by Commissioner Broten and carried, with instructions to the applicant and preparer of the initial study to provide additional information and site specific plans for pad near the Magnola Mine site.

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1:30 p.m.-Continued Discussion of the INITIAL STUDY for Burmah Oil and Gas for Geothermal Drilling of One Exploratory Well located 4 miles southeast of Middletown, known as BJ Well #1 was held at this time.

Director Johnson reported this discussion had been continued from a previous meeting with the recommendation that the applicant submitt additional information for the Magnola Mine as an alternate site. Burmah had done that but the Commissioners had not been given enough time to review it. The Commissioners had visited the Magnola Mine site on January 6, which was the second visit to the proposed drilling site.

Chairman Stolesen called for anyone wishing to make comments at this time and responding was Bill Woods of Burmah Oil and Gas who said as the applicant he had no further comments to make at this time, but would be willing to answer any questions.

Commissioner Broten questioned Mr. Woods if they plan to culver or bridge the road over the creek near the site and he responded he could not answer but they would like to culvert it if that was possible, and satisfactory to the Commission. Suggested it might be a condition of the permit.

Chairman Stolesen questioned if there would be some way to have the road go around the first grade as it appears to have a 20 to 25% slope. Mr. Woods said, yes, it would go around that grade in their proposed road plan, as shown on the exhibit map. With the new road the grade would be 15 to 16%.grade.

John Emig of Fish & Game asked if the small spring on the access road be affected by the new road as far as vegetation and wildlife.

Mr. Woods said he did not believe so as the spring will be above the road.

Chairman Stolesen suggested the applicant find out where the pipe line is located that runs from the spring to the water tank, before they begin to build the new road.

Hamilton Hess, of the Sierra Club asked what the applicants position was on the two sites. Mr. Woods said they are agreeable to either drill site, that it appeared the Magnola Mine site is the better one. It requires less road building and thus would have the least environmental impact.

Commissioner Moorhead questioned if they plan to straight drill and Mr. Woods said yes, as straight as possible.

Mike Heffernan questioned why the statement on page 6 of the supplemental report regarding energy consumption was even in it. Mr. Woods said if you're going to shorten the road there will be less engery used.

Jim Stokes, who prepared the report said the CEQA guidelines requires that you mention energy consumption.

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Director Johnson questioned Mr. Stokes if he felt the Commission should require a full E.I.R. to get more baseline data. He said he felt the information submitted was satisfactory, that the upper intermittent stream was the most sensitive area, by bridging that you would have a less damaging effect. He also commented that according to studies made any of the alternative sites would be feasible.

Hamilton Hess questioned where they planned to secure the drilling water from for this site. Mr. Woods said from the private reservoir on the property which is fed by a spring and perennial drainage.

Mr. Hess suggested that an E.I.R. should be required for all geothermal exploratory operations; urged the Planning Commission to require full E.I.R.

Mr. Stokes said the most acceptable area for drilling in his opinion includes the Magnola site, its confined to one drainage and if there were any spillage it would drain first into the reservoir.

Carl Brown commented that spillage control might be affected depending on the time of year and the amount of rainfall.

Mr. Knight, representing the Indian population said the McGuire Peak area is their hunting grounds, they have 40 acres and it is only about 2 miles (air miles) from the Magnola Mine, they do not want this area disturbed with geothermal drilling.

Muriel Jordan questioned Hamilton Hess about the qualifications of the members of the Sierra Task Force to make recommendations on geothermal matters. Mr. Hess responded that those members are all volunteers and represent the fields of geology, mechanical engineering chemistry, biology, meteorology and environmental planning.

Director Johnson said the closest approved drill site to this area is the Shell Company Bounsall site.

Fayne Tucker of the Air Pollution Control District said he does not usually make statements of recommendation on geothermal but he would like to urge the Commission seriously consider accepting a Negative Declaration on this project as he felt it would not have any significant impact on the environment; suggested they should concentrate on areas for geothermal drilling which will have little or no impact such as this proposed site.

Discussion resulted in continuing this discussion until January 22 at 11:30 a.m. in order that the Commission would have sufficient time to review the supplemental data submitted.

11:55 a.m.-Continued Discussion and Action re: BURMAH OIL COMPANY B J WELL #1 INITIAL STUDY was held at this time.

Chairman Stolesen asked if the Commission was ready to make a motion on the Initial Study and Commissioner Jones responded with a motion to approve a Negative Declaration on this project, seconded by Commissioner Broten and carried by unanimous vote. Chairman Stolesen said the Negative Declaration would be kept on file in the Planning Department for the required 2 weeks.

Mike Heffernan questioned Chairman Stolesen as to how much discussion was held on this subject before the motion was made and she responded "none".