

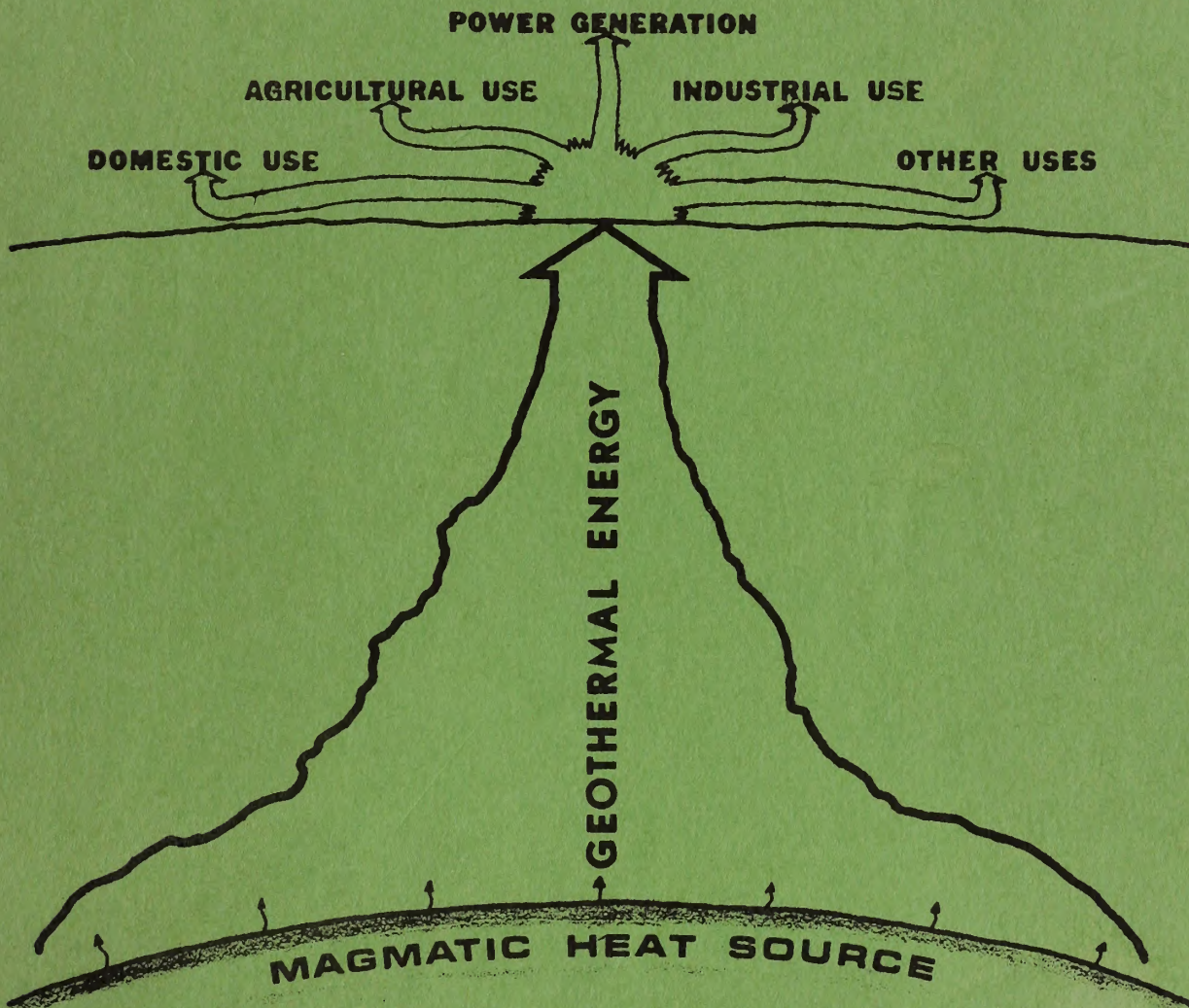
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ENVIRONMENTAL ANALYSIS RECORD AND TECHNICAL REPORT ON PROPOSED GEOTHERMAL LEASING IN THE RADIUM SPRINGS AREA



UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT

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PROPOSED GEOTHERMAL LEASING IN THE RADIUM SPRINGS AREA

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February 1, 1977

ENVIRONMENTAL ANALYSIS RECORD AND TECHNICAL REPORT
on
PROPOSED GEOTHERMAL LEASING IN THE RADIUM SPRINGS AREA

Prepared by:

John J. Grensten, Surface Protection Specialist
Kirby K. Kline, Outdoor Recreation Planner
William B. McMahan, Environmental Coordinator &
Wildlife Biologist
Walter Nowak, Geothermal Specialist
Karen Way, Archaeologist

Staff Support:

Elva Barela, Typist
Jane Farmer, Typist
Bruce Flinn, Surface Protection Specialist
Evelyn Horst, Writer-Editor and Typist
Elizabeth A. Hummer, Environmental Assistant
William D. Tipton, Geologist

ERRATA

ENVIRONMENTAL ANALYSIS RECORD AND TECHNICAL REPORT

RADIUM SPRINGS AREA

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- 164 T. 10S., R. 1E., NMPM
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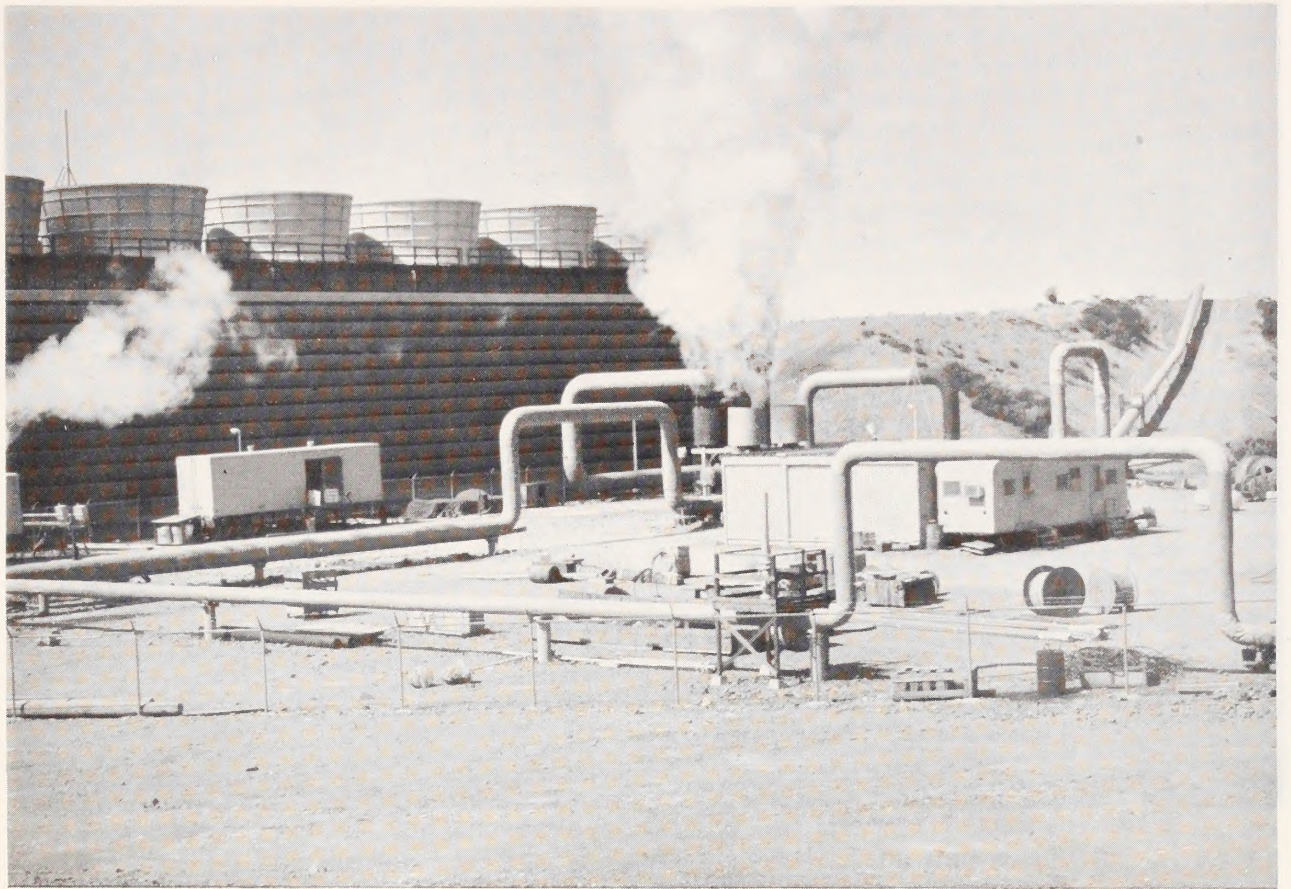
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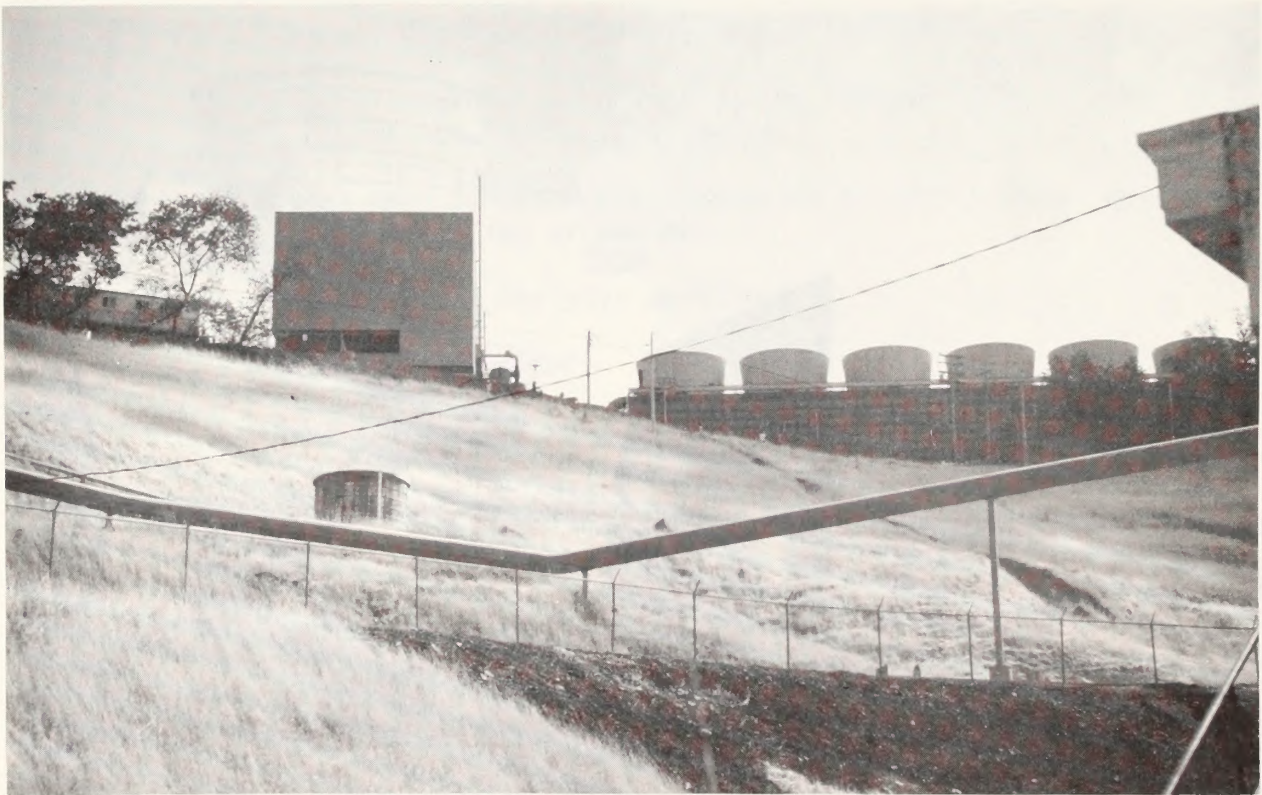
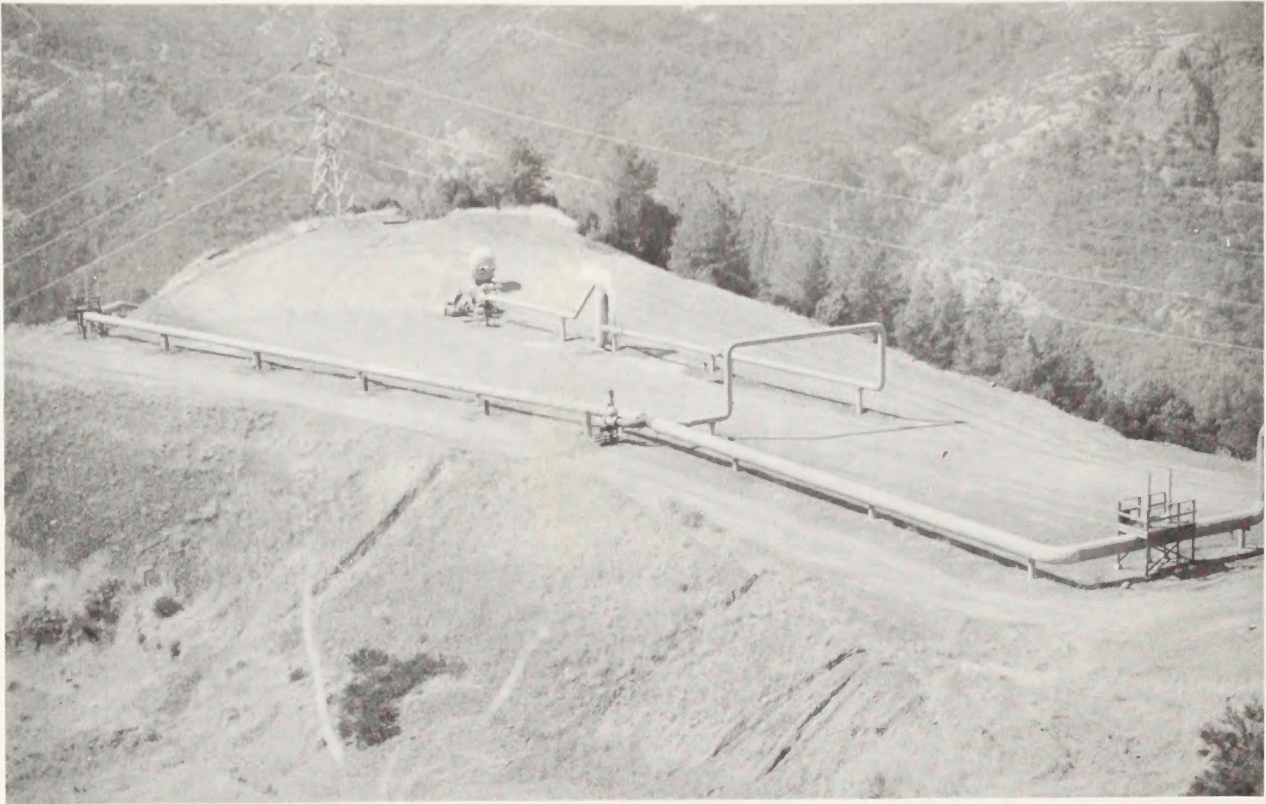
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- A Geothermal Steam Act of 1970 and Regulations on the Leasing of Geothermal Resources
Geothermal Resources Operational Orders 1 through 4
- B. Glossary of Terms
- C Notice of Intent to Conduct Geothermal Resource Exploration
Notice of Completion of Geothermal Resource Exploration Operations
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- D Plant List for the Jornada Plains
- E Animal Species Occurring in the Radium Springs Geothermal Assessment Area
- F Federal Register - Endangered and Threatened Species, Plants
Federal Register - Endangered and Threatened Wildlife and Plants, List of Animal Species
State Game Commission's Regulation No. 563 - Endangered Species and Subspecies of New Mexico
- G. Environmental Analysis Worksheet
- H Notification Letter
News Release
Letter to Recipients of Rough Draft



POWER PLANT (110 MW) AT THE GEYSERS, CALIFORNIA



GEOHERMAL FIELD DEVELOPMENT - THE GEYSERS, CALIFORNIA

Steam or hot water from the well (top photo) is transmitted through pipelines to the power plant (bottom photo)

I. DESCRIPTION OF THE PROPOSED ACTION

A. The Proposal

The proposed action is to offer for leasing approximately 403,000 ha (1,008,000 ac) of national resource lands within and adjacent to the Radium Springs Known Geothermal Resource Area (KGRA) New Mexico (Fig. 1 and 2). Approximately 3,925 ha (9,812 ac) of federal lands within the KGRA may be leased by competitive bid on May 25, 1977, following the provisions set forth in 43 CFR 3220. Non-competitive lease applications will be considered for lands outside the proposed KGRA following provisions of 43 CFR 3210. Pre-lease exploration activities authorized under 43 CFR 3209 are also considered within this document.

Lands described within this Environmental Analysis Record and Technical Report (EAR-TR) were selected because: (1) the geology of the area suggests that there is good geothermal potential; (2) industry has shown interest in the area by filing geothermal lease applications; (3) recommendations for the development of geothermal resources were included in the Bureau of Land Management (BLM) land use planning system for this area.

Geothermal lease applications have been received for approximately 61,210 ha (153,025 ac) of the federal lands considered in this document. The assessment area has been expanded to cover adjoining lands to insure that all resource values are given fair consideration.

B. The Alternatives

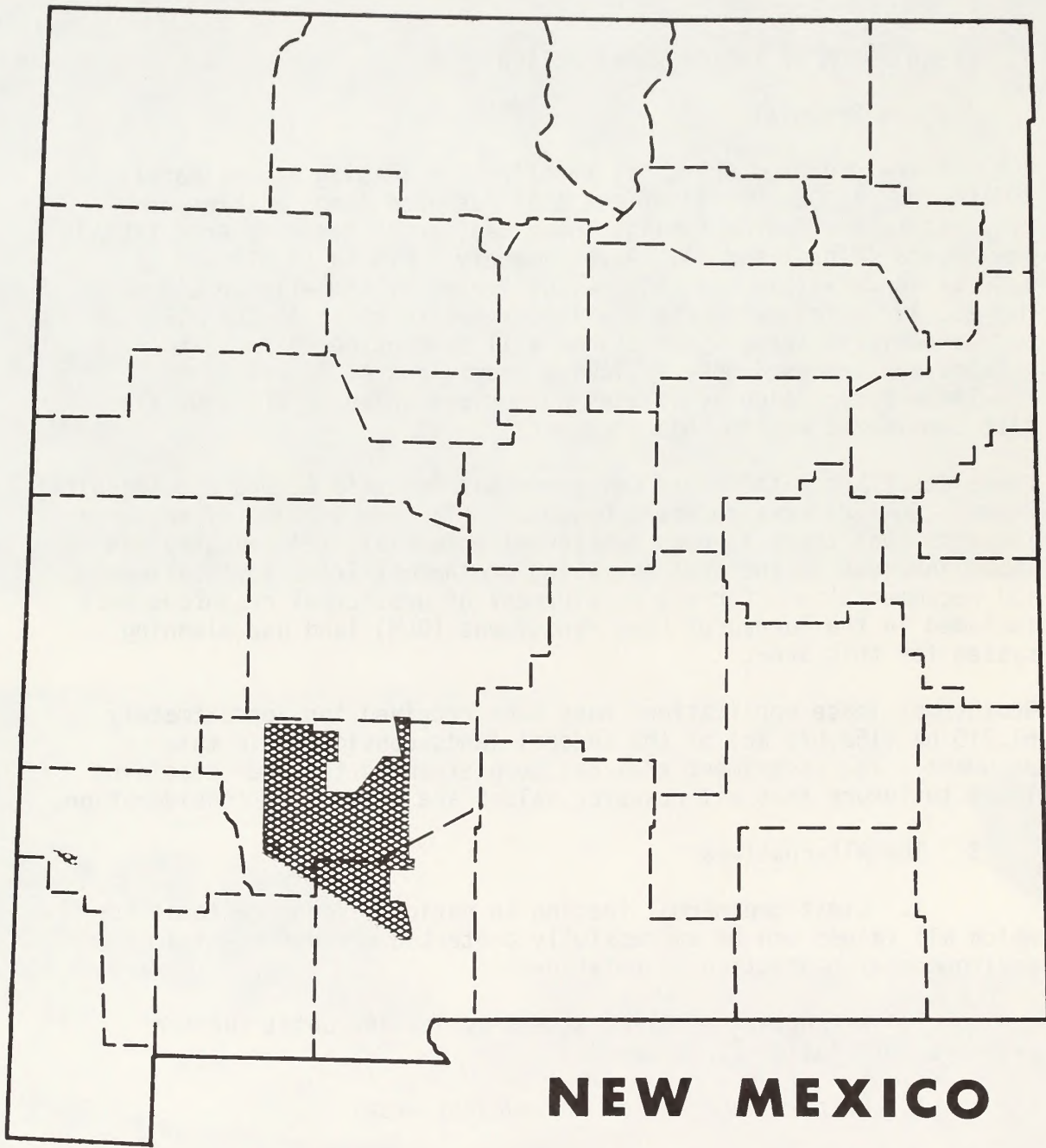
1. Limit geothermal leasing to national resource lands for which all values can be successfully protected through special environmental protection stipulations.

2. Withhold the entire area from leasing until further resource information is gathered.

3. Do not lease any of the subject area.

C. Background Information

Presently, geothermal energy is a source of comparatively low cost energy. Geothermal electrical generating costs are, in many cases, lower than the costs of generating electric power from nuclear reactors, coal, or fossil fuels (Kruger & Otte, 1973). An increase in activity in the exploration of the earth's energy can be expected with advances in sophisticated geothermal exploration techniques. Refer to Table 1 for producible reserves. The production of geothermal electric power




 Proposed Leasing Area

FIGURE 1 PROPOSED RADIUM SPRINGS GEOTHERMAL LEASING AREA
IN RELATION TO NEW MEXICO

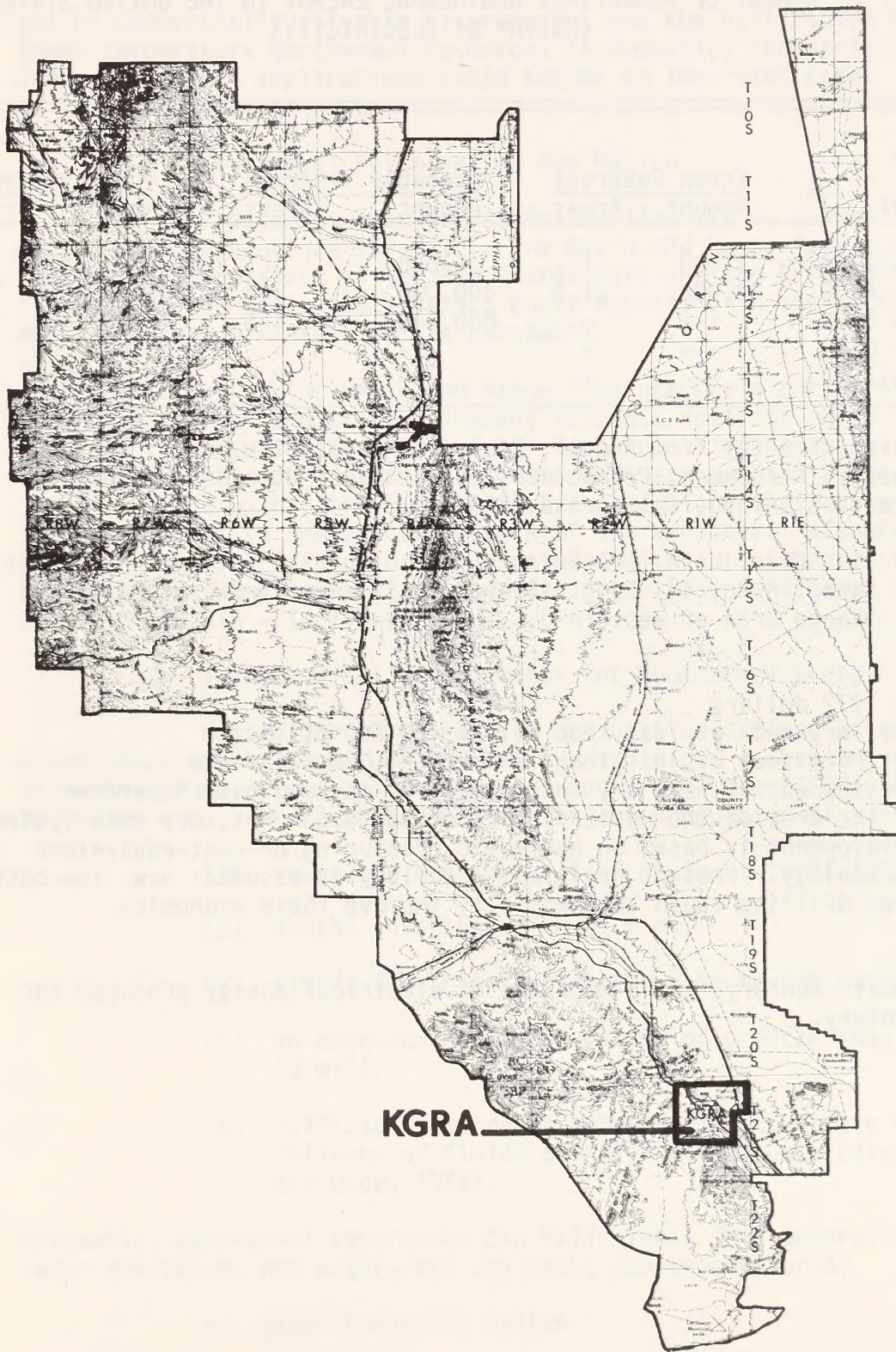


FIGURE 2 PROPOSED RADIUM SPRINGS GEOTHERMAL LEASE AREA
AND
KNOWN GEOTHERMAL RESOURCE AREA (KGRA)

TABLE 1 AMOUNT OF PRODUCIBLE GEOTHERMAL ENERGY IN THE UNITED STATES 1/
(MWCEN* of ELECTRICITY)

Energy Price (Mill/kwhr) ^a	Known Reserves		Probable Reserves		Undiscovered	
	Amount	Areas	Amount	Areas	Amount	Areas
2.90 - 3.00	1,000	1	5,000	1	10,000	1
3.00 - 4.00	30,000	1-2	400,000	1-4	2,000,000	1-5
4.00 - 5.00	---	-	600,000	1-6	12,000,000 ^b	1-7
5.00 - 8.00	---	-	---	-	20,000,000 ^c	d
8.00 -12.00	---	-	---	-	40,000,000 ^c	d

1/ Taken directly from Kruger, Paul, and Carel Otte, 1973; Geothermal Energy, Resources, Production, Stimulation; Stanford University Press, Stanford, California, 360 pgs.

Areas: 1 - Clear Lake, The Geysers; 2 - Imperial Valley; 3 - Jemez area, N.M.; 4 - Long Valley, Ca.; 5 - remainder of Basin and Range area of western U.S.; 6 - Hawaii; 7 - Alaska.

- a. In 1972 dollars
- b. Hot, dry rock at less than 6.1 km (20,000 ft) depth
- c. Hot, dry rock at less than 10.7 km (35,000 ft) depth
- d. Development of hot, dry rock energy is assumed over 5 percent of the area of the western third of the U.S. Hot, dry rock systems development is based on hydraulic fracturing or cost-equivalent technology. Present drilling technology is assumed; new, low-cost deep drilling could substantially improve these economics.

* Megawatt-century. . . a megawatt of electrical energy produced for a century.

and of commercially valuable by-products, and the utilization of lower temperature geothermal resources in domestic, industrial, and agricultural applications could become an important asset to the economy of this State.

1. Geothermal Potential in New Mexico

A major portion of New Mexico lies within the Basin and Range Geologic Province (Fig. 3). The Basin and Range Province in New Mexico is bordered by the Rio Grande Rift and the Great Plains Province on the east, the southern Rocky Mountains on the north, and the Colorado Plateau on the northwest.

Characteristics of the Basin and Range Province are a series of en échelon horsts and grabens, recent volcanic activity, high heat flow, and an anomalously thin crust. Geothermal fields are potentially associated with such features. Hot and warm springs and wells are commonly found within the Rio Grande Rift and along the western border faults adjacent to the eastern margin of the Province (Swanberg, 1975). Such thermal waters are closely associated with late Cenozoic volcanism and intrusion, and normal faulting within the Basin and Range Province (Fig. 4).

2. Technological Requirements for Geothermal Energy

Usable geothermal energy can best be defined as energy which results from anomalous thermal events (e.g., volcanism, rising of molten magma, etc.). According to Kruger and Otte (1973), the following requirements should be met for the production of electricity:

- (1) reservoir temperatures of at least 180°C (356°F);
- (2) depths less than 3 km (1.8 mi);
- (3) fluids for transferring the heat to the surface;
- (4) an adequate reservoir volume of greater than 14 km³ (3 mi³).
- (5) sufficient reservoir permeability to ensure sustained delivery of fluids to wells at adequate rates (Kruger and Otte, 1973).

Presently, geothermal reservoirs can fall within four general systems: vapor dominated, hot water, hot dry rock, and geopressured.

a. Vapor Dominated System

This system is dominated by hot, gaseous, water vapor or steam. Presently, the only commercial geothermal field in

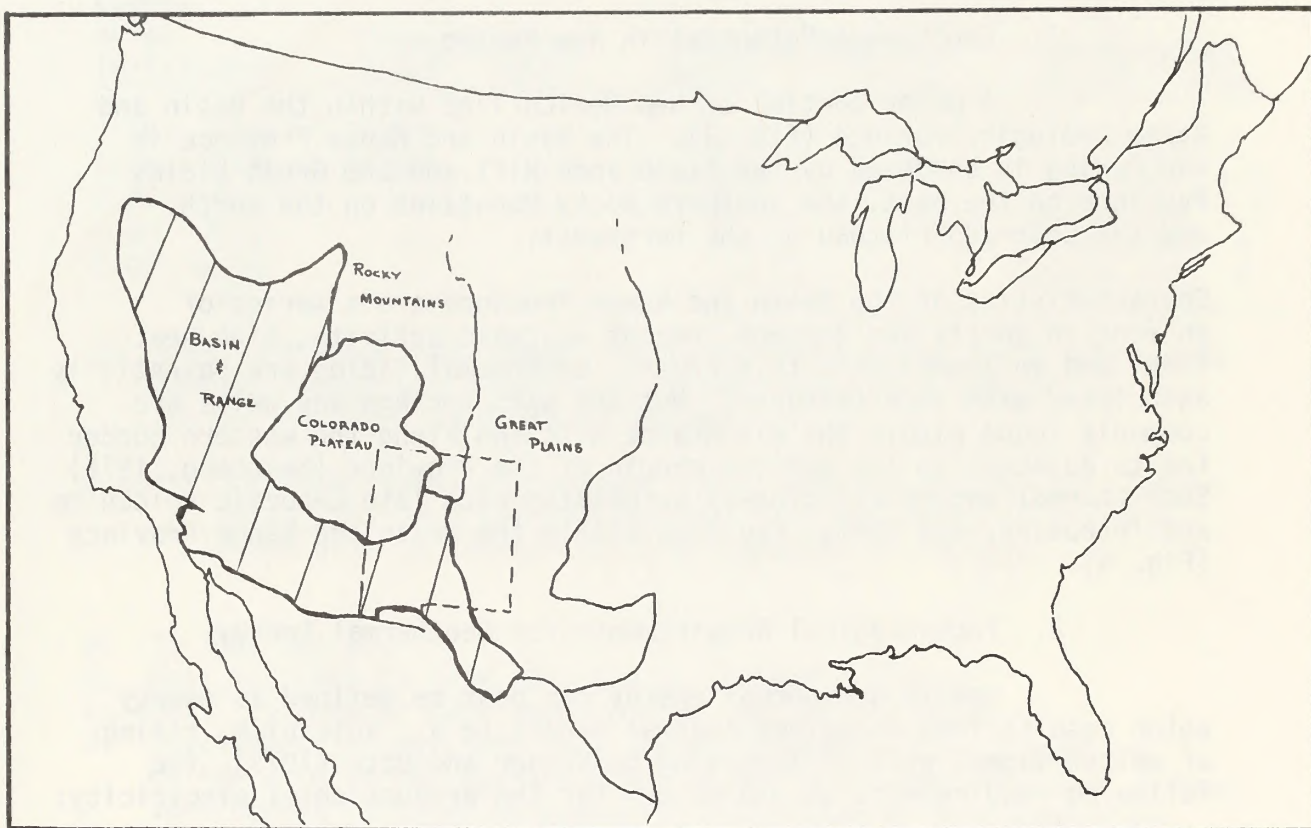
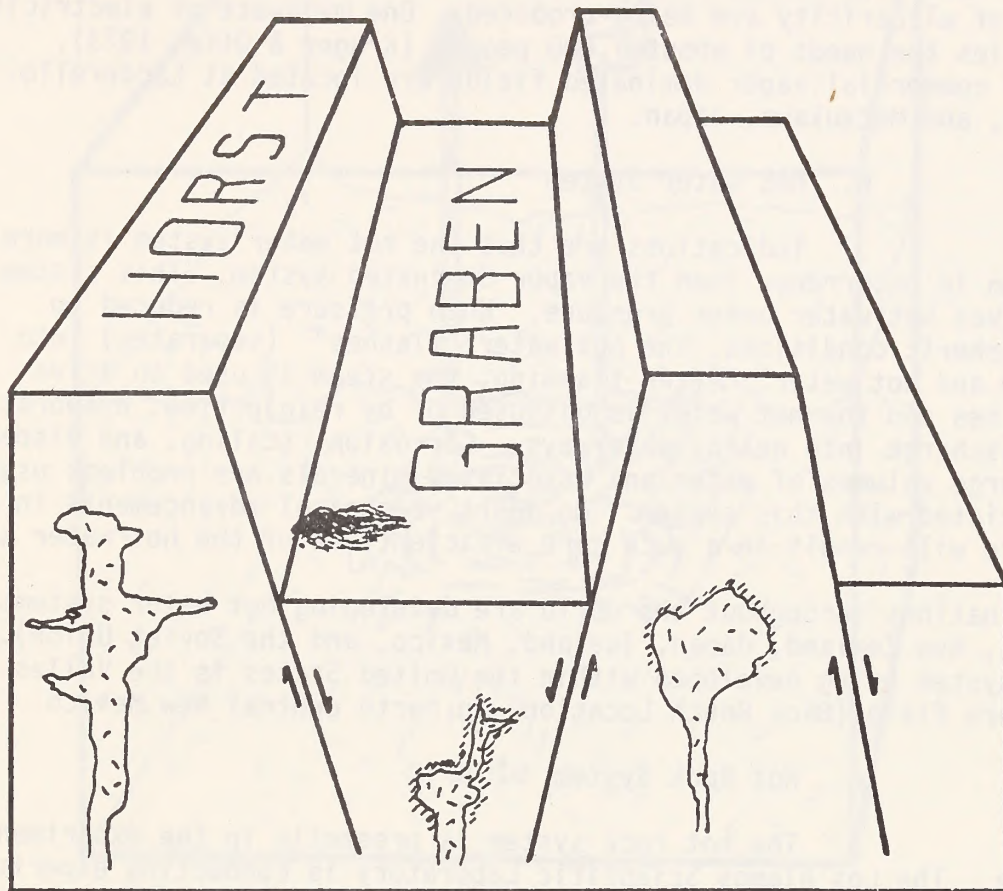


FIGURE 3 MAP OF THE UNITED STATES SHOWING RELATIONSHIP OF NEW MEXICO TO THE VARIOUS GEOLOGICAL PROVINCES







-  geothermal fluids
-  intrusions
-  volcano
-  normal fault

FIGURE 4 SCHEMATIC ILLUSTRATING RELATIONSHIP OF HORSTS AND GRABENS IN THE BASIN AND RANGE PROVINCE

the United States is a vapor dominated system located at The Geysers, approximately 130 km (80 mi) north of San Francisco, California. Production first began in 1960. The field is still undergoing development. Over 100 wells have been drilled and approximately 500 megawatts (MW) of electricity are being produced. One megawatt of electricity supplies the needs of about 1,000 people (Kruger & Otte, 1973). Other commercial vapor dominated fields are located at Larderello, Italy, and Matsukawa, Japan.

b. Hot Water System

Indications are that the hot water system is more common in occurrence than the vapor dominated system. This system involves hot water under pressure. When pressure is reduced to atmospheric conditions, the hot water "flashes" (separates) into steam and hot water. After flashing, the steam is used to drive turbines and the hot water is disposed of by reinjection, evaporation, or discharge into nearby waterways. Corrosion, scaling, and disposal of large volumes of water and associated minerals are problems usually associated with this system. No doubt, technical advancements in the future will result in a much more efficient use of the hot water system.

Many nations throughout the world are developing hot water systems (i.e., New Zealand, Japan, Iceland, Mexico, and the Soviet Union). One system being developed within the United States is the Valles Caldera Field (Baca Ranch Location) in north central New Mexico.

c. Hot Rock System

The hot rock system is presently in the experimental stage. The Los Alamos Scientific Laboratory is conducting experiments in the Valles Caldera area, New Mexico, for the Energy Research Development Administration (ERDA). The purpose of the experiment is to design a working model to determine its feasibility. In theory, the model involves drilling into hot rock; fracturing the rock; drilling a second well into the fracture; then circulating water down one well, through the hot rock, and pumping it from the second well to a generating plant to produce electricity. So far, the Los Alamos Scientific Laboratory has drilled an observation well and hydraulically fractured the hot granite at a depth where the temperature of the rock is about 250°C (482°F). They have also drilled the remaining well of this model and have achieved circulation. Future plans are to begin circulating water through a large heat exchanger to demonstrate the feasibility of this system for power generation (Fig. 5).

d. Geopressured Reservoir System

Geopressured reservoirs lie within sedimentary basins (e.g., Gulf Coast) which receive continuous accumulations of sediment.

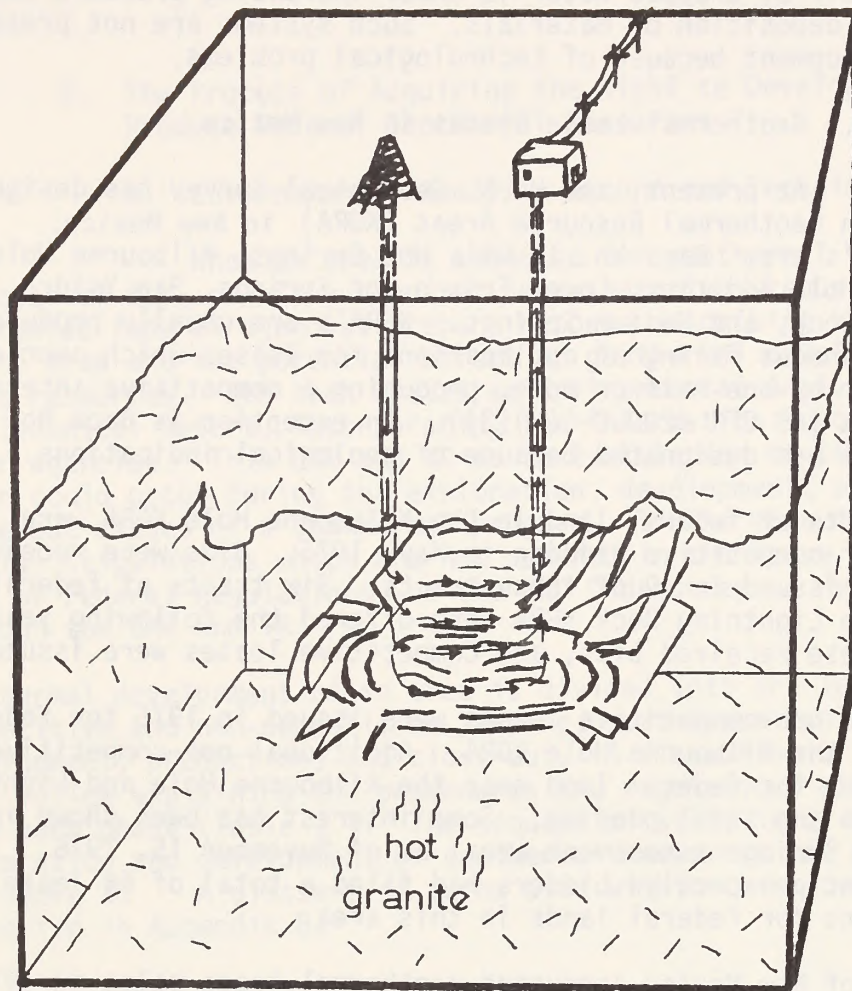


FIGURE 5 DIAGRAM OF HOT ROCK SYSTEM IN JEMEZ MOUNTAINS, NEW MEXICO

The reservoir of trapped water is under increasing pressure because of continuous deposition of materials. Such systems are not presently under development because of technological problems.

3. Geothermal Lease Status in New Mexico

At present, the U. S. Geological Survey has designated eight Known Geothermal Resource Areas (KGRA) in New Mexico. These KGRA's are: Baca No. 1, Gila Hot Springs, Kilbourne Hole, Kilbourne Hole Addition, Lower Frisco Hot Springs, San Ysidro, Lightning Dock, and Radium Springs. KGRA's are usually produced by the simultaneous filing of applications for leases which overlap one another by one-half or more, producing a competitive interest in the area (43 CFR 3200.0-5(k)(3)). An exception is Baca No. 1 KGRA, which was designated because of geological indications.

Twelve tracts of federal land in the Kilbourne Hole KGRA were offered for competitive bidding in May, 1975. Bids were received and leases issued for 9 of these tracts. Six tracts of federal land in the Lightning Dock KGRA were offered the following year. Four of these received bids, and competitive leases were issued.

Forty-seven non-competitive leases were issued in 1975 for federal lands near the Kilbourne Hole KGRA. Additional non-competitive lease applications for federal land near the Kilbourne Hole and Lightning Dock KGRA's are still pending. Some interest has been shown in the Radium Springs assessment area; as of November 15, 1976, 12 different prospective bidders had filed a total of 64 lease applications for federal lands in this area.

The State of New Mexico conducted geothermal lease sales in 1974 and 1975. Bids were received only for lands within or near indicated thermal anomalies. These lands were subsequently leased.

No information is available concerning the leasing of private lands. Many land owners are refraining from leasing to see what develops in regard to geothermal resources adjacent to their private lands.

4. The Geothermal Steam Act of 1970

The Geothermal Steam Act of 1970 provides for the orderly development of federal geothermal resources. On January 1, 1974, Title 43 of the Code of Federal Regulations (CFR) Group 3200, and Title 30, CFR, Part 270 and 271, became effective. The purpose of these regulations is to implement the Geothermal Steam Act of 1970. Since then, four Geothermal Resource Operation Orders (GRO) have been formulated and passed pursuant to 30 CFR 270.11 (Appendix A). GRO Orders 5, 6, 7, and 8 are now being prepared and will be published in the Federal Register.

5. The Process of Acquiring the Right to Develop and Produce Federal Geothermal Resources

a. Environmental Analysis Record and Technical Report

When an area is selected for geothermal leasing, the Director of BLM, or his authorized representative, requests that other interested federal agencies prepare reports describing known resources in the area and the potential effect of geothermal development on these resources. BLM then writes an Environmental Analysis Record and Technical Report, incorporating the information supplied by the other agencies. This EAR and TR is an evaluation of the impacts which could occur during the exploration, development, production, and close-out stages of a geothermal program. If the area is to be leased, special stipulations which are not covered in the lease contract, the Code of Federal Regulations, or the GRO Orders may be recommended through the EAR and TR.

Geothermal development of an area is divided into pre-lease exploration, competitive and non-competitive leasing, post-lease exploration, development, production, and close-out. A discussion of each phase will follow explaining the procedures and regulations associated with each phase (Table 2). The sequential steps involved in the exploration and development of geothermal resources are presented in Figure 6. A glossary of terms used within this document is presented in Appendix B.

b. Pre-lease Exploration

Pre-lease exploration is divided into "Casual Use" and "Exploration Operations."

(1) Casual Use

"Casual Use" as defined in 43 CFR 3209.0-5(d) means "activities that involve practices which do not ordinarily lead to any appreciable disturbance or damage to lands, resources, and improvements." The activities do not involve use of heavy equipment or explosives, and do not involve vehicular movement except over established roads and trails. Casual use does not require a permit, EAR, or TR. Casual use generally includes the following:

(a) Research

Initial research starts with a literature review. Included along with this is a study of available maps, charts, aerial photographs, and geologic publications of the selected area.

TABLE 2 STAGES OF IMPLEMENTATION, AGENCY RESPONSIBILITIES AND REGULATIONS ASSOCIATED WITH GEOTHERMAL DEVELOPMENT

Stage of Implementation	BLM Responsibilities	USGS Responsibilities	Regulations
Pre-lease Exploration	Environmental Analysis Record and Technical Examination (EAR & TE)	Input (Stipulations)	Cooperative Agreement 43 CFR 3209
Leasing	Environmental Analysis Record and Technical Report (EAR & TR)	Input Plan of Exploration	43 CFR 23.5 43 CFR 3200
Post-lease Exploration	Input	Plan of Operation Environmental Analysis (EA) Permit to Drill	43 CFR 3200 30 CFR 270-271 GRO Orders
Development	Input	Plan of Development EA Permit to Drill	43 CFR 3200 30 CFR 270-271 GRO Orders
Production	Input Permit for Powerlines, Pipelines, Power Plants and Roads	Plan of Development EA Permit to Drill	43 CFR 3200 30 CFR 270-271 GRO Orders
Close-out	Input	(Certificate of Public Convenience and Necessity from Public Utility Commission of New Mexico to construct power plant) Input	43 CFR 3200 30 CFR 270-271 GRO Orders

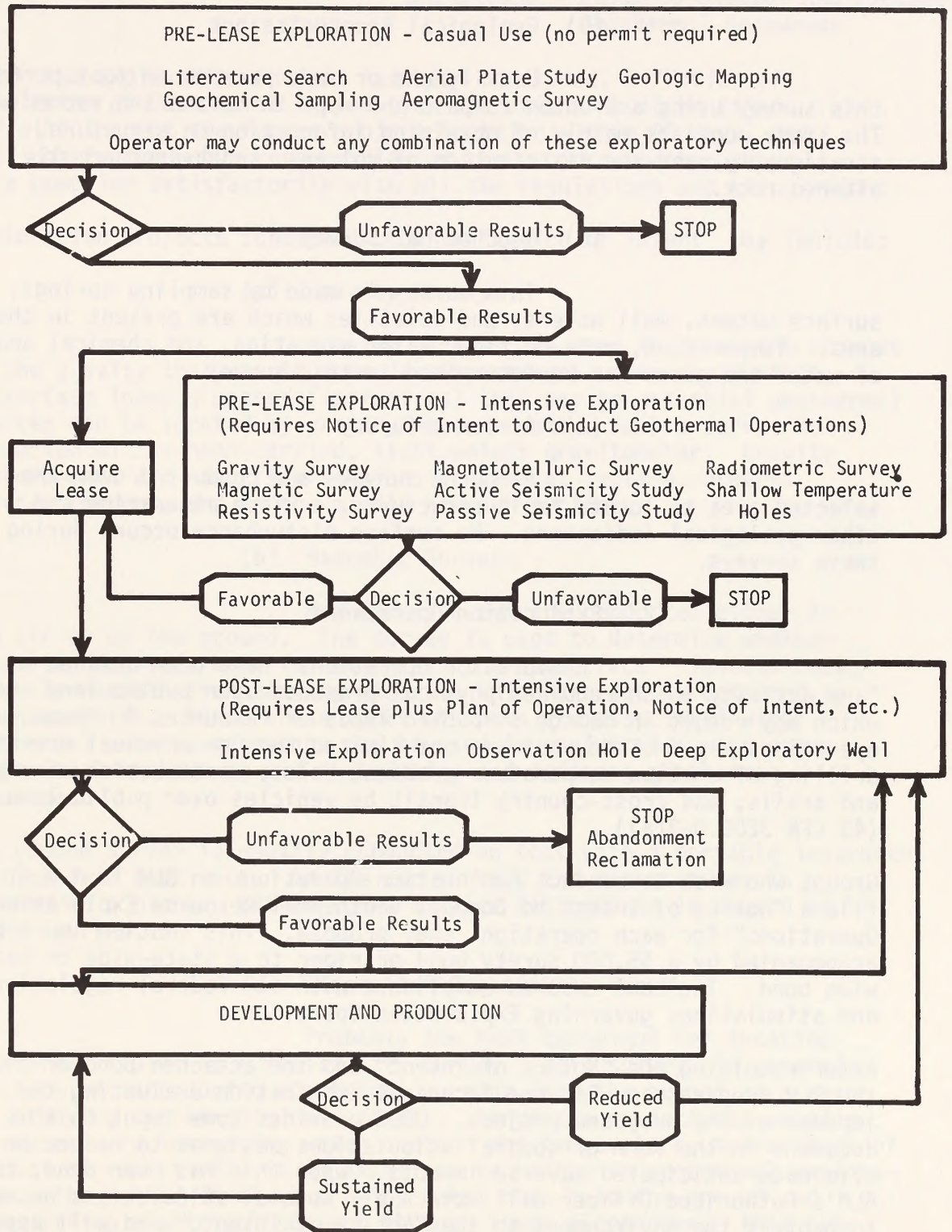


FIGURE 6 TYPICAL EXPLORATION AND DEVELOPMENT SEQUENCE

Raschen, et al., 1976

(b) Geological Reconnaissance

Usually one or more persons on foot perform this survey using a Brunton compass and maps to obtain and record data. The study consists mainly of obtaining information on structure, stratigraphy, and the distribution of volcanic and hydrothermally altered rock.

(c) Geochemical Survey

This survey is made by sampling springs, surface waters, well waters, and volatiles which are present in the area. Temperature, rate of flow, water migration, and chemical analysis of water and gases can be determined in this survey.

(d) Airborne Survey

Airborne surveys are conducted over the selected area to locate fault structures, surface alteration and other geological indicators. No surface disturbance occurs during these surveys.

(2) Exploration Operations

"Exploration Operations" have been defined as "any activity which requires physical presence upon public land and which may result in damage to public lands or resources." These operations may include, but are not limited to: geophysical operations; drilling of shallow temperature gradient holes; construction of roads and trails; and cross-country transit by vehicles over public lands (43 CFR 3209.0-3(a)).

Groups who wish to conduct Exploration Operations on BLM land must file a "Notice of Intent to Conduct Geothermal Resource Exploration Operations" for each operation they propose. This "Notice" must be accompanied by a \$5,000 surety bond or rider to a state-wide or nation-wide bond. The bond ensures compliance with all federal regulations and stipulations governing Exploration Operations.

After receiving the "Notice of Intent" and the attached bond or rider, the BLM prepares an EAR and Technical Examination evaluating the impacts of the proposed project. USGS provides some input to this document in the form of special stipulations designed to reduce or eliminate anticipated adverse impacts. When this has been done, the BLM's Authorized Officer will attach all special stipulations necessary to protect the environment to the "Notice of Intent," and will approve the proposed project in writing.

After the exploration project has been concluded, a "Notice of Completion of Geothermal Exploration Operations" must be filed. BLM will inspect the former project location within 90 days, and will notify the group responsible for the project whether they have complied satisfactorily with all the regulations and stipulations.

Exploration projects conducted under a "Notice of Intent" may include:

(a) Gravity Surveys

Gravity surveys are used to determine changes in the gravity that result from density changes under the surface. Subsurface igneous masses (intrusives) that may be potential geothermal sources can be located by gravity measurements. Such a survey is conducted with a hand-carried, light-weight gravitometer. Gravity measurements are made from stations located at section corners, quarter corners, and in the middle of each section.

(b) Magnetic Surveys

Magnetic surveys are conducted either in the air or on the ground. The survey is used to determine whether anomalous magnetic material exists in the subsurface. Igneous rocks commonly contain iron-bearing minerals which are easily detected by a magnetometer. Since these types of rocks are associated with geothermal waters, magnetics can be used in conjunction with other geophysical methods to aid in locating and defining geothermal resources.

The ground survey is usually conducted on foot with a portable instrument carried as a back pack. In the air survey, the magnetometer is mounted in a plane. Little to no surface disturbance is caused by either survey.

(c) Electrical Resistivity Survey

Probably the best technique for locating geothermal fluids is a resistivity survey. This survey, in general, consists of introducing electrical current into the ground as a means for studying the earth's resistivity. Since the resistivity usually decreases with increasing water content and temperature, measurement of electrical resistivity is an excellent technique in geothermal exploration. The method involves driving metal rods into the ground and transmitting electrical current through these electrodes. This type of survey usually necessitates vehicular movement over surface terrain. In some areas existing roads are sufficient, so minimum surface disturbance can be anticipated.

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(d) Telluric Surveys

Telluric surveys involve measuring the variations in natural electric currents in the earth. As in resistivity survey, potentiometers are placed in the ground at various locations. A two-man crew using a pick-up truck is required to conduct this survey. Surface disturbance should be minimal, depending upon the method of transporting the instruments (Raschen and Cook, 1976).

(e) Radiometric Surveys

The natural emissions from vents or hot springs may be monitored for radioactive constituents. A hand-held scintillometer is used in monitoring the waters. Existing roads and trails are used in conducting this survey, so impacts are minimal.

(f) Passive Seismic Surveys

Passive seismic surveys may detect the numerous microearthquakes and ground noises frequently associated with geothermal areas. Several small geophones are placed in the ground, each connected by cable to recorders about the size of a small suitcase. The geophones pick up seismic events and transfer the information to the recorder. The study may last two to four weeks. Usually, one to two men are required to conduct this survey. The sensitivity of the geophones may restrict the use of vehicles which generate extraneous vibrations (Raschen and Cook, 1976).

(g) Active Seismic Surveys

Active seismic surveys may be used to obtain information on subsurface geology. Vibroseis* is currently the most popular form of active seismic survey because of its reduced adverse effects on the environment (Jiracek, 1974, pers. comm.) This method involves using a truck-mounted vibrator to create seismic waves of controlled frequencies.

Dinoseis* although not as popular as Vibroseis, is also an efficient method of producing seismic waves. In this technique, an explosion confined within a truck-mounted drum forces a plate against the ground to produce the necessary vibrations. Dinoseis produced about the same minimal surface disturbance as Vibroseis.

Detonation of explosives (shot-holes) in drill holes to generate seismic energy is a technique which is not normally used by industry because of the surface disturbance and the lack of frequency control.

*Trademark

Weight drop seismics are nearly non-existent in industry. This technique uses a small, portable, heavy weight attached to a pulley on a truck. When the weight is released, the impact creates seismic energy.

(h) Shallow Temperature Gradient Holes

Drill holes involved in exploration to determine geothermal potential of an area can be used to obtain a variety of information. These shallow exploration holes are used mainly for determining temperature gradients, heat flow, lithology, and shallow geologic structures. Geothermal and geological test holes below 152 m (500 ft) to determine the presence of geothermal resources are allowed only under a lease. Drill holes of no more than 152 m (500 ft) in depth are drilled by portable, truck-mounted drills, and usually require only a short time to complete.

c. Leasing

The process of leasing federal geothermal resources is separated into competitive (43 CFR 3220) and non-competitive (43 CFR 3210) leasing.

(1) Competitive Leasing

Competitive leases are usually issued to the highest qualified bidder on designated tracts of land within a KGRA. These tracts of land are selected by surface and subsurface geological features, drill log data, chemical analysis of water, or by competitive interest in areas.

When a sale is to be conducted, notice is published weekly in a paper of general circulation for four consecutive weeks. The notice specifies time, place, bidding requirements, land descriptions, royalty, rental terms, and any special stipulations. An application, with one-half of the bonus bid, is filed pursuant to 43 CFR 3220.5(a-b). On the date, at the time and place of the competitive bid, all bids are opened and displayed. The lessor has 30 days to accept or reject the bids. When a bidder is successful, he is required to sign three copies of the lease contract, to pay the first year's rental, to pay the balance of the bonus bid, to file the required bond or bonds, and to submit a proposed "Plan of Exploration." If these requirements are accomplished in the specified time frame, a geothermal lease contract is issued. Failure to comply within the time allowed will result in rejection of the bid and any money submitted with the bid will be forfeited (43 CFR 3220.6(d-e)). If a bidder is unsuccessful, the money tendered with the bonus bid is returned to the applicant with the information about the lease sale.

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(2) Non-competitive Leasing

Non-competitive leases are issued on any available federal lands outside of a KGRA. Geothermal resources supposedly have a lower potential in these areas. Limitations concerning available lands are described in 43 CFR 3201.1-2--5; however, certain lands are, or may be, withheld from leasing (43CFR 3201.1-6).

A non-competitive lease is acquired in a manner similar to competitive leasing. An application, bond or bonds, an application fee, and a proposed "Plan of Exploration" are sent to the proper BLM office (43 CFR 3210.2-1(a-e)). No bonus bids are required on non-competitive geothermal leases. When the application is approved, three copies of the lease contract are sent to the applicant. The applicant must sign the lease contracts and return them along with the first year's rent (43 CFR 3205.3-5).

(3) Lease Terms

The "Plan of Exploration" is required by federal regulations. This plan should describe briefly the activities that will be conducted on the lands described in the application.

The "Geothermal Resource Lease Contract" (Form 3200-21) allows the federal government to lease geothermal resources and at the same time provides protection for other natural resources. Provisions within the contract require protection of the environment, antiquities, historic values, etc., in compliance with federal regulations (43 CFR, parts 3000 and 3200, and 30 CFR 270 and 271; GRO Orders, and all written or oral orders of the Geothermal Supervisor). In addition, special stipulations needed to protect unique values of a particular area may be incorporated into the lease contract and compliance becomes mandatory.

d. Post-lease Exploration

After a lease is issued, federal regulations under 30 CFR 270.34 and 43 CFR 3202.6 require that a "Plan of Operation" be filed and approved by the land management agency and the U.S. Geological Survey before any activity other than "casual use" may commence. The "Plan," accompanied by maps, will describe all exploration activities that will be conducted on the leased lands. The U. S. Geological Survey, the lead agency, studies the "Plan" and sends copies to the surface managing agency and other interested agencies for comments.

The USGS must prepare an Environmental Analysis (EA) covering the specific site of the "Plan of Operation." A discussion of the

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proposed exploration, such as gravity, resistivity, and temperature gradient surveys, may be included in the "Plan." Generally, the proposal is to drill one or more geothermal resource exploratory wells. An on-site inspection with representatives of the lessee, USGS, and the land management agency is then conducted to assess the potential impacts of the proposed operation. The "Plan" and a draft EA are presented to the Geothermal Environmental Advisory Panel (GEAP), who then advises the Area Geothermal Supervisor on the environmental aspects of the "Plan of Operation." The GEAP also recommends mitigating measures to protect the environment. The EA is completed after input is obtained from the GEAP. After considering the effects upon the environment and developing the special conditions or stipulations deemed necessary to protect the environment, the Area Geothermal Supervisor and the appropriate land management agency jointly approve the "Plan of Operation."

Upon approval of the lessee's application(s) for "Permit to Drill" (Form 9-331C), a permit, including GRO Order No. 2 and any special stipulations, is issued. The lessee then may commence only those operations authorized under the approved "Plan of Operations." The lessee's authorized operations are continuously monitored and inspected by the Area Geothermal Supervisor to ensure that the lessee complies with the applicable regulations and stipulations. Any additional exploratory operations proposed by the lessee require an additional "Plan of Operation" pursuant to 30 CFR 270.34, resulting in a procedure essentially the same as the preceding steps.

Pre-lease exploration methods have been defined previously; however, post-lease exploration uses many of these methods on a more intensive basis. For example, exploratory drilling methods, geological information holes and deep exploration wells requiring depths of more than 152 m (500 ft) may be used.

(1) Geological Information Holes

Deep exploration holes are drilled for subsurface geological information. The holes are drilled with large rigs which increase surface disturbance. Drill pads of .4 to .8 ha (1 to 2 ac) are cleared and leveled. A service road is constructed to the drill pad to provide access for men and equipment. Large volumes of drilling fluids or large air compressors are required to remove drill cuttings from the bottom of the hole. Drilling a hole takes from several days to weeks, depending upon depth and hardness of the subsurface strata. The drill holes provide subsurface geological information concerning geophysical and reservoir conditions. If fluids are encountered, chemical analysis may also provide valuable information.

(2) Exploration Wells

Deep exploration wells are drilled once exploration work has determined the probable location of geothermal resources. The drilling procedure follows that which is described under "Geological Information Holes." The deep holes are cased and cemented.

Occasionally, zones in the subsurface strata have sufficient pressure to blow drilling fluids out of the hole unexpectedly. High mud temperatures also may cause blowouts. In preparing a drill rig, a blowout preventor is installed beneath the rig floor on the surface casing. If a high pressure or high temperature zone is penetrated, the preventor will shut in the well and confine the fluids or gases.

If an exploratory well discovers a geothermal reservoir, a series of tests are made to determine flow rates, pressures, temperatures, and chemical content. The purpose of these tests, basically, is to determine whether there is potential for an economically productive well. Utility companies require a minimum of 30 years of production capacity before they will build a generation plant (Neilson, 1974, pers. comm.). The chemical analysis of the gases, steam, and water also provides an insight into possible production problems. Some noxious gases and materials that may be produced, such as ammonia, boric acid, carbon dioxide, carbon monoxide, hydrogen sulfide, mercury, and methane, could be toxic if present in sufficient quantities. The steam and water could contain other minerals, also, which would precipitate if the pressure and temperature were reduced below a certain point.

During the testing, steam and fluids will be produced at the surface and proper precautions are necessary to prevent surface pollution. After the testing is completed, the drilling rig will be removed and a "Christmas tree," a series of valves, will be attached to the casing head. The disturbed area then will be rehabilitated.

e. Development

Once a successful exploratory well is drilled, plans are made to develop the geothermal resource. A new plan, called a "Plan of Development," must be filed pursuant to the requirements of 30 CFR 270.34 and .35. No development operations will commence until the "Plan" is approved by USGS and the appropriate land managing agency. Another EA covering the activities within the "Plan of Development" is prepared by USGS. The GEAP again recommends mitigating measures for protection of the environment, which may result in additional stipulations imposed upon the lessee. The lessee then may commence only those development operations authorized by the "Plan of Development."

Again, all activities must be in compliance with the regulations and stipulations. The development of the geothermal resource requires the drilling of a number of development wells.

(1) Development Wells

The information obtained during the exploratory phase is very helpful in planning field development and well locations. Additional geophysical work may be conducted in order to gain more detailed information. Development wells are drilled and completed in basically the same manner as the exploratory wells, and require the same considerations.

The number of development wells drilled in an area will depend on a number of factors, including the type of geothermal resource (steam or hot water), temperature, capacity of the wells, and reservoir conditions.

Since the development phase is the critical time from the standpoint of environmental impacts and surface disturbance, the program may be modified as new data becomes available. For instance, if the development wells are drilled with 8 ha (20 ac) spacing, rather than 16 ha (40 ac) spacing, the surface disturbance will be greater. There will be more service roads, pipelines, surface facilities, and general activity. However, if the wells are slant drilled (directionally drilled) from central locations, the impacts will be significantly less. The capability of a company to conduct slant drilling depends on economical, technical, and geological considerations. The variability of these factors from area to area may make slant drilling impractical.

f. Production

After a sufficient number of development wells are drilled, plans are made for the most economical and feasible use of the geothermal resource. The "Plan of Development" may be revised and submitted to the USGS for approval, and no actions will proceed until the revised "Plan" is approved.

A number of procedures must be followed before production begins within a geothermal field. Prior to placing the subject wells on prolonged production, the lessee, pursuant to 30 CFR 270.34(k), must collect data concerning existing air and water quality, noise, seismic and land subsidence activities, and the ecosystem of the leased lands for at least one year prior to the submission of a "Plan of Production." Additionally, the lessee, pursuant to 30 CFR 270.76, must submit an annual report of compliance with environmental protection requirements, giving a full account of the actions taken. The use of the leased lands, or other federal

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lands, for geothermal production will be authorized only under a separate permit issued by the appropriate agency (43 CFR 3200.0-8(a)).

An EAR is a prerequisite to the issuance of a permit for the use of the leased lands or other federal lands for a power generation plant, pipeline, transmission line, or other facility. Granting of a permit pursuant to 43 CFR 3200.0-8(a) is not a license to construct a power generation plant. The construction, operation, and maintenance of a power generation plant can only be accomplished by obtaining a "Certificate of Public Convenience and Necessity." This certificate is granted by the Public Utilities Commission of the state having jurisdiction and regulatory authority over the company making application.

Stipulations are imposed at this time to protect the environment from the results of construction and operation of a power generation plant and necessary transmission lines. Provided that all the foregoing steps indicate that the construction can be accomplished within all applicable regulations and stipulations, the company can construct its power generation plant.

The production phase is a very active time in the development of a geothermal field. Pipelines, power plants, and transmission lines may be constructed if the resource is such that electricity can be produced. If the production of electricity is not feasible because of the reservoir conditions, the geothermal resource may be used for other purposes, such as greenhouses, hothouses, space heating - air conditioning, food processing, etc. These industrial uses may occur also in conjunction with electrical generating plants.

(1) Pipelines and Roads

The number of roads and pipelines, as stated previously, will be directly related to the method of field development and the intensity of the development. Usually, frequency of road use and the severity of the weather determine how elaborately the roads are constructed. Roads will be associated mainly with drill sites, pipelines, power plants, transmission lines, and other facilities.

Pipelines range in size from 25 to 75 cm (10 to 30 in) in diameter. They are constructed above ground because the extreme temperature changes can cause pipe movement by expansion and contraction. An underground pipeline within another larger pipeline is mechanically possible, but not economically feasible at this time. The length of the pipelines is limited in order to lessen the drop in water temperature and pressure. Heat loss is further reduced by insulating the outside of the pipe. Centrifugal scrubbers are attached to the pipeline to remove rock particles. Mufflers are installed at various locations within the pipeline system to reduce the noise level. The visual impact of these pipelines may be reduced by painting them to blend with the landscape.

(2) Power Plant Construction

Geothermal energy use and development is just beginning, and there appears to be almost unlimited opportunity for technological advancement. Power plant construction is probably one area that will have significant changes in the future.

At The Geysers, a power plant, cooling towers, and associated structures (parking lots, offices, etc.) occupy an area of approximately 1 to 2 ha (3 to 5 ac). The largest power plant generates approximately 110 MW of electricity. The cooling towers and transmission lines are the tallest structures in the complex. A power plant and associated wells, similar to those at The Geysers, would occupy about 256 ha (640 ac).

In the hot water system, there could be problems in utilizing and disposing of large volumes of mineralized water. If hot, mineralized water is used directly in turbines, pipelines, and cooling towers, corrosion and precipitation associated with pressure and temperature drops may result in equipment failure.

A "heat exchanger," presently in the experimental stage, is a piece of equipment designed to transfer the heat in the hot water to another media, such as Freon or iso-butane, to drive turbines. The hot water is then reinjected into the reservoir. A closed circuit system such as this eliminates or greatly reduces the problems of scaling, corrosion, disposal of gases, odors, and excess water.

(3) Transmission Lines

Conventional power lines mounted on steel or wood structures transmit the electricity to market. There is some flexibility on the routing of transmission lines and the construction technique which can reduce visual impacts.

(4) Generating Electricity

After a sufficient number of development wells have been drilled, a power plant and associated equipment are constructed. The lag time from discovery to ultimate field development is several years.

Repairs will be necessary from time to time on transmission lines, pipelines, cooling towers, buildings, generators, turbines, etc. These activities may be restricted to existing roads and trails.

The life of an average geothermal field is impossible to estimate at this time because production information is very limited. Only two

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fields have been subjected to high rates of draw-off for periods measurable in decades: the Wairakei Field in New Zealand, and the Larderello Field in Italy. At the Wairakei Field, aquifer pressures declined during the first few years (1957-1964) of production, and at the same time there was appreciable ground subsidence. By 1970, the ground subsidence and pressure drop had diminished greatly, and by 1973, there was no further net loss of mass from the aquifer. Apparently, the draw-off is being replaced by natural recharge. The production wells in Wairakei are relatively shallow in depth, approximately 1030 m (3,400 ft), and the excess hot water is not being returned to the geothermal reservoir. During the production period, the water temperature dropped, apparently due to lower pressure; however, there was no marked fall in the enthalpy of hot fluid produced from the wells. Other effects of production on the general area have been complete cessation of hot spring and geyser activity in the Wairakei Valley, and an increase in the size and number of fumaroles in a natural steam area 5 km (3 mi) away. At Larderello, Italy, studies over the last few years indicate that average source steam temperatures have increased between 30^o and 40^oC (86^o and 104^o F), while pressures have stabilized after an initial falling period (Kruger and Otte, 1973).

(5) Other Uses

Other uses of geothermal energy are diversified. At the present time, the generation of electricity appears to be the primary concern of industry and government. Generation of electricity requires reservoir temperatures of at least 180^o C (356^o F), but many of the reservoirs discovered will not meet this requirement. These lower-temperature reservoirs may be used in a variety of ways. Space heating, product processing and canning, agricultural heating, mineral recovery, air conditioning, desalinization, sugar processing, fermentation processes, freeze drying of food, production of heavy water, mineral extraction from brines, production of alumina from bauxite, gasification of coal, carbonaceous textite processing, and production of ethyl alcohol, butanol acetone, and citric acid are some of the possible uses.

A large portion of the Rio Grande Valley is presently under cultivation. Geothermal resources could enhance this industry immensely. The water may be used to irrigate additional acreage while the geothermal resource is used in various agriculturally related industries. Hothouses and greenhouses may be constructed to enhance food production. Although the growing season within the Rio Grande Valley ranges from 186 to 202 days (Maker, et al., 1971), the geothermal heat under ideal conditions should produce an environment that will increase the growing season to 365 days.

Geothermal energy can also be used in the processing of the various crops. Food processing industries require steam at 140^o C (285^o F). These industries could benefit from geothermal development.

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Waters from geothermal reservoirs may be used for a freeze-drying operation, using a standard ammonia absorption refrigeration method to freeze dry coffee, tomatoes, onions, or other vegetables (Raschen, et al., 1976).

Farmers have used natural gas or propane for crop drying; however, escalating fuel costs are causing financial problems. Geothermal steam or hot water heat may be used as a more economical source of energy for crop drying (Raschen, et al., 1976)

Radium Springs and Truth or Consequences, New Mexico are locally famous for the presence of mineral baths. The baths at 40^o to 43^o C (105^o to 110^o F) are said to cure or relieve a large number of ailments. The developments are small now, but may expand with national recognition.

The majority of geothermal systems which are presently known or that will be discovered in the future will not meet the criteria for producing electricity. Even though these systems cannot be applied to power generation, many other uses have already been developed (Table 3). Some uses for low temperature geothermal resources in the United States are listed in Table 4. Innovative uses for geothermal heat in other parts of the world are presented in Table 5.

g. Close Out

A sizable geothermal field would be abandoned gradually; in a small field, an abrupt cessation may be likely.

The exhausted production wells may be revitalized before they are plugged and abandoned. If these wells are strategically located, fluids reinjected into the reservoir through the exhausted wells may lengthen the life of the remaining field. If the wells are shut in, tests may reveal that the bottom hole temperatures and fluids have recharged after a lapse of time. Plugging and abandonment of geothermal wells must be done in accordance with GRO Order No. 3 (Appendix A).

Close out or abandonment of all or a portion of a geothermal field would take place in three phases: (1) abandonment of the subsurface; (2) removal of the surface installations; and (3) rehabilitation of the surface (30 CFR 270.45, 43 CFR 3204.1(1), and GRO Order No. 4).

The method of abandonment of equipment in the wells would depend upon several factors including the condition, age, method of installation, and the type of equipment. Federal regulations require that all casing on a geothermal well remain in the hole (GRO Order No. 4) (Appendix A). The well is properly plugged to protect the fresh water zones in the subsurface. Cement plugs are usually set at various levels, the casing

TABLE 3

TEMPERATURES REQUIRED FOR
VARIOUS GEOTHERMAL APPLICATIONS

TEMP.	APPLICATION	
°C		
200		
190		
180	Evaporation of Highly Concentrated Solutions Refrigeration by Ammonia Absorption Digestion in Paper Pulp	Temperature range of conventional power production
170	Heavy Water via H ₂ S Processing Drying of Diatomaceous Earth	
160	Drying of Fish Meal Drying of Timber	
150	Alumina Via Bayers Process	
140	Drying Farm Products at High Rates Canning of Food	Present expected temperature range for binary power plants
130	Evaporation in Sugar Refining Extraction of Salts by Evaporation and Crystallization	
120	Fresh Water by Distillation. Most Multiple Effect Evaporations, Concentration of Saline Solutions. Refrigeration by Medium Temperatures	
110	Drying and Curing of Light Aggregate Cement Slabs	
100	Drying of Organic Materials, Seaweeds, Grass, Vegetables, etc. Washing and Drying of Wool	
90	Drying of Stock Fish De-Icing Operations	
80	Space Heating Greenhouses by Space Heating	
70	Pasteurization (harmful bacteria killed at 74.4°C or 166° F) Refrigeration by Low Temperatures	
60	Animal Husbandry Greenhouses by Combined Space and Hotbed Heating	
50	Mushroom Growing Balneological Baths	
40	Soil Warming	
30	Swimming Pools, Biodegrading, Fermentating Warm Water for Year-around Mining in Cold Climates. De-Icing	
20	Hatching of Fish. Fish Farming.	

1/ Source: Raschen, Rory, and William S. Cook, 1976 Exploration and Development of Geothermal Resources, Conservation Division, Office of the Area Geothermal Supervisor, US Geological Survey, Menlo Park, California. 29 pages and 14 plates

TABLE 4

APPLICATIONS OF GEOTHERMAL ENERGY
IN THE UNITED STATES ^{1/}

Application	<u>Location</u>				
	Alaska	California	Idaho	Nevada	Oregon
<u>Present Applications</u>					
Swimming pools	x		x		
Bath houses	x				
Greenhouses	x	x	x	x	x
Space heating	x	x	x	x	x
Power generation		x			
Heating water for domestic use		x	x	x	x
Spas and recreation		x		x	
Lumber mill drying kilns		x			
Fish propagation			x		
Irrigation			x		
Animal husbandry			x		
Forest campgrounds			x		
Safe heat source for processing explosives				x	
Pasteurization					x
Industrial cleaning					x
Refrigeration					x
Coils under pavement to prevent accumulation of ice and snow					x
Tree seedling nurseries					x

^{1/} Source: Raschen, Rory and William S. Cook, 1976, Exploration and Development of Geothermal Resources, Conservation Division, Office of the Area Geothermal Supervisor, U.S. Geological Survey, Menlo Park, California, 29 pages and 14 plates.

OUTSIDE OF THE UNITED STATES 1/

Hungary

1. Greenhouses
2. Animal Husbandry
3. Space Heating
4. Crop Drying

Iceland

1. Space heating on a large scale (40% of population)
2. Hot houses for flowers and vegetables
3. Industrial utilization
4. Power generation
5. Drying of seaweeds
6. Curing cement building slabs
7. Mining of diatomaceous earth
8. Fish breeding (Salmon)

Italy

1. Power generation
2. Chemical production
3. Ore Processing

Japan

1. Space heating
2. Melting road snow
3. Sewage heat treating
4. Livestock barn heating
5. Egg hatching and poultry
6. Power generation
7. Tropical animal breeding
8. Tropical and food fish breeding, eels
9. Greenhouses
10. Sapling growing
11. Soil disinfecting
12. Heating irrigation water
13. Cooking
14. Bathing
15. Heating swimming pools and fire fighting water
16. Salt making or desalting sea water
17. Tropical

Japan (Continued)

18. Food dry
19. Mineral water and medicinal
20. Rice processing
21. Extraction of gases
22. Production of sulfuric acid
23. Brewing and Distillation
24. Raising alligators and crocodiles
25. Sinter extraction (alum)

Mexico

1. Power generation

New Zealand

1. Process heat for newsprint, pump and lumber mills
2. Space heating
3. Power generation
4. Space cooling by lithium bromide absorption unit powered with geothermal heat
5. Biodegradation of wastes from pigsties
6. Washing and drying of wool
7. Soil and bulb sterilization
8. Tree seedling nurseries
9. Cooking and sterilizing garbage feed
10. Alfalfa drying

USSR

1. Domestic hot water
2. Space heating
3. Greenhouses
4. Soil Heating (permafrost)
5. Industrial Uses
6. Mining uses
7. Dairy farming
8. Power generation (experimental)
9. Iodine recovery

1/ Ibid.

is cut off below ground surface, and a steel cap is welded over the top of the casing. A marker of the well's location may or may not be installed.

Removal of surface installations, such as buildings, roads, foundations, and equipment, will be accomplished over a period of time. Many of the installations are used at other locations or have salvage value.

Rehabilitation of the field area probably will take considerable time, depending on the topography and the size of the developed area. The obliteration of access roads will, probably, be difficult to accomplish, particularly where there are cuts and fills in rough terrain. Pits and sumps will be filled, steep areas will be sloped and contoured, and all disturbed areas may be revegetated.

6. Economic Analysis

Leasing of the area in this study would allow interested companies to investigate the geothermal potential of the area more thoroughly than they have been able to do in the past. Each interested company, not the federal government, would decide how much time and money might be invested in the area at each stage of implementation. Consequently, the economic scale of activity which may take place at any one stage of a geothermal program is uncertain.

The Bureau of Land Management can make a few general statements about the basic nature of the activities which might take place in the earliest stages of implementation. Pre-lease exploration has already taken place in the area to some extent. Operations at this stage usually consist of only a few people visiting the area for a short time. These people might be expected to spend money in hotels, restaurants, stores, bars, etc. The amount of money added to the local economy in this way would vary depending on the intensity of exploration. Post-lease exploration would similarly consist of only a few people entering the area temporarily. People conducting post-lease exploratory operations might be expected to stay in the area somewhat longer. Both will add an undetermined amount of money to the economy, primarily for services and supplies.

At any stage of operations, a company may decide to continue or abandon their efforts. Figure 6 shows a typical exploration and development sequence, including points at which a company might discontinue or abandon its efforts. If a geothermal field is ultimately developed in the proposed leasing area, the local economy will benefit from even more incidental expenditures and from capital investments.

DESCRIPTION OF THE PROPOSED ACTION

It should be remembered that the federal government does not make the decision to develop a geothermal field; interested businesses make the decision and provide the capital. The scale of development activities will probably depend on how profitable development of the field promises to be. Since uses chosen for a geothermal resource may vary depending on the quality of that resource, it is not possible to discuss even the basic economic nature of the development or production stages of implementation.

a. Market Study of the Mineral Commodity

(1) Present and Anticipated Demands

In recent years, the national demand for all forms of energy has been high. Regional demand for power in the southwest has been increasing rapidly as evidenced by the recent construction of new power plants in Arizona, Texas, and New Mexico. The transfer of industry to the southwest and the region's continued population growth both suggest that the regional demand for power of all kinds will continue to rise in the future.

Although the demand for power continues to rise, fuels traditionally used to generate that power are being depleted rapidly. Recent petroleum shortages have promoted general recognition of the limited and irreplaceable nature of our traditional fuels. As a result, efforts to develop alternate, economically feasible sources of power have increased.

The use of geothermal energy may provide one alternative to traditional power generation. Geothermal energy can be converted to electricity for regional use or used directly for its heat in the area of origination. Any practical applications of geothermal energy would help meet the demands for power and reduce the strain on our traditional power sources.

(2) Geographic Demand/Distribution

The demand for energy is nation-wide, but distribution of geothermal energy in most forms is limited by geological occurrence of the resource. Electricity is the only form in which geothermal energy may be economically distributed from its area of origin. Consequently, distribution of geothermally-produced electricity might be expected throughout the southwest, while other uses will be confined to the small local communities in the Rio Grande Valley of New Mexico.

(3) Economic Feasibility of Extraction

The potential worth of any one geothermal well can vary greatly. For example: steam which can produce 20 lbs/in² (1.4 kg/cm²)

of pressure per hour is capable of generating one kilowatt (KW) of electricity worth about 3.5 mills on today's market. A geothermal well which produces 265° C (510° F) steam is capable of providing 92,000 kg (200,000 lb) of steam per hour, or 10,000 KW of electricity. This quantity of electricity is worth 10,000 times \$.0035 or \$35. per hour. During the course of a year, continuous well operation could generate \$306,600 worth of electricity. On the other hand, many wells may cost more to develop than their resource is worth.

Extensive exploration will allow energy-related industries to evaluate the potential of a geothermal field. The economic feasibility of development and production of New Mexico fields may be determined as a result of extensive exploration and evaluation by interested industries.

(4) Alternate Sources

Alternate sources of power include coal, petroleum, natural gas, nuclear energy, solar energy, and wind. Use of coal, petroleum, and natural gas is limited by finite reserves and the basic nature of these resources. The comparative costs, advantages, and disadvantages of the alternatives remaining are beyond the scope of this document.

(5) Transportation Networks

Current energy transportation networks handle adequately the energy produced in the area today. The production of geothermal energy would require construction of additional transportation facilities including transmission lines, pipelines, and service roads.

II. DESCRIPTION OF THE EXISTING ENVIRONMENT

A. Non-living Components

1. Air

a. Air Movement Patterns

Generally, winds blow from the northwest during the winter and from the southeast and southwest during the remainder of the year. The winter winds, usually associated with cold fronts, are generally light and occasionally yield snow with wind speeds being less than 10 kph (6 mph). During late winter and early spring, the winds change direction and prevail from the southwest, averaging 12 kph (7.5 mph). The greatest yearly movement of air occurs during this period, with gusty winds of 60 to 80 kph (40 to 50 mph) causing severe dust storms. The prevailing summer and fall winds originate from the Gulf of Mexico to the southeast, with winds usually being light and variable. During this period, moderately high gusty winds may precede thunderstorms, with dust devils being a common occurrence.

Air inversions are not common, but occur occasionally in the Jornada Basin and along the Rio Grande Valley during the winter months. These inversions occur when cool air settles on lower-lying warm air. As temperatures increase during the morning, the cool air is heated and the inversion usually dissipates (Maker, et al., 1971 and 1972).

b. Temperatures

The mean annual temperatures within this geothermal assessment area vary from 15.5^o to 16.0^o C (60^o to 61^o F) depending upon the general location. Daily temperatures fluctuations of 17^o C (30^o F) are common throughout the year. Summer days are warm with temperatures usually attaining 32^o C (90^o F) while the evenings are mild with temperatures ranging from 13^o C to 20^o C (55^o F to 68^o F). Winter days are mild and sunny with highs varying from 13^o C to 19^o C (55^o F to 65^o F) while 75 percent of the evening temperatures fall below freezing. Temperatures of more than 38^o C (100^o F) in summer or less than -18^o C (0^o F) in winter are uncommon and occur in only a few instances. Tables 6, 7, 8 and 9 provide average monthly and annual temperature and precipitation data for the period of record ending in 1960.

The sun shines over 80 percent of the daylight hours annually and the average growing season is over 200 days a year in the valleys. These averages encompass basins below 1525 m (5,000 ft) elevation within the analysis area (Maker, et al. 1971 and 1972).

TABLE 6 - MONTHLY TEMPERATURES AND PRECIPITATION, NEW MEXICO STATE UNIVERSITY, DONA ANA COUNTY, NEW MEXICO
FOR PERIOD OF RECORD THROUGH 1960, EXCEPT AS INDICATED. 1/

Item	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Temperatures (°F)												
Average daily maximum	57	62	69	77	85	94	94	92	87	78	66	57
Average daily minimum	26	29	34	42	49	59	65	64	56	44	31	26
Daily mean	42	46	52	59	67	77	79	78	71	61	49	42
Extreme maximum	78	86	90	94	103	107	109	103	102	93	83	78
Extreme minimum	-8	2	12	20	27	36	42	44	30	22	5	1
Precipitation												
Average (inches)	.34	.45	.32	.20	.30	.52	1.64	1.70	1.26	.72	.49	.47
Average days 0.10 inch or more (no.)* 1	1	1	1	**	1	1	4	3	3	2	1	2
Average snowfall (inches)	.5	.4	.2	T	0	0	0	0	0	0	.4	.9

1/ Taken directly from Maker, H. J., R. E. Neher, P. H. Derr, and J. U. Anderson, 1971, Soil Associations and Land Classification for Irrigation, Dona Ana County, NMSU Agricultural Experiment Station, Research Report 183, 41 pgs.

* Period of record 1936-1965

** Less than 1/2

T Trace, less than 0.05 inch

TABLE 7 - MONTHLY TEMPERATURES AND PRECIPITATION, ELEPHANT BUTTE DAM, SIERRA COUNTY, NEW MEXICO FOR PERIOD
ENDING 1960 * 1/

Item	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Temperatures (°F)												
Average daily maximum	54	60	66	75	83	92	92	90	85	76	63	54
Average daily minimum	28	32	37	45	53	63	67	65	59	48	35	28
Mean daily	41	46	52	60	68	77	80	78	72	62	49	41
Extreme maximum	78	81	87	93	101	109	108	106	100	98	90	77
Extreme minimum	-2	-5	14	19	26	34	48	51	36	22	2	-3
Precipitation												
Average (inches)	.30	.39	.37	.39	.35	.69	1.82	2.16	1.33	.76	.36	.54
Average days 0.10 inch or more (no.)	1	1	1	1	1	2	4	4	3	2	1	1
Average snowfall (inches)	1.1	0.4	0	T**	T	0	0	0	0	T	0.2	2.1

1/ Taken directly from Maker, H. J., J. M. Downs and J. U. Anderson, 1972, Soil Association and Land Classification for Irrigation, Sierra County, NMSU Agricultural Experiment Station, Research Report 233, 56 pgs.

* Period of record: Temperatures, 63 years; average precipitation, 76 years; average snowfall, 52 years; average days with 0.10 or more, 30 years.

**T = trace, less than 0.05 inch.

TABLE 8 - ANNUAL AVERAGES OF SELECTED CLIMATOLOGICAL DATA, DONA ANA COUNTY, NEW MEXICO, FOR THE PERIOD OF RECORD THROUGH 1960 ^{1/}

Station	Elevation	Temperature		Precipitation Mean Annual	Yrs. of Record	Last 32°F or Lower in Spring	First 32°F or Lower in Fall	Time Between Dates
		Maximum	Minimum					
	feet	F°	F°	in.	no.	- - average date	- -	days
Hatch	4,402	78	42	8.96	30	April 10	Oct. 24	197
Jornada Experiment Range	4,265	76	41	8.91	47	April 22	Oct. 25	186
State University	3,881	76	44	8.41	103	April 9	Oct. 28	202
Afton (5 mi. ESE)	4,200			7.10	18			

^{1/} Taken directly from Maker, H. J., R. E. Neher, P. H. Derr and J. W. Anderson, 1971, Soil Associations and Land Classification for Irrigation, Dona Ana County, NMSU Agricultural Experiment Station, Research Report 183, 41 pgs.

TABLE 9 - ANNUAL AVERAGES OF SELECTED CLIMATOLOGICAL DATA, SIERRA COUNTY, NEW MEXICO, FOR THE PERIOD OF RECORD THROUGH 1960 ^{1/}

Station	Elevation	Temperature		Precipitation Mean Annual	Yrs. of Record	number	inches	number	- - average date	Last 32°F or Lower in Spring	First 32°F or Lower in Fall	Time Between Dates
		Mean Maximum	Mean Minimum									
	feet	F°	F°									days
Aleman Ranch	4,550	76	41	7.85	5	15	April 18	Oct. 28	192			
Caballo Dam	4,190	77	45	8.32	24	24	April 4	Nov. 5	215			
Elephant Butte Dam	4,576	74	47	9.46	63	76	Mar. 29	Nov. 12	228			
Hillsboro	5,270	73	43	11.53	18	56	April 16	Oct. 29	196			
Truth or Consequences Airport	4,820	74	46	7.26	10	11	April 3	Nov. 6	217			
Winston	6,200	71	35	12.17	11	30	May 14	Oct. 12	151			

^{1/} Taken directly from Maker, H. J., J. M. Downs, and J. U. Anderson, 1972, Soil Associations and Land Classification for Irrigation, Sierra County, NMSU Agricultural Experiment Station, Research Report 233, 56 pgs.

c. Particulate Matter

Most of the particulate matter suspended over the assessment area is caused by gusty winds acting upon unpaved roads and land bared for agricultural or construction purposes. Within the past few years, three monitoring sites maintained by the New Mexico State Environmental Protection Agency at Truth or Consequences, Hatch and Las Cruces, New Mexico, have each yielded levels below the National Ambient Air Quality Standards for particulate matter. The highest seasonal concentrations, areawide, are during the spring months and are primarily caused by gusty winds. The lowest concentrations, areawide, are during the rainy summer months. The highest localized concentrations of particulate matter are in the Las Cruces area where, incidentally, monitor records have shown a marked decrease since 1970. According to the Environmental Improvement Agency, this decrease is probably due to changing weather trends (Wohlenberg, 1976a). Results from the Hatch and Truth or Consequences monitors over the past few years are fairly equal and show a stable trend well below national standards.

d. Carbon Monoxide

Two monitoring stations with the capacity for sampling carbon monoxide (CO) have been set up and maintained in Las Cruces by the State Environmental Improvement Agency. Both monitors have registered CO levels in excess of the accepted National Ambient Air Quality Standard of 9.0 ppm according to evidence presented at a court hearing held by the New Mexico Environmental Improvement Board in 1974. In 1973, concentrations had been recorded in excess of 16.0 ppm. The major source of CO areawide is motor vehicle related, and high concentrations in the immediate vicinity of Las Cruces are considered to be a localized problem. According to testimony presented at the aforementioned hearing, this problem is expected to persist and increase in the future. No data is known to be available for the remainder of the geothermal assessment area regarding CO concentration levels.

e. Photochemical Oxidants

Photochemical oxidants (ozone, O₃) are formed by the complex interaction of hydrocarbons and nitrogen oxides in the atmosphere under the presence of sunlight. Annual hydrocarbon emission levels recorded for Dona Ana and Sierra Counties are 6,908 metric tons, (7,591 short tons) and 1,178 metric tons (1294 short tons), respectively. Both levels are within the National Ambient Air Quality Standards. No data is known to be available for nitrogen oxide concentrations within the geothermal assessment area. Photochemical oxidant levels have been monitored for Dona Ana County; these levels do not exceed

the national standard of .08 ppm. Persistence and areal extent of the above concentrations are contingent upon seasonal wind patterns and air inversion durations. Industry in the El Paso, Texas and Juarez, Mexico, area is a primary source of hydrocarbon emissions and smog concentrations originating in that area. The effects of these emissions on the assessment area have not been fully determined and are dependent upon varying atmospheric conditions (Lockie, 1976).

f. Sulfur Oxides

Records of sulfur dioxide (SO₂) concentrations are available only for southeast Dona Ana County. Transportation emissions are the major source of SO₂, but national standards have not been exceeded (Wohlenberg, 1976b).

g. Radiological Contaminants

No known man-caused sources of radiological contaminants which might degrade air quality are believed to exist within the assessment area.

h. Non-ionizing Radiation

A significant number of radio transmitters and high voltage electric transmission lines exist within the assessment area. At this time, no problems in air quality are believed to exist from non-ionizing radiation.

2. Land

a. Soils

Over thirty different soil associations cover lands within the assessment area. Three associations have been selected for discussion in this section. Factors determining the selections were diversity of characteristics, importance to man, their relatively large areal extent over the assessment area, and the probability of exploration and leasing occurring on them. The three soil associations selected are: the Gila-Glendale-Vinton; Berino-Pintura, and Rough Broken Land-Caliza-Vado.

(1) Soil Depth

Extremes in soil depths throughout the assessment area range from 0 to 150 cm (0 to 60 in). The Gila-Glendale-Vinton association varies from 6 to 15 cm (2.5 to 6 in) in depth. Rough Broken Land-Calizo-Vado varies from 2.5 to 10 cm (1 to 4 in) and

along with the Berino-Pintura association, is confined mostly to the broad basins (Maker, et al., 1971 and 1972). The texture of Berino-Pintura association is considered fine loamy sand to sandy clay loam with a maximum particle size less than 2 mm (.08 in) and an unknown minimum size. The average water holding capacity (AWHC) is 6.4 to 15.2 cm (2.5 to 6 in) per hour. This soil type has a good bearing capacity under compaction and a low to moderate shrink-swell potential (Maker, et al., 1972).

The Rough Broken Land-Caliza-Vado soil association varies from loamy sand to very gravelly sandy loam with most particles being less than 5 mm (.2 in) and greater than .05 mm (.02 in) in size. The permeability varies from 5 to over 16 cm (2 to over 6.3 in) per hour with an AWHC of 2.5 to 8.2 cm (1 to 3.5 in) for this soil association. This soil type has a low shrink-swell potential and a good bearing capacity under compaction.

The Gila-Glendale-Vinton soil association is basically a clay loam to sandy loam with particle sizes ranging from less than 2 mm (.08 in) to greater than .025 mm (.01 in). Its permeability, based on porosity, is .12 to 16 cm (.05 to 6.3 in) per hour and it has a low to high shrink-swell potential. The AWHC is 8.0 to 20.3 cm (3 to 8 in) of depth and it has a fair to good bearing capacity under compaction.

(2) Soil Nutrient Properties

The Gila-Glendale-Vinton soil association is well suited for cropland under irrigation and is utilized for this purpose over the major portion of its coverage. The Rough Broken Land-Caliza-Vado association is mostly (76 percent) unsuitable for cropland under irrigation due to unfavorable soil properties and topographic conditions. The Berino-Pintura soil association requires an above normal amount of conditioning and soil modification in preparation for irrigation (Maker, et al., 1971 and 1972).

(3) Soil Pollutant Properties

Man-caused pollutants on lands within the assessment area are relatively non-existent. Natural pollutants in the form of various salts are negligible throughout most of the assessment area, although the high salinity levels of some valley soils causes localized problems.

(4) Soil Erosion

Running water and wind are the two major causes of erosion within the assessment area. Flash floods and sheet wash

DESCRIPTION OF THE EXISTING ENVIRONMENT

mostly, occur during the summer rainy season. This type of erosion moves relatively large amount of soil over a short time period, forming gullies or rills. Gusty winds and dust devils also have a significant erosional effect on the barren or sparsely vegetated lands which predominate throughout the assessment area. Wind erosion results in a relatively small amount of material being moved over longer periods of time.

The Gila-Glendale-Vinton soil association occurs mostly on flat, lower-lying land. Its primary uses are as irrigated farmland and for urban developments. Protection is necessary to prevent erosion caused by runoff from adjacent lands with higher elevations.

The Rough Broken Land-Caliza-Vado soil association covers moderately to steeply sloping lands dissected by many intermittent stream channels. These creosotebush dominated lands are used mostly as range. Flash flooding and sheetwashing erosion are active over much of this area due to the sparse vegetation and the topography.

The Berino-Pintura association is comprised mostly of sandy soils occurring on gently sloping undulating or dune landscapes. Grazing is the primary use on these mesquite dominated lands. Wind erosion is extensive, forming coppice or mesquite dunes.

Erosion susceptibility will vary from one soil type to another and within a type, depending upon existing vegetative cover, slope, and land use.

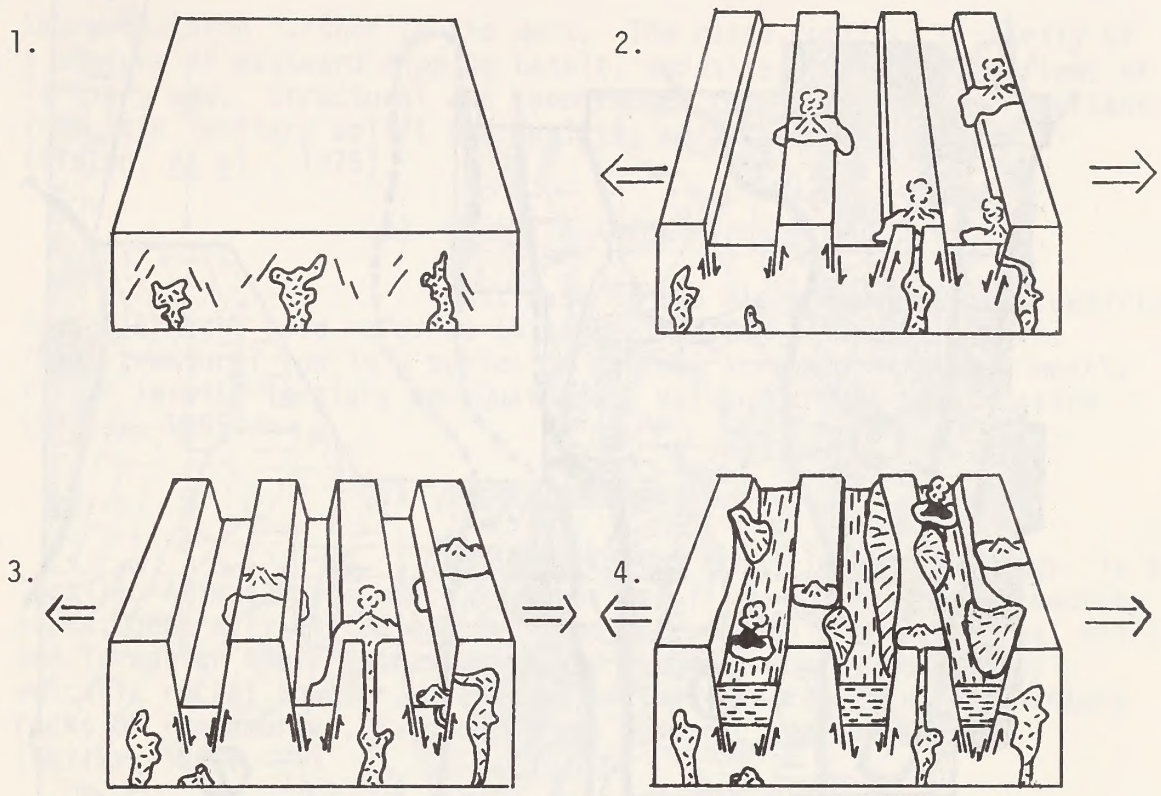
(5) Geological Structure

The Radium Springs assessment area is located in the Rio Grande sector of the Mexican Highlands in the Basin and Range Geological Province. The general setting is north-south oriented chains of uplifted mountains (horsts) alternating with downdropped valleys (grabens). The generalized structural evolution of Basin and Range topography is diagrammatically and historically explained in Figure 7.

The assessment area can be divided into nine subprovinces, usually delineated by topographic relief caused by vertical faulting at the boundaries between these units (Figure 8). A brief geologic description follows for each subprovince from west to east.

(a) The Black Range Uplift

The portion of the Black Range uplift within the assessment area is mostly composed of the outflow facies from the








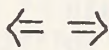
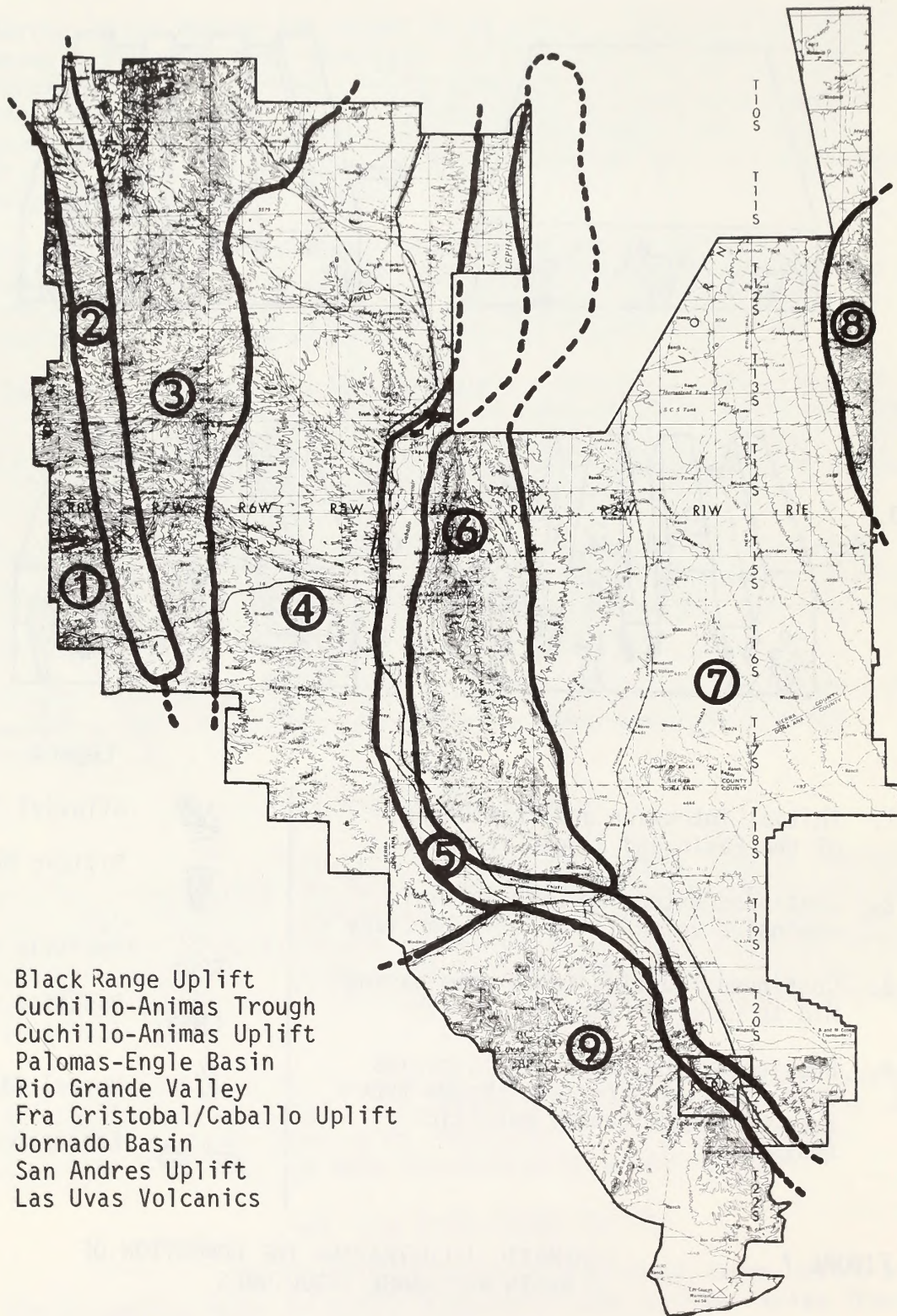
- | | |
|--|---|
| | Legend |
| 1. Initial intrusion and fracturing of the Basin and Range Cretaceous. |  Alluvial fill |
| 2. Continued extension with initial explosive volcanism - Early Tertiary |  Silicic Magma |
| 3. Continued faulting forms deep basins Mid to Late Tertiary |  Rhyolitic volcanoes |
| 4. Erosion of the ranges fills basins with alluvial material. Magma type becomes predominantly basaltic Quaternary |  Basaltic volcanoes |
| |  Normal faults |
| |  Extensional Forces |

FIGURE 7 SCHEMATIC ILLUSTRATING THE FORMATION OF BASIN AND RANGE STRUCTURES



1. Black Range Uplift
2. Cuchillo-Animas Trough
3. Cuchillo-Animas Uplift
4. Palomas-Engle Basin
5. Rio Grande Valley
6. Fra Cristobal/Caballo Uplift
7. Jornada Basin
8. San Andres Uplift
9. Las Uvas Volcanics

FIGURE 8

GENERALIZED PHYSIOGRAPHIC SUBPROVINCES

Emory cauldron further to the west. The range consists primarily of a mixture of eastward dipping basalt, andesite, and rhyolite flows of Tertiary age. Structural and topographic relief are mostly resultant from late Tertiary uplift and faulting and subsequent erosion (Elston, et al., 1975).

(b) Cuchillo-Animas Trough

Just east of the Black Range is the Cuchillo-Animas trough, also referred to as the Winston-Hillsboro graben. This structural low is a series of narrow, irregular grabens, mostly filled in with Tertiary and Quaternary volcanic rocks and clastics (Kelley, 1955).

(c) Cuchillo-Animas Range

Adjacent to the Cuchillo-Animas trough is the Cuchillo-Animas Range which is a series of low uplifts of sedimentary rocks, generally tilted eastward and intruded by numerous dikes, sills, and irregular small intrusions. The range is mostly covered by volcanic rocks; however, along the western faulted edge, sedimentary rocks of Precambrian, Paleozoic, and Mesozoic age are exposed (Kelley, 1955).

(d) Rio Grande Graben - Palomas- Engle Basin

Just east of the Cuchillo-Animas uplift is the Rio Grande depression or graben, which includes the Palomas-Engle Basin as well as the narrow Rio Grande Valley itself (discussed below). The Palomas Basin is separated from the Engle Basin by the northwest trending Mud Springs uplift at the northern end of the Caballo Range. Valley fill in the Palomas-Engle area varies from approximately 610 to 1830 m (2,000 to 6,000 ft) throughout the assessment area. The late Tertiary and Quaternary valley fill slopes eastward to the Rio Grande and is erosionally incised by 12 principal streams and numerous other cuts and rills.

(e) The Rio Grande Valley

The Rio Grande Valley follows the great intermontane rift of the same name past the western flank of the Caballo Range, eastward through the Rincon Valley near Hatch, and then southeast along the eastern flank of the Las Uvas Volcanics (Kelley, 1955).

(f) The Fra Cristobal-Caballo Uplift

The Fra Cristobal-Caballo uplift is a north-south trending range separated by the Cutter Sag. This uplift is composed of Precambrian to Cenozoic sedimentary rocks with eastward tilted beds terminated on the west by the vertical Hot Springs and Caballo faults (Kelley and Silver, 1952).

(g) The Jornada del Muerto Basin

The Jornada del Muerto Basin to the east is a broad synclinal downwarp, and not a graben, or downdropped block, as the general physiographic region might imply. It is bound on the west by the Caballo Mountains and on the east by the San Andres Mountains. Valley fill in the Jornada is generally thin, but it is thicker in the eastern half of the basin (Kelley, 1955).

(h) San Andres Range

The arcuate portion of the San Andres Range within the assessment area consists mostly of outwash erosional fans with some westward tilted strata.

(i) The Las Uvas Volcanics

The Las Uvas Volcanics, mostly of Tertiary age, dominate the southern portion of the assessment area. Tertiary folding, faulting, uplifting, and subsequent erosion are the factors responsible for today's topography. Although igneous rock of rhyolitic, andesitic, and basaltic composition cap most of the area, some scattered outcrops of older, Paleozoic and Mesozoic sedimentary rocks do occur.

Sedimentary rock units throughout the assessment area are fairly consistent. Allowing for some variations in bed thicknesses and discrepancies due to erosion and volcanism, the stratigraphic table of the Caballo Mountains (Table 10) is a fair representation of these rock units.

(6) Land Use Suitability

Land use suitability is the appropriateness of the relationship between human land use and the natural environment. Human land use is usually determined by such characteristics as availability. Major land uses within the assessment area include ranching, urban and rural development, mining, recreation, and

TABLE 10

STRATIGRAPHIC TABLE OF THE CABALLO MOUNTAINS AREA ^{1/}

Age	Stratigraphic Units	Thickness (feet)	
Quaternary	Valley fill and pediment gravel	0 - 500	
Tertiary	Santa Fe Formation	2,000 +	
	Thurman formation	2,000 - 2,500	
	Palm Park formation	1,000 +	
	McRae formation	3,000 +	
Cretaceous	Mesaverde formation	2,500 +	
	Mancos shale	400 - 500	
	Dakota sandstone	125 - 250	
Permian	Manzano group		
	San Andres formation	700 - 1,000	
	Yeso formation	200 - 1,200	
	Abo formation	500 - 900	
Pennsylvanian	Magdalena group		
	Bar B formation	335 +	
	Nakaye formation	420 +	
	Red House formation	360 +	
Mississippian	Lake Valley formation		
	Nunn member	0 - 13	
	Alamogordo member	0 - 36	
Devonian	Percha formation	0 - 105	
Silurian	Fusselman dolomite	0 - 50	
Ordovician	Montoya group		
	Cutter formation	0 - 162	
	Aleman formation	0 - 170	
	Upham dolomite	20 - 80	
	Cable Canyon sandstone	0 - 35	
	El Paso Group		
	Bat Cave formation	216 - 305	
	Sierrite limestone	127 - 167	
	Cambrian	Bliss formation	110 - 160
	Precambrian	Granite, gneiss, and shist	
Total (maximum) thickness of sedimentary rocks		17,248	

^{1/} Taken directly from Geology of the Caballo Mountains, Kelley, V.C., and C. Silver. University of New Mexico Publications in Geology, Number 4, 1952, p. 31.

DESCRIPTION OF THE EXISTING ENVIRONMENT

rights of way. In most cases, these uses represent a suitable use of the land. Farming, urban development, and Elephant Butte and Caballo Lakes are located in the Rio Grande Valley, while the mesas are used for rural development, ranching, and rights-of-way. Most mining takes place in the mountainous areas.

3. Water

a. Hydrologic Cycle

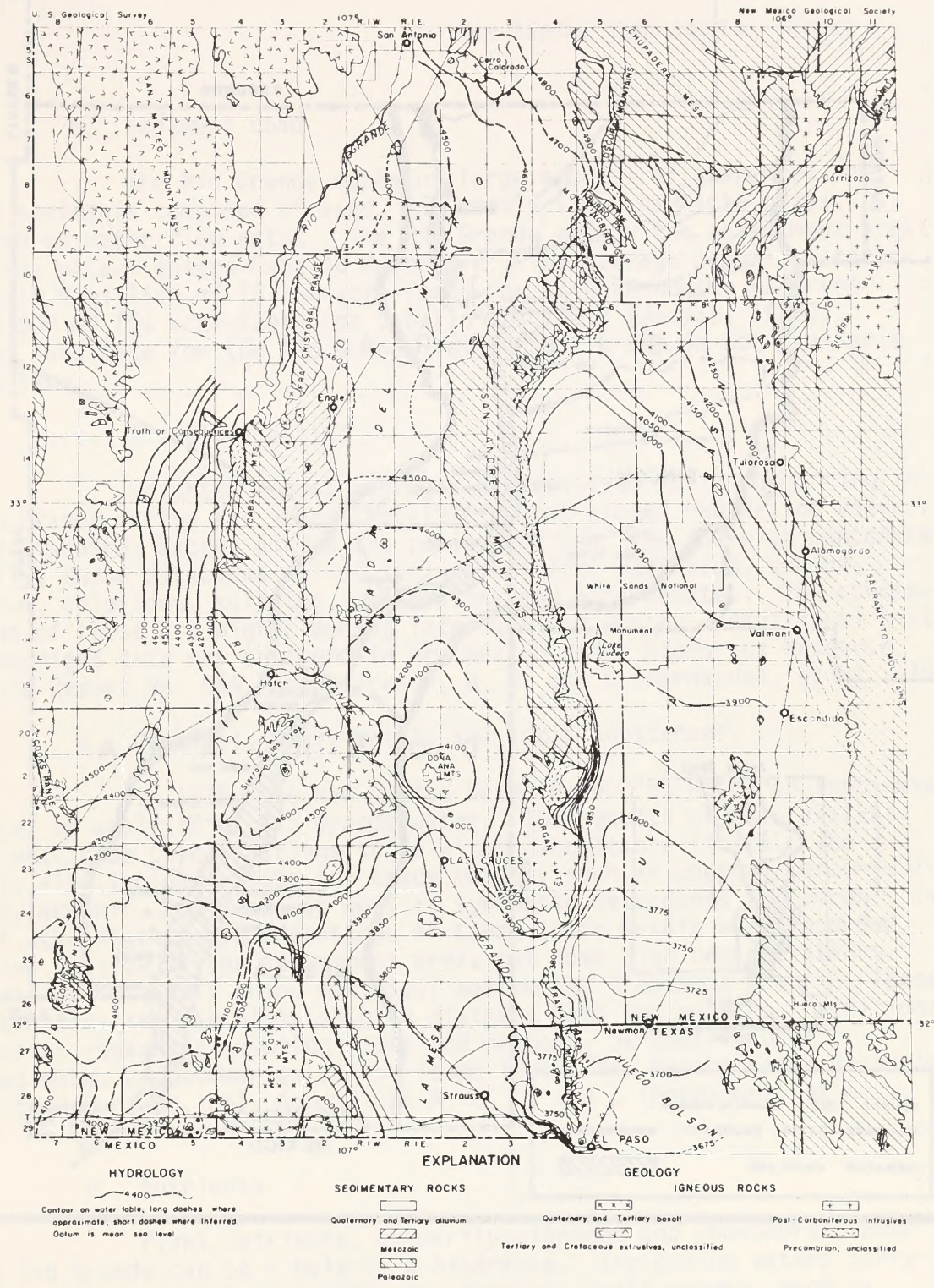
Water in the assessment area is derived from three major sources, the Rio Grande, ground water, and precipitation.

The sole source of perennial surface water is provided by the Rio Grande and the two reservoirs, Elephant Butte and Caballo, with all other streams in the assessment area being intermittent. The average annual runoff fed into both reservoirs is 1.15 billion m³ (923,000 acre-feet) while the average annual storage release approaches 975 million m³ (790,000 acre-feet). The annual evaporation rate ranges from 280 to 306 cm (110 to 120 in), reaching a peak rate in June and a low in December (Jarvis, 1975).

Great quantities of ground water are stored within the Rio Grande Rift Basin and the Jornada del Muerto Basin. Fresh and slightly saline water stored in the Jornada ground water basin is estimated to be 136 billion m³ (110 million acre-feet). In addition, it is assumed that twice this amount of saline water is stored within this area (Grant, 1975).

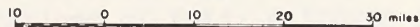
Originally, ground water in the Rio Grande aquifer system discharged into the river; however, this has been reversed due to irrigation wells lowering the water table. Sedimentation has raised the elevation of the river floodway making storage estimates of ground water difficult (Bureau of Reclamation, 1975). Depth to water table varies from less than 3 m (10 ft) near the Rio Grande to over 152 m (500 ft) near the mountains to the east and west (Jarvis, 1975). For additional ground water depth data and basin drainage information, refer to Figures 9 and 10.

The annual precipitation for this area averages 18-23 cm (7-10 in) in the basins and 27-31 cm (11-12 in) in the mountainous areas. Nearly 75 percent of this precipitation occurs from May through October, usually in the form of brief, high intensity thunderstorms. Monthly precipitation data and annual averages of selected climatological data for Dona Ana and Sierra Counties can be found in Maker, et al., 1971 and 1972.



GENERALIZED GEOLOGY AND APPROXIMATE ALTITUDE OF THE WATER TABLE IN SOUTH-CENTRAL NEW MEXICO 1955

FIGURE 9



Geology after Darton (1928)

Source: Conover, C. S., et al., 1955.

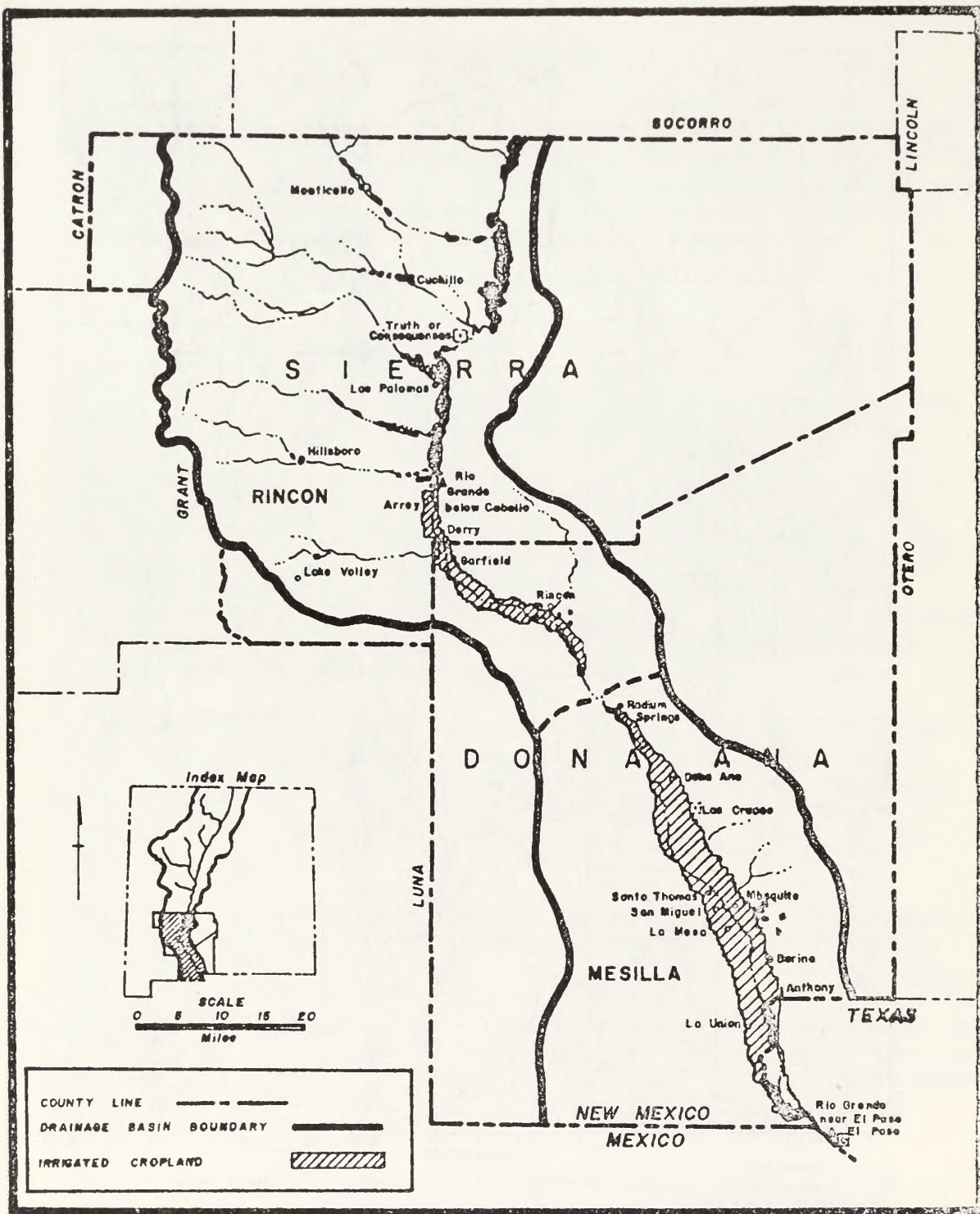


FIGURE 10 MAP OF DRAINAGE BASIN BOUNDARIES OF THE LOWER RIO GRANDE REGION IN NEW MEXICO

Source: Lansford, et al., 1974.

b. Sediment Load

The Rio Grande contains large amounts of suspended and bedload sediments composed of sand, but mostly finer particle sizes, depending on water flow rates. The Rio Grande enters the assessment area before the water enters Caballo Reservoir. The average annual siltation rate is 10.8 million m³ (8,756 acre-feet) for Elephant butte Reservoir and 116,000 m³ (94 acre-feet) for Caballo Reservoir (Jarvis, 1975). Sediment load data for the Rio Grande below Caballo Dam is not available at this time.

c. Dissolved Solids

Weighted annual averages of dissolved solids occurring in the Rio Grande during the years 1955-1970 do not exceed New Mexico Water Quality Standards except during the periods of low flow and high concentrations. Generally, these dissolved solids include calcium, magnesium, sodium, potassium, chlorides, sulfates, carbonates, and bicarbonates. The concentrations of these are higher during late fall and winter. Additional historic and summarized data may be found in New Mexico Water Resources Research Institute Report No. 064, Appendices A, B, C, and D (Hernandez, et al., 1976).

d. Chemical, Heavy Metals and Toxic Substances.

In 1975, the New Mexico Water Resources Research Institute conducted an analysis of Rio Grande water. The results of this analysis showed pesticide concentrations to be within acceptable limits. The analysis also included tests for trace metals, such as copper, mercury, zinc, cadmium, arsenic, and lead, as well as synthetic detergents and boron. In general, the highest concentrations of these trace metals were recorded south and outside of the assessment area, but some high concentrations were noted immediately below municipal wastewater treatment plants. These concentrations tend to diminish with distance from the sources. Additional information regarding sampling sites and methods, parameter, past recorded data, and summaries can be found in the New Mexico Water Resources Institute Report No. 064, Appendices A, B, C, and D (Hernandez, et al., 1976).

e. Nutrients

Plant nutrients, primarily nitrogen and phosphorus found in the Rio Grande can be a help or a hindrance. Irrigation waters carrying these nutrients can aid croplands; however, still waters, such as backwater on the river and both reservoirs, can yield excessive algal blooms and weed growths. Concentrations of total nitrogen appear higher in summer and lower in winter, while seasonal levels of phosphorus showed no discernible pattern. Additional information can be found by referring to New Mexico Water Resources Research Institute Report No. 064, Appendices A, B, C, and D (Hernandez, et al., 1976).

DESCRIPTION OF THE EXISTING ENVIRONMENT

f. Solid Debris

No data regarding solid debris is known to be available.

g. Coliform Contamination

The study of coliform and fecal coliform counts over that portion of the Rio Grande and its canal system within the geothermal assessment area leads to several conclusions. The Water Resources Research Institute at New Mexico State University conducted studies which indicate that coliform and fecal coliform counts increase and decrease together in most cases. These studies have also shown that during periods of high runoff, bacterial levels increased; and during dry weather, the levels decreased. Coliform and fecal coliform counts increased downstream and were particularly high just below sewage treatment plants and in irrigation canals at the lower end of the Rio Grande in southern New Mexico. Additional information regarding coliform and fecal coliform can be obtained in the New Mexico Water Resources Research Institute Report No. 064, Appendices A, B, C, and D (Hernandez, et al., 1976).

h. Temperature and Acid Balance

The pH symbol is an expression of the degree of acidity or alkalinity of a solution. On the pH scale (0 to 14), the values for acid solutions range from 0 to 7, alkaline or basic values range from 7 to 14, and 7 is considered neutral.

The pH value of the Rio Grande throughout the assessment area is generally alkaline. Recorded values at various sampling sites tend to show a decrease of pH just below sewage treatment plants (Hernandez, et al., 1976). Temperature data for river water in the analysis area is unavailable at this time; however, river water temperatures north of the assessment area vary from 0 to 35° C (32 to 95° F) (Bureau of Reclamation, 1975).

Ground water throughout the assessment area also has been found to have a high pH. The Sodium-Potassium-Calcium (Na-K-Ca) geothermometer shows temperature estimates in excess of 200° C (over 390° F) for thermal waters in the Radium Springs area. Temperatures vary depending on mixing of thermal and other ground waters.

i. Biochemical Oxygen Demand

Throughout the assessment area, biochemical oxygen demand (BOD) was consistently higher just below sewage treatment plants and studies have shown a higher demand trend during periods of runoff than during dryer periods. Refer to New Mexico Water Resources Research Institute Report No. 064, Appendices A, B, C, and D (Hernandez, et al., 1976).

j. Radiological Contaminants

No data regarding radiological contaminants is known to be available at this time.

B. Living Components

All organisms within an ecosystem are referred to as living components. They consist of all representatives of the plant and animal kingdoms from the simplest to the most complex.

Plants and animals within a certain locality may be described in a number of ways. The currently acceptable description is through the use of community concepts, often referred to as biotic communities. Odum (1956) defines a biotic community as "any assemblage of populations living in a prescribed area or physical habitat." Further, Smith (1966) states that the aggregation of organisms in any given locality or habitat must be regarded as a unit if the community is to be studied, described, or compared with similar communities in other areas.

A highly useful method of naming and delineating communities within large areas is by physiognomy (general appearance). The major types within the area can be subdivided into representative communities. Smith (1966) also states that animal distribution is most closely correlated to the structure of vegetation and not the species composition. Classification by physiognomy describes the relationship of both the animals and vegetation of an area. Communities classified in this manner are named after the most dominant life form, which is usually a plant.

The dominant biotic communities within the Radium Springs Geothermal Assessment Area described by physiognomy consist of: creosotebush, mesquite, desert grassland, desert shrub, pinyon-juniper, and agricultural. Table 11 lists the acreage of each community and the percent each represents of the total acreage within the assessment area. The animal populations within the assessment area will be described as they relate to each biotic community.

1. Vegetation

The environmental assessment area is within the Mexican Highlands section of the Basin and Range Physiographic Province (Hunt, 1976). This Province has characteristics of being among the most arid in the United States, with an average annual rainfall of less than 25 cm (10 in). The mountains of the Province are

TABLE 11 VEGETATION COMMUNITIES OF THE RADIUM SPRINGS
GEOHERMAL ASSESSMENT AREA

Vegetative Community	Total		Percent of Total
	Hectares	Acres	
Aquatic	19,203	48,000	2.6
Creosotebush	370,769	926,923	50.2
Mesquite	66,473	166,181	9.0
Desert Grassland	215,666	539,166	29.2
Desert Shrub	7,386	18,465	1.0
Pinyon-juniper	44,315	110,788	6.0
Agricultural	14,772	36,929	2.0

isolated and rise abruptly above adjacent plains. This contrast in topography produces variations in vegetation due to soils, amount of rainfall, steepness of slope, and aspect. The vegetative changes will be discussed according to the major biotic communities within the assessment area.

a. Aquatic Vegetation

Aquatic plants are directly related to the presence of water. These plants are present in less than 3 percent of the total acreage included within the assessment area. The Rio Grande, Caballo and Elephant Butte Reservoirs, most stockwater tanks, and irrigation ponds contain water yearlong. Aquatic plants have become established within and adjacent to the waters; however, the production and diversity of vegetation depends upon the type of water catchment (steel or dirt), movement of water, and the nutrient content of the soils or water. Cattails, *Typha* spp., sedges, *Carex* spp., and rushes, *Juncus* spp., are rooted vascular plants present in association with most of these waters. Some floating vascular plants may be present in some of the waters; however, no data is available.

Elephant Butte Reservoir contains 70 species of phytoplankton of which four are dominant. Some species of green and blue-green algae are present during the months of July and August. The phytoplankton population, however, is less dense in this reservoir than in other large reservoirs of the southwest.

Many plants are unable to establish themselves in the reservoir due to constant siltation. A dense growth of submersed, rooted, aquatic vegetation does not exist and will not exist until siltation decreases. Extensive fluctuation in water levels also reduces the changes of aquatic vegetation establishment.

Caballo Reservoir relies heavily on Elephant Butte for its supply of water. Clearer and shallower water, greater light penetration, and warmer temperatures result in a greater production of aquatic plants and animals (Bureau of Reclamation, 1975).

Some playas (dry lake beds) are present in the assessment area. These playas and some stockwater tanks contain standing water only during and after the rainy season, with depths dependent upon the intensity of the rains. These areas contain aquatic plant species which have adapted to the harsh environment existing in these lakes. Phytoplankton and other aquatic plant species could be present, but no data is known to be available.

b. Terrestrial Vegetation

(1) Creosotebush Community

The creosotebush community is the dominant vegetative community within the Radium Springs Assessment Area (Fig. 11). This community covers approximately 50.2 percent or 370,769 ha (926,923 ac) of the assessment area. Creosotebush, *Larrea tridentata*, is the dominant shrub, and is often the only plant species within the community.

Creosotebush grows on a variety of soil types. The shrub is frequently found on areas of deep sand, on relatively deep, heavy soils, on shallow soils underlain by caliche, and in arroyo beds (Gardner, 1951, and Chew and Chew, 1965). These soils must be well drained in order for creosotebush to grow on these sites. In sandy and well watered areas, such as arroyo bottoms, creosotebush will reach a height of 2 m (6.8 ft); however, on the shallower, drier sites, the average height is 50-75 cm (20-30 in). Creosotebush is also associated with desert pavement which is a collection of coarse material 3-5 cm (1-2 in) in diameter.

Creosotebush is a very adaptable species within the southwestern deserts of North America. Barbour (1968) refers to creosotebush as the most drought-tolerant vascular plant in North America. Runyon (1934) states that creosotebush is the most widely distributed, conspicuous, and successful xerophytic perennial plant in the southwestern desert. The evergreen shrub is known for its ability to survive long periods of drought accompanied by high temperatures and low atmospheric humidity (Spalding, 1964).

Creosotebush does grow in pure stands, but it also is found in association with many other plants. Gardner (1951), in his study of creosotebush in the Rio Grande Valley, lists a large number of shrubs, half shrubs, forbs, and grasses which he found growing with creosotebush.

Little and Campbell (1943) compiled a list of 523 species of ferns and seed plants of the Jornada Experimental Range, which is approximately 8 km (5 mi) east of Radium Springs, New Mexico. These species represent 301 genera and 82 families. Fosberg (1940) described the flora of the Mesilla Valley Region. For a complete list of plants found in the assessment area, refer to the previously mentioned works. The Agricultural Research Service (1975) published a plant list of the Jornada Experimental Range which can be found in Appendix D.

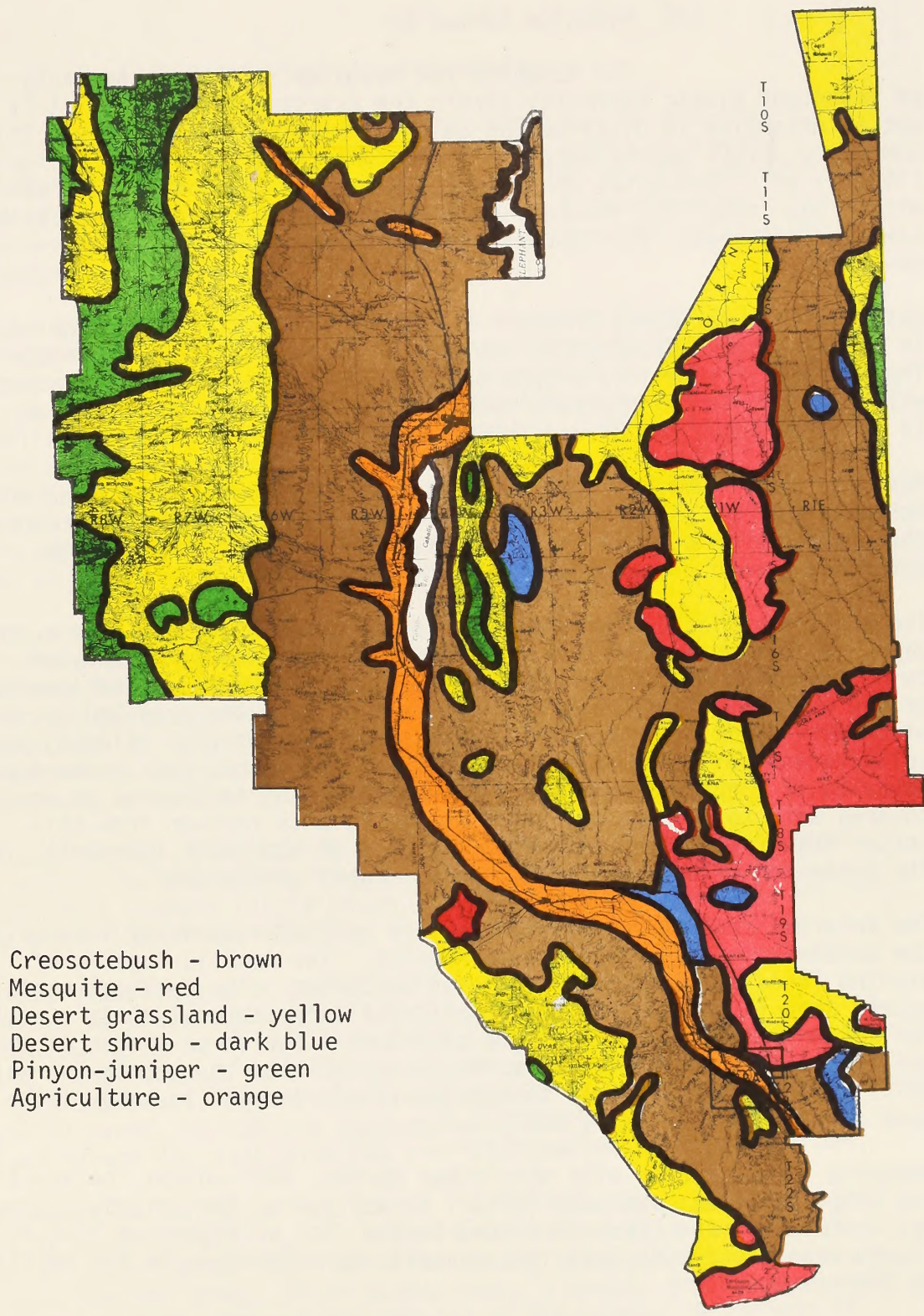


FIGURE 11

BIOTIC COMMUNITIES

(2) Mesquite Community

The mesquite and mesquite sand dune community is an important biotic community within the assessment area, but it is not as extensive in distribution as the creosotebush community. This community covers approximately 9 percent of the area, 66,473 ha (166,181 ac). Mesquite, *Prosopis juliflora*, is the dominant shrub within the community; however, other shrubs, such as four-wing saltbush, *Atriplex canescens*, and soaptree yucca, *Yucca elata*, may become co-dominant.

Mesquite is a deciduous shrub, 1.5-3.0 m (5 to 10 ft) high, growing in a many-stemmed clump which may be 0.9-15.5 m (3-50ft) in diameter. The shrub will grow into a tree 4-6.2 m (15-20 ft) tall with adequate water and nutrients; however, mesquite normally grows 0.9 to 1.5 m (3 to 5 ft) above the ground (USDA, 1937).

Mesquite has a number of uses other than forage for livestock and wildlife. Mesquite wood is used for fence posts and firewood. Gum is extracted from the stems and is used in the manufacture of gumdrops and mucilage. The seeds are ground and used as flour (Benson, 1941).

The soils associated with mesquite are sandy in character. These soils may be stable or active sand dunes on plains and mesas, in canyons, and on hillsides at elevations of 750-1500 m (2500-5000 ft). The structure of the mesquite plant helps stabilize the soil in the area and decreases wind-caused erosion. The form of the shrub reduces wind velocity and collects the soil particles at the base of the shrub, thus producing mesquite or coppice dunes. Many times, the plant is covered or nearly covered with soil; however, the plant is able to recover from this better than from losing soil from the base of the shrub (Campbell, 1929). The expansion of the root system helps stabilize the dune.

The enlarged central root system is very well developed for survival in the southwestern deserts of North America. The root is capable of storing large quantities of nutrients and water. The vertical roots extend deep into the sandy soil, while the large lateral roots spread far beyond the limits of a single sand dune. The large number of small, shallow roots further aids mesquite in its ability to compete for water. It is one of the few plants to survive severe drought in sandy soils or sand dune areas (Campbell, 1929).

Mesquite is associated with many other shrubs, half-shrubs, perennial and annual grasses, and many forbs. In wet years, the interdune area may contain a dense cover of annual forbs. For an extensive list of plants associated with mesquite, consult the references in the section on Creosotebush.

(3) Desert Grassland Community

The desert grassland community is important in supplying forage for livestock production. The community covers approximately 29.2 percent of the area, or 215,666 ha (539,166 ac). A number of grass species are characteristic of this community. Major genera include: grama grasses, *Bouteloua* spp. and *Hilaria* spp., and threeawns, *Aristida* spp., (Humphrey, 1958).

The desert grassland is found primarily in southern Arizona, south-central and southwestern New Mexico, and southwestern Texas. It is the driest of all grasslands, and this is expressed by density and species composition. The grassland is described as a short grass type (Whitfield and Beutner, 1938; and Humphrey, 1958). It does not cover the entire area described previously, but is localized and interspersed with other vegetation. The grassland lies in broad belts at 900 to 1050 m (3,000 to 3,500 ft) in elevation around the bases of mountain ranges. Within the basin itself, the grassland community is found on the more productive soils.

The grasses may grow in pure stands or associated with shrubs and trees. The most common and highly productive grasses consist of: black grama, *Bouteloua eriopoda*; blue grama, *B. gracilis*; sideoats grama, *B. curtipendula*; tobosa, *Hilaria mutica*; galleta, *H. jamesii*; curlymesquite, *H. belangeri*; poverty threeawn, *Aristida divaricata*; red threeawn, *A. longiseta*; desert threeawn, *A. hamulosa*; and Santa Rita threeawn, *A. glabrata*; (Whitfield and Beutner, 1938).

Even though shrubs, low-growing trees, and cacti are present to some extent within the grassland, they were originally restricted to drainages that support little grass. These areas contain rocky or shallow soils (Humphrey, 1958).

The desert grasslands also produce different climax plant species in relation to elevation and soil type. At or below 1200 m (4,000 ft), the *Bouteloua-Hilaria* climax is present. Representative species consist of black grama, tobosa, Rothrock grama, *Bouteloua rothrockii*, bush muhly, *Muhlenbergia porteri*, poverty threeawn, purple threeawn, *Aristida purpurea*, and sand dropseed, *Sporobolus cryptandrus*. These grass plants are excellent forage for livestock and are interspersed with many shrubs.

As the elevation increases to 1,500 m (5,000 ft), the grassland climax changes to *Hilaria-Bouteloua*. Representatives of this association consist of: curlymesquite, blue grama, hairy grama, *Bouteloua hirsuta*, New Mexico feather grass, *Stipa neomexicana*, sideoats grama, bush muhly, black grama, tobosa, and various species of threeawns. A variety of shrubs is present in this climax.

(4) Desert Shrub Community

The desert shrub community is a small transition area between the desert grassland and pinyon-juniper communities. It is minor in distribution, covering only 1 percent of the area, or 7,386 ha (18,465 ac); but it supports a wide variety of shrub species with an understory of grasses and forbs. No one species dominates this community. The community is important because it contains many palatable plant species used by wildlife at various times of the year. Some of the more important plant species include: wolfberry, *Lycium berlandieri*; Apache plume, *Fallugia paradoxa*; soaptree yucca; desert willow, *Chilopsis linearis*; bristlebush, *Brickellia* spp.; mountain mahogany, *Cercocarpus montanus*; four-wing saltbush; graythorn, *Condalia obtusifolia*; Mormon tea, *Ephedra trifurca*; winterfat, *Eurotia lanata*; Fendlerbush, *Fendlera rupicola*; Wright's silktassel, *Garrya wrightii*; littleleaf sumac, *Rhus microphylla*; and skunkbush sumac, *Rhus trilobata*.

(5) Pinyon-juniper Community

The pinyon-juniper community is rather small in distribution within the assessment area. This community covers approximately 6 percent (44,315 ha or 110,788 ac) of the area.

The pinyon-juniper community is represented by pinyon pine and various juniper species. The common pinyon pine is *Pinus edulis*, while the juniper consists of Rocky Mountain juniper, *Juniperus scopulorum*, oneseed juniper, *J. monosperma*, and alligator juniper, *J. deppeana*. These species are not lumber producing, so the main use of this land is for grazing (Stoddart, et al., 1975, and Lamb, 1971).

The low-growing life forms within the pinyon-juniper community inhabit intermediate elevations. The community lies between the desert shrub or desert grasslands and coniferous forests at elevations between 1500-2100 m (5,000-7,000 ft) The sites are usually steep foothills with rapid soil erosion.

The pinyon-juniper community is an open woodland composed of tree species. Many shrub, grass, and forb species also are present. Some of the more common plant species include: mountain mahogany, cliffrose, *Cowania stansburiana*; bluebunch wheatgrass, *Agropoyron spicatum*; western wheatgrass, *A. smithii*; blue grama, needlegrass, *Stipa* spp.; galleta; Indian ricegrass, *Oryzoposis hymenoides*; sideoats grama; and muhlys, *Muhlenbergia* spp. (Stoddart, et al., 1975).

(6) Agricultural Community

The agricultural community is a small, but important, community within the assessment area. It covers approximately 2 percent (14,772 ha or 36,929 ac) of the area. The community supports a large variety of annual and perennial crops which include: grapes, pecans, cotton, chili, tomatoes, lettuce, onions, wheat, barley, corn, alfalfa, grain sorghum and others.

(7) Endangered and Threatened Flora

A list of endangered and threatened plant species prepared by the Smithsonian Institute was published in the Federal Register July 1, 1975, Vol. 40, No. 127, Part V. As a result of comments received on the proposed list, the U.S. Fish and Wildlife Service published a second proposed list of endangered or threatened plant species in the Federal Register on June 16, 1976, (Vol. 41, No. 117, Part IV). The proposed rules for protection of these species were published in the Federal Register June 7, 1976 (Vol. 41, No. 110, Part III).

An inventory of endangered and threatened plant species within the assessment area has not been completed. However, the New Mexico State Heritage Program has developed an Information Management System which includes the collection and computer filing of available information relative to endangered and threatened plant species. A search of their computer file has revealed records of three endangered and threatened plant species within the assessment area. These species and an indication of their general location is given in the following table.

TABLE 12 ENDANGERED AND THREATENED PLANT SPECIES OF THE
RADIUM SPRINGS GEOTHERMAL ASSESSMENT AREA
(N.M. State Heritage Program, 1977, pers. comm.)

Plant Species	Status	General Location
<i>Astragalus castetteri</i>	Endangered	Caballo and San Andres Mts.
<i>Helianthus lacirriatus</i> <i>crenatus</i>	Endangered	South of Truth or Consequences and Williamsburg city limits
<i>Perityle staurophylla</i>	Threatened	Caballo and San Andres Mts.

2. Animals

The assessment area includes aquatic and terrestrial habitat for a diversity of animal species. An estimated 90 species of mammals, 310 species of birds, and 12 species of amphibians, 37 species of reptiles, 27 species of fish, and countless species of invertebrates inhabit the assessment area (BLM, 1974 and 1975).

Species of significance will be discussed. Endangered and threatened species will be discussed at the end of this section.

Terrestrial habitat is the dominant habitat form within the assessment area. It provides the greatest number of ecological "niches," and the greatest opportunity for interaction between populations (Odum, 1959). However, the added ingredient of aquatic habitat in the quantity of that present within the assessment area greatly increases the number of available "niches," and consequently, the opportunities for interaction between populations (i.e., predator - prey interactions; aquatic species - terrestrial species interactions; etc.).

Aquatic habitat occurs in several forms. Approximately 64 km (40 mi) of the Rio Grande bisects the assessment area. This river offers an abundance of riparian habitat in the form of woodland, brush, reeds, and rushes which attract many aquatic and terrestrial species. Situated in the north-central portion of the assessment area on the Rio Grande are two large reservoirs, Elephant Butte (1460 ha or 36,600 ac), and Caballo (464.5 ha or 11,613 ac) (Bureau of Reclamation, 1975). Elephant Butte is an irrigation water retention and hydroelectric power generating reservoir and Caballo is a flood control and irrigation water storage reservoir. Each of these provides abundant habitat for a diversity of fish, aquatic birdlife, and a few species of aquatic mammals. Numerous small, non-permanent, livestock reservoirs and natural ponds are found throughout the assessment area with which a variety of aquatic vertebrate and invertebrate life is associated. The most numerous and commonly observed animal species are aquatic birds. Figure 12 shows major terrestrial and aquatic habitat within the assessment area. A partial list of animal species for the assessment area is found in Appendix E.

a. Aquatic Animals

(1) Mammals

Two species of aquatic mammals occur within the assessment area. These are the muskrat, *Ondatra zibethica*, and the beaver, *Castor canadensis*. Both species are associated with the Rio Grande as well as Caballo and Elephant Butte Reservoirs. A few beaver

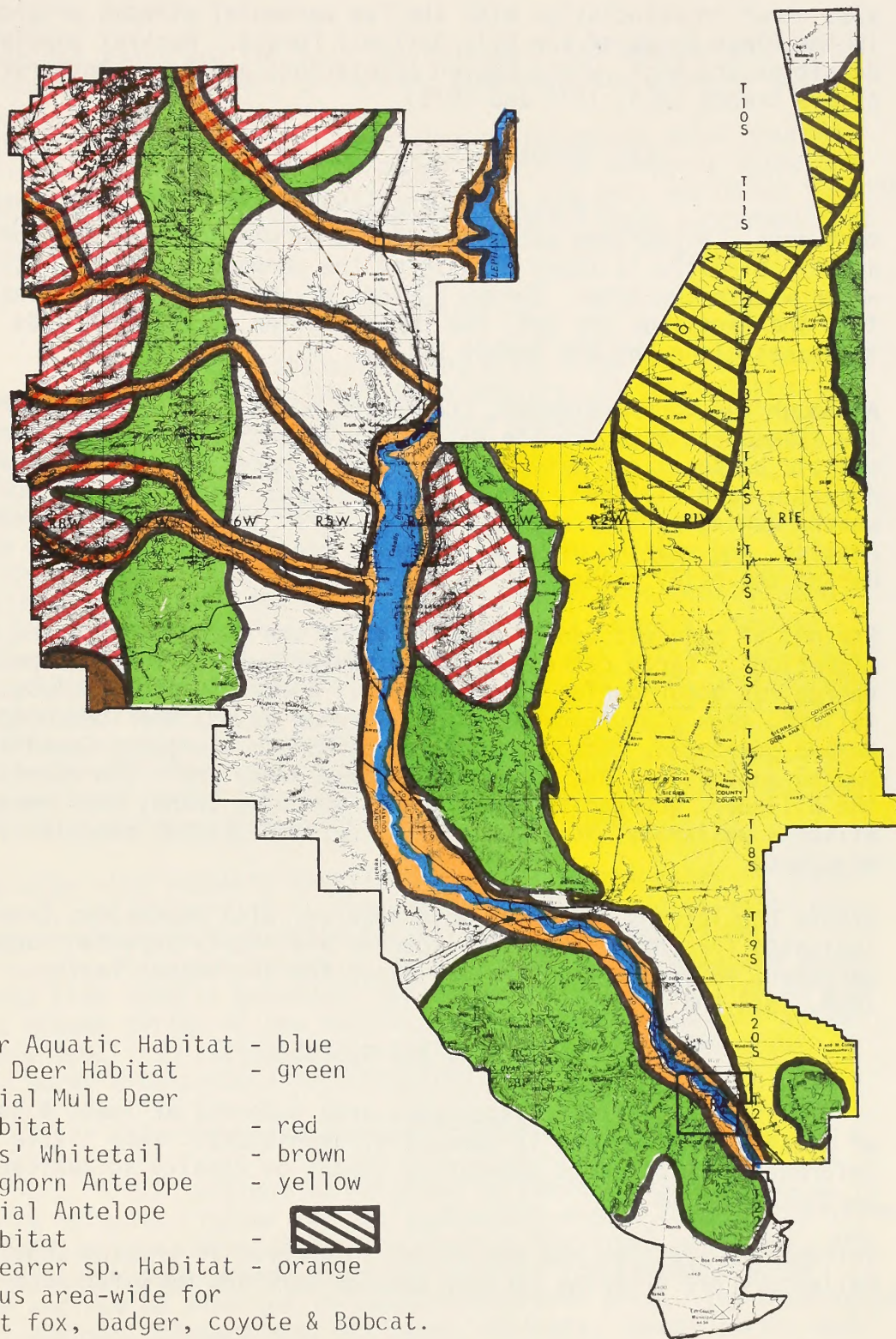


FIGURE 12 TERRESTRIAL AND AQUATIC HABITAT FOR MAJOR SPECIES OF MAMMALS

also occur in association with the few perennial streams originating in the Black Range of the Gila National Forest. Muskrat population densities are high, while beaver populations are low. Both reflect stable trends (BLM, 1974 and 1975).

(2) Birds

A variety of aquatic birds occur within the assessment area. A yearlong occurrence and area wide distribution of aquatic birdlife is found because of the permanent availability of water within the area. During periods of irrigation, when canals are full and farmlands are wet, the concentration of aquatic birds increases along the Rio Grande Valley.

Although the many drainages, creeks and ponds scattered throughout the assessment area provide water only intermittently, many species of aquatic birds, i.e., waterfowl, sandhill crane, *Grus canadensis*, heron, *Ardeidae*, and killdeer, *Charadrius vociferus*, make use of these waters during periods when sufficient water is available. Breeding, nesting, and rearing of young occur in conjunction with these waters during the rainy season.

Periods of heaviest use by aquatic birds are during spring and fall migrations. Large concentrations of waterfowl and various species of shorebirds occur during these periods. Common species include: mallard, *Anas platyrhynchos*; pintail, *Anas acuta*; American widgeon, *Mareca americana*; common goldeneye, *Bucephala clangula*; Canadian goose, *Branta canadensis*; and cormorant, *Phalacrocorax* spp. Shorebirds include the killdeer, greater sandhill crane, whooping crane, *Grus americana*, Wilson's phalarope, *Steganopus tricolor*, and spotted sandpiper, *Actitis macularia*.

Stable populations exist for most species, with increasing trends indicated for some. Migratory species are highly dependent upon the permanent water sources provided along the Rio Grande Valley (BLM, 1974 and 1975.)

(3) Amphibians and Reptiles

The assessment area supports at least 4 species of aquatic reptiles and 12 species of amphibians. Very little information relative to population status or density is available on these species.

Interest in reptiles and amphibians in general is growing continuously. Collectors are trapping various species more and more for such uses

as sale in pet shops and for club collections. The amateur biologist or young boy is also actively collecting specimens for study or play.

The bullfrog, *Rana catesbeiana*, a resident of permanent water sources and aquatic vegetation such as that existing around Elephant Butte and Caballo Reservoirs and along the Rio Grande is the only amphibian to hold game status. There is no data available on the bullfrog concentrations or distribution.

(4) Fish

Within the assessment area, fish are most abundant in the two large Bureau of Reclamation Reservoirs, Elephant Butte and Caballo. Of the two, Caballo produces a greater number of fish and other aquatic organisms. This is primarily due to the less turbid, shallower water, greater light penetration, and warmer water temperatures (Bureau of Reclamation, 1975).

Both bodies of water are inhabited by essentially the same species of fish. Each supports such sport fish as largemouth bass, *Micropterus salmoides*; white crappie, *Pomoxis annularis*; black crappie, *Pomoxis nigromaculatus*; white bass, *Roccus chrysops*; channel catfish, *Ictalurus punctatus*; flathead catfish, *Pylodictis olivaris*; walleye, *Stizostedion vitreum*; northern pike, *Esox lucius*; gizzard shad, *Dorsoma cepedianum*; carp, *Cyprinus carpio*; yellow perch, *Perca flavescens*; and bullhead, *Ictalurus spp.* Rainbow trout, *Salmo gairdneri*, inhabit the waters as transient residents resulting from winter plantings (Bureau of Reclamation, 1975; N.M. Game and Fish Department, 1977, pers. comm.).

The Rio Grande also supports fishlife, but because the water is often quite turbid, and because it is frequently nearly devoid of water due to irrigation diversions, habitat for fishlife is extremely poor. Fishing opportunities are sporadic, occurring only when adequate water is released from Caballo Reservoir during periods of irrigation in the Lower Rio Grande Valley of New Mexico. Various species of catfish in the primary game fish caught during these periods. No other known fisheries occur within the assessment area.

(5) Invertebrates and Zooplankton

Information relative to these forms of aquatic animal life is quite limited for the assessment area. Zooplankton (free floating microscopic animals) benthic (bottom-dwelling) organisms, and macro-invertebrates have been partially defined for Elephant Butte Reservoir and may be expected in Caballo Reservoir also. The zooplankton includes copepods, cladocerans, protozoa, rotifers, insect larva, and

DESCRIPTION OF THE EXISTING ENVIRONMENT

invertebrate eggs (Bureau of Reclamation, 1975). Benthic organisms include *Chironomidae*, *Oligochaeta*, and *Chasborinae* (Jester, 1974, Bureau of Reclamation, 1975).

Limited aquatic communities have become established also in other parts of the assessment area where waters are ephemeral, temporary, seasonal, or semi-permanent. Common aquatic invertebrates associated with such waters include the waterstrider, *Gerris sp.*; damselfly, *Lestes sp.*; mosquito, *Culex pipens*; and giant water bug, *Abedus sp.* (Wilson, 1973).

b. Terrestrial Animals

(1) Mammals

At least 88 species of terrestrial mammals occur within the assessment area. Many of the species occurring within these arid lands of the Chihuahuan Desert have special xeric adaptations. Some are of the burrowing type and some restrict their activities to early morning, late evening, and night.

The distribution of mammals within the assessment area is directly related to habitat availability or the availability of a specific habitat "niche." Some species are restricted in their distribution while others are more wide-ranging. Soils, vegetation, topography, water availability, and other factors are all involved in the regulation of species distribution.

(a) Game Mammals

Mammals inhabiting the area that are considered of special interest include those classified as "game." A discussion of these follows:

i. Mule Deer

Mule deer, *Odocoileus hemionus*, are native to the area and may be found in any of the major biotic communities identified. The communities most favorable and best suited for the propagation and perpetuation of this species are quite specific. The most suitable habitat (Fig. 12) within the assessment area occurs in the Las Uvas, Robledo, Dona Ana, and Caballo Mountains as well as within the foothills of the San Andres and San Mateo Mountains and the Black Range. Mule deer habitat within these areas is considered fair to good. Current population estimates range from 5.8 deer/km² (16 deer/mi²) in the Caballo Mountains to an average of 2 deer/km² (5.7 deer/mi²) in the foothills area of the San Andres and San Mateo Mountains and the Black Range, and 0.7 deer/km² (2 deer/mi²) in the Las Uvas, Robledo, and Dona Ana Mountains. Stable populations exist in all areas except in the Black Range where populations are down.

Four areas have been identified as providing crucial habitat for mule deer within the assessment area (Fig. 12). These are the foothill areas of the Black Range and the San Mateo, San Andres, and Caballo Mountains which provide yearlong habitat for mule deer and also provide important winter range for migratory deer. These areas become extremely important during the winters of above normal mountain snowfall.

The Caballo Mountains provide yearlong habitat for a relatively isolated population. The isolated nature of this area and the dependence upon it by a high population of resident mule deer creates a crucial habitat situation (BLM, 1974 and 1975).

ii. Coues' Whitetail

Coues' or Sonoran whitetail, *Odocoileus virginianus couesi*, occur in the southern portion of the Black Range of the Gila National Forest. A small segment of this population ranges east outside the National Forest (Fig. 12) into the foothill area. Very few of these animals actually utilize national resource lands. Little information is currently available on the population; however, trends appear stable (BLM, 1974 and 1975).

iii. Pronghorn Antelope

Pronghorn antelope, *Antilocapra americana*, although historically recorded in larger numbers in southern New Mexico and the assessment area, have suffered tremendous declines. Contributing factors have been identified as: lasting effects of the droughts which occurred in 1930 and 1949-1950; human influences, which include poaching and restraining fence construction as well as agricultural and residential development and expansion. All of these contributed to the loss of a limited supply of extremely important habitat.

The most important antelope habitat within the assessment area is that associated with the Jornada del Muerto, or the Jornada Plains (Fig. 12). Currently, the most productive habitat is located in the northern third of the Jornada Plains. An estimated 200 head of antelope are associated with this area. The southern two-thirds provide only isolated areas of habitat, most of which is associated with dry lake beds where forbs and other suitable forage are most abundant. An estimated 50 to 70 head of antelope inhabit this area.

The northern third of the Jornada Plains has been identified as crucial antelope habitat. This area provides the most suitable habitat and supports the greatest number of antelope.

An occasional antelope may be observed between the Cuchillo Mountains and the San Mateo Mountains, and in the vicinity of Nutt, New Mexico.

Habitat conditions within these portions of the assessment area are considered only fair because of the vast expanses of creosotebush.

iv. Other Game Mammals

Other mammals of "game" status occurring within the assessment area but for which relatively marginal habitat exists are the mountain lion, *Felis concolor*; black bear, *Ursus americanus*; and the red (chickaree) squirrel, *Tamiasciurus hudsonicus*. Each of these animals is associated with coniferous forests. The mountain lion does range away from such areas; nevertheless, its habitat is closely tied to that occupied by the mule deer.

(b) Furbearers and Predators

Nine furbearing species inhabit the assessment area. A list of these species and a brief description of their associated habitat is presented in Table 13. Figure 12 delineates major habitat for furbearing and predatory animal species.

The first seven species are classified by the State of New Mexico as furbearers and are protected by New Mexico State law which requires a permit before taking. The coyote, *Canis latrans*, and bobcat, *Lynx rufus*, although often sought for their pelts, are considered predators and may be taken at any time.

Habitat and population status of the seven furbearers is not known specifically. Kit fox, *Vulpes macrotis*, and ringtail, *Bassariscus astutus*, populations are considered low but stable. Populations of the other five species are believed to be at moderate levels and stable.

Coyote populations, according to the New Mexico Department of Game and Fish and the U.S. Fish and Wildlife Service, are increasing, while bobcat populations are generally stable to decreasing (BLM, 1974 and 1975).

(c) Other Mammals

In addition to the previously mentioned animal species, numerous other terrestrial mammals inhabit the assessment area. Those commonly observed include the cottontail rabbit, *Sylvilagus spp.*; blacktailed jackrabbit, *Lepus californicus*; bannertailed kangaroo rat, *Dipodomys spectabilis*; and the spotted and striped skunks, *Spilogale putorius* and *Mephitis mephitis*. Others common to the area but not so frequently observed include several species of bats, ground squirrels, mice and other rodents.

Several species of livestock also occur. Cattle and horses are the most dominant livestock species within the assessment area. A few domestic sheep, goats, and swine occur in association with private lands.

TABLE 13 FURBEARERS AND PREDATORS OCCURRING WITHIN THE
RADIUM SPRINGS GEOTHERMAL ENVIRONMENTAL ASSESSMENT AREA

FURBEARER	HABITAT
Kit Fox, <i>Vulpes macrotis</i>	Low desert vegetation; pinyon-juniper grassland; creosote; open, level, sandy ground
Badger, <i>Taxidea taxus</i>	Open grasslands and mountain foothills
Longtailed Weasel, <i>Mustela frenata</i>	Riparian woodlands; Rio Grande Valley; major drainages
Racoon, <i>Procyon lotor</i>	Riparian woodlands; Rio Grande Valley
Muskrat, <i>Ondatra zibethica</i>	Marshes, ponds, lakes, streams, channels and streams.
Ringtail, <i>Bassariscus ostutus</i>	Rocky ridges and cliffs near water
Beaver, <i>Castor canadensis</i>	Rio Grande
<u>PREDATOR</u>	
Coyote, <i>Canis latrans</i>	Associated with all communities
Bobcat, <i>Lynx rufus</i>	Rimrock, chaparral, mountain shrub

DESCRIPTION OF THE EXISTING ENVIRONMENT

(2) Birds

Terrestrial birdlife considered of special significance include those of "game" status and resident and wintering birds of prey (raptors). The wintering populations of other species of migratory birds are highly dependent upon habitat provided within the assessment area.

(a) Game Birds

i. Quail

Gambel's quail, *Lophortyx gambelii*, scaled (blue) quail, *Callipepla squamata*, and Mearns' quail, *Cyrtonyx montezumae*, are abundant in the assessment area (Fig.13). Each carries game status and is highly sought by hunters during seasonal hunts. The Gambel's and scaled quail are well distributed below 2100 m (7000 ft) elevation and are quite numerous throughout the assessment area. Mearns' quail are found associated with the higher elevations, generally above 1500 m (5000 ft) in the western portion of the assessment area in the foothill areas of the Black Range.

Gambel's and scaled quail populations within this area are considered among the highest in the state. A combined estimate of population density for both species is 29 birds/km² (80 birds/mi²) during high years and 3.6 birds/km² (10 birds/mi²) during low years.

Estimates of population density for Mearns' quail have not been indicated. State Game and Fish personnel believe that population densities may be higher than estimated because of the remote nature of the habitat they occupy, and because of the instinctive "freezing" (not flushing) behavior of this species, they are difficult to see, thus giving the impression of being scarce (BLM, 1974 and 1975).

ii. Mourning Dove

Mourning dove, *Zenaidura macroura*, are the most widely distributed of all game birds, breeding in 48 of the 50 states. This species may be observed yearlong throughout the assessment area, as it occupies a variety of habitats. Mourning dove are migratory and in the spring, warmer days and increasing day length stimulate the start of movement to northern nesting areas.

Many mourning dove do not leave the area, but remain yearlong, and those leaving are replaced by others migrating from areas further south.

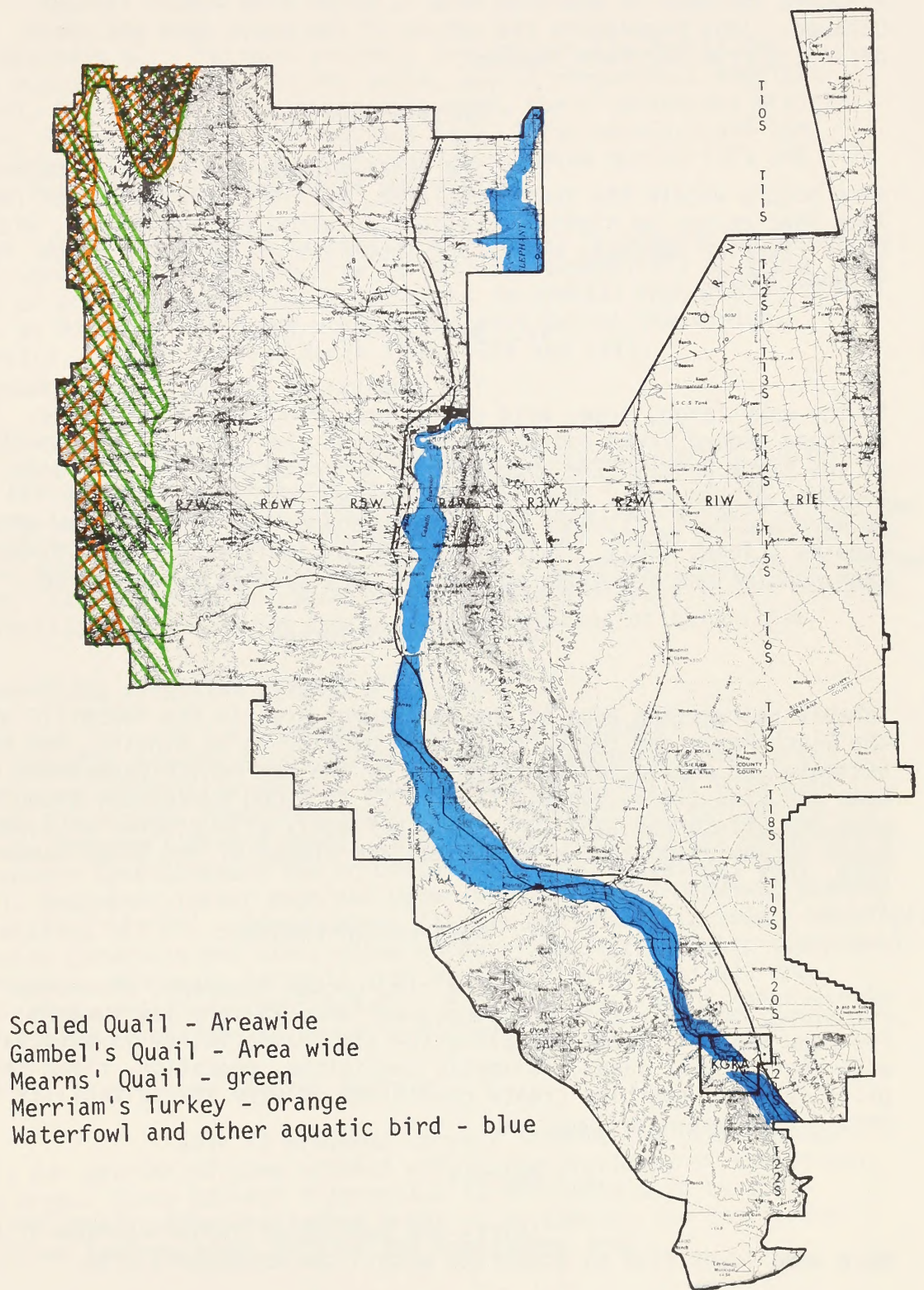


FIGURE 13

TERRESTRIAL AND AQUATIC HABITAT FOR
MAJOR SPECIES OF BIRDS

A sudden increase in mourning dove is noted from August through October. This represents the return of the adult dove and their offspring from northern regions.

iii. White-winged Dove

The white-winged dove, *Zenaida asiatica*, also occurs within the assessment area, but it is only a summer resident. This species may be sighted occasionally along the Rio Grande, within other riparian habitat, and in the foothills of the Black Range (Ligon, 1961).

iv. Band-tailed Pigeon

The band-tailed pigeon, *Columba fasciatica*, is the only large, true, wild pigeon occurring within the state. It is found around farms and orchards, and in the foothills and mountains of the Black Range. The abundance or scarcity of preferred foods, (acorns, pinyon nuts, cherries, mulberries, etc.) is believed to have a direct influence upon the abundance and distribution of this species (Ligon, 1961). This species is a highly sought game bird. When populations are high, hunting of this species is permitted.

v. Merriam's Turkey

Merriam's turkey, *Meleagris gallopavo*, inhabit the western edge of the assessment area in the foothills of the Black Range and the Cuchillo Mountains north of Winston, New Mexico. Estimates of population density made by the New Mexico Department of Game and Fish (1975) suggest that 1,000 to 2,000 turkey are associated with the off-forest land (primarily private), with a total of 5,000 to 6,000 turkey associated with the eastern slopes of the Black Range (BLM, 1974 and 1975).

vi. Ring-necked Pheasant

The ring-necked pheasant, *Phasianus colchicus*, occurs within the assessment area in very low numbers. The population is scattered along the Rio Grande Valley in association with agricultural lands. Climatic conditions, predation, clean farming practices, and poaching create conditions of very low suitability for prolific pheasant propagation.

(b) Raptors

Thirty-one species of raptors (birds of prey) have been identified as occurring within the assessment area

(see Appendix E). The most abundant species are the red-tailed hawk, *Buteo jamaicensis*, golden eagle, *Aquila chrysaetos*; American kestrel, *Falco sparverius*; Swainson's hawk, *Buteo swainsoni*; prairie falcon, *Falco mexicanus*; ferruginous hawk, *Buteo regalis*; and the marsh hawk, *Circus cyaneus*, (information gathered during 1973 and 1974 by the Public Service Company of New Mexico).

Though little information is available relative to population densities, it is known that the entire area is utilized extensively by these birds of prey yearlong. Large increases in overall raptor densities occur as migrants enter and utilize the area during the winter, generally, October through March (BLM, 1974 and 1975).

(3) Reptiles

Over 33 species of reptiles (Appendix E) have been identified as inhabitants of the assessment area. Currently, no consolidated documentation exists for the occurrence and distribution of reptiles in southwestern New Mexico. The Las Cruces District Office of the BLM is in the process of completing a literature and museum review of the class *Reptilia* to consolidate and make available in one document the locations of collected and/or observed species of this class.

(4) Invertebrates

A tremendous variety and abundance of invertebrates inhabit this assessment area. Members of the Class *INSECTA* are especially common. Representative Orders of this Class include *Coleoptera* (beetles), *Lepidoptera* (butterflies and moths), *Odonata* (dragonflies and damselflies), *Diptera* (flies and mosquitoes), *Orthoptera* (grasshoppers and crickets), *Hymenoptera* (wasps, bees, and ants), *Hemiptera* (water bugs and water striders), and *Cursoria* (mantis and walking sticks). Other common Classes and Orders include: *ARACHNIDA*, *Araneida* (trantula and black widow spiders), *Pedipalpi* (whip scorpions); *GASTROPODA*, *Pulmonata* (endemic land and fresh water snails); and *MYRIAPODA*, *Chilopoda* (centipedes). A partial listing of invertebrate species inhabitants can be found in Appendix E.

c. Game Species Harvest

Table 14 presents harvest information (1971 through 1974) for species of game animals within the proximity of the assessment area. Since harvest information is available only by State Wildlife Agency Game Management Areas or by County, the statistics presented include areas outside the assessment area.

TABLE 14 GAME SPECIES HARVEST, 1971 THROUGH 1974

Species	Hunt Area	1974			1973			1972			1971		
		Harvest	Number Hunters	Percent Hunter Success	Harvest	Number Hunters	Percent Hunter Success	Harvest	Number Hunters	Percent Hunter Success	Harvest	Number Hunters	Percent Hunter Success
Mule deer & Coues' whitetail	46 52 56 58	192 491 247 70	1,488 3,251 1,606 549	12.9 15.1 15.4 12.8	340 689 283 71	1,398 2,998 1,562 446	24.3 30. 18.1 15.9	286 696 254 100	1,375 3,177 1,454 544	28.1 21.9 17.5 18.4	305 971 106 53	1,219 4,074 832 365	25. 23.8 12.7 14.5
Pronghorn 1/	SW	70	130	53.8	74	89	83.1	No Hunt	No Hunt			No Hunt	
Cougar 1/	SW	33	98	33.7	3	21	14.3	8	16	50.		Unknown	
	12	--	--	--	--	--	--	0	2	0		Unknown	
	13	--	--	--	--	--	--	2	2	100		Unknown	
	14	--	--	--	--	--	--	2	2	100		Unknown	
Merriam's turkey	52 56	118 13	Unknown Unknown		105 --	Unknown Unknown		66 --	Unknown Unknown		68 --	Unknown Unknown	
Quail 2/	Sierra Dona Ana	Co.6,215 11,246	843 2,234	10.3 7.0	12,761 34,508	848 2,687	15.1 12.9	3,891 6,573	487 1,841	9.05 4.04	1,192 8,215	303 2,119	5.2 5.2
Dove 2/	Sierra Dona Ana	11,184 53,617	617 3,301	32.4 29.1	4,292 42,209	352 3,065	19.1 21.6	6,034 54,705	471 3,182	20.4 27.3	1,689 33,624	195 2,771	15.0 21.1
Ducks 2/	Sierra Dona Ana	4,564 6,295	525 566	28.9 37.0	3,140 2,676	391 442	27.8 21.0	4,778 3,031	373 420	41.2 23.2	1,718 2,937	260 499	22.3 19.9
Geese 2/	Sierra Dona Ana	36 91	116 107	4.4 11.7	45 72	83 83	7.2 11.6	23 113	140 113	2.3 14.2	38 75	118 74	4.7 14.9

1/ Information available only for southwestern section of state with no further breakdown
 2/ N.M. Department of Game and Fish statistics are given by county only

Deer (mule deer and Coues' whitetail) harvest and hunter success show steady declines, suggesting declines in population levels. Such declines have been experienced in other areas of the state as well. The establishment of a stratified deer season in 1975 should benefit deer populations. A more balanced distribution of hunters has been achieved, reducing initial hunting pressures.

Antelope populations are extremely low in all portions of the assessment area. For this reason, the state wildlife agency has closed the assessment area to antelope hunting. This closure has been in effect since 1969.

Quail (Gambel's, scaled, and Mearns') harvest statistics reflect fluctuations customarily associated with these species. Current population levels are at or near optimum. Mourning dove harvest statistics, as with quail, reflect population fluctuations.

Waterfowl hunting has not been as enthusiastically pursued as have other forms of hunting. Elephant Butte and Caballo Reservoirs provide some of the best waterfowl hunting in the state.

d. Endangered and Threatened Fauna

On December 10, 1976, the Las Cruces District Office of the BLM received a final report on an endangered and threatened fauna survey of Dona Ana and Sierra Counties, New Mexico (BLM contract No. NM-030-CT6-818). This survey consisted of a review of literature pertinent to the distribution and status of endangered or threatened faunal species within the two county area. In addition, individuals and agencies with specific knowledge of endangered species of the same area were consulted for unpublished or undocumented data.

Species considered include faunal species classified by Federal and State government as endangered or threatened. These lists of species were compiled from the list published in the Federal Register on September 26, 1976 by the U.S. Fish and Wildlife Service, and from the list in the New Mexico State Game Commission's Regulation No. 563, adopted January 24, 1975 and amended March 21, 1976 (Appendix F).

Based upon the information provided, a list of the species identified within the assessment area has been prepared. The regularity of occurrence of each species was then entered under one of three categories: common, uncommon, or casual (chance visitor) (Table 15). Each species' current status, season of use, important habitat, and distribution has been summarized and presented in Table 16. A map has been prepared (Fig. 14) which portrays the potential

TABLE 15 ENDANGERED AND THREATENED FAUNA AND THEIR REGULARITY OF OCCURRENCE WITHIN THE RADIUM SPRINGS
GEOHERMAL ASSESSMENT AREA (Orda1, 1976)

COMMON	UNCOMMON	CASUAL
<p>Little Blue Heron (-E1) 1/ <i>Florida caerulea</i></p>		<p>Jaguar (E-E1) 1/ <i>Felis onca arizonensis</i></p>
<p>Mexican Duck (E-E1) <i>Anas diazi novimexicana</i></p>	<p>Federal and State (Group 1) Endangered Species</p>	<p>Aplomado Falcon (-E1) <i>Falco femoralis septentrionalis</i></p>
<p>Southern Bald Eagle (E-E1) <i>Haliaeetus l. leucocephalus</i></p>	<p><u>Mammals</u></p>	<p>Caracara (-E1) <i>Caracara cheriway auduboni</i></p>
<p>Peregrine Falcon (E-E1) <i>Falco peregrinus anatum</i></p>	<p><u>Birds</u></p>	
<p>Olivaceous Cormorant (-E2) <i>Phalacrocorax olivaceus</i></p>	<p>State (Group 2) Endangered Species</p>	<p>Inland Least Tern (-E2) <i>Sterna albifrons athalassos</i></p>
	<p><u>Birds</u></p>	
	<p>Zone-tailed Hawk (-E2) <i>Buteo albonotatus</i></p>	

TABLE 15 (continued)

COMMON	UNCOMMON	CASUAL
Osprey <i>Pandion haliaetus carolinensis</i> (-E2)	Red-headed Woodpecker <i>Melanerpes erythrocephalus</i> caurinus (-E2)	
Bell's Vireo <i>Vireo bellii</i> (-E2)	Baird's Sparrow <i>Ammodramus bairdii</i> (-E2)	
McCown's Longspur <i>Calcarius mccownii</i> (-E2)	Reptiles	
Trans-Pecos Rat Snake <i>Elaphe subocularis</i> (-E2)	Sonora Mountain Kingsnake <i>Lampropeltis p. pyromelana</i> (-E2)	
Lyre Snake <i>Trimorphodon biscutatus</i> wilkonsoni (-E2)		

1/ (E-E1) means species is endangered and is listed on the Federal list and Group 1 of the State list.

(-E2) means species does not occur on the Federal list but is listed as endangered, Group 2 by the State.

TABLE 16 ENDANGERED AND THREATENED FAUNA OF THE RADIUM SPRINGS GEOTHERMAL ASSESSMENT AREA
SPECIES, STATUS, SEASON OF USE, HABITAT, AND DISTRIBUTION (Ordal, 1976)

Common Name	Scientific Name	1/ Species Status	Season of 2/ Use	Habitat	Distribution 3/
<u>Mammals</u>					
Jaguar	<i>Felis onca arizonensis</i>	E-E1	M	Mountainous areas dense chaparral and timbered sections of low mountains. Food availability (i.e., peccaries, other mammals) important in determining habitat.	Chance visitor in the San Andres and Caballo Mountains and Black Range during migration or movements.
<u>Birds</u>					
Little Blue Heron	<i>Florida caerulea</i>	-E1	S	Fresh water marshes, streams and creeks	Summers, irregularly in marshes along lower Rio Grande and at Elephant Butte and Caballo Reservoirs.
Mexican Duck	<i>Anas diazi novimexicana</i>	E-E1	Y	Tule, grass, or sedge-lined rivers, irrigation ditches, ponds and shallow lakes. Dense growth within one mile of water required for breeding and nesting. Shallow standing water and flooded fields used for feeding.	Yearlong occurrence in lower Rio Grande Valley, Elephant Butte and Caballo Reservoirs. Concentrations occur in flood plain of Rio Grande in vicinity of Salem and Rincon, irrigated crop pasture lands in Uvas Valley west of Hatch, and marsh bosques north of Radium Springs.
Southern Bald Eagle	<i>Haliaeetus l. leucocephalus</i>	E-E1	W	Rivers and large lakes with clean water, fish, and tall trees or cliff ledges available for nests	Occurs during winter and at one time bred in Rio Grande Valley and Elephant Butte and Caballo Reservoirs.

TABLE 16 (continued)

Common Name	Scientific Name	Species Status	Season of Use	Habitat	Distribution
Peregrine Falcon	<i>Falco peregrinus a natum</i>	E-E1	Y	Cliffs for nesting, offering extensive view of countryside; preferred habitat includes rivers, streams, or large bodies of water because of the occupancy of such areas of peregrine prey species	Occurs yearlong in Rio Grande Valley in conjunction with Elephant Butte and Caballo Reservoirs; and the Black Range, Caballo and the Fra Cristobal Mountains.
Caracara	<i>Caracara cheriway auduboni</i>	-E1	W	Lowland shrub communities and riparian woodland.	Casual visitor along lower Rio Grande Valley.
Aplomado Falcon	<i>Falco femoralis septentrionalis</i>	-E1	Y	Yucca-grassland, shrub-desert, or shrub-grassland. Nests almost exclusively in yucca.	Casual summer or winter visitor of yucca-grassland or shrub-grassland of Jornada del Muerto.
Olivaceous Cormorant	<i>Phalacrocorax olivaceus</i>	-E2	Y	Lowland marshes with downed trees or trees near water for feeding and nesting	Yearlong occurrence at Elephant Butte and Caballo Reservoirs. May also occur along lower Rio Grande Valley.

TABLE 16 (continued)

Common Name	Scientific Name	Species Status	Season of Use	Habitat	Distribution
Zone-tailed Hawk	<i>Buteo albonotatus</i>	-E2	M-W	Large cottonwood or sycamore trees of streams, canyons and coniferous forests or high mountains. Nests in sycamore, walnut, cottonwood, or pine trees along streams or rivers.	Uncommon summer or migratory visitor of Lower Rio Grande Valley, Monticello Canyon, and Palomas Canyon.
Osprey	<i>Pandion haliaetus carolinensis</i>	-E2	W-M	Streams, rivers or lakes with abundant fish supplies. Nearby riparian woodland is important for nesting. Dead snags frequently used for nests. Pinnacles of cliff ledges may be used as nesting base.	Winter/migratory occurrence at Elephant Butte and Caballo Reservoirs. Also along the Rio Grande Valley.
Bell's Vireo	<i>Vireo bellii</i>	-E2	S	Dense shrubland or woodland along stream or river courses. Willows, mesquite, and seep willow are characteristic plant species.	Irregular summer migrant of the Lower Rio Grande Valley and areas adjacent to Elephant Butte and Caballo Reservoirs.

TABLE 16 (continued)

Common Name	Scientific Name	Species Status	Season of Use	Habitat	Distribution
McCown's Longspur	<i>Calcarius macounti</i>	-E2	W-M	Feeds on semi-arid ground where grass is short and sparse. Winters on dry lake beds, plowed fields and plains. Typical plants include buffalo grass and prickly pear	Regularly winters in the agricultural areas of the Rio Grande Valley, the Jornada del Muerto and in the grassland areas north of Nutt, N.M., along the foothill areas of the Black Range.
Red-headed Woodpecker	<i>Melanerpes erythrocephalus caurinus</i>	-E2	S	Associated with low-land riparian woodlands, planted trees and utility poles	Occasionally summers along the central Rio Grande Valley.
Baird's Sparrow	<i>Ammodramus bairdi</i>	-E2	W-M	In winter, grassland prairies and plains where grass cover is densest. Occasionally uses alfalfa and overgrown fields.	Winter migrant along Lower Rio Grande Valley and grasslands of the Jornada del Muerto and foothill areas of the Black Range.
Inland Least Tern	<i>Sterna albifrons athalassos</i>	-E2	S	Sandbars, spits, and alkali flats near water. Nests on sandy or clay flats.	Casual visitor along Rio Grande Valley during summer months.

TABLE 16 (continued)

Common Name	Scientific Name	Species Status	Season of Use	Habitat	Distribution
<u>Reptiles</u>					
Trans-Pecos Rat Snake	<i>Elaphe subocularis</i>	-E2	Y	Arid and semi-arid environments associated with rocky areas supporting shrubby vegetation.	Lower Rio Grande Valley.
Lyre Snake	<i>Trimorphodon biscutatus wilkonsoni</i>	-E2	Y	Rocky desert or semi-desert regions. Also ranges into evergreen woodland and ponderosa pine forest in canyons and rocky areas. Preferred habitat found where vegetation and rocks combine to provide good cover.	Lower Rio Grande Valley breaks; Hillsboro; breaks adjacent to Elephant Butte Reservoir.
Sonora Mountain Kingsnake	<i>Lampropeltis p. pyromelana</i>	-E2	Y	Ranges in mountains from chaparral and pinyon-juniper woodland upward into pine-fir forests. Usually concealed under rocks or logs.	Probable occurrence in Black Range. Peripheral habitat found within assessment area.
1/ See Table	15 (footnote).				
2/ Season of Use:	M = migration, S = Summer; Y = Yearlong; W = Winter				
3/ See Figure	14 for general location of important habitat of species occurring or occasionally occurring.				

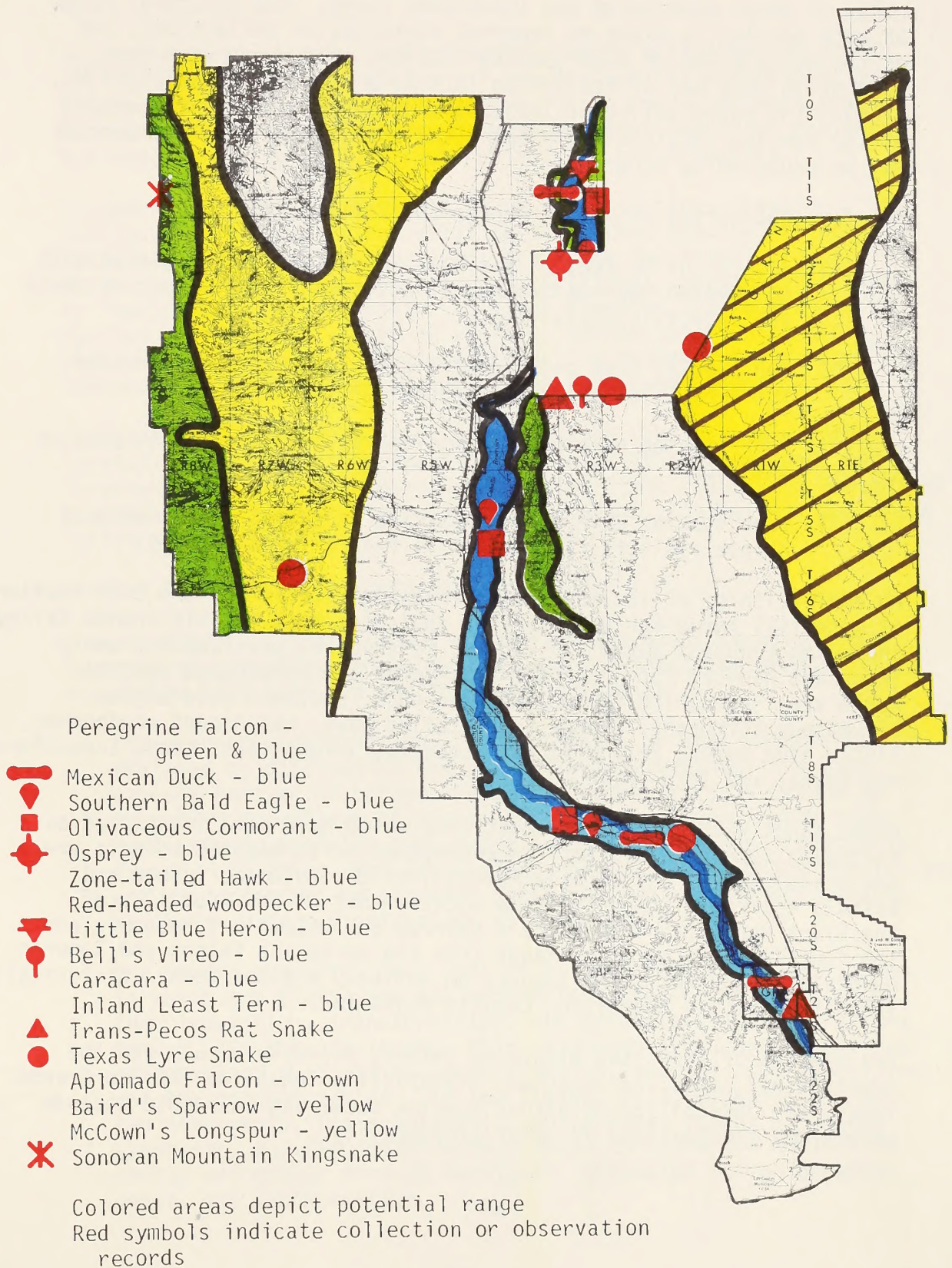


FIGURE 14 ENDANGERED AND THREATENED FAUNA OF THE RADIUM SPRINGS GEOTHERMAL ASSESSMENT AREA

DESCRIPTION OF THE EXISTING ENVIRONMENT

range of these endangered and threatened fauna. The potential range of each species is based on reported sightings or collections, and on the correlation of each species' habitat preference with the vegetative type map of New Mexico (N.M.A. & M.A., 1975; Ordal, J.M., 1976). The potential range includes areas where important elements of the species' habitat are present and where members of the species may be expected to occur.

Briefly, the survey results indicate the following:

- (a) A total of 18 species has been identified as associated with the Radium Springs Geothermal Assessment Area. Four of these are Federally classified.
- (b) Ten species have been identified as common inhabitants of the area, 3 of which are Federally classified.
- (c) Four species have been identified as uncommon inhabitants of the area.
- (d) Four species have been identified as casual inhabitants or chance visitors, 1 of which is Federally classified.

An evaluation of collection and observation records and the distribution of potential range for each species indicates that the Rio Grande Valley, including Elephant Butte and Caballo Reservoirs, provides extremely important habitat for 13 of the endangered and threatened species. These are: peregrine falcon, Mexican duck, southern bald eagle, olivaceous cormorant, osprey, zone-tailed hawk, red-headed woodpecker, little blue heron, Bell's vireo, caracara, inland least tern, trans-Pecos rat snake, and lyre snake.

Other lands within the assessment area which have been identified as including important habitat for endangered or threatened animals are the grasslands of the Jornada Plains (for the aplomado falcon and Baird's sparrow), the grasslands located east of the foothills of the Black Range (for the Baird's sparrow and McCown's longspur), and the foothills of the Black Range (for the peregrine falcon and Sonoran mountain kingsnake). The jaguar, an unlikely visitor today, historically inhabited the San Andres and Caballo Mountains.

Two species of fish, the bluntnose shiner, *Notropis simus*, and the American eel, *Anguilla rostrata*, historically inhabited the Rio Grande. Today, the possibility of either species occurring is remote because of extreme fluctuations in water availability.

As mentioned previously, the potential ranges delineated on Fig. 14 are the result of a correlation of species habitat preferences or requirements with existing vegetation within the assessment area. The areas delineated, however, do not represent "critical habitat," but undoubtedly do include such habitat for these species.

To determine "critical habitat" for a given species, specific information relative to the vital needs of that species are required. Vital needs which are most relevant are space for normal growth, movement, or territorial behavior; nutritional requirements such as food, water, and minerals; sites for breeding, reproduction, or rearing of offspring; cover or shelter; and any other biological, physical, or behavioral requirement that is deemed vital to the continued existence of an endangered or threatened animal.

It is obvious, therefore, that comprehensive studies are needed, initially with respect to the Federally classified endangered and threatened species, and then the remaining State classified endangered and threatened species, to specifically define, locate, and delineate "critical habitat."

C. Ecological Interrelationships

Robert L. Smith, (1966) summarizes the basic structure and function of community and ecosystem, and the intricate relationships associated with each, in the following quotation:

"However the community may be classified, or what methods may be employed to distinguish one community from another, the basic concept remains unchanged. A biotic community is a naturally occurring assemblage of plants and animals living in the same environment, mutually sustaining and interdependent, constantly fixing, utilizing, and dissipating energy. Interacting populations are characterized by constant death and replacement and usually by immigration and emigration of individuals.

The biotic community is a part of a larger whole, the ecosystem, in which the living and the non-living interact to bring about the circulation, transformation, and accumulation of energy and matter. In the non-living, this is accomplished by the physical processes of evaporation, precipitation, erosion, and deposition, and the gaseous cycles. In the living, it is accomplished by two components, the autotrophic, which fixes energy by photosynthesis, and the heterotrophic, which utilizes and circulates energy and matter through herbivory, predation in the broadest sense, and decomposition.

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Each organism in the community occupies a particular functional niche at which it arrived by a long process of natural selection and evolution. The more niches there are to occupy, the more complex the community, the greater the diversity of species, and the more stable the ecosystem.

Among these species, a few may exert a dominant role over the rest of the community. Usually, plants govern its development and influence the total species composition. The make-up of any one community is determined in part by the species that happen to be distributed on the area and can grow and survive under the prevailing conditions. Thus, an element of chance is involved. The exact species that settle on an area and the number that survive are rarely repeated in any two places at a time, but there is a certain recurring pattern of more or less similar groups. Rarely can different groups of communities be sharply delineated, for they blend together to form a sequence of communities gradually changing in composition, known as a continuum. A place where two major communities meet and blend together is called an ecotone.

All communities exhibit some form of layering or stratification, which largely reflects the life form of the plants and which influences the nature and distribution of animal life in the community. Communities most highly stratified offer the richest variety of animal life, for they contain a greater assortment of microhabitats and available niches."

A discussion of the three key processes at work (succession, food relationships, and community relationships) will follow. This discussion will relate the living and non-living components identified in the previous sections. Special consideration will be given to significant relationships whose environmental components might be affected by the proposed action.

1. Succession

Succession is the orderly development of an ecosystem from a pioneer or primary stage to climax. Primary succession is when development begins on an area that has not been previously occupied by a community, and secondary succession is developed in an area where a community did exist and was removed (Odum, 1971).

The following will consider the present stages of succession, principle changes, invading species, trend, and climax. The discussion will be

in regard to the major biotic communities previously described in the vegetation section.

a. Aquatic Ecosystem

Many of the stock ponds within the assessment area contain water yearlong, as do Elephant Butte and Caballo Reservoirs. These waters contain a certain biota that have evolved through the successional stages.

In the initial stage of succession, the bottoms were barren of plant life. Soon various species of phytoplankton began to inhabit the waters. As the microscopic plants and animals died, they settled to the bottom and formed a layer of muck. The muck, once built up, could support rooted submerged aquatic plants. These plants may have included branching green algae, pondweeds, and waterweeds. The rooted plants produced a firm matrix at the bottom of the lake. Sediment from soil erosion reduced the depth of the water, creating a substrate for other rooted aquatic plants. The succession of Elephant Butte and Caballo Reservoirs, and many of the dirt tanks found in the area which contain a permanent source of water consists of many of the above stages, depending on their age and amount of siltation (Smith, 1966).

Other ponds in the assessment area are dry during certain times of the year. Both aquatic and terrestrial succession take place within these ponds, but the stages vary from tank to tank.

Generally, all of the aquatic systems occurring within the assessment area are influenced greatly by tremendous fluctuations in water levels and large amounts of suspended and deposited sediment. In addition, more periodic mechanical maintenance of water edges (i.e., phreatophyte control around Elephant Butte and Caballo Reservoirs) and complete reconstruction or maintenance of many dirt stock tanks result in a continuous shifting between secondary succession and regression stages of development.

The two large reservoirs maintain adequate depths to produce zooplankton, benthic organisms, macro-vertebrates, mussel, and crayfish, as well as, algae and other aquatic plants to support other forms of animal life, such as fish (bass, crappie, walleye, catfish), birdlife (waterfowl, shorebirds, raptorial birds), mammals (beaver, muskrat), reptiles (turtles) and amphibians (frogs, toads).

The Rio Grande may be completely or nearly void of water during non-irrigating periods of the year. As a result, aquatic plant and animal

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life are continually fluctuating, and again, reflect some stage of secondary succession or regression.

The numerous small dirt stock tanks and natural ponds are extremely important and valuable in this desert region even though they provide only an ephemeral source of water. They are important not only because they provide a source of drinking water and food for numerous animal species, but also because they play a significant role in the life cycles of numerous invertebrates. During the rainy season (July, August and September), many of the natural depressions and man-made dirt tanks are filled with runoff. During the few months that this water is present (July through December), the inhabitants which are in a dormant or pupal stage must complete their reproductive cycle. Dependent forms of aquatic animal life include the sowbugs, *Porcellio*; waterflea, *Daphnia*; flatworm, *Phagocytes vermalis*; copepod, *Cyclops*; and fairy shrimp, *Branchinecta*; various species of toads, primarily the spadefoot, *Scaphiopus*; mosquito, *Diptera*; and numerous other insects. These commonly comprise the ephemeral and temporary aquatic secondary or primary successional stages.

b. Terrestrial Ecosystem

(1) Desert Grassland Ecosystem

The desert grasslands within the assessment area have undergone some drastic successional changes. The original desert grasslands have been invaded by creosotebush and mesquite, so that what once was desert grassland is now composed of all three types of vegetation.

The desert grassland community developed slowly through primary succession. The successional stages were mainly xeroseres (dry stages) that started on rocky outcrops, sand, or similar strata. The occurrence and plant composition of each stage in the succession is determined largely by the type of soil and its associated habitat factors. Each stage builds up the humus content and water-holding capacity of the soil, thus preparing it for the next stage, until the climax is reached (Campbell, 1931). The climax vegetation of this ecosystem is composed of grama grasses, mainly black grama.

In the normal process of succession, annual forbs are the first vascular plants to occupy the sites. Then annual grasses and perennial forbs replace the existing vegetation. Genera represented in this process include: grama grass, *Bouteloua*; threeawns, *Aristida*; fescues, *Festucae*; *Pectocarya*; *Cryptantha*; and lupine, *Lupinus*. Short-lived perennial grasses replace the annual grasses as the ecosystem develops. Rothrock grama, *Bouteloua rothrockii*, and burrograss, *Scleropogon brevifolius*, are important short-lived perennials. These grasses are

eventually replaced by long-lived perennials such as broom snakeweed, *Gutierrezia sarothrae*; burroweed, *Aplopappus hartwegii*; brittlebush, *Encelia farinosa*; paper daisy, *Psilostrophe cooperi*; sacaton, *Sporobolus arroides*; tobosa, desert saltgrass, *Distichlis stricta*; and various species of buckwheat, *Eriogonum* spp. The final stage of succession, or climax, is represented by plant species such as black grama, tobosa, sideoats grama, and Arizona cottontop. Distribution of these species varies depending on the sites and soil types which they inhabit. Many other plant species occupy small areas within the ecosystem. These consist of creosotebush, four-wing saltbush, blackbrush, *Coleogyne ramosissima*, Mormon tea, mesquite, catclaw, *Acacia greggii*, sotol, *Dasylyrion wheeleri*, shrub oak, *Quercus* spp., mountain mahogany, pinyon pine, manzonita, *Arctostaphylos pungins*, squawberry, *Rhus trilobata*; and buckbrush, *Ceanothus* spp. (Whitfield and Beutner, 1938).

The original grassland ecosystem has been greatly altered within the assessment area. Factors such as changes in climate, intensive grazing by domestic livestock plant competition, rodent competition, soil erosion, and fire have resulted in a successional regression of vast acreages of grassland to a vegetative community now comprised of creosotebush and mesquite (Humphrey, 1958; Norris, 1947; Dick-Peddie, 1961; and Campbell, 1931).

Early explorers and settlers wrote of the vast amount of grama grass in the Rio Grande Valley. These records indicate that the settlers who came to the Valley could not make a living farming, so they went to the table lands along the Rio Grande and cut grama grass which they sold for feed. This was common throughout the Rio Grande Valley in the mid 1800's. These records indicate that the table lands were once covered with something other than the present shrub form. This suggests that there have been drastic changes in vegetation patterns since the mid 1800's. A marked climatic change 100 years ago is unlikely, because the grass has held its own against shrub invasions at a number of locations (Dick-Peddie, 1961).

Changes in the ecosystem began to occur with the exploration and settlement of these lands. Cattlemen took advantage of the lush grama grasslands, and deterioration began. The grass plants became weakened from over-utilization and were not able to recover. Overgrazing was not entirely to blame for the deteriorating grassland ecosystem; drought also played an important part. Jardine and Forsling (1922) reported that a severe two year drought killed 40 percent of the best grazing plants. This reduced the quantity of forage by half. Plants lost were replaced by less desirable plants, causing regression. A valuable cover was lost and did not become re-established immediately because succession requires many years, or even decades, to complete (Campbell, 1931). During this regression, certain plants were present that were

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able to spread and adapt to the conditions within the deteriorated areas (Buffington and Herbel, 1965). Two of these plants were creosotebush and mesquite.

Once a colony was established, its density increased and gradually spread. The combination of drought, grazing, competition between plants, and soil erosion through wind and water resulted in the steady decline of grass species and an increase in the density of the heartier creosotebush. The invasion of broom snakeweed, the complete disappearance of grass, the presence of erosional pavement, and the dominance of this shrub over large areas were characteristic of complete takeover of an area by creosotebush. The final results of creosotebush invasion were loss of a desert grassland climax, loss of many inches of soil through wind and water erosion, and the loss of productive land (habitat) for domestic livestock and wildlife (Gardner, 1951).

Drastic changes would have to take place in most areas for grass species to reoccupy these sites. In isolated sites, if the area were protected from grazing and climatic conditions were favorable (a series of moist years), and a source of seed were available, grass species might become reestablished. This is a long, slow process (Gardner, 1951). This phenomenon occurs today in isolated areas where soil erosion was minimal in the past.

On the other hand, Muller (1940), said that once a creosotebush community is established, a climax is formed. Muller (1940) based his belief on the fact that creosotebush is the dominant shrub which occupies a large area even though many other xeric shrubs and herbs are present. A large amount of soil was lost through erosion, and desert pavement now helps protect the soils. The microhabitat which supports the grassland has been destroyed and replaced by a new microhabitat.

Creosotebush is still an active invader of some southern deserts (Gardner, 1951). The process is slow, but valuable acres of desert grassland are being replaced by creosotebush. This invasion will continue unless measures are taken to halt its spread (Anderson, 1956).

Mesquite also invades deteriorated rangelands. Mesquite was once confined more to sandy soils of the mesas and heavy soils in the valleys, while creosotebush was found on all soil types (Buffington and Herbel, 1965). Mesquite was already established in isolated areas and had spread into the sites occupied by the early Indian camps (Dick-Peddie, 1961).

Domestic livestock and many wildlife species began utilizing the mesquite beans as the ranges deteriorated. The plants are now usually

found around watering places and along trails due to the fact that the animals ingested the seeds and subsequently dropped them in their feces as they moved from watering to grazing areas. The reduced competition of the dominant grasses released the young mesquite plants, and hastened deterioration of the grassland and dominance by mesquite.

The formation of the mesquite dunes was caused by the breaking up of grasslands by trampling of livestock on overstocked ranges. The plants were reduced in size and the soil was loosened. This allowed the wind to pick up the soil from around the grass roots and deposit it around the mesquite shrubs forming dunes (Jardine and Forsling, 1922; and Campbell, 1929). Once a range has reached the dune stage, it is very hard to bring it back to grassland; however, during a three-year period of conservative grazing and ample rainfall, Campbell, (1929) was able to trace the stages in the recovery of sand dune country.

The mesquite shrub occupies the top of the sand dune. Many plants may be found growing within the protection of the shrub. In years of above average moisture, the plants associated with mesquite begin to revegetate from the north (or sun-protected) side of each dune. The plants become established, produce seed, and may spread into unstable areas of the dune.

Black grama, even though it is a climax species, is very susceptible to grazing. The plant spreads mostly by vegetative reproduction; it is slow to recover because of poor seed production. Broom snakeweed may take over some of the black grama range, but with good moisture and conservative grazing, the black grama range will recover (Campbell and Bomberger, 1934).

Of all of the factors causing a change in vegetation within the desert grassland ecosystem, climate has had the least effect. Considering the other factors, fires that were formerly frequent and widespread played a large part in restricting shrub invasion. Since fires have been controlled, the introduction of domestic livestock, plant competition, and rodents have been very effective in enhancing the habitat for woody species at the expense of grasses. Humphrey (1958) indicates that, if fire had not been controlled, the desert grassland would still occupy about the same area as it did in the past.

Dick-Peddie (1961) summarizes the succession of desert grasslands by saying . . .

"It may be valid to assume that grass occupied mesa sites on which creosotebush now dominates. However, it would not likely be correct

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to assume that the present microhabitat is identical or even similar to that which existed under grass. Therefore, a creosotebush site today may be so modified that it will not support grass successfully. The mesquite occupied sites may further deteriorate and eventually be occupied by creosotebush. And finally, the invasion of grasslands by creosotebush, mesquite, juniper, or cholla is most likely a symptom of an already deteriorated site. It may be more explicit to say that these shrubs have become established upon sites which had been suitable for grass at some earlier time."

Plants generally govern the development and influence the composition of an entire ecosystem. As the plant species change, so does the animal life. Studies conducted on the Jornada Experimental Range indicate an animal species biomass of over 35 kg per km² (200 lbs per mi²) in desert grassland, as high as 148 kg per km² (840 lbs per mi²) in mesquite, and less than 17 kg per km² (100 lbs per mi²) in creosotebush communities. This suggests that regression which is apparent on the mesas along the Rio Grande and in the Jornada Plain, indicated by the invasion of desert grasslands by creosotebush and mesquite, also has resulted in changes in the densities and distribution of animal species (Dick-Peddie, 1976, pers. comm.)

Animal species typical of the desert region are much like the plant life in that they are either drought resistors or drought evaders (Smith, 1966). Many of the animals have evolved in such a way that they are capable of circumventing the aridity and high temperatures. Other species that are more mobile (i.e., large mammals and birds) utilize desert regions during the cooler periods of the year. Migrations of other animal species to and from the area occur annually.

Animal species inhabiting the desert grasslands show various traits. Common locomotion is by hopping or leaping, such as with the grasshopper, jackrabbit, and kangaroo rat. Speed is also a trait common to a few of the grassland dwellers, such as the antelope and gray fox.

Invertebrates, particularly insects, are extremely abundant. All of the strata within the grassland community are utilized by them. The ground and litter strata are utilized by the scavenger or hunter (i.e., spiders, beetles), and the herbaceous strata by abundant and diverse invertebrate life (i.e., *Diptera* (flies), *Hymenoptera*, (ants and bees), *Homoptera* (aphids), *Coleoptera* (beetles) etc.).

Mammals are the most conspicuous form of animal life within the assessment area. Various rodents, (i.e., prairie dog, ground squirrel) lagamorpha (i.e., jackrabbits, cottontails), and carnivorous species

(i.e., badgers, fox, weasel), occur. These species are generally of the burrowing type or use vegetation, where adequate, for cover.

Various sparrow species (including the endangered Baird's sparrow), meadowlark, horned lark, and Gambel's and scaled quail are associated with these grasslands when cover is adequate. Nesting and feeding activities are prominent life functions of these and other birds in their association with the desert grasslands. Birds of prey frequent such communities because of the ease with which prey is sighted and caught.

Reptiles are not common, but do occur. Gopher snakes, whiptails and others may be observed.

At one time, the distribution of animal species associated with desert grasslands extended over much of the assessment area; but now, the desert grassland ecosystem is greatly reduced. The areas invaded by creosotebush exhibit the fewest niches for animal species. Some creosotebush communities exhibit better soil conditions than others and contain other vegetal species. In these areas there are additional niches for invertebrates, mammals, birds, and reptiles. Generally, less than 17 kg per km² (100 lbs per mi²) of animal biomass are produced by the creosotebush communities.

The invading mesquite communities are more highly stratified. The greater aerial extension of this dominant shrub, in addition to the dune-forming common to many of the mesquite communities, has added strata and available niches. As suggested by the Jornada Experimental Range Studies (148 kg per km² or 840 lbs of animal biomass per mi²), this community supports an extremely large number of animals and a diversity of animal species.

Mesquite ecosystems which have various sized dunes established around the mesquite plants provide the greatest number of niches. Invertebrates and rodents are of the greatest abundance and diversity. The dune provides a substrate highly suitable for burrowing, and each will contain numerous burrows. Reptiles, including lizards and snakes, will frequent these areas in search of food and cover. The mesquite bush also is used extensively by various ground and aerial nesting birds.

(2) Desert Shrub Ecosystem

The desert shrub ecosystem is a transition between the grassland and pinyon-juniper life forms. The ecosystem seems to be stable and supports a number of valuable plant species

that are important to both livestock and wildlife. The specific successional stages of this ecosystem are not described by literature. Desert shrub communities generally occur either in isolated pockets where moisture collection is greater than the surrounding area or in mountain foothill areas where moisture conditions are favorable.

The desert shrub community is especially attractive to animal species. The diversity of plant life and the increase in stratification greatly increases the number of niches available to animal species. The distribution of this community is very limited (Fig. 11).

(3) Pinyon-juniper Ecosystem

The pinyon-juniper ecosystem is within a higher moisture belt than the ecosystems previously discussed (25-50 m or 10-20 in annual rainfall), and reflects increases in vegetation diversity where the pinyon-juniper is scattered or sparse. Where dense stands of pinyon-juniper occur, a greatly reduced vegetal diversity exists as the result of competition. The pinyon-juniper ecosystem represents a belt, or transition zone, between the desert grasslands, desert shrubs, and the coniferous forests.

These pinyon-juniper vegetal communities are extremely important to animal species within the desert southwest. The occurrence of a diversity of other vegetal species results in a well stratified community because of the scattered or sparse cover. The pinyon nuts and cedar berries provide an important food source for residents and winter migrants into the area. The pinyon jay, *Gymnorhinus cyanocephalus*; plain titmouse, *Parus inornatus*; Harris' sparrow, *Zonotrichia querula*; red crossbill, *Loxia curvirostra*; black headed grosbeak, *Pheucticus melanocephalus*; and others commonly inhabit the pinyon-juniper community. This community also provides especially important mule deer, and consequently, mountain lion habitat. Species of both the desert grassland-desert shrub ecosystems and the coniferous forest ecosystem occur.

(4) Agricultural Ecosystem

The agricultural ecosystem contains a large number of annual crops. Very little successional development occurs within this ecosystem until fields are abandoned.

As a result of the agricultural development, vast acreages of important habitat for animal species such as the antelope have been destroyed. With the extensive agricultural development and the introduction of plant species, a diversity of other habitats for other animal species have been developed. Especially abundant are insects, birds, and various mammals.

2. Food Relationships

a. Aquatic Ecosystem

The food chain typical of aquatic ecosystems is represented in the assessment area. The ecosystem provides food for different plant and animal species during all stages of succession. The decaying plankton provide nutrients for the bottom dwelling aquatic plants. The plankton also supply nutrients for various species of fish and other aquatic animals (i.e., fairy shrimp). The dead organisms decompose and provide nutrients for the floating and emergent vegetation (Smith, 1966). The emergent vegetation, algae, and other aquatic plants provide a source of food for surface dwelling aquatic animals which have generally herbaceous food habits (i.e., waterfowl, beaver, muskrat, etc.). These species are then preyed upon and consumed by carnivorous species (i.e., osprey, *Pandion haliaetus*; skunk, raccoon, bullfrog, gopher snake, *Pituophis melanoleucus*; etc.). Some of these species are omnivorous and are generally represented at the top of the food chain.

b. Terrestrial Ecosystems

(1) Creosotebush Ecosystem

The creosotebush ecosystem produces little forage for its inhabitants. Creosotebush is unpalatable and offers no forage value to domestic livestock and only limited forage value to a few wildlife species. Many of the plant species which are associated with the creosotebush ecosystem do not supply additional forage of any value. A very low population of wildlife species inhabits this area because of the low forage production. The change which has taken place on these lands has reduced its value from a highly productive grassland to a relatively worthless shrub ecosystem.

(2) Mesquite Ecosystem

The mesquite ecosystem supplies a large amount of forage for its inhabitants and produces the highest animal biomass of the ecosystems. Mesquite is desired by grazing animals in the early spring before the leaves form on the shrubs. These tender branches are very nutritious. The plant's flowers attract bees and other insects to these shrubs. Once the plant has flowered and produced the seed pods, these seed pods are sought by domestic livestock and many wildlife species. Livestock eat the pods and disperse many of the undigested seeds throughout the area in their feces. Many small wildlife species, such as rodents and rabbits, collect and store the seed in their burrows. This action further enhances the spread of the mesquite shrub.

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Many plant species associated with the mesquite dunes are palatable to livestock and wildlife. Some of these species are four-wing saltbush, mesa dropseed, sand dropseed, spike dropseed, black grama, and many other forbs and shrubs.

Plant species growing directly in association with mesquite shrubs are higher in protein than plants out away from the shrubs. The mesquite plant produces nitrogen in its roots; this nitrogen is released in the soil and utilized by associated plants.

The mesquite dunes support very large wildlife populations of rodents and rabbits. Large numbers of rodents and rabbits burrow into the dunes. These wildlife species are food for the many birds of prey associated with this ecosystem. Many song birds nest in the shrubs and survive on the various seeds and insects within the ecosystem.

(3) Desert Grassland Ecosystem

The desert grassland ecosystem is a very productive natural ecosystem within the assessment area; however, the ecosystem has been greatly reduced in acreage. The climax grasses and forbs supply high value forage for both livestock and wildlife species.

A number of wildlife populations are present in this area. Most of the species are ground dwellers and survive on the seeds and insects associated with this ecosystem. Birds of prey are also common in these grasslands and the small ground dwellers supply food for these species.

The antelope are restricted almost entirely to the grassland ecosystem. They depend greatly on the annual and perennial forbs when they are green and succulent in addition to the grasses.

(4) Desert Shrub Ecosystem

The desert shrub ecosystem contains many desirable shrubs which supply browse vegetation for livestock and wildlife species. These plant species are used during all periods of the year. The shrubs provide food and cover for many small wildlife species that, in turn, supply food for predator species such as the raptors, bobcat, coyote, and mountain lion.

(5) The Pinyon-juniper Ecosystem

The pinyon-juniper ecosystem contains, in addition to pinyon and juniper, a variety of other trees, shrubs, and grasses.

Many of these plant species provide valuable forage and cover for livestock and wildlife. Where a dense canopy cover of pinyon and juniper exists, it limits the forage production of many valuable grass and shrub species. In addition to providing important cover for nesting, resting, and protection from the elements, the pinyon pine produces a nut that is highly sought by several species of wildlife including the mule deer, wild turkey, and numerous species of birds and rodents.

The juniper, which generally occurs in conjunction with pinyon, is of equal importance, as it also provides food and cover for many species of wildlife (i.e., mule deer, turkey, quail, and many species of songbirds). The foliage is utilized by deer, antelope, and livestock, and the seeds are eaten by fox, bear, squirrel, chipmunk, songbirds, deer and turkey.

(6) Agricultural Ecosystem

The agricultural ecosystem is perhaps the most productive within the assessment area. Most of the annual crops within the valley supply food for man as well as livestock and wildlife species. Large populations of songbirds, rodents, and insects inhabit the valley and utilize the available food. Birds of prey and various predatory mammals also rely on these valley populations for subsistence.

The agricultural lands are essentially under the full control and management of man and will continue to be cultivated, planted, and harvested. Riparian ecosystems, however, that are generally associated with these agricultural areas, are of immediate concern and importance. Riparian woodlands are so unique, rare, and important within the desert southwest that every effort should be made to protect them from destruction and unnecessary disturbances. A diversity of animal species is associated with these highly stratified vegetal communities. An abundance of invertebrates occur, of which some are herbivorous, some are carnivorous, and some are omnivorous. The invertebrates, in addition to vegetal species, provide an essential food source for numerous vertebrates, especially amphibians, reptiles, and birds. Fewer mammals feed strictly on invertebrates. Various reptiles, amphibians, birds, and mammals rely on other vertebrates for subsistence. Of special significance are the birds of prey which utilize the areas, not only for food, but also for nesting, resting and protective cover.

3. Community Relationships

a. Aquatic Ecosystem

The aquatic ecosystem relies upon each species within the system in order to maintain itself. The various seral stages within

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the aquatic ecosystem provide nutrients for subsequent stages. The plants and animals provide food and habitat for each other. A large number of wildlife species, such as fish, aquatic invertebrates, shorebirds, and waterfowl, are totally dependent on these communities. Numerous terrestrial species also are dependent upon aquatic ecosystems. The water and adjacent vegetation provide essential life-sustaining components for antelope, deer, quail, dove, and numerous songbirds.

b. Terrestrial Ecosystem

(1) Creosotebush Ecosystem

Creosotebush populations in the assessment area have stabilized. The plants are of uniform height and distribution. Usually, very little additional vegetation is associated with the shrub. Went (1955) indicated the reason for the lack of other plant species in the ecosystem was that creosotebush contains a water soluble growth inhibitor that remains in soils. If the area receives above average rainfall, the inhibitor is washed away and other plants germinate and grow. Knipe and Herbel (1966) also studied the growth inhibitors in creosotebush. Both Went and Herbel concluded that creosotebush does contain a growth inhibitor. Went (1955) believed it inhibited germination, but Knipe and Herbel (1966) found that the inhibitor reduces the development of the shoots and roots of the major grasses (black grama and bush muhly) after germination occurs. This, along with the fact that creosotebush is able to extract water from the soil at high altitudes (25 atmospheres) may explain the lack of other plants within the ecosystem.

The growth inhibitor within creosotebush does not inhibit its own growth. However, once the shrub population is established, the viability of the seeds decreases (Barbour 1968 and 1969). Due to the general harshness of the creosotebush community, the desert pavement, the growth inhibitors produced by the plant, and the unpalatable nature of the plant, the community is used by few animal species. Around its periphery, where ecotones are formed in its overlap with the ecosystems of grasslands, mesquite, or desert shrub, a more significant use of the creosotebush is made by nesting birds, resting animals, or by animals seeking escape cover. This is, perhaps, the most significant relationship between the creosotebush ecosystem and adjacent ecosystems.

(2) Mesquite Ecosystem

Mesquite is generally the dominant shrub in the mesquite ecosystem. The shrub is usually low-growing, and the spines on the shrub protect many of the underlying grasses from being

overgrazed by livestock. The shrub does not protect these associated plants from all the small wildlife species utilizing the areas under the shrubs.

The roots of the mesquite shrub are long and branching. They provide stabilization of the dune as reinforcement bar does in concrete. This stabilization allows many other plants to become established on the dune. The roots of mesquite also release nitrogen into the soil enhancing the growth, development, and palatability of associated plant species. Even though the roots of mesquite enhance other vegetation, the roots do take a lot of water out of the soil, increasing the competition among other plants within the ecosystem.

The majority of the animal species associated with the mesquite ecosystem is dependent upon the dunes that are common to many of these ecosystems. Antelope will utilize forbs and other succulent plants associated with this ecosystem in addition to utilizing the mesquite bean. The pyrrhuloxia, *Pyrrhuloxia sinuata*, and other species of birdlife are especially dependent upon mesquite for nesting and protection. Numerous reptiles (lizards and snakes) occupy an important niche within this ecosystem because of the abundance of invertebrates and rodents.

(3) Desert Grassland Ecosystem

The desert grassland ecosystem is dominated by grama grasses in association with numerous other species. Many of these grasses are adaptive to certain soils, while other inhabit all sites. The grasses produce a specific microclimate that must persist if the plants are to survive. Under such conditions, the soils are cooler and contain more moisture than those in areas which do not have a developed microclimate. Many of the grass plants are capable of producing seed but are more apt to spread by vegetative reproduction through rhizomes and stolens (Jackson, 1928).

Shrubs, such as creosotebush, are able to invade the grasslands because of the lack of grass seed in the soil and when the vigor of the grass is reduced by drought and heavy grazing. The shrub seeds germinate and grow with little interference from the deteriorating grass plants. Once creosotebush invades a grassland and becomes established, its physiological characteristics provide competition which grasses cannot withstand. If these areas are provided proper protection, however, the grasses do have the ability to compete and eventually re-establish themselves over the area. The grassland community is basically comprised of three strata: the roots, the ground cover, and the plant foliage. Most of the animal life associated with this community is directly dependent upon one or more of these strata.

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Species occupying the soil or root stratum may be decomposers that help in maintaining the fertility of that stratum, or they may be simply residents (i.e., ants, overwintering pupae, or eggs). Ground stratum inhabitants include such predatory scavengers as spiders, beetles, and scorpions, which prey upon other invertebrates. The foliage stratum is inhabited by a diversity of insects, including grasshoppers, aphids, bees, and flies. Populations of rodents will utilize all three strata, feeding on roots and foliage, and constructing dens in the soil. Various species of birdlife, some of which have developed loud, specific songs or calls by which they define their territory (i.e., meadowlark), utilize the ground and foliage strata. These strata are used for feeding where insects and seeds are taken; and in addition, the foliage stratum is used for nesting and for loafing cover.

Another prominent animal species of these desert grasslands is the pronghorn antelope. This animal is especially dependent upon the green, succulent grasses which appear following early spring precipitation and during the rainy season. During the remainder of the year, forbs and weeds, along with various palatable shrubs (i.e., wild buckwheat, sand sage, and mariola) comprise the antelope's diet. The scattered dry lake beds are frequented by the antelope during both moist and dry periods, since these areas provide the most available source of food.

(4) Desert Shrub Ecosystem

The desert shrub ecosystems are isolated, located between the grassland and pinyon-juniper ecosystems which have developed because of better moisture conditions. The shrubs within these systems compete with each other for the moisture and soil nutrients. Generally, no one shrub species is dominant.

The desert shrub ecosystem has a diversity of associated shrub species and an understory of grasses, forbs, and litter. Its sub-surface root stratum provides a somewhat "upper class" desert ecosystem. Abundant populations of invertebrates and vertebrates live in this ecosystem. Often these isolated ecosystems may be over-utilized by livestock grazing. Even a small amount of destruction or unnecessary or prolonged disturbance could be devastating to this ecosystem because of the diversity of animal species that are dependent upon the areas for food and cover and because of its relatively small acreage.

(5) Pinyon-juniper Ecosystem

Pinyon and juniper species are able to displace associated plant species through competition. The grasses and shrubs have been reduced and soils lost. The conifer species have stabilized most of the soils, but through competition for nutrients, the associated species are inhibited.

The pinyon-juniper ecosystem is especially attractive to animal species because of the abundant food source provided. It is most important during the fall and winter months, when numerous migratory birds, mammals, and insects enter the area in need of food and cover. Birds which have specialized beaks for cracking seed (i.e., Clark's nutcracker, red crossbill, blackheaded grosbeak) are common visitors. Other species dependent upon the seeds include mule deer and antelope. In addition, the foliage of these trees, as well as the foliage and seeds of the grasses, forbs and shrubs associated with this community, provides essential foods.

(6) Agriculture Ecosystem

There is no actual community relationship between the many annual crops in this system. The crops are grown individually and harvested without concern for what is growing in the adjacent field. Nutrients, insecticides, herbicides, and water are introduced into this system to enhance crop production; there is little competition between plants.

Although the agricultural areas and their associated crops are the result of unnatural development and require the constant assistance of man to maintain productivity, a diversity of animal species is dependent upon them. The grains and forage crops produced attract numerous birds (i.e., mourning dove, quail, sandhill crane, geese) as well as mammals, reptiles, amphibians, and invertebrates.

D. Human Interest Values

1. Landscape Character

a. Open Space

The primary landscape is desert type with elevations ranging from 1241 m (4,205 ft) at Rincon, N.M., to 2230 m (7,560 ft) on Caballo Mountain. Most of the land is covered with vegetation common to the semi-arid and arid portions of southwestern New Mexico. The Rio Grande Valley, which divides the study area and provides contrast and variety, contains croplands, non-croplands, two major reservoirs, and desert foothills. The river and the contrasting

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colors of the croplands contribute variety to the normal monotone of the desert.

Desert mountains form the eastern boundary of the area. Foothills of the Gila National Forest form the western boundary. As the land rises, vegetative changes occur, creating gradual relief from the creosotebush benches which make up the lower mesas adjacent to the Rio Grande Valley. Deep arroyos cut the landscape close to the river valley, allowing runoff to occur.

Open space is dominant throughout the assessment area. Man-made intrusions interrupt visual reference, but do not form major intrusions to open space except on a very localized basis.

b. Scenic Quality

Land form, color, water, vegetation, uniqueness, and intrusions are key factors in evaluating scenic quality (BLM, 1970). A numerical value and alphabetical class evaluation score results from using given criteria and making comparisons to regional land areas. A classification scale ranging from A to C (high to low) is used in arriving at an evaluation score. The Radium Springs geothermal assessment area varies in scenic quality from C to B. The mesas and flat lands are in C class and vary within the class from high to low. The mountain areas and river valley lands, including Caballo and Elephant Butte Reservoirs, are B class, but again, vary within the class from high to low (Fig. 15). The assessment area was compared with desert and semi-desert areas of southwestern New Mexico and received an average scenic quality rating. This situation is typical of most of the assessment area with the exception of the Rio Grande Valley. Factors reducing scenic quality are lack of variety and color.

c. Primitive Values

Primitive value rating of the Radium Springs geothermal assessment area is being considered in the Bureau of Land Management planning system. Criteria used in evaluating the area include the following rating factors: (1) intrusions, (2) scenic quality, (3) wildlife, (4) fisheries, (5) water usability, (6) size, and (7) uniqueness (BLM, 1976).

By rating remote areas according to these factors and applying numerical values, a primitive value score of C was established (Kline, 1974). The criteria used take into consideration qualities which are thought to be pertinent to primitive values. The rating of C expresses a low average value when compared to other areas in the

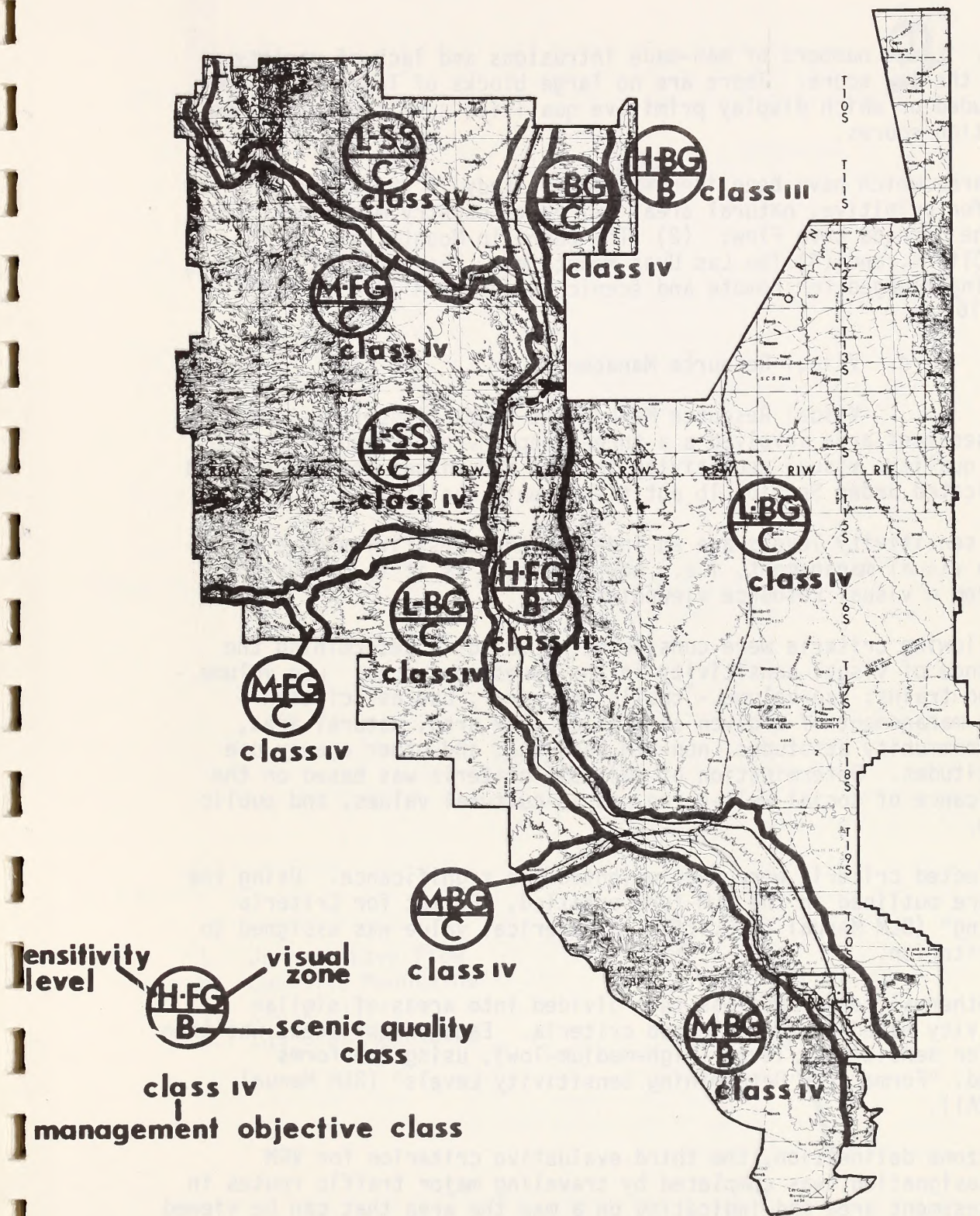


FIGURE 15 VISUAL RESOURCE MANAGEMENT CLASSES FOR RADIUM SPRINGS GEOTHERMAL ASSESSMENT AREA

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region. Large numbers of man-made intrusions and lack of variety caused the low score. There are no large blocks of land which are unintruded or which display primitive qualities sufficient to raise evaluation scores.

Major areas which have been identified for study in the BLM's land use plans for primitive, natural area, or remote country management are: (1) The Jornada Lava Flow; (2) The Cuchillo Mountains; (3) The Chalk Cliffs; and (4) The Las Uvas Mountains. The Las Uvas Mountains are being managed for remote and scenic values (BLM 1974 and 1975) (Fig. 16).

d. Visual Resource Management

Visual Resource Management (VRM) classes assigned to the assessment area involved a three step inventory and evaluation. Scenic quality, visual sensitivity levels, and visual zones were used as indicated under Section 1b entitled Scenic Quality.

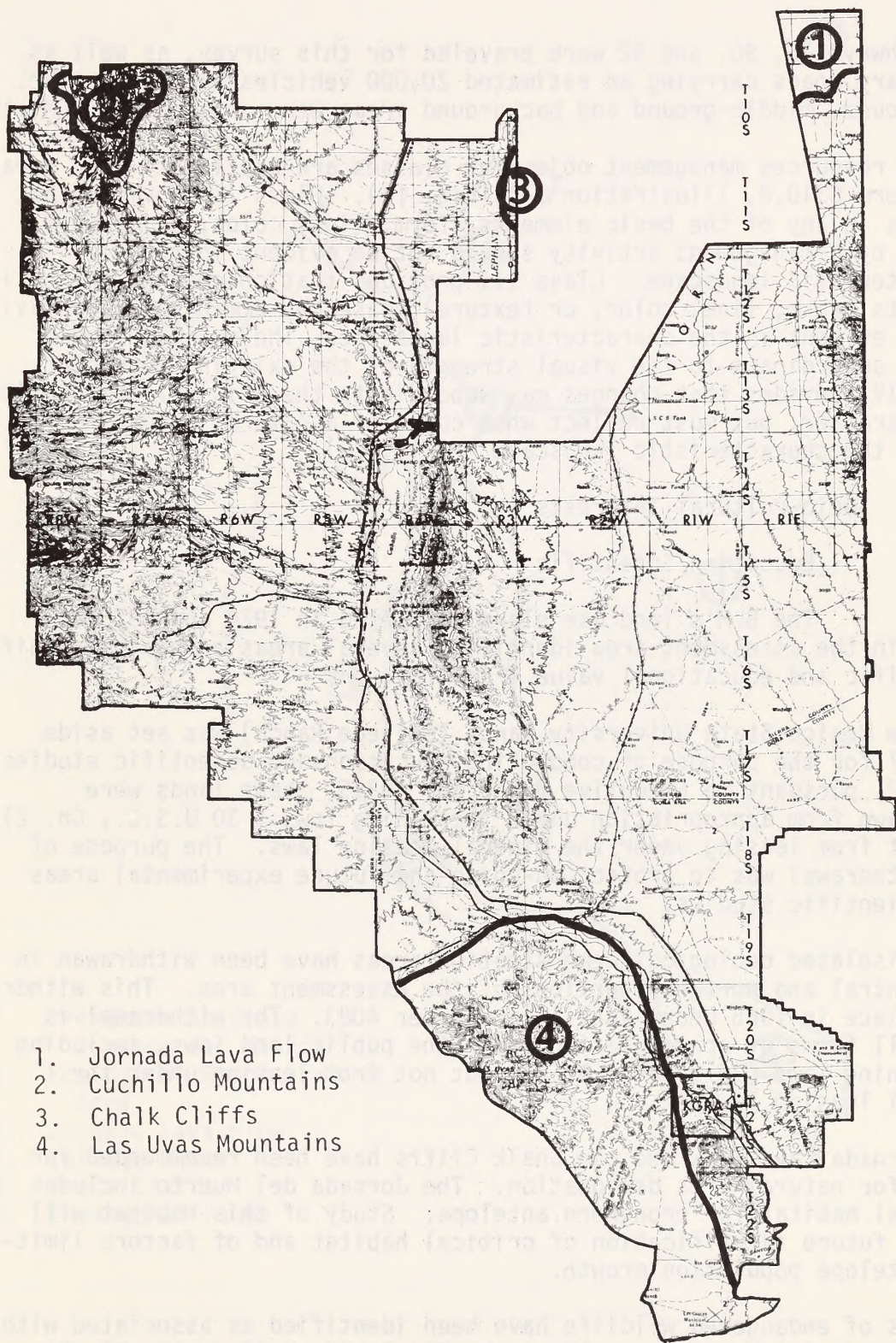
Visual sensitivity levels are an index to the sensitivity of a given area to visual management, i.e., how important is it to manage the area from a visual resource viewpoint?

The following criteria were considered as valid in determining the importance of visual sensitivity in the assessment area: use volume - cars and trains; use volume - trails and river; use association - current management of a given area (i.e., ORV area, natural area, etc.); community attitudes; non-BLM land use; and other agency use and attitudes. Determination of suitable criteria was based on the significance of social well-being, socio-cultural values, and public opinion.

The selected criteria were then weighted for significance. Using the procedure outlined in the BLM form entitled, "Format for Criteria Weighting" (BLM Manual 6310.12A2), a numerical value was assigned to each criterion.

The geothermal lease area was then divided into areas of similar sensitivity based on the selected criteria. Each of the areas was then rated for sensitivity level (high-medium-low), using BLM forms entitled, "Format for Determining Sensitivity Levels" (BLM Manual 6310.12A1).

Visual zone delineation, the third evaluative criterion for VRM class designation, was completed by traveling major traffic routes in the assessment area and indicating on a map the area that can be viewed from each point along the highway. U.S. Highways 85 and I-25,



1. Jornada Lava Flow
2. Cuchillo Mountains
3. Chalk Cliffs
4. Las Uvas Mountains

FIGURE 16

MAJOR AREAS IDENTIFIED FOR PRIMITIVE, NATURAL AREA OR REMOTE COUNTRY MANAGEMENT STUDY

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NM Highways 26, 90, and 52 were traveled for this survey, as well as secondary roads carrying an estimated 20,000 vehicles or more a year. Foreground, middle-ground and background areas were delineated (BLM, 1975).

Visual resources management objective classes are applied to each area (BLM Form 6310.8, Illustration 11) (Fig. 15). Class II provides that changes in any of the basic elements (form, line, color, or texture) caused by a management activity should not be evident in the characteristic landscape. Class III provides that changes in the basic elements (form, line, color, or texture) caused by a management activity may be evident in the characteristic landscape. The changes should remain subordinate to the visual strength of the existing character. Class IV provides that changes may subordinate the original composition and character, but must reflect what could be a natural occurrence within the characteristic landscape (Fig. 15).

E. Socio-cultural Interests

1. Education/Scientific

The BLM's land use plans completed in 1974 and 1975 on lands in the assessment area identified several areas as having significant scientific and educational value (Fig. 17).

The New Mexico State University Ranch (College Ranch) was set aside in 1927 for the purpose of conducting education and scientific studies. In 1952, pursuant to Executive Order No. 10355, these lands were withdrawn from appropriation under the mining laws (30 U.S.C., Ch. 2), but not from leasing under the mineral leasing laws. The purpose of the withdrawal was to protect on-going and future experimental areas and scientific studies.

Three isolated ecological demonstration areas have been withdrawn in the central and northern portions of the assessment area. This withdrawal took place in 1966 under Public Land Order 4083. The withdrawal is from all forms of appropriation under the public land laws, including the mining laws (30 U.S.C. Ch. 2), but not from leasing under the mineral leasing laws.

The Jornada Lava Flow and the Chalk Cliffs have been recommended for study for natural area designation. The Jornada del Muerto includes critical habitat for pronghorn antelope. Study of this habitat will enable future identification of critical habitat and of factors limiting antelope population growth.

Species of endangered wildlife have been identified as associated with the Jornada del Muerto as well as the Rio Grande Valley, the Black

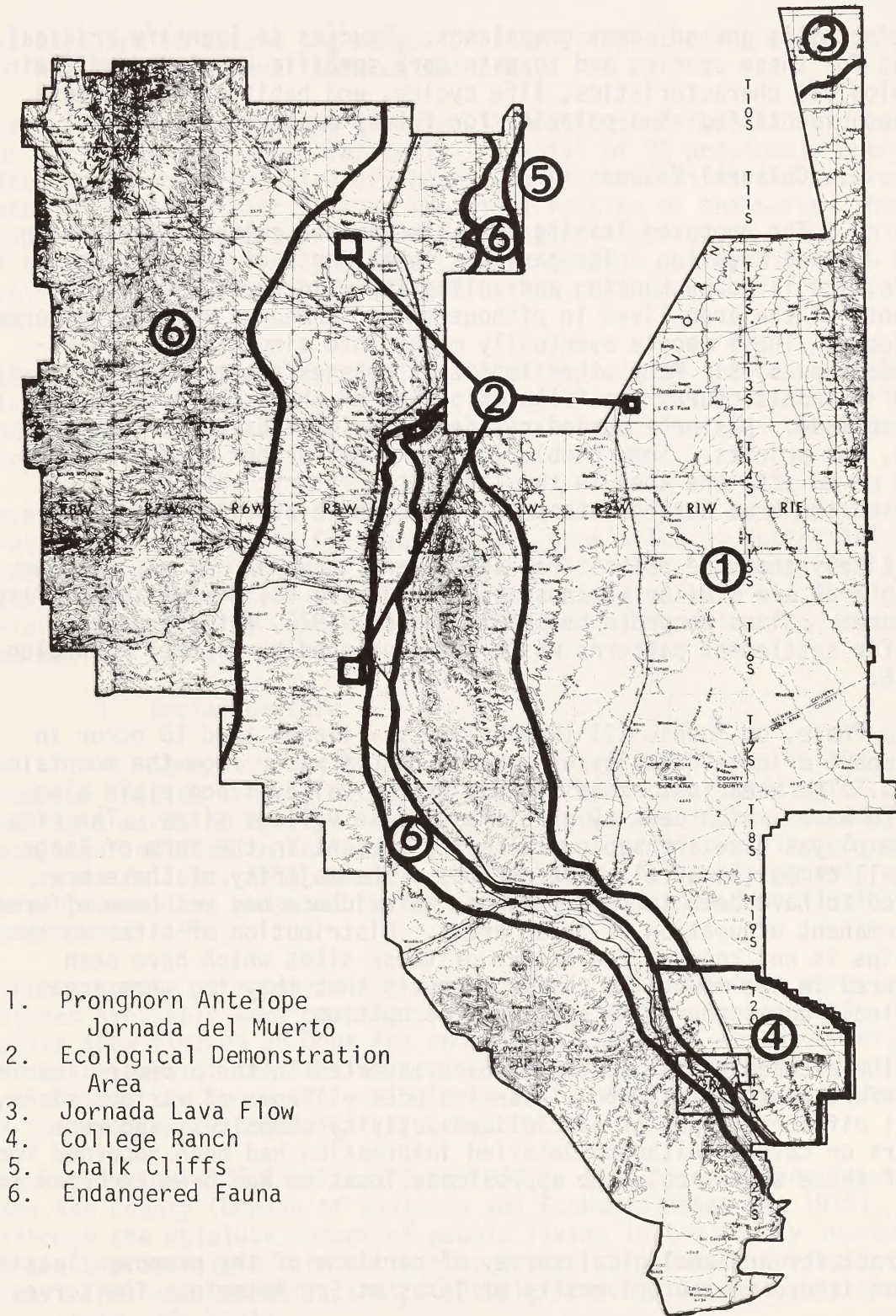


FIGURE 17

AREAS OF RARE OR UNIQUE RESOURCES WHICH SHOULD BE STUDIED FOR EDUCATIONAL AND SCIENTIFIC VALUES

DESCRIPTION OF THE EXISTING ENVIRONMENT

Range foothills and adjacent grasslands. Studies to identify critical habitat for these species and to gain more specific knowledge of their physiological characteristics, life cycles, and habitat requirements have been identified as a priority for future management.

2. Cultural Values

The proposed leasing area lies in the cultural area known as the Jornada Mogollon. The earliest inhabitants of the area were nomadic, and lived by hunting and collecting wild foods. Later residents of the area lived in pithouses and farmed as well as gathered wild foods. These people eventually moved into single-story, multi-room adobe pueblos. Many other important changes accompanied this change in architecture, but full definition of these changes has not yet been made. Historic period residents included European ranchers, miners, and priests. Some pueblo Indians from further north in New Mexico moved into the area in the late 17th century. Apache groups also used the area during late prehistoric and historic times.

It is likely that the prehistoric settlement patterns in the proposed leasing area are similar to those in the Las Cruces, New Mexico-El Paso, Texas area. Sites recorded before September, 1976, fit the general model for settlement patterns which was developed by Michael E. Whalen in 1976.

El Paso Phase, or Pueblo III (Rouse 1962), villages tend to occur in areas where a large quantity of surface runoff water from the mountains settles. The area just above the Rio Grande Valley flood plain also tends to have a high density of El Paso Phase village sites. The rims of some playas have archaeological sites present in the form of large and small campsites of all time periods. The majority of these are believed to have been temporary camps; no evidence has yet been offered for permanent occupation of these areas. Distribution of sites in the mountains is not known. The nature of those sites which have been discovered in the mountains so far suggests that they too were areas of periodic use rather than permanent occupation.

About 100 archaeological sites had been reported in the proposed leasing area before September, 1976. These included villages of various sizes, several different types of specialized activity campsites, and rock shelters or caves. Although detailed information had been recorded for some of these sites, only the approximate location had been recorded for others.

A contract for archaeological survey of portions of the proposed leasing area was issued to the University of Texas at San Antonio. The survey

Socio-cultural Interests

was expected to double the number of known sites, adding significantly to the information available on the area.

The University field crews surveyed 33 sections of federal land under the direction of Colonel Tom Kelly. A total of 95 previously unknown sites were recorded. Five of these were historic sites and the rest dated from prehistoric times. The final results of the survey should help either to support or to modify existing theories on the prehistory of the area. A copy of the final report on this survey will be available for public use at the BLM Office, Las Cruces District, after February 15, 1977

Other types of culturally significant sites include shrines and other places with religious significance, as well as areas involved in local annual festivals, etc. No compilation of these sites was possible for this document.

Several historic trails cross national resource lands in the assessment area. They include the Chihuahua Trail, Cook's Trail, Butterfield Trail, and the San Antonio to Santa Fe mail route. Camps sites, stage stops, forts, and other historic places associated with the trails are briefly described by John Wilson in "Historical Profile of Southwestern New Mexico" (1975).

3. Social Welfare

Some description of social welfare conditions in the proposed leasing area is necessary for a proper understanding of the leasing area as an entity. Figures for population income and employment have been included in Tables 17 through 20. A brief profile and analysis of trends follows, with some discussion of the regional economic development plans proposed by the Southern Rio Grande Council of Governments (1976).

Since a county is a convenient economic unit with which to work, most figures available were compiled on a county basis. Consequently, all tables show figures of Dona Ana and Sierra Counties, which comprise the major part of the leasing area. The portion of Socorro County included in the proposed leasing area is so small that no consideration of Socorro County economics is necessary.

Figures in Table 18 show that from 1960 to 1970, people were leaving Dona Ana County (Bureau of Business and Economic Research, 1975). Although the absolute number of people living in the county increased, this was primarily due to new births rather than people moving into the area. The same tendency, that of people leaving the area, was shown on a state-wide basis.

TABLE 17 LAND OWNERSHIP, 1966-1967, FOR DONA ANA AND SIERRA COUNTIES
IN RELATIONSHIP TO THE STATE OF NEW MEXICO 1/

Unit	STATUS								
	Federal		Indian		State		Private		
	Acres	% Unit Area	Acres	% Unit Area	Acres	% Unit Area	Acres	% Unit Area	
Total Unit Acreage									
State of New Mexico	26,735,431	34.4	7,348,563	9.4	9,413,017	12.1	34,369,229	44.1	
	10,694,172*		2,939,425*		3,765,207*		13,717,691*		
Dona Ana County	1,821,515	74.8	-	-	286,910	11.8	326,135	13.4	
	728,606*				114,764*		131,054*		
Sierra County	1,830,310	67.8	-	-	361,195	13.4	508,655	18.8	
	732,124*				144,478*		203,462*		

1/ New Mexico Statistical Abstract, 1975, Bureau of Business and Economic Research, University of New Mexico, Albuquerque, N.M. 141 pp.

*Hectares

TABLE 18 POPULATIONS, 1960-1970, FOR DONA ANA AND SIERRA COUNTIES
IN RELATIONSHIP TO THE STATE OF NEW MEXICO ^{1/}

Unit	1960	1970	Change Numbers	Percent	Natural Increase	Inferred Net Migration
State	951,023	1,016,000	64,977	6.8	184,870	-119,893
Dona Ana County	59,948	69,773	9,825	16.4	14,625	- 4,800
Sierra County	6,409	7,189	780	12.2	- 282	1,062

^{1/} New Mexico Statistical Abstract, 1975, Bureau of Business and Economic Research,
University of New Mexico, Albuquerque, N.M., 141 pp.

TABLE 19 EMPLOYMENT FOR 1960, 1966, and 1973, BY PERCENT OF TOTAL EMPLOYMENT FOR DONA ANA AND SIERRA COUNTIES IN RELATIONSHIP TO THE STATE OF NEW MEXICO ^{1/}

Sector of Industry	Dona Ana County		Sierra County		State	
	1960	1966	1960	1966	1960	1966
Agriculture	13.1	10.5	12.9	11.0	6.8	5.7
Mining	9.0	0.1	0.5	0.0	6.2	4.6
Government	32.3	42.2	8.0	24.2	16.5	28.3
Other	54.5	47.2	78.6	64.8	70.5	61.4
Total	100.	100.	100.	100.	100.	100.

^{1/} New Mexico Statistical Abstract, 1975, Bureau of Business and Economic Research, University of New Mexico, Albuquerque, N.M. 141 pp.

TABLE 20 PERCENT OF PERSONAL INCOME BY INDUSTRIAL SECTOR FOR DONA ANA AND SIERRA COUNTIES IN RELATIONSHIP TO THE STATE OF NEW MEXICO 1966 ^{1/}

Sector of Industry	Dona Ana County	Sierra County	State
Agriculture	8.0	10.9	6.1
Mining	0.1	0.0	4.8
Government	40.9	14.6	23.6
Other	<u>51.0</u>	<u>74.5</u>	<u>65.5</u>
Total	100.	100.	100.

^{1/} New Mexico Statistical Abstract, 1975, Bureau of Business and Economic Research University of New Mexico, Albuquerque, N.M. 141 pp.

DESCRIPTION OF THE EXISTING ENVIRONMENT

The unemployment rate in Dona Ana County for 1970 was slightly higher, at 6.4 percent, than the New Mexico state average (Bureau of Business and Economic Research, 1975). An analysis of employment trends from 1960 to 1973 reveals that the percent of the employed work force engaged in agriculture has steadily dropped, while the percent working for federal, state, and local governments has steadily increased. The percent of the work force engaged in mining has remained constant. The percent working in other types of jobs (including manufacturing, construction, sales and service organization, tourist attractions such as mineral hot baths, etc.) has varied somewhat, with no steady trends apparent at this time.

While no trends can be established for rates of income in Dona Ana County due to lack of information, some points may be made on the basis of the available figures. Table 20 represents the percentage of all personal income paid to people working at different kinds of jobs within the two counties. The figures for 1966 (Tables 19 and 20) show that people employed in agriculture and government made slightly less than average wages, while people in "other" jobs made higher than average wages.

Population figures from 1960 to 1970 for Sierra County show that people have been moving into Sierra County at a relatively high rate. In addition, it seems that the death rate has been higher than the birth rate. Both of these trends may be due to the high percentage of retirees in the county along with the influx of more retirees to Truth or Consequences.

The unemployment rate in Sierra County was slightly lower, at 3.7 percent, than the New Mexico State average (Bureau of Business and Economic Research, 1975). The employment figures for 1960 to 1973 show a steady increase in the percentage of people employed by federal, state and local governments. At the same time, the percentage of people employed in jobs other than agricultural or government has dropped sharply. The percentage of people employed in agriculture rose sharply between 1960 and 1973, although this trend has apparently not been steady. All of the employment trends in Sierra County have been in line with state-wide trends.

Again, no trends can be discussed for personal income. The same comparisons with employment can be made for Sierra County as were made for Dona Ana County. It should be kept in mind that all figures have been supplied for a specific year and cannot be compared from table to table unless compared with figures from the same year.

The whole leasing area, in 1974, had proportionately fewer doctors per population than the state as a whole, with each doctor in the

area responsible for over 1,000 people (Bureau of Business and Economic Research, 1975). A similar shortage of hospital facilities exists in the area. Sierra County has two hospitals to serve roughly 8,000 people and Dona Ana County has one hospital to serve 78,000 people. The pressures on Dona Ana County facilities may be somewhat alleviated by the use of facilities in El Paso, Texas.

Among the plans for economic development in these counties are the following projects enumerated by the Southern Rio Grande Council of Governments:

a. Dona Ana County

- (1) Ground Water Availability Study
- (2) Greater Las Cruces Industrial Development Board
- (3) Dona Ana County Occupational Education Branch
- (4) Solar Energy Development Program
- (5) The Telemedicine System

b. Sierra County

- (1) Improvement of Elephant Butte Lake State Park and Caballo State Park
- (2) Willimsburg State Park Improvement
- (3) Community College

More information on each of these programs and on economic planning and coordination efforts is available from the Southern Rio Grande Council of Governments. All of the programs point toward an attempt to bring industry and other additional income sources into the proposed leasing area. An attempt to plan for increased population is also evident.

4. Local Regulatory Structure

Regulatory structure includes all official provisions for regulating human activity in an area. Three basic components of regulatory structure are: (1) federal, state, and local legislation; (2) all groups of people officially elected or appointed to make or enforce the laws; and (3) all mechanical regulatory aids, i.e., street lights, road signs, and crosswalks.

It was not possible to compile a complete inventory of the regulatory structures in the proposed leasing area. A lack of zoning regulations in most communities of the area may prove a deficiency in the local regulatory structure as the population increases.

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5. Land Use Compatibility

Uses of private, state, and federal lands are generally compatible. Lands are mostly used for livestock grazing, wildlife habitat, watershed, and recreation. Housing and irrigated croplands are found on privately held lands, while mining, grazing, and other resource uses are attributed mostly to state and federal holdings. A description of major land uses follows.

a. Recreation

The Rio Grande Valley is densely inhabited and provides considerable recreational opportunity, while the remainder of the area is sparsely inhabited and provides a back country environment which offers dry land and mountain type recreational opportunity.

Water sports, fishing, driving for pleasure, sightseeing, small game, upland game, and waterfowl hunting, yearlong casual shooting, rockhounding, picnicking, and camping account for most of the outdoor recreation in the assessment area. Mountain climbing, hiking for pleasure, and historical and archaeological study are also primary recreational pursuits. Many visitors may participate in several of the activities during one trip. Residents usually pursue a variety of recreational activities, including big game hunting where resources are available.

Tourists pass through the area on Interstate 25 and U.S. Highways 85 and 26. Approximately 2.5 million persons visit Elephant Butte and Caballo Lake State Parks annually. While the Rio Grande Valley, including the lakes, attracts large numbers of visitors, the back country offers solitude and sanctuary. Most back country visitation is by local persons or individuals maintaining part-time residence in the area of Truth or Consequences.

b. Grazing

The major portion of the land in the assessment area is used to some extent for grazing of livestock with the exception of cultivated farm lands in the Rio Grande Valley. Licensed use on national resource lands in the area amounts to approximately 130,800 Animal Unit Months (AUM's); however, it is believed that actual use is less than licensed use due to inadequate range conditions (BLM, 1974 and 1975). Livestock grazing constitutes approximately 2 percent of economic activity in the area and utilizes approximately 85 percent of the land.

c. Agriculture

Much of the Rio Grande Valley is currently under irrigation and cultivation. In 1973, cotton, lettuce, and onions were the crops which contributed most to Dona Ana county income. Hay, cotton, and sorghum contributed the most to the income of Sierra County.

d. Urban and Suburban

According to the U.S. Bureau of Census figures (1970) 66.2 percent of Dona Ana County's population were considered urban residents in 1970, while 33.8 percent were considered rural residents. Most of the urban population centered in five settlements: Las Cruces, Anthony, La Mesilla, Meadow Vista, and White Sands Missile Range.

The population of Sierra County in 1970 was divided into 64.8 percent urban dwellers and 35.2 percent rural residents. The urban population in this county was centered in Truth or Consequences.

There are no easily definable suburban zones surrounding the cities in these counties. The Rio Grande Valley is used extensively for agriculture and might be considered suburban because of numerous farmhouses and small communities.

e. Rights-of-way

The lands in the assessment area are crossed by a number of rights-of-way of vital importance of the population of El Paso, Texas, and central and southern New Mexico. Major rights-of-way are as follows:

(1) Transportation Rights-of-way

Interstate 25, running north and south from El Paso, Texas, to Albuquerque, New Mexico, and State Highway 26, from Hatch to Deming, New Mexico, are the major routes of travel in the area. According to New Mexico Highway department figures, about 3,000 vehicles travel the routes daily.

A Southern Pacific Railroad line runs north and south through the area from Radium Springs to Socorro, and west from Hatch to Deming. Traffic on the routes varies, but rarely is less than one train each way per day. Limited passenger accommodations are available on the route.

Other paved roads include State Road 52 from Engle to Winston, 90 from Caballo to Hillsboro, 142 from Truth or Consequences to Placita, and Highway 58 from Truth or Consequences to Radium Springs and Las Cruces. Improved and unimproved dirt roads lead to ranch headquarters and various other destinations.

DESCRIPTION OF THE EXISTING ENVIRONMENT

(2) Electric Power Rights-of-way

A number of power lines are found throughout the assessment area. A 345 kV line runs north and south in the east central portion of the assessment area, and a 115 kV line parallels Highway 26 and Interstate 25 in the western portion of the area. There are numerous lesser voltage lines serving small communities and ranches which are scattered throughout the area.

(3) Gas Pipeline Rights-of-way

A Chevron Pipe Line Company petroleum products line runs north and south through the east-central part of the assessment area. It is located in the Jornada Plain east of the Caballo Mountains (BLM, 1975). There is also a natural gas line running north and south along the Rio Grande Valley which serves the communities located in the Valley.

(4) Communications Rights-of-way

Several communication facilities are located on Caballo Mountain. The top of Caballo Mountain is known as a "communication site" and has 16 present users.

Microwave towers are located on a small peak 2.8 km (1.75 mi) north of Rincon, New Mexico, and on Lone Mountain, which is about 6.4 km (4 mi) east of Caballo Mountain. Telephone lines serve communities, ranches and other installations throughout the assessment area.

(5) Proposed Rights-of-way

One 115 kV line from Caballo Lake to the Quintana Company copper mine development north of Highway 90, east of Hillsboro, is in early planning stages. No other rights-of-way are pending.

(6) Other Considerations

Approximately 445 ha (1,100 ac) in Sections 3, 10, and 15, T. 13S., R. 4W., and in Section 33, T. 12S., R. 4W., are available for residential, commercial and industrial use. These lands are 3.2 to 6.4 km (2 to 4 mi) northeast of Truth or Consequences between Interstate 25 and Elephant Butte Lake. Part of the land in Section 33 contains an interchange on the interstate highway. This interchange provides access to Elephant Butte Estates and the State Park.

Socio-cultural Interests

The adjacent lands are being developed for homesites and recreation. It is expected that the lands will be needed for intensive use purposes because of their proximity to Truth or Consequences and Elephant Butte Lake. Utility and transportation rights-of-way may be needed here to serve residential populations.

There are a few tracts of national resource lands between Elephant Butte Reservoir and Caballo Reservoir. These tracts may be suitable for recreation purposes or homesites. In the event private lands accommodate demand, public lands may serve as open space, recreational lands, land fill areas, or may fill other needs for rights-of-way.

There are two pending Recreation and Public Purposes (R&PP) applications filed by Sierra County to lease 4 ha (10 ac) of public land for a landfill and .8 ha (2 ac) for a baseball field and stadium. The Sheriff's posse R&PP site north of Truth or Consequences is being considered for change of use to a rifle range. It may be expected that community needs will change as populations change, and existing land uses may be no longer suitable. Lands affected most will be those closest to the communities.

III. ANALYSIS OF THE PROPOSED ACTION AND ALTERNATIVES

A. Environmental Impacts

1. Anticipated Impacts

Anticipated impacts of geothermal leasing in the Radium Springs KGRA were assessed by a team of specialists using the Environmental Analysis Worksheet (Form 1790-3) (Appendix G). The stages of implementation were divided into: Pre-lease Exploration (Casual Use), Pre-lease Exploration (Exploration Operations) Post-lease Exploration, Development, Production, and Close-out. The discrete operations are those which take place under the various stages of implementation. These stages and the discrete operations occurring in each stage were discussed in the background information of the "Description of the Proposed Action and Alternatives."

In an attempt to reduce personal bias, a team approach was used in evaluating the impacts of each type of operation on each environmental element. First, a list of all the environmental elements suggested for consideration by the BLM Environmental Analysis Manual 1791 was distributed to the team members. A list of the discrete operations which might occur during geothermal operations was then developed. Each team member then rated the impact of each discrete action on each environmental element. The team as a group discussed the anticipated impacts and reached agreements on the most reasonable rating for each of these impacts. After this analysis, some of the environmental elements were eliminated because no significant impacts were expected from a discrete operation or stage of implementation.

Casual use methods utilized during the pre-lease stage of exploration have almost no impact on the environment. Field exploration is confined to existing roads and trails or crossing country on foot. Small water or rock samples will be collected for analysis. Casual use methods also include a literature search confined to libraries and public records, and airborne surveys, neither of which impact the environment. The field surveys will bring a small amount of money into the community. Results of the surveys may add to the geologic knowledge of the area, yielding minor positive impacts.

Close-out is that stage which occurs after a developed and productive geothermal resource is exhausted. Considering that a period of 5 to 10 years passes from leasing to production, and that a developable geothermal resource must have a minimum life expectancy of 30 years; it is difficult to anticipate the impacts of close-out on the environment that far in the future.

*Environmental Impacts - Anticipated
Non-living Components*

The issuance of a geothermal lease, in itself, does not produce impacts upon the environment; but once the lease is issued, impacts may occur. The information gathered during exploration may determine the fate of the geothermal field. If a resource is encountered, plans will be made for the most practical use of the resource. The geothermal resources may be used for the production of electricity, space heating, agricultural production, etc., or a combination of these. If, on the other hand, an economical resource is not discovered at any stage of implementation, industry will probably withdraw from the area and no further impacts will result. Anticipated impacts, however, will be analyzed in the following sections titled "Pre-lease Exploration (Exploration Operations)," "Post-lease Exploration," "Development," and "Production," even though the development of the field may never take place.

a. Non-living Components

(1) Air

(a) Pre-lease Exploration (Exploration Operations)

Impacts upon air quality due to pre-lease exploration activities should be minimal. Exploration will be confined to existing roads in most instances. Shallow temperature gradient holes and active seismic methods usually require some vehicular movement and off-road travel. This may produce a low impact on air quality by adding to the current levels of particulate matter and carbon monoxide. Negligible amounts of noxious gases will be released during all pre-lease exploratory action utilizing equipment or vehicles.

(b) Post-lease Exploration

Air quality impacts during post-lease activities are similar to those during pre-lease exploration. The possible exception is the increased activity and the inadvertent release of noxious gases associated with deep exploratory wells. This would cease when exploration is complete and the wells are plugged.

(c) Development

During this stage of implementation, moderate to high impacts on air quality are expected from particulate matter, and negligible to low impacts are expected from noxious gases. Increased impacts will be due to additional wells being drilled and tested and increased vehicular movement.

(d) Production

The greatest activity in the field should occur during this stage of facility construction and plant operation. Based on the implementation of an electrical generating operation, particulate matter and noxious gas levels should increase on a local basis. These levels will decrease with paving, construction completion, erosion control, and revegetation.

Air movement patterns and air temperature may also be affected locally by production. A low impact on air quality is expected from electrical transmission lines emitting non-ionizing radiation.

Air quality also may be affected by radiological contaminants escaping into the atmosphere if tracer isotopes are used. In The Geysers area, such isotopes were used to study underground reservoir characteristics.

Other uses of geothermal resources, such as space heating, health spas, canneries, hothouses, etc., will require less construction activity and fewer surface facilities than electrical generation. Fewer roads and pipelines, and no transmission lines, will be required, so these activities will produce less impact on air quality.

(2) Land

(a) Pre-lease Exploration (Exploration Operation)

Pre-lease exploration is usually confined to existing roads and trails. Active seismic and shallow drill hole methods require some off-road travel, producing some impact from soil disturbance.

(b) Post-lease Exploration

Methods used during this stage will be more disturbing to the environment. Sites for exploration wells and geologic information holes vary in location. Some roads will be graded to move equipment to the drill sites. These sites must be cleared and graded, creating an additional impact to soil depth, and resulting in erosion. If drilling mud is used, retention pits may be dug, causing further soil disturbance. Inadvertent oil or fuel spills, as well as accidental release of deep reservoir water containing toxic chemicals, could contribute to soil pollution on a localized basis.

*Environmental Impacts - Anticipated
Non-living Components*

(c) Development

Impacts on soil will be essentially the same as in "Post-lease Exploration," only more severe. Service roads will be constructed to carry increased traffic to existing and additional development wells, and to gain access for construction of pipelines and other surface facilities. Impacts of medium severity could be expected on soils during this phase.

(d) Production

Impacts on soils should remain unchanged through this stage, but will diminish when construction is completed, roads are paved, and rehabilitation programs implemented. Structural subsidence might be anticipated as the result of depletion of the underground reservoirs.

(3) Water

(a) Pre-lease Exploration (Exploration Operations)

No significant impacts are expected.

(b) Post-lease Exploration

Exploratory drilling for geothermal resources should have little or no impact on water quality. One possible exception might be near-surface ground water, which could be contaminated by chemicals, toxic substances, or hot brines from deep geothermal reservoirs.

(c) Development

During development the normal hydrologic cycle may be affected by venting steam into the atmosphere, and by the surfacing of ground waters. Changes of near-surface ground water contamination may increase due to additional development wells being drilled. Sediment load levels in surface waters may be impacted if proper erosional constraints are not implemented.

(d) Production

Impacts on water quality during this stage are similar to those anticipated during the development stage. It is possible that the ground water level could be lowered if water were to be withdrawn in large quantities over a short period of time. Reinjection of waste water will be dependent on geologic and other

conditions. Radiological contamination of deep or shallow ground water could occur if tracer isotopes are used in geothermal reservoir studies.

b. Living Components

(1) Vegetation

(a) Pre-lease Exploration (Exploration Operations)

i. Aquatic Vegetation

The aquatic plant communities associated with the small stock water reservoirs could be affected by drilling shallow temperature gradient holes. The holes may be drilled with mud. In the past, some drillers have used the water from these small stock water reservoirs to prepare the drilling muds. The removal of some or all of the water decreases or eliminates the habitat necessary for the survival of the aquatic community.

ii. Terrestrial Vegetation

Many of the pre-lease exploration surveys will be confined to existing roads and trails, or the survey will be conducted on foot. Active seismic surveys and temperature gradient holes will produce some impacts to the vegetation. Active seismic surveys are conducted in straight lines over a specified area. The number and size of vehicles and the configuration of the geothermal field will determine the amount of destruction of vegetation. A trail along the seismic lines will result from the vehicular activity.

The trails may cross one to many vegetative communities. The trails are very visible in the creosotebush community due to the uniform height of the shrubs and the opening the trail creates. Creosotebush is very slow to recover, thus the impact will persist for an extended period of time. The trails through the mesquite community are covered very quickly by the moving sands associated with the dunes. The trails usually avoid the mesquite shrubs due to the fact that the shrubs are usually located on the tops of the dunes, and because the shrubs contain spines that puncture tires. The trail through the grasslands will be obliterated with the next growing season because of the flexibility of the grass plant in withstanding trampling. Any trails through the desert shrub community may destroy valuable forage plants, but this community and the pinyon-juniper community are situated where exploration is unlikely. Trails through the cropland-riparian community will usually be permitted during a fallow season so little impact will result.

*Environmental Impacts - Anticipated
Living Components*

The area disturbed by drilling temperature gradient holes may cover an area of about 270 m² (3,000 ft²). The vegetation on these sites will be crushed by the equipment or covered by some drill cuttings. These sites are normally less than 45 m (150 ft) from an existing road. The drill cuttings will normally cover an area of about 3.2 m² (36 ft²). Thus, a small amount of disturbance will be produced by the activity associated with the drilling of temperature gradient holes in any vegetative community.

Endangered and threatened plant species could be placed in further jeopardy if care is not taken to locate and protect sites on which they are growing. Three such plant species have been identified in three different locations: (1) south of Truth or Consequences and Williamsburg city limits; (2) in the Caballo Mountains, and (3) in the San Andres Mountains.

(b) Post-lease Exploration

i. Aquatic Vegetation

Geologic information holes and exploration wells will be drilled in this stage of implementation. The holes are usually drilled using mud and large volumes of water; about 522-770 l/m (42-62 gal/ft) (W. D. Tipton, pers. comm.). Drillers in the past have used stock tanks to supply water for the drilling operation. Water also may be used to control dust on the access roads and drill pads. These activities will reduce, or may eliminate, the available water in one or a number of stockwater reservoirs, resulting in the reduction or loss of aquatic vegetation.

ii. Terrestrial Vegetation

Off-road activities during post-lease exploration will intensify. Vehicular travel will crush or break off portions of shrubs and grasses. The degree of impact depends upon the vegetative community affected. Off-road trails may later become roads to drill sites, etc., which are cleared, shaped, compacted, and sloped.

Small, mobile drill rigs with the capability of drilling about 600 m (2,000 ft) are used to drill the geologic information holes. The small drill pads 30 m by 30 m (10,000 ft²) are cleared and leveled, and a pit is dug. The vegetation is completely removed from the pad. A temporary access road may be built into the site, then upgraded if the need arises. All of these activities remove and disturb vegetation.

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Large drill rigs used in drilling deep geological and exploration wells require a level drill pad of approximately .81 ha (2 ac). These areas will be completely cleared of vegetation. The intense activities around the drill rig will restrict vegetative regrowth because of soil compaction.

Fluids that inhibit vegetative regrowth may be used in any of the drilling operations, but such fluids are usually confined to mud pits, mud sumps, and drill holes. Oils and greases used at the drill site occasionally are spilled on the ground. When spills occur, the vegetation which contacts the fluids usually is destroyed.

The degree of impact, again, depends upon the vegetative community involved and the number of geologic and exploration holes drilled. For example, the creosotebush community offers little in the way of usable forage. Removing the vegetation may increase soil erosion, but may allow other plant species to become established and produce usable forage.

Mesquite and associated plants produce highly valuable forage for livestock and wildlife. When these plants are removed, forage production is decreased and soil erosion is increased. If natural revegetation takes place, forage production may again increase and the soil may be stabilized.

The grassland community is one of the most valuable forage producing communities in the assessment area. When the grasslands are reduced by clearing, the area is significantly impacted by reducing the forage production and soil stability. Proper revegetation techniques are needed to replace this valuable forage for wildlife and livestock.

The desert shrub and pinyon-juniper communities contain highly valuable forage for wildlife species. These communities, however, are in areas where potential development is unlikely.

The cropland-riparian community is very valuable to man and wildlife. The large trees which grow along the Rio Grande provide habitat for a large number of wildlife species. Removing any of these trees would decrease this habitat and significantly affect the wildlife because of the small amount of riparian habitat in the assessment area.

(c) Development

i. Aquatic Vegetation

No significant impacts will occur in this stage of implementation. The operation will be large enough so that

water for drilling must come from large storage reservoirs or wells.

ii. Terrestrial Vegetation

Vegetation will be removed from the drill pads and roads, and will be disturbed or destroyed during the construction of the pipelines which connect each well. The impacts imposed on vegetation are discussed in the Post-lease Exploration section. The development will continue until the field is fully productive. The total impact on vegetation will increase with each development in the assessment area. Again, the degree of impact depends upon the vegetative community and the area involved.

The hot waters associated with geothermal activities contain soluble compounds. Some of these compounds, such as excessive amounts of sulfur, boron, or others, can inhibit plant growth. If solutions of these compounds escape during drilling and testing, plant growth could be inhibited or destroyed.

Non-condensable gases are released into the atmosphere from steam and hot water during testing. A number of these gases can affect plant growth. Hydrogen sulfide, carbon monoxide, and others, are absorbed into plant tissues and may, temporarily or permanently, inhibit some plant growth.

The small residential communities within the area will increase in population. People moving into these areas may consider collecting some of the vegetation in the adjoining area. Problems may develop if exotic plant species are introduced. These exotic species may invade and take over range lands already in poor condition, thus reducing the forage production in the area. An example of this occurred in the Pacific northwest. Exotic plant species, leafy spurge, *Euphorbia esula*, and dalmation toadflax, *Linaria dalmatica*, were introduced to the area as ornamental plants. Plant seeds were carried by various means (wind, birds, etc.,) to other locations where they were deposited and became established. These plants then spread very rapidly in areas where range conditions were poor. Both leafy spurge and dalmation toadflax are somewhat palatable to livestock and wildlife, but they considerably decreased the forage production of the sites upon which they became established. Also, grazing stimulated growth. Leafy spurge can be controlled with sprays over a 3 year period, which is very costly. At the present time (1974) there is no control for dalmation toadflax. Care must be taken to safeguard against the reoccurrence of this type of exotic species introduction.

(d) Production

i. Aquatic Vegetation

Very little to no impact should result during the production stage. Water will probably be taken from the Rio Grande or from deep wells. Considering present fluctuations in river water levels, the development of a geothermal facility should not create significant changes or impacts on aquatic vegetation. Deep waters brought to the surface and used in the geothermal facility may be purified and released on the surface, thus possibly increasing the amount of aquatic vegetation.

ii. Terrestrial Vegetation

Vegetation will be impacted as long as any activity associated with geothermal development remains in this area. Pipelines will be needed to carry the energy source to the power plant or other facilities. Power plants, transmission lines, and/or other facilities must be constructed before the geothermal energy can be utilized.

Pipelines connect the producing wells to the power plant. During the construction of these pipelines, vegetation will be either damaged or destroyed. In the past, the rights-of-way for pipelines have been cleared of vegetation and a maintenance road constructed to parallel each pipeline. Once a pipeline road is constructed, activities will be conducted on the maintenance road and on portions of the pipeline that need attention. Vegetative regrowth will, thus, be hindered by continued use of the area. Pipelines could leak or break; and bleed-off from the wells, or other accidents could release toxic compounds that hinder plant growth.

Power plants will be constructed in specific areas and vegetation will be removed from 2 to 4 ha (5 to 10 ac). The constant activity around these power plants will curtail the regrowth of vegetation. Also, soil sterilants may be placed on the soils to eliminate vegetation which might become a fire hazard.

Transmission lines will be required to transport electricity from the power plants to population centers. The construction of these lines will disturb the vegetation within the powerline rights-of-way. Large vehicles will be needed to transport and erect the facilities needed. A bladed road for the maintenance of powerlines could result, causing further vegetative destruction.

Each facility within the field requires a road. These roads could be trails used once during activity, or improved roads to well heads, pipelines, power plants, powerlines, etc. This large transportation network continually affects the vegetative communities.

If agricultural growing and processing facilities are constructed, vegetation will be impacted. This industry could actually increase the vegetative production of the area. Undesirable vegetation or low producing crops may be replaced by crops producing higher yields. Water may become available for uses other than crop production. Thus, the entire way of life may change from livestock ranching to crop production and processing.

Again, the degree of impact depends upon the placement of the developments. If the developments are in the creosotebush community, the impacts will be less than if the developments are in the grassland, desert shrub, or cropland-riparian communities.

Once the facility is in operation, many of the disturbed areas will be revegetated naturally or mechanically. The vegetative communities could benefit from proper rehabilitation and may produce more usable forage for livestock and wildlife.

The other uses of geothermal energy should have less impact on the vegetation than the production of electricity. Other developments should be less extensive than electrical developments, thus reducing impacts to the vegetation.

(2) Animals

(a) Pre-lease Exploration (Exploration Operations)

The Exploration Operations phase of pre-lease exploration may result in temporary, site-specific impacts. The magnitude or extent to which animals and their habitat will be affected cannot be fully evaluated at this time because the locations and number of roads, trails, and drill sites, the number and types of vehicles, and the number of operating personnel involved in the exploration is unknown. It is anticipated that negative impacts of a significant magnitude will not occur except in areas where endangered species are involved. In these areas, high impacts may be expected.

Variances in vegetative composition and density, topography, water availability, etc., directly affect animal species distribution, diversity, and density. The magnitude and severity of impacts will vary from location to location within the assessment area because of these ecological phenomenon. The relative significance of the impacts

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will also vary among different animal species (e.g., species of common occurrence vs. species of endangered or threatened classification) and among specific ecosystems (e.g., creosotebush vs. desert shrub ecosystems).

The degree to which aquatic animals may be impacted will vary depending upon the proximity and duration of such activity to existing waters and adjacent shorelines. Aquatic animal life will be influenced by any changes in the availability of water and vegetation. Animals and birds which depend upon aquatic life for food may be influenced.

Vehicular travel, drilling operations, and other associated activities may cause some temporary displacement and harrassment. If such activity were to occur during the nesting season, nests could be abandoned or destroyed and the young lost. Some species, such as the killdeer, are flexible in their habitat needs and could find suitable habitat elsewhere within the assessment area. Other species, such as the bald eagle, *Haliaeetus l. leucocephalus*, or Mexican duck, *Anas diazi*, (endangered species) are more specific in their needs, and would be more seriously affected because other suitable habitat may not be readily available.

Several areas along the Rio Grande have been identified as being inhabited or utilized by several endangered species, including the Mexican duck, olivaceous cormorant, little blue heron, bald eagle, peregrine falcon, osprey, trans-Pecos rat snake, and lyre snake. Most of these species are easily disturbed. As a result, exploration activities near the edges of these areas during periods of breeding or nesting could seriously jeopardize the continued propagation of these species. For example, the Mexican duck has been categorized as a relatively secretive species, unable to withstand prolonged disruption, and therefore, requires extremely quiet conditions (Davis and Brevill, 1970).

Significant detrimental impacts to terrestrial animals should be minor if pre-lease exploration is confined to existing roads. Travel over undisturbed terrain can cause seriously harmful effects to some animal species. Any concentrated or long-term traffic may affect both breeding and nesting activities. Bird nests constructed in low-growing shrubs, young birds, and species which have greatly reduced mobile abilities may be disturbed or destroyed by surface vehicles traveling cross-country.

Off-road vehicular travel and drilling operations could result in the loss of valuable food and/or cover for various animal species. The magnitude and severity of such loss will depend upon the location of

such activities and the relative importance of these areas to the animal species using them as well as the relative importance of the impacted species (e.g., game animal, endangered or threatened species, furbearer, etc.).

Intensive "active" seismic and drilling activity in the area of the Jornada Plains could cause serious impacts on antelope if the disturbance occurs during the dry summer months and/or during fawning (May-June). The use of stockwaters as a source for drilling water could also seriously affect antelope and other animal species (aquatic and terrestrial) if the water hole is depleted and no other drinking source is available.

Pre-lease exploration in the Las Uvas, Robledo, Caballo, and San Andres Mountains, and along the foothill areas of the Black Range could result in low, temporary disturbances to associated animal species, (e.g., mule deer, Coues' whitetail, wild turkey, Mearns', Gambel's, and scaled quail). The construction of drainage crossings or any drilling occurring within drainage bottoms could result in the destruction of important vegetation, the disturbance of the soil substrate, and the disruption and destruction of various soil dwelling organisms.

Within the Rio Grande Valley proper, moderate impacts upon terrestrial habitat and associated species may occur. The agricultural-riparian areas identified would receive the greatest impacts. Such areas are extremely valuable to wildlife, including several endangered and threatened species. During the exploration phase, local sites of riparian habitat could be altered substantially. Agricultural areas, although created and controlled by man, are extremely enticing to many forms of wildlife. The ecotone created results in additional diversity of animal life. Since exploration within these areas more than likely will be confined to existing roads and trails, crop damage should not result. Nevertheless, species may be run over by vehicles or may be temporarily disturbed or displaced.

Exploration operations within the creosotebush, mesquite, and desert grassland ecosystems could result in the loss of a small amount of vegetation in addition to the temporary displacement, harassment, and possible loss of animal life.

Throughout the assessment area, water is a highly limiting component for many animal species. Any alteration in the availability of this essential, life-sustaining habitat component could result in devastating effects to dependent animal life.

(b) Post-lease Exploration

Post-lease exploration generally includes the same methods as pre-lease exploration; however, all activities will be greatly intensified. Off-road vehicular use, road and trail construction, drilling duration, and site disturbance will all increase. Corresponding increases in the impacts on animal species and their habitat may occur. The amount of acreage involved in post-lease exploration may be smaller than that involved in pre-lease exploration since more specific, localized sites are involved.

The area of greatest potential impact to animal species (aquatic and terrestrial) during post-lease exploration will be along the Rio Grande Vally, especially within 1.6 k (1 mi) of the river. Thirteen species of endangered and threatened wildlife (3 federal, 13 state) have been identified as inhabiting this area, some seasonally, some yearlong. In addition, numerous species of birds, furbearers, and game species inhabit this valley. Based on Ordal's report, Table 21 has been prepared for endangered species. This table summarizes probable critical habitat and behavioral components, and factors to which decline has been attributed. From this, the activities associated with exploration which will have the greatest impact upon these endangered species can be more readily determined. An evaluation of Table 21 indicates that those activities causing further loss or alteration of habitat or prolonged disturbance will result in the greatest impacts.

Habitat alteration has been identified as the primary reason for the decline of 9 of the endangered species listed as inhabitants of the Rio Grande Valley. Human activity (shooting, prolonged disturbance) is the second most harmful factor to which decline has been attributed, with 7 species adversely affected.

Two species of reptiles, the lyre snake and the trans-Pecos rat snake, are associated with rocky areas supporting vegetation adjacent to the Rio Grande. Their limited mobility and availability of other suitable habitat could render them especially susceptible if roads or drill pads are located on such areas.

The Jornada Plains and the Black Range and its foothills also support species of endangered fauna, in addition to game species, furbearers, and wintering birds of prey. Habitat alteration and human activity (shooting, prolonged disturbance) have been identified as primary limiting factors of endangered species in these areas. Any reduction in the availability of grassland areas, including playas beds, through road construction, drill site location, etc., would significantly impact endangered species (Baird's sparrow, McCown's longspur). These areas also provide an essential food source for antelope.

TABLE 21 ENDANGERED AND THREATENED SPECIES HABITAT COMPONENTS OR SPECIFIC BEHAVIORAL CHARACTERISTICS CONSIDERED CRITICAL TO SPECIES SURVIVAL AND FACTORS ATTRIBUTABLE TO SPECIES DECLINE

Species	Critical Habitat Components or Species Behavioral Characteristics	Factors Attributing to Species Decline
Little blue heron	Breeding and feeding in and along fresh water marshes, streams, creeks. Nest constructed over water.	Peripheral habitat. Limited breeding & feeding habitat.
Mexican duck	Highly secretive. Breeding, nesting and brood rearing in dense growth near water	Drainage of marshes and diversion of streams and rivers for irrigation, etc. Hybridization.
Southern bald eagle	Tall trees or cliffs near water; nesting and feeding	Shooting or poisoning; human disturbance; removal of nest trees.
Caracara	Brush or woodland areas; nesting	Human disturbance
Peregrine falcon	Cliffs, old trees, river cutbanks overlooking water, night roosts, nesting, hunting	DDT, alteration and loss of habitat; habitat destruction; shooting, collecting, and falconry.
Aplomado falcon	Shrub desert-shrub grassland-yucca; nesting exclusively in yuccas.	Alteration of habitat, decline in yucca grassland vegetative type.
Olivaceous cormorant	Lowland marshes to mountain streams; requires drowned trees or groves near water for nest- and feeding.	Limited availability of nest sites; fluctuation in food supply; human disturbance.
Zone-tailed hawk	Large cottonwoods of streams and canyons; coniferous forests of high mountains; nesting and hunting in trees along streams.	Shooting; destruction of lowland riparian habitat.

TABLE 21 (continued)

Species	Critical Habitat Components or Species Behavioral Characteristics	Factors Attributing to Species Decline
Osprey	Forest, strips of timber along streams or large bodies of clear water; hunting, protection from predators, good visibility and nesting in these areas.	Pesticides; human activity, degradation of streams with subsequent diminished food supplies.
Inland least tern	Sandbars; spits; alkali, level unvegetated ground near water; nesting.	Lack of suitable breeding habitat.
Red-headed woodpecker	Lowland riparian woodlands; planted trees; utility poles	Habitat destruction (riparian woodland); competition with starling, <i>Sturnus vulgaris</i> , for nest holes.
Bell's vireo	Dense shrubland, woodland along stream courses; willows, mesquite, seep willows, characteristic plant species.	Loss of riparian habitat, nest parasitism by brown-headed cowbird
Baird's sparrow	Breeding in shortgrass prairies scattered low bushes, old, matted vegetation.	Drought, agricultural development, excessive grazing affecting shrubby shortgrass prairies where the species winters.
McCown's longspur	Feeding and nesting on semi-arid ground; short, sparse grass; winter drylake beds, plowed fields & plains.	Degradation of habitat due to drought; agriculture and over-grazing. Decline in winter seed crops.
Trans-Pecos rat snake	Arid, semi-arid rocky areas with shrubby vegetation	Limited mobility, commercial collection.
Sonoran Mountain kingsnake	Chapparal and pinyon-juniper woodland into pine-fir forest; secretive, seeks cover.	Limited mobility, commercial collection.
Lyre snake	Rocky desert, semi-desert, evergreen woodlands, ponderosa pine in canyons, rocky areas; seeks cover.	Limited mobility Commercial collection.

(c) Development

Impacts associated with development will be similar to those associated with exploration, but will be more localized. involve less acreage, and entail more concentrated and intense disturbance. Intensified road construction, drill site preparation and drilling activity will occur. The sites associated with development will require clearance of all vegetation. Disturbance and destruction of animal species and habitat will occur.

(d) Production

Construction of power plants or other facilities (greenhouses, etc.) may take place. Permanent vegetative clearance will be required at the sites of some facilities. Additional animal species and their habitat may be lost. The rehabilitation of disturbed sites associated with the exploration and development phases should occur during the production phase. Eventually, partial revegetation should occur.

As indicated previously, the impacts ultimately resulting from this phase will depend upon the locations of activities associated with the development and production phases. Based upon available information, impacts of greatest significance, in descending order of consequence, would be associated with the Rio Grande Valley, the Caballo and Cuchillo Mountains, the Jornada del Muerto, the foothills of the Black Range and San Andres Mountains, riparian woodland, and the Las Uvas and Robledo Mountains.

Immediate and cumulative impacts associated with an increase in population will have wide-ranging effects upon wildlife species and their habitat. The increased population related to development of geothermal resources in conjunction with the expansions and increases associated with other mining activities (i.e., Quintana Copper Mine) may cause an increased degradation of the wildlife resource on a wide-ranging basis. Animal species and their habitat will be greatly affected as the result of indiscriminate shooting, poaching, increased legal harvests, increased off-road vehicle activity, or other unforeseeable actions.

The impacts associated with increased human populations will not stop at the boundaries of the assessment area. Other areas exhibiting important and unique biota may also be affected. Remote areas of the Black Range and the San Mateo Mountains may be frequented as the result of increased human pressures.

c. Ecological Interrelationships

(1) Pre-lease Exploration (Exploration Operations)

No drastic changes in succession, food relationships, or community relationships will occur during this phase. Slight changes may take place at isolated locations where exploration activities occur.

(2) Post-lease Exploration

Changes in succession, food relationships, and community relationships may occur as the post-lease activities increase. Water, which is a limiting factor in the desert, may become much less available. If water becomes more limited, plants and animals within the area will suffer. Noise and actual presence of man within the area will disrupt and displace a number of animal species, most susceptible of which are the endangered species. The destruction of plant species and dependent animal species are related to the amount of surface disturbance. The disturbed surface becomes susceptible to erosion or invasion by other plant species, either enhancing or degrading the area.

Variations in vegetative composition and density, topography, water availability, etc., result in comparable variations in plant and animal species distribution, diversity, and density. The magnitude or severity of impacts will also vary from location to location within the assessment area because of these ecological phenomenon. The relative significance of impacts will also vary from ecosystem to ecosystem (e.g., ecosystems of common occurrence vs. ecosystems of limited occurrence).

(3) Development

The impacts on succession, food relationships, and community relationships will intensify during the development phase. These impacts will be similar to those discussed in the Post-lease Exploration section, but will be greater due to the increased activity.

(4) Production

Impacts on succession, food relationships, and community relationships will intensify during the production phase. These impacts will be similar to those discussed in the Post-lease Exploration section.

Additional water may become available during the production phase and may be stored in earthen reservoirs. If additional water becomes available, plants and animals attracted to the water will expand their distribution. This expansion may be beneficial in that additional diversified plant and animal communities will become established. The increased water could also attract plant species that include noxious and/or poisonous plants, upsetting the trends of various plant communities. Successional changes through rehabilitation may result in a more desirable and productive ecosystem (i.e., mesquite ecosystem to grassland ecosystem).

d. Human Interest Values

(1) Landscape Character

(a) Open Space

Open space is an area which provides minimum obstruction to movement and sight. The New Mexico Environmental Institute (Dick-Peddie, 1974) appraised the open space situation in the southwest desert of New Mexico as a distinctive scenic feature. The proposed geothermal lease area has many man-made intrusions affecting open space. The effects of these are localized because of the vastness of the area. Sight distances range up to 80 km (50 mi).

Generally, natural, as opposed to man-made, features do not intrude open space except on a localized basis. The feeling of spaciousness is affected when the ability to see the horizon is restricted by natural or man-made structures. The Caballo Mountains in the central portion of the area, the Black Range on the west, and the San Andres Mountains on the east form horizons that can be seen from great distances. Views from arroyo bottoms and deep canyons are restricted. Vegetation is generally not restrictive, although some arroyo bottoms contain taller shrubs and trees which localize views and restrict movement. Alluvial valleys and rolling hills make up the topography of the rest of the area.

i. Pre-lease Exploration (Exploration Operations)

All intrusions are considered detrimental to the open space characteristics. These intrusions should occur only on a temporary basis during this stage.

ii. Post-lease Exploration

Post-lease exploration is similar to pre-lease exploration, but will influence open space to a greater degree. Exploration is a continuous process until the geothermal field is fully

developed. This exploration will become part of the total intrusion, but in itself, is temporary.

iii. Development

Drilling rigs will become a fixture located at the well head for the duration of the drilling process. Usually, the process of drilling a well lasts less than 90 days (Union Oil Co., pers. comm., 1974). One company may employ 1, 2, or 3 rigs, depending upon the availability of rigs. The requirement that many wells are needed to support one generating plant implies that the process of drilling wells is an activity continuing over an extended period of time. Under this concept, the development process and the equipment required will intrude the open space.

Field development, which could result in the construction of several plants, would require that drilling continue until the field is fully developed. The intrusion to open space by the drilling phase can be considered equivalent to the life of the production phase and a part of the total impact.

iv. Production

The production phase will begin with the construction of electric generating plants, pipelines, transmission lines, greenhouses, hothouses, etc. This work may begin as soon as development of the field is sufficient to support such facilities. The production phase will continue for the life of the field, and it will impact open space for that period of time.

(b) Scenic Quality

Scenic quality is affected by aesthetically undesirable intrusions. One aspect of the scenery is open space. It can be concluded that any intrusions which are visible and obtrusive would be detrimental to present values. The effect of the intrusions will be less if it is intermingled with other structures where the natural scene has been previously disturbed. Structures contrasting with existing fixtures in shape, size, and color will have a greater effect, regardless of their location. An electric generating plant or a greenhouse situated among other large structures will not affect the general scene as much as if the building were to be located by itself in an area of greater open space. For example: if an electric power plant were to be located among farm buildings or other structures, or in the proximity of a community, it will be less obtrusive than it would be if it were located in an open field or in native pasture lands.

The presence of man-made structures invades the natural scene. Often the feature is acceptable aesthetically, but it alters the scenic situation. The construction of facilities within the assessment area will change the scenic quality, the extent of change will depend upon the status of the location concerned. For instance, the mountain areas of the assessment area appear from a distance to be undisturbed by man-made intrusions. A power plant complex would change the natural look of the mountains, mesa tops, and alluvial valleys. Localized intrusions distributed throughout the remainder of the proposed lease area may be detrimental to scenic quality.

i. Pre-lease Exploration (Exploration Operations)

Pre-lease exploration should not introduce significant undesirable intrusions. Pre-lease exploration will cause minimal impacts on scenic values on a very localized basis, and then for a short time only.

ii. Post-lease Exploration

The natural scenic environment will be intruded most significantly by drilling and associated activity. At this time, the general scenic situation will begin to change. The rapidity and amount of change will depend on the magnitude and location of the exploration.

iii. Development

Development of a geothermal field usually consists of drilling wells until the resources are sufficient to support a generating plant. During this period of time, drill rigs will be moved from drill pad to drill pad. The pads are constructed to support the rig and are usually .4 to .8 ha (1 to 2 ac) in size. After the drilling is completed and the well is capped, the rig will be moved to a new location. If the drilling takes place on level ground, the drill pad probably will not be sufficiently noticeable to severely damage scenic values. If the drill pad and well head are located on the side of a hill or on the horizon, they will be more visible, increasing the impact on scenic values. Wells produced during geothermal field development will alter scenic situations, particularly in areas where the vegetation cover is sparse or where significant surface damage is required.

iv. Production

Large pipelines to carry steam or hot water, generating plants, and transmission lines will be constructed during

the production phase. As these facilities are developed, the existing scene will be intruded. Curiosity-arousing, eye-catching aspects of the normal scenery will be temporarily transferred to the new structures until they are considered part of the normal scene. The production phase will change existing scenic characteristics of the landscape.

(c) Primitive Values

One element in the evaluation of primitive values is the degree to which an area has been intruded by man-made facilities. The Rio Grande Valley is heavily intruded. Mountainous regions of the assessment area are less intruded, but roads, mines, ranches and support facilities can be seen throughout the region. Any action required to exploit geothermal energy will further reduce primitive values. The greatest impacts will be in areas where primitive values are the highest, such as the Jornada Lava Flow, the Cuchillo Mountains, and the Las Uvas Mountains.

i. Pre-lease Exploration (Exploration Operations)

Roads which may be formally constructed or made merely by driving over a surface in a manner which leaves tracks for someone else to follow will be detrimental to primitive values. Exploration of any kind which requires vehicular travel off existent roads will only temporarily reduce primitive values barring further use by ORV's or other non-exploration related traffic. The larger a roadless area is, the greater the impact will be, because the opportunity for isolation will be reduced.

ii. Post-lease Exploration

Encroachment upon primitive values will increase proportionately to the extent of exploration.

iii. Development

As development of a geothermal resource area progresses, primitive values will be lost. Criteria for rating and establishing primitive values specify that man's influence be minimal. The area under consideration is moderately intruded, but contains areas of open space, natural ecosystems, and primitive appearance. An increase in man's activities will reduce such areas in size and number.

vi. Production

The production phase will introduce pipelines, generating plants, transmission lines, other fixtures, and people to the area. This will destroy local primitive qualities.

(d) Visual Resource Management

The Visual Resource Management (VRM) units and VRM classes discussed in "The Existing Environment" section of this report and BLM's Contrast Ratings, Manual 6320, were used to provide a basis for measuring impacts of the proposed action on the visual resources of the lease area.

There are three possible VRM classes in the Radium Springs lease area. Generally, these classes provide management objectives which can be used to assess the impact of an action by relating the modification and resulting visual contrast rating to the basic elements of form, line, color, and texture.

i. Pre-lease Exploration (Exploration Operations)

Pre-lease Exploration is not expected to impact the visual resources of the assessment area.

ii. Post-lease Exploration

It is possible to discuss the impacts of exploration and future actions on visual resources in only general terms. Specific site analysis will be required if post-lease exploration requires manipulation of visible surfaces, particularly in Class II areas. It can be expected, however, that post-lease exploration impacts will be minimal.

iii. Development

The development phase will impose a greater degree of impact on visual resources than any previous activity. An analysis of each proposed action during the development phase will be necessary in order to fully realize total impacts.

iv. Production

Impacts occurring during the production phase will depend upon the location, size, color, architectural design, etc., of the production facilities. This phase will result in more significant impacts than any previous phase.

e. Socio-cultural Interests

(1) Scientific/Educational

(a) Pre-lease Exploration (Exploration Operations)

Pre-lease exploration should have little adverse effect on the scientific and educational values previously mentioned (Existing Environment section). Possible beneficial impacts may result from the collection of geologic, geothermal, and hydrologic data. These beneficial impacts will be proportionate to the amount of pre-lease activity.

(b) Post-lease Exploration

The impacts of post-lease exploration should be similar to those encountered during the pre-lease exploration. The impacts will again be proportional to the amount of activity which takes place.

(c) Development

Some of the scientific values (i.e., experimental ranch, primitive areas, wildlife habitat) are particularly sensitive to surface disturbing activities. Construction of access roads or other surface occupancy could result in disturbance of these values over a limited area. However, during development and production, significant advancements in geologic and geothermal data should be realized.

(d) Production

Since it is not known at this time what form geothermal production might take, any discussion of the impacts of this stage on scientific/educational values must remain hypothetical. Generally, one might expect impacts caused by production to be greater than those caused by any other stage of implementation. These impacts will also be more localized, necessitating careful analysis of each project proposed during this state.

(2) Cultural Values

(a) Pre-lease Exploration (Exploration Operations)

Pre-lease exploration requires minimal surface disturbance and is generally restricted to existing roads. Few people are involved in any single pre-lease operation.

All surface-disturbing activities require archaeological clearance before operations can be started. The clearance survey reports all archaeological or historic materials in the vicinity of the proposed project. Normally, an effort is made to avoid these materials *in situ*.

It is often possible to relocate proposed pre-lease projects so as to avoid these materials. Direct adverse impacts to archaeological or historic sites are minimal during pre-lease exploration. Indirect adverse impacts caused by exploration teams removing cultural materials or creating new access roads for others to follow are also minimal. Beneficial impacts include the discovery of previously unrecorded archaeological or historic sites.

There are currently no stipulations to provide for the identification of other types of sites with local cultural significance (i.e., historic trails, religious sites). Culturally significant sites which lack cultural debris cannot be identified by field examination. These sites could be damaged during pre-lease operations.

(b) Post-lease Exploration

The effects of post-lease exploration on cultural resources will be similar to those of pre-lease exploration. The scale of impacts will be greater, since some off-road vehicle movement will occur. Indirect adverse impacts will increase as new access roads allow greater public use of the area.

(c) Development

Impacts to cultural resources during the development stage will be greater than the impacts of pre-lease or post-lease exploration. Since development projects are harder to relocate than exploration projects, some other form of mitigation, such as intensive surface collection or excavation, is likely to be necessary. These types of mitigating measures lessen, but do not eliminate, impacts to cultural resources. Because of this, some cultural sites may suffer damage during this stage. Increased public use of the area could also result in damage. Beneficial impacts will include retrieval of data from sites as a result of mitigation projects.

(d) Production

It is not known whether production will take place in the proposed leasing area, or what form it might take if it does occur. This makes it difficult to discuss the direct impacts of production on cultural resources. It can be expected that the

impacts of production will be greater than those of any preceding stage.

Indirect impacts of a project in any stage of implementation can be serious. Damage promoted by easy access to public lands, increased population in the area, and deliberate vandalism cannot be easily controlled. This type of impact should be considered when planning measures to reduce the adverse impact of a project.

(3) Social Welfare

(a) Pre-lease Exploration (Exploration Operations)

Pre-lease exploration is expected to have a low beneficial impact on the local economy. This impact will be created by people visiting the area and spending money in the communities. The effects will be of the same type as those which occur during tourist season.

(b) Post-lease Exploration

Impacts of post-lease exploration should be similar to those of pre-lease exploration. The degree of impact may be slightly greater.

(c) Development

Impacts to the local economy during development should be greater than the impacts of pre-lease or post-lease exploration. The nature of these impacts may be different than those encountered in previous stages. Capital entering the area will still be added through the economic sector classified as "other" in Table 19. A few jobs might become available, and people affiliated with development projects may move into the area.

(d) Production

Impacts to the local economy during production would be greater than those of any preceding stage. The nature of these impacts should be similar to those encountered during development. Currently available information on geothermal reservoirs is inadequate to determine whether there will be any impacts to surface hot springs and associated dependent business (hot mineral bath houses), located along the Rio Grande Valley. The bath house businesses are located in Truth or Consequences and at Radium Springs. If production wells enter the same geothermal reservoirs that are feeding the surface hot springs, then possible impacts of the production stage could be: (1) reduction in flow of thermal springs; (2) reduction in temperature

of thermal springs; (3) termination of thermal springs' flow; (4) air pollution if deep reservoirs contain high amounts of hydrogen sulfide (H₂S); and/or (5) termination of mineral hot bath businesses.

(4) Local Regulatory Structure

(a) Pre-lease Exploration (Exploration Operations)

Pre-lease exploration will have no significant impact on the local regulatory structure.

(b) Post-lease Exploration

Post-lease exploration will have no significant impact on the local regulatory structure.

(c) Development

The development stage may bring an increase in population. This population increase may have an adverse impact on the local regulatory structure, including law enforcement, schools, public safety organizations, and health agencies.

(d) Production

The impacts of production may be similar to and greater than those encountered during development.

(5) Land Use Compatibility

(a) Recreation

i. Pre-lease Exploration (Exploration Operations)

Pre-lease exploration is not expected to affect recreational values.

ii. Post-lease Exploration

Recreational values will not be seriously affected because of the temporary nature of post-lease exploration.

iii. Development

Recreational uses of the area will be adversely affected by development activities. Areas with fewer intrusions

will be affected to a greater degree. Some access may be affected if a road to a geothermal development is closed in order to facilitate development or to protect the public or the site. Primitive and back-country values will be most affected.

iv. Production

Recreational use will be impacted in a manner similar to that of the development phase. Visitor days would probably increase due to the public interest in the uniqueness of geothermal development. Increases in visitation related to the uniqueness of the industry would subside as development and production expanded. Long range negative impacts could result because of activities which reduce recreational opportunities and restrict movement. Greatest impacts would be on hunting and the reduction of open space for casual shooting.

(b) Grazing

i. Pre-lease Exploration (Exploration Operations)

There will be no significant impacts to grazing from pre-lease exploration.

ii. Post-lease Exploration

Grazing use will be moderately impacted due to livestock disturbance caused by vehicular traffic both on and off existing roads and trails. Vegetation will be removed from the new roads and trails and from drill pads. Water discovered during drilling may be used for livestock waters. This would be a beneficial impact.

iii. Development

Grazing will be moderately impacted in a local area during the development phase due to the loss of forage production. The development activities could disturb animals and interrupt ranchers' routine grazing operations. Grazing would be temporarily displaced in the immediate area of development. If pipelines are not elevated at least 1.5 m (5 ft) off the ground, they may present a barrier to livestock movement.

iv. Production

Impacts on grazing use will continue during the production phase as more land surface will be taken up

by roads, well sites, pipelines, power transmission lines, generating facilities, and other needed facilities. Noise, human and mechanical activities, noxious gases and fluids will disrupt grazing during this phase. Cattle graze near well heads at The Geysers Field, California, indicating that they are not greatly disturbed by the production activities. Nevertheless, the facilities used in the production phase will inhibit livestock movement and reduce the quantity of forage available because of the surface occupancy.

(c) Agriculture

i. Pre-lease Exploration (Exploration Operations)

Pre-lease exploration will have no significant impact on agriculture.

ii. Post-lease Exploration

The impacts of post-lease exploration may include limited destruction of agricultural crops if agricultural lands are occupied by equipment, roads, etc. The quality of agricultural crops might be lowered as a result of increased vehicular activity and emission of noxious gases.

iii. Development

Development could have moderate to severe impacts on agricultural lands, depending on geothermal project location, the number of people entering the area on a long-term basis, and the existence or non-existence of town and county zoning regulations. Cropland may be affected by oil or geothermal water spills or leakage.

iv. Production

The impacts of production on agricultural land use will be similar in nature and degree to those encountered during development.

(d) Urban and Suburban

i. Pre-lease Exploration (Exploration Operations)

Pre-lease exploration should have no impact on urban-suburban land use.

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ii. Post-lease Exploration

Post-lease exploration should have no impact on urban-suburban land use.

iii. Development

If development takes place, the use of land for urban or suburban purposes could increase. This might create a conflict between urban-suburban use and other land uses.

iv. Production

The impacts of production on urban-suburban land use may be more severe than those encountered during development.

(e) Rights-of-way

i. Pre-lease Exploration (Exploration Operations)

Pre-lease exploration should have no impact on rights-of-way.

ii. Post-lease Exploration

Post-lease exploration should have no significant impact on rights-of-way.

iii. Development

Rights-of-way now present will not be adversely affected. Future rights-of-way may require some route adjustments if they are in conflict with development activities.

iv. Production

Present rights-of-way will probably be crossed by power transmission lines carrying power from generators to consuming areas. The present rights-of-way have prior rights. There undoubtedly will be additional adverse impacts from the new lines needed to transport geothermally produced power, similar to those encountered in the operation of major powerlines of the 345 kV class. Other types of geothermal use are unlikely to affect rights-of-way.

2. Possible Mitigating Measures

The Geothermal Steam Act of 1970, the GRO Orders 1-4, and the Geothermal Resources Lease (Appendix A) state the environmental protection requirements which must be met by anyone conducting geothermal operations on federal land. In some cases, these documents have prescribed specific measures designated to fill the requirements. In others, the Authorized Officer of the managing agency will prescribe the way in which the requirements must be met.

All of the requirements stated in these documents must be met by the permittee/lessee who intends to conduct geothermal operations, including pre-lease exploration, on federal land in the BLM Las Cruces District. The permittee/lessee will be expected to take all the mitigating measures which are specified by the Steam Act and the GRO Orders.

A site-specific EAR is written for every proposed surface-disturbing project, regardless of the stage of implementation. This allows determination of site-specific impacts and development of specialized mitigating measures. The Authorized Officer of the managing agency adds these measures in the form of special stipulations to the lease, permit, or other written authorization to begin operations. Special stipulations of this nature augment the standard stipulations and requirements, but do not replace them unless this is specifically stated.

Possible ways of mitigating or enhancing the anticipated impacts of a geothermal program in the Radium Springs Geothermal Assessment Area include, but are not limited to, those listed in the following pages. Some are a reiteration of measures already required in the Steam Act or GRO Orders, but because of special conditions are repeated.

a. Non-living Components

(1) Air

(a) Dust may be controlled by sprinkling disturbed areas with water periodically. This may be required on heavily used roads or construction sites.

(b) Paving of heavily used roads would reduce airborne particulate matter.

(c) Geothermal wells that produce excessive radioactivity, toxic, or noxious fluids or gases could be shut in until the hazard has been eliminated.

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(d) Odor filters could be installed on all facilities to minimize the impacts of noxious, odiferous substances.

(e) All measures designed to reduce erosion will help to maintain air quality.

(f) The number of operating combustion engines allowed in an area at one time could be limited to reduce the impacts of exhaust emissions.

(g) Any constructed, maintained road with vehicular travel in excess of 150 vehicles per day will be stabilized and paved in a manner most suitable to the traffic load.

(2) Land

Erosion is a major concern in the assessment area. Measures designed to reduce erosion are listed below.

(a) Erosion control structures may be required in areas where accelerated erosion could take place.

(b) All facilities related to the geothermal program should be constructed on level lands where possible to reduce impacts incurred in rough topography.

(c) All facilities related to the geothermal program should be constructed on soils that are suited to such development.

(d) Initial drilling could be restricted to sites where the surface is relatively flat and where vegetative and soil disturbance could be kept to a minimum.

(e) Roads could be located in existing rights-of-way wherever possible.

(f) No roads should be built in areas where terrain will allow vehicles to maneuver without the aid of such roads.

(g) Runoff from thunderstorms should be controlled by reshaping and revegetation to prevent erosion.

(h) All measures designed to reduce impacts to terrestrial vegetation will reduce erosion by preserving the vegetative cover.

Environmental Impacts
Possible Mitigating Measures

(i) Impacts caused by movement of vehicles over open terrain may be reduced by:

- i. Directing the vehicles single file over a route.
- ii. Driving around large vegetation and critical topography.
- iii. Requiring large tires.
- iv. Requiring light trucks.
- v. Reducing the number of vehicles.
- vi. Permitting only one or two vehicles to follow the same tracks over open terrain.
- vii. Allowing exploration only when weather conditions are favorable.
- viii. Requiring the construction of road barriers on critical areas to prevent further use.

(j) Shallow exploratory holes could be drilled with air except where conditions require the use of mud to reduce the chances of soil pollution.

(k) Soil sterilants should be restricted from use on BLM-administered lands.

(l) At the conclusion of drilling operations, mud pits could be cleaned, backfilled, and replanted with native vegetation.

(m) Portable steel mud pits could be used.

(n) Where excavation will be extreme or where bedrock will be encountered, existing topsoil should be replaced. Stockpiled topsoil (if any) should be evenly distributed over the disturbed area before reseeding.

(o) Bentonite lining could be used in earthen pits to prevent fluids from escaping into subsurface strata.

(3) Water

(a) Stock water tanks or reservoirs should be protected by locating operations away from these areas, and by selecting locations so that an accidental escape of fluids would not eventually drain into the tanks.

(b) Fresh water zones in the subsurface should be protected by running casing and cementing off these zones to prevent contamination.

(c) Only water wells that have good recharge should be used as a source of water for drilling rigs.

(d) Casing which was set through the fresh water zones and cemented should be left in place. If such casing is removed, the holes should be properly plugged with cement to protect the fresh water zones.

(e) Cooling towers used during production require large quantities of water. Rather than using fresh water from shallow zones in the subsurface, the waste water from geothermal production should be used if feasible.

(f) Drilling water should not be obtained from surface water tanks or reservoirs except that water produced from geothermal fluids may be stored on the surface, with approval of BLM, and used to meet drilling requirements.

(g) If an operational geothermal field produces waters in excess of those required for production, the operator should contact BLM and enter into an agreement on the best method of disposing of these fluids. If the water quality is such that it is not harmful to plants or animals, full consideration shall be given to the use of this water to provide additional wildlife habitat or to provide watering holes or tanks for wildlife and/or livestock.

(h) The locations of shallow drill holes for the measurement of temperature gradients or heat flow require the special approval of the Authorized Officer if the proposed locations are within a radius of 300 m (1000 ft) from hot springs, fumaroles, or other surface geothermal indicia, or are in areas of known artesian water flow. Locations proposed within such areas will require a detailed drilling program for each hole, approved by the Authorized Officer. The Authorized Officer may require special drilling and completion techniques for such holes (such as cemented surface casing and simple

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Possible Mitigating Measures*

expansion-type blowout preventers) to safely control formations containing geothermal or other resources which may be penetrated.

(i) Drill pads should not be located in or adjacent to major drainage bottoms, lakes, or perennial streams, and should not be closer than 182 m (200 yds) without special approval by BLM.

(j) Upon completion of drilling, a sample of the reserve pit liquids should be analyzed for toxic substances. A certified analysis will be furnished USGS as to time, location of sample, and accuracy of analysis.

(k) The permittee/lessee should provide effective controls over the discharge of toxic substances.

(l) All measures designed to prevent erosion will also help to maintain water quality.

(m) The use of explosives should be severely restricted and allowed only when conditions are favorable.

b. Living Components

(1) Vegetation

(a) Reclamation of disturbed areas should take place progressively during the course of operations when feasible.

(b) Any plants that may be disturbed by geothermal operations and for which a demand is evident should be salvaged and made available for public use.

(c) All areas should be reclaimed during abandonment.

(d) Slant drilling could be required when environmental conditions require it, and when conditions permit it.

(e) When an explored or developed area is no longer needed for geothermal activities or immediately following termination of the lease, whichever occurs first, the operator should, after removing all surface improvements, contact BLM in relation to the plan of rehabilitation of the site for the time of seeding and the seed mixture to be used. This will be done before release from bond by USGS. The authorized BLM official will be advised when the planting has been accomplished. If, in the opinion of the authorized official, the first seeding or planting is unsuccessful, he may require the lessee or grantee to make additional seedings or plantings.

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(f) The operator should take all reasonable precautions to prevent and suppress fires.

(g) Endangered and threated plant species and their habitats shall be protected from destruction or modification. This protection shall be in a manner which will assure that the continued existence of these species is not placed in further jeopardy (P.L. 93-205).

(h) All major drainages and other drainages supporting a variety of shrubby vegetation and all waters of permanent nature supporting aquatic and terrestrial vegetation should be provided a protective buffer zone of at least 182 m (200 yds) and .4 k (.25 mi) respectively.

(2) Animals

(a) The operator should screen over mud pits containing any additives know to be toxic to wildlife.

(b) Noise-suppressing mufflers should be installed on vents to minimize the adverse effect of operational noise on wildlife.

(c) No drilling or other surface activities should be allowed within .8 k (.5 mi) of any pond or reservoir regularly used by waterfowl or shore bires for nesting, resting, or feeding. This includes those locations where use is seasonal.

(d) All prolonged surface activity (drilling, development) should be excluded from a 182 m (200 yds) buffer zone on either side of brushy arroyos and draws and around playas beds and small (less than 16.2 ha or 40 ac) grassland areas within key antelope areas.

(e) The construction of all electric distribution lines should conform to appropriate raptor stipulations (BLM Instruction Memorandum No. W0-76-45, dated January 23, 1976).

(f) When pole lines are abandoned, the Authorized Officer may designate the retention of certain poles for raptor perching and nesting.

(g) Prolonged activity should not be allowed within .4 k (.25 mi) of cliffs, ledges, escarpments, rock outcrops, or canyon walls and rims suitable for raptor nesting.

*Environmental Impacts
Possible Mitigating Measures*

(h) No trees should be removed or damaged in any way. All exploration, development and production activity should be restricted from at least a .4 km (.25 mi) buffer zone around all trees, groves, thickets, etc.

(i) No vegetation should be removed from within .8 km (.5 mi) of water (springs, reservoirs, tanks, seeps, etc.).

(j) Pipelines should not be placed across migration routes or regular routes traveled by antelopes, deer, or other ungulates. Such action should be coordinated with the BLM to minimize impacts to the extent practical, considering the best and most feasible technology available.

(k) To minimize impacts to vegetation and wildlife, all activities related to geothermal exploration, development, production, and abandonment should be confined to access roads, exploration lines, rights-of-way, drill pads, power generating sites, and other areas designated for such activities. Activities outside these areas should be approved in writing by BLM prior to start of the activity.

(l) Endangered and threatened plant and animal species and their habitat shall be protected from destruction or modification. This protection shall be in a manner which will assure that the continued existence of these species is not further jeopardized (P. L. 93-205, and Wildlife Conservation Act for the State of New Mexico).

(m) The Rio Grande Valley is inhabited by 13 species of endangered fauna (3 of which are federally classified) and 1 known species of endangered flora. Except for the peripheries of Caballo and Elephant Butte Reservoirs, which are administered by the Bureau of Reclamation, the Valley is essentially privately controlled (including subsurface). To adequately mitigate potential impacts to endangered species and their habitat, all exploration, development, and production should be restricted to areas outside a .8 km (.5 mi) buffer zone along either side of the Rio Grande and around all trees, groves, thickets, etc., that occur beyond this buffer zone. This should be an added stipulation to all "Notices of Intent" and leases on national resource lands within the valley in addition to a "Biological Clearance" for endangered or threatened species and/or habitat prior to entry.

c. Ecological Interrelationships

(1) Mitigating measures which provide protection for soils, vegetation, and animals will likewise mitigate impacts upon ecological interrelationships.

ANALYSIS OF THE PROPOSED ACTION AND ALTERNATIVES

(2) Special attention should be paid to avoid changes in runoff patterns (i.e., road location, berms, etc.) which might adversely affect vegetal communities dependent upon seasonal flooding.

d. Human Interest Values

(1) Open Space

(a) During close out, all development and production facilities will be removed, including foundations, paved areas, footings, or other permanent structures. Residue will be properly disposed of in an approved landfill area.

(2) Scenic Quality

(a) During all geothermal exploration, development, and production phases, the area should be kept free of debris, trash, and/or other unsightly items that would detract from the surrounding environment. This also includes the pick-up of windblown debris on surrounding lands resulting from exploration, development, or production operations.

(b) Abandoned or unneeded roads will be closed off, reshaped, and reseeded as the need is determined by the Authorized Officer. Access to these roads should be blocked to discourage their use by off-road vehicles.

(c) Each proposed project should meet the Visual Resource Management Class requirements for the area in which it will be located.

(3) Primitive Values

All development areas, following initial construction, should be closed to ORV travel (both company and public) or use off established and maintained roads.

e. Socio-cultural Interests

(1) Scientific/Educational

(a) Research should be conducted in conjunction with all geothermal operations as long as these actions do not interfere with normal activities or jeopardize the lease holder's development position.

(b) Companies conducting operations in areas of mutual interest should communicate in the planning stages to avoid conflicts.

(c) Accurate maps should be maintained by development companies of all road networks, locations of developments and their nature. All such information should be maintained on standard 7-½' USGS topographic maps. The maps should be revised semiannually and made available to BLM and other agencies with official need of such data.

(d) Some areas of scientific and educational value are particularly sensitive to all surface-disturbing activities. These should be recommended for leasing with no surface occupancy.

(e) New Mexico State University (NMSU) College Ranch: Special stipulations for exploration and other operations on the College Ranch have already been developed. They include, but are not limited to, those listed here. A more complete list is available at the Las Cruces District BLM Office.

i. The permittee/lessee, his contractors, subcontractors, and employees shall comply with all requirements for geothermal operations and activities on BLM land in conducting geothermal operations and activities on the College Ranch.

ii. The permittee/lessee shall submit a copy of his Plan of Exploration or Plan of Operation, as applicable, to the Authorized Representative of the College Ranch through the Authorized Officer of the BLM at least 30 days in advance of beginning any activities on the Ranch.

iii. The Authorized Officer and/or the Area Geothermal Supervisor shall coordinate all plans and proposed lessee operations with the College Ranch Administrator to guarantee that operations do not unduly conflict or interfere with research and unique biological areas.

iv. The Authorized Officer and/or the Area Geothermal Supervisor shall coordinate with the College Ranch Administrator all changes in previously approved plans before any field operations or activities recommence.

v. No geothermal operations will be allowed within 762 m (2,500 ft) of any permanent enclosure, study site, building, corral, irrigation structure, or watering place without written approval from the Authorized Representative of the College Ranch

ANALYSIS OF THE PROPOSED ACTION AND ALTERNATIVES

vi. All existing roads which are used by the permittee/lessee, and new roads which are constructed by him, must be maintained in good condition and free of dust.

vii. Pipelines should be constructed so that they do not interfere with livestock movement and vehicular traffic.

viii. The College Ranch Representative shall be notified immediately of any damage to improvements which was not considered in the approved Plan.

ix. Unforeseen damage must be corrected immediately to avoid adverse effects on the livestock and range research programs.

x. Slant drilling may be required in some areas to maintain the present use of the surface and the integrity of on-going studies.

xi. The surface of some areas, which will be identified in each lease, shall not be used for any purpose without the written approval of the College Ranch Representative.

(2) Cultural Values

The following special stipulations have been developed for protection of archaeological values:

Prior to undertaking any ground disturbing activities on lands covered under the provisions of the lease, the lessee shall engage the services of a qualified archaeologist, acceptable to the Authorized Officer, to conduct a thorough and complete survey of areas to be disturbed for evidence of archaeological or historical sites or materials. The archaeologist must prepare the certified statement on archaeological values described in Section 18 of the Geothermal Resources Lease, Form 3200-21.

The Authorized Officer (Las Cruces District Manager) and Supervisor (Menlo Park, CA, USGS Area Geothermal Supervisor) retain the prerogative to require relocation of operations to protect any archaeological values located on the leased lands, or they may require the lessee to have the archaeological site(s) excavated and salvaged by a qualified archaeologist(s) prior to proceeding with operations.

*Environmental Impacts
Possible Mitigating Measures*

There are no ways to mitigate direct impacts to archaeological sites other than avoiding the site or excavating and salvaging the site. Of these two, avoiding the site will generally be the recommended course of action.

The District Archaeologist will identify all known cultural resources which could be affected on an individual case action basis. This will include prehistoric, historic, ethnological, and palaeontological values. Measures to protect these values will be developed at that time.

(3) Social Welfare

(a) Appropriate care should be taken to protect all improvements, whether they belong to BLM or the private landowner.

(b) A continuous monitoring of exploration and development operations should be maintained to provide advance notice of any possible changes to surface hot springs. The Area Geothermal Supervisor (USGS) should complete an evaluation of exploration and development data as it is received in order to determine the likelihood and the significance of impacts to the hot springs in the area.

(c) If significant impacts to surface hot springs are anticipated as the result of the development and production on national resource lands, an Environmental Statement (ES) may be necessary.

(4) Local Regulatory Structure

(a) It is suggested that measures to reduce impacts to regulatory structure be arranged between the developing company and the community to be impacted as the need arises.

(5) Land Use Compatibility

Where compatible with operations conducted by the lessee, the area included in the lease shall be available for other public uses, including, but not limited to, livestock grazing, hunting, camping, and hiking.

(a) Recreation

i. Key management roads identified by BLM should not be reclaimed, but maintained for access and use by the general public for recreation needs.

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ii. At any time during production if it becomes necessary to release steam or other fluid vapors on either an intermittent or regular basis, adequate provisions should be instituted to insure the safety and protection of any travelers on nearby roads where vapor clouds may occur and obstruct clear vision. Such provisions should be made relative to adequate posting of all hazards on road networks.

iii. All measures designed to protect the environment and reduce the impacts of the geothermal program will protect recreational values by maintaining pleasing, healthful surroundings.

iv. Measures designed to turn features such as water ponds and access roads to recreational advantage could be added to the provisions of geothermal projects.

v. No off-road vehicular travel in connection with geothermal operations should be allowed within .4 km (.25 mi) parallel to the route of the Butterfield Trail.

(b) Grazing

i. Efforts should be made to minimize livestock disturbance. Livestock access to customary water sources should not be blocked. Most mitigating measures designed to protect living components of the environment will also reduce impacts to grazing use.

ii. The BLM grazing lessee or permittee should be informed of the approximate starting and completion dates for any geothermal related activity.

iii. Any excavation, hazardous area, or modification to a fence associated with or as a result of geothermal development should be fenced or otherwise made acceptable to the Authorized Officer.

iv. The location of new gates or cattleguards on federal land must be approved by the Authorized Officer and meet standard specifications for such projects.

(c) Agriculture

i. Most agriculture takes place on private land. Arrangements for mitigating impacts to agriculture should be made between the developing company and the private landowners.

*Environmental Impacts
Alternatives*

(d) Urban-Suburban

i. The developing companies should discuss possible mitigating measures with representatives of the communities which may be affected.

(e) Other Land Uses

i. Development and production operations should be restricted from lands which contain other mineral resources that may be needed in the near future.

ii. All measures designed to protect the environment and reduce the impacts of the geothermal program should likewise protect other land uses.

3. Alternatives

a. The proposed action is to make available for leasing all national resource lands in the assessment area.

Most land in the assessment area could be leased without serious residual impacts to the environment. Special environmental protection stipulations could be attached to the lease which would successfully mitigate most impacts of a geothermal program.

Some acreage in the assessment area is very sensitive to surface-disturbing activities. While impacts to some of this acreage can be mitigated sufficiently through special leasing stipulations, present technological limitations preclude proper protection of the values on other sensitive lands. For this reason, it is not recommended that all the national resource lands be made available for leasing at this time.

b. The first alternative is to limit geothermal leasing to national resource lands for which all values can be successfully protected through special environmental protection stipulations.

Most national resource lands in the assessment area could be leased without serious residual impacts to the environment. Special environmental protection stipulations could be attached to leases which would successfully protect all but the most sensitive lands. A stipulation of "no surface occupancy" would eliminate impacts to the most sensitive surface values.

Lands for which no surface occupancy is stipulated could still be developed through the use of slant drilling techniques. These techniques allow a driller to reach resources up to 1.6 km (1 mi) away from his rig without disturbing the surface directly above the resource. This

would allow development of all but a small amount of acreage in the assessment area.

The remaining acreage requires no surface occupancy for adequate environmental protection, but cannot be reached with today's technology. These lands would be withheld from leasing until technological advances make development of these areas feasible or until the reasons for withholding them are no longer appropriate.

This alternative is recommended.

c. A second alternative was to withhold the entire area from leasing until further resource information has been gathered.

A delay of this type would impede collection of the geologic and technologic information needed to develop geothermal resources into a cheaper and more efficient energy source. It could delay the development of these resources for years. A delay of this kind would be inconsistent with national policy to develop new energy sources.

This alternative is not recommended.

d. A third alternative is not to lease any of the area.

Geothermal resources can contribute substantially to the nation's supply of energy. To decline to lease would not be in the best interest of the nation, and would be contrary to both the President's Second Energy Message and the Steam Act.

This alternative is not recommended.

e. None of the alternatives provide for federal protection of values on private lands. Protective measures may be required by private citizens, or by state or local governments. The Rio Grande Valley in particular has been judged environmentally sensitive. Although a great amount of disturbance has already taken place in the Valley, it remains a haven for many rare wildlife species. Other significant cultural values may also be found in the Valley. Archaeological and historic sites abound, and the area has higher quality scenery than much of the surrounding national resource lands. Its prime farmland may be the most significant resource from a long-term viewpoint.

Geothermal potential is also highest in the Rio Grande Valley. This suggests that some environmental protection measures may be needed to protect the Valley resources.

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Because of the small size of federal holding in the Valley, and because of the high geothermal potential in this area, these lands will not be withheld from leasing. Surface occupancy will be allowed. Special biological clearance will be recommended for these lands.

4. Recommendations for Mitigation

a. General Recommendations

(1) It is recommended that national resource lands within the Radium Springs Geothermal Assessment Area be made available for geothermal leasing.

(2) General stipulations covering such topics as prevention of air and water pollution, noise abatement, aesthetic considerations, etc., are discussed in the Geothermal Regulations and GRO Orders 1-4 (Appendix A).

(3) It is recommended that all of the "Possible Mitigating Measures" listed be followed and stipulated where appropriate in all "Notices of Intent" and leases except as modified by mutual agreement of the lessee, the Supervisor, and the Authorized Officer.

(4) It is recommended that areas particularly sensitive to surface disturbance be leased with no surface occupancy. These include environmentally sensitive lands and lands for which the current or previously planned surface use is not compatible with geothermal operations.

(5) It is recommended that sensitive lands which can not be reached within these constraints with today's limited technology be withheld from leasing at this time. These areas could be leased at a later date when technological advances ensure the protection of these lands.

(6) State and local governments and private land owners, especially those located along the Rio Grande Valley, may wish to develop similar measures or incorporate the mitigating measures recommended in this section in leases for geothermal resources.

b. Specific Leasing Recommendations

Lands which should be leased with no surface occupancy, lands which should not be leased at this time, and lands carrying other special stipulations are listed in the following pages. Their general locations may be found in Figure 18.

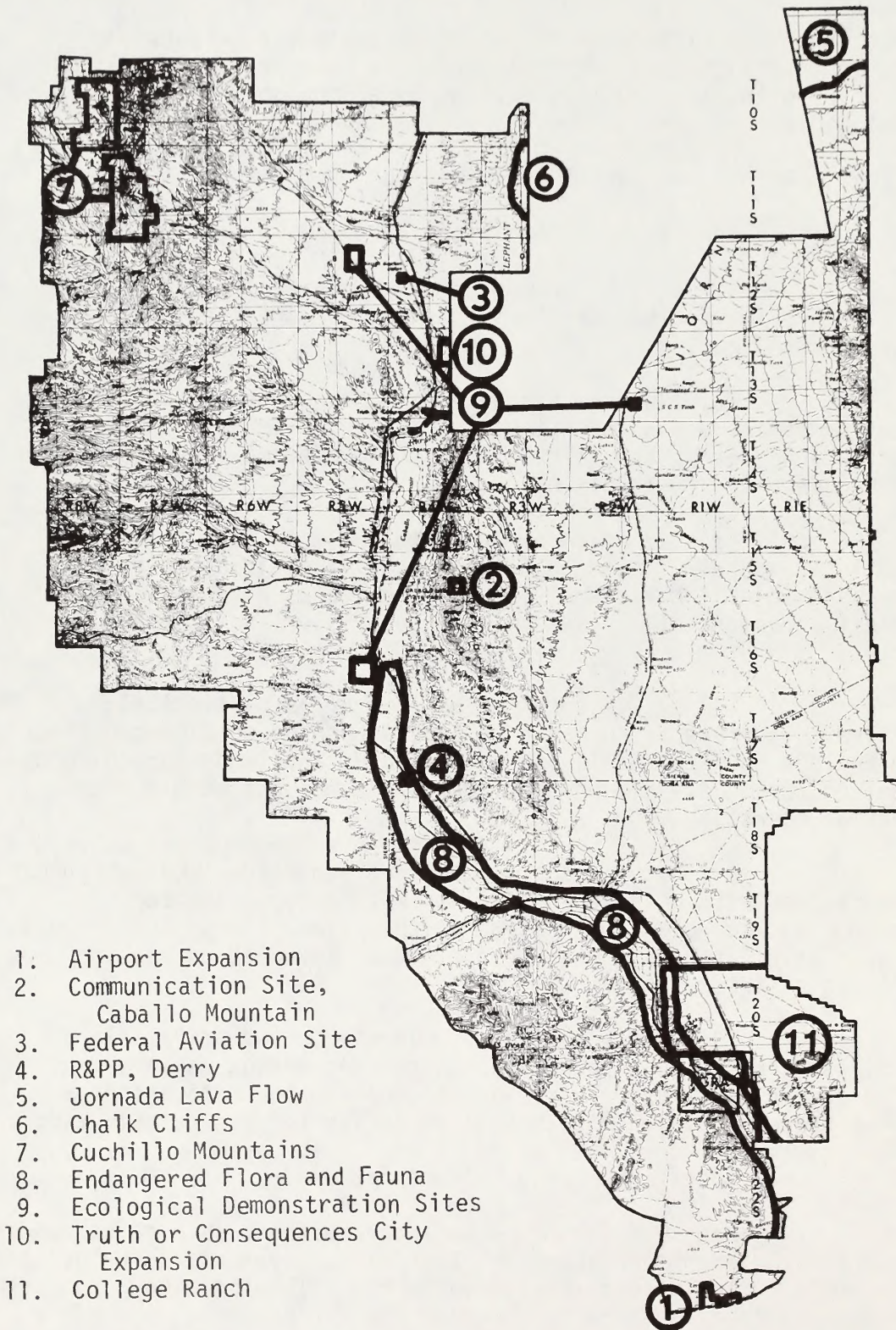


FIGURE 18

AREAS IDENTIFIED FOR THE PROPOSED RECOMMENDATIONS

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Recommendations for Mitigation*

(1) An area adjacent to the Las Cruces Airport, comprised of 368 ha (910 ac) has been marked for airport expansion and identified in the Las Uvas Management Framework Plan. These lands may be leased with no surface occupancy for geothermal related activity, and are described as follows:

T. 23S., R. 1W., NMPM

Sec. 21: E $\frac{1}{2}$

Sec. 26: SE $\frac{1}{4}$ SW $\frac{1}{4}$ NW $\frac{1}{4}$

S $\frac{1}{2}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$

E $\frac{1}{2}$ NW $\frac{1}{4}$ SW $\frac{1}{4}$

NE $\frac{1}{4}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$

NE $\frac{1}{4}$ SW $\frac{1}{4}$

N $\frac{1}{2}$ SE $\frac{1}{4}$ SW $\frac{1}{4}$

N $\frac{1}{2}$ SE $\frac{1}{4}$

N $\frac{1}{2}$ SW $\frac{1}{4}$ SE $\frac{1}{4}$

N $\frac{1}{2}$ SE $\frac{1}{4}$ SE $\frac{1}{4}$

S $\frac{1}{2}$ S $\frac{1}{2}$ NE $\frac{1}{4}$

Sec. 27: S $\frac{1}{2}$ S $\frac{1}{2}$ NW $\frac{1}{4}$

SW $\frac{1}{4}$

S $\frac{1}{2}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$

SW $\frac{1}{4}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$

W $\frac{1}{2}$ SE $\frac{1}{4}$

W $\frac{1}{2}$ SE $\frac{1}{4}$ SE $\frac{1}{4}$

Sec. 28: SE $\frac{1}{4}$

W $\frac{1}{2}$ NE $\frac{1}{4}$

SE $\frac{1}{4}$ NE $\frac{1}{4}$

E $\frac{1}{2}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$

(2) A communications site of approximately 65 ha (160 ac) is located on Caballo Mountain. The site is used by different lessees. These lands may be leased with no surface occupancy for geothermal activities. The lands are described as follows:

T. 15S., R. 4W., NMPM

Sec. 26: SW $\frac{1}{4}$

(3) A Federal Aviation Administration UHF omni-range (VOR) site (48 ha or 120 ac) is located north of Truth or Consequences. This land may be leased only with the concurrence of the Federal Aviation Administration. The land is described as follows:

T. 12S., R. 4W., NMPM

Sec. 7: SE $\frac{1}{4}$ NE $\frac{1}{4}$

N $\frac{1}{2}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$

Sec. 8: SW $\frac{1}{4}$ NW $\frac{1}{4}$

N $\frac{1}{2}$ NW $\frac{1}{4}$ SW $\frac{1}{4}$

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(4) A ball park covered under a Recreation and Public Purposes lease to Sierra County has been let on 1 ha (3 ac) of land at Derry. This land may be leased with no surface occupancy for geothermal activities. The land is described as follows:

T. 17S., R. 4W., NMPM
Sec. 30: NW $\frac{1}{4}$ of Lot 15

(5) The Jornada Lava Flow is an area which is to be studied for possible Natural Area designation. Portion of these lands in the assessment area (approximately 1268 ha, or 3133 ac) may be leased with no surface occupancy for geothermal activities. They are:

T. 9S., R. 2E., NMPM
Sec. 31: SE $\frac{1}{4}$, S $\frac{1}{2}$ SW $\frac{1}{4}$

T. 10S., R. 1E., NMPM
Sec. 1: SE $\frac{1}{4}$
Sec. 10: Lots 2-4, W $\frac{1}{2}$ NE $\frac{1}{4}$, N $\frac{1}{2}$ SE $\frac{1}{4}$, SE $\frac{1}{4}$ SE $\frac{1}{4}$
Sec. 11: S $\frac{1}{2}$ NE $\frac{1}{4}$, S $\frac{1}{2}$, S $\frac{1}{2}$ NW $\frac{1}{4}$
Sec. 12: NE $\frac{1}{4}$, S $\frac{1}{2}$, S $\frac{1}{2}$ NW $\frac{1}{4}$
Sec. 13: N $\frac{1}{2}$ N $\frac{1}{2}$
Sec. 14: N $\frac{1}{2}$ N $\frac{1}{2}$
Sec. 15: Lots 1, 2, E $\frac{1}{2}$ NE $\frac{1}{4}$

T. 10S., R. 2E., NMPM
Sec. 5: Lots 1, 2, and 4, SW $\frac{1}{4}$ NW $\frac{1}{4}$
Sec. 6: All
Sec. 7: Lost 1, 2, E $\frac{1}{2}$ NW $\frac{1}{4}$

Other portions of the Jornada Lava Flow (approximately 4,539 ha or 11,216 ac) cannot be reached by current slant drilling techniques and should not be occupied. These lands will not be leased at this time. These lands are described as follows:

T. 9S., R. 1E., NMPM
Sec. 13: S $\frac{1}{2}$
Sec. 14: S $\frac{1}{2}$
Sec. 15: S $\frac{1}{2}$
Sec. 21: Lots 1-4, E $\frac{1}{2}$ E $\frac{1}{2}$
Sec. 28: Lots 1-4, NE $\frac{1}{4}$ NE $\frac{1}{4}$
Sec. 33: Lots 1 and 2
Sec. 34 and 35: All
Sec. 22 through 27: All

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T. 9S., R. 2E., NMPM

- Sec. 17: $S\frac{1}{2}$
- Sec. 18: Lots 3, 4, $SE\frac{1}{4}$, $E\frac{1}{2}SW\frac{1}{4}$
- Sec. 19, 20, 29, and 30: All
- Sec. 31: Lots 1-4, $NE\frac{1}{4}$, $E\frac{1}{2}NW\frac{1}{4}$

T. 10S., R. 1E., NMPM

- Sec. 1: Lots 1-4, $S\frac{1}{2}N\frac{1}{2}$, $SW\frac{1}{4}$
- Sec. 3: Lots 1-7, $S\frac{1}{2}NE\frac{1}{4}$, $SE\frac{1}{4}$, $SE\frac{1}{4}NW\frac{1}{4}$
- Sec. 10: Lot 1, $N\frac{1}{2}NE\frac{1}{4}$

In the event technology advances in such a way that additional areas may be reached, or if the Jornada Lava Flow is determined to be unsuitable for designation as a Natural Area, then the appropriate restrictions will be removed.

(6) The Chalk Cliff area east of Elephant Butte Reservoir is an unintruded area of some 1667 ha (4120 ac) set aside in the Caballo Management Framework Plan for wildlife habitat. This area will not be leased pending further study. It is described as follows:

T. 10S., R. 3W., NMPM

- Sec. 21: $S\frac{1}{2}SE\frac{1}{4}$
- Sec. 22: Lot 4
- Sec. 27: Lots 1-4
- Sec. 28: $E\frac{1}{2}$
- Sec. 33: $E\frac{1}{2}$, $SE\frac{1}{4}SW\frac{1}{4}$
- Sec. 34: Lots 1-4

T. 11S., R. 3W., NMPM

- Sec. 3: Lots 1-4
- Sec. 4: $E\frac{1}{2}$, $E\frac{1}{2}W\frac{1}{2}$
- Sec. 8: $E\frac{1}{2}SE\frac{1}{4}$
- Sec. 9: $E\frac{1}{2}NW\frac{1}{4}$, $E\frac{1}{2}$, $SW\frac{1}{4}$
- Sec. 10: Lots 1-4
- Sec. 15: Lots 1-4
- Sec. 16: All
- Sec. 17: $E\frac{1}{2}E\frac{1}{2}$
- Sec. 20: $E\frac{1}{2}NE\frac{1}{4}$
- Sec. 21: $E\frac{1}{2}$, $NW\frac{1}{4}$
- Sec. 22: Lots 1-4
- Sec. 27: Lots 1-4
- Sec. 28: $E\frac{1}{2}$

(7) The Cuchillo Mountains (see Figure 18) were identified in the Caballo Management Framework Plan for management in a manner which will perpetuate their relatively unintruded, remote, and scenic values.

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To comply with this management guideline, special restrictive exploration, lease, and development stipulations (i.e., location of drilling platforms) will be required. These stipulations will be identified during the development of the site-specific EAR's.

(8) The following special stipulations are recommended for all national resource lands within the Rio Grande Valley (approximately 4,790 ha or 11,835 ac). These stipulations are necessary for the conservation and protection of endangered and threatened species of flora and fauna as set forth in federal and state regulations, and as provided for under Section 14 of the Geothermal Resources Lease (form 3200-21) and Section 6 of GRO order No. 4.

(a) To protect known as well as unknown species of endangered and threatened flora and fauna and their habitat, a "biological clearance" will be required before each soil disturbing activity covered by a "Notice of Intent," "Plan of Operation," or "Plan of Development." Before each surface disturbing activity, the Authorized Officer and the Area Supervisor will conduct a field examination of the site and prepare a certified statement relative to endangered or threatened floral or faunal species inhabiting or utilizing the area. The statement should also include whatever measures are considered necessary to minimize or eliminate adverse effects and to protect the endangered or threatened species.

(b) The Authorized Officer and the Area Geothermal Supervisor retain the prerogative to require the relocation of operations to protect all endangered and threatened flora and fauna inhabiting national resource lands.

(c) Lands upon which the above stipulations shall be required are described as follows:

- T. 16S., R. 4W., NMPM
 - Sec. 30: $W\frac{1}{2}SE\frac{1}{4}$, $SW\frac{1}{2}NE\frac{1}{4}$, $E\frac{1}{2}E\frac{1}{2}$
 - Sec. 31: $NW\frac{1}{2}NE\frac{1}{4}$

- T. 17S., R. 4W., NMPM
 - Sec. 6: Lots 13, 14, 16-18, 21
 - Sec. 7: Lots 9, 11-16
 - Sec. 18: Lots 5, 9, 10, 15
 - Sec. 19: Lots 5, 11-18
 - Sec. 30: Lots 11-15

- T. 17S., R. 5W., NMPM
 - Sec. 35: $SE\frac{1}{4}$

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- T. 18S., R. 4W., NMPM
Sec. 18: $S\frac{1}{2}NE\frac{1}{4}$, $SW\frac{1}{4}$, $W\frac{1}{2}SE\frac{1}{4}$
Sec. 19: All
Sec. 33: $SW\frac{1}{4}$, $S\frac{1}{2}SE\frac{1}{4}$
- T. 19S., R. 2W., NMPM
Sec. 19: $W\frac{1}{2}NW\frac{1}{4}$, $SE\frac{1}{4}NW\frac{1}{4}$, $SW\frac{1}{4}NE\frac{1}{4}$
Sec. 27: $S\frac{1}{2}SW\frac{1}{4}$
Sec. 28: $S\frac{1}{2}$
Sec. 34: $W\frac{1}{2}E\frac{1}{2}$, $NW\frac{1}{4}$
- T. 19S., R. 3W., NMPM
Sec. 3: $SE\frac{1}{4}SE\frac{1}{4}$
Sec. 23: $S\frac{1}{2}NE\frac{1}{4}$
- T. 19S., R. 4W., HMPM
Sec. 3: $W\frac{1}{2}NW\frac{1}{4}$
Sec. 4: $NE\frac{1}{4}$
- T. 20S., R. 1W., NMPM
Sec. 6: All except patented mining claims
Sec. 31: $SW\frac{1}{4}SW\frac{1}{4}$
- T. 20S., R. 2W., NMPM
Sec. 1: $E\frac{1}{2}NE\frac{1}{4}$
Sec. 3: $W\frac{1}{2}E\frac{1}{2}$, $NE\frac{1}{4}NE\frac{1}{4}$
Sec. 10: $SE\frac{1}{4}NE\frac{1}{4}$
Sec. 11: $S\frac{1}{2}$
Sec. 14: $E\frac{1}{2}$
Sec. 23: $E\frac{1}{2}$
Sec. 24: $SW\frac{1}{4}SW\frac{1}{4}$
Sec. 25: $W\frac{1}{2}NW\frac{1}{4}$, $SE\frac{1}{4}NW\frac{1}{4}$, $SW\frac{1}{4}$, $W\frac{1}{2}SE\frac{1}{4}$
- T. 21S., R. 1W., NMPM
Sec. 3: $N\frac{1}{2}$, $N\frac{1}{2}S\frac{1}{2}$
Sec. 4: $N\frac{1}{2}$, $SE\frac{1}{4}$, $N\frac{1}{2}SW\frac{1}{4}$
Sec. 5: $S\frac{1}{2}NW\frac{1}{4}$, $SW\frac{1}{4}NE\frac{1}{4}$, $NW\frac{1}{4}SE\frac{1}{4}$, $SW\frac{1}{4}$
Sec. 8: $N\frac{1}{2}$
Sec. 9: $SW\frac{1}{4}NW\frac{1}{4}$, $W\frac{1}{2}SW\frac{1}{4}$, $SE\frac{1}{4}SW\frac{1}{4}$, $SW\frac{1}{4}SE\frac{1}{4}$
Sec. 15: $SW\frac{1}{4}$, $W\frac{1}{2}NW\frac{1}{4}$
Sec. 22: $N\frac{1}{2}$, $SE\frac{1}{4}$
Sec. 23: $SW\frac{1}{4}$, $S\frac{1}{2}SE\frac{1}{4}$, $NW\frac{1}{4}SE\frac{1}{4}$
Sec. 26: All
Sec. 35: $E\frac{1}{2}$
Sec. 36: Lots 1-3
- T. 21S., R. 2W., NMPM
Sec. 1: $NE\frac{1}{4}$
- T. 22S., R. 1W., NMPM
Sec. 1: $NW\frac{1}{4}$, $NW\frac{1}{4}NE\frac{1}{4}$, $S\frac{1}{2}NE\frac{1}{4}$

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T. 22S., R. 1E., NMPM
Sec. 6: SW $\frac{1}{4}$, W $\frac{1}{2}$ SE $\frac{1}{4}$
Sec. 7: E $\frac{1}{2}$ SE $\frac{1}{4}$, SE $\frac{1}{4}$ NE $\frac{1}{4}$
Sec. 8: SW $\frac{1}{4}$ SW $\frac{1}{4}$
Sec. 17: W $\frac{1}{2}$ NW $\frac{1}{4}$, NW $\frac{1}{4}$ SW $\frac{1}{4}$
Sec. 18: E $\frac{1}{2}$ E $\frac{1}{2}$
Sec. 19: E $\frac{1}{2}$ E $\frac{1}{2}$
Sec. 20: Lots 1-3, W $\frac{1}{2}$ SW $\frac{1}{4}$, SE $\frac{1}{4}$ SE $\frac{1}{4}$
Sec. 29: NW $\frac{1}{4}$ NE $\frac{1}{4}$, NE $\frac{1}{4}$ NW $\frac{1}{4}$

(9) Three sites within the assessment area have been withdrawn by Public Land Order 4038 for ecological evaluation and demonstration purposes. These lands can be leased with no surface occupancy for geothermal activities. The lands are described as follows:

Engle Demonstration Area (16 ha or 40 ac)

T. 13S., R. 2W., NMPM
Sec. 35: NE $\frac{1}{4}$ NE $\frac{1}{4}$

Cuchillo Demonstration Area (583 ha or 1440 ac)

T. 12S., R. 5W., NMPM
Sec. 10: SE $\frac{1}{4}$
Sec. 11 and 14: All

Nordstrom Demonstration Area (566 ha or 1400 ac)

T. 16S., R. 5W., NMPM
Sec. 27: All
Sec. 28: E $\frac{1}{2}$
Sec. 33: N $\frac{1}{2}$ NE $\frac{1}{4}$
Sec. 34: N $\frac{1}{2}$
Sec. 35: NW $\frac{1}{4}$ NW $\frac{1}{4}$

(10) An intensive use area directly north of Truth or Consequences, N.M., has been identified in the Caballo Management Framework Plan as land available for city expansion. These lands, comprised of 380 ha or 940 ac) will be leased with no surface occupancy and are described as follows:

T. 13S., R. 4W., NMPM
Sec. 3: Lots 1, 5-7, SW $\frac{1}{4}$ NE $\frac{1}{4}$, W $\frac{1}{2}$ SE $\frac{1}{4}$,
E $\frac{1}{2}$ SW $\frac{1}{4}$, SE $\frac{1}{4}$ NW $\frac{1}{4}$
Sec. 10: Lots 1-4, W $\frac{1}{2}$ E $\frac{1}{2}$, SW $\frac{1}{4}$, S $\frac{1}{2}$ NW $\frac{1}{4}$
Sec. 15: Lots 1 and 2

(11) The New Mexico State University Ranch is an area set aside for various research projects. Grazing animal behavior,

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vegetative manipulation, phenological studies, and other research projects are currently in progress and should not be disturbed by geothermal exploration activities.

(a) The following lands, comprised of some 3624 ha (8954 ac) should be leased with no surface occupancy to protect these studies:

T. 20S., R. 1W., NMPM
Sec. 1, 2, and 3:
Sec. 4, 9, and 10: That portion east of I-25
Sec. 13: $S\frac{1}{2}$, $S\frac{1}{2}NW\frac{1}{4}$, $NE\frac{1}{4}$
Sec. 14: $S\frac{1}{2}$, $S\frac{1}{2}N\frac{1}{2}$, $NW\frac{1}{4}NW\frac{1}{4}$
Sec. 15 and 22: That portion east of I-25
Sec. 23: $N\frac{1}{2}N\frac{1}{2}$
Sec. 24: $N\frac{1}{2}N\frac{1}{2}NW\frac{1}{4}$

T. 20S., R. 1E., NMPM
Sec. 6: A11
Sec. 7: $E\frac{1}{2}$
Sec. 8: $S\frac{1}{2}NE\frac{1}{4}$, $NW\frac{1}{4}$, $S\frac{1}{2}$
Sec. 9: $SW\frac{1}{4}$
Sec. 18 and 36: A11

T. 20S., R. 2E., NMPM
Sec. 31: A11

T. 21S., R. 1E., NMPM
Sec. 1: A11
Sec. 12: $N\frac{1}{2}$, $SE\frac{1}{4}$

T. 21S., R. 2E., NMPM
Sec. 7: $S\frac{1}{2}$
Sec. 18: A11

(b) Other lands (approximately 1112 ha or 2748 ac) located interiorly to those described in (a) above cannot be reached with todays technology by directional drilling. These lands will be withheld from leasing until technological advances make development of these areas feasible or until the reasons for withholding them are no longer appropriate. These lands are described as follows:

T. 20S., R. 1W., NMPM
Sec. 11 and 12: A11
Sec. 13: $N\frac{1}{2}NW\frac{1}{4}$
Sec. 14: $N\frac{1}{2}NE\frac{1}{4}$, $NE\frac{1}{4}NW\frac{1}{4}$

T. 20S., R. 1E., NMPM
Sec. 7: $W\frac{1}{2}$

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T. 21S., R. 2W., NMPM
Sec. 6: All
Sec. 7: N $\frac{1}{2}$

(c) Other remaining lands within the College Ranch may also require "no surface occupancy" to protect permanent enclosures, study sites, etc. Identification of the specific areas and stipulations will be made during the development of the site-specific EAR.

(d) To provide for the protection of endangered and threatened species of flora and fauna, the College Ranch lands which border the Rio Grande (approximately 1377 ha or 3403 ac) may be leased, but with no surface occupancy. Future occupancy may be permitted however, this is contingent upon the determination and delineation (if appropriate) of critical habitat. These lands are described as follows:

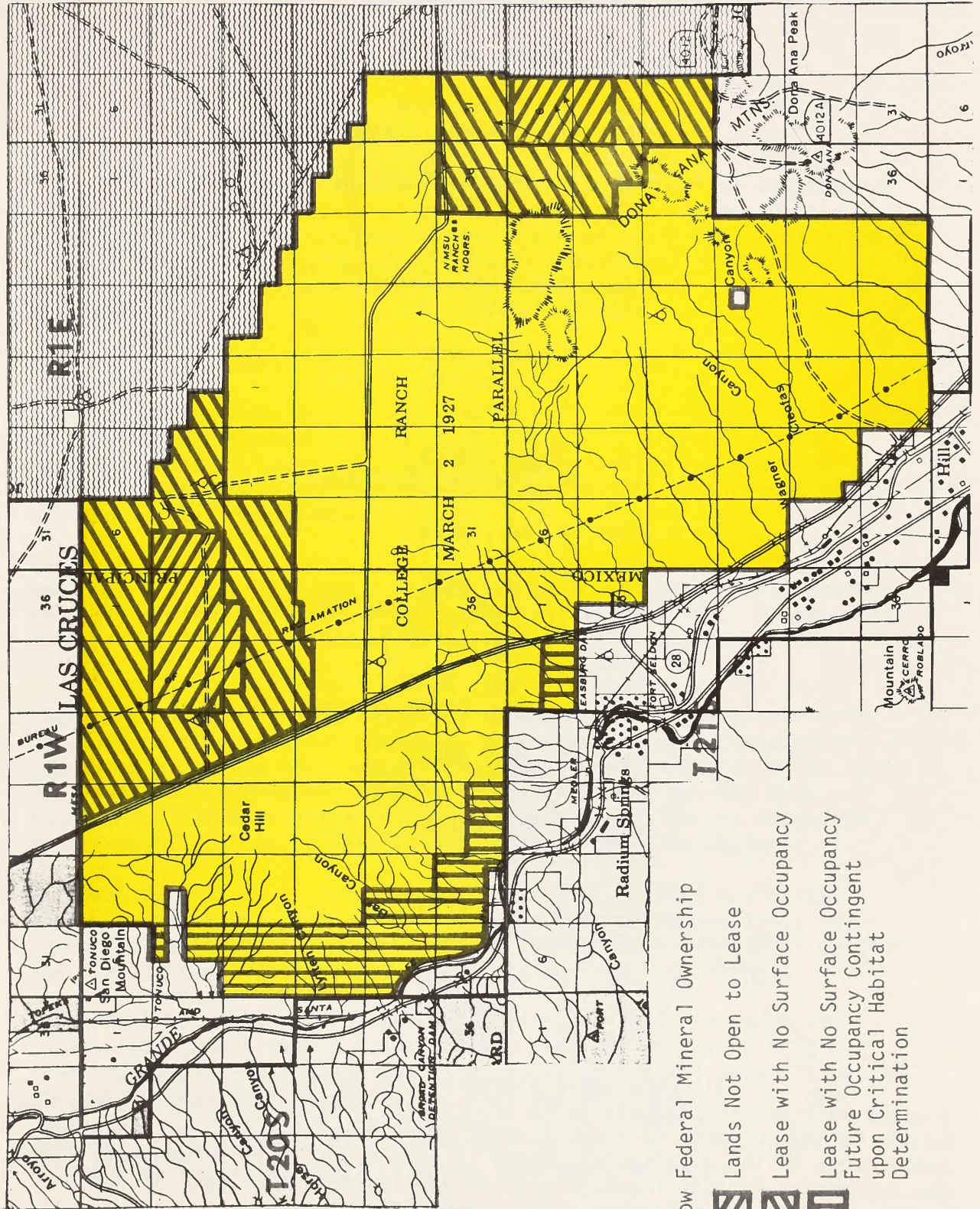
T. 20S., R. 1W., NMPM
Sec. 7: N $\frac{1}{2}$ NE $\frac{1}{4}$, SE $\frac{1}{4}$
Sec. 18 and 19: All
Sec. 29: W $\frac{1}{2}$
Sec. 30: Lots 1, 2, 3, & 8; E $\frac{1}{2}$, E $\frac{1}{2}$ NW $\frac{1}{4}$
Sec. 31: Lots 1, 6, 7, & 8; E $\frac{1}{2}$ NE $\frac{1}{4}$
Sec. 32: N $\frac{1}{2}$, N $\frac{1}{2}$ SW $\frac{1}{4}$, N $\frac{1}{2}$ SE $\frac{1}{4}$, SE $\frac{1}{4}$ SE $\frac{1}{4}$

T. 21S., R. 1W., NMPM
Sec. 2: S $\frac{1}{2}$

(e) As studies terminate on the College Ranch, additional lands may be made available for leasing with surface occupancy. All changes must be coordinated with the College Ranch directorate. The above recommendations are shown in Figure 18.

(12) Several areas of national resource lands have been selected by the State of New Mexico in lieu of state lands lost to military withdrawals, etc. These lands comprised of some 2529 ha (6249 ac) have been withdrawn under Executive Orders 6276 and 6583, closing them to metal leasing and non-metalliferous mineral exploration. To lease these lands, a relinquishment must be made by the state and an opening order published in the Federal Register by BLM. It is recommended that the Authorized Officer (upon receipt of applications for lease of such lands) initiate the action necessary to open these lands. A description of these lands follows:

T. 10S., R. 8W., NMPM
Sec. 19: W $\frac{1}{2}$ NW $\frac{1}{4}$, SW $\frac{1}{4}$
Sec. 21: SE $\frac{1}{4}$ NW $\frac{1}{4}$, SW $\frac{1}{4}$ NE $\frac{1}{4}$, E $\frac{1}{2}$ SW $\frac{1}{4}$, W $\frac{1}{2}$ SE $\frac{1}{4}$
Sec. 28: NW $\frac{1}{4}$ NE $\frac{1}{4}$, NE $\frac{1}{4}$ NW $\frac{1}{4}$
Sec. 29: NW $\frac{1}{4}$ NW $\frac{1}{4}$, W $\frac{1}{2}$ SW $\frac{1}{4}$
Sec. 30: NE $\frac{1}{4}$ NE $\frac{1}{4}$



Yellow Federal Mineral Ownership



Lands Not Open to Lease

Lease with No Surface Occupancy

Lease with No Surface Occupancy
Future Occupancy Contingent
upon Critical Habitat
Determination

FIGURE 19

NEW MEXICO STATE UNIVERSITY COLLEGE RANCH

ANALYSIS OF THE PROPOSED ACTION AND ALTERNATIVES

- T. 11S., R. 7W., NMPM
 - Sec. 5: NW $\frac{1}{4}$
 - Sec. 6: N $\frac{1}{2}$ NW $\frac{1}{4}$, NE $\frac{1}{4}$
 - Sec. 33: NW $\frac{1}{4}$ SW $\frac{1}{4}$
- T. 12S., R. 6W., NMPM
 - Sec. 3: NW $\frac{1}{4}$ SW $\frac{1}{4}$
- T. 12S., R. 7W., NMPM
 - Sec. 4: W $\frac{1}{2}$ NW $\frac{1}{4}$, E $\frac{1}{2}$ SW $\frac{1}{4}$
 - Sec. 9: NE $\frac{1}{4}$ NW $\frac{1}{4}$
- T. 13S., R. 2W., NMPM
 - Sec. 13: S $\frac{1}{2}$ N $\frac{1}{2}$, S $\frac{1}{2}$
 - Sec. 24: N $\frac{1}{2}$ N $\frac{1}{2}$
- T. 15S., R. 7W., NMPM
 - Sec. 24: SW $\frac{1}{4}$ NW $\frac{1}{4}$, S $\frac{1}{2}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$
- T. 20S., R. 3W., NMPM
 - Sec. 21: A11
 - Sec. 27: W $\frac{1}{2}$, W $\frac{1}{2}$ E $\frac{1}{2}$
 - Sec. 28: W $\frac{1}{2}$ W $\frac{1}{2}$, NE $\frac{1}{4}$ NW $\frac{1}{4}$, NW $\frac{1}{4}$ NE $\frac{1}{4}$, E $\frac{1}{2}$ E $\frac{1}{2}$
 - Sec. 29: SE $\frac{1}{4}$, SE $\frac{1}{4}$ NE $\frac{1}{4}$
 - Sec. 31: A11
 - Sec. 33: NW $\frac{1}{4}$, N $\frac{1}{2}$ SW $\frac{1}{4}$
 - Sec. 34: N $\frac{1}{2}$, N $\frac{1}{2}$ SW $\frac{1}{4}$, SE $\frac{1}{4}$ SW $\frac{1}{4}$, SE $\frac{1}{4}$
- T. 20S., R. 4W., NMPM
 - Sec. 9: N $\frac{1}{2}$ NW $\frac{1}{4}$, SE $\frac{1}{4}$ SW $\frac{1}{4}$
- T. 21S., R. 2W., NMPM
 - Sec. 11: A11
- T. 22S., R. 1W., NMPM
 - Sec. 1: NE $\frac{1}{4}$ NE $\frac{1}{4}$
- T. 22S., R. 1E., NMPM
 - Sec. 29: NW $\frac{1}{4}$ NW $\frac{1}{4}$
 - Sec. 30: N $\frac{1}{2}$ NE $\frac{1}{4}$

(13) Land administered by the Bureau of Reclamation located adjacent to Elephant Butte and Caballo Reservoirs and along the Rio Grande Valley is open to leasing under the mineral leasing laws provided concurrence of the withdrawing agency is obtained. It is recommended that the Authorized Officer (upon receipt of applications for lease of such lands) initiate the action to obtain concurrence.

Environmental Impacts
Residual Impacts

c. Other Recommendations

(1) As the EAR for each proposed surface disturbing project is prepared, a determination of site-specific impacts and the development of specialized mitigating measures shall be accomplished. The possible mitigating measures listed in this EAR, the Steam Act, and GRO Orders will form the basis for development of site-specific mitigating measures.

5. Residual Impacts

Residual impacts include lasting impacts which could not be or were not successfully mitigated during the geothermal program. Possible residual impacts to both non-living and living components of the environment must be considered, as well as lasting impacts of socio-cultural importance.

Residual impacts to air should be non-existent. Carbon monoxide, dust, and other forms of pollution related to man's activities will decrease as man's activities in the area become less intensified. Proper control of toxic geothermal wastes should eliminate any long-term effects of the program.

There should be no residual impacts on water quality if proper care is taken to prevent water pollution or contamination. Consumptive yearround water use could affect the water supply. The need for water for geothermally produced electricity in this area has not been determined. If full scale production takes place, and is dependent upon present sources of water, these sources could be depleted.

Residual impacts to surface hot springs and associated businesses (hot mineral baths) could occur. However, currently available information on geothermal reservoirs is inadequate to determine whether there will be any significant impacts to surface hot springs.

There need be no long-term residual impacts to soils in the area. Careful management should eliminate any problems with accelerated erosion or toxic residues. The withdrawals of thermal waters from the geothermal reservoirs might allow localized subsidence of the overlying strata, creating a lasting impact to the topography. In addition, intensive use of a geothermal resource could deplete the resource to the point where it would take years to recover.

If the non-living environment is properly protected, there should be only low residual impacts to the living environment. Areas which have been cleared of vegetation will revegetate, whether naturally or with man's help. Animals will slowly return to live in these areas as the evidence of prior disturbance decreases. Special care to protect threatened and endangered species of plants and animals during the program should eliminate any serious residual impacts to species which might find recovery difficult. All residual impacts to living components of the environment should be relatively short-term impacts, since plants and animals are a renewable resource. Some features, such as abandoned water ponds, could have a permanent beneficial effect on living components.

Buildings, homes, roads, or other facilities left behind as a result of geothermal activity will degrade primitive values, scenic values, and open space. They may enhance some forms of recreation; the abandoned facilities could become an attraction to people who are enticed by historic ghost towns and abandoned mining camps. There may also be a permanent loss of currently existing archaeological and historical values as a result of increased human activity during the geothermal program.

Communities in the area would feel economic stress from the loss of jobs and tax-base during close-out. Regulatory structure would suffer as well, since both the need for regulatory mechanisms and the method of their support is based on the size of the taxable population. Fortunately, human communities can adjust to and recover from impacts of this nature, just as other living components do. The residual impacts to social welfare could be serious on a local basis, but will create relatively short-term problems.

B. Relationship between Short-term Use and Long-term Productivity

Lands in the proposed leasing area have been used primarily for livestock production since the 17th century. Mining and farming have been economically important, but limited land uses in the area. In recent years, public recreational interest in the area has increased due to expanding populations and recreational opportunities available on national resource lands. Public interest is primarily confined to primitive, cultural, scenic, ecological, and open space values, and general leisure use of the lands for a variety of participant activities. Off-road vehicle use, rockhounding, and hunting are major participant uses.

Significant geothermal development throughout the potential leasing area would immediately affect the livestock and wildlife forage resources as well as recreational resources and opportunities on localized areas. Major effects would be reduced forage, habitat, and recreational values, plus soil disturbance, noise, and air pollution.

*Relationship between Short-term
Use and Long-term Productivity*

It could promote urban expansion in the area, causing a conversion of prime farmland to housing developments, shopping centers, and gas stations. On the other hand, geothermal waste water might prove usable for expansion of agricultural land uses. These effects would last as long as the geothermal program. Since a geothermal field must have at least 30 years of production potential before it is developed, these "short-term" changes in land use can be expected to last more than 30 years. Both the beneficial and the negative impacts of geothermal development will affect not only the present generation, but at least two future generations.

Under these circumstances, long-term productivity refers to productivity of the land beginning at least 50 years from now and extending indefinitely into the future. Assuming that the historical uses of the land have been suited to the land and have provided materials necessary to man's survival and comfort, it is likely that these uses will continue to be important.

Livestock production, mining operations, and recreation should suffer little or no residual impacts from a full-scale geothermal development program. Proper protection of potable water sources during the program will enable a speedy recovery from any impacts to livestock production. Recreation would recover as development areas are rehabilitated. Mining operations should not be affected even during the program.

Most of the land suitable for farming is privately owned, and many of the federal environmental protection stipulations cannot be required for actions on these lands. If extensive urban development takes place on prime farmland, the land may never recover completely even if it is returned to agricultural use in later years. This could seriously undermine the subsistence resources necessary to all sedentary societies, and could markedly reduce the human population which could be supported permanently in the area. Although these impacts cannot be controlled through federal efforts, state and local authorities may be able to minimize these impacts through zoning ordinances or other regulation.

If farmlands are retained and maintained or expanded with geothermal waste water, no residual impacts need occur. Great care should be taken to control the salinity and mineral content of geothermal irrigation water, since an excessive build-up of mineral salts in the soil could reduce its agricultural productivity.

Primitive values, scenic quality, open space values, archaeological and historical resources, and wildlife preservation efforts may all

suffer long-term residual impacts. All of these are of cultural and scientific rather than economic interest. In the past, these types of considerations have been the privilege of complex societies and advanced civilizations.

When a civilization is placed under stress to maintain its existence and its economic standard of living, these considerations may become luxuries which it can no longer afford. Full geothermal development may require that cultural and scientific values in the development area be sacrificed in favor of technological maintenance and advancement. Whether this involves destruction or simply a reduction of the quality of these resources, it will constitute a permanent trade-off in resources for short-term benefits. This will affect all future generations adversely, but will allow economic benefits to the next few generations.

Social welfare would improve on a long-term basis if the geothermal resource proves to be rechargeable. If it is not rechargeable, the economic welfare of those using its energy would be short-term, lasting only a few generations. Under these circumstances, the impacts of close-out could be substantial, but long-term impacts are unlikely. While exhaustion of a non-rechargeable resource certainly affects the productivity of a region, the resource is of no more use in the ground unused than it would be if it were absent.

In conclusion, a fully developed geothermal program will have many short-term benefits, and possibly long-term benefits. It need not affect long-term productivity of the land. It will require some sacrifice of the quality of all cultural resources in the area. This will be a permanent trade-off for increased economic benefits and maintenance of the American standard of living. If exploration does not result in a discovery of a significant geothermal resource, the short-term loss of grazing, wildlife habitat, recreational resources, water resources, and other values will be minimal and the long-term productivity of these resources will not be greatly affected.

C. Irreversible and Irretrievable Commitment of Resources

Knowledge of geothermal reservoirs is limited at this time. It may be that the geothermal resource in the assessment area is rechargeable. If it is not rechargeable, full development and commitment of the resource to production of electricity could constitute an irreversible and irretrievable commitment of resources.

Any destruction of cultural resources which occurs as a direct or indirect result of the geothermal program will constitute an irreversible commitment of non-renewable resources.

*Irreversible and Irretrievable
Commitment of Resources*

If care is not maintained during all phases of geothermal operations to conserve and protect endangered and threatened plant and animal species, the result could be an irreversible and irretrievable commitment of these resources through neglect.

No other irreversible commitments are likely to result from a geothermal program as long as the developers comply conscientiously with all environmental protection measures.

IV. PUBLIC INTEREST

A. Persons, Groups, and Government Agencies Consulted

Copies of the rough draft of this document were made available for public review at the New Mexico State University Library and the Bureau of Land Management District Office in Las Cruces, the U. S. Post Office at Garfield, the Hatch City Clerk's Office, and the public library in Truth or Consequences. Notices advertising the availability of the draft were sent to newspapers, radio stations, and television stations in the region. In addition, letters of notification were mailed to everyone on the Caballo Planning Unit mailing list and to livestock operators in that portion of the Las Uvas Planning Unit included within the assessment area.

Copies of the rough draft were sent for review and comment to federal and state agencies, various conservation organizations and business and industry representatives that had expressed a direct interest in such material. Additional copies were given to people who made requests after the public announcements. Because of an insufficient number of printed copies to honor all requests, duplicated copies were made available at cost.

A copy of the mailing list for letters of notification, a list of the people who received copies of the rough draft, a copy of the news release, letter of notification, and letter to recipients of the rough draft can be found in Appendix H.

No public meetings were held during or following the preparation of this document. However, public meetings were held during the preparation of land use plans for the Caballo, Las Uvas, and Organ Mountain Planning Units in the Las Cruces District, each included a discussion relative to geothermal leasing.

B. Intensity of Public Interest

In contrast to the publicity and number of requests for the rough draft, few people submitted comments on the material presented at the public meetings or on the EAR and TR. Most of those who sent replies were representatives of state or federal government agencies or conservation groups.

Comments included notice of typographical and grammatical errors. Inadequacies in the sections on impacts and mitigating measures were frequently mentioned.

An effort has been made to incorporate all of the comments in appropriate sections. The letters received will be kept on file permanently at the BLM's Las Cruces District Office and will be available for review upon request.

Intensity of Public Interest

The Bureau of Land Management wishes to thank all those who commented on the rough draft for helping to improve the quality of the final document.

Formal letters of comment were submitted by the following groups:

College of Agriculture and Home Economics
New Mexico State University

Area Geothermal Supervisor
United States Geological Survey

New Mexico State Engineer's Office

New Mexico Department of Game and Fish

Division of Ecological Services
United States Fish and Wildlife Services

International Boundary and Water Commission
United States and Mexico

Southwest Regional Representative
The Wilderness Society

Woodward-Clyde Consultants

Area Geologist, USGS, Roswell, N.M.

New Mexico State Heritage Program

State of New Mexico, State Planning Office

Bureau of Land Management, Socorro District

Bureau of Land Management, New Mexico State Office

Goodrich-Bartlett & Associates

Chevron Pipe Line Company

V. SUMMARY CONCLUSIONS

Low or negligible residual impacts to all components of the environment may be expected if all appropriate mitigating measures are taken. The quantitative and physical limits of impacts incurred by production must be determined at that time. In particular, an interpretation of data collected during exploration will be necessary for evaluation of the effects of production on potable water, surface hot springs, and the geothermal resource of the area.

If no program develops, the exploration will have created minor impacts (beneficial and adverse), and will not affect the long-term productivity of the land.

If a program does develop, the short-term use of geothermal resources should have great beneficial impacts. The adverse impacts should be minimized by proper use of mitigating measures and careful control procedures. Due care during production should reduce residual impacts a great degree. The program need have no significant effects on the long-term productivity of the land.

Irreversible and irretrievable commitment of resources will undoubtedly include the loss of historic and archaeological values. Carelessness could result in the loss of endangered flora and fauna. In addition, the geothermal resource could be irretrievably committed if these are found to be non-rechargeable.

The level of public interest seems to be low. Most replies to the request for comments on the EAR and TR were from other governmental agencies. Some interest was shown by prospective developers and conservation groups. Private citizens in the affected area gave little feed-back at the public meetings held on land use planning or on the rough draft, although several asked for copies of the final document.

Most input received concerned mitigating measures. This section was, consequently, rewritten in more detail.

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GEOHERMAL STEAM ACT OF 1970

and

Regulations on the Leasing of Geothermal Resources

APPENDIX A

Geothermal Steam Act of 1970

Regulations on the Leasing of Geothermal Resources

Geothermal Resource Operational Orders 1 through 4

APPENDIX A

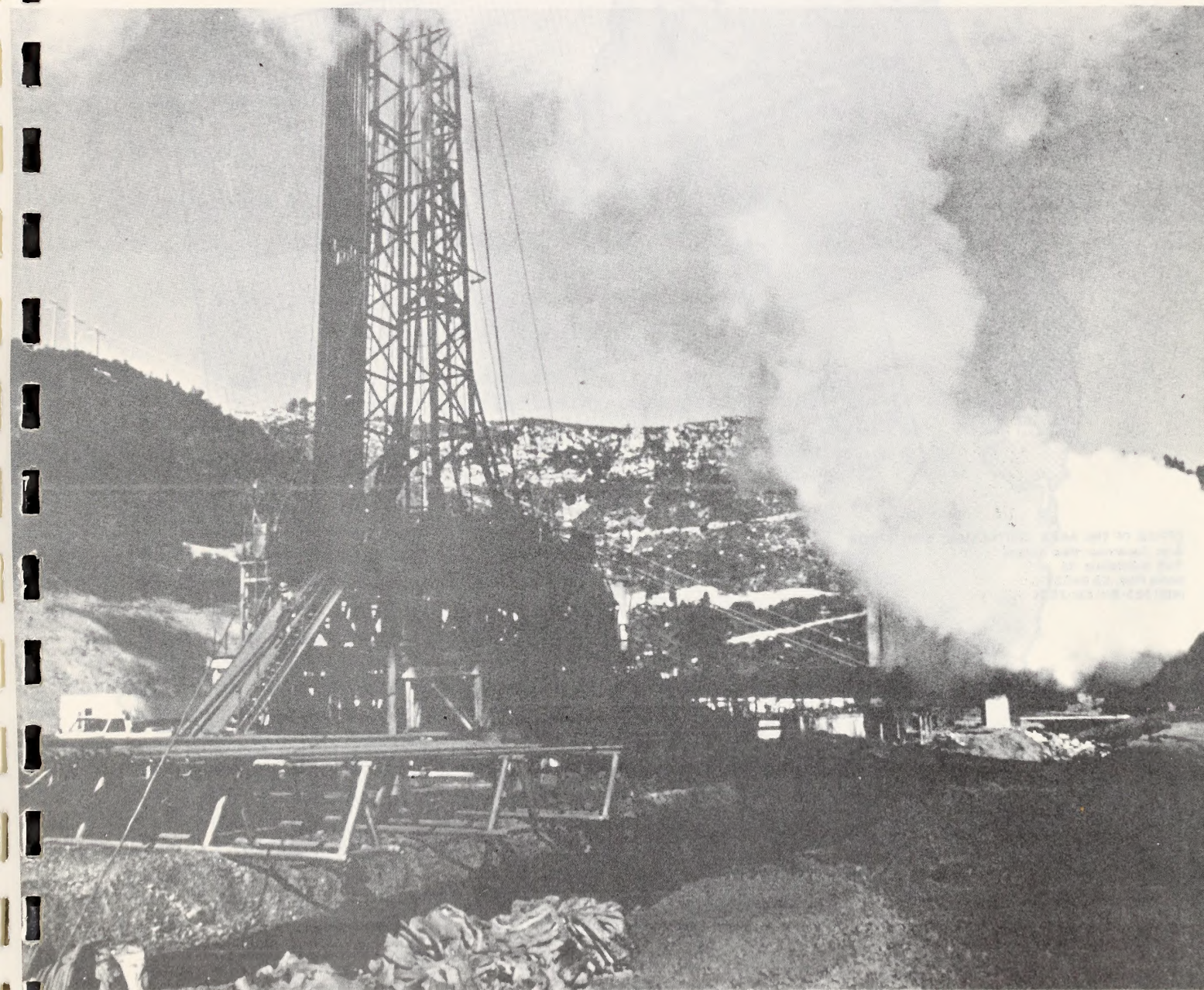
Geothermal Steam Act of 1970

Registration on enhancing the National Resources
Geothermal Resource (Original Order) through 4

GEOHERMAL STEAM ACT OF 1970

and

Regulations on the Leasing of Geothermal Resources

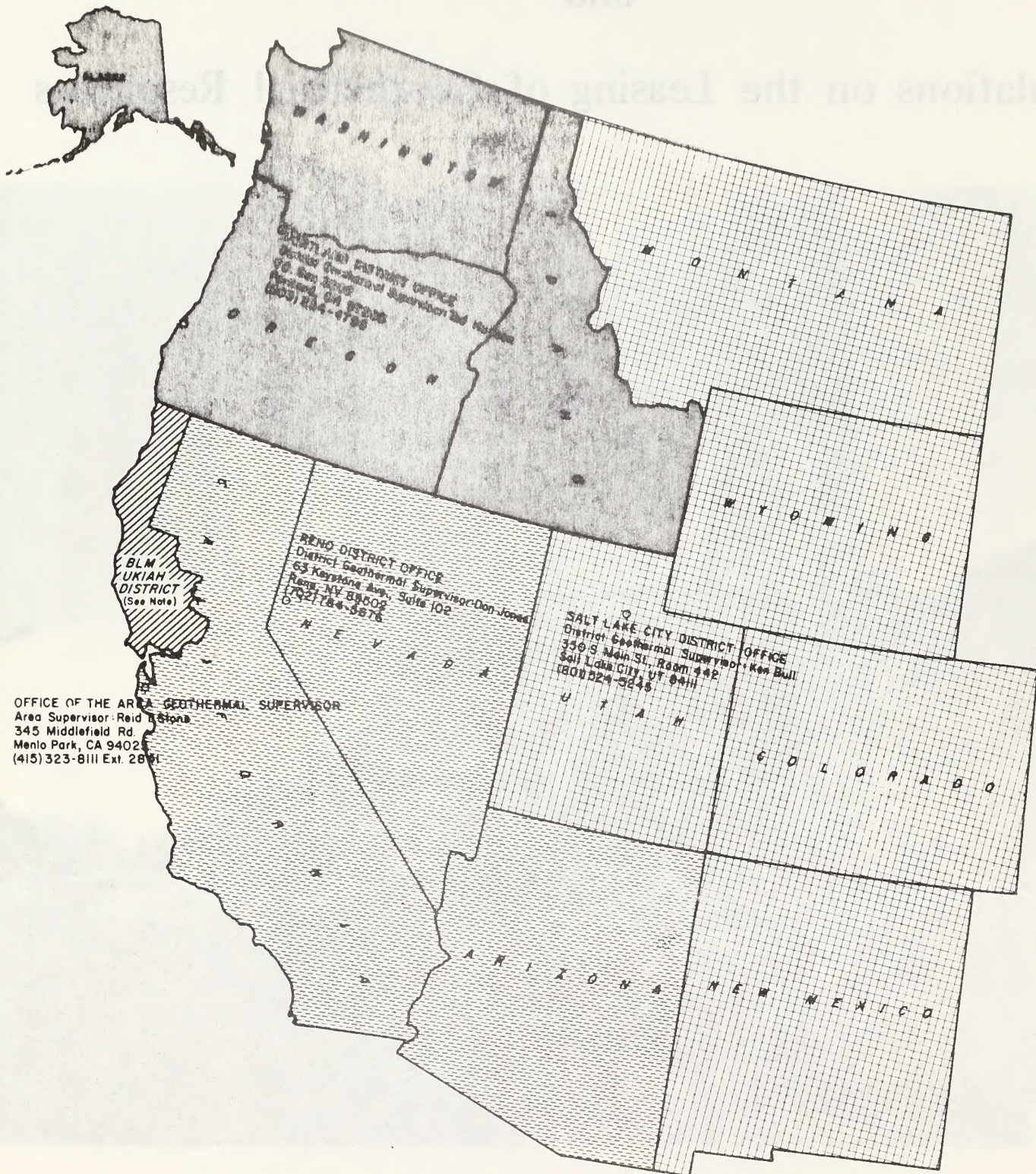


United States Geological Survey

United States Department of the Interior

May 1975

USGS AREA and DISTRICT GEOTHERMAL OFFICES



OFFICE OF THE AREA GEOTHERMAL SUPERVISOR
Area Supervisor: Reid Nelson
345 Middlefield Rd.
Menlo Park, CA 94025
(415) 323-8111 Ext. 2891

NOTE: Geothermal lease operations in the Bureau of Land Management's Ukiah District, CA and in all of the U.S. Geological Survey Eastern Region are administered by the Area Geothermal Supervisor in Menlo Park, CA.

Public Law 95-341
95th Congress, 2d Sess.
December 29, 1978

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GEOTHERMAL STEAM ACT OF 1970

Public Law 91-581
91st Congress, S.368
December 24, 1970
(84 Stat. 1566)
(30 U.S.C. 1001-1025)



Public Law 91-581
91st Congress, S. 368
December 24, 1970

An Act

84 STAT. 1566

To authorize the Secretary of the Interior to make disposition of geothermal steam and associated geothermal resources, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Geothermal Steam Act of 1970".

Geothermal Steam
Act of 1970.
Definitions.

SEC. 2. As used in this Act, the term—

- (a) "Secretary" means the Secretary of the Interior;
- (b) "geothermal lease" means a lease issued under authority of this Act;
- (c) "geothermal steam and associated geothermal resources" means (i) all products of geothermal processes, embracing indigenous steam, hot water and hot brines; (ii) steam and other gases, hot water and hot brines resulting from water, gas, or other fluids artificially introduced into geothermal formations; (iii) heat or other associated energy found in geothermal formations; and (iv) any byproduct derived from them;
- (d) "byproduct" means any mineral or minerals (exclusive of oil, hydrocarbon gas, and helium) which are found in solution or in association with geothermal steam and which have a value of less than 75 per centum of the value of the geothermal steam or are not, because of quantity, quality, or technical difficulties in extraction and production, of sufficient value to warrant extraction and production by themselves;
- (e) "known geothermal resources area" means an area in which the geology, nearby discoveries, competitive interests, or other indicia would, in the opinion of the Secretary, engender a belief in men who are experienced in the subject matter that the prospects for extraction of geothermal steam or associated geothermal resources are good enough to warrant expenditures of money for that purpose.

SEC. 3. Subject to the provisions of section 15 of this Act, the Secretary of the Interior may issue leases for the development and utilization of geothermal steam and associated geothermal resources (1) in lands administered by him, including public, withdrawn, and acquired lands, (2) in any national forest or other lands administered by the Department of Agriculture through the Forest Service, including public, withdrawn, and acquired lands, and (3) in lands which have been conveyed by the United States subject to a reservation to the United States of the geothermal steam and associated geothermal resources therein.

Leases.

SEC. 4. If lands to be leased under this Act are within any known geothermal resources area, they shall be leased to the highest responsible qualified bidder by competitive bidding under regulations formulated by the Secretary. If the lands to be leased are not within any known geothermal resources area, the qualified person first making application for the lease shall be entitled to a lease of such lands without competitive bidding. Notwithstanding the foregoing, at any time within one hundred and eighty days following the effective date of this Act:

Bids.

Conversion.

- (a) with respect to all lands which were on September 7, 1965, subject to valid leases or permits issued under the Mineral Leasing Act of February 25, 1920, as amended (30 U.S.C. 181 et seq.), or under the Mineral Leasing Act of Acquired Lands, as amended (30 U.S.C. 351, 358), or to existing mining claims located on or prior to September 7, 1965, the lessees or permittees or claimants or their successors in interest who are qualified to hold geothermal

41 Stat. 437.

61 Stat. 913.

leases shall have the right to convert such leases or permits or claims to geothermal leases covering the same lands;

(b) where there are conflicting claims, leases, or permits therefor embracing the same land, the person who first was issued a lease or permit, or who first recorded the mining claim shall be entitled to first consideration;

(c) with respect to all lands which were on September 7, 1965, the subject of applications for leases or permits under the above Acts, the applicants may convert their applications to applications for geothermal leases having priorities dating from the time of filing of such applications under such Acts;

Acresage limitation.

(d) no person shall be permitted to convert mineral leases, permits, applications therefor, or mining claims for more than 10,240 acres; and

(e) the conversion of leases, permits, and mining claims and applications for leases and permits shall be accomplished in accordance with regulations prescribed by the Secretary. No right to conversion to a geothermal lease shall accrue to any person under this section unless such person shows to the reasonable satisfaction of the Secretary that substantial expenditures for the exploration, development, or production of geothermal steam have been made by the applicant who is seeking conversion, on the lands for which a lease is sought or on adjoining, adjacent, or nearby Federal or non-Federal lands.

(f) with respect to lands within any known geothermal resources area and which are subject to a right to conversion to a geothermal lease, such lands shall be leased by competitive bidding: *Provided*, That, the competitive geothermal lease shall be issued to the person owning the right to conversion to a geothermal lease if he makes payment of an amount equal to the highest bona fide bid for the competitive geothermal lease, plus the rental for the first year, within thirty days after he receives written notice from the Secretary of the amount of the highest bid.

Lease provisions. Royalties.

SEC. 5. Geothermal leases shall provide for—

(a) a royalty of not less than 10 per centum or more than 15 per centum of the amount or value of steam, or any other form of heat or energy derived from production under the lease and sold or utilized by the lessee or reasonably susceptible to sale or utilization by the lessee;

41 Stat. 437.

(b) a royalty of not more than 5 per centum of the value of any byproduct derived from production under the lease and sold or utilized or reasonably susceptible of sale or utilization by the lessee, except that as to any byproduct which is a mineral named in section 1 of the Mineral Leasing Act of February 25, 1920, as amended (30 U.S.C. 181), the rate of royalty for such mineral shall be the same as that provided in that Act and the maximum rate of royalty for such mineral shall not exceed the maximum royalty applicable under that Act;

Rent.

(c) payment in advance of an annual rental of not less than \$1 per acre or fraction thereof for each year of the lease. If there is no well on the leased lands capable of producing geothermal resources in commercial quantities, the failure to pay rental on or before the anniversary date shall terminate the lease by operation of law: *Provided, however*, That whenever the Secretary discovers that the rental payment due under a lease is paid timely but the amount of the payment is deficient because of an error or other reason and the deficiency is nominal, as determined by the Secretary pursuant to regulations prescribed by him, he shall notify the lessee of the deficiency and such lease shall not automatically terminate unless

the lessee fails to pay the deficiency within the period prescribed in the notice: *Provided further*, That, where any lease has been terminated automatically by operation of law under this section for failure to pay rental timely and it is shown to the satisfaction of the Secretary of the Interior that the failure to pay timely the lease rental was justifiable or not due to a lack of reasonable diligence, he in his judgment may reinstate the lease if--

(1) a petition for reinstatement, together with the required rental, is filed with the Secretary of the Interior; and

(2) no valid lease has been issued affecting any of the lands in the terminated lease prior to the filing of the petition for reinstatement; and

(d) a minimum royalty of \$2 per acre or fraction thereof in lieu of rental payable at the expiration of each lease year for each producing lease, commencing with the lease year beginning on or after the commencement of production in commercial quantities. For the purpose of determining royalties hereunder the value of any geothermal steam and byproduct used by the lessee and not sold and reasonably susceptible of sale shall be determined by the Secretary, who shall take into consideration the cost of exploration and production and the economic value of the resource in terms of its ultimate utilization.

SEC. 6. (a) Geothermal leases shall be for a primary term of ten years. If geothermal steam is produced or utilized in commercial quantities within this term, such lease shall continue for so long thereafter as geothermal steam is produced or utilized in commercial quantities, but such continuation shall not exceed an additional forty years.

(b) If, at the end of such forty years, steam is produced or utilized in commercial quantities and the lands are not needed for other purposes, the lessee shall have a preferential right to a renewal of such lease for a second forty-year term in accordance with such terms and conditions as the Secretary deems appropriate.

(c) Any lease for land on which, or for which under an approved cooperative or unit plan of development or operation, actual drilling operations were commenced prior to the end of its primary term and are being diligently prosecuted at that time shall be extended for five years and so long thereafter, but not more than thirty-five years, as geothermal steam is produced or utilized in commercial quantities. If, at the end of such extended term, steam is being produced or utilized in commercial quantities and the lands are not needed for other purposes, the lessee shall have a preferential right to a renewal of such lease for a second term in accordance with such terms and conditions as the Secretary deems appropriate.

(d) For purposes of subsection (a) of this section, production or utilization of geothermal steam in commercial quantities shall be deemed to include the completion of one or more wells producing or capable of producing geothermal steam in commercial quantities and a bona fide sale of such geothermal steam for delivery to or utilization by a facility or facilities not yet installed but scheduled for installation not later than fifteen years from the date of commencement of the primary term of the lease.

(e) Leases which have extended by reasons of production, or which have produced geothermal steam, and have been determined by the Secretary to be incapable of further commercial production and utilization of geothermal steam may be further extended for a period of not more than five years from the date of such determination but only for so long as one or more valuable byproducts are produced in commercial quantities. If such byproducts are leasable under the Mineral Leasing Act of February 25, 1920, as amended (30 U.S.C. 181, et seq.), or under the Mineral Leasing Act for Acquired Lands (30 U.S.C.

Term.

Limitation.

Renewal.

Extension.

61 Stat. 913.

351-358), and the leasehold is primarily valuable for the production thereof, the lessee shall be entitled to convert his geothermal lease to a mineral lease under, and subject to all the terms and conditions of, such appropriate Act upon application at any time before expiration of the lease extension by reason of byproduct production. The lessee shall be entitled to locate under the mining laws all minerals which are not leasable and which would constitute a byproduct if commercial production or utilization of geothermal steam continued. The lessee in order to acquire the rights herein granted him shall complete the location of mineral claims within ninety days after the termination of the lease for geothermal steam. Any such converted lease or the surface of any mining claim located for geothermal byproducts mineral affecting lands withdrawn or acquired in aid of a function of a Federal department or agency, including the Department of the Interior, shall be subject to such additional terms and conditions as may be prescribed by such department or agency with respect to the additional operations or effects resulting from such conversion upon adequate utilization of the lands for the purpose for which they are administered.

(f) Minerals locatable under the mining laws of the United States in lands subject to a geothermal lease issued under the provisions of this Act which are not associated with the geothermal steam and associated geothermal resources of such lands as defined in section 2(c) herein shall be locatable under said mining laws in accordance with the principles of the Multiple Mineral Development Act (68 Stat. 708; found in 30 U.S.C. 521 et seq.).

Leases,
acreage.

SEC. 7. A geothermal lease shall embrace a reasonably compact area of not more than two thousand five hundred and sixty acres, except where a departure therefrom is occasioned by an irregular subdivision or subdivisions. No person, association, or corporation, except as otherwise provided in this Act, shall take, hold, own, or control at one time, whether acquired directly from the Secretary under this Act or otherwise, any direct or indirect interest in Federal geothermal leases in any one State exceeding twenty thousand four hundred and eighty acres, including leases acquired under the provisions of section 4 of this Act.

Limitation.

At any time after fifteen years from the effective date of this Act the Secretary, after public hearings, may increase this maximum holding in any one State by regulation, not to exceed fifty-one thousand two hundred acres.

Increase.

Readjustment.

SEC. 8. (a) The Secretary may readjust the terms and conditions, except as otherwise provided herein, of any geothermal lease issued under this Act at not less than ten-year intervals beginning ten years after the date the geothermal steam is produced, as determined by the Secretary. Each geothermal lease issued under this Act shall provide for such readjustment. The Secretary shall give notice of any proposed readjustment of terms and conditions, and, unless the lessee files with the Secretary objection to the proposed terms or relinquishes the lease within thirty days after receipt of such notice, the lessee shall conclusively be deemed to have agreed with such terms and conditions. If the lessee files objections, and no agreement can be reached between the Secretary and the lessee within a period of not less than sixty days, the lease may be terminated by either party.

Notice.

(b) The Secretary may readjust the rentals and royalties of any geothermal lease issued under this Act at not less than twenty-year intervals beginning thirty-five years after the date geothermal steam is produced, as determined by the Secretary. In the event of any such readjustment neither the rental nor royalty may be increased by more than 50 per centum over the rental or royalty paid during the preceding period, and in no event shall the royalty payable exceed 22½ per centum. Each geothermal lease issued under this Act shall provide

for such readjustment. The Secretary shall give notice of any proposed readjustment of rentals and royalties, and, unless the lessee files with the Secretary objection to the proposed rentals and royalties or relinquishes the lease within thirty days after receipt of such notice, the lessee shall conclusively be deemed to have agreed with such terms and conditions. If the lessee files objections, and no agreement can be reached between the Secretary and the lessee within a period of not less than sixty days, the lease may be terminated by either party.

Notice.

(c) Any readjustment of the terms and conditions as to use, protection, or restoration of the surface of any lease of lands withdrawn or acquired in aid of a function of a Federal department or agency other than the Department of the Interior may be made only upon notice to, and with the approval of, such department or agency.

SEC. 9. If the production, use, or conversion of geothermal steam is susceptible of producing a valuable byproduct or byproducts, including commercially demineralized water for beneficial uses in accordance with applicable State water laws, the Secretary shall require substantial beneficial production or use thereof unless, in individual circumstances he modifies or waives this requirement in the interest of conservation of natural resources or for other reasons satisfactory to him. However, the production or use of such byproducts shall be subject to the rights of the holders of preexisting leases, claims, or permits covering the same land or the same minerals, if any.

Byproducts.

SEC. 10. The holder of any geothermal lease at any time may make and file in the appropriate land office a written relinquishment of all rights under such lease or of any legal subdivision of the area covered by such lease. Such relinquishment shall be effective as of the date of its filing. Thereupon the lessee shall be released of all obligations thereafter accruing under said lease with respect to the lands relinquished, but no such relinquishment shall release such lessee, or his surety or bond, from any liability for breach of any obligation of the lease, other than an obligation to drill, accrued at the date of the relinquishment, or from the continued obligation, in accordance with the applicable lease terms and regulations, (1) to make payment of all accrued rentals and royalties, (2) to place all wells on the relinquished lands in condition for suspension or abandonment, and (3) to protect or restore substantially the surface and surface resources.

Relinquishment.

SEC. 11. The Secretary, upon application by the lessee, may authorize the lessee to suspend operations and production on a producing lease and he may, on his own motion, in the interest of conservation suspend operations on any lease but in either case he may extend the lease term for the period of any suspension, and he may waive, suspend, or reduce the rental or royalty required in such lease.

Suspension.

SEC. 12. Leases may be terminated by the Secretary for any violation of the regulations or lease terms after thirty days notice provided that such violation is not corrected within the notice period, or in the event the violation is such that it cannot be corrected within the notice period then provided that lessee has not commenced in good faith within said notice period to correct such violation and thereafter to proceed diligently to correct such violation. Lessee shall be entitled to a hearing on the matter of such claimed violation or proposed termination of lease if request for a hearing is made to the Secretary within the thirty-day period after notice. The period for correction of violation or commencement to correct such violation of regulations or of lease terms, as aforesaid, shall be extended to thirty days after the Secretary's decision after such hearing if the Secretary shall find that a violation exists.

Leases,
termination.
Notice.

SEC. 13. The Secretary may waive, suspend, or reduce the rental or royalty for any lease or portion thereof in the interests of conservation and to encourage the greatest ultimate recovery of geothermal

resources, if he determines that this is necessary to promote development or that the lease cannot be successfully operated under the lease terms.

Surface
land, use.

SEC. 14. Subject to the other provisions of this Act, a lessee shall be entitled to use so much of the surface of the land covered by his geothermal lease as may be found by the Secretary to be necessary for the production, utilization, and conservation of geothermal resources.

SEC. 15. (a) Geothermal leases for lands withdrawn or acquired in aid of functions of the Department of the Interior may be issued only under such terms and conditions as the Secretary may prescribe to insure adequate utilization of the lands for the purposes for which they were withdrawn or acquired.

41 Stat. 1075;
62 Stat. 275.

(b) Geothermal leases for lands withdrawn or acquired in aid of functions of the Department of Agriculture may be issued only with the consent of, and subject to such terms and conditions as may be prescribed by, the head of that Department to insure adequate utilization of the lands for the purposes for which they were withdrawn or acquired. Geothermal leases for lands to which section 24 of the Federal Power Act, as amended (16 U.S.C. 818), is applicable, may be issued only with the consent of, and subject to, such terms and conditions as the Federal Power Commission may prescribe to insure adequate utilization of such lands for power and related purposes.

16 USC 1.

(c) Geothermal leases under this Act shall not be issued for lands administered in accordance with (1) the Act of August 25, 1916 (39 Stat. 535), as amended or supplemented, (2) for lands within a national recreation area, (3) for lands in a fish hatchery administered by the Secretary, wildlife refuge, wildlife range, game range, wildlife management area, waterfowl production area, or for lands acquired or reserved for the protection and conservation of fish and wildlife that are threatened with extinction, (4) for tribally or individually owned Indian trust or restricted lands, within or without the boundaries of Indian reservations.

Lessees,
citizenship
requirement.

SEC. 16. Leases under this Act may be issued only to citizens of the United States, associations of such citizens, corporations organized under the laws of the United States or of any State or the District of Columbia, or governmental units, including, without limitation, municipalities.

SEC. 17. Administration of this Act shall be under the principles of multiple use of lands and resources, and geothermal leases shall, insofar as feasible, allow for coexistence of other leases of the same lands for deposits of minerals under the laws applicable to them, for the location and production of claims under the mining laws, and for other uses of the areas covered by them. Operations under such other leases or for such other uses, however, shall not unreasonably interfere with or endanger operations under any lease issued pursuant to this Act, nor shall operations under leases so issued unreasonably interfere with or endanger operations under any lease, license, claim, or permit issued pursuant to the provisions of any other Act.

Cooperative
or unit
plan.

SEC. 18. For the purpose of properly conserving the natural resources of any geothermal pool, field, or like area, or any part thereof, lessees thereof and their representatives may unite with each other, or jointly or separately with others, in collectively adopting and operating under a cooperative or unit plan of development or operation of such pool, field, or like area, or any part thereof, whenever this is determined and certified by the Secretary to be necessary or advisable in the public interest. The Secretary may in his discretion and with the consent of the holders of leases involved, establish, alter, change, revoke, and make such regulations with reference to such leases in connection with the institution and operation of any such cooperative or unit plan as he may deem necessary or proper to secure reasonable protection of the

public interest. He may include in geothermal leases a provision requiring the lessee to operate under such a reasonable cooperative or unit plan, and he may prescribe such a plan under which such lessee shall operate, which shall adequately protect the rights of all parties in interest, including the United States. Any such plan may, in the discretion of the Secretary, provide for vesting in the Secretary or any other person, committee, or Federal or State agency designated therein, authority to alter or modify from time to time the rate of prospecting and development and the quantity and rate of production under such plan. All leases operated under any such plan approved or prescribed by the Secretary shall be excepted in determining holdings or control for the purposes of section 7 of this Act.

When separate tracts cannot be independently developed and operated in conformity with an established well-spacing or development program, any lease, or a portion thereof, may be pooled with other lands, whether or not owned by the United States, under a communitization or drilling agreement providing for an apportionment of production or royalties among the separate tracts of land comprising the drilling or spacing unit when determined by the Secretary to be in the public interest, and operations or production pursuant to such an agreement shall be deemed to be operations or production as to each lease committed thereto.

The Secretary is hereby authorized, on such conditions as he may prescribe, to approve operating, drilling, or development contracts made by one or more lessees of geothermal leases, with one or more persons, associations, or corporations whenever, in his discretion, the conservation of natural products or the public convenience or necessity may require or the interests of the United States may be best served thereby. All leases operated under such approved operating, drilling, or development contracts, and interests thereunder, shall be excepted in determining holdings or control under section 7 of this Act.

SEC. 19. Upon request of the Secretary, other Federal departments and agencies shall furnish him with any relevant data then in their possession or knowledge concerning or having bearing upon fair and adequate charges to be made for geothermal steam produced or to be produced for conversion to electric power or other purposes. Data given to any department or agency as confidential under law shall not be furnished in any fashion which identifies or tends to identify the business entity whose activities are the subject of such data or the person or persons who furnished such information.

SEC. 20. All moneys received under this Act from public lands under the jurisdiction of the Secretary shall be disposed of in the same manner as moneys received from the sale of public lands. Moneys received under this Act from other lands shall be disposed of in the same manner as other receipts from such lands.

Moneys.

SEC. 21. (a) Within one hundred and twenty days after the effective date of this Act, the Secretary shall cause to be published in the Federal Register a determination of all lands which were included within any known geothermal resources area on the effective date of the Act. He shall likewise publish in the Federal Register from time to time his determination of other known geothermal resources areas specifying in each case the date the lands were included in such area; and

Publication in
Federal Register.

(b) Geothermal resources in lands the surface of which has passed from Federal ownership but in which the minerals have been reserved to the United States shall not be developed or produced except under geothermal leases made pursuant to this Act. If the Secretary of the Interior finds that such development is imminent, or that production from a well heretofore drilled on such lands is imminent, he shall so report to the Attorney General, and the Attorney General is authorized

and directed to institute an appropriate proceeding in the United States district court of the district in which such lands are located, to quiet the title of the United States in such resources, and if the court determines that the reservation of minerals to the United States in the lands involved included the geothermal resources, to enjoin their production otherwise than under the terms of this Act: *Provided*, That upon an authoritative judicial determination that Federal mineral reservation does not include geothermal steam and associated geothermal resources the duties of the Secretary of the Interior to report and of the Attorney General to institute proceedings, as hereinbefore set forth, shall cease.

SEC. 22. Nothing in this Act shall constitute an express or implied claim or denial on the part of the Federal Government as to its exemption from State water laws.

Waste,
prevention.

SEC. 23. (a) All leases under this Act shall be subject to the condition that the lessee will, in conducting his exploration, development, and producing operations, use all reasonable precautions to prevent waste of geothermal steam and associated geothermal resources developed in the lands leased.

(b) Rights to develop and utilize geothermal steam and associated geothermal resources underlying lands owned by the United States may be acquired solely in accordance with the provisions of this Act.

Rules and
regulations.

SEC. 24. The Secretary shall prescribe such rules and regulations as he may deem appropriate to carry out the provisions of this Act. Such regulations may include, without limitation, provisions for (a) the prevention of waste, (b) development and conservation of geothermal and other natural resources, (c) the protection of the public interest, (d) assignment, segregation, extension of terms, relinquishment of leases, development contracts, unitization, pooling, and drilling agreements, (e) compensatory royalty agreements, suspension of operations or production, and suspension or reduction of rentals or royalties, (f) the filing of surety bonds to assure compliance with the terms of the lease and to protect surface use and resources, (g) use of the surface by a lessee of the lands embraced in his lease, (h) the maintenance by the lessee of an active development program, and (i) protection of water quality and other environmental qualities.

SEC. 25. As to any land subject to geothermal leasing under section 3 of this Act, all laws which either (a) provide for the disposal of land by patent or other form of conveyance or by grant or by operation of law subject to a reservation of any mineral or (b) prevent or restrict the disposal of such land because of the mineral character of the land, shall hereafter be deemed to embrace geothermal steam and associated geothermal resources as a substance which either must be reserved or must prevent or restrict the disposal of such land, as the case may be. This section shall not be construed to affect grants, patents, or other forms of conveyances made prior to the date of enactment of this Act.

30 USC 530.

SEC. 26. The first two clauses in section 11 of the Act of August 13, 1954 (68 Stat. 708, 716), are amended to read as follows:

30 USC 181.

30 USC 281.

"As used in this Act, 'mineral leasing laws' shall mean the Act of February 25, 1920 (41 Stat. 437); the Act of April 17, 1926 (44 Stat. 301); the Act of February 7, 1927 (44 Stat. 1057); Geothermal Steam Act of 1970, and all Acts heretofore or hereafter enacted which are amendatory of or supplementary to any of the foregoing Acts; 'Leasing Act minerals' shall mean all minerals which, upon the effective date of this Act, are provided in the mineral leasing laws to be disposed of thereunder and all geothermal steam and associated geothermal resources which, upon the effective date of the Geothermal Steam Act of 1970, are provided in that Act to be disposed of thereunder;".

December 24, 1970

Pub. Law 91-681

84 STAT. 1574

SEC. 27. The United States reserves the ownership of and the right to extract under such rules and regulations as the Secretary may prescribe oil, hydrocarbon gas, and helium from all geothermal steam and associated geothermal resources produced from lands leased under this Act in accordance with presently applicable laws: *Provided*, That whenever the right to extract oil, hydrocarbon gas, and helium from geothermal steam and associated geothermal resources produced from such lands is exercised pursuant to this section, it shall be exercised so as to cause no substantial interference with the production of geothermal steam and associated geothermal resources from such lands.

Certain mineral
rights, retention
by U. S.

Approved December 24, 1970.

LEGISLATIVE HISTORY:

HOUSE REPORT No. 91-1544 (Comm. on Interior and Insular Affairs).
SENATE REPORT No. 91-1160 (Comm. on Interior and Insular Affairs).
CONGRESSIONAL RECORD, Vol. 116 (1970):
Sept. 16, Oct. 14, Dec. 4, 10, considered and passed Senate.
Oct. 5, Dec. 9, considered and passed House.

REGULATIONS ON THE LEASING
OF GEOTHERMAL RESOURCES

Title 30, Chapter II of the Code of Federal Regulations
and

Title 43, Chapter II of the Code of Federal Regulations

RULES AND REGULATIONS

Title 30—Mineral Resources

CHAPTER II—GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

PART 270—GEOHERMAL RESOURCES OPERATIONS ON PUBLIC, ACQUIRED, AND WITHDRAWN LANDS

PART 271—GEOHERMAL RESOURCES UNIT PLAN REGULATIONS (INCLUDING SUGGESTED FORMS)

The purpose of these regulations is to implement the Geothermal Steam Act of 1970 (30 U.S.C. 1001-1025) and provide for the leasing of the public and acquired lands of the United States for the purpose of geothermal resources exploration, development, and production.

The public was afforded an opportunity to comment on proposed rulemaking published on July 23, 1971, November 29, 1972, and July 23, 1973 and supplemented on August 8, 1973. These regulations reflect consideration of all comments received on the published proposed rulemaking.

A Final Environmental Statement, prepared in accordance with the provisions of section 102(2)(C) of the National Environmental Policy Act of 1969 (42 U.S.C. 4332(2)(C)), was issued on October 23, 1973. It discussed the environmental impact of leasing federally owned geothermal resources under the proposed rulemaking, and proposed provisions for inclusion in regulations and leases to mitigate any possible impacts on the environment.

These regulations will be effective January 1, 1974.

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270.76 Annual report of compliance with environmental protection requirements.
270.77 Annual report of expenditures for diligent exploration operations.
270.78 Notice of intent and permit to conduct exploration operations (other than drilling, see 43 CFR 3209.0-5 (a)).
270.79 Public inspection of records.

PROCEDURE IN CASE OF VIOLATION OF THE REGULATIONS OR LEASE TERMS

- 270.80 Noncompliance with regulations or lease terms.

APPEALS

- 270.90 Appeals.

GENERAL PROVISIONS

§ 270.1 Purpose and authority.

The Geothermal Steam Act enacted on December 24, 1970 (84 Stat. 1566) referred to in this part as "the Act", authorizes the Secretary of the Interior to prescribe rules and regulations applicable to operations conducted under a lease granted pursuant to that Act, and for the development and conservation of geothermal steam and associated geothermal resources, the prevention of waste, the protection of the public interest, and the protection of water quality, and other environmental qualities. The regulations in this part shall be administered by the Director through the Chief, Conservation Division, or his duly appointed representative.

§ 270.2 Definitions.

As used in the regulations in this part, the term:

(a) "Secretary" means the Secretary of the Interior or any person duly authorized to exercise the powers vested in that officer.

(b) "Director" means the Director of the Geological Survey.

(c) "Supervisor" means a representative of the Secretary, subject to the direction and supervisory authority of the Director, the Chief, Conservation Division, Geological Survey, and the appropriate Regional Conservation Manager, Conservation Division, Geological Survey, authorized and empowered to regulate operations and to perform other duties prescribed in the regulations in this part or any subordinate of such a representative acting under his direction.

(d) "Geothermal lease" means a lease issued under 43 CFR Group 3200.

(e) "Lessee" means the individual, corporation, association, or municipality to which a geothermal lease has been issued and its successor in interest or assignee. It also means any agent of the lessee or an operator holding authority by or through the lessee.

(f) "Operator" means the individual, corporation, or association having control or management of operations on the leased lands or a portion thereof. The operator may be the lessee, designated operator, or agent of the lessee, or holder of rights under an approved operating agreement.

(g) "Geothermal resources" means (1) all products of geothermal processes, embracing indigenous steam, hot water, and hot brines; (2) steam and other gases, hot water, and hot brines, resulting from water, gas, or other fluids artificially introduced into geothermal formations; (3) heat or other associated energy found in geothermal formations; and (4) any byproduct derived therefrom.

(h) "Byproduct" means (1) any mineral or minerals (exclusive of oil, hydrocarbon gas, and helium), which are found in solution or developed in association with geothermal steam and which have a value of less than 75 per centum of the value of the geothermal steam or are not, because of quantity, quality, or technical difficulties in extraction and production, of sufficient value to warrant extraction and production by themselves, and (2) commercially demineralized water.

(i) "Participating area" means that part of the unit area which is deemed to be productive from a horizon or deposit and to which production would be allocated in the manner described in the unit agreement assuming that all lands are committed to the unit agreement.

(j) "Waste" means (1) physical waste, as that term is generally understood; (2) waste of reservoir energy through inefficiency, improper use of or unnecessary dissipation of reservoir energy; (3) the location, spacing, drilling, equipping, operating, or producing of any geothermal well or wells in a manner which causes or tends to cause reduction in the quantity of geothermal energy ultimately recoverable from a reservoir under prudent and workmanlike operations or which tends to cause unnecessary or excessive surface or subsurface loss or destruction of geothermal energy; and (4) the inefficient transmission of geothermal energy from the source (wellhead) to point of utilization.

(k) "Directionally drilled well" means the deviation of a well bore from the vertical or from its normal course in an intended predetermined direction or course with respect to the points of the compass. Directionally drilled well shall not include a well deviated for the purpose of straightening a hole that has become crooked in the normal course of drilling or holes deviated at random

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without regard to compass direction in an attempt to sidetrack a portion of the hole on account of mechanical difficulty in drilling.

(l) "Geothermal resources operational order" or "GRO order" means a formal numbered order, issued by the Supervisor, with the prior approval of the Chief, Conservation Division, Geological Survey, which implements the regulations in this part and applies to operations in an area, region, or any significant portion thereof.

(m) "Producible well" means a well which is capable of producing geothermal resources in commercial quantities.

(n) "Commercial quantities" means quantities sufficient to provide a return after all variable costs of production have been met.

(o) "Area of operations" means that area of the leased lands which is required for exploration, development, and producing operations, and which is delineated on a map or plat which is made a part of the approved plan of operations. It encompasses the area generally needed for wells, flow lines, separators, surge tanks, drill pads, mud pits, workshops, and other such facilities used for on-project geothermal resources field exploration, development, and production operations.

JURISDICTION AND FUNCTIONS OF SUPERVISOR

§ 270.10 Jurisdiction.

Drilling and production operations, handling and measurement of production, determination and collection of royalty and, in general, all operations conducted on a geothermal lease are subject to the regulations in this part and the applicable regulations contained in 43 CFR Group 3200, and are under the jurisdiction of the Supervisor for the area in which the leased land is situated, subject to the supervisory authority of the Secretary and the Director.

§ 270.11 General functions.

The Supervisor is authorized and directed to carry out the provisions of this part. He will require compliance with the terms of geothermal leases, with the regulations in this part and the applicable regulations in 43 CFR Group 3200, and with the applicable statutes. He shall act on all applications, requests, and notices required in this part. In executing his functions under this part the Supervisor shall ensure that all operations, within the area of operations, will conform to the best practice and are conducted in such manner as to protect the deposits of the leased lands and to result in the maximum ultimate recovery of geothermal resources, with minimum waste, and are consistent with the principles of the use of the land for other purposes and of the protection of the environment. Inasmuch as conditions in one area may vary widely from conditions in another area, the regulations in this part are intended to be general in nature. Detailed procedures hereunder in any particular area

will be covered by GRO orders. The requirements to be set forth in GRO orders relating to surface resources or uses will be coordinated with the appropriate land management agency. The Supervisor may issue oral orders to govern lease operations, but such orders shall be confirmed in writing by the Supervisor as promptly as possible. The Supervisor may issue other orders and rules to govern the development and method for production of a deposit, field, or area. Prior to the issuance of GRO orders and other orders and rules and the approval of any plan of operations, the Supervisor shall, consult with, and receive comments from appropriate Federal and State agencies, lessees, operators, or interested parties. Before permitting other operations on the leased land, the Supervisor shall determine if the lease is in good standing, whether the lessee is authorized to conduct operations, has filed an acceptable bond, and has an approved plan of operations.

§ 270.12 Regulation of operations.

The Supervisor shall inspect and supervise operations performed under the regulations in this part to: (a) Prevent waste and damage to formations or deposits containing geothermal resources; (b) prevent unnecessary damage to other natural resources; (c) prevent degradation of the water quality; (d) protect air quality, water quality, and other environmental qualities; and (e) prevent injury to life or property. The Supervisor shall issue such GRO orders as are necessary to accomplish these purposes.

§ 270.13 Required samples, tests, and surveys.

When necessary or advisable, the Supervisor shall require that adequate samples be taken and tests or surveys be made using acceptable techniques, without cost to the lessor, to determine the identity and character of formations; the presence of geothermal resources, water, or reservoir energy; the quantity and quality of geothermal resources, water or reservoir energy; the amount and direction of deviation of any well from the vertical; formation, casing, and tubing pressures, temperatures, rate of heat and fluid flow, and whether operations are conducted in a manner looking to the protection of the interests of the lessor.

§ 270.14 Drilling and abandonment of wells.

The Supervisor shall require that drilling be conducted in accordance with the terms of the lease, GRO orders, and the regulations in this part and 43 CFR Group 3200; and shall require plugging and abandonment of any well or wells no longer necessary for operations in accordance with plans approved or prescribed by him. Upon the failure of a lessee to comply with any requirement under this section, the Supervisor is authorized to perform the work at the expense of the lessee and the surety.

§ 270.15 Well spacing and well casing.

The Supervisor shall approve proposed well-spacing and well-casing programs or prescribe such modifications to the programs as he determines necessary for proper development, giving consideration to such factors as: (a) Topographic characteristics of the area; (b) hydrologic, geologic and reservoir characteristics of the field; (c) the number of wells that can be economically drilled to provide the necessary volume of geothermal resources for the intended use; (d) protection of correlative rights; (e) minimizing well interference; (f) unreasonable interference with multiple use of land; and (g) protection of the environment, including ground water quality.

§ 270.16 Values and payment for losses.

The Supervisor shall determine the value of production accruing to the lessor where there is loss through waste or failure to drill and produce protection wells on the lease, and the compensation due to the lessor as reimbursement for such loss. Payment for such losses will be paid when billed.

§ 270.17 Suspension of operations and production.

(a) On receipt of an application filed in accordance with 43 CFR 3205.3-8 for suspension of operations or production, or both, under a producing geothermal lease (or for relief from any drilling or producing requirements of such a lease), the Supervisor may, if he deems the suspension or relief warranted, approve the application.

(b) In the interest of conservation, the Supervisor may, on his own motion, suspend operations or production, or both, on any geothermal lease.

(c) Where operations or production, or both, under a lease, have been suspended, the Supervisor may approve resumption of operations or production either on his own motion or upon written request by the lessee or his agent.

(d) Whenever it appears from facts adduced by or furnished to the Supervisor that the interest of the lessor requires additional drilling or producing operations, he may, by written notice, order the beginning or resumption of such operations.

(e) See 43 CFR 3205.3-7 and 3205.3-8 for regulations concerning requests to waive, suspend, or reduce payments of rental or royalty, and extensions of leases on which operations or production have been suspended.

REQUIREMENTS FOR LESSEES (INCLUDING OPERATORS)

§ 270.30 Lease terms, regulations, waste, damage, and safety.

(a) The lessee shall comply with the lease terms, lease stipulations, applicable laws and regulations and any amendments thereof, GRO orders, and other written or oral orders of the Supervisor. All oral orders (to be confirmed in writing as provided in § 270.11) are effective when issued unless otherwise specified.

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(b) The lessee shall take all reasonable precautions to prevent: (1) Waste; (2) damage to any natural resource including trees and other vegetation, fish and wildlife and their habitat; (3) injury or damage to persons, real or personal property; and (4) any environmental pollution or damage.

(c) Any significant effect on the environment created by the lessee's operations or failure to comply with environmental standards shall be reported to the Supervisor within 24 hours and confirmed in writing within 30 days.

§ 270.31 Designation of operator or agent.

In all cases where operations are not conducted by the lessee but are to be conducted under authority of an unapproved operating agreement, assignment or other arrangement, a "designation of operator" shall be submitted to the Supervisor, in a manner and form approved by him, prior to commencement of operations. Such a designation will be accepted as authority of the operator or his local representative to act for the lessee and to sign any papers or reports required under the regulations in this part. All changes of address and any termination of the authority of the operator shall be immediately reported, in writing, to the Supervisor.

§ 270.32 Local agent.

When required by the Supervisor, the lessee shall designate a local representative empowered to receive notices and comply with orders of the Supervisor issued pursuant to the regulations in this part.

§ 270.33 Drilling and producing obligations.

(a) The lessee shall diligently drill and produce such wells as are necessary to protect the lessor from loss by reason of production on other properties, or in lieu thereof, with the consent of the Supervisor, shall pay a sum determined by the Supervisor as adequate to compensate the lessor for failure to drill and produce any such well.

(b) The lessee shall promptly drill and produce such other wells as the Supervisor may require in order that the lease be developed and produced in accordance with good operating practices. (See 43 CFR 3204.5.)

§ 270.34 Plan of operation.

Prior to commencing any operations on the leased lands or on any lands covered by a unit or cooperative agreement, the lessee shall submit in triplicate and obtain the approval of the Supervisor and the appropriate land management agency of a plan of operation for the area. Such plan shall include:

(a) The proposed location of each well including a layout showing the position of the mud tanks, reserve pits, cooling towers, pipe racks, etc.;

(b) Existing and planned access and lateral roads;

(c) Location and source of water supply and road building material;

(d) Location of camp sites, air-strips, and other supporting facilities;

(e) Other areas of potential surface disturbance;

(f) The topographic features of the land and the drainage patterns;

(g) Methods for disposing of waste material;

(h) A narrative statement describing the proposed measures to be taken for protection of the environment, including, but not limited to, the prevention or control of (1) fires, (2) soil erosion, (3) pollution of the surface and ground water, (4) damage to fish and wildlife or other natural resources, (5) air and noise pollution, and (6) hazards to public health and safety during lease activities;

(i) All pertinent information or data which the Supervisor may require to support the plan of operations for the utilization of geothermal resources and the protection of the environment;

(j) Provisions for monitoring deemed necessary by the Supervisor to ensure compliance with these regulations for the operations under the plan; and

(k) A requirement for the collection of data concerning the existing air and water quality, noise, seismic and land subsidence activities, and ecological system of the leased lands covering a period of at least one year prior to the submission of a plan for production. The information required for paragraphs (a) through (f) of this section may be shown on a map or maps available from State or Federal sources.

§ 270.35 Subsequent well operations.

After completion of all operations authorized under any previously approved notice or plan, the lessee shall not begin to redrill, repair, deepen, plug back, shoot, or plug and abandon any well, make casing tests, alter the casing or liner, stimulate production, change the method of recovering production, or use any formation or well for brine or fluid injection until he has submitted to the Supervisor in writing a new plan of operations and has received written approval from him. However, in an emergency a lessee may take action to prevent damage without receiving prior approval from the Supervisor, but in such cases the lessee shall report his action to the Supervisor as soon as possible.

§ 270.36 Well designations.

The lessee shall mark each derrick upon commencement of drilling operations and each producing or suspended well in a conspicuous place with his name or the name of the operator, the serial number of the lease, the number and location of the well. Whenever possible, the well location shall be described by section or tract, township, range, and by quarter-quarter section or lot. The lessee shall take all necessary means and precautions to preserve these markings.

§ 270.37 Well records.

(a) The lessee shall keep for each well at his field headquarters or at other locations conveniently available to the Supervisor, accurate and complete rec-

ords of all well operations including production, drilling, logging, directional well surveys, casing, perforation, safety devices, redrilling, deepening, repairing, cementing, alterations to casing, plugging, and abandoning. The records shall contain a description of any unusual malfunction, condition or problem; all the formations penetrated; the content and character of mineral deposits and water in each formation; thermal gradients, temperatures, pressures, analyses of geothermal waters, the kind, weight, size, grade, and setting depth of casing; and any other pertinent information.

(b) The lessee shall, within 30 days after completion of any well, transmit to the Supervisor copies of the records of all operations in a form prescribed by the Supervisor.

(c) Upon request of the Supervisor, the lessee will furnish (1) legible, exact copies of service company reports on cementing, perforating, acidizing, analyses of cores, electrical, and temperature logs, chemical analyses of steam and waters, or other similar services; (2) other reports and records of operations in the manner and form prescribed by the Supervisor.

§ 270.38 Samples, tests, and surveys.

(a) The lessee, when required by the Supervisor, will make adequate sampling, tests and/or surveys using acceptable techniques, to determine the presence, quantity, quality, and potential of geothermal resources, mineral deposits, or water; the amount and direction of deviation of any well from the vertical; and/or formation temperatures and pressures, casing, tubing, or other pressures and such other facts as the Supervisor may require. Such tests or surveys shall be made without cost to the lessor.

(b) The lessee shall, without cost to the lessor, take such formation samples or cores to determine the identity and character of any formation as are required and prescribed by the Supervisor.

§ 270.39 Directional survey.

The Supervisor may require an angular deviation and directional survey to be made of the finished hole of each directionally drilled well. The survey shall be made at the risk and expense of the lessee unless requested by an offset lessee, and then, at the risk and expense of the offset lessee. A copy of the survey shall be furnished the Supervisor.

§ 270.40 Well control.

The lessee or operator shall: (a) Take all necessary precautions to keep all wells under control at all times; (b) utilize trained and competent personnel; (c) utilize properly maintained equipment and materials; and (d) use operating practices which insure the safety of life and property. The selection of the types and weights of drilling fluids and provisions for controlling fluid temperatures, blowout preventers, and other surface control equipment and materials, casing and cementing programs, etc., to be used shall be based on sound engineering principles and shall take into account apparent geothermal gradients, depths and

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pressures of the various formations to be penetrated and other pertinent geologic and engineering data and information about the area.

§ 270.41 Pollution.

The lessee shall comply with all Federal and State standards with respect to the control of all forms of air, land, water, and noise pollution, including, but not limited to, the control of erosion and the disposal of liquid, solid, and gaseous wastes. The Supervisor may, in his discretion, establish additional and more stringent standards, and, if he does so, the lessee shall comply with those standards. Plans for disposal of well effluents must take into account effects on surface and subsurface waters, plants, fish and wildlife and their habitats, atmosphere, or any other effects which may cause or contribute to pollution, and such plans must be approved by the Supervisor before action is taken under them.

§ 270.42 Noise abatement.

The lessee shall minimize noise during exploration, development and production activities. Welfare of the operating personnel and the public must not be affected as a consequence of the noise created by the expanding gases. The method and degree of noise abatement shall be as approved by the Supervisor.

§ 270.43 Land subsidence and seismic activity.

In the event subsidence or seismic activity results from the production of geothermal resources, as determined by monitoring activities by the lessee or a government body, the lessee shall take such action as required by the lease or by the Supervisor.

§ 270.44 Pits and sumps.

The lessee shall provide and use pits and sumps of adequate capacity and design to retain all materials and fluids necessary to drilling, production, or other operations unless otherwise specified by the Supervisor. In no event shall the contents of a pit or sump be allowed to: (a) Contaminate streams, artificial canals or waterways, ground waters, lakes or rivers; (b) adversely affect environment, persons, plants, fish and wildlife and their habitats; or (c) damage the aesthetic values of the property or adjacent properties. When no longer needed, pits and sumps are to be filled and covered and the premises restored to a near natural state, as prescribed by the Supervisor.

§ 270.45 Well abandonment.

The lessee shall promptly plug and abandon any well on the leased land that is not used or useful. No well shall be abandoned until its lack of capacity for further profitable production of geothermal resources has been demonstrated to the satisfaction of the Supervisor. Before abandoning a producible well, the lessee shall submit to the Supervisor a

statement of reasons for abandonment and his detailed plans for carrying on the necessary work. The detailed plans shall provide for the preservation of fresh water aquifers and for the prevention of intrusion into such aquifers of saline or polluted waters. A producible well may be abandoned only after receipt of written approval by the Supervisor. No well shall be plugged and abandoned until the manner and method of plugging have been approved or prescribed by the Supervisor. Equipment shall be removed, and premises at the well site shall be restored as near as reasonably possible to its original condition immediately after plugging operations are completed on any well except as otherwise authorized by the Supervisor. Drilling equipment shall not be removed from any suspended drilling well without taking adequate measures to close the well and protect the subsurface resources.

§ 270.46 Accidents.

The lessee shall take all reasonable precautions to prevent accidents and shall notify the Supervisor within 24 hours of all accidents on the leased land, and shall submit a full report thereon within 15 days.

§ 270.47 Workmanlike operations.

The lessee shall carry on all operations and maintain the property at all times in a workmanlike manner, having due regard for the conservation of the property and the environment and for the health and safety of employees. The lessee shall remove from the property or store, in an orderly manner, all scrap or other materials not in use.

§ 270.48 Departure from orders.

The Supervisor may prescribe or approve either in writing or orally, with prompt written confirmation, variances from the requirements of GRO orders and other orders issued pursuant to these regulations, when such variances are necessary for the proper control of a well, conservation of natural resources, protection of human health and safety, property, or the environment. The Supervisor shall inform appropriate Federal and State agencies, of any action taken under this section.

§ 270.49 Sales contracts.

The lessee shall file with the Supervisor within 30 days after the effective date of the sales contract a copy of any contract for the disposal of geothermal resources from the lease.

§ 270.50 Royalty payments.

The lessee shall pay all royalties as due under the terms of the lease. Payments of royalties are due not later than the last day of the month following the month in which the resource is sold or utilized, and shall be by check, bank draft, or money order, drawn to the order of the United States Geological Survey.

MEASUREMENT OF PRODUCTION AND COMPUTATION OF ROYALTIES

§ 270.60 Measurement of geothermal resources.

The lessee shall measure or gauge all production in accordance with methods approved by the Supervisor. The quantity and quality of all production shall be determined in accordance with the standard practices, procedures, and specifications generally used in industry. All measuring equipment shall be tested periodically and, if found defective, the Supervisor will determine the quantity and quality of production from the best evidence available.

§ 270.61 Determination of content of byproducts.

The lessee shall periodically furnish the Supervisor the results of periodic tests showing the content of byproducts in the produced geothermal fluid and gases. Such tests shall be taken as specified by the Supervisor and by the method of testing approved by him.

§ 270.62 Value of geothermal production for computing royalties.

(a) The value of geothermal production from the leased premises for the purpose of computing royalties shall be the reasonable value of the energy and the byproducts attributable to the lease as determined by the Supervisor. In determining the reasonable value of the energy and the byproducts the Supervisor shall consider:

(1) The highest price paid for a majority of the production of like quality in the same field or area;

(2) The total consideration accruing to the lessee from any disposition of the geothermal production;

(3) The value of the geothermal production used by the lessee;

(4) The value and cost of alternate available energy sources and byproducts;

(5) The cost of exploration and production, exclusive of taxes;

(6) The economic value of the resource in terms of its ultimate utilization;

(7) Production agreements between producer and purchaser; and

(8) Any other matters which he may consider relevant.

(b) Under no circumstances shall the value of any geothermal production for the purposes of computing royalties be less than:

(1) The total consideration accruing to the lessee from the sale thereof in cases where geothermal resources are sold by the lessee to another party;

(2) That amount which is the value of the end product attributable to the geothermal resource produced from a particular lease where geothermal resources are not sold by the lessee before being utilized, but are instead directly used in manufacturing, power production, or other industrial activity; or

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(3) When a part of the resource only is utilized by the lessee and the remainder sold, the sum of the value of the end product attributable to the geothermal resource and the sales price received for the geothermal resources

§ 270.63 Computation of royalties.

(a) The value of geothermal production from a particular lease as determined pursuant to § 270.62 hereof, shall be apportioned between geothermal steam, heat, and other forms of energy and the byproducts.

(b) The royalties payable shall be the sum of (1) the amount resulting from the multiplication of the value attributable to the geothermal steam, heat, and other forms of energy by the royalty rate set for such forms of geothermal energy in the lease and (2) the amount resulting from the multiplication of the value attributable to byproducts by the royalty rate for byproducts set in the lease.

§ 270.64 Commingling production.

The supervisor may authorize a lessee to commingle production from wells on his lease with production from other leases held by him or by other lessees subjects to such conditions as he may prescribe.

REPORTS TO BE MADE BY ALL LESSEES (INCLUDING OPERATORS)

§ 270.70 General requirements.

Information required to be submitted in accordance with the regulations in this part shall be furnished as directed by the Supervisor. Copies of forms can be obtained from the Supervisor and must be filed with that official within the time limit prescribed.

When forms or reports other than those referred to in the regulations in this part may be necessary, instructions for the filing of such forms or reports will be given by the Supervisor.

§ 270.71 Application for permit to drill, redrill, deepen, or plug-back.

(a) A permit to drill, redrill, deepen, or plug-back a well on Federal lands must be obtained from the Supervisor before the work is begun. The application for the permit, which shall be filed in triplicate with the Supervisor, shall state the location of the well in feet, and direction from the nearest section or tract lines as shown on the official plat of survey or protracted surveys; the altitude of the ground and derrick floor above sea level and how it was determined, and should be accompanied by a proposed plan of operations as required by these regulations.

(b) The proposed drilling and casing plan shall be outlined in detail under the heading "Details of Work" in the applications referred to herein, and shall describe the type of tools and equipment to be used, the proposed depth to which the well will be drilled, the estimated depths to the top of important markers, the estimated depths at which water, geothermal resources, or other mineral

resources are expected, the proposed casing program (including the size and weight of casing), the depth at which each string is to be set, and the amount of cement and mud to be used, the drilling method and type of circulating media (water, mud, foam, air or combinations thereof), the type of blowout prevention equipment to be used, the proposed coring, logging, or other program (such as drilling time log and sample description) to be used to determine the formations penetrated and the proposed program for determining geothermal gradients and the sampling and analysis of geothermal resources.

(c) Each application shall be accompanied by a plat showing the surface and expected bottomhole locations and the distances from the nearest section or tract lines as shown on the official plat of survey or protracted surveys. The scale shall not be less than 2,000 feet to 1 inch.

(d) Each application should be accompanied by supporting structural and hydrologic information based on available geologic and geophysical data.

§ 270.72 Sundry notices and reports on wells.

(a) Any written notice of intention to do work or to change plans previously approved must be filed with the Supervisor in triplicate, unless otherwise directed, and must be approved by him before the work is begun. If, in case of emergency, any notice is given orally or by wire, and approval is obtained, the transaction shall be confirmed in writing. A subsequent report of the work performed must also be filed with the Supervisor.

(b) Casing test: Notice shall be given in advance to the Supervisor or his representative of the date and time when the operator expects to make a casing test. Later, by agreement, the exact time shall be fixed. In the event of casing failure during the test, the casing must be repaired or replaced or recemented as required by the Supervisor or his representative. The results of the test must be reported within 30 days after making a casing test. The report must describe the test completely and state the amount of mud and cement used, the lapse of time between running and cementing the casing and making the test, and the method of testing.

(c) Repairs or conditioning of well: Before the repairing or conditioning of a well, a notice setting forth in detail the plan of work must be filed with, and approved by, the Supervisor. A detailed report of the work accomplished and the methods employed, including all dates, and the results of such work must be filed within 30 days after completion of the repair work.

(d) Well stimulation: Before the lessee commences stimulation of a well by any means, a notice, setting forth in detail the plan of work, must be filed with and approved by the Supervisor. The notice shall name the type of stimulant and the amount to be used. A report showing the

amount of stimulant used and the production rate before and after stimulation must be filed within 30 days from completion of the work.

(e) Altering casing in a well: Notice of intention to run a liner or to alter the casing by pulling or perforating by any means must be filed with and approved by the Supervisor before the work is started. This notice shall set forth in detail the plan of work. A report must be filed within 30 days after completion of the work stating exactly what was done and the results obtained.

(f) Notice of intention to abandon well: Before abandonment work is begun on any well, whether a drilling well, geothermal resources well, water well, or so-called dry hole, notice of intention to abandon shall be filed with, and approved by, the Supervisor. The notice must be accompanied by a complete log, in duplicate, of the well to date, provided the complete log has not been filed previously, and must give a detailed statement of the proposed work, including such information as kind, location, and length of plugs (by depths), plans for mudding, cementing, shooting, testing, and removing casing, and any other pertinent information.

(g) Subsequent report of abandonment: After a well is abandoned or plugged, a subsequent record of work done must be filed with the Supervisor. This report shall be filed separately within 30 days after the work is done. The report shall give a detailed account of the manner in which the abandonment or plugging work was carried out, including the nature and quantities of materials used in plugging and the location and extent (by depths) of the plugs of different materials; records of any tests or measurements made, and of the amount, size, and location (by depths) of casing left in the well; and a detailed statement of the volume of mud fluid used, and the pressure attained in mudding. If an attempt was made to part any casing, a complete report of the methods used and results obtained must be included.

§ 270.73 Log and history of well.

The lessee shall furnish in duplicate to the Supervisor, not later than 30 days after the completion of each well, a complete and accurate log and history, in chronological order, of all operations conducted on the well. A log shall be compiled for geologic information from cores or formations samples and duplicate copies of such log shall be filed. Duplicate copies of all electric logs, temperature surveys, water and steam analyses, hydrologic or heat flow tests, or direction surveys, if run, shall be furnished.

§ 270.74 Monthly report of operations.

A report of operations for each lease must be made for each calendar month, beginning with the month in which drilling operations are initiated. The report must be filed in duplicate with the Supervisor on or before the last day of the month following the month for which the report is filed unless an extension of

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time for the filing of the report is granted by the Supervisor. The report shall disclose accurately all operations conducted on each well during the month, the status of operations on the last day of the month, and a general summary of the status of operations on the leased lands. The report must be submitted each month until the lease is terminated or until omission of the report is authorized by the Supervisor. The report shall show for each calendar month:

(a) The lease serial number or the unit or communitization agreement number which shall be inserted in the upper right corner;

(b) Each well listed separately by number, and its location by 40-acre subdivision (quarter-quarter section or lot), section number, township, range, and meridian;

(c) The number of days each well was produced, whether steam or hot water or both were produced, and the number of days each input well was in operation, if any;

(d) The quantity of production and any byproducts obtained from each well, if any are recovered;

(e) The depth of each active or suspended well, and the name, character, and depth of each formation drilled during the month, the date and reason for every shutdown, the names and depths of important formation changes, the amount and size of any casing run since the last report, the dates and results of any tests or environmental monitoring conducted, and any other noteworthy information on operations not specifically provided for in the form.

(f) The footnote must be completely filled out as required by the Supervisor. If no sales were made during the calendar month, the report must so state.

§ 270.75 Monthly report of sales and royalty.

A report of sales and royalty for each productive lease must be filed each month once sales of production are made even though sales may be intermittent, unless otherwise authorized by the Supervisor. Total volumes of geothermal resources produced and sold, the value of production, and the royalty due the lessor must be shown. If byproducts are being recovered, the same requirement shall be applicable. This report is due on or before the last day of the month following the month in which production was obtained and sold or utilized, together with the royalties due the United States. Payment or royalty is to be made pursuant to § 270.50 unless otherwise authorized by the Supervisor.

§ 270.76 Annual report of compliance with environmental protection requirements.

The lessee shall submit annually a report giving a full account of the actions taken to comply with the appropriate Federal and State regulations or requirements of the Supervisor pertaining to the protection of the surface and subsurface environment. This report shall include but is not limited to such matters as:

- (a) Noise abatement;
- (b) Water quality;
- (c) Air quality;
- (d) Erosion control;
- (e) Subsidence and seismic activity;
- (f) Rehabilitation activities;
- (g) Waste disposal; and
- (h) Environmental effects on flora and fauna.

§ 270.77 Annual report of expenditures for diligent exploration operations.

A report of expenditures for exploration operations conducted during a lease year must be submitted annually to the Supervisor in order that such expenditures may be considered for qualification as diligent exploration pursuant to 43 CFR 3203.5.

§ 270.78 Notice of intent and permit to conduct exploration operations other than drilling, see 43 CFR 3209.0-5 (a).

(a) A permit to conduct exploration operations on the leased lands or on any lands covered by a unit or cooperative agreement must be obtained from the Supervisor before the work is begun. The form used for exploration operations conducted pursuant to 43 CFR 3209 will be acceptable.

(b) The notice of intent shall be filed in triplicate with the Supervisor and shall include:

(1) The name and address, including zip code, both of the person, association, or corporation for whom the operations will be conducted and of the person who will be in charge of the actual exploration activities;

(2) A statement that the signers agree that exploration operations will be conducted pursuant to the terms and conditions listed on the approved form;

(3) A brief description of the type of operations which will be undertaken;

(4) The approximate dates of the commencement and termination of exploration operations; and

(5) A plan of operation as required by § 270.34 covering paragraphs (a) through (h), of this section.

(c) The lessee shall, within 30 days after completion of such operations, furnish the Supervisor two copies of the records of the operation.

§ 270.79 Public inspection of records.

Geologic and geophysical interpretations, maps, and data required to be submitted under this part shall not be available for public inspection without the consent of the lessee so long as the lease remains in effect.

PROCEDURE IN CASE OF VIOLATION OF THE REGULATIONS OR LEASE TERMS

§ 270.80 Noncompliance with regulations or lease terms.

(a) Whenever a lessee or anyone acting under his authority fails to comply with the provisions of the regulations or lease terms, the Supervisor shall give the lessee notice to remedy any defaults or violations. Failure by the lessee to perform or commence the necessary remedial action pursuant to the notice may

result in a shut down of operations and may result in referral of the matter to the authorized offices of the Bureau of Land Management for action pursuant to 43 CFR 3244.3.

(b) The Supervisor is authorized to shut down any operations which he determines are unsafe or are causing or can cause pollution.

APPEALS

§ 270.90 Appeals.

Appeals from final orders or decisions issued under the regulations in this part shall be made in the manner provided in 30 CFR Part 290.

PART 271—GEOTHERMAL RESOURCES UNIT PLAN REGULATIONS (INCLUDING SUGGESTED FORMS)

GENERAL PROVISIONS

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271.15	Form of collective bond.
271.16	Form of designation of successor unit operator by working interest owners.
271.17	Form of change in unit operator by assignment.

AUTHORITY: Section 18 of the Geothermal Steam Act of 1970 (84 Stat. 1566) (see 43 CFR Subpart 3244).

§ 271.1 Introduction.

The regulations in this part prescribe the procedure to be followed and the requirements to be met by holders of Federal geothermal leases (see § 271.2d) and their representatives who wish to unite with each other, or jointly or separately with others, in collectively adopting and operating under a cooperative or unit plan for the development of any geothermal resources pool, field, or like area, or any part thereof. Such agreements may be initiated by lessees, or where in the interest of conserving natural resources they are deemed necessary they may be required by the Director.

§ 271.2 Definitions.

The following terms, as used in this part or in any agreement approved under the regulations in this part, shall have the meanings here indicated unless otherwise defined in such agreement:

(a) *Unit agreement.* An agreement or plan of development and operation for the production and utilization of separately owned interests in the geothermal resources made subject thereto

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as a single consolidated unit without regard to separate ownerships and which provides for the allocation of costs and benefits on a basis defined in the agreement or plan.

(b) *Cooperative agreement.* An agreement or plan of development and operations for the production and utilization of geothermal resources made subject thereto in which separate ownership units are independently operated without allocation of production.

(c) *Agreement.* For convenience, the term "agreement" as used in the regulations in this part refers to either a unit or a cooperative agreement as defined in paragraphs (a) and (b) of this section unless otherwise indicated.

(d) *Geothermal lease.* A lease issued under the act of December 24, 1970 (84 Stat. 1566), pursuant to the leasing regulations contained in 43 CFR Part 3200, and, unless the context indicates otherwise, "lease" means a geothermal lease.

(e) *Unit area.* The area described in a unit agreement as constituting the land logically subject to development under such agreement.

(f) *Unitized land.* The part of a unit area committed to a unit agreement.

(g) *Unitized substances.* Deposits of geothermal resources recovered from unitized land by operation under and pursuant to a unit agreement.

(h) *Unit operator.* The person, association, partnership, corporation, or other business entity designated under a unit agreement to conduct operations on unitized land as specified in such agreement.

(i) *Participating area.* That part of the Unit Area which is deemed to be productive from a horizon or deposit and to which production would be allocated in the manner described in the unit agreement assuming that all lands are committed to the unit agreement.

(j) *Working interest.* The interest held in geothermal resources or in lands containing the same by virtue of a lease, operating agreement, fee title, or otherwise, under which, except as otherwise provided in a unit or cooperative agreement, the owner of such interest is vested with the right to explore for, develop, produce, and utilize such resources. The right delegated to the unit operator as such by the unit agreement is not to be regarded as a working interest.

(k) *Secretary.* The Secretary of the Interior or any person duly authorized to exercise powers vested in that officer.

(l) *Director.* The Director of the U.S. Geological Survey.

(m) *Supervisor.* A representative of the Secretary, subject to the direction and supervisory authority of the Director, the Chief, Conservation Division, Geological Survey, and the appropriate Regional Conservation Manager, Conservation Division, Geological Survey, authorized and empowered to regulate operations and to perform other duties prescribed in the regulations in this part or any subordinate of such representative acting under his direction.

§ 271.3 Designation of area.

An application for designation of an area as logically subject to development and/or operation under a unit or cooperative agreement may be filed, in triplicate, by any proponent of such an agreement through the Supervisor. Each copy of the application shall be accompanied by a map or diagram on a scale of not less than 1 inch to 1 mile, outlining the area sought to be designated under this section. The Federal, State, and privately owned land should be indicated on said map by distinctive symbols or colors and Federal geothermal leases and lease applications should be identified by serial number. Geological information, including the results of geophysical surveys, and such other information as may tend to show that unitization is necessary and advisable in the public interest should be furnished in triplicate. Geological and geophysical information and data so furnished will not be available for public inspection, as provided by 5 U.S.C. section 552(b), without the consent of the proponent. The application and supporting data will be considered by the Director and the applicant will be informed of the decision reached. The designation of an area, pursuant to an application filed under this section, shall not create an exclusive right to submit an executed agreement for such area, nor preclude the inclusion of such area or any part thereof in another unit area.

§ 271.4 Preliminary consideration of agreements.

The form of unit agreement set forth in § 271.12 is acceptable for use in unproved areas. The use of this form is not mandatory, but any proposed departure therefrom should be submitted with the application submitted under § 271.3 for preliminary consideration and for such revision as may be deemed necessary. In areas proposed for unitization in which a discovery of geothermal resources has been made, or where a cooperative agreement is contemplated, the proposed agreement should be submitted with the application submitted under § 271.3 for preliminary consideration and for such revision as may be deemed necessary. The proposed form of agreement should be submitted in triplicate and should be plainly marked to identify the proposed variances from the form of agreement set forth in § 271.12.

§ 271.5 State land.

Where State-owned land is to be included in the unit, approval of the agreement by appropriate State officials should be obtained prior to its submission to the Department for approval of the executed agreement. When authorized by the laws of the State in which the unitized land is situated, provisions may be made in the agreement accepting State law, to the extent that they are applicable to non-Federal unitized land.

§ 271.6 Qualifications of unit operator.

A unit operator must qualify as to citizenship in the same manner as those holding interests in geothermal leases issued under the Geothermal Steam Act of 1970. The unit operator may be an owner of a working interest in the unit area or such other party as may be selected by the owners of working interests and approved by the Supervisor. The unit operator shall execute an acceptance of the duties and obligations imposed by the agreement. No designation of, or change in, a unit operator will become effective unless and until approved by the Supervisor, and no such approval will be granted unless the unit operator is deemed qualified to fulfill the duties and obligations prescribed in the agreement.

§ 271.7 Parties to unit or cooperative agreement.

The owners of any rights, title, or interest in the geothermal resources deposits to be developed and operated under an agreement can be regarded as proper parties to a proposed agreement. All such owners must be invited to join as parties to the agreement. If any owner fails or refuses to join the agreement, the proponent of the agreement should declare this to the Supervisor and should submit evidence of efforts made to obtain joinder of such owner and the reasons for nonjoinder.

§ 271.8 Approval of an executed unit or cooperative agreement.

(a) A duly executed unit or cooperative agreement will be approved by the Secretary, or his duly authorized representative, upon a determination that such agreement is necessary or advisable in the public interest and is for the purpose of properly conserving the natural resources. Taking into account the environmental consequences of the action. Such approval will be incorporated in a certificate appended to the agreement. No such agreement will be approved unless at least one of the parties is a holder of a Federal lease embracing lands being committed to the agreement and unless the parties signatory to the agreement hold sufficient interests in the area to give effective control of operations therein.

(b) Where a duly executed agreement is submitted for Departmental approval, a minimum of six signed counterparts should be filed. The same number of counterparts should be filed for documents supplementing, modifying, or amending an agreement, including change of operator, designation of new operator, and notice of surrender, relinquishment, or termination.

(c) The address of each signatory party to the agreement should be inserted below the party's signature. Each signature should be attested by at least one witness, if not notarized. Corporate or other signatures made in a representative capacity must be accompanied by evidence of the authority of the signatories to act unless such evidence is already a matter of record in the United

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States Geological Survey. (The parties may execute any number of counterparts of the agreement with the same force and effect as if all parties signed the same document, or may execute a ratification or consent in a separate instrument with like force and effect.)

(d) Any modification of an approved agreement will require approval of the Secretary or his duly authorized representative under procedures similar to those cited in paragraph (a) of this section.

§ 271.9 Filing of papers and number of counterparts.

(a) All proposals and supporting papers, instruments, and documents submitted under this part should be filed with the Supervisor, unless otherwise provided in this part or otherwise instructed by the Director.

(b) Plans of development and operation, plans of further development and operation, and proposed participating areas and revisions thereof should be submitted in quadruplicate.

(c) Each application for approval of a participating area, or revision thereof, should be accompanied by three copies of a substantiating geologic and engineering report, structure contour map or maps, cross-section or other pertinent data.

(d) Other instruments or documents submitted for approval should be submitted for approval in sufficient number to permit the approving official to return at least one approved counterpart.

§ 271.10 Bonds.

In lieu of separate bonds required for each Federal lease committed to a unit agreement, the unit operator may furnish and maintain a collective corporate surety bond or a personal bond conditioned upon faithful performance of the duties and obligations of the agreement and the terms of the leases subject thereto. Personal bonds shall be accompanied by a deposit of negotiable Federal securities in a sum equal at their par value to the amount of the bond and by a proper conveyance to the Secretary of full authority to sell such securities in case of default in the performance of the obligations assumed. The liability under the bond shall be for such amount as the Supervisor shall determine to be adequate to protect the interests of the United States. Additional bond coverage may be required whenever deemed necessary by the Supervisor. The bond must be filed with and accepted by the Bureau of Land Management before operations will be approved. A form of corporate surety bond is set forth in § 271.15. In case of changes of unit operator, a new bond must be filed or a consent of surety to the change in principal under the existing bond must be furnished.

§ 271.11 Appeals.

Appeals from final orders or decisions issued under the regulations in this part shall be made in the manner provided in 30 CFR Part 290.

§ 271.12 Form of unit agreement for unproved areas.

UNIT AGREEMENT FOR THE DEVELOPMENT AND OPERATION OF THE ----- UNIT AREA
COUNTY OF -----
STATE OF -----

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----- UNIT AGREEMENT
----- COUNTY -----

This Agreement entered into as of the ----- day of -----, 19--, by and between the parties subscribing, ratifying, or consenting hereto, and herein referred to as the "parties hereto".

WITNESSETH: Whereas the parties hereto are the owners of working, royalty, or other geothermal resources interests in land subject to this Agreement; and

Whereas the Geothermal Steam Act of 1970 (84 Stat. 1566), hereinafter referred to as the "Act", authorizes Federal lessees and their representatives to unite with each other, or jointly or separately with others, in collectively adopting and operating under a cooperative or unit plan of development or operation of any geothermal resources pool, field, or like area, or any part thereof, for the purpose of more properly conserving the natural resources thereof, whenever determined and certified by the Secretary of the Interior to be necessary or advisable in the public interest; and

Whereas the parties hereto hold sufficient interest in the ----- Unit Area covering the land herein described to effectively control operations therein; and

Whereas, it is the purpose of the parties hereto to conserve natural resources, prevent waste, and secure other benefits obtainable through development and operations of the area subject to this Agreement under the terms, conditions, and limitations herein set forth;

Now, therefore, in consideration of the premises and the promises herein contained,

the parties hereto commit to this agreement their respective interests in the below-defined Unit Area, and agree severally among themselves as follows:

ARTICLE I—ENABLING ACT AND REGULATIONS

1.1 The Act and all valid pertinent regulations, including operating and unit plan regulations, heretofore or hereafter issued thereunder are accepted and made a part of this agreement as to Federal lands.

1.2 As to non-Federal lands, the geothermal resources operating regulations in effect as of the effective date hereof governing drilling and producing operations, not inconsistent with the laws of the State in which the non-Federal land is located, are hereby accepted and made a part of this agreement.

ARTICLE II—DEFINITIONS

2.1 The following terms shall have the meanings here indicated:

(a) *Geothermal lease.* A lease issued under the act of December 24, 1970 (84 Stat. 1566), pursuant to the leasing regulations contained in 43 CFR Group 3200 and, unless the context indicates otherwise, "lease" shall mean a geothermal lease.

(b) *Unit area.* The area described in Article III of this Agreement.

(c) *Unit Operator.* The person, association, partnership, corporation, or other business entity designated under this Agreement to conduct operations on Unitized Land as specified herein.

(d) *Participating area.* That part of the Unit Area which is deemed to be productive from a horizon or deposit and to which production would be allocated in the manner described in the unit agreement assuming that all lands are committed to the unit agreement.

(e) *Working interest.* The interest held in geothermal resources or in lands containing the same by virtue of a lease, operating agreement, fee title, or otherwise, under which, except as otherwise provided in this Agreement, the owner of such interest is vested with the right to explore for, develop, produce and utilize such resources. The right delegated to the Unit Operator as such by this Agreement is not to be regarded as a Working Interest.

(f) *Secretary.* The Secretary of the Interior or any person duly authorized to exercise powers vested in that officer.

(g) *Director.* The Director of the U.S. Geological Survey.

(h) *Supervisor.* A representative of the Secretary, subject to the direction and supervisory authority of the Director, the Chief, Conservation Division, Geological Survey, and the appropriate Regional Conservation Manager, Conservation Division, Geological Survey, authorized and empowered to regulate operations and to perform other duties prescribed in the regulations in this part or any subordinate of such representative acting under his direction.

ARTICLE III—UNIT AREA AND EXHIBITS

3.1 The area specified on the map attached hereto marked "Exhibit A" is hereby designated and recognized as constituting the Unit Area, containing ----- acres, more or less.

The above-described Unit Area shall when practicable be expanded to include therein any additional lands or shall be contracted to exclude lands whenever such expansion or contraction is deemed to be necessary or advisable to conform with the purposes of this Agreement.

3.2 Exhibit A attached hereto and made a part hereof is a map showing the boundary

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of the Unit Area, the boundaries and identity of tracts and leases in said area to the extent known to the Unit Operator.

3.3 Exhibit B attached hereto and made a part hereof is a schedule showing to the extent known to the Unit Operator the acreage, percentage, and kind of ownership of geothermal resources interests in all lands in the Unit Area.

3.4 Exhibits A and B shall be revised by the Unit Operator whenever changes in the Unit Area render such revision necessary, or when requested by the Supervisor, and not less than five copies of the revised Exhibits shall be filed with the Supervisor.

ARTICLE IV—CONTRACTION AND EXPANSION OF UNIT AREA

4.1 Unless otherwise specified herein, the expansion and/or contraction of the Unit Area contemplated in Article 3.1 hereof shall be effected in the following manner:

(a) Unit Operator either on demand of the Director or on its own motion and after prior concurrence by the Director, shall prepare a notice of proposed expansion or contraction describing the contemplated changes in the boundaries of the Unit Area, the reasons therefore, and the proposed effective date thereof, preferably the first day of a month subsequent to the date of notice.

(b) Said notice shall be delivered to the Supervisor, and copies thereof mailed to the last known address of each Working Interest Owner, Lessee, and Lessor whose interests are affected, advising that 30 days will be allowed for submission to the Unit Operator of any objections.

(c) Upon expiration of the 30-day period provided in the preceding item (b) hereof, Unit Operator shall file with the Supervisor evidence of mailing of the notice of expansion or contraction and a copy of any objections thereto which have been filed with the Unit Operator, together with an application in sufficient number, for approval of such expansion or contraction and with appropriate joinders.

(d) After due consideration of all pertinent information, the expansion or contraction shall, upon approval by the Supervisor, become effective as of the date prescribed in the notice thereof.

4.2 Unitized Leases, insofar as they cover any lands which are excluded from the Unit Area under any of the provisions of this Article IV may be maintained and continued in force and effect in accordance with the terms, provisions, and conditions contained in the Act, and the lease or leases and amendments thereto, except that operations and/or production under this Unit Agreement shall not serve to maintain or continue the excluded portion of any lease.

4.3 All legal subdivisions of unitized lands (i.e., 40 acres by Governmental survey or its nearest lot or tract equivalent in instances of irregular surveys), no part of which is entitled to be within a Participating Area on the fifth anniversary of the effective date of the initial Participating Area established under this Agreement, shall be eliminated automatically from this Agreement effective as of said fifth anniversary and such lands shall no longer be a part of the Unit Area and shall no longer be subject to this Agreement unless diligent drilling operations are in progress on an exploratory well on said fifth anniversary, in which event such lands shall not be eliminated from the Unit Area for as long as exploratory drilling operations are continued diligently with not more than four (4) months time elapsing between the completion of one exploratory well and the commencement of the next exploratory well.

4.4 An exploratory well, for the purposes of this Article IV is defined as any well, regardless of surface location, projected for com-

pletion in a zone or deposit below any zone or deposit for which a Participating Area has been established and is in effect, or any well, regardless of surface location, projected for completion at a subsurface location under Unitized Lands not entitled to be within a Participating Area.

4.5 In the event an exploratory well is completed during the four (4) months immediately preceding the fifth anniversary of the initial Participating Area established under this Agreement, lands not entitled to be within a Participating Area shall not be eliminated from this Agreement on said fifth anniversary, provided the drilling of another exploratory well is commenced under an approved Plan of Operation within four (4) months after the completion of said well. In such event, the land not entitled to be in participation shall not be eliminated from the Unit Area so long as exploratory drilling operations are continued diligently with not more than four (4) months time elapsing between the completion of one exploratory well and the commencement of the next exploratory well.

4.6 With prior approval of the Supervisor, a period of time in excess of four (4) months may be allowed to elapse between the completion of one well and the commencement of the next well without the automatic elimination of nonparticipating acreage.

4.7 Unitized lands proved productive by drilling operations which serve to delay automatic elimination of lands under this Article IV shall be incorporated into a Participating Area (or Areas) in the same manner as such lands would have been incorporated in such areas had such lands been proven productive during the year preceding said fifth anniversary.

4.8 In the event nonparticipating lands are retained under this Agreement after the fifth anniversary of the initial Participating Area as a result of exploratory drilling operations, all legal subdivisions of unitized land (i.e., 40 acres by Government survey or its nearest lot or tract equivalent in instances of irregular surveys), no part of which is entitled to be within a Participating Area shall be eliminated automatically as of the 121 day, or such later date as may be established by the Supervisor, following the completion of the last well recognized as delaying such automatic elimination beyond the fifth anniversary of the initial Participating Area established under this Agreement.

ARTICLE V—UNITIZED LAND AND UNITIZED SUBSTANCES

5.1 All land committed to this Agreement shall constitute land referred to herein as "Unitized Land". All geothermal resources in and produced from any and all formations of the Unitized Land are unitized under the terms of this agreement and herein are called "Unitized Substances."

ARTICLE VI—UNIT OPERATOR

6.1 _____ is hereby designated as Unit Operator and by signature hereto as Unit Operator agrees and consents to accept the duties and obligations of Unit Operator for the discovery, development, production, distribution and utilization of Unitized Substances as herein provided. Whenever reference is made herein to the Unit Operator, such reference means the Unit Operator acting in that capacity and not as an owner of interest in Unitized Substances, and the term "Working Interest Owner" when used herein shall include or refer to Unit Operator as the owner of a Working Interest when such an interest is owned by it.

ARTICLE VII—RESIGNATION OR REMOVAL OF UNIT OPERATOR

7.1 Prior to the establishment of a Participating Area, hereunder, Unit Operator

shall have the right to resign. Such resignation shall not become effective so as to release Unit Operator from the duties and obligations of Unit Operator or terminate Unit Operator rights, as such, for a period of six (6) months after notice of its intention to resign has been served by Unit Operator on all Working Interest Owners and the Supervisor, nor until all wells then drilled hereunder are placed in a satisfactory condition for suspension or abandonment whichever is required by the Supervisor, unless a new Unit Operator shall have been selected and approved and shall have taken over and assumed the duties and obligations of Unit Operator prior to the expiration of said period.

7.2 After the establishment of a Participating Area hereunder Unit Operator shall have the right to resign in the manner and subject to the limitations provided in 7.1 above.

7.3 The Unit Operator may, upon default or failure in the performance of its duties or obligations hereunder, be subject to removal by the same percentage vote of the owners of Working Interests as herein provided for the selection of a new Unit Operator. Such removal shall be effective upon notice thereof to the Supervisor.

7.4 The resignation or removal of Unit Operator under this Agreement shall not terminate its right, title, or interest as the owner of a Working Interest or other interest in Unitized Substances, but upon the resignation or removal of Unit Operator becoming effective, such Unit Operator shall deliver possession of all wells, equipment, material, and appurtenances used in conducting the unit operations to the new duly qualified successor Unit Operator or, if no such new unit operator is elected, to the common agent appointed to represent the Working Interest Owners in any action taken hereunder to be used for the purpose of conducting operations hereunder.

7.5 In all instances of resignation or removal, until a successor Unit Operator is selected and approved as hereinafter provided, the Working Interest Owners shall be jointly responsible for performance of the duties and obligations of Unit Operator, and shall not later than 30 days before such resignation or removal becomes effective appoint a common agent to represent them in any action to be taken hereunder.

7.6 The resignation of Unit Operator shall not release Unit Operator from any liability for any default by it hereunder occurring prior to the effective date of its resignation.

ARTICLE VIII—SUCCESSOR UNIT OPERATOR

8.1 If, prior to the establishment of a Participating Area hereunder, the Unit Operator shall resign as Operator, or shall be removed as provided in Article VII, a successor Unit Operator may be selected by vote of the owners of a majority of the Working Interests in Unitized Substances, based on their respective shares, on an acreage basis, in the Unitized Land.

8.2 If, after the establishment of a Participating Area hereunder, the Unit Operator shall resign as Unit Operator, or shall be removed as provided in Article VII, a successor Unit Operator may be selected by vote of the owners of a majority of the Working Interests in Unitized Substances, based on their respective shares, on a participating acreage basis. Provided, that, if a majority but less than 60 percent of the Working Interest in the Participating Lands is owned by the party to this agreement, a concurring vote of one or more additional Working Interest Owners owning 10 percent or more of the Working Interest in the participating land shall be required to select a new Unit Operator.

8.3 The selection of a successor Unit Operator shall not become effective until

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(a) The Unit Operator so selected shall accept in writing the duties, obligations and responsibilities of the Unit Operator, and

(b) The selection shall have been approved by the Supervisor.

8.4 If no successor Unit Operator is selected and qualified as herein provided, the Director at his election may declare this Agreement terminated.

ARTICLE IX—ACCOUNTING PROVISIONS AND UNIT OPERATING AGREEMENT

9.1 Costs and expenses incurred by Unit Operator in conducting unit operations hereunder shall be paid and apportioned among and borne by the owners of Working Interests; all in accordance with the agreement or agreements entered into by and between the Unit Operator and the owners of Working Interests, whether one or more, separately or collectively.

9.2 Any agreement or agreements entered into between the Working Interest Owners and the Unit Operator as provided in this Article, whether one or more, are herein referred to as the "Unit Operating Agreement".

9.3 The Unit Operating Agreement shall provide the manner in which the Working Interest Owners shall be entitled to receive their respective share of the benefits accruing hereto in conformity with their underlying operating agreements, leases, or other contracts, and such other rights and obligations, as between Unit Operator and the Working Interest Owners.

9.4 Neither the Unit Operating Agreement nor any amendment thereto shall be deemed either to modify any of the terms and conditions of this Agreement or to relieve the Unit Operator of any right or obligation established under this Agreement.

9.5 In case of any inconsistency or conflict between this Agreement and the Unit Operating Agreement, this Agreement shall govern.

9.6 Three true copies of any Unit Operating Agreement executed pursuant to this Article IX shall be filed with the Supervisor prior to approval of this Agreement.

ARTICLE X—RIGHTS AND OBLIGATIONS OF UNIT OPERATOR

10.1 The right, privilege, and duty of exercising any and all rights of the parties hereto which are necessary or convenient for prospecting, producing, distributing or utilizing Unitized Substances are hereby delegated to and shall be exercised by the Unit Operator as provided in this Agreement in accordance with a Plan of Operations approved by the Supervisor.

10.2 Upon request by Unit Operator, acceptable evidence of title to geothermal resources interests in the Unitized Land shall be deposited with the Unit Operator, and together with this Agreement shall constitute and define the rights, privileges, and obligations of Unit Operator.

10.3 Nothing in this Agreement shall be construed to transfer title to any land or to any lease or operating agreement, it being understood that the Unit Operator, in its capacity as Unit Operator shall exercise the rights of possession and use vested in the parties hereto only for the purposes specified in this Agreement.

10.4 The Unit Operator shall take such measures as the Supervisor deems appropriate and adequate to prevent drainage of Unitized Substances from Unitized Land by wells on land not subject to this Agreement.

10.5 The Director is hereby vested with authority to alter or modify from time to time, in his discretion, the rate of prospecting and development and the quantity and rate of production under this Agreement.

ARTICLE XI—PLAN OF OPERATION

11.1 Concurrently with the submission of this Agreement for approval, Unit Operator

shall submit an acceptable Initial Plan of Operation. Said plan shall be as complete and adequate as the Supervisor may determine to be necessary for timely exploration and/or development and to insure proper protection of the environment and conservation of the natural resources of the Unit Area.

11.2 Prior to the expiration of the initial Plan of Operation, or any subsequent Plan of Operation, Unit Operator shall submit for approval of the Supervisor an acceptable subsequent Plan of Operation for the Unit Area which, when approved by the Supervisor, shall constitute the exploratory and/or development drilling and operating obligations of Unit Operators under this Agreement for the period specified therein.

11.3 Any plan of Operation submitted hereunder shall

(a) Specify the number and locations of any wells to be drilled and the proposed order and time for such drilling, and

(b) To the extent practicable, specify the operating practices regarded as necessary and advisable for proper conservation of natural resources and protection of the environment in compliance with section 1.1.

11.4 The Plan of Operation submitted concurrently with this Agreement for approval shall prescribe that within six (6) months after the effective date hereof, the Unit Operator shall begin to drill an adequate test well at a location approved by the Supervisor, unless on such effective date a well is being drilled conformably with the terms, hereof, and thereafter continue such drilling diligently until the ----- formation has been tested or until at a lesser depth unitized substances shall be discovered which can be produced in paying quantities (i.e., quantities sufficient to repay the costs of drilling, completing, and producing operations, with a reasonable profit) or the Unit Operator shall at any time establish to the satisfaction of the Supervisor that further drilling of said well would be unwarranted or impracticable, provided, however, that Unit Operator shall not in any event be required to drill said well to a depth in excess of ----- feet.

11.5 The initial Plan of Operation and/or subsequent Plans of Operation submitted under this article shall provide that the Unit Operator shall initiate a continuous drilling program providing for drilling of no less than one well at a time, and allowing no more than six (6) months time to elapse between completion of one well and the beginning of the next well, until a well capable of producing Unitized Substances in paying quantities is completed to the satisfaction of the Supervisor or until it is reasonably proved that the Unitized Land is incapable of producing Unitized Substances in paying quantities in the formations drilled under this Agreement.

11.6 When warranted by unforeseen circumstances, the Supervisor may grant a single extension of any or all of the critical dates for exploratory drilling operations cited in the initial or subsequent Plans of Operation. No such extension shall exceed a period of four (4) months for each well, required by the initial Plan of Operation.

11.7 Until there is actual production of Unitized Substances, the failure of Unit Operator to timely drill any of the wells provided for in Plans of Operation required under this Article XI or to timely submit an acceptable subsequent Plan of Operations, shall, after notice of default or notice of prospective default to Unit Operator by the Supervisor and after failure of Unit Operator to remedy any actual default within a reasonable time (as determined by the Supervisor), result in automatic termination of this Agreement effective as of the date of the default, as determined by the Supervisor.

11.8 Separate Plans of Operations may be submitted for separate productive zones,

subject to the approval of the Supervisor. Also subject to the approval of the Supervisor, Plans of Operation shall be modified or supplemented when necessary to meet changes in conditions or to protect the interest of all parties to this Agreement.

ARTICLE XII—PARTICIPATING AREAS

12.1 Prior to the commencement of production of Unitized Substances, the Unit Operator shall submit for approval by the Supervisor a schedule (or schedules) of all land then regarded as reasonably proved to be productive from a pool or deposit discovered or developed; all lands in said schedule (or schedules), on approval of the Supervisor, will constitute a Participating Area (or Areas) effective as of the date production commences or the effective date of this Unit Agreement, whichever is later. Said schedule (or schedules) shall also set forth the percentage of Unitized Substances to be allocated, as herein provided, to each tract in the Participating Area (or Areas) so established and shall govern the allocation of production commencing with the effective date of the Participating Area.

12.2 A separate Participating Area shall be established for each separate pool or deposit of Unitized Substances or for any group thereof which is produced as a single pool or deposit and any two or more Participating Areas so established may be combined into one, on approval of the Supervisor. The effective date of any Participating Area established after the commencement of actual production of Unitized Substances shall be the first of the month in which is obtained the knowledge or information on which the establishment of said Participating Area is based, unless a more appropriate effective date is proposed by the Unit Operator and approved by the Supervisor.

12.3 Any Participating Area (or Areas) established under 12.1 or 12.2 above shall, subject to the approval of the Supervisor, be revised from time to time to include additional land then regarded as reasonably proved to be productive from the pool or deposit for which the Participating Area was established or to include lands necessary to unit operations, or to exclude land then regarded as reasonably proved not to be productive from the pool or deposit for which the Participating Area was established or to exclude land not necessary to unit operations and the schedule (or schedules) of allocation percentages shall be revised accordingly.

12.4 Subject to the limitation cited in 12.1 hereof, the effective date of any revision of a Participating Area established under Articles 12.1 or 12.2 shall be the first of the month in which is obtained the knowledge or information on which such revision is predicated, provided, however, that a more appropriate effective date may be used if justified by the Unit Operator and approved by the Supervisor.

12.5 No land shall be excluded from a Participating Area on account of depletion of the Unitized Substances, except that any Participating Area established under the provisions of this Article XII shall terminate automatically whenever all operations are abandoned in the pool or deposit for which the Participating Area was established.

12.6 Nothing herein contained shall be construed as requiring any retroactive adjustment for production obtained prior to the effective date of the revision of a Participating Area.

ARTICLE XIII—ALLOCATION OF UNITIZED SUBSTANCES

13.1 All Unitized Substances produced from a Participating Area, established under this Agreement, shall be deemed to be produced equally on an acreage basis from the several tracts of Unitized Land within the

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Participating Area established for such production.

13.2 For the purpose of determining any benefits accruing under this Agreement, each Tract of Unitized Land shall have allocated to it such percentage of said production as the number of acres in the Tract included in the Participating Area bears to the total number of acres of Unitized Land in said Participating Area.

13.3 Allocation of production hereunder for purposes other than for settlement of the royalty obligations of the respective Working Interest Owners, shall be on the basis prescribed in the Unit Operating Agreement whether in conformity with the basis of allocation set forth above or otherwise.

13.4 The Unitized Substances produced from a Participating Area shall be allocated as provided herein regardless of whether any wells are drilled on any particular part or tract of said Participating Area.

ARTICLE XIV—RELINQUISHMENT OF LEASES

14.1 Pursuant to the provisions of the Federal leases and 43 CFR 3244.1, a lessee of record shall, subject to the provisions of the Unit Operating Agreement, have the right to relinquish any of its interests in leases committed hereto, in whole or in part; provided, that no relinquishment shall be made of interests in land within a Participating Area without the prior approval of the Director.

14.2 A Working Interest Owner may exercise the right to surrender, when such right is vested in it by any non-Federal lease, sublease, or operating agreement, provided that each party who will or might acquire the Working Interest in such lease by such surrender or by forfeiture is bound by the terms of this Agreement, and further provided that no relinquishment shall be made of such land within a Participating Area without the prior written consent of the non-Federal Lessor.

14.3 If as the result of relinquishment, surrender, or forfeiture the Working Interests become vested in the fee owner or lessor of the Unitized Substances, such owner may:

(1) Accept those Working Interest rights and obligations subject to this Agreement and the Unit Operating Agreement; or

(2) Lease the portion of such land as is included in a Participating Area established hereunder, subject to this Agreement and the Unit Operating Agreement; and provide for the independent operation of any part of such land that is not then included within a Participating Area established hereunder.

14.4 If the fee owner or lessor of the Unitized Substances does not, (1) accept the Working Interest rights and obligations subject to this Agreement and the Unit Operating Agreement, or (2) lease such lands as provided in 14.3 above within six (6) months after the relinquished, surrendered, or forfeited Working Interest becomes vested in said fee owner or lessor, the Working Interest benefits and obligations accruing to such land under this Agreement and the Unit Operating Agreement shall be shared by the owners of the remaining unitized Working Interests in accordance with their respective Working Interest ownerships, and such owners of Working Interests shall compensate the fee owner or lessor of Unitized Substances in such lands by paying sums equal to the rentals, minimum royalties, and royalties applicable to such lands under the lease or leases in effect when the Working Interests were relinquished, surrendered, or forfeited.

14.5 Subject to the provisions of 14.4 above, an appropriate accounting and settlement shall be made for all benefits accruing to or payments and expenditures made or incurred on behalf of any surrendered or forfeited

Working Interest subsequent to the date of surrender or forfeiture, and payment of any moneys found to be owing by such an accounting shall be made as between the parties within thirty (30) days.

14.6 In the event no Unit Operating Agreement is in existence and a mutually acceptable agreement cannot be consummated between the proper parties, the Supervisor may prescribe such reasonable and equitable conditions of agreement as he deems warranted under the circumstances.

14.7 The exercise of any right vested in a Working Interest Owner to reassign such Working Interest to the party from whom obtained shall be subject to the same conditions as set forth in this Article XIV in regard to the exercise of a right to surrender.

ARTICLE XV—RENTALS AND MINIMUM ROYALTIES

15.1 Any unitized lease on non-Federal land containing provisions which would terminate such lease unless drilling operations are commenced upon the land covered thereby within the time therein specified or rentals are paid for the privilege of deferring such drilling operations, the rentals required thereby shall, notwithstanding any other provisions of this Agreement, be deemed to accrue as to the portion of the lease not included within a Participating Area and become payable during the term thereof as extended by this Agreement, and until the required drillings are commenced upon the land covered thereby.

15.2 Rentals are payable on Federal leases on or before the anniversary date of each lease year; minimum royalties accrue from the anniversary date of each lease year and are payable at the end of the lease year.

15.3 Beginning with the lease year commencing on or after _____ and for each lease year thereafter, rental or minimum royalty for lands of the United States subject to this Agreement shall be made on the following basis:

(a) An advance annual rental in the amount prescribed in unitized Federal leases, in no event creditable against production royalties, shall be paid for each acre or fraction thereof which is not within a Participating Area.

(b) A minimum royalty shall be charged at the beginning of each lease year (such minimum royalty to be due as of the last day of the lease year and payable within thirty (30) days thereafter) of \$2 an acre or fraction thereof, for all Unitized Acreage within a Participating Area as of the beginning of the lease year. If there is production during the lease year the deficit, if any, between the actual royalty paid and the minimum royalty prescribed herein shall be paid.

15.4 Rental or minimum royalties due on leases committed hereto shall be paid by Working Interest Owners responsible therefor under existing contracts, laws, and regulations, or by the Unit Operator.

15.5 Settlement for royalty interest shall be made by Working Interest Owners responsible therefor under existing contracts, laws, and regulations, or by the Unit Operator, on or before the last day of each month for Unitized Substances produced during the preceding calendar month.

15.6 Royalty due the United States shall be computed as provided in the operating regulations and paid in value as to all Unitized Substances on the basis of the amounts thereof allocated to unitized Federal land as provided herein at the royalty rate or rates specified in the respective Federal leases.

15.7 Nothing herein contained shall operate to relieve the lessees of any land from their respective lease obligations for the payment of any rental, minimum royalty, or royalty due under their leases.

ARTICLE XVI—OPERATIONS ON NONPARTICIPATING LAND

16.1 Any party hereto owning or controlling the Working Interest in any Unitized Land having thereon a regular well location may, with the approval of the Supervisor and at such party's sole risk, costs, and expense, drill a well to test any formation of deposit for which a Participating Area has not been established or to test any formation or deposit for which a Participating Area has been established if such location is not within said Participating Area, unless within 30 days of receipt of notice from said party of his intention to drill the well, the Unit Operator elects and commences to drill such a well in like manner as other wells are drilled by the Unit Operator under this Agreement.

16.2 If any well drilled by a Working Interest Owner other than the Unit Operator proves that the land upon which said well is situated may properly be included in a Participating Area, such Participating Area shall be established or enlarged as provided in this Agreement and the well shall thereafter be operated by the Unit Operator in accordance with the terms of this Agreement and the Unit Operating Agreement.

ARTICLE XVII—LEASES AND CONTRACTS CONFORMED AND EXTENDED

17.1 The terms, conditions, and provisions of all leases, subleases, and other contracts relating to exploration, drilling, development, or utilization of geothermal resources on lands committed to this Agreement, are hereby expressly modified and amended only to the extent necessary to make the same conform to the provisions hereof, otherwise said leases, subleases, and contracts shall remain in full force and effect.

17.2 The parties hereto consent that the Secretary shall, by his approval hereof, modify and amend the Federal leases committed hereto and the regulations in respect thereto to the extent necessary to conform said leases and regulations to the provisions of this Agreement.

17.3 The development and/or operation of lands subject to this Agreement under the terms hereof shall be deemed full performance of any obligations for development and operation with respect to each and every separately owned tract subject to this Agreement, regardless of whether there is any development of any particular tract of the Unit Area.

17.4 Drilling and/or producing operations performed hereunder upon any tract of Unitized Lands will be accepted and deemed to be performed upon and for the benefit of each and every tract of Unitized Land.

17.5 Suspension of operations and/or production on all Unitized Lands pursuant to direction or consent of the Secretary or his duly authorized representative shall be deemed to constitute such suspension pursuant to such direction or consent as to each and every tract of Unitized Land. A suspension of operations and/or production limited to specified lands shall be applicable only to such lands.

17.6 Subject to the provisions of Article XV hereof and 17.10 of this Article, each lease, sublease, or contract relating to the exploration, drilling, development, or utilization of geothermal resources of lands other than those of the United States committed to this Agreement, is hereby extended beyond any such term so provided therein so that it shall be continued for and during the term of this Agreement.

17.7 Subject to the lease renewal and the readjustment provision of the Act, any Federal lease committed hereto may, as to the Unitized Lands, be continued for the term

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so provided therein, or as extended by law. This subsection shall not operate to extend any lease or portion thereof as to lands excluded from the Unit Area by the contraction thereof.

17.8 Each sublease or contract relating to the operations and development of Utilized Substances from lands of the United States committed to this Agreement shall be continued in force and effect for and during the term of the underlying lease.

17.9 Any Federal lease heretofore or hereafter committed to any such unit plan embracing lands that are in part within and in part outside of the area covered by any such plan shall be segregated into separate leases as to the lands committed and the lands not committed as of the effective date of unitization.

17.10 In the absence of any specific lease provision to the contrary, any lease, other than a Federal lease, having only a portion of its land committed hereto shall be segregated as to the portion committed and the portion not committed, and the provisions of such lease shall apply separately to such segregated portions commencing as of the effective date hereof. In the event any such lease provides for a lump-sum rental payment, such payment shall be prorated between the portions so segregated in proportion to the acreage of the respective tracts.

17.11 Upon termination of this Agreement, the leases covered hereby may be maintained and continued in force and effect in accordance with the terms, provisions, and conditions of the Act, the lease or leases, and amendments thereto.

ARTICLE XVIII—EFFECTIVE DATE AND TERM

18.1 This Agreement shall become effective upon approval by the Secretary or his duly authorized representative and shall terminate five (5) years from said effective date unless,

(a) Such date of expiration is extended by the Director, or

(b) Utilized Substances are produced or utilized in commercial quantities in which event this Agreement shall continue for so long as Utilized Substances are produced or utilized in commercial quantities, or

(c) This Agreement is terminated prior to the end of said five (5) year period as heretofore provided.

18.2 This Agreement may be terminated at any time by the owners of a majority of the Working Interests, on an acreage basis, with the approval of the Supervisor. Notice of any such approval shall be given by the Unit Operator to all parties hereto.

ARTICLE XIX—APPEARANCES

19.1 Unit Operator shall, after notice to other parties affected, have the right to appear for and on behalf of any and all interests affected hereby before the Department of the Interior, and to appeal from decisions, orders or rulings issued under the regulations of said Department, or to apply for relief from any of said regulations or in any proceedings relative to operations before the Department of the Interior or any other legally constituted authority: *Provided, however,* That any interested parties shall also have the right, at its own expenses, to be heard in any such proceeding.

ARTICLE XX—NO WAIVER OF CERTAIN RIGHTS

20.1 Nothing contained in this Agreement shall be construed as a waiver by any party hereto of the right to assert any legal or constitutional right or defense pertaining to the validity or invalidity of any law of the State wherein lands subject to this Agreement are located, or of the United States, or regulations issued thereunder, in any way affecting

such party or as a waiver by any such party of any right beyond his or its authority to waive.

ARTICLE XXI—UNAVOIDABLE DELAY

21.1 The obligations imposed by this Agreement requiring Unit Operator to commence or continue drilling or to produce or utilize Utilized Substances from any of the land covered by this Agreement, shall be suspended while, but only so long as, Unit Operator, despite the exercise of due care and diligence, is prevented from complying with such obligations, in whole or in part, by strikes, Acts of God, Federal or other applicable law, Federal or other authorized governmental agencies, unavoidable accidents, uncontrollable delays in transportation, inability to obtain necessary materials in open market, or other matters beyond the reasonable control of Unit Operator, whether similar to matters herein enumerated or not.

21.2 No unit obligation which is suspended under this section shall become due less than thirty (30) days after it has been determined that the suspension is no longer applicable.

21.3 Determination of creditable "Unavoidable Delay" time shall be made by the Unit Operator subject to approval of the Supervisor.

ARTICLE XXII—POSTPONEMENT OF OBLIGATIONS

22.1 Notwithstanding any other provisions of this Agreement, the Director, on his own initiative or upon appropriate justification by Unit Operator, may postpone any obligation established by and under this Agreement to commence or continue drilling or to operate on or produce Utilized Substances from lands covered by this Agreement when in his judgement, circumstances warrant such action.

ARTICLE XXIII—NONDISCRIMINATION

23.1 In connection with the performance of work under this Agreement, the Operator agrees to comply with all of the provisions of section 202 (1) to (7) inclusive, of Executive Order 11248 (30 F.R. 12319), as amended by Executive Order 11375 (32 F.R. 14303), which are hereby incorporated by reference in this Agreement.

ARTICLE XXIV—COUNTERPARTS

24.1 This Agreement may be executed in any number of counterparts no one of which needs to be executed by all parties, or may be ratified or consented to by separate instruments in writing specifically referring hereto, and shall be binding upon all parties who have executed such a counterpart, ratification or consent hereto, with the same force and effect as if all such parties had signed the same document.

ARTICLE XXV—SUBSEQUENT JOINDER

25.1 If the owner of any substantial interest in geothermal resources under a tract within the Unit Area falls or refuses to subscribe or consent to this Agreement, the owner of the Working Interest in that tract may withdraw said tract from this Agreement by written notice delivered to the Supervisor and the Unit Operator prior to the approval of this Agreement by the Supervisor.

25.2 Any geothermal resources interests in lands within the Unit Area not committed hereto prior to approval of this Agreement may thereafter be committed by the owner or owners thereof subscribing or consenting to this Agreement, and, if the interest is a Working Interest, by the owner of such interest also subscribing to the Unit Operating Agreement.

25.3 After operations are commenced hereunder, the right of subsequent joinder, as

provided in this Article XXV, by a working interest owner is subject to such requirements or approvals, if any, pertaining to such joinder, as may be provided for in the Unit Operating Agreement. Joinder to the Unit Agreement by a Working Interest Owner, at any time, must be accompanied by appropriate joinder to the Unit Operating Agreement, if more than one committed Working Interest Owner is involved, in order for the interest to be regarded as committed to this Unit Agreement.

25.4 After final approval hereof, joinder by a nonworking interest owner must be consented to in writing by the Working Interest Owner committed hereto and responsible for the payment of any benefits that may accrue hereunder in behalf of such nonworking interest. A nonworking interest may not be committed to this Agreement unless the corresponding Working Interest is committed hereto.

25.5 Except as may otherwise herein be provided, subsequent joinders to this Agreement shall be effective as of the first day of the month following the filing with the Supervisor of duly executed counterparts of all or any papers necessary to establish effective commitment of any tract to this Agreement unless objection to such joinder is duly made within sixty (60) days by the Supervisor.

ARTICLE XXVI—COVENANTS RUN WITH THE LAND

26.1 The covenants herein shall be construed to be covenants running with the land with respect to the interest of the parties hereto and their successors in interest until this Agreement terminates, and any grant, transfer, or conveyance, of interest in land or leases subject hereto shall be and hereby is conditioned upon the assumption of all privileges and obligations hereunder by the grantee, transferee, or other successor in interest.

26.2 No assignment or transfer of any Working Interest or other interest subject hereto shall be binding upon Unit Operator until the first day of the calendar month after Unit Operator is furnished with the original, photostatic, or certified copy of the instrument of transfer.

ARTICLE XXVII—NOTICES

27.1 All notices, demands or statements required hereunder to be given or rendered to the parties hereto shall be deemed fully given if given in writing and personally delivered to the party or sent by postpaid registered or certified mail, addressed to such party or parties at their respective addresses set forth in connection with the signatures hereto or to the ratification or consent hereto or to such other address as any such party may have furnished in writing to party sending the notice, demand or statement.

ARTICLE XXVIII—LOSS OF TITLE

28.1 In the event title to any tract of Utilized Land shall fall and the true owner cannot be induced to join in this Agreement, such tract shall be automatically regarded as not committed hereto and there shall be such readjustment of future costs and benefits as may be required on account of the loss of such title.

28.2 In the event of a dispute as to title as to any royalty, Working Interest, or other interests subject hereto, payment or delivery on account thereof may be withheld without liability for interest until the dispute is finally settled: *Provided,* That, as to Federal land or leases, no payments of funds due the United States shall be withheld, but such funds shall be deposited as directed by the Supervisor to be held as unearned money

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pending final settlement of the title dispute, and then applied as earned or returned in accordance with such final settlement.

ARTICLE XXIX—TAXES

29.1 The Working Interest Owners shall render and pay for their accounts and the accounts of the owners of nonworking interests all valid taxes on or measured by the Unitized Substances in and under or that may be produced, gathered, and sold or utilized from the land subject to this Agreement after the effective date hereof.

29.2 The Working Interest Owners on each tract may charge a proper proportion of the taxes paid under 29.1 hereof to the owners of nonworking interests in said tract, and may reduce the allocated share of each royalty owner for taxes so paid. No taxes shall be charged to the United States or the State of _____ or to any lessor who has a contract with his lessee which requires the lessee to pay such taxes.

ARTICLE XXX—RELATION OF PARTIES

30.1 It is expressly agreed that the relation of the parties hereto is that of independent contractors and nothing in this Agreement contained, expressed, or implied, nor any operations conducted hereunder, shall create or be deemed to have created

a partnership or association between the parties hereto or any of them.

ARTICLE XXXI—SPECIAL FEDERAL LEASE STIPULATIONS AND/OR CONDITIONS

31.1 Nothing in this Agreement shall modify special lease stipulations and/or conditions applicable to lands of the United States. No modification of the conditions necessary to protect the lands or functions of lands under the jurisdiction of any Federal agency is authorized except with prior consent in writing whereby the authorizing official specifies the modification permitted.

In witness whereof, the parties hereto have caused this Agreement to be executed and have set opposite their respective names the date of execution.

Witnesses: _____ Unit operator (as
 _____ unit operator and
 _____ as working interest
 _____ owner)
 Witnesses: _____

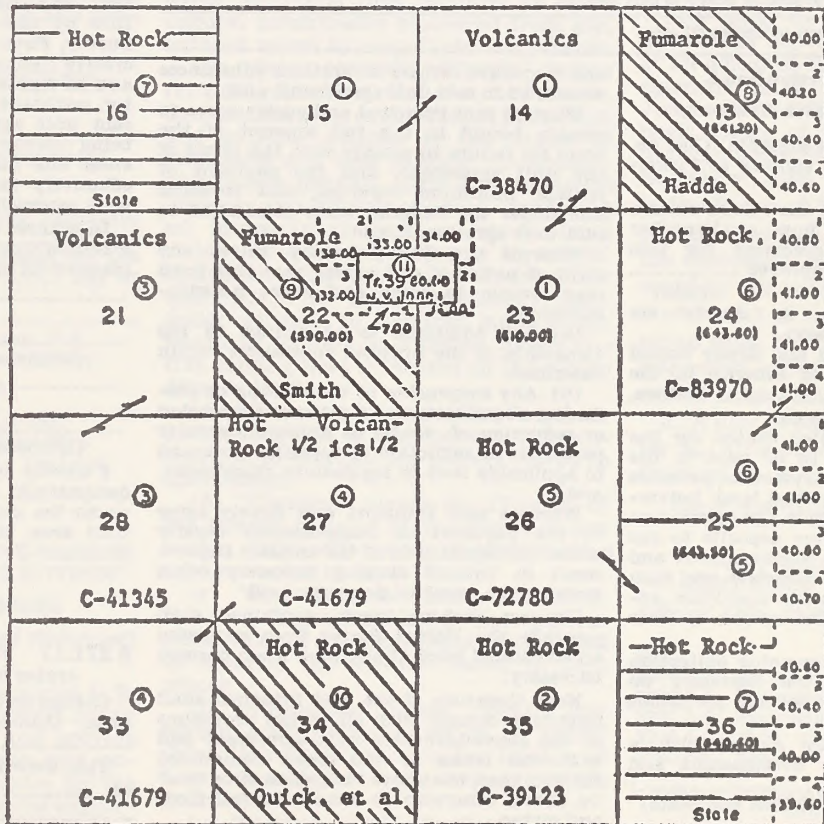
 Witnesses: _____ By Working Interest
 _____ Owners:

 _____ By Other Interest
 _____ Owners:

 _____ By _____




§ 271.13 Sample form of Exhibit A of unit agreement.

EXHIBIT A—BIG VAPOR UNIT AREA, T. 13 N., R. 10 W., M.D.M., California R. 1 W.



T.
13
N.

① Means tract number as listed on Exhibit B

-  PUBLIC LAND
-  STATE LAND
-  PATENTED LAND

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§ 271.14 Sample form of Exhibit B of unit agreement.

EXHIBIT B—BIG VAPOR UNIT AREA, NAPA COUNTY, CALIF., T. 13 N., R. 10 W.

Tract No.	Description of land	No. of acres	Serial No. and expiration date of lease	Basic royalty and ownership percentage	Lessee of record	Working interest and percentage
<i>Federal land</i>						
1	Sec. 14: All. Sec. 15: All. Sec. 23: Lots 1, 2, S½, NE¼, E½NW¼.	1,800.00	38470 July 31, 1982	United States: All.	Volcanics, Inc.	Volcanics, Inc.: All.
<i>California serials</i>						
2	Sec. 35: All.	640.00	39123 July 31, 1982	do.	D. H. Boller	Hot Rock Co.: All.
3	Sec. 21: All.	1,280.00	41345 July 31, 1982	do.	C. S. Waters—50% D. F. Mann—50%	Volcanics, Co.: 50% Hot Rock Co.: 50%
4	Sec. 27: All.	1,280.00	41679	do.	H. C. Pipes	Fumarole Ltd.: All.
5	Sec. 26: All.	961.50	71278 Sept. 31, 1982	do.	Hot Rock Co.	Hot Rock Co.: All.
6	Sec. 25: S¾. Sec. 24: All. Sec. 25: N¾.	965.80	83970 Application.	do.	H. C. Pipes	Do.
6 Federal tracts 7,017.30 acres or 68.47% of unit area.						
<i>California State land</i>						
7	Sec. 16: All. Sec. 36: All.	1,280.60	65-67430	State of California: All.	Hot Rock Co.	Hot Rock Co.: All.
1 State tract 1,280.60 acres or 12.40% of unit area.						
<i>Patented land</i>						
8	Sec. 13: All.	641.20	June 30, 1979	I. B. Hadde: All.	Fumarole, Ltd.	Fumarole, Ltd.: All.
9	Sec. 22: Lots 1, 2, 3, 4, S¾, NW¼.	590.00	Feb. 28, 1981	J. P. Smith: All.	do.	Do.
10	Sec. 34: All.	640.00	Mar. 31, 1981	A. G. Quick: 75% P. T. Land: 25%	Hot Rock Co.	Hot Rock Co.: All.
11	Tract 39	80.00	Apr. 30, 1981	M. V. Jones: All.	Unleased	M. V. Jones: All.
3 Patented tracts 1,951.20 acres or 19.04% of unit area.						
Total... 11 tracts 10,249.10 acres in entire unit area.						

§ 271.15 Form of collective bond.

COLLECTIVE CORPORATE SURETY

Known all men by these presents, That we, _____ signing as Principal, (Name of Unit Operator) _____, for and on behalf of the record owners of unitized substances now or hereafter covered by the unit agreement for this _____, approved _____, (Name of Unit) _____ (Date) _____, as Surety are (Name and address of Surety) _____ jointly and severally held and firmly bound unto the United States of America in the sum of _____ Dollars, (Amount of bond) _____

lawful money of the United States, for the use and benefit of and to be paid to the United States and any entryman or patentee of any portion of the unitized land, heretofore entered or patented with the reservation of the geothermal resources deposits to the United States, for which payment well and truly to be made, we bind ourselves, and each of us, and each of our heirs, executors, administrators, successors, and assigns by these presents.

The condition of the foregoing obligation is such that, whereas the Secretary on _____ approved under the provisions (Date) _____ of the Geothermal Steam Act of 1970, a unit agreement for the development and operation of the _____; (Name of Unit and State) _____ and

Whereas said Principal and record owners of unitized substances, pursuant to said unit agreement, have entered into certain covenants and agreements as set forth therein, under which operations are to be conducted; and

Whereas said Principal as Unit Operator has assumed the duties and obligations of

the respective owners of unitized substances as defined in said unit agreement; and

Whereas said Principal and surety agree to remain bound in the full amount of the bond for failure to comply with the terms of the unit agreement, and the payment of rentals, minimum royalties, and royalties due under the Federal leases committed to said unit agreement; and

Whereas the Surety hereby waives any right of notice of and agrees that this bond may remain in force and effect notwithstanding:

(a) Any additions to or change in the ownership of the unitized substances herein described.

(b) Any suspension of the drilling or producing requirements or waiver, suspension or reduction of rental or minimum royalty payments or reduction of royalties pursuant to applicable laws or regulations thereunder; and

Whereas said Principal and Surety agree to the payment of compensatory royalty under the regulations of the Interior Department in lieu of drilling necessary offset wells in the event of drainage; and

Whereas nothing herein contained shall preclude the United States from requiring an additional bond at any time when deemed necessary:

Now, therefore, if the said Principal shall faithfully comply with all of the provisions of the above-identified unit agreement and with the terms of the leases committed thereto, then the above obligation is to be of no effect; otherwise to remain in full force and virtue.

Signed, sealed, and delivered this _____ day of _____, 19____, in the presence of:

Witnesses: _____

(Principal)

(Surety)

§ 271.16 Form of designation of successor unit operator by working interest owners.

Designation of successor Unit Operator _____, Unit Area, County of _____ State of _____, No. _____

This indenture, dated as of the _____ day of _____, 19____, by and between _____ hereinafter designated as "First Party," and the owners of unitized working interest, hereinafter designated as "Second Parties,"

Witnesseth: Whereas under the provisions of the Geothermal Steam Act of December 24, 1970, 84 Stat. 1566, the Secretary on the _____ day of _____, 19____, approved a unit agreement for the _____ Unit Area, wherein _____ is designated as Unit Operator; and

Whereas said _____ has resigned as such Operator,¹ and the designation of a successor Unit Operator is now required pursuant to the terms thereof; and

Whereas First Party has been and hereby is designated by Second Parties as a Unit Operator, and said First Party desires to assume all the rights, duties, and obligations of Unit Operator under the said unit agreement.

Now, therefore, in consideration of the premises hereinbefore set forth and the promises hereinafter stated, the First Party hereby covenants and agrees to fulfill the duties and assume the obligations of Unit Operator under and pursuant to all the terms of the _____ unit agreement, and the Second Parties covenant and agree that, effective upon approval of this indenture by the Supervisor, of the Geological Survey, First Party shall be granted the exclusive right and privilege of exercising any and all rights and privileges and Unit Operator, pursuant to the terms and conditions of said unit agreement; said unit agreement being hereby incorporated herein by references and made a part hereof as fully and effectively as though said unit agreement were expressly set forth in this instrument.

In witness whereof, the parties hereto have executed this instrument as of the date hereinabove set forth.

(First Party)

(Witnesses)

(Second Party)

(Witnesses)

I hereby approve the foregoing indenture designating _____ as Unit Operator under the unit agreement for the _____ Unit Area, this _____ day of _____, 19____.

Supervisor,
U.S. Geological Survey.

§ 271.17 Form of change in unit operator by assignment.

Change in Unit Operator _____ unit Area, County of _____, State of _____, No. _____

This indenture, dated as of the _____ day of _____, 19____, by and between _____ hereinafter designated as "First Party," and _____ hereinafter designated as "Second Party."

¹ Where the designation of a successor Unit Operator is required for any reason other than resignation, such reason shall be substituted for the one stated.

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Witnesseth: Whereas under the provisions of the Geothermal Steam Act of December 24, 1970, 84 Stat. 1566, the Secretary on the _____ day of _____, 19____, approved a unit agreement for the _____ Unit Area, wherein the First Party is designated as Unit Operator; and

Whereas the First Party desires to transfer, assign, release, and quitclaim, and the Second Party desires to assume all the rights, duties, and obligations of Unit Operator under the unit agreement; and

Whereas for sufficient and valuable consideration, the receipt whereof is hereby acknowledged, the First Party has transferred, conveyed and assigned all his/its rights under certain operating agreements involving lands within the area set forth in said unit agreement unto the Second Party:

Now, therefore, in consideration of the premises hereinbefore set forth, the First Party does hereby transfer, assign, release, and quitclaim unto Second Party all of First Party's rights, duties and obligations as Unit Operator under said unit agreement; and

Second Party hereby accept this assignment and hereby covenants and agrees to fulfill the duties and assume the obligations of Unit Operator under and pursuant to all the terms of said unit agreement to the full extent set forth in this assignment, effective upon approval of this indenture by the Supervisor of the Geological Survey; said unit agreement being hereby incorporated herein by reference and made a part hereof as fully and effectively as though said unit agreement were expressly set forth in this instrument.

In witness whereof, the parties hereto have executed this instrument as of the date hereinabove set forth.

(First Party)

(Witnesses)

(Second Party)

(Witnesses)

I hereby approve the foregoing indenture designated _____ as Unit Operator under the unit agreement for the _____ Unit Area, this _____ day of _____, 19____.

Supervisor, U.S.
Geological Survey

Dated: December 17, 1973.

W. W. LYONS,
*Deputy Under Secretary
of the Interior.*

[FR Doc.73-26891 Filed 12-20-73; 8:45 am]

**CHAPTER II—BUREAU OF LAND MANAGEMENT, DEPARTMENT OF THE INTERIOR:
GEOTHERMAL RESOURCES**

Leasing on Public, Acquired and Withdrawn Lands

The purpose of these regulations is to implement the Geothermal Steam Act of 1970 (30 U.S.C. 1001-1025) and provide for the leasing of the public and acquired lands of the United States for the purpose of geothermal resources exploration, development, and production.

The public was afforded an opportunity to comment on proposed rulemaking published on July 23, 1971, November 29, 1972, and July 23, 1973 and supplemented on August 8, 1973. These regulations reflect consideration of all comments received on the published proposed rulemaking.

A Final Environmental Statement, prepared in accordance with the provisions of section 102(2)(C) of the National Environmental Policy Act of 1969 (42 U.S.C. 4332(2)(C)), was issued on October 23, 1973. It discussed the environmental impact of leasing federally owned geothermal resources under the proposed rulemaking, and proposed provisions for inclusion in regulations and leases to mitigate any possible impacts on the environment.

These regulations will be effective January 1, 1974.

PART 3000—MINERALS MANAGEMENT; GENERAL

1. Section 3000.0-5 of Subpart 3000, Chapter II, Title 43 of the Code of Federal Regulations is revised to read as follows:

§ 3000.0-5 Definitions.

As used in this subchapter:

(a) "Leasable minerals" means oil and gas. (1) Gas means any fluid, either combustible or noncombustible, which is produced in a natural state from the earth and which maintains a gaseous or rarefied state at ordinary temperature and pressure conditions. (2) Oil or crude oil means any liquid hydrocarbon substance which occurs naturally in the earth, including drip gasoline or other natural condensates recovered from gas, without resort to manufacturing process.

(b) "Other leasable minerals" means (1) Coal, chlorides, sulphates, carbonates, borates, silicates, or nitrates of potassium and sodium; sulphur in the States of Louisiana and New Mexico; phosphate; and native asphalt, solid and semisolid bitumen and bituminous rock (including oil impregnated rock or sands from which oil is recoverable only by special treatment after the deposit is mined or quarried); (2) solid (hardrock) minerals; minerals in acquired lands which would be subject to location under the U.S. mining laws if located in the public domain lands.

(c) "Secretary" means the Secretary of the Interior or any person duly authorized to exercise the powers vested in that officer.

(d) "Director" means the Director of the Bureau of Land Management or any person duly authorized to exercise the powers vested in that officer.

(e) "State Director" means the Director of a Bureau of Land Management State office or any person duly authorized to exercise the powers vested in that officer.

(f) "Authorized officer" means any person authorized by law or by lawful delegation of authority in the Bureau of Land Management to perform the duties described.

(g) "Proper BLM office" means the Bureau of Land Management office having jurisdiction over the lands subject to the regulation where the term is used.

(h) "Public domain lands" means original public domain lands which have never left Federal ownership; also, lands in Federal ownership which were obtained by the Government in exchange for public lands or for timber on such

lands; also original public domain lands which have reverted to Federal ownership through operation of the public land laws.

(i) "Acquired lands" means lands which the United States obtains by deed through purchase or gift, or through condemnation proceedings. They are distinguished from public domain lands in that acquired lands may or may not have been originally owned by the Government. If originally owned by the Government such lands have been disposed of (patented) under the public land laws and thereafter reacquired by the United States.

(j) "Other lands" means (1) "Withdrawn lands." Lands which have been withdrawn and dedicated to public purposes. (2) "Reserved lands." Lands which have been withdrawn from disposal and dedicated to a specific public purpose. (3) "Segregated lands." Lands included in a withdrawal, or in an application or entry or in a proper classification which segregates them from operation of the public land laws.

2. Section 3000.4 of Subpart 3000, Chapter II, Title 43 of the Code of Federal Regulations is revised to read as follows:

§ 3000.4 Appeals.

Any party to a case who is adversely affected by any official action or decision of an officer of the Bureau of Land Management or of an Administrative Law Judge of the Office of Hearings and Appeals, Office of the Secretary, except a decision which has been approved by the Secretary, shall have a right of appeal to the Board of Land Appeals in the Office of Hearings and Appeals, Office of the Secretary. All appeals shall be governed by the rules of practice in Subpart E of Part 4 of this title. Nothing in this group shall be construed to prevent any interested party from seeking judicial review as authorized by law.

3. A new Group 3200 is added to Chapter II, Title 43 of the Code of Federal Regulations to read as follows:

Group 3200—Geothermal Resources Leasing

PART 3200—GEOTHERMAL RESOURCES LEASING; GENERAL

Subpart 3200—Geothermal Resources Leasing; General

- Sec. 3200.0-3 Authority.
- 3200.0-5 Definitions.
- 3200.0-6 Preleasing procedures.
- 3200.0-7 Cross reference.
- 3200.0-8 Use of surface.

Subpart 3201—Available Lands; Limitations; Unit Agreements

- Sec. 3201.1 Lands subject to geothermal leasing.
- 3201.1-1 General.
- 3201.1-2 Department of the Interior.
- 3201.1-3 Department of Agriculture.
- 3201.1-4 Federal Power Commission.
- 3201.1-5 Patented lands.
- 3201.1-6 Excepted areas.
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Subpart 3200—Geothermal Resources Leasing; General

§ 3200.0-3 Authority.

These regulations are issued pursuant to the Geothermal Steam Act of 1970 (84 Stat. 1566; 30 U.S.C. 1001-1025) and rights to develop and utilize geothermal resources in land subject to these regulations may be acquired only in accordance with these regulations.

§ 3200.0-5 Definitions.

As used in Group 3200, the term:

(a) "The Act" means the Geothermal Steam Act of 1970.

(b) "Geothermal lease" means a lease issued under authority of the Act; and unless the context indicates otherwise, "lease" means a "geothermal lease".

(c) "Geothermal resources" means geothermal steam and associated geothermal resources which include: (1) All products of geothermal processes, embracing indigenous steam, hot water and hot brines; (2) steam and other gases, hot water and hot brines resulting from water, gas, or other fluids artificially introduced into geothermal formations; (3) heat or other associated energy found in geothermal formations; and (4) any byproducts derived from them.

(d) "Byproduct" means (1) any mineral or minerals (exclusive of oil, hydrocarbon gas, and helium) which are found in solution or in association with geothermal steam and which have a value of less than 75 per centum of the value of the geothermal steam or are not, because of quantity, quality, or technical difficulties in extraction and production, of sufficient value to warrant extraction and production by themselves, and (2) commercially demineralized water.

(e) "Sole party in interest" means a party who is and will be vested with all legal and equitable rights under the lease. No one is, or shall be deemed to be, a sole party in interest with respect to a lease in which any other party has any interest in the lease.

(f) "Interest in the lease" means any interest whatever in a geothermal lease,

including, but not limited to: A record title interest; a working interest; an operating right; an overriding royalty interest; a claim to any prospective or future advantage or benefit from a lease; a participation in any increment, issue, or profit which may be derived, or accrue in any manner, from the lease based upon, or pursuant to, any agreement or understanding in existence at the time when the offer is filed; and an agreement pertaining to any of the foregoing.

(g) "Supervisor" means a representative of the Secretary, subject to the direction and supervision of the Director, the Chief, Conservation Division, Geological Survey and the appropriate Regional Conservation Manager, Conservation Division, Geological Survey, authorized and empowered to regulate operations and to perform other duties prescribed in the regulations in this part or any subordinate of such representative acting under his direction.

(h) "Primary term" means the first 10 years in the life of the lease, exclusive of any period of suspension of operations or production, or both.

(i) "Area of operation" means that area of the leased lands which is required for exploration, development and producing operations, and which is delineated on a map or plat which is made a part of the approved plan of operations. It encompasses the area generally needed for wells, flow lines, separators, surge tanks, drill pads, mud pits, workshops, and other such facilities used for on-project geothermal resources field exploration, development and production operations.

(j) "Commercial quantities" means quantities sufficient to provide a return after all variable costs of production have been met.

(k) "Known geothermal resource area" or "KGRA" means an area in which the geology, nearby discoveries, competitive interests, or other indicia would, in the opinion of the Secretary, engender a belief in men who are experienced in the subject matter that the prospects for extraction of geothermal steam or associated geothermal resources are good enough to warrant expenditures of money for that purpose.

(l) In determining whether the geology of an area is of such a nature that the area should be designated a KGRA the Director, Geological Survey, acting for the Secretary, shall use such geologic and technical evidence as he shall deem appropriate, including the following:

(i) The existence of siliceous sinter and natural geysers;

(ii) The temperatures of fumaroles, thermal springs, and mud volcanoes;

(iii) The SiO₂ content of spring water;

(iv) The Na/K ratio in spring waters of hot-water systems;

(v) The existence of volcanoes and calderas of late Tertiary or Quaternary age;

(vi) Conductive heat flows and geothermal gradient;

(vii) The porosity and the permeability of a potential reservoir;

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(viii) The results of electrical resistivity surveys;

(ix) The results of magnetic, gravity, and airborne infrared geophysical surveys; and

(x) The information obtained through other geophysical methods such as microseismic, seismic ground noise, electromagnetic, and telluric surveys if such methods prove to have significant use in evaluation.

(2) For purposes of KGRA classification, a "discovery" or "discoveries" will be considered to be any well deemed by the Director, Geological Survey, to be capable of producing geothermal resources in commercial quantities and, where the geological structure is not known, "nearby" will be considered to be five miles or less from any such discovery. Lands nearby a discovery will be classified as KGRA unless the Geological Survey determines that the lands are on a different geologic structure from the discovery. Where the Geological Survey has determined the extent of a structure on which a discovery has been made, all land in that structural area contributing geothermal resources to that discovery will be deemed a KGRA regardless of the distance from the discovery.

(3) "Competitive interest" shall exist in the entire area covered by an application for a geothermal lease if at least one-half of the lands covered by that application are also covered by another application which was filed during the same application filing period, whether or not that other application is subsequently withdrawn or rejected. Competitive interest shall not be deemed to exist in the entire area covered by an application because of an overlapping application, if less than one-half of the lands subject to the first application are covered by any other single application filed during the same application filing period; however, some of the lands subject to the first application may be determined to be within a KGRA pursuant to the first sentence of this subparagraph (3).

(1) "Primarily valuable" means the principal mineral value for which the leasehold is being produced.

§ 3200.0-6 Preleasing procedures.

(a) When an area is initially considered for geothermal leasing or when the need arises, the Director shall request other interested Bureaus and Federal agencies to prepare reports describing, to the extent known, resources contained within the general area and the potential effect of geothermal resources operations upon the resources of the area and its total environment. If the Director determines that the issuance of leases in an area would be a major Federal action significantly affecting the quality of the human environment, he shall issue no leases in that area unless an environmental impact statement under section 102(2)(C) of the National Environmental Policy Act of 1969 (42 U.S.C. 4332(2)(C)) has been issued.

(b) Prior to the final selection of tracts for leasing, the Director, or the head of

the agency charged with the administration of the surface, if that officer so elects, shall, when appropriate, evaluate fully the potential effect of the geothermal resources operations pursuant to a leasing program on the total environment, fish and other aquatic resources, wildlife habitat and populations, aesthetics, recreation, and other resources in the entire area during exploratory, developmental, and operational phases. This evaluation will consider the potential impact of the possible development and utilization of the geothermal resources including the construction of power generating plants and transmission facilities on lands which may or may not be included in a geothermal lease. To aid him in his evaluation and selection of tracts the Director shall request and consider the views and recommendations of appropriate Federal agencies, may hold public hearings after appropriate notice, and shall, as appropriate, consult with State agencies, organizations, industries, and lease applicants, and shall consider all other potential factors, such as use of the land and its natural resources, the need for the energy mineral deposits, and socio-economic conditions consistent with multiple-use management principles. If a decision is made to lease, the Director shall develop special terms and conditions to be included in leases as required to protect the environment, to permit use of the land for other purposes, and to protect other natural resources. If tracts are offered for competitive leasing, the notice announcing the availability of the land for leasing will specify the proper BLM office where all terms and conditions to be included in leases for such tracts are available.

§ 3200.0-7 Cross reference.

(a) The regulations governing operations under geothermal leases are found in 30 CFR Part 270.

(b) The regulations setting forth the basic policies for management of the public lands are found in Part 1725 of this chapter.

§ 3200.0-8 Use of surface.

(a) A lessee shall be entitled to use for the production, utilization, and conservation of geothermal resources only so much of the surface of the leased Federal lands as is deemed necessary for such purposes. The lessee shall have the right to use so much of the leased lands as may be deemed necessary for a power generation plant or a commercial or industrial facility, and may apply for the right to use so much of other Federal lands as may be deemed necessary for such purposes; however, any use of the leased lands or other Federal lands for a power generation plant or a commercial or industrial facility will be authorized only under a separate permit issued by the appropriate agency for that specific use and subject to all terms and conditions which it may include in that permit. The uses of the lands within the area of operation are subject to the supervision of the super-

visor, and the uses of the remaining leased lands or other Federal lands are subject to the supervision of the appropriate surface management agency. The lessee shall not be entitled to use any mineral materials subject to the Materials Act except as provided by Part 3600 of this chapter.

(b) Operations under other leases or uses on the same lands shall not unreasonably interfere with or endanger operations under leases issued under these regulations nor shall operations under these regulations unreasonably interfere with or endanger operations under any lease, license, claim, permit, or other authorized use pursuant to the provisions of any other Act.

Subpart 3201—Available Lands; Limitations, Unit Agreements

§ 3201.1 Lands subject to geothermal leasing.

§ 3201.1-1 General.

Subject to the exceptions listed below, geothermal leases may be issued in combination or separately for (a) lands administered by the Secretary of the Interior; (b) national forest lands or other lands administered by the Department of Agriculture through the Forest Service; and (c) geothermal resources in lands which have been conveyed by the United States subject to a reservation to the United States of geothermal resources.

§ 3201.1-2 Department of the Interior.

(a) Except as provided in this section, leases may be issued in accordance with the regulations in this part for withdrawn lands, for acquired lands, and for geothermal resources in lands which have passed from Federal ownership subject to a reservation to the United States of the geothermal resources therein where such lands or resources are administered by the Secretary of the Interior.

(b) Notwithstanding any other provision in these regulations, geothermal leases shall not be issued for: (1) Lands which the Secretary has identified or may identify as being necessary to the performance of his or any other Federal officer's authorized functions, and on which geothermal resource development would in his judgment interfere with such functions; or (2) lands respecting which the Secretary has made or may make a finding that the issuance of geothermal leases would be contrary to the public interest. Upon receipt of an application for a geothermal lease affecting lands withdrawn under section 3 of the Reclamation Act of 1902 (43 U.S.C. 416) or any other appropriate authority, notice thereof and an opportunity to comment thereon shall be given to the head of the agency for whose benefit the withdrawal was made. No geothermal lease affecting lands withdrawn for any agency outside the Department of the Interior shall be leased without the consent of the head of the agency for which the lands are withdrawn. Where leases are issued under Part 3210 of this chapter or 3220 for lands neighboring such reserved lands, the lessees shall be required

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to perform such lease operations and take such measures as are prescribed by the Secretary for the protection of the Federal interests therein.

§ 3201.1-3 Department of Agriculture.

Leases for public, withdrawn or acquired lands administered by the Forest Service, may be issued by the Secretary of the Interior only with the consent of, and subject to such terms and conditions as may be prescribed by, the head of that Department to insure adequate utilization of the lands for the purpose for which they were withdrawn or acquired.

§ 3201.1-4 Federal Power Commission.

Leases for lands to which section 24 of the Federal Power Act, as amended (16 U.S.C. 818), is applicable, may be issued by the Secretary of the Interior only with the consent of, and subject to, such terms and conditions as the Federal Power Commission may prescribe to insure adequate utilization of such lands for power and related purposes.

§ 3201.1-5 Patented lands.

(a) Geothermal resources in lands which have passed from Federal ownership subject to a reservation to the United States of geothermal resources therein may be leased under the regulations in this group subject to the provisions in this part and to such terms and conditions as may be prescribed by the authorized officer to insure adequate protection of the patented lands and any improvements thereon.

(b) Geothermal resources in lands the surface of which has passed from Federal ownership but in which the minerals have been reserved to the United States shall not be developed or produced except under terms and conditions prescribed by the Secretary and pursuant to any agreements made therefor while the question of the title to such resources is being resolved pursuant to the provisions of section 21(b) of the Act.

§ 3201.1-6 Excepted areas.

Leases shall not be issued for lands which are: (a) Administered under the National Park System; (b) within a national recreation area; (c) in a fish hatchery administered by the Secretary, wildlife refuge, wildlife range, game range, wildlife management area, or waterfowl production area, or for lands acquired or reserved for the protection and conservation of fish and wildlife which are designated as rare and endangered species by the Secretary; or under active consideration for inclusion in categories (a), (b), or (c) as evidenced by the filing of an application for a withdrawal or a proposed withdrawal; or (d) tribally or individually owned Indian trust or restricted lands, within or without the boundaries of Indian reservations.

§ 3201.2 Acreage limitations.

(a) *Maximum holdings.* No citizen, association, corporation, or governmental unit shall take, hold, own, or control at one time, whether acquired directly

from the Secretary or otherwise, any direct or indirect interest in Federal geothermal leases in any one State exceeding 20,480 acres, including leases acquired under the provisions of section 4 (a)-(f) of the Act. Nor may any citizen, association, or corporation be permitted to convert mineral leases, permits, applications therefor, or mining claims, pursuant to the provisions of section 4 (a)-(f) of the Act into geothermal leases for more than 10,240 acres.

(b) *Computation.* In computing acreage holdings or control, the accountable acreage of a party owning an undivided interest in a lease shall be that party's proportionate part of the total lease acreage. Likewise, the accountable acreage of a party owning an interest in a corporation or association shall be his proportionate part of the corporation's or association's accountable acreage except that no person shall be charged with his pro rata share of any acreage holdings of any association or corporation unless he is the beneficial owner of more than 10 per centum of the stock or other instruments of ownership or control of that association or corporation. Parties owning a royalty or other interest determined by or payable out of a percentage of production from a lease will be charged with a similar percentage of the total lease acreage.

(1) An association shall not be deemed to exist between the parties to a contract for development of leased lands, whether or not coupled with an interest in the lease, nor between co-lessees, but each party to any such contract or each co-lessee will be charged with his proportionate interest in the lease.

(2) Lessees holding acreage in common shall be considered a single entity and cannot hold acreage in excess of the maximum specified in the law for any one lessee.

(c) *Excepted acreage.* Leases committed to any unit or cooperative plan approved or prescribed by the Secretary of the Interior shall not be included in computing accountable acreage. Leases subject to an operating, drilling or development contract approved by the Secretary pursuant to section 18 of the Act, other than communication or drilling agreements, shall be excepted in determining the accountable acreage of the lessees or operators.

(d) *Excess acreage.* (1) Where, as the result of the termination or contraction of a unit or cooperative plan, or the elimination of a lease from operating, drilling, or development plan, a party holds or controls excess accountable acreage, such party shall have 90 days from such termination or contraction or elimination in which to reduce his holdings to the prescribed limitation.

(2) If any person holding or controlling leases or interests in leases is found to hold accountable acreage in violation of the provisions of this section and of the Act, the last lease or leases or interest or interests acquired by him which created the excess acreage holdings shall be canceled or forfeited in their

entirety, even though only part of the acreage in the lease or interest constitutes excess holdings, unless it can be shown to the satisfaction of the Director that the holding or control of the excess acreage is not the result of negligence or willful intent in which event the lease or leases shall be canceled only to the extent of the excess acreage.

(3) Any person holding or controlling leases or interests in leases below the acreage limitation provided in this section, shall be subject to these rules:

(1) If he files an application which causes him to exceed the acreage limitation, that application will be rejected.

(i) If he files a group of applications at the same time, any one of which causes him to exceed the acreage limitation, the entire group of applications will be rejected.

(4) If any person holding or controlling leases or interests in leases below the acreage limitation provided in this section, acquires a lease or leases, or an interest or interests therein, which cause him to exceed the acreage limitation, his most recently filed application for lease or applications for leases then containing acreage in excess of the limitation provided in this section will be rejected in its or their entirety. For the purpose of this subparagraph, time of filing shall be determined by the date of filing marked on the application, or, if the same date is marked on two or more applications, by the serial number of the applications.

(e) *Showing required.* No lease will be issued and no transfer or operating agreement will be approved until it has been shown that the applicant, operator, or transferee is entitled to hold the acreage or obtain the operating rights. At any time upon request by the authorized officer, the record title holder of any lease or a lease operator or a lease applicant may be required to file in the proper BLM office a statement, showing as of a specified date the serial number and the date of each lease of which he is the record holder, or under which he holds operating rights, and each application for lease held or filed by him in the particular State setting forth the acreage covered thereby, and the nature, extent and acreage interest, including royalty interests held by him in any geothermal lease of which the reporting party is not the lessee of record, whether by corporate stock ownership, interest in unincorporated associations and partnerships, or in any other manner.

§ 3201.3 Leases within unit areas.

Before issuance of a geothermal lease for lands within an approved unit agreement, the lease applicant or successful bidder will be required to file evidence that he has entered into an agreement with the unit operator for the development and operation of the lands in a lease if issued to him under and pursuant to the terms and provisions of the approved unit agreement, or a statement giving satisfactory reasons for the failure to enter into such agreement. If such

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statement is acceptable, he will be permitted to operate independently but will be required to perform his operations in a manner which the Supervisor deems to be consistent with the unit operations.

Subpart 3202—Qualifications of Lessees

§ 3202.1 Who may hold leases.

Leases may be issued only to: (a) Citizens of the United States who have reached the age of majority; (b) associations of such citizens; (c) corporations organized under the laws of the United States, any state or the District of Columbia; or (d) governmental units, including, without limitation, municipalities. The term "association" includes a partnership.

§ 3202.2 Statements required to be submitted.

§ 3202.2-1 General.

(a) Each applicant for a lease is required to submit with his application a statement that his interests, direct and indirect, in Federal geothermal leases do not exceed the acreage limitations prescribed in § 3201.2, together with a statement of his citizenship.

(b) If the applicant is an association or corporation the application must be accompanied by: (1) A statement showing that it is authorized to hold geothermal leases; (2) a statement that the officer executing the application is authorized to act on behalf of the association or corporation; (3) a statement setting forth the State in which it was incorporated or formed and the names and addresses of all members or stockholders holding more than 10 percent of the association or corporation; and (4) a statement from each person owning or controlling more than 10 percent of the association or corporation setting forth his citizenship and his holdings.

(c) If the applicant is a municipality, or governmental unit, the application must be accompanied by: (1) A statement showing that it is authorized to hold geothermal leases; (2) a statement that the officer executing the application is authorized to act on behalf of the municipality or governmental unit, and (3) a copy of its governing body's resolution authorizing such action.

§ 3202.2-2 Guardian or trustee.

(a) *Guardian.* If the application is made by a guardian, he must submit: (1) A certified copy of the court order authorizing him to act as guardian and, in behalf of his ward, to enter into contractual agreements and to fulfill all obligations arising under the lease; and (2) statements as to the citizenship and holdings under the Act of himself and of each person under his guardianship for whom the application is made.

(b) *Trustee.* If the application is made by a trustee, he must submit a copy of the instrument establishing the trust or a certified copy of the court order authorizing him to act as trustee, in behalf of the beneficiary, as to all obligations arising under the lease; and statements as to the citizenship and holdings under

the Act of himself and of each beneficiary.

§ 3202.2-3 Attorney-in-fact.

If an application is filed by an attorney-in-fact, it must be accompanied by a statement as to his authority to act.

§ 3202.2-4 Statements previously filed.

Where the statements required by § 3202.2 have been previously filed a reference by serial number to the record in which they have been filed, together with a statement as to any amendments will be accepted.

§ 3202.2-5 Showing as to sole party in interest.

Each application must indicate whether the applicant is the sole party in interest. Where the applicant is not the sole party in interest, separate statements must be signed by each of the parties and by the applicant setting forth the nature of the agreement between them. All interested parties must furnish evidence of their qualifications to hold such lease interest. These separate statements must be filed in the proper BLM office with the application, except as provided in § 3211.2 of this chapter.

§ 3202.2-6 Heirs and devisees (estates).

If an applicant or a successful bidder dies before the lease is issued, the lease will be issued to the executor or administrator of the estate if probate of the estate has not been completed, and if probate has been completed, or is not required, to the heirs or devisees, provided there is filed in all cases an application to lease in compliance with the requirements of this section which will be effective as of the effective date of the original application filed by the deceased. If there are any minor heirs or devisees, the application can only be made by their legal guardian or trustee in his name. Each such application must be accompanied by the following information:

(a) Where probate of the estate has not been completed:

(1) Evidence that the person who as executor or administrator submits the application, and bond form if a bond is required, has authority to act in that capacity and to sign the application and bond forms.

(2) A statement over the signature of each heir or devisee or, if the heir or devisee is a minor, over the signature of his legal guardian or trustee, concerning citizenship and holdings.

(3) Evidence that the heirs or devisees are the heirs or devisees of the deceased applicant or successful bidder and are the only heirs or devisees of the deceased.

(b) Where the executor or administrator has been discharged or no probate proceedings are required:

(1) A certified copy of the will or decree of distribution, if any, and if not, a statement signed by the heirs that they are the only heirs of the applicant or successful bidder and the provisions of the law of the deceased's last domicile showing that no probate is required.

(2) A statement over the signature of each of the heirs or devisees with reference to holdings and citizenship. If the heir or devisee is a minor, the statement must be over the signature of the guardian or trustee.

§ 3202.2-7 Fractional present interests.

(a) An application for a fractional present interest noncompetitive lease must be executed on a form approved by the Director and it must be accompanied by a statement showing the extent of the applicant's ownership of the operating rights to the fractional geothermal resources interest not owned by the United States in each tract covered by the application to lease. Ordinarily, the issuance of a lease to one who, upon such issuance, would own less than 50 percent of the operating rights in any such tract, will not be regarded as in the public interest, and an application leading to such results will be rejected.

(b) Geothermal resources in lands which have passed from Federal ownership but which lands have been purchased by the Federal Government with a fractional interest in the geothermal resources shall not be developed or produced, except under prescribed terms and conditions and pursuant to any agreement made between the parties of interest prior to the resolution of the question of ownership of the geothermal resources.

Subpart 3203—Leasing Terms

§ 3203.1 Primary and additional term.

§ 3203.1-1 Dating of leases.

All geothermal leases will be dated as of the first day of the month following the date on which the leases are signed on behalf of the lessor except that, where prior written request has been made, a lease may be dated as of the first day of the month within which it is so signed. A renewal lease will be dated from the termination of the original lease.

§ 3203.1-2 Primary term.

All leases shall be for a primary term of 10 years.

§ 3203.1-3 Additional term.

(a) If geothermal steam is produced or utilized in commercial quantities within the primary term of a lease, that lease shall continue for so long thereafter as geothermal steam is produced or utilized in commercial quantities, but the lease shall in no event continue for more than 40 years after the end of the primary term except that the lessee shall have a preferential right to a renewal of his lease for a second 40-year term upon such terms and conditions as the authorized officer deems appropriate, if at the end of the first 40-year term the lands are not needed for another purpose and geothermal steam is produced or utilized in commercial quantities. Production or utilization of geothermal steam in commercial quantities shall be deemed to include the completion of one or more wells producing or capable of

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producing geothermal steam in commercial quantities and a bona fide sale of such geothermal steam for delivery to or utilization by a facility or facilities not yet installed but scheduled for installation not later than 15 years from the date of commencement of the primary term of the lease.

§ 3203.1-4 Extensions.

(a) A lease which has been extended by reason of production, or on which geothermal steam has been produced, and which has been determined by the Secretary to be incapable of further commercial production and utilization of geothermal steam may be further extended so long as one or more valuable byproducts are produced in commercial quantities but for not more than 5 years.

(b) Where the lessee commenced actual drilling operations prior to the end of the primary term and those operations are being diligently prosecuted at that time, a lease shall be extended for a period of five years and so long thereafter as geothermal steam is produced or utilized in commercial quantities (but for not more than 35 years).

(c) A lease committed to a cooperative plan, communitization agreement or a unit plan under or for which actual drilling operations were commenced prior to the end of the primary term of the lease, shall, if such operations are being diligently prosecuted at that time be extended for a period of five years and so long thereafter as geothermal steam is produced or utilized in commercial quantities (but for not more than thirty five years).

(d) Any lease on which there has been a suspension of operations or production, or both, under 30 CFR 270.17 shall continue in effect for the life of the suspension and, at the end of the suspension, shall be extended for a period equal to that portion of the primary term during which the suspension was in effect.

(e) If, at the end of 40 years after the conclusion of the primary term, steam is being produced or utilized in commercial quantities and the lands are not needed for other purposes, the lessee shall have a preferential right to a renewal of the lease for a second 40-year term on such terms and conditions as the Secretary deems appropriate.

§ 3203.1-5 Segregation of leases on commitment to, or contraction of, cooperative or unit plan or communitization or drilling agreement.

(a) Any lease committed to any cooperative plan, communitization agreement, drilling agreement, or unit plan, which covers lands within and lands outside the area covered by the plan or agreement, shall be segregated, as of the effective date of that plan or agreement, into separate leases, one covering the lands committed to that plan or agreement and the other as to the lands not so committed. The segregated lease covering the portion of the lands not subject to that plan or agreement shall not be entitled to an extension by reason of

the segregation, but the term of the lease of such segregated lands shall be as provided in the original lease.

(b) When only part of the land subject to a lease included in a cooperative plan, a communitization agreement, a drilling agreement, or a unit plan is excluded from that plan or agreement because of the contraction of the area subject to that plan or agreement, the part of the lease which is excluded and the part which remains subject to the plan or agreement shall be segregated into separate leases. The term of the segregated lease composed of the excluded land shall not be extended because of production in commercial quantities or the existence of a producible well on the segregated lease remaining subject to the cooperative or unit plan or the communitization or drilling agreement or because actual drilling operations were at the time of contraction being conducted on that other lease, but the term of the lease composed of the excluded land shall be as provided in the original lease.

(c) Where all the land subject to a lease included in a cooperative plan, a communitization agreement, a drilling agreement, or a unit plan is excluded from that plan or agreement because of the contraction of the area subject to that plan or agreement, the term of the lease shall not be extended because of production in commercial quantities or the existence of a producible well on the lands remaining subject to the cooperative or unit plan or the communitization or drilling agreement or because actual drilling operations were being conducted on the other lands, but the term of the lease shall be as provided in the original lease.

(d) Contraction of a unit or cooperative plan or a communitization or drilling agreement causing all or part of the land in the lease to be excluded from such plan or agreement shall not serve to extend the term of such lease excluded by reason of the contraction where the 10-year primary term has already expired.

§ 3203.1-6 Conversion to mineral leases or mining claims.

(a) If the byproducts capable of being produced in commercial quantities are leasable under the Mineral Leasing Act of February 25, 1920 as amended and supplemented (30 U.S.C. sections 181-287), or under the Mineral Leasing Act for Acquired Lands (30 U.S.C. sections 351-359), and the leasehold is primarily valuable for the production thereof, the lessee shall be entitled to convert his geothermal lease to a mineral lease under and subject to all the terms and conditions of the appropriate act, provided the lands and its resources are available for this purpose, upon application at any time before expiration of the lease extension by reason of byproduct production.

(b) The lessee shall be entitled to locate under the mining laws all minerals which are not leasable and which would constitute a byproduct if commercial

production or utilization of geothermal steam continued. The lessee, to acquire the rights herein granted him, shall complete the location of mining claims within 90 days after the termination of the geothermal lease, provided the lands and its resources are available for location.

(c) Any lease converted under paragraphs (a) or (b) of this section affecting lands withdrawn or acquired in aid of a function of a Federal department or agency, including the Department of the Interior, shall be subject to such additional terms and conditions as may be prescribed by that department or agency with respect to the additional operations or effects resulting from such conversion upon the utilization of the lands for the purpose for which they are administered.

§ 3203.2 Lease acreage limitation.

(a) A geothermal lease may not embrace more than 2,560 acres in a reasonably compact area, except where a departure is occasioned by an irregular subdivision or subdivisions, entirely within an area of six miles square or within an area not exceeding six surveyed or protracted sections in length or width measured in cardinal directions. Where a departure is occasioned by an irregular subdivision, the leased acreage may exceed 2,560 acres by an amount which is smaller than the amount by which the area would be less than 2,560 acres if the irregular subdivision were excluded. No lease will be issued for less than 640 acres, except at the discretion of the Secretary, or where a departure is occasioned by an irregular subdivision, or as provided for in Subpart 3230 of this chapter. In event of a departure, the leased acreage may be less than 640 acres by amount which is smaller than the amount by which the area would be more than 640 acres if the irregular subdivision were added.

(b) The authorized officer may add isolated tracts in nearby sections, notwithstanding the 640-acre minimum, where it is determined that such addition is necessary for the proper management of the resource, provided the additional lands will not cause the lessee to exceed the maximum acreage limitation as provided in § 3201.2(a) of this chapter. However, prior to the issuance of such a lease based on the application as amended by the authorized officer, the applicant will be given the option to refuse such a lease. Failure of the applicant to execute and return the lease within 30 days after receipt thereof will constitute a withdrawal of his application, as amended, without further notice.

§ 3203.3 Consolidation of leases.

Two or more contiguous leases issued to the same lessee may be consolidated if the total combined acreage does not exceed 2,560 acres. Except where a departure is caused by an irregular subdivision or subdivisions as stated in § 3203.2.

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§ 3203.4 Description of lands.

Applications and nominations shall include a description of the lands sought to be included in a geothermal lease.

(a) *Surveyed lands.* If the lands have been surveyed under the public land rectangular system, each application or nomination shall describe the lands by legal subdivision, section, township, and range.

(b) *Unsurveyed lands.* If the lands have not been so surveyed, each application shall describe the lands by metes and bounds, giving courses and distances between the successive angle points on the boundary of the tract, in cardinal directions except where the boundaries of the lands are in irregular form, and connected by courses and distances to an official corner of the public land surveys or to a prominent topographic feature. In Alaska the description of unsurveyed lands must be connected by courses and distances to either an official corner of the public land surveys or to a triangulation station established by any agency of the United States (such as the U.S. Geological Survey, the Coast and Geodetic Survey, or the International Boundary Commission), if the record position thereof is available to the general public.

(c) When protracted surveys have been approved and the effective date thereof published in the FEDERAL REGISTER, each application or nomination for lands shown on such protracted surveys, filed on or after such effective date, shall describe the lands according to the legal subdivision, section, township, and range shown on the approved protracted surveys.

(d) *Unsurveyed public lands adjacent to tidal waters in southern Louisiana and in Alaska.* In lease applications embracing unsurveyed public lands adjacent to tidal waters in southern Louisiana and in Alaska, if the applicant finds it impracticable to furnish a metes and bounds description, as required in paragraph (b) of this section with respect to the water boundary, he may, at his option, extend the boundary of his application into the water a distance sufficient to permit complete enclosure of the water boundary of his application by a series of courses and distances in cardinal directions (the object being to eliminate the necessity of describing the meanders of the water boundary of the public lands included in the application). The description in the lease application shall in all other respects conform to the requirements of paragraph (b) of this section. Such description would not be deemed for any purpose to describe the true water boundaries of the lease, such boundaries in all cases being the ordinary high water mark of the navigable waters. The land boundaries of such overall area shall include only the public lands embraced in the application. The applicant shall agree to pay rental on the full acreage included within the description with the understanding that rights

under any lease to be issued on that application will apply only to the areas within that description properly subject to lease under the act, but that the total area described will be considered as the lease acreage for purposes of rental payments, acreage limitations under § 3201.2 of this chapter and the maximum or minimum area to be included in a lease pursuant to § 3203.2. The tract should be shown in outline on a current quadrangle sheet published by the U.S. Geological Survey or such other map as will adequately identify the lands described.

§ 3203.5 Diligent exploration.

Each geothermal lease will include provisions for the diligent exploration of the leased resources until there is production in commercial quantities applicable to the lands subject to the lease, and failure to perform such exploration may subject the lease to termination. Diligent exploration means exploration operations (subsequent to the issuance of the lease) on, or related to the leased lands, including, but not limited to, operations such as geochemical surveys, heat flow measurements, core drilling, or drilling of a test well. Exploration operations, in order to qualify as diligent exploration, must be approved by the Supervisor, and evidence of all expenditures therefor and the results thereof must be submitted annually to the Supervisor in compliance with applicable regulations and Geothermal Resources Operational (GRO) Orders or upon his request. Moreover, after the fifth year of the primary lease term, exploration operations, to qualify as diligent exploration for a year, must entail expenditures during that year equal to at least two times the sum of (a) the minimum annual rental required by statute, and (b) the amount of rental for that year in excess of the fifth year's rental, but in no event shall the required expenditures exceed twice the rental for the 10th year. However, any expenditures for diligent operations during the first 5 years of the lease and any expenditures for diligent operations during any subsequent year in excess of the minimum required expenditures for that year may be credited, in such proportions as the lessee may designate, against (1) expenditures needed to qualify exploration operations as diligent operations for future years, or (2) any rental requirement for that or any future years in excess of the fifth year's rental pursuant to § 3205.3-3 of this chapter. In all cases, the lessee must pay the basic annual rental specified in the lease for the initial five years of the primary term until there is production of geothermal steam in commercial quantities on the leased lands.

§ 3203.6 Plan of operation.

A lessee will be required to submit a plan of operation pursuant to 30 CFR 270.34, prior to entry upon the leased lands for any purpose other than casual use as that term is defined in § 3209.0-5 (d) of this chapter. Operations will not

be permitted on the lands until the plan of operation has been approved.

Subpart 3204—Surface Management Requirements, Special Requirements

§ 3204.1 General.

A lessee shall comply with and be bound by the following general terms and conditions, the specific requirements contained in the lease stipulations and any GRO orders that may be issued pursuant to 30 CFR 270.11. Assuring compliance with the requirements of this section is the responsibility of the Supervisor as to the lands within the area of operations and is the responsibility of the appropriate land management agency as to the remaining lands in the lease.

(a) *Equal employment opportunity.* The lessee shall comply with Executive Order 11246, as amended, 30 F.R. 12319 (1965), and regulations issued pursuant thereto, 41 CFR Chapter 60 and 43 CFR Part 17.

(b) *Public access.* (1) The lessee shall permit free and unrestricted public access to and upon the leased lands for all lawful and proper purposes except in areas where such access would unduly interfere with operations under the lease or would constitute a hazard to health and safety. Restrictions on access will not be allowed without prior approval.

(2) During construction, the lessee shall regulate public access and vehicular traffic to protect the public, wildlife, and livestock from hazards associated with the project. For this purpose, the lessee shall provide warnings, fencing, flag men, barricades, and other safety measures as appropriate.

(c) *Pollution abatement.* The lessee shall comply with all Federal and State standards and all applicable local standards with respect to the control of all forms of air, land, water, and noise pollution, including, but not limited to, the control of erosion and the disposal of liquid, solid, and gaseous wastes. The Supervisor may, in his discretion, establish additional and more stringent standards, and, if he does so, the lessee shall comply with those standards. The lessee, in addition to any other action required by those standards, shall take the following specific actions:

(1) *Pesticides and herbicides.* The lessee shall comply with all rules issued by the Department of the Interior and the Environmental Protection Agency pertaining to the use of poisonous substances on public lands.

(2) *Water pollution.* The lessee shall conduct lease operations and maintenance in accordance with Federal and State water quality standards and public health and safety standards, and applicable local water quality standards and public health and safety standards. Toxic materials shall not be released into any surface waters or underground waters. ReInjection of waste geothermal fluids into geothermal or other suitable aquifers will be permitted upon approval of the lessee's plan of operation submitted pursuant to 30 CFR 270.34.

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(3) *Air pollution.* The lessee shall control emissions from operations in accordance with Federal and State air quality standards, and applicable local air quality standards.

(4) *Erosion control.* The lessee shall minimize disturbance to vegetation, drainage channels, and streambanks. The lessee shall employ such soil and resource conservation and protection measures on the leased lands as the Supervisor deems necessary.

(5) *Noise control.* The lessee shall control noise emissions from operations, in accordance with Federal and State noise emission standards, and applicable local noise emission standards.

(d) *Sanitation and waste disposal.* The lessee shall remove or dispose of all waste material generated in connection with the exploration, development, production and transportation operations in a manner set forth in the approved plan of operation submitted pursuant to 30 CFR 270.34.

(e) *Land subsidence, seismic activity.* The lessee shall take precautions necessary to minimize land subsidence or seismic activity which could result from production of geothermal resources and the disposal of waste fluid where such activity could damage or curtail the use of the geothermal resources or other resources, or other uses of the land and take such measures as stipulated to: (1) monitor operations for land subsidence and for seismic activity; and (2) maintain, and when requested, make available to the lessor, records of all monitoring activities.

(f) *Aesthetics.* The lessee shall take aesthetics into account in the planning, design, and construction of facilities on the leased premises.

(g) *Fish and wildlife.* The lessee shall employ such measures as are deemed necessary to protect fish and wildlife and their habitat.

(h) *Antiquities and historical sites.* The lessee shall conduct activities on discovered, known or suspected archeological, paleontological, or historical sites in accordance with lease terms or specific instructions.

(i) *Restoration.* The lessee shall provide for the restoration of all disturbed lands in an approved manner.

(j) The lessee shall submit annual reports to the authorized officer on compliance with the requirements of paragraphs (b)-(i) of this section and report within 24 hours, and if the report is oral, shall confirm the report in writing within 30 days, any significant environmental damage suffered by the lands subject to his lease. However, if, after drilling operations have begun, the lessee is required to submit a similar report under 30 CFR 270.30 and 270.76, he may fulfill the requirement of this subsection by submitting to the authorized officer a copy of that report.

§ 3204.2 Waste prevention.

All leases shall be subject to the condition that the lessee will, in conducting his exploration, development, and pro-

ducing operations, use all reasonable precautions to prevent waste of geothermal resources and other natural resources found or developed in the leased lands.

§ 3204.3 Readjustment of terms and conditions.

(a) (1) Except as otherwise provided by law, the terms and conditions of any geothermal lease may be readjusted as determined by the authorized officer at not less than 10-year intervals beginning 10 years after the date geothermal steam is produced. Each lease shall provide for such readjustments.

(2) The authorized officer shall give notice to the lessee of any proposed readjustment of the terms and conditions of the lease and the nature thereof, and unless the lessee files with the authorized officer an objection to the proposed terms and conditions or relinquishes the lease within 30 days after receipt of such notice, the lessee shall be deemed conclusively to have agreed to such terms and conditions. If the lessee files objections, and agreement cannot be reached between the authorized officer and the lessee within a period of 60 days, the lease may be terminated by either party, subject to the provisions of § 3000.4 of this chapter. If the lessee files objections to the proposed readjusted terms and conditions, the existing terms and conditions, except for those concerning rental and royalty rates, will remain in effect until there has been an agreement between the authorized officer and the lessee on the new terms and conditions to be applied to the lease or until the lease is terminated. The readjustment of any terms concerning rental and royalty rates will be subject to § 3205.3 of this chapter.

(b) Any readjustment of the terms and conditions of any lease of lands withdrawn or acquired in aid of a function of a Federal department or agency may be made only with the approval of that other agency.

§ 3204.4 Reservation to the United States of oil, hydrocarbon gas, and helium.

The United States reserves the ownership of and the right to extract oil, hydrocarbon gas, and helium from all geothermal steam and associated geothermal resources produced from lands leased under the Act. Whenever the right to extract oil, hydrocarbon gas, and helium, from geothermal steam and associated geothermal resources produced from such lands is exercised, it shall be exercised so as to cause no substantial interference with the production of geothermal resources from such lands.

§ 3204.5 Compensation for drainage; compensatory royalty.

(a) Upon a determination by the Supervisor that lands owned by the United States are being drained of geothermal resources by wells drilled on adjacent or cornering lands, the authorized officer may execute agreements with the owners of adjacent or cornering lands whereby

the United States, or the United States and its lessees, shall be compensated for such drainage, such agreements to be made with the consent of any lessee affected thereby. The precise nature of any agreement will depend on the conditions and circumstances involved in the particular case.

(b) Where land in any lease is being drained of its geothermal resources by a well either on a Federal lease issued at a lower rate of royalty or on land not the property of the United States, the lessee must drill and produce all wells necessary to protect the leased lands from drainage. In lieu of drilling such wells, the lessee may, with the consent of the Supervisor, pay compensatory royalty in the amount determined in accordance with 30 CFR Part 270.

§ 3204.6 Patented lands.

The terms and conditions of any geothermal resource lease for lands conveyed by the United States subject to a reservation to the United States of geothermal resources may be readjusted upon notification to the surface owner.

Subpart 3205—Service Charges, Rentals and Royalties

§ 3205.1 Payments.

§ 3205.1-1 Form of remittance.

Remittances required under these regulations may be made by cash payment, check certified check, bank draft, bank cashier's check, or money order. All remittances will be deposited as received.

§ 3205.1-2 Where submitted.

(a) *Rentals on nonproducing leases.* Rentals under all nonproducing leases issued shall be paid at the proper BLM office. All remittances to the Bureau of Land Management shall be made payable to the Bureau of Land Management.

(b) *Other payments.* All royalties on producing leases, communitized leases in producing well units, unitized leases in producing unit areas, leases on which compensatory royalty is payable and all royalty payments under easements for directional drilling are to be paid to the Supervisor. All remittances to the Supervisor shall be made payable to the U.S. Geological Survey.

§ 3205.2 Service charges.

(a) *Competitive lease applications.* No service charge is required.

(b) *Noncompetitive lease applications.* Applications for noncompetitive leases must be accompanied by a nonrefundable service charge of \$50 for each application.

(c) *Assignments.* Applications for approval of an assignment of a lease or interest therein must be accompanied by a nonrefundable service charge of \$50 for each application.

(d) *Nominations.* No service charge is required.

§ 3205.3 Rentals and royalties.

§ 3205.3-1 Payment with application.

Each application, except an application filed pursuant to Subpart 3211 of

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this chapter, of this part, must be accompanied by payment of the first year's rental of \$1 per acre or fraction thereof based on the total acreage included in the application. An application accompanied by a payment of the first year's rental which is deficient by not more than 10 percent will be approved by the authorized officer provided all other requirements are met, but, if the additional rental is not paid within 30 days from notice, the application or the lease, if issued, will be canceled. If the annual rental rate established for the lease to be issued is more than \$1 per acre or fraction thereof, the applicant will be required to submit the additional rental prior to issuance of the lease upon notice from the authorized officer.

§ 3205.3-2 Payment of annual rental.

(a) Annual rental in the amount specified in the lease which shall be not less than \$1 per acre or fraction thereof must be paid in advance and must be received by the proper BLM office on or before the anniversary date of the lease. If there is no well on the leased lands capable of producing geothermal resources in commercial quantities, the failure to pay rental on or before the anniversary date shall terminate the lease by operation of law, except as provided by § 3244.2 of this chapter.

(b) If, on the anniversary date of the lease, less than a full year remains in the lease term, the rentals shall be payable in the same proportion as the period remaining in the lease term is to a full year. The rentals shall be prorated on a monthly basis for the full months, and on a daily basis for the fractional month remaining in the lease term. For the purpose of prorating rentals for a fractional month, each month will be deemed to consist of 30 days.

(c) If the term of a lease for which prorated rentals have been paid is further extended to or beyond the next anniversary date of the lease, rentals for the balance of the lease year shall be due and payable on the 1st day of the first month following the date through which the prorated rentals were paid. If the rentals are not paid for the balance of the lease year, the lease will be subject to cancellation. However, if the anniversary date occurs before the end of the notice period, the rental for the following lease year shall nevertheless be due on the anniversary date and failure to pay the full rental for that year on or before that date shall cause the lease to terminate automatically by operation of law except as provided by § 3244.2 of this chapter. The lessee shall not be relieved of liability for rental due for the balance of the previous lease year.

(d) If the payment is due on a day in which the proper BLM office to receive payment is not open, payment received on the next official working day will be deemed to be timely.

§ 3205.3-3 Escalating rental rates.

To encourage the orderly and timely development of geothermal leases, all

leases issued pursuant to the regulations in this Group will provide that, beginning with the sixth year and for each year thereafter until the lease year beginning on or after the commencement of production of geothermal resources in commercial quantities, the rental will be set by the authorized officer as the amount of rental for the preceding year plus an additional rental of \$1 per acre, or fraction thereof, but the authorized officer may, upon a showing of sufficient justification by the lessee, waive the payment of all or any portion of the additional rental.

§ 3205.3-4 Fractional interests.

Rentals, minimum royalties, and royalties payable for lands in which the United States owns an undivided fractional interest shall be in the same proportion to the rentals, minimum royalties, and royalties provided for in § 3205.3, as the undivided fractional interest of the United States in the geothermal resources is to the full geothermal resources interest.

§ 3205.3-5 Royalty on production.

Royalty shall be paid at the following rates on geothermal resources:

(a) A rate, as set forth in the lease, of not less than 10 per centum and not more than 15 per centum of the amount or value of steam, or any other form of heat or energy derived from production under the lease and sold or utilized by the lessee or reasonably susceptible to sale or utilization by the lessee; (b) a rate as set forth in the lease, of not more than 5 per centum of any byproduct derived from production under the lease and sold or utilized or reasonably susceptible of sale or utilization by the lessee, except that as to any byproduct which is a mineral named in section 1 of the Mineral Leasing Act of February 25, 1920, as amended (30 U.S.C. 181), the rate of royalty for such mineral shall be the same as that provided in that Act and the maximum rate of royalty for such mineral shall not exceed the maximum royalty applicable under that Act; (c) in no event shall the royalty on any producing lease for any lease year, commencing with the lease year beginning on or after the commencement of production in commercial quantities, be less than \$2 per acre or fraction thereof, and this minimum royalty, in lieu of rental, shall be payable at the expiration of each lease year.

§ 3205.3-6 Royalty on commercially demineralized water.

All geothermal leases issued pursuant to the provisions of this group shall provide for the payment to the lessor of a royalty on commercially demineralized water at a rate to be specified in the lease of not more than 5 per centum of the value of such commercially demineralized water that has been sold or utilized by the lessee or is reasonably susceptible of sale or utilization by the lessee, except that no payment of a royalty will be required on such water if it

is used in plant operation for cooling or in the generation of electric energy or otherwise.

§ 3205.3-7 Waiver, suspension or reduction of rental or royalty.

(a) The authorized officer may waive, suspend, or reduce the rental or royalty for any lease or portion thereof in the interests of conservation and to encourage the greatest ultimate recovery of geothermal resources if he determines that this is necessary to promote development or that the lease cannot be successfully operated under the lease terms. No waiver, suspension or reduction of rental or royalty will be granted where the only reason for the request for such relief is the unavailability of power generating facilities to utilize the geothermal steam.

(b) An application hereunder shall be filed in triplicate with the Supervisor, and must: (1) Contain the serial number of the leases and the names of the lessee and operator; (2) show the number, location, and status of each well that has been drilled, a tabulated statement for each month covering a period of not less than 6 months prior to the date of filing the application of the aggregate amount of production subject to royalty computed in accordance with the operating regulations, the number of wells counted as producing each month, and the average production per well per day; (3) contain a detailed statement of expenses and costs of operating the lease, the income from the sale of any leased products and all facts tending to show whether the wells can be successfully operated using the royalty or rental fixed in the lease; and (4) where the application is for a reduction in royalty, furnish full information as to whether royalties or payments out of production are paid to others than to the United States, the amounts so paid, and the efforts made to reduce them. The applicant must also file agreements of the holders to a comparable reduction of all other royalties from the leasehold to an aggregate not in excess of one-half the Government royalties.

§ 3205.3-8 Application for and effect of suspension of operations and production.

(a) Applications by lessees for suspensions of operations or production, or both, under a producing geothermal lease (or for relief from any drilling or producing requirements of such a lease) shall be filed in triplicate with the Supervisor, who is authorized to act on applications filed pursuant to this section and to terminate suspensions which have been or may be granted. Complete information must be furnished showing the necessity of the relief sought.

(b) A suspension shall take effect as of the time specified in the order of the Supervisor. Rental or minimum royalty payments will be suspended during any period of suspension of all operations and production directed, or assented to, by the Supervisor, beginning with the first day of the lease month in which the

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suspension of operations and production becomes effective or, if the suspension of operations and production becomes effective on any date other than the first day of a lease month, beginning with the first day of the lease month following such effective date. The suspension of rental or minimum royalty payments shall end on the first day of the lease month in which operations or production is resumed. Where rentals are creditable against royalties and have been paid in advance, proper credit will be allowed on the next rental or royalty due under the lease.

(c) No lease shall be deemed to expire by reason of a suspension of either operations or production, pursuant to any order or assent of the Supervisor.

(d) If there is a well on the leased premises capable of producing geothermal resources and all operations and production are suspended pursuant to any order of the Supervisor, approval of recommencement of drilling operations will terminate the suspension as to operations but not as to production, and will terminate both the period of suspension of rental and minimum royalty payments provided in paragraph (b) of this section and the period of suspension for which an equivalent extension will be granted. However, as provided in paragraph (c) of this section, the lease will not be deemed to expire so long as the suspension of operations or production remains in effect.

(e) The relief authorized under this section may also be obtained for any leases included within an approved unit or cooperative plan of development and operation.

(f) See 30 CFR 270.17 for regulations concerning action of the Supervisor on applications filed pursuant to this section.

§ 3205.3-9 Readjustments.

The rentals and royalties of any geothermal lease may be readjusted at not less than 20-year intervals beginning 35 years after the date geothermal steam is produced as determined by the Supervisor. In the event of any such readjustment neither the rental nor royalty paid during the preceding period shall be increased by more than 50 per centum, and in no event shall the royalty payable exceed 22½ per centum. Each geothermal lease shall provide for such readjustment. The Supervisor will give notice of any proposed readjustment of rental or royalties. Unless the lessee relinquishes the lease within 30 days after receipt of such notice, he shall conclusively be deemed to have agreed to such terms and conditions. If the lessee files a protest, and no agreement can be reached between the authorized officer and the lessee within a period of 60 days, the lease may be terminated by either party, subject to the provisions of § 3000.4 of this chapter. If the lessee files a protest to the proposed readjusted terms and conditions, the existing terms and conditions will remain in effect until there has been an agreement between the au-

thorized officer and the lessee on the new terms and conditions to be applied to the lease or until the lease is terminated, except payments of any proposed readjusted rentals and royalties must be paid in the timely manner prescribed in these regulations and may be paid under protest. The readjusted terms and conditions will be effective as of the end of the term being adjusted.

§ 3205.4 Rental and minimum royalty liability of lands committed to cooperative or unit plans.

§ 3205.4-1 Prior to production.

All lands within any lease committed to an approved cooperative or unit plan shall at all times prior to production on any of the lands so committed remain subject to rental in accordance with § 3205.3.

§ 3205.4-2 After production.

As soon as production is obtained on or for any lands included in an approved cooperative or unit plan those lands which are included within the participating area of the producing well shall become liable for royalties in accordance with Subpart 3205. All other unutilized lands, shall remain subject to rental in accordance with § 3205.3.

Subpart 3206—Lease Bonds

§ 3206.1 Types of bonds and filing.

§ 3206.1-1 Types of bonds.

(a) Bonds shall be either corporate surety bonds or personal bonds except that bonds with individual sureties may be furnished for the protection of the entryman or owner of the surface rights.

(b) Lease compliance bond. The applicant for a noncompetitive lease or the successful bidder for a competitive lease must furnish, prior to the issuance of the lease, and thereafter maintain a bond of not less than \$10,000 conditioned on compliance with all the terms of the lease.

(c) Protection bond. A lessee will be required, prior to entry on the leased lands, to furnish and maintain a bond of not less than \$5,000 for indemnification for all damages occasioned to persons or property as the result of lease operations.

§ 3206.1-2 Filing of bonds.

A single original copy of the bond on forms approved by the Director must be filed in the proper BLM office. Bonds may be filed with a noncompetitive lease application to expedite action thereon, or within 30 days after receipt of notice by the applicant of the bond requirement, or as required and directed by the authorized officer. For unit bond forms see 30 CFR Part 271.

§ 3206.2 Termination of period of liability.

The period of liability of any bond will not be terminated until all lease terms and conditions have been fulfilled.

§ 3206.3 Operator's bond.

§ 3206.3-1 Compliance.

An operator, or, if there are more than one for different portions of the lease, each operator may furnish a general lease bond of not less than \$10,000 in his own name as principal on the bond in lieu of the lessee. Where there is more than operator's bond affecting a single lease, each such bond must be conditioned upon compliance with all lease terms for the entire leasehold.

§ 3206.3-2 Approval.

An operator's bond will not be accepted unless the operator holds an operating agreement which has been approved by the Department or has pending an operating agreement in proper condition for approval. The mere designation as operator will not suffice.

§ 3206.3-3 Default.

Where a bond is furnished by an operator, suit may be brought thereon without joining the lessee if he is not a party to the bond.

§ 3206.4 Personal bond or corporate bond.

§ 3206.4-1 Amount.

In lieu of a surety bond, a personal bond in a like amount may be given by the obligor with the deposit as security thereof of negotiable bonds of the United States of a par value equal to the amount specified in the bond.

§ 3206.4-2 Deposit of securities.

Personal bonds must be accompanied by a deposit of negotiable Federal securities in a sum equal at their par value to the amount of the bond and by a proper conveyance to the Secretary of full authority to sell such securities in case of default in the performance of the conditions of the lease bond.

§ 3206.4-3 Qualified corporate sureties.

Treasury lists. A list of companies holding certificates of authority from the Secretary of the Treasury under the Act of July 30, 1947 (6 U.S.C. 6-13), as acceptable sureties on Federal bonds is published in the FEDERAL REGISTER annually.

§ 3206.5 Nationwide bond.

In lieu of bonds required under any of the preceding paragraphs, the holder of leases or of operating agreements approved by the Department or holder of operating rights by virtue of being designated operator or agent by the lessee pending departmental approval of operating agreements may furnish a bond the amount of which must be not less than \$150,000 for full nationwide coverage for all geothermal leases.

§ 3206.6 Statewide bond.

In lieu of any of the bonds required by the preceding paragraphs, the holder of leases or of operating agreements approved by the Department or holder of operating rights by virtue of being designated operator or agent by the lessee

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pending Departmental approval of operating agreements, may furnish a statewide bond, applicable to the State in which the leases are situated, the amount of which must be not less than \$50,000.

§ 3206.7 Default.

§ 3206.7-1 Payment by surety.

Where upon a default the surety makes payment to the Government of any indebtedness due under a lease, the face amount of the surety bond and the surety's liability thereunder shall be reduced by the amount of such payment.

§ 3206.7-2 Penalty.

Thereafter, upon penalty of cancellation of all of the leases covered by that bond, the principal shall post a new nationwide bond in the amount of \$150,000 or a new statewide bond in the amount of \$50,000 as the case may be, within 6 months after notice, or within such shorter period as the authorized officer may fix. However, in lieu thereof, the principal may within that time file separate bonds for each lease.

§ 3206.8 Applicability of provisions to existing bonds.

The provisions of these regulations may be made applicable to any oil and gas nationwide or statewide bond in force at the effective date of these regulations by filing in the proper BLM office a written consent to that effect and an agreement to be bound by the provisions hereof executed by the principal and the surety. Upon receipt thereof the bond will be deemed to be subject to the provisions of these regulations.

Subpart 3207—[Reserved]

Subpart 3208—[Reserved]

Subpart 3209—Geothermal Resources Exploration Operations

§ 3209.0-1 Purposes.

(a) The regulations in this Subpart establish procedures to be followed in conducting exploration operations on the public land for geothermal resources. The regulations in this subpart are not applicable to exploration operations conducted pursuant to a geothermal resources lease.

(b) The rights obtained under this subpart do not include an exclusive right to prospect for geothermal resources on the land described in a Notice of Intent or any preference right to a geothermal resources lease.

§ 3209.0-2 Objectives.

The regulations in this Subpart encourage exploration of the public lands for geothermal resources in a manner that is consistent with the management policy set forth in § 1725.3 of this chapter. No exploration operations will be allowed if the authorized officer determines that such operations would be inconsistent with that policy. The authorized officer may suspend or terminate exploration operations upon due notice to the operator at any time if he determines that there is non-compliance with the

terms and conditions of the Notice of Intent.

§ 3209.0-5 Definitions.

As used in this subpart:

(a) "Exploration operations" means any activity relating to the search for evidence of geothermal resources which requires physical presence upon public lands and which may result in damage to public lands or resources thereon. It includes, but is not limited to, geophysical operations, drilling of shallow temperature gradient wells, construction of roads and trails, and cross-country transit by vehicle over public lands. It does not include the casual use of public lands for geothermal resources exploration. It does not include core drilling for subsurface geologic information, except drilling of shallow temperature gradient wells, or drilling for geothermal resources; these activities will be authorized only by the issuance of a geothermal resources lease. The regulations in this Subpart, however, are not intended to prevent drilling operations necessary for placing explosive charges for seismic exploration, nor do they affect the exclusive right of a lessee to drill for geothermal resources upon the land subject to his lease.

(b) "Notice of Intent" means a "Notice of Intent and Permit to Conduct Exploration Operations (Geothermal Resources)."

(c) "Public lands" means lands owned by the United States and administered by the Bureau of Land Management. It does not include a retained mineral interest in lands, title to which has passed from the United States.

(d) "Casual use" means activities that involve practices which do not ordinarily lead to any appreciable disturbance or damage to lands, resources, and improvements. For example, activities which do not involve use of heavy equipment or explosives and which do not involve vehicle movement except over established roads and trails are "casual use."

§ 3209.1 Notice of intent and permit to conduct exploration operations (Geothermal Resources).

§ 3209.1-1 Application.

(a) *Forms and where filed.* Any persons desiring to conduct exploration operations under the regulations of this subpart shall, prior to entry upon the lands, file for approval with the authorized officer for the district in which the public lands are located a Notice of Intent on a form approved by the Director.

(b) *Requirements.* The Notice of Intent will contain the following:

(1) The name and address, including zip code, both of the person, association, or corporation for whom the operations will be conducted and of the person who will be in charge of the actual exploration activities;

(2) a statement that the signers agree that exploration operations will be conducted pursuant to the terms and conditions listed on the approved form;

(3) a brief description of the type of operations which will be undertaken;

(4) a description of the lands to be explored by township;

(5) a map or maps, available from state or Federal sources, showing the lands to be entered or disturbed by the proposed exploration operations; and

(6) the approximate dates of the commencement and termination of exploration operations.

§ 3209.1-2 Review of Notice of Intent.

The authorized officer will either approve or disapprove a Notice of Intent as promptly as practicable, but in any event within 30 calendar days after the date of the filing of the Notice of Intent. If the authorized officer shall disapprove a Notice of Intent, he shall explain in writing to the applicant the reasons for disapproval.

§ 3209.2 Exploration operations.

No exploration operations will be conducted on public lands except pursuant to the terms of a Notice of Intent which has been approved by the authorized officer.

§ 3209.3 Completion of operations.

Upon completion of the exploratory operations, there shall be filed with the authorized officer a "Notice of Completion of Exploration Operations." Within 90 days after the filing of such "Notice of Completion," the authorized officer shall notify the party who had conducted compliance with all of the terms and conditions set out by the regulations in this Subpart and in the Notice of Intent, or whether any additional measures must be taken to rectify any damage to the land, specifying the nature and extent thereof.

§ 3209.4 Bond requirement.

§ 3209.4-1 General.

(a) Simultaneously with the filing of the Notice of Intent, and before the entry is made on the land, the party or parties filing the Notice of Intent must file with the authorized officer a surety company bond for each exploration operation in the amount of not less than \$5,000, conditioned upon the full and faithful compliance with all of the terms and conditions of the regulations in this Subpart and of that Notice of Intent.

(b) A party will be excused from compliance with the requirements of paragraph (a) of this section if he possesses either a nationwide bond in the amount of not less than \$50,000 covering all exploration operations or a statewide bond in the amount of not less than \$25,000 covering all exploration operations in the State in which the lands on which he has filed the Notice of Intent are situated.

§ 3209.4-2 Riders to existing bond forms.

Holders of nationwide and statewide oil and gas exploration bonds shall be permitted, in lieu of furnishing additional bonds, to amend their bonds to include geothermal resources exploration operations.

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§ 3209.4-3 Termination of period of liability.

The authorized officer will not give his consent to the cancellation of the bond if an individual bond was submitted or to the termination of the period of liability if a State or nationwide bond was submitted, unless and until there has been compliance with all of the terms and conditions of the Notice of Intent. Should the authorized officer fail to notify the party within 90 days from the filing of "Notice of Completion" that all terms and conditions have been complied with or that additional corrective measures must be taken to rehabilitate the land, the period of liability under an individual bond or the period of liability for a particular exploration operation under a State or nationwide bond shall automatically terminate on the 91st day.

PART 3210—NONCOMPETITIVE LEASES

Subpart 3210—Noncompetitive Leases; General Sec.

- 3210.1 Availability of land.
- 3210.2-1 Application.
- 3210.2-2 Submission of applications.
- 3210.2-3 Withdrawal of application.
- 3210.2-4 Amendment to lease.
- 3210.3 Determination of priorities.
- 3210.4 Rejections.

Subpart 3211—Bureau Motion, Lands Previously Leased for Geothermal Resources

- 3211.1 Releasing of formerly leased lands.
- 3211.2 Applications during simultaneous filing periods.
- 3211.3 Insurance of leases for unit on posted list.

Subpart 3210—Noncompetitive Leases; General

§ 3210.1 Availability of land.

(a) Applications to lease, except for those filed pursuant to Part 3230, of this chapter, filed prior to the effective date of these regulations are unacceptable and will be returned summarily without earning any priority.

(b) Lands and deposits subject to disposition under this part which are not within any KGRA will be available for leasing after the effective date of these regulations. Lands which are available for noncompetitive leasing and which were included in cancelled, relinquished, expired, or terminated leases shall be available for leasing only subject to the provisions of Subpart 3211 of this chapter. All other lands available for noncompetitive leasing will be available for leasing only subject to the provisions of this Subpart. All applications to lease the same lands which are filed between the effective date of these regulations and 30 days following that time will be considered to have been filed simultaneously, and the respective priority of the various applications will be determined by a public drawing. In other respects the first 30 days after the effective date of these regulations shall be treated as an application filing period as provided in § 3210.2-2.

§ 3210.2-1 Application.

An application for a lease must be filed on a form approved by the Director in the proper BLM office in duplicate for public lands and in triplicate where acquired lands are involved. The application must be submitted in a sealed envelope marked "Application for lease pursuant to 43 CFR 3210". An application will be considered filed when it is received in the proper office during business hours. The application must include the following:

(a) The applicant's name and address;

(b) a statement of applicant's citizenship and qualifications;

(c) a complete and accurate description of the lands applied for, which must include all available lands, including reserved geothermal resources, within a surveyed or protracted section, or, if the lands are neither surveyed or protracted and are described by metes and bounds, all the lands which will be included in a section when the lands are surveyed or protracted;

(d) a proposed plan which shall include: (1) A map, or maps, available from State or Federal sources, showing the topography of the land applied for, on which the applicant shall show drainage patterns, present road and trail locations, present utility systems, proposed road and trail location, proposed well locations and potential surface disturbance, and (2) a narrative statement setting forth his proposed plan and methods for diligent exploration. Such plan shall provide for a program of diligent exploration as defined in § 3203.5 of this chapter.

The narrative statement shall also describe the measures proposed to be taken to prevent or control fire, soil erosion, pollution of surface and ground water, damage to fish and wildlife or other natural resources, air and noise pollution and hazards to public health and safety during lease activities. However, the proposed plan required by this paragraph need not be submitted with the application during the initial 30-day simultaneous filing period provided by § 3210.1(b) or during any application filing period pursuant to § 3210.2-2, but must be filed prior to the issuance of the lease, upon notice from the authorized officer; and

(e) a statement that the applicant does not hold, own, or control any interest, direct or indirect, in other Federal geothermal leases in the same State in excess of 20,480 acres.

§ 3210.2-2 Submission of applications.

Except for applications filed during the first 30 days after the effective date of these regulations, applications for leases pursuant to this subpart shall be submitted only during application filing periods. An application filing period shall begin on the first working day of each calendar month and shall end at the close of business on the last working day of that month. The first application filing period shall begin on the first working

day of the month following the conclusion of the initial 30 day filing period provided in § 3210.1(b). No applicant shall file during the same application filing period a second application which overlaps any of the land covered by his first application. When an application is filed with the authorized officer, the date of filing shall be stamped on the envelope. The envelope containing the application shall remain sealed until the end of the application filing period during which the application is filed. On the first working day following the end of the application filing period all applications shall be opened, and it will be determined which applications are for lands included in a KGRA. In determining whether land included in an application is a KGRA because of competitive interest, no application submitted during any subsequent application filing period will be considered. Applications for land determined to be KGRA will be rejected. All other applications will be assigned priority according to the date of filing. If any application covers both land within a KGRA and land outside a KGRA, the applicant will be granted the opportunity to amend his application to exclude the portion included in a KGRA, and his amended application will be assigned priority according to the date of filing of his original application, but must comply with all other requirements of these regulations.

§ 3210.2-3 Withdrawal of application

An application may not be withdrawn, either in whole or in part, unless the request is received by the proper BLM office before the lease or an amendment of the lease, whichever covers the land described in the withdrawal, has been signed on behalf of the United States even though the effective date of the lease is subsequent to the date of filing of the withdrawal, except where a separate conflicting lease has been signed on behalf of the United States covering the land described in the withdrawal.

§ 3210.2-4 Amendment to lease.

If any of the land applied for was open to filing when the application was filed but is omitted from the lease for any reason and thereafter becomes available for noncompetitive leasing, the original lease will be amended to include the omitted land unless, before the issuance of the amendment, the proper BLM office receives a withdrawal of the lessee's application with respect to such land or such omitted lands have been determined to be within a KGRA. The lease term for the land added by such an amendment shall be the same as if the land had been included in the original lease when it was issued.

§ 3210.3 Determination of priorities.

(a) No lease shall be issued before final action has been taken on (1) any prior application to lease the land, (2) any subsequent application to lease the land that is based upon a claimed preferential

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right, and (3) any petition for the renewal or reinstatement of an existing or former lease on the land.

(b) Where a lease is issued before final action has been taken on such applications and petitions, it shall be canceled, and the advance rental returned, after due notice to the lessee, where the applicant or petitioner is found to be qualified and entitled to receive a lease of the land.

(c) Applications for lease received in the mail or delivered on the same day will be deemed to have been simultaneously filed, and the right of priority and the order of processing will be determined by a public drawing.

(d) Prior to the issuance of any lease, a determination shall be made as to whether or not the lands are within a KGRA. Applications for lands determined to be within any KGRA will be rejected.

§ 3210.4 Rejections.

If, after the filing of an application for a noncompetitive lease and before the issuance of a lease, or amendment thereto, pursuant to that application, the land embraced in the application becomes included within a KGRA, the application will be rejected as to such KGRA lands. The authorized officer retains discretion to reject an application for a noncompetitive lease even though the tract for which application is made is not determined to be within a KGRA.

Subpart 3211—Bureau Motion—Land Previously Leased for Geothermal Resources

§ 3211.1 Releasing of formerly leased lands.

Lands available for noncompetitive leasing in canceled or relinquished leases or in leases which expire by operation of law at the end of their primary or extended terms or in leases which terminate by operation of law for nonpayment of rental pursuant to 30 U.S.C. sec. 1004, shall be subject to further leasing only in accordance with the provisions of this section. From time to time the authorized officer will publish in the FEDERAL REGISTER, post in each proper BLM office, and provide appropriate news coverage of:

(a) A list of leasing units composed of lands which are available for noncompetitive leasing and which were in canceled, expired, relinquished, or terminated leases.

(b) An announcement that applications for leases on such lands will be received after a specific hour and date and that any applications filed during a specified simultaneous filing period beginning at that time will be regarded as simultaneously filed;

(c) The address of the proper BLM office where applications must be filed and where the terms and conditions under which the lease will be issued are available; and

(d) Requirements for a complete application, indicating that the proposed plan of operation, as required by § 3210.-

2-1(d) of this chapter, will not be required until there has been a drawing and a consequent determination of priority, but must be filed prior to the issuance of the lease, upon notice from the authorized officer.

§ 3211.2 Applications during simultaneous filing periods.

(a) An application shall conform to the requirements of § 3210.2-1 of this chapter, except as provided below.

(b) Only one complete leasing unit, identified by unit number, may be included in an application. Lands not on the published list may not be included in the application.

(c) An applicant is permitted to file only one application for each numbered unit on the posted list. Submission of more than one application by or on behalf of the applicant for any unit on the posted list will result in the disqualification of all applications submitted by that applicant for the drawing to be held for that particular unit.

(d) The application must be accompanied by a signed statement that the applicant will furnish the information required by these regulations within 15 days after notification that his application is the only one for the tract, or that he is the successful drawee.

(e) Each application filed during a simultaneous filing period must be submitted in a sealed envelope marked "Application for a lease pursuant to 43 CFR subpart 3211". The envelope will remain sealed until the end of the 30-day simultaneous filing period, at which time the application will be time-stamped simultaneously and serialized. A public drawing of all applications received during the simultaneous 30-day period will be held to determine respective priorities and order of processing.

(f) Applications filed during a simultaneous filing period are subject to the classification criteria established in § 3200.0-5(k) of this chapter, and will be considered as all filed the same day.

(g) The requirements of § 3210.2-1(d) of this chapter requiring a proposed plan of operation need not be satisfied for a complete application during the 30-day simultaneous filing period or during any future designated simultaneous filing period. Such plan must be filed by the successful drawee prior to the issuance of the lease, upon notice from the authorized officer.

(h) Each application must be accompanied by the service charge of \$50. The first year's advance rental need not be submitted with the application. A lease may be issued to the first drawee qualified to receive a lease upon payment of the first year's rental. Rental must be received in the proper BLM office within fifteen days from the date of receipt of notice that such rental is due. The drawee failing to submit the rental payment within the time allowed will be automatically disqualified to receive the lease, and consideration will be given to the application of the drawee having the next highest priority in the drawing.

§ 3211.3 Issuance of leases for units on posted list.

(a) If more than one application is received during the simultaneous filing period for the same unit on the list posted pursuant to § 3211.1(a), all applications on that unit filed during that period will be considered simultaneously filed. Priority of filing for such units will be determined by a public drawing. Three applications will be drawn for each unit, and the order in which they are drawn will fix the order in which the successful drawee will be determined. Where less than three applications have been filed, all applications will be drawn to determine priority.

If the lands are determined not to be within any KGRA, a lease may be issued to the successful drawee upon his compliance with all applicable regulations, including those in Subpart 3210 of this chapter.

(b) If only one application is filed during the simultaneous filing period on a unit on the list posted pursuant to § 3211.1(a), a lease on that unit, if the land is not included within any KGRA, may be issued to the applicant, upon his compliance with all applicable regulations, including those in Subpart 3210 of this chapter.

(c) If no application is filed on a unit on the list posted pursuant to § 3211.1(a) within the prescribed simultaneous filing period, the land in that unit, if not within a KGRA, will become available for leasing in accordance with Subpart 3210 of this chapter.

PART 3220—COMPETITIVE LEASES

Subpart 3220—Competitive Leases; General

Sec.

- 3220.1 General.
- 3220.2 Nominations.
- 3220.3 Publication of notice of lease sale.
- 3220.4 Contents of notice of lease sale.
- 3220.5 Bidding requirements.
- 3220.6 Award of lease.

Subpart 3220—Competitive Leases; General

§ 3220.1 General.

(a) Lands within a KGRA, except as provided under § 3201.1 of this chapter, will be available for leasing on the effective date of these regulations.

(b) The authorized officer will accept nominations to lease, or may on his own motion from time to time call for nominations to lease. Nominations may be withdrawn at any time.

§ 3220.2 Nominations.

(a) Nominations will be submitted on a card approved by the Director.

(b) A nomination must be filed in the proper BLM office in duplicate for public lands and triplicate where acquired lands are involved and must include the following:

- (1) The nominator's name and address;
- (2) A statement of citizenship and qualifications for lease;
- (3) A description of the lands; and

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(4) A statement of the interests, direct or indirect, held in other Federal geothermal leases in the same State.

§ 3220.3 Publication of notice of lease sale.

Where the Secretary determines to offer lands for competitive leasing he will publish a notice of lease sale in a newspaper of general circulation in the area in which the lands to be leased are located once a week for 4 consecutive weeks, or for such other period as he may direct.

§ 3220.4 Contents of notice of lease sale.

The notice will specify the time and place of sale, the manner in which bids may be submitted, the description of the lands, and the terms and conditions of the sale, including royalty and rental rates.

The notice will indicate the proper BLM office where the terms and conditions under which the lease will be issued are available. The notice will also indicate that the proposed plan of operation, as required by § 3210.2-1(d) of this chapter, must be filed before a lease can be issued.

§ 3220.5 Bidding requirements.

(a) A separate identified sealed bid must be submitted for each lease unit. Each bidder must submit with his bid a certified or cashier's check, bank draft, money order or cash in the amount of one-half of the amount bid together with proof of qualifications as required by these regulations.

(b) All bidders are warned against violation of the provisions of Title 18 U.S.C. section 1860 prohibiting unlawful combination or intimidation of bidders.

§ 3220.6 Award of lease.

(a) All sealed bids shall be opened at the place, date, and hour specified in the notice. No bids will be accepted or rejected at that time.

(b) Leases will be awarded to the highest responsible qualified bidder, except as required under Part 3230 of this chapter.

(c) The right to reject any and all bids is reserved. If the authorized officer fails to accept the highest bid for a lease within 30 days after the date on which the bids are opened (or such longer period as may be needed to comply with § 3230.1-6 of this chapter), all bids for that lease will be considered rejected. Deposits on rejected bids will be returned.

(d) If the lease is awarded, three copies of the lease will be sent to the successful bidder who shall be required to execute them within 30 days from receipt thereof, to pay the first year's rental, the balance of the bonus bid, file the required bond or bonds, and submit the proposed plan of operation as required by § 3210.2-1(d) of this chapter. When the three copies of the lease are executed by the successful bidder and returned to the authorized officer, the lease will be executed by the authorized officer and a copy will be mailed to the lessee.

(e) If the successful bidder fails to execute the lease or otherwise comply with the applicable regulations, his deposit will be forfeited and disposed of as provided in section 20 of the Act. In this event the lands will be reoffered when it is determined, in the opinion of the Secretary, that sufficient interest exists to justify a competitive lease sale.

PART 3230—RIGHTS TO CONVERSION TO GEOTHERMAL LEASES OR APPLICATION FOR GEOTHERMAL LEASES

Subpart 3230—Rights to Conversion to Geothermal Leases or Application for Geothermal Leases; General

Sec.	
3230.1	General.
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Subpart 3230—Rights to Conversion to Geothermal Leases or Application for Geothermal Leases

§ 3230.1 General.

§ 3230.1-1 Rights to conversion to geothermal leases.

Where lands were on September 7, 1965, subject to valid leases or permits issued under the Mineral Leasing Act of 1920, as amended and supplemented (30 U.S.C. 181-287), or the Mineral Leasing Act for Acquired Lands, as amended (30 U.S.C. 351-358), or subject to existing mining claims located on or prior to September 7, 1965, the lessees, permittees, or claimants, or their successors in interest, if qualified to hold geothermal leases, shall have the right, subject to certain limitations as hereinafter provided, to convert such leases, permits or claims to geothermal leases covering the same lands. Upon issuance of a geothermal lease based upon the exercise of conversion rights hereunder, such outstanding leases, permits, or mining claims shall be deemed to be terminated or relinquished, respectively.

§ 3230.1-2 Rights to conversion to applications for geothermal leases.

Where lands were subject to application for leases or permits under the mineral leasing laws referred to in

§ 3230.1-1 on September 7, 1965, the applicants may, subject to certain limitations as hereinafter provided, convert their applications to applications for geothermal leases having priorities dating from the time of filing such applications under said mineral leasing laws. Upon issuance of a geothermal lease based upon the exercise of conversion rights hereunder, such pending applications for leases or permits shall be deemed to be withdrawn.

§ 3230.1-3 Land in which minerals are reserved to the United States.

Where a right to one of the forms of conversion referred to in § 3230.1-1 or § 3230.1-2 is claimed as to lands the surface of which has passed from Federal ownership but in which the minerals have been reserved to the United States, final action on any claim to conversion rights under section 4 of the Act shall be held in abeyance until such time as the question of title to the geothermal resources in such lands has been resolved pursuant to the provisions of section 21(b) of the Act, unless the Secretary determines that it is in the public interest to make a determination of such claims at an earlier time, subject to the rights, if any, of surface owners.

§ 3230.1-4 Conflicting claims of rights to conversion to geothermal leases, or to applications for geothermal leases.

(a) Where there are conflicting claims of rights to conversion to geothermal leases based upon mineral leases, mineral permits, or mining claims embracing the same land, the date of issuance of the permit or lease or of recordation of the claim shall determine priority.

(b) Where there are rights to conversion to applications for geothermal leases based on applications for mineral leases or permits in conflict with rights to conversion to geothermal leases based upon mining claims embracing the same lands, the mining claim right to convert to a geothermal lease shall have priority. If the applicant for a geothermal lease based upon a mining claim fails to qualify for any reason, the application for an application for a geothermal lease is entitled to priority based on the date of filing the application for a mineral lease or permit.

§ 3230.1-5 Evidence required to qualify for grant of rights to conversion to geothermal leases, or to applications for geothermal leases.

(a) Any person claiming rights to conversion to a geothermal lease must show to the reasonable satisfaction of the authorized officer that substantial expenditures for the exploration, development or production of geothermal steam, but not associated geothermal resources, were made by the applicant who is seeking the conversion on the lands for which a lease is sought or on adjoining, adjacent or nearby lands, including both Federal and non-Federal lands. The substantial expenditures must have been

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made prior to December 24, 1970, and either by the applicant seeking conversion or by his predecessors in interest.

(b) For purposes of these regulations, an application for a lease or a permit, filed pursuant to applicable mineral leasing acts, pending on September 7, 1965, which subsequently ripened into a lease or permit, and which remains outstanding or has either terminated, expired or been canceled or relinquished, retains the right to conversion to an application for a geothermal lease. Applications for a lease or permit, filed pursuant to applicable mineral leasing acts, pending on September 7, 1965, which were subsequently withdrawn, retain the right to conversion to an application for a geothermal lease. Leases or permits issued pursuant to the applicable mineral leasing acts and outstanding on September 7, 1965, which were subsequently terminated, expired, or were canceled or relinquished, retain the right to conversion to a geothermal lease.

§ 3230.1-6 Method of leasing to owners of conversion rights to geothermal leases, or to applications for geothermal leases.

(a) *Lands included within any KGRA*—(1) *Competitive lease.* Where lands have been included within any KGRA prior to the issuance of a lease, the owner of a conversion right to a geothermal lease for such lands shall be entitled to the issuance of a competitive lease only in accordance with the provisions of subparagraph (2) of this paragraph. If the lands subject to a conversion right to a geothermal lease are in part within a KGRA and in part outside a KGRA, the holder of that conversion right shall have the right to divide his conversion right into two separate conversion rights so that he may receive a geothermal lease to the lands within the KGRA only subject to subparagraph (2) of this paragraph and a geothermal lease to the lands not within a KGRA subject to paragraph (b) of this section.

(2) *Preference right.* (i) Lands which have been included within any KGRA shall be leased only by competitive bidding in the manner prescribed in Subpart 3220 of this chapter, except that, in addition, the name and address of the applicant for any conversion right to a geothermal lease will be set forth in the lease sale notice.

(ii) The person owning the right to conversion to a geothermal lease shall be informed by written notice of the highest bona fide bid submitted for the lease at the sale. If within thirty (30) days after he has received that written notice, the person owning the right to conversion to a geothermal lease shall inform the authorized officer that he wishes such a lease, pay an amount equal to the highest bona fide bid submitted, pay the rental for the first year, file the required bond or bonds, and submit the data required by § 3210.2-1(d) and (e) of this chapter, a lease will be issued to him.

(iii) Failure of the owner of the right to conversion to a geothermal lease to

inform the authorized officer timely will constitute a forfeiture of his conversion rights without further notice to him. In this event, the lease will be offered to the highest bona fide bidder, if otherwise qualified.

(iv) Where no bids are received, the person owning the right to conversion to a geothermal lease will not be awarded the lease. Failure of the owner of the right to conversion to submit a bona fide bid or to meet the high bid for the tract offered at the sale will constitute a forfeiture of his conversion right without further notice.

(b) *Lands not included within any KGRA—Noncompetitive lease.* Where lands have not been included within any KGRA prior to the issuance of a lease, the owner of a conversion right to a geothermal lease for such lands, if otherwise qualified, shall be entitled to the issuance of a noncompetitive lease for such lands.

(c) *Lands included within a KGRA*—

(1) *Application for a lease.* Where lands have been included within a KGRA prior to the issuance of a lease, the owner of a conversion right to an application for a geothermal lease to those lands shall be entitled to receive a competitive geothermal lease only in accordance with the provisions of Subpart 3220 of this chapter. If the lands subject to a conversion right to a geothermal application are in part within a KGRA and in part outside a KGRA, the holder of that conversion right may amend his application to cover only the land outside the KGRA.

(2) *Preference right.* The owner of a conversion right to an application for a geothermal lease where the lands have been included within a KGRA shall receive no preference right to meet the highest bona fide bid.

(d) *Lands not included within any KGRA*—(1) *Application for a lease.* Where lands have not been included within a KGRA, the owner of a conversion right to an application for a geothermal lease, if otherwise qualified, shall be entitled to convert his right into an application for a non-competitive lease.

(2) *Preference right.* The owner of a conversion right to an application for a geothermal lease where the lands have not been included within a KGRA, if otherwise qualified, shall be entitled to the issuance of a non-competitive geothermal lease for such lands in accordance with Subpart 3210 of this chapter.

§ 3230.1-7 Acreage limitation.

No person shall be permitted to obtain, through conversion of mineral leases or prospecting permits, or applications therefor, or mining claims, leases for more than 10,240 acres, or a lease to any land not included in the lease, permit, application or claim converted, except that any such geothermal lease issued may include some lands not embraced in the lease, permit, application or claim on which the conversion right is based, where a metes and bounds description was used to describe lands in issued leases or permits or in filed ap-

plications or mining claim locations. In such event, the metes and bounds description will be conformed by the authorized office to a legal subdivision, to the extent possible.

§ 3230.2 Qualifications.

Persons who believe they are qualified under the Act to convert mineral leases or permits or existing mining claims to geothermal leases and persons who believe they are entitled to convert applications for mineral leases and permits to applications for geothermal leases shall comply with the procedures set forth below.

§ 3230.3 Applications.

§ 3230.3-1 Filing of application.

(a) A person seeking to convert a lease, permit, or application therefor, or a mining claim to a geothermal lease or application must have filed a written application on or before June 22, 1971. If such an application has been filed and does not contain the information specified in § 3230.3-2, such information must be supplied by the applicant within 60 days of the effective date of these regulations.

(b) Failure to have filed a conversion right application on or before June 22, 1971, will result in the loss of any such rights so claimed.

§ 3230.3-2 Statements required.

(a) An application based on a valid lease or permit referred to in section 3230.1-1 hereof shall include the date of issuance, the State in which the lands are located, and the serial number of the lease or permit. An application based on a mining claim referred to in § 3230.1-1 shall include the name, location, legal description or reference sufficient to identify the lands on the ground, date of location and date and place of recordation of the mining claim (including volume and page), which the applicant seeks to convert to a geothermal lease. An application based on an application for a mineral lease or permit referred to in § 3230.1-1 shall include the date the application for the lease or permit was filed with the Bureau of Land Management and the location of the proper BLM office where the application was filed, and should indicate the serial number assigned to the application.

(b) An application shall include a description of the lands sought to be included in a geothermal lease. If the lands have been surveyed under the public land rectangular survey system, each application shall describe the lands by legal subdivision, section, township, and range. If otherwise officially surveyed, the lands shall be described by the legal description, mining claim survey, or irregular tracts. If the lands have not been so surveyed, but protracted surveys for those lands have been approved and the effective date thereof published in the FEDERAL REGISTER, each application for lands shown on such protracted surveys, filed on or after such effective date, shall describe the lands according to the

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legal subdivision, section, township, and range shown on the approved protracted surveys. If the lands have not been so surveyed, or included within approved protracted surveys, or it is otherwise appropriate, each application shall describe the lands by metes and bounds, giving courses and distances between the successive angle points on the boundary of the tract, and connected by courses and distances to a monument or to a prominent topographic feature.

(c) An application shall be accompanied by a detailed statement showing: (1) The expenditure made for the exploration, development, or production of geothermal steam, but not associated geothermal resources, on lands for which a geothermal lease is sought or on adjoining, adjacent or nearby Federal or non-Federal lands and the date or dates such expenditures were made, (2) the names and current addresses of the persons who actually performed the aforesaid exploration, development, or production work, (3) the geological, geophysical, and engineering data acquired in such exploration, development, or production which demonstrates, or tends to demonstrate the expenditures claimed, (4) a map showing the location where the expenditures and improvements were made, (5) a proposed plan as required by § 3210.2-1(e) of this chapter, and (6) a statement that he will be bound by the terms and conditions of a lease, if issued. The applicant shall file such additional information with respect to the application as requested by the authorized officer.

§ 3230.4 Conversion to geothermal leases or to applications for geothermal leases.

§ 3230.4-1 Processing and adjudicating applications.

Application for conversion to geothermal leases or to applications for geothermal leases together with all information and data submitted or requested by the authorized officer pursuant to § 3230.3-2 and any other pertinent available information or data shall be reviewed by the authorized officer to determine whether the required showing has been made, and thereafter the authorized officer shall prepare a proposed determination which shall be submitted to the Secretary, who will make a determination that the applicant has or has not satisfactorily shown that he is entitled to receive the grant of a geothermal lease, or application for a geothermal lease.

PART 3240—RULES GOVERNING LEASES

Subpart 3240—Rules Governing Leases

Subpart 3241—Assignments and Transfers

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3241.1 Assignments, transfers, interests, qualifications.
3241.1-1 Record title assignments or transfers of leases or undivided lease interests.

- Sec.
3241.1-2 Qualifications.
3241.2 Requirements for filing of assignments or transfers.
3241.2-1 Place of filing and service charge.
3241.2-2 Number of copies required.
3241.2-3 Time of filing assignments, transfers of leases, or undivided lease interests.
3241.2-4 Forms and statements.
3241.2-5 Description of lands.
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- 3243.1 Cooperative or unit plans.
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Subpart 3241—Assignments and Transfers

§ 3241.1 Assignments, transfers, interests, qualifications.

§ 3241.1-1 Record title assignments or transfers of leases or undivided lease interests.

(a) The record title of leases may be assigned as to all or part of the leased acreage, except that no assignment will be approved where (1) either the assigned or retained portions created by the assignment would be less than 640 acres, unless the total acreage in the lease being partially assigned includes an irregular subdivision, as provided in § 3203.2 of this chapter in which case the assigned and retained portions may be less than 640 acres by an amount which is smaller than the amount by which the area would be more than 640 acres if the

irregular subdivision were added, or (2) an undivided interest is created by assignment of a lease containing less than 640 acres, or (3) where the lease being assigned contains 640 acres or more, an undivided interest of less than 10 percent would be created in the leased acreage. An exception to the minimum acreage provision of this section may be made by the Secretary where he finds such exception is necessary in the interest of conservation of the resources.

(b) A working interest or operating right may be assigned, in accordance with this section, *Provided* That the assigned interest or right, divided or undivided, vests in the holder only the right to explore, develop and produce geothermal resources from the leased lands to the extent of not less than the interest assigned.

(c) All requests for approval of any assignment will be reviewed, prior to approval, to adjust environmental terms and conditions where necessary.

§ 3241.1-2 Qualifications.

(a) No assignment will be approved (1) if the assignee or any other party in interest is not qualified to take and hold a lease; (2) if a required bond is not filed; or (3) if the statement of interest required under § 3202.2-1(a) of this chapter is not filed.

(b) An assignment to a minor other than an heir or devisee of a lessee will not be approved.

(c) The assignment must be accompanied by a signed statement by the assignee either (1) that he is the sole party in interest in the assignment, or (2) setting forth the names and qualifications of the other parties holding interests in the lease. Where the assignee is not the sole party in interest, separate statements must be signed by each of the parties setting forth the nature and extent of the interest of each party and the nature of the agreement between them.

(d) Where an attorney-in-fact or agent signs, on behalf of the assignor or assignee, the instrument of transfer or the application for approval, evidence of the authority of the attorney-in-fact or agent to sign such assignment or application must be furnished to the authorized officer.

(e) For the heir or devisee of the deceased holder of a lease, an operating agreement, or an overriding royalty interest in a producing lease, to be recognized by the authorized officer as the holder of that lease, agreement or interest, the appropriate showing required under the regulations in § 3202.2-6 of this chapter must be furnished to the authorized officer.

§ 3241.2 Requirements for filing of assignments or transfers.

§ 3241.2-1 Place of filing and service charge.

A request for approval of any assignment or other instrument of transfer of a lease or interest therein must be filed

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in the proper BLM office and accompanied by a nonrefundable service charge of \$50. An application request not accompanied by payment of such a service charge will not be accepted for filing.

§ 3241.2-2 Number of copies required.

Three copies of all instruments of assignment or transfer, and a single copy of any additional information required by § 3202.2 of this Chapter relating to citizenship or qualification of corporations and associations, including partnerships, must be filed in the proper BLM office.

§ 3241.2-3 Time of filing assignments, transfers of leases, or undivided lease interests.

(a) Any assignment or instrument of transfer of a lease or of an interest therein, including an assignment of working interests, operating agreements, and operating rights, must be filed in the proper BLM office for approval within 90 days from the date of execution of that instrument and must contain all of the terms and conditions agreed upon by the parties thereto, together with evidence and statements similar to that required of an applicant under these regulations in this group.

(b) A separate instrument of assignment must be filed in the proper BLM office for each geothermal lease involving transfers of record title. When transfers to the same person, association, including partnerships, or corporation involve more than one geothermal lease, one request for approval and one showing as to the qualifications of the assignee will be sufficient.

§ 3241.2-4 Forms and statements.

A form approved by the Director, or unofficial copies of that form in current use, must be used for transfers and requests for approval referred to in this section and must be filed in duplicate for public lands and in triplicate where acquired lands are involved. The approved form may be used for an assignment which affects a transfer of the record title to all or part of a geothermal lease, but it is not to be used for any other type of transfer. The application for assignment shall be deemed to be approved upon execution by the authorized officer.

§ 3241.2-5 Description of lands.

Each instrument of transfer must describe the lands involved in the same manner as described in the lease.

§ 3241.3 Bonds.

Where an assignment does not create separate leases, the assignee, if the assignment so provides, may become a joint principal on the bond with the assignor. Any assignment which does not convey the assignor's record title in all of the lands in the lease must also be accompanied by consent of his surety to remain bound under the bond of record as to the lease retained by said assignor, if the bond, by its terms, does

not contain such consent. If a party to the assignment has previously furnished a nationwide or statewide bond, no additional showing by such party is necessary as to the bond requirement.

§ 3241.4 Approval.

Upon approval, an assignment shall be effective as of the first day of the lease month following the date of filing of the assignment.

§ 3241.5 Continuing responsibility.

(a) The assignor and his surety will continue to be responsible for the performance of any obligation under the lease until the assignment is approved.

(b) Upon approval, the assignee and his surety shall be responsible for the performance of all lease obligations notwithstanding any terms in the assignment to the contrary.

§ 3241.6 Production payments.

If payments out of production are reserved, a statement must be submitted stating the details as to the amount, method of payment, and other pertinent items.

§ 3241.7 Overriding royalty interests.

§ 3241.7-1 General.

(a) Overriding royalty interests in geothermal leases constitute accountable acreage holdings under these regulations.

(b) If an overriding royalty interest is created which is not shown in the instrument of assignment or transfer, a statement must be filed in the proper BLM office describing the interest.

(c) Any such assignment will be deemed valid if accompanied by a statement over the assignee's signature that the assignee is a citizen of the United States, an association of such citizens, or a corporation organized under the laws of the United States or of one of the States or the District of Columbia, and that his interests in geothermal leases do not exceed the acreage limitations provided in these regulations.

(d) All assignments of overriding royalty interests must be filed for record in the proper BLM office within 90 days from the date of execution. Such interests will not receive formal approval.

§ 3241.7-2 Limitation of overriding royalties.

(a) Except as herein provided, an overriding royalty on the value of the output of all geothermal resources, or any of them, at the point of shipment to market may be created by assignment or otherwise: *Provided*, That, (1) the overriding royalty is not for less than one-fourth ($\frac{1}{4}$) of 1 percent of the value of such output, and does not exceed 50 percent of the rate of royalty due to the United States as specified in the geothermal lease, or as reduced pursuant to such lease, and (2) the overriding royalty, when added to overriding royalties previously created, does not exceed the maximum rate established herein.

(b) The creation of an overriding royalty interest that does not conform to

the requirements of paragraph (a) of this section shall be deemed a violation of the lease terms, unless the agreement creating overriding royalties provides (1) for a prorated reduction of all overriding royalties so that the aggregate rate of royalties does not exceed the maximum rate established in paragraph (a) of this section and (2) for the suspension of an overriding royalty during any period when the royalties due to the United States have been suspended pursuant to the terms of the geothermal lease.

§ 3241.8 Lease account status; requirements.

Unless the lease account is in good financial standing as to the area covered by an assignment at the time the assignment and bond are filed, or is placed in good standing before the assignment is reached for action, the request for approval of the assignment will be denied, and the lease shall be subject to termination in accordance with these regulations.

§ 3241.9 Effect of assignment.

An assignment of the record title of the complete interest in a portion of the lands in a lease shall segregate the assigned and retained portions into separate and distinct leases. An assignment of an undivided interest in the entire leasehold shall not segregate the lease into separate or distinct leases.

Subpart 3242—Production and Use of Byproducts

§ 3242.1 General.

Where the Supervisor determines that production, use, or conversion of geothermal steam under a geothermal lease is susceptible of producing a valuable by-product or byproducts, including commercially demineralized water contained in or derived from such geothermal steam for beneficial use in accordance with applicable State water laws, the authorized officer shall require substantial beneficial production or use thereof, except where he determines that:

(a) Beneficial production or use is not in the interest of conservation of natural resources;

(b) beneficial production or use would not be economically feasible; or

(c) beneficial production and use should not be required for other reasons satisfactory to him.

§ 3242.2 Production and use of commercially demineralized water as a by-product, production, and use of other sources of water.

§ 3242.2-1 General.

Except as provided in these regulations, or the lease, the lessee shall have the right to process fluids, including brine, condensate, and other fluids, which are associated with geothermal steam within lands subject to the geothermal lease for the purpose of developing, producing, and utilizing the commercially demineralized water recovered as a result of such processing.

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§ 3242.2-2 Prohibition on production of commercially demineralized water.

The lessee shall not be authorized to engage in the primary production of commercially demineralized water from the produced fluids contained in or derived from geothermal steam referred to in § 3242.2-1, where such use would result in the undue waste of geothermal energy.

§ 3242.2-3 Water wells on geothermal areas.

All leases issued under these regulations shall be subject to the condition that, where the lessee finds only potable water in any well drilled for production of geothermal resources, the Secretary may, when the water is of such quality and quantity as to be valuable and useable for agricultural, domestic, or other purpose, acquire the well with casing installed in the well at the fair market value of the casing.

§ 3242.2-4 State water laws.

Nothing in these regulations shall constitute an express or implied claim or denial on the part of the Federal Government as to its exemption from State water laws.

Subpart 3243—Cooperative Conservation Provisions

§ 3243.1 Cooperative or unit plans.

To conserve the natural resources of any geothermal pool, field or like area more properly, lessees and their representatives may unite with each other or jointly or separately with others, in collectively adopting and operating under a cooperative or unit plan of development or operation or any geothermal resource area, or any part thereof (whether or not any part of that geothermal resource area is then subject to any cooperative or unit plan of development or operation). Applications to unitize shall be filed with the Supervisor who shall certify whether such plan is necessary or advisable in the public interest. The procedure in obtaining approval of a cooperative or unit plan of development, the provisions for the supervision of the cooperative or unit plan, and a suggested text of an agreement, are contained in 30 CFR Part 271.

§ 3243.2 Acreage chargeability.

All leases committed to any unit or cooperative plan approved or prescribed by the Supervisor shall be excepted in determining holdings or control for purposes of acreage chargeability. For the extension of leases committed to a unit plan, see Subpart 3203 of this part.

§ 3243.3 Communitization or drilling agreements.

§ 3243.3-1 Approval.

(a) The Supervisor is authorized, when separate tracts under lease cannot be independently developed and operated in conformity with an established well-spacing or well-development program, to approve, or to require lessees to enter into, communitization or drilling

agreements providing for the apportionment of production or royalties among the separate tracts of land comprising the drilling or spacing unit for the lease, or any portion thereof, with other lands, whether or not owned by the United States, when in the public interest. Operations or production pursuant to such an agreement shall be deemed to be operations or production as to each lease committed thereto.

(b) Preliminary requests to communitize separate tracts shall be filed in triplicate with the Supervisor.

(c) Executed agreements shall be submitted to the Supervisor in sufficient number to permit retention of five copies after approval.

§ 3243.3-2 Requirements.

The agreement shall describe the separate tracts comprising the drilling or spacing unit, disclose the apportionment of the production or royalties to the several parties and the name of the operator, and shall contain adequate provisions for the protection of the interests of all parties, including the United States. The agreement must be signed by or in behalf of all interested necessary parties and will be effective only after approval by the Supervisor.

§ 3243.4 Operating, drilling, development contracts or a combination for joint operations.

§ 3243.4-1 Approval.

(a) The Secretary may on such conditions as he may prescribe, approve operating, drilling, or development contracts made by one or more geothermal lessees, with one or more persons, associations, including partnerships, or corporations whenever he shall determine that such contracts are required for the conservation of natural resources or in the best interest of the United States.

(b) Contracts submitted for approval under this section should be filed with the Supervisor together with enough copies to permit retention of five copies after approval.

(c) The authority of the Secretary to approve operating, drilling, or development contracts without regard to acreage limitations ordinarily will be exercised only to permit operators to enter into contracts with a number of lessees sufficient to justify operations on a large scale for the discovery, development, production, or transmission, transportation, or utilization of geothermal resources, and to finance the same.

§ 3243.4-2 Requirements.

(a) The contract must be accompanied by a statement showing all the interests held by the contractor in the area or field and the proposed or agreed plan of operation or development of the field. All the contracts held by the same contractor in the area or field should be submitted for approval at the same time, and full disclosure of the project made. Complete details must be furnished so the Secretary may have facts upon which to make a definite determination in accordance herewith and to prescribe

the conditions on which approval of the contracts shall be made.

(b) The application must show a reasonable need for the contract and that it will not result in any concentration of control over the production or sale of geothermal resources which would be inconsistent with the antimonopoly provisions of law.

§ 3243.4-3 Acreage chargeability.

All leases operated under approved operating, drilling or development contracts shall be excepted in determining holdings or control for purposes of acreage chargeability.

Subpart 3244—Terminations and Expirations

§ 3244.1 Relinquishments.

(a) A lease, or any legal subdivision of the area covered by such lease, may be relinquished by the record title holder by filing a written relinquishment in triplicate in the proper BLM office, provided the partial relinquishment does not reduce the remaining acreage in the lease to less than 640 acres, except where a departure is occasioned by an irregular subdivision in which case the remaining leased acreage may be less than 640 acres by an amount which is smaller than the amount by which the area would be more than 640 acres if the irregular subdivision were added, and except that the minimum acreage provision of this section may be waived by the Secretary where he finds such exception is justified on the basis of exploratory and development data derived from activity on the leasehold. The relinquishment must: (1) Describe the lands to be relinquished as described in the lease; (2) include a statement as to whether the relinquished lands had been disturbed and if so whether they were restored as prescribed by the terms of the lease; (3) state whether wells had been drilled on the lands and if so whether they had been placed in condition for abandonment; and (4) furnish a statement that all moneys due and payable to workmen employed on the leased premises have been paid.

(b) A relinquishment shall take effect on the date it is filed, subject to the continued obligation of the lessee and his surety: (1) To make payments of all accrued rentals and royalties; (2) to place all wells on the land to be relinquished in condition for suspension of operations or abandonment; (3) to restore the surface resources in accordance with all regulations and the terms of the lease; and (4) to comply with all other environmental stipulations provided for by such regulations or lease. A statement must be furnished that all moneys due and payable to workmen employed on the leased premises have been paid.

§ 3244.2 Automatic terminations and reinstatements.

§ 3244.2-1 General.

Except as provided in § 3244.2-2 any lease will automatically terminate by operation of law if the lessee fails to pay

RULES AND REGULATIONS

the rental on or before the anniversary date of such lease. However, if the time for payment falls upon any day in which the proper office to receive payment is not open, payment received on the next official working day shall be deemed to be timely. The termination of the lease for failure to pay the rental must be noted on the official records of the proper BLM office. Upon such notation the lands included in such lease will become subject to leasing as provided for in Subpart 3211 of this chapter.

§ 3244.2-2 Exceptions.

(a) *Nominal deficiency.* If the rental payment due under a lease is paid on or before its anniversary date but the amount of the payment is deficient and the deficiency is nominal, the lease shall not have automatically terminated unless the lessee fails to pay the deficiency within the period prescribed in a Notice of Deficiency, or by the due date, whichever is later. A deficiency is nominal if it is not more than \$10 or one percentum (1%) of the total payment due, whichever is more. The authorized officer shall send a Notice of Deficiency to the lessee on an approved form. The Notice shall be sent by certified mail, return receipt requested, and shall allow the lessee 15 days from the date of receipt to submit the full balance due to the proper BLM office. If the payment called for in the notice is not made within the time allowed, the lease will have terminated by operation of law as of its anniversary date.

(b) *Reinstatements.* (1) Except as hereinafter provided, the authorized officer may reinstate a lease which has terminated automatically for failure to pay the full amount of rental due on or before the anniversary date, if it is shown to his satisfaction that such failure was either justifiable or not due to a lack of reasonable diligence on the part of the lessee; and a petition for reinstatement, together with the required rental, including any back rental which has accrued from the date of termination of the lease, is filed with the proper BLM office.

(2) The burden of showing that the failure to pay on or before the anniversary date was justifiable or not due to lack of reasonable diligence will be on the lessee. Reasonable diligence normally requires sending or delivering payments sufficiently in advance of the

anniversary date to account for normal delays in the collection, transmittal, and delivery of the payment. The authorized officer may require evidence, such as post office receipts, of the time of sending or delivery of payments.

(3) Under no conditions will a lease be reinstated if (1) a valid lease has been issued prior to the filing of a petition for reinstatement affecting any of the lands covered by the terminated lease, or (ii) the interest in the lands has been withdrawn, disposed of, or has otherwise become unavailable for leasing. However, the authorized officer will not issue a new lease for lands covered by a lease which terminated automatically until 90 days after the date of termination.

(4) Reinstatement of terminated leases is discretionary with the Secretary. The basic criterion in accordance with which this discretion will be exercised is whether the Secretary would be willing to issue a lease if a new lease offer for the same land were under consideration.

§ 3244.3 Cancellation of lease for non-compliance with regulations or lease terms; notice; hearing.

A lease may be canceled by the authorized officer for any violation of these regulations, the regulations in 30 CFR Part 270, or the lease terms, 30 days after receipt by the lessee of notice from the authorized officer of the violation, unless (a) the violation has been corrected, or (b) the violation is one that cannot be corrected within the notice period and the lessee has in good faith commenced within the notice period to correct the violation and thereafter proceeds diligently to complete the correction. A lessee shall be entitled to a hearing on the matter of any such claimed violation or proposed cancellation of lease if a request for a hearing is made to the authorized officer within the 30-day period after notice. The procedures with respect to notice of such hearing and the conduct thereof, and with respect to appeals from decisions of Administrative Law Judges upon such hearings, shall follow insofar as practicable the procedural rules applicable to hearings and appeals in public lands cases within the jurisdiction of the Board of Land Appeals, Office of Hearings and Appeals, contained in Department Hearings and Appeals Procedures,

Part 4 of this title. The period for correction of violation or commencement to correct a violation of regulations or of lease terms, as aforesaid, shall be extended to 30 days after the lessee's receipt of the Administrative Law Judge's decision upon such a hearing if the Administrative Law Judge shall find that a violation exists.

§ 3244.4 Expiration by operation of law.

Any lease for land on which, or for which under an approved cooperative or unit plan of development or operation, there is no production in commercial quantities, or a producing well, or actual drilling operations being diligently prosecuted, will expire at the end of its primary term without notice to the lessee. Notation of such expiration need not be made on the official records, but the lands previously covered by that expired lease will be subject to the filing of new applications for leases only as provided in these regulations.

§ 3244.5 Removal of materials and supplies upon termination of lease.

Upon the expiration of the lease, or the earlier termination thereof pursuant to this subpart, the lessee shall have the privilege at any time within a period of ninety (90) days thereafter of removing from the premises any materials, tools, appliances, machinery, structures, and equipment other than improvements needed for producing wells. Any materials, tools, appliances, machinery, structures, and equipment subject to removal, but not removed within the 90-day period, or any extension thereof that may be granted because of adverse climatic conditions during that period, shall, at the option of the Supervisor, become property of the lessor, but the lessee shall remove any or all such property where so directed by the lessor.

NOTE: Forms 3200-4 and 3200-1 filed as part of the original document. Copies of these forms may be obtained by writing Geothermal Coordinator, Department of the Interior, Washington, D.C. 20240.

Dated: December 17, 1973.

W. W. LYONS,
Deputy Under Secretary
of the Interior.

[FR Doc.73-26890 Filed 12-20-73;8:45 am]



GEOTHERMAL RESOURCES
OPERATIONAL ORDERS

Issued under the Geothermal Steam Act of 1970

- GRO Order 1. Exploratory Operations
- GRO Order 2. Drilling, Completion and Spacing of Geothermal Wells
- GRO Order 3. Plugging and Abandonment of Wells
- GRO Order 4. General Environmental Protection Requirements



United States Department of Interior
Geological Survey
Conservation Division
Office of the Area Geothermal Supervisor

January 1976

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GRO Order No. 1: Exploratory Operations

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CONSERVATION DIVISION

GEOHERMAL RESOURCES OPERATIONAL ORDER NO. 1

Effective February 1, 1975

EXPLORATORY OPERATIONS

This Order is established pursuant to the authority prescribed in 30 CFR 270.11 and in accordance with 30 CFR 270.78. All exploratory operations other than drilling of exploratory and development wells will be conducted in accordance with the provisions of this Order. All plans for exploratory operations to be conducted shall include provisions for appropriate environmental protection and reclamation of disturbed lands. A cultural resources investigation approved by the Area Geothermal Supervisor (Supervisor) shall be performed prior to any surface disturbance other than Casual Use.

All variances from the requirements specified in this Order shall be subject to approval pursuant to 30 CFR 270.48. Each Notice of Intent to Conduct Geothermal Resources Exploration Operations shall include a notation of any proposed variances from the requirements of this Order. References in this Order to approvals, determinations, or requirements are to those given or made by the Supervisor or his delegated representative.

The following exploratory operations and reasonable expenditures therefor will qualify as diligent exploration if approved by the Supervisor prior to the initiation of such operations.

1. Casual Use. Casual Use shall include any entrance on the leased lands for geological reconnaissance or surveying purposes. Sampling of springs and water wells on the lease for geochemical analysis shall be construed as casual use. Such non-disturbing surveys and reconnaissance operations will not require a Notice of Intent to Conduct Geothermal Resources Exploration Operations. The lessee shall notify the Supervisor prior to commencing such casual use operations. Casual Use operations proposed or completed shall be included in any subsequent Plan of Operations.

2. Geophysical Exploration. Geophysical exploration shall include, but is not limited to, surface electrical resistivity surveys, seismic ground noise surveys, passive micro-earthquake monitoring surveys, magneto-telluric surveys and all other geophysical surveys, including airborne techniques.

Geophysical surveys other than airborne techniques will require a Notice of Intent to Conduct Geothermal Resources Exploration Operations, (Form 3200-9). All such anticipated surveys should be included in the Plan of Operations and must be approved by the Supervisor before the work is begun.

The lessee shall furnish the Supervisor two copies of the records of such surveys within 30 days after the completion of such operations.

3. Drilling of Shallow Holes. Drilling of shallow holes for the measurement of temperature gradients or heat flow will be considered as an exploration operation and will require approval of a Notice of Intent to Conduct Geothermal Resources Exploration Operations (Form 3200-9) by the Supervisor. The following stipulations shall apply to the drilling of such shallow holes:

A. Holes for measuring temperature gradients shall be limited to a depth of 152 metres (500 feet), unless otherwise authorized by the Supervisor.

B. Return-line temperatures shall be taken at no less than 9-metre (30 foot) intervals during drilling operations on shallow holes drilled with mud. If return-line mud temperature should reach 52°C. (125°F.), drilling ahead shall cease immediately and the hole will be either

(1) Completed as an observation hole by running steel tubing as deep as possible, filling the annulus with drilling mud from total depth to 3 metres (10 feet) below the surface and with cement from 3 metres (10 feet) to the surface;

(2) Abandoned by filling the hole with drilling mud from total depth to 3 metres (10 feet) below the surface and cement to the surface thereafter, or

(3) Equipped with mud cooling and wellhead control devices to maintain well control and mud returns temperature at or below 52°C. (125°F.).

C. If flowing steam or hot water at 65°C (150°F.) or greater is encountered, further drilling shall stop immediately and the hole will be either

(1) Completed as an observation hole using steel tubing cemented from total depth to surface; or

(2) Abandoned by plugging with cement from total depth to surface.

D. If cold flowing artesian water is encountered, the hole will be completed as in (C) hereinabove, except that plastic tubing may be used.

If the conditions outlined in (B), (C) or (D) are encountered, the Supervisor shall be notified immediately.

No exceptions to the stipulations of (B), (C) or (D) will be allowed without specific prior permission of the Supervisor.

E. The lessee shall submit the following information with the Notice of Intent to Conduct Geothermal Resources Exploration Operations (Form 3200-9):

(1) The approximate location (to the nearest 30 metres (100 feet) from some identifiable marker or object within the smallest legal subdivision) and hole number or designation of each proposed hole and probable order of drilling;

(2) The type and size of drilling rig;

(3) The proposed drilling program including the drilling system (type of bit and circulating medium), approximate depths and casing (conductor) program for each such hole;

(4) The type of drilling sump and proposed method of sump abandonment at each location;

(5) The approximate time that each hole will be used for observation; and

(6) The proposed method of abandonment for each hole. Additionally, the lessee shall notify and receive the approval of the Supervisor prior to any change in the location of an approved hole or for any additional holes which the lessee desires to drill.

F. Locations proposed in natural thermal areas within a 300-metre (1,000-foot) radius of hot springs, fumaroles, or other surface geothermal indicia, or in areas of known artesian water flow, will require a detailed drilling program for each hole, approved by the Supervisor. The Supervisor may require special drilling and completion techniques for such holes (such as cemented surface casing and simple expansion-type blowout preventers) to safely control formations containing geothermal or other resources which may be penetrated.

G. A supply of mud and lost circulation material shall be kept on hand while drilling to control abnormal pressure if rotary equipment is used.

H. Holes shall be completed for observation purposes in a manner which will allow satisfactory subsequent abandonment. As a minimum, the annular space shall be filled with mud (cuttings and dirt if drilled with air or auger) to 3 metres (10 feet) below the surface and with cement from 3 metres (10 feet) to the surface, and the tubing shall be capped when not in use.

I. Holes shall be abandoned in a manner that will prevent subsurface interzonal migration of fluids and surface leakage. As a minimum, the top 3 metres (10 feet) of tubing below the surface shall be filled with cement. Tubing shall be cut off at ground level or as directed by the Supervisor.

4. Reporting Completion of Exploration Operations. The Notice of Completion of Geothermal Resources Exploration Operations (Form 3200-10) shall be submitted in triplicate, and shall include the following information for each hole drilled:

- A. Final hole designation and location;
- B. A driller's log noting water table and water aquifers encountered (if determined), and salt, coal beds or other mineral deposits, if present;
- C. Method of completion, cementing, and casing and/or tubing used;
- D. Complete details of the abandonment procedures;
- E. Any information on drilling difficulties or unusual circumstances encountered which would be helpful in assuring future safety of operations or protection of the environment in the area concerned; and
- F. Temperature data and logs for each hole surveyed.

5. General. Drilling fluids or cuttings shall not be discharged onto the surface where such discharge might contaminate lakes and perennial or intermittent streams. Excavated pits or sumps used in drilling shall be backfilled as soon as drilling is completed and restored to conform with the original topography. Unattended sumps shall be completely fenced for the protection of the public, domestic animals and wildlife.

6. Notice of Entry. Applicant shall contact the appropriate U. S. Geological Survey Geothermal District Office prior to entry on the land to conduct exploration operations.

Reid T. Stone

Reid T. Stone
Area Geothermal Supervisor

Approved:

Russell G. Wayland
Russell G. Wayland,
Chief, Conservation Division

GRO Order No. 2: Drilling, Completion and Spacing
of Geothermal Wells

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CONSERVATION DIVISION

GEOHERMAL RESOURCES OPERATIONAL ORDER NO. 2

Effective February 1, 1975

DRILLING, COMPLETION AND SPACING OF GEOHERMAL WELLS

This Order is established pursuant to the authority prescribed in 30 CFR 270.11 and in accordance with 30 CFR 270.14, 270.15, and 270.40. All wells shall be drilled in such a manner as to minimize damage to the environment and to protect life, health, property, usable ground waters and geothermal resources.

All exploratory wells drilled for geothermal resources shall be drilled in accordance with the provisions of this Order. Initial development wells drilled for geothermal resources shall be drilled in accordance with the provisions of this Order, and these provisions shall continue in effect until field rules are issued. After field rules have been established by the Area Geothermal Supervisor (Supervisor), development wells in the individual fields shall be drilled in accordance with such rules.

Where sufficient geologic and engineering information is obtained through exploratory drilling, lessees may make application or the Supervisor may request the lessee to submit an application for the establishment of field rules. The Supervisor may issue field rules at any time he deems appropriate upon failure of the lessee to timely file for such field rules.

All wells drilled under the provisions of this Order shall have been included in an exploratory or development Plan of Operations as required under 30 CFR 270.34. Each Application for Permit to Drill (Form 9-331C) shall include all information required under 30 CFR 270.71, and shall include a notation of any proposed variances from the requirements of this Order. All variances from the requirements specified in this Order shall be subject to approval pursuant to 30 CFR 270.48. References in this Order to approvals, determinations, and requirements for submitting of information or applications for approval are to those granted, made or required by the Supervisor or his delegated representative. The lessee shall comply with the following requirements:

1. Well Casing. All wells shall be cased and cemented in accordance with the requirements of 30 CFR 270.15, and the application for permit to drill shall include the casing design safety factors for collapse, tension and burst. The permanent wellhead completion equipment shall be attached to the production casing or to the intermediate casing if the production casing does not reach to the surface except as otherwise authorized by the Supervisor to meet special well conditions. All casing strings reaching the surface shall be cemented at a sufficient

depth to provide adequate anchorage and support for the casing and any blowout prevention equipment required thereon. For the purpose of this Order, the several casing strings in order of normal installation are (1) conductor, (2) surface, (3) intermediate and (4) production strings. The following casing setting depth requirements are general in nature and subject to variations to permit the casing to be set and cemented in a competent formation. The Supervisor's determination of adequate casing setting depths shall be based upon all geologic and engineering factors including apparent geothermal gradients, depths and pressures of the various formations to be penetrated and all other pertinent information about the area. All depths in this Order refer to true vertical depth (TVD) below ground level, unless otherwise specified.

A. Conductor Casing. This casing shall be set at a minimum depth of 15 metres (50 feet) and a maximum depth of 60 metres (200 feet) before drilling into shallow formations suspected or known to contain geothermal resources, non-condensable gases, or other mineral resources or upon encountering such formations.

B. Surface Casing. This casing shall be set at a depth equivalent to or in excess of ten percent of the proposed total depth of the well provided, however, that such setting depth shall be not less than 60 metres (200 feet) nor more than 400 metres (1,300 feet).

C. Intermediate Casing. This casing shall be set at any time when required by well conditions encountered in drilling below the surface casing such as anomalous pressure zones, uncased fresh water aquifers, cave-ins, washouts, lost circulation zones, rapidly increasing thermal gradients or other drilling hazards. If a liner is used as an intermediate string, the lap shall be tested by a fluid entry or pressure test to determine whether a seal between the liner top and the next larger casing string has been achieved. The liner overlap shall be a minimum of 30 metres (100 feet). The test shall be recorded on the driller's log and may be witnessed by the Supervisor. In the event of lap or casing failure during the test, the lap or casing must be repaired or recemented and successfully retested as required by the Supervisor.

D. Production Casing. This casing may be set at the top of or through the potential producing zone and shall be set before completing the well for production. Production casing shall be run to the surface or lapped into the next larger casing string. The liner overlap, if utilized, shall be at least 30 metres (100 feet) and shall be tested, witnessed and recorded as in the case of intermediate casing hereinabove. In the event of lap or casing failure during the test, the lap or casing must be repaired or recemented and successfully retested as required

by the Supervisor. Production casing shall normally be of consistent nominal outside diameter from the surface or from the top of the lap to the casing shoe. The surface casing shall not be used as production casing, unless otherwise authorized by the Supervisor to meet special well conditions.

E. Cementing of Casing. The conductor and surface casing strings shall be cemented with a quantity of cement sufficient to fill the annular space back to the surface. The intermediate casing string shall likewise be cemented back to the surface or to the top of the lap if a liner is used as an intermediate string. Production casing shall be cemented with a high temperature resistant admix, unless waived by the Supervisor and shall be cemented in a manner necessary to exclude, isolate or segregate overlying formation fluids from the geothermal resources zone and to prevent the movement of fluids into possible fresh water zones. Production casing shall be cemented back to the surface or, if lapped, to the top of the lap. A temperature or cement bond log may be required by the Supervisor after setting and cementing the production casing and after all primary cementing operations if an unsatisfactory cementing job is indicated. Proposed well cementing techniques differing from the requirements of this paragraph will be considered by the Supervisor on an individual well basis.

F. Pressure Testing. Prior to drilling out the casing shoe after cementing, all casing strings set to a depth of 152 metres (500 feet) or greater, except for conductor casing, shall be pressure tested to a minimum pressure of 69 bars (1,000 psi) or 0.045 bars/metre (0.2 psi/ft) whichever is greater. All casing strings set at a depth less than 152 metres (500 feet), except for conductor casing, shall be pressure tested to a minimum pressure of 35 bars (500 psi). Such test shall not exceed the rated working pressure of the casing or the blow-out preventer stack assembly, whichever is lesser.

In the event of casing failure during the test, the casing must be repaired or recemented until a satisfactory test is obtained. A pressure decline of 10 percent or less in 30 minutes shall be considered satisfactory.

Casing test results shall be recorded on the driller's log and reported to the Supervisor within 30 days after the completion of such test. Advance notice of all casing and lap tests shall be given in sufficient time to enable the Supervisor to be present to witness such tests. The casing and lap test reports shall give a detailed description of the test, including mud and cement volumes, lapse of time between running and cementing casing and testing, method of testing and test results.

G. Directional Surveys.

(1) General. Deviation surveys (inclination from vertical or single shot) shall be taken on all wells during the normal course of drilling at intervals not to exceed 152 metres (500 feet). The Supervisor may require a directional survey giving both inclination and azimuth or a dipmeter to be obtained on all wells. In calculating all surveys, a correction from true north to Lambert-Grid north shall be made after making the magnetic to true north correction. All surveys shall be filed with the Supervisor. Where directional surveys are required, composite surveys shall be filed with the Supervisor showing the interval from the bottom of the conductor casing to total depth.

(2) Vertical Wells. Wells are considered vertical if inclination does not exceed an average of five degrees from the vertical. The Supervisor may require a directional survey giving both inclination and azimuth at intervals not exceeding 30 metres (100 feet) between stations prior to, or upon, setting any casing string or liner (except conductor casing) and at total depth on any vertical well drilled in close proximity to lease boundaries or areas with an unstable land surface, highly faulted or steeply dipping beds, or in areas of suspected abnormal formation pressures.

(3) Directional Wells. Wells are considered directional if inclination exceeds an average of five degrees from the vertical. Directional surveys giving both inclination and azimuth shall be obtained at intervals not to exceed 30 metres (100 feet) between stations prior to, or upon, setting any casing string or liner (except conductor casing) and at total depth.

2. Blowout Prevention Equipment and Procedures. All necessary precautions shall be taken to keep all wells under control at all times, utilize trained and competent personnel, and utilize properly maintained equipment and materials. Blowout preventers and related well control equipment shall be installed, tested immediately thereafter and maintained ready for use until drilling operations are completed. Certain components, such as packing elements and ram rubbers, shall be of high temperature resistant material as necessary. All kill lines, blowdown lines, manifolds and fittings shall be steel and shall have a temperature derated minimum working pressure rating equivalent to the maximum anticipated wellhead surface pressure. Subject to subparagraphs (A) and (B) hereinbelow blowout prevention equipment shall have manually operated gates and hydraulic actuating systems and accumulators of sufficient capacity to close all of the hydraulically-operated equipment and have a minimum pressure of 69 bars (1,000 psi) remaining on the accumulator. Dual control stations shall be installed with a high

pressure backup system. One control panel shall be located at the driller's station and one control panel shall be located on the ground at least 15 metres (50 feet) away from the wellhead or rotary table. Air or other gaseous fluid drilling systems shall have blowout prevention assemblies. Such assemblies may include, but are not limited to, a rotating head, a double ram blowout preventer or equivalent, a banjo-box or an approved substitute therefor and a blind ram blowout preventer or gate valve, respectively. Exceptions to the requirements of this paragraph will be considered by the Supervisor only for certain geologic and well conditions such as stable surface areas with known low subsurface formation pressures and temperatures.

A proposed blowout prevention program and a blowout contingency plan including proposed containment, public health and safety and clean-up measures shall be submitted with the Application for Permit to Drill (Form 9-331C).

A. Conductor Casing. Before drilling below this string, at least one remotely controlled hydraulically-operated expansion type preventer or an acceptable alternative, approved by the Supervisor, including a drilling spool with side outlets or equivalent, shall be installed. A kill line and blowdown line with appropriate fittings shall be connected to the drilling spool.

B. Surface, Intermediate and Production Casing. Before drilling below any of these strings, the blowout prevention equipment shall include a minimum of:

- (1) One expansion-type preventer and accumulator or a rotating head;
- (2) A manual and remotely controlled hydraulically-operated double ram blowout preventer or equivalent having a temperature derated minimum working pressure rating which exceeds the maximum anticipated surface pressure at the anticipated reservoir fluid temperature;
- (3) A drilling spool with side outlets or equivalent;
- (4) A fillup line;
- (5) A kill line equipped with at least one valve; and
- (6) A blowdown line equipped with at least two valves and securely anchored at all bends and at the end.

C. Testing and Maintenance. Ram-type blowout preventers and auxiliary equipment shall be tested to a minimum of 69 bars (1,000 psi) or to the working pressure of the casing or assembly, whichever is the lesser. Expansion-type blowout preventers shall be tested to 70

percent of the above pressure testing requirements.

The blowout prevention equipment shall be pressure tested:

- (1) When installed;
- (2) Prior to drilling out plugs and/or casing shoes;
- (3) Not less than once each week, alternating the control stations; and
- (4) Following repairs that require disconnecting a pressure seal in the assembly.

During drilling operations blowout prevention equipment shall be actuated to test proper functioning as follows:

- (1) Once each trip for blind and pipe rams but not less than once each day for pipe rams; and
- (2) At least once each week on the drill pipe for expansion-type preventers.

All flange bolts shall be inspected at least weekly and re-tightened as necessary during drilling operations. The auxiliary control systems shall be inspected daily to check the mechanical condition and effectiveness and to ensure personnel acquaintance with the method of operation. Blowout prevention and auxiliary control equipment shall be cleaned, inspected and repaired, if necessary, prior to installation to assure proper functioning. Blowout prevention controls shall be plainly labeled, and all crew members shall be instructed on the function and operation of such equipment. A blowout prevention drill shall be conducted weekly for each drilling crew. All blowout prevention tests and crew drills shall be recorded on the driller's log.

D. Related Well Control Equipment. A full opening drill string safety valve in the open position shall be maintained on the rig floor at all times while drilling operations are being conducted. A kelly cock shall be installed between the kelly and the swivel.

3. Drilling Fluid. The properties, use and testing of drilling fluids and the conduct of related drilling procedures shall be such as are necessary to prevent the blowout of any well. Sufficient drilling fluid materials to ensure well control shall be maintained in the field area readily accessible for use at all times.

A. Drilling Fluid Control. Before pulling drill pipe, the drilling fluid shall be properly conditioned or displaced. The hole shall be kept reasonably full at all times, however, in no event shall the annular mud level be deeper than 30 metres (100 feet) from the rotary table when coming out of the hole with drill pipe. Mud cooling techniques shall be utilized when necessary to maintain mud characteristics for proper well control and hole conditioning.

B. Drilling Fluid Testing. Mud testing and treatment consistent with good operating practice shall be performed daily or more frequently as conditions warrant. Mud testing equipment shall be maintained on the drilling rig at all times.

The following drilling fluid system monitoring or recording devices shall be installed and operated continuously during drilling operations, with mud, occurring below the shoe of the conductor casing. No exceptions to these requirements will be allowed without the specific prior permission of the Supervisor:

(1) High-low level mud pit indicator including a visual and audio-warning device;

(2) Degassers, desilters and desanders;

(3) A mechanical, electrical or manual surface drilling fluid temperature monitoring device. The temperature of the drilling fluid going into and coming out of the hole shall be monitored, read and recorded on the driller's or mud log for a minimum of every 9 metres (30 feet) of hole drilled below the conductor casing; and

(4) A hydrogen sulfide indicator and alarm shall be installed in areas suspected or known to contain hydrogen sulfide gas which may reach levels considered to be dangerous to the health and safety of personnel in the area.

C. Monitoring. From the time drilling operations are initiated and until the well is completed or abandoned, a member of the drilling crew or the toolpusher shall monitor the rig floor at all times for surveillance purposes, unless the well is secured with blowout preventers or cement plugs.

4. Well Logging. All wells shall be logged with an induction electric log or equivalent from total depth to the shoe of the conductor casing. The Supervisor may grant an exception to this requirement when well conditions make it impractical or impossible to meet the above requirements.

A. Electric Logs. The lessee shall furnish to the Supervisor two legible exact copies of all logs run, within 30 days after completion of drilling operations on each well. Two copies of field prints of such logs shall be made immediately available to the Supervisor upon his request. Two copies of chemical analyses of geothermal fluids or other similar services performed shall be submitted to the Supervisor within 30 days after such services are completed.

B. Lithologic Logs. Two legible exact copies of core analysis reports and lithologic (mud) logs shall be submitted to the Supervisor within 30 days after the completion of such reports or logs, when such services are used. However, daily logs shall be made available to the Supervisor immediately upon the completion of such daily logs upon his request.

5. Wellhead Equipment and Testing.

A. Completions. All wellhead connections shall be fluid pressure tested to the API or ASA working pressure rating. Cold water is recommended as the testing fluid. Welding of wellhead connections shall be performed by a certified welder using materials in conformance with ASTM specifications.

B. Wellhead Equipment. All completed wells shall be equipped with a minimum of one casinghead with side outlets, one master valve and one production valve, unless otherwise authorized by the Supervisor. All casingheads, Christmas trees, fittings and connections shall have a temperature derated working pressure equal to or greater than the surface shut-in pressure of the well at reservoir temperature. Packing, sealing mediums and lubricants shall consist of materials or substances that function effectively at, and are resistant to, high temperatures. Wellhead equipment, valves, flanges and fittings shall meet minimum ASA standards or minimum API Standard 6A specifications. Casinghead connections shall be made such that fluid can be pumped between casing strings.

C. Testing. Any well showing sustained casinghead pressure or leaking of geothermal fluids between casing strings shall be tested to determine the origin of the failure, when such failure point is not otherwise determinable, and corrective measures shall be taken.

6. Well Spacing. No producing interval of any well shall be located within 30 metres (100 feet) of the outer boundaries of the leased lands, except where approved by the Supervisor. No surface location of a well shall be located within 15 metres (50 feet) of the boundary of any legal subdivision unless otherwise authorized by the Supervisor. The Supervisor may approve or prescribe such well

spacing as he determines to be necessary for the proper development of the geothermal resources in accordance with the provisions of 30 CFR 270.15.

Reid T. Stone

Reid T. Stone
Area Geothermal Supervisor

Approved:

Russell G. Wayland

Russell G. Wayland
Chief, Conservation Division

GRO Order No. 3: Plugging and Abandonment of Wells

[Handwritten Signature]
Michael G. ...
Chief, Conservation Division

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CONSERVATION DIVISION

GEOTHERMAL RESOURCES OPERATIONAL ORDER NO. 3

Effective February 1, 1975

PLUGGING AND ABANDONMENT OF WELLS

This Order is established pursuant to the authority prescribed in 30 CFR 270.11 and in accordance with 30 CFR 270.14 and 270.45. The lessee shall comply with the following minimum plugging and abandonment procedures for all geothermal resources wells. Oral approvals shall be in accordance with 30 CFR 270.11. All variances from the requirements specified in this Order shall be subject to approval pursuant to 30 CFR 270.48. Each Sundry Notice (Form 9-331) shall include a notation of any proposed variances from the requirements of this Order. References in this Order to approvals, determinations or requirements are to those given or made by the Area Geothermal Supervisor (Supervisor) or his delegated representative.

The lessee shall promptly plug and abandon any well on the leased land that is not in use or demonstrated to be potentially useful. No well shall be abandoned until its lack of capacity for further profitable production of geothermal resources has been demonstrated to the satisfaction of the Supervisor. No well shall be plugged and abandoned until the manner and method of plugging have been approved or prescribed by the Supervisor.

Cement used to plug any geothermal resources well, except that cement or concrete used for surface plugging, shall be placed in the hole by pumping through drill pipe or tubing. Such cement shall consist of a high temperature resistant admix, unless this requirement is waived by the Supervisor in accordance with the particular circumstances existing in that well or area.

Prior to commencing abandonment operations, the Supervisor shall be notified of all such proposed operations.

Each Sundry Notice (Form 9-331) shall include all information required under 30 CFR 270.45 and 270.72. Any bond or rider thereto covering a lease or an individual well thereon, shall remain in full force and effect until the lease or individual well is properly abandoned and the surface properly restored. Written approval of the abandonment must be obtained from the Supervisor before release of any bonds will be recommended.

1. Permanent Abandonment.

A. Uncased Hole. In uncased portions of wells, cement plugs shall be placed to protect all subsurface mineral resources including fresh water aquifers. Such plugs shall extend a minimum of 30 metres

(100 feet) below, if possible, and 30 metres (100 feet) above such aforementioned zones. Cement plugs shall be placed in a manner necessary to isolate formations and to protect the fluids in such formations from interzonal migration or contamination.

B. Open Hole. Where there is open hole (uncased and open into the casing string above), a cement plug shall be placed in the deepest casing string by either (1) or (2) below. In the event lost circulation conditions exist or are anticipated, or if the well has been drilled with air or other gaseous substance, the plug shall be placed in accordance with (3) below.

(1) A cement plug shall be placed across the shoe extending a minimum of 30 metres (100 feet) above and 30 metres (100 feet) below; or

(2) A cement retainer with effective back pressure control set approximately 30 metres (100 feet) above the casing shoe with at least 61 metres (200 feet) of cement below the retainer and 30 metres (100 feet) of cement above.

(3) A permanent bridge plug set at the casing shoe and capped with a minimum of 61 metres (200 feet) of cement.

C. Perforations, Junk, Fish and Collapsed Pipe. A cement plug shall be placed across production perforations, extending 30 metres (100 feet) below (where possible) and 30 metres (100 feet) above the perforated interval. When a cement retainer is used to squeeze cement the perforated interval, the retainer shall be set a minimum of 30 metres (100 feet) above the perforations. Where the casing contains perforations at or below fish, junk or collapsed casing, thereby preventing cleanout operations, a cement retainer shall be set at least 30 metres (100 feet) above such point, and the interval below the retainer shall be squeeze cemented.

D. Casing Shoes, Stubs, Laps, and Liners. No casing shall be cut and recovered without first obtaining the written approval of the Supervisor. A cement plug shall be placed across all casing stubs, laps, liner tops and all casing shoes not protected by an inner casing string. Such plug shall extend a minimum of 15 metres (50 feet) below and 15 metres (50 feet) above any such shoe, stub, lap or liner top.

E. Plugging of Annular Space. All open annuli extending to the surface shall be plugged with cement.

F. Surface Plug. The innermost casing string which reaches ground level shall be cemented or concreted to a minimum depth of 15 metres (50 feet) measured from 2 metres (6 feet) below ground level.

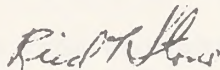
G. Testing of Plugs. The hardness and location of cement plugs placed across perforated intervals and at the top of uncased or open hole shall be verified by setting down with tubing or drill pipe a minimum of 6,803 kilograms (15,000 pounds) weight on the plug or the maximum weight of the available tubing or drill pipe string, if less than 6,803 kilograms (15,000 pounds).

H. Mud. The intervals of the hole not filled with cement shall be filled with good quality heavy mud.

2. Surface Restoration. All casing strings shall be cut off at least 2 metres (6 feet) below ground level and capped by welding a steel plate on the casing stub. Cellars, pads, structures and other facilities shall be removed. The surface area shall be restored as specified by the Supervisor in consultation with the appropriate surface management agency.

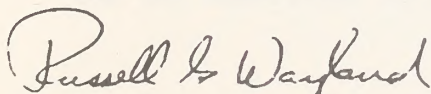
3. Temporary Abandonment. An uncompleted drilling well that is to be temporarily abandoned shall be mudded and cemented as required hereinabove for permanent abandonment except for the provisions of subparagraphs E, F, and I.

4. Suspended Wells. The drilling equipment shall not be removed on any geothermal resources well where drilling operations have been suspended, either temporarily or indefinitely, without prior approval of the Supervisor and after approved measures have been taken to close the well and to protect all subsurface resources, including fresh water aquifers.



Reid T. Stone
Area Geothermal Supervisor

Approved:



Russell G. Wayland,
Chief, Conservation Division

GRO Order No. 4: General Environmental Protection Requirements

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CONSERVATION DIVISION

GEOHERMAL RESOURCES OPERATIONAL ORDER NO. 4

Effective August 1, 1975

GENERAL ENVIRONMENTAL PROTECTION REQUIREMENTS

This Order is established pursuant to the authority prescribed in 30 CFR 270.11 and in accordance with 30 CFR 270.2, 270.34(k), 270.37, 270.41, 270.42, 270.43, 270.44, and 270.76. Lessees shall comply with the provisions of this Order. All variances from the requirements specified in this Order shall be subject to approval pursuant to 30 CFR 270.48. References in this Order to approvals, determinations, or requirements are to those given or made by the Area Geothermal Supervisor (Supervisor) or his delegated representative.

All data submitted under this Order shall be available for inspection in accordance with the Freedom of Information Act of 1966 (P.L. 89-487), as amended in 1974 (P.L. 93-502), except information such as geological, geophysical, reservoir, trade secrets, and financial data and interpretations of such data, maps, and related files for which a lessee requests proprietary status; provided that such status is determined by the Supervisor to be warranted and is approved by appropriate officials of the Department of the Interior.

Protection of the environment includes the lessee's responsibility to: conduct exploration and development operations in a manner that provides maximum protection of the environment; rehabilitate disturbed lands; take all necessary precautions to protect the public health and safety; and conduct operations in accordance with the spirit and objectives of all applicable Federal environmental legislation and supporting executive orders.

Adverse environmental impacts from geothermal-related activity shall be prevented or mitigated through enforcement of applicable Federal, State, and local standards, and the application of existing technology. Inability to meet these environmental standards or continued violation of environmental standards due to operations of the lessee, after notification, may be construed as grounds for the Supervisor to order a suspension of operations.

The lessee shall be responsible for the monitoring of readily identifiable localized environmental impacts associated with specific activities that are under the control of the lessee. Monitoring of environmental impacts may be conducted by the use of aerial surveys, inspections, periodic samplings, continuous recordings, or by such other means or methods as required by the Supervisor. Due to the differing natural environmental conditions among geothermal areas, the extent and frequency of such monitoring activities will be determined by the Supervisor on an individual basis. In the event the Supervisor determines that the degree and adequacy of existing environmental protection regulations in certain areas are insufficient, the Supervisor may establish additional and more stringent requirements by the issuance of field orders or by modifying existing orders.

Lessees shall provide for acquisition of environmental baseline data as required in accordance with 30 CFR 270.34(k) for a period of one year prior to submission of a plan for production. Techniques and standards to be used by the lessee for meeting these requirements shall receive prior approval by the Supervisor.

1. Aesthetics. The lessee shall reduce visual impact, where feasible, by the careful selection of sites for operations and facilities on leased lands. The design and construction of facilities shall be conducted in a manner such that the facilities will blend into the natural environmental setting of the area by the appropriate use of landscaping, vegetation, compatible color schemes, and minimum profiles. Native plants or other compatible vegetation shall be used, where possible, for landscaping and revegetation.

2. Land Use and Reclamation. Operating plans shall be designed so that operations will result in the least disturbance of land, water, and vegetation. Existing roads shall be used where suitable. Entry upon certain environmentally fragile land areas, as designated by the surface management agency, may be either seasonally restricted or restricted to special vehicles or transportation methods which will minimize disturbance to the surface or other resources as specified by the Supervisor and surface management agency.

Operating plans shall provide for the reclamation and revegetation of all disturbed lands in a manner approved by the Supervisor and the appropriate surface management agency. Land

reclamation may include preparation and seeding with prescribed wildlife food and plant cover or improved and acceptable substitutes thereof which will equal or enhance the food values for indigenous wildlife species and domesticated animals. Temporary fencing for such reclaimed areas may be required to facilitate restoration thereof.

The lessee shall at all times maintain the leased lands in a safe and orderly condition and shall perform the operations in a workmanlike manner. The lessee shall remove or store all supplies, equipment, and scrap in a timely and orderly fashion.

Operations under a geothermal lease shall not unreasonably interfere with or endanger operations under any other lease, license, claim, permit, or other authorized use on the same lands.

3. Public Access. The public shall have free and unrestricted access to geothermal leased lands, excepting however, where restrictions are necessary to protect public health and safety or where such public access would unduly interfere with the lessee's operations or the security thereof. The lessee shall provide warning signs, fencing, flagmen, barricades, or other safety measures deemed necessary by the Supervisor to protect the public, wildlife, and livestock from hazardous geothermal or related activities.

4. Recreation. Recreational values shall be adequately protected through planning and designing of site development to minimize the aesthetic degradation of the particular recreation area. The lessee shall generally be restricted from surface locations for drilling and other lease operations within 61 metres (200 feet) of established recreation sites and access routes thereto. However, the lessee may relocate a recreational site and/or access routes thereto when approved by the Supervisor with the concurrence of the land management agency.

5. Slope Stability and Erosion Control. Operations shall be conducted in such a manner so as to minimize erosion and disturbance to natural drainage. The lessee shall provide adequate erosion and drainage control to prevent sediments from disturbed sites from entering water courses for soil and natural resource conservation protection.

Mitigating measures to lessen environmental damage may include reseeded of disturbed soils, chemical stabilization, and dust and erosion control on well sites, roads, and construction areas.

All operating plans shall give proper consideration to the potential hazards of slope instability. Where potentially unstable ground conditions exist, design of proposed roads, drill sites, and surface facilities shall be approved by and constructed under the supervision of a qualified engineer or engineering geologist satisfactory to the Supervisor.

6. Biota. The lessee shall conduct all operations in such a manner as to afford reasonable protection of fish, wildlife, and natural habitat. The lessee shall take such measures as are necessary for the conservation of endangered and threatened species of flora and fauna as set forth in applicable executive orders, regulations, and State or Federal legislation such as the Endangered Species Act of 1973 and the Fish and Wildlife Coordination Act. When such species would be adversely affected by the lessee's operations on the leased lands, the lessee shall implement those measures necessary to minimize or eliminate such adverse effects and to protect the flora and fauna as specified by the Supervisor in accordance with recommendations by appropriate Federal and State agencies. Such measures may be in addition to provisions set forth in the lease or accompanying stipulations.

The Supervisor may receive information from recognized experts that a delicate balance of flora and/or fauna exists in the area of operations or proposed operations. Upon receiving such notice, the Supervisor will request timely advice and assistance from appropriate Federal and State agencies regarding: (1) an assessment of the status of flora and fauna in the area which may be adversely affected by operations, and (2) advice as to reasonable mitigating measures appropriate to minimizing or preventing adverse trends in populations, growth, vegetative recovery, or repopulations in potentially affected flora and/or fauna. Based on timely receipt of advice from appropriate agencies, the Supervisor will direct the lessee to take appropriate measures to minimize significant adverse trends in flora and fauna. Such measures may include, but not be limited to, revegetation with grasses, shrubs, or other vegetation of high forage values desirable for habitat, replacement of fauna where lost, replacement of water supply, or sources where destroyed.

Where the lessee's operations have destroyed significant flora and/or fauna or their natural habitat and replacement by natural processes will not take place in a normal growth cycle, the lessee shall take reasonable measures to replace those species or their habitat with the same or other acceptable species or habitat as directed by the Supervisor. The Supervisor's requirements shall be based on recommendations and advice received from appropriate Federal and State agencies.

7. Cultural Resources Preservation. The lessee shall exercise due diligence in the conduct of his operations to protect and preserve significant archaeological, historical, cultural, paleontological, and unique geologic sites. The lessee shall not disturb any known cemetery or burial ground of any group or culture.

Previously unknown sites uncovered by the lessee shall be immediately reported to the Supervisor, and operations on the particular site shall cease until said site can be assessed for its archaeological value and preservation. Necessary controls and remedial actions for the protection and preservation of cultural resources shall be issued on an individual site basis by the Supervisor as warranted.

The preservation, restoration, maintenance, and nomination of all resources for purposes of the National Register of Historic Places shall be in accordance with the provisions of Executive Order 11593 (36 FR 8921) entitled, "Protection and Enhancement of the Cultural Environment," or any amendments thereto.

8. Subsidence and Seismicity. Surveying of the land surface prior to and during geothermal resources production will be required for determining any changes in elevation of the leased lands. Lessees shall make such resurveys as required by the Supervisor to ascertain if subsidence is occurring. Production data, pressures, reinjection rates, and volumes shall be accurately recorded and filed monthly with the Supervisor as provided in 30 CFR 270.37. In the event subsidence activity results from the production of geothermal resources, as determined by surveys by the lessee or a governmental body, the lessee shall take such mitigating actions as are required by the lease terms and by the Supervisor.

If subsidence is determined by the Supervisor to present a significant hazard to operations or adjoining land use, then the Supervisor may require remedial action including, but not limited to, reduced production rates, increased injection of waste or other fluids, or a suspension of production.

A. Surveys. All required surveys shall be second order or better and shall be conducted under the direct supervision of a registered civil engineer or licensed land surveyor using equipment acceptable by the National Ocean Survey for second order surveys. All such work shall be coordinated with the county surveyor of the county in which the surveys and bench marks are to be established. Level lines and networks shall be tied to available regional networks.

Adjusted survey data shall be filed with the Supervisor within 60 days after leveling is completed. Any

lessee having a commercially productive geothermal well or wells shall participate in cooperative County/State subsidence detection programs. All survey data filed with the Supervisor shall be available to the public.

B. Bench Marks. One or more wellsite bench marks shall be required at each completed well prior to prolonged production and said bench marks shall be located in a manner such that there is a minimal probability of destruction or damage to said bench marks. Wellsite bench marks shall be tied to existing regional networks. Additional bench marks between the wellsites and the regional network shall be at 0.8-km (one-half mile) intervals or as otherwise specified by the Supervisor. These bench marks shall be resurveyed during well production operations on a periodic basis as determined by the Supervisor.

Acceptable bench marks include, but are not limited to, a brass rod driven to refusal or 9 metres (about 30 feet) and fitted with an acceptable brass plate or a permanent structure with an installed acceptable brass plate.

C. Reservoir Data. Initial reservoir pressure and temperature shall be reported to the Supervisor in duplicate on Well Completion or Recompletion Report (Form 9-330C) for all completed wells within 30 days after the completion of measurements or tests conducted for the purpose of obtaining such data. Initial production test data including steamwater ratio, surface pressure and temperature, quality, and quantity of well effluent shall also be filed with the Supervisor on Form 9-330C within 30 days after a well is completed.

D. Seismicity. The installation of seismographs or other like instruments in producing geothermal areas for the purpose of detecting potential seismic activity may be initiated from time to time by appropriate public agencies. Lessees shall cooperate with the appropriate public agencies in this regard. The lessee and the appropriate public agency should take care not to unreasonably interfere with or endanger each other's respective operations. The Supervisor shall coordinate such detection programs between the appropriate public agency conducting the program and the lessee.

Where induced seismicity caused by the production of geothermal fluids is determined to exist by the Supervisor, then the Supervisor may require the lessee to install such monitoring devices as necessary to adequately quantify the effects thereof. If induced seismicity is determined to represent a significant hazard, the Supervisor may require remedial

actions including, but not limited to, reduced production rates, increased injection of waste or other fluids, or suspension of production.

9. Pollution, Waste Disposal, and Fire Prevention. The lessee shall comply with all applicable Federal and State standards with respect to the control of all forms of air, land, water, and noise pollution, including the control of erosion and the disposal of liquid, solid, and gaseous wastes. The Supervisor may, at his discretion, establish additional and more stringent standards. Plans for disposal of well effluents must be approved by the Supervisor before any implementation action is undertaken. Immediate corrective action shall be taken in all cases where pollution has occurred.

The lessee shall timely remove or dispose of all waste including human waste, trash, refuse, and extraction and processing waste generated in connection with the lessee's operations in a manner acceptable to the Supervisor.

The lessee shall provide safeguards to minimize potential accidental fires and shall instruct field personnel in fire-prevention methods. The lessee shall maintain fire-fighting equipment in working order at strategic locations on the leased lands.

A. Pollution Prevention. In the conduct of all geothermal operations, the lessee shall not contaminate any natural waters and shall minimize adverse effects on the environment.

(1) Liquid Disposal. Liquid well effluent or the liquid residue thereof containing substances, including heat, which may be harmful or injurious and cannot otherwise be disposed of in conformance with Federal, State, and regional standards, shall be injected into the geothermal resources zone or such other formation as is approved by the Supervisor.

Toxic drilling fluids shall be disposed of in a manner approved by the Supervisor and in conformance with applicable Federal, State, and regional standards.

(2) Solid Waste Disposal. Drill cuttings, sand, precipitates, and other solids shall be disposed of as directed by the Supervisor either on location or at other approved disposal sites. Containers for mud additives for chemicals and other solid waste materials shall be disposed of in a manner and place approved by the Supervisor.

(3) Air Quality. Noncondensable gases such as carbon dioxide, ammonia, and hydrogen sulfide may be vented or ejected into the atmosphere, provided, however, that the volume and the measured concentration of such vented gas or gases shall not exceed applicable Federal, State, or regional air pollution standards. Copies of each permit issued by the appropriate air pollution control agency and the reports required thereunder shall be submitted to the Supervisor.

(4) Pits and Sumps. Pits and sumps shall be lined with impervious material and purged of environmentally harmful chemicals and precipitates before backfilling. In no event shall the contents of a pit or sump be allowed to contaminate streams, lakes, and ground waters. Pits and sumps shall be constructed in a manner and in such locations so as to minimize damage to the natural environment and aesthetic values of the lease or adjacent property. When no longer used or useful, pits and sumps shall be backfilled and the premises restored to as near a natural state as reasonably possible. Temporary fencing of unattended pits and sumps to protect wildlife, livestock, and the public may be required by the Supervisor and the surface management agency.

(5) Production Facilities Maintenance. Production facilities shall be operated and maintained at all times in a manner necessary to prevent pollution. The lessee's field personnel shall be instructed in the proper maintenance and operations of production facilities for the prevention of pollution.

B. Inspection and Reports. Lessees shall comply with the following pollution inspection and reporting requirements.

(1) Pollution Inspections. Drilling and production facilities shall be inspected daily by the lessee. Appropriate preventative maintenance shall be performed as necessary to prevent failures and malfunctions which could lead to pollution. Wells and areas not under production shall be inspected by the lessee at intervals prescribed by the Supervisor. Necessary repairs or maintenance shall be made as required.

(2) Pollution Reports. All pollution incidents shall be reported orally within 18 hours to the appropriate Geothermal District Supervisor and shall be followed within 30 days thereof by a written report stating the cause and corrective action taken.

C. Injection. The use of any subsurface formation, including the geothermal resources zone for the disposal of well effluent, the residue thereof, or the injection of fluids

for other purposes such as subsidence prevention shall not be permitted until the lessee has submitted a plan of injection covering the proposed injection project and has subsequently received the Supervisor's written approval thereof.

(1) Plan of Injection. The plan of injection shall include the quantity, quality, and source of the proposed injection fluid; the means and method by which the fluid is to be injected; a structure map contoured on the intended injection zone; and cross-sections showing producing well locations and the proposed injection well location(s).

(2) Injection Report. The lessee shall file in duplicate with the Supervisor a Monthly Water Injection Report in a form approved by the Supervisor. The subject report shall be filed on or before the last day of the month following the month in which the injection took place.

(3) Inspection. Injection wells and facilities shall be inspected by the lessee at intervals as prescribed by the Supervisor to ascertain that all injected fluids are confined to the approved injection zone. A spinner survey, a radioactive tracer survey, and a cement bond log may be required on each injection well within 30 days after injection begins. The lessee shall furnish to the Supervisor two legible exact copies of any and all such surveys and logs. In the event of a casing failure, inadequate annular cement, or other mechanical failure, the lessee shall without unreasonable delay repair, suspend, or abandon the well. Where failure occurs in a zone which may damage surface or fresh water aquifers, injection shall immediately cease.

(4) New Wells. The drilling of new injection wells in accordance with an approved plan of injection shall be in conformance with the provisions of GRO Order No. 2. An Application for Permit to Drill, Form 9-331C, shall be filed in triplicate and approved for each injection well.

(5) Conversions. The conversion of an existing well to an injection well in accordance with or modification of an approved plan of injection shall be in conformance with the requirements of GRO Order No. 2. The lessee shall demonstrate to the satisfaction of the Supervisor by appropriate testing and logging that the well is mechanically sound and suitable for injection purposes. A Sundry Notice, Form 9-331, shall be filed in triplicate and approved for each conversion.

10. Water Quality. The primary responsibility for water quality and pollution control has been delegated to the States where such States have standards approved by the Environmental

Protection Agency. Such State standards must meet basic Federal requirements prohibiting the deterioration of waters whose existing quality is higher than established water quality standards. The lessee shall comply with the State water quality control organization's standards in such States as have federally-approved standards. The Supervisor, at his discretion, may establish additional and more stringent standards.

The lessee shall file, in duplicate, a detailed water analysis report for all completed geothermal wells within 30 days after completion and annually thereafter or as otherwise specified by the Supervisor. Unless otherwise prescribed by the Supervisor, such analyses shall include a determination of arsenic, boron, radioactive content, and radioactivity of the produced fluids. In the event that a health hazard exists, the Supervisor shall require appropriate health and safety precautions, periodic monitoring, or the suspension of production.

11. Noise Abatement. The lessee shall minimize noise during exploration, development, and production activities. The method and degree of noise abatement shall be as approved by the Supervisor.

The lessee shall conduct noise level measurements during exploration, development, and production operations to determine the potential objectionability to nearby residents as well as the potential health and safety danger due to noise emissions.

Noise level measurements and accompanying data shall be filed with the Supervisor. Such data shall provide the basis for operational and noise control decisions by the Supervisor and shall be based on an assessment of the noise relative to Federal or State criteria including adjustments for the area involved, meteorological conditions, and the time of day of the noise occurrence.

The lessee shall comply with Federal occupational noise exposure levels applicable to geothermal activity under the Occupational Safety and Health Act of 1970 as set forth in 29 CFR 1910.95, which are incorporated herein by reference, or with State standards for protection of personnel where such State standards are more restrictive than Federal standards.

A. Measurement Condition. Outdoor noise measurements shall be made at least 3 metres (10 feet) from structures, facilities, or other sound reflecting sources and approximately 1 metre (3 feet) above ground level. Extreme weather conditions, electrical interference, and unusual background noise levels shall be avoided or given due consideration when measuring sound levels.

B. Measurements. The lessee shall monitor and measure noise levels using an octave band noise analyzer with an A-weighted frequency response or a standard sound level meter that conforms to the requirements set forth in USA Standard Specifications for General Purpose Sound Level Meters USASI S1.4-1961 or the latest approved revision thereof. Bandpass filters shall conform to the requirements of USASI S1.11-1966. The lessee shall measure noise level frequency distribution as required by the Supervisor. Sound levels shall be measured in conformance with the USA Standard-Method for the Physical Measurement of Sound USASI S1.2-1962.

C. Criteria. In the absence of more restrictive criteria as may be established in this paragraph, the lessee shall not exceed a noise level of 65 dB(A) for all geothermal-related activity including but not limited to, exploration, development, or production operations as measured at the lease boundary line or 0.8 km (one-half mile) from the source, whichever is greater, using the A-weighted network of a standard Sound Level Meter. However, the permissible noise level of 65 dB(A) may be exceeded under emergency conditions or with the Supervisor's approval if written permission is first obtained by the lessee from all residents within 0.8 km (one-half mile).

D. Assessment. The lessee shall be responsible for taking such noise level measurements as are deemed necessary by the Supervisor. The background noise level shall serve as the criterion for the rating and assessment, by the Supervisor, of the objectionableness of noise emission from a particular source. The background or ambient noise is defined hereby as the minimum sound level at the relevant place and time in the absence of the source noise and shall include consideration for the type of land use, the season, atmospheric conditions, and the time of day.

E. Attenuation. To attenuate objectionable noise, the lessee shall utilize properly designed muffling devices as required by the Supervisor.

F. Relationships. Reference levels and relationships for noise measurements shall be as follows:

- (1) Reference sound pressure for airborne sounds shall be 20 MN/m (20 micronewtons per square metre).
- (2) Reference power shall be 10-12 watts.
- (3) Sound levels shall be measured using a standard Sound Level Meter with an "A" frequency response characteristic (weighting network).

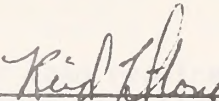
(4) Sound level meter controls shall be set for as uniform a frequency response as possible when measuring sound pressure levels.

(5) Octave band noise levels shall be reported in equivalent A-weighted levels.

G. Record of Sound Measurements. The Supervisor may require sound level measurements during drilling, testing, and producing operations. Such measurements shall be filed in duplicate with the Supervisor and shall include the following data:

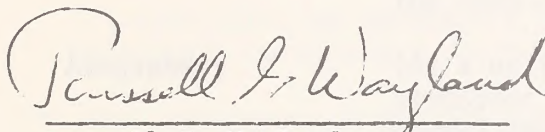
- (1) Date, time, and location.
- (2) Name of observer.
- (3) Description of primary noise source emitter under test.
- (4) Kind of operation and operating conditions.
- (5) Description of secondary noise sources including location, type, and kind of operation.
- (6) Type and serial numbers on all microphones, sound level meters, and octave band analyzers used. Length and type of microphone cables.
- (7) Position of observer.
- (8) Direction of arrival of sound with respect to microphone orientation.
- (9) Approximate temperature of microphone.
- (10) Results of maintenance and calibration tests.
- (11) Weighting network and meter speed used.
- (12) Measured overall response and band levels at each microphone position and extent of meter fluctuation.
- (13) Background overall response and band levels at each microphone position with primary noise source not operating.
- (14) Cable and microphone corrections.
- (15) Any other pertinent data such as personnel

exposed directly and indirectly, time pattern of the exposure, atmospheric conditions, attempts at noise control, and personnel protection.



Reid T. Stone
Area Geothermal Supervisor

APPROVED:



Russell G. Wayland
Chief, Conservation Division

APPENDIX B

Glossary of Terms

GLOSSARY

- Andesite** A fine-grained igneous rock, lighter in appearance than basalt. An andesite contains greater amounts of sodium, potassium, and water in its mineralogy than basalt.
- Animal Unit Months** A measure of forage or feed requirement to maintain 1 animal unit (roughly, 1 cow, horse, or mule, or 5 sheep, or 2 six-month old calves, etc.) for a period of 30 days.
- Arcuate** Said of a mountain range, fold, fault, shape, etc., the form or line of which is curved or bowed.
- Atmosphere** (As a unit of pressure) - one atmosphere is that atmospheric pressure that exists at sea level under normal temperatures.
- Basalt** A dark to medium dark extrusive volcanic rock.
- Breccia** A coarse-grained rock composed of large (greater than sand-sized, or 2 mm in diameter), angular, and broken rock fragments that are cemented together in a finer-grained matrix.
- Bonus Bid** A lump sum paid to the U.S. by the successful bidder for a mineral lease, such payment being in addition to the rents and royalties specified in the lease.
- Carnivorous** Feeding on animal tissue.
- Cauldron** An inclusive term for all volcanic subsidence structures regardless of shape or size, depth of erosion, or connection with the earth's surface.
- Ecological Succession** The orderly and progressive replacement of one community by another until a relatively stable community occupies the area (Smith, 1966).
- Ecotone** A transition between two or more biotic communities.
- Electrical Resistivity** A geophysical survey used to measure the natural resistivity of given rock masses by inducing an electrical current. This is an excellent tool for locating buried thermal waters because decreasing resistivity can indicate an increase in temperatures.
- Endangered Species** Those in danger of extinction throughout all or a significant portion of their range.

Endangered Species Group One	Those which are believed to be or to have been regular in occurrence in New Mexico and to have suffered declines in numbers and/or range in the State to the point that their survival there is severely jeopardized or possibly has ceased.
Endangered Species Group Two	Those that are believed to be or to have been regular in occurrence in New Mexico and are suffering or facing declines in numbers and/or range in the State to the point that their survival there could soon become severely jeopardized.
En echelon	In steplike arrangement; said of geologic features that are in an overlapping or staggered arrangement.
Exclosure	A fence or similar apparatus used to exclude unwanted animals; for research purposes.
Extensional Stress Regime	Said of a set of stresses (forces which result in pulling apart, or splitting).
Facies	General appearance; a particular local aspect or modification of an ecological community
Geothermometer	A mineral or mineral assemblage whose composition, structure, and inclusions are fixed within known thermal limits under particular conditions of pressure and composition, and whose presence thus denotes a limit or range for the temperature of formation of the enclosing rock or fluid.
Graben	An elongate, down-faulted crustal unit or block that is bound by faults on its long dimensions. In the Basin and Range, grabens are commonly valleys.
Heat Conductivity	A measure of the ability of a material to conduct heat. Rocks with abundant quartz have high thermal conductivities. Poorly consolidated sediments have lower thermal conductivities.
Herbivorous	Feeding on plants
Horst	An elongate, uplifted crustal unit or block that is bound by faults on its long dimensions. In the Basin and Range, horsts are commonly mountain ranges.
Igneous	Fire rock. Molten rock.

Life Zones	A classification of flora and fauna on the bases of elevation and latitude.
Lower Sonoran	The life zone which extends from about 2,817 to 5,000 feet elevation. The major floral type is desert shrub.
Mesic	Characterized by or requiring a moderate amount of moisture.
Metamorphic	Said of a rock which results from recrystallization in a solid state due to increasing pressure and/or temperature.
Meteoric	From the sky. Pertaining to the atmosphere, meteoric water = rain. (Dictionary - pertaining to water of recent atmospheric origin).
MWCEN	MWCEN of electricity - megawatt-century . . . a megawat of electrical energy produced for a century.
Niche	The space occupied and the function of each species within a community.
Omnivorous	Feeding on both animal and plant substances
Phenological	Said to be of the study of the time of appearance of characteristic periodic events in the life cycles of organisms in nature and how these events are influenced by environmental factors.
Phreatophyte	A deep-rooted plant that obtains its water from the water table or the layer of soil just above it.
Primary Succession	The first occupation of areas that were previously devoid of organisms.
Rhizome	A horizontal underground stem, usually sending out shoots and above-ground shoots at the nodes.
Rhyolite	An igneous rock that is a fine-grained equivalent to a granite.
Secondary Succession	Species diversity changes occurring on areas as the result of disturbance by man, animals, or natural forces, such as fires, wind storms, and floods.

Seral	A biotic community which is a developmental, transitory stage in an ecological succession.
Stolon	A horizontal stem which grows along the surface of the soil and roots at the nodes.
Stoma	One of the minute openings in the epidermis of a plant organ (as a leaf) through which gaseous interchange takes place.
Stratum (plural, strata)	A bed or layer of some material spread over a surface.
Syncline	A concave, upward fold, the core of which contains the stratigraphically younger rocks.
Tectonic	Structural features as a whole, the field of geology concerned with structure, especially with folding and faulting.
Threatened Species	Species which are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.
Transition Zone	The life zone which extends from about 7,000 to 9,500 feet elevation. The major floral type is ponderosa pine.
Upper Sonoran	The life zone which extends from about 4,500 to 8,000 feet elevation. The major floral type is pinyon-juniper.
Xeric	Characterized by or requiring only a small amount of moisture.
Xerophyte	A plant structurally adapted for life and growth with a limited water supply.

APPENDIX C

Notice of Intent to Conduct Geothermal Resource Exploration
(From 3200-9)

Notice of Completion of Geothermal Resource Exploration
Operations (From 3200-10)

Competitive Geothermal Resource Lease Bid (From 3200-4)

Application to Lease Geothermal Resources (Sec. 4 Non-competitive
Leases) (From 3200-8)

Geothermal Resources Lease (From 3200-21)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Notice Number

NOTICE OF INTENT TO CONDUCT GEOTHERMAL RESOURCE
EXPLORATION OPERATIONS

Applicant(s)	Address (include zip code)
Operator	Address (include zip code)
Contractor(s)	Address (include zip code)

hereby apply for authorization to conduct exploration operations pursuant to the provisions of 43 CFR 3209 now or hereafter in force across and upon the following-described lands (give description of lands by township, attach map or maps showing lands to be entered or affected)

Type of operations to be conducted (give brief description)

Exploration operations will be conducted during the period (date) from _____ to _____

Attached \$ _____ Surety bond Rider to Nationwide bond Rider to Statewide bond Bond to be furnished

Upon completion of exploration operations the undersigned agrees to notify the Authorized Officer that authorized exploration operations have been completed in conformance with the general and special terms and stipulations of the notice.

The undersigned hereby agrees (1) that he will not enter upon the described land until he has been informed in writing whether there are special stipulations applicable to his Notice of Intent, as to either time or method of operation or otherwise, and, if there are such stipulations, what those stipulations are, (2) that he will comply with those special stipulations, if any; and (3) that he will not enter upon the described lands until his entry has been approved by the Authorized Officer.

The undersigned agrees to be bound by the terms and conditions of this notice to conduct exploration operations when approved by the Authorized Officer.

The undersigned agrees that the filing of this Notice under the regulations (43 CFR Subpart 3209) does not vest or confer any preference right to a geothermal resources lease.

The undersigned agrees further that all exploration operations shall be conducted pursuant to the following terms and conditions:

1. Exploration operations shall be conducted in compliance with all Federal, State, and local laws, ordinances, or regulations which are applicable to the area of operations including, but not limited to, those pertaining to fire, sanitation, conservation, water pollution, fish, and game. All operations hereunder shall be conducted in a prudent manner.
2. Due care shall be exercised in protecting the described lands from damage. All necessary precautions shall be taken to avoid any damage other than normal wear and tear to improvements on the land including, but not limited to, gates, bridges, roads, culverts, cattle guards, fences, dams, dikes, vegetative cover, improvements, stock watering, and other facilities.
3. All drill holes shall be capped when not in use and appropriate procedures shall be taken to protect against

hazards in order to protect the lives, safety, or property of other persons or of wildlife and livestock.

4. All vehicles shall be operated at a reasonable rate of speed and, in the operation of vehicles, due care shall be taken to safeguard livestock and wildlife in the vicinity of operations. Existing roads and trails shall be used wherever possible. If new roads and trails are to be constructed, the Authorized Officer must be consulted prior to construction as to location and specifications. Reclamation and/or reseeding of new roads and trails shall be made as requested by the Authorized Officer.
5. Upon expiration, conclusion, or abandonment of operations conducted pursuant to this Notice, all equipment shall be removed from the land, and the land shall be restored as nearly as practicable to its original condition by such measures as the Authorized Officer may specify. All geophysical holes shall be safely plugged. The Authorized Officer shall be furnished a Notice of Completion of Geothermal Resource Exploration Operations (Form 3200-3) immediately upon cessation of all such operations and shall be further informed of the completion of reclamation work as soon as possible.
6. Location and depth of water sands encountered shall be disclosed to the Authorized Officer.

(Continued on reverse)

Form 3200-9 (December 1973)

Operator shall contact the Authorized Officer, prior to actual entry upon the land in order to be appraised of practices which shall be followed or avoided in the conduct of exploration operations pursuant to the terms of this Notice and applicable regulations. Operator will conduct no operations on the land unless the attached bond is in good standing.

8. Due care shall be exercised to avoid scarring or removal of ground vegetative cover.
9. All operations shall be conducted in such a manner to avoid (a) blockage of any drainage systems; (b) changing the character, or causing the pollution or siltation of rivers, streams, lakes, ponds, waterholes, seeps, and marshes; and (c) damaging fish and wildlife resources or habitat. Cuts or fills causing any of the above-mentioned problems will be repaired immediately in accordance with specifications of the Authorized Officer.
10. Vegetation shall not be disturbed within 300 feet of waters designated by the Authorized Officer, except at approved stream crossings.
11. Surface damage which induces soil movement and/or water pollution shall be subject to corrective action as required by the Authorized Officer.
12. Trails and campsites shall be kept clean. All garbage and foreign debris shall be eliminated as required by the Authorized Officer.
13. Operator shall protect all survey monuments, witness corners, reference monuments, and bearing trees against destruction, obliteration, or damage. He shall, at his expense reestablish damaged, destroyed, or obliterated monuments and corners, using a licensed surveyor, in accordance with Federal survey procedures. A record of the reestablishment shall be submitted to the Authorized Officer.
14. Operator shall make every reasonable effort to prevent, control, or suppress any fires started by the operator, and

to report, as soon as possible, to the Authorized Officer location and size of fires, and assistance needed to suppress such fires. Operator shall inform the Authorized Officer as soon as possible of all fires, regardless of location, noted, or suppressed by independent action.

15. No work shall be done within one-half mile of a developed recreation site without specific written authority from the Authorized Officer. Any travel within one-half mile of a recreation site shall be over existing roads or trails.
16. Use of explosives within one-half mile of designated waters is prohibited unless approved, in writing, by the Authorized Officer.
17. If operations conducted under the provisions of this Notice causes any damage to the surface of the national resource lands, such as, but not limited to, soil erosion, pollution of water, injury or destruction of livestock or wildlife, or littering, operator shall, within 48 hours, file with the Authorized Officer a map showing exact location of such damage and a written report containing operator's plans for correcting or minimizing damage, if possible.
18. Violation of, or failure to comply with any of these terms and conditions shall result in immediate shutdown of field operations until deficiency is corrected. Failure to correct deficiency within the time period allowed by the Authorized Officer shall result in forfeiture of bond.
19. The Bureau of Land Management reserves the right to close any area to operators in periods of fire danger or when irreparable damage to natural resources is imminent.
20. Contractor shall be liable for assuring compliance with all terms and conditions of this Notice and all actions of his designated operator, agents, and employees.
21. Where continuation of the operation will result in irreparable damage to the land and other natural resources this Notice will be immediately cancelled by the Authorized Officer.

22. Special Stipulations:

(Signature of Applicant)

(Date)

(Signature of Operator)

(Date)

We hereby agree to the special stipulations added and made a part of this Notice to conduct exploration operations.

(Signature of Holder of Notice)

(Date)

(Signature of Operator)

(Date)

I hereby approve this Notice to conduct exploration operations.

(Signature of Authorized Officer)

(Title)

(Date)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

NOTICE OF COMPLETION OF GEOTHERMAL RESOURCE
EXPLORATION OPERATIONS

Name	Address (include zip code)
------	----------------------------

Pursuant to the *Notice Number* _____ heretofore filed to conduct geothermal resource exploration operations,
this is to

advise that such operations were completed (*date*) _____, on the lands described in the above
identified notice.

(Geophysical Operator's Signature)

(Address, include zip code)

(Date)

Instructions: Submit original and one (1) copy of completed form to proper Bureau of Land Management Office. Insert
Notice Number of *Notice of Intent to Conduct Exploration Operation* (Form 3200-2) which authorized the
exploration completed.

UNITED STATES
DEPARTMENT OF JUSTICE
FEDERAL BUREAU OF INVESTIGATION

MEMORANDUM FOR THE DIRECTOR, FBI
FROM: SAC, [illegible]

[The remainder of the page contains extremely faint and illegible text, likely a memorandum body or report content.]

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

COMPETITIVE GEOTHERMAL RESOURCES
LEASE BID

FORM APPROVED
OMB NO. 42-R1687

Known Geothermal Resources Area

State

Date of Sale

The following bid is submitted for competitive geothermal resources lease on the lands identified below

PARCEL NUMBER OR LAND DESCRIPTION	AMOUNT OF BID		
	TOTAL	PER ACRE	DEPOSIT SUBMITTED WITH BID

1. Are you a citizen of the United States? Yes No

2. If a corporation or other legal entity, specify kind

3. Are you the sole party in interest in this lease? Yes No

I CERTIFY That I am qualified to hold any lease which may issue as a result of this sale under the Geothermal Steam Act of 1970 (84 Stat. 1566) and the regulations thereunder.

(Signature of Bidder)

(Address of Bidder)

(City, State, and zip code)

Title 18 U.S.C. Section 1001, makes it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious or fraudulent statements or representations as to any matter within its jurisdiction.

(Instructions on reverse)

Form 3200-4 (December 1973)

INSTRUCTIONS

1. Separate bid for *each* parcel is required. If no parcel number has been assigned to tract, then land description or identification should be furnished.
2. Bid *must* be accompanied by one-half of total amount of bid. The amount should be cash or money order, certified or cashier's check, or bank draft which *must* be made payable to the *Bureau of Land Management*.
3. Identify envelope *Bid for Geothermal Resources Lease in (name of KGRA)*. Be sure correct parcel number of tract on which bid is submitted and date of bid opening are noted plainly on envelope. No bid may be modified or withdrawn unless such modification or withdrawal is received prior to time fixed for opening of bids.
4. Mail or deliver bid to office and place indicated in *Notice of Sale*.
5. If bid is submitted by an agent or attorney-in-fact, association (including a partnership), corporation, guardian, or a trustee the showing required by 43 CFR 3202.2 should accompany bid, *except* that if the required information has previously been filed, a reference by serial number to the record in which it was filed, together with a statement as to any amendments, will be sufficient.
6. If bidder is *not* the sole party in interest in the lease for which bid is submitted, full disclosure of interests of all other parties *must* be made as required by 43 CFR 3202.2-5, accompanied by a separate showing of qualifications of such parties to hold the lease interest.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

FORM APPROVED
OMB NO. 42-R1688

Serial Number

APPLICATION TO LEASE GEOTHERMAL RESOURCES
(Sec. 4 Noncompetitive Lease)

The undersigned hereby makes application to lease all or any of the lands described herein that are available for lease pursuant and subject to the terms and provisions of the Act of December 24, 1970 (84 Stat. 1566, 30 U.S.C. Sec. 1001), or any amendments hereafter enacted, hereinafter referred to as the Act, and to all applicable regulations now or hereafter in force when not inconsistent with any express and specific provisions herein, which are made a part hereof.

1. Name (<i>Last, First, Middle initial, print or type</i>)	Address (<i>include zip code</i>)																								
Social Security or Taxpayer Number																									
2. Legal description																									
State	County																								
NATIONAL RESOURCE LANDS	ACQUIRED LANDS																								
<div style="display: flex; justify-content: space-between;"> Total area Acres </div>	<div style="display: flex; justify-content: space-between;"> Total area Acres </div>																								
3. Service charge enclosed	<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:80%;"></td> <td style="width:10%; text-align: center;">YES</td> <td style="width:10%; text-align: center;">NO</td> </tr> <tr> <td>4. Rental enclosed</td> <td></td> <td></td> </tr> <tr> <td>5. Compliance bond enclosed</td> <td></td> <td></td> </tr> <tr> <td>6. Are you the sole party in interest?</td> <td></td> <td></td> </tr> <tr> <td>7. Are you a citizen of the United States?</td> <td></td> <td></td> </tr> <tr> <td>8. Have you reached the age of majority?</td> <td></td> <td></td> </tr> <tr> <td>9. Is application made for a corporation or other legal entity?</td> <td></td> <td></td> </tr> <tr> <td>10. Has a statement of qualifications been filed?</td> <td></td> <td></td> </tr> </table>		YES	NO	4. Rental enclosed			5. Compliance bond enclosed			6. Are you the sole party in interest?			7. Are you a citizen of the United States?			8. Have you reached the age of majority?			9. Is application made for a corporation or other legal entity?			10. Has a statement of qualifications been filed?		
	YES	NO																							
4. Rental enclosed																									
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8. Have you reached the age of majority?																									
9. Is application made for a corporation or other legal entity?																									
10. Has a statement of qualifications been filed?																									

I CERTIFY That my interests, direct or indirect, in geothermal resources leases in the above State do not exceed 20,480 acres. That the statements made herein are true, complete, and correct to the best of my knowledge and belief and are made in good faith.

(Signature of Applicant)	(Signature of Applicant)
(Date)	(Attorney-in-Fact)

Title 18 U.S.C. Section 1001 makes it a crime for any person knowingly and wilfully to make to any department or agency of the United States any false, fictitious, or fraudulent statements or representations as to any matter within its jurisdiction.

(Instructions on reverse)

Form 3200-8 (December 1973)

GENERAL INSTRUCTIONS

Submit copies of application typewritten or printed plainly, and signed in ink. Application *must* be filed in the proper BLM Office for the State in which the lands are located, in *duplicate* for national resource lands and in *triplicate* where acquired lands are involved. Applications for lands in the following States which have no proper BLM Office should be filed in the office indicated below.

North Dakota, South Dakota
State Office, BLM
Billings, Montana 59101

Kansas, Nebraska
State Office, BLM
Cheyenne, Wyoming 82001

Oklahoma
State Office, BLM
Santa Fe, New Mexico 87501

Eastern States
Eastern States Office, BLM
7981 Eastern Avenue
Silver Spring, Maryland 20910

If additional space is needed in furnishing any of the required information, it should be prepared on additional sheets, initialed, and attached to your application.

Item 1 - Give last name, first name, middle initial, and Social Security or Taxpayer Number. Give street and number (P.O. Box), City, State, and Zip Code.

*Item 2 - Land Description - Give complete and accurate description of lands for which lease is desired. If lands have been surveyed under the public land rectangular system, each application *must* describe lands by legal subdivision, section, township, and range. When protracted surveys have been approved and effective date thereof published in the Federal Register, all applications to lease lands shown on such protracted surveys, filed on or after such effective date, *must* describe lands only according to section, township, and range shown on approved protracted surveys. If lands have neither been surveyed on the ground nor shown on records as protracted surveys, each application *must* describe lands by metes and bounds, giving courses and distances between successive angle points on the boundary of tract, in cardinal directions except where boundaries of lands are in irregular form, and connected by courses and distances to an official corner of the public land surveys. In Alaska, descriptions of unsurveyed lands *must* be connected by courses and distances to either an official corner of the public land surveys or to a triangulation station established by any agency of the United States (such as the United States Geological Survey, the Coast and Geodetic Survey, or the International Boundary Commission), if the record position thereof is available to the general public. For description of unsurveyed public lands adjacent to tidal waters in Louisiana and Alaska, see 43 CFR 3203.4(d).*

Total area of land requested should be shown, in acres, in space provided. That area, except where the rule of approximation applies, must not exceed 2560 acres. All of the land applied for, must be within a six (6) mile square or an area of six (6) surveyed or protracted sections in length or width. In instances where the United States does not own a 100 percent interest in the mineral deposits in any particular tract, the offeror should indicate the percentage of Government ownership.

Item 3 - Service Charge - Nonrefundable service charge of fifty dollars (\$50) must accompany application.

Item 4 - Rental - Advance rental at rate of not less than one dollar (\$1) per acre, or fraction thereof, must be submitted at time of filing application.

*Item 5 - Bonding - A single copy of the bonds on forms approved by the Director *must* be filed in the proper BLM Office. Bonds may be filed with application or *must* be filed within thirty (30) days after receipt of notice from Authorized Officer.*

*Item 6 - Party in Interest - Indicate whether sole party in interest or not. If not, submit, at the time application is filed, a signed statement setting forth names of other interested parties and the nature of the agreement between them. All interested parties *must* furnish evidence of their qualifications to hold an interest in the lease when application is filed.*

*Item 8 - Age of Majority - Indicate whether or not the age of majority. If application is made by a guardian or trustee for a person who has not reached the age of majority, the application *must* be accompanied by evidence required by Section 3202.2-2 of the Regulations.*

*Item 9 - Application by Corporation or Association - If the applicant is a corporation, or an association, it must submit a statement containing the following information: (1) State in which it is incorporated or formed; (2) that it is authorized to hold geothermal leases; (3) that the officer executing this application is authorized to act on behalf of corporation or association in such matters; and, (4) the percentage of voting stock and all stock owned by aliens or for those having addresses outside the United States. If 10 percent or more of the stock of any class is owned or controlled by, or on behalf of, any one stockholder, a separate showing as to his name, citizenship, and holdings *must* be furnished.*

Item 10 - Statement of Qualifications Filed - If qualification statement has been previously filed indicate and identify by serial number the record in which such statements were filed together with a statement as to any amendments thereof.

Submit application in a sealed envelope. Envelope *must* be plainly identified that it is an application for a lease pursuant to 43 CFR 3210. (*Items not listed are self-explanatory*).

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Serial Number

USGS - KGRA Determination:

GEOHERMAL RESOURCES LEASE

Competitive Noncompetitive

In consideration of the terms and conditions contained herein, and the grant made hereby, this lease is entered into by the UNITED STATES OF AMERICA (hereinafter called the "Lessor"), acting through the Bureau of Land Management (hereinafter called the "Bureau") of the Department of the Interior (hereinafter called the "Department"), and

(hereinafter called the

"Lessee").

This lease is made pursuant to the Geothermal Steam Act of 1970 (84 Stat. 1566, 30 U.S.C. 1001-1025) (hereinafter called "the Act") to be effective on _____ (hereinafter called the "effective date"). It is subject to all the provisions of the Act and to all the terms, conditions, and requirements of (a) all regulations promulgated by the Secretary of the Interior (hereinafter called "the Secretary") in existence upon the effective date, specifically including, but not limited to, 43 CFR Parts 3000 and 3200 and 30 CFR Parts 270 and 271, (b) all geothermal resources operational orders (hereinafter called "GRO orders") issued pursuant thereto, all of which are incorporated herein and by reference made a part hereof, and (c) any regulations hereafter issued by the Secretary (except those inconsistent with any specific provisions of this lease other than regulations incorporated herein by reference) all of which shall be, upon their effective date, incorporated herein and, by reference, made a part hereof.

Sec. 1. GRANT - The Lessor hereby grants and leases to the Lessee the exclusive right and privilege to drill for, extract, produce, remove, utilize, sell, and dispose of geothermal steam and associated geothermal resources, (hereinafter called "geothermal resources"), in or under the following described lands situated within the County of _____ State of _____:

National Resource Lands			Acquired Lands		
T.	R.	Meridian	T.	R.	Meridian
Total Area			Total Area		

Containing _____ acres (hereinafter called the "leased area" or "leased lands"), together with:

- (a) The nonexclusive right to conduct within the leased area geological and geophysical exploration in accordance with applicable regulations; and
- (b) The right to construct or erect and to use, operate, and maintain within the leased area, together with ingress and egress thereupon all wells, pumps, pipes, pipelines, buildings, plants, sumps, brine pits, reservoirs, tanks, waterworks, pumping stations, roads, electric power generating plants, transmission lines, industrial facilities, electric, telegraph or telephone lines, and such other works and structures and to use so much of the surface of the land as may be necessary or reasonably convenient for the production, utilization, and processing of geothermal resources or to the full enjoyment of the rights granted by this lease, subject to compliance with applicable laws and regulations; *Provided that*, although the use of the leased area for an electric power generating plant or transmission facilities or a commercial or industrial facility is authorized hereunder, the location of such facilities and the terms of occupancy therefor shall be under separate instruments issued under any applicable laws and regulations; and
- (c) The nonexclusive right to drill potable water wells in accordance with state water laws within the leased area and to use the water produced therefrom for operations on the leased lands free of cost, provided that such drilling and development are conducted in accordance with procedures approved by the Supervisor of the Geological Survey (hereinafter called "Supervisor"); and
- (d) The right to convert this lease to a mineral lease under the Mineral Leasing Act of February 25, 1920, as amended, and supplemented (30 U.S.C. 181-287) or under the Mineral Leasing Act for Acquired Lands (30 U.S.C. 351-359), whichever is appropriate, if the leasehold is primarily valuable for the production of one or more valuable by-products which are leaseable under those statutes, and the lease is incapable of commercial production or utilization of geothermal steam; *Provided that*, an application is made therefor prior to the expiration of the lease extension by reason of by-product production as hereinafter provided, and subject to all the terms and conditions of said appropriate Acts. The Lessee is also granted the right to locate mineral deposits under the mining laws (30 U.S.C. 21-54), which would constitute by-products if commercial production or utilization of geothermal steam continued, but such a location to be valid must be completed within ninety (90) days after the termination of this lease. Any conversion of this lease to a mineral lease or a mining claim is contingent on the availability of such lands for this purpose at the time of the conversion. If the lands are withdrawn or acquired in aid of a function of any Federal Department or agency, the mineral lease or mining claim shall be subject to such additional terms and conditions as may be prescribed by such Department or agency for the purpose of making operations thereon consistent with the purposes for which these lands are administered; and
- (e) The right, without the payment of royalties hereunder, to reinject into the leased lands geothermal resources and condensates to the extent that such resources and condensates are not utilized, but their reinjection is necessary for operations under this lease in the recovering or processing of geothermal resources. If the Lessee, pursuant to any approved plan, disposes of the unusable brine and produced waste products into underlying formations, he may do so without the payment of royalties.

Sec. 2. TERM

(a) This lease shall be for a primary term of ten (10) years from the effective date and so long thereafter as geothermal steam is produced or utilized in commercial quantities but shall in no event continue for more than forty (40) years after the end of the primary term. However, if at the end of that forty-year period geothermal steam is being produced or utilized in commercial quantities, and the leased lands are not needed for other purposes, the Lessee shall have a preferential right to a renewal of this lease for a second forty-year term in accordance with such terms and conditions as the Lessor deems appropriate.

(b) If actual drilling operations are commenced on the leased lands or under an approved plan or agreement on behalf of the leased lands prior to the end of the primary term,

and are being diligently prosecuted at the end of the primary term, this lease shall be extended for five (5) years and so long thereafter, but not more than thirty-five (35) years, as geothermal steam is produced or utilized in commercial quantities. If at the end of such extended term geothermal steam is being produced or utilized in commercial quantities, the Lessee shall have a preferential right to a renewal for a second term as in (a) above.

(c) If the Lessor determines at any time after the primary term that this lease is incapable of commercial production and utilization of geothermal steam, but one or more valuable by-products are or can be produced in commercial quantities, this lease shall be extended for so long as such by-products are produced in commercial quantities but not for more than five (5) years from the date of such determination.

Sec. 3. RENTALS AND ROYALTIES

(a) *Annual Rental* - For each lease year prior to the commencement of production of geothermal resources in commercial quantities on the leased lands, the Lessee shall pay the Lessor on or before the anniversary date of the lease a rental of \$ _____ for each acre or fraction thereof.

(b) *Escalating Rental* - Beginning with the sixth lease year and for each year thereafter until the lease year beginning on or after the commencement of production of geothermal resources in commercial quantities, the Lessee shall pay on or before the anniversary date of the lease an escalated rental in an amount per acre or fraction thereof equal to the rental per acre for the preceding year and an additional sum of one (1) dollar per acre or fraction thereof. If the lease is extended beyond ten (10) years for reasons other than the commencement of production of geothermal resources in commercial quantities, the rental for the eleventh year and for each lease year thereafter until the lease year beginning on or after the commencement of such production will be the amount of rental for the tenth lease year. If any expenditures are made in any lease year for diligent exploration on the leased lands in excess of the minimum required expenditures for that year, the excess may be credited against any rentals in excess of \$ _____ per acre or fraction thereof due the Lessor for that or any future year.

(c) *Royalty* - On or before the last day of the calendar month after the month of commencement of production in commercial quantities of geothermal resources and thereafter on a monthly basis, the Lessee shall pay to the Lessor:

(1) A royalty of _____ percent on the amount or value of steam, or any other form of heat or other associated energy produced, processed, removed, sold, or utilized from this lease or reasonably susceptible to sale or utilization by the Lessee.

(2) A royalty of _____ percent of the value of any by-product derived from production under this lease, produced, processed, removed, sold, or utilized from this lease or reasonably susceptible of sale or utilization by the Lessee, except that as to any by-product which is a mineral named in Sec. 1 of the Mineral Leasing Act of February 25, 1920, as amended, (30 U.S.C. 181), the rate of royalty for such mineral shall be the same as that provided in that statute and the maximum rate of royalty for such mineral shall not exceed the maximum royalty applicable under that statute.

(3) A royalty of _____ percent of the value of commercially demineralized water which has been produced from the leased lands, and has been sold or utilized by the Lessee or is reasonably susceptible of sale or utilization by the Lessee. In no event shall the Lessee pay to the Lessor, for the lease year beginning on or after the commencement of production in commercial quantities on the leased lands or any subsequent lease year, a royalty of less than two (2) dollars per acre or fraction thereof. If royalty paid on production during the lease year has not satisfied this requirement, the Lessee shall pay the difference on or before the expiration date of the lease year for which it is paid.

(d) *Waiver and Suspension of Rental and Royalties* - Rentals or royalties may be waived, suspended, or reduced pursuant to the applicable regulations on the entire leasehold or any portion thereof in the interest of conservation or for the purpose of encouraging the greatest ultimate recovery of geothermal resources if the Lessor determines that it is necessary to do so to promote such development, or because the lease cannot be successfully operated under the terms fixed herein.

(e) *Undivided Fractional Interests* - Where the interest of the Lessor in the geothermal resources underlying any tract or tracts described in Sec. 1 is an undivided fractional interest, the rentals and royalties payable on account of each such tract shall be in the same proportion to the rentals and royalties provided in this lease as the individual fractional interest of the Lessor in the geothermal resources underlying such tract is to the full fee interest.

(f) *Adjustments* - Rentals and royalties hereunder may be readjusted in accordance with the Act and regulations to rates not in excess of the rates provided therein, and at not less than twenty (20) year intervals beginning thirty-five (35) years after the date geothermal steam is produced from the lease as determined by the Supervisor.

Sec. 4. *PAYMENTS* - It is expressly understood that the Secretary may establish the values and minimum values of geothermal resources to compute royalties in accordance with the applicable regulations. Unless otherwise directed by the Secretary, all payments to the Lessor will be made as required by the regulations. If there is no well on the leased lands capable of producing geothermal resources in commercial quantities, the failure to pay rental on or before the anniversary date shall cause the lease to terminate by operation of law except as provided by Sec. 3244.2 of the regulations. If the time for payment falls on a day on which the proper office to receive payment is closed, payment shall be deemed to be made on time if made on the next official working day.

Sec. 5. *BONDS* - The Lessee shall file with the Authorized Officer of the Bureau (hereinafter called the "Authorized Officer") shall maintain at all times the bonds required under the regulations to be furnished as a condition to the issuance of this lease or prior to entry on the leased lands in the amounts established by the Lessor and to furnish such additional bonds or security as may be required by the Lessor upon entry on the lands or after operations or production have begun.

Sec. 6. WELLS

(a) The Lessee shall drill and produce all wells necessary to protect the leased land from drainage by operations on lands not the property of the Lessor, or other lands of the Lessor leased at a lower royalty rate, or on lands as to which royalties and rentals are paid into different funds from those

into which royalties under this lease are paid. However, in lieu of any part of such drilling and production, with the consent of the Supervisor, the Lessee may compensate the Lessor in full each month for the estimated loss of royalty through drainage in the amount determined by said Supervisor.

(b) At the Lessee's election, and with the approval of the Supervisor, the Lessee shall drill and produce other wells in conformity with any system of well spacing or production allotments affecting the field or area in which the leased lands are situated, which is authorized by applicable law.

(c) After due notice in writing, the Lessee shall diligently drill and produce such wells as the Supervisor shall require so that the leased lands may be properly and timely developed and for the production of geothermal steam and its by-products, including commercially demineralized water for beneficial uses in accordance with applicable state laws. However, the Supervisor may waive or modify the requirements of this subparagraph (c) in the interest of conservation of natural resources or for economic feasibility or other reasons satisfactory to him. If the products or by-products of geothermal production from wells drilled on this lease are susceptible of producing commercially demineralized water for beneficial uses, and a program therefor is not initiated with due diligence, the Lessor may at its option elect to take such products or by-products and the Lessee shall deliver all or any portion thereof to the Lessor at any point in the Lessee's geothermal gathering or disposal system without cost to the Lessee, if the Lessee's activities, under the lease, would not be impaired and such delivery would otherwise be consistent with field and operational requirements. The retention of this option by the Lessor shall in no way relieve the Lessee from the duty of producing commercially demineralized water where required to do so by the Lessor, except when the option is being exercised and then only with respect to wells where it is being exercised, or limit the Lessor's right to take any action under Sec. 25 to enforce that requirement.

Sec. 7. *INSPECTION* - The Lessee shall keep open at all reasonable times for the inspection of any duly authorized representative of the Lessor the leased lands and all wells, improvements, machinery, and fixtures thereon and all production reports, maps, records, books, and accounts relative to operations under the lease, and well logs, surveys, or investigations of the leased lands.

Sec. 8. *CONDUCT OF OPERATIONS* - The Lessee shall conduct all operations under this lease in a workmanlike manner and in accordance with all applicable statutes, regulations, and GRO orders, and all other appropriate directives of the Lessor to prevent bodily injury, danger to life or health, or property damage, and to avoid the waste of resources, and shall comply with all requirements which are set forth in 43 CFR Group 3200, including, but not limited to, Subpart 3204, or which may be prescribed by the Lessor pursuant to the regulations, and with the special stipulations which are attached to the lease, all of which are specifically incorporated into this lease. A breach of any term of this lease, including the stipulations attached hereto, will be subject to all the provisions of this lease with respect to remedies in case of default. Where any stipulation is inconsistent with a regular provision of this lease, the stipulation shall govern.

Sec. 9. INDEMNIFICATION

(a) The Lessee shall be liable to the Lessor for any damage suffered by the Lessor in any way arising from or connected with the Lessee's activities and operations conducted pursuant to this lease, except where damage is caused by employees of the Lessor acting within the scope of their authority.

(b) The Lessee shall indemnify and hold harmless the Lessor from all claims arising from or connected with the Lessee's activities and operations under this lease.

(c) In any case where liability without fault is imposed on the Lessee pursuant to this section, and the damages involved were caused by the action of a third party, the rules of subrogation shall apply in accordance with the law of the jurisdiction where the damage occurred.

Sec. 10. *CONTRACTS FOR SALE OR DISPOSAL OF PRODUCTS* - The Lessee shall file with the Supervisor not later than thirty (30) days after the effective date thereof any contract, or evidence of other arrangement for the sale or disposal of geothermal resources.

Sec. 11. ASSIGNMENT OF LEASE OR INTEREST THEREIN

Within ninety (90) days from the date of execution thereof, the Lessee shall file for approval by the Authorized Officer any instruments of transfer made of this lease or of any interest therein, including assignments of record title and working or other interests.

Sec. 12. *REPORTS AND OTHER INFORMATION* - At such times and in such form as the Lessor may prescribe, the Lessee shall comply with all reporting requirements of the geothermal resources leasing, operating, and unit regulations and shall submit quarterly reports containing the data which it has collected through the monitoring of air, land, and water quality and all other data pertaining to the effect on the environment by operations under the lease. The Lessee shall also comply with such other reporting requirements as may be imposed by the Authorized Officer or the Supervisor. The Lessor may release to the general public any reports, maps, or other information submitted by the Lessee except geologic and geophysical interpretations, maps, or data subject to 30 CFR 270.79 or unless the Lessee shall designate that information as proprietary and the Supervisor or the Authorized Officer shall approve that designation.

Sec. 13. *DILIGENT EXPLORATION* - In the manner required by the regulations, the Lessee shall diligently explore the leased lands for geothermal resources until there is production in commercial quantities applicable to this lease. After the fifth year of the primary term the Lessee shall make at least

the minimum expenditures required to qualify the operations on the leased lands as diligent exploration under the regulations.

Sec. 14. PROTECTION OF THE ENVIRONMENT (LAND, AIR AND WATER) AND IMPROVEMENTS - The Lessee shall take all mitigating actions required by the Lessor to prevent: (a) soil erosion or damage to crops or other vegetative cover on Federal or non-Federal lands in the vicinity; (b) the pollution of land, air, or water; (c) land subsidence, seismic activity, or noise emissions; (d) damage to aesthetic and recreational values; (e) damage to fish or wildlife or their habitats; (f) damage to or removal of improvements owned by the United States or other parties; or (g) damage to or destruction or loss of fossils, historic or prehistoric ruins, or artifacts. Prior to the termination of bond liability or at any other time when required and to the extent deemed necessary by the Lessor, the Lessee shall reclaim all surface disturbances as required, remove or cover all debris or solid waste, and, so far as possible, repair the offsite and onsite damage caused by his activity or activities incidental thereto, and return access roads or trails and the leased lands to an acceptable condition including the removal of structures, if required. The Supervisor or the Authorized Officer shall prescribe the steps to be taken by Lessee to protect the surface and the environment and for the restoration of the leased lands and other lands affected by operations on the leased lands and improvements thereon, whether or not the improvements are owned by the United States. Timber or mineral materials may be obtained only on terms and conditions imposed by the Authorized Officer.

Sec. 15. WASTE - The Lessee shall use all reasonable precautions to prevent waste of natural resources and energy, including geothermal resources, or of any minerals, and to prevent the communication of water or brine zones with any oil, gas, fresh water, or other gas or water bearing formations or zones which would threaten destruction or damage to such deposits. The Lessee shall monitor noise, air, and water quality conditions in accordance with any orders of the Supervisor.

Sec. 16. MEASUREMENTS - The Lessee shall gauge or otherwise measure all production, sales, or utilization of geothermal resources and shall record the same accurately in records as required by the Supervisor. Reports on production, sales, or utilization of geothermal resources shall be submitted in accordance with the terms of this lease and the regulations.

Sec. 17. RESERVATIONS TO LESSOR - All rights in the leased area not granted to the Lessee by this lease are hereby reserved to the Lessor. Without limiting the generality of the foregoing such reserved rights include:

(a) *Disposal* - The right to sell or otherwise dispose of the surface of the leased lands or any resource in the leased lands under existing laws, or laws hereafter enacted, subject to the rights of the Lessee under this lease;

(b) *Rights-of-way* - The right to authorize geological and geophysical explorations on the leased lands which do not interfere with or endanger actual operations under this lease, and the right to grant such easements or rights-of-way for joint or several use upon, through or in the leased area for steam lines and other public or private purposes which do not interfere with or endanger actual operations or facilities constructed under this lease;

(c) *Mineral Rights* - The ownership of and the right to extract oil, hydrocarbon gas, and helium from all geothermal steam and associated geothermal resources produced from the leased lands;

(d) *Casing* - The right to acquire the well and casing at the fair market value of the casing where the Lessee finds only potable water, and such water is not required in lease operations; and

(e) *Measurements* - The right to measure geothermal resources and to sample any production thereof.

Sec. 18. ANTIQUITIES AND OBJECTS OF HISTORIC VALUE - The Lessee shall immediately bring to the attention of the Authorized Officer any antiquities or other objects of historic or scientific interest, including but not limited to historic or prehistoric ruins, fossils, or artifacts discovered as a result of operations under this lease, and shall leave such discoveries intact. Failure to comply with any of the terms and conditions imposed by the Authorized Officer with regard to the preservation of antiquities may constitute a violation of the Antiquities Act (16 U.S.C. 431-433). Prior to operations, the Lessee shall furnish to the Authorized Officer a certified statement that either no archaeological values exist or that they may exist on the leased lands to the best of the Lessee's knowledge and belief and that they might be impaired by geothermal operations. If the Lessee furnishes a statement that archaeological values may exist where the land is to be disturbed or occupied, the Lessee will engage a qualified archaeologist, acceptable to the Authorized Officer, to survey and salvage, in advance of any operations, such archaeological values on the lands involved. The responsibility for the cost for the certificate, survey, and salvage will be borne by the Lessee, and such salvaged property shall remain the property of the Lessor or the surface owner.

Sec. 19. DIRECTIONAL DRILLING - A directional well drilled under the leased area from a surface location on nearby land not covered by the lease shall be deemed to have the same effect for all purposes of this lease as a well drilled from a surface location on the leased area. In such circumstances, drilling shall be considered to have been commenced on the nearby land for the purposes of this lease, and production of geothermal resources from the leased area through any directional well located on nearby land, or drilling or reworking of any such directional well shall be considered production or drilling or reworking operations (as the case may be) on the leased area for all purposes of this lease. Nothing contained in this section shall be construed as

granting to the Lessee any right in any land outside the leased area.

Sec. 20. OVERRIDING ROYALTIES - The Lessee shall not create overriding royalties of less than one-quarter (1/4) of one percent of the value of output nor in excess of 50 percent of the rate of royalty due to the Lessor specified in Sec. 3 of this lease except as otherwise authorized by the regulations. The Lessee expressly agrees that the creation of any overriding royalty which does not provide for a prorated reduction of all overriding royalties so that the aggregate rate of royalties does not exceed the maximum rate permissible under this section, or the failure to suspend an overriding royalty during any period when the royalties due to the Lessor have been suspended pursuant to the terms of this lease, shall constitute a violation of the lease terms.

Sec. 21. READJUSTMENT OF TERMS AND CONDITIONS - The terms and conditions of this lease other than those related to rentals and royalties may be readjusted in accordance with the Act at not less than ten-year intervals beginning ten (10) years after the date geothermal steam is produced from the leased premises as determined by the Supervisor.

Sec. 22. COOPERATIVE OR UNIT PLAN - The Lessee agrees that it will on its own, or at the request of the Lessor where it is determined to be necessary for the conservation of the resource or to prevent the waste of the resource, subscribe to and operate under any reasonable cooperative or unit plan for the development and operation of the area, field, or pool, or part thereof embracing the lands subject to this lease as the Secretary may determine to be practicable and necessary or advisable in the interest of conservation. In the event the leased lands are included within a unit, the terms of this lease shall be deemed to be modified to conform to such unit agreement. Where any provision of a cooperative or unit plan of development which has been approved by the Secretary, and which by its terms affects the leased area or any part thereof, is inconsistent with a provision of this lease, the provisions of such cooperative or unit plan shall govern.

Sec. 23. RELINQUISHMENT OF LEASE - The Lessee may relinquish this entire lease or any officially designated subdivision of the leased area in accordance with the regulations by filing in the proper BLM office a written relinquishment, in triplicate, which shall be effective as of the date of filing. No relinquishment of this lease or any portion of the leased area shall relieve the Lessee or its surety from any liability for breach of any obligation of this lease, including the obligation to make payment of all accrued rentals and royalties and to place all wells in the leased lands to be relinquished in condition for suspension or abandonment, and to protect or restore substantially the surface or subsurface resources in a manner satisfactory to the Lessor.

Sec. 24. REMOVAL OF PROPERTY ON TERMINATION OR EXPIRATION OF LEASE

(a) Upon the termination or expiration of this lease in whole or in part, or the relinquishment of the lease in whole or in part, as herein provided, the Lessee shall within a period of ninety (90) days (or such longer period as the Supervisor may authorize because of adverse climatic conditions) thereafter remove from the leased lands, no longer subject to the lease all structures, machinery, equipment, tools, and materials in accordance with applicable regulations and orders of the Supervisor. However, the Lessee shall, for a period of not more than six (6) months, continue to maintain any such property needed in the relinquished area, as determined by the Supervisor, for producing wells or for drilling or producing geothermal resources on other leases.

(b) Any structures, machinery, equipment, tools, appliances, and materials, subject to removal by the Lessee, as provided above, which are allowed to remain on the leased lands shall become the property of the Lessor on expiration of the 90-day period or any extension of that period which may be granted by the Supervisor. If the Supervisor directs the Lessee to remove such property, the Lessee shall do so at its own expense, or if it fails to do so within a reasonable period, the Lessor may do so at the Lessee's expense.

Sec. 25. REMEDIES IN CASE OF DEFAULT

(a) Whenever the Lessee fails to comply with any of the provisions of the Act, or the terms and stipulations of this lease, or of the regulations issued under the Act, or of any order issued pursuant to those regulations, and that default shall continue for a period of thirty (30) days after service of notice by the Lessor, the Lessor may (1) suspend operations until the requested action is taken to correct the noncompliance, or (2) cancel the lease in accordance with Sec. 12 of the Act (30 U.S.C. 1011). However, the 30-day notice provision applicable to this lease under Sec. 12 of the Act shall also apply as a prerequisite to the institution of any legal proceedings by the Lessor to cancel this lease while it is in a producing status. Nothing in this subsection shall be construed to apply to, or require any notice with respect to any legal action instituted by the Lessor other than an action to cancel the lease pursuant to Sec. 12 of the Act.

(b) Whenever the Lessee fails to comply with any of the provisions of the Act, or of this lease, or the regulations, or of any GRO Orders, or other orders, and immediate action is required, the Lessor without waiting for action by the Lessee may enter on the leased lands and take such measures as it may deem necessary to correct the failure, including a suspension of operations or production, all at the expense of the Lessee.

(c) A waiver of any particular violation of the provisions of the Act, or of this lease, or of any regulations promulgated by the Secretary under the Act, shall not prevent the cancellation of this lease or the exercise of any other remedy or remedies under paragraphs (a) and (b) of this section by reason of any other such violation, or for the same violation occurring at any other time.

(d) Nothing herein shall limit or affect the Lessee's right to a hearing and appeal as provided in Sec. 12 of the

Act and in the regulations promulgated thereunder.

(e) Upon cancellation, the Lessee shall remove all property in accordance with Sec. 24 hereof, and shall restore the leased lands in a manner acceptable to the Lessor or as may be otherwise required by the Lessor.

Sec. 26. HEIRS AND SUCCESSORS IN INTEREST - Each obligation hereunder shall extend to and be binding upon, and every benefit hereof shall inure to, the heirs, executors, administrators, successors, or assigns, of the respective parties hereto.

Sec. 27. UNLAWFUL INTEREST - No Member of, or Delegate to Congress, or Resident Commissioner, after his election or appointment, either before or after he has qualified, and during his continuance in office, and no officer, agent, or employee of the Department shall be admitted to any share or part in this lease or derive any benefit that may arise therefrom; and the provisions of Sec. 3741 of the Revised Statutes (41 U.S.C. Sec. 22), as amended, and Sections 431, 432, and 433 of Title 18 of the United States Code, relating to contracts made or entered into, or accepted by or on behalf of the United States, form a part of this lease so far as the same may be applicable.

Sec. 28. MONOPOLY AND FAIR PRICES - The Lessor reserves full power and authority to protect the public interest by promulgating and enforcing all orders necessary to insure the sale of the production from the leased lands at reasonable prices, to prevent monopoly, and to safeguard the public interest.

Sec. 29. EQUAL OPPORTUNITY CLAUSE - The Lessee agrees that, during the performance of this contract:

(1) The Lessee will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Lessee will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Lessee agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Lessor setting forth the provisions of this Equal Opportunity clause.

(2) The Lessee will, in all solicitations or advertisements for employees placed by or on behalf of the Lessee, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(3) The Lessee will send to each labor union or representative of workers with which Lessee has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the Lessor, advising the labor union or workers' representative of the Lessee's commitments under this Equal Opportunity clause, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The Lessee will comply with all provisions of Executive Order No. 11246 of September 24, 1965, as amended, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(5) The Lessee will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, as amended, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to its books, records, and accounts by the Secretary

of the Interior and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the Lessee's noncompliance with the Equal Opportunity clause of this lease or with any of said rules, regulations, or orders, this lease may be canceled, terminated or suspended in whole or in part and the Lessee may be declared ineligible for further Federal Government contracts or leases in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, as amended, and such other sanctions as may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, as amended, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The Lessee will include the provisions of Paragraphs (1) through (7) of this Section (29) in every contract, subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, as amended, so that such provisions will be binding upon each contractor, subcontractor, or subcontract, or purchase order as the Secretary may direct as a means of enforcing such provisions including sanctions for noncompliance; provided, however, that in the event the Lessee becomes involved in, or is threatened with, litigation with a contractor, subcontractor, or vendor as a result of such direction by the Secretary, the Lessee may request the Lessor to enter into such litigation to protect the interests of the Lessor.

Sec. 30. CERTIFICATION OF NONSEGREGATED FACILITIES - By entering into this lease, the Lessee certifies that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The Lessee agrees that a breach of this certification is a violation of the Equal Opportunity clause of this lease. As used in this certification, the term "segregated facilities" means, but is not limited to, any waiting rooms, work areas, rest rooms and wash rooms, or restaurants or other eating areas, time clocks, or locker rooms, and other storage or dressing rooms, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive, or are in fact segregated on the basis of race, color, religion, or national origin because of habit, local custom, or otherwise. Lessee further agrees that (except where it has obtained identical certifications from proposed contractors and subcontractors for specific time periods) it will obtain identical certifications from proposed contractors and subcontractors prior to the award of contracts or subcontracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity clause; that it will retain such certifications in its files; and that it will forward the following certification to such proposed contractors and subcontractors (except where the proposed contractor or subcontractor has submitted identical certifications for specific time periods); it will notify prospective contractors and subcontractors of requirement for certification of nonsegregated facilities. A Certification of Nonsegregated Facilities, as required by the May 9, 1967 Order (32 F.R. 7439, May 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted prior to the award of a contract or subcontract exceeding \$10,000 which is not exempt from the provisions of the Equal Opportunity clause. The certification may be submitted either for each contract and subcontract or for all contracts and subcontracts during a period (i.e., quarterly, semiannually, or annually).

Sec. 31. SPECIAL STIPULATIONS - (stipulations, if any, are attached hereto and made a part hereof)

In witness whereof the parties have executed this lease.
Lessee:

THE UNITED STATES OF AMERICA, Lessor:

(Signature of Lessee)

By

(Authorized Officer)

(Signature of Lessee)

(Title)

SEAL

(Date)

(Date)

APPENDIX D

Plant List for the Jornada Plains

Preface

The following list of plants does not follow a single published source as there are some available which include all plants found in the region. The most of the "Journal of the Royal Botanic Society" by Correll and Johnston in the west coast of the United States and is followed with a few modifications, especially in the names of the plants. Appropriate names other than those used by Correll and Johnston have been retained the same used by Correll and Johnston in their "Flora of the United States and Canada" and some are included in parentheses for comparison.

This list does follow the distribution of plants and is not a list of plants available in the region. It is a list of plants which are known to occur in the region.

1950

University of California Press

Los Angeles, California

1950

Plant List for the Jornada Plains

Jornada Experimental Range

Agricultural Research Service

USDA

(Revised, 1975)

Preface

The following list of plants does not follow a single published manual as there are none available which include all plants found in New Mexico. "The Manual of the Vascular Plants of Texas" by Correll and Johnston is the most recent major manual available and it is followed more or less consistently, especially in areas of taxonomic confusion. Wherever names other than those used in Correll and Johnston have been retained the name used by Correll and Johnston is included in parentheses, preceded by "C&J". Some names now reduced to synonyms are included in parentheses for convenience.

Plant codes follow SCS designations except that the codes have been shortened wherever possible to four symbols by leaving off tie-breaking numerals.

Scientific Name	Common Name	Code	Proper Use Factor	Annual or Perennial	Family
<u>GRASSES</u>					
<i>Aristida adscensionis</i>	Sixweeks threeawn	Arad		A	Gramineae
<i>Aristida barbata</i>	Havard threeawn	Arba	60	P	"
<i>Aristida divaricata</i>	Poverty threeawn	Ardi	50	P	"
<i>Aristida glauca</i>	Blue threeawn	Argl	60	P	"
<i>Aristida longisetata</i>	Red threeawn	Arlo	70	P	"
<i>Aristida orcuttiana</i>	Single threeawn	Aror	70	P	"
<i>Aristida pansa</i>	Wooton threeawn	Arpa	50	P	"
<i>Aristida purpurea</i>	Purple threeawn	Arpu	70	P	"
<i>Bothriochloa saccharoides</i> (<i>Andropogon</i>)	Silver sourgrass	Bosa	50	P	"
<i>Bouteloua aristidoides</i>	Needle grama	Boar	10	A	"
<i>Bouteloua barbata</i>	Sixweeks grama	Boba	10	A	"
<i>Bouteloua curtispindula</i>	Sideoats grama	Bocu	55	P	"
<i>Bouteloua eriopoda</i>	Black grama	Boer	80	P	"
<i>Bouteloua gracilis</i>	Blue grama	Bogr	80	P	"
<i>Bouteloua parryi</i>	Parry grama	Bopa	3	P	"
<i>Bromus unioloides</i> (<i>cartharicus</i>)	Rescue brome	Brun		A	"
<i>Cenchrus incertus</i> (<i>pauciflorus</i>)	Mat sandbur	Cein		A	"

Scientific Name	Common Name	Code	Proper Use		Annual or Perennial	Family
			Factor	Use		
<u>GRASSES</u>						
<i>Chloris virgata</i>	Showy chloris	Chvi4			A	Gramineae
<i>Cynodon dactylon</i>	Bermudagrass	Cyda			P	"
<i>Distichlis spicata</i> var. <i>stricta</i>	Inland saltgrass	Disps			P	"
<i>Echinochloa crusgalli</i>	Barnyardgrass	Eccr			A	"
<i>Echinochloa crusgalli</i> var. <i>mitis</i>	Beardless barnyardgrass	Eccrm			A	"
<i>Echinochloa crusgalli</i> var. <i>zelayensis</i>	Alkali barnyardgrass	Eccrz			A	"
<i>Enneapogon desvauxii</i>	Spike pappusgrass	Ende	20		P	"
<i>Eragrostis cillanensis</i>	Stinkgrass	Erci			A	"
<i>Eragrostis erosa</i>	Chihuahua lovegrass	Erer	5		P	"
<i>Eragrostis pectinacea</i>	Carolina lovegrass	Erpe			A	"
<i>Eragrostis pilosa</i>	India lovegrass	Erpi	2		A	"
<i>Erioneuron pulchellum</i> (<i>Tridens pulchellus</i>)	Fluffgrass	Erpu	5		P	"
<i>Hilaria mutica</i>	Tobosa	Himu	58		P	"
<i>Leptochloa dubia</i>	Green sprangletop	Ledu	20		P	"
<i>Leptoloma cognatum</i>	Fall witchgrass	Leco	10		P	"
<i>Muhlenbergia arenacea</i>	Ear muhly	Muar			P	"

Scientific Name	Common Name	Code	Proper Use Factor	Annual or Perennial	Family
<u>GRASSES</u>					
<i>Muhlenbergia arenicola</i>	Sand muhly	Muar2	50	P	Gramineae
<i>Muhlenbergia asperifolia</i>	Alkali muhly	Muas	30	P	"
<i>Muhlenbergia porteri</i>	Bush muhly	Mupo	60	P	"
<i>Munroa squarrosa</i>	False buffalograss	Musq		A	"
<i>Oryzopsis hymenoides</i>	Indian ricegrass	Orhy	50	P	"
<i>Panicum capillare</i>	Common witchgrass	Paca	40	A	"
<i>Panicum hallii</i>	Halls panicum	Paha	30	P	"
<i>Panicum hirticaule</i>	Roughstalk witchgrass	Pahi	20	A	"
<i>Panicum lanuginosum</i> var. <i>fasciculatum</i> (<i>Panicum huachucae</i>)	Huachuca panicum	Palaf		P	"
<i>Panicum obtusum</i>	Vine mesquite	Paob	50	P	"
<i>Paspalum stramineum</i>	Sand paspalum	Past	50	P	"
<i>Scleropogon brevifolius</i>	Burrograss	Scbr	30	P	"
<i>Setaria lutescens</i> (C&J S. glauca)	Yellow bristlegrass	Selu		A	"
<i>Setaria macrostachya</i>	Plains bristlegrass	Sema	10	P	"
<i>Setaria viridis</i>	Green bristlegrass	Sevi		A	"
<i>Sorghum halepense</i>	Johnsongrass	Soha		P	"

Scientific Name	Common Name	Code	Proper Use Factor	Annual or Perennial	Family
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GRASSES

<i>Sporobolus airoides</i>	Alkali sacaton	Spai	40	P	Gramineae
<i>Sporobolus contractus</i>	Spike dropseed	Spco	70	P	"
<i>Sporobolus cryptandrus</i>	Sand dropseed	Spcr	70	P	"
<i>Sporobolus flexuosus</i>	Mesa dropseed	Spfl	70	P	"
<i>Sporobolus giganteus</i>	Giant dropseed	Spgi	70	P	"
<i>Sporobolus nealleyi</i>	Gypgrass	Spne	10	P	"
<i>Tragus berteronianus</i>	Spike burgrass	Trbe		A	"
<i>Trichachne californica</i>	Arizona cottontop	Trca	60	P	"
<i>Vulpia octoflora</i> (<i>Festuca octoflora</i>)	Sixweeks fescue	Vuoc	5	A	"

Scientific Name	Common Name	Code	Proper Use Factor	Annual or Perennial	Family
<u>FORBS</u>					
<i>Abronia angustifolia</i>	Narrowleaf sandverbena	Aban		A	Nyctaginaceae
<i>Abronia fragrans</i>	Snowball sandverbena	Abfr		P	"
<i>Acanthochiton wrightii</i>	Greenstripe amaranth	Acwr		A	Amaranthaceae
<i>Agastachne cana</i>	Mosquito plant	Agca	2	P	Labiatae
<i>Allionia incarnata</i>	Trailing allionia	Alin		P	Nyctaginaceae
<i>Amaranthus blitoides</i>	Prostrate amaranth	Ambl		A	Amaranthaceae
<i>Amaranthus retroflexus</i>	Redroot amaranth	Amre	10	A	"
<i>Ammocodon chenopodioides</i> (<i>Selinocarpus</i>)	Purple wingseed	Amch		P	Nyctaginaceae
<i>Amsonia arenaria</i>	Broncoweed	Amar		P	Apocynaceae
<i>Aphanostephus ramosissimus</i>	Faint crown	Apra	5	A	Compositae
<i>Apodanthera undulata</i>	Melonloco gourd	Apun		P	Cucurbitaceae
<i>Argemone platyceras</i>	Crested pricklepoppy	Arpl		P	Papaveraceae
<i>Asclepias asperula</i> subsp. <i>capricornu</i> (<i>Asclepiodora decumbens</i>)	Spider antelopehorn	Asasc		P	Asclepiadaceae
<i>Asclepias subverticillata</i> (<i>galiioides</i>)	Poison milkweed	Assu		P	"
<i>Aster ericoides</i> (<i>Leucelene</i>)	Babywhite aster	Aser		P	Compositae

Scientific Name	Common Name	Code	Proper Use Factor	Annual or Perennial	Family
FORBS					
<i>Astragalus allochrous</i>	Halfmoon loco	Asal		P	Leguminosae
<i>Astragalus mollissimus</i> var. <i>bigelovi</i>	Woolly milkvetch	Asmob		P	Leguminosae
<i>Astragalus nuttallianus</i>	Dwarfpea	Asnu	40	A	"
<i>Astragalus pattersoni</i>	Patterson loco	Aspa		P	Leguminosae
<i>Astragalus tephrodes</i>	Ashen milkvetch	Aste		P	"
<i>Astragalus wootonii</i>	Wooton loco	Aswo		P	"
<i>Bahia absinthifolia</i> var. <i>dealbata</i>	Hairyseed bahia	Baabd	30	P	Compositae
<i>Baileya multiradiata</i>	Desert baileya	Bamu	30	P	"
<i>Berlandiera lyrata</i>	Lyreleaf greeneyes	Bely		P	"
<i>Boerhaavia torreyana</i> (C&J B. <i>spicata</i>)	Spiderling	Boto		A	Nyctaginaceae
<i>Brayulinea densa</i> (C&J <i>Guilleminea densa</i> var. <i>densa</i>)	Small matweed	Brde		P	Amaranthaceae
<i>Calycoseris wrightii</i>	White agoseris	Cawr		A	Compositae
<i>Carlowrightia linearifolia</i>	Heath carlowrightia	Cal12		P	Acanthaceae
<i>Cassia bahuinoides</i>	Twoleaf senna	Caba	10	P	Leguminosae
<i>Cassia lindheimeriana</i>	Lindheimer senna	Cal1	10	P	"

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<u>FORBS</u>					
<i>Chamaesaracha coronopus</i>	Green falsenightshade	Chco		P	Solanaceae
<i>Chamaesaracha sordida</i> (coniodes)	Hairy falsenightshade	Chso		P	"
<i>Chenopodium incanum</i>	Goosefoot	Chin	20	A	Chenopodiaceae
<i>Chenopodium leptophyllum</i>	Slimleaf goosefoot	Chle	20	A	"
<i>Cirsium ochrocentrum</i>	Yellow thistle	Cioc	5	P	Compositae
<i>Coldenia canescens</i>	Spreading coldenia	Coca2		P	Boraginaceae
<i>Comandra pallida</i>	False toadflax	Copa		P	Santalaceae
<i>Commelina erecta</i> var. <i>angustifolia</i> (<i>crispa</i>)	Curlyleaf dayflower	Coera		P	Commelinaceae
<i>Convolvulus incanus</i>	Nebraska bindweed	Coin		P	Convolvulaceae
<i>Conyza canadensis</i> (<i>Erigeron</i>)	Horseweed fleabane	Coca		A	Compositae
<i>Conyza coulteri</i>	Coulter raylessaster	Coco		A	"
<i>Cooperia drummondii</i>	Eveningstar rainlily	Codr		P	Amaryllidaceae
<i>Corispermum nitidum</i>	Shinning tickseed	Coni		A	Chenopodiaceae
<i>Corydalis aurea</i> (<i>montana</i>) var. <i>occidentalis</i>	Mountain corydalis	Coauo	5	P	Papaveraceae
<i>Croton corymbulosus</i> (<i>C&J C. pottsii</i> var. <i>pottsii</i>)	Leatherweed croton	Crco	5	P	Euphorbiaceae

Scientific Name	Common Name	Code	Proper Use Factor	Annual or Perennial	Family
	<u>FORBS</u>				
<i>Cryptantha crassisejala</i>	Deer's tongue	Crcr	10	A	Boraginaceae
<i>Cryptantha micrantha</i>	Redroot cryptantha	Crmi		A	"
<i>Cucurbita foetidissima</i>	Buffalogourd	Cufo		P	Cucurbitaceae
<i>Cuscuta salina</i>	Saltmarsh dodder	Cusa		A	Convolvulaceae
<i>Cycloloma atriplicifolium</i>	Tumble ringwing	Cyat		A	Chenopodiaceae
<i>Dalea nana</i>	Dwarf dalea	Dana	40	P	Leguminosae
<i>Dalea terminalis</i>	Prostrate dalea	Date		P	"
<i>Datura meteloides</i>	Sacred datura	Dame		P	Solanaceae
<i>Delphinium virescens</i> var. <i>penardi</i>	Plains larkspur	Devip	10	P	Ranunculaceae
<i>Descurainia pinnata</i> (<i>menziesii</i>) var. <i>ochroleuca</i>	Tansymustard	Depio	5	A	Cruciferae
<i>Desmanthus cooleyi</i>	James bundleflower	Deco		P	Leguminosae
<i>Dithyrea wislizeni</i>	Wislizenus spectaclepod	Diwi	10	A	Cruciferae
<i>Draba cuneifolia</i>	Wedgeleaf draba	Drcu		A	Cruciferae
<i>Drymaria pachyphylla</i> (<i>holosteoides</i>)	Thickleaf drymary	Drpa		A	Caryophyllaceae
<i>Dyssodia papposa</i>	Prairie dogweed	Dypa		A	Compositae

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	<u>FORBS</u>				
<i>Erigeron bellidiastrum</i>	Western fleabane	Erbe		A	Compositae
<i>Eriogonum abertianum</i>	Orange wildbuckwheat	Erab		A	Polygonaceae
<i>Eriogonum annuum</i>	Annual wildbuckwheat	Eran		A	"
<i>Eriogonum jamesii</i>	James wildbuckwheat	Erja		P	Polygonaceae
<i>Eriogonum rotundifolium</i>	White wildbuckwheat	Erro		A	Polygonaceae
<i>Eriogonum trichopes</i>	Fineleaved wildbuckwheat	Ertr		A	"
<i>Erodium cicutarium</i>	Redstem filaree	Erci6	30	A	Geraniaceae
<i>Erodium texanum</i>	Texas filaree	Erte	30	A	"
<i>Erucastrum gallicum</i>	Rocket weed	Erga		A	Cruciferae
<i>Erysimum capitatum</i> (<i>Cheirinia</i>) (<i>elatatum</i>)	Tall erysimum	Erca	5	P	"
<i>Eschscholtzia mexicana</i>	Mexican goldpoppy	Esme	30	A	Papaveraceae
<i>Euphorbia albomarginata</i>	Whitemargin euphorbia	Eual		P	Euphorbiaceae
<i>Euphorbia parryi</i>	Parry euphorbia	Eupa		A	"
<i>Evolvulus pilosus</i> (<i>C&J E. nuttallianus</i>)	Hairy evolvulus	Evpi	50	P	Convolvulaceae
<i>Franseria acanthicarpa</i>	Annual bursage	Frac		A	Compositae
<i>Froelichia floridana</i> var. <i>campestris</i>	Plains snakecotton	Frflc		A	Amaranthaceae

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<u>FORBS</u>					
<i>Gaillardia pinnatifida</i>	Slender gaillardia	Gapi	10	A	Compositae
<i>Gaillardia pulchella</i>	Rosering gaillardia	Gapu		A	"
<i>Gaura coccinea</i>	Scarlet Gaura	Gaco		P	Onagraceae
<i>Gilia longiflora</i> (C&J <i>Ipomopsis longiflora</i>)	Whiteflower gilia	Gilo	20	A	Polemoniaceae
<i>Gilia pumila</i> (C&J <i>Ipomopsis pumila</i>)	Dwarf gilia	Gipu		A	"
<i>Gutierrezia sphaerocephala</i> (C&J <i>Xanthocephalum</i> s.)	Roundleaf broom snakeweed	Gusp		A	Compositae
<i>Hedeoma nanum</i>	False pennyroyal	Hena		P	Labiatae
<i>Hedyotis humifusa</i> (<i>Houstonia humifusa</i>)	Mat bluets	Hehu		A	Rubiaceae
<i>Hedyotis pygmaea</i> (<i>Houstonia wrightii</i>)	Wrights bluets	Hepy		A	"
<i>Helianthus ciliaris</i>	Blueweed sunflower	Heci	5	P	Compositae
<i>Helianthus petiolaris</i>	Prairie sunflower	Hepe	5	A	"
<i>Helianthus petiolaris</i> (canus) var. <i>canescens</i>	Sunflower	Hepec	5	A	"
<i>Heliotropium convolvulaceum</i> (<i>Euploca</i>)	Bindweed heliotrope	Heco		A	Boraginaceae
<i>Heliotropium curassavicum</i>	Salt heliotrope	Hecu		A	"

Scientific Name	Common Name	Code	Proper Use Factor	Annual or Perennial	Family
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FORBS

<i>Heliotropium greggii</i>	Fragrant heliotrope	Hegr		P	Boraginaceae
<i>Heterotheca fulcrata</i> (<i>Chrysopsis</i>)	Goldaster	Hefu		P	Compositae
<i>Hoffmanseggia densiflora</i> (C&J H. glauca)	Indian rushpea	Hode	60	P	Leguminosae
<i>Hoffmanseggia jamesii</i> (C&J <i>Caesalpinia jamesii</i>)	James rushpea	Hoja	60	P	"
<i>Hybanthus verticillatus</i>	Nodding violet	Hyve		P	Violaceae
<i>Hymenopappus robustus</i>	Hymenopappus	Hyro	10	P	Compositae
<i>Hymenothrix wislizeni</i>		Hywi		A	"
<i>Hymenoxys odorata</i> (<i>Actinea</i>)	Bitterweed actinea	Hyod		A	"
<i>Iberillea tenuisecta</i>	Slimlobe gourd	Ibte		P	Cucurbitaceae
<i>Iva dealbata</i>	Woolly sumpweed	Ivde		P	Compositae
<i>Kallstroemia hirsutissima</i>	Hairy caltrop	Kahi	5	A	Zygophyllaceae
<i>Kuhnia chlorolepis</i> (<i>rosmarinifolia</i>)	Prairie boneset	Kuch		P	Compositae
<i>Lepidium montanum</i> (<i>eastwoodiae</i>)	Mountain pepperweed	Lemo		P	Cruciferae

Scientific Name	Common Name	Code	Proper Use Factor	Annual or Perennial	Family
<u>FORBS</u>					
<i>Lepidium lasiocarpum</i> var. <i>wrightii</i>	Hairy pod pepperweed	Lelaw		P	Cruciferae
<i>Lesquerella fendleri</i>	Fendler bladderpod	Lefe	30	P	"
<i>Lesquerella gordonii</i>	Gordon bladderpod	Lego		A	"
<i>Linum australe</i>	Yellow flax	Liau		P	Linaceae
<i>Lithospermum incisum</i> (<i>angustifolium</i>)	Narrowleaf gromwell	Liin		P	Boraginaceae
<i>Lotus wrightii</i>	Wrights deervetch	Lowr		P	Leguminosae
<i>Machaeranthera gracilis</i> (<i>Haplopappus</i> , <i>Aplopappus</i>)	Annual goldenweed	Magr		A	Compositae
<i>Machaeranthera spinulosus</i>	Ironplant goldenweed	Masp		P	"
<i>Machaeranthera tanacetifolia</i> (<i>Aster</i>)	Tansyleaf aster	Mata	5	A	"
<i>Malacothrix fendleri</i>	Yellow agoseris	Mafe		A	"
<i>Melampodium leucanthum</i>	Plains blackfoot	Mele		P	"
<i>Menodora scabra</i>	Rough menodora	Mesc	5	P	Oleaceae
<i>Mentzelia albicaulis</i>	Whitestem stickleaf	Meal		A	Loasaceae
<i>Mirabilis linearis</i> (<i>Allionia</i>)	Linearleaf four-o'clock	Mili		P	Nyctaginaceae

Scientific Name	Common Name	Code	Proper Use Factor	Annual or Perennial	Family
<u>FOR3S</u>					
<i>Mirabilis multiflora</i>	Colorado four-o'clock	Mimu		P	Nyctaginaceae
<i>Mollugo cerviana</i>	Threadstem carpetweed	Moce		A	Aizoaceae
<i>Nama hispidum</i>	Purple rolleaf	Nahi		A	Hydrophyllaceae
<i>Nerisyrenia camporum</i>	Mesa greggia	Neca		F	Cruciferae
<i>Nerisyrenia linearifolia</i>	Narrowleaf greggia	Neli		P	"
<i>Oenothera primiveris</i>	Yellow eveningprimrose	Oepr		P	Onagraceae
<i>Oenothera runcinata</i> (C&J <i>O. pallida</i> subsp. <i>runcinata</i>)	White eveningprimrose	Oeru	5	P	"
<i>Oligomeris linifolia</i> (<i>Dipetalia subulata</i>)		Olli		A	Resedaceae
<i>Oxalis amplifolia</i>	Sheep sour	Oxam	5	P	Oxalidaceae
<i>Palafoxia sphacelata</i> (Othake)	Rayed palafoxia	Pasp		A	Compositae
<i>Parthenium confertum</i> (lyratrum)	Parthenium	Paco		P	"
<i>Pectis papposa</i>	Manybristle pectis	Pepa		A	"
<i>Penstemon ambiguus</i>	<i>Gilia penstemon</i>	Peam		P	Scrophulariaceae
<i>Perezia nana</i>	Desertholly perezia	Pena		P	Compositae
<i>Perezia wrightii</i>	Hollyleaf perezia	Pewr		P	"

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<u>FORBS</u>					
<i>Petalostemum compactum</i>	Prairieclover	Peco		P	Leguminosae
<i>Phacelia intermedia</i>	Purple scorpionhead	Phin		A	Hydrophyllaceae
<i>Physalis hederifolia</i>	Heartleaf groundcherry	Phhe		P	Solanaceae
<i>Pinaropappus parvus</i>	Small rocketlettuce	Pipa		P	Compositae
<i>Plantago patagonica</i> (purshii) var. <i>gnaphaloides</i>	Woolly plantain	Plpag	10	A	Plantaginaceae
<i>Polanisia uniglandulosa</i>	Onegland clammyweed	Foun		A	Capparidaceae
<i>Portulaca mundula</i> (<i>pilosa</i>)	Shaggy portulaca	Pomu		A	Portulacaceae
<i>Portulaca oleracea</i>	Purslane portulaca	Pool		A	"
<i>Proboscidea louisianica</i> (<i>jussieui</i>)	Louisiana deveilsclaws	Prlo		A	Martyniaceae
<i>Psilostrophe tagetinae</i>	Woolly paperflower	Psta	20	P	Compositae
<i>Pyrrhopappus multicaulis</i>	Manystem falsedandelion	Pymu		P	"
<i>Reverchonia arenaria</i>	Sand reverchonia	Rear		A	Euphorbiaceae
<i>Rumex hymenosepalus</i>	Canaigre dock	Ruhy		P	Polygonaceae
<i>Rumex mexicanus</i>	Mexican dock	Rume		P	Polygonaceae
<i>Salsola kali</i> var. <i>tenuifolia</i>	Russianthistle	Sakat	10	A	Chenopodiaceae

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<u>FORBS</u>					
<i>Sanvitalia abertii</i>	Abert sanvitalia	Saab		A	Compositae
<i>Sarcostemma cynanchoides</i> (<i>Philibertia</i> , <i>Funastrum</i>)	Climbing milkweed	Sacy		P	Asclepiadaceae
<i>Sartwellia flaveriae</i>	False glandleaf	Safl		A	Compositae
<i>Schrankia occidentalis</i>	Eastern sensitivebriar	Scoc		P	Leguminosae
<i>Selenia dissecta</i>	Texas selenia	Sedi		A	Cruciferae
<i>Senecio longilobus</i>	Threadleaf groundsel	Selo		P	Compositae
<i>Senecio riddellii</i>	Riddell groundsel	Seri		P	"
<i>Sida leprosa</i> (<i>Lepidota</i>) var. <i>depauperata</i>	Scurfy sida	Siled		P	Malvaceae
<i>Sida physocalyx</i> (<i>hastata</i>)	Spearleaf sida	Siph		P	"
<i>Sisymbrium irio</i>	Londonrocket mustard	Siir		A	Cruciferae
<i>Sisymbrium linearifolium</i>	Narrowleaf mustard	Sili		P	"
<i>Solanum elaeagnifolium</i>	Silverleaf nightshade	Soel		P	Solanaceae
<i>Solanum rostratum</i>	Buffalobur nightshade	Soro		A	Solanaceae
<i>Sonchus asper</i>	Prickly sowthistle	Soas		A	Compositae
<i>Sophora stenophylla</i>	Fringeleaf sophora	Sost		P	Leguminosae
<i>Sphaeralcea coccinea</i> var. <i>elata</i>	Scarlet globemallow	Spcoe		P	Malvaceae

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<u>FORBS</u>					
<i>Sphaeralcea incana</i>	Big globemallow	Spin	60	P	Malvaceae
<i>Sphaeralcea subastata</i>	Wrinkled globemallow	Spsu	60	P	"
<i>Stephanomeria exigua</i>	Annual wirelettuce	Stex		A	Compositae
<i>Stephanomeria pauciflora</i>	Wirelettuce	Stpa		P	"
<i>Streptanthus validus</i>	Twistflower	Stva		A	Cruciferae
<i>Talinum angustissimum</i>	Flameflower	Taan		P	Portulacaceae
<i>Tetradlea coulteri</i>	Tetradlea	Teco		P	Verbenaceae
<i>Tetradlea coulteri</i> var. <i>angustifolia</i>	Tetradlea	Tecoa		P	Verbenaceae
<i>Tidestromia lanuginosa</i>	Woolly tidestromia	Tila		A	Amaranthaceae
<i>Tradescantia occidentalis</i> var. <i>scopulorum</i>	Prairie spiderwort	Trocs		P	Commelinaceae
<i>Tragia nepetaefolia</i> (C&J T. <i>ramosa</i>)	Catnip noseburn	Trne		P	Euphorbiaceae
<i>Tribulus terrestris</i>	Puncturevine	Trte	10	A	Zygophyllaceae
<i>Verbena wrightii</i>	Wrights verbena	Vewr	5	P	Verbenaceae
<i>Verbesina encelioides</i> var. <i>exauriculata</i>	Golden crownbeard	Veene		A	Compositae
<i>Viguiera longifolia</i>	Longleaf goldeneye	Vilo		A	"

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<u>FORBS</u>					
<i>Sphaeralcea incana</i>	Big globemallow	Spin	60	P	Malvaceae
<i>Sphaeralcea subhastata</i>	Wrinkled globemallow	Spsu	60	P	"
<i>Stephanomeria exigua</i>	Annual wirelettuce	Stex		A	Compositae
<i>Stephanomeria pauciflora</i>	Wirelettuce	Stpa		P	"
<i>Streptanthus validus</i>	Twistflower	Stva		A	Cruciferae
<i>Talinum angustissimum</i>	Flameflower	Taan		P	Portulacaceae
<i>Tetradlea coulteri</i>	Tetradlea	Teco		P	Verbenaceae
<i>Tetradlea coulteri</i> var. <i>angustifolia</i>	Tetradlea	Tecoa		P	Verbenaceae
<i>Tidestromia lanuginosa</i>	Woolly tidestromia	Tila		A	Amaranthaceae
<i>Tradescantia occidentalis</i> var. <i>scopulorum</i>	Prairie spiderwort	Trocs		P	Commelinaceae
<i>Tragia nepetaefolia</i> (C&J T. <i>ramosa</i>)	Catnip noseburn	Trne		P	Euphorbiaceae
<i>Tribulus terrestris</i>	Puncturevine	Trte	10	A	Zygophyllaceae
<i>Verbena wrightii</i>	Wrights verbena	Vewr	5	P	Verbenaceae
<i>Verbesina encelioides</i> var. <i>exauriculata</i>	Golden crownbeard	Veene		A	Compositae
<i>Viguiera longifolia</i>	Longleaf goldeneye	Vilo		A	"

Scientific Name	Common Name	Code	Proper Use Factor	Annual or Perennial	Family
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FORBS

<i>Xanthium strumarium</i> (affine, saccharatum)	Cocklebur	Xast		A	Compositae
<i>Zephyranthes longifolia</i>	Copper zephyrlily	Zelo		P	Amaryllidaceae
<i>Zinnia grandiflora</i>	Rockymountain zinnia	Zigr	10	P	Compositae
<i>Zinnia pumila</i>	Dwarf zinnia	Zipu		P	"

Scientific Name	Common Name	Code	Proper Use Factor	Family
	<u>SHRUBS AND TREES</u>			
<i>Acacia constricta</i>	Mescat acacia	Acco	10	Leguminosae
<i>Artemisia filifolia</i>	Sand sagebrush	Arfi	30	Compositae
<i>Atriplex canescens</i>	Fourwing saltbush	Atca	60	Chenopodiaceae
<i>Baccharis glutinosa</i>	Seepwillow baccharis	Bagl		Compositae
<i>Baccharis pteronioides</i>	Yerbapasma baccharis	Bapt		"
<i>Brickellia floribunda</i>	Bigleaf brickellbush	Brfl		"
<i>Brickellia laciniata</i>	Splitleaf brickellbush	Brla		"
<i>Ceanothus greggi</i>	Desert ceanothus	Cegr	40	Rhamnaceae
<i>Chilopsis linearis</i>	Desertwillow	Chli		Bignoniaceae
<i>Chrysoactinia mexicana</i>	Damianita	Chme		Compositae
<i>Chrysothamnus pulchellus</i>	Southwest rabbitbrush	Chpu		"
<i>Chrysothamnus viscidiflorus</i>	Douglas rabbitbrush	Chvi		"
<i>Clematis drummondii</i>	Drummond clematis	Cldr		Ranunculaceae
<i>Clematis ligusticifolia</i> (<i>neomexicana</i>)	Virgin bower	Clli		"
<i>Condalia lycioides</i> (<i>Zizyphus</i>)	Southwestern condalia	Coly		Rhamnaceae
<i>Condalia spathulata</i>	Knifeleaf condalia	Cosp		"
<i>Croton fruticosus</i>	Bush croton	Crfr		Euphorbiaceae

Scientific Name	Common Name	Code	Proper Use Factor	Family
<u>SHRUBS AND TREES</u>				
<i>Dalea formosa</i>	Feather dalea	Dafo		Leguminosae
<i>Dalea scoparia</i>	Broom dalea	Dasc		"
<i>Dyssodia acerosa</i>	Prickleleaf dogweed	Dyac		Compositae
<i>Ephedra torreyana</i>	Torrey ephedra	Epto		Ephedraceae
<i>Ephedra trifurca</i>	Longleaf ephedra	Eptr		"
<i>Eurotia lanata</i> (<i>Ceratoides</i>)	Common winterfat	Eula		Chenopodiaceae
<i>Fallugia paradoxa</i>	Apacheplume	Fapa		Rosaceae
<i>Flourensia cernua</i>	American tarbush	Flce		Compositae
<i>Gutierrezia sarothrae</i> (<i>C&J Xanthocephalum</i> s.)	Broom snakeweed	Gusa		"
<i>Hedyotis intricata</i> (<i>Houstonia fasciculata</i>)	Tangle bluets	Hein		Rubiaceae
<i>Koeberlinia spinosa</i>	Spiny allthorn	Kosp		Koberliniaceae
<i>Krameria lanceolata</i> (<i>secundiflora</i>)	Trailing ratany	Krla		Krameriaceae
<i>Larrea tridentata</i>	Creosotebush	Latr		Zygophyllaceae
<i>Lycium berlandieri</i>	Berlandier wolfberry	Lybe		Solanaceae
<i>Lycium pallidum</i>	Pale wolfberry	Lypa		"
<i>Mimosa biuncifera</i>	Catclaw mimosa	Mibi		Leguminosae

Proper Use
Factor

Family

Code

Common Name

Scientific Name

SHRUBS AND TREES

Opuntia engelmannii	Engelmann pricklypear	Open		Cactaceae
Opuntia filipendula	Pricklypear	Opfi		"
Opuntia imbricata	Walkingstick cholla	Opim		"
Parthenium incanum	Mariola parthenium	Pain		Compositae
Polygala macradenia	Glandleaf milkwort	Poma		Polygalaceae
Prosopis juliflora var. glandulosa (C&J P. glandulosa var. glandulosa)	Honey mesquite	Prju		Leguminosae
Rhus microphylla	Littleleaf sumac	Rhmi		Anacardiaceae
Rhus trilobata (C&J R. aromatica var. flabelliformis)	Skunkbush sumac	Rhtr		"
Sapindus saponaria var. drummondii	Western soapberry	Sasad		Sapindaceae
Tamarix gallica	French tamarisk	Taga		Tamaricaceae
Vigiera tenuifolia (probably V. stenoloba)	Slimleaf goldeneye	Vite		Compositae
Yucca baccata	Datil yucca	Yuba		Liliaceae
Yucca elata	Soaptree yucca	Yuel		Liliaceae

1. Elaphe subocularis 4.5 mi. N. Radium Springs - Hwy 85
9/7/74 NMSU(1)
- 1a. Elaphe subocularis 61 mi. N. Radium Springs - Exit I-25
Hwy 85
9/4/75 NMSU(1)
- 1b. Elaphe subocularis 8 mi. E. Elephant Butte - Engle Rd.
Junction UNM(1)
- 1c. Elaphe subocularis S. R. 52 3 mi. E. Elephant Butte
Dam UNM(1)
- 1d. Elaphe subocularis Between main and subordinate dams
at Elephant Butte UNM(1)
- 1e. Elaphe subocularis 2 mi. E. Elephant Butte 4600'
7/14/64 LACM(2)
- 1f. Elaphe subocularis E. Side Elephant Butte Dam
5/15/65 LACM(1)
- 1g. Elaphe subocularis 8.1 mi. N I-25 at Radium Springs on
U. S. 85
7/20/76
2. Trimorphodon biscutatus 2.3 mi. E. Elephant Butte - Engle
vilkinsoni X Rd. UNM(3)
- 2a. Trimorphodon b. wilkinsoni Elephant Butte dam park - between
main dam and auxillary dam
UNM(1)
- 2b. Grimorphodon b. wilkinsoni 3 mi. E. Hillsboro on NM 90 - Rocky
Rd. Cut UNM(1)
- 2c. Grimorphodon b. wilkinsoni Rt. 85, 5.2 mi. N. Radium Springs
5/9/76 Jones(1)
- 2d. Grimorphodon biscutatus ½ mi. E. Rincon, 4200' LACM(1)
7/13/65
- 2e. Grimorphodon biscutatus 500' SE Elephant Butte Dam
5/22/76 LACM(1)
- 2f. Grimorphodon biscutatus 1 mi. E. Elephant Butte Dam
6/17/65 LACM(1)

2g. Grimorphodon biscutatus

500' NE Elephant Butte Dam
6/8/65 LACM(1)

3. Lampropeltis pyromelana
pyromelana

3½ mi. W. Chloride Price(1)

ANIMAL SPECIES OCCURRING IN
THE RADIUM SPRINGS GEOTHERMAL AREA

Birds

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION* (See pg)
Common Loon	<i>Gavia immer</i>	M	Large lakes, rivers
Western Grebe	<i>Aechmophorus occidentalis</i>	M - W	Large lakes, bays, rushy lakes
Eared Grebe	<i>Podiceps caspicus</i>	W	Large Lakes
Pied-billed Grebe	<i>Podilymbus podiceps</i>	YL	Lakes, streams, marshes
Horned Grebe	<i>Podiceps auritus</i>	M - W	Lakes, ponds
White Pelican	<i>Pelecanus erythrorhynchos</i>	M - W	Lakes, marshes
Double-crested cormorant	<i>Phalacrocorax auritus</i>	YL	Lakes, rivers, large marshes
Wood Ibis	<i>Mycteria americana</i>	M	Lakes, rivers, large marshes
White-faced Ibis	<i>Plegadis chihi</i>	S	Marshes
Common Egret	<i>Casmerodius albus</i>	YL	Marshes, irrigated lands, ponds, mud flats
Snowy Egret	<i>Leucophoyx thula</i>	M - S	Marshes, irrigated lands, ponds, mud flats
Great Blue Heron	<i>Ardea herodias</i>	YL	Marshes, streams, shores, lakes
Green Heron	<i>Butorides virescens</i>	YL	Lakes, marshes, slow-moving streams
Louisiana Heron	<i>Hydranassa tricolor</i>	M	Lakes, marshes, rivers
Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	YL	Marshes, shores, slow-moving rivers
American Bittern	<i>Botaurus lentiginosus</i>	M - YL	Marshes, reedy lakes
Least Bittern	<i>Ixobrychus exilis</i>	S - M	Marshes, reedy lakes
Whistling Swan	<i>Olor columbianus</i>	M - W	Large Lakes, marshes, rivers
Canada Goose	<i>Branta canadensis</i>	M - W	Lakes, marshes, rivers, grain fields
White-fronted Goose	<i>Anser albifrons</i>	M - W	Lakes, marshes, rivers, grain fields

BIRDS

ANIMAL SPECIES OCCURRING IN
THE RADIUM SPRINGS GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION *
Snow Goose	<i>Chen hyperborea</i>	M - W	Lakes, grain fields
Mallard	<i>Anas platyrhynchos</i>	YL	Marshes, ponds, streams, grain fields
Mexican Duck	<i>Anas diazi</i>	YL	Marshes, ponds, streams
Rintail	<i>Anas acuta</i>	M - W	Marshes, ponds, lakes, grain fields
Gadwall	<i>Anas strepera</i>	M - W	Marshes, ponds, lakes, rivers
American Widgeon	<i>Mareca americana</i>	M - W	Marshes, ponds, lakes, rivers
Blue-winged Teal	<i>Anas discors</i>	M - W	Ponds, marshes, slow streams
Cinnamon Teal	<i>Anas cyanoptera</i>	M	Ponds, marshes, slow streams
Green-winged Teal	<i>Anas carolinensis</i>	M - W	Ponds, marshes, rivers
Wood Duck	<i>Aix sponsa</i>	M - W	Wooded swamps, rivers, ponds
Redhead	<i>Aythya americana</i>	M - W	Marshes, lakes
Canvasback	<i>Aythya valisineria</i>	M - W	Marshes, lakes
Ring-necked Duck	<i>Aythya collaris</i>	M - W	Marshes, ponds
Lesser Scaup	<i>Aythya affinis</i>	M - W	Marshes, ponds, lakes
Common Goldeneye	<i>Bucephala clangula</i>	M - W	Lakes, rivers
Bufflehead	<i>Bucephala albeola</i>	M - W	Lakes, ponds, rivers
Ruddy Duck	<i>Oxyura jamaicensis</i>	YL	Lakes, ponds, marshes
Common Merganser	<i>Mergus merganser</i>	M - W	Lakes, ponds, marshes
Red-breasted Merganser	<i>Mergus serrator</i>	M - W	Lakes, ponds
Hooded Merganser	<i>Lophodytes cucullatus</i>	M - W	Lakes, rivers

ANIMAL SPECIES OCCURRING IN
THE RADIUM SPRINGS GEOTHERMAL AREA

Birds

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION*
Shoveler	<i>Spatula clypeata</i>	M - W	Shallow lakes, ponds, marshes
Turkey Vulture	<i>Cathartes aura</i>	S	All vegetative types within area
Mississippi Kite	<i>Ictinia mississippiensis</i>	S	Riparian, marshes
Goshawk	<i>Accipiter gentilis</i>	M	P-J, riparian
Cooper's Hawk	<i>Accipiter cooperii</i>	YL	P-J, riparian
Sharp-shinned Hawk	<i>Accipiter striatus</i>	M	P-J, riparian
Marsh Hawk	<i>Circus cyaneus</i>	M - W	Marshes; grassland, creosote
Rough-legged Hawk	<i>Buteo lagopus</i>	M - W	Marshes, grassland
Ferruginous Hawk	<i>Buteo regalis</i>	M - W	Grasslands desert shrub P-J
Red-tailed Hawk	<i>Buteo jamaicensis</i>	YL	P-J, desert shrub, mt. shrub
Swainson's Hawk	<i>Buteo swainsoni</i>	S - M	Grassland creosote
Zone-tailed Hawk	<i>Buteo albonotatus</i>	S	P-J, riparian
Golden Eagle	<i>Aquila chrysaetos</i>	YL	P-J, grasslands, desert or mt. shrub
Bald Eagle	<i>Haliaeetus leucocephalus</i>	M - S	Riparian
Osprey	<i>Pandion haliaetus</i>	M	Riparian
Caracara	<i>Caracara cheriway</i>	S	Riparian, desert shrub
Prairie Falcon	<i>Falco mexicanus</i>	YL	Any vegetative type with open space
Pigeon Hawk	<i>Falco columbarius</i>	M - W	P-J riparian
Kestrel	<i>Falco sparverius</i>	YL	Most vegetative types

ANIMAL SPECIES OCCURRING IN
THE RADIUM SPRINGS GEOTHERMAL AREA

Birds

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION
Apomado Falcon	Falco femoralis	W	Grassland. desert shrub (only one sighting in area in 1918)
Peregrine Falcon	Falco peregrinus	M - W	Riparian
Scaled Quail	Callipepla squamata	YL	Grassland. desert shrub, creosote, mesquite
Gambel's Quail	Lophortyx gambelii	YL	Mesquite, desert shrub. near water
Harlequin Quail	Cyrtonyx montezumae	YL	P-J. mt shrub (grassy areas of these)
Ring-necked Pheasant	Phasianus colchicus	YL	Farm land
White-winged Pheasant	Phasianus colchicus bianchivii	YL	Farm land
Wild Turkey	Meleagris gallopavo	YL	P-J
Greater Sandhill Crane	Grus canadensis	M - W	Marshes. grain fields, grassland
Virginia Rail	Rallus limicola	M - W	Marshes
Sora	Porzana carolina	M - W	Marshes
Common Gallinule	Gallinula chloropus	YL	Marshes reedy ponds
American Coot	Fulica americana	YL	Ponds, lakes, marshes
Mountain Plover	Eupoda montana	M	Grasslands
Snowy Plover	Charadrius alexandrinus	M - S	Beaches, alkali flats
Semipalmated Plover	Charadrius semipalmatus	M	Mud flats
Killdeer	Charadrius vociferus	YL	Shores. irrigated lands
Common Snipe	Capella gallinago	M - W	Marshes. irrigation ditches
Long-billed Curlew	Numenius americanus	M	Grassland

ANIMAL SPECIES OCCURRING IN
THE RADIUM SPRINGS GEOTHERMAL AREA

Birds

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION
Upland Plover	<i>Bartramia longicauda</i>	M	Grassland
Spotted Sandpiper	<i>Actitis macularia</i>	M	Lake shores ponds stream sides
White-rumped Sandpiper	<i>Erolia fuscicollis</i>	M	Lake shores, ponds
Solitary Sandpiper	<i>Tringa solitaria</i>	M	Marshes, ponds, stream sides
Willet	<i>Catoptrophorus semipalmatus</i>	M	Marshes
Greater Yellowlegs	<i>Totanus melanoleucus</i>	M	Marshes, mud flats, streams ponds
Lesser Yellowlegs	<i>Totanus flavipes</i>	M	Marshes; mud flats streams, ponds
Bairds Sandpiper	<i>Erolia bairdii</i>	M	Mud flats, rain pools
Least Sandpiper	<i>Erolia minutilla</i>	M	Grassy marshes, shores
Dunlin	<i>Erolia alpina</i>	M	Beaches
Long-billed Dowitcher	<i>Limnodromus scolopaceus</i>	M	Mud flats, shallow pools, lake margins
Western Sandpiper	<i>Ercunetes mauri</i>	M	Mud flats, lake margins, marshes
Marbled Godwit	<i>Limosa fedoa</i>	M	Grassland near water, lakes
Sanderling	<i>Crocethia alba</i>	M	Lake shores
Pectoral Sandpiper	<i>Erolia melanotos</i>	M	Marshy shores
American Avocet	<i>Recurvirostra americana</i>	S	Marshes mud flats ponds
Black-necked Stilt	<i>Himantopus mexicanus</i>	M	Marshes, mud flats, ponds
Wilson's Phalarope	<i>Steganopus tricolor</i>	M	Marshes, mud flats, ponds
Northern Phalarope	<i>Lobipes lobatus</i>	M	Marshes, mud flats, ponds
Herring Gull	<i>Larus argentatus</i>	M	Beaches farm lands, dumps

ANIMAL SPECIES OCCURRING IN
THE RADIUM SPRINGS GEOTHERMAL AREA

Birds

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION
Ring-billed Gull	<i>Larus delawarensis</i>	W - M	Beaches, farm lands, dumps
Franklin's Gull	<i>Larus pipixcan</i>	M	Beaches, farm lands, dumps
Bonaparte Gull	<i>Larus philadelphia</i>	M	Rivers, lakes
Forster's Tern	<i>Sterna forsteri</i>	M	Marshes, lakes, bays, beaches
Least Tern	<i>Sterna albifrons</i>	M	Sandy or gravelly beaches
Black Tern	<i>Chlidonias niger</i>	M	Marshes, lakes
Sabine Gull	<i>Xema sabini</i>	M	Rivers, lakes
Band-tailed Pigeon	<i>Columba fasciata</i>	M	P-J. mt. shrub
Rock Dove	<i>Columba livia</i>	YL	Cities, farms
White-winged Dove	<i>Zenaida asiatica</i>	M - S	Riparian, mesquite, towns
Mourning Dove	<i>Zenaidura macroura</i>	YL	Farms, towns, riparian, mesquite, desert shrub, grassland.
Inca Dove	<i>Scardafella inca</i>	M	Towns, farms
Ground Dove	<i>Columbigallina passerina</i>	YL	Riparian, farms
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	M - S	Riparian, mesquite
Roadrunner	<i>Geococcyx californianus</i>	YL	Creosote, open desert shrub, open P-J.
Barn Owl	<i>Tyto alba</i>	YL	Riparian, cliffs
Screech Owl	<i>Otus asio</i>	YL	Riparian, farms, P-J
Flammulated Owl	<i>Otus flammeolus</i>	S	P-J
Great Hornet Owl	<i>Bubo virginianus</i>	YL	Riparian, P-J, cliffs
Pygmy Owl	<i>Glaucidium gnoma</i>	YL	P-J

ANIMAL SPECIES OCCURRING IN
THE RADIUM SPRINGS GEOTHERMAL AREA

Birds

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION
Burrowing Owl	<i>Speotyto cunicularia</i>	YL	Grassland
Long-eared Owl	<i>Asio otus</i>	M - S	Riparian, P-J
Short-eared Owl	<i>Asio flammeus</i>	M - W	Grassland, marshes
Saw-whet Owl	<i>Aegolius acadicus</i>	S - M	Conifers, P-J, riparian
Spotted Owl	<i>Strix occidentalis</i>	S - M	Conifers, P-J, riparian
Whip-poor-will	<i>Caprimulgus vociferus</i>	M - S	P-J
Poor-will	<i>Phalaenoptilus nuttallii</i>	S	P-J, desert shrub
Common Nighthawk	<i>Chordeiles minor</i>	S	Grassland, desert shrub, P-J
Lesser Nighthawk	<i>Chordeiles acutipennis</i>	S	Mesquite, grassland
Chimney Swift	<i>Chactura pelagica</i>	M - S	Towns, riparian
White-throated Swift	<i>Aeronautes saxatalis</i>	M - W	Cliffs
Black-chinned Hummingbird	<i>Archiochus alexandri</i>	M - S	Riparian, mt. shrub
Broad-tailed Hummingbird	<i>Selasphorus platycercus</i>	M - S	Riparian
Rufous Hummingbird	<i>Selasphorus rufus</i>	M - S	P-J
Calliope Hummingbird	<i>Stellula calliope</i>	M	P-J
Belted Kingfisher	<i>Megaceryle alcyon</i>	W	Riparian
Yellow-shafted Flicker	<i>Colaptes auratus</i>	M - W	P-J, riparian
Red-shafted Flicker	<i>Colaptes cafer</i>	S	P-J, riparian
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	YL	Riparian, towns
Lewis Woodpecker	<i>Asyndesmus lewis</i>	M	Riparian

ANIMAL SPECIES OCCURRING IN
THE RADIUM SPRINGS GEOTHERMAL AREA

Birds

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION
Yellow-bellied Sapsucker	<i>Sphyrapicus varius</i>	S	Woodlands
Williamson's Sapsucker	<i>Sphyrapicus thyroideus</i>	YL	P-J, riparian
Hairy Sapsucker	<i>Dendrocopos villosus</i>	YL	P-J, riparian
Downy Sapsucker	<i>Dendrocopos pubescens</i>	S	P-J, riparian
Ladder-backed Woodpecker	<i>Dendrocopos scalaris</i>	YL	P-J, riparian
Northern Three-toed Woodpecker	<i>Dendrocopos tridactylus</i>	W	P-J
Acorn Woodpecker	<i>Melanerpes formicivorus</i>	M	Riparian, P-J
Eastern Kingbird	<i>Tyrannus tyrannus</i>	M	Riparian
Western Kingbird	<i>Tyrannus verticalis</i>	M - S	Grassland, P-J
Cassin's Kingbird	<i>Tyrannus vociferans</i>	M - S	P-J, riparian
Ash-throated Flycatcher	<i>Myiarchus cinerascens</i>	S	Creosote; mesquite, P-J
Eastern Phoebe	<i>Sayornis phoebe</i>	W	Riparian
Black Phoebe	<i>Sayornis nigricans</i>	YL	Riparian
Say's Phoebe	<i>Sayornis saya</i>	YL	Creosote, mesquite
Traill's Flycatcher	<i>Empidonax traillii</i>	S	Riparian - willows and alders
Hammond's Flycatcher	<i>Empidonax hammondi</i>	M	P-J, riparian
Dusky Flycatcher	<i>Empidonax oberholseri</i>	M	Mt. shrub
Gray Flycatcher	<i>Empidonax wrightii</i>	M	P-J, riparian
Western Flycatcher	<i>Empidonax difficilis</i>	S - M	Riparian (at higher elevations)

ANIMAL SPECIES OCCURRING IN
THE RADIUM SPRINGS GEOTHERMAL AREA

Birds

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION
Western Wood Pewee	<i>Contopus sordidulus</i>	M - S	P-J, riparian
Olive-sided Flycatcher	<i>Nuttallornis borealis</i>	M	P-J, riparian
Vermilion Flycatcher	<i>Pyrocephalus rubinus</i>	YL	Riparian
Horned Lark	<i>Eremophila alpestris</i>	YL	Grassland
Violet-Green Swallow	<i>Tachycineta thalassina</i>	S - M	Riparian, P-J
Tree Swallow	<i>Iridoprocne bicolor</i>	M	Riparian, marshes
Bank Swallow	<i>Riparia riparia</i>	S	Marshes, lakes
Rough-winged Swallow	<i>Stelgidopteryx ruficollis</i>	S - M	Streams, lakes
Cliff Swallow	<i>Petrochelidon pyrrhonata</i>	M - S	Rivers, lakes, cliffs, man-made structures
Purple Martin	<i>Progne subis</i>	S	P-J
Barn Swallow	<i>Hirundo rustica</i>	S	Rivers, lakes, cliffs, man-made structures
Steller's Jay	<i>Cyanocitta stelleri</i>	W	P-J
Blue Jay	<i>Cyanocitta cristata</i>	M	Riparian
Scrub Jay	<i>Aphelocoma coerulescens</i>	YL	P-J, oaks
Pinon Jay	<i>Gymnorhinus cyanocephalus</i>	YL	P-J
Clark's Nutcracker	<i>Nucifraga columbiana</i>	W - M	P-J
Black-billed Magpie	<i>Pica pica</i>	M	Riparian
Common Crow	<i>Corvus brachyrhynchos</i>	W	Riparian, farmlands
Common Raven	<i>Corvus corax</i>	YL	P-J, riparian
White-necked Raven	<i>Corvus cryptoleucus</i>	S	Grassland, creosote, riparian

ANIMAL SPECIES OCCURRING IN
THE RADIUM SPRINGS GEOTHERMAL AREA

Birds

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION
Mountain Chickadee	<i>Parus gambeli</i>	S - W	P-J, riparian
Plain Titmouse	<i>Parus indrnatu</i> s	YL	P-J, riparian
Bridled Titmouse	<i>Parus wollweberi</i>	M	P-J, riparian
Verdin	<i>Auriparus flaviceps</i>	YL - S	Mesquite
Common Bushtit	<i>Plastriparus minimus</i>	YL - S	P-J, riparian
White-breasted Nuthatch	<i>Sitta carolinensis</i>	YL - S	Riparian
Red-breasted Nuthatch	<i>Sitta canadensis</i>	W - M	Riparian, P-J
Pygmy Nuthatch	<i>Sitta pygmaea</i>	W	P-J
Brown Creeper	<i>Certhia familiaris</i>	W	Riparian
House Wren	<i>Troglodytes aedon</i>	S	Riparian
Winter Wren	<i>Troglodytes troglodytes</i>	W	Mt. shrub
Bewick's Wren	<i>Thryomanes bewickii</i>	YL - W	P-J, riparian
Cactus Wren	<i>Campylorhynchus bruneicapillus</i>	YL	Grassland, desert shrub, mesquite
Long-billed Marsh Wren	<i>Telmatodytes palustris</i>	M	Marshes
Canyon Wren	<i>Catherpes mexicanus</i>	YL	Canyons, cliffs
Rock Wren	<i>Salpinctes obsoletus</i>	YL - S	Rocky areas
Mockingbird	<i>Mimus polyglottos</i>	YL	Towns, mesquite
Catbird	<i>Dumetella carolinensis</i>	M	Mesquite, riparian
Brown Thrasher	<i>Toxostoma rufum</i>	W	Mesquite, desert shrub
Curve-billed Thrasher	<i>Toxostoma curvirostre</i>	YL	Desert shrub

ANIMAL SPECIES OCCURRING IN
THE RADIUM SPRINGS GEOTHERMAL AREA

Birds

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION
Crissal Thrasher	<i>Toxostoma dorsale</i>	YL	Mesquite
Sage Thrasher	<i>Oreoscoptes montanus</i>	W	Desert shrub
Robin	<i>Turdus migratorius</i>	YL	Riparian, P-J, towns
Hermit Thrush	<i>Hylocichla guttata</i>	W	P-J, riparian
Swainson's Thrush	<i>Hylocichla ustulata</i>	M	P-J, riparian
Eastern Bluebird	<i>Sialia sialis</i>	M	P-J, riparian
Western Blue bird	<i>Sialia mexicana</i>	YL	P-J, Riparian
Mountain Bluebird	<i>Sialia currucoides</i>	W	P-J
Townsend's Solitaire	<i>Myadestes townsendi</i>	W	P-J, riparian
Blue-gray Gnatcatcher	<i>Poliioptila caerulea</i>	S	P-J, oaks
Black-tailed Gnatcatcher	<i>Poliioptila melanura</i>	YL	Creosote, mesquite
Golden-crowned Kinglet	<i>Regulus satrapa</i>	W	P-J, riparian
Ruby-crowned Kinglet	<i>Regulus calendula</i>	M - W	P-J, mt. shrub
Water Pipit	<i>Anthus spinoletta</i>	M - W	Grassland, shores
Cedar Waxwing	<i>Bombycilla cedrorum</i>	W	Residential, riparian, P-J
Phainopepla	<i>Phainopepla nitens</i>	YL	Riparian, mesquite, P-J, oak
Northern Shrike	<i>Lanius excubitor</i>	W	Grassland
Loggerhead Shrike	<i>Lanius ludovicianus</i>	YL	Grassland, creosote, desert shrub, P-J
Starling	<i>Sturnus vulgaris</i>	YL	Riparian, farms, grassland
Bell's Vireo	<i>Vireo bellii</i>	S	Riparian, mesquite, oak woodland

ANIMAL SPECIES OCCURRING IN
THE RADIUM SPRINGS GEOTHERMAL AREA

Birds

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION
Solitary Vireo	<i>Vireo solitarius</i>	S	P-J, riparian
Warbling Vireo	<i>Vireo gilvus</i>	S	Riparian
Orange-crowned Warbler	<i>Vermivora celata</i>	M	P-J, oak woodland
Virginia Warbler	<i>Vermivora virginiae</i>	S - M	Oak woodland, P-J, riparian
Lucy Warbler	<i>Vermivora luciae</i>	S	Mesquite, semi-riparian
Nashville Warbler	<i>Vermivora ruficapilla</i>	M	P-J, oak woodland (especially forest edges)
Black-throated Green Warbler	<i>Dendroica virens</i>	M	Riparian, P-J
Yellow Warbler	<i>Dendroica petechia</i>	S	Riparian
Myrtle Warbler	<i>Dendroica coronata</i>	M	Riparian, P-J
Audubon's Warbler	<i>Dendroica auduboni</i>	YL	Riparian, residential, P-J
Grace Warbler	<i>Dendroica graciae</i>	S	P-J, oak woodland
MacGillivray's Warbler	<i>Oporornis tolmiei</i>	M	Mesquite, riparian
Wilson Warbler	<i>Wilsonia pusilla</i>	M	Riparian
Red-faced Warbler	<i>Cardellina rubrifrons</i>	M	Riparian, pine-oak
Ovenbird	<i>Seiurus aurocapillus</i>	M	Riparian
Yellowthroat	<i>Geothlypis trichas</i>	S	Marshes, riparian
Yellow-breasted Chat	<i>Icteria virens</i>	S	Riparian thickets
American Redstart	<i>Setophaga ruticilla</i>	M	Riparian
Painted Redstart	<i>Setophaga picta</i>	S	P-J, oak, riparian
House Sparrow	<i>Passer domesticus</i>	YL	Residential

ANIMAL SPECIES OCCURRING IN
THE RADIUM SPRINGS GEOTHERMAL AREA

Birds

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION
Eastern Meadowlark	<i>Sturnella magna</i>	YL	Grasslands
Western Meadowlark	<i>Sturnella neglecta</i>	YL	Grasslands
Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>	W	Marshes
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	YL	Marshes, fields
Orchard Oriole	<i>Icterus spurius</i>	M	Riparian, planted trees
Hooded Oriole	<i>Icterus cucullatus</i>	S	Riparian, residential
Scott's Oriole	<i>Icterus parisorum</i>	S	Yucca-grassland, P-J, oak
Bullock's Oriole	<i>Icterus bullockii</i>	S	Riparian, oak, farms
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>	W	Fields, farms, towns
Boat-tailed Grackle	<i>Cassidix mexicanus</i>	YL	Riparian, residential
Brown-headed Cowbird	<i>Molothrus ater</i>	YL	Riparian, oak, towns, farms
Western Tanager	<i>Piranga ludoviciana</i>	S - M	Riparian, P-J
Hepatic Tanager	<i>Piranga flava</i>	S - M	P-J oak, riparian
Summer Tanager	<i>Piranga rubra</i>	S	Riparian
Pyrrhuloxia	<i>Pyrrhuloxia sinuata</i>	S	Residential riparian
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	S	Riparian
Black-headed Grosbeak	<i>Pheucticus melanocephalus</i>	S	P-J, oak
Indigo Bunting	<i>Passerina cyanea</i>	M	Riparian, fields
Lazuli Bunting	<i>Passerina amoena</i>	M	Riparian thickets, desert shrub
Painted Bunting	<i>Passerina ciris</i>	S - M	Mesquite, riparian

ANIMAL SPECIES OCCURRING IN
THE RADIUM SPRINGS GEOTHERMAL AREA

Birds

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION
Evening Grosbeak	<i>Hesperiphona vespertina</i>	W	Riparian, P-J
Blue Grosbeak	<i>Guiraca caerulea</i>	S	Riparian, mesquite
Cassin Finch	<i>Carpodacus cassinii</i>	M	P-J
House Finch	<i>Carpodacus mexicanus</i>	YL	Towns, riparian
Pine Siskin	<i>Spinus pinus</i>	W	P-J
American Goldfinch	<i>Spinus tristis</i>	M	Riparian
Lesser Goldfinch	<i>Spinus psaltria</i>	YL	Riparian
Lawrence Goldfinch	<i>Spinus lawrencei</i>	M - W	Oak woodland
Red Crossbill	<i>Loxia curvirostra</i>	YL	P-J, oak woodland
Green-tailed Towhee	<i>Chlorura chlorura</i>	W	Riparian shrubland
Rufous-sided Towhee	<i>Pipilo erythrophthalmus</i>	YL	P-J, riparian
Brown Towhee	<i>Pipilo fuscus</i>	YL	P-J, mt. shrub, desert shrub
Lark Bunting	<i>Calamospiza melanocorys</i>	W - M	Grassland, desert shrub
Savannah Sparrow	<i>Passerculus sandwichensis</i>	W	Grassland, salt marshes
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	M	Grassland
Baird's Sparrow	<i>Ammodramus bairdii</i>	M	Grassland
Lark Sparrow	<i>Chondestes grammacus</i>	S	Desert shrub, P-J
Vesper Sparrow	<i>Poocetes gramineus</i>	W	Grassland, desert shrub
Rufous-crowned Sparrow	<i>Aimophila ruficeps</i>	YL	Mt. shrub, P-J
Cassin's Sparrow	<i>Aimophila cassinii</i>	S	Grassland, creosote

Birds

ANIMAL SPECIES OCCURRING IN
THE RADIUM SPRINGS GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION
Black-throated Sparrow	<i>Amphispiza bilineata</i>	YL	Desert shrub, creosote
Sage Sparrow	<i>Amphispiza bellii</i>	W	Creosote, desert Shrub
Slate-colored Junco	<i>Junco hyemalis</i>	W	P-J
Oregon Junco	<i>Junco oreganus</i>	W	P-J
Gray-headed Junco	<i>Junco caniceps</i>	YL - W	P-J, oak
Chipping Sparrow	<i>Spizella passerina</i>	YL	P-J, oak
Brewer's Sparrow	<i>Spizella breweri</i>	W	Grassland, marshes
Black-chinned Sparrow	<i>Spizella atrogularis</i>	S	P-J, mt. shrub
Harris' Sparrow	<i>Zonotrichia querula</i>	M	P-J, mt. shrub, desert shrub
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>	W	Desert shrub, creosote, mesquite
Golden-crowned Sparrow	<i>Zonotrichia atricapilla</i>	W	Desert shrub, creosote
White-throated Sparrow	<i>Zonotrichia albicollis</i>	W	Desert shrub, creosote
Fox Sparrow	<i>Passerella iliaca</i>	M - W	Riparian, mesquite
Lincoln's Sparrow	<i>Melospiza lincolni</i>	W	Riparian, desert shrub
Song Sparrow	<i>Melospiza melodia</i>	W	Riparian shrubs
McCown's Longspur	<i>Rhynchophanes mccowni</i>	W	Grassland
Chestnut-collared Longspur	<i>Calcarius ornatus</i>	W	Grassland

ANIMAL SPECIES OCCURRING IN
THE RADIUM SPRINGS GEOTHERMAL AREA

Mammals

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION
Desert Shrew	<i>Notiosorex crawfordi</i>	YL	Desert shrub, P-J, mt. shrub
Little Brown Myotis	<i>Myotis lucifugus</i>	M - S	Any vegetative type near water
Yuma Myotis	<i>Myotis yumanensis</i>	M - S	Riparian
Arizona Myotis	<i>Myotis occultus</i>	M - S	Any vegetative type near water
Fringed Myotis	<i>Myotis thysanodes</i>	M - S	Most vegetative types - caves, buildings
Long-legged Myotis	<i>Myotis volans</i>	M - S	Usually ponderosa, pine, sometimes grasslands
California Myotis	<i>Myotis californicus</i>	M - S	Most vegetative types, in rocky areas
Western Pipistrelle	<i>Pipistrellus hesperus</i>	M - S	Grassland, desert shrub, P-J, in rocky areas
Big Brown Bat	<i>Eptesicus fuscus</i>	M - S	P-J, riparian during migration
Red Bat	<i>Lasiurus borealis</i>	M - S	Riparian (Cottonwoods)
Hoary Bat	<i>Lasiurus cinereus</i>	M - S	P-J
Spotted Bat	<i>Euderma maculata</i>	M - S	P-J, in rocky areas; riparian during migration
Western Big-eared Bat	<i>Plecotus townsendi</i>	M - S	Most vegetative types, in rocky areas
Pallid Bat	<i>Antrozous pallidus</i>	M - S	Grassland, desert shrub
Mexican Free-tail Bat	<i>Tadarida brasiliensis</i>	M - S	P-J, grassland, desert shrub in caves, manmade structures
Blacktail Jackrabbit	<i>Lepus californicus</i>	YL	Grassland, desert shrub
Desert Cottontail	<i>Sylvilagus auduboni</i>	YL	Most vegetative types in area
Blacktail Prairie Dog	<i>Cynomys ludovicianus</i>	YL	Grassland
Whitetail Prairie Dog	<i>Cynomys gunnisoni</i>	YL	Grassland, at higher elevations

ANIMAL SPECIES OCCURRING IN
THE RADIUM SPRINGS GEOTHERMAL AREA

Mammals

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION
Rock Squirrel	<i>Spermophilus variegatus</i>	YL	Rocky areas in most vegetative types
Spotted Ground Squirrel	<i>Spermophilus spilosoma</i>	YL	Grassland, desert shrub in sandy soil
Gray-tailed Antelope Squirrel	<i>Amospermophilus interpres</i>	YL	Grassland, desert shrub, P-J, in rocky areas
Cliff Chipmunk	<i>Eutamias dorsalis</i>	YL	P-J
Valley Pocket Gopher	<i>Thomomys bottae</i>	YL	Most vegetative types with suitable soil
Desert Pocket Gopher	<i>Geomys arenarius</i>	YL	Most vegetative types in sandy or loamy soils
Silky Pocket Mouse	<i>Perognathus flavus</i>	YL	Most vegetative types in loose soils
Apache Pocket Mouse	<i>Perognathus apache</i>	YL	Grassland
Desert Pocket Mouse	<i>Perognathus penicillatus</i>	YL	Mesquite, desert shrub
Rock Pocket Mouse	<i>Perognathus intermedius</i>	YL	Desert shrub in lava flows, rocky areas
Hispid Pocket Mouse	<i>Perognathus hispidus</i>	YL	Grassland
Bainertail Kangaroo Rat	<i>Dipodomys spectabilis</i>	YL	Grassland
Ord Kangaroo Rat	<i>Dipodomys ordii</i>	YL	All vegetative types except P-J
Merriam Kangaroo Rat	<i>Dipodomys merriami</i>	YL	Mesquite, creosote
Beaver	<i>Castor canadensis</i>	YL	Riparian
Western Harvest Mouse	<i>Reithrodontomys megalotis</i>	YL	All vegetative types
Cactus Mouse	<i>Peromyscus eremicus</i>	YL	Mt. shrub, desert shrub, mesquite
White-footed Mouse	<i>Peromyscus leucopus</i>	YL	Mt. shrub, desert shrub
Deer Mouse	<i>Peromyscus maniculatus</i>	YL	Most vegetative types
Brush Mouse	<i>Peromyscus boylii</i>	YL	Oak

ANIMAL SPECIES OCCURRING IN
THE RADIUM SPRINGS GEOTHERMAL AREA

Mammals

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION
Pinon Mouse	<i>Peromyscus truei</i>	YL	P-J
Rock Mouse	<i>Peromyscus difficilis</i>	YL	P-J, oak, in rocky areas
Northern Grasshopper Mouse	<i>Onychomys leucogaster</i>	YL	Grassland, mesquite
Southern Grasshopper Mouse	<i>Onychomys torridus</i>	YL	Creosote
Whitethroat Woodrat	<i>Neotoma albigula</i>	YL	Most vegetative types
Mexican Woodrat	<i>Neotoma mexicana</i>	YL	P-J
Hispid Cotton Rat	<i>Sigmodon hispidus</i>	YL	Grassland
Least Cotton Rat	<i>Sigmodon minimus</i>	YL	Marshes
Muskrat	<i>Ondatra zibethica</i>	YL	Riparian
Norway Rat	<i>Rattus norvegicus</i>	YL	Cities
Black Rat	<i>Rattus rattus</i>	YL	Agricultural areas
House Mouse	<i>Mus musculus</i>	YL	Grassland, weedy areas, agricultural area, human habitation
Porcupine	<i>Erethizon dorsatum</i>	YL	Any vegetative type
Coyote	<i>Canis latrans</i>	YL	All vegetative types
Kit Fox	<i>Vulpes macrotis</i>	YL	Grassland
Gray Fox	<i>Urocyon cinereoargenteus</i>	YL	P-J, oak
Raccoon	<i>Procyon lotor</i>	YL	Riparian
Ringtail	<i>Bassariscus astutus</i>	YL	Grassland. P-J, in rocky areas
Longtail Weasel	<i>Mustela frenata</i>	YL	Riparian

Mammals

ANIMAL SPECIES OCCURRING IN
THE RADIUM SPRINGS GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION
Badger	<i>Taxidea taxus</i>	YL	Grassland, most other types
Spotted Skunk	<i>Spilogale putorius</i>	YL	Most vegetative types in rocky, brushy areas
Striped Skunk	<i>Mephitis mephitis</i>	YL	All vegetative types
Hognose Skunk	<i>Conepatus leuconotus</i>	YL	Most vegetative types
Mountain Lion	<i>Felis concolor</i>	YL	P-J
Bobcat	<i>Lynx rufus</i>	YL	All vegetative types
Mule Deer	<i>Odocoileus hemionus</i>	YL	All habitats
Whitetail Deer	<i>Odocoileus virginianus</i>	YL	Oak
Pronghorn	<i>Antilocapra americana</i>	YL	Grassland

Reptiles and
Amphibians

ANIMAL SPECIES OCCURRING IN
THE RADIUM SPRINGS GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION
Tiger Salamander	<i>Ambystoma tigrinum</i>	YL	Riparian, other vegetation near temporary water
Couch's Spadefoot Toad	<i>Scaphiopus couchi</i>	YL	Grassland, mesquite, creosote
Western Spadefoot Toad	<i>Scaphiopus hammondi</i>	YL	Alkali flats, alluvial fans, mt. valleys
Plains Spadefoot Toad	<i>Scaphiopus bombifrons</i>	YL	Desert shrub to P-J
Woodhouse's Toad	<i>Bufo woodhousei</i>	YL	Grassland, other vegetative types
Great Plains Toad	<i>Bufo cognatus</i>	YL	Grassland, creosote mesquite
Green Toad	<i>Bufo debilis</i>	YL	Mesquite, grassland
Red-spotted Toad	<i>Bufo punctatus</i>	YL	Grassland, arroyos, rocky canyons
Leopard Frog	<i>Rana pipiens</i>	YL	Aquatic vegetation
Bullfrog	<i>Rana catesbeiana</i>	YL	Aquatic vegetation
Western Box Turtle	<i>Terrapene ornata</i>	YL	Grassland, other vegetative types in sandy soils
Pond Slider	<i>Pseudemys scripta</i>	YL	Quiet water with aquatic vegetation
Painted Turtle	<i>Chrysemys picta</i>	YL	Quiet water with aquatic vegetation
Spiny Softshell	<i>Trionyx spiniferus</i>	YL	Quiet rivers
Texas Banded Gecko	<i>Coleonyx brevis</i>	YL	Arid-type vegetation, in rocky canyons and outcrops
Lesser Earless Lizard	<i>Holbrookia maculata</i>	YL	Grassland, mesquite in sand or gravel
Greater Earless Lizard	<i>Cophosaurus texanum</i>	YL	Cactus, mesquite, creosote, ocotillo, in sandy washes
Collared Lizard	<i>Crotaphytus collaris</i>	YL	Sparse vegetation in rocky areas
Leopard Lizard	<i>Crotaphytus wislizenii</i>	YL	Creosote, scattered vegetation in gravelly soil or rocks

ANIMAL SPECIES OCCURRING IN
THE RADIUM SPRINGS GEOTHERMAL AREA

Reptiles and
Amphibians

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION
Crevice Spiny Lizard	<i>Sceloporus poinsetti</i>	YL	Rocky areas with arid-type vegetation
Desert Spiny Lizard	<i>Sceloporus magister</i>	YL	Creosote, mesquite, desert shrub, P-J
Eastern Fence Lizard	<i>Sceloporus undulatus</i>	YL	P-J, grassland, desert shrub
Side-blotched Lizard	<i>Uta stansburiana</i>	YL	Most habitat types
Tree Lizard	<i>Urosaurus ornatus</i>	YL	Mesquite, oak, P-J, riparian
Texas Horned Lizard	<i>Phrynosoma cornutum</i>	YL	Sparse vegetation of desert shrub, P-J. grass
Round-tailed Horned Lizard	<i>Phrynosoma modestum</i>	YL	Sandy or gravelly soils in oak, mesquite, creosote
Great Plains Skink	<i>Eumeces obsoletus</i>	YL	Grassland, P-J
Many-lined Skink	<i>Eumeces multivirgatus</i>	YL	Most habitats in area
New Mexican Whiptail	<i>Cnemidophorus neomexicanus</i>	YL	Mesquite, desert shrub
Little Striped Whiptail	<i>Cnemidophorus inornatus</i>	YL	Grassland. grassy areas in P-J in sandy or silty plains
Desert Grassland Whiptail	<i>Cnemidophorus uniparens</i>	YL	Grassland. mesquite
Chihuahua Whiptail	<i>Cnemidophorus exsanguis</i>	YL	Grassland to oak
Western Whiptail	<i>Cnemidophorus tigris</i>	YL	Sparse plants in desert shrub. oak, P-J areas
Checkered Whiptail	<i>Cnemidophorus tessellatus</i>	YL	Creosote to P-J, sparse vegetation in rocky areas
Texas Blind Snake	<i>Leptotyphlops dulcis</i>	YL	Grassland canyon bottoms, rocky or sandy deserts
Western Hognose Snake	<i>Heterodon nasicus</i>	YL	Grassland, farmlands, river, floodplains
Ringneck Snake	<i>Diadophis punctatus</i>	YL	Grassland. woodland in moist areas
Coachwhip	<i>Masticophis flagellum</i>	YL	Most vegetative types, if not dense enough

Reptiles and
Amphibians

ANIMAL SPECIES OCCURRING IN
THE RADIUM SPRINGS GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION
Striped Whipsnake	<i>Masticophis taeniatus</i>	YL	Desert shrub, grassland, P-J
Western Patch-nosed Snake	<i>Salvadora deserticola</i>	YL	Grassland, oak, desert shrub
Mountain Patch-nosed Snake	<i>Salvadora grahamiae</i>	YL	P-J, above 4000'
Trans-Pecos Rat Snake	<i>Elaphe subocularis</i>	YL	Desert shrub in rocky areas
Glossy Snake	<i>Arizona elegans</i>	YL	Oak, P-J, grassland
Bull Snake	<i>Pituophis melanoleucus</i>	YL	Most vegetative types
Common Kingsnake	<i>Lampropeltis getulus</i>	YL	Most vegetative types
Sonora Mountain Kingsnake	<i>Lampropeltis pyromelana</i>	YL	P-J
Milk Snake	<i>Lampropeltis triangulum</i>	YL	Riparian, marshes, grassland
Long-nosed Snake	<i>Rhinocheilus lecontei</i>	YL	Desert shrub, grassland
Common Garter Snake	<i>Thamnophis sirtalis</i>	YL	Marshes, grassland
Checkered Garter Snake	<i>Thamnophis marcianus</i>	YL	Marshes, grassland
Western Ground Snake	<i>Sonora semiannulata</i>	YL	Creosote, river bottoms
Western Hook-nosed Snake	<i>Gyalopion canum</i>	YL	Grassland, P-J
Plains Black-headed Snake	<i>Tantilla nigriceps</i>	YL	Grassland, desert shrub
Western Black-headed Snake	<i>Tantilla planiceps</i>	YL	Grassland, oak, desert shrub
Night Snake	<i>Hysiglena torquata</i>	YL	Grassland, oak, P-J, desert shrub
Texas Lyre Snake	<i>Trimorphodon biscuitatus</i>	YL	P-J, mt. shrub
Massasauga (Pygmy) Rattlesnake	<i>Sistrurus catenatus</i>	YL	Grassland, mesquite, juniper

ANIMAL SPECIES OCCURRING IN
THE RADIUM SPRINGS GEOTHERMAL AREA

Reptiles and
Amphibians

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION
Western Diamondback	<i>Crotalus atrox</i>	YL	Grassland, mesquite, desert shrub
Rock Rattlesnake	<i>Crotalus lepidus</i>	YL	P-J, mt. shrub
Black-tailed Rattlesnake	<i>Crotalus molossus</i>	YL	Rocky areas in P-J, mt. shrub
Western Rattlesnake	<i>Crotalus viridis</i>	YL	Grassland, P-J, mt. shrub in rocky areas

ANIMAL SPECIES OCCURRING IN
THE RADIIUM SPRINGS GEOTHERMAL AREA

Fish

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION
Gizzard Shad	<i>Dorosoma cepedianum</i>	YL	Elephant Butte
Rainbow Trout	<i>Salmo gairdneri</i>	YL	"
Brown Trout	<i>Salmo trutta</i>	YL	"
Northern Pike	<i>Esox lucius</i>	YL	"
River Carpsucker	<i>Caripiodes carpio</i>	YL	"
White Sucker	<i>Catostomus commersoni</i>	YL	"
Smallmouth Buffalo	<i>Ictiobus bubalus</i>	YL	"
Goldfish	<i>Carassius auratus</i>	YL	"
Carp	<i>Cyprinus carpio</i>	YL	"
Red Shiner	<i>Notropis lutrensis</i>	YL	"
Fathead Minnow	<i>Pimephales promelas</i>	YL	"
Blue Catfish	<i>Ictalurus furcatus</i>	YL	"
Black Bullhead	<i>Ictalurus melas</i>	YL	"
Yellow Bullhead	<i>Ictalurus natalis</i>	YL	"
Channel Catfish	<i>Ictalurus punctatus</i>	YL	"
Flathead Catfish	<i>Pylodictis olivaris</i>	YL	"
Mosquitofish	<i>Gambusia affinis</i>	YL	"
White Bass	<i>Morone chrysops</i>	YL	"
Marmouth	<i>Lepomis gulosus</i>	YL	"
Green Sunfish	<i>Lepomis cyanellus</i>	YL	"

ANIMAL SPECIES OCCURRING IN
THE RADIUM SPRINGS GEOTHERMAL AREA

Fish

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION
Bluegill	<i>Lepomis macrochirus</i>	YL	Elephant Butte
Longer Sunfish	<i>Lepomis megalotis</i>	YL	"
Largemouth Bass	<i>Micropterus salmoides</i>	YL	"
White Crappie	<i>Pomoxis annularis</i>	YL	"
Black Crappie	<i>Pomoxis nigromaculatus</i>	YL	"
Yellow Perch	<i>Perca flavescens</i>	YL	"
Walleye	<i>Stizostedium vitreum</i>	YL	"

ANIMAL SPECIES OCCURRING IN
THE RADIUM SPRINGS GEOTHERMAL AREA

INVERTEBRATES

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION
Juniper Cerambycid Beetle	<i>Tetraopes femoratus</i>	S	P-J
Tenebrionid Beetle	<i>Eleodes lonicollis</i>	S	Semi-arid areas - mesquite; creosote, desert
Rabbit-brush Beetle	<i>Cysteodemus wislizenii</i>	S	Semi-arid areas with rabbit brush
Metallic Leaf-beetle	<i>Chrysochus auratus</i>	S	<i>Apocynum</i> sp.
Lady Bug Beetle	<i>Hippodamia convergens</i>	S	All habitats
Mesquite Girdler	<i>Oncideres rodostica</i>	S	Mesquite
Broomwood Longhorn Beetle	<i>Crossidius pulchrus</i>	S	Broomweed
Monarch Butterfly	<i>Danaus plexippus</i>	Sp - S	Milkweed
Mourning-Cloak Butterfly	<i>Nymphalis antiopa</i>	Sp - S	Riparian (deciduous trees)
Swallowtail	<i>Papilio turnus</i>	Sp - S	Riparian
Polyphemus	<i>Telega polyphemus</i>	Sp - S	Broad-leaved trees at lower elevations
Tent Caterpillars	<i>Malacosoma americana</i>	Sp - S	Most habitat areas
Clear-winged Moth	<i>Calesesia coccinea</i>	Sp - S	Rabbit brush
Noctuid Moth	<i>Erebus odora</i>	Sp - S	Rabbit brush
Painted Lady	<i>Vanessa cardui</i>	Sp - S	All habitats
Damselfly	<i>Lestes</i> sp.	S	Marshes
Dragonflies	<i>Libellula</i> sp.	S	Marshes, riparian
Mosquitoes	<i>Culex pipiens</i>	S	Riparian, marshes
Horse or Deer Flies	<i>Silvius</i> sp.	S	All habitats
House Fly	<i>Musca domestica</i>	Sp - S - F	All habitats

ANIMAL SPECIES OCCURRING IN
THE RADIUM SPRINGS GEOTHERMAL AREA

INVERTEBRATES

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION
Migratory Grasshopper	Melanoplus bilituratus	S	Most vegetative types
Field Cricket	Acheta assimilis	S	Most vegetative types
Pinon Grasshopper	Trimerotropis cyaneid*	S	P-J
Mesa Grasshopper	Trimerotropis vinculata	S	Grassland on up
Sand Cricket	Stenopelmatus fasciatus	S	Grassland, mesquite
Lubberly Locust	Brachystola magna	S	Annual grasses
Desert Grasshopper	Heliastus aridus	S	Mesquite
Barber-Pole Grasshopper	Dactyloctenium pictum	S	Croton texensis
Carolina Locust	Dissosteira carolina	S	Cultivated crops
Lesser Migrating Locust	Melanoplus atlantis	S	Cultivated crops
Yellow Jacket	Polistes sp.	Sp - S - F	All vegetative types
Honey Bee	Apis mellifera	Sp - S - F	All vegetative types
Bumble Bee	Bombus sp.	Sp - S - F	Marsh, wet grassland.
Harvester Ant	Pogonomyrmex occidentalis	Sp - S - F	Grassland
Digger Wasps	Bembex sp.	Sp - S - F	Sandy areas with grassland, desert shrub
Water Strider	Serris sp.	Sp - S - F	Water areas
Backswimmer	Notonecta undulata	Sp - S - F	Water areas
Water Boatman	Arctocorixa intercrypta	Sp - S - F	Water areas
Pentatomid Bug	Peribalus limbolaris	Sp - S - F	P-J, Yucca grassland
Desert Stinkbug	Eusattus convexus	Sp - S - F	Desert shrub, grassland
Ambush Bug	Phymata erosa	S	Rabbit brush

ANIMAL SPECIES OCCURRING IN
THE RADIUM SPRINGS GEOTHERMAL AREA

INVERTEBRATES

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	VEGETATIVE ASSOCIATION
Squash Bug	<i>Anasa tristis</i>	S	Irrigated farmlands
Giant Water Bugs	<i>Abedus</i> sp.	S	Quiet, permanent water
Minor Praying Mantis	<i>Litaneutria minor</i>	S	Grassland
Walking Stick	<i>Diapheromera femorata</i>	S	Grassland, desert shrub
Prairie Centipede	<i>Scolopendra</i> sp.	S	Grassland
Common Centipede	<i>Scutigera forceps</i>	YL	Houses, old buildings
_____	<i>Gammarus lacustris</i>	YL	Freshwater areas
Wood Tick	<i>Dermacentor</i> sp.	YL	P-J, mt. shrub
Tarantula	<i>Aphonopelma</i> sp.	YL	Mt. shrub, desert shrub
Black Widow	<i>Latrodectus mactans</i>	YL	Most vegetative types around buildings
Desert Scorpion	<i>Centruroides</i> sp.	Sp - S - F	Desert shrub
Whiptail Scorpion	<i>Thelyphonus</i> sp.	Sp - S - F	Most vegetative types in area
Sand Scorpion	<i>Buthus</i> sp.	Sp - S - F	Sandy soils with semi-arid vegetation
_____	<i>Holospira regis</i>	YL	Unique to an area near Kingston
_____	<i>Oreohelix pilsbryi</i>	YL	Unique to an area near Chloride

* Vegetative association given on this list refers to the type of habitat in which the species might be found during the season of the year it occurs in the assessment area. It is not necessarily the common habitat or the breeding habitat of the species.

APPENDIX F

Federal Register - Endangered and Threatened Species, Plants

Federal Register - Endangered and Threatened Wildlife and Plants
List of Animal Species

State Game Commission's Regulation No. 563 - Endangered Species
and Subspecies of New Mexico

WEDNESDAY, JUNE 16, 1976



PART IV:

DEPARTMENT OF
THE INTERIOR

Fish and Wildlife Service



ENDANGERED AND
THREATENED SPECIES

Plants

Federal Register

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

[50 CFR Part 17]

ENDANGERED AND THREATENED
WILDLIFE AND PLANTSProposed Endangered Status for Some
1700 U.S. Vascular Plant Taxa

The Director, U.S. Fish and Wildlife Service (hereinafter, the Director and the Service, respectively), hereby issues a proposed rulemaking which would determine approximately 1700 native, U.S., vascular plant taxa to be Endangered Species, pursuant to section 4 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1543, 87 Stat. 884; hereinafter, the Act). He also requests comments regarding the determination of "Critical Habitat" of any of these taxa.

BACKGROUND

On December 28, 1973, the Act became effective and, thereby, provided a means whereby plants in danger of extinction and their dependent ecosystems may be conserved. Recognizing that prior to this Act, members of only the animal kingdom had been considered and that adequate concern for plants was urgent, section 12 of the Act states:

ENDANGERED PLANTS

Sec. 12. The Secretary of the Smithsonian Institution, in conjunction with other affected agencies, is authorized and directed to review (1) species of plants which are now or may become endangered or threatened and (2) methods of adequately conserving such species, and to report to Congress, within one year after the date of the enactment of this Act, the results of such review including recommendations for new legislation or the amendment of existing legislation.

The Secretary of the Smithsonian Institution presented his report to Congress on January 9, 1975, by transmittal to the Speaker of the U.S. House of Representatives. Designated as House Document No. 94-51 of the 94th Congress, 1st Session, it was subsequently published by the Government Printing Office, Washington, D.C., for use of the House Committee on Merchant Marine and Fisheries, which oversees the Act through its Subcommittee on Fisheries and Wildlife Conservation and the Environment. That report contains lists of over 3,100 U.S. vascular plant taxa which the scientists who compiled the report consider to be endangered, threatened, or perhaps extinct; the criteria used in the selection of such plants; and recommendations for adequate plant conservation. Recommendations 1 and 3 read as follows:

1. Preservation of endangered and threatened species of plants in their native habitat should be adopted as the best method of ensuring their survival. Cultivation or artificial propagation of these species is an unsatisfactory alternative to *in situ* perpetuation and should be used only as a last resort, when extinction appears certain, with the purpose of re-establishing the species in its natural habitat.

3. In accordance with section 4 of the Endangered Species Act of 1973, the Secretary of the Interior should review the lists in this report and publish proposed lists of endan-

gered and threatened plants in the FEDERAL REGISTER.

On April 22, 1975, the Director published a notice in the FEDERAL REGISTER (40 FR 17764-17765), describing the process of determination of "Critical Habitat" for Endangered and Threatened species, as encouraged by section 2(b) and provided for by section 7 of the Act.

On July 1, 1975, the Director published a notice in the FEDERAL REGISTER (40 FR 27823-27924), of his acceptance of the report of the Smithsonian Institution as a petition within the context of section 4(c)(2) of the Act, and of his initiation thereby of a review of the status of the plant taxa named therein as well as any habitat of these taxa which might be determined to be critical, pursuant to section 7 of the Act. On April 21, 1975, the Director had published (40 FR 17612), a similar notice of the review of four plant species of the eastern United States; one of which, *Aconitum noveboracense*, is included in the present proposal.

These publications have received wide distribution among government agencies, private groups, and interested individuals; they also have been provided at meetings and conferences, and references or excerpts from some of them have appeared in scientific and popular journals and in public newspapers and other media outlets.

In the FEDERAL REGISTER of June 7, 1976 (41 FR 22915-22922), the Service published proposed rules which, among other things:

(1) Set forth the procedural steps of determining Endangered or Threatened Species of Plants;

(2) Proscribe the prohibitions which apply to such Endangered or Threatened Plants or to the seeds, roots, or parts thereof;

(3) Establish procedures, conditions, and criteria for the application for and issuance of permits to conduct otherwise prohibited activities.

Any plant herein proposed which is eventually determined to be a Threatened Species or an Endangered Species would be subject to those regulations.

DISCUSSION OF COMMENTS RECEIVED

As a result of the dissemination of the FEDERAL REGISTER notices discussed above and as a result of the publicity given them, the Service has received hundreds of comments from the scientific community, various States, Federal agencies, industry groups, other special interest groups and the general public pertaining to the need, the procedures and the process of the determination of Threatened or Endangered Species of Plants. Many of these comments have been responded to individually, all have been considered and those containing substantive information will be analyzed further prior to finalization of this Proposal. All such comments have been incorporated into the background files for this Proposal which are maintained in the Service's Office of Endangered Species, Suite 1100, 1612 K Street, N.W., Washington, D.C., and have been catalogued in a correspondence log entitled "Comments on U.S. Plant Candidates Through April

1976." That log, dated May 5, 1976, also has been incorporated into the permanent background files.

DESCRIPTION OF THE PROPOSAL

Section 4(a) of the Act states that the Secretary may determine a species to be an Endangered Species or a Threatened Species because of any of the five factors following:

(1) The present or threatened destruction, modification, or curtailment of its habitat or range;

(2) Overutilization for commercial, sporting, scientific, or educational purposes;

(3) Disease or predation;

(4) The inadequacy of existing regulatory mechanisms; or

(5) Other natural or mandate factors affecting its continued existence.

The U.S. Fish and Wildlife Service has reviewed the information gathered and compiled by the Smithsonian Institution (Department of Botany) in the preparation of their report and in subsequent investigations to be sufficient for proposing an Endangered Species the approximately 1,700 plants named hereinafter. In obtaining this information which is on file at the Smithsonian Institution's Department of Botany, Washington, D.C., they contacted and received recommendations from a majority of the top botanists in the country, and this resulting list is a further refinement of their views. At least one of the above five factors threaten each of the identified plant taxa with extinction throughout all or a significant portion of its range. Certain plants proposed herein are of such a restricted range or habitat that they qualify despite their locally sufficient numbers.

The list of some 1,700 taxa proposed represents a portion of the revised report of the Smithsonian Institution, and has been assembled on the basis of the comments and data received by that Institution and the U.S. Fish and Wildlife Service in response to the publications mentioned above, particularly House Document No. 94-51 and the FEDERAL REGISTER notices of April 21 and July 1, 1975.

The Act requires inclusion of the " * * * scientific and common name or names, if any, * * *" upon the list of those species determined to be Threatened or Endangered. No generally recognized common name exists for many of the plants included on the list contained herein. In such cases, the entry (n.c.n.) follows the scientific name and indicates the Service has located No Common Name for that taxon.

In other cases, acceptable common names exist for the genera or species in question, but no such names for lesser taxa have been located. In these instances, the common name for the genus or species, as appropriate, will be followed by the notation (unnamed).

As usage of such names varies considerably, it should be recognized that only the scientific names carry legal significance. Comments and data toward improving the accuracy of common names, as well as scientific names, are requested.

The Service recognizes that plant taxonomy is not an exact science, that the knowledge of plants continues to develop, and that scientific nomenclature reflects such understanding. It further recognizes that the classification and nomenclatural rank given to a plant is subject to opinion, based on the specialist's knowledge of the plant in question, and his interpretation of the terms and concepts of plant taxonomy. Consequently, those plants named as "varieties" in the Smithsonian Institution report and its revision are here considered to be subspecies and, therefore, "species" as defined in section 3(11) of the Act.

Determination that a plant is a Threatened or Endangered Species would, among other things, make that species, including its seeds, roots, or other parts, subject to the prohibitions of section 9(a)(2) of the Act which reads as follows:

(2) Except as provided in sections 6(g)(2) and 10 of this Act, with respect to any endangered species of plants listed pursuant to section 4 of this Act, it is unlawful for any person subject to the jurisdiction of the United States to—

(A) Import any such species into, or export any such species from the United States;

(B) Deliver, receive, carry, transport, or ship in interstate or foreign commerce, by any means whatsoever and in the course of a commercial activity, any such species;

(C) Sell or offer for sale in interstate or foreign commerce any such species; or

(D) Violate any regulation pertaining to such species or to any threatened species of plants listed pursuant to section 4 of this Act and promulgated by the Secretary pursuant to authority provided in this Act.

Such determination also would make the Threatened or Endangered Plant eligible for the protection provided by section 7 of the Act which reads as follows:

INTERAGENCY COOPERATION

SEC. 7. The Secretary shall review other programs administered by him and utilize such programs in furtherance of the purposes of this Act. All other Federal departments and agencies shall, in consultation with and with the assistance of the Secretary, utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species listed pursuant to section 4 of this Act and by taking such action necessary to insure that actions authorized, funded, or carried out by them do not jeopardize the continued existence of such endangered species and threatened species or result in the destruction or modification of habitat of such species which is determined by the Secretary, after consultation as appropriate with the affected States, to be critical.

It should be noted that a determination that a plant is a Threatened Species or an Endangered Species imposes no restrictions upon: the "taking"; the interstate sale; nor upon the interstate movement of such plants unless such movement is in the course of a commercial activity involving a change of ownership of the plant. In this context, the term "commercial activity" is defined in section 3(1) of the Act as follows:

(1) The term "commercial activity" means all activities of industry and trade, including, but not limited to, the buying or sell-

ing of commodities and activities conducted for the purpose of facilitating such buying and selling.

The terms "industry or trade," as used in the above definition, were defined in the September 26, 1975, FEDERAL REGISTER (40 FR 44416) as follows:

"Industry or trade" in the definition of "commercial activity" in the Act means the actual or intended transfer of wildlife or plants from one person to another person in the pursuit of gain or profit;

In the case of Endangered Species of plants, regulations proposed in the June 7, 1976, FEDERAL REGISTER (41 FR 22915-22922), would provide for the issuance of permits to carry out otherwise prohibited activities under certain circumstances. Such permits would be available for scientific purposes or to enhance the propagation or survival of the species. In some instances permits may be issued during a specified period of time to relieve undue economic hardship which would be suffered if such relief were not available.

PUBLIC COMMENTS SOLICITED

The Director intends for the finally adopted rules to be as accurate and effective in the conservation of Endangered plants as possible. Therefore, any comments or suggestions from the public, other concerned governmental agencies, the scientific community, industry, private interests or any other interested party concerning any aspect of these proposed rules are hereby solicited. Comments particularly are sought concerning:

1. The location of any living specimen of those plants which are identified on the following list by an asterisk preceding the scientific name;

2. Botanical, horticultural or other relevant data concerning any threat (or the lack thereof) to any plant included on the following list;

3. Detailed information concerning the range and distribution of any of these plants;

4. The location of and reasons why any habitat of any plant on the following list should be determined to be "Critical Habitat" as provided for by section 7 of the Act;

5. Improved scientific or common names for any plant on the following list;

6. The extent and kinds of impact in regulating the importation or exportation, or the delivering, receiving, carrying, transporting, shipping, or sale or offer for sale in interstate or foreign commercial activity, of these plants;

7. The extent and kinds of impact on actions authorized, funded or carried out by Federal agencies which might affect these plants or any Critical Habitats which may be determined for any of them.

The list of plants following is arranged alphabetically in the sequence of subspecies (variety) within species within genus within family. The family names are included solely for the purpose of aiding in the identification of the other lower taxa and have no other legal significance.

The reader should be aware that the following list consists of two parts:

- (1) The main list and
- (2) An addendum immediately following which contains the names of several floral taxa brought to the Service's at-

tention after the main list had been typed. Plants included in this addendum are arranged in the same sequence as those in the main list.

The Service is aware that this proposal, together with the already published proposed regulations for plants, could have a noticeable impact. It is hoped that comments to the Service will bring out any potential problem areas so that our final rules will be effective, equitable and conducive to voluntary compliance. Therefore, the Service will hold several public hearings in various areas of the country relating to this proposal, jointly with the proposal on plant regulations, before any final rulemakings are published. The dates, times, and locations of these public hearings will be announced in the FEDERAL REGISTER and press releases in the near future. It is planned that this proposal and the proposal on plant regulations will be considered together, and may be implemented together. If necessary, the period for comments on this proposal will be extended. Final promulgation of the regulations on these plant taxa will take into consideration the comments and any additional information received by the Director and such communications may lead him to adopt final regulations that differ from this proposal.

An environmental assessment has been prepared in conjunction with this proposal. It is on file in the Service's Office of Endangered Species and International Activities, 1612 K Street, N.W., Washington, D.C. and may be examined during regular business hours. A determination will be made before the time of final rulemaking as to whether this is a major Federal action which would significantly affect the quality of the human environment within the meaning of section 102 (2)(c) of the National Environmental Policy Act of 1969.

SUBMITTAL OF WRITTEN COMMENTS

Interested persons may participate in this rulemaking by submitting written comments and other documents, preferably in triplicate, to the Director (FWS/LE), U.S. Fish and Wildlife Service, P.O. Box 19183, Washington, D.C. 20036. All relevant comments and materials received no later than August 16, 1976, will be considered. Comments and materials received will be available for public inspection during normal business hours at the Service's office in Suite 600, 1612 K Street, N.W., Washington, D.C.

This proposed rulemaking is issued under the authority contained in the Endangered Species Act of 1973 (16 U.S.C. 1531-1543; 87 Stat. 884).

Dated: June 7, 1976.

LYNN A. GREENWALT,
Director,
Fish and Wildlife Service.

Accordingly, it is hereby proposed to amend Part 17, Subchapter B of Chapter I, Title 50 of the Code of Federal Regulations, as set forth below.

In § 17.12 it is proposed to add the following:

§ 17.12 Endangered or threatened plants.

ENDANGERED AND
THREATENED SPECIES

Plants
in
New Mexico

Extracted from
Federal Register
Vol. 41, No. 117
June 16, 1976

Scientific Name	Common Name	Known Range	Portion of Range Where Threatened or Endangered	Status	Special Rules
ASTERACEAE - Aster Family:					
<u>Erigeron rhizomatus</u>	Fleabane, (unnamed)	New Mexico	Entire	E	N/A
<u>Helianthus paradoxus</u>	Sunflower, (unnamed)	Texas, New Mexico	Do	E	N/A
BRASSICACEAE - Mustard Family:					
<u>Lesquerella aurea</u>	Bladderpod, golden	New Mexico	Do	E	N/A
<u>Lesquerella lata</u>	Bladderpod, (unnamed)	New Mexico	Do	E	N/A
<u>Lesquerella valida</u>	Bladderpod, (unnamed)	Texas, New Mexico	Do	E	N/A
CACTACEAE - Cactus Family:					
<u>Echinocereus hempelii</u>	Hedgehog cactus, Hempf's	New Mexico, Mexico	Do	E	N/A
<u>Echinocereus lloydii</u>	Hedgehog cactus, Lloyd's	Texas, New Mexico	Do	E	N/A
<u>Pediocactus knowltonii</u>	(n.c.n.)	New Mexico, Colorado	Do	E	N/A
<u>Sclerocactus mesae-verdae</u>	(n.c.n.)	Colo., New Mexico	Do	E	N/A
CARYOPHYLLACEAE - Pink Family:					
<u>Silene plankii</u>	(n.c.n.)	Texas, New Mexico	Do	E	N/A
FABACEAE - Pea Family:					
<u>Astragalus castetteri</u>	Milkvetch, Castetter's	New Mexico	Do	E	N/A

Scientific Name	Common Name	Known Range	Portion of Range Where Threatened or Endangered	Status	Special Rules
FABACEAE - Pea Family: (con't.)					
<u>Astragalus siliceus</u>	Milkvetch, (unnamed)	New Mexico	Entire	E	N/A
<u>Petalostemum scariosum</u>	Prairie-clover, (unnamed)	New Mexico	Do	E	N/A
OROBANCHACEAE - Broomrape Family:					
<u>Argemone pleiacantha</u> ssp. <u>pinnatisecta</u>	Prickly-poppy, (unnamed)	New Mexico	Do	E	N/A
POLYGALACEAE - Milkwort Family					
<u>Polygala rimulicola</u>	(n.c.n.)	Texas, New Mexico	Do	E	N/A
PLOYGONACEAE - Buckwheat Family:					
<u>Eriogonum gypsophilum</u>	Wild buckwheat, (unnamed)	New Mexico	Do	E	N/A
RANUNCULACEAE - Buttercup Family:					
<u>Aguilegia chaplinei</u>	Wild columbine, (unnamed)	Texas, New Mexico	Do	E	N/A

Scientific Name	Common Name	Known Range	Portion of Range Where Threatened or Endangered	Status	Special Rules
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SCROPHULARIACEAE - Snapdragon
Family:

Scrophularia coccineas

Figwort, (unnamed)

New Mexico

Entire

E

N/A

CACTACEAE - Cactus Family:

Coryphantha sneedii

(n.c.n.)

New Mexico

Do

E

N/A

var. leel

Coryphantha sneedii

(n.c.n.)

New Mexico, Texas

Do

E

N/A

var. sneedii

WEDNESDAY, OCTOBER 27, 1978
 DEPARTMENT OF THE INTERIOR
 Fish and Wildlife Service
 ENDANGERED AND
 THREATENED WILDLIFE
 AND PLANTS

federal register

WEDNESDAY, OCTOBER 27, 1976



PART IV:

**DEPARTMENT OF
THE INTERIOR**

Fish and Wildlife Service

■
**ENDANGERED AND
THREATENED WILDLIFE
AND PLANTS**

Republication of the List of Species

RULES AND REGULATIONS

Title 50—Wildlife and Fisheries

CHAPTER I—UNITED STATES FISH AND
WILDLIFE SERVICE, DEPARTMENT OF
THE INTERIORSUBCHAPTER B—TAKING, POSSESSION, TRANS-
PORTATION, SALE, PURCHASE, BARTER,
EXPORTATION, AND IMPORTATION OF WILD-
LIFEPART 17—ENDANGERED AND
THREATENED WILDLIFE AND PLANTS

Republication of List of Species

Pursuant to 5 U.S.C. 553, § 17.11 of 50
CFR Chapter I is hereby republished.

In the FEDERAL REGISTER of Septem-
ber 30, 1976 (41 FR 43339-43358) the
Fish and Wildlife Service republished the
List of Endangered and Threatened
Wildlife and Plants. Unfortunately, there
are numerous errors in that list, pri-
marily due to repetition of those unde-
tected previously, and the Service now
corrects the errors in that list through
republishing. In addition, minor amend-
ments are made in order to correct re-
cent changes of country names and to
harmonize format.

Accordingly, § 17.11 of Chapter I, Title
50, Code of Federal Regulations, is
amended as set forth below.

Dated: October 20, 1976.

LYNN A. GREENWALT,
*Director, Fish and
Wildlife Service.*

SPECIES			RANGE		Status	When listed	Special rules
Common name	Scientific name	Population	Known Distribution	Portion of range where endangered or threatened			
MAMMALS:							
Anoa	<u>Anoa depressicornis</u>	N/A	Indonesia	Entire	E	3	N/A
Anoa, mountain	<u>Bubalus (Anoa) quarlesi</u>	N/A	Indonesia	Entire	E	15	N/A
Anteater, scaly	<u>Manis temmincki</u>	N/A	Africa	Entire	E	15	N/A
Antelope, giant sable	<u>Hippotragus niger variani</u>	N/A	Angola	Entire	E	15	N/A
Antelope, Saiga	<u>Saiga tatarica mongolica</u>	N/A	Mongolia*	Entire	E	15	N/A
Argali	<u>Ovis ammon hodgsoni</u>	N/A	China (Tibet)	Entire	E	15	N/A
Armadillo, giant	<u>Priodontes giganteus (=maximus)</u>	N/A	Venezuela, Guyana, Argentina	Entire	E	15	N/A
Armadillo, pink fairy	<u>Chlamyphorus truncatus</u>	N/A	Argentina	Entire	E	3	N/A
Ass, African wild	<u>Equus asinus</u>	N/A	Ethiopia, Somalia,	Entire	E	3	N/A
Ass, Asian wild	<u>Equus hemionus</u>	N/A	Southwestern and Central Asia	Entire	E	3	N/A
Avahis	<u>Avahi spp. (all species)</u>	N/A	Malagasy Republic (Madagascar)	Entire	E	4	N/A
Aye-Aye	<u>Daubentonia madagaascariensis</u>	N/A	Malagasy Republic (Madagascar)	Entire	E	3	N/A
Babiroussa	<u>Babyrousa babyroussa</u>	N/A	Indonesia	Entire	E	15	N/A
Bandicoot, barred	<u>Perameles bougainville</u>	N/A	Australia	Entire	E	4	N/A
Bandicoot, desert	<u>Perameles eremiana</u>	N/A	Australia	Entire	E	6	N/A
Bandicoot, rabbit	<u>Macrotis lagotis</u>	N/A	Australia	Entire	E	4	N/A
Bandicoot, lesser rabbit	<u>Macrotis leucura</u>	N/A	Australia	Entire	E	4	N/A
Bandicoot, pig-footed	<u>Chaeropus ecaudatus</u>	N/A	Australia	Entire	E	4	N/A
Banteng	<u>Bibos banteng</u>	N/A	Southeast Asia	Entire	E	4	N/A
Bat, gray	<u>Myotis grisescens</u>	N/A	Central and South-eastern USA	Entire	E	13	N/A
Bat, Hawaiian hoary	<u>Lasiurus cinereus semotus</u>	N/A	USA (Hawaii)	Entire	E	3	N/A
Bat, Indiana	<u>Myotis sodalis</u>	N/A	Eastern and Mid-western USA	Entire	E	1	N/A
Bear, brown	<u>Ursus arctos pruinosus</u>	China (Tibet)	China (Tibet)	Entire	E	15	N/A
Bear, brown	<u>Ursus arctos</u>	Italy	Holarctic	Entire	E	15	N/A
Bear, brown	<u>Ursus arctos</u>	USA (48 contiguous states)	Holarctic	Entire	T	9	17.40(b)
Bear, brown	<u>Ursus arctos nelsoni</u>	Mexico	Mexico	Entire	E	3	N/A
Beaver	<u>Castor fiber birulai</u>	N/A	Mongolia	Entire	E	15	N/A
Bison, wood	<u>Bison bison athabascae</u>	N/A	Canada	Entire	E	3	N/A
Bobcat	<u>Felis (Lynx) rufus escuinapae</u>	N/A	Central Mexico	Entire	E	15	N/A
Camel, Bactrian	<u>Camelus bactrianus</u>	N/A	Mongolia, China	Entire	E	15	N/A
Cat, Andean	<u>Felis jacobita</u>	N/A	Chile, Peru, Bolivia, Argentina	Entire	E	15	N/A
Cat, black-footed	<u>Felis nigripes</u>	N/A	Southern Africa	Entire	E	15	N/A
Cat, flat-headed	<u>Felis planiceps</u>	N/A	Malaysia	Entire	E	15	N/A
Cat, leopard	<u>Felis bengalensis bengalensis</u>	N/A	Eastern Asia	Entire	E	15	N/A
Cat, marbled	<u>Felis marmorata</u>	N/A	Nepal, Burma, Malaysia (Sumatra, Borneo)	Entire	E	15	N/A
Cat, Temminck's	<u>Felis temmincki</u>	N/A	China (Tibet), Malaysia, (Sumatra)	Entire	E	15	N/A
Cat, tiger	<u>Felis tigrina</u>	N/A	Costa Rica to Northern South America	Entire	E	4	N/A
Chamois	<u>Rupicapra rupicapra ornata</u>	N/A	Italy	Entire	E	15	N/A
Cheetah	<u>Acinonyx jubatus</u>	N/A	Africa to India	Entire	E	3,5	N/A
Chimpanzee	<u>Pan troglodytes</u>	N/A	Western and Central Africa	Entire	T	16	17.40(c)
Chimpanzee, Pigmy	<u>Pan paniscus</u>	N/A	Zaire	Entire	T	16	17.40(c)

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SPECIES			RANGE		Portion of range where endangered or threatened	When Status listed	Special rules
Common name	Scientific name	Population	Known Distribution				
Chinchilla	<u>Chinchilla brevicaudata boliviana</u>	N/A	Bolivia	Entire	E	15	N/A
Colobus, black	<u>Colobus satanas</u>	N/A	Cameroon, Equatorial Guinea, Gabon, Congo, (Brazzaville)	Entire	E	16	N/A
Colobus, red	<u>Colobus badius rufomitatus</u>	N/A	Kenya	Entire	E	16	N/A
Colobus, Zanaibar red	<u>Colobus badius kirkii</u>	KOK	Tanzania	Entire	E	4	N/A
Cougar, eastern	<u>Felis concolor cougar</u>	N/A	USA (Eastern)	Entire	E	6	N/A
Deer, Bawean	<u>Hylaphus kuhli</u> (<u>Cervus kuhli</u>)	N/A	Indonesia	Entire	E	3	N/A
Deer, Eld's brow-antlered	<u>Cervus eldi</u>	N/A	India, Southeast Asia	Entire	E	4	N/A
Deer, Cedros Island mule	<u>Odocoileus hemionus cerrosensis</u>	N/A	Mexico (Cedros Island)	Entire	E	10	N/A
Deer, Columbian white-tailed	<u>Odocoileus virginianus leucurus</u>	N/A	USA (Oregon, Washington)	Entire	E	1	N/A
Deer, hog	<u>Axis (Hylaphus) porcinus annamiticus</u>	N/A	India, Thailand, Laos, Cambodia Vietnam	Entire	E	15	N/A
Deer, key	<u>Odocoileus virginianus clavium</u>	N/A	USA (Florida)	Entire	E	1	N/A
Deer, marsh	<u>Blastocerus dichotomus</u>	N/A	Argentina, Uruguay, Paraguay, Brazil	Entire	E	4	N/A
Deer, musk	<u>Moschus moschiferus moschiferus</u>	N/A	Southcentral Asia	Entire	E	15	N/A
Deer, McNeill's	<u>Cervus claphus macneilli</u>	N/A	China	Entire	E	4	N/A
Deer, pampas	<u>Ozotoceras bezoarcticus</u>	N/A	Brazil, Paraguay, Uruguay, Argentina	Entire	E	15	N/A
Deer, Persian fallow	<u>Dama dama mesopotamica</u>	N/A	Iraq, Iran	Entire	E	3	N/A
Deer, Philippine	<u>Axis (Hylaphus) calamianensis</u>	N/A	Philippines (Calamian Islands)	Entire	E	15	N/A
Deer, swamp	<u>Cervus duvauceli</u>	N/A	India, Nepal	Entire	E	4	N/A
Dibbler	<u>Antechinus apicalis</u>	N/A	Australia	Entire	E	4	N/A
Dog, Asiatic wild (Dhole)	<u>Cuon alpinus</u>	N/A	Soviet Union, India	Entire	E	4	N/A
Drill	<u>Papio leucophaeus</u>	N/A	Western Cameroon, eastern Nigeria	Entire	E	16	N/A
Dugong	<u>Dugong dugong</u>	N/A	East Africa to Ryukyu Islands, including USA (Trust Territories)	Entire	E	4	N/A
Elephant, Asian	<u>Elephas maximus</u>	N/A	India, Burma, Thailand, Cambodia, Laos, Malaysia, Sri Lanka, Vietnam	Entire	E	15	N/A
Ferret, black-footed	<u>Mustela nigripes</u>	N/A	USA (Western and Western Canada)	Entire	E	1,3	N/A
Forester, Tasmanian (kangaroo)	<u>Macropus giganteus tasmanicus</u>	N/A	Australia	Entire	E	6	N/A
Fox, Northern kit	<u>Vulpes velox hebes</u>	N/A	Canada	Entire	E	3	N/A
Fox, San Joaquin kit	<u>Vulpes macrotis mutica</u>	N/A	USA (California)	Entire	E	1	N/A
Gazelle, Clark's (Dibatag)	<u>Ammodorcas clarki</u>	N/A	Somalia, Ethiopia	Entire	E	3	N/A
Gazelle, Cuvier's	<u>Gazella cuvieri</u>	N/A	Morocco, Tunisia	Entire	E	4	N/A
Gazelle, Dorcas	<u>Damaliscus dorcas dorcas</u>	N/A	South Africa	Entire	E	15	N/A
Gazelle, Mhorr	<u>Gazella dama mhorr</u>	N/A	Morocco	Entire	E	4	N/A
Gazelle, Moroccan (Dorcas)	<u>Gazella dorcas massaesyala</u>	N/A	Morocco, Algeria	Entire	E	4	N/A
Gazelle, Rio de Oro Dama	<u>Gazella dama lozanoi</u>	N/A	Spanish Sahara	Entire	E	4	N/A
Gazelle, slender-horned (Rhim)	<u>Gazella leptoceros</u>	N/A	Sudan, Algeria, Egypt, Libya	Entire	E	4	N/A
Gelada	<u>Theropithecus gelada</u>	N/A	Northern Ethiopia	Entire	T	16	17.40(c)
Gibbon, Kloss	<u>Hylobates klossi</u>	N/A	Indonesia	Entire	E	4	N/A

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SPECIES			RANGE		Portion of range where endangered or threatened	When listed	Special rules
Common name	Scientific name	Population	Known Distribution				
Gibbon, pileated	<u>Hylobates pileatus</u>	N/A	Laos, Thailand, Cambodia	Entire	E	4	N/A
Gibbons,	<u>Hylobates</u> supp.	N/A	China, Burma, India, Thailand, Malaysia (Sumatra, Java, Borneo)	Entire	E	15	N/A
Goral	<u>Naemorhaedus goral</u>	N/A	East Asia	Entire	E	15	N/A
Gorilla	<u>Gorilla gorilla</u>	N/A	Central and Western Africa	Entire	E	4	N/A
Hare, hispid	<u>Caprolagus hispidus</u>	N/A	India, Nepal	Entire	E	15	N/A
Hartebeest, Swayne's	<u>Alcelaphus buselaphus swaynei</u>	N/A	Ethiopia	Entire	E	4	N/A
Hog, pygmy	<u>Sus salvanius</u>	N/A	India, Nepal, Bhutan, Sikkim	Entire	E	4	N/A
Horse, Przewalski's	<u>Equus przewalskii</u>	N/A	Mongolia	Entire	E	15	N/A
Huemal, South Andean	<u>Hippocamelus bisulcus</u>	N/A	Chile, Argentina	Entire	E	15	N/A
Huemal, North Andean	<u>Hippocamelus antisimensis</u>	N/A	Ecuador, Peru, Bolivia, Chile, Argentina	Entire	E	15	N/A
Hyaena, Barbary	<u>Hyaena hyaena barbara</u>	N/A	Morocco	Entire	E	4	N/A
Hyaena, brown	<u>Hyaena brunnea</u>	N/A	South Africa	Entire	E	4	N/A
Ibex, Pyrenean	<u>Capra pyrenaica pyrenaica</u>	N/A	Spain	Entire	E	3	N/A
Ibex, Walia	<u>Capra waliae</u>	N/A	Ethiopia	Entire	E	3	N/A
Impala, black-faced	<u>Aepyceros melampus petersi</u>	N/A	Namibia, Angola	Entire	E	4	N/A
Indris	<u>Indri</u> spp. (all species)	N/A	Malagasy Republic (Madagascar), Comoro I. sd.	Entire	E	3,4	N/A
Jaguar	<u>Panthera onca</u>	N/A	Central and South America	Entire	E	4	N/A
Jaguarundi	<u>Felis yagouarundi cacomitli</u>	N/A	Mexico	Entire	E	15	N/A
Jaguarundi	<u>Felis yagouarundi fossata</u>	N/A	Mexico, Nicaragua	Entire	E	15	N/A
Jaguarundi	<u>Felis yagouarundi panamensis</u>	N/A	Nicaragua, Costa Rica, Panama	Entire	E	15	N/A
Jaguarundi	<u>Felis yagouarundi tolteca</u>	N/A	Mexico	Entire	E	15	N/A
Kangaroo, eastern gray (see also Forester, Tasmanian)	<u>Macropus giganteus</u> (all subspecies except <u>tasmaniensis</u>)	N/A	Australia	Entire	T	7	17.40(a)
Kangaroo, red	<u>Megaleia rufa</u>	N/A	Australia	Entire	T	7	17.40(a)
Kangaroo, western gray	<u>Macropus fuliginosus</u>	N/A	Australia	Entire	T	7	17.40(a)
Kouprey	<u>Bos sauveli</u>	N/A	Cambodia	Entire	E	3	N/A
Langur	<u>Presbytis pileatus</u>	N/A	India, Burma,	Entire	E	15	N/A
Langur	<u>Presbytis entellus</u>	N/A	China (Tibet), India, Nepal, Sri Lanka, Pakistan, Kashmir, Sikkim, Bangladesh	Entire	E	15	N/A
Langur, Douc	<u>Pygathrix nemaeus</u>	N/A	Cambodia, Laos, Vietnam, China	Entire	E	4	N/A
Langur, golden	<u>Presbytis geei</u>	N/A	Assam, Bhutan	Entire	E	15	N/A
Langur, long-tailed	<u>Presbytis potenzani</u>	N/A	Mentawi Islands, Indonesia	Entire	T	16	17.40(c)
Langur, Pagi Island	<u>Simias concolor</u>	N/A	Indonesia	Entire	E	4	N/A
Langur, purple-faced	<u>Presbytis senex</u>	N/A	Sri Lanka (Ceylon)	Entire	T	16	17.40(c)
Lechwe	<u>Kobus leche</u>	N/A	Southwest Africa	Entire	E	15	N/A
Lechwe, black	<u>Kobus leche smithemani</u>	N/A	Zambia	Entire	E	4	N/A
Lemur	<u>Allocebus</u> spp.	N/A	Malagasy Republic (Madagascar)	Entire	E	15	N/A
Lemurs	Lemuridae; all members of the genera <u>Lemur</u> , <u>Haplemur</u> , <u>Lepilemur</u> , <u>Cheirogaleus</u> , <u>Microcebus</u> , <u>Phaner</u>	N/A	Malagasy Republic (Madagascar) and Comoro Islands	Entire	E	3,4	N/A

SPECIES			RANGE				
Common name	Scientific name	Population	Known Distribution	Portion of range where endangered or threatened	Status	When listed	Special rules
Leopard	<u>Panthera pardus</u>	N/A	Africa and Asia	Entire	E	3,5	N/A
Leopard, clouded	<u>Neofelis nebulosa</u>	N/A	Southeast Asia	Entire	E	15	N/A
Leopard, Formosan clouded	<u>Neofelis nebulosa brachyurus</u>	N/A	Taiwan	Entire	E	4	N/A
Leopard, snow	<u>Panthera uncia</u>	N/A	Central Asia	Entire	E	5	N/A
Linsang, spotted	<u>Prionodon pardicolor</u>	N/A	Nepal, Assam, Burma Cambodia, Laos, Vietnam	Entire	E	15	N/A
Lion, Asiatic	<u>Panthera leo persica</u>	N/A	India	Entire	E	3	N/A
Loris, lesser slow	<u>Nycticebus pygmaeus</u>	N/A	Philippines (Mindanao, Bohol, Leyte, Samar Islands)	Entire	T	16	17.40(c)
Lynx, Spanish	<u>Felis lynx pardina</u> (<u>Felis pardina</u>)	N/A	Spain	Entire	E	3	N/A
Macaque, Formosan rock	<u>Macaca cyclopis</u>	N/A	Taiwan	Entire	T	16	17.40(c)
Macaque, Japanese	<u>Macaca fuscata</u>	N/A	Japan (Shikoku, Kyushu and Honsu Islands)	Entire	T	16	17.40(c)
Macaque, lion-tailed	<u>Macaca silenus</u>	N/A	India	Entire	E	3	N/A
Macaque, stump-tail	<u>Macaca arctoides</u>	N/A	Assam (India), to southern China and Malay Peninsula	Entire	T	16	17.40(c)
Macaque, Toque	<u>Macaca sinica</u>	N/A	Sri Lanka (Ceylon)	Entire	T	16	17.40(c)
Manatee, Amazonian	<u>Trichechus inunguis</u>	N/A	South America; Amazon River Basin	Entire	E	3	N/A
Manatee, West Indian (Florida)	<u>Trichechus manatus</u>	N/A	USA (Florida), Caribbean Ocean, South America	Entire	E	1,3	N/A
Mandrill	<u>Papio sphinx</u>	N/A	Central West Africa	Entire	E	16	N/A
Mangabey, Tana River	<u>Cercocebus galeritus galeritus</u>	N/A	Kenya	Entire	E	3	N/A
Mangabey, white-collared	<u>Cercocebus torquatus</u>	N/A	Senegal to Ghana; Nigeria to Gabon	Entire	E	16	N/A
Margay	<u>Felis wiedii</u>	N/A	Central and South America	Entire	E	5	N/A
Markhor, Chiltan	<u>Capra falconeri chiltanensis</u>	N/A	Pakistan	Entire	E	15	N/A
Markhor, Kabal	<u>Capra falconeri megaceros</u>	N/A	Afghanistan, Pakistan	Entire	E	15	N/A
Markhor, straight-horned	<u>Capra falconeri jerdoni</u>	N/A	Pakistan, Afghanistan border	Entire	E	15	N/A
Naromset, cotton-top	<u>Saguinus oedipus</u>	N/A	Panama, Costa Rica, Colombia	Entire	E	16	N/A
Naromset, Goeldi's	<u>Callimico goeldii</u>	N/A	Brazil, Colombia, Ecuador, Peru	Entire	E	4	N/A
Naromset, eastern jerboa	<u>Antechinomys laniger</u>	N/A	Australia	Entire	E	4	N/A
Naromset, mouse, large desert	<u>Sminthopsis psammophila</u>	N/A	Australia	Entire	E	4	N/A
Naromset, mouse, long-tailed	<u>Sminthopsis longicaudata</u>	N/A	Australia	Entire	E	4	N/A
Marten, Formosan yellow-throated	<u>Martes flavigula chrysoptila</u>	N/A	Taiwan	Entire	E	4	N/A
Monkey, black howler	<u>Alouatta pigra</u>	N/A	Mexico, Guatamala, Belize	Entire	T	16	17.40(c)
Monkey, Diana	<u>Cercopithecus diana</u>	N/A	Coastal West Africa	Entire	E	16	N/A
Monkey, Francois' leaf	<u>Presbytis francoisi</u>	N/A	Kwangsi (Peoples' Republic of China), Indochina	Entire	E	16	N/A
Monkey, howler	<u>Alouatta palliata</u> (<u>villosa</u>)	N/A	Mexico, Ecuador, Colombia	Entire	E	15	N/A
Monkey, L'hoest's	<u>Cercopithecus lhoesti</u>	N/A	Upper eastern Congo Basin, Cameroon, Nigeria	Entire	E	16	N/A

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SPECIES			RANGE		Portion of range where endangered or threatened	Status	When listed	Special rules
Common name	Scientific name	Population	Known Distribution					
Monkey, proboscis	<u>Nasalis larvatus</u>	N/A	Borneo	Entire	E	15	N/A	
Monkey, red-backed squirrel	<u>Saimiri oerstedii</u> (<u>Saimiri sciureus oerstedii</u>)	N/A	Costa Rica, Panama	Entire	E	3	N/A	
Monkey, red-bellied	<u>Cercopithecus erythrogaster</u>	N/A	Western Nigeria	Entire		16	N/A	
Monkey, red-eared nose spotted	<u>Cercopithecus erythrotis</u>	N/A	Nigeria, Fernando Po	Entire	E	16	N/A	
Monkey, spider	<u>Ateles geoffroyi frontatus</u>	N/A	Costa Rica, Nicaragua	Entire	E	3	N/A	
Monkey, spider	<u>Ateles geoffroyi panamensis</u>	N/A	Costa Rica, Panama	Entire	E	3	N/A	
Monkey, Tonkin snub-nosed	<u>Rhinopithecus avunculus</u>	N/A	Vietnam	Entire	T	16	17.40(c)	
Monkey, woolly spider	<u>Brachyteles arachnoides</u>	N/A	Brazil	Entire	E	4	N/A	
Monkey, yellow-tailed woolly	<u>Lagothrix flavicuada</u>	N/A	Andes of northern Peru	Entire	E	16	N/A	
Mouse, Australian native	<u>Zyomys pedunculatus</u>	N/A	Australia	Entire	E	15	N/A	
Mouse, Australian natv.	<u>Notomys aquilo</u>	N/A	Australia	Entire	E	15	N/A	
Mouse, Field's	<u>Pseudomys fieldi</u>	N/A	Australia	Entire	E	4	N/A	
Mouse, Gould's	<u>Pseudomys gouldii</u>	N/A	Australia	Entire	E	6	N/A	
Mouse, New Holland	<u>Pseudomys novaehollandiae</u>	N/A	Australia	Entire	E	4	N/A	
Mouse, Salt Marsh Harvest	<u>Reithrodontomys raviventris</u>	N/A	USA (California)	Entire	E	2	N/A	
Mouse, Shark Bay	<u>Pseudomys praeconis</u>	N/A	Australia	Entire	E	4	N/A	
Mouse, Shortridge's	<u>Pseudomys shortridgei</u>	N/A	Australia	Entire	E	4	N/A	
Mouse, Smoky	<u>Pseudomys fumeus</u>	N/A	Australia	Entire	E	4	N/A	
Mouse, Western	<u>Pseudomys occidentalis</u>	N/A	Australia	Entire	E	4	N/A	
Native-cat, Eastern	<u>Dasyurus viverrinus</u>	N/A	Australia	Entire	E	6	N/A	
Numbat	<u>Myrmecobius fasciatus</u>	N/A	Australia	Entire	E	6	N/A	
Ocelot	<u>Felis pardalis</u>	N/A	Central and South America	Entire	E	5	N/A	
Orangutan	<u>Pongo pygmaeus</u>	N/A	Indonesia, Malaysia, Brunei	Entire	E	3	N/A	
Oryx, Arabian	<u>Oryx leucoryx</u>	N/A	Arabian Peninsula	Entire	E	3	N/A	
Otter, Cameroon clawless	<u>Paraonyx microdon</u>	N/A	Cameroon	Entire	E	4	N/A	
Otter, giant	<u>Pteronura brasiliensis</u>	N/A	South America	Entire	E	3	N/A	
Otter, La Plata	<u>Lutra platensis</u>	N/A	Uruguay, Argentina, Bolivia, Brazil	Entire	E	4	N/A	
Otter, long-tailed	<u>Lutra longicaudis</u>	N/A	South America	Entire	E	15	N/A	
Otter, marine	<u>Lutra felina</u>	N/A	Peru, Chiloe Island, Straits of Magellan	Entire	E	15	N/A	
Otter, Southern River	<u>Lutra provocax</u>	N/A	Chile, Argentina	Entire	E	15	N/A	
Panther, Florida	<u>Felis concolor coryi</u>	N/A	USA (Florida)	Entire	E	1	N/A	
Planigale, little	<u>Planigale subtilissima</u>	N/A	Australia	Entire	E	4	N/A	
Planigale, Southern	<u>Planigale tenuirostris</u>	N/A	Australia	Entire	E	4	N/A	
Porcupine, thin-spined	<u>Chaetomys subspinosus</u>	N/A	Brazil	Entire	E	3	N/A	
Possum, "mountain pygmy	<u>Burramys parvus</u>	N/A	Australia	Entire	E	4	N/A	
Possum, scaly-tailed	<u>Wyulda squamicaudata</u>	N/A	Australia	Entire	E	4	N/A	
Prairie Dog, Mexican	<u>Cynomys mexicanus</u>	N/A	Mexico	Entire	E	4	N/A	
Prairie Dog, Utah	<u>Cynomys parvidens</u>	N/A	USA (Utah)	Entire	E	6	N/A	
Pronghorn, peninsular	<u>Antilocapra americana peninsularis</u>	N/A	Mexico (Baja California)	Entire	E	10	N/A	
Pronghorn, Sonoran	<u>Antilocapra americana sonoriensis</u>	N/A	USA (Arizona), Mexico	Entire	E	1,3	N/A	
Pudu	<u>Pudu pudu</u>	N/A	Southern South America	Entire	E	15	N/A	
Puma, Costa Rican	<u>Felis concolor costaricensis</u>	N/A	Nicaragua, Costa Rica, Panama	Entire	E	15	N/A	
Quokka	<u>Setonix brachyurus</u>	N/A	Australia	Entire	E	6	N/A	
Rabbit, volcano	<u>Romerolagus diazi</u>	N/A	Mexico	Entire	E	4	N/A	
Rat, Morro Bay kangaroo	<u>Dipodomys heermanni morroensis</u>	N/A	USA (California)	Entire	E	2	N/A	

SPECIES			RANGE				
Common name	Scientific name	Population	Known Distribution	Portion of range where endangered or threatened	Status	When listed	Special rules
Rat, stick-nest	<u>Leporillus conditor</u>	N/A	Australia	Entire	E	6	N/A
Rat, false water	<u>Xeromys myoides</u>	N/A	Australia	Entire	E	4	N/A
Rat, kangaroo, brush-tailed	<u>Bettongia penicillata</u>	N/A	Australia	Entire	E	4	N/A
Rat-kangaroo, Gaimard's	<u>Bettongia gaimardi</u>	N/A	Australia	Entire	E	6	N/A
Rat-kangaroo, Lesuer's	<u>Bettongia lesueur</u>	N/A	Australia	Entire	E	4	N/A
Rat-kangaroo, plain	<u>Caloprymnus campestris</u>	N/A	Australia	Entire	E	4	N/A
Rat-kangaroo, Queensland	<u>Bettongia tropica</u>	N/A	Australia	Entire	E	4	N/A
Rhinoceros, great Indian	<u>Rhinoceros unicornis</u>	N/A	India, Nepal	Entire	E	4	N/A
Rhinoceros, Javan	<u>Rhinoceros sondaicus</u>	N/A	Indonesia, Burma, Thailand	Entire	E	3	N/A
Rhinoceros, northern white	<u>Ceratotherium simum cottoni</u>	N/A	Zaire, Uganda, Sudan	Entire	E	4	N/A
Rhinoceros, Sumatran	<u>Dicerosceros sumatrensis</u>	N/A	Bangladesh to Vietnam to Indonesia (Borneo)	Entire	E	3	N/A
Saki, white-nosed	<u>Chiropotes albinasus</u>	N/A	Brazil	Entire	E	4	N/A
Seal, Mediterranean monk	<u>Monachus monachus</u>	N/A	Mediterranean, Northwest African Coast and Black Sea	Entire	E	3	N/A
Seledang (Gaur)	<u>Bos gaurus</u>	N/A	India, Southeast Asia, Bangladesh	Entire	E	4	N/A
Serow, Sumatran	<u>Capricornis sumatraensis</u>	N/A	Sumatra	Entire	E	15	N/A
Serval, Barbary	<u>Felis serval constantina</u>	N/A	Algeria	Entire	E	4	N/A
Shapo	<u>Ovis vignei</u>	N/A	Kashmir	Entire	E	15	N/A
Shou	<u>Cervus elaphus wallichi</u>	N/A	Tibet, Bhutan	Entire	E	4	N/A
Siamang	<u>Symphalangus syndactylus</u>	N/A	Thailand, Malaysia (Malay Peninsula, Sumatra)	Entire	E	15	N/A
Sifakas	<u>Propithecus spp. (all species)</u>	N/A	Malagasy Republic (Madagascar)	Entire	E	4	N/A
Sloth, Brazilian three-toed	<u>Bradypus torquatus</u>	N/A	Brazil	Entire	E	4	N/A
Solenodon, Cuban	<u>Atopogale cubana</u>	N/A	Cuba	Entire	E	4	N/A
Solenodon, Haitian	<u>Solenodon paradoxus</u>	N/A	Dominican Republic, Haiti	Entire	E	4	N/A
Squirrel, Delmarva Peninsula fox	<u>Sciurus niger cinereus</u>	N/A	USA (Maryland)	Entire	E	1	N/A
Stag, Barbary	<u>Cervus elephus barbarus</u>	N/A	Tunisia, Algeria	Entire	E	3	N/A
Stag, Kashmir	<u>Cervus elephus hanglu</u>	N/A	Kashmir	Entire	E	3	N/A
Tamaraw	<u>Anoa mindorensis</u>	N/A	Philippines	Entire	E	4	N/A
Tamarin, golden-rumped (Golden-headed Tamarin; golden-lion Marmoset)	<u>Leontideus spp. (all species)</u>	N/A	Brazil	Entire	E	3	N/A
Tamarin, pied	<u>Saguinus bicolor</u>	N/A	Northern Brazil	Entire	E	16	N/A
Tamarin, white-footed	<u>Saguinus leucopus</u>	N/A	Northern Colombia	Entire	T	16	17.40(c)
Tapir, Asian	<u>Tapirus indicus</u>	N/A	Burma, Thailand, Cambodia, Laos, Vietnam, Malaysia (Sumatra)	Entire	E	15	N/A
Tapir, Brazilian	<u>Tapirus terrestris</u>	N/A	Venezuela, Argentina, Brazil, Colombia	Entire	E	4	N/A
Tapir, Central American	<u>Tapirus bairdii</u>	N/A	Southern Mexico to Colombia and Ecuador	Entire	E	4	N/A
Tapir, mountain	<u>Tapirus pinchaque</u>	N/A	Colombia	Entire	E	4	N/A
Tarsier, Philippino	<u>Tarsius syrichta</u>	N/A	Philippines	Entire	T	16	17.40(c)
Tiger	<u>Panthera tigris</u>	N/A	Temperate and Tropical Asia	Entire	E	3,5	N/A
Tiger, Tasmanian (Thylacine)	<u>Thylacinus cynocephalus</u>	N/A	Australia	Entire	E	3	N/A

SPECIES			RANGE		Portion of range where endangered or threatened	When Status listed	Special rules
Common name	Scientific name	Population	Known Distribution	Entire			
Uakari	<u>Cacajao</u> spp. (all species)	N/A	Peru, Colombia, Brazil, Venezuela, Ecuador	Entire	E	3	N/A
Urial	<u>Ovis orientalis ophion</u>	N/A	Cyprus	Entire	E	15	N/A
Vicuña	<u>Vicugna vicugna</u>	N/A	Peru, Bolivia, Argentina	Entire	E	3	N/A
Wallaby, banded hare	<u>Lagostrophus fasciatus</u>	N/A	Australia	Entire	E	4	N/A
Wallaby, brindled	<u>Onychogalea frenata</u>	N/A	Australia	Entire	E	4	N/A
Wallaby, crescent nail-tailed	<u>Onychogalea lunata</u>	N/A	Australia	Entire	E	4	N/A
Wallaby, Parma	<u>Macropus parma</u>	N/A	Australia	Entire	E	4	N/A
Wallaby, western hare	<u>Lagorchestes hirsutus</u>	N/A	Australia	Entire	E	4	N/A
Wallaby, yellow-footed rock	<u>Petrogale xanthopus</u>	N/A	Australia	Entire	E	6	N/A
Whale, blue	<u>Balaenoptera musculus</u>	N/A	Oceanic	Entire	E	4	N/A
Whale, bowhead	<u>Balaena mysticetus</u>	N/A	Oceanic	Entire	E	4	N/A
Whale, finback	<u>Balaenoptera physalus</u>	N/A	Oceanic	Entire	E	4	N/A
Whale, gray	<u>Eschrichtius gibbosus</u>	N/A	Oceanic	Entire	E	4	N/A
Whale, humpback	<u>Megaptera novaeangliae</u>	N/A	Oceanic	Entire	E	4	N/A
Whale, right	<u>Eubalaena</u> spp. (all species)						
Whale, Sei	<u>Balaenoptera borealis</u>	N/A	Oceanic	Entire	E	4	N/A
Whale, sperm	<u>Physeter catodon</u>	N/A	Oceanic	Entire	E	4	N/A
Wolf, eastern timber	<u>Canis lupus lycaon</u>	N/A	USA (Minnesota, Michigan)	Entire	E	1	N/A
Wolf, gray	<u>Canis lupus monstrabilis</u>	N/A	Texas, New Mexico, Mexico	Entire	E	15	N/A
Wolf, maned	<u>Chrysocyon brachyurus</u>	N/A	Argentina, Bolivia, Brazil, Paraguay	Entire	E	4	N/A
Wolf, Mexican	<u>Canis lupus baileyi</u>	N/A	Mexico, USA (Arizona, New Mexico, Texas)	Entire	E	13	N/A
Wolf, Northern Rocky Mountain	<u>Canis lupus irremotus</u>	N/A	USA (Wyoming, Montana)	Entire	E	6	N/A
Wolf, red	<u>Canis rufus</u>	N/A	USA (Texas, Louisiana)	Entire	E	2	N/A
Wombat, Barnard's	<u>Lasiorhinus barnardi</u>	N/A	Australia	Entire	E	4	N/A
Wombat, Queensland hairy-nosed	<u>Lasiorhinus gillespiei</u>	N/A	Australia	Entire	E	6	N/A
Yak, wild	<u>Bos grunniens mutus</u>	N/A	China (Tibet) India	Entire	E	4	N/A
Zebra, mountain	<u>Equus zebra zebra</u>	N/A	Southern Africa	Entire	E	15	N/A

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SPECIES		RANGE		Portion of range where endangered or threatened	Status	When listed	Special rules
Common name	Scientific name	Population	Known Distribution				
SNAILS:							
Snails, Manus Island tree	<u>Papustyla pulcherrima</u>	N/A	Admiralty Islands (Manus Isds.)	Entire	E	4	N/A
CLAMS:							
Mussel, Alabama lamp pearly	<u>Lampsilis virescens</u>	N/A	USA (Alabama)	Entire	E	15	N/A
Mussel, Appalachian monkeyface pearly	<u>Quadrula sparsa</u>	N/A	USA (Virginia, Tennessee)	Entire	E	15	N/A
Mussel, birdwing pearly	<u>Conradilla caelata</u>	N/A	USA (Virginia, Tennessee)	Entire	E	15	N/A
Mussel, Cumberland bean pearly	<u>Villosa (=Micromya) trabilis</u>	N/A	USA (Kentucky)	Entire	E	15	N/A
Mussel, Cumberland monkeyface pearly	<u>Quadrula intermedia</u>	N/A	USA (Virginia, Tennessee)	Entire	E	15	N/A
Mussel, Curtis' pearly	<u>Epioblasma (=Dysnomia) florentina curtisi</u>	N/A	USA (Missouri)	Entire	E	15	N/A
Mussel, Dromedary pearly	<u>Dromus dromas</u>	N/A	USA (Virginia, Tennessee)	Entire	E	15	N/A
Mussel, fat pocketbook pearly	<u>Potamilus (=Proptera) capax</u>	N/A	USA (Arkansas, Missouri)	Entire	E	15	N/A
Mussel, fine-rayed pigtoe pearly	<u>Fusconaia cuneolus</u>	N/A	USA (Alabama, Virginia, Tennessee)	Entire	E	15	N/A
Mussel, green-blossom pearly	<u>Epioblasma (=Dysnomia) torulosa gubernaculum</u>	N/A	USA (Virginia, Tennessee)	Entire	E	15	N/A
Mussel, Higgin's eye pearly	<u>Lampsilis higginsii</u>	N/A	USA (Minnesota, Wisconsin, Illinois, Missouri)	Entire	E	15	N/A
Mussel, Nicklin's pearly	<u>Unio (possibly Megaloniais) nickliniana</u>	N/A	Mexico	Entire	E	15	N/A
Mussel, pale lilliput pearly	<u>Toxolasma (=Carunculina) cylindrella</u>	N/A	USA (Alabama, Tennessee)	Entire	E	15	N/A
Mussel, pink mucket pearly	<u>Lampsilis orbiculata orbiculata</u>	N/A	USA (Alabama, West Virginia, Tennessee)	Entire	E	15	N/A
Mussel, rough pigtoe pearly	<u>Pleurobema plenum</u>	N/A	USA (Kentucky, Virginia, Tennessee)	Entire	E	15	N/A
Mussel, Sampson's pearly	<u>Epioblasma (=Dysnomia) sampsoni</u>	N/A	USA (Indiana, Illinois)	Entire	E	15	N/A
Mussel, shiny pigtoe pearly	<u>Fusconaia edgariana</u>	N/A	USA (Alabama, Virginia, Tennessee)	Entire	E	15	N/A
Mussel, Tampico pearly	<u>Cyrtoniais tampicoensis tecomatensis</u>	N/A	USA (Mexico)	Entire	E	15	N/A
Mussel, tuberculed-blossom pearly	<u>Epioblasma (=Dysnomia) torulosa torulosa</u>	N/A	USA (Kentucky, Illinois, Tennessee, West Virginia)	Entire	E	15	N/A
Mussel, turgid-blossom pearly	<u>Epioblasma (=Dysnomia) turgidula</u>	N/A	USA (Tennessee)	Entire	E	15	N/A
Mussel, white cat's	<u>Epioblasma (=Dysnomia) sulcata delicata (including perobliqua)</u>	N/A	USA (Ohio, Michigan, Indiana)	Entire	E	15	N/A
Mussel, white warty-back pearly	<u>Plethobasis cicatricosus</u>	N/A	USA (Alabama, Tennessee)	Entire	E	15	N/A
Mussel, yellow-blossom pearly	<u>Epioblasma (=Dysnomia) florentina florentina</u>	N/A	USA (Tennessee)	Entire	E	15	N/A
Pimpleback, orange footed	<u>Plethobasis cooperianus</u>	N/A	USA (Alabama, Tennessee)	Entire	E	15	N/A

CRUSTACEANS: Reserved

SPECIES			RANGE		When Status listed	Special rules
Common name	Scientific name	Population	Known Distribution	Portion of range where endangered or threatened		
Creeper, Oahu (Alauwahio) (honeycreeper)	<u>Loxops maculata maculata</u>	N/A	USA (Hawaii)	Entire	E	2 N/A
Crow, Hawaiian (Alala)	<u>Corvus tropicus</u>	N/A	USA (Hawaii)	Entire	E	1 N/A
Cuckoo-shrike, Mauritius	<u>Coquus typicus</u>	N/A	Mauritius	Entire	E	3 N/A
Cuckoo-shrike Reunion	<u>Coquus newtoni</u>	N/A	Indian Ocean: France (Reunion Isd.)	Entire	E	3 N/A
Curassow, red billed	<u>Grax blumenbachii</u>	N/A	Brazil	Entire	E	4 N/A
Curassow, Trinidad white-headed	<u>Pipile pipile pipile</u>	N/A	West Indies: Trinidad	Entire	E	3 N/A
Curlew, Eskimo	<u>Numenius borealis</u>	N/A	Canada to Argentina	Entire	E	1,3 N/A
Dove, cloven-feathered	<u>Drepanoptila holosericea</u>	N/A	Southwest Pacific Ocean: New Calendonia	Entire	E	4 N/A
Dove, Grenada	<u>Leptotila wellsi</u>	N/A	West Indies: Grenada	Entire	E	4 N/A
Dove, Palau ground	<u>Gallicolumba canifrons</u>	N/A	West Pacific Ocean: USA (Palau Islands)	Entire	E	4 N/A
Duck, Hawaiian (Koloa)	<u>Anas wyvilliana</u>	N/A	USA (Hawaii)	Entire	E	1 N/A
Duck, Laysan	<u>Anas laysanensis</u>	N/A	USA Hawaii)	Entire	E	1 N/A
Duck, Mexican	<u>Anas diazi</u>	N/A	USA (Texas, Arizona), Mexico	Entire	E	1 N/A
Duck, pink-headed	<u>Rhodonessa carophyllacea</u>	N/A	India	Entire	E	15 N/A
Duck, white-winged wood	<u>Cairina scutulata</u>	N/A	India, Burma, Thailand, Malaysia, Indonesia	Entire	E	3 N/A
Eagle, Greenland white-tailed	<u>Haliaeetus albicilla greenlandicus</u>	N/A	Greenland and adjacent Atlantic Islands	Entire	E	15 N/A
Eagle, harpy	<u>Harpia harpyja</u>	N/A	Mexico, Central America, Bolivia, Brazil, Argentina	Entire	E	15 N/A
Eagle, monkey-eating	<u>Pithecophaga jefferyi</u>	N/A	Philippines	Entire	E	3 N/A
Eagle, Southern bald	<u>Haliaeetus leucocephalus leucocephalus</u>	N/A	USA (South of 40th Parallel)	Entire	E	1 N/A
Eagle, Spanish imperial	<u>Aquila heliaca adalberti</u>	N/A	Spain, Morocco, Algeria	Entire	E	4 N/A
Egret, Chinese	<u>Egretta eulophotes</u>	N/A	China, Korea	Entire	E	4 N/A
Falcon, american peregrine	<u>Falco peregrinus anatum</u>	N/A	Canada, USA, Mexico	Entire	E	2,3 N/A
Falcon, arctic peregrine	<u>Falco peregrinus tundrius</u>	N/A	Canada, USA, Greenland	Entire	E	2,4 N/A
Falcon, peregrine	<u>Falco peregrinus peregrinus</u>	N/A	Europe, Soviet Union	Entire	E	15 N/A

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SPECIES			RANGE		Portion of range where endangered or threatened	Status	When listed	Special rules
Common name	Scientific name	Population	Known Distribution					
Finches, Laysan and Nihoa (honeycreepers)	<u>Psittirostra cantans</u>	N/A	USA (Hawaii)	Entire	E	1	N/A	
Flycatcher, Chatham Island robin	<u>Petroica traversi ultima</u>	N/A	New Zealand	Entire	E	4	N/A	
Flycatcher, Euler's (tyrant)	<u>Empidonax euleri johnstonei</u>	N/A	West Indies: Grenada	Entire	E	3	N/A	
Flycatcher, grey-neck rock-fowl	<u>Picathartes oreas</u>	N/A	Cameroon	Entire	E	3	N/A	
Flycatcher, Palau fantail	<u>Rhipidura lepida</u>	N/A	West Pacific Ocean: USA (Palau Islands)	Entire	E	4	N/A	
Flycatcher, scarlet-breasted robin (tyrant)	<u>Petroica multicolor multicolor</u>	N/A	Australia (Norfolk Isd.)	Entire	E	3	N/A	
Flycatcher, Seychelles black	<u>Terpsiphone corvina</u>	N/A	Indian Ocean: Seychelles	Entire	E	4	N/A	
Flycatcher, Tahiti	<u>Pomerea nigra nigra</u>	N/A	South Pacific Ocean: Tahiti	Entire	E	3	N/A	
Flycatcher white-necked rock fowl	<u>Picathartes gymnocephalus</u>	N/A	Africa: Togo to Sierra Leone	Entire	E	3	N/A	
Fody, Seychelles (Weaver-finch)	<u>Foudia sechellarum</u>	N/A	Indian Ocean:	Entire	E	3	N/A	
Frigatebird, Andrew's	<u>Fregata andrewsi</u>	N/A	East Indian Ocean	Entire	E	15	N/A	
Gallinule, Hawaiian	<u>Gallinula chloropus sandvicensis</u>	N/A	USA (Hawaii)	Entire	E	1	N/A	
Goose, Aleutian Canada	<u>Branta canadensis leucopareia</u>	N/A	Western USA, Japan	Entire	E	1,4	N/A	
Goose, Hawaiian (Nene)	<u>Branta sandvicensis</u>	N/A	USA (Hawaii)	Entire	E	1	N/A	
Goshawk, Christmas Island	<u>Accipiter fasciatus natalis</u>	N/A	Indian Ocean: Australia (Christmas Isd.)	Entire	E	3	N/A	
Grackle, slender-billed	<u>Cassidix palustris</u>	N/A	Mexico	Entire	E	4	N/A	
Grass-wren, Eyrean (flycatcher)	<u>Amytornis goyderi</u>	N/A	Australia	Entire	E	4	N/A	
Grebe, Atitlan	<u>Podilymbus gigas</u>	N/A	Guatemala	Entire	E	3	N/A	
Greenshank, Nordmann's	<u>Tringa guttifer</u>	N/A	Bangladesh, Sakhalin Island, Japan, Korea, Thailand, Malaysia, Burma	Entire	E	15	N/A	
Guan, horned	<u>Oreophasis derbianus</u>	N/A	Guatemala, Mexico	Entire	E	3	N/A	
Gull, Audouin's	<u>Larus audouinii</u>	N/A	Mediterranean Sea and adjacent lands	Entire	E	3	N/A	
Hawk, Anjouan Island sparrow	<u>Accipiter francesii pusillus</u>	N/A	Indian Ocean: Comoro Islands	Entire	E	3	N/A	
Hawk, Galapagos	<u>Buteo galapagoensis</u>	N/A	Ecuador (Galapagos Islands)	Entire	E	3	N/A	
Hawk, Hawaiian (lo)	<u>Buteo solitarius</u>	N/A	USA (Hawaii)	Entire	E	1	N/A	
Hermit, hook-billed (hummingbird)	<u>Ramphodon dohrnii</u>	N/A	Brazil	Entire	E	15	N/A	
Honeycreeper, crested (Akohekohe)	<u>Palmeria dolei</u>	N/A	USA (Hawaii)	Entire	E	1	N/A	
Honeyeater, helmeted	<u>Meliphaga cassidix</u>	N/A	Australia	Entire	E	4	N/A	
Hornbill, helmeted	<u>Rhinoplax vigil</u>	N/A	Thailand, Malaysia	Entire	E	15	N/A	
Ibis, Japanese crested	<u>Nipponia nippon</u>	N/A	China, Japan, Korea, Soviet Union	Entire	E	3	N/A	
Kagu (rail) crested	<u>Rhynochetos jubatus</u>	N/A	Southwest Pacific Ocean: New Caledonia	Entire	E	3	N/A	
Kakapo (owl parrot)	<u>Strigops habroptilus</u>	N/A	New Zealand	Entire	E	4	N/A	
Kestrel, Mauritius	<u>Falco punctatus</u>	N/A	Mauritius	Entire	E	3	N/A	
Kestrel, Seychelles	<u>Falco araea</u>	N/A	Indian Ocean: Seychelles Isds.	Entire	E	3	N/A	

SPECIES			RANGE		Portion of range where endangered or threatened	Status	When listed	Special rules
Common name	Scientific name	Population	Known Distribution					
Kite, Cuba hook-billed	<u>Chondrohierax wilsonii</u>	N/A	Cuba	Entire	E	4	N/A	
Kite, Grenada hook-billed	<u>Chondrohierax uncinatus mirus</u>	N/A	West Indies: Grenada	Entire	E	4	N/A	
Kite, Florida Everglade (snail kite)	<u>Rostrhamus sociabilis plumbeus</u>	N/A	USA (Florida)	Entire	E	1	N/A	
Kokako (Wattlebird)	<u>Callacas cinerea</u>	N/A	New Zealand	Entire	E	3	N/A	
Macaw, glaucous	<u>Anodorhynchus glaucus</u>	N/A	Paraguay, Uruguay, Brazil	Entire	E	15	N/A	
Macaw, indigo	<u>Anodorhynchus leari</u>	N/A	Brazil	Entire	E	15	N/A	
Macaw, little blue	<u>Cyanopsitta spixii</u>	N/A	Brazil	Entire	E	15	N/A	
Magpie-robin, Seychelles (thrush)	<u>Copsychus sechellarum</u>	N/A	Indian Ocean: Seychelles Isds.	Entire	E	3	N/A	
Malkoha, red-faced	<u>Phaenicophaeus pyrrhocephalus</u>	N/A	Sri Lanka	Entire	E	3	N/A	
Megapode, La Perouse's	<u>Megapodius laperouse</u>	N/A	Western Pacific Ocean: USA (Palau Islands, Mariana Islands)	Entire	E	4	N/A	
Megapode, Maleo	<u>Macrocephalon maleo</u>	N/A	Indonesia (Celebes)	Entire	E	4	N/A	
Millerbird, Nihoa (warbler)	<u>Acrocephalus kingi</u>	N/A	USA (Hawaii)	Entire	E	1	N/A	
Mitu	<u>Mitu mitu mitu</u>	N/A	Colombia, Brazil, Peru, Bolivia	Entire	E	15	N/A	
Monarch, Tinian tyrant flycatcher)	<u>Monarcha takatsukasae</u>	N/A	Western Pacific Ocean: USA (Mariana Islands)	Entire	E	3	N/A	
Nukupuu, Kauai & Maui (honeycreeper)	<u>Hemignathus lucidus</u>	N/A	USA (Hawaii)	Entire	E	2	N/A	
Oo, Kauai (Oo Aa) (honeyeater)	<u>Moho braceatus</u>	N/A	USA (Hawaii)	Entire	E	1	N/A	
Ostrich, Arabian	<u>Struthio camelus syriacus</u>	N/A	Jordan, Saudi Arabia	Entire	E	3	N/A	
Ostrich, West African	<u>Struthio camelus spatzi</u>	N/A	Spanish Sahara	Entire	E	4	N/A	
Ou (honeycreeper)	<u>Psittirostra psittacea</u>	N/A	USA (Hawaii)	Entire	E	1	N/A	
Owl, Anjouan scops	<u>Otus rutilus capnodes</u>	N/A	Indian Ocean: Comoro Islands	Entire	E	3	N/A	
Owl, Pacific scops	<u>Otus gurneyi</u>	N/A	Islands of Marinduque and Minda	Entire	E	15	N/A	
Owl, Palau	<u>Otus podargina</u>	N/A	Western Pacific Ocean: USA (Palau Islands)	Entire	E	4	N/A	
Owl, Seychelles	<u>Otus insularis</u>	N/A	Indian Ocean: Seychelles Isds.	Entire	E	3	N/A	
Owlet, Mrs. Morden's	<u>Otus irenae</u>	N/A	Kenya	Entire	E	3	N/A	
Palila (honeycreeper)	<u>Psittirostra bailleui</u>	N/A	USA (Hawaii)	Entire	E	1	N/A	
Parakeet, Forbes'	<u>Cyanoramphus auriceps forbesi</u>	N/A	New Zealand	Entire	E	15	N/A	
Parakeet, golden	<u>Aratinga guaruba</u>	N/A	Brazil	Entire	E	4	N/A	
Parakeet, golden-shouldered	<u>Psephotus chrysopterygius</u>	N/A	Australia	Entire	E	4	N/A	
Parakeet, Mauritius ring-neck	<u>Psittacula krameri echo</u>	N/A	Mauritius	Entire	E	4	N/A	
Parakeet, ochre-marked	<u>Pyrrhura cruentata</u>	N/A	Brazil	Entire	E	4	N/A	
Parakeet, orange-bellied	<u>Neophema chrysogaster</u>	N/A	Australia	Entire	E	4	N/A	
Parakeet, paradise	<u>Psephotus pulcherrimus</u>	N/A	Australia	Entire	E	4	N/A	
Parakeet, scarlet-chested	<u>Neophema splendida</u>	N/A	Australia	Entire	E	4	N/A	
Parakeet, turquoise	<u>Neophema pulchella</u>	N/A	Australia	Entire	E	4	N/A	
Parrot, Bahaman or Cuban	<u>Amazona leucocephala</u>	N/A	West Indies (Cuba, Bahamas, Cayman Islands, Isle of Pines)	Entire	E	15	N/A	

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Common name	Scientific name	Population	Known Distribution	Portion of range where endangered or threatened	Status	When listed	Special rules
Parrot, ground	<u>Pezoporus wallicus</u>	N/A	Australia	Entire	E	6	N/A
Parrot imperial	<u>Amazona imperialis</u>	N/A	West Indies: Dominica	Entire	E	4	N/A
Parrot, Australian night	<u>Geopsittacus occidentalis</u>	N/A	Australia	Entire	E	3	N/A
Parrot, Puerto Rican	<u>Amazona vittata</u>	N/A	USA (Puerto Rico)	Entire	E	1	N/A
Parrot, red-browed	<u>Amazona rhodocorytha</u>	N/A	Brazil	Entire	E	4	N/A
Parrot, red-capped	<u>Pionopsitta pileata</u>	N/A	Brazil	Entire	E	15	N/A
Parrot red-spectacled	<u>Amazona pretrei pretrei</u>	N/A	Brazil, Argentina	Entire	E	15	N/A
Parrot, St. Lucia	<u>Amazona versicolor</u>	N/A	West Indies: St. Lucia	Entire	E	4	N/A
Parrot, St. Vincent	<u>Amazona guildingii</u>	N/A	West Indies: St. Vincent	Entire	E	3	N/A
Parrot, thick-billed	<u>Rhynchopsitta pachyrhyncha</u>	N/A	Mexico, USA (Arizona, New Mexico)	Entire	E	3	N/A
Parrot, vinaceous-breasted	<u>Amazona vinacea</u>	N/A	Brazil	Entire	E	15	N/A
Parrotbill, Maui (honeycreeper)	<u>Pseudonestor xanthophrys</u>	N/A	USA (Hawaii)	Entire	E	1	N/A
Pelican, brown	<u>Pelecanus occidentalis</u>	N/A	USA, West Indies, Central and South America: Coastal	Entire	E	2,4	N/A
Penguin, Galapagos	<u>Spheniscus mendiculus</u>	N/A	Ecuador (Galapagos Islands)	Entire	E	2,4	N/A
Petrel, Hawaiian dark-rumped	<u>Pterodroma phaepygia sandwichensis</u>	N/A	USA (Hawaii)	Entire	E	1	N/A
Pheasant, bar-tailed	<u>Symaticus humiae</u>	N/A	Burma, China	Entire	E	3	N/A
Pheasant, Blyth's tragopan	<u>Tragopan blythii</u>	N/A	Burma, China, India	Entire	E	3	N/A
Pheasant, brown-eared	<u>Crossoptilon mantchuricum</u>	N/A	China	Entire	E	3	N/A
Pheasant, Cabot's tragopan	<u>Tragopan caboti</u>	N/A	China	Entire	E	3	N/A
Pheasant, Chinese monal	<u>Lophophorus lhuysii</u>	N/A	China	Entire	E	3	N/A
Pheasant, Edward's	<u>Lophura edwardsi</u>	N/A	Vietnam	Entire	E	3	N/A
Pheasant, Elliot's	<u>Symaticus ellioti</u>	N/A	China	Entire	E	15	N/A
Pheasant, imperial	<u>Lophura imperialis</u>	N/A	Vietnam	Entire	E	3	N/A
Pheasant, Mikado	<u>Symaticus mikado</u>	N/A	Taiwan	Entire	E	4	N/A
Pheasant, Palawan peacock	<u>Polyplectron emphanum</u>	N/A	Philippines	Entire	E	3	N/A
Pheasant, Sclater's monal	<u>Lophophorus sclateri</u>	N/A	Burma, China, India	Entire	E	3	N/A
Pheasant, Swinhoe's	<u>Lophura swinhoii</u>	N/A	Taiwan	Entire	E	3	N/A
Pheasant, western tragopan	<u>Tragopan melanocephalus</u>	N/A	India, Pakistan	Entire	E	3	N/A
Pheasant, white-eared	<u>Crossoptilon crossoptilon</u>	N/A	China (Tibet), India	Entire	E	4	N/A
Pigeon, Azores wood	<u>Columba palumbus azorica</u>	N/A	East Atlantic Ocean: Portugal (Azores)	Entire	E	3	N/A
Pigeon, Chatham Island	<u>Hemiphaga novaeseelandiae chathamensis</u>	N/A	New Zealand	Entire	E	4	N/A
Pigeon, Mindoro zone-tailed	<u>Ducula mindorensis</u>	N/A	Philippines	Entire	E	15	N/A
Pigeon, Puerto Rican plain	<u>Columba inornata wetmorei</u>	N/A	USA (Puerto Rico)	Entire	E	2	N/A
Piopio (Wattlebird)	<u>Turnagra capensis</u>	N/A	Indian Ocean: Reunion Island	Entire	E	3	N/A
Piping-guan, black-fronted	<u>Pipile jacutinga</u>	N/A	Argentina	Entire	E	15	N/A
Pitta, Koch's	<u>Pitta kochi</u>	N/A	Philippines	Entire	E	15	N/A
Prairie chicken	<u>Tympanuchus cupido</u>	N/A	USA (Texas)	Entire	E	1	N/A
Attwater's greater Plover, New Zealand Shore	<u>Thinornis novaeseelandiae</u>	N/A	New Zealand	Entire	E	4	N/A

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Poo-uli	<u>Melamprosops phaeosoma</u>	N/A	USA (Hawaii)	Entire	E	10	N/A
Quail, Montezuma	<u>Cyrtonyx montezumae merriami</u>	N/A	Mexico	Entire	E	15	N/A
Quetzal, resplendent	<u>Pharomachrus mocinno</u>	N/A	Central America	Entire	E	15	N/A
Quetzal, resplendent	<u>Pharomachrus mocinno costaricensis</u>	N/A	Costa Rica	Entire	E	15	N/A
Rail, Auckland Island	<u>Rallus pectoralis muelleri</u>	N/A	New Zealand	Entire	E	3	N/A
Rail, California clapper	<u>Rallus longirostris obsoletus</u>	N/A	USA (California)	Entire	E	2	N/A
Rail, light-footed clapper	<u>Rallus longirostris levipes</u>	N/A	Mexico, USA	Entire	E	2	N/A
Rail, Lord Howe wood	<u>Tricholimnas sylvestris</u>	N/A	Lord Howe Island	Entire	E	15	N/A
Rail, Yuma clapper	<u>Rallus longirostris yumanensis</u>	N/A	Mexico, USA (Arizona, California)	Entire	E	1	N/A
Rhea, Darwin's	<u>Pterocnemia pennata</u>	N/A	Argentina, Bolivia, Peru, Uruguay	Entire	E	4	N/A
Roller, long-tailed ground	<u>Uratelornis chimaera</u>	N/A	Malagasy Republic (Madagascar)	Entire	E	4	N/A
Scrub-bird, noisy	<u>Atrichornis clamosus</u>	N/A	Australia	Entire	E	3	N/A
Shama, Cebu black (thrush)	<u>Copsychus niger cebuensis</u>	N/A	Philippines	Entire	E	3	N/A
Shearwater; Newell's Manx	<u>Puffinus puffinus newelli</u>	N/A	USA (Hawaii)	Entire	T	10	N/A
Silvereye, white-breasted	<u>Zosterops albogularis</u>	N/A	Indian Ocean: Norfolk Isd.	Entire	E	15	N/A
Siskin, red	<u>Spinus cucullatus</u>	N/A	South America	Entire	E	15	N/A
Sparrow, Cape Sable	<u>Ammospiza maritima mirabilis</u>	N/A	USA (Florida)	Entire	E	1	N/A
Sparrow, dusky seaside	<u>Ammospiza maritima nigrescens</u>	N/A	USA (Florida)	Entire	E	1	N/A
Sparrow, Santa Barbara song	<u>Meospiza melodia graminea</u>	N/A	USA (California)	Entire	E	6	N/A
Starling, Ponape mountain	<u>Aplonis pelzelni</u>	N/A	Western Pacific Ocean: USA (Caroline Isds.)	Entire	E	4	N/A
Starling, Rothschild's (Myna)	<u>Leucopsar rothschildi</u>	N/A	Indonesia (Bali)	Entire	E	4	N/A
Stilt, Hawaiian	<u>Himantopus himantopus knudseni</u>	N/A	USA (Hawaii)	Entire	E	2	N/A
Stork, white oriental	<u>Ciconia ciconia boyciana</u>	N/A	China, Japan, Korea, Soviet Union	Entire	E	4	N/A
Teal, Campbell Island flightless	<u>Anas aucklandica nesiotis</u>	N/A	Campbell Island, New Zealand	Entire	E	15	N/A
Tern, California least	<u>Sterna albifrons browni</u>	N/A	Mexico, USA	Entire	E	2,4	N/A
Thrasher, white-breasted	<u>Ramphocinclus brachyurus</u>	N/A	West Indies: Martinique, St. Lucia	Entire	E	3	N/A
Thrush, large Kauai	<u>Phaeornis obscurus myadestina</u>	N/A	USA (Hawaii)	Entire	E	2	N/A
Thrush, Molokai (Olomau)	<u>Phaeornis obscurus rutha</u>	N/A	USA (Hawaii)	Entire	E	2	N/A
Thrush, small Kauai (Puaiohi)	<u>Phaeornis palmeri</u>	N/A	USA (Hawaii)	Entire	E	1	N/A
Tinamou, solitary	<u>Tinamus solitarius</u>	N/A	Brazil, Paraguay, Argentina	Entire	E	15	N/A
Trembler, Martinique brown (thrasher)	<u>Cinlocerthia ruficauda gutturalis</u>	N/A	West Indies: Martinique	Entire	E	3	N/A
Tsakhlai, Khar Turuut (gull)	<u>Larus relictus</u>	N/A	India, China	Entire	E	15	N/A
Wanderer, plain	<u>Pedionomus torquatus</u>	N/A	Australia	Entire	E	6	N/A
Warbler (wood), Bachman's	<u>Vermivora bachmanii</u>	N/A	Cuba, USA (Southeastern)	Entire	E	1,4	N/A
Warbler (wood), Barbados yellow	<u>Dendroica petechia petechia</u>	N/A	West Indies: Barbados	Entire	E	4	N/A

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Common name	Scientific name	Population	Known Distribution	Portion of range where endangered or threatened			
Warbler, (wood) Kirtland's	<u>Dendroica kirtlandii</u>	N/A	USA, West Indies: Bahama Isds.	Entire	E	1,4	N/A
Warbler, reed	<u>Acrocephalus luscinia</u>	N/A	Western Pacific Ocean: Mariana Islands	Entire	E	3	N/A
Warbler, Rodrigues	<u>Bebornis rodericanus</u>	N/A	Mauritius (Rodrigues Isd.)	Entire	E	3	N/A
Warbler, Semper's	<u>Leucopezia semperi</u>	N/A	West Indies: St. Lucia	Entire	E	3	N/A
Warbler, Seychelles	<u>Bebornis sechellensis</u>	N/A	Indian Ocean: Seychelles Isds.	Entire	E	3	N/A
Whipbird, Western (thrush)	<u>Psophodes nigrogularis</u>	N/A	Australia	Entire	E	4	N/A
Whip-poor-will Puerto Rican	<u>Caprimulgus noctitherus</u>	N/A	USA (Puerto Rico)	Entire	E	6	N/A
White-eye, Ponape great	<u>Rukia sanfordi</u>	N/A	Western Pacific Ocean: USA (Caroline Isds.)	Entire	E	4	N/A
White-eye, Seychelles	<u>Zosterops modestus</u>	N/A	Indian Ocean: Seychelles	Entire	E	4	N/A
Woodpecker, Imperial	<u>Campephilus imperialis</u>	N/A	Mexico	Entire	E	3	N/A
Woodpecker, ivory-billed	<u>Campephilus principalis</u>	N/A	Cuba, USA (South-central and south-eastern)	Entire	E	1,3	N/A
Woodpecker, red-cockaded	<u>Dendrocopos borealis</u>	N/A	USA (Southcentral and Southeastern)	Entire	E	2	N/A
Woodpecker, Tristaan's	<u>Dryocopus jarensis richardsi</u>	N/A	Korea	Entire	E	3	N/A
Wren, Guadeloupe house	<u>Troglodytes aedon guadeloupensis</u>	N/A	West Indies: Guadeloupe	Entire	E	3	N/A
Wren, New Zealand bush	<u>Xenicus longipes</u>	N/A	New Zealand	Entire	E	3	N/A
Wren, St. Lucia	<u>Troglodytes aedon mesoleucus</u>	N/A	West Indies: St. Lucia	Entire	E	3	N/A
REPTILES:							
Alligator, American	<u>Alligator mississippiensis</u>	Wherever found in the wild, except in Cameron, Vermillion, and Calcasieu Parishes in Louisiana	Southeastern USA	Entire	E	11	N/A
Alligator, American	<u>Alligator mississippiensis</u>	In the wild in Cameron, Vermillion, and Calcasieu Parishes in Louisiana	USA (Cameron, Vermillion, Calcasieu Parishes in Louisiana)	N/A	T(S/A)	11	17.42(a)
Alligator, American	<u>Alligator mississippiensis</u>	In captivity wherever found	Worldwide	N/A	T(S/A)	11	N/A
Alligator, Chinese	<u>Alligator sinensis</u>	N/A	China	Entire	E	15	N/A
Boa, Jamaican	<u>Epicrates subflavus</u>	N/A	Jamaica	Entire	E	4	N/A
Boa, Puerto Rico	<u>Epicrates inornatus</u>	N/A	USA (Puerto Rico)	Entire	E	2	N/A
Caiman, Apaporis River	<u>Caiman crocodilus apaporiensis</u>	N/A	Columbia	Entire	E	15	N/A
Caiman, black	<u>Melanosuchus niger</u>	N/A	Amazon basin	Entire	E	15	N/A
Caiman, broad-snouted	<u>Caiman latirostris</u>	N/A	Brazil, Uruguay, Argentina, Paraguay	Entire	E	15	N/A
Crocodile, African dwarf	<u>Osteolaemus tetraspis tetraspis</u>	N/A	West Africa	Entire	E	15	N/A
Crocodile, African slender-snouted	<u>Crocodylus cataphractus</u>	N/A	Western and Central Africa	Entire	E	15	N/A

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Crocodile, American	<u>Crocodylus acutus</u>	Florida	USA (South Florida and Florida keys), Central America, South American (coastal)	Entire	E	10	N/A
Crocodile, Ceylon mugger	<u>Crocodylus palustris kimbula</u>	N/A	Sri Lanka, Africa	Entire	E	15	N/A
Crocodile, Congo dwarf	<u>Osteolaemus tetraspis osborni</u>	N/A	Congo River drainage	Entire	E	14	N/A
Crocodile, Cuban	<u>Crocodylus rhombifer</u>	N/A	Cuba,	Entire	E	15	N/A
Crocodile, Morelet's	<u>Crocodylus moreletii</u>	N/A	Mexico, Belize, Guatemala	Entire	E	4	N/A
Crocodile, mugger	<u>Crocodylus palustris palustris</u>	N/A	India, Pakistan, Bangladesh, Iran	Entire	E	15	N/A
Crocodile, Nile	<u>Crocodylus niloticus</u>	N/A	Africa	Entire	E	4	N/A
Crocodile, Orinoco	<u>Crocodylus intermedius</u>	N/A	South America: Orinoco River Basin	Entire	E	4	N/A
Crocodile Philippine	<u>Crocodylus novaeguineae mindorensis</u>	N/A	Philippine Islands	Entire	E	15	N/A
Crocodile, Siamese	<u>Crocodylus siamensis</u>	N/A	Southeast Asia, Malay Peninsula	Entire	E	15	N/A
Gavial (Gharial)	<u>Gavialis gangeticus</u>	N/A	Pakistan, India, Burma, Bangladesh	Entire	E	4	N/A
Gecko, day	<u>Phelsuma newtoni</u>	N/A	Mauritius	Entire	E	4	N/A
Gecko, Round Island day	<u>Phelsuma quentheri</u>	N/A	Mauritius	Entire	E	4	N/A
Inguana, Anegada ground	<u>Cyclura pinquus</u>	N/A	West Indies: Virgin Islands (Anegada Island)	Entire	E	3	N/A
Iguana, Barrington land	<u>Conolophus pallidus</u>	N/A	Ecuador: Galapagos Islands	Entire	E	4	N/A
Lizard, blunt-nosed leopard	<u>Crotaphytus silus</u>	N/A	USA: California	Entire	E	1	N/A
Monitor, Bengal	<u>Varanus bengalensis</u>	N/A	Iran, Iraq, Afganistan, India, Sri Lanka, Burma, Thailand, Vietnam, Malaysia	Entire	E	15	N/A
Monitor, desert	<u>Varanus griseus</u>	N/A	North Africa to Near-east, Caspian Sea through Soviet Union to Pakistan, Northwest India	Entire	E	15	N/A
Monitor, Komodo Island	<u>Varanus komodensis</u>	N/A	Indonesia (Komodo, Rintja, Padar, and Western Flores Islands)	Entire	E	15	N/A
Monitor, yellow	<u>Varanus flavescens</u>	N/A	West Pakistan through India to Bangladesh	Entire	E	15	N/A
Python, Indian Snake,	<u>Python molurus molurus</u>	N/A	Sri Lanka and India	Entire	E	15	N/A
San Francisco garter	<u>Thamnophis sirtalis tetrataenis</u>	N/A	USA: California	Entire	E	1	N/A
Terrapin, river (Tuntong)	<u>Batagur baska</u>	N/A	Burma, India, Indonesia, Malaysia, Bangladesh	Entire	E	4	N/A
Tomistoma	<u>Tomistoma schlegelii</u>	N/A	Malaysia, Indonesia	Entire	E	15	N/A
Tortoise, angulated	<u>Geochelone (=Testudo) yniphora</u>	N/A	Malagasy Republic (Madagascar)	Entire	E	15	N/A
Tortoise, Galapagos	<u>Geochelone (=Testudo) elephantopus</u>	N/A	Ecuador: Galapagos Islands	Entire	E	4	N/A
Tortoise, Indian flap-shell	<u>Lissemys punctata punctata</u>	N/A	India, Pakistan, and Bangladesh	Entire	E	15	N/A
Tortoise Madagascar radiated	<u>Geochelone (=Testudo) radiata</u>	N/A	Malagasy Republic (Madagascar)	Entire	E	4	N/A
Tortoise, short-necked or swamp	<u>Pseudemys umbrina</u>	N/A	Australia	Entire	E	4	N/A
Tuatara	<u>Sphenodon punctatus</u>	N/A	New Zealand	Entire	E	4	N/A

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Turtle, aquatic box	<u>Terrapene coahuila</u>	N/A	Mexico	Entire	E	6	N/A
Turtle, Atlantic Ridley	<u>Lepidochelys kempii</u>	N/A	Mexico	Entire	E	4	N/A
Turtle, black softshell	<u>Trionyx nigricans</u>	N/A	Bangladesh	Entire	E	15	N/A
Turtle, Burmese peacock	<u>Morenia ocellata</u>	N/A	Burma	Entire	E	15	N/A
Turtle, Cuatro Ciénegas softshell	<u>Trionyx ater</u>	N/A	Mexico	Entire	E	15	N/A
Turtle, geometric	<u>Geochelone (=Testudo) geometrica</u>	N/A	Union of South Africa	Entire	E	15	N/A
Turtle, hawksbill	<u>Eretmochelys imbricata imbricata</u>	N/A	Tropical Seas	Entire	E	3	N/A
Turtle, Indian sawback	<u>Kachuga tecta tecta</u>	N/A	India	Entire	E	15	N/A
Turtle, Indian softshell	<u>Trionyx gangeticus</u>	N/A	Pakistan, India,	Entire	E	15	N/A
Turtle, leather back	<u>Derموchelys coriacea</u>	N/A	Tropical and Temperate Seas	Entire	E	3	N/A
Turtle, peacock softshell	<u>Trionyx hurum</u>	N/A	India and Bangladesh	Entire	E	15	N/A
Turtle, South American	<u>Podocnemis expansa</u>	N/A	South America: Orinoco and Amazon River basins	Entire	E	3	N/A
Turtle, South American	<u>Podocnemis unifilis</u>	N/A	South America: Orinoco and Amazon River basins	Entire	E	4	N/A
Turtle, spotted pond	<u>Geoclemmys (=Damonina) hamiltonii</u>	N/A	Northern India, Pakistan	Entire	E	15	N/A
Turtle, three-keeled Asian	<u>Geomyda (=Nicatoria) tricarinata</u>	N/A	Central India to Bangladesh and Burma	Entire	E	15	N/A
Yacare (Caiman)	<u>Caiman yacare</u>	N/A	Bolivia, Argentina, Peru, Brazil	Entire	E	3	N/A
AMPHIBIANS:							
Frog, Israel painted	<u>Discoglossus nigriventer</u>	N/A	Israel	Entire	E	4	N/A
Frog, Panamanian golden	<u>Atelopus varius zeteki</u>	N/A	Panama	Entire	E	15	N/A
Frog, Stephen Island	<u>Leiopelma hamiltoni</u>	N/A	New Zealand	Entire	E	4	N/A
Salamander, Chinese giant	<u>Andrias (=Megalobatrachus) davidianus davidianus</u>	N/A	Western China	Entire	E	15	N/A
Salamander, desert slender	<u>Batrachoseps aridus</u>	N/A	USA (California)	Entire	E	5	N/A
Salamander, Japanese giant	<u>Andrias (=Megalobatrachus) davidianus japonicus</u>	N/A	Japan	Entire	E	15	N/A
Salamander, Santa Cruz long-toed	<u>Ambystoma macrodactylum croceum</u>	N/A	USA (California)	Entire	E	1	N/A
Salamander, Texas blind	<u>Typhlomolge rathbuni</u>	N/A	USA (Texas)	Entire	E	1	N/A
Toads, African viviparous	<u>Nectophrynoides sps.</u>	N/A	Tanzania, Guinea	Entire	E	15	N/A
Toads, Cameroon	<u>Bufo superciliaris</u>	N/A	Equatorial Africa	Entire	E	15	N/A
Toad, Houston	<u>Bufo houstonensis</u>	N/A	USA (Texas)	Entire	E	2	N/A
Toad, Mont Verde	<u>Bufo periglenes</u>	N/A	Costa Rica	Entire	E	15	N/A

SPECIES		RANGE				
Common name	Scientific name	Population	Known Distribution	Portion of range where endangered or threatened	When Status listed	Special rules
FISHES:						
Ala Balik	<u>Salmo platycephalus</u>	N/A	Turkey	Entire	E 3	N/A
Ayumodoki	<u>Hymenophysa curta</u>	N/A	Japan	Entire	E 3	N/A
Blindcat, Mexican	<u>Prietella phreatophila</u>	N/A	Mexico	Entire	E 3	N/A
Bonytail, Pahrana-gat	<u>Gila robusta jordoni</u>	N/A	USA (Nevada)	Entire	E 2	N/A
Bonytongue, Asian	<u>Scleropages formosus</u>	N/A	Thailand, Indonesia, Malaysia	Entire	E 15	N/A
Catfish	<u>Pangasius sanitwongsei</u>	N/A	Thailand	Entire	E 3	N/A
Catfish, giant	<u>Pangasianodon gigas</u>	N/A	Thailand	Entire	E 3	N/A
Chub, humpback	<u>Gila cypha</u>	N/A	USA (Arizona, Utah, Wyoming)	Entire	E 1	N/A
Chub, Mohave	<u>Gila (=Siphateles) mohavensis</u>	N/A	USA (California)	Entire	E 2	N/A
Cicek	<u>Acanthorutilus handlirschi</u>	N/A	Turkey	Entire	E 3	N/A
Cisco, lonjaw	<u>Coregonus alpenae</u>	N/A	USA (Lakes Michigan, Huron, and Erie)	Entire	E 1	
Cui-ui	<u>Chasmistes cujus</u>	N/A	USA (Nevada)	Entire	E 1	N/A
Dace, Kendall Warm Springs	<u>Rhinichthys osculus thermalis</u>	N/A	USA (Wyoming)	Entire	E 2	N/A
Dace, Moapa	<u>Moapa coriacea</u>	N/A	USA (Nevada)	Entire	E 1	N/A
Darter, bayou	<u>Etheostoma rubrum</u>	N/A	USA (Mississippi)	Entire	T 10	17.44 (b)
Darter, fountain	<u>Etheostoma fonticola</u>	N/A	USA (Texas)	Entire	E 2	N/A
Darter, Maryland	<u>Etheostoma sellare</u>	N/A	USA (Maryland)	Entire	E 1	N/A
Darter, Okaloosa	<u>Etheostoma okaloosae</u>	N/A	USA (Florida)	Entire	E 6	N/A
Darter, snail	<u>Percina tanasi</u>	N/A	USA (Tennessee)	Entire	E 12	N/A
Darter, watercress	<u>Etheostoma nuchale</u>	N/A	USA (Alabama)	Entire	E 2	N/A
Gambusia, Big Bend	<u>Gambusia galgei</u>	N/A	USA (Texas)	Entire	E 1	N/A
Gambusia, Clear Creek	<u>Gambusia heterochir</u>	N/A	USA (Texas)	Entire	E 1	N/A
Gambusia, Pecos	<u>Gambusia nobilis</u>	N/A	USA (Texas)	Entire	E 2	N/A
Killifish, Pahrump	<u>Empetrichthys latos</u>	N/A	USA (Nevada)	Entire	E 1	N/A
Madtom, Scioto	<u>Noturus trautmani</u>	N/A	USA (Ohio)	Entire	E 10	N/A
Nekogigi	<u>Coreobagrus ichikawai</u>	N/A	Japan	Entire	E 3	N/A
Pike, blue	<u>Stizostedion vitreum glaucum</u>	N/A	USA (Lakes Erie and Ontario)	Entire	E 1	N/A
Pupfish, Comanche Springs	<u>Cyprinodon elegans</u>	N/A	USA (Texas)	Entire	E 1	N/A
Pupfish, Devil's Hole	<u>Cyprinodon diabolis</u>	N/A	USA (Nevada)	Entire	E 1	N/A
Pupfish, Owens River	<u>Cyprinodon radiosus</u>	N/A	USA (California)	Entire	E 1	N/A
Pupfish, Tecopa	<u>Cyprinodon nevadensis calidae</u>	N/A	USA (California)	Entire	E 2	N/A
Pupfish, Warm Springs	<u>Cyprinodon nevadensis pectoralis</u>	N/A	USA (Nevada)	Entire	E 2	N/A
Squawfish, Colorado River	<u>Ptychocheilus lucius</u>	N/A	USA (Arizona, California, Colorado, New Mexico, Utah, Wyoming)	Entire	E 1	N/A
Stickleback, unarmored three-spine	<u>Gasterosteus aculeatus williamsoni</u>	N/A	USA (California)	Entire	E 2	N/A
Sturgeon, shortnose	<u>Acipenser brevirostrum</u>	N/A	USA (Atlantic Coast of US and Canada)	Entire	E 1	N/A
Tango, Miyako	<u>Tanakia tanago</u>	N/A	Japan	Entire	E 3	N/A
Temolek, Ikan	<u>Probarbus jullieni</u>	N/A	Thailand, Cambodia, Laos, Vietnam, Malaysia	Entire	E 15	N/A
Topminnow, Gila	<u>Poeciliopsis occidentalis</u>	N/A	USA (Arizona), Mexico	Entire	E 1	N/A
Trout Arizona	<u>Salmo apache</u>	N/A	USA (Arizona)	Entire	T 8	17.44 (a)
Trout, Gila	<u>Salmo gilae</u>	N/A	USA (New Mexico)	Entire	E 1	N/A
Trout, greenback cutthroat	<u>Salmo clarki stomias</u>	N/A	USA (Colorado)	Entire	E 1	N/A
Trout, Lahontan cutthroat	<u>Salmo clarki henshawi</u>	N/A	USA (California, Nevada)	Entire	T 8	17.44 (a)
Trout, Paiute cutthroat	<u>Salmo clarki seleniris</u>	N/A	USA (California)	Entire	T 8	17.44 (a)
Woundfin	<u>Plagopterus argentissimus</u>	N/A	USA (Arizona, Nevada, Utah)	Entire	E 2	N/A

RULES AND REGULATIONS

47197

SPECIES		RANGE		Portion of range where endangered or threatened	When Status listed	Special rules
Common name	Scientific name	Population	Known Distribution			
SNAILS:						
Snails, Manus Island tree	<u>Papustyla pulcherrima</u>	N/A	Admiralty Islands (Manus Isds.)	Entire	E	4 N/A
CLAMS:						
Mussel, Alabama lamp pearly	<u>Lampsilis virescens</u>	N/A	USA (Alabama)	Entire	E	15 N/A
Mussel, Appalachian monkeyface pearly	<u>Quadrula sparsa</u>	N/A	USA (Virginia, Tennessee)	Entire	E	15 N/A
Mussel, birdwing pearly	<u>Conradilla caelata</u>	N/A	USA (Virginia, Tennessee)	Entire	E	15 N/A
Mussel, Cumberland bean pearly	<u>Villosa (=Micromya) trabilis</u>	N/A	USA (Kentucky)	Entire	E	15 N/A
Mussel, Cumberland monkeyface pearly	<u>Quadrula intermedia</u>	N/A	USA (Virginia, Tennessee)	Entire	E	15 N/A
Mussel, Curtis' pearly	<u>Epioblasma (=Dysnomia) florentina curtisi</u>	N/A	USA (Missouri)	Entire	E	15 N/A
Mussel, Dromedary pearly	<u>Dromus dromas</u>	N/A	USA (Virginia, Tennessee)	Entire	E	15 N/A
Mussel, fat pocketbook pearly	<u>Potamilus (=Proptera) capax</u>	N/A	USA (Arkansas, Missouri)	Entire	E	15 N/A
Mussel, fine-rayed pigtoe pearly	<u>Fusconaia cuneolus</u>	N/A	USA (Alabama, Virginia, Tennessee)	Entire	E	15 N/A
Mussel, green-blossom pearly	<u>Epioblasma (=Dysnomia) torulosa gubernaculum</u>	N/A	USA (Virginia, Tennessee)	Entire	E	15 N/A
Mussel, Higgin's eye pearly	<u>Lampsilis higginsii</u>	N/A	USA (Minnesota, Wisconsin, Illinois, Missouri)	Entire	E	15 N/A
Mussel, Nicklin's pearly	<u>Unio (possibly Megaloniais) nickliniana</u>	N/A	Mexico	Entire	E	15 N/A
Mussel, pale lilliput pearly	<u>Toxolasma (=Carunculina) cylindrella</u>	N/A	USA (Alabama, Tennessee)	Entire	E	15 N/A
Mussel, pink mucket pearly	<u>Lampsillis orbiculata orbiculata</u>	N/A	USA (Alabama, West Virginia, Tennessee)	Entire	E	15 N/A
Mussel, rough pigtoe pearly	<u>Pleurobema plenum</u>	N/A	USA (Kentucky, Virginia, Tennessee)	Entire	E	15 N/A
Mussel, Sampson's pearly	<u>Epioblasma (=Dysnomia) sampsoni</u>	N/A	USA (Indiana, Illinois)	Entire	E	15 N/A
Mussel, shiny pigtoe pearly	<u>Fusconaia edgariana</u>	N/A	USA (Alabama, Virginia, Tennessee)	Entire	E	15 N/A
Mussel, Tampico pearly	<u>Cyrtoneis tampicoensis tecomatensis</u>	N/A	USA (Mexico)	Entire	E	15 N/A
Mussel, tubercled-blossom pearly	<u>Epioblasma (=Dysnomia) torulosa torulosa</u>	N/A	USA (Kentucky, Illinois, Tennessee, West Virginia)	Entire	E	15 N/A
Mussel, turgid-blossom pearly	<u>Epioblasma (=Dysnomia) turgidula</u>	N/A	USA (Tennessee)	Entire	E	15 N/A
Mussel, white cat's	<u>Epioblasma (=Dysnomia) sulcata delicata (including perobliqua)</u>	N/A	USA (Ohio, Michigan, Indiana)	Entire	E	15 N/A
Mussel, white warty-back pearly	<u>Plethobasis cicatricosus</u>	N/A	USA (Alabama, Tennessee)	Entire	E	15 N/A
Mussel, yellow-blossom pearly	<u>Epioblasma (=Dysnomia) florentina florentina</u>	N/A	USA (Tennessee)	Entire	E	15 N/A
Pimpleback, orange footed	<u>Plethobasis cooperianus</u>	N/A	USA (Alabama, Tennessee)	Entire	E	15 N/A

CRUSTACEANS: Reserved

RULES AND REGULATIONS

SPECIES		RANGE		Portion of range where endangered or threatened	When Status listed	Special rules
Common name	Scientific name	Population	Known Distribution			
INSECTS:						
Butterfly, Bahama swallowtail	<u>Papilio andraemon bonhottei</u>	N/A	USA (Florida), Bahamas	Entire	T 13	17.47
Butterfly, El Segundo blue	<u>Shijimiaeooides battoides allyni</u>	N/A	USA (California)	Entire	E 14	N/A
Butterfly, Lange's metalmark	<u>Apodemia mormo langei</u>	N/A	USA (California)	Entire	E 14	N/A
Butterfly, Lotis blue	<u>Lycaeides argyrognomon lotis</u>	N/A	USA (California)	Entire	E 14	N/A
Butterfly, mission blue	<u>Icaricia icarioides missionensis</u>	N/A	USA (California)	Entire	E 14	N/A
Butterfly, San Bruno elfin	<u>Callophrys mossii bayensis</u>	N/A	USA (California)	Entire	E 14	N/A
Butterfly, Schaus swallowtail	<u>Papilio aristodemus ponceanus</u>	N/A	USA (Florida)	Entire	T 13	17.47
Butterfly, Smith's blue	<u>Shijimiaeooides enoptes smithi</u>	N/A	USA (California)	Entire	E 14	N/A

COMMON SPONGES AND
OTHER FORMS: Reserved

1--32 FR 4001; March 11, 1967
2--35 FR 16047; October 13, 1970
3--35 FR 8491; June 2, 1970
4--35 FR 18319; December 2, 1970
5--37 FR 6476; March 30, 1972

6--38 FR 14678; June 4, 1973
7--39 FE 44990; December 30, 1974
8--40 FR 29863; June 16, 1975
9--40 FR 31734; July 28, 1975
10--40 FR 44149; September 25, 1975
11--40 FR 44412; September 26, 1975

12--40 FR 47506; October 9, 1975
13--41 FR 17740; April 28, 1976
14--41 FR 22044; June 1, 1976
15--41 FR 204061; June 14, 1976
16--41 FR 45990; October 19, 1976

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STATE GAME COMMISSION'S
REGULATION NO. 563

As adopted January 24, 1975, and amended March 7, 1975,
December 5, 1975, and May 21, 1975

* Species or subspecies marked with an asterisk are named on the federal list of endangered fauna.

PROTECTION OF ENDANGERED SPECIES AND SUBSPECIES OF NEW MEXICO

The following forms of wildlife indigenous to New Mexico are found to be endangered within New Mexico, as the term "endangered" is defined by Section 53-2-51 D, and are therefore declared to be subject to the provisions of Sections 53-2-50 through 53-2-59, New Mexico Statutes Annotated, 1953 Compilations:

ENDANGERED SPECIES AND SUBSPECIES OF NEW MEXICO

Group No. 1. Species and subspecies whose prospects of survival or recruitment in New Mexico are in jeopardy.

Mammals

- white-sided jackrabbit, *Lepus callotis gaillardi*
- * (Mexican) wolf, *Canis lupus baileyi*
- * black-footed ferret, *Mustela nigripes*
- river otter, *Lutra canadensis sonora*
- * jaguar, *Felis onca arizonensis*

Birds

- little blue heron, *Florida caerulea*
- * Mexican duck, *Anas diazi novimexicana*
- gray hawk, *Buteo nitidus maximus*
- * (southern) bald eagle, *Haliaeetus leucocephalus leucocephalus*
- caracara, *Caracara cheriway audubonii*
- * peregrine falcon, *Falco peregrinus anatum*
- apomado falcon, *Falco femoralis septentrionalis*
- white-tailed ptarmigan, *Lagopus leucurus altipetens*
- sharp-tailed grouse, *Pedioecetes phasianellus columbianus*
- sage grouse, *Centrocercus urophasianus*
- * whooping crane, *Grus americana*
- coppery-tailed trogon, *Trogon elegans canescens*
- buff-breasted flycatcher, *Empidonax fulvifrons pygmaeus*
- sulphur-bellied flycatcher, *Myiodynastes luteiventris swarthi*

Reptiles

- Gila monster, *Heloderma suspectum suspectum*
- (Chihuahuan) ridge-nosed rattlesnake, *Crotalus willardi silus*

Fish

- shovelnose sturgeon, *Scaphirhynchus platyrhynchus*
American eel, *Anguilla rostrata*
*Gila trout, *Salmo gilae*
blue sucker, *Cycoreptus elongatus*
gray redhorse, *Moxostoma congestum*
bonytail chub, *Gila elegans*
Mimbres chub, *Gila nigrescens*
*Colorado River squawfish, *Ptychocheilus lucius*
southern redbelly dace, *Phoxinus erythrogaster*
bluntnose shiner, *Notropis simus*
beautiful shiner, *Notropis formosus*
proserpine shiner, *Notropis proserpinus*
silverband shiner, *Notropis cf. shumardi*
Arkansas River shiner, *Notropis girardi*
*Pecos gambusia, *Gambusia nobilis*
*Gila topminnow, *Poeciliopsis occidentalis occidentalis*

- Group No. 2. Species and subspecies whose prospects of survival or recruitment within the state are likely to be in jeopardy within the foreseeable future.

Mammals

- Mexican long-tongued bat, *Choeronycteris mexicana*
Sanborn's long-nosed bat, *Leptonycteris sanborni nivalis*
southern yellow bat, *Lasiurus ega xanthinus*
(Arizona) black-tailed prairie dog, *Cynomys ludavicianus arizonensis*
southern pocket gopher, *Thomomys umbrinus ematus*
Nelson's pocket mouse, *Perognathus nelsoni canescens*
white-ankled mouse, *Peromyscus pectoralis laceianus*
prairie vole, *Microtus ochrogaster* spp.
coatimundi, *Nasua narica molaris*
marten, *Martes americana origenes*
mink, *Mustela vison energumenos*

Birds

- olivaceous cormorant, *Phalacrocorax olivaceus* spp.
Mississippi kite, *Ictinia mississippiensis*
zone-tailed hawk, *Buteo albonotatus*
black hawk, *Buteogallus anthracinus anthracinus*
osprey, *Pandion haliaetus carolinensis*
(Mexican) turkey, *Meleagris gallopavo mexicana*
(inland) least tern, *Sterna albifrons athalasses*
buff-collared nightjar, or Ridgway's whip-poor-will,
Caprimulgus ridgwayi
violet-crowned hummingbird, *Amazilia violiceps elliotti*
broad-billed hummingbird, *Cynanthus latirostris*
blue-throated hummingbird, *Lampornis clemenciae* spp.
red-headed woodpecker, *Melanerpes erythrocephalus caurinus*
Gila woodpecker, *Centurus uropygialis uropygialis*
thick-billed kingbird, *Tyrannus crassirostris pompalis*
beardless flycatcher, *Camptostoma imberbe ridgwayi*

Birds (Contd.)

Mexican chickadee, *Parus sclateri eidos*
Bell's vireo, *Virea bellii* sspp.
varied bunting, *Passerina versicolor* sspp.
Baird's sparrow, *Ammodramus bairdii*
Mexican junco, *Junco phaeonotus palliatus*
McCown's longspur, *Calcarius mccowni*

Reptiles

smooth softshell turtle, *Trionyx muticus muticus*
(western) spiny softshell turtle, *Trionyx spiniferus hartwegi*
(Texas) slider turtle, *Chrysemys concinna texana*
bunchgrass lizard, *Sceloporus scalaris*
(sanddune) sagebrush lizard, *Sceloporus graciosus arenicolous*
mountain skink, *Eumeces callicephalus*
giant spotted whiptail lizard, *Cnemidophorus burti stictogrammus*
rough green snake, *Opheodrys aestivus*
(Sonora) coachwhip, *Masticophis flagellum cingulum*
(blotched) plain-bellied water snake, *Natrix erythrogaster trans-*
narrow-headed garter snake, *Thamnophis rufipunctatus versa*
(pecos) western ribbon snake, *Thamnophis proximus diabolicus*
Trans-Pecos rat snake, *Elaphe subocularis*
Sonora mountain kingsnake, *Lampropeltis pyromelana pyromelana*
lyre snake, *Trimorphodon biscutatus*
Arizona coral snake, *Micruroides euryxanthus euryxanthus*
(mottled) rock rattlesnake, *Crotalus lepidus lepidus*
(Arizona black) western rattlesnake, *Crotalus viridis cerberus*
Mojave rattlesnake, *Crotalus scutulatus scutulatus*

Amphibians

Jemez Mountain salamander, *Plethodon neomexicanus*
Sacramento Mountain salamander, *Aneides hardyi*
(eastern) barking frog, *Hylactophryne augusti latrans*
Colorado River toad, *Bufo alvarius*
western (boreal) toad, *Bufo boreos boreas*
(Blanchard's) cricket frog, *Acris crepitans blanchardi*

Fish

Mexican tetra, *Astyanax mexicanus*
Zuni mountain sucker, *Pantosteus discobolus yarrowi*
roundtail chub, *Gila robusta*
loach minnow, *Tiaroga cobitis*
suckermouth minnow, *Phenacobius mirabilis*
roundnose minnow, *Dionda episcopa*
spikedace, *Meda fulgida*
rainwater killifish, *Lucania parva*
Pecos pupfish, *Cyprinodon* sp.
"Chihuahua" pupfish, *Cyprinodon* sp.
White Sands pupfish, *Cyprinodon tularosa*
bigscale perch, *Percina macrolepida*
Pecos darter, *Etheostoma lepidum*
brook stickleback, *Culaea inconstans*

APPENDIX G

Environmental Analysis Worksheet

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

ENVIRONMENTAL ANALYSIS WORKSHEET

1. Action

Proposed Geothermal Leasing in the Radium Springs Area

2. Stages of implementation

Pre-lease exploration (Casual use)

3. DISCRETE OPERATIONS

Research (lit.)
Geol. Reconnaissance
Geochemical Survey
Airborne Surveys

4. COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED		5. ANTICIPATED IMPACTS				6. REMARKS
I. NONLIVING COMPONENTS	A. AIR					
	Air movement patterns	0	0	0	0	
	Temperature	0	0	0	0	
	Particulate matter	0	0	0	0	
	Carbon monoxide	0	0	0	0	
	Hydrocarbons	0	0	0	0	
	Nitrogen oxides	0	0	0	0	
	Sulfur oxides	0	0	0	0	
	Radiological contaminants	0	0	0	0	
	Non-ionizing radiation	0	0	0	0	
	B. LAND					
	Soil depth	0	0	0	0	
	Soil structure	0	0	0	0	
	Soil nutrient properties	0	0	0	0	
	Soil erosion	0	0	0	0	
	Geologic structure	0	0	0	0	
	Land use compatibility	0	0	0	0	
	Land use suitability	0	0	0	0	
	C. WATER					
	Hydrologic cycle	0	0	0	0	
	Sediment load	0	0	0	0	
	Dissolved solids	0	0	0	0	
	Solid debris	0	0	0	0	
	Temperature	0	0	0	0	
	Chemicals, toxic substances	0	0	0	0	
	Nutrients	0	0	0	0	
	Coliform contamination	0	0	0	0	
	Acid balance (ph)	0	0	0	0	
Dissolved oxygen	0	0	0	0		
Radiological contaminants	0	0	0	0		
II. LIVING COMPONENTS	A. PLANTS (Aquatic)					
	Large Storage Reservoirs	0	0	0	0	
	Small stockwater reservoir	0	0	0	0	
	River	0	0	0	0	

DISCRETE OPERATIONS

Research
 Geol. Reconnaissance
 Geochemical Survey
 Airborne Survey

COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED		ANTICIPATED IMPACTS				REMARKS
II. LIVING COMPONENTS (Con.)	B. PLANTS (<i>Terrestrial</i>)					
	Creosote	0	0	0	0	
	Mesquite	0	0	0	0	
	Grassland	0	0	0	0	
	Desert shrub	0	0	0	0	
	Pinyon-juniper	0	0	0	0	
	Cropland-riparian	0	0	0	0	
	C. ANIMALS (<i>Aquatic</i>)					
	Mammals	0	0	0	0	
	Birds	0	0	0	0	
	Reptiles	0	0	0	0	
	Amphibians	0	0	0	0	
	Fish	0	0	0	0	
	Invertebrates	0	0	0	0	
	D. ANIMALS (<i>Terrestrial</i>)					
Mammals	0	0	0	0		
Birds	0	0	0	0		
Reptiles	0	0	0	0		
Invertebrates	0	0	0	0		
III. INTERRELATIONSHIPS	A. ECOLOGICAL PROCESSES					
	Succession	0	0	0	0	
	Food relationships	0	0	0	0	
	Community relationships	0	0	0	0	
IV. HUMAN VALUES	A. LANDSCAPE CHARACTER					
	Open space	0	0	0	0	
	Scenic quality	0	0	0	0	
	Primitive values	0	0	0	0	
	B. SOCIOCULTURAL INTERESTS					
	Socioeconomic conditions	0	+L	+L	0	
	Local regulatory structure	0	0	0	0	
	Cultural values	0	0	0	0	
	Attitudes and expectations	X	X	X	X	
	Scientific & educ. consid.s	+L	+L	+L	+L	
Land use compatibility						
Recreation	0	0	0	0		
Grazing	0	0	0	0		
Agriculture	0	0	0	0		
Urban & Suburban	0	0	0	0		
Rights-of-Way	0	0	0	0		
Other considerations	0	0	0	0		

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

ENVIRONMENTAL ANALYSIS WORKSHEET

1. Action

Proposed Geothermal Leasing in the Radium Springs Area

2. Stages of implementation

Pre-lease exploration (exploration operations)

3. DISCRETE OPERATIONS

Gravity Surveys
Magnetic Surveys
Electrical Surveys
Telluric Resistivity
Radiometric Surveys
Passive Seismic
Active Seismic
Shallow Drill Holes

4. COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED		5. ANTICIPATED IMPACTS								6. REMARKS
I. NONLIVING COMPONENTS	A. AIR									
	Air movement patterns	0	0	0	0	0	0	0	0	
	Temperature	0	0	0	0	0	0	0	0	
	Particulate matter	0	0	0	0	0	0	-L	0	
	Carbon monoxide	0	0	0	0	0	0	-L	-1	
	Hydrocarbons	x	x	x	x	x	x	x	x	
	Nitrogen oxides	x	x	x	x	x	x	x	x	
	Sulfur oxides	x	x	x	x	x	x	x	x	
	Radiological contaminants	0	0	0	0	0	0	0	0	
	Non-ionizing radiation	0	0	0	0	0	0	0	0	
	B. LAND									
	Soil depth	0	0	0	0	0	0	-L	x	
	Soil structure	0	0	0	0	0	0	0	0	
	Soil nutrient properties	0	0	0	0	0	0	0	0	
	Soil erosion	0	0	0	0	0	0	-L	x	
	Geologic structure	0	0	0	0	0	0	0	0	
	Land use compatibility	0	0	0	0	0	0	-L	-L	
	Land use suitability	+L	+L	+L	+L	+L	+L	+L	+L	
	C. WATER									
	Hydrologic cycle	0	0	0	0	0	0	0	0	
Sediment load	0	0	0	0	0	0	0	0		
Dissolved solids	0	0	0	0	0	0	0	0		
Solid debris	0	0	0	0	0	0	0	0		
Temperature	0	0	0	0	0	0	0	0		
Chemicals, toxic substances	0	0	0	0	0	0	0	0		
Nutrients	0	0	0	0	0	0	0	0		
Coliform contamination	0	0	0	0	0	0	0	0		
Acid balance (ph)	0	0	0	0	0	0	0	0		
Dissolved oxygen	0	0	0	0	0	0	0	0		
Radiological contaminants	0	0	0	0	0	0	0	0		
II. LIVING COMPONENTS	A. PLANTS (<i>Aquatic</i>)									
	Large Storage Reservoirs	0	0	0	0	0	0	0	0	
	Small stockwater reservoir	0	0	0	0	0	0	0	-L	
	River	0	0	0	0	0	0	0	0	

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

ENVIRONMENTAL ANALYSIS WORKSHEET

1. Action

Proposed Geothermal Leasing in the Radium Springs Area

2. Stages of implementation

Post-lease exploration

3. DISCRETE OPERATIONS

Geologic Information
Holes
Exploration Wells

4. COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED		5. ANTICIPATED IMPACTS				6. REMARKS
I. NONLIVING COMPONENTS	A. AIR					
	Air movement patterns	0	0			
	Temperature	0	0			
	Particulate matter	-L	-L			
	Carbon monoxide	-L	-L			
	Hydrocarbons	x	x			
	Nitrogen oxides	x	x			
	Sulfur oxides	x	x			
	Radiological contaminants	0	0			
	Non-ionizing radiation	0	0			
	B. LAND					
	Soil depth	-L	-L			
	Soil structure	x	x			
	Soil nutrient properties	x	x			
	Soil erosion	-L	-L			
	Geologic structure	0	0			
	Land use compatibility	-L	-L			
	Land use suitability	+L	+L			
	C. WATER					
	Hydrologic cycle	0	0			
	Sediment load	0	0			
	Dissolved solids	0	0			
	Solid debris	0	0			
	Temperature	0	0			
	Chemicals, toxic substances	-L	-L			
	Nutrients	0	0			
	Coliform contamination	0	0			
	Acid balance (ph)	0	0			
Dissolved oxygen	0	0				
Radiological contaminants	0	0				
II. LIVING COMPONENTS	A. PLANTS (Aquatic)					
	Large Storage Reservoirs	0	0			
	Small stockwater reservoir	-M	-M			Water loss
	River	0	0			

DISCRETE OPERATIONS

Geologic Information Holes
Exploration Well

COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED		ANTICIPATED IMPACTS				REMARKS
II. LIVING COMPONENTS (Con.)	B. PLANTS (<i>Terrestrial</i>)					
	Creosote	-L	-L			
	Mesquite	-M	-M			
	Grassland	-H	-H			
	Desert shrub	-M	-M			
	Pinyon-juniper	0	0			Potential Development Unlikely
	Cropland-riparian	-H	-H			
	C. ANIMALS (<i>Aquatic</i>)					
	Mammals	0	0			
	Birds	-L	-L			
	Reptiles	0	0			
	Amphibians	-M	-M			
	Fish	0	0			
	Invertebrates	0	0			
	D. ANIMALS (<i>Terrestrial</i>)					
	Mammals	-M	-M			
Birds	-M	-M				
Reptiles	-M	-M				
Invertebrates	-L	-L				
III. INTERRELATIONSHIPS	A. ECOLOGICAL PROCESSES					
	Succession	M	M			
	Food relationships	M	M			
	Community relationships	M	M			
IV. HUMAN VALUES	A. LANDSCAPE CHARACTER					
	Open space	0	0			
	Scenic quality	0	0			
	Primitive values	-M	-M			Access tracks or roads cause greater impacts.
	B. SOCIOCULTURAL INTERESTS					
	Socioeconomic conditions	+L	+L			
	Local regulatory structure	0	0			
	Cultural values	-L	-L			
Attitudes and expectations	X	X				
Scientific & educ. consid.s	+L	+L				
Land use compatibility						
Recreation	-L	-L				
Grazing	-L	-L				
Agriculture	-H	-H				
Urban & Suburban	0	0				
Rights-of-Way	0	0				
Other considerations	X	X				

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

ENVIRONMENTAL ANALYSIS WORKSHEET

1. Action

Proposed Geothermal Leasing in the Radium Springs Area

2. Stages of implementation

Development

3. DISCRETE OPERATIONS

Development Wells
Service Roads
Pipelines
Surface facilities at well location
Vehicles

4. COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED		5. ANTICIPATED IMPACTS					6. REMARKS
I. NONLIVING COMPONENTS	A. AIR						
	Air movement patterns	0	0	0	0	0	
	Temperature	0	0	0	0	0	
	Particulate matter	-M	-H	-M	-M	-M	
	Carbon monoxide	-H	0	-0	-0	-H	
	Hydrocarbons	x	x	x	x	x	
	Nitrogen oxides	x	x	x	x	x	
	Sulfur oxides	-L	0	-L	0	-L	
	Radiological contaminants	0	0	0	0	0	
	Non-ionizing radiation	0	0	0	0	0	
	B. LAND						
	Soil depth	-M	-M	-M	-M	0	
	Soil structure	-M	-M	-L	-L	0	
	Soil nutrient properties	-M	-M	-L	-L	0	
	Soil erosion	-M	-M	-M	-M	0	
	Geologic structure	0	0	0	0	0	
	Land use compatibility	-M	-M	-M	-M	-M	
	Land use suitability	M	M	M	M	M	
C. WATER							
Hydrologic cycle	L	L	L	L	0		
Sediment load	-L	-L	-L	-L	0		
Dissolved solids	x	x	x	x	0		
Solid debris	0	0	0	0	0		
Temperature	0	0	0	0	0		
Chemicals, toxic substances	-M	-L	-M	0	0		
Nutrients	0	0	0	0	0		
Coliform contamination	0	0	0	0	0		
Acid balance (ph)	0	0	0	0	0		
Dissolved oxygen	0	0	0	0	0		
Radiological contaminants	0	0	0	0	0		
II. LIVING COMPONENTS	A. PLANTS (<i>Aquatic</i>)						
	Large Storage Reservoirs	0	0	0	0	0	
	Small stockwater reservoir	0	0	0	0	-L	
	River	x	0	0	0	0	

DISCRETE OPERATIONS

Development Wells
Service Roads
Pipelines
Surface facilities
Vehicles

COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED		ANTICIPATED IMPACTS					REMARKS
II. LIVING COMPONENTS (Con.)	B. PLANTS (<i>Terrestrial</i>)						
	Creosote	-L	-L	-L	-L	-L	
	Mesquite	-M	-M	-M	-L	-L	
	Grassland	-H	-H	-H	-L	-L	
	Desert shrub	-M	-M	-M	-L	-L	
	Pinyon-juniper	0	0	0	0	0	
	Cropland-riparian	-H	-H	-H	-L	-L	
	C. ANIMALS (<i>Aquatic</i>)						
	Mammals	-L	-L	-L	L	L	
	Birds	M	-M	-M	0	-M	
	Reptiles	0	0	0	0	0	
	Amphibians	0	-M	-M	0	-M	
	Fish	0	0	0	0	0	
	Invertebrates	0	0	0	0	0	
	D. ANIMALS (<i>Terrestrial</i>)						
Mammals	-M	-H	-H	-L	-M		
Birds	M	-M	-L	-L	-M		
Reptiles	-L	-M	-L	-L	-M		
Invertebrates	0	0	0	0	-L		
III. INTER-RELATIONSHIPS	A. ECOLOGICAL PROCESSES						
	Succession	M	M	M	M	-L	
	Food relationships	M	M	M	M	-L	
	Community relationships	M	M	M	M	-L	
IV. HUMAN VALUES	A. LANDSCAPE CHARACTER						
	Open space	-M	0	-M	-M	-L	
	Scenic quality	-M	-M	-M	-M	-M	
	Primitive values	-H	-H	-H	-H	-H	
	B. SOCIOCULTURAL INTERESTS						
	Socioeconomic conditions	+M	+M	+M	+M	+M	
	Local regulatory structure	-M	-L	-L	-L	0	Development Wells-Zoning Considerations
	Cultural values	-M	-H	-M	-M	0	
	Attitudes and expectations	X	X	X	X	X	
	Scientific & educ. consid.s	+M	0	0	0	0	
Land use compatibility							
Recreation	-M	-M	-H	-H	-M		
Grazing	-M	-M	-H	-H	-M		
Agriculture	-H	-H	-H	-H	-L		
Urban & Suburban	L	L	L	L	L	Expansion of urban-suburban land use w/population	
Rights-of-Way	0	0	0	0	0		
Other considerations							

DISCRETE OPERATIONS

Pipelines & Roads
Construction of Surface Facilities
Transmission Lines
Facility Operation
Other Uses

COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED		ANTICIPATED IMPACTS					REMARKS
II. LIVING COMPONENTS (Con.)	B. PLANTS (<i>Terrestrial</i>)						
	Creosote	-L	-L	-L	M	L	
	Mesquite	-M	-M	-L	M	L	
	Grassland	-H	-H	-L	M	-M	
	Desert shrub	-H	-H	-L	M	-M	
	Pinyon-juniper	0	0	0	0	0	
	Cropland-riparian	-H	-H	-H	M	M	
	C. ANIMALS (<i>Aquatic</i>)						
	Mammals	-L	-L	-L	L	L	Assuming these operations occur near aquatic habitat
	Birds	-M	-M	-L	M	M	
	Reptiles	0	0	0	0	0	
	Amphibians	-M	-M	-L	L	L	
	Fish	0	0	0	0	0	
	Invertebrates	0	0	0	0	0	
D. ANIMALS (<i>Terrestrial</i>)							
Mammals	-H	-M	-L	M	M		
Birds	-M	-M	-L	L	L		
Reptiles	-M	-M	-L	L	L		
Invertebrates	0	0	0	L	L		
III. INTERRELATIONSHIPS	A. ECOLOGICAL PROCESSES						
	Succession	M	M	L	H	M	
	Food relationships	M	M	L	L	L	
	Community relationships	M	M	L	L	L	
IV. HUMAN VALUES	A. LANDSCAPE CHARACTER						
	Open space	-M	-M	-M	-M	-L	
	Scenic quality	-M	-M	-M	-M	-L	
	Primitive values	-H	-H	-H	-H	-L	
	B. SOCIOCULTURAL INTERESTS						
	Socioeconomic conditions	+M	+H	+M	X	X	
	Local regulatory structure	-M	-H	-M	X	X	
	Cultural values	-H	-H	-M	X	X	
	Attitudes and expectations	X	X	X	X	X	
	Scientific & educ. consid.s	0	0	0	+L	+L	
Land use compatibility							
Recreation	-H	-H	-M	-M	X		
Grazing	-M	-M	-L	-L	X		
Agriculture	-H	-H	-H	M	M	Dependent on facility location	
Urban & Suburban	H	H	H	H	H	Expansion of Urban-Suburban	
Rights-of-Way	0	0	0	0	0	land use w/population.	
Other considerations							

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

ENVIRONMENTAL ANALYSIS WORKSHEET

1. Action

Proposed Geothermal Leasing in the Radium Springs Area

2. Stages of implementation

Close-out

3. DISCRETE OPERATIONS

Abandonment of
subsurface facilities
Removal of surface
installations
Reclamation

4. COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED		5. ANTICIPATED IMPACTS				6. REMARKS
I. NONLIVING COMPONENTS	A. AIR					
	Air movement patterns					
	Temperature					
	Particulate matter					
	Carbon monoxide					
	Hydrocarbons					
	Nitrogen oxides					
	Sulfur oxides					
	Radiological contaminants					
	Non-ionizing radiation					
	B. LAND					
	Soil depth					
	Soil structure					
	Soil nutrient properties					
	Soil erosion					
	Geologic structure					
	Land use compatibility					
	Land use suitability					
	C. WATER					
	Hydrologic cycle					
Sediment load						
Dissolved solids						
Solid debris						
Temperature						
Chemicals, toxic substances						
Nutrients						
Coliform contamination						
Acid balance (ph)						
Dissolved oxygen						
Radiological contaminants						
II. LIVING COMPONENTS	A. PLANTS (<i>Aquatic</i>)					
	Large Storage Reservoirs					
	Small stockwater reservoir					
	River					

DISCRETE OPERATIONS

COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED		ANTICIPATED IMPACTS					REMARKS
II. LIVING COMPONENTS (Con.)	B. PLANTS (Terrestrial)						
	Creosote						
	Mesquite						
	Grassland						
	Desert shrub						
	Pinyon-juniper						
	Cropland-riparian						
	C. ANIMALS (Aquatic)						
	Mammals						
	Birds						
	Reptiles						
	Amphibians						
	Fish						
	Invertebrates						
D. ANIMALS (Terrestrial)							
Mammals							
Birds							
Reptiles							
Invertebrates							
III. INTERRELATIONSHIPS	A. ECOLOGICAL PROCESSES						
	Succession						
	Food relationships						
	Community relationships						
IV. HUMAN VALUES	A. LANDSCAPE CHARACTER						
	Open space						
	Scenic quality						
	Primitive values						
	B. SOCIOCULTURAL INTERESTS						
	Socioeconomic conditions						
	Local regulatory structure						
	Cultural values						
	Attitudes and expectations						
	Scientific & educ. consid.s						
	Land use compatibility						
	Recreation						
	Grazing						
Agriculture							
Urban & Suburban							
Rights-of-Way							
Other considerations							

INSTRUCTIONS

- Action** - Enter action being taken, analytic step for which worksheet is being used, environmental viewpoint of impact, and any assumptions relating to impact.
 - Worksheet is normally used to analyze "Anticipated Impacts" of action, however, it may be used to analyze "Residual Impacts." Worksheets may also be used to compare impacts before and after mitigating measures are applied.
 - State viewpoint that best describes environmental impact. For example, a fence viewed down the fence line has greater impact than the same fence viewed over an entire allotment. Generally, narrow viewpoints better illustrate specific impacts than will broad viewpoints.
 - Assumptions may be made to establish a base for analysis (e.g. estimated time periods, season of year, etc.).
- Stages of Implementation** - Identify different phases of proposed project (e.g. a road project consists of survey, construction, use, and maintenance stages).
- Discrete Operations** - Identify separate actions comprising a particular stage of implementation (e.g. the construction stage of the road project has the discrete operations of clearing, grading, and surfacing).
- Elements Impacted** - Enter under appropriate heading all environmental elements susceptible to impact from action and alternatives. Relevant elements not contained in the digest should also be entered. See BLM Manual 179I, Appendix 2, Environmental Digest.
- Anticipated Impact** - Evaluate anticipated impact on each element and place an entry in the appropriate square indicating degree of impact as low (L), medium (M), high (H), no impact (O), or unknown or negligible (X). Precede each entry by a plus (+) or minus (-) sign indicating a beneficial or adverse type of impact. If type of impact reflects a matter of opinion or is not known, do not precede with a sign. For example, construction of a wind mill on open range has a definite visual impact, however, to some people the effect is detrimental while to others it is an improvement. By not entering a plus (+) or minus (-) sign the worksheet is kept factual and unbiased. If both degree and type of impact are unknown, place an (x) in the appropriate square.
 - The measures of impact (e.g. low, medium, and high) are relative and their meaning may vary slightly from action to action. The term "low" should not be applied to impacts of a negligible nature. For example, we know that a pickup truck driving down a proposed fence line laying wire has some impact on air quality. However, the significance of this impact is not normally great enough to warrant even a "low" rating. In cases like this, the impact will usually be marked "O" or the element left off the worksheet.
 - It is recognized that some environmental elements may defy accurate measurement or in-depth analysis within current Bureau capabilities or expertise. The nature of the action as well as type and degree of impact should guide in the decision to seek outside expertise or assistance.
- Remarks** - Enter clarifying information.



BUREAU OF LAND MANAGEMENT
DISTRICT OFFICE
P.O. Box 1400

1975

APPENDIX H

Notification Letter with Mailing List

News Release with Mailing List

Letter to Recipients of Rough Draft with Mailing List

[Faint, mostly illegible text, likely bleed-through from the reverse side of the page]

[Handwritten signature]
Dennis C. A. [illegible]
District Manager





United States Department of the Interior

IN REPLY REFER TO

3200

BUREAU OF LAND MANAGEMENT
DISTRICT OFFICE
P. O. Box 1420
Las Cruces, New Mexico
88001

December 1, 1976

Dear Sir:

We now have available in this office a limited number of draft copies of the Environmental Analysis Record and Technical Report on proposed geothermal leasing in the Radium Springs area which extends from Las Cruces to Truth or Consequences, New Mexico.

Copies of this report are available for review at the following locations:

Clerk's Office, 112 Franklin, Hatch, N.M.
U. S. Post Office, Garfield, N.M.
Public Library, Truth or Consequences, N. M.
New Mexico State University Library, (on reserve), Las Cruces, N.M.
Bureau of Land Management Office, 1705 N. Valley Dr., Las Cruces. N.M.

If, for any reason, you cannot review a copy at one of the above locations, we have a limited number of additional copies which will be made available.

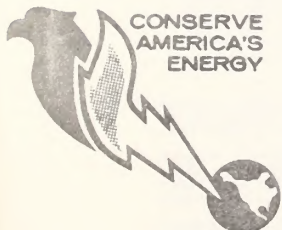
This EAR and TR includes a number of Appendices which are not made a part of the draft, but will be made a part of the final document.

We are most interested in receiving your comments on the material content of this report. We ask that, if you review the document and care to comment, your comments be in writing and received in this office no later than January 3, 1977.

If you have any questions, please do not hesitate to call on us at 505-523-5571, or come to our office at 1705 N. Valley Drive, Las Cruces.

Sincerely yours,

Daniel C. B. Rathbun
District Manager



Save Energy and You Serve America!

Mailing List for letter of notification dated December 1, 1976

Dr. Stanley Bussey, NMSU
Charles Hendrickson, Environmental Improvement Agency
New Mexico State Park and Recreation Commission
Joe Campbell, Truth or Consequences Chamber of Commerce
Charles Markosky, City Manager, Truth or Consequences
Elmore Taylor, Mayor of the Village of Hatch
Mayor, Village of Williamsburg
Allen Beck, County Agent, Sierra County
Chairman of Sierra County Commission
Al Galves, Southern Rio Grande Council of Governments
County Manager, Dona Ana County
County Agent, Dona Ana County
Welsey Leonard
Area Conservationist, Soil Conservation Service
Agriculture Stabilization and Conservation Commission
Bureau of Reclamation, Rio Grande Project
International Boundary and Water Commission
Chief, Power Field Division, Bureau of Reclamation
Dr. Carlton Herbel, Jornada Experimental Range, USDA
Commanding General White Sands Missile Range
Max S. Adams
Ramundo Apodaca
Zelfa & Lucas Apodaca
Armendaris Land Development, Oppenheimer Industries
Armijo Community Allotment, c/o Horacio Armijo
Mrs. Barbarita Baca, c/o Hernandez Baca
Bason & Cox, Inc., co/ Jimmy R. Bason
Margaret and Allan Beck, c/o Allan Beck
E. S. and R. E. Berridge
James T. Brewster
Charles Bierner, Jr.
George C. Birner and Betty Hamilton
Elgie Booth
Darwin Bourquet
S. J. Boykin
Buckhorn Ranch, c/o Ben Cain
Caballo Grazing Association, c/o Dick Gordon
Caballo Mountain Ranch, c/o Rod Hille
Cain Brothers & Company, c/o Ben Cain
Ben Cain
Jack Cain
Lewis Cain
W. N. Castle
W. N. & J. A. Castle

Essie M. Gage
Clyde Goff
Barry Gonzales
Gonzales Community, c/o James T. Martin, Jr.
Tony, Reynauldo & Barry Gonzales
Dick Gordon
W. B. and J. H. Jones
John Gordon
Neil O. Graham
G. S. Greer
Ralph Hackey
Mrs. Charles W. Hardin
Hatley & Underwood, c/o Carrell A. Hatley
Robert S. Hayner, Estate, c/o Limmian Hayner
A. R. and Maxine Hille
Howard Lee Holden, c/o John R. Holden
Velma Hopkins, c/o Bill Hopkins
Dr. Ellsworth E. Hubble
James W. Hurt
L. B. & Leona Johnson
Earl F. Jones
Laney Ranch, Inc., Laurence Laney
Robert E. Lara
J. J. Lett (Calhoun), c/o Joe Lett
Celso Lopez Estate, c/o Lorenzo Lopez
Frank Luchini
Evangelisto Sedillo, c/o Justin Sedillo
Luna Brothers, c/o Amando T. Luna
Pete Martinez
Olive B and Carlton H. McGregor
Henry C. Meadows
Thomas L. Miller
Mrs. B. T. Miranda
Romolo L. & Casper L. Montoya
Morre and Lasiter
David H and Janice R. Munger
Pete and Josephine Nuanez
David M. Nunn
Henry Nunn, c/o L. C. Production Credit Association
Eugene Oldfield
Belsan B. Armijo
Nicholas T. Ortega
Pankey Land & Cattle Co., c/o Joe L, Pankey
R. L & J. R. Pearson
Potter, Johnson and Potter, c/o Ms. Hazel Johnson
Ralph Rainwater
Jesse U. Richardson, Jr.

Euel R. Nave
Fred S. Riggs
Rio Grazing Association, c/o Dale Hopkinds
S. O. Roberts
Rockin Rafters Land U Cattle Co., Inc., c/o John Downs
Ruffini and Stoops, c/o Donald E. Stoops
Adan T. Sanchez
Sedillo community Allotment, c/o Franck Luchini
Eduardo Sedillo
Remigio Sedillo Estate, c/o Aurelio M. Sedillo
Marianne B. Sullivan
Victor Sullivan
Ciriaco B. Tafoya
Jacobo Tafoya
Jack G. and J. G. Terrazas
Adan Torres
Freddie J. Torres
G. F. Trimbel & Scott Levins, c/o Scott Levins
Cristobal Trujillo (Sedillo Allotment)
John L. Tucker
Underwood and Downs, c/o John Downs
George Perkins
Vernon and Joanne Van Cleve
E. J. Ward
A. E. Welch
George T. Whittenburg
Dale Wolf
Leonard Resources
Rector Lathan Corporation
Russell Gray, El Paso Electric Company
Charles R. Bowman, El Paso Natural Gas Co.
W. W. Nordheim, Chevron Pipeline Co.
Dave Wilson, Allied Chemical Co.
Wayne P. Cunningham, Elephant Butte Irrigation District.
R. R. M. Mining Co., c/o J. L. Pinson, Sr.
Mrs. Sally L. Berkone
Bob Donegan, Quintana Minerals Corp.
J. R. McMahan, Field Boss, Exxon Co., USA
Francis & Mary M. Burke
Mogens I rasmussen, Altamira Ranch
Four-S, Inc., c/o Ronald P. Spicer,
James E. Bobo, Sr.
H. N. Bailey
Lois Ellen Gray
Lawrence A. Horner Estate, c/o Mrs. L. A. Horner
E. J. Ward

Charles C. Brewster
Wilford Cothern
Howard Cothern
Mike Cordova, et al.
O. L. Smith
Mundy & Morrow, Inc., c/o Joe Morrow
W. N. Castle (South)
Juan F. Garcia & Harvey Nunn
Juan Bustamente
Las Uvas Ranch, c/o O. L. Hilburn
New Mexico State Planning Office, Al Lobato
Forest D. Chastain
Harvey Chatfield & Children
Albert and Esquipula Chavez
Daniel Chavez
Isaac N. Chavez
Lorenzo Chavez
Cluff Land and Cattle Co., c/o O. Leath Cluff
Jay Cox
Robert C. Cox
Verne Cunningham
Dalton & Barwise Land and Cattle Co., c/o Mack Dalton
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Ralph T. Dayberry
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Frank & Margie L. Dines
Marshall Doolittle
Chandler Elkins
Carl Faubion
Franzoy Cattle Co., c/o Fred L. Franzoy



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BUREAU OF LAND MANAGEMENT

UNITED STATES

FOR RELEASE IMMEDIATELY

CONTACT DANIEL C. B. RATHBUN
District Manager, 523-5571

News Release

DEPARTMENT OF THE INTERIOR

December 1, 1976

A draft Environmental Analysis Record (EAR) and Technical Report (TR) concerning leasing of geothermal resources on national resource lands within Sierra and northern Dona Ana Counties, referred to as the Radium Springs Proposed Geothermal Leasing Area, has been compiled by the Las Cruces District Office, Bureau of Land Management.

Copies of the draft EAR and TR are available for public review and have been placed at the following locations:

Clerk's Office, 112 Franklin, Hatch, N.M.

U. S. Post Office, Garfield, N.M.

Public Library, Truth or Consequences, N.M.

New Mexico State University Library, Las Cruces, N.M.

BLM District Office, 1705 N. Valley Drive, Las Cruces, N.M.

The Bureau of Land Management is interested in receiving comments concerning the material content of this report. Mr. Rathbun asks that those who evaluate and review the document and wish to comment, address those comments to him in writing, and that they be received in the Las Cruces Office, BLM, P. O. Box 1420, Las Cruces, N.M. 88001 prior to January 3, 1977.

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BUREAU OF LAND MANAGEMENT
DISTRICT OFFICE
P. O. Box 1420
Las Cruces, New Mexico
88001

December 1, 1976

Enclosed is a draft copy of the Environmental Analysis Record and Technical Report on proposed geothermal leasing in the Radium Springs area which extends from Las Cruces north to the boundary common to Sierra and Socorro Counties, New Mexico.

This EAR and TR lacks a number of Appendices which are not complete, but which will be included in the final document. We are most interested in your comments on the material content of this report. We ask that, if you review the document and care to comment, your comments be in writing and received in this office no later than January 3, 1977.

If you have any questions, please do not hesitate to call on us at (505) 523-5571 or come to our office at 1705 N. Valley Drive, Las Cruces.

Sincerely yours,

Daniel C. B. Rathbun
District Manager

Enclosure



Save Energy and You Serve America!

List of those receiving rough draft copy of EAR & TE

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Jack Kennedy, State Land Office
Dan Nutter, Oil Conservation Commission
Mary Alice Black, Environmentalist III
Mr. Carl Hall, NMSU
Ken Bull, District Geothermal Supervisor
Area Geologist, USGS
U. S. Geological Survey, Jim Knopf
Fish and Wildlife Service (USDI)
New Mexico Department of Game & Fish (Las Cruces)
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Janie Chavez, Field Coordinator

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