Final Environmental Impact Statement of the Island Park Geothermal Area

Idaho • Montana • Wyoming

United States Department of Agriculture
Forest Service

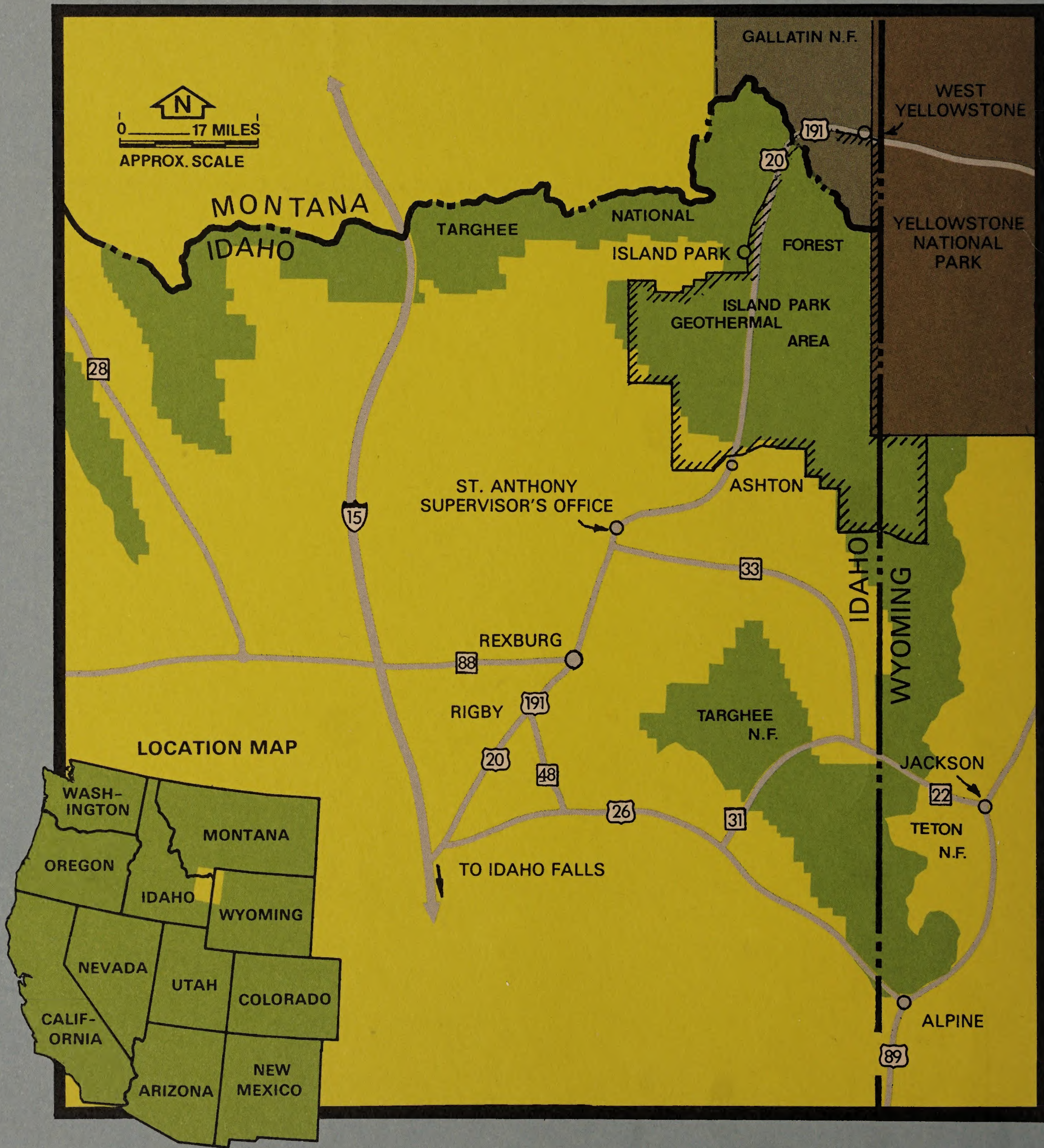
United States Department of the Interior
Bureau of Land Management

ISLAND PARK GEOTHERMAL AREA

FREMONT CO. - GALLATIN CO. - TETON CO.

IDAHO - MONTANA - WYOMING

FOREST SERVICE & BUREAU OF LAND MANAGEMENT



NOTE: The format of this final environmental impact statement is consistent with the draft environmental impact statement released on March 21, 1979. Although new format guidelines were issued prior to completion of this final statement, we believe review and implementation will be accomplished best by consistent format for both documents.

RECORD OF DECISION

ISLAND PARK GEOTHERMAL AREA
IDAHO-MONTANA-WYOMING
FINAL ENVIRONMENTAL IMPACT STATEMENT
USDA, FOREST SERVICE

The Island Park Geothermal Area Environmental Impact Statement has been an interagency project since its inception in 1975. The data and evaluations contained in the final EIS reflect this interagency participation.

Based on the analysis and evaluation in the final EIS for the Island Park Geothermal Area, it is our decision to adopt Alternative 7 as the selected alternative subject, however, to the limitation that the Secretary of Agriculture's consent to the leasing of National Forest lands, which has been delegated to Regional Foresters, will not be given until the Secretary of the Interior in consultation with the Secretary of Agriculture determines the following:

- that a valuable geothermal resource exists within the IPGA based upon research or tests such as drilling, geophysical and geochemical data interpretation or other indicators
- development of the potential geothermal resource in the Island Park area will not adversely affect the unique thermal features of Yellowstone National Park
- development would not adversely affect habitat of threatened or endangered wildlife
- any potential air or water pollution from hydrogen sulphide or other noxious gases can be controlled so as not to adversely affect soil, water, vegetation, or air quality in areas of human habitation.

Upon receipt of favorable findings on these four areas of concern, the Secretary of Agriculture will prescribe lease terms and conditions needed to ensure adequate protection and utilization of the affected lands. The Secretary of Agriculture's consent, terms, and conditions will be consistent with the selected alternative (Alternative 7) of this final Environmental Impact Statement.

The selected alternative most fully addresses the major public concerns: the protection of the thermal features of Yellowstone National Park and protection of wildlife and fish and their habitats. The final EIS describes (Section IV) seven alternatives. These alternatives differ as to the acreages available for leasing, the time frames for leasing, and/or the acreages available for surface occupancy. Except for Alternative 1 (no leasing), the selected alternative is considered to be environmentally preferable.

This decision represents a proposal for geothermal leasing based on the management responsibilities of the USDA, Forest Service, and the USDI, Bureau of Land Management (surface management agencies). It is also responsive to the Geothermal Steam Act of 1970.

Implementation of this decision will not take place sooner than 45 days after the final EIS and this Record of Decision have been filed with the Environmental Protection Agency and made available to interested individuals, organizations, and agencies.

This decision is subject to administrative review (appeal) pursuant to 36 CFR 211.19. Any notice of appeal filed should be received within 45 days from the date of this decision.

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JAN 15 1980

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Date

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Date

FINAL ENVIRONMENTAL IMPACT STATEMENT
LEASING AND DEVELOPMENTAL
ISLAND PARK GEOTHERMAL AREA
FREMONT CO. IDAHO, GALLATIN CO. MONTANA, TETON CO. WYOMING

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USDA—FOREST SERVICE
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324 - 25th STREET
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COOPERATING AGENCIES:

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RESOURCES DIVISION
345 MIDDLEFIELD ROAD
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ABSTRACT: This final environmental impact statement describes seven alternatives for leasing 488,031 acres of Federal lands in Idaho, Montana, and Wyoming. The statement describes the estimated effects of a geothermal leasing program by the various alternatives. Alternative 7 is the selected alternative. It integrates many substantive public comments on three major concerns: Yellowstone National Park, wildlife, and fish.

TIMING AND RIGHT OF APPEAL: A notice of appeal must be filed within 45 days from the date of the Record of Decision (36 CFR 211.19)

SUMMARY

FINAL ENVIRONMENTAL IMPACT STATEMENT

LEASING AND DEVELOPMENT

ISLAND PARK GEOTHERMAL AREA

FREMONT CO. IDAHO, GALLATIN CO. MONTANA, TETON CO. WYOMING

I. Description

This environmental impact statement considers the effects of geothermal leasing and development on 488,031 acres of public land in Idaho, Montana and Wyoming administered by two Federal agencies: the USDA—Forest Service and the USDI—Bureau of Land Management. The lands considered are known collectively as the Island Park Geothermal Area (IPGA) and contain two areas classified as "Known Geothermal Resource Areas" (KGRA) by the U.S. Geological Survey.

Approximately 200 lease applications have been received for geothermal exploration and development within the Island Park Geothermal Area. These applications are outside the two designated Known Geothermal Resource areas and would be leased non-competitively if leasing is approved.

Major considerations of a geothermal leasing program within the Island Park Geothermal Area include:

—Potential effects on surface and groundwater resources.

—Potential effects on threatened and/or endangered wildlife species.

—Proximity to Yellowstone National Park and its surface hydrothermal features.

—Economic and social effects.

II. Alternatives Considered

Alternative 1—No leasing.

Alternative 2—Leasing as proposed by participants of the public workshop.

Alternative 3—Lease a portion of the area. Defer leasing on a portion and refuse leasing on some of the lands.

Alternative 4—Lease most of the area, but much of the available lands would be restricted to no surface occupancy restrictions.

Alternative 5—Allow leasing on a large portion of the area, but restrict some of this to surface occupancy restrictions, i.e. use of existing roads, use of portable drilling rigs. Deny leasing on environmentally sensitive lands.

Alternative 6—Lease the entire area.

Alternative 7—Lease a portion of the area. Defer leasing on a portion including a two mile wide "buffer" strip next to Yellowstone National Park. Refuse leasing on some of the land.

III. Environmental effects

Cause	Potential Effects
Exploration and Development	Increased employment relative to the extent of discovery and development
Development of Resource	Additional energy for electricity, space heating and other industrial/ agricultural uses Alteration of Yellowstone National Park Thermal Features
Operation of Facilities	Air pollution from geothermal gases Increased noise and objectionable odors Local climatic modifications Royalty payments and rent to Federal Government
Construction and Development	Soil erosion and possible mass failures Increased man-caused wildfires Reduced visual quality Destruction of vegetation Improved access Reduction in timber production Increased noise levels Stream habitat modification Conflict with recreational pursuits Obliteration of archaeological/historical sites Air pollution from dust and debris burning Increased traffic and road maintenance Increased tax base for affected counties Displacement and disturbance of wildlife Possible water degradation from spills, blowouts or casing failures Social and economic stress from increased population Modification of wildlife habitat
Environmental Studies	Additional resource data for future management decisions

IV. Date of Transmission to EPA and the Public: Draft - March 21, 1979
Final - JAN 15 1980

INDIVIDUALS

Denzil and Betty Acklin, Boulder, CO
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Michael R. McSorley, Pocatello, ID
Mark Newman, M.D., Sundance, WY
Henry C. Phibbs II, Jackson, WY
Ann Puddicombe, St. Anthony, ID
Vernon Pugh, Boulder, CO
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Betty N. Wilson, Boulder, CO
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ORGANIZATIONS

Anadarko Production Company, Houston, TX
Atlantic Richfield Company, Denver, CO
Boulder Land Company, Inc., Boulder, CO
Capital Ventures, Inc., Denver, CO
Edward Hines Lumber Co., St. Anthony, ID
Fall River Rural Electric Cooperative, Inc., Ashton, ID
Fremont Outdoor Education and Recreation, Inc., St. Anthony, ID
Idaho Chapter of the Wildlife Society, Boise, ID
Idaho Enviornmental Council, Idaho Falls, ID
Louisiana-Pacific Corporation, Rexburg, ID
Moore and Company, Littleton, CO
Nuclear Dynamics, Phoenix, AZ
Phillips Petroleum Company, Salt Lake City, UT
Power Resources Corporation, Denver, CO
Sawtelle Chapter, Outdoors Unlimited, St. Anthony, ID
Stewart Capital Corporation, New York, NY
Trout Unlimited, Bozeman, MT
The Wilderness Society, Boise, ID
Wildlife Management Institute, Washington, DC
Wyoming Chapter Sierra Club, Wilson, WY

STATES

Idaho

Department of Agriculture, Boise
East Central Idaho Planning and Development Association, Rexburg
Office of Energy, Boise
Department of Fish and Game, Idaho Falls
Department of Health and Welfare, Division of Environment, Boise
Department of Health and Welfare, Division of Environment, Pocatello
Natural Resources Bureau, Boise
Department of Parks and Recreation, Boise
Department of Water Resources, Boise
University of Idaho—Cooperative Extension Service, Pocatello
Clearinghouse, State of Idaho, Boise

Montana

Department of Fish and Game, Helena
Montana Historical Society, Helena

Wyoming

Department of Agriculture (State Conservation Commission), Cheyenne
Department of Environmental Quality, Cheyenne
Executive Department, Cheyenne
Game and Fish Department, Cheyenne
The Geological Survey of Wyoming, Laramie
Wyoming Recreation Commission, Cheyenne
Wyoming Recreation Commission—Office of the State Archaeologist, Laramie
State Engineer's Office, Cheyenne

California

Senator Bob Wilson, Sacramento, CA

FEDERAL AGENCIES

Advisory Council on Historic Preservation, Denver, CO
U.S. Environmental Protection Agency, Seattle, WA
Department of Health, Education and Welfare—Public Health Service, Atlanta, GA
Department of Health, Education and Welfare, Denver, CO
U.S. Department of the Interior, Washington, DC
USDA—Office of the Secretary, Washington, DC
USDA—Science and Education Administration, Beltsville, MD
USDA—Soil Conservation Service, Boise, ID

IV. Written comments to the draft environmental impact statement were received from the following individuals, organizations, agencies and officials.

FEDERAL AGENCIES

Action
Advisory Council on Historic Preservation
Central Intelligence Agency
Department of Agriculture

- Agricultural Research Service
- Agricultural Stabilization and Conservation Service
- Farmers Home Administration
- Forest Service
- Office of Equal Opportunity
- Office of the General Counsel
- Office of the Secretary
- Rural Electrification Administration
- Soil Conservation Service

Department of Commerce
Department of Defense
Department of Energy
Department of Health, Education and Welfare
Department of Housing and Urban Development
Department of the Interior
Environmental Protection Agency
Federal Energy Regulatory Commission
Federal Highway Administration
General Services Administration
Interstate Commerce Commission
Missouri River Basins Commission
Nuclear Regulatory Commission
Office of Economic Opportunity
Pacific Northwest River Basins Commission
Water Resources Council

STATE AND LOCAL AGENCIES

STATE OF IDAHO

Attorney General's Office
Bureau of Mines and Geology
Bureau of State Planning and Community Affairs
Department of Agriculture
Department of Education
Department of Employment
Department of Health and Welfare, Division of Environment
Department of Lands
Department of Parks and Recreation
Department of Water Resources
Division of Budget Policy Planning and Coordination
Division of Tourism and Industrial Development
Fish and Game Department
Harriman State Park
Historic Preservation Officer
Office of Energy
Public Utilities Commission
Southeast Idaho Council of Governments
State Archaeologist
State Coordinator of Federal Programs
State Historical Society
Transportation Department
Water Resources Board

LOCAL

Fremont County Board of Commissioners, St. Anthony

STATE OF MONTANA

Bureau of Mines and Geology
Department of Agriculture
Department of Community Affairs
Department of Health
Department of Intergovernmental Relations, Economic Development Division
Department of Lands
Department of Natural Resources and Conservation
Environmental Quality Council
Fish and Game Department
Governor's Office
Historic Preservation Officer

LOCAL

Gallatin County Board of Commissioners, Bozeman

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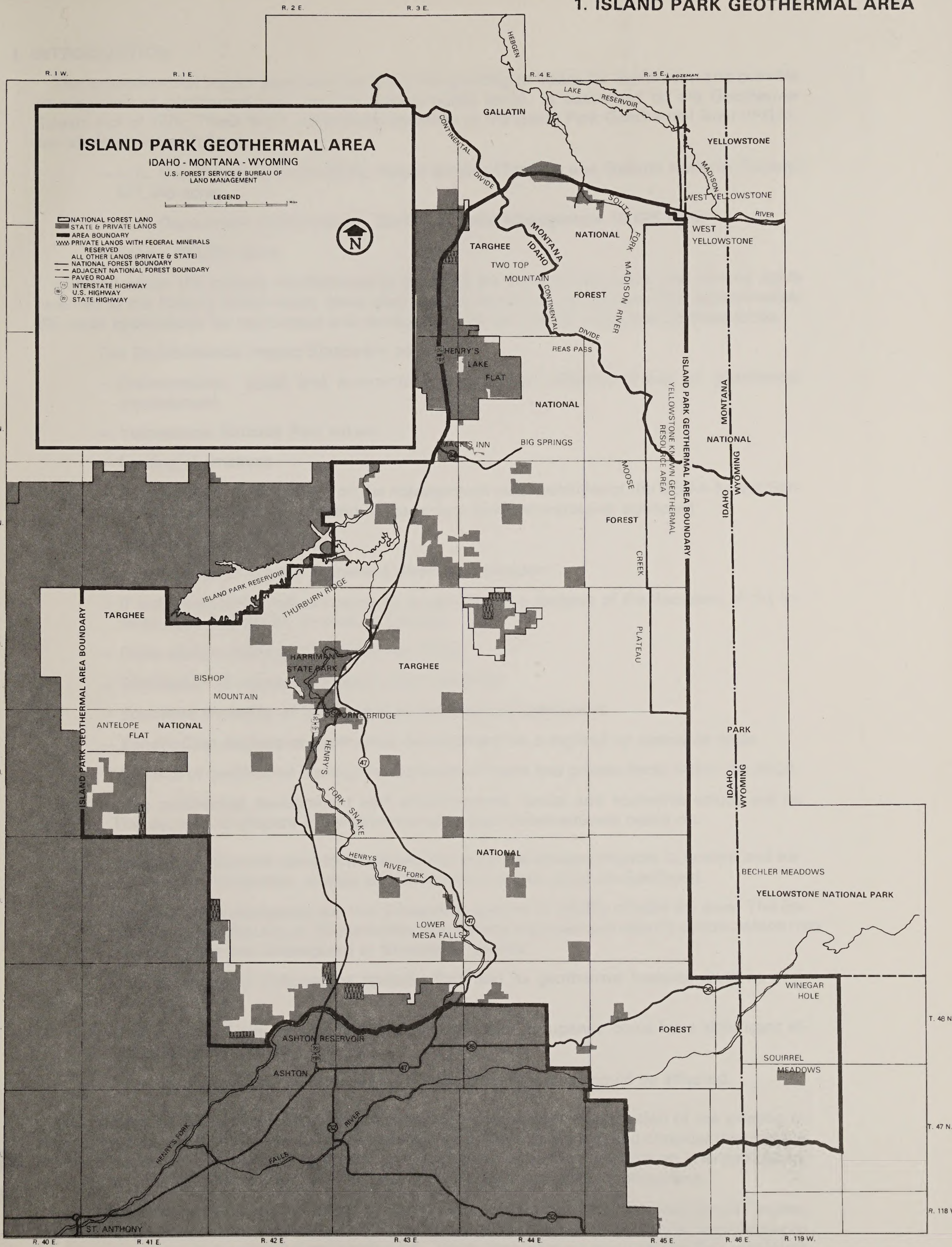


I. INTRODUCTION

This environmental impact statement considers the granting of leases for exploration and possible development of geothermal resources on Federal public lands, as authorized by the Geothermal Stream Act of 1970. These lands, collectively identified as the Island Park Geothermal Area (IPGA), are administered as follows:

—U.S. Department of Agriculture, Forest Service (Targhee and Gallatin National Forests) 477,346 acres

—U.S. Department of the Interior, Bureau of Land Management 10,685 acres

—Total—488,031 acres

Included within the acreage administered by the BLM are some private lands with mineral rights reserved to the Federal Government. More than seventy interested parties have filed approximately 200 lease applications for exploration and development of geothermal resources on these lands.

The Environmental Impact Statement considers:

— Environmental, social and economic effects of the different phases of geothermal development

— Yellowstone National Park values

— Leasing alternatives

— A proposal for leasing based on the management responsibilities of the USDA-Forest Service and USDI-Bureau of Land Management (surface managing agencies)

— Mitigation and monitoring

The Environmental Impact Statement **does not** consider:

— If and where leases will ultimately be issued—this is a decision of the Secretary of the Interior (See Section III, Evaluation Criteria)

— Other energy resources in or near the IPGA

— Distribution of energy developed within the IPGA

— Economic feasibility of geothermal electrical power production

— Benefit-Cost analysis of geothermal development on a regional or statewide basis

— Impacts of geothermal leasing/development on state and private lands within the IPGA.

Harmonizing geothermal development with environmental, social and economic values will be complex. The decision to prepare the environmental impact statement was based on:

—Existing geothermal operations indicate that potential adverse impacts to ground and surface water, landscape, wildlife and recreational values could be significant.

—At least two endangered and one threatened species of wildlife inhabit the area. The Endangered Species Act of 1973 provides that Federal Agencies will take no actions which may be adverse to any endangered or threatened species.

—The proximity of Yellowstone National Park and its geothermal features must be considered.

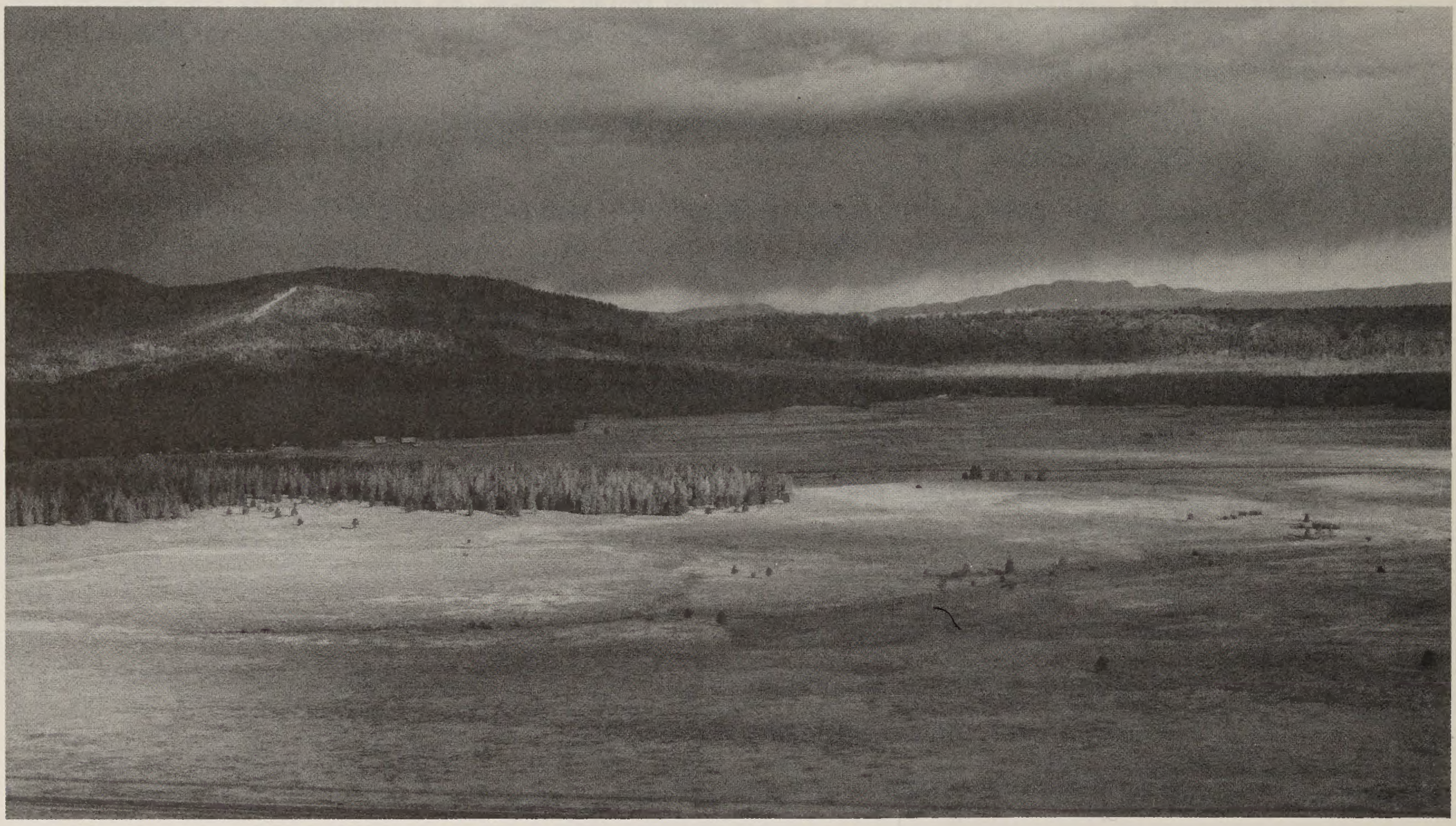
—Disturbances from construction and long-term site occupancy could have significant effects on several wildlife species.

— The social structure and economies of several communities could be affected.

The purpose of this environmental impact statement is to present a description of the existing or affected environment, show a range of alternatives for geothermal leasing, and consider the possible effects of implementing a leasing program. The alternatives were developed by an interdisciplinary team of resource specialists using existing and collected data and public involvement.

Land management plans provide specific direction for managing surface resources for all Targhee National Forest lands within the IPGA. These plans provide the basis of many special considerations common to several of the alternatives (section IV). These management plans (Island Park and West Slope of the Tetons) are on file in the Forest Supervisor's office in St. Anthony, Idaho.

Only information pertinent to geothermal resource leasing considerations is presented in this statement. The text (supported by an appendix) is brief to keep the effects of geothermal development clear to the reviewer. Considerable supporting data including source material, supporting calculations, and special reports are available for review at the Targhee National Forest Supervisor's Office in St. Anthony, Idaho. Figure 1. illustrates the environmental impact statement process.



The IPGA is located adjacent to Yellowstone National Park. The east boundary is 13.5 miles west of Old Faithful Geyser. The IPGA includes portions of Fremont County, Idaho; Gallatin County, Montana; and Teton County, Wyoming (Map 1).

The IPGA is astride the Continental Divide. West of the Divide are the headwaters of the Henrys Fork of the Snake River, a major tributary of the Columbia River, which flows into the Pacific Ocean. East of the Divide are the headwaters of the South Fork of the Madison River, a tributary of the Missouri River whose waters eventually reach the Gulf of Mexico.

ADMINISTRATION OF LEASING PROGRAM

As set forth in the Geothermal Steam Act of 1970, the Secretary of Agriculture is responsible for determining where and if lands under his jurisdiction are available for leasing (P.L. 91-581, Sec. 15(b)). This responsibility is further delegated to the Chief of the USDA—Forest Service and to Regional Foresters working under the Chief.

The Geothermal Steam Act authorizes the Secretary of the Interior to issue leases to develop and use geothermal resources on Federal lands. This includes conveyed to other owners by the United States subject to a mineral resource reserve.

The Bureau of Land Management within the Department of the Interior has jurisdiction over mineral and related subsurface resources on public lands. The Bureau role includes:

(1) Receiving and processing lease applications for non-competitive leases.

(2) Publishing lease sale notices for competitive bid lands.

(3) Awarding leases.

(4) Administering leases (except those functions assigned to the U.S. Geological Survey or Forest Service as outlined below).

The Conservation Division U.S. Geological Survey has expertise in geothermal geology and engineering, deep-well drilling and other technical aspects of geothermal development operations. Their role in the leasing program is:

(1) Supervising activity inside the area of operation on leased lands including enforcement of regulations covering all aspects of exploration, development and utilization.

(2) Preparing post-lease environmental studies on specific development proposals. The Forest Service or Bureau of Land Management provides input on surface management environmental considerations.

(3) Providing input on geothermal geology and geothermal operations for pre-lease environmental studies.

(4) Issuing Geothermal Resource Operational Orders.

(5) Concurring to special stipulations proposed (by the land managing agency) to mitigate or control situations peculiar to the lease area.

On National Forest land the Forest Service is responsible for:

(1) Preparing environmental assessments on suitability of National Forest lands for geothermal leasing purposes (Geological Survey provides input).

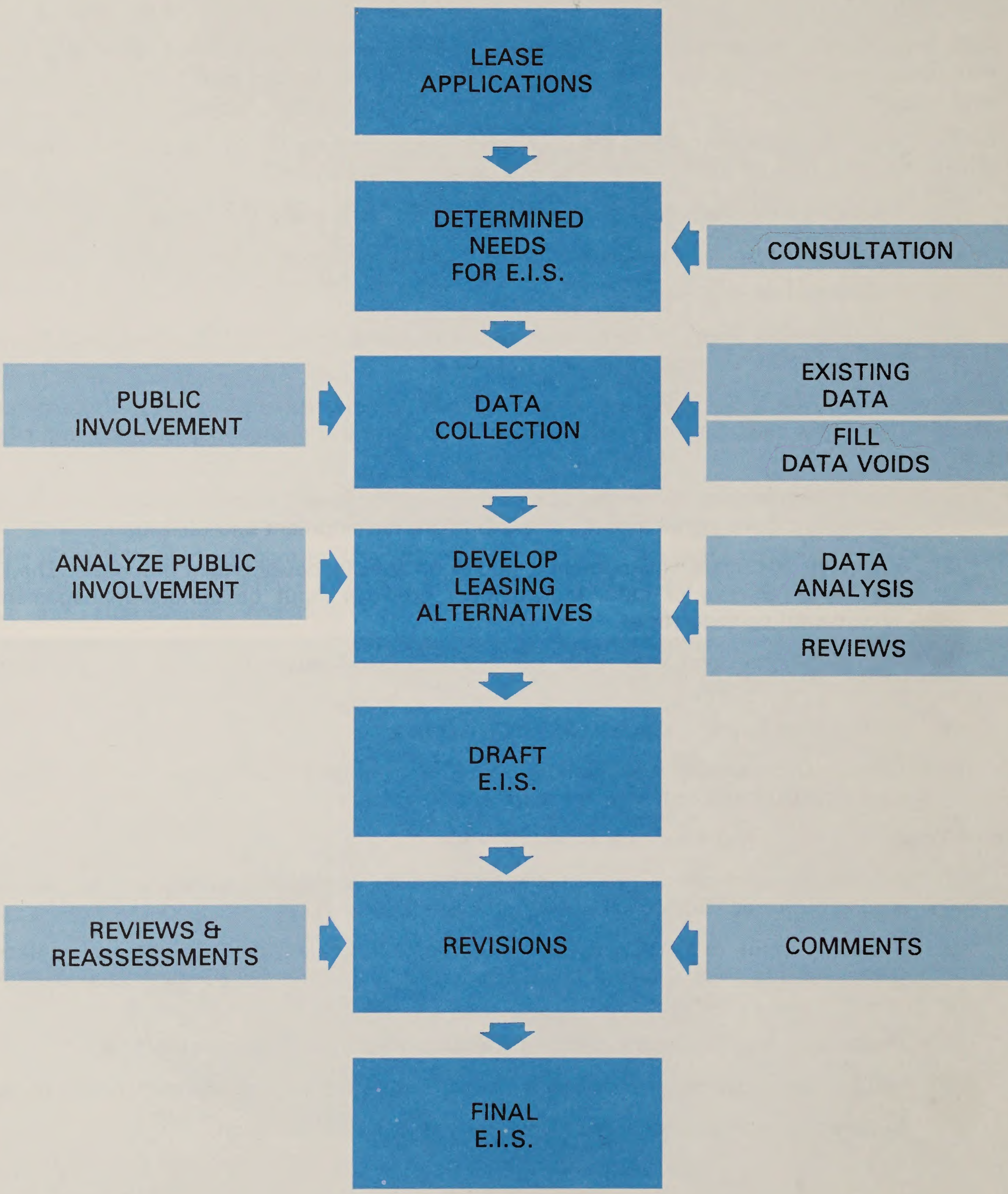
(2) Providing input to the Conservation Division, U.S. Geological Survey, on surface environmental considerations of post-lease environmental studies (Conservation Division has primary responsibility).

(3) Preparing lease stipulations covering special surface management problems.

(4) Issuing special use permits for occupancy of leased lands needed for development purposes.

(5) Supervising land uses on leased lands outside areas of operation.

FIGURE 1. ISLAND PARK GEOTHERMAL ENVIRONMENTAL IMPACT STATEMENT PROCESS



GENERAL DEVELOPMENT PROCEDURE

Lands determined leaseable by the Secretary of the Interior will probably be developed in the following manner. Following lease issuance and prior to deep-well drilling (generally over 500 feet), the lessee must submit a plan for test drilling. The Conservation Division U.S. Geological Survey then prepares an environmental study. If the test drilling establishes an economically developable resource, the lessee submits a plan for development. The Conservation Division, with Forest Service input, prepares an environmental study of the proposed plan. The U.S. Fish and Wildlife Service reviews acreage to be leased and determines specific requirements necessary to protect fish and wildlife values. Special stipulations to protect values peculiar to the area are made a part of the plan. Since development of a geothermal field is usually accomplished in stages, the initial development plan is normally expanded and amended many times during the life of the project. All such plans must be approved by both the Conservation Division and the surface managing agency. It if is found during test drilling or subsequent development or production phases that environmental standards cannot be met, the law and regulations enable the Geological Survey to suspend operations pending solution of the problems(s).

THE NATURE OF A GEOTHERMAL RESOURCE

Geothermal energy is derived from the natural heat of the earth. Observations in mines and wells indicate that temperatures increase with depth to between 390° F and 1,830° F at the base of the earth's crust. In some places on the earth's surface, the natural heat flow is much greater than other places. Areas with abnormally high heat flow are potentially valuable for geothermal resource development and are frequently marked by hot springs.

Natural earth heat originates from radioactive decay, from friction between rock strata, and perhaps from the molten origin of the earth. Under present technology most of this heat is too diffuse to serve as a resource. Locally, however, it has been concentrated in the crust by volcanic activity, forces that create mountains and move continents, and by water circulating above buried molten rock. This heat is stored in rocks, water, and steam. Water and steam transfer the heat through pores, fractures, and fissures.

Four types of geothermal systems are known to occur in nature: geopressured, hot water, vapor dominated and hot, dry rock. The hot water type is most probable in the IPGA. Hot water systems are thought to be thermally driven; that is, groundwater from rain and snow is heated by a local heat source and moves upward (figure 2). This upwelling of hot water often reaches the surface as hot springs, geysers, and other surface phenomena. Temperatures of the water may range from about 195°F to more than 300°F.

A well drilled into such a resource can serve as an escape route for the hot water which is likely to be under high pressure. This water and steam are transported by pipeline to a power plant where electricity is generated, or to an area where the heat in the steam and/or water is used for non-electrical application (e.g. space heating, drying, etc.).

Once cooled, the geothermal fluid is either discharged to the surface or reinjected. The duration of a geothermal operation depends on the rate heat is removed from the producing zone. It also depends on how the water bearing and water transmitting characteristics of the rock in the heated zone change through time.

The hot water and vapor dominated systems produce the hydrothermal phenomena in Yellowstone National Park. At least one hot spring system in the Park is vapor dominated. This type is rare. In such a system, a great supply of heat exists but very little water enters the heated rock. Consequently, the fractures and pores in the rock hold steam.

PHASES OF GEOTHERMAL ENERGY DEVELOPMENT

Four phases of geothermal development are:

(1) Exploration

(2) Test Drilling

(3) Construction and Development

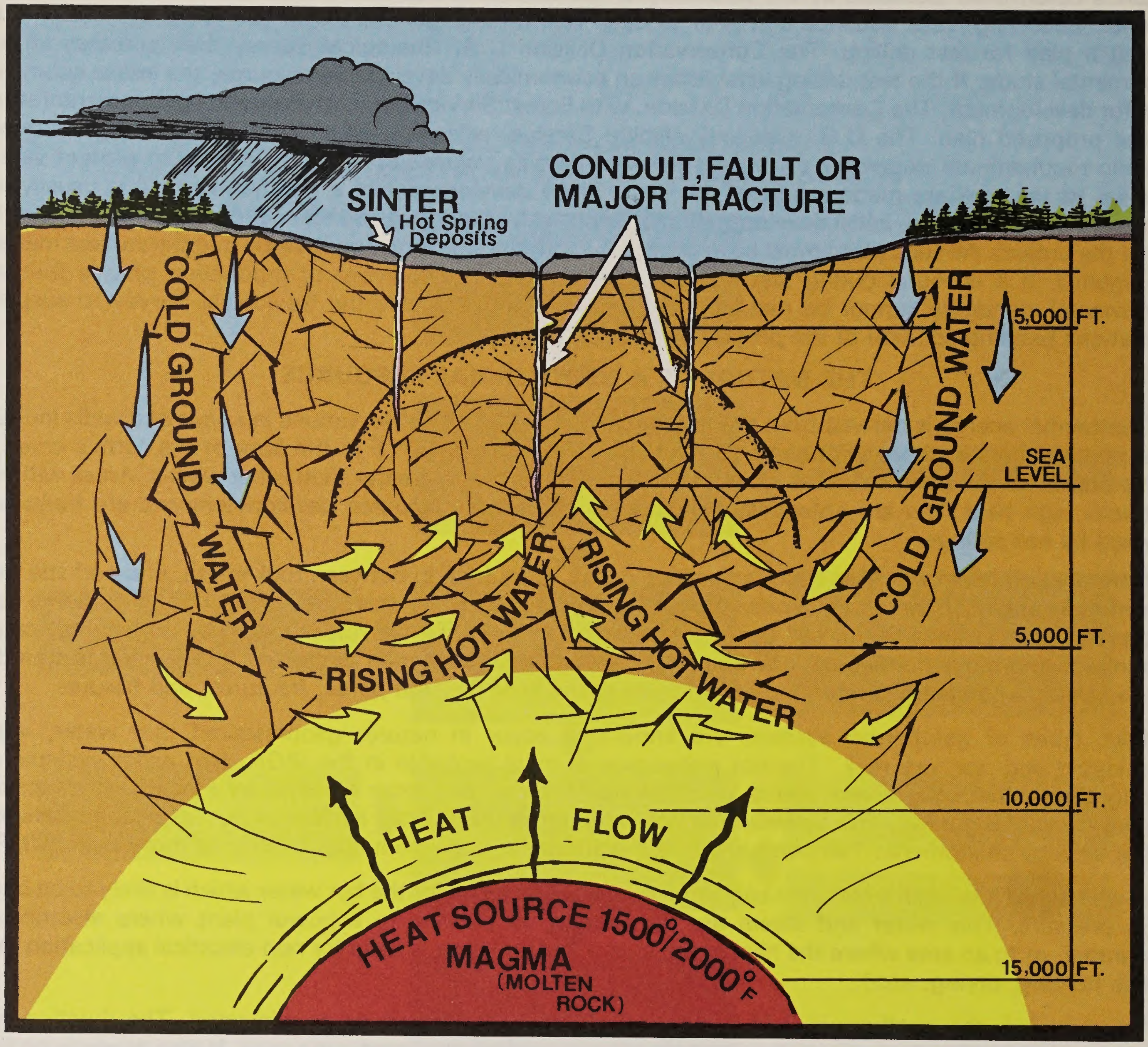
(4) Operation

Exploration

Exploration is done to locate and define the extent of geothermal reservoirs and determine the economical and financial feasibility of development. Exploratory operations may include aerial and surface surveys. Small fixed wing aircraft and helicopters make low level flights (one hundred to five hundred feet) for heat and magnetic sensing and initial reconnaisance of geological features. Flights above three thousand feet are made to conduct photograhic and magnetic sensing and geological visual reconnaisance surveys.

Surface exploration activities which use existing roads and trails are classified as either casual or intensive.

FIGURE 2. CROSS SECTION OF A GEOTHERMAL AREA



Source: Testimony for the Subcommittee on Water and Power Resources, Senate Committee on Interior and Insular Affairs, June 13, 1973.

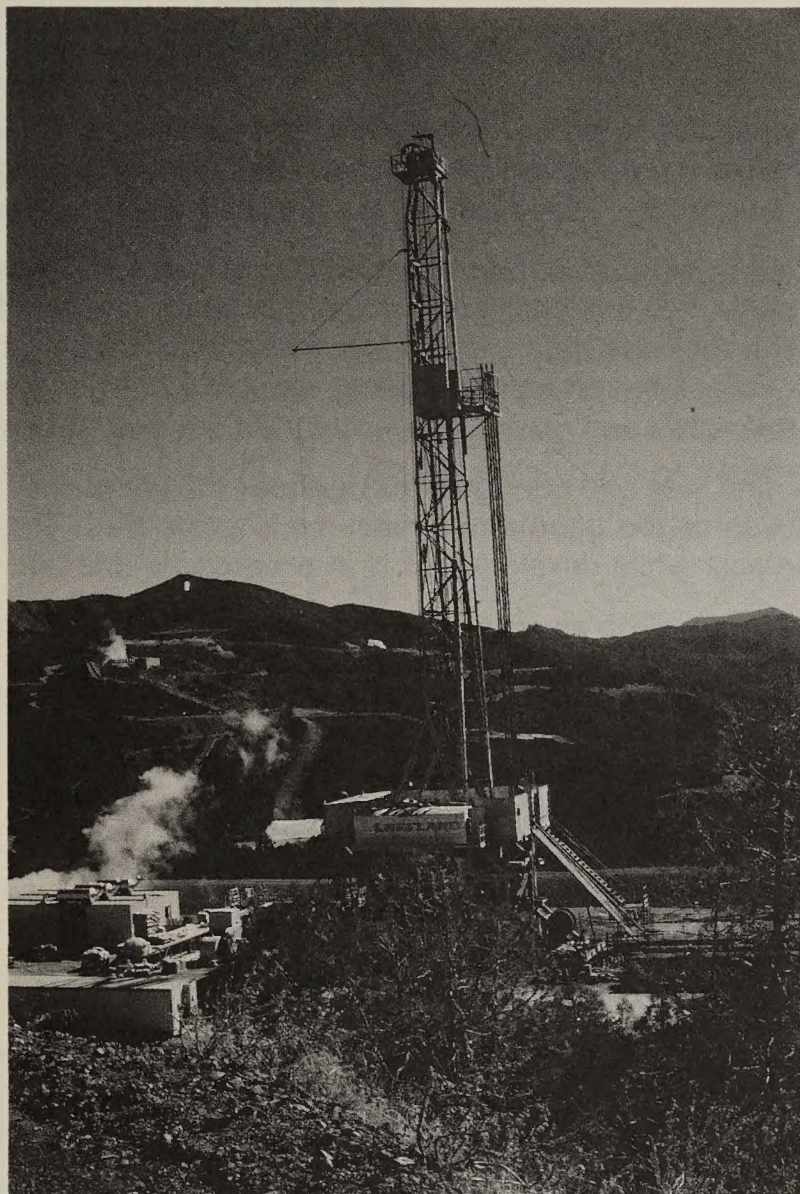
Casual exploration requires little land disturbance and may include geochemical surveys of water and vegetation, stratigraphic, lithological and structural geologic mapping, and micro-gas surveys where air samples are taken from various points. Other casual exploration activities include reconnaisance of surface features and natural phenomena without land disturbance, geophysical exploration including resistivity, microseismic, magnetic and gravity surveys and ground noise studies.

Intensive activities require minor land disturbances. This includes shallow well drilling for temperature gradient and heat flow measurement. Road construction and clearing are seldom required for access to these sites.

Test Drilling

Test wells are drilled to provide subsurface geologic data, locate productive zones, help delineate limits and provide a means for determining the physical and chemical properties of reservoir fluids. Locations for **test wells** are determined from data acquired during exploration.

Test drilling equipment often consists of a truck mounted drilling rig and truck mounted air compressor or water tank, depending on whether water or air is used in the drilling. In some cases a drill rig with a conventional superstructure is used. Drilling areas or pads generally require clearing or leveling of one half to two acres. Drilling rigs, mud pumps, mud tanks, generators, drill pipe stockpiles, toolsheds, etc., are usually on the drill pad. Storage tanks may be either on the pad or on another nearby site. A reserve pit (sump) six to



In the test drilling and construction and development phases, large drill rigs are used. These rigs usually drill to depths greater than 5,000 feet.

eight feet deep covering a surface area of approximately 1,000 to 10,000 square feet is often excavated to hold waste fluids produced during drilling operations.

The investment in each well is considerable. Recent wells (1977) cost an average of $100 per foot or $600,000 for a 6,000 foot well.

If promising wells are developed during the test drilling phase, production testing is conducted to clean them and to determine the flow rate, composition and temperature of fluids and gases, recharge characteristics, pressures, compressibility and other physical properties of reservoir fluids. Hydrodynamic properties and/or boundary characteristics are also determined during production testing. If a steam resource exists, venting of wells to the atmosphere is included in this process. Venting is done through a system of mufflers to prevent noise exceeding ambient levels at a distance of about one-half mile. Noises may be muffled even more effectively by venting under water. Production testing seldom extends beyond two or three days.

Construction and Development

Favorable results in test drilling and production testing programs generally lead to drilling of additional wells to develop a field. Field development requires improvement of access roads to standards suitable for full-time use. Living quarters, with the necessary water and sewage facilities, must be added during this phase, or must be available within commuting distance.

Development of a large geothermal field involves clearing and grading for access roads, well drilling pads, and pipelines. Well pads are from one-half to two acres. Between 5 and 25 wells are usually required to supply one power plant, depending on geothermal reservoir characteristics and individual wells. Pipeline clearings need only be wide enough to accommodate equipment needed for their construction and fire safety. It is not necessary to clear corridors wide enough to prevent trees from falling across the pipeline.

If the resource is developed for power, construction of facilities for generation and transmission of power follows an examination of the environmental effects including an analysis of available information on the geothermal reservoir and fluids. Power generation and transmission facilities are constructed in stages consistent with the capacity of the geothermal reservoir.

Above ground insulated pipes with U-shaped expansion loops are sometimes used to pipe steam or hot water from wells to power plants. Underground pipelines are possible but under present technology, because of pipe expansion and high costs, are impractical. Installation of underground pipes would increase pipeline costs by about 25%.

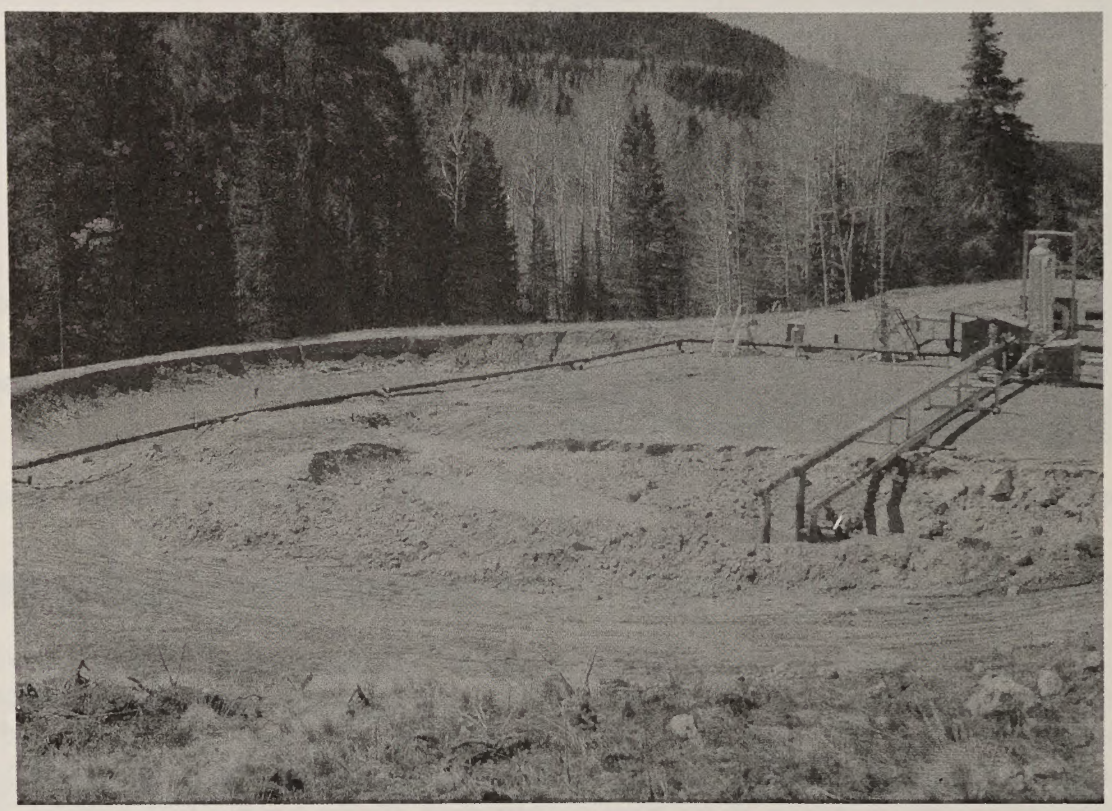
Operation

During the operation phase, maintenance of industrial plants, power plants, related facilities and the drilling, redrilling and workover of geothermal wells to maintain production takes place. Construction during the operation phase is reduced and allows much of the land in the leased area to be returned to other uses.

Throughout the life of the geothermal field, wells must be improved and maintained and new wells must be drilled to keep an adequate supply of steam or hot water flowing. Information is obtained on site and from regional geohydrology and hydrodynamics studies. This includes data such as rate and path of recharge and natural discharge of the geothermal reservoir. Prediction of the effects of scaling, extraction of geothermal fluids and estimates of reserves, optimum rates of production and resource conservation are also obtained.s

Site reclamation begins with the completion of the first well and continues throughout the life of the field. Wells, power plants, and other installations are removed as the geothermal resource is exhausted. Thus, in the same field reclamation may be under way in one part while development is in progress in another.

Complete reclamation includes removing all installations such as pipe, buildings, generators, and power transmission towers and lines. Wells are sealed; roads, well pads, and other clearings are regraded and revegetated.



KNOWN GEOTHERMAL RESOURCE AREA DEFINITION

A Known Geothermal Resource Area (KGRA) is a region in which the geology, nearby discoveries, competitive interests, of other indications would, in the opinion of the Secretary of the Interior, lead experts to believe the prospects for extracting geothermal steam or associated geothermal resources are good enough to warrant spending money for the purpose (Geothermal Steam Act of 1970). Lands administered by the U.S. Forest Service within the IPGA contain two KGRA's: the Yellowstone KGRA containing 42,400 acres and the Island Park KGRA with 28,350 acres. The Island Park KGRA was created from lease applications filed for the same section of land during a one-month period. Geothermal leases for areas within a KGRA are issued on a competitive bid basis. Lands outside KGRA's are leased non-competitively.

USES OF GEOTHERMAL RESOURCES

Among the possible uses of geothermal resources are generation of electric power, space heating, industrial processing, and some applications in agriculture. Figure 3 shows possible uses and the approximate required temperature of geothermal fluids or steam for each use.

The life of geothermal fields fully developed for economical conditions is generally believed to be 25 to 100 years. The Larderello Field in Italy, which is not fully developed, has operated since 1913, a period of 65 years.

FIGURE 3. THE REQUIRED TEMPERATURE OF GEOTHERMAL FLUIDS (APPROXIMATE)

Temperature °F	Temperature °C	Use
392	200	
374	190	
356	180	Evaporation of Highly Conc. Solutions Refrigeration by Ammonia Absorption Digestion in Paper Pulp, Kraft
338	170	Heavy Water via Hydrog. Sulfide Proc. Drying of Diatomaceous Earth.
320	160	Drying of Fish Meal Drying of Timber
302	150	Alumina via Bayers Process
284	140	Drying Farm Products at High Rates. Canning of food.
266	130	Evaporation in Sugar Refining. Extraction of Salts by Evaporation and Crystalization.
248	120	Fresh Water by Distillation. Most Multiple Effect Evaporations, Concentr. of Saline Sol.
230	110	Refrigeration by Medium Temperatures. Drying and Curing of Light Aggreg. cement Slabs.
212	100	Drying of Organic Materials, Seaweed, Grass, Vegetables, etc. Washing and Drying of Wool.
194	90	Drying of Stock Fish. Intensive De-Icing Operations.
176	80	Space Heating. Greenhouses by Space Heating.
158	70	Refrigeration by Low Temperature.
140	60	Animal Husbandry. Greenhouses by Combined Space and Hotbed Heating.
122	50	Mushroom Growing. Balneological Baths.
104	40	Soil Warming.
86	30	Swimming Pools, Biodegradation, Fermentation. Warm water for year around Mining in Cold Climates. De-Icing.
68	20	Hatching of Fish, Fish Farming.

Saturated Steam

Water

Temp. Range of Conventional Power Production

Source: **Geothermal Development**, final environmental statement for the Breitenbush Area of the Willamette and Mt. Hood National Forests, Oregon, Jan., 1978, p. 14.

II. AFFECTED ENVIRONMENT

PHYSIOGRAPHY

A major part of the IPGA is the Island Park caldera, a large volcanic feature located between the Eastern Snake River Plain and the Yellowstone volcanic plateau of Yellowstone National Park. Prominent topographic features include the western rim of the caldera, scattered volcanic buttes, and extensive volcanic flows that moved westward from Yellowstone National Park.

North and northeast of the caldera the Continental Divide separates Idaho and Montana and divides the headwaters of the Columbia and Missouri Rivers. Henrys Fork of the Snake River flows to the Columbia River which moves westward to the Pacific Ocean. The South Fork of the Madison River flows to the Missouri, a tributary of the Mississippi River, which empties into the Gulf of Mexico.

Elevations range from 8,386 feet on the Continental Divide to 5,160 feet near Ashton, Idaho. Extensive flat areas occur in Henrys Lake Flat, in the interior of the caldera, and at Antelope Flat on the west side of the IPGA (Map 1).

LANDTYPES AND SOILS

Influences of geologic history and processes on the various rock and earth materials in the IPGA have produced a variety of landtypes (map 2). The prominent topographic features are the result of the volcanic and pre-volcanic mountain building aspects of the region's history. Scarps, canyons, and elevated plateaus border the highlands. Erosion in the uplands brings materials down to the broad open area at lower elevations, especially around Henrys Lake. Winds blow materials into the caldera bottom; no surface water network is found in this area. Map 2 shows the landtype associations in the IPGA and Table 1 displays the characteristics of each landtype and its soils.

Within the IPGA, soils have been derived from the products of weathering of rock and from materials brought by wind, water and glaciers.

Depth of soil depends on steepness of slopes and varies from 10 inches to tens of feet deep. In most locations, fractured bedrock lies beneath the soil at a depth of more than 40 inches.

Soil textures vary due to differences in parent materials and climate. Coarse-loamy, fine loamy, and loamy skeletal are prevalent. Except for deep accumulations of loess (wind blown) soils, most soils contain cobble and gravel sized materials. Generally the soils have good porosity and permeability.

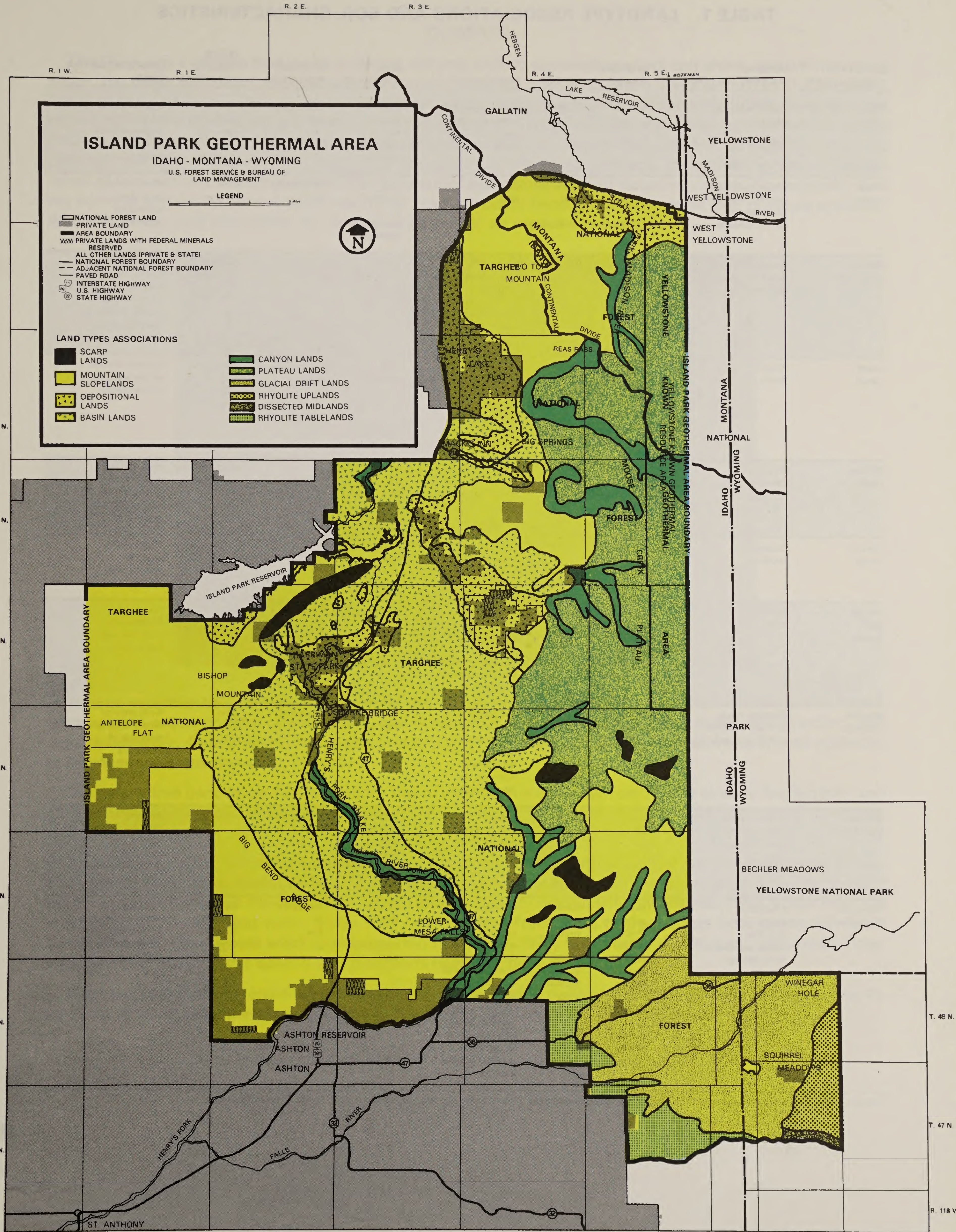

ISLAND PARK GEOTHERMAL AREA
IDAHO - MONTANA - WYOMING
U.S. FOREST SERVICE & BUREAU OF LAND MANAGEMENT
LEGEND
NATIONAL FOREST LAND
PRIVATE LAND
AREA BOUNDARY
PRIVATE LANDS WITH FEDERAL MINERALS RESERVED
ALL OTHER LANDS (PRIVATE & STATE)
NATIONAL FOREST BOUNDARY
ADJACENT NATIONAL FOREST BOUNDARY
PAVED ROAD
INTERSTATE HIGHWAY
U.S. HIGHWAY
STATE HIGHWAY
N
LAND TYPES ASSOCIATIONS
SCARP LANDS
MOUNTAIN SLOPELANDS
DEPOSITIONAL LANDS
BASIN LANDS
CANYON LANDS
PLATEAU LANDS
GLACIAL DRIFT LANDS
RHYOLITE UPLANDS
DISSECTED MIDLANDS
RHYOLITE TABLELANDS
R. 1 W.
R. 1 E.
R. 2 E.
R. 3 E.
R. 4 E.
R. 5 E.
BOZEMAN
HEBGEN
LAKE
RESERVOIR
GALLATIN
CONTINENTAL
DIVIDE
YELLOWSTONE
MADISON
WEST YELLOWSTONE
RIVER
WEST YELLOWSTONE
MONTANA
TARGHEE
MOUNTAIN
NATIONAL
FOREST
REAS PASS
HENRY'S LAKE FLAT
NATIONAL
MACKS INN
BIG SPRINGS
YELLOWSTONE
YELLOWSTONE KNOWN GEOTHERMAL RESOURCE AREA
ISLAND PARK GEOTHERMAL AREA BOUNDARY
MONTANA
NATIONAL
IDAHO
WYOMING
MOOSE
FOREST
CREEK
PLATEAU
AREA
T. 14 N.
T. 13 N.
T. 12 N.
T. 11 N.
T. 10 N.
T. 9 N.
T. 8 N.
ISLAND PARK RESERVOIR
TARGHEE
ISLAND PARK GEOTHERMAL AREA BOUNDARY
BISHOP
MOUNTAIN
TARGHEE
STATE PARK
OSBORNE BRIDGE
ANTELOPE FLAT
NATIONAL
PARK
IDAHO
WYOMING
HENRY'S FORK SNAKE RIVER
BIG BEND RIDGE
NATIONAL
FOREST
LOWER MESA FALLS
BECHLER MEADOWS
YELLOWSTONE NATIONAL PARK
WINEGAR HOLE
FOREST
SQUIRREL MEADOWS
T. 48 N.
T. 47 N.
R. 118 W.
ASHTON RESERVOIR
ASHTON
ASHTON
HENRY'S FORK
RIVER
FALLS
ST. ANTHONY
R. 40 E.
R. 41 E.
R. 42 E.
R. 43 E.
R. 44 E.
R. 45 E.
R. 46 E.
R. 119 W.

TABLE 1. LANDTYPE ASSOCIATIONS AND SOIL CHARACTERISTICS

LANDTYPE ASSOCIATION	GEOLOGY (PARENT MATERIAL)	% SLOPE GRADE	ASPECT	VEGETATION	SOIL DRAINAGE	EROSION POTENTIAL	SLOPE FAILURE POTENTIAL	LIMITATIONS FOR USES
Depositional Lands	Glacial outwash, alluvium	0 to 10	South	Sage, grasses, some drought resistant forbs	Well drained to excessively drained	Moderately low	Low to moderately low	High potential for pollution of groundwater from septic systems
Basin Lands	Glacial outwash (around Henrys Lake) basalt (in the caldera)	0 to — 15	Nearly level to southerly	Lodgepole pine	Well drained to excessively drained	Moderately low	Low	Much bedrock at or near surface (in caldera)
Mountain Slope Lands	Basalt, rhyolite flows and welded tuffs, sedimentary units	0 to > 65	All	Lodgepole pine, aspen, Douglas fir, choke-cherry, service-berry, mountain ash, grasses and forbs	Well drained to excessively drained	Moderate	Moderately low to low	Slumping of soils due to increased pore water pressures (in sedimentary rocks); erosion on steep igneous slopes
Scarp Lands	Rhyolite flows	45 to 65	South to south-west	Grasses, forbs, low shrubs to conifers and stunted aspen where soil and moisture support these	Well drained	Moderately high	Moderately low	Erosion of soils where water is concentrated
Plateau Lands	Rhyolite flows	25 to > 65	South to west	Subalpine fir, grouse whortle-berry, lodgepole pine	Well drained to excess-ively drained	Moderate	Moderately low to low	Potential for pollution of distant or nearby springs; septic system
Canyon Lands	Volcanic rocks	25 to > 65	All	Lodgepole pine, grouse whortle-berry, pine grass	Excess-ively to well drained	Moderate	Moderately low	Steep slopes preclude various uses
Glacial Drift Lands	Glacial drift	5 to 30	All	Lodgepole pine, Douglas fir, aspen (below 7000 ft.) Engelmann spruce, white-bark pine, subalpine fir	Moderately to well drained	Low to moderately low	Low	Localized flooding and seasonal high water table
Rhyolite Uplands	Rhyolite flows and some glacial drift in drainage	10 to 45	All	Lodgepole pine, huckleberry and pine grass; Douglas fir and subalpine fir common on steeper slopes	Well drained	Moderate	Low	Soils erosive where unusual amounts of water are concentrated
Rhyolite Tablelands	Rhyolite with loess mantle; some glacial drift	3 to 30	West	Lodgepole pine, various ground cover	Moderately well to well drained	Moderate	Low	Ponding of water troublesome where road drainage is poor; slick when wet, ruts easily
Dissected Midlands	Rhyolite, glacial drift and silty eolian deposits on north facing slopes	North aspects: >50% south aspects convex slopes, very steep to to gentle slopes	North and south for slopes; all for bottom-lands	Complex pattern tied closely to slope aspect and landform: dense conifer stands on north canyon slopes; brush and open timber on south aspects; grass-forb-sub alpine fir parklands on faceted west aspects	Well drained to moderately well	Moderate to low	Low in bottom-lands, high on slopes	Localized, seasonal flooding in bottomlands; slope stability problems

Source: Island Park Land Management Plan, July 1978; West Slope of the Tetons Land Use Plan, unpublished U.S. Forest Service documents

CLIMATE

The IPGA has a climate that is wet in spring, fall and winter; summers are cool and short, and winters bring snow, the major portion of the annual precipitation. Westerly prevailing winds are governed by the opposing Aleutian low and Pacific high pressure systems. In winter, moisture laden southwesterly winds move into the region due to the controlling influence of the Aleutian low. The mountains and other high elevations in the IPGA cause moisture in the air masses to fall as snow. As summer approaches, the Pacific high becomes the primary controller of the weather, reducing the intensity of the winter process. In summer, increased occurrence of convective cell storms sometimes generates high intensity, short duration storms. Occasionally during summer and winter, a reversal of normal air flow can occur because of continental high pressure systems. At these times, cold dry winter air, or hot, dry summer air moves westward.

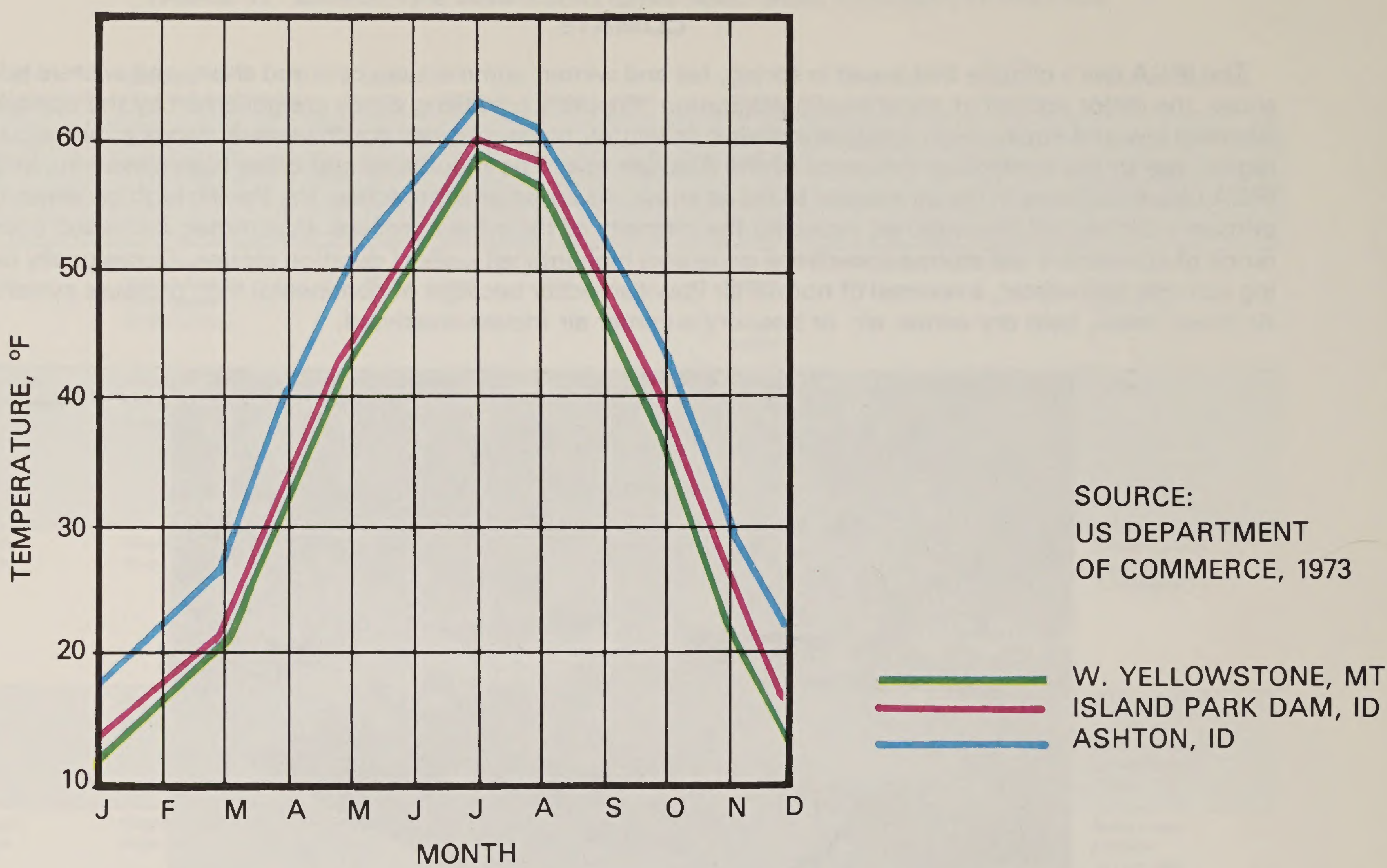
Various weather data are collected within the IPGA. Weather conditions studied include precipitation (snow depth, water content of snow, rain, and duration of rain), temperature, wind speed and direction, and relative humidity. Annual temperature and precipitation changes are shown in Figures 4 and 5; data collected at snow courses are shown in Table 2.

The freeze-free periods for Ashton and for Island Park Dam are 90 days (early June to early September) and 45 days (early July to mid August), respectively. At the higher elevations in the IPGA a frost can occur at any time.

The Forest Service measures wind speed and direction at the Buffalo Ranger Station from June to October. From July-September, 1974-1977, the prevailing winds came from the southwest. The second and third most common wind directions were south and southeast, respectively. Winds also have blown from the northwest, north, east and west. Since 1967, wind speeds from June to September have commonly been below 10 mph. The highest wind speed reported from 1967-1977, taken around 2:00 p.m., Mountain Time, was 29 mph. Winter wind speeds and directions have not been studied.

The topography of the region around the Idaho and Wyoming parts of the IPGA does not allow thermal inversions to form; inversions are common in the winter months in the W. Yellowstone vicinity.

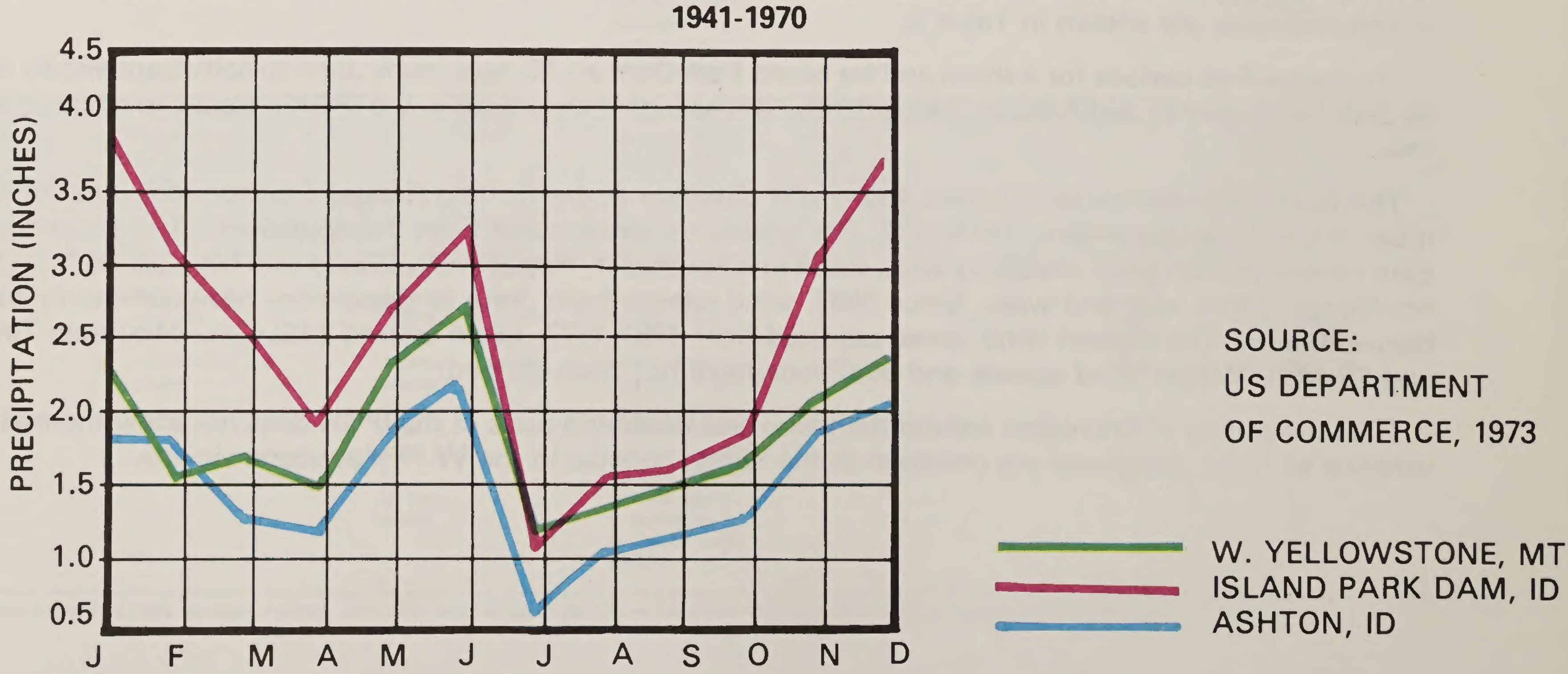
FIGURE 4. MEAN MONTHLY TEMPERATURES FOR ISLAND PARK GEOTHERMAL AREA, 1941-1970



MEAN ANNUAL TEMPERATURE (°F)

LOCATION	ELEVATION (FEET)	TEMPERATURE
W. YELLOWSTONE, MT	6662	34.9
ISLAND PARK, ID	6300	36.5
ASHTON, ID	5220	41.0

FIGURE 5. MEAN MONTHLY PRECIPITATION FOR ISLAND PARK GEOTHERMAL AREA 1941-1970



MEAN ANNUAL PRECIPITATION (INCHES)

LOCATION	ELEVATION (FEET)	AMOUNT
W. YELLOWSTONE, MT	6662	22.67
ISLAND PARK DAM, ID	6300	30.84
ASHTON, ID	5220	18.27

TABLE 2. SNOW COURSE DATA FROM THE ISLAND PARK GEOTHERMAL AREA (IPGA) (INCHES)

(sd = snow depth, we = water equivalent[1], por = period of record)

Snow Course		January 1			February 1			March 1			April 1			May 1			June 1		
		sd	we	por	sd	we	por	sd	we	por	sd	we	por	sd	we	por	sd	we	por
Black Bear, MT[2]	min:	20	3.7	'73 to	33	8.1	'73 to	38	9.9	'72 to	57	17.5	'72 to	17	7.7	'72 to	48	3.4	'72 to
elev. 7,950 ft.	max:	86	24.9	'77	122	40.9	'77	126	48.2	'77	165	66.8	'77	137	66.6	'77	102	58.7	'77
Island Park, ID[3]	min:	11	1.0	'38 to	24	3.7	'38 to	30	7.6	'38 to	29	8.5	'38 to	9	2.9	'43, & '49			
elev. 6,315 ft.	max:	58	11.6	'73	73	19.7	'73	75	26.4	'73	83	30.7	'73	47	18.4	'63 to '73			
Latham Spring, ID[4]	min:	25	6.3	'63 to	63	18.6	'62 '64	55	15.6	'61 '63	59	20.6	'61 to	82	34.2	'67 '72			
elev. 7,650 ft.	max:	42	8.4	'64	104	34.4	'66 to '73	107	41.4	to '73	116	46.6	'73	107	44.2	to '73			

[1] Water content varies with the density of the snow

[2] Near Continental Divide and border of Yellowstone National Park

[3] Near mouth of the Buffalo River; see map 5

[4] Slightly northeast of Buffalo Ranger Station and roughly 2½ miles west of Yellowstone Park border; see map 5

Source: Soil Conservation Service, U.S. Department of Agriculture

AIR QUALITY

The sparsely populated and non-industrialized IPGA has high air quality. Sources of air pollutants include:

Natural Pollutants

— Forest fires
— Pollen
— Wind blown dust

Man Caused Air Pollution

— Forest fires
— Wood burning stoves
— Auto emissions
— Burning of forest debris (slash)
— Road dust
— Dust from farming operations outside the IPGA

No natural venting of gases, often associated with hydrothermal phenomena, is known to occur anywhere in the IPGA. Human activities that cause air pollution do not occur simultaneously or continuously. Auto emissions are greatest when traffic from tourists and recreationists peaks in the summer; slash burning occurs in the fall, and wood is burned in fall, winter and spring for domestic heating. Because of this, pollutants vary in chemical and physical nature during the year.

Air quality in the IPGA was sampled in October 1977 and in late June and early July, 1978. The sampling and some of the analyses was done by the Conservation Division of the US Geological Survey. The results are:

	1977 (Oct. 7-12; 4 stations)	1978 (June 30, July 1-5; 6 stations)
H_2S	Not detected	Not detected
SO_2	Not detected	25 to 26.4 ug/m^3
NO_x	Not detected	below detection limit to 108 ug/m^3
NH_3	Not detected to 0.028 ppm	7.9 to 135 ug/m^3
suspended particulates	4.74 to 63.0 ug/m^3	21.7 to 685 ug/m^3

Road dust accounts for the greatest percentage of the total suspended particulates (83 to 96%), followed by pollen (4 to 15%), and soot (0 to 7%).

Idaho and Federal air quality standards were not exceeded anywhere in the 1977 survey, although the same standards were exceeded in 1978 for particulates at a few stations affected by road dust.

The US Environmental Protection Agency has placed the IPGA and adjoining areas into the following clean air classes:

Area	Class	General Constraints
Yellowstone National Park	I	Only minor air quality deterioration tolerated*
Upper Snake River Valley and IPGA	II	Moderate air quality deterioration tolerated

*Air quality in certain locations may be below Class I standards. For example, excessive H_2S and possibly SO_2 may be evident in the air near Mammoth and other geyser basins.

GEOLOGY

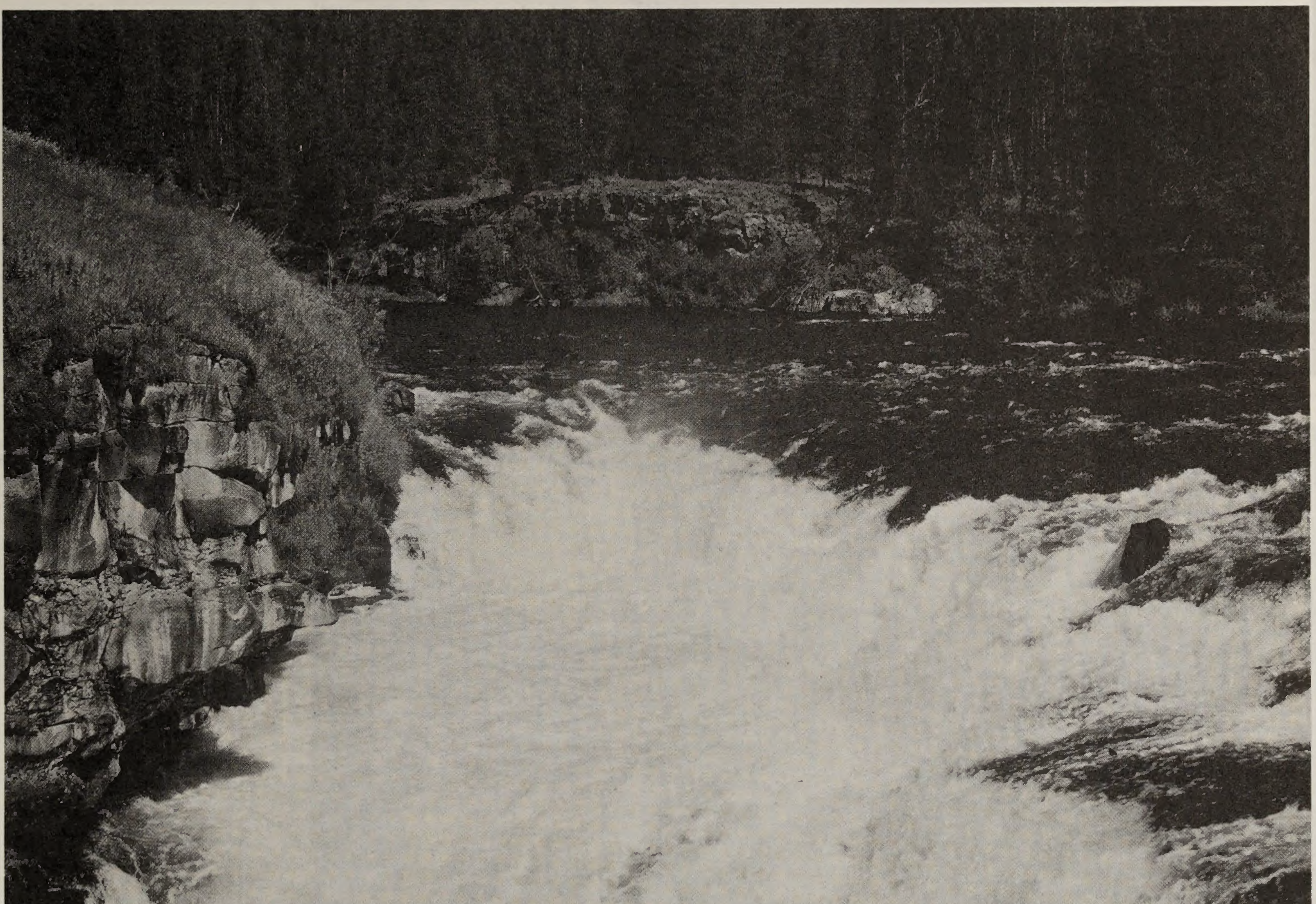
The geologic history of the IPGA is dominated by widespread volcanic activity, although sedimentary and metamorphic rocks are also found. Water, gravity, wind, and glaciers have acted on the geologic units and on the products of rock disintegration. While water and gravity reworked and redistributed materials already in the IPGA, wind and glaciers brought foreign earth materials into the IPGA.

Geologic History

According to a geologic history summarized by Whitehead (1978), the upper Henrys Fork basin is at the eastern end of the Snake River Plain, a downwarped feature extending in an arc across southern Idaho and into Wyoming. The plain cuts across preexisting Mesozoic and Cenozoic structures at nearly right angles. The pre-Cenozoic rocks underlying and bordering the plain are comprised of igneous, metamorphic, and sedimentary rocks. As the plain was being downwarped, volcanism and sedimentation filled it with basalt, rhyolite, and sedimentary deposits.

A large shield volcano formed in the south central part of the IPGA and later collapsed to form the Island Park caldera. The elliptical collapse structure covers an area approximately 18 by 23 miles. The western and southern rims of this feature are clearly visible as a semicircular arc formed by Thurmon Ridge and Big Bend Ridge (Map 1).

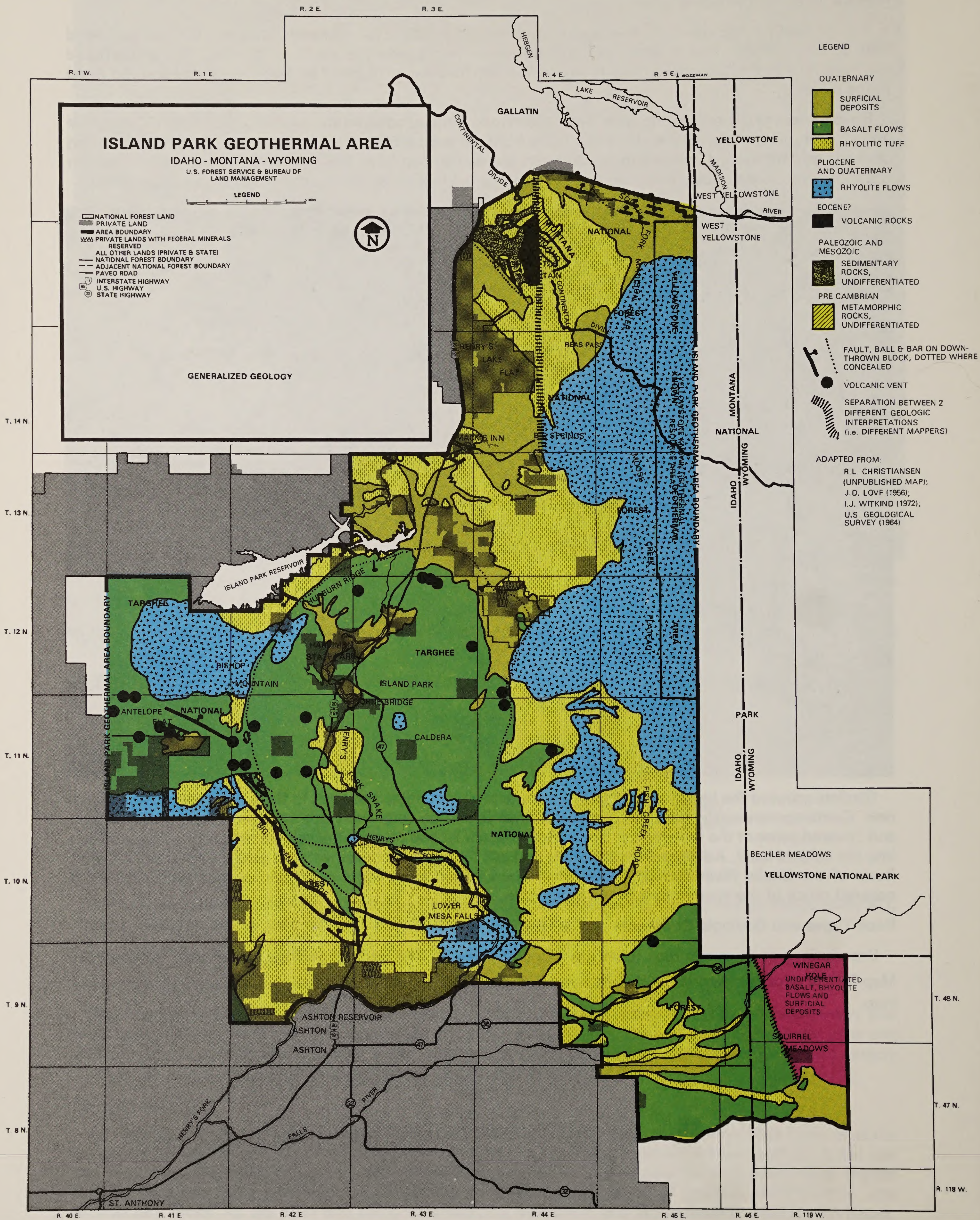
Rhyolitic ash flows originating from the Yellowstone Plateau covered the eastern part of the IPGA before and after eruption of rhyolitic and basaltic flows from the pre-caldera shield volcano. The flows that occurred after the caldera formed covered the eastern rim and overlapped flows from the collapsed volcano. At about the same time, basalt flows occurred southeast of the caldera along the southern part of the study area.



Glaciers scoured the highlands in late Pleistocene time, providing outwash to the valleys and stream channels. Contemporaneously, basalt of the Snake River Group flowed from vents south and west of the caldera and covered some of the rhyolitic ash flows. Some basalt lapped up onto the caldera rim and may have spilled into the caldera itself. Additional rhyolitic lava and ash flows were coeval with the glacial deposits and basalt flows of the Snake River Group. These latest flows issued from vents north and east of the caldera and covered much of the eastern part of the study area.

Rock Types and Geologic Structures

Descriptions of the major rock types are found in Table 3. The general geology of the area is shown on Map 3. The geologic reports used in its compilation provide much more detail than the units shown on the map.


ISLAND PARK GEOTHERMAL AREA
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GENERALIZED GEOLOGY
LEGEND
QUATERNARY
SURFICIAL DEPOSITS
BASALT FLOWS
RHYOLITIC TUFF
PLIOCENE AND QUATERNARY
RHYOLITE FLOWS
EOCENE?
VOLCANIC ROCKS
PALEOZOIC AND MESOZOIC
SEDIMENTARY ROCKS, UNDIFFERENTIATED
PRE CAMBRIAN
METAMORPHIC ROCKS, UNDIFFERENTIATED
FAULT, BALL & BAR ON DOWN-THROWN BLOCK; DOTTED WHERE CONCEALED
VOLCANIC VENT
SEPARATION BETWEEN 2 DIFFERENT GEOLOGIC INTERPRETATIONS (i.e. DIFFERENT MAPPERS)
ADAPTED FROM:
R.L. CHRISTIANSEN (UNPUBLISHED MAP);
J.D. LOVE (1956);
I.J. WITKIND (1972);
U.S. GEOLOGICAL SURVEY (1964)
R. 1 W.
R. 1 E.
R. 2 E.
R. 3 E.
R. 4 E.
R. 5 E.
HEBGEN
LAKE
RESERVOIR
GALLATIN
CONTINENTAL
DIVIDE
YELLOWSTONE
MADISON
WEST YELLOWSTONE
RIVER
WEST YELLOWSTONE
NATIONAL
FOREST
HENRY'S LAKE FLAT
RAYS PASS
NATIONAL
MACKS INN
BIG SPRINGS
ISLAND PARK GEOTHERMAL AREA BOUNDARY
MONTANA
IDAHO
WYOMING
NATIONAL
FOREST
MOOSE
CREEK
PLATEAU
AREA
ISLAND PARK RESERVOIR
TARGHEE
BISHOP
MOUNTAIN
ANTELOPE FLAT
NATIONAL
TARGHEE
ISLAND PARK
CALDERA
HENRY'S
FORK
SNAKE
PARK
IDAHO
WYOMING
NATIONAL
FISH
CREEK
ROAD
BIG
BENT
FOREST
LOWER MESA FALLS
BECHLER MEADOWS
YELLOWSTONE NATIONAL PARK
WINEGAR HOLE
UNDIFFERENTIATED BASALT, RHYOLITE FLOWS AND SURFICIAL DEPOSITS
SQUIRREL MEADOWS
FOREST
ASHTON RESERVOIR
ASHTON
ASHTON
HENRY'S FORK
RIVER
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T. 14 N.
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T. 10 N.
T. 9 N.
T. 8 N.
T. 48 N.
T. 47 N.
R. 118 W.
R. 40 E.
R. 41 E.
R. 42 E.
R. 43 E.
R. 44 E.
R. 45 E.
R. 46 E.
R. 119 W.

TABLE 3. ROCK UNITS IN THE ISLAND PARK GEOTHERMAL AREA

ERA	PERIOD	EPOCH	ROCK UNIT	DESCRIPTION
Cenozoic	Quaternary	Holocene	Alluvium	Alluvium, colluvium, landslide and glacial materials; primarily unconsolidated silt, sand and gravel.
		Holocene and Pleistocene	Plateau Rhyolite	Rhyolitic ash-flow tuff, light gray, dense, lithoidal, fine grained to aphanitic; angular to round phenocrysts of quartz, sanidine, clinopyroxene, orthopyroxene, fayalite, and sphene make up about 25% of rock volume.
			Basalt	Composed of basalt of the Snake River Group, older basalt of Island Park caldera fill, and basalt south and southeast of Henrys Fork near Ashton. The flows consist chiefly of olivine basalt. Generally, the flows of the older basalt are of the pahoehoe type, whereas those of the Snake River Group consist of both aa and pahoehoe types.
			Yellowstone Group	Rhyolitic ash-flow tuff; consists of three formations similar in mineral content and chemical composition. Phenocrysts of quartz, sanidine, and oligoclase are common, some phenocrysts of clinopyroxene, fayalite, hornblende, chevkinite, allanite(?), apatite, and zircon. The formations are Lava Creek Tuff, Mesa Falls Tuff, and Huckleberry Ridge Tuff.
	Tertiary	Pliocene	Snake River Butte Rhyolite	Crystalline rhyolite, locally preserved glassy outer zone, somewhat hydrothermally altered; quartz, sanadine, plagioclase, and clinopyroxene present.
Cenozoic and Pre-Cenozoic	Pre-Quaternary	Pre-Pleistocene	Undifferentiated Rocks	Undifferentiated igneous, sedimentary, and metomorphic rocks. Includes igneous volcanic rocks of Tertiary age comprising about two 15-square mile areas, one roughly centered on Sawtell Peak, and the other from Mount Two Top south toward Reas Pass. Sedimentary and metamorphic rocks of pre-Tertiary age are exposed along the Continental Divide. The sedimentary and metamorphic rocks consist chiefly of limestone, dolomite, sandstone, siltstone, and quartzose sandstone.

Source: Whitehead, R.L., 1978; Pacific Northwest River Basins Commission, 1970; Christiansen, R., personal communication, 1978.

The subsurface distribution of geologic units is defined in a general way and only for parts of the IPGA because data are lacking. The thickness of the alluvium is better defined than that of other geologic units because drillers' logs are the chief source of subsurface information and most wells were drilled near stream channels in alluvial deposits.

A gravity survey by Peterson and Witkind (1975) indicates that the alluvial fill in the elongate valley of Henrys Lake is 3,600 feet or more thick. The fill is derived from volcanic and sedimentary rocks from adjacent highlands (map 3). It is thickest near the southern end of Henrys Lake and thins toward the edges of the valley. In the southern end of the valley near Big Springs, the alluvium is less than 100 feet thick, and at many places, only a few feet thick.

The eastern part of the basin and the Island Park caldera, which are partly covered by Plateau Rhyolite, were described in detail by Hamilton (1960 and 1965). In the Last Chance-Osborne Bridge area, the alluvial deposits are generally less than 100 feet thick and thin rapidly toward the south.

Normal faults found in the IPGA are shown on Map 3. The faults associated with the land collapse that created the caldera are superimposed on fault blocks which trend north to northwest. These blocks are bounded by normal and vertical faults. The Island Park area is flanked on the north and east by the very active intermountain seismic belt; however, Island Park itself is conspicuous by its lack of seismicity.

Economic Geology

The IPGA is not known for its mineral wealth or mineral production. Mineral commodities are limited to materials that are low in unit value. The absence of valuable ore deposits is a result of the recent volcanic activity.

Crushed rhyolite and basalt are used as road metal and aggregate; rhyolitic cinders are also used but are inferior to non-cinder basalt. Basalt is also used for building purposes (the facing of homes, chimneys, patio walks).

A deposit of pumicite is located in the Montana part of the IPGA. This light colored, finely divided volcanic ash or dust is most commonly added as an abrasive to hand soaps and household cleansers. Pumicite, in the past, was extracted from the Montana site and sold in small amounts as a polishing agent. The site is now inactive.

Some sand and gravel deposits are located on the Idaho and Wyoming parts of the IPGA, while the Montana section has limited quantities. These glacial and alluvial materials are used as aggregate for concrete and for subbase in road construction.

Variscite, a semiprecious mineral, occurs in sedimentary rocks near Mount Two Top at the north end of the Idaho part of the IPGA (see Map 1). This mineral slightly resembles turquoise and can be used in jewelry.

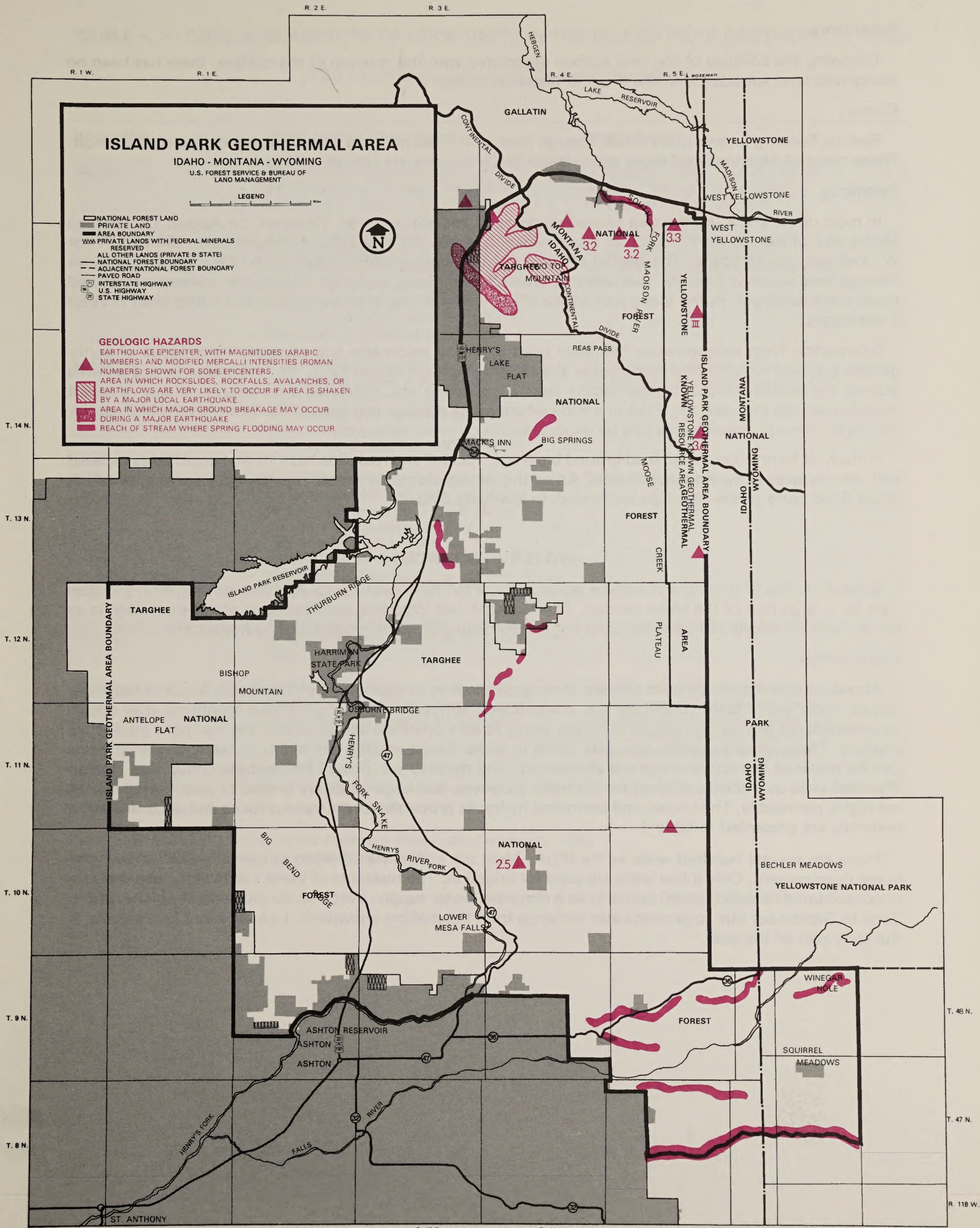
The IPGA is near the Willard overthrust belt, a geologic province with great oil and gas potential. Discoveries have been made in the overthrust belt in northern Utah and southwestern Wyoming. Oil and gas may be in Idaho as well, but the potential in and near the IPGA is unknown since no drilling has been undertaken.

The geothermal potential of the IPGA is unknown at present. Existing data are inadequate to predict areas of high geothermal potential. A hot geothermal system similar to that in Yellowstone National Park is not likely because no major silicic body now underlies the IPGA, as is the case for Yellowstone National Park. It is important to consider, however, that a lower temperature geothermal resource might exist at moderate depth. Thus, the exact nature of a geothermal system, if present, will probably not be known until a geothermal exploration and drilling program has been completed.

GEOLOGIC HAZARDS

Avalanches, Land and Earthslides

The potential for landslides, earthquakes and snow avalanches exists in the rugged mountains around Henrys Lake. The variety of sedimentary rocks, faults, the relative positions of rock units, and the erosion patterns could trigger some form of rock or earth failure. Abundant moisture from spring snowmelt can lessen stresses between soil and rock and between rock types resulting in an earth or rockslide. A major earthquake could have disastrous effects on loose and unstable slopes in these mountains. Map 4 indicates the area with the highest potential for these hazards. Elsewhere in the IPGA the possibility of these hazards is low to nonexistent.



ISLAND PARK GEOTHERMAL AREA
IDAHO - MONTANA - WYOMING
U.S. FOREST SERVICE & BUREAU OF LANO MANAGEMENT
LEGEND
NATIONAL FOREST LANO
PRIVATE LAND
AREA BOUNDARY
PRIVATE LANOS WITH FEOERAL MINERALS RESERVED
ALL OTHER LANOS (PRIVATE & STATE)
NATIONAL FOREST BOUNOARY
AOJACENT NATIONAL FOREST BOUNOARY
PAVEO ROAD
INTERSTATE HIGHWAY
U.S. HIGHWAY
STATE HIGHWAY
GEOLOGIC HAZARDS
EARTHOUAKE EPICENTER, WITH MAGNITUDES (ARABIC NUMBERS) AND MODIFIED MERCALLI INTENSITIES (ROMAN NUMBERS) SHOWN FOR SOME EPICENTERS.
AREA IN WHICH ROCKSLIDES, ROCKFALLS, AVALANCHES, OR EARTHFLOWS ARE VERY LIKELY TO OCCUR IF AREA IS SHAKEN BY A MAJOR LOCAL EARTHQUAKE.
AREA IN WHICH MAJOR GROUND BREAKAGE MAY OCCUR DURING A MAJOR EARTHOUAKE
REACH OF STREAM WHERE SPRING FLOODING MAY OCCUR
N
R. 2 E.
R. 3 E.
R. 1 W.
R. 1 E.
R. 4 E.
R. 5 E.
BOZEMAN
HEBGEN
LAKE
RESERVOIR
GALLATIN
CONTINENTAL
DIVIDE
YELLOWSTONE
MADISON
WEST YELLOWSTONE
RIVER
WEST YELLOWSTONE
SOUTH
FORK
MADISON
RIVER
MONTANA
IDAHO
NATIONAL
3.2
3.2
3.3
TARGHEE
TWO TOP MOUNTAIN
CONTINENTAL
DIVIDE
FOREST
YELLOWSTONE
III
REAS PASS
HENRY'S LAKE FLAT
NATIONAL
ISLAND PARK GEOTHERMAL AREA BOUNDARY
YELLOWSTONE KNOWN GEOTHERMAL RESOURCE AREA
KNOWN
MONTANA
WYOMING
IDAHO
NATIONAL
MACK'S INN
BIG SPRINGS
MOOSE
CREEK
FOREST
PLATEAU
AREA
T. 14 N.
T. 13 N.
T. 12 N.
T. 11 N.
T. 10 N.
T. 9 N.
T. 8 N.
ISLAND PARK RESERVOIR
THURBURN RIDGE
TARGHEE
ISLAND PARK GEOTHERMAL AREA BOUNDARY
HARRIMAN STATE PARK
TARGHEE
BISHOP
MOUNTAIN
ANTELOPE FLAT
NATIONAL
OSBORNE BRIDGE
HENRY'S
FORK
SNAKE
PARK
IDAHO
WYOMING
BIG BEND RIDGE
HENRYS RIVER FORK
NATIONAL
2.5
FOREST
LOWER MESA FALLS
BECHLER MEADOWS
YELLOWSTONE NATIONAL PARK
WINEGAR HOLE
FOREST
ASHTON RESERVOIR
ASHTON
ASHTON
SQUIRREL MEADOWS
T. 48 N.
T. 47 N.
HENRY'S FORK
RIVER
FALLS
ST. ANTHONY
R. 118 W.
R. 40 E.
R. 41 E.
R. 42 E.
R. 43 E.
R. 44 E.
R. 45 E.
R. 46 E.
R. 119 W.

Subsidence

Following the collapse of the land surface associated with the creation of the caldera, there has been no recognized land subsidence in the IPGA in historical times.

Floods

Serious flooding is rare in the IPGA, though overbank flows occur in some streams during spring runoff. These areas of high localized flows along lesser IPGA streams are shown in Map 4.

Seismicity

In most of the IPGA, earthquake caused devastation has not occurred. However, on August 17, 1959, an earthquake of magnitude 7.1 (Richter Scale) violently shook the area around Hebgen Lake, Montana, near W. Yellowstone, Montana. The shocks affected 600,000 square miles, including all of the IPGA. Extensive damage was reported from W. Yellowstone, where foundations, chimneys, structures, railroad tracks, and roads were damaged. In the Idaho part of the IPGA, damage was also widespread but milder than in West Yellowstone.

Information from seismometers has been used to locate epicenters and compute magnitudes of earthquakes believed to have originated under the IPGA (Map 4). Hebgen Lake, W. Yellowstone, and an area around the nuclear reactor testing facility near Arco, Idaho are monitored with seismometers. A recent seismic risk map included the IPGA in a zone where major damage can occur. This zone has the highest risk and high intensity disturbances can be expected.

A study of Henrys Lake examined ground breakage, rockfall and rockslide hazards that could be associated with earthquakes of varying magnitudes. An earthquake could cause a sloshing effect in Henrys Lake which could flood parts of the shoreline and inundate low-lying land.

WATER RESOURCES

Several studies of ground and surface water in the IPGA have been done. A recent investigation provides data for a large part of the Idaho section. The Montana and Wyoming sections have not been studied in as much detail. However, all three sections are meteorologically, geologically, and hydrologically similar.

Groundwater

Almost all of the geologic units contain some groundwater, as described by Whitehead. Much of the water occurs under water table conditions (i.e. unconfined), although artesian conditions (confined) may occur. Unconsolidated alluvial and glacial materials along stream channels and in valleys are the more productive aquifers. These usually provide adequate yields to wells. Basalt aquifers are highly variable, but large yields can be obtained if fracture zones are penetrated. The rhyolitic ash flows (Yellowstone Group and Plateau Rhyolite) yield quantities sufficient for domestic purposes, but large yields are limited to places where flows are highly permeable. The known and estimated hydraulic properties of the various rocks and unconsolidated materials are presented in table 4.

There are several hundred wells in the IPGA. Most are concentrated along streams in areas of summer home development. Only a few wells are used for irrigation. The residents of West Yellowstone use wells (in unconsolidated obsidian sands) primarily as a domestic water supply. Water levels are generally highest from June to September due to groundwater recharge from the melting snowpack. Lowest water levels occur in the early part of the year.

TABLE 4. HYDROLOGIC ASPECTS OF ROCK UNITS IN THE ISLAND PARK GEOTHERMAL AREA

(TDS = total dissolved solids; T = transmissibility)

Rock Unit[1]	Water-bearing Characteristics	Water Quality
Alluvium	Typical reliable source of water for domestic use; T ranges from 5,000 to 170,000 gal/day/ft	TDS rarely exceeds 1,000 and usually less than 500 mg/l; water generally moderately hard to very hard
Plateau Rhyolite	Extensive fractures create high secondary permeability; no well developed surface water drainage system; melt water and rain easily seep downward into soil and rock in the permeable ash flows; T ranges from 3,000 to 90,000 gal/day/ft	TDS generally less than 300 mg/l; water soft to moderately hard; Na and K predominate over Ca and Mg
Basalt	Yields abundant water for most uses. An important aquifer in parts of the IPGA Low rock permeability, high formation permeability; water travels between flows and along rubble separating flows; T ranges from 1,500 to 65,000 gal/day/ft	TDS generally less than 300 mg/l; Ca and Mg predominate over K and Na
Yellowstone Group	Generally yields adequate supplies of water for domestic and stock use. Highly permeable at places but in other places the unit is tightly welded and will not yield adequate supplies of water for irrigation use. Important to the basin's water yielding capability; T ranges from 400 to 12,000 gal/day/ft	Similar to Plateau Rhyolite
Snake River Butte Rhyolite	Intensely fractured and jointed, probable moderate to high permeability; no wells drilled	Probably similar to Plateau Rhyolite
Undifferentiated Rocks	Probable water bearing units are limestone, dolomite and sandstone; others are very poor suppliers of water or are aquicludes	Variable, depends on rock type; quartzose sandstone and some metamorphic and igneous rocks would probably be soft to moderately hard, while limestone and dolomite would be hard to very hard.

[1] The order of this column is the same as in table 3.

Source: Whitehead, R.L., 1978; Pacific Northwest River Basins Commission, 1970; Christiansen, R., personal communication, 1978

Warm River Spring flows 90,000 gallons of water per minute from the base of the Moose Creek Plateau.

Numerous springs occur within the IPGA; some are perennial and others are ephemeral (flowing only when the local groundwater supply is sufficient). The two largest, Big Springs and Warm River Spring, each discharge about 90,000 gal./min. to Henrys Fork and Warm River, respectively. Several springs are thermal (greater than 12° C or 54° F; map 5). Discharge values and chemical parameters from selected springs are shown in table 5. A more complete listing of chemical analyses of thermal and cold groundwater is in Appendix A and B.

There are 13 thermal features in Yellowstone National Park less than 12 miles from the IPGA. These include small seeps, springs, fumaroles, mud pots, thermally and chemically altered areas, and one small geyser. Temperatures range from 18° C (64° F) to 94° C (201° F) and flows range from relatively insignificant seepage to large volumes of warm water.

Data are not available in detail to determine groundwater flow patterns over the entire IPGA. However, some information for Henrys Fork basin indicates that groundwater movement occurs locally within the basin between low subbasin drainages. But in general, around Henrys Lake it moves toward the lake. South of Henrys Lake, it moves south, paralleling the flow of Henrys Fork. Near Island Park Reservoir, it moves south and east towards the reservoir. Near Ashton, it flows north and west toward Henrys Fork. However, most of the water in the Henrys Fork drainage basin above Ashton is from precipitation in the basin. A small part of the basin's natural drainage system is in Yellowstone National Park on the Yellowstone Plateau where a large part of the basin's precipitation occurs. Groundwater flow in the West Yellowstone area is assumed to be from the highlands toward the South Fork of the Madison River. Groundwater flow in the Wyoming part of the IPGA is assumed to be towards the major streams draining the area.

TABLE 5. CHARACTERISTICS OF SELECTED SPRINGS IN THE ISLAND PARK GEOTHERMAL AREA

Name	Flow gal/min	Water Temperature °C and date of Measurement	Geohydrologic unit	Specific Conductance in field umhos/cm at 25° C	pH	Total Hardness mg/l
(Idaho)						
Big Springs	92,200	11.8 (9/8/77)	Rhyolitic flows & tuffs	110	6.7	21
Warm River Spring	90,000	10.3 (9/21/77)	same	118	6.8	21
Pineview Campground Springs	4,300	5.0 (9/10/75)	Basalt	82	—	—
Osborne Springs	3,460	5.5 (6/08/74)	Basalt	81	7.3	—
(Montana)						
Black Sand Spring	—	9.5 (9/07/77)	Alluvial obsidian sand; rhyolitic tuff	98	6.8	18
S. Fork Madison River Springs	—	4.8 (9/07/77)	Rhyolitic flows & tuffs	48	6.6	17

Source: Whitehead, R.L., 1978; U.S. Forest Service, 1977, unpublished records

The quality of IPGA groundwater is generally satisfactory for most uses and meets Federal and State drinking water standards. However, fluoride concentrations in some parts of the IPGA may exceed the recommended limit of 2.4 mg/l.

Groundwater in sedimentary rocks in the northern part of the IPGA is the calcium magnesium bicarbonate type; in basalts, it contains calcium and magnesium and relatively little sodium and potassium, and is less mineralized than water moving through the sedimentary rocks. In the rhyolitic flows and tuffs, it has a predominance of sodium and potassium over calcium and magnesium, and has a low dissolved mineral content. Table 4 summarizes the water quality characteristics of the IPGA rock types.

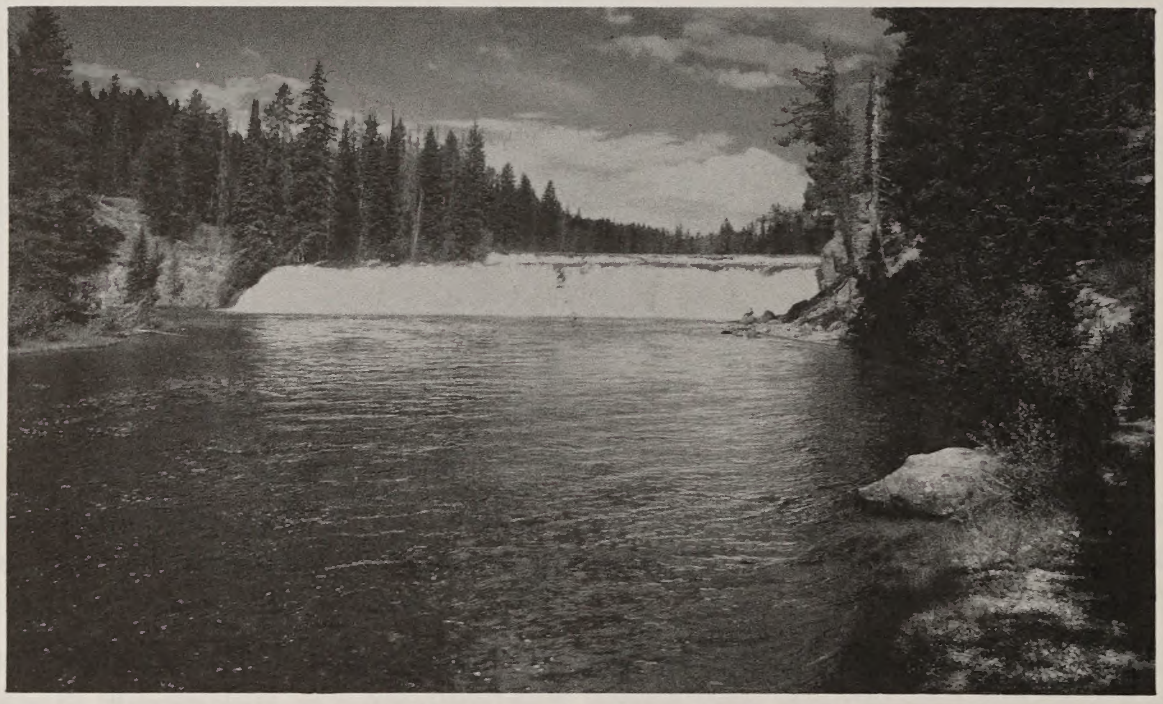
Human influences on the surface water and shallow groundwater systems are likely in areas of the IPGA where septic tank systems are used for waste disposal, particularly along streams where summer homes are concentrated.

Little is known about a geothermal resource in the IPGA. Most of the information on thermal water in the area is from a few water samples from selected springs, shown in Appendix A. However, detailed water quality data from Yellowstone National Park thermal water are available. The hot springs in the Shoshone and Upper Geyser Basins are known to be generally neutral to alkaline and have high concentrations of silica, sodium, chloride, bicarbonate, fluoride and boron. Some Upper Geyser Basin springs have acidic sulfate water (pH=2) and low chloride concentrations. Chemical analyses from hot springs and geysers on the west side of Yellowstone National Park appear in Appendix C.

Surface Water

The IPGA is an important headwaters area for the Snake River and Missouri River. Water from the Montana part of the IPGA drains into the Missouri River and water from Idaho and Wyoming drains into the Snake River. Three significant watersheds in the IPGA include the South Fork of the Madison River in Montana, Henrys Fork of the Snake River, primarily Idaho, and Falls River in Wyoming and Idaho (Map 5).

Henrys Fork of the Snake River winds through the center of the Island Park Geothermal Area.



Falls River originates in Yellowstone National Park and flows to Henrys Fork of the Snake River.

Data collection in the Upper Henrys Fork drainage began in 1890 when the US Geological Survey installed a gaging station on Henrys Fork near Ashton. Other stations were subsequently added and volumes of stored water in Henrys Lake and in Island Park Reservoir were also measured. Numerous miscellaneous streamflow measurements in the Upper Henrys Fork drainage have been made. A great deal of hydrological information is available for the Idaho part of the IPGA and some exists for the Montana and Wyoming parts.

The flow in Warm River, Buffalo River, and Big Springs Creek is maintained at a nearly constant rate by large contributions from groundwater. Minor streams are ephemeral, flowing only when the water table is high or when runoff is suitable. The mean annual discharge for two of the three main rivers draining the area is as follows: Henrys Fork near Ashton, 1,441 cfs (1,044,000 ac-ft./yr.; from 55 years of record), and Falls River, near the point where it leaves the IPGA, 777 cfs (562,900 ac-ft./yr.; from 61 years of record). Annual discharge data for the South Fork of the Madison River are not adequate to determine annual flow (table 6). Mean annual and mean monthly hydrographs for Henrys Fork and selected tributaries are presented in figure 6.

The flow on Henrys Fork is regulated at three dams located at Henrys Lake, Island Park Reservoir, and Ashton Reservoir. These dams prevent natural variation in flows. Water diversions into irrigation canals near the west edge of the IPGA alter the flow of Falls River during late spring and summer. No major diversions are made from the South Fork of the Madison River in Montana.

Island Park Reservoir stores water from Henrys Fork of the Snake River for downstream water uses.

Storage capacity for Island Park Reservoir, Ashton Reservoir, Henrys Lake, and Hebgen Lake are in table 7.

Major flooding is not a problem along Henrys Fork at most places because reservoirs control flows and the channel is well defined. Streams where localized flooding occurs from spring runoff are shown in map 4. High water invades low-lying willow thickets and does little damage. However, one exceptional flood on Thirsty Creek (map 5) in 1960 damaged U.S. Forest Service roads and undermined a quarter mile stretch of Union Pacific Railroad track.

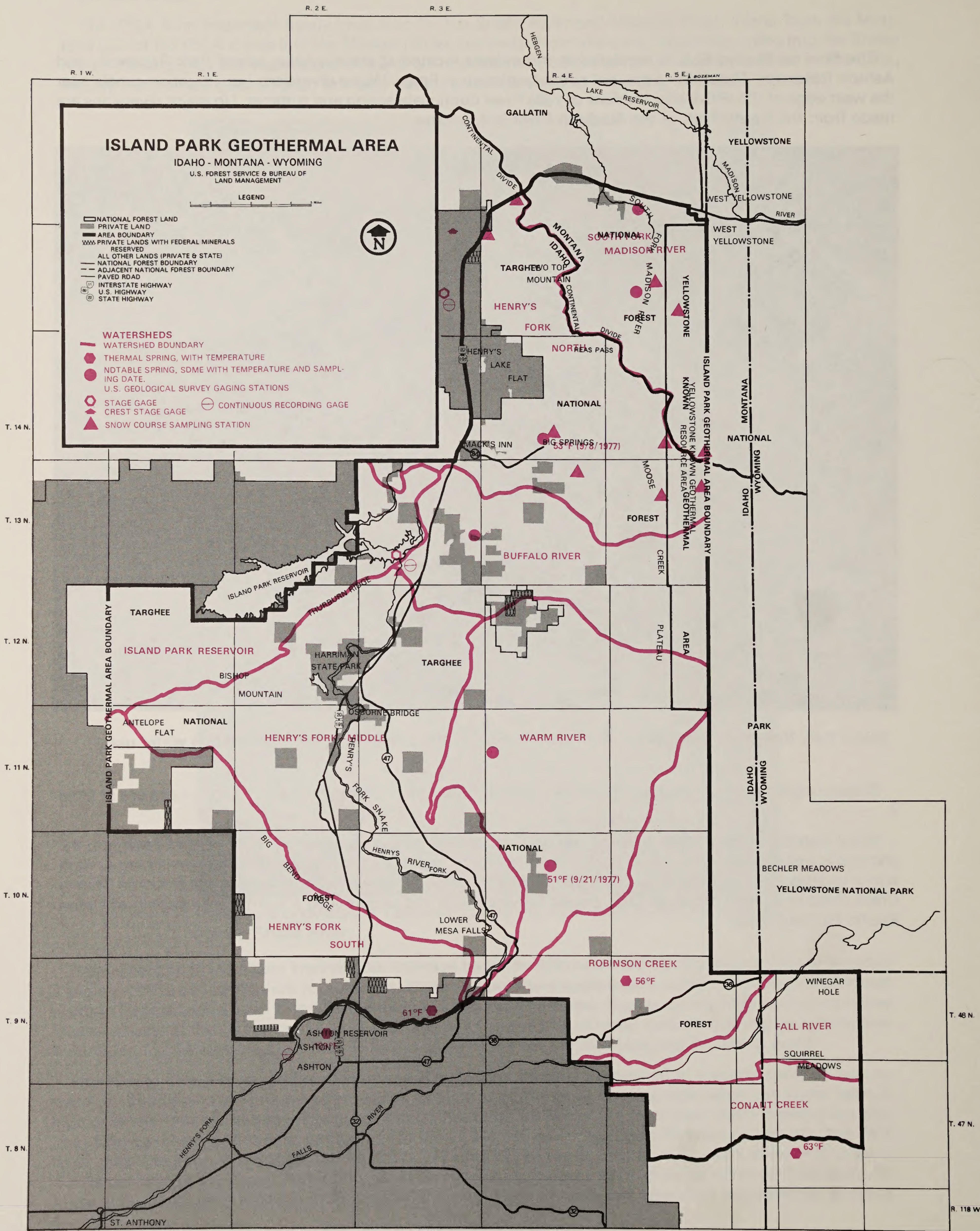

ISLAND PARK GEOTHERMAL AREA
IDAHO - MONTANA - WYOMING
U.S. FOREST SERVICE & BUREAU OF LAND MANAGEMENT
LEGEND
NATIONAL FOREST LAND
PRIVATE LAND
AREA BOUNDARY
PRIVATE LANDS WITH FEDERAL MINERALS RESERVED
ALL OTHER LANDS (PRIVATE & STATE)
NATIONAL FOREST BOUNDARY
ADJACENT NATIONAL FOREST BOUNDARY
PAVED ROAD
INTERSTATE HIGHWAY
U.S. HIGHWAY
STATE HIGHWAY
WATERSHEDS
WATERSHED BOUNDARY
THERMAL SPRING, WITH TEMPERATURE
NOTABLE SPRING, SOME WITH TEMPERATURE AND SAMPLING DATE.
U.S. GEOLOGICAL SURVEY GAGING STATIONS
STAGE GAGE
CREST STAGE GAGE
CONTINUOUS RECORDING GAGE
SNOW COURSE SAMPLING STATION
HENRY'S FORK NORTH
SOUTH FORK MADISON RIVER
BUFFALO RIVER
ISLAND PARK RESERVOIR
HENRY'S FORK - MIDDLE
WARM RIVER
HENRY'S FORK SOUTH
ROBINSON CREEK
FALL RIVER
CONANT CREEK
53°F (9/8/1977)
51°F (9/21/1977)
56°F
61°F
63°F
ISLAND PARK GEOTHERMAL AREA BOUNDARY
YELLOWSTONE KNOWN GEOTHERMAL RESOURCE AREA
YELLOWSTONE NATIONAL PARK
TARGHEE NATIONAL FOREST
GALLATIN NATIONAL FOREST
HENRY'S LAKE FLAT
BIG SPRINGS
MACK'S INN
ISLAND PARK RESERVOIR
HARRIMAN STATE PARK
OSBORNE BRIDGE
LOWER MESA FALLS
ASHTON RESERVOIR
ASHTON
ST. ANTHONY
WEST YELLOWSTONE
BECHLER MEADOWS
WINEGAR HOLE
SQUIRREL MEADOWS
HEBGEN LAKE RESERVOIR
MADISON RIVER
CONTINENTAL DIVIDE
MONTANA
IDAHO
WYOMING

TABLE 6. DISCHARGE DATA FOR STREAMS IN THE ISLAND PARK GEOTHERMAL AREA

—IDAHO STREAMS—

Stream	Average Discharge, cfs	Period of Record	Recorded Peak Flows: cfs and date	Drainage Area in Square Miels
Henrys Lake Outlet, below dam	52.9 (38,330 ac-ft/yr)	46 yrs.	907 (6/1926)	99.3
Henrys Fork near Island Park, below Island Park Reservoir Dam	594 (430,400 ac-ft/yr)	42 yrs.	2,770 (4/1946)	481
Henrys Fork near Ashton, downstream of Ashton Reservoir Dam	1,441 (1,044,000 ac-ft./yr)	55 yrs.	6,220 (5/1925)	1,040
Falls River, 3 miles west of IPGA boundary	777 (562,900 ac-ft/yr)	61 yrs.	6,440 (6/1927)	326
Buffalo River, at Island Park	180 (130,090 ac-ft/yr)	9 yrs.	638 (4/30/38)	59.1
Warm River, at Warm River	210 (151,770 ac-ft/yr)	22 yrs.	900 (6/2/12)	145
Robinson Creek, at Warm River	120 (86,720 ac-ft/yr)	20 yrs.	1,140 (5/28/12)	126

—MONTANA—

Discharge in the S. Fork of the Madison River; measured at the US 191-20 highway bridge (the north edge of the IPGA)

Date	Flow, cfs
22 June 1977	110.1
10 August 1977	105
13 Sept. 1977	105

Source: US Geological Survey, 1976; US Geological Survey, personal communication, 1978; unpublished records of the US Forest Service

TABLE 7. STORAGE CAPACITY IN LAKES AND RESERVOIRS IN OR NEAR THE ISLAND PARK GEOTHERMAL AREA

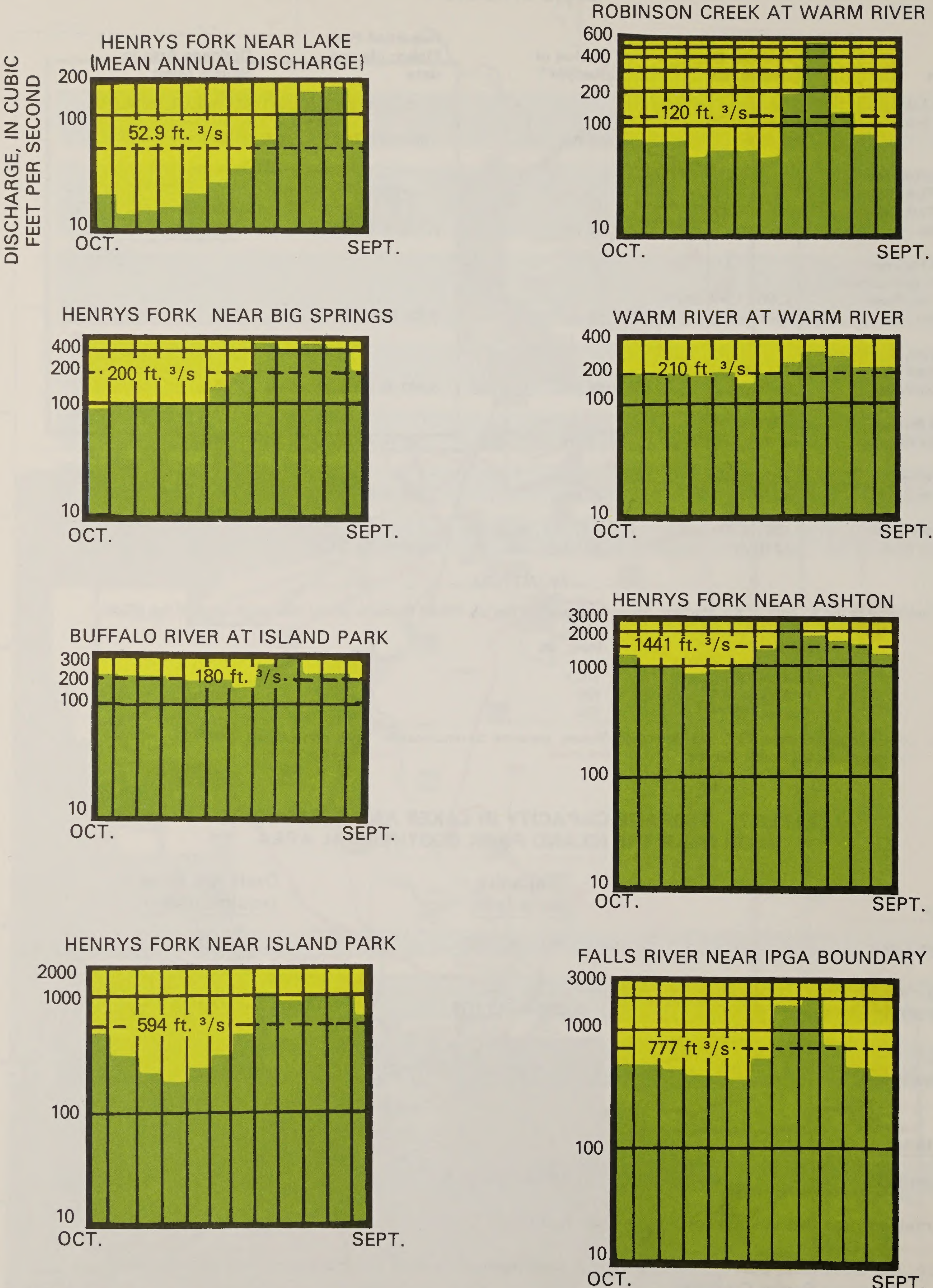
Idaho	Capacity (acre-feet)	Drainage Area (square miles)
Henrys Lake	140—92,100	99
Island Park Reservoir	5,280—143,500	481
Ashton Reservoir	7,457[1]	1,040
Montana		
Hebgen Lake	200,000—350,000	905

[1] Maintained near this volume for power generation

Source: US Geological Survey, 1976; personal communication with US Bureau of Reclamation, and Montana Power Company

FIGURE 6. STREAMFLOW CHARACTERISTICS IN THE IDAHO PART OF THE ISLAND PARK GEOTHERMAL AREA (IPGA)

(MEAN ANNUAL AND MEAN MONTHLY DISCHARGE)



SOURCE: Whitehead, R.L., 1978

Idaho, Montana and Wyoming have established a water quality classification system for State surface water networks. The surface waters in the IPGA flowing on Federal lands fall under the water quality classification schemes of these States. Table 8 presents each State's surface water classification system.

TABLE 8. WATER USE AND QUALITY DESIGNATIONS IN THE ISLAND PARK GEOTHERMAL AREA: STATE CLASSIFICATION SYSTEMS FOR SURFACE WATER

	State Classification Grading Level	Basis for Classification	Uses to be Protected	Number of Streams in the IPGA in this Class
Idaho	A (highest of 3 classes)	Primary contact recreational waters in which bodily submergence and accidental swallowing of water may occur	Domestic and industrial water supply, irrigation, livestock watering, salmonid fish spawning and rearing, other fishing and aquatic life, hunting and wildlife, water skiing and swimming, pleasure boating, aesthetics	All
Montana	B-D1 (3rd highest of 8 classes)	Maintenance of quality for drinking, culinary and food processing purposes (after adequate treatment)	Bathing, swimming and recreation, growth and propagation of salmonid fishes and associated aquatic life, waterfowl, furbearers, agricultural and industrial water supply	All
Wyoming	II (2nd highest of 4 classes)	Support game fish or have the hydrologic and natural water quality potential to do so	(the 4 classes are based on fisheries quality, or potential; Wyoming seeks to protect the best possible quality of waters commensurate with the uses in or for; agriculture, fish and wildlife, industry, public water supply, recreation, scenic value)	All

Source: State of Idaho Water Quality Standards and Wastewater Treatment Requirements (June, 1973), and Idaho Water Quality Status (May, 1975); State of Wyoming Water Quality Rules and Regulations, Chapter 1, Quality Standards for Wyoming Surface Waters (May, 1978); State of Montana Water Quality Standards (undated, MAC 16-12.14 (10)-S 14480)

The chemical composition of surface water is dependent on the rocks with which it has come in contact. The general composition of surface water in the IPGA is as follows: calcium magnesium bicarbonate water drains from sedimentary rocks that include carbonates, calcium magnesium water drains from the basalts, and sodium potassium water drains from the rhyolite ash flows and lava. However, the surface water may have contacted more than one predominant rock type and thus represent a mixture of different waters (e.g. Henrys Fork near Ashton, table 9). Table 9 shows water chemistry for the three main drainages in the IPGA. Water quality for other drainages appears in Appendix D.

Turbidity and suspended solids have been studied in the surface water. While erosion is not a major problem in the IPGA, surface water quality is sometimes adversely influenced by logging activities, road construction near streams, grazing animals that trample streambanks, and dirt roads that channel surface runoff to streams. Turbidity is low in the Upper Henrys Fork drainage, averaging 1.4 Jackson turbidity units; suspended solids average about 7.5 mg/l. Limited sampling in the South Fork of the Madison River at the U.S. 191/20 highway bridge showed turbidity of zero Jackson units, and suspended solids of 2.7 and 4.9 mg/l (2 samples).

TABLE 9. SURFACE WATER CHEMISTRY FOR THREE DRAINAGES IN THE ISLAND PARK GEOTHERMAL AREA (mg/l except where noted)

	Headwaters			Lowest Parts of Drainages in the IPGA		
	So. Fork Madison River[1] (Montana)	Henrys Fork near Henrys Lake (Idaho)	Falls River[2] by Yellowstone National Park boundary (Wyoming)	So. Fork Madison River near US 191-20 highway bridge (Montana)	Henrys Fork near Ashton, Idaho	Falls River near edge of IPGA (Idaho)
Date sampled	9/7/77	9/8/77	9/21/77	10/5/77	9/6/77	9/7/77
Water Temp °C	4.8	13.5	7.5	7.5	17.8	18.1
pH (field)	6.6	7.7	7.7	6.8	7.7	7.4
Specific conductance field) umhos/cm at 25° C	48	(lab) 187	200	85	159	210
alkalinity, total as $CaCO_3$	15	110	65	40	72	76
HCO_3	18	130	79	49	88	93
B, ug/l	6	—	360	50	50	310
Ca	5.2	19	6.8	7.6	14	5.5
CO_3	0	0	0	0	0	0
Cl	0.5	1.2	15	3.2	2.9	13
F	1.4	0.1	3.7	2.9	1.8	3.6
Hardness noncarb	2	0	0	0	0	0
Hardness, total	17	97	20	24	53	18
Mg	1.0	12	0.7	1.1	4.3	1.1
NO_2 and NO_3 as N dissolved	0.09	0.09	0.05	0.02	0.01	0.06
P total as P	0.01	0.03	0.01	0.00	0.03	0.01
K	1.5	1.4	3.9	1.8	2.1	3.8
TDS	46	105	158	86	105	164
SAR	0.2	0.1	3.4	0.8	0.6	3.7
SiO_2	24	1.7	51	34	23	51
Na	2.2	2.2	35	9.0	10	36
Na%	20	5	75	43	28	77
SO_4	0.9	2.7	2.5	1.9	3.8	3.4
Pesticides and Herbicides (19 total)	—	—	—	None detected in these surface water flows		

[1] Sampled at a headwater spring source in summer

[2] not headwaters; Falls River rises in Yellowstone National Park

Source: unpublished records of the US Geological Survey

Much is known about surface water quality in the Upper Henrys Fork basin from Whitehead's 1974 and 1975 work. Nitrogen and phosphorous are generally low, but show some seasonal variation and are troublesome in places. During the warm months, when biological activity is high, the concentrations are at their lowest levels, suggesting consumption by plant and animal life.

In parts of Henrys Fork and its tributaries above Ashton, algal and plant growths are common for part of the summer, although not at nuisance levels. However, nuisance growths do occur in Henrys Fork from near Last Chance to Osborne Bridge (map 5). The river is unshaded, wide, and fairly shallow in this reach and is downstream from most of man's influences in the upper part of the basin. Water temperature, also important to a stream's biologic activity, can remain over 20° C (68° F) in this reach for several days at a time under certain weather conditions.

Phytoplankton data from Henrys Lake and Island Park Reservoir indicate that the water bodies undergo yearly changes in fertility. Generally, in the spring after winter stagnation under ice cover the dominant algae are diatoms. When circulation improves with warmer temperatures and sunlight, blue-green algae, which are indicators of eutrophication, are dominant. Nutrient concentrations for water from Henrys Lake and Island Park Reservoir indicate an increase during the cold months, when blue-green algae production slows down, and a decrease during the season of productivity.

Hebgen Lake, north of the Montana part of the IPGA, is relatively warm and high in nutrients, with relatively high concentrations of arsenic and fluoride. The Madison River enters the lake from Yellowstone National Park and contains water high in dissolved minerals from many hot springs and geysers. The abundant nutrients stimulate seasonal algae growths creating a eutrophic condition (highly enriched).

Microbiological sampling done by Whitehead revealed that human and animal wastes affect the surface water at some sites, particularly during the summer. In July 1975, Henrys Fork above Island Park Reservoir had a combination of bacteria that indicates a predominance of human waste in a mixed animal and human source pollution. Henrys Fork near Ashton during the same period had bacteria indicative of wastes wholly or predominantly from animal sources.

Pesticides and herbicides have been used in the IPGA. In 1977, surface water was sampled for these substances in Henrys Fork, Falls River, and the South Fork of the Madison River at the IPGA boundary. No residual pesticide or herbicide was detected in this sampling (Table 9).

Boron is often found in waters draining from volcanic lands. Cultivated crops have varying sensitivities to boron in irrigation water. According to a U.S. Department of Agriculture study which rates crop tolerance to boron, the commercial crops grown downstream of the IPGA are either semi-tolerant (oats, wheat, barley and potatoes), or tolerant (alfalfa and sugar beets) to boron in irrigation water. This study has also rated the quality of the irrigation water with respect to boron concentration. For the water to be considered in the excellent grade class, the boron concentration must not exceed 0.67 mg/l for semi-tolerant crops, and must be less than 1.00 mg/l for tolerant crops. In Falls River where it leaves the IPGA, the concentration is 0.3 mg/l; in the South Fork of the Madison River and in Henrys Fork, where each river leaves the IPGA, the concentration is 0.05 mg/l.

Water Rights

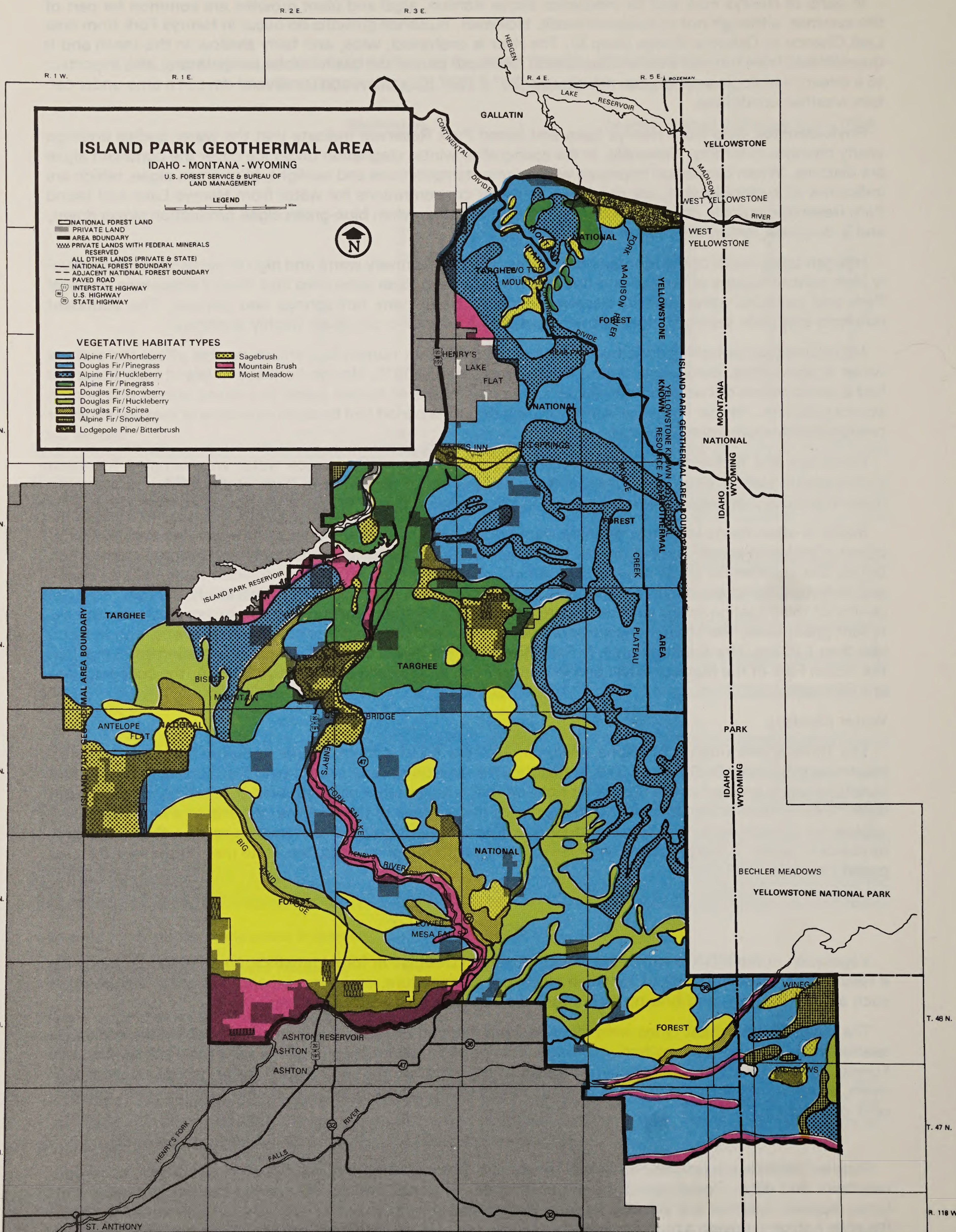
The three states (Idaho, Montana, Wyoming) in the IPGA adhere to the Appropriation Doctrine, also known as the Colorado Doctrine. This states that the user on a water source who first applies the water to a beneficial use is entitled to the first water right on that source; other uses follow in succeeding order through time. "First in time is first in right" often expresses the purpose of the doctrine. Whenever a new water user applies for a water right, the State must decide if prior water rights will continue to receive their respective amounts of water. If the proposed new use interferes with existing rights, the State may disapprove the proposed new use.

VEGETATION

Vegetation in the IPGA is within the Rocky Mountain Douglas-fir forest province. Vegetal habitat types are a result of complex interactions between elevation, temperature, moisture, aspect, and soils. Disturbances such as fire, logging, and grazing also affect the vegetation to varying degrees.

The major forest habitat types were identified and mapped (Map 6). A document describing the ecological relationships, species composition, coverage, etc. of each habitat type is on file with the Targhee National Forest. Table 10 is a summary of characteristics and percent of the total of each major habitat on the IPGA; rivers, streams, marshes, riparian, and unique habits (cliffs, caves, and talus) account for less than one percent of the area.

Riparian habitats are typified by sedges, rushes and grasses with a shrubby overstory of willows, dogwood, hawthorn and alder. Found along the edges of streams, ponds and poorly drained canyon and valley bottoms, riparian habitats are virtually flooded during spring runoff, but usually dry by mid-to late-summer. Riparian habitats, having a high capacity for filtering out sediment of overland flows from adjacent lands, are


ISLAND PARK GEOTHERMAL AREA
IDAHO - MONTANA - WYOMING
U.S. FOREST SERVICE & BUREAU OF LAND MANAGEMENT
LEGEND
NATIONAL FOREST LAND
PRIVATE LAND
AREA BOUNDARY
PRIVATE LANDS WITH FEDERAL MINERALS RESERVED
ALL OTHER LANDS (PRIVATE & STATE)
NATIONAL FOREST BOUNDARY
ADJACENT NATIONAL FOREST BOUNDARY
PAVED ROAD
INTERSTATE HIGHWAY
U.S. HIGHWAY
STATE HIGHWAY
VEGETATIVE HABITAT TYPES
Alpine Fir/Whortleberry
Douglas Fir/Pinegrass
Alpine Fir/Huckleberry
Alpine Fir/Pinegrass
Douglas Fir/Snowberry
Douglas Fir/Huckleberry
Douglas Fir/Spirea
Alpine Fir/Snowberry
Lodgepole Pine/Bitterbrush
Sagebrush
Mountain Brush
Moist Meadow
N
R. 1 W.
R. 1 E.
R. 2 E.
R. 3 E.
R. 4 E.
R. 5 E.
HEBGEN
LAKE
RESERVOIR
GALLATIN
CONTINENTAL
DIVIDE
YELLOWSTONE
MADISON
WEST YELLOWSTONE
RIVER
WEST
YELLOWSTONE
NATIONAL
TARGHEE
FORK
MADISON
RIVER
FOREST
YELLOWSTONE
ISLAND PARK GEOTHERMAL AREA BOUNDARY
YELLOWSTONE KNOWN GEOTHERMAL RESOURCE AREA
MONTANA
IDAHO
WYOMING
NATIONAL
HENRY'S
LAKE
FLAT
NATIONAL
HARRIS INN
BIG SPRINGS
FOREST
CREEK
PLATEAU
AREA
ISLAND PARK RESERVOIR
TARGHEE
BISHOP
MOUNTAIN
ANTELOPE
FLAT
NATIONAL
ISLAND PARK GEOTHERMAL AREA BOUNDARY
TARGHEE
BRIDGE
HENRY'S
FORK
SNAKE
RIVER
PARK
NATIONAL
BECHLER MEADOWS
YELLOWSTONE NATIONAL PARK
BIG
BEND
RIDGE
FOREST
LOWER
MESA FALLS
FOREST
ASHTON RESERVOIR
ASHTON
ASHTON
HENRY'S FORK
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T. 8 N.
T. 48 N.
T. 47 N.
R. 118 W.
R. 40 E.
R. 41 E.
R. 42 E.
R. 43 E.
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R. 45 E.
R. 46 E.
R. 119 W.

also highly susceptible to overuse and easily disturbed. Studies have shown that because riparian habitats are extremely important to wildlife they receive more use per unit area than any other type. Of 253 species of wildlife known to occur on the IPGA, 193 (76 percent) are either directly dependent on riparian zones or use them proportionately more than any other site.

TABLE 10. CHARACTERISTICS OF VEGETATIVE HABITATS ON THE ISLAND PARK GEOTHERMAL AREA

Habitat (percent) of total IPGA)	General location on IPGA	Ecological characteristics	Characteristic plant species
Douglas-fir Series (42)	• Moderate elevations (5100-7200 feet) • Broad belt which merges with mountain brush and alpine fir series	• Warmest and driest Forest areas • Lodgepole pine presently dominates most sites • Alpine fir and spruce are accidental • Aspen sometimes dominates but on small areas • Lodgepole pine is under epidemic attack by mountain pine beetle	• Douglas-fir • Lodgepole pine • Quaking aspen • Snowberry • Spirea • Globe huckleberry • Meadowrue • Aster • Sticky geranium • Pinegrass • Elk sedge
Alpine fir Series (44)	• Borders Douglas-fir Series and extends to timberline or Continental Divide • Predominantly in eastern and southeastern portions next to Yellowstone National Park and the Teton range	• Cooler, damper sites • Lodgepole pine presently dominates and persists for longer time • Douglas-fir occurs in a seral role • Aspen, limber pine and spruce occur periodically • Lodgepole pine is under attack by pine beetle.	• Subalpine fir • Lodgepole pine • Quaking aspen • Douglas-fir • Limber pine • Engelmann spruce • Globe huckleberry • Grouse whortleberry • Snowberry • Spirea • Meadowrue • Lupine • Pinegrass • Elk sedge
Sagebrush-grass (6)	• Lower elevations, on dry, course-textured soil • Occurs largely on Bureau of Land Management lands in central and western portions • Also found scattered throughout the forested series on dry, rocky, windswept outcrops	• Sagebrush usually dominant • Scattered Douglas-fir along southern portion along ecotone with Douglas-fir series	• Big sagebrush • Threetip sagebrush • Snowberry • Woods rose • Knotweed • Sticky geranium • Bluebunch wheatgrass • Nevada bluegrass • Idaho fescue
Mountain brush (3)	• Found on lowest and driest sites • Borders the Douglas-fir series along southwestern border • Also found along river courses on dry, southwest-facing slopes	• Dominated by shrubs other than sagebrush although sagebrush is present	• Rocky Mountain maple • Chokecherry • Rabbitbrush • Big sagebrush • Serviceberry • Eriogonum • Aster • Bluebunch wheatgrass
Wet Meadow (3)	• Scattered throughout—predominantly in northern, central and southeastern portions • Found on sites with high water table, or where run-in or flooding is common	• Floristically and ecologically diverse • Highly susceptible to disturbance during growing season • Rate of recovery at higher elevations is slower than at lower sites	• Willow • Wyethia • Camass • Pondweed • Yampa • Bluegrass • Junegrass • Sedges • Rushes

Marshes occur on areas with very poor drainage, and usually are inundated during most of the growing season. The largest concentration is in the southeastern portion of the IPGA. This vegetation type can also be found in and along shallow potholes, meandering streams, and large water bodies. Typical plants include rushes, sedges, cattails, pondweed, mosses, and water lily.

Unique habitats (cliffs, caves, and talus) where little vegetation is found are widely distributed. Individually they occupy a small percentage of the total area and are restricted in location. Since unique habitats are a product of geologic processes, they cannot be artificially created or maintained.

Approximately 5 fires per year occur on the IPGA. About half are man-caused and half lightning-caused. Fires are usually less than ½ acre and less than 10% reach 10 acres. Most man-caused fires occur near developed areas (Island Park) and heavily used recreation sites and travel routes (popular trails, campgrounds, etc.). Lightning fires occur throughout the IPGA.

In the past, fire played a significant part in the structure and function of vegetative communities. Prior to 1920, large, infrequent fires occurred throughout the IPGA. Large expanses of lodgepole pine presently occupying most of the area resulted from fires which occurred at approximately 100-200 year intervals. After 1920 effective suppression techniques reduced fires of significant size. However, with the change in Forest Service fire policy and increased fire management planning, fire's role in portions of the IPGA may be expected to take a more natural course.

With the extensive downfall of lodgepole pine resulting from the mountain pine beetle attack, fuel loads in the IPGA are increasing rapidly. It is estimated that they will reach 50-75 tons per acre by 1982. This increase will be due to beetle-killed lodgepole pine which will fall and create "jackstraw" fuel and access hazards. The current salvage and fuel management program is alleviating this increased loading somewhat. Topographic and climatological conditions conducive to a large fire in lodgepole pine (steep terrain, high winds, high temperatures, and low fuel moisture) are infrequent, and the probabability of a large fire is low. Nevertheless, a large fire could threaten developments within the IPGA, necessitating fuel reduction around these improvements.

Threatened and Endangered Plants

The Endangered Species Act of 1973 authorized the Secretary of the Interior to designate threatened and endangered plants as well as animals. The Act also directed the Smithsonian Institute, in conjunction with other agencies, to prepare a list of plants considered endangered or threatened. This list was published by the Fish and Wildlife Service (Federal Register, Vol. 40, No. 127) in 1975.

In 1977 and 1978 a survey of the IPGA was conducted to determine the presence of any species on the Smithsonian list. The list in **Endangered and Threatened Plants of Idaho** by D.M. Henderson was also checked. No species on either list was found on the IPGA. The final report is on file with the Targhee National Forest.

CULTURAL RESOURCES

An overview of cultural resources was prepared for the Island Park Geothermal Area in October, 1977, to review existing information and to identify sites of historical or archaeological significance for future surveys. This report is filed in the Supervisor's Office, Targhee National Forest, St. Anthony, Idaho.

Prehistoric

Evidence from the IPGA and surrounding regions indicates that human occupation dates back at least 12,000 years. The consensus of archaeologists who have examined the region is that the IPGA was used seasonally or as a migration route. The exception to this was year-round occupation by the Tukudika or Sheepeaters, mountain Indians who were primarily hunters and did not travel as much as mounted tribes.

The eastern Shoshone (Snake) tribes were the most common summer migrants through the area. Other tribes which are thought to have spent some time in the area include Blackfeet, Crow, and Flathead.

Historic

During the summer of 1810, an expedition of trappers under the leadership of Andrew Henry became the first known white men to pass through the Island Park area. Until about 1840, trapping was an important activity in the area.

The first known white man to settle close to the IPGA was Gilman Sawtell who took up residence in about 1868 and developed a business taking fish from Henrys Lake and shipping them to markets in Montana and Utah.

In 1877 the Nez Perce Indians, led by Chief Joseph and retreating from U.S. Army pursuit, passed through Henrys Lake Flat and into Montana by way of Targhee Pass.

Many Indian campsites and most historic sites of early white settlers are located on private land.

Big Springs, the headwaters of Henrys Fork of the Snake River, was nominated for addition to the National Registry of Natural Landmarks, but has not yet been added to the register by the advisory committee.

RECREATION

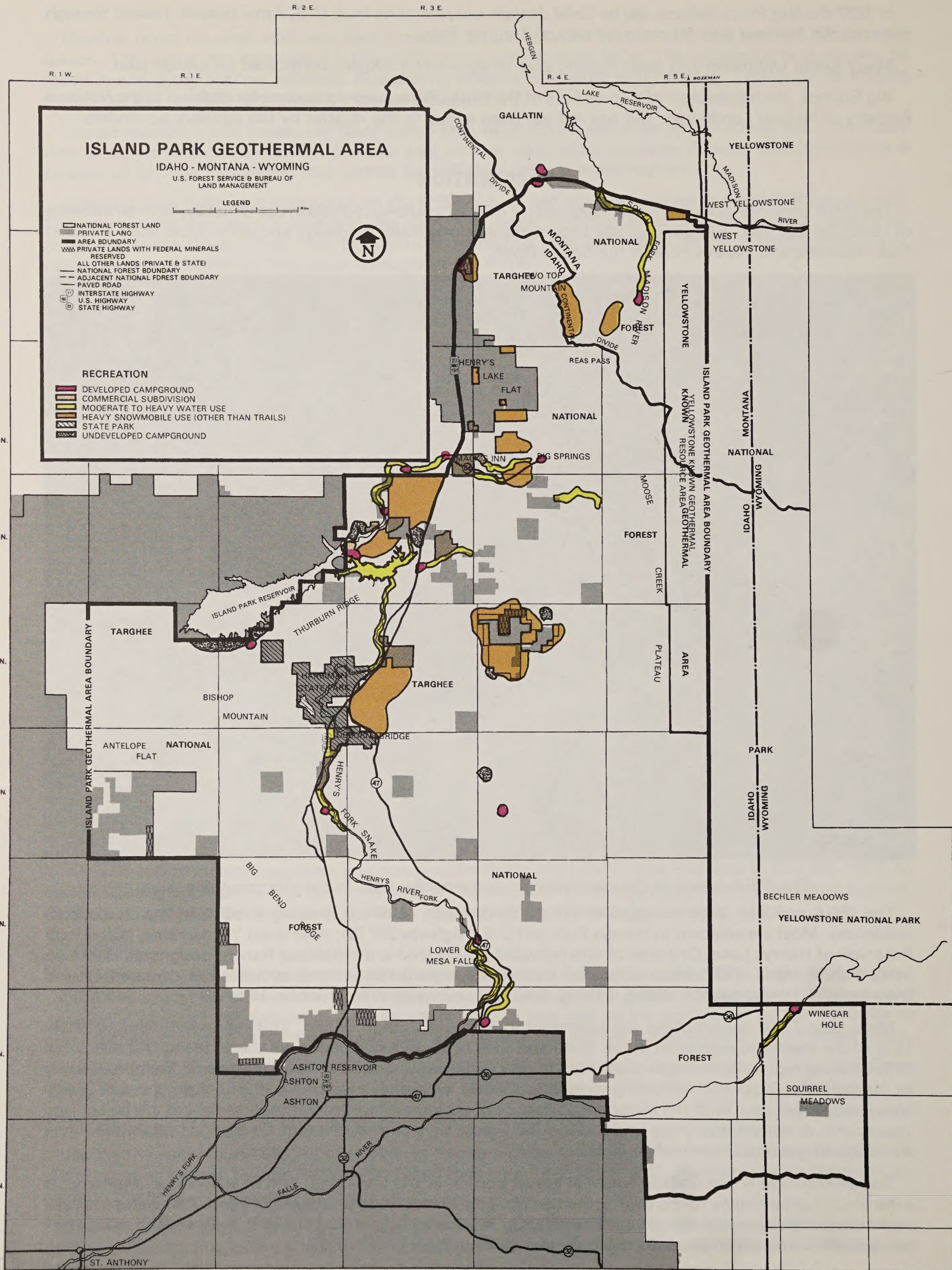
The IPGA provides more than one million visitor days of yearlong recreation use annually, with an increase of about 5% per year. Recreational use occurs mainly along major roadways and water areas such as Island Park Reservoir and Henrys Fork of the Snake River.

The IPGA is one of the most popular snowmobile areas in the intermountain west.

The IPGA contains large acreages of private land, much of which is being subdivided for recreational residences. Most are adjacent to Henrys Fork and U.S. Highway 20/191, near West Yellowstone, Island Park Reservoir of Henrys Lake. One area of unsubdivided private land is the Railroad Ranch, designated Harriman State Park in April, 1977. Most dispersed (non-concentrated) recreational activities are centered around snowmobiling, cross country skiing, fishing, boating, and water skiing. (tables 11 & 12)

More than 2,500 snowmobiles are registered in Fremont County, Idaho. This represents approximately 15% of the machines registered in the State and 33% of those registered in southeast Idaho. An estimated 70% of these registrations are by residents of other counties who register their machines in Fremont County to support the local trail grooming program. Winter weekend use in the IPGA often exceeds 2,000 snowmobiles per day. With the increased popularity of snowmobiling, recreational residences are being used year-round. A cooperative program between the Forest Service and Fremont County has established over 400 miles of groomed snowmobile trails.

Snowmobile use in the Gallatin National Forest portion of the IPGA near West Yellowstone, Montana, is extensive. A snowmobile racing oval located on National Forest lands southwest of West Yellowstone is used many times each winter for competitive events. A number of motels in West Yellowstone offer daily snowmobile tours which primarily use groomed trails on National Forest lands.


ISLAND PARK GEOTHERMAL AREA
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PRIVATE LANDS WITH FEDERAL MINERALS RESERVED
ALL OTHER LANDS (PRIVATE & STATE)
NATIONAL FOREST BOUNDARY
ADJACENT NATIONAL FOREST BOUNDARY
PAVED ROAD
INTERSTATE HIGHWAY
U.S. HIGHWAY
STATE HIGHWAY
RECREATION
DEVELOPED CAMPGROUND
COMMERCIAL SUBDIVISION
MODERATE TO HEAVY WATER USE
HEAVY SNOWMOBILE USE (OTHER THAN TRAILS)
STATE PARK
UNDEVELOPED CAMPGROUND
N
GALLATIN
NATIONAL
FOREST
HEBGEN
LAKE
RESERVOIR
YELLOWSTONE
WEST YELLOWSTONE
MADISON
RIVER
CONTINENTAL
DIVIDE
MONTANA
IDAHO
SOUTH FORK MADISON RIVER
TARGHEE
TWO TOP
MOUNTAIN
REAS PASS
HENRY'S
LAKE
FLAT
MACK'S INN
BIG SPRINGS
ISLAND PARK GEOTHERMAL AREA BOUNDARY
YELLOWSTONE KNOWN GEOTHERMAL RESOURCE AREA
MOOSE CREEK PLATEAU
YELLOWSTONE AREA
MONTANA
WYOMING
IDAHO
ISLAND PARK RESERVOIR
THURBURN RIDGE
STATE PARK
BISHOP
MOUNTAIN
ANTELOPE
FLAT
OSBORNE BRIDGE
HENRY'S FORK SNAKE
HENRYS RIVER FORK
BIG BEND RIDGE
LOWER
MESA FALLS
PARK
BECHLER MEADOWS
YELLOWSTONE NATIONAL PARK
WINEGAR
HOLE
SQUIRREL
MEADOWS
ASHTON RESERVOIR
ASHTON
HENRY'S FORK
FALLS
RIVER
ST. ANTHONY
R. 1 W.
R. 1 E.
R. 2 E.
R. 3 E.
R. 4 E.
R. 5 E.
BOZEMAN
T. 14 N.
T. 13 N.
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T. 11 N.
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T. 48 N.
T. 47 N.
R. 118 W.
R. 40 E.
R. 41 E.
R. 42 E.
R. 43 E.
R. 44 E.
R. 45 E.
R. 46 E.
R. 119 W.

Volume of recreational use is primarily a product of access to points of interest. U.S. Highway 20/191 traverses the IPGA and enables high volume recreational use. This highway is a main artery for traffic through the West Yellowstone gate of Yellowstone National Park. The 1967 Yellowstone Park travel survey (assumed to also indicate present use) indicates that 25% of all visitors entered the Park through the West Yellowstone gate and 27% of all visitors exited there. Projections in the Greater Yellowstone Transportation Study indicate that by 1985, the Park will annually receive three million visitors. If use of gates is the same then, more than 1.5 million visitors will either enter or exit through the West Yellowstone gate. A high percentage of these visitors will traverse the Island Park Geothermal Area.

Recreational use considerations are shown on Map 7.

TABLE 11. SUMMER RECREATION USE OF FEDERAL LANDS IN AND ADJACENT TO THE ISLAND PARK GEOTHERMAL AREA

	TARGHEE NATIONAL FOREST	GALLATIN NATIONAL FOREST	BUREAU OF LAND MANAGEMENT LANDS	YELLOWSTONE NATIONAL PARK*
Developed Sites	Close to Island Park Reservoir, Henrys Fork of Snake River, Fall River	None	None	None
Undeveloped Sites	Close to streams and rivers—widely distributed	Close to S. Fork of Madison River	East of Island Park siding	Cave Falls Area, S.W. corner of Park
Dispersed Activities				
a. Hiking (also backpacking)	a. Lionhead Mtn. Area, Two-Top Mtn. Area, Henrys Fork of Snake River	a. South fork of Madison River	a. None	a. Bechler Meadows Area, Boundary Creek (s.w. park)
b. Recreational Vehicle Riding	b. Woods roads throughout area	b. Adjacent To West Yellowstone and on woods roads	b. Primarily in S.W. portion of area & near Island Park siding	b. None
c. Fishing	c. Lakes Rivers & Streams throughout	c. S. Fork of Madison River and Hebgen Lake	c. Ashton Reservoir, Henrys Lake Outlet	c. Fall River, Bechler River
d. Viewing	d. Along primary transportation routes	d. Along U.S. 20 & S. Fork of Madison River	d. Henrys Lake Flat, Ashton Reservoir	d. Cave Falls Area of S.W. Park

* Not in IPGA, but use immediately adjacent to area is important to leasing considerations.

TABLE 12. WINTER RECREATION USE OF FEDERAL LANDS IN AND ADJACENT TO THE ISLAND PARK GEOTHERMAL AREA

	TARGHEE NATIONAL FOREST	GALLATIN NATIONAL FOREST	BUREAU OF LAND MANAGEMENT	YELLOWSTONE NATIONAL PARK*
Developed Sites	Bear Gulch Ski Area	Snowmobile Racing Oval S.W. of West Yellowstone	None	None
Concentrated Use (Snowmobiles)	Island Park Siding, between Coffee Pot Rapids & Island Park Reservoir, & Big Springs Area	Just west of W. Yellowstone, Indian Creek & head of S. Fork of Madison River	Island Park Siding, Meadow Creek & Henrys Lake Flat	Hwy. through West Entrance
Dispersed Activities				
a. Cross Country Skiing	a. Warm River Area, Bear Gulch, Buffalo River, adjacent to commercial development	a. S.W. of West Yellowstone on groomed trails	a. Little Use	a. Along Madison River East of West Yellowstone
b. Snowmobiling	b. All groomed trails & many ungroomed roads throughout entire area	b. Groomed trails south of West Yellowstone	b. Trails on west side of IPGA	b. None

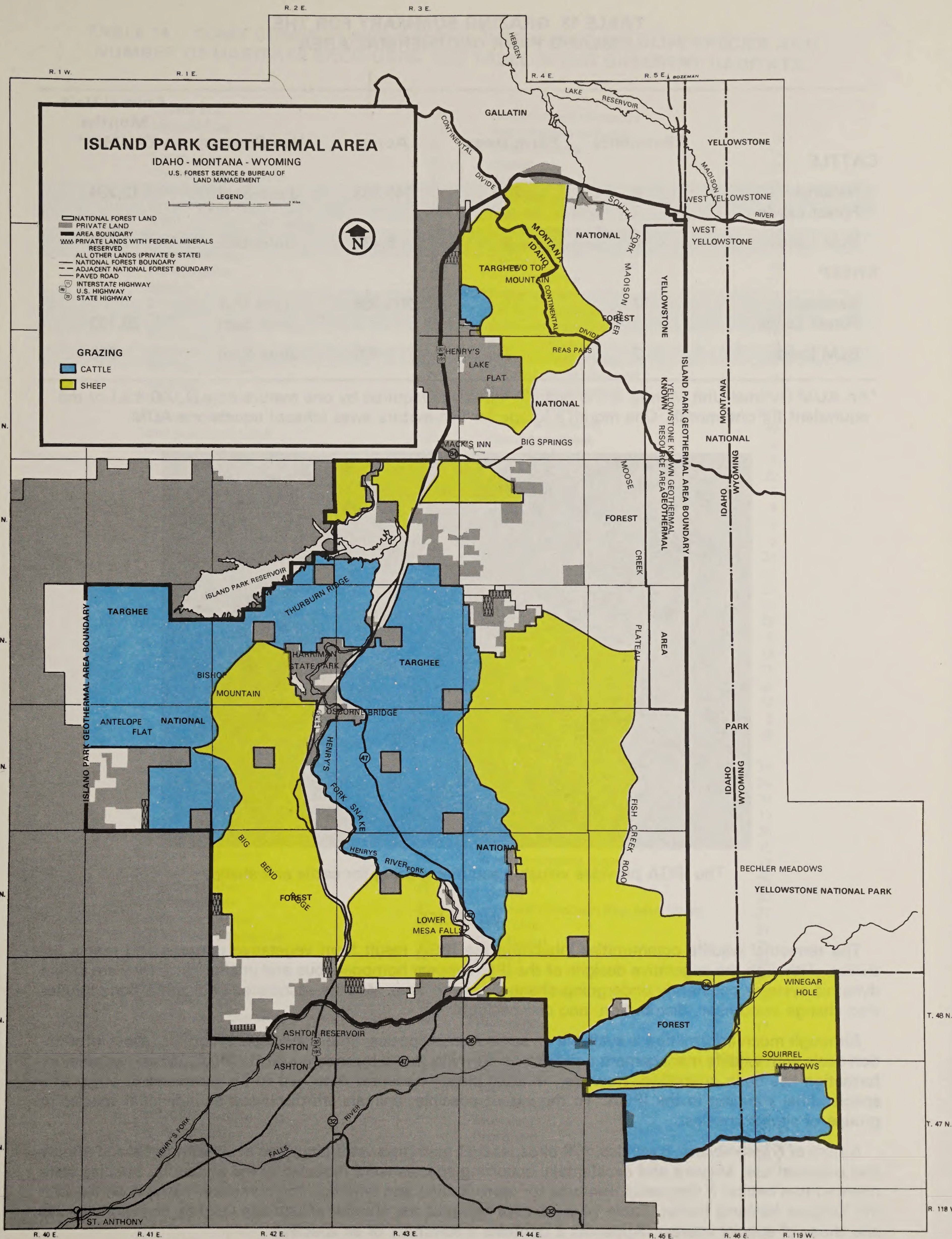
* Not in IPGA, but use immediately adjacent to area is important to leasing considerations.

GRAZING

Forage used by livestock contributes significantly to the economies of communities adjacent to the Island Park area. This forage, an important part of many livestock operations, provides summer grazing necessary to maintain viable year-long operations.

Water development structures (troughs, impoundments), and more than 120 miles of range fencing help control livestock distribution and forage utilization.

Approximately 4,300 head of cattle and 15,000 head of sheep use forage within the IPGA. The extent of grazing is shown on map 8. Table 13 summarizes forage use.


ISLAND PARK GEOTHERMAL AREA
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NATIONAL FOREST BOUNDARY
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PAVED ROAD
INTERSTATE HIGHWAY
U.S. HIGHWAY
STATE HIGHWAY
N
GRAZING
CATTLE
SHEEP
R. 1 W.
R. 1 E.
R. 2 E.
R. 3 E.
R. 4 E.
R. 5 E.
R. 40 E.
R. 41 E.
R. 42 E.
R. 43 E.
R. 44 E.
R. 45 E.
R. 46 E.
R. 119 W.
R. 118 W.
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T. 48 N.
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HEBGEN
LAKE
RESERVOIR
GALLATIN
CONTINENTAL
DIVIDE
YELLOWSTONE
MADISON
WEST YELLOWSTONE
RIVER
WEST
YELLOWSTONE
SOUTH
FORK
MADISON
RIVER
NATIONAL
MONTANA
IDAHO
TARGHEE
TWO TOP
MOUNTAIN
CONTINENTAL
DIVIDE
FOREST
REAS PASS
HENRY'S
LAKE
FLAT
NATIONAL
YELLOWSTONE
YELLOWSTONE KNOWN GEOTHERMAL RESOURCE AREA
KNOWN GEOTHERMAL
ISLAND PARK GEOTHERMAL AREA BOUNDARY
MONTANA
WYOMING
IDAHO
WYOMING
NATIONAL
MACK'S INN
BIG SPRINGS
MOOSE
FOREST
CREEK
ISLAND PARK RESERVOIR
THURBURN RIDGE
TARGHEE
PLATEAU
AREA
HARRIMAN
STATE PARK
TARGHEE
BISHOP
MOUNTAIN
OSBORNE BRIDGE
ANTELOPE
FLAT
NATIONAL
ISLAND PARK GEOTHERMAL AREA BOUNDARY
PARK
HENRY'S
FORK
SNAKE
IDAHO
WYOMING
FISH
CREEK
ROAD
BIG
BEND
RIDGE
FOREST
NATIONAL
HENRYS
RIVER
FORK
BECHLER MEADOWS
YELLOWSTONE NATIONAL PARK
LOWER
MESA FALLS
WINEGAR
HOLE
FOREST
SQUIRREL
MEADOWS
ASHTON RESERVOIR
ASHTON
ASHTON
HENRY'S FORK
FALLS
RIVER
ST. ANTHONY

TABLE 13. GRAZING SUMMARY FOR THE ISLAND PARK GEOTHERMAL AREA

	Allotments	Permittees	Acres	Use Season	Animal Unit Months (AUMS)*
CATTLE					
National Forest Lands	8	20	145,353	June-Sept.	12,284
BLM Lands	6	8	6,437	June-Oct.	1,158
SHEEP					
National Forest Lands	17	11	204,558	Late Mid June-Sept.	29,103
BLM Lands	2	2	400	June-Sept.	300

*An AUM (Animal Unit Month) is the quantity of forage required by one mature cow (1,000 lbs.) or the equivalent for one month. One month's forage for five mature ewes (sheep) equals one AUM.

The IPGA provides valuable summer grazing for cattle and sheep.

WILDLIFE

The terrestrial wildlife communities inhabiting the IPGA result from vegetative patterns and man's activities. Although the vegetative designs of the IPGA appear homogeneous and unchanging, they are in fact dynamic systems constantly undergoing change through time. Wildlife associated with these communities also change in number, distribution, and composition.

Although much information is available on some animal species, little is available on others. Most information deals with wildlife management units not conforming to the boundaries of the IPGA. When possible, information has been quantified. However, in most cases, dissimilar data had to be combined to arrive at a species final standing in the IPGA. To the extent possible, animals are discussed as individual species or groups of similar species.

A total of 5 amphibians, 8 reptiles, 179 birds, and 61 mammals were identified according to habitat affinity and seasonal use. Migrant and accidentally occurring species were included in the appendix. Species were oriented to a habitat if they used that type for reproduction and feeding. The complete matrix is on file with the Targhee National Forest. Table 14 is a partial listing of the number of habitats used by common species and those of special interest (Appendix E contains a summary of all species).

TABLE 14. SOME COMMON AND SPECIAL INTEREST (*) WILDLIFE SPECIES AND NUMBER OF HABITATS EACH USES. SEE TABLE 15 FOR DIFFERENT HABITATS.

Chorus frog	6	Black-capped chickadee	25
Leopard frog	19	Red-breasted nuthatch	18
*Rubber boa	21	Brown creeper	14
Racer	20	Dipper	20
Common garter snake	23	Canyon wren	15
*Western grebe	13	American robin	26
Great blue heron	19	Mountain bluebird	26
*Black-crowned night heron	5	Golden-crowned kinglet	14
*American bittern	4	*Loggerhead shrike	10
*Trumpeter swan	19	Starling	10
Canada goose	12	*Warbling vireo	11
Mallard	23	*Yellow warbler	5
Gadwall	15	Yellow-rumped warbler	23
Pintail	16	*Yellow-breasted chat	16
Blue-winged teal	12	House sparrow	7
Baldpate	15	Western meadowlark	7
Northern shoveler	15	Yellow-headed blackbird	6
Redhead	16	Red-winged blackbird	7
*Canvasback	11	Northern oriole	14
Turkey vulture	25	Brewer's blackbird	15
*Sharp-shinned hawk	23	Evening grosbeak	19
*Cooper's hawk	24	House finch	19
Red-tailed hawk	27	Pine siskin	22
*Swainson's hawk	21	Green-tailed towhee	11
*Ferruginous hawk	5	*Vesper sparrow	4
*Golden eagle	29	Dark-eyed junco	18
*Bald eagle	23	Brewer's sparrow	5
*Marsh hawk	10	White-crowned sparrow	24
*Osprey	17	Vagrant shrew	24
*Prairie falcon	7	Little brown myotis	23
*Merlin	23	Silver-haired bat	19
*American kestrel	25	Big brown bat	25
Blue grouse	25	Pika	5
Ruffed grouse	20	Snowshoe hare	18
*Sharp-tailed grouse	8	Least chipmunk	19
*Sage grouse	6	Yellow pine chipmunk	25
Sandhill crane	14	Yellow-bellied marmot	12
Common snipe	14	Richardson's ground squirrel	2
Spotted sandpiper	11	Red squirrel	18
American avocet	12	Northern pocket gopher	24
California gull	11	Beaver	24
Mourning dove	17	Deer mouse	31
*Barn owl	17	Boreal red-back vole	12
Great horned owl	24	Mountain vole	20
*Burrowing owl	4	Muskrat	10
*Short-eared owl	14	Western jumping mouse	17
Common nighthawk	22	Porcupine	25
Calliope hummingbird	18	Coyote	30
Belted kingfisher	17	*Gray wolf (Northern Rky. Mtn. Wolf)	27
Common flicker	21	Black bear	31
*Lewis woodpecker	21	*Grizzly bear	27
Yellow-bellied sapsucker	15	Marten	14
*Hairy woodpecker	19	*Fisher	21
Eastern kingbird	19	Long-tailed weasel	30
Western tanager	21	Mink	26
Hammond flycatcher	19	*Wolverine	17
Western wood pee-wee	18	Badger	16
Olive-sided flycatcher	22	Striped skunk	18
Horned lark	7	*Canada lynx	19
Tree swallow	24	*Bobcat	26
Bank swallow	17	Elk (Wapiti)	24
Gray jay	19	Mule deer	23
Black-billed magpie	21	Pronghorn	25
Common raven	23	Moose	25
Clark's nutcracker	16		

The number of habitats each species uses for feeding and reproduction is a measure of the adaptability of the species. The greater the number of habitats used the more adaptable the species and the less vulnerable it is to habitat manipulation or loss. The more species using the habitat for feeding and reproduction, the more important it is to wildlife. Table 15 gives a summary of the wildlife-habitat associations.

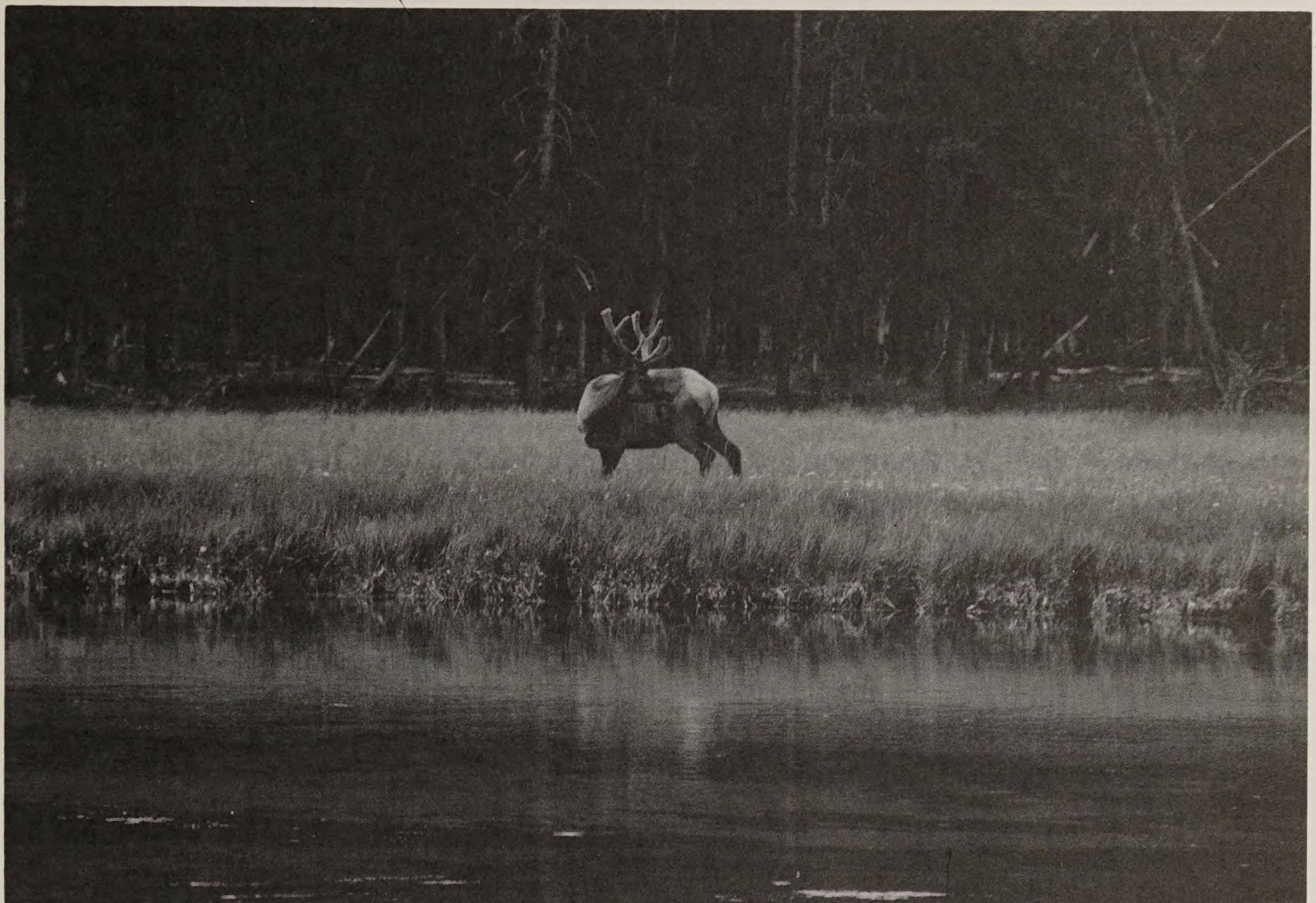
Analysis of wildlife in the preceding manner does not allow consideration of certain key components of important wildlife groups (winter range, migration routes, reproduction areas, legal considerations, etc.). The following discussion considers key points for species or groups of special interest on the IPGA.

The IPGA does not conform to State Fish and Game Department big game management units, herd units, or hunting districts. Approximately 85% of the IPGA is within portions of Idaho Management Units 60, 61, 62, and 62A, none of which lie entirely within the area. Data collected for these four units, when adjusted to include portions in Montana and Wyoming, reflect features of the big game populations that inhabit the IPGA as a whole. In most cases, available data on big game within the Montana and Wyoming units are identical or very similar to Idaho information.

TABLE 15. WILDLIFE-HABITAT ASSOCIATIONS BASED ON REPRODUCTION AND FEEDING. AF=SUBALPINE FIR: DF=DOUGLAS-FIR; LPP=LODGEPOLE PINE.

Habitat	Number of wildlife species using habitat for: Reproduction	Feeding	Total number of species using habitat
AF/Snowberry	122	141	142
DF/Snowberry	130	160	162
AF/Spirea	121	142	143
AF/Huckleberry	99	106	108
AF/Whortleberry	90	95	96
AF/Pinegrass	94	105	106
DF/Huckleberry	137	162	163
DF/Pinegrass	133	168	168
DF/Spirea	90	116	143
DF/Mountain Maple	127	148	149
LPP/Bitterbrush	72	73	74
Forest Successional Stage			
Grass-Forb	57	164	165
Shrub-seedling	85	175	175
Seral pole	83	150	151
Full-size seral	128	142	152
Full-size climax	125	133	143
Old growth	113	127	136
Aspen Groves	77	123	126
Sagebrush	68	103	103
Mountain brush	71	103	104
Dry Meadows	41	122	122
Wet Meadows	48	128	128
Rivers & Streams	132	192	193
Lakes & Reservoirs	82	144	144
Riparian Deciduous	123	170	176
Marshes	109	148	152
Cliffs & Rims	39	48	62
Talus	23	59	61
Caves	21	10	25
Snags	44	43	58
Down Material	45	73	84

Information on small game and waterfowl was collected by counties and an estimate was made of the proportion occurring on the IPGA. In all cases wildlife population projections and goals are presented and, when relevant, past trends are discussed.



Big Game

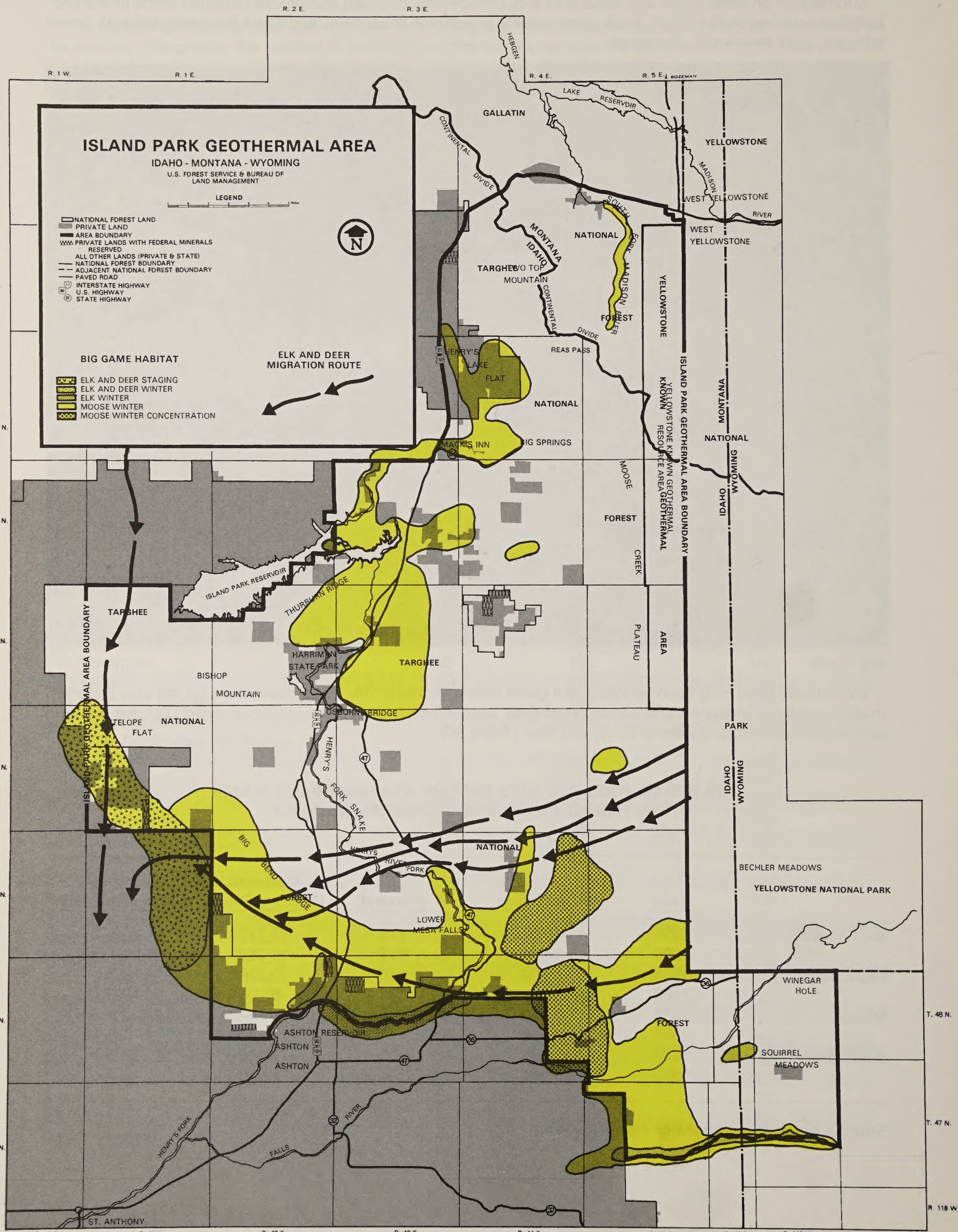
Elk (Wapiti) have long been an important game animal on the IPGA. Their occurrence on the area depends mainly upon the presence and condition of their food supply. Their numbers have varied, but the present population is increasing after a 10-15 year low (Table 16).

TABLE 16. PRESENT AND FUTURE STATUS OF BIG GAME ON THE ISLAND PARK GEOTHERMAL AREA

	Year	Population	Harvest	Demand (Hunter Days)	Success (Days/Animal)
Elk (Wapiti)	1975	1,700	275	12,712	40.6
	1980	1,920	375	15,750	38.1
Mule Deer	1975	2,700	525	6,220	13.3
	1980	2,300	295	6,000	12.5
Moose	1975	320	22	84	4.7
	1980	200	4	20	5.0
Black Bear	1975	430	25	845	30.8
	1980	465	35	1,630	48.0

Source: Idaho Department of Fish and Game

9. WILDLIFE MIGRATION ROUTES



Most elk migrate by late November and congregate on a major staging area in the southwestern portion of the IPGA (Map 9). Much of this staging area is on adjoining lands administered by the Bureau of Land Management and the State of Idaho. Approximately 35% is on the IPGA. The specific function of this staging area is unknown; however, animals spend most of the time feeding, apparently preparing for winter. During mild winters they use the area for winter range.

In summer elk are distributed throughout the IPGA. Habitat use patterns vary with climate and various activities in the area (grazing, logging, recreation, etc.). The entire IPGA is fair summer range for elk. Elk wander back and forth across the Yellowstone National Park boundary throughout the summer.

Elk migrate along distinct routes through the IPGA (Map 9). Elk from Yellowstone National Park and surrounding portions of the Targhee and Gallatin National Forests also use these routes, but the exact numbers or proportions of these herds using the routes are unknown. In the northeastern portion of the IPGA east of the Continental Divide, elk from the Madison River herd in Yellowstone National Park migrate and spend the fall and winter along the South Fork of the Madison River. Here, no distinct migration routes have been identified.

By mid-December elk have moved to the Juniper Mountains/Sand Dunes winter range approximately 30 miles southeast of the IPGA. This winter range is administered by the Bureau of Land Management and the Idaho Fish and Game Department in cooperation with the Department of Lands and private landowners. Most of the elk that summer on the IPGA spend the winter on this range. In the winter of 1977-78, the winter range held approximately 1,500 elk, 200 more than the previous winter. Herd productivity rates have ranged from 45 to 76 calves per 100 cows over the last three years. The Idaho Fish and Game Department has set a goal of achieving an optimum herd size of 2,000 by 1980.

Approximately 200 elk winter on the IPGA (Map 9). The winter ranges, located along Boone Creek and Conant Creek in the southeastern portion and along Willow Creek in the Southwest, are in fair to poor condition with much of the winter browse overused, old, and decadent. The Idaho Fish and Game Department fed 103 elk on an emergency basis along the southwestern border of the IPGA during the 1977-78 winter.

Since 1974 hunting in Idaho has been "bulls only" during general seasons, with fewer special permits, fewer general hunts, and shorter seasons. Some either sex permits issued during special hunts within the IPGA will continue to be issued in the future. In the Montana portion of the IPGA, hunting is also "bulls only", with some permits for antlerless elks. Wyoming allows late either sex hunts on its elk within the IPGA.

There are no discrete elk calving grounds on the IPGA. Calving occurs on the winter, spring, and summer range and is totally dependent upon climate. In years with heavy snowfall and a "late" spring, calving takes place off the IPGA or along the western and southwestern edges. In years with light snowfall, elk may calve anywhere on the IPGA in suitable habitat. However, key calving areas (those used every year of "normal" snowfall) are along Big Bend Ridge and Thurburn Ridge.

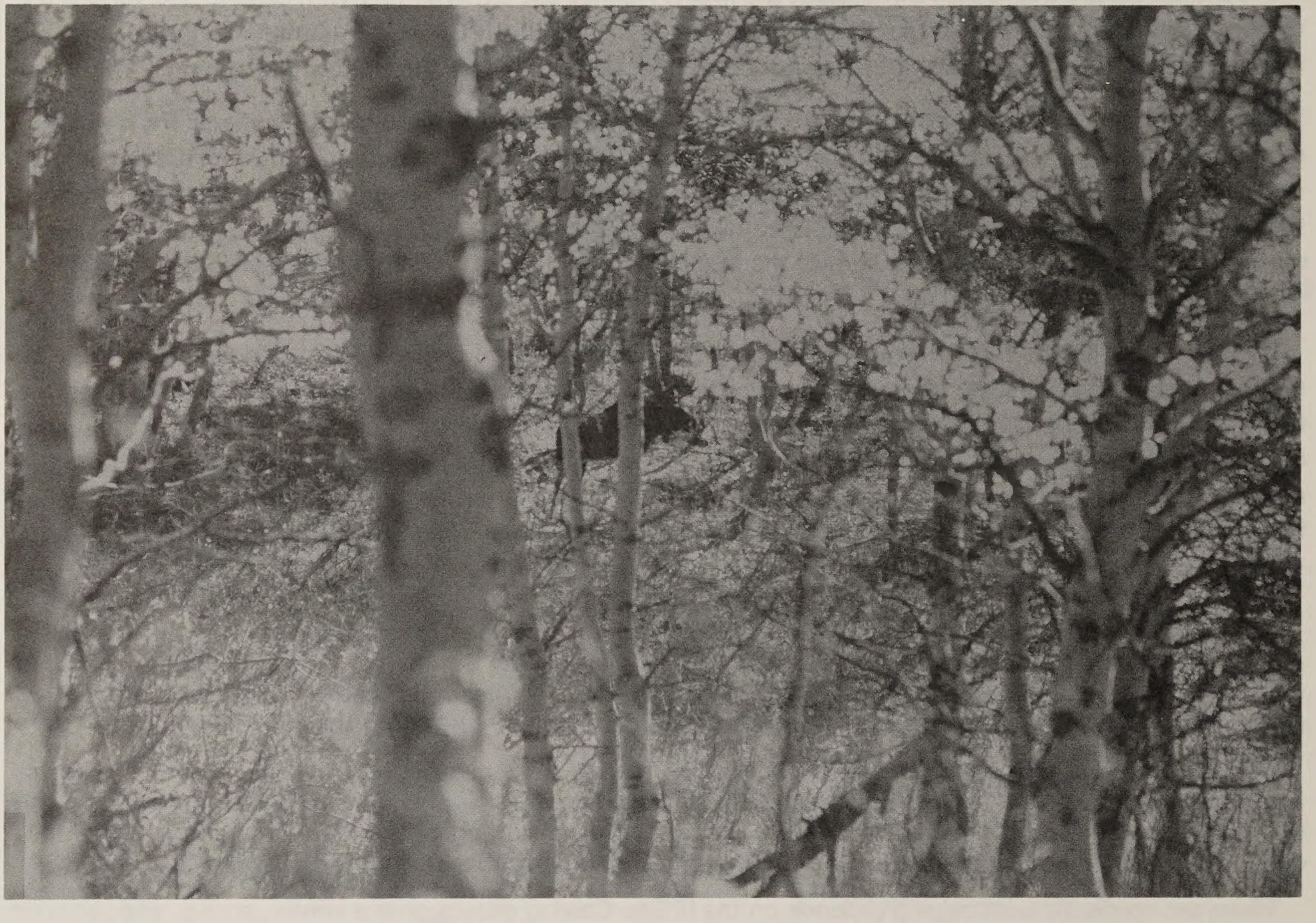
The mule deer is the most important big game species in Idaho, Wyoming, and Montana in terms of total animals harvested and hunter participation. The entire IPGA is summer range in fair to good condition with good summer range in short supply.

Present deer numbers are low (Table 16) due to several factors: mule deer populations have fluctuated over the past 100 years with variations in habitat, climatic conditions, reproductive success, and fawn/yearling survival. Low deer numbers are not limited to Idaho or the IPGA, as adjacent States have indicated that deer herds are below desired levels and have declined for the past several years.

Most of the mule deer that summer on the IPGA spend the winter off the area. The main winter range is the Juniper Mountains/Sand Dunes range described above. Approximately 1,200 deer used this range in the winter of 1977-78. Numbers have ranged from 700-1,100 in the past 5-10 years. Deer use the migration routes described earlier (Map 9), and fawning occurs along these routes. In 1977 a ground count by the Idaho Fish and Game Department estimated a production of 70 fawns per 100 does along Big Bend Ridge. Some deer winter on the IPGA along the southern boundary (Map 9). In the winter of 1977-78, approximately 70-80 deer were emergency-fed by the Idaho Fish and Game Department along the Ashton Hill and Warm River in order to pull them through this particularly harsh winter. Some feeding occurs on private land each year.

Moose are distributed throughout the IPGA with variable patterns of habitat use. During the summer small groups (2-5) and single individuals are scattered through the various habitats. Moose prefer forest, mountain brush, and riparian habitat types. Willow areas within the riparian type receive considerable use.

Previous high density moose populations in the IPGA have declined severely in the past five years. Wintering numbers have decreased due to winter mortality, uncontrolled Indian harvest, and illegal kills. The Idaho Fish and Game Department no longer allows hunting of moose within the Idaho portion. The Wyoming Game and Fish Department has reduced the number of permits in the herd unit overlapping the IPGA. Moose are still hunted in the Montana portion, but current hunter success is declining.



The IPGA provides extensive winter range for moose (Map 9). The condition of ranges varies throughout the area, but in most portions is good. The main winter areas are: (1) Fall River-Warm River Butte, which receives heavy use during extreme winters and is rated fair to poor winter range. Moose in portions of this area reach densities of 10-20 animals per square mile. Most move into Yellowstone National Park and Wyoming during the summer. (2) Big Bend Ridge—this range is in good condition, but the population has been declining, possibly due to illegal harvest. The main concentration areas are Snake River Butte and drainages. (3) Island Park-Henrys Lake—the main areas of use are along Henrys Fork with scattered use in the Henrys Flat region. This range is also considered good. Approximately 30-40 moose winter along the south shoreline of Island Park Reservoir utilizing willow-covered peninsulas. Some of these animals range into the IPGA and utilize forested habitats, but the degree of use has not been determined. (4) Hebgen Lake—this range, located along the South Fork of the Madison River and in riparian areas along the Henrys Lake Mountain, is considered good range.

Snow depth in the IPGA in extreme winters can be a problem to moose. They are able to get along in deep snow, but depths of six and seven feet can increase mortality of old and young animals. Food availability determines winter range selection and overall well-being of the herds. Important forage species include willow, bitterbrush, chokecherry, serviceberry, subalpine fir, sedges, and grasses.

Black bear reach highest numbers in the eastern half of the IPGA; however, they are present throughout the area. Despite a continual open season and indiscriminate killing, densities remain high in certain portions, especially the southeastern section. No information is available on reproductive rates, sex ratios, or other population parameters. Studies to be completed in 1979 by the Targhee National Forest are expected to fill some of these voids.

The mountain lion is present in the IPGA, but its status and numbers are unknown. Total numbers are undoubtedly low since the area is less than optimum habitat. They are currently protected in Idaho and hunted on a limited basis in Wyoming and Montana.

Pronghorns (antelope) use Henrys Lake Flat in the northwestern corner of the IPGA. This is predominantly private grassland used for livestock grazing, with small pockets of sagebrush throughout. The Idaho Fish and Game Department estimates that 180 pronghorn use the summer range in and around Henrys Lake Flat, approximately one-half of which is on the IPGA. The herd migrates through Raynolds Pass into Montana for the winter. Pronghorns are not presently hunted on the IPGA.

Upland Game

The importance of upland game birds is tabulated in table 17. Upland game hunting is a significant use of wildlife on the IPGA.

Sage grouse use sagebrush-grass and mountain brush habitats for summer feeding and brood rearing (map 10). Preferred habitats are associated with stream bottoms where water and meadows with succulent vegetation are available for brood rearing. The closest strutting grounds to the IPGA are approximately five miles southwest of the area. Preferred nesting habitat is usually within a two mile radius of the strutting grounds. No nests have been found on the IPGA. Despite annual fluctuations, sage grouse populations generally have increased since 1960. A peak was reached around 1970, and a decline was evident by 1975. It is projected that populations will gradually rebuild through 1990, with greater hunter demand and essentially the same hunter success rate (table 17).

Sharp-tailed grouse are rare on the IPGA with most sightings in mountain brush along the southwestern edge of Big Bend Ridge. They are associated largely with grasslands interspersed with brush. The sharp-tailed grouse is a species of special concern to the Idaho Fish and Game Department, which recommends that all possible measures be taken to protect, enhance, and expand existing habitat. In recent years, some increased since 1960. A peak was reached around 1970, and a decline was evident by 1975. It is projected that populations will gradually rebuild through 1990, with greater hunter demand and essentially the same hunter success rate (table 17).

Two species of forest grouse, blue and ruffed grouse, are common throughout the IPGA. Blue grouse use most habitats and move to higher elevations for wintering. They nest on grassy open slopes and sagebrush-covered ridges, usually at the base of a small tree or shrub. Nesting habitat is usually found at elevations below the mature coniferous forest used for wintering. They depend on conifer needles for winter food and have been known to gain weight on this diet.

Ruffed grouse are also found in most habitats on the IPGA. Although these birds eat a variety of food during much of the year, they feed largely on buds of aspen and various other deciduous species during the winter.

TABLE 17. UPLAND GAME BIRD STATISTICS FOR THE ISLAND PARK GEOTHERMAL AREA

Year	Pre-season Population	Total Harvest	Total Hunters	Total Hunting Days	Success (Birds/Day)
			SAGE GROUSE AND SHARPTAILED GROUSE		
1975	5,500	600	330	790	0.8
1980	5,600	680	340	800	0.8
1985	5,760	860	360	800	1.0
1990	6,000	1,000	400	1,000	1.0
			FOREST GROUSE		
1975	40,000	2,100	700	2,800	0.8
1980	45,000	2,600	1,000	4,000	0.7
1985	45,000	3,000	1,200	4,800	0.6
1990	45,000	3,800	1,500	6,000	0.6
			MOURNING DOVE		
1975	2,000	345	35	117	2.9
1980	2,000	360	40	130	2.8
1985	2,000	380	48	160	2.4
1990	2,000	400	50	170	2.4

Source: Idaho Fish and Game Department

Populations of forest grouse typically fluctuate and may be cyclic. Allowing for these fluctuations, past populations have been relatively stable, and this trend is expected to continue through 1990 (table 17). Most forest grouse are harvested coincidental to big game hunting although bird hunting is increasing in popularity. Due to this growing demand, harvest levels have steadily increased. Demand and harvest are both projected to continue increasing through 1990, with a constant hunter success rate.

The mourning dove is common throughout the IPGA; migratory and nesting populations are present. It is associated mainly with sagebrush-grass, mountain brush, and riparian habitats, but also occurs in some forested habitat types. Mourning dove populations gradually increased from 1960 through 1975. Under current management levels and habitat trends, populations should remain at present levels through 1990 (Table 17).

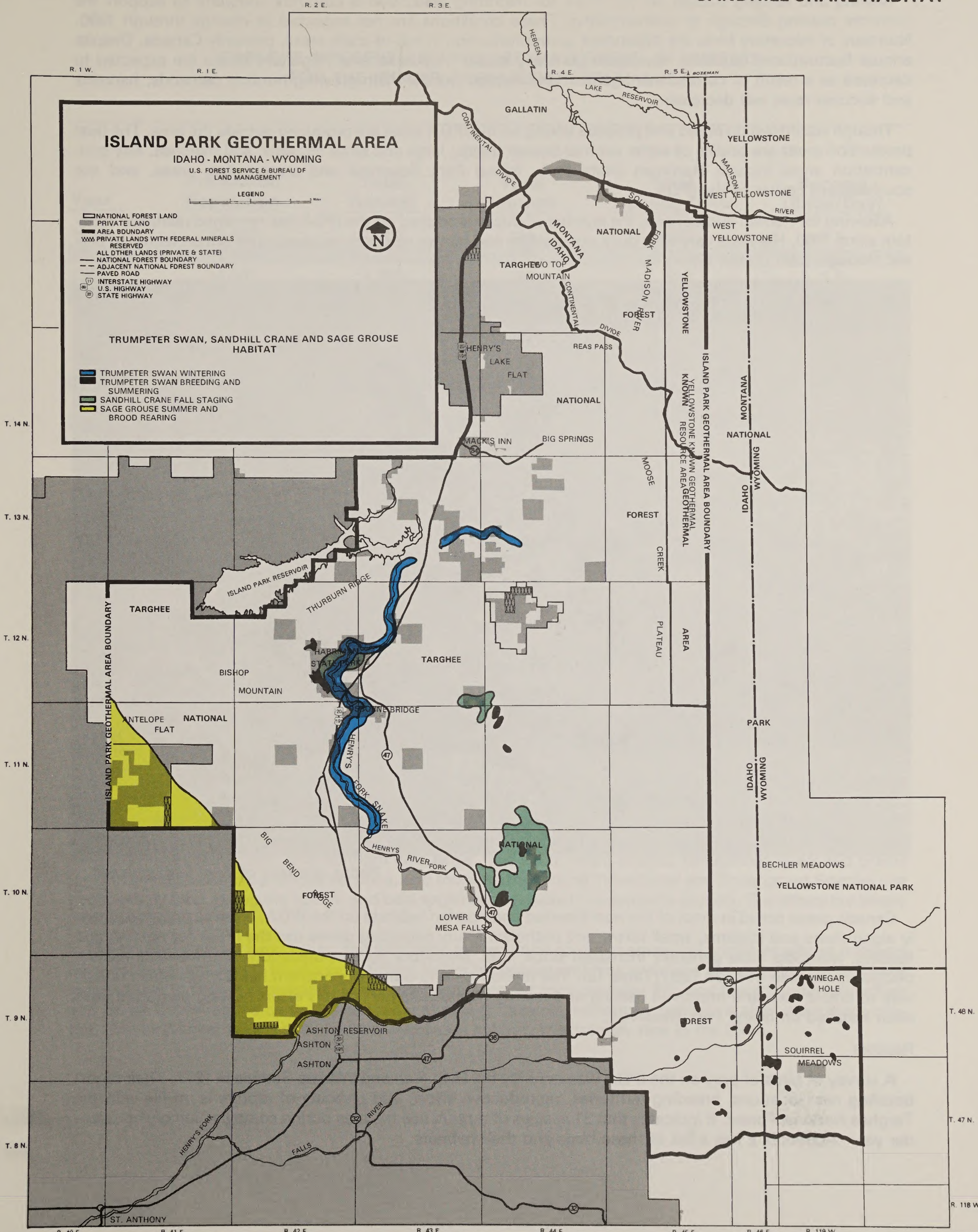
Mourning doves fall under the jurisdiction of the Migratory Bird Treaty Act. Under this Act, harvest regulations and management are primarily the responsibility of the U.S. Fish and Wildlife Service. The earliest opening date allowed under this Act is September 1, which coincides with the peak of migration out-of-state and effectively limits hunting.

Mountain cottontails (rabbits) are associated primarily with nonforested habitat, aspen groves, and riparian habitats. Essentially stable populations of the last 10-15 years are projected to remain so through 1990. Less than 20 cottontails are harvested in any year on the IPGA. Cottontails are a main constituent in the diet of many raptorial birds.

Waterfowl

The IPGA is located in the Pacific waterfowl flyway. Over a million waterfowl migrate over the IPGA in spring and fall. Fall movements begin in mid-to-late-August and continue through December. Large numbers of ducks and geese concentrate on and around Island Park reservoir, Henrys Lake, Hebgen Lake, and Harriman State Park before moving south. These concentration areas are immediately adjacent to the IPGA and Red Rock Lakes Migratory Waterfowl Refuge in Montana, only 15 miles to the northwest. Migrating waterfowl also make extensive use of Henrys Fork and other watercourses, lakes, marshes, and potholes on the area. The northward migration begins in late March and continues through April and May.

10. SAGE GROUSE, TRUMPETER SWAN, AND SANDHILL CRANE HABITAT



Resting and feeding habitat on the IPGA for migrating waterfowl is currently adequate to support the numbers passing through or overwintering. These conditions are not expected to change through 1990. Numbers of migratory birds are dependent upon production in out-of-state areas, primarily Canada. Despite annual fluctuations, numbers have been generally stable. Populations of migratory ducks are expected to decrease as a result of current management and habitat trends. With growing hunting demands, harvests and success rates will decrease.

Though waterfowl do breed and produce young on the IPGA most are produced outside the area. The best production areas are bodies of water such as beaver ponds, large and small streams, and marshes. Key concentration areas include Harriman State Park, Island Park Reservoir and surrounding areas, and the southeastern corner of the IPGA.

Allowing for normal fluctuations, the number of ducks produced on the IPGA has remained relatively constant since 1960. Harvests vary with duck populations and hunter numbers; success rates are projected to persist through 1990 (Table 18).

Photo courtesy of Sam Winegardner

Canada geese breed in most of the non-forested and riparian habitats on the IPGA. Nesting occurs primarily along rivers and streams, small lakes, and potholes. Many migrating geese use the IPGA for nesting and feeding. Numbers have generally increased since 1960. Migratory goose populations and harvests are expected to increase through 1990 (Table 18). The Idaho Fish and Game Department has a major effort underway to create new and improved nesting and rearing habitat. As part of this effort nesting platforms have been installed on Island Park Reservoir.

Raptors

A survey of birds of prey on the IPGA was done by the U.S. Fish and Wildlife Service in 1977. Their report detailing nest locations, breeding territories, reproductive effort, and diversity of raptors is on file with the Targhee National Forest. It indicates that 31 species of raptors use the area during some portion of the calendar year. Appendix E has a list of these birds and their habitats.

TABLE 18. PRESENT AND FUTURE WATERFOWL STATISTICS FOR THE ISLAND PARK GEOTHERMAL AREA

Year	Pre-season Population	Total Harvest	Total Hunters	Total Hunting Days	Success (Birds/Day)
			DUCKS		
1975	13,500	1,000	165	660	1.5
1980	13,500	1,100	175	720	1.5
1985	14,500	1,200	180	800	1.5
1990	15,000	1,400	200	900	1.6
			CANADA GEESE		
1975	1,500	450	360	1,080	0.4
1980	1,500	480	390	1,365	0.4
1985	1,500	525	420	1,640	0.3
1990	1,500	540	435	1,780	0.3

Source: Idaho Department of Fish and Game

Birds of prey subsist mainly on small rodents, fish, reptiles, amphibians, carrion, and an occasional hooved animal (ungulate). Shrubs, trees, and cliffs provide cover and nesting sites for most of the species. In open country around Henrys Lake Flat utility poles, fence posts, snags, and other isolated structures provide important perches for nesting and hunting. Many of these structures are also found around sagebrush flats, meadows, and riparian habitats on the IPGA. Raptors are important elements in predator-prey relationships in most ecosystems. They can help control small prey species such as rabbits, hares, and rodents.

The Fish and Wildlife Service raptor report emphasized the importance of Henrys Lake Flat, which extends onto the IPGA. This high elevation grassland is used by hundreds of fledged falcons and hawks as a staging area during migration in August and September. Nearby ridges funnel birds in from the north, south, and west to the Flats, where they use the surrounding forest for hunting, roosting, and perching.

Raptors are completely protected by the Federal Migratory Bird Treaty Act and state regulations.

Species of Special Concern

Of special concern to Idaho, Montana, and Wyoming are species whose restricted range, specific habitat requirements, and/or low numbers make them vulnerable if adverse impacts on populations or habitat occur. Of the 22 state-listed species, the following are found on the IPGA: grizzly bear, Northern Rocky Mountain wolf, Canada lynx, fisher, wolverine, trumpeter swan, sharp-tailed grouse, ferruginous hawk, prairie falcon, American peregrine falcon, and northern bald eagle. The sharp-tailed grouse, ferruginous hawk and prairie falcon were discussed in previous sections, and those on the federal Threatened and Endangered Species List (wolf, grizzly bear, peregrine falcon, and bald eagle) are discussed in a separate section. The others are briefly discussed below.

The bobcat, Canada lynx, fisher, and wolverine are common-to-rare mammalian predators whose numbers have declined in the past 10-15 years. Rising prices for bobcat and lynx pelts and uncontrolled harvest have reduced their numbers drastically. They have been removed from predator lists and placed under Idaho Fish and Game Department's control. The fisher, requiring forested, wilderness habitat, is also under state control. The wolverine, which also requires wilderness habitat, is extremely rare in the IPGA.

The IPGA is a very important wintering area for Trumpeter Swans.

The trumpeter swan is a common resident of the IPGA (Map 10). While the species is no longer endangered or threatened, in recent years trumpeter breeding populations have experienced extremely high mortality among cygnets (60%-90%). Evidence points to a possible nutritional problem in the wintering areas. Breeding habitat requirements of these birds are:

1. Waters with a relatively static level, not marked by seasonal fluctuations.
2. Quiet waters of lakes, marshes, or sloughs, not subject to current or constant wave action.
3. Shallow waters of lakes or open marshes, not so deep as to preclude digging and foraging for lower aquatic plant parts, roots, tubers, etc.
4. Minimum human disturbance and relatively remote areas.

The open waters of the Henrys Fork drainage within the IPGA are the primary wintering areas for all of Canada's Trumpeter Swans. In addition to the migrants, approximately 50% of the year-round resident Trumpeters winter within the IPGA. The relative isolation, abundant submerged vegetation, and open waters of the Henrys Fork are critical to the welfare of the remaining Trumpeter population of Canada and the U.S. Hebgen Lake, approximately 4 miles north of the IPGA, also supports wintering Trumpeters.

Photo courtesy of Sam Winegardner

Several locations in the IPGA provide suitable Sandhill Crane habitat.

The sandhill crane, considered unique, is common on the IPGA. It is a summer resident which breeds and nests where there are abundant marsh and riparian habitat. Cranes congregate on a major staging area on the IPGA (Map 10) where they feed and prepare for the fall migration.

Threatened and Endangered species

The Endangered Species Act of 1973 (P.L. 93-205) officially recognizes two categories of animals, Endangered Species and Threatened Species. Section 7 requires all federal agencies to take necessary actions to insure critical habitat for endangered or threatened species is not adversely modified or destroyed.

Three endangered and one threatened species inhabit the IPGA. Although most wildlife species lists and maps show the range of the endangered spotted bat (**Euderma maculata**) extending into the IPGA, no authenticated records of spotted bats have been collected.

The Northern Rocky Mountain wolf (**Canis lupus irremotus**), one of 32 subspecies or geographic races of the gray wolf, was listed as endangered and became legally protected in 1974. The historical and current distribution of the wolf includes the IPGA. Unverified sightings have occurred on the area for several years, and verified sightings have been made adjacent to the IPGA. The area is at the edge of the wolf's present distribution, and thus is used occasionally (Dennis Flath, Team leader, Northern Rocky Mountain Wolf Recovery Team, 1978).

The American peregrine falcon (**Falco peregrinus anatum**). an endangered species, is known to use the IPGA, but no nesting was observed or reported in 1975 or 1977. Historic eyries on the area are not active. One peregrine sighted in 1977 in the northern section of the IPGA along the Continental Divide was probably migrating, since the sighting coincided with the migration period. No other sightings have been reported.

The bald eagle (**Haliaeetus leucocephalus**), recently listed as an endangered species, is an uncommon breeder on the IPGA. One nest was discovered within the IPGA in 1977, and another to the west along Henrys Lake. Five young fledged from the two nests. There are two productive nests north of the IPGA along Hebgen Lake. Bald eagles feed extensively on lakes and reservoirs in the IPGA in summer, and some birds winter on the area. Eagles are scattered throughout the area in summer. Targhee and Gallatin National Forests are presently identifying essential habitat for the bald eagle.

The grizzly bear (**Ursus arctos horribilis**), a threatened species, occurs throughout the IPGA, except the extreme western section. Bears on the area are part of the Yellowstone population, which has been studied since 1973 by an Interagency Grizzly Bear Study Team of research biologists from the National Park Service, Fish and Wildlife Service, Forest Service, and the States of Wyoming, Montana, and Idaho.

Approximately 94,000 acres (19%) of the IPGA have been designated as land where the grizzly bear will receive management priority (Map 11). Pending formal determination of critical habitat, this area will be treated as critical habitat and protected from adverse modification or destruction.

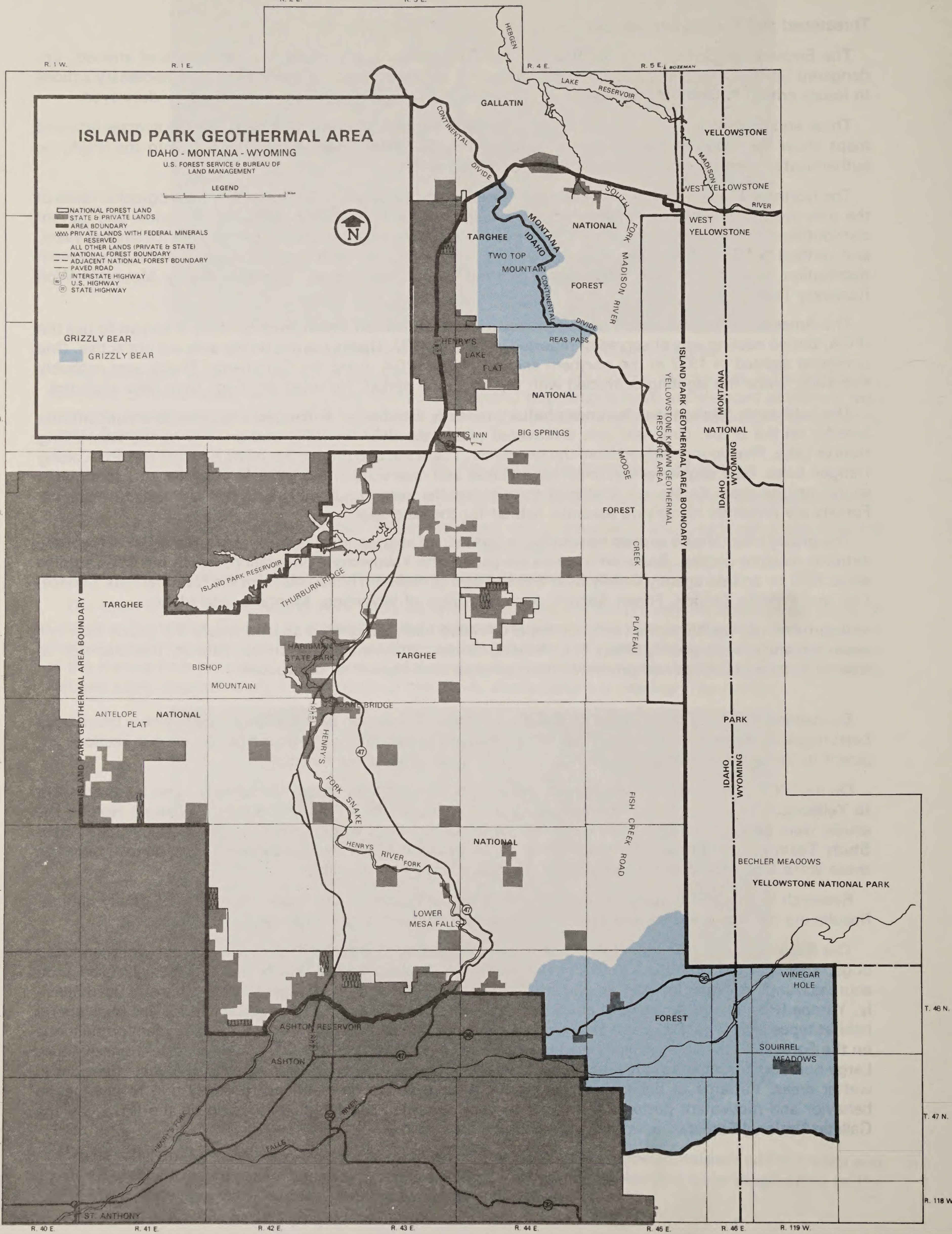
Delineation of grizzly bear habitat on the IPGA relied heavily upon past sightings; areas where bears have been regularly observed. All of the IPGA is historical grizzly habitat, but bears are usually seen in sections adjacent to Yellowstone National Park where human-bear conflicts are minimal.

On the IPGA some habitat appears more valuable to grizzlies than others, particularly those lands adjacent to Yellowstone National Park. The two designated portions (Reas Pass in the north, Winegar Hole in the south) were originally chosen because of the numerous sightings within them. The Interagency Grizzly Bear Study Team has confirmed that these areas contain habitat highly desired by bears. The plateau between these areas lacks many habitat features and is accordingly less desirable.

Research is being conducted on the Targhee National Forest to determine the quality of grizzly habitat. Results are not yet available, but on the IPGA some conclusions can be made.

The Reas Pass and Winegar Hole areas have highly productive forest understories, open wet meadows, bogs, swamps and potholes. Both contain extensive downed timber which supports heavily used food sources (fungi, rodents, insects). In wet areas, **Potamogeton** sp., an emergent aquatic plant, is used heavily. Yampa (**Perideridia gairdneri**) abundant throughout both areas, is an important food. Tall huckleberry habitat types (AF/Vagl, DF/Vagl) in Winegar Hole supports some of the most productive rodent populations on the Forest. Rodents, particularly pocket gophers (**Thomomys talpoides**), are an important grizzly food. Large numbers of rodents are present in both the Reas Pass and Winegar Hole areas with highest densities in wetter areas. Patterns of habitat use on the IPGA have yet to be identified, possibly due to changes in behavior and movement patterns from year to year. One den site has been located on the IPGA, on the Gallatin National Forest.

11. GRIZZLY BEAR HABITAT



As previously stated, the delineation of essential habitat was based primarily on recent sightings. However, additional data has been used to evaluate grizzly bear habitat. These data are from three primary sources:

1. Flight reports of the Interagency Team on radio-collared grizzlies:

   #14—A male collared in Winegar Hole in July 1976

   #23—A female collared in the Reas Pass region in September 1977

   #24—A female collared in the Reas Pass region in September 1977

   #25—A sow with two cubs collared in Gardiner, Montana which was shot at Island Park, Idaho in September 1977

   #30—A sow with two yearlings which ranged into Reas Pass in October 1977 (one yearling tagged near West Yellowstone)

   #37—A cub collared in Squirrel Meadows, August 1978

2. Data from an on-going monitoring program on livestock allotments in the Reas Pass and Winegar Hole regions.

3. Procedures in **Criteria For Grizzly Bear Critical Habitat Identification**, U.S. Forest Service, Region 1, December 1975. A state of the art compendium.

FISHERIES

The major drainage system within the IPGA is the Henrys Fork (North Fork) of the Snake River. Relatively uniform water flows and temperatures, combined with high natural fertility and physical characteristics, provide for an outstanding cold-water fishery.

The sport fishery in Henrys Fork on the IPGA attracts fishermen from throughout the nation. With an annual use of nearly 95,000 angler days (valued at approximately 1.4 million dollars annually), and a catch of 175,000 salmonids (mostly trout) in 1973, this reach of Henrys Fork is possibly the most important stream in the State of Idaho.

Two reservoirs are influenced by streams flowing from the IPGA. The south fork of the Madison River, in the northeastern portion of the IPGA, supplies fish to Hebgen Lake, a significant fishery in Montana. Island Park Reservoir, within and adjacent to the IPGA, receives over 20,000 angler days use each year. Fish from Island Park Reservoir and Hebgen Lake rely heavily upon streams within the IPGA for spawning and rearing.

TABLE 19. SIGNIFICANT FISHERIES WITHIN THE ISLAND PARK GEOTHERMAL AREA

River or Stream	Recorded fish species												Fishery[1] rating	Fish habitat[2] suitability
	Wild rainbow trout	Hatchery rainbow trout	Cutthroat trout	Rainbow/Cutthroat hybrid	Brook trout	Brown trout	Mountain whitefish	Kokanee and Coho salmon	Suckers	Shiners	Dace	Sculpin		
Henrys Fork	X	X	X	X	X		X	X	X	X		X	4	very good
Fall River	X	X	X	X	X		X		X			X	3	good
Conant Creek	X	X	X		X		X		X	X	X	X	2	good
Squirrel Creek	X		X		X		X		X		X	X	2	fair
Boone Creek					X								2	*good
Sand Creek	X				X								unrated	undetermined
Rattlesnake Creek	X				X								1	poor
Willow Creek	X				X								1	*fair
Warm River	X		X	X	X		X		X			X	3	*good
Robinson Creek	X		X		X	X	X		X	X	X	X	3	*good
Rock Creek	X				X				X		X	X	2	good
Snow Creek			X		X								2	*good
Partridge Creek	X		X										2	poor
Thurburn Creek	X				X								unrated	very good
Split Creek					X								1	poor
Buffalo River	X	X			X							X	3	*very good
Moose Creek	X				X			X					4	*good
Big Springs	X		X	X									unrated	good
Henrys Lake Outlet	X		X	X	X		X	X		X	X	X	4	very good
Meadow Creek					X								1	fair
Jesse Creek					X								1	fair
Twin Creek			X		X							X	2	fair
Targhee Creek			X		X							X	2	fair
So. Fork Madison River	X					X							4	*good

[1] Fishery ratings were determined as follows:

1 = The aquatic environment produces some fish but stream or fishery conditions do not attract fishermen; or there is opportunity for this stream to contribute a low number of fish to offsite streams.

2 = The aquatic environment produces fair fish populations receiving some fishing pressure; or the stream contributes low numbers of fish to offsite streams used by fishermen.

3 = The aquatic environment produces good fish populations which are sought after by anglers; or the stream contributes moderate numbers of fish to offsite streams receiving moderate recreation demand.

4 = The aquatic environment produces excellent fish populations which are highly sought; or the stream may contribute high numbers of fish to offsite streams receiving high recreation use.

[2] Fish habitat suitability was assessed by evaluating the following parameters: pool habitat, streamside cover, food abundance, channel stability, and spawning habitat (* = significant spawning habitat)

Only a few aquatic environments and their fisheries have been studied in detail, and a full evaluation of these habitats is not possible. However, available data permit a general evaluation of fisheries and significant streams within the IPGA.

In 1977, the Fish and Wildlife Service's Office of Ecological Services evaluated the streams on the IPGA in a qualitative manner. Their report, on file with the Targhee National Forest, contains:

(1) a description of each stream's general physical characteristics

(2) fishery data collected by the State Fish and Game Departments

(3) individual data for each distinct stream reach

(4) available water quality data from state and federal agencies

(5) maps displaying trout habitat suitabilities, channel stability ratings, and significant stream features.

Table 19 is a summary of significant fisheries within the IPGA.

In 1976, the composition of game fish harvested on the Henrys Fork was 53% wild rainbow, 19% hatchery rainbow, 16% brook trout, 5% rainbow/cutthroat hybrids, less than 1% cutthroat trout, less than 0.1% kokanee salmon, and 7% mountain whitefish. Total angler hours have increased four percent in the last three to four years, while trout harvest has decreased 11 percent due to more restrictive regulations and fish population fluctuations.

Henrys Fork is stocked in a few locations with catchable-size rainbow trout which make up 11-20 percent of the fish harvest. However, most of Henrys Fork is currently managed as a "wild" trout stream.

Most of the tributary rivers and streams of Henrys Fork provide habitat for smaller resident fisheries. Many contain significant spawning and rearing habitat for native cutthroat trout. Kokanee salmon also depend on some of these streams (table 19). The Fall River, Warm River, and Robinson Creek are planted regularly by the Idaho Fish and Game Department. Many smaller streams with low fishery and habitat ratings are very important because they influence water quality of streams with higher ratings.

The South Fork of the Madison River in the northeastern part of the IPGA is one of two primary spawning grounds for fish from Hebgen Lake. The Montana Fish and Game Department plans to reestablish the wild trout fishery, and the tributaries are most important in achieving this goal. Any increase in nutrients or toxic substances could jeopardize this effort.

There are no significant lake fisheries within the IPGA other than Island Park Reservoir. Most of the lakes and potholes in the southeastern portion are small, shallow, and stagnant. Some do contain fish, but most are non-game species. Those that do have game fish receive very little use. However, there is potential to improve these aquatic habitats and increase the recreational opportunity. Two fish-holding reservoirs are in Harriman State Park: Golden and Silver lake. Golden Lake has an excellent population of brook and rainbow trout, while Silver Lake due to too many chubs is in need of rehabilitation. Ashton Reservoir, which extends onto the southwestern portion of the IPGA, receives flow from many streams in the Big Bend Ridge area, but production of invertebrate fauna and fish is poor.

Henrys Lake and Island Park Reservoir both receive heavy fishing pressure. The Island Park Dam is scheduled for repair in 1979 and the reservoir will be drawn down in mid-1979. The Idaho Fish and Game Department plans to chemically treat the reservoir during this drawdown.

There are no known federal or state listed threatened or endangered fish species, or any species of special concern on the IPGA.

In 1977 the Geothermal Environmental Statement Team decided that information on macroinvertebrates would make baseline data available for the geothermal environmental statement and also assist land managers on public lands.

Information on aquatic macroinvertebrates can be used to:

- Detect stress conditions and determine if they are due to natural causes or management practices
- Identify specific problems in a stream by determining the species present
- Help evaluate a stream's fishery potential.

Twelve major rivers and streams within IPGA were analyzed. When two stations were established on a stream, the upper one was located near the source or the point where the watercourse entered the IPGA, and the lower one was located where the stream exited the area. This provided data to make a control/treatment analysis of the streams.

The Geothermal Team established sampling stations and collected monthly samples during 1977. The samples were analyzed at the U.S. Forest Service's Aquatic Ecosystems Lab in Provo, Utah. Table 20 presents a summary of the results. The entire report is on file with the Targhee National Forest.

TABLE 20. SUMMARY OF AQUATIC MACROINVERTEBRATE SAMPLING ON THE ISLAND PARK GEOTHERMAL AREA.

River or stream	Diversity[1], [3]	Biomass[2], [3]	Water quality[3]	Environmental Influences[3]: sedimentation	Environmental Influences[3]: organic enrichment
Henrys Fork					
Upper	Good	Good	Fair		X
Lower	Good	Excellent	Good		
Fall River					
Upper	Good	Fair	Good		X
Lower	Fair to Good	Poor to Excellent	Good		X
Conant Creek	Good	Excellent	Good		X
Warm River					
Upper	Good	Excellent	Excellent		X
Lower	Fair to Good	Good to Excellent	Good		X
Robinson Creek					
Upper	Good	Good	Good		X
Lower	Good	Good to Excellent	Good		X
Rock Creek	Good	Good	Good		
Thurburn Creek (Middle Fork)	Fair	Excellent	Good	X	
Split Creek	Good	Fair	Good	X	X
Buffalo River	Good	Good to Excellent	Fair	X	
Moose Creek					
Upper	Good	Fair to Good	Good	X	
Lower	Good	Poor	Good	X	
Big Springs	Fair to Good	Good to Excellent	Excellent	X	
Madison River (South Fork)					
Upper	Fair to Good	Good	Excellent		X
Lower	Good to Excellent	Good to Excellent	Good		X

[1] Diversity—An index which combines the number of different organisms and their relative abundance.
Excellent = The community is well balanced and in excellent condition relative to physical and chemical conditions.
Good = Habitat or water quality is short of excellent.
Fair = Macroinvertebrates are waving a red flag indicating degeneration of the ecosystem.

[2]Biomass—The dry weight of the macroinvertebrates.

[3]The scales rate each study stream with a stream having ideal habitat and water chemistry for optimal productivity. An X under environmental influences indicates sedimentation and/or organic enrichment is above what is expected in the ideal stream.

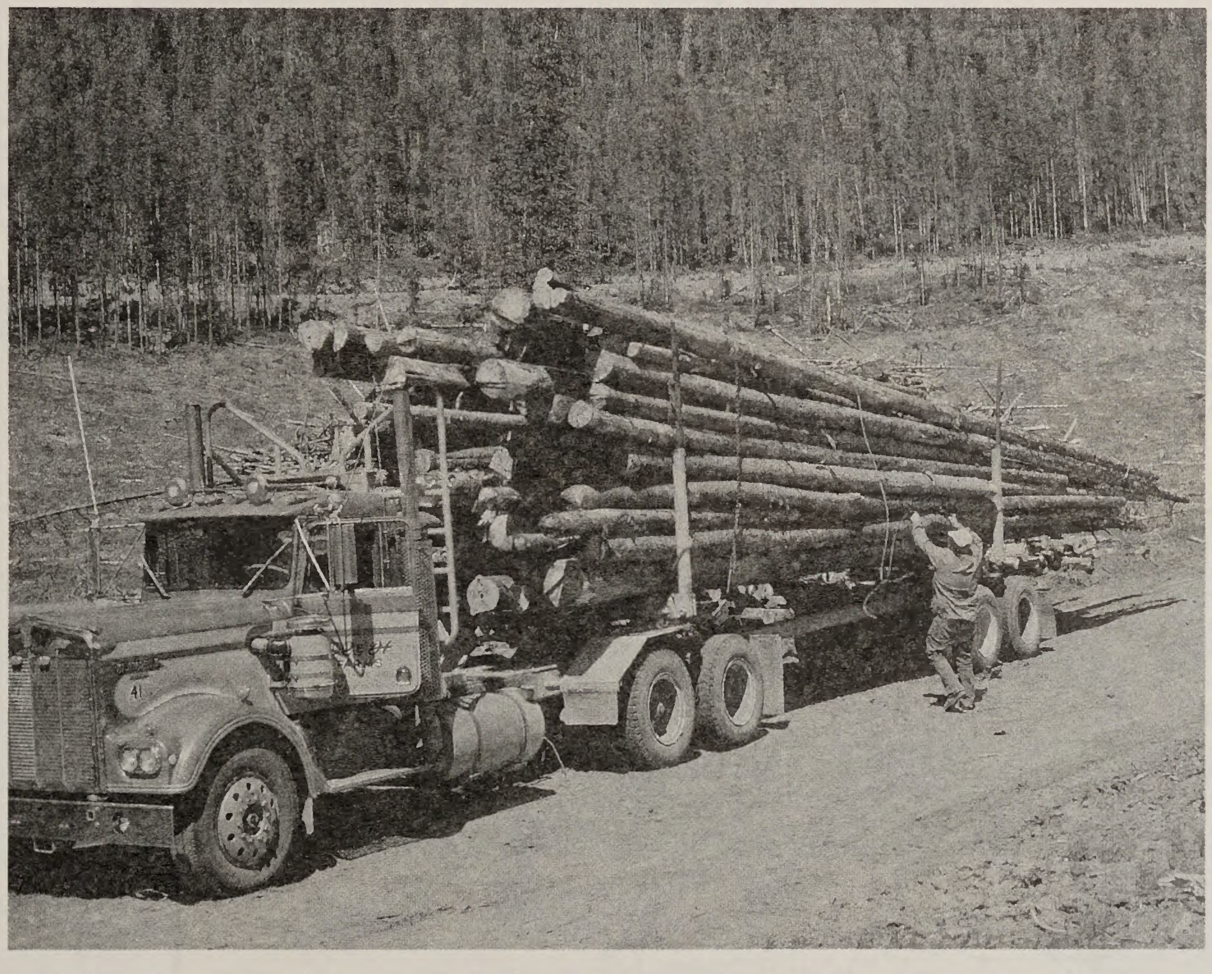
TIMBER

Timber resources are an important economic asset to the Upper Snake River Valley. The IPGA provides most of the timber for mills in Fremont County and some for other mills in Idaho, Montana and Wyoming.

Mountain pine beetle attacks have greatly impacted the timber management program within the lodgepole pine type. Many areas examined in 1976 contained nearly 70% dead trees, and some 80%. This dead material has resulted in development of other timber markets. An estimated 250-300 million board feet of lodgepole pine has been lost annually from 1976-1978 in the IPGA. Future sales of deadwood could be greater than 75 million board feet per year. Another 30-40 million board feet per year is removed by people with free use firewood permits.

The Moose Creek Plateau timber sale in the IPGA, comprising 318 million board feet, is the largest timber sale outside Alaska. Mountain pine beetle mortality has considerably reduced the available sale volume. Additional reductions may occur before the end of the timber sale contract period. Presently, the final harvest volume is expected to be about 200 million board feet from the 100 square mile sale area. Insect mortality and highly defective trees (rot, crook, etc.) have caused timber in some areas to be classed as unsalable. The current estimate of the area to be harvested is about 25,000 acres.

Timber from the IPGA provides a diversity of forest products. Fence posts, corral poles, house logs, cellar timbers and mineprops, in addition to stud log material, account for a significant portion of the sale volume. Indications are that demand for these products will continue to increase. Timber productivity estimates are presented in Table 21. Timber types are shown on Map 12.



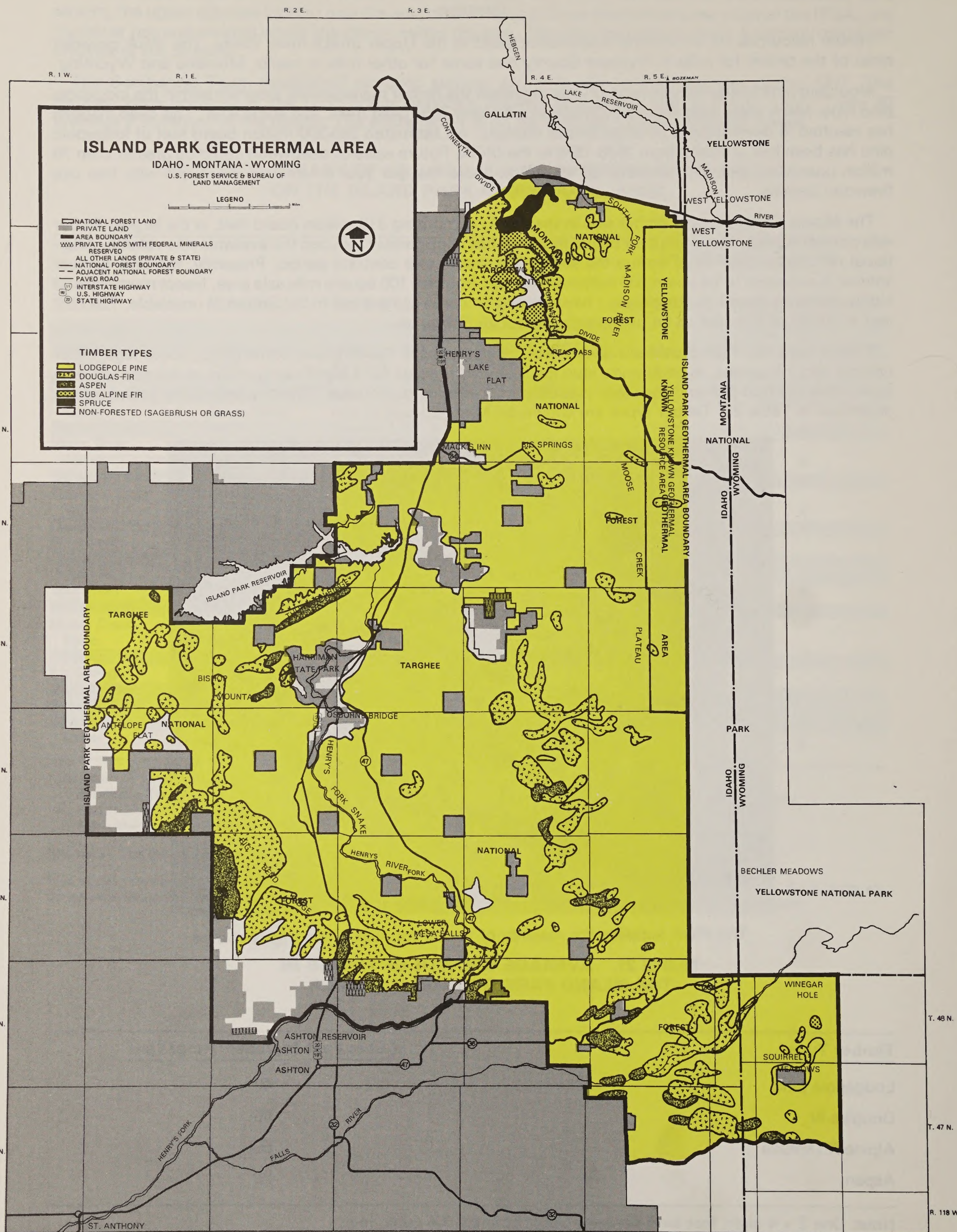
The IPGA supplies the majority of timber for mills in the adjacent area.

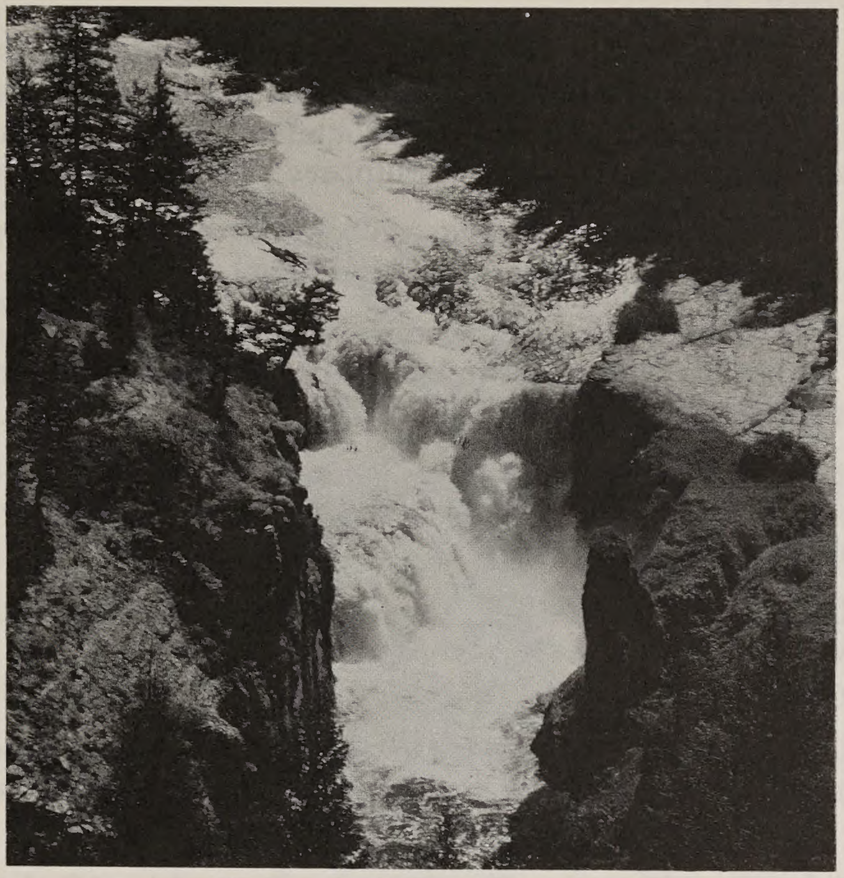
TABLE 21. AVERAGE GROWTH OF TIMBER IN THE ISLAND PARK GEOTHERMAL AREA

Timber Type	Cubic Feet Increase/Acre/Year
Lodgepole pine	40
Douglas-fir	60
Alpine fir/spruce	69
Aspen	23

Note: One 2 x 4 eight feet long contains approximately 0.4 cubic feet.

12. TIMBER TYPES





Grandview offers a picturesque view of Lower Mesa Falls and is in the heart of the IPGA.

VISUALS

The landscape character of the IPGA is varied. The quality and sensitivity depend on diversity of landforms, rock formations, vegetation, color, water features, number of viewers and distance from which the characteristics are viewed. Table 22 illustrates some of the visual characteristics.

Visual resource management goals have been established for the Island Park Geothermal Area. These were the result of a process which considers landscape variety and public concern for scenic quality (Sensitivity levels).

TABLE 22. VISUAL CHARACTER OF LANDTYPES IN THE ISLAND PARK GEOTHERMAL AREA

LANDTYPE	VISUAL CHARACTER	LOCATION	GENERAL QUALITY/SENSITIVITY
Mountainous	Much relief, rocky slopes sharp-exposed ridges, steep slopes, dominating landform rockform features	Continental Divide-N.E. portion (Mt. Two Top) Bishop Mtn. - High Point - West side of Big Bend Ridge (Rim of Island Park Caldera)	High
Plateau	0-30% slopes with little variety	East Side of Area (Moose Creek Plateau)	Low
Basin Lands-Flat	Little variety in vegetation patterns types, color or texture	Central Portion - within Island Park Caldera	Low
Open Park-Like	High degree of vegetation patterns and diversity	North portion E. of Henrys Lake and Central portion around Harriman State Park and widely scattered meadows	High
Mountain Slopelands (Forested)	Moderate slopes, common vegetation patterns - some diversity	Widely distributed, dominant landscape in S.E. portion	Medium
Aquatic or Water Associated	Large size, unique features, great diversity of flow, meandering shoreline patterns, etc.	Central and Eastern portions, widely distributed. (Streams & Lakes)	High
Canyons	Landform and rockform diversity, steep slopes	Primarily in the Southern portion	High

Five quality objectives describe different degrees of acceptable landscape change measured in terms of visual contrast with the surrounding natural landscape. These quality objectives are shown on map 13. Included with each quality objective is a time frame for reduction of visual impacts resulting from man's use of the land for timber harvest, construction and other purposes. The five objectives are:

1. *PRESERVATION*—This allows only ecological or natural changes and very low visual impact recreation facilities (examples: trails, log bridge).
2. *RETENTION*—Provides for management activities not visually evident (noticeable to most viewers) within the characteristic landscape. The objective should be accomplished either during operations or immediately after.
3. *PARTIAL RETENTION*—Management activities remain subordinate to the characteristic landscape (never dominate the view). Visual impact must be reduced as soon as possible after project completion or at most within the first year.
4. *MODIFICATION*—Activities may dominate, but must borrow form, color, and texture from the landscape. This objective should be accomplished in the first year or at a minimum should meet existing regional guidelines if they allow a long period.
5. *MAXIMUM MODIFICATION*—Management activities may dominate the characteristic landscape, but should appear as natural occurrences when viewed as background. Reduction of contrast should be accomplished within five years.

Table 23 compares the visual qualities of two locations within the Island Park area. This brief analysis contrasts the variability of the visual resource.

TABLE 23. COMPARISON OF VISUAL QUALITITES OF TWO LOCATIONS WITHIN THE ISLAND PARK GEOTHERMAL AREA

	BIG SPRINGS	MOST ANY POINT ON MOOSE CREEK PLATEAU ALONG FISH CREEK ROAD
Esthetic Concern of Viewer	High	Low
Number of Viewers	Several hundred per day	Less than 50 per day
Diversity of Landscape	Highly variable	Fairly uniform
Capacity to Absorb Alteration	Very low	Medium
Viewing Distance	Short (foreground)	Slightly variable (foreground & middleground)
Subject Focus of Viewer	Water, individual plants, fish	Road, groups of trees, regeneration areas
Visual Resource Management Goal (Quality objective)	Retention	Modification

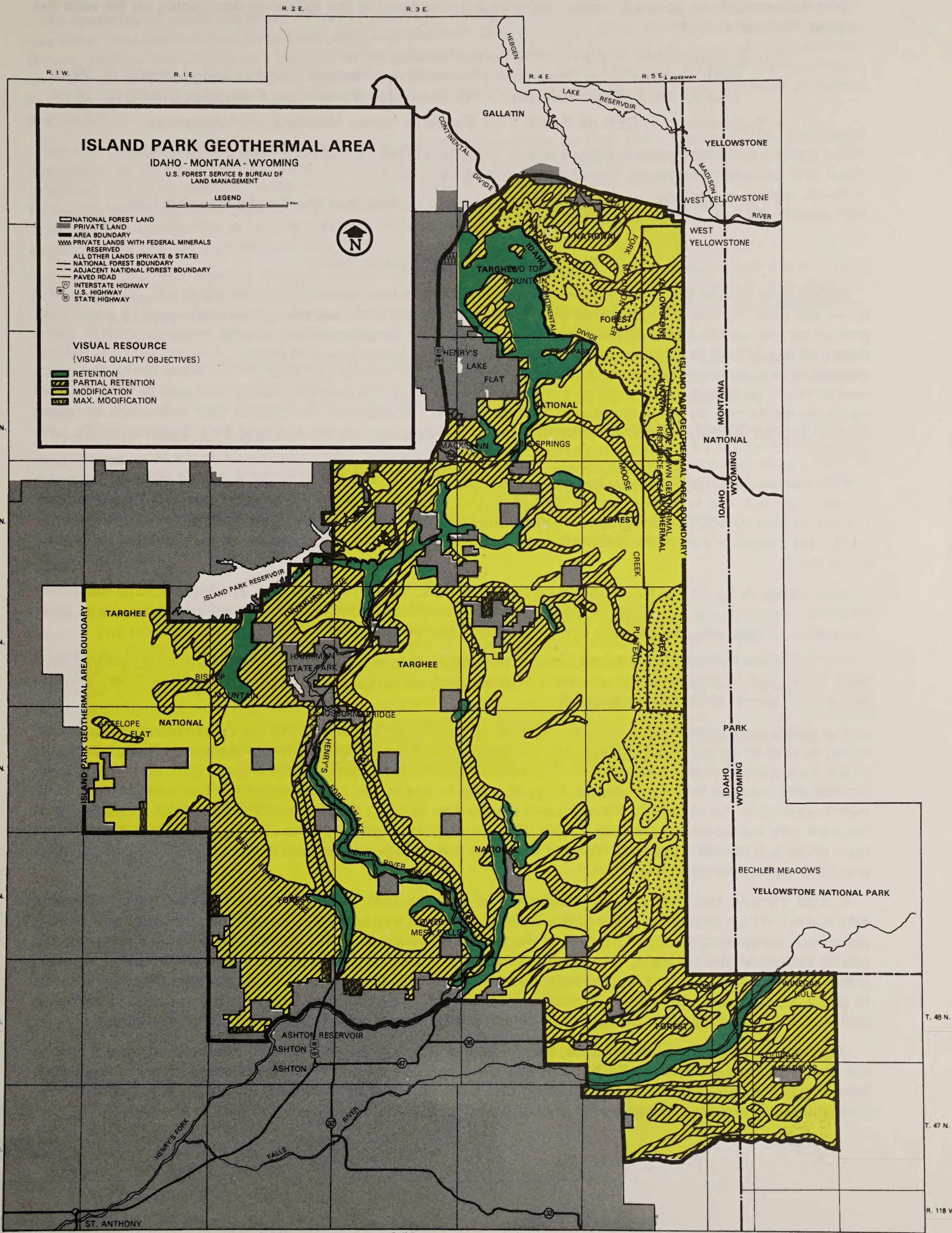
WILDERNESS

The Final Environmental Statement for Roadless Area Review and Evaluation (RARE II) includes 70 acres proposed for wilderness in the IPGA. Other roadless areas were identified earlier in RARE I and the Draft Environmental Statement for RARE II. They were either allocated to non-wilderness through the land management planning process and removed from the RARE II inventory, or they have been recommended for non-wilderness in the Final Environmental Statement for RARE II. Portions of two areas are in the latter category and include:

—Dry Canyon 01-550, Gallatin National Forest, Montana

—West Slope of the Tetons (West) W4-610, Targhee National Forest, Wyoming

The 70 acres recommended for wilderness is in the West Slope of the Tetons (East) E4-610, Targhee National Forest, Wyoming.


ISLAND PARK GEOTHERMAL AREA
IDAHO - MONTANA - WYOMING
U.S. FOREST SERVICE & BUREAU OF LAND MANAGEMENT
LEGEND
NATIONAL FOREST LAND
PRIVATE LAND
AREA BOUNDARY
PRIVATE LANDS WITH FEDERAL MINERALS RESERVED
ALL OTHER LANDS (PRIVATE & STATE)
NATIONAL FOREST BOUNDARY
ADJACENT NATIONAL FOREST BOUNDARY
PAVED ROAD
INTERSTATE HIGHWAY
U.S. HIGHWAY
STATE HIGHWAY
VISUAL RESOURCE
(VISUAL QUALITY OBJECTIVES)
RETENTION
PARTIAL RETENTION
MODIFICATION
MAX. MODIFICATION
N
R. 1 W.
R. 1 E.
R. 2 E.
R. 3 E.
R. 4 E.
R. 5 E.
HEBGEN
LAKE
RESERVOIR
GALLATIN
CONTINENTAL
DIVIDE
YELLOWSTONE
MADISON
WEST YELLOWSTONE
RIVER
WEST YELLOWSTONE
TARGHEE
HENRY'S LAKE FLAT
NATIONAL
BIG SPRINGS
MACK'S INN
MOOSE
CREEK
PLATEAU
FOREST
ISLAND PARK GEOTHERMAL AREA BOUNDARY
MONTANA
NATIONAL
IDAHO
WYOMING
ISLAND PARK RESERVOIR
TARGHEE
HARRIMAN STATE PARK
BISHOP MOUNTAIN
OSBORNE BRIDGE
ANTELOPE FLAT
NATIONAL
ISLAND PARK GEOTHERMAL AREA BOUNDARY
HENRY'S FORK SNAKE
HENRY'S RIVER
LOWER MESA FALLS
FOREST
PARK
BECHLER MEADOWS
YELLOWSTONE NATIONAL PARK
ASHTON RESERVOIR
ASHTON
HENRY'S FORK
RIVER
FALLS
ST. ANTHONY
T. 14 N.
T. 13 N.
T. 12 N.
T. 11 N.
T. 10 N.
T. 9 N.
T. 8 N.
T. 48 N.
T. 47 N.
R. 40 E.
R. 41 E.
R. 42 E.
R. 43 E.
R. 44 E.
R. 45 E.
R. 46 E.
R. 119 W.
R. 118 W.

Data and evaluations for each designated area are contained in the following documents on file with the Targhee National Forest:

- U.S. Department of Agriculture, Forest Service, 1978.
  Draft Environmental Statement—Roadless Area Review and Evaluation (RARE II), 78-04.
  Final Environmental Statement—Roadless Area Review and Evaluation (RARE II), 78-04.
- Supplements to DES on RARE II for States of Idaho, Montana, and Wyoming.
- Land Management Plan, Targhee National Forest, Island Park Planning Unit, and accompanying Final Environmental Statement.
- Land Use Plan, Targhee National Forest, West Slope of the Tetons Planning Unit.

YELLOWSTONE NATIONAL PARK

Immediately east of the IPGA is Yellowstone, the world's first national park (see Map 22). Its 2.2 million acres, set aside by the U.S. Congress in 1872, was "dedicated and set apart as a public park or pleasuring ground for the benefit and enjoyment of the people...". The Secretary of the Interior was instructed to make rules and regulations for "...the preservation, from injury or spoilation of all timber, mineral deposits, natural curiosities or wonders of said park, and their retention in their natural condition." The intent of the Congress was to totally protect the park's geysers and hot springs, using the best knowledge available in 1872. This intent was reaffirmed by the Congress in 1978 when the Secretary of the Interior was instructed to guard against actions which may compromise the values and purposes of the National Park System (Public Law 95-250).

Yellowstone National Park now has multiple significance. In addition to its geysers and scenic wonders, it is also a century-old wildlife preserve, including the habitats of endangered and threatened species. The United Nations (UNESCO) designated Yellowstone National Park as one of the first "World Heritage Sites" in 1978, and earlier, a part if the International Biosphere Reserve to recognize the global value of its natural ecosystems.

These three designations for Yellowstone (National Park, World Heritage Site, and International Biosphere Reserve) combine to give the highest possible recognition of its significance to the nation and the world. Over 2.5 million people visit Yellowstone and its surroundings each year.

The features that initially attracted interest and led to the reservation of Yellowstone as a national park were geological: the geothermal phenomena, the colorful Grand Canyon of the Yellowstone River, and the size and elevation of Yellowstone Lake.

The park's geological history includes formations from the most ancient to the most recent. Precambrian rocks, having an age of 2 to 3 billion years, are exposed in the northern section of the park. Most of the rocks of the Yellowstone plateau are volcanic. Quaternary rhyolites and basalts were erupted after an enormous explosion and collapse formed a caldera 30 by 45 miles in size in the central portion of the present park. Lava overflowed from the caldera to the west and southwest, forming the Madison Plateau which extends out of the park into the adjoining national forests. It is through the rhyolite plateau that groundwater is recharged from snow and rainfall, supplying many of the major hot springs and geysers inside the park, as well as warm and cold water springs in the IPGA.

A cold climate coniferous forest composed of species that reseeded from adjacent regions became established, which accounts for the park's limited number of tree species. One of these, the lodgepole pine, is abundant, comprising about 80 percent of the forest; however, at higher elevations, in stream valleys and in glacial kettles on the plateaus, Engelmann spruce and subalpine fir are present. The whitebark pine, often growing near the spruce and fir, also reproduces in many places under the lodgepole pine. Douglas-fir tends to grow only at lower elevations, as does the aspen, the one significant broad-leaved species. Limber pine and Rocky Mountain juniper occupy sites detached from the regular forest in the lower elevations.

Ungulates such as the bison, moose, elk, mule deer, pronghorn antelope, and bighorn sheep are among the park's greatest attractions. Both grizzly and black bear are present in normal numbers, though rarely seen from roadsides. Regulations against feeding bears are now strictly enforced, and other sources of human food removed, resulting in bears with almost no attraction to human developments in the park.

An assembly of predators exists ranging from insect-eating bats to large carnivores. Populations of mountain lions, and gray wolves have been seriously depleted through man's early efforts to protect ungulates. Others, such as the coyote, red fox, marten, and weasel, while exercising control on the rodent populations, can do little to fill the gap left by the elimination of these larger carnivores. They add, however, to the diversity of the park fauna, as do winged predators such as bald and golden eagles, and various species of hawks and owls.

Several mammals and birds depend upon the aquatic environment for their prey. The river otter, extirpated over much of its range, is still found in most of the major rivers and lakes in the park. An important avian predator, the white pelican, nests on the Molly Islands in Yellowstone Lake. During the summer, this hugh fish-eater fishes the lakes, sloughs, and quiet backwaters throughout the upper Yellowstone Valley. Another common fish-eating bird, is the osprey. Cormorants, sandhill cranes, great blue herons, and kingfishers also depend upon fish for a portion of their diet.

Conspicuous bird species include several ducks, the Canada goose, and the trumpeter swan. Once threatened with extinction, the trumpeter swan has been able to strengthen its numbers in Yellowstone. Although present in the park, the bald eagle is apparently severely affected by the accumulation of pesticides in the national environment, and as elsewhere, its population has diminished.

Yellowstone's fishery is comprised of both native and introduced fish and holds a high degree of interest for the visitor as a recreational resource—the catching of wild fish in a wilderness environment. Of greater importance, the fish are an essential part of the diet for several species of birds and mammals.

The human history of the park is diverse. It began with prehistoric use of the high plateaus by various Indian groups as much as 10,000 years ago, and continued with the area's rediscovery by trappers and adventurers in the early 1800's. Reports of the geologic wonders and concentrations of wildlife acted as a magnet for exploration parties, whose excitement over and recognition of the uniqueness of Yellowstone's natural phenomena led to its establishment as the world's first national park.

SOUND

Qualitative and quantitative evaluation of sound levels, sound quality, or sources of noise (unwanted sound) has not been made on the IPGA. Without a thorough study of background sound levels and noise problems, there can be no accurate assessment of the proposal's effects on the sound environment. However, a cursory description of sound levels and noise sources is in table 24. The Geothermal E.S. Team recorded sound levels on the IPGA using a hand-held sound meter on the A-weighted scale with slow response. Table 24 compares sound levels on the IPGA with levels from other sources and with the Geysers Geothermal Area. The IPGA has low overall ambient sound levels (less than 45 db (A)). Most of the sound was caused by wind, with higher levels associated with man's activities (highways, timber harvesting, recreation sites, etc.). Federal and state guidelines on noise exposure are presented in table 25.

TABLE 24. SOUND LEVEL COMPARISONS BETWEEN THE ISLAND PARK GEOTHERMAL AREA (IPGA), OTHER SOURCES OF NOISE, AND THE GEYSERS GEOTHERMAL AREA IN CALIFORNIA

	Source	Sound level (dB(A))[1]	Distance from source (feet)
IPGA	Forested habitat	less than 40	—
	Riparian habitat	40 - 45	—
	Open meadow	40 - 45	—
	Upper Mesa Falls	79	50
	U.S. Highway 20-191	63 - 78	50
	Timber cutting operation		
	—falling	65	200
	—yarding & decking	50 - 55	200
	Chainsaw, snowmobile	75	50
	Campground	40 - 45	—
	Summer home area	less than 40	—
Other sources	Threshold of pain	120	—
	Jet aircraft takeoff	125	200
	Unmuffled diesel truck	100	50
	Street corner in Idaho Falls	70	—
	Residential area in St. Anthony at night	less than 40	—
	Conversation	60	3
	Loud motorcycle	95	50
Geysers Geothermal Area	Drilling operation (air)	126	25
	Drilling operation (air)	55	1500
	Muffled test well	100	25
	Muffled test well	65	1500
	Steam line vent	100	50
	Steam line vent	90	250

[1] Sound levels were measured using the universal standard called the decibel, dB. The term dB(A) is the decibel value measured using the A weighting network of a standard sound level meter with slow response.

TABLE 25. FEDERAL AND STATE GUIDELINES ON OCCUPATIONAL NOISE EXPOSURE[1]

Environmental Protection Agency			Montana and Wyoming permissible noise exposure levels[2]	
Effect	**Level (dB)[3]**	**Area**	**Duration per day (hours)**	**Sound level (dB(A))**
Hearing loss	$L_{eq(24)}$ = 70	All areas	8	90
Outdoor activity interference and annoyance	L_{dn} = 55	Outdoors in residential areas, farms, and other areas where people spend widely varying amounts of time, and other places in which quiet is a basis for use.	6	92
			4	95
			3	97
			2	100
			1½	102
	$L_{eq(24)}$ = 55	Outdoor areas where people spend limited amounts of time, such as school yards, playgrounds, etc.	1	105
			¾	107
Indoor activity interference and annoyance	L_{dn} = 45	Indoor residential areas.	½	110
	$L_{eq(24)}$ = 45	Other outdoor areas with human activities such as schools, etc.	¼	115—ceiling value: no exposure in excess of 115 dB(A).

[1] Sources: (a) Environmental Protection Agency, 1974. Information on levels of environmental noise requisite to protect public health and welfare with an adequate margin of safety. EPA, Washington, D.C.,(b) State of Montana, Department of Health and Environmental Sciences, Helena, Montana. (c) State of Wyoming, Occupational Health and Safety, Cheyenne, Wyoming.

[2]The state of Idaho has no specific regulations, guidelines, or standards on noise exposure other than that motor vehicles be equipped with mufflers to prevent excessive or unusual noise.

[3]dB = decibles; $L_{eq(24)}$ represents sound energy averaged over a 24-hour period expressed in decibles; L_{dn} represents the L_{eq} with a 10 decible nighttime weighting.

TRANSPORTATION

The existing road system in the IPGA includes State highways, County roads and forest development roads. A study being made to classify the roads by use will identify roads needed for public access or for land management. Unnecessary roads will be eliminated. Map 14 shows the existing transportation system within the IPGA.

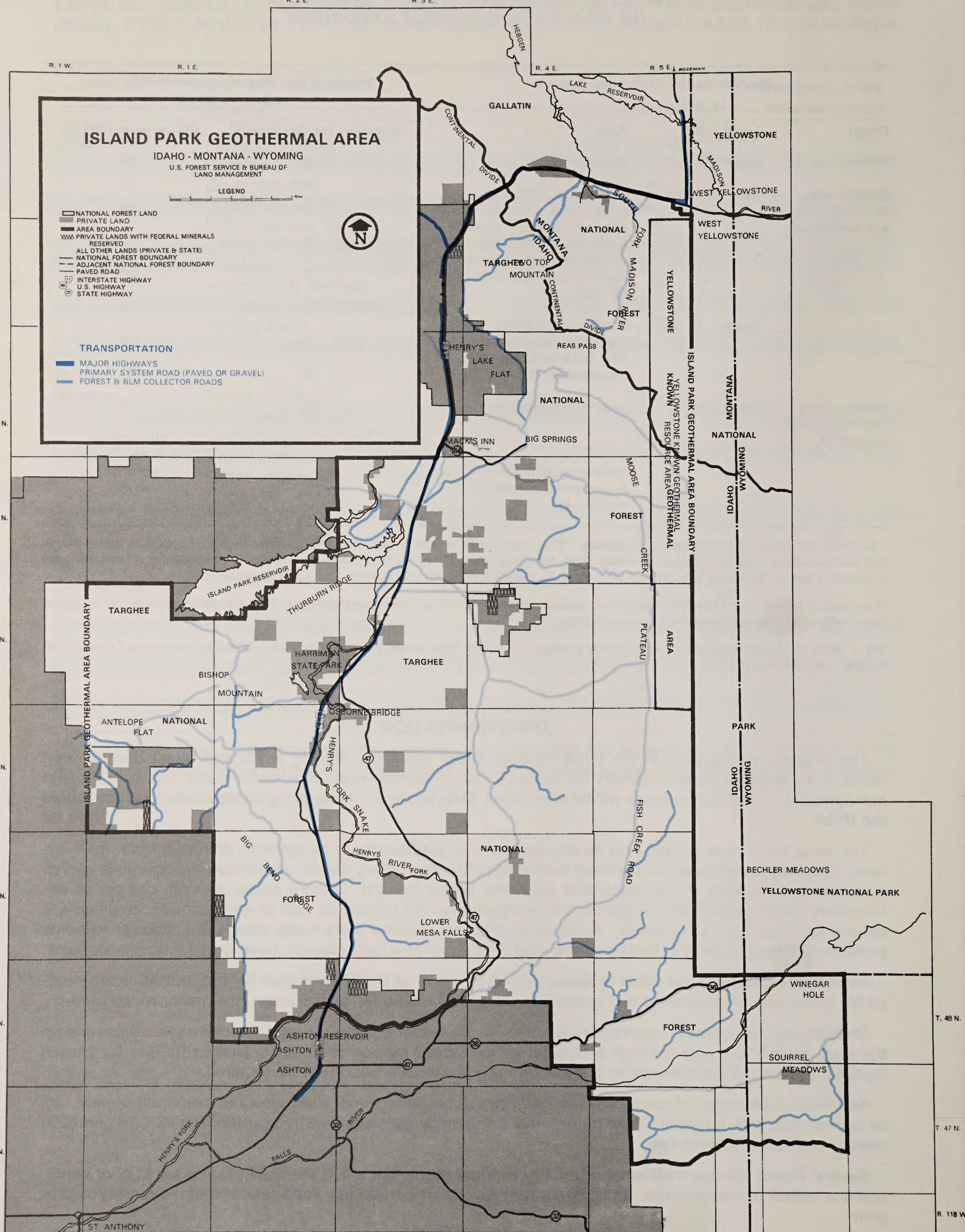
The need for a road system and its required level of maintenance change with demands upon resource uses. Presently, most road development relates to timber harvesting. Roads range from multipurpose graveled types to temporary roads obliterated following timber harvest. Current policy requires closure of unnecessary roads when their use will adversely affect resource protection, use or development, or when it is determined that the road is unsafe. A resource use often requires more roads than is desirable for resource protection. When re-entry is foreseen, the road is retained as a road closure, open on an intermittent basis.

Most road closures are an effort to lessen vehicle pressure on wildlife and their habitat, but some are needed for protection of watershed and roadway values, and others for construction, maintenance and safety.

On National Forest lands, road closure is posted at the Forest Supervisor and District Ranger offices and on the road. Vehicle passage through a closure can be gained by permit from the District Ranger for certain legitimate needs. When damage to the road is likely to occur a bond may be required.

No official designation of roads on BLM Public Lands has been done. Road closures, construction, etc. will be coordinated with National Forest management and made consistent with Regulations in 43 CFR part 6290 dealing with off-road-vehicles.

Several Forest Service trails established for resource protection are in the IPGA. Some are in poor condition due to lack of maintenance. Use of trails for hiking is an increasingly important part of the recreation program.


ISLAND PARK GEOTHERMAL AREA
IDAHO - MONTANA - WYOMING
U.S. FOREST SERVICE & BUREAU OF LAND MANAGEMENT
LEGEND
NATIONAL FOREST LAND
PRIVATE LAND
AREA BOUNDARY
PRIVATE LANDS WITH FEDERAL MINERALS RESERVED
ALL OTHER LANDS (PRIVATE & STATE)
NATIONAL FOREST BOUNDARY
ADJACENT NATIONAL FOREST BOUNDARY
PAVED ROAD
INTERSTATE HIGHWAY
U.S. HIGHWAY
STATE HIGHWAY
TRANSPORTATION
MAJOR HIGHWAYS
PRIMARY SYSTEM ROAD (PAVED OR GRAVEL)
FOREST & BLM COLLECTOR ROADS
R. 2 E.
R. 3 E.
R. 1 W.
R. 1 E.
R. 4 E.
R. 5 E.
BOZEMAN
HEBGEN
LAKE
RESERVOIR
GALLATIN
CONTINENTAL
DIVIDE
YELLOWSTONE
MADISON
WEST YELLOWSTONE
RIVER
SOUTH
WEST
YELLOWSTONE
NATIONAL
FORK
MONTANA
IDAHO
TARGHEE
TWO TOP
MOUNTAIN
MADISON RIVER
FOREST
CONTINENTAL
DIVIDE
REAS PASS
YELLOWSTONE
ISLAND PARK GEOTHERMAL AREA BOUNDARY
YELLOWSTONE KNOWN GEOTHERMAL RESOURCE AREA
MONTANA
NATIONAL
WYOMING
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HENRY'S
LAKE
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MACK'S INN
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MOOSE
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T. 14 N.
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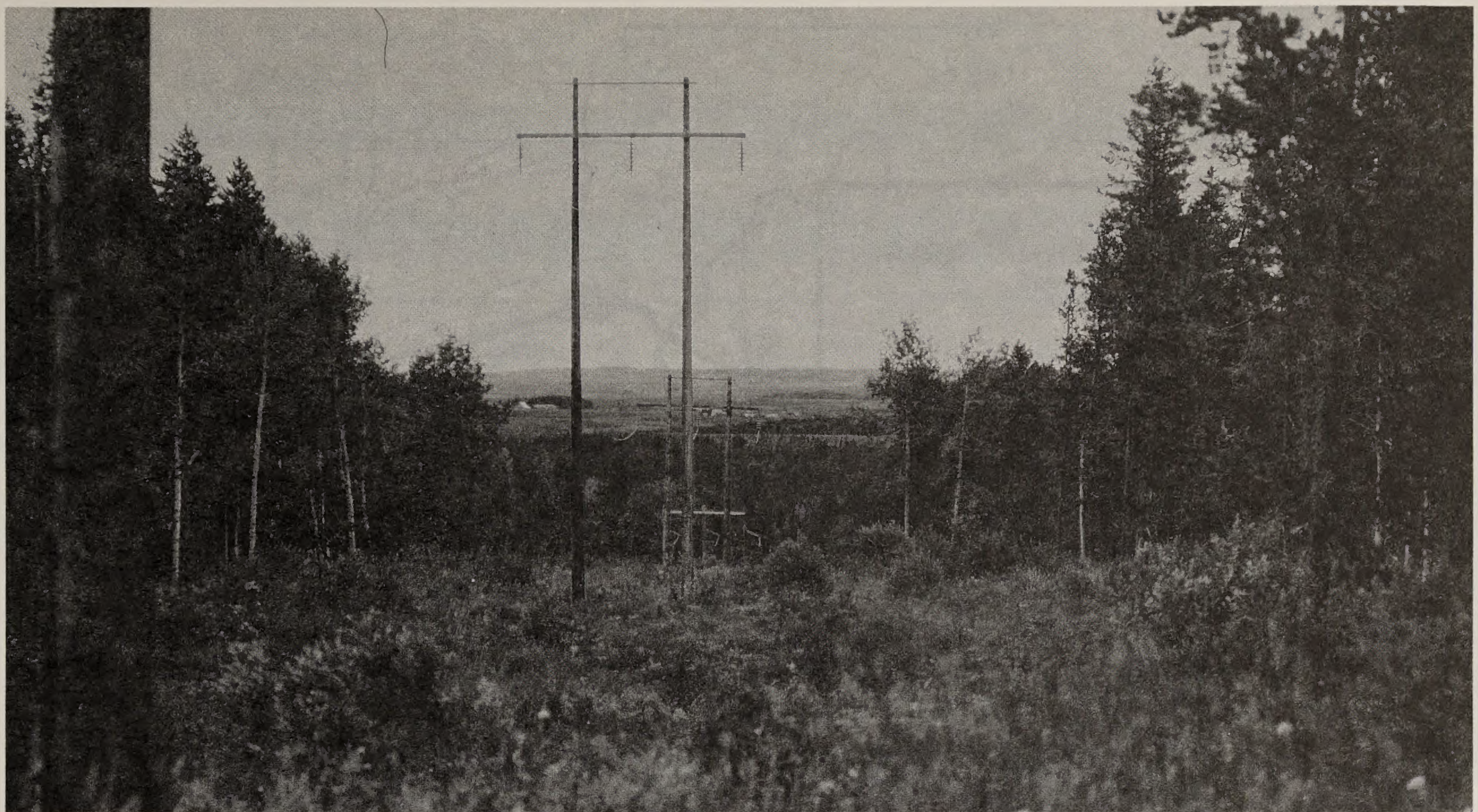
ISLAND PARK RESERVOIR
THURBURN RIDGE
TARGHEE
ISLAND PARK GEOTHERMAL AREA BOUNDARY
PLATEAU
AREA
HARRIMAN
STATE PARK
TARGHEE
BISHOP
MOUNTAIN
OSBORNE BRIDGE
ANTELOPE
FLAT
NATIONAL
PARK
HENRY'S
FORK
SNAKE
IDAHO
WYOMING
FISH CREEK ROAD
BIG
BEND
RIDGE
FOREST
HENRYS
RIVER
FORK
NATIONAL
BECHLER MEADOWS
YELLOWSTONE NATIONAL PARK
LOWER
MESA FALLS
WINEGAR
HOLE
FOREST
SQUIRREL
MEADOWS
ASHTON RESERVOIR
ASHTON
ASHTON
T. 48 N.
T. 47 N.
HENRY'S FORK
RIVER
FALLS
ST. ANTHONY
R. 118 W.
R. 40 E.
R. 41 E.
R. 42 E.
R. 43 E.
R. 44 E.
R. 45 E.
R. 46 E.
R. 119 W.



A 115 Kilovolt transmission line extends from the southern boundary to Mack's Inn.

UTILITIES

Two transmission lines transect the IPGA. Both are administered by Fall River Rural Electric Cooperative, Inc. of Ashton, Idaho. The 44 KV line constructed in 1949 runs from Ashton Reservoir north to West Yellowstone, Montana. The 115 KV line constructed in 1971 runs from Drummond, Idaho north to Mack's Inn, located on U.S. 191/20. Map 15 shows the transmission lines and the subdivisions they service within the Idaho portion of the IPGA.

Electricity from the two transmission lines is used primarily for residential service in Island Park and West Yellowstone. Commercial electrical uses are for resorts, shops, restaurants, service stations, and motels in and adjacent to the IPGA.

An extension of the 115 KV transmission line from Mack's Inn to West Yellowstone is being considered.

The Island Park Land Management Plan (1978) provides that utility corridors will be concentrated along existing use paths. These corridors are presently on a north-south axis through the area, but as regional demands increase and transmission grids become more complex, lines may be proposed to tie into services west of the IPGA.

SOCIO-ECONOMICS

A review of Fremont County, Idaho economic characteristics provides a good picture of the economy of the IPGA. As an estimate of the economy of the IPGA, Fremont County data somewhat overemphasizes agriculture and under-estimates the importance of the lumber industry.

Population

The 1975 Fremont County population of 9,616 is only 6% greater than in 1950, but 10% greater than the 1970 population, an annual growth rate of 2% for the years 1970-75. The county and Idaho are experiencing a population surge. The State's population grew more than 15.1% between 1970 and 1975. In 1970, Fremont County's population was:

23%	Rural farm
44%	Rural Non-farm
33%	Urban

The July 1976 population and employment forecast by the Idaho Department of Water Resources and Boise State University in Boise, Idaho, projects a 61% population increase in Fremont County by the year 2000, a 2% annual growth rate. Most of the IPGA has a fluctuating population due to the seasonal nature of the recreation industry.

Tables 26 and 27 present town population estimates and projected county population respectively.

15. TRANSMISSION LINES AND SUBDIVISIONS

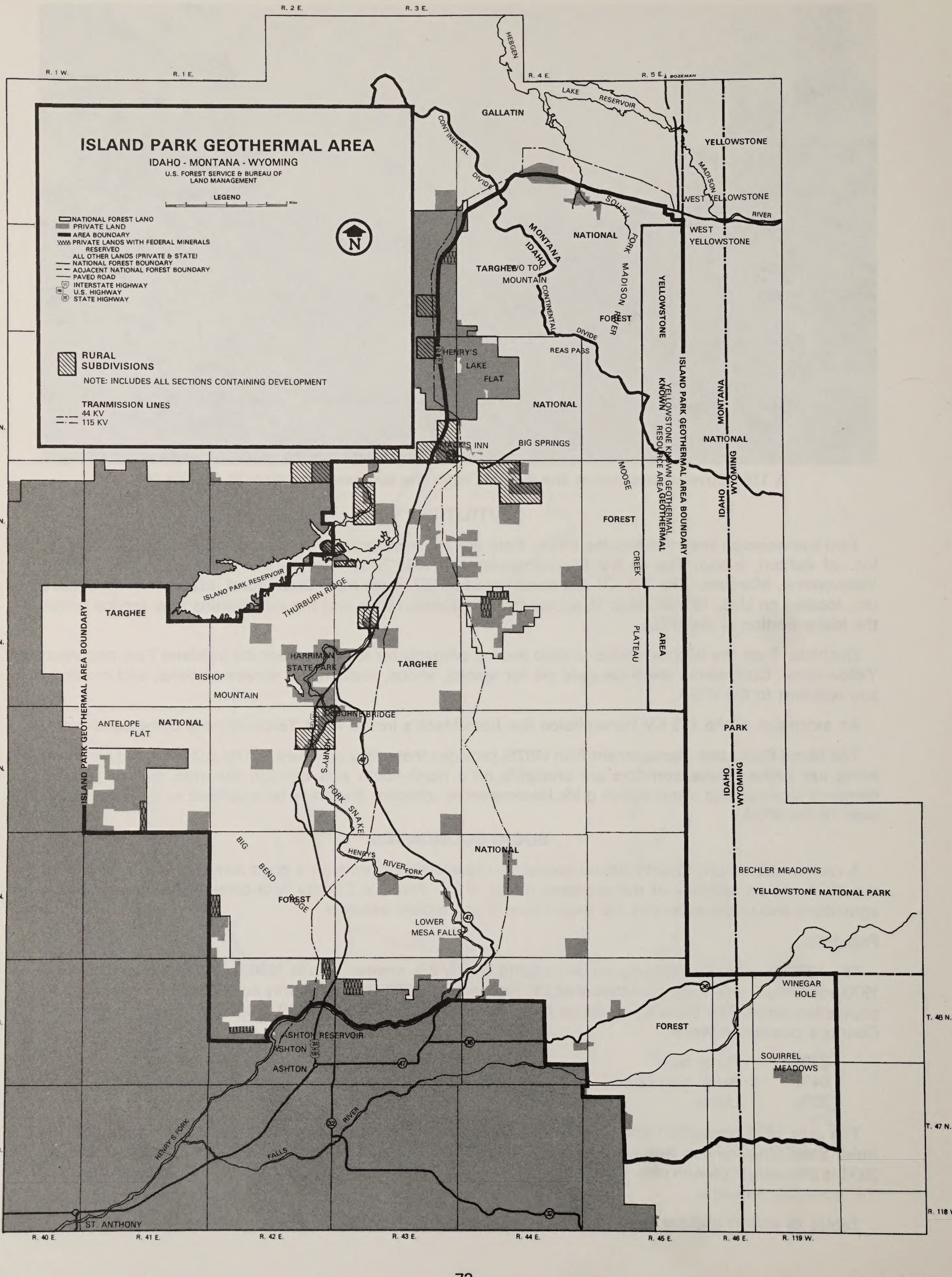


TABLE 26. TOWN POPULATIONS

	1970[1]	1975
St. Anthony	2,877	3,021[2]
Ashton	1,187	1,300
Island Park	136	168[3]
West Yellowstone	756	823[4]

[1] U.S. Census
[2] Town Clerk
[3] 1978 Edition—County Profiles of Idaho
[4] Montana State Department of County Affairs

St. Anthony, the largest town in Fremont County, Idaho is approximately 18 miles from the IPGA.

TABLE 27. FREMONT COUNTY, IDAHO POPULATION PROJECTIONS

AGE GROUP	1970	1975	1980	1985	1990	1995	2000
0- 4	878	1056	1361	1549	1626	1694	1840
5- 9	928	905	1048	1398	1599	1626	1625
10-14	1076	961	898	1094	1458	1601	1549
15-19	1080	1107	952	942	1153	1458	1522
20-24	466	1088	1097	966	963	1148	1417
25-29	475	478	1077	1110	987	959	1107
30-34	435	485	472	1088	1126	981	921
35-39	420	444	478	486	1101	1117	942
40-44	488	429	435	493	507	1087	1065
45-49	430	491	417	441	507	498	1031
50-54	432	429	471	422	454	491	450
55-59	472	425	403	468	428	433	432
60-64	386	448	389	388	455	396	372
65-69	268	344	402	350	350	412	362
70-74	202	226	288	340	297	298	353
75-79	146	154	174	221	264	230	232
80-84	88	94	100	114	144	173	152
85+	40	54	61	65	74	91	111
TOTAL	8710	9618	10523	11938	13493	14693	15483

SOURCE: Idaho Dept. of Water Resources and Boise State Univ.

Employment

Agriculture, a primary industry in Fremont County, employed 969 people in 1972, with 171,000 acres devoted to irrigated or dry crop land. The livestock industry is significant with 37,500 head of cattle in the county in 1974.

Table 28 summarizes employment in Fremont County. The unemployment rate in Fremont County (mid 1978) is about 6.4%. Since West Yellowstone, Montana is a resort community with a constantly fluctuating population and seasonal unemployment, it is difficult to estimate an unemployment rate in the West Yellowstone area.

TABLE 28. FREMONT COUNTY, IDAHO
EMPLOYMENT FORECASE BY MAJOR INDUSTRY (EMPLOYEES)

MAJOR INDUSTRY	1972	1975	1980	1985	1990	1995	2000
AGRICULTURE	968	948	906	862	819	785	753
MANUFACTURING	273	274	312	346	383	418	457
CONSTRUCTION	120	150	191	212	231	259	291
TRANSPORTATION	106	134	157	174	192	212	235
TRADE	726	803	893	928	964	997	1032
FINANCE	64	66	84	95	106	119	133
FEDERAL GOVERNMENT	160	152	153	154	155	156	157
STATE AND LOCAL GOVERNMENT	530	615	656	722	789	846	908
SERVICES	463	528	645	719	802	895	998
TOTAL	3410	3670	3997	4212	4441	4687	4964

SOURCE: Idaho Department of Water Resources and Boise State University
Population and Employment Forecast—State of Idaho Series 2—Projects 1975-2000, July, 1978, pp. 161-162.

Income

The relative prosperity in the county and the area seems to be improving. In 1970 county per capita income was only 63.7% of the national per capita income but by 1974 it had risen to 87.2%. In Idaho per capita personal income as a percentage of national average income increased from 82% in 1972 to 91% in 1974; in Wyoming from 94% in 1972 to 99% in 1974; and in Montana 90% in 1972 to 91% in 1974. Tables 29 and 30 review per capita personal income for the years 1966 to 1974 for counties in Southeast Idaho, adjacent to and including the IPGA.

Table 30 shows per capita income in constant 1977 dollars. This shows the reduction in purchasing power of the dollar from 1966 to 1977. For example the per capita income in Bonneville County in 1966 was $2,738, but in terms of 1977 dollars, it was $5,113.

TABLE 29. PER CAPITA PERSONAL INCOME OF SOUTHEAST IDAHO BY COUNTY IN DOLLARS

COUNTY	1966	1968	1970	1972	1974
BONNEVILLE	2738	3031	3408	4106	5214
BUTTE	1919	2558	3313	3588	4395
CLARK	1811	2979	5446	3527	4207
CUSTER	1892	2150	2500	2882	3551
FREMONT	1988	2139	2525	3224	4752
JEFFERSON	1820	1765	2327	2785	3674
LEMHI	1832	2115	2578	3014	3428
MADISON	1904	1897	2008	2562	4031
TETON	1358	1639	2463	2606	4880

SOURCE: R.D. Payne, Recreation Home Development in Idaho: Five Case Studies, 1977.

TABLE 30. PER CAPITA PERSONAL INCOME OF SOUTHEAST IDAHO BY COUNTY (1977 DOLLARS)

COUNTY	1966	1968	1970	1972	1974
BONNEVILLE	5113	5280	5319	5948	6407
BUTTE	3583	4456	5170	5197	5401
CLARK	3382	5189	8499	5109	5170
CUSTER	3533	3745	3902	4175	4364
FREMONT	3712	3726	3941	4670	5839
JEFFERSON	3398	3074	3632	4034	4515
LEMHI	3421	3684	4023	4366	4212
MADISON	3555	3304	3133	3711	4953
TETON	2536	2855	3844	3775	5997

SOURCE: Consumer Price Index, Economic Report of the President, January 1978, (Indexed)

Housing

Ashton and St. Anthony have a very tight housing market. Public officials and Forest Service personnel indicate that even at the present slow rate of growth, it is difficult for newcomers to find housing. The following year by year building permits record from 1970 to 1975 illustrates this situation:

	1970	1971	1972	1973	1974	1975	1976	1977
ASHTON	3	2	4	2	6	4		5*
ST. ANTHONY	5	12	33	10	24	19	13	22

*Includes 1976 and 1977.

The 33 building permits issued in St. Anthony in 1972 reflect the population influx from the Teton Dam construction. This seems to indicate that supply is responsive to changes in demand. Ashton approved one new subdivision during 1977. In St. Anthony two new subdivisions have been accepted in the last year with 60 single family lots and 24 apartment units. The destruction and reconstruction resulting from the collapse of the Teton Dam seem to have caused the latest housing pinch and also increased construction of housing.

These towns can accommodate increased housing demand if it happens at a slow rate. There is no provision for the temporary housing or trailer parks.

West Yellowstone has the capacity to house all workers the geothermal development is likely to bring. In 1976 there were 506 residential units divided evenly among single family homes, mobile homes and apartments. In addition, there were 55 motels with 1,951 beds for which workers would be competing with the tourists. Construction workers, especially those who come without families and can share a rented apartment or motel, will be able to outbid the tourists because they will arrive earlier in the year and stay longer. However, the result is likely to be high cost housing for worker and tourist alike. At present all of West Yellowstone is commercially zoned. New residential development has to leapfrog to private lands several miles from town. The Island Park area in the middle of the IPGA contains 600 or more seasonal homes. While some are certainly income producing properties, most are not in the short term housing market.

Schools

Two school districts which would have to absorb the student load created by geothermal development in the IPGA are located in West Yellowstone, Montana, and Fremont County, Idaho. For the 1977 to 1978 school year, West Yellowstone schools budgeted for an enrollment of 242 students. The Fremont County District budgeted for 2,533 students. School officials generally felt optimistic about their ability to cope with growth.

The construction of Teton Dam in the early 1970's put 70 children into the Fremont School District and stimulated a building program and improvements that have left the district with the capability to add new students to existing capacity and to finance additional facilities.

The West Yellowstone schools have 36 less students than in 1972 due to the closing of the nearby stud mill in the Gallatin National Forest. Bonded indebtedness is only 11% of capacity.

Public Issues and Attitudes

In-depth interviews were conducted with eleven people to assist in assessing social impacts and public attitudes towards geothermal development. Included were two school superintendents, one electric utilities executive, one mayor, two Forest Service District Rangers, one local merchant, one town clerk, one farmer, one magistrate and one timber industry forester. Three live in West Yellowstone, the remainder in and around St. Anthony, Ashton, and Island Park.

A panel of five members knowledgeable of the people and resources within the IPGA participated in a work session to analyze social group attitudes. Four issues were identified and panel members estimated a response for each social group delineated. Table 31 is a summary of this evaluation.

Considerable sociological and economic data specific to geothermal development in the IPGA are on file in the Supervisor's Office, Targhee National Forest. Most of these data were generated for the report, "Island Park Geothermal Energy Development—Social and Economic Assessment," EDAW Inc., Fort Collins, Colorado.

TABLE 31. POSITIONS ESTIMATED TO BE TAKEN BY SOCIAL GROUP CATEGORIES ON FOUR BASE ISSUES*

Conflict Issues	Sawmills/ Planing Mills	Logging Contractors	Cattle Grazers	Sheep Grazers	Farmers	Food Processing/ Wholesaling	Realtors/ Bankers	Retail Sales/ Services	Dispersed Recreation/ Non-Motorized	Dispersed Recreation/ Motorized	Hunting	Water Based Recreation/Developed	Water Based Recreation/Undeveloped	Developed Land Based Recreation	Seasonal Residents (Within Study Area)	Year-Round Residents Within Study Area)	Residents (Adjacent to Study Area)
Designation of Critical Grizzly Bear Habitat in the National Forest	–	–	–	–	–	0	–	0	+	–	–	0	+	–	0	–	–
Designation of Additional Roadless Areas in the National Forest	–	–	–	–	–	0	–	–	+	–	–	–	+	–	–	–	–
Residential and Commercial Development in Island Park Area	–	–	–	–	0	0	+	+	–	–	–	+	–	+	–	–	–
Increased Public Access to Harriman State Park	+	+	+	+	+	0	+	+	–	+	0	+	–	+	+	+	+

* (+) = for; (–) = against; (0) = neutral
Values represent medians for the Delphi panel estimates.

III. EVALUATION CRITERIA

Criteria are standards on which a judgement or decision may be based. Our criteria deal with goals, objectives and tests of feasibility used to evaluate alternatives for geothermal leasing. Any alternative proposed must meet the legal requirements established by laws and regulations. No attempt will be made to name all of the laws and regulations pertaining to the management of National Forest and Bureau of Land Management lands. For the purpose of this process, the following partial list of laws is considered important reference:

Organic Administration Act of 1897
Multiple Use—Sustained Yield Act of 1960
The Wilderness Act of 1964
National Historic Preservation Act of 1966
National Environmental Policy Act of 1969
Geothermal Steam Act of 1970
Forest and Rangeland Resources Planning Act of 1974
National Forest Management Act of 1976
Federal Land Policy and Management Act of 1976
The Endangered and Threatened Species Act of 1976
The Clean Air Act as Amended, August 1977

Within the Forest and Rangeland Resources Planning Act (RPA), the Forest Service has proposed a program for the 1977-2020 period. The recommended program takes the form of National goals or objectives and focuses on each resource as follows:

Recreation. Increase supply of outdoor opportunities and services through Forest Service programs that emphasize dispersed recreation.

Wilderness. Provide for a moderate increase in wilderness on National Forest Land.

Wildlife and Fish. Provide for greater species diversity and wildlife and fish populations through large increases of habitat management.

Range. Provide forage at present levels without impairing land productivity, or provide forage to the extent benefits are commensurate with costs without impairing land productivity.

Timber. Increase timber supplies and quality to the point where benefits are commensurate with costs.

Land and Water. Meet minimum air and water quality standards. Selectively improve, commensurate with benefits produced, air quality, soil productivity, water quality and supply, and meet other land stewardship standards.

Minerals. Develop and demonstrate the use of technologies necessary to anticipate and ameliorate major adverse effects of fossil fuel and mineral development on the environment, surface resources, and people by 1985.

The Bureau of Land Management minerals objectives are developed in response to the Mining and Minerals Policy Act of 1970. The objective is to make energy minerals available for use on a managed and controlled basis, consistent with National energy and related demands.

The above laws, regulations, policy and direction items, form limitations that are imposed on the management options for an area. With these limitations as constants, the following criteria were developed. Each alternative will:

1. Protect surface and subsurface resources within Yellowstone National Park.
2. Provide habitat to sustain viable populations of all groups of wildlife and fish, and protect threatened and endangered species and their habitat.
3. Maintain water quality as defined by State and Federal standards, and ensure adequate downstream quantity for other uses.
4. Ensure that direction and policy within existing land management plans are followed.
5. Provide lands for geothermal leasing in relation to alternate energy development needs in the United States.

In section VI each alternative has been evaluated to determine how well they agree with the above criteria. This evaluation forms the basis for the selected alternative. This selected alternative, if adopted by the responsible officials, will become the Decision and so stated in the Record of Decision attached to the front of this document.

Subsequent to any decision made by the responsible officials, the Secretary of the Interior will decide where and if leases will be issued within the IPGA. In addition to this environmental impact statement, the Secretary of the Interior may also be guided by policy, legal, economic, and political goals. As stated in the Department of the Interior's letter of comment (consultation section of this EIS), any leasing activities will be predicated on a thorough technical evaluation as to possible risks to the Yellowstone National Park geothermal system.

IV. ALTERNATIVES CONSIDERED

Alternatives developed to compare the effects of geothermal leasing and development in the IPGA identify several options for leasing and are consistent with existing laws and federal land management policies. Obviously, many other alternatives could be developed, including a mixture or perhaps different considerations from those presented here. However, most concerns and viewpoints are incorporated in the range of alternatives presented.

Table 32 shows the distribution of acres in the IPGA for each alternative. Figure 7 graphically shows the allocation of land by percentages for each alternative.

TABLE 32. DISTRIBUTION OF ACRES IN THE ISLAND PARK GEOTHERMAL AREA BY ALTERNATIVE

	Alternative						
	1	2	3	4	5	6	7
Leasing	0	268,418	233,420	233,420	233,420	448,031	178,620
No Leasing	488,031	219,613	87,916	0	87,916	0	94,316
Deferred	0	0	166,695	0	0	0	215,095
Leasing with no surface occupancy	0	0	0	254,611	0	0	0
Leasing with surface occupancy restrictions	0	0	0	0	166,695	0	0
TOTALS	488,031	488,031	488,031	488,031	488,031	488,031	488,031

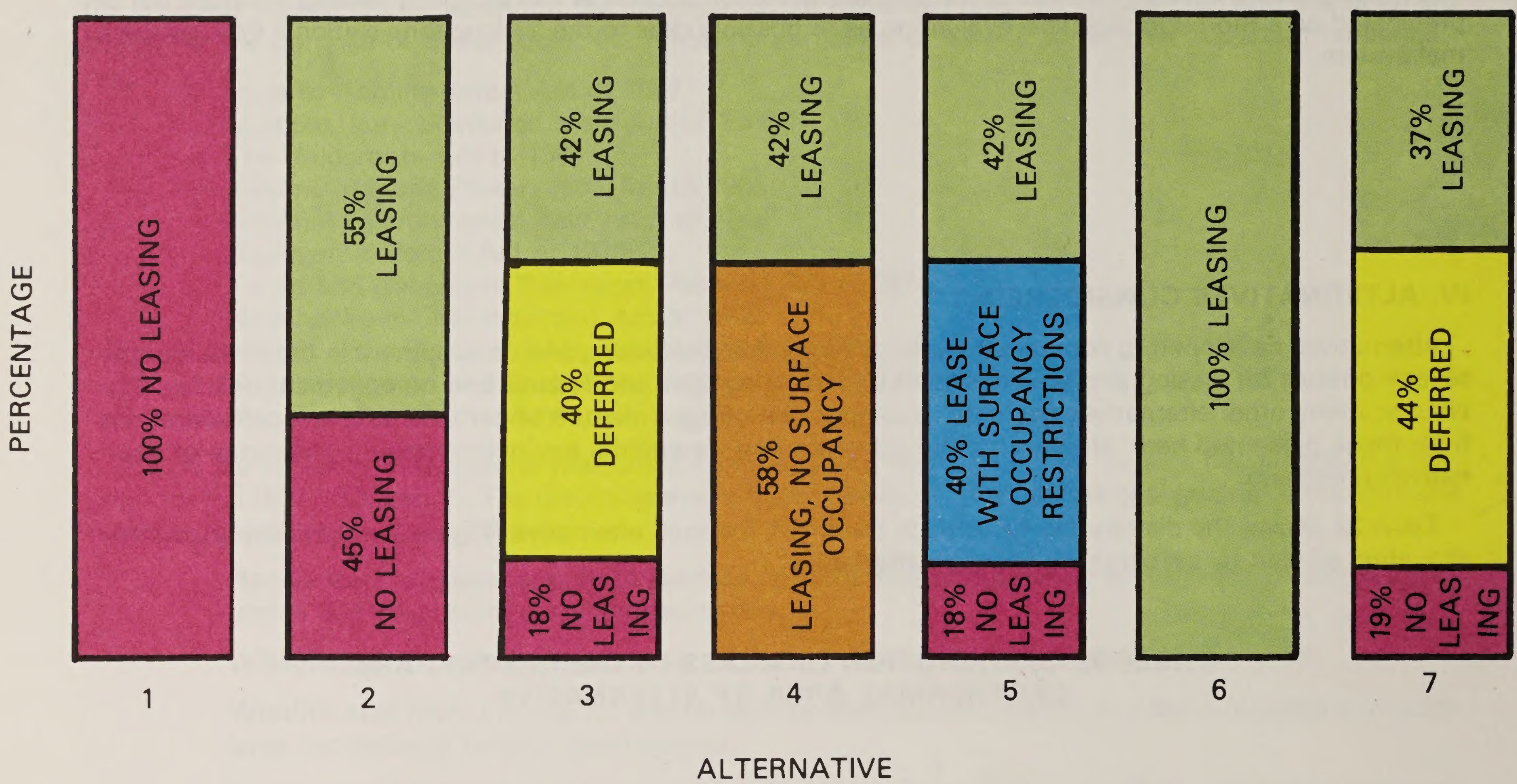
ALTERNATIVE 1

No leasing. This alternative is required under the Council on Environmental Quality's guidelines and represents the status quo. It places emphasis on other resources at the expense of geothermal leasing and development.

While geothermal development is unlikely under this alternative, publicly owned geothermal reserves could be depleted by extraction on adjacent state and private lands. Leases have been issued on approximately 24,705 acres of state and private lands within the IPGA (Appendix L). Cumulative surface and subsurface effects from adjacent developments could significantly affect the IPGA. Such effects include subsidence, seismicity, air and noise pollution, wildlife habitat deterioration, and reduced visual quality. Also the development of these lands adjacent to non-developed public lands could result in a less efficient use of the geothermal resources of the general area.

The geothermal leases on Idaho state lands in the IPGA are authorized and administered by the State of Idaho Department of Lands. All drilling of geothermal wells on both private and state lands in Idaho is authorized and controlled by the Idaho Department of Water Resources.

FIGURE 7. PERCENTAGE OF LAND ALLOCATION BY ALTERNATIVE IN THE IPGA



ALTERNATIVE 2

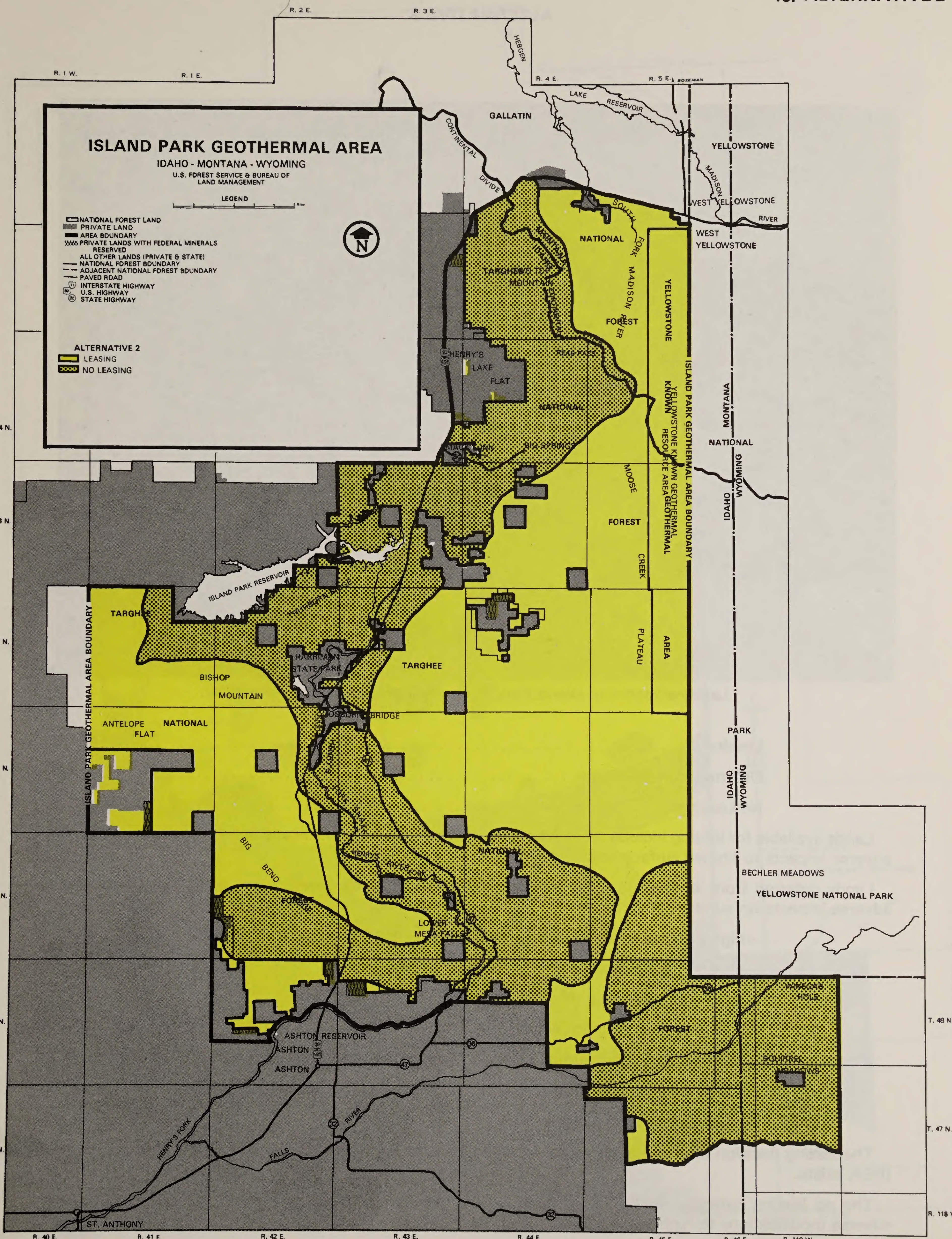
Lease only those lands identified as suitable by participants of the Geothermal Workshop held in Rexburg, Idaho on March 18, 1978.

Under this alternative, lands within the IPGA are divided as follows:

Leasing	268,418 acres
No Leasing	219,613 acres

The Geothermal Workshop was an all-day meeting allowing the public to indicate their concerns about geothermal leasing and development on the IPGA. Fifty-six people participated representing a variety of occupations.

The participants, divided into seven groups of five to seven people, were asked to collectively produce a map showing where leasing should or should not occur in the Island Park Geothermal Area. All but one group responded by either producing a map or making comments. Two groups made comments and five groups produced a map. Alternative 2 represents land more than half of the groups agreed should be available for leasing.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PAVED ROAD
INTERSTATE HIGHWAY
U.S. HIGHWAY
STATE HIGHWAY
ALTERNATIVE 2
LEASING
NO LEASING
N
GALLATIN
HEBGEN
LAKE
RESERVOIR
CONTINENTAL DIVIDE
YELLOWSTONE
MADISON
WEST YELLOWSTONE
RIVER
SOUTH FORK MADISON RIVER
NATIONAL
FOREST
TARGHEE
HENRY'S LAKE FLAT
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IDAHO
WYOMING
NATIONAL
MOOSE
CREEK
PLATEAU
AREA
ISLAND PARK RESERVOIR
HARRIMAN STATE PARK
BISHOP MOUNTAIN
ANTELOPE FLAT
OSBORNE BRIDGE
PARK
BIG BEND
LOWER MESA FALLS
BECHLER MEADOWS
YELLOWSTONE NATIONAL PARK
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R. 118 W.
R. 40 E.
R. 41 E.
R. 42 E.
R. 43 E.
R. 44 E.
R. 45 E.
R. 46 E.
R. 119 W.

Lands adjacent to Island Park Reservoir have high visual sensitivity.

Leasing .... 233,420 acres

Deferred at present time .... 166,695 acres

No Leasing .... 87,916 acres

Lands available for leasing include those where geothermal development would not likely cause significant adverse impacts to known surface resource values.

Lands deferred from leasing are those where geothermal resource development could have significant adverse impacts on surface resource values. These values include:

—highly visible timberland lands adjacent to Island Park Reservoir (Map 13)

—elk and deer migration routes (Map 9)

—moose winter range (Map 9)

—fish spawning steams (Table 19)

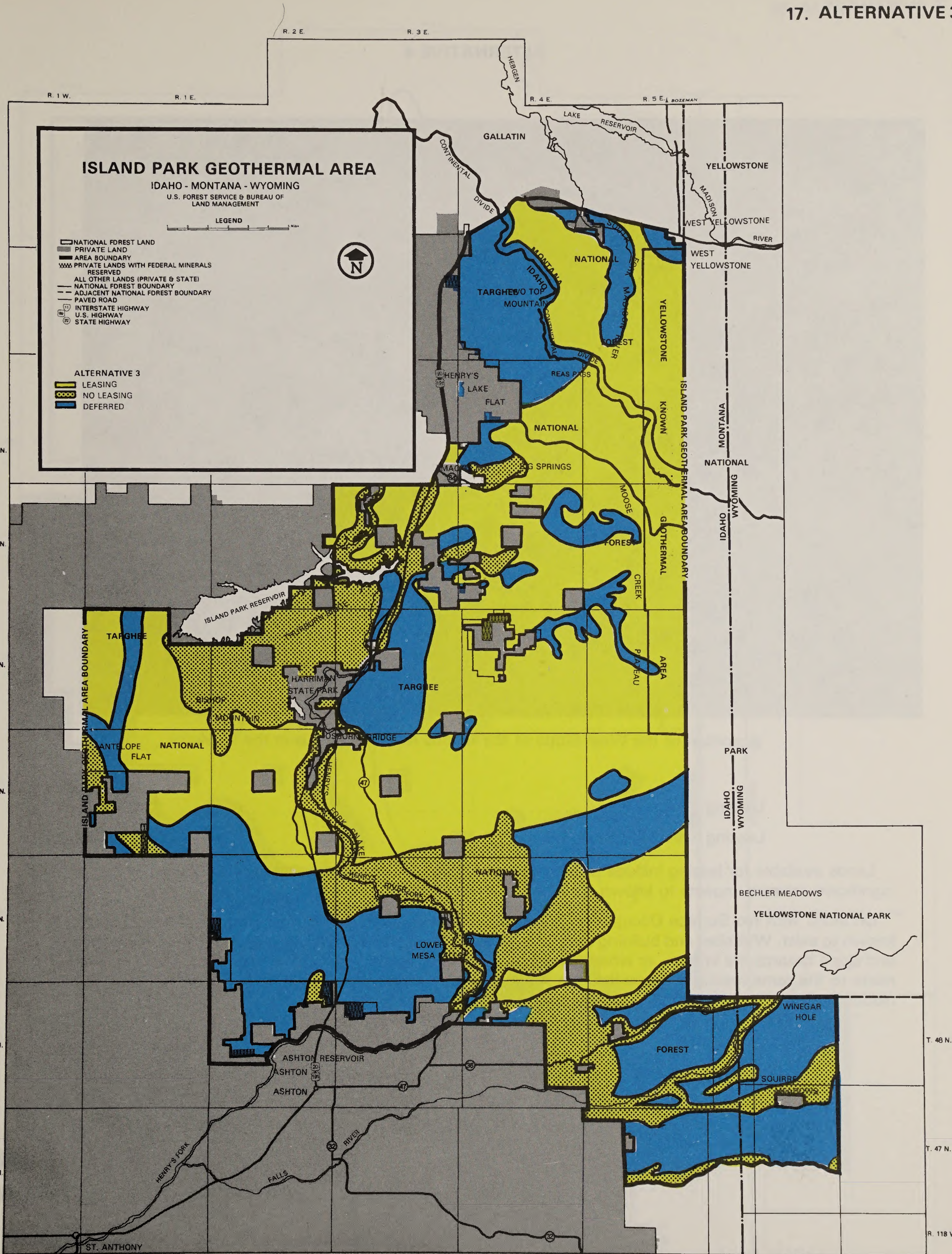
—sandhill crane and trumpeter swan feeding and nesting areas (Map 10)

—grizzly bear habitat (Map 11)

—areas of human development

The leasing decision on these lands will be made when more knowledge of the geothermal resource in the IPGA exists.

The no leasing category applies to all lands where geothermal development would create significant adverse modifications to high value surface resources.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DEFERRED
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YELLOWSTONE KNOWN GEOTHERMAL AREA
ISLAND PARK GEOTHERMAL AREA BOUNDARY
MONTANA
NATIONAL
IDAHO WYOMING
ISLAND PARK RESERVOIR
TARGHEE
HARRIMAN STATE PARK
BISHOP MOUNTAIN
TARGHEE
OSBORN BRIDGE
ANTELOPE FLAT
NATIONAL
PARK
IDAHO WYOMING
NATIONAL
LOWER MESA
BECHLER MEADOWS
YELLOWSTONE NATIONAL PARK
WINEGAR HOLE
FOREST
ASHTON RESERVOIR
ASHTON
ASHTON
ST. ANTHONY
HENRY'S FORK
FALLS RIVER
R. 1 W.
R. 1 E.
R. 2 E.
R. 3 E.
R. 4 E.
R. 5 E.
R. 40 E.
R. 41 E.
R. 42 E.
R. 43 E.
R. 44 E.
R. 45 E.
R. 46 E.
R. 119 W.
R. 118 W.
T. 14 N.
T. 13 N.
T. 12 N.
T. 11 N.
T. 10 N.
T. 9 N.
T. 8 N.
T. 48 N.
T. 47 N.

ALTERNATIVE 4

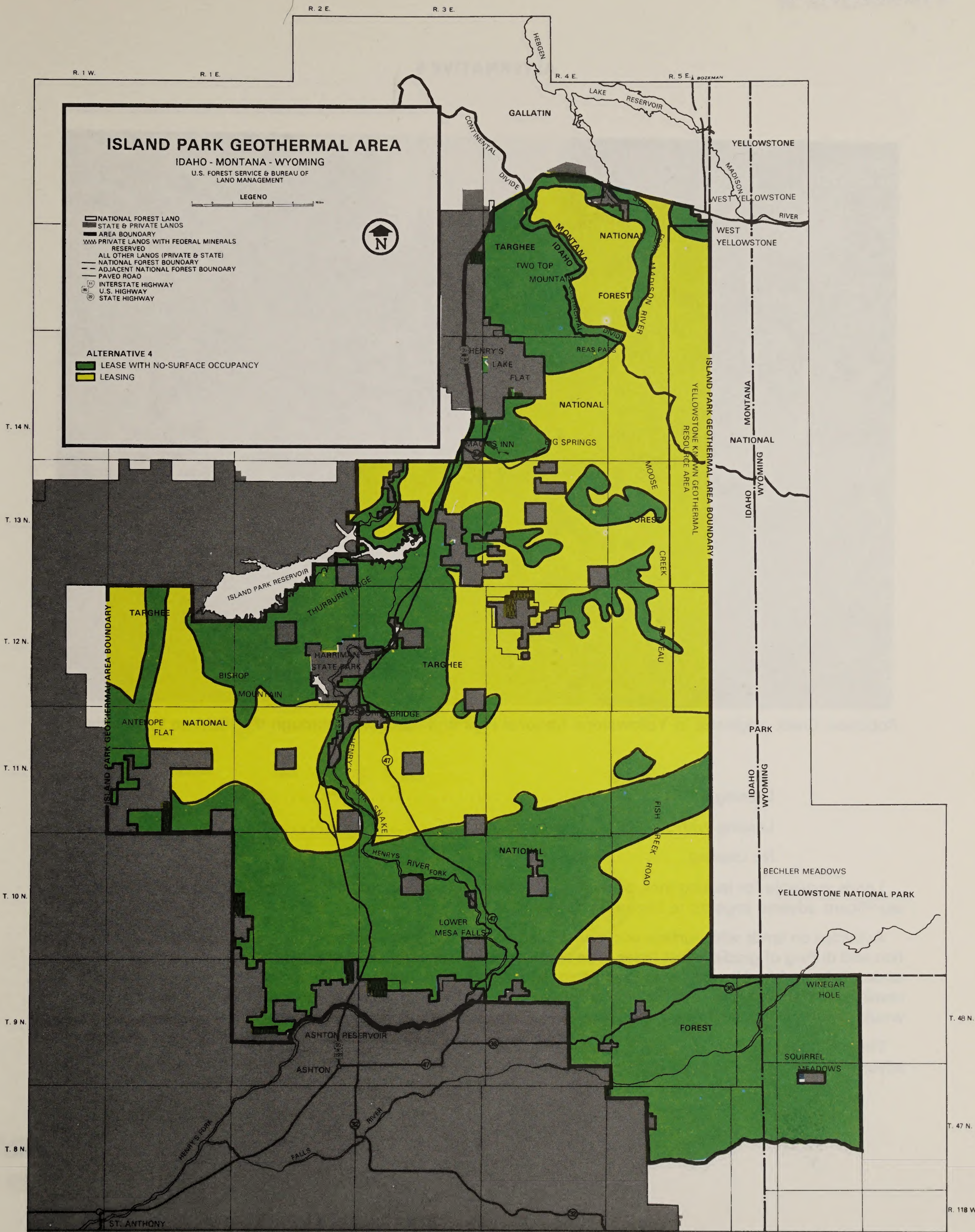
A portion of the West Slope of the Tetons RARE II Area is in the IPGA.

Leasing . . . . 233,420 acres

Leasing with No Surface Occupancy . . . . 254,611 acres

Lands available for leasing include those where geothermal resource development would not likely cause significant adverse impacts to known surface resource values.

On lands with No Surface Occupancy, conditions unfavorable to geothermal resource development are known to exist. Well sites and building sites cannot be allowed where problems include terrain, unstable soils and slope hazards are known, or where human use activities will be impaired or disrupted. These problems relate to the same resource values listed in Alternative 3. However, a lessee could develop the geothermal resource beneath the lands by directional drilling from adjacent lands.


ISLAND PARK GEOTHERMAL AREA
IDAHO - MONTANA - WYOMING
U.S. FOREST SERVICE & BUREAU OF LAND MANAGEMENT
LEGEND
NATIONAL FOREST LAND
STATE & PRIVATE LANDS
AREA BOUNDARY
PRIVATE LANDS WITH FEDERAL MINERALS RESERVED
ALL OTHER LANDS (PRIVATE & STATE)
NATIONAL FOREST BOUNDARY
ADJACENT NATIONAL FOREST BOUNDARY
PAVED ROAD
INTERSTATE HIGHWAY
U.S. HIGHWAY
STATE HIGHWAY
ALTERNATIVE 4
LEASE WITH NO-SURFACE OCCUPANCY
LEASING
GALLATIN
HEBGEN LAKE RESERVOIR
CONTINENTAL DIVIDE
YELLOWSTONE
WEST YELLOWSTONE
MADISON RIVER
TARGHEE
TWO TOP MOUNTAIN
NATIONAL FOREST
MONTANA
IDAHO
REAS PASS
HENRY'S LAKE FLAT
MACKS INN
BIG SPRINGS
MOOSE CREEK
YELLOWSTONE KNOWN GEOTHERMAL RESOURCE AREA
ISLAND PARK GEOTHERMAL AREA BOUNDARY
MONTANA
NATIONAL
IDAHO
WYOMING
PARK
ISLAND PARK RESERVOIR
THURBURN RIDGE
HARRIMAN STATE PARK
BISHOP MOUNTAIN
ANTELOPE FLAT
BRIDGE
HENRY'S FORK SNAKE
HENRYS FORK RIVER
FISH CREEK ROAD
LOWER MESA FALLS
BECHLER MEADOWS
YELLOWSTONE NATIONAL PARK
WINEGAR HOLE
SQUIRREL MEADOWS
ASHTON RESERVOIR
ASHTON
FALLS RIVER
ST. ANTHONY
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BOZEMAN
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T. 9 N.
T. 8 N.
T. 48 N.
T. 47 N.
R. 118 W.
R. 40 E.
R. 41 E.
R. 42 E.
R. 43 E.
R. 44 E.
R. 45 E.
R. 46 E.
R. 119 W.

ALTERNATIVE 5

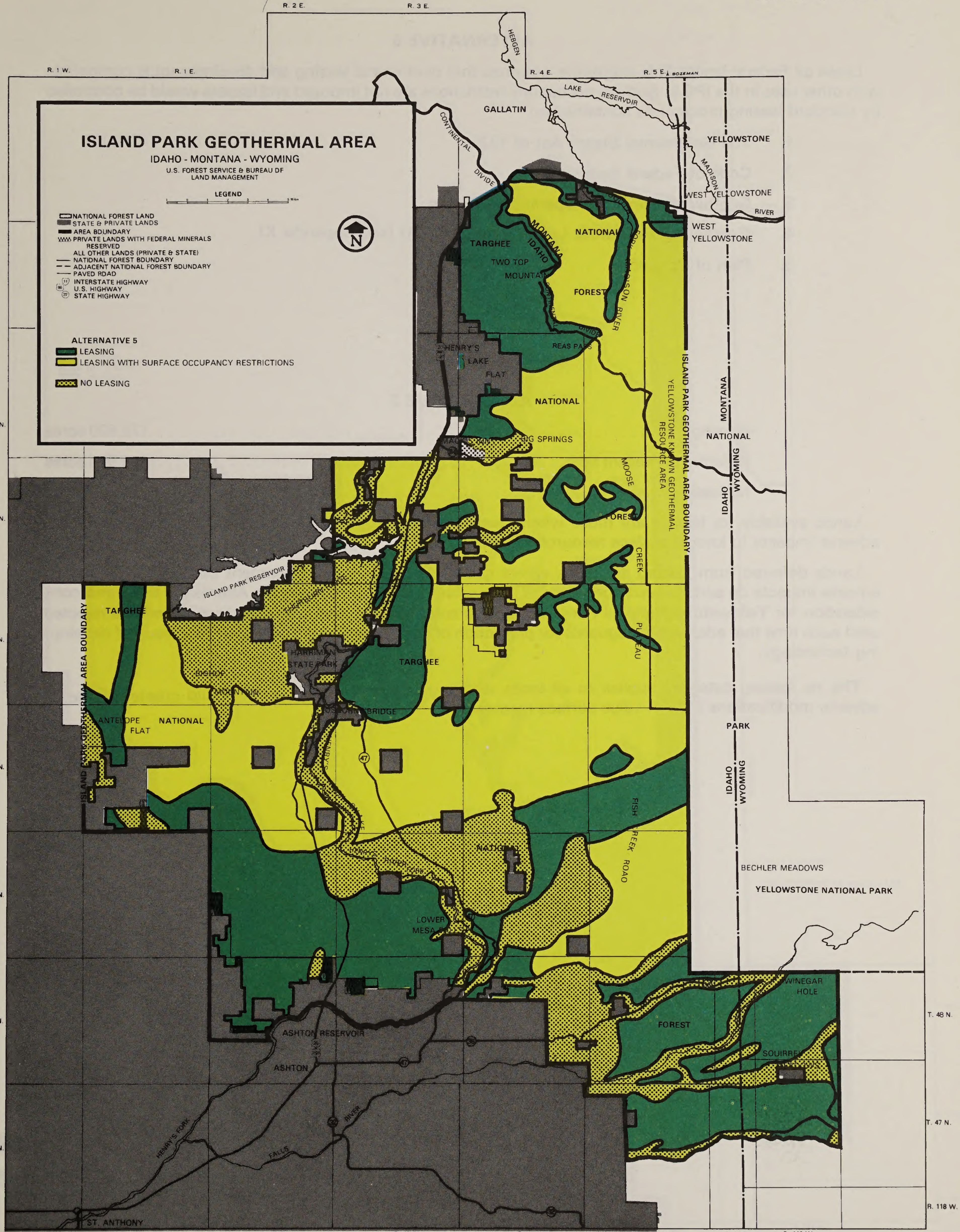
Robinson Creek originates in Yellowstone National Park and flows west through the IPGA to Warm River.

Leasing	233,420 acres
Leasing with surface occupancy restrictions	166,695 acres
No Leasing	87,916 acres

Lands available for leasing include those where geothermal resource development would not likely cause significant adverse impacts to known surface values.

Activities on lands with surface occupancy restrictions would be limited to non-disruptive surface exploration and drilling of gradient test holes. The resource values being protected here are the same as those listed under **deferred** in Alternative 3. Existing roads would be used and test holes drilled by truck mounted or readily portable rigs only. Any additional proposals to develop a known or suspected geothermal resource would require site specific analysis under the NEPA process.

The no leasing category applies to all lands where geothermal development would create significant adverse modifications to high value surface resources.


ISLAND PARK GEOTHERMAL AREA
IDAHO - MONTANA - WYOMING
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LEGEND
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PRIVATE LANDS WITH FEDERAL MINERALS RESERVED
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NATIONAL FOREST BOUNDARY
ADJACENT NATIONAL FOREST BOUNDARY
PAVED ROAD
INTERSTATE HIGHWAY
U.S. HIGHWAY
STATE HIGHWAY
ALTERNATIVE 5
LEASING
LEASING WITH SURFACE OCCUPANCY RESTRICTIONS
NO LEASING
N
R. 1 W.
R. 1 E.
R. 2 E.
R. 3 E.
R. 4 E.
R. 5 E.
BOZEMAN
HEBGEN
LAKE
RESERVOIR
GALLATIN
CONTINENTAL
DIVIDE
YELLOWSTONE
MADISON
WEST YELLOWSTONE
RIVER
WEST YELLOWSTONE
TARGHEE
MONTANA
IDAHO
TWO TOP MOUNTAIN
NATIONAL
FOREST
MADISON RIVER
DIVIDE
REAS PASS
HENRY'S LAKE
FLAT
NATIONAL
BIG SPRINGS
ISLAND PARK GEOTHERMAL AREA BOUNDARY
YELLOWSTONE KNOWN GEOTHERMAL RESOURCE AREA
MONTANA
NATIONAL
IDAHO
WYOMING
MOOSE
FOREST
CREEK
PLATEAU
ISLAND PARK RESERVOIR
TARGHEE
HARRIMAN STATE PARK
TARGHEE
BISHOP MOUNTAIN
ANTELOPE FLAT
NATIONAL
OSBORNE BRIDGE
47
PARK
IDAHO
WYOMING
FISH CREEK ROAD
NATIONAL
BECHLER MEADOWS
YELLOWSTONE NATIONAL PARK
LOWER MESA
WINEGAR HOLE
FOREST
SQUIRREL
ASHTON RESERVOIR
ASHTON
HENRY'S FORK
RIVER
FALLS
ST. ANTHONY
T. 14 N.
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T. 8 N.
T. 48 N.
T. 47 N.
R. 118 W.
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R. 41 E.
R. 42 E.
R. 43 E.
R. 44 E.
R. 45 E.
R. 46 E.
R. 119 W.

ALTERNATIVE 6

Lease all Federal lands. This alternative assumes that geothermal leasing and development is compatible with other uses in the IPGA. Surface occupancy restrictions are not imposed and lessees would be controlled by standard leasing procedures contained in:

1. The Geothermal Steam Act of 1970.
2. Code of Federal Regulations.
3. Geothermal Resource Operational Orders.
4. Geothermal Resources Lease Form (3200-21) (see Appendix K).
5. Plan of Operation.

ALTERNATIVE 7

Leasing . . . . 178,620 acres

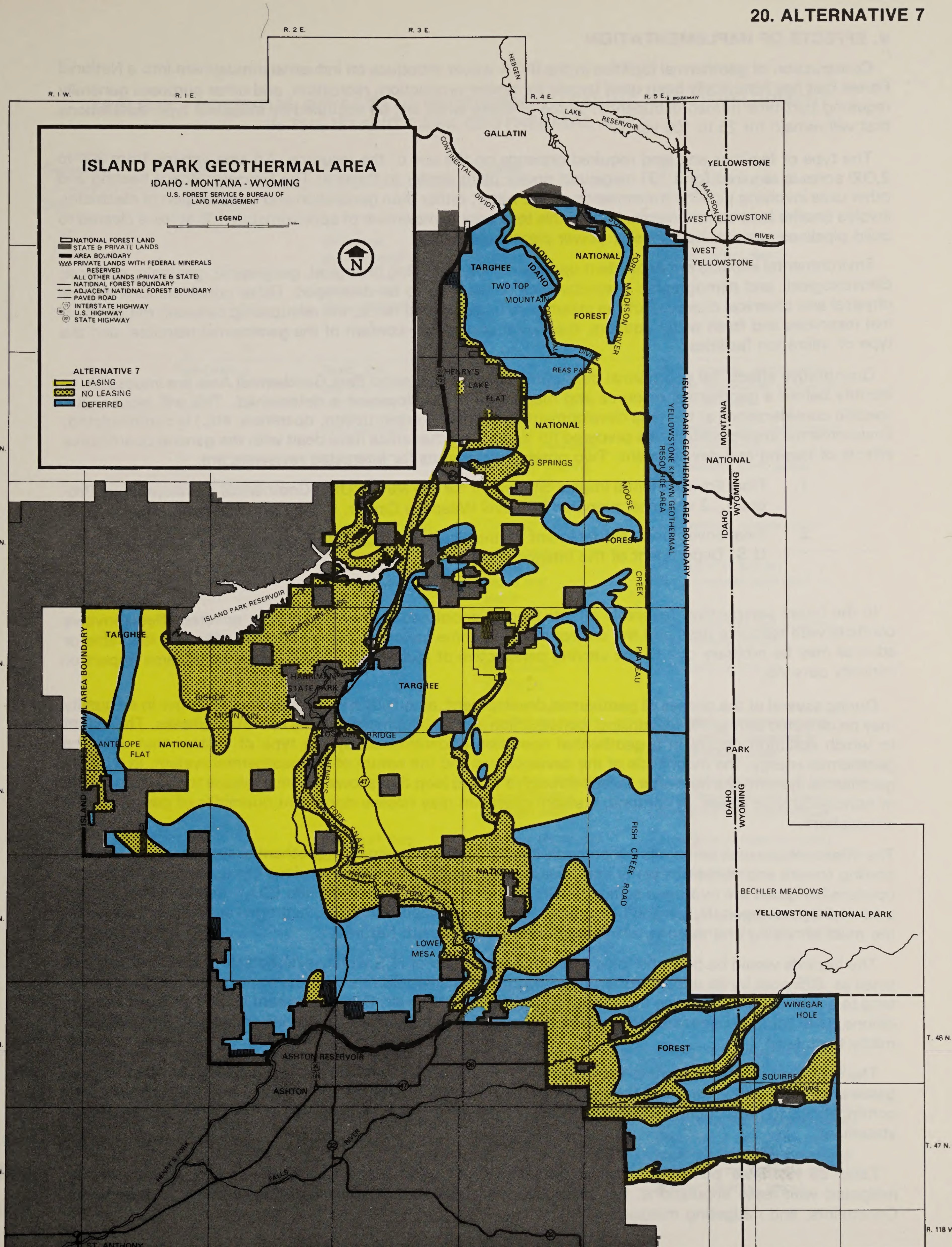
Deferred at present time . . . . 215,095 acres

No leasing . . . . 94,316 acres

Lands available for leasing are those where geothermal development would not likely cause significant adverse impacts to known surface resource values.

Lands deferred from leasing are those where geothermal resource development could have significant adverse impacts on surface resource values. These values include those listed in Alternative three and consideration for Yellowstone National Park. In deferred areas existing and future applications will be rejected until such time that adequate safeguards for protection of surface resources may exist as a result of developing technology.

The no leasing category applies to all lands where geothermal development would create significant adverse modifications to high value surface resources.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PAVED ROAD
INTERSTATE HIGHWAY
U.S. HIGHWAY
STATE HIGHWAY
ALTERNATIVE 7
LEASING
NO LEASING
DEFERRED
GALLATIN
HEBGEN LAKE RESERVOIR
YELLOWSTONE
WEST YELLOWSTONE
MADISON RIVER
TARGHEE NATIONAL FOREST
TWO TOP MOUNTAIN
HENRY'S LAKE FLAT
REAS PASS
ISLAND PARK GEOTHERMAL AREA BOUNDARY
YELLOWSTONE KGRA
ISLAND PARK RESERVOIR
HARRIMAN STATE PARK
ANTELOPE FLAT
LOWER MESA
ASHTON RESERVOIR
ASHTON
ST. ANTHONY
BECHLER MEADOWS
YELLOWSTONE NATIONAL PARK
WINEGAR HOLE
SQUIRREL MEADOWS
FISH CREEK ROAD
MOOSE CREEK
IDAHO
MONTANA
WYOMING

V. EFFECTS OF IMPLEMENTATION

Construction of geothermal facilities in the IPGA would introduce an industrial atmosphere into a National Forest that has historically been used largely for timber production, recreation, and other purposes generally requiring part-time human occupancy. Some of these lands will be occupied by industrial type installations that will remain for 25 to 100 years.

The type of facilities and land required depends on the use of the resource. An area varying from 800 to 2,000 acres is required for a 100 megawatt power plant similar to those at The Geysers. Space heating and other uses involving pipeline transmission of hot water, rather than generation and transmission of electricity, involve smaller land commitments. Within this total area, a maximum of approximately 180 acres is cleared to build pipelines, access roads, wells, power plants. etc.

Environmental impacts are dependent upon variables, including biological, geographic, geologic, physical, climatological, and demographic characteristics of the area to be developed. Other considerations are the physical and chemical character of the steam and/or associated fluids, the relationship between the geothermal reservoirs and fresh water aquifers, the extent and energy content of the geothermal resource, and the type of utilization facilities.

Quantitative effects for geothermal development within the Island Park Geothermal Area are impossible to identify before a geothermal resource and magnitude of development is determined. This will require site-specific considerations at the time development (test drilling, construction, operation, etc.) is contemplated. Environmental impact statements prepared for leasing in other areas have dealt with the general quantitative effects of leasing and development. Two notable statements for interested reviewers are:

1. Final Environmental Impact Statement for the Navy COSO Geothermal Developmental Program...2 volumes, prepared by Naval Weapons Center, China Lake, California, March 1979.
2. Final Environmental Statement for the Geothermal Leasing Program, report in four volumes, U.S. Department of the Interior, 1973.

In the broad perspective, favorable effects involve social and economic benefits; adverse effects involve conflicts with resource uses and the environment. In some instances categorizing an effect as favorable or adverse may be arbitrary due to the varying perspective of individuals. There will be no adverse impact on minority persons.

During several of the phases of geothermal development, air quality may be affected. Changes in air quality may be detected during the test drilling, construction and development and the operation phases. The extent to which pollution occurs in a geothermal operation is determined by the type of system that uses the geothermal energy, the magnitude of the development and the nature of the geothermal system. In a binary geothermal system, the hot water moves through a closed loop that allows minimal release to the atmosphere of noncondensible gases. In contrast, a steam operation may release significant quantities of gases into the atmosphere.

The effects of gaseous emissions are primarily known from the steam type geothermal system which employs cooling towers and numerous vents that release water vapor and various noxious gases. Among these non-condensible gases are hydrogen sulfide (H_2S), ammonia (NH_3), carbon dioxide (CO_2), methane (CH_4), boric acid (H_3BO_3), nitrogen (N_2), argon (A), radon, and mercury vapor. Of these, hydrogen sulfide has been by far the most annoying and the one which may pose serious health hazards.

The hazards would be both the toxicity and nuisance odor of H_2S which is detectable in concentrations as small as .025 ppm by its odor of rotten eggs. Normally H_2S would mix with the atmosphere, and would not tend to accumulate locally even though it is slightly heavier than air. During stagnant air and air inversion conditions, H_2S could accumulate locally from a geothermal operation to a high nuisance level, and perhaps a mildly toxic level.

The areas within and adjacent to the IPGA which would probably be most affected by H_2S or other noxious gases are West Yellowstone and the residential/commercial developments in Island Park. Requirements and contingencies to protect people from the effects of the gases are in Section VII, of this environmental impact statement.

Table 33 identifies **possible** impacts associated with geothermal leasing which may or may not be mitigated with lease stipulations. For corrective measures, see Section VIII, Management Requirements, Constraints, and mitigating measures.

TABLE 33. POTENTIAL IMPACTS OF GEOTHERMAL LEASING AND DEVELOPMENT IN THE ISLAND PARK GEOTHERMAL AREA.

Resource	Phase	Activity	Change	Impact
Soil	Exploration	Drilling of shallow temperature gradient and observation holes	• Clearing of access	—Minor excavation for mud pits in some cases
	Test Drilling	Road, drill pad and sump construction	• Clearing, grading, cut and fill, excavation	—Soils: erosion, compaction, loss of attenuation properties in borrow areas
		Well blowout	• Uncontrolled effluent discharge	—Soil erosion and undermining of well pad area
	Construction and development	Power plant and facilities	• Clearing, grading, cut and fill, excavation	—Soil erosion, compaction
		Transmission and pipelines	• Clearing lanes	—Soil erosion, compaction
	Operation	Power plant operation and maintenance	• Release of gases and vapor	—Alteration of soil pH (from localized acid rain)
			• Erosion	—Permanent soil loss resulting from surface runoff
		Cooling tower operation and maintenance	• Blow-down discharge	—Alteration of soil pH
Water	Exploration	Explosives and seismic exploration	• Clearing for access	—Negligible increase in runoff which will be absorbed in non-disturbed areas.
			• Fracturing of bedrock in sedimentary geologic areas	—Temporary alteration of groundwater flow with reduction in springflow and streamflows
		Drilling of shallow temperature and observation holes	• Clearing for access	—Negligible increase in runoff which will be absorbed in non-disturbed areas
			• Discharge of drilling wastes, mud, geothermal fluids, chemicals, etc.	—Water quality degradation (changes in pH, TDS, alkalinity, etc.)
			• Creation of route for groundwater movement and mixing	—Interaquifer transfer of water (e.g. water with high TDS moving into water with low TDS)
		Camping and housing of personnel	• Soil disturbance	—Negligible increase in runoff which will be absorbed in non-disturbed areas
	Test Drilling	Road, drill pad, and sump construction	• Clearing, grading, cut and fill, excavation	—Streams: bank alteration, diversions, siltation, chemical quality degradation (pH, TDS, color, organic agents), flow alteration from covering recharge areas, gradient change, etc.

Resource	Phase	Activity	Change	Impact
				—Groundwater: increased recharge and infiltration in borrow pits —Groundwater: loss of recharge in compacted areas
			• Possible discharge of drilling wastes, mud, geothermal fluids, etc.	—Streams: Direct entry into streams or leaching of noxious chemicals through soil to streams (increase in pH, Na, TDS, alkalinity) —Groundwater: Contamination of shallow groundwater aquifers (same chemical changes)
		Equipment maintenance	• Discharge of detergents, compounds (oil, gas, etc.)	—Pollution of surfce and groundwater
		Drilling and production testing	• Release of gases, vapors and toxic liquids	Water pollution same as above: —Streams: direct entry... —Groundwater: contamination...
		Well blowout	• Uncontrolled effluent discharge	Water pollution same as above: —Streams: direct entry... —Groundwater: contamination... —Chemical changes in water from increased dissolving power of warm and hot effluents (increases TDS, and many chemical constituents)
	Construction and development	Power plant and facilities	• Clearing and grading, cut and fill, excavation	Similar to test drilling but more intense: —Loss of groundwater recharge areas
			• Increased human presence	—Need for increased amounts of potable water (more wells, increased water treatment) —Reduction in the reserve of high quality groundwater —Increased sewage causing water quality degradation from septic systems
		Dewatering for deep excavation	• Lowered water table	—Reduces flow to small streams and springs (chemical and dilutional changes) —Causes nearby domestic and commercial wells to dry up —Disposal of pumped water into surface water causing channel and bank alteration, or onto dry land causing flooding —Reduces fisheries habitat
		Transmission lines and pipeline	• Clearing lanes	Similar to test drilling: —Loss of groundwater recharge areas
			• Increased human presence	Same as above: —Need for increased... —Reduction in the reserve... —Increased sewage...

Resource	Phase	Activity	Change	Impact
		Well drilling for cooling or make-up water	• Alteration of groundwater systems	—Creates a consumptive loss of water for other uses Similar to dewatering: —Reduces flows to streams... —Causes nearby wells... —Reduces instream fishery habitat
		Surface water impoundment or diversion for make-up or cooling water	• Reduced flows to downstream and instream uses	—Changes water chemistry (increased TDS, pH, temperature, hardness, alkalinity) —Creates demand on groundwater as substitute source —Reduces fishery habitat —Reduces recreational values (floating, fishing, etc.)
		Drilling production wells	• Release of gases, vapors, and toxic liquids	Water pollution same as in test drilling —Streams: direct entry... —Groundwater: contamination...
		Well blowout	• Uncontrolled effluent discharge	Water pollution same as in test drilling —Streams: direct entry... —Groundwater: contamination... —Chemical changes in water...
	Operation	Powerplant operation and maintenance	• Fertilization of grounds around facility, and use of weed control toxins	—Pollution to groundwater from leaching of chemical residues
			• Release of thermal water	Similar to test drilling: —Chemical changes in water...
			• Erosion	—Increases stream turbidity
			• Increased human presence	Similar to construction and development but long term: —Need for increased... —Reduction in the reserve of... —Increased sewage...
		Cooling tower operation and maintenance	• Washing of cooling tower baffles; blowdown discharge	—Pollutants to surface and groundwater (Cl, TDS, other salts)
		Reinjection	• "Lubricates faults"	—Potential for activation of faults; upward leakage of reinjected water could cause slope failures (earthslide) and soil erosion
			• Alteration of surface and groundwater quantity and quality	—Changes water chemistry (TDS, pH, hardness) through accidental losses —Water losses from well into aquifer can cause raised water table, increased seepage into streams and springs, appearance of new springs

Resource	Phase	Activity	Change	Impact
Air	Exploration	ORV travel, explosives and seismic exploration	• Increased dust	—Short term increase in particulates
	Test Drilling	Drilling and Production testing	• Release of gases, vapors and toxic liquids	—Air quality degradation (H_2S, NO_x, NH_3, CH_4, SO_2) —Short term increased humidity (fog, icing)
		Well blowout	• Uncontrolled effluent discharge	Same as above: —Air quality degradation... —Short term increased humidity (fog, icing)
	Construction and Development	Drilling production wells	• Release of gases, vapors	Similar to test drilling —Air quality degradation (H_2S, NO_x, NH_3, CH_4, SO_2) —Short term increased humidity (fog, icing)
		Well blowout	• Uncontrolled effluent discharge	Air pollution same as above; —Air quality degradation... —Increased humidity (until well is closed)...
		Power plant, facilities, roads, transmission lines, pipelines	• Increased dust	Similar to exploration —Short term increase...
	Operation	Power plant operation and maintenance	• Release of gases and vapors	Similar to test drilling but long term: —Air pollution (H_2S, NO_x, etc.)... —Increased humidity (fog, icing)...
		Cooling tower operation and maintenance	• Blowdown discharge	Similar to release of gases and vapors above: —Air pollution (H_2S, NO_x, etc.)... —Increased humidity (fog, icing)...

Resource	Phase	Activity	Change	Impact
Vegetation	Exploration	ORV travel	• Vegetation crushing	—Slight if routes are not used permanently or frequently
		Explosives and seismic exploration	• Soil/vegetation destruction and/or modification	—Minimal if not repeated on same site (shallow crater) —Stream habitat alteration
			• Clearing access routes	—Limited vegetation disturbance if use is mainly along existing roads; no new roads built —Increases fire hazard
		Drilling of shallow gradient holes	• Clearing access routes	Same as above: —Limited vegetation... —Increased fire hazard (fuel)
			• Preparation of drilling area	—Vegetation disturbance usually slight, less than one acre
			• Discharge of drilling wastes, mud, geotermal fluids, chemicals, etc.	—Kills terrestrial and aquatic vegetation —Alters nutrient cycles —Alteration of groundwater quality and quantity will affect the diversity, productivity, and abundance of vegetation dependent on water table (riparian, marshes, potholes, etc.)
		Camping and housing of personnel	• Refuse accumulation	—Improper management of garbage will alter vegetation nutrient cycles and surface water quality
	Test Drilling	Road, drill pad, and sump construction	• Clearing, grading, cut and fill, excavation	—Slash accumulation will increase hazard (fuel) of fires —Soil/vegetation destruction and/or modification
			• Herbicidal control of unwanted vegetation	—Toxic (kills) to non-target vegetation —Alters nutrient cycles
			• Possible discharge of drilling wastes, mud, geothermal fluids, chemicals, etc.	Same as under exploration although on a larger scale
			• Erosion	—Destruction and/or modification of surface and aquatic vegetation —Impaired plant growth —Stream channel alteration with deterioration of riparian and stream habitat
			• Increased human presence	—Possible destruction of terrestrial and aquatic vegetation —Increases risk of man-caused fires
			• Improper disposal of garbage and other waste	—Modifies nutrient cycling in soil and vegetation
		Equipment maintenance	• Discharge of detergents, oil, gas, etc.	—Destroys terrestrial and aquatic vegetation
		Blooie (steam well vent) line operation	• Projection of foreign particles (rocks, dirt, etc.)	—Soil/vegetation destruction and/or modification
		Drilling and production testing	• Release of gases, vapors, and toxic liquids	—Alteration of terrestrial and aquatic ecosystems—direct mortality of vegetation, reduced productivity, impaired growth, etc.
		Well Blowout	• Uncontrolled effluent discharge	—Pollution of terrestrial and aquatic ecosystems—poisoning of plants, direct destruction, etc.

Resource	Phase	Activity	Change	Impact
		Abandonment of wells	• Dismantling and grading	— Minimal disturbance of adjacent habitat; most activity is on site
			• Erosion from wind and water	Same as above
			• Landscape rehabilitation and revegetation	— Will benefit vegetation species of early successional stages; increases diversity, abundance, etc.
		Increased human access	• Increased human presence	Same as above
	Construction and development	Power plant and facilities	• Clearing, grading for permanent roads buildings, switch yard, etc.	— Direct vegetation destruction and/or modification of vegetation
			• Erosion	— Destruction and/or modification of vegetation — Alteration of ecosystem structure and function (productivity, diversity, nutrient cycling, etc.)
			• Increased human presence	— Increases risk of man-caused fire
			• Improper disposal of garbage and other wastes	— Modifies nutrient cycling
		Transmission lines and pipelines	• Clearing lanes	— Direct destruction and/or modification of vegetation — Alteration of ecosystem structure and function (productivity, diversity, nutrient cycling, etc.)
			• Increased human presence	— Increases risk of man-caused fire
			• Erosion	Same as above
	Operation	Power plant and facilities operation and maintenance	• Thermal discharges to streams and atmosphere	— Modification of terrestrial and aquatic ecosystems (productivity, diversity, etc.)
			• Increased human presence	— Increases risk of man-caused fires
			• Erosion	Same as under test drilling although on a larger, permanent scale
			• Condensate discharge	— Alteration of terrestrial and aquatic vegetation (structure) and function of ecosystems)
			• Discharge of acid washings of "scaled" machinery	— Direct destruction of vegetation — Accumulation of toxic substances in vegetation
			• Herbicidal control of unwanted vegetation	— Toxic to non-target vegetation — Alters nutrient cycling
		Cooling tower operation and maintenance	• Cooling water drift	— Lowered sunlight penetration will decrease photosynthesis — Toxic particles will fallout on vegetation and streams resulting in direct loss and/or reduced productivity, abundance, diversity etc. of vegetation
			• Blowdown discharge	— Contamination and/or alteration of terrestrial and aquatic flora — Could kill vegetation
			• Thermal discharges	Same as above

Resource	Phase	Activity	Change	Impact
		Reinjection	• Alteration of surface and groundwater quantity and quality	—Destruction and/or modification of terrestrial and aquatic vegetation dependent on surface and groundwater (bogs, marshes, riparian)
		Transmission line operation and maintenance	• Increased human access	—Increases risk of man-caused fires
			• Increased "edge" effect due to vegetation manipulation	—Edge associated flora will benefit (increased abundance, diversity, productivity, etc.)
Archaeological/ Historical	Test Drilling	Road building, pad and sump construction	• Cut and fill, grading	—Obliteration of archaeological and/or historical sites
	Construction and Development	Power plant, transmission and pipe lines	• Clearing and grading, clearing lanes, etc.	—Obliteration of archaeological and/or historical sites
Recreation	Exploration	Gradient test hole drilling	• Increased noise	—Distracting to some forms of recreation (hunting, hiking, fishing, etc.) —Disturbing to humans in campgrounds, summer homes, and wilderness environments
	Test Drilling	Road building, pad and sump construction	• Increased human presence	—More people in primitive or remote recreation areas
		Drilling and production testing	• Increased noise	Same as above
			• Air emissions	—Irritating to adjacent landowners and/or users
		Well blowout	• Increased noise	Same as above
	Construction and Development	Power plant and facilities	• Increased noise	Same as above
			• Increased human presence	Same as above
			• Exclusive use of acreage	—Effectively eliminates some forms of recreation
		Transmission lines	• Increased human presence	Same as above
		Pipelines	• Increased noise	Same as above
	Operation	Power plant operation and maintenance	• Increased noise	Same as above
			• Increased human presence	Same as above
			• Emission of non-condensable gases	—Unhealthy or offensive to adjacent property owners and/or recreationists
		Cooling tower operation and maintenance	• Increased noise	Same as above
Grazing	Exploration	Aerial surveys	• Increased aircraft noise	—Possible disruption (scattering) of livestock
		Gradient test hole drilling	• Increased noise	—Disturbance of livestock
		Explosives and seismic exploration	• Increased risk of man-caused fires	—Alteration of grazing commodities
			• Increased noise	—Disturbance of livestock
	Test Drilling	Road building, pad and sump construction	• Increased access to remote areas	—Improved access for grazing livestock (e.g. trucking, driveways, etc.)

Resource	Phase	Activity	Change	Impact
		Drilling and production testing	• Increased noise	Same as above
		Well abandonment	• Revegetation	—Possible to increase livestock forage production
	Construction and Development	Power plant and facilities	• Clearing, grading excavation	—Destruction of forage plants
			• Exclusive use of acreage	—Effectively precludes grazing on some lands
		Transmission and pipelines	• Clearing operations	—Destroys and alters forage plant communities
	Operation	Power plant operation and maintenance	• Emission of non-condensable gases	—Potentially harmful to livestock (poisoning, illness, etc.)
		Cooling tower operation and maintenance	• Blowdown and condensate discharge	—Potentially harmful to livestock (poisoning, illness, etc.)
		Transmission line maintenance	• No overstory to shade plants	—Increased forage for livestock
Non Threatened and Endangered Wildlife	Exploration	Aerial surveys	• Increased noise (aircraft)	—Temporary disturbance of wildlife. No significant alterations of behavior, physiology, etc. if flights are short, relatively infrequent, and do not harass wildlife
		ORV travel	• Increased noise	—Insignificant disturbance if vehicles are legally muffled
		Explosives and seismic exploration	• Increased noise	—Temporary disturbance of wildlife
		Drilling shallow gradient holes	• Accidental discharge of drilling wastes, mud, geothermal fluids, chemicals, etc.	—Poisoning of terrestrial invertebrates, soil flora and fauna, vegetation and wildlife
				—Alteration of surface water quality and quantity which affects wildlife through loss of food, habitat, interference with feeding and behavior, etc.
				—Encourages growth of nuisance organisms
				—Alteration of groundwater quality and quantity which affects the diversity, productivity, and quantity of vegetation dependent on water table (riparian, marshes, potholes, etc.) and dependent wildlife
			• Increased noise	—Temporary disturbance of wildlife, usually minimal and temporary;
			• Increased human presence	—Increased human-wildlife conflicts
				—Some wildlife will avoid the area and thereby lose use of that habitat for feeding, security, nesting, wintering, migration, etc.
				—Limits the ability of some wildlife to find food, conduct mating, raise young, and maintain protective awareness
		Camping and housing of personnel	• Increased noise from bivouac	—Temporary disturbance of wildlife
			• Soil/vegetation alteration	—Minimal destruction of soil, vegetation, wildlife, etc.
			• Refuse accumulation	—Improper management of garbage will alter the feeding habits of some wildlife (bears, jays, ravens, etc.)

Resource	Phase	Activity	Change	Impact
	Test Drilling	Road, drill pad and sump construction	• Clearing, grading, cut and fill, excavation, etc.	—Crushing of small wildlife (small mammals, reptiles, amphibians, invertebrates) —Sensitive wildlife species will avoid area thereby losing use of the habitat (birds of prey, wolverine, etc.) —Reduction of cover and food for resident wildlife —Disruption and/or elimination of wildlife breeding, nesting, brooding, resting, and rearing activities —Interferes with migration of big game —Alters predator/prey relationships
			• Herbicidal control of unwanted vegetation	—Toxic to non-target vegetation and associated wildlife
			• Accidental discharge of drilling wastes, mud, geothermal fluids, etc.	Same as under exploration although on a larger scale
			• Wildlife dispersal to surrounding habitat	—Increases stress, predation, etc. on resident wildlife populations and habitat; alters species composition, diversity, abundance, etc.
			• Increased vehicular traffic	—Increased collisions with wildlife and inevitable loss —Increases stress on wildlife populations
			• Increased noise levels	—Interferes with predator/prey relationships, reproduction (courting, mating, nesting, rearing), resting and/or hibernation, feeding, migration, etc.
			• Erosion	—Reduces breeding and nesting sites, cover, and/or other important wildlife habitat —Reduces food and/or water availability
			• Increased human presence	Same as under exploration although on a larger scale
			• Improper disposal of food-related garbage and other waste	—Alters feeding habits of some wildlife species, especially black bears
		Equipment maintenance	• Discharge of detergents, compounds (oil, gas, etc.)	—Pollution of terrestrial ecosystems (poisoning of wildlife, sterility, etc.)
		Blooie line	• Increased noise	Same as above
		Drilling and Production testing	• Increased noise levels	Same as above
			• Release of gases, vapors, and toxic liquids	—Modification of atmosphere and dependent wildlife —Alteration of terrestrial ecosystems (direct mortality of vegetation and animals, reduced productivity, decreased plant vigor, etc.)

Resource	Phase	Activity	Change	Impact
				—Unpleasant odors may impair certain wildlife functions: hunting by smell, individual recognition, etc.
		Well blowout	• Uncontrolled effluent discharge	—Pollution of terrestrial ecosystems; poisoning of insects, small mammals, birds, etc.
			• Thermal pollution	—Modification of atmosphere and disturbance of wildlife dependent on air space for travel, feeding, etc. (birds, bats, insects)
			• Increased noise levels	Same as above
		Abandonment of wells	• Dismantling and grading	—Minimum disturbance of adjacent habitat; most activity is on occupied site
			• Increased noise levels	—Temporary disturbance of wildlife
			• Increased human presence	Same as under exploration:
			• Erosion from wind and water	Same as above
			• Landscape rehabilitation and revegetation	—Will benefit wildlife species associated with early successional stages: increases abundance, diversity, etc.
		Increased Human access	• Increased human presence	Same as under exploration
	Construction and Development	Power plant and facilities	• Clearing and grading for permanent roads, buildings, switch yard, etc.	Same as under test drilling although on a larger scale: —Crushing of the small wildlife... —Sensitive wildlife species avoidance... —Reduction of cover and food... —Disruption and/or elimination... —Interferes with migration... —Alters predator/prey relationships
			• Increased air pollution	—Direct loss of wildlife due to poisoning by toxic materials —Damage to supportive habitat —Interference with wildlife behavior, physiology, predator/prey relationships, etc.
			• Wildlife dispersal to surrounding habitat	Same as under test drilling although on a larger, permanent scale: —Increases stress, predation...
			• Increased vehicular traffic	Same as under test drilling although on a larger, permanent scale: —Increases collisions with wildlife... —Increased stress...
			• Increased noise levels	Same as under test drilling: —Interferes with predator/prey...
			• Erosion	Same as under test drilling although on a larger scale: —Reduces breeding and nesting... —Reduces food and/or water...
			• Increased human presence	Same as under exploration although on a larger scale: —Increased human-wildlife conflicts... —Some wildlife will avoid... —Limits the ability of some wildlife...

Resource	Phase	Activity	Change	Impact
				—Increases opportunity for game poaching... —Increases demand on wildlife associated recreation (hunting)
			• Improper disposal of garbage and other wastes	Same as under test drilling although on a larger scale: —Alters feeding habits...
		Transmission lines and pipelines	• Clearing lanes	—Temporary dispersal of wildlife with associated stresses to the populations, and habitat loss for feeding, breeding sites, cover, etc. —Early successional wildlife species will increase in abundance, diversity, etc.
			• Increased noise presence	Same as under exploration; usually temporary but on a larger scale
			• Increased noise	Same as under test drilling
			• Erosion	Same as above
	Operation	Power plant operation and maintenance	• Thermal discharges to atmosphere	—Modification of atmosphere and disturbance of wildlife dependent on air space for travel, feeding, etc. (birds, bats, insects)
			• Increased noise	Same as under test drilling: —Interferes with predator/prey...
			• Increased human presence (permanent)	Same as under exploration although on a larger, permanent scale: —Increased human-wildlife conflicts —Some wildlife will avoid... —Limits the ability of some wildlife... —Increases hunting opportunities —Increases opportunity for poaching
			• Erosion	Same as under test drilling although on a larger, permanent scale: —Reduces breeding and nesting... —Reduces food and/or water...
			• Condensate discharge	—Toxic to terrestrial habitats and associated wildlife
			• Discharge of acid washings of "scaled" machinery	—Toxic salts and chemicals will destroy and/or modify terrestrial ecosystems
			• Emission of noncondensable gases	—Accumulation of toxic substances in food chains causing death, sterility, etc. —Unnatural odors will cause impairment of olfactory senses in some wildlife species
			• Herbicidal control of unwanted vegetation	Same as under test drilling although on larger, permanent scale
		Cooling tower operation and maintenance	• Cooling water drift	—Fog and low clouds will alter temperature, precipitation, etc. patterns thereby modifying wildlife habitat —Toxic particles will fallout on soil, vegetation, wildlife, resulting in direct loss and/or reduced productivity, abundance, diversity, etc. of wildlife
			• Blowdown discharge	—Contamination and/or alteration of terrestrial flora and fauna

Resource	Phase	Activity	Change	Impact
			• Increased noise	Same as under test drilling: —Interferes with predator/prey...
			• Interference with bird movements	—Loss of bird life due to collisions —Alteration of flight patterns (waterfowl) —Alteration of local birds feeding, roosting, and reproductive flights
			• Thermal discharges	Same as above: —Modification of atmosphere... —Modification of aquatic...
		Reinjection	• Alteration of surface and ground water quantity and quality	—Destruction and/or modification of terrestrial ecosystems dependent on surface and ground water (bogs, marshes, riparian, waterfowl, some furbearers, etc.) and associated wildlife
		Transmission line operation and maintenance	• Increased human access (permanent)	—Increases human-wildlife conflicts —Increases opportunity for game poaching and harassment —Increases hunting opportunities
			• Interference with bird movements	Same as under cooling tower (above) although on a larger scale: —Loss of bird life... —Alteration of flight... —Electrocution of birds —Alteration of local birds...
			• Increases raptor perches	—Facilitates hunting and roosting by birds of prey
			• May facilitate animal movements	—Easier for animals to reach seasonal ranges (elk, deer, moose, bears, etc.), feeding, social interactions, etc.
			• Increases "edge effect" due to vegetation manipulation	—Edge associated vegetation and wildlife species will benefit (increased abundance, diversity, etc.)
		Pipeline operation	• Increased thermal pollution	Same as under test drilling although on a smaller scale: —Modification of atmosphere...
			• Barrier to wildlife movement	—Interferes with the ability of big game to reach seasonal ranges

Threatened and Endangered Wildlife

The impacts to Non Threatened and Endangered Wildlife apply as well to Threatened and Endangered species. However, the severity of the impacts will be greater on Threatened and Endangered species because they are restricted by scarcity of habitat, sensitivity to man, and/or low numbers. Below are five major ecological parameters that if impacted will adversely affect Threatened and Endangered wildlife. These are compared to the major changes which are common to phases and most activities. An x indicates the parameters primarily impacted by each change. Refer to the preceding section on Non Threatened and Endangered Wildlife to see where each change and impact occurs for any activity and/or phase. The bald eagle, peregrine falcon, and grey wolf do not have essential or critical habitat proposed at this time. Those lands where these species are likely to occur, based upon current data and information have been designated "no leasing" and/or "deferred" under the selected alternative. When essential habitat has been officially designated for these species, and exact proposals for exploration, development, etc., have been made, formal consultation may be initiated. At this time, based upon these designations and the known status of the species, a no affect determination is made.

	Food	Cover	Space	Behavior	Reproduction
• Increased noise				X	X
• Increased human presence			X	X	X
• Habitat destruction and/or alteration	X	X	X		X
• Refuse accumulation	X			X	
• Discharge of toxic materials	X				X
• Erosion	X	X	X		X
• Surface and ground-water effects	X	X			X
• Air pollution				X	X

Resource	Phase	Activity	Change	Impact
Fisheries	Exploration	Explosives and seismic exploration	• Soil/vegetation destruction and/or modification	—Alteration of stream habitat and/or direct destruction of fish, aquatic insects, etc.
		Drilling of shallow gradient holes	• Accidental discharge of drilling wastes, mud, geothermal fluids, chemicals, etc.	—Poisoning of aquatic flora and fauna —Direct destruction of aquatic flora and fauna
			• Increased human presence	—Destruction of aquatic habitat and wildlife
		Camping and housing of personnel	• Soil/vegetation destruction and/or modification	Same as above
			• Refuse accumulation	—Alteration of surface water quality and aquatic wildlife
	Test Drilling	Road, drill pad, and sump construction	• Clearing, grading, cut and fill excavation, etc.	—Crushing of fish, insects, etc. —Destruction and/or alteration of fisheries habitat
			• Herbicidal control of unwanted vegetation	—Toxic to fish and other aquatic organisms —Contaminates aquatic food chains
			• Accidental discharge of drilling wastes, mud, geothermal fluids, etc.	—Poisoning of aquatic flora and fauna —Direct destruction of aquatic habitat
			• Erosion	—Leads to increased stream turbidity and siltation—reduced primary productivity, insect populations, abundance and/or growth of fish, spawning success, etc. —Interferes with fish migration patterns thereby reducing productivity, abundance, spawning, etc. —Stream channel alteration may deteriorate stream and riparian habitats —Reduces breeding and nesting sites, cover, etc.
			• Increased human presence	—Possible destruction of aquatic habitat and fish
		Equipment maintenance	• Discharge of detergents, oil, gas, etc.	—Pollution of aquatic habitat (poisoning of fish, sterility, etc.)
		Drilling and production testing	• Release of gases, vapors, and toxic liquids	—Alters aquatic ecosystems (direct mortality of vegetation, fish, insects, reduced production, etc.)
		Well Blowout	• Uncontrolled effluent discharge	—Pollution and alteration of aquatic ecosystems (poisoning of insects, flora, fish, etc.)
			• Thermal pollution	—Will kill fish, insects, plants, etc. Could severely alter aquatic habitat, fish migration patterns, etc.
		Abandonment of wells	• Erosion from wind and water	Same as above. Erosion should decrease with revegetation. Severest impact will be in the early stages of abandonment.
		Increased human access	• Increases human presence	—Increases fishing

Resource	Phase	Activity	Change	Impact
	Construction and Development	Power plant and facilities	• Clearing, grading, cut and fill, etc. for permanent roads, buildings, switch yard, etc.	—Crushing of fish, insects, etc. —Alteration and/or destruction of fisheries habitat
			• Erosion	Same as above
			• Increases human presence	—Increases fishing
			• Improper disposal of garbage and other wastes	—Alteration of surface water quality and associated aquatic wildlife
		Transmission and pipelines	• Clearing lanes	—Possible destruction of aquatic habitat and wildlife if streams are crossed or paralleled
			• Increased human presence	Same as above
			• Erosion	Same as above under test drilling
	Operation	Power plant operation and maintenance	• Thermal discharges to streams	—Modifies aquatic ecosystems as under Well Blowout. Will alter their structure and function.
			• Increase human presence (permanent)	Same as above
			• Erosion	Same as under test drilling
			• Condensate discharge	—Toxic to aquatic ecosystem (poisons insects, fish, plants, etc.)
			• Discharge of acid washings of "scaled" machinery	—Toxic salts and chemicals will destroy and/or modify aquatic ecosystems (kills fish and other aquatic organisms)
			• Emission of noncondensable gases	—Accumulation of toxic substance in aquatic food chains causing death, sterility, etc.
			• Herbicidal control of unwanted vegetation	—Toxic to non-target vegetation and aquatic wildlife —Contaminates aquatic food chains
		Cooling tower operation and maintenance	• Cooling water drift	—Toxic particles will fallout on streams, reservoirs, etc. resulting in direct loss and/or reduced productivity, abundance, diversity, etc. of fish, insects, flora, etc.
			• Blowdown discharge	—Contamination and/or alteration of aquatic flora and fauna —Will kill some fish, insects, plants, etc.
			• Thermal discharges	Same as above
		Reinjection	• Alteration of surface and ground water quantity and quality	—Destruction and/or modification of aquatic ecosystems dependent on surface and ground water (bogs, marshes, riparian) and associated wildlife
		Transmission and pipelines operation and maintenance	• Increased human access (permanent)	Same as under test drilling although permanent
Timber	Exploration	Explosives and seismic exploration	• Increases risk of man-caused fires (equipment use)	—Fires could jeopardize timber commodity

Resource	Phase	Activity	Change	Impact
	Test Drilling	Road building, pad and sump construction	• Soil/vegetation disturbance	—Destruction of trees
	Construction and development	Power plant and facilities	• Exclusive use of acreage	—Effectively eliminates timber harvest
		Transmission lines	• Clearing and grading	—Destruction of trees
		Pipelines	• Clearing lanes	—Destruction of trees
	Operation	Power plant, transmission lines, and other facilities	• Exclusive use of acreage	—Effectively eliminates timber harvest
Visual	Exploration	Gradient test hole drilling	• Presence of drill rig • Drill cutting piles	—Temporary visual distraction —Local visual scar
	Test drilling	Road building, pad and sump construction	• Man-made feature on landscape	—Distracting from natural setting (in most cases)
		Well Blowout	• Uncontrolled emissions	—Visually distracting
	Construction and development	Power plant and facilities	• Clearing and grading	—Visual disturbance
		Transmission and pipelines	• Clearing lanes	—Visual disturbance
	Operation	Power plant, cooling tower, transmission and pipeline	• Permanent industrial complex	—Permanent alteration of the visual character (e.g. from forested to industrial)
Wilderness and Yellowstone National Park	Exploration	Aerial surveys	• Increased noise (aircraft)	—Temporary intrusion on quiet and solitude of wilderness
		ORV travel	• Increased noise	Same as above
		Explosive and seismic exploration	• Increased noise	Same as above: —Temporary intrusion...
		Drilling of shallow gradient holes	• Increased noise	Same as above, although slightly more permanent
			• Air pollution from vehicles and construction equipment	—Air quality will be degraded
	Test Drilling	Road, drill pad, and sump construction	• Increased noise	Same as under exploration although on larger, permanent basis: —Intrusion on quiet...
		Blooie Line operation	• Increased noise	Same as above: —Intrusion on quiet...
		Drilling and production testing	• Increased noise	Same as above: —Intrusion on quiet...
			• Release of some H_2S	—Unpleasant odor could slightly alter wilderness air quality
			• Presence of drilling facilities	—Modification of wilderness visual quality
		Well blowout	• Uncontrolled increase in noise	Same as above: —Intrusion on quiet...
			• Uncontrolled release of gases and vapors	Same as above: —Unpleasant odors will...
	Construction and development	Power plant and facilities	• Increased air pollution	Same as under exploration although on permanent, larger scale: —Air quality will be degraded
			• Increased noise	Same as under test drilling: —Intrusion on quiet...

Resource	Phase	Activity	Change	Impact
		Transmission line and pipeline	• Increased noise	Same as under exploration: —Temporary intrusion...
	Operation	Power plant operation and maintenance	• Thermal discharge to atmosphere • Utilization of geothermal fluids	—Modification of wilderness visual quality —Possible alteration of YNP geothermal features (see possible effects to Yellowstone N.P. in this section)
			• Increased noise	Same as under test drilling: —Intrusion on quiet...
			• Emission of noncondensable gases	—Unnatural odors will alter wilderness air quality
			• Presence of facilities	Same as under test drilling: —Modification of wilderness visual...
		Cooling tower operation and maintenance	• Thermal discharges and cooling water drift	—Modification of wilderness visual quality
			• Increased noise	Same as above: —Intrusion on quiet...
			• Presence of facilities	Same as above: —Modification of wilderness visual...
		Transmission lines and pipeline	• Presence of facilities	Same as above: —Modification of wilderness visual...
Transportation System	Exploration	Gradient test hole drilling	• Increases heavy equipment use	—Increased maintenance of transportation system
	Test Drilling	Road building, pad and sump construction	• Increased access	—More roads to maintain and/or close
	Construction and development	Road building	• Increased access	Same as above
	Operation	Equipment travel (trucks, cars)	• Increased use of existing roads	—Increased maintenance of transportation systems
Socio-Economic	Exploration	Aerial surveys	• Increase inmigration See Appendix G	—Slight population increase —Slight employment increase
			• Increased revenue to economy See Appendix H	—Slight increase in income —Slight increase in sales tax revenues —Continuing geothermal lease income to local government —Slight increase in land values
			• Change in community attitudes See Appendix —	—Community attitudes become positive or negative toward geothermal development depending on the perceived effect of geothermal development on the community
		Surface surveys	• Increased inmigration See Appendix G	—Slight population increase
			• Increased revenue to economy See Appendix H	—Slight employment increase —Slight income increase —Slight increase in land values —Slight increase in sales tax revenues —Slight increase in state income tax revenues —Continuing geothermal lease income to local government

Resource	Phase	Activity	Change	Impact
			• Change in community attitudes See Appendix I	Same as aerial surveys: —Community attitudes become positive or negative...
		Thermal gradient hole drilling	• Increased inmigration See Appendix G	—Slight population increase —Slight employment increase
			• Increased revenue to economy See Appendix H	Same as aerial surveys: —Slight increase in income —Slight increase in sales tax revenues —Slight increase in state income tax revenues —Continuing geothermal lease income to local government —Slight increase in land values
			• Minor change in land usage	—Small parcels of land are used for drilling sites
			• Housing changes	—Change in type and occupancy level —Recreational homes may be leased to geothermal drilling crews
			• Change in community attitudes See Appendix I	Same as aerial surveys: —Community attitudes become positive or negative...
			• Increased demand on health and social services See Appendix I	—Health manpower needs increase because of drilling crews and increased potential of industrial accidents —Law enforcement requirements increase —Fire protection needs increase slightly —Use of waste water treatment facilities increase slightly —The need for solid waste collection increases slightly
			• Increased demand on educational facilities See Appendix I	—Elementary and secondary schools will have a slight increase in attendance
			• Changes in demand on transportation systems	—Slightly increased use of roads, highways, and air transportation by drilling crews
			• Land use patterns change	—Grazing, timber harvest, and recreation no longer occur on those small tracts of land used for drilling
	Test Drilling	Road Construction	• Increased inmigration See Appendix G	Same as exploration but to a greater extent: —Population increase —Employment increase
			• Increased revenue to economy See Appendix H	Same as exploration but to a greater extent: —Increase in income —Increase in sales tax revenues —Increase in state income tax revenues —Continuing geothermal lease income to local government —Increase in land values
			• Change in community attitudes See Appendix I	Same as exploration but to a greater extent: —Community attitudes become more positive or negative...

Resource	Phase	Activity	Change	Impact
			• Minor change in land usage	Same as exploration but to a greater extent: —More land is used for geothermal development and support activities
			• Housing changes	Same as exploration but to a greater extent: —Change in type and occupancy level...
			• Increased demand for social and health service See Appendix I	Same as exploration but to a greater extent: —Health manpower needs... —Law enforcement... —Fire protection... —Use of waste water treatment facilities... —The need for solid waste collection
			• Increased demand on educational facilities See Appendix I	Same as exploration but to a greater extent: —Elementary and secondary schools
			• Increased demand on transportation systems	Same as exploration but to a greater extent: —Increased use of road and highways...
			• Land use patterns change	Same as exploration but to a greater extent: —Grazing timber harvest and recreation...
			• Some increases in local sale of support goods and services See Appendix H	—Created by local purchases of equipment, construction material, and support services
		Test well drilling, pad and sump construction, etc.	• Increased inmigration See Appendix G	Same as exploration but to a greater extent: —Population increase —Employment increase
			• Increased revenue to economy See Appendix H	Same as exploration but to a greater extent: —Increase in income —Increase in sales tax revenues —Increase in state income tax revenues —Continuing geothermal lease income to local government —Increase in land values
			• Change in community attitudes See Appendix I	Same as exploration but to a greater extent: —Community attitudes become more positive or negative
			• Minor changes in land usage	Same as exploration but to a greater extent: —More land is used for geothermal developments and support activities
			• Housing changes	Same as exploration but to a greater extent:

Resource	Phase	Activity	Change	Impact
				—Change in type and occupancy level...
			• Change in demand for social and health services See Appendix I	Same as exploration but to a greater extent: —Health manpower needs... —Law enforcement... —Fire protection... —Use of waste water treatment facilities... —The need for solid waste collection...
			• Change in demand on education facilities See Appendix I	Same as exploration but to a greater extent: —Elementary and secondary schools
			• Changes in demand on transportation systems	Same as exploration but to a greater extent: —Increased use of roads and highways
			• Land use patterns change	Same as exploration but to a greater extent: —Grazing, timber harvest, and recreation...
			• Some increase in local sales of support goods and services See Appendix H	—Created by local purchases of equipment, construction material, and support services
		Well Blowout	• Health and safety hazard	—Particles under pressure in hot water could injure people nearby —Possibility of burns from steam or hot water
	Construction and Development	Power plant or heating plant facilities	• Increased inmigration See Appendix G	Same as exploration but to a greater extent: —Population increase —Employment increase
			• Increased revenue to economy See Appendix H	Same as exploration but to a greater extent: —Increase in income —Increase in sales tax revenue —Increase in state income tax revenue —Continuing geothermal lease income to local government —Increase in land values
			• Change in community attitudes See Appendix I	Same as exploration but to a greater extent: —Community attitudes become more positive or negative...
			• Minor change in land usage	Same as exploration but to a greater extent: —More land is used for geothermal development and support activities
			• Housing changes	Same as exploration but to a greater extent: —Change in type and occupancy level...

Resource	Phase	Activity	Change	Impact
			• Increased demand for social and health services See Appendix I	Same as exploration but to a greater extent: —Health manpower needs... —Law enforcement... —Fire protection... —Use of waste water treatment facilities... —The need for solid waste collection...
			• Increased demand on educational facilities See Appendix I	Same as exploration but to a greater extent: —Elementary and secondary schools...
			• Increased demand on transportation systems	Same as exploration but to a greater extent: —Increased use of roads and highways...
			• Land use patterns change	Same as exploration but to a greater extent: —Grazing timber harvest and recreation...
			• Some increase in local sales of support goods and services See Appendix H	—Created by local purchases of equipment, construction material, and support services
	Operation	Power plant or heating plant operation and maintenance	• Increased immigration See Appendix G	Same as exploration but to a greater extent: —Population increase —Employment increase
			• Increased revenue to economy See Appendix H	Same as exploration but to a greater extent: —Increase in income —Increase in sales tax revenue —Increase in state income tax revenue —Continuing geothermal lease income to local government —Increase in land values
			• Change in community attitudes See Appendix I	Same as exploration but to a greater extent: —Community attitudes become positive or negative...
			• Minor change in land usage	Same as exploration but to a greater extent: —More land is used for geothermal development and support activities
			• Housing changes	Same as exploration but to a greater extent: —Change in type and occupancy level...

Resource	Phase	Activity	Change	Impact
			• Increased demand for social and health services See Appendix I	Same as exploration but to a greater extent: —Health manpower needs... —Law enforcement... —Fire protection... —Use of waste water treatment facilities... —The need for solid waste collection...
			• Increased demand on educational facilities See Appendix I	Same as exploration but to a greater extent: —Elementary and secondary schools...
			• Increased demand on transportation systems	Same as exploration but to a greater extent: —Increased use of roads and highways...
			• Land use patterns change	—Some land uses that were stopped during the construction phase can be resumed near the geothermal development
			• Some increase in local sale of support goods and services See Appendix H	—Created by local purchases of equipment, construction material, and support services
			• Production of electricity	—Electricity produced will be competitive with alternative methods
			• Production of heat See Appendix J	—Heat may be produced for space heating, industrial, or agricultural use
			• Lease royalty	—Royalty income begins with commercial production
			• Educational facility	—Opportunity for public to learn about geothermal energy use
Minerals	Exploration	Aerial surveys	• Specific information gathering	—Increases knowledge of geological features —Possible collection of other management data
	Operation	Utilization of geothermal resource	• Extraction of geothermal fluids	—Gradual depletion of the resource

POSSIBLE EFFECTS OF GEOTHERMAL DEVELOPMENT ON YELLOWSTONE NATIONAL PARK

The geysers of Yellowstone National Park are the rarest of thermal features. There are 200 of these erupting hot springs inside the park, more than in the rest of the world combined. Of the ten major geyser areas in the world, Yellowstone ranks first. In the last three decades, seven of these ten areas have been destroyed or damaged by geothermal exploration or development.

Geysers depend on a dynamic, yet fragile system which can be easily disrupted. In the case of Yellowstone geysers, there is a source of heat relatively close to the surface which heats an abundant supply of groundwater. This water circulates easily and at great depth through fractured volcanic rock and glacial gravel cemented together by mineral deposits from the hot water. Periodic eruptions apparently take place because constrictions in the underground passageways cause water to become superheated, then flash into steam. Any alteration of heat or water that flow through these natural systems can cause the "plumbing" to dry out, disintegrate, and no longer produce geyser action.

Commercial geothermal development in other areas of the world has had profound effects on thermal basins. In New Zealand, for example, the Wairakei plant was installed during the early 1950's. By 1954, the Great Geyser in Geyser Thermal Valley which ranked fifth among the major geyser areas of the world, became inactive coincident with Wairakei's declining reservoir pressure. All other springs and geysers in the valley were also diminishing in their discharge of hot water and the last known natural geyser eruption occurred around 1965. Geyser Thermal Valley was closed as a tourist attraction in 1972, and the Karapiti Blowhole ceased activity in 1973. Further, production from Wairakei also affected another thermal area thought to be independent with no connection at depth. Recent drilling nine to twelve miles from Waiotopu, another New Zealand thermal area, may have induced a chemical change or "interference" within its reservoir.

Near cessation or total destruction of natural hot spring or geyser activity from adjacent geothermal development is not limited to New Zealand. Similar changes have been recorded in Iceland; Lardarello, Italy; Beowawe, Nevada; and Steamboat Springs, Nevada. The Beowawe Geysers of Nevada were second to Yellowstone on the North American continent in amount of activity before the period of 1945-1958 when geothermal exploration began. Wells were drilled and permitted to discharge while not converted to commercial use; by 1961, all springs and geysers had ceased flowing. Without the natural continuous supply of hot water levels dripping below the surface, the geyser hot spring formations rapidly disintegrated due to desiccation and frost expansion. A similar destruction of the small geysers of Steamboat Springs, Nevada occurred in response to geothermal exploitation between 1950 and the early 1960's. In the case of Yellowstone National Park, a number of its natural hot springs areas lie within 12 miles of the Island Park Geothermal Area.

It should be noted that in all of the above cases except Waiotopu, geothermal development took place in the **immediate vicinity** of the hydrothermal attractions. It should also be noted that in New Zealand, what was disturbing to Wilson, (1976) was...."There seems to have been no serious consideration beforehand of the threat to each attraction and no public interest in the loss".

The exact boundaries of the Yellowstone geothermal reservoir(s) are uncertain and no definite evidence is apparently available on what the permeability is at depth. Thus, it is difficult to say how much of a connection—if any—there is between the possible geothermal resource of the IPGA and thermal areas inside the park, or if any adverse effects might result.

The thermal areas of Yellowstone National Park are important not only for the hot springs, geysers, mud pots, etc., which lie within its margins. The natural heat flow and hot water discharge is critical to the wildlife in the park. Bison, elk, trumpeter swan, Canada geese, and many other waterfowl congregate in the thermal areas or on the rivers during the winter months.

Each impact listed in Table 33 was evaluated by the Geothermal Evironmental Statement Team. The impact was assessed by alternative based upon formation gathered by the team. This judgement was based upon the team member's knowledge of the resource, the Island Park Geothermal Area, geothermal development, the quantity and quality of information available, and input from other members of the interagency team. Recognized authorities on each resource were consulted to arrive at a consensus of the impact. These assessments were then used in the matrix analysis.

Table 34 is a sample of the matrix used to evaluate each alternative. The rows and columns have been numbered for reference in the following discussion.

1. When each row (resource) intersects with columns 1-4 (phase) the box is divided into three parts (figure 8):

   —The number (value in the "a" part represents the relative importance of the phase to the resource. The values range from 0 to 1.0 and total 1.0 ($a_1, + a_2 + a_3 + a_4 = 1.0$). The larger the number, the more "important" that phase is to the resource (important infers that **portion** of the total impact on the resource expected to occur in that phase). These values were established by the Geothermal Team collectively.

   —The numbers in the "b" part stand for the total impact a phase will have on the resource. These values were calculated during each member's assessment of the impacts. The values range from 0 to 1.0 and, in general, the larger the number the greater the impact of the phase. They were arrived at by individual team members and represent the opinions of experts.

   —The figure (value) in the "c" part is the product of the "a" and "b" boxes ($a_1 \times b_1 = c_1$). This represents the weighted effect of the phase on the resource.

2. After each box has been completed, the **Weighted Effects** (c parts) are summed across each row and establish the value in column 5 ($c_1 + c_2 + c_3 + c_4 = W_1$). This figure ($W_1$) represents the total cumulative effect of all phases of geothermal development on the resource.

3. Column 6 contains the **Weighted Resource Values**. These numbers represent the relative value of each resource on the Island Park Geothermal Area when the sum of the numbers equals 100. These values were determined by resource specialists, land managers and the Geothermal Team on the Targhee and Gallatin National Forests. Twenty-seven people contributed to the value assignments. When ranking the resources and assigning values, each person considered the following criteria:

   - Condition of the resource and its productivity,
   - quantity of the resource (its significance to the IPGA, the Forests, and the Region),
   - accessibility of the resource,
   - uniqueness and quality of the resource,
   - dominance the resource has in relation to the other area resources.

4. In column 7 is the **Total Environment Effects** on the resource of all phases ($W_1 \times R_1 = E_1$). It considers the Weighted Effects of each phase, and the resources' relative importance to the IPGA. These figures are summed vertically to establish an alternatives final "score".

The Total Environmental Effects value (E) and the alternative's total "score" are abstract and have no units. However, they may be used to obtain relative rankings of environmental impacts when compared to other resource values and total "scores". Each resource can be compared within and between alternatives, and alternatives can be compared to each other. The lower the total, the less negative effects of the alternative.

TABLE 34. MATRIX USED TO EVALUATE EFFECTS OF GEOTHERMAL LEASING ALTERNATIVES

EFFECTS OF PHASES / ON RESOURCE	1 EXPLORATION	2 TEST DRILLING	3 CONSTRUCTION & DEVELOPMENT	4 OPERATION	5 TOTAL OF WEIGHTED EFFECTS	6 WEIGHTED RESOURCE VALUES	7 TOTAL ENVIRONMENTAL EFFECTS
(1) SOIL	a_1 b_1 / c_1	a_2 b_2 / c_2	a_3 b_3 / c_3	a_4 b_4 / c_4	W_1	R_1	E_1
(2) WATER						R_2	E_3
(3) AIR							E
(4) VEGETATION							
(5) FISHERIES							
(6) NON THR... ANGERE...							
...ERNESS AND YELLO... NATIONAL PARK							
(14) SOCIO-ECONOMIC							
(15) MINERALS (GEOTHERMAL)							
						TOTAL	

FIGURE 8. COMPOSITION OF ONE BOX IN THE MATRIX.

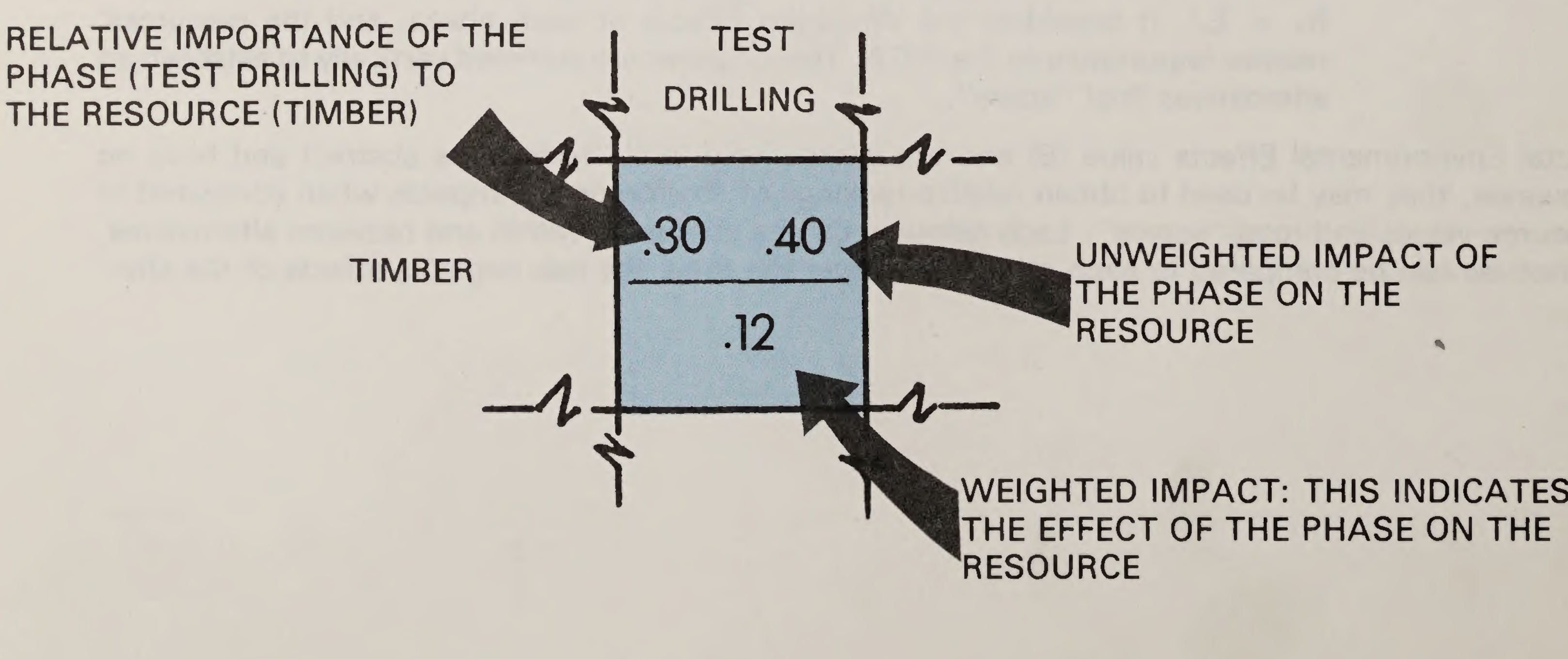

TABLE 35. SUMMARY OF NEGATIVE ENVIRONMENTAL EFFECTS OF ALTERNATIVES

	WEIGHTED RESOURCE VALUE	TOTAL ENVIRONMENTAL EFFECTS OF ALTERNATIVE # 2	TOTAL ENVIRONMENTAL EFFECTS OF ALTERNATIVE # 3	TOTAL ENVIRONMENTAL EFFECTS OF ALTERNATIVE # 4	TOTAL ENVIRONMENTAL EFFECTS OF ALTERNATIVE # 5	TOTAL ENVIRONMENTAL EFFECTS OF ALTERNATIVE # 6	TOTAL ENVIRONMENTAL EFFECTS OF ALTERNATIVE # 7
SOIL	4	2.12	1.40	2.12	1.40	2.76	1.32
WATER	16	8.32	5.12	8.48	5.12	12.48	4.64
AIR	7	4.06	2.45	2.94	2.45	5.39	2.31
VEGETATION	5	2.15	1.40	1.90	1.40	3.40	1.30
FISHERIES	13	5.72	4.16	4.55	4.68	9.23	3.90
NON THREATENED & ENDANGERED WILDLIFE	9	4.59	3.24	3.78	3.87	7.11	2.88
THREATENED & ENDANGERED WILDLIFE	6	4.32	2.64	2.82	3.30	5.76	2.52
TIMBER	11	4.84	3.41	4.84	3.41	9.90	3.41
GRAZING	4	1.24	0.96	1.24	0.96	2.32	0.96
RECREATION	9	5.04	3.24	5.04	3.42	6.84	2.88
VISUAL	6	3.00	2.16	3.12	2.64	4.62	1.92
ARCHAEOLOGICAL/HISTORICAL	2	1.04	0.80	1.04	0.80	1.60	0.80
WILDERNESS & YELLOWSTONE NATIONAL PARK	3	2.40	1.83	1.95	1.98	2.73	1.53
SOCIO-ECONOMIC	3	1.62	1.11	1.11	1.11	1.68	1.11
MINERALS (GEOTHERMAL)	2	1.60	1.20	1.20	1.20	2.00	1.00
TOTAL	100	52.06	35.12	46.13	37.74	77.82	32.48

Table 35 is a summary of the evaluation of alternatives two through seven. The analysis was not applied to alternative one since that alternative proposes no leasing. Therefore, effects would equal zero as would the total score. Tables 36 through 41 are the matrices for alternatives two through seven.

TABLE 36. GEOTHERMAL LEASING ALTERNATIVE NUMBER 2

EFFECTS OF PHASES ON RESOURCE	1 EXPLORATION	2 TEST DRILLING	3 CONSTRUCTION & DEVELOPMENT	4 OPERATION	5 TOTAL OF WEIGHTED EFFECTS	6 WEIGHTED RESOURCE VALUES	7 TOTAL ENVIRONMENTAL EFFECTS
(1) SOIL	.01 .40 / .004	.20 .40 / .08	.65 .60 / .39	.14 .40 / .056	.53	4	2.12
(2) WATER	.02 .36 / .007	.18 .62 / .11	.45 .49 / .22	.35 .51 / .178	.52	16	8.32
(3) AIR	.01 .40 / .004	.09 .60 / .054	.30 .52 / .156	.60 .60 / .36	.58	7	4.06
(4) VEGETATION	.05 .40 / .02	.30 .37 / .111	.50 .46 / .23	.15 .45 / .068	.43	5	2.15
(5) FISHERIES	.10 .36 / .036	.20 .38 / .076	.60 .48 / .288	.10 .42 / .042	.44	13	5.72
(6) NON THREATENED & ENDANGERED WILDLIFE	.05 .40 / .02	.10 .40 / .04	.55 .55 / .30	.30 .50 / .15	.51	9	4.59
(7) THREATENED & ENDANGERED WILDLIFE	.05 .60 / .03	.10 .65 / .065	.45 .75 / .34	.40 .70 / .28	.72	6	4.32
(8) TIMBER	.01 .20 / .002	.30 .40 / .12	.59 .50 / .295	.10 .20 / .02	.44	11	4.84
(9) GRAZING	.10 .20 / .02	.20 .20 / .04	.40 .40 / .16	.30 .30 / .09	.31	4	1.24
(10) RECREATION	.10 .40 / .04	.20 .60 / .12	.60 .60 / .36	.10 .40 / .04	.56	9	5.04
(11) VISUAL	.10 .60 / .06	.20 .40 / .08	.40 .60 / .24	.30 .40 / .12	.50	6	3.00
(12) ARCHAEOLOGICAL/HISTORICAL	- - / -	.40 .40 / .16	.60 .60 / .36	- - / -	.52	2	1.04
(13) WILDERNESS AND YELLOWSTONE NATIONAL PARK	.05 .60 / .03	.10 .70 / .07	.40 .85 / .34	.45 .80 / .36	.80	3	2.40
(14) SOCIO-ECONOMIC	.05 .20 / .01	.10 .28 / .028	.65 .62 / .403	.20 .47 / .094	.54	3	1.62
(15) MINERALS (GEOTHERMAL)	- - / -	- - / -	- - / -	1.0 .80 / .80	.80	2	1.60
						TOTAL	52.06

TABLE 37. GEOTHERMAL LEASING ALTERNATIVE NUMBER 3

EFFECTS OF PHASES ON RESOURCE	1 EXPLORATION	2 TEST DRILLING	3 CONSTRUCTION & DEVELOPMENT	4 OPERATION	5 TOTAL OF WEIGHTED EFFECTS	6 WEIGHTED RESOURCE VALUES	7 TOTAL ENVIRONMENTAL EFFECTS
(1) SOIL	.01 .20 / .002	.20 .30 / .06	.65 .40 / .26	.14 .20 / .028	.35	4	1.40
(2) WATER	.02 .20 / .004	.18 .45 / .081	.45 .26 / .117	.36 .33 / .115	.32	16	5.12
(3) AIR	.01 .20 / .002	.09 .40 / .036	.30 .24 / .072	.60 .40 / .24	.35	7	2.45
(4) VEGETATION	.05 .30 / .015	.30 .20 / .060	.50 .35 / .175	.15 .20 / .030	.28	5	1.40
(5) FISHERIES	.10 .30 / .03	.20 .25 / .05	.60 .35 / .21	.10 .25 / .025	.32	13	4.16
(6) NON THREATENED & ENDANGERED WILDLIFE	.05 .30 / .015	.10 .30 / .030	.55 .40 / .220	.30 .30 / .09	.36	9	2.88
(7) THREATENED & ENDANGERED WILDLIFE	.05 .20 / .010	.10 .30 / .03	.45 .45 / .20	.40 .50 / .20	.44	6	2.64
(8) TIMBER	.01 .20 / .002	.30 .20 / .06	.59 .40 / .236	.10 .10 / .01	.31	11	3.41
(9) GRAZING	.10 .20 / .02	.20 .20 / .04	.40 .30 / .12	.30 .20 / .06	.24	4	0.96
(10) RECREATION	.10 .20 / .02	.20 .40 / .08	.60 .40 / .24	.10 .20 / .02	.36	9	3.24
(11) VISUAL	.10 .20 / .02	.20 .20 / .04	.40 .60 / .24	.30 .20 / .06	.36	6	2.16
(12) ARCHAEOLOGICAL/HISTORICAL	- - / -	.40 .40 / .16	.60 .40 / .24	- - / -	.40	2	0.80
(13) WILDERNESS AND YELLOWSTONE NATIONAL PARK	.05 .40 / .02	.10 .60 / .06	.40 .60 / .24	.45 .65 / .293	.61	3	1.83
(14) SOCIO-ECONOMIC	.05 .16 / .008	.10 .22 / .022	.65 .42 / .273	.20 .31 / .062	.37	3	1.11
(15) MINERALS (GEOTHERMAL)	- - / -	- - / -	- - / -	1.0 .60 / .60	.60	2	1.20
						TOTAL	35.80

TABLE 38. GEOTHERMAL LEASING ALTERNATIVE NUMBER 4

EFFECTS OF PHASES ON RESOURCE	1 EXPLORATION	2 TEST DRILLING	3 CONSTRUCTION & DEVELOPMENT	4 OPERATION	5 TOTAL OF WEIGHTED EFFECTS	6 WEIGHTED RESOURCE VALUES	7 TOTAL ENVIRONMENTAL EFFECTS
(1) SOIL	.01 .20 / .002	.20 .40 / .08	.65 .60 / .39	.14 .40 / .056	.53	4	2.12
(2) WATER	.02 .36 / .007	.18 .65 / .117	.45 .49 / .221	.35 .53 / .186	.53	16	8.48
(3) AIR	.01 .20 / .002	.09 .50 / .045	.30 .24 / .072	.60 .50 / .30	.42	7	2.94
(4) VEGETATION	.05 .40 / .02	.30 .30 / .09	.50 .38 / .19	.15 .54 / .081	.38	5	1.90
(5) FISHERIES	.10 .36 / .036	.20 .30 / .06	.60 .40 / .24	.10 .18 / .018	.35	13	4.55
(6) NON THREATENED & ENDANGERED WILDLIFE	.05 .25	.10 .36 / .036	.55 .43 / .237	.30 .43 / .129	.42	9	3.78
(7) THREATENED & ENDANGERED WILDLIFE	.05 .25 / .013	.10 .30 / .03	.45 .51 / .23	.40 .51 / .20	.47	6	2.82
(8) TIMBER	.01 .20 / .002	.30 .40 / .12	.59 .50 / .295	.10 .10 / .01	.44	11	4.84
(9) GRAZING	.10 .20 / .02	.20 .20 / .04	.40 .40 / .16	.30 .30 / .09	.31	4	1.24
(10) RECREATION	.10 .40 / .04	.20 .60 / .12	.60 .60 / .36	.10 .40 / .04	.56	9	5.04
(11) VISUAL	.10 .60 / .06	.20 .50 / .10	.40 .60 / .24	.30 .40 / .12	.52	6	3.12
(12) ARCHAEOLOGICAL/HISTORICAL	- - / -	.40 .40 / .16	.60 .60 / .36	- - / -	.52	2	1.04
(13) WILDERNESS AND YELLOWSTONE NATIONAL PARK	.05 .40 / .02	.10 .60 / .06	.40 .70 / .28	.45 .65 / .293	.65	3	1.95
(14) SOCIO-ECONOMIC	.05 .16 / .008	.10 .22 / .022	.65 .42 / .273	.20 .31 / .062	.37	3	1.11
(15) MINERALS (GEOTHERMAL)	- - / -	- - / -	- - / -	1.0 .60 / .60	.60	2	1.20
						TOTAL	46.13

TABLE 39. GEOTHERMAL LEASING ALTERNATIVE NUMBER 5

EFFECTS OF PHASES / ON RESOURCE	1 EXPLORATION	2 TEST DRILLING	3 CONSTRUCTION & DEVELOPMENT	4 OPERATION	5 TOTAL OF WEIGHTED EFFECTS	6 WEIGHTED RESOURCE VALUES	7 TOTAL ENVIRONMENTAL EFFECTS
(1) SOIL	.01 .20 .002	.20 .30 .06	.65 .40 .26	.14 .20 .028	.35	4	1.40
(2) WATER	.02 .20 .004	.18 .45 .081	.45 .26 .117	.35 .33 .116	.32	16	5.12
(3) AIR	.01 .20 .002	.09 .40 .036	.30 .24 .072	.60 .40 .24	.35	7	2.45
(4) VEGETATION	.05 .40 .02	.30 .26 .078	.50 .30 .150	.15 .22 .033	.28	5	1.40
(5) FISHERIES	.10 .44 .044	.20 .25 .05	.60 .40 .24	.10 .25 .025	.36	13	4.68
(6) NON THREATENED & ENDANGERED WILDLIFE	.05 .05 .025	.10 .35 .035	.55 .49 .270	.30 .32 .096	.43	9	3.87
(7) THREATENED & ENDANGERED WILDLIFE	.05 .40 .02	.10 .40 .04	.45 .60 .27	.40 .55 .22	.55	6	3.30
(8) TIMBER	.01 .20 .002	.30 .20 .06	.59 .40 .236	.10 .10 .01	.31	11	3.41
(9) GRAZING	.10 .20 .02	.20 .20 .04	.40 .30 .12	.30 .20 .06	.24	4	0.96
(10) RECREATION	.10 .40 .04	.20 .40 .08	.60 .40 .24	.10 .20 .02	.38	9	3.42
(11) VISUAL	.10 .60 .06	.20 .40 .08	.40 .60 .24	.30 .20 .06	.44	6	2.64
(12) ARCHAEOLOGICAL/HISTORICAL	- - -	.40 .40 .16	.60 .40 .24	- - -	.40	2	0.80
(13) WILDERNESS AND YELLOWSTONE NATIONAL PARK	.05 .45 .023	.10 .65 .065	.40 .70 .28	.45 .65 .293	.66	3	1.98
(14) SOCIO-ECONOMIC	.05 .16 .008	.10 .22 .022	.65 .42 .273	.20 .31 .062	.37	3	1.11
(15) MINERALS (GEOTHERMAL)	- - -	- - -	- - -	1.0 .60 .60	.60	2	1.20
						TOTAL	37.74

TABLE 40. GEOTHERMAL LEASING ALTERNATIVE NUMBER 6

EFFECTS OF PHASES / ON RESOURCE	1 EXPLORATION	2 TEST DRILLING	3 CONSTRUCTION & DEVELOPMENT	4 OPERATION	5 TOTAL OF WEIGHTED EFFECTS	6 WEIGHTED RESOURCE VALUES	7 TOTAL ENVIRONMENTAL EFFECTS
(1) SOIL	.01 .45 .005	.20 .45 .09	.65 .80 .52	.14 .55 .077	.69	4	2.76
(2) WATER	.02 .80 .016	.18 .87 .156	.45 .74 .33	.35 .78 .273	.78	16	12.48
(3) AIR	.01 .60 .006	.09 .85 .077	.30 .68 .204	.60 .80 .48	.77	7	5.39
(4) VEGETATION	.05 .80 .04	.30 .60 .18	.50 .67 .335	.15 .82 .123	.68	5	3.40
(5) FISHERIES	.10 .80 .08	.20 .65 .13	.60 .70 .42	.10 .80 .08	.71	13	9.23
(6) NON THREATENED & ENDANGERED WILDLIFE	.05 .76 .038	.10 .68 .068	.55 .78 .429	.30 .86 .258	.79	9	7.11
(7) THREATENED & ENDANGERED WILDLIFE	.05 .80 .04	.10 .90 .09	.45 1.0 .45	.40 .95 .38	.96	6	5.76
(8) TIMBER	.01 .40 .004	.30 .60 .18	.59 .70 .413	.10 .30 .30	.90	11	9.90
(9) GRAZING	.10 .40 .04	.20 .20 .04	.40 .60 .24	.30 .60 .18	.58	4	2.32
(10) RECREATION	.10 .60 .06	.20 .80 .16	.60 .80 .48	.10 .60 .06	.76	9	6.84
(11) VISUAL	.10 1.0 .10	.20 .60 .12	.40 1.0 .40	.30 .50 .15	.77	6	4.62
(12) ARCHAEOLOGICAL/HISTORICAL	- - -	.40 .80 .32	.60 .80 .48	- - -	.80	2	1.60
(13) WILDERNESS AND YELLOWSTONE NATIONAL PARK	.05 .60 .03	.10 .70 .07	.40 1.0 .40	.45 .90 .405	.91	3	2.73
(14) SOCIO-ECONOMIC	.05 .25 .013	.10 .32 .032	.65 .64 .416	.20 .48 .096	.56	3	1.68
(15) MINERALS (GEOTHERMAL)	- - -	- - -	- - -	1.0 1.0 1.0	1.0	2	2.00
						TOTAL	77.82

TABLE 41. GEOTHERMAL LEASING ALTERNATIVE NUMBER 7

EFFECTS OF PHASES ON RESOURCE	1 EXPLORATION	2 TEST DRILLING	3 CONSTRUCTION & DEVELOPMENT	4 OPERATION	5 TOTAL OF WEIGHTED EFFECTS	6 WEIGHTED RESOURCE VALUES	7 TOTAL ENVIRONMENTAL EFFECTS
(1) SOIL	.01 .19 / .002	.20 .28 / .056	.65 .38 / .247	.14 .18 / .025	.33	4	1.32
(2) WATER	.02 .20 / .004	.18 .43 / .077	.45 .24 / .108	.35 .30 / .105	.29	16	4.64
(3) AIR	.01 .18 / .002	.09 .38 / .034	.30 .22 / .066	.60 .38 / .228	.33	7	2.31
(4) VEGETATION	.05 .30 / .015	.30 .18 / .054	.50 .32 / .16	.15 .18 / .027	.26	5	1.30
(5) FISHERIES	.10 .29 / .029	.20 .24 / .048	.60 .33 / .198	.10 .22 / .022	.30	13	3.90
(6) NON THREATENED & ENDANGERED WILDLIFE	.05 .28 / .014	.10 .28 / .023	.55 .36 / .198	.30 .27 / .081	.32	9	2.88
(7) THREATENED & ENDANGERED WILDLIFE	.05 .18 / .009	.10 .28 / .028	.45 .43 / .194	.40 .48 / .192	.42	6	2.52
(8) TIMBER	.01 .20 / .002	.30 .20 / .06	.59 .40 / .236	.10 .10 / .01	.31	11	3.41
(9) GRAZING	.10 .20 / .02	.20 .20 / .04	.40 .30 / .12	.30 .20 / .06	.24	4	0.96
(10) RECREATION	.10 .20 / .02	.20 .35 / .07	.60 .35 / .21	.10 .20 / .02	.32	9	2.88
(11) VISUAL	.10 .20 / .02	.20 .20 / .04	.40 .50 / .20	.30 .20 / .06	.32	6	1.92
(12) ARCHAEOLOGICAL/HISTORICAL	- - / -	.40 .40 / .16	.60 .40 / .24	- - / -	.40	2	0.80
(13) WILDERNESS AND YELLOWSTONE NATIONAL PARK	.05 .30 / .015	.10 .50 / .05	.40 .50 / .20	.45 .55 / .248	.51	3	1.53
(14) SOCIO-ECONOMIC	.05 .16 / .008	.10 .22 / .022	.65 .42 / .273	.20 .31 / .062	.37	3	1.11
(15) MINERALS (GEOTHERMAL)	- - / -	- - / -	- - / -	1.0 .50 / .50	.50	2	1.00
						TOTAL	32.48

A few adverse impacts cannot be avoided if geothermal development takes place in the Island Park Geothermal Area. Table 42 summarizes these impacts.

TABLE 42. ADVERSE IMPACTS WHICH CANNOT BE AVOIDED

Soil	Some soil losses are expected, particularly during the first winter following construction operations.
Water Quality	Stream turbidity will occur when large areas are cleared and graded. Some chemical spills may accidently occur which will contaminate portions of streams due to the chemical toxicity.
Wildlife	The loss of habitat for animals requiring a forested environment and a parallel reduction in their numbers is unavoidable if geothermal energy development occurs. Unavoidable losses of elk, deer, bear, and other species sensitive to noise and human presence will be caused by geothermal development and production activities. Certain species may return as they become accustomed to the new conditions. Others unable to make the necessary adaptation will probably be absent throughout the life of the activity.
Fisheries	Chemical or hot water spills will adversely affect the aquatic environment. Toxic substances will kill many aquatic organisms and thermal plumes can block fish migration patterns. Increased stream sedimentation from disturbed areas will cause channel modification and increased turbidity.
Timber Production	Loss of timber yields is an unavoidable impact where clearing occurs for any purpose.
Visual Quality	Geothermal facilities can, to some extent, be screened or blended into the background. Because of the extensive network of pipelines, transmission lines, roads, and buildings, however, it is unlikely that all such installations can be blended into the surroundings. Vapor plumes from cooling towers likewise cannot be hidden, particularly in winter.
Recreation	Development of geothermal facilities in the IPGA will reduce the area available for recreation. It would also impose unavoidable impacts on the quality of both dispersed and developed site recreation. Although the proposed action is designed to minimize impacts on the recreation resource, it is not possible to introduce such activity into an area without affecting the qualities currently available to recreationists visiting the area.
Fire Risk	The presence of men and equipment essential to geothermal exploration, development, and production will unavoidably increase fire risk. A small increase in the amount of fuel can be expected during construction.
Air Quality	The escape of small quantities of noxious and ordorous gases must be regarded as an unavoidable consequence of geothermal development. Burning of debris produced in clearing for access roads and facility development will result in some smoke pollution. Dust control and watering can effectively control the dust raised along access roads and around earth-moving operations. However, there will be some dust in spite of the preventive measures.
Noise	Higher than present noise levels must be regarded as unavoidable around geothermal operations. The adverse impacts to wildlife, recreation, grazing livestock and adjoining landowners are also considered unavoidable.
Vegetation	Loss and damage of vegetation are unavoidable during all phases of geothermal development. Various activities will either crush or remove vegetation and adversely affect grazing livestock and wildlife.

VI. EVALUATION OF ALTERNATIVES

Each alternative was rated on a scale (1 to 5) as to how well it satisfied the criteria. The larger the score the more agreeable the alternative. The criteria are listed in a relative order or importance based upon an evaluation by resource specialists and land managers from the Targhee National Forest, Bureau of Land Management, and the National Park Service. Table 43 summarizes the evaluation.

TABLE 43. SUMMARY OF EVALUATION OF ALTERNATIVES

	Alternative						
Evaluation Criteria	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Yellowstone National Park	5	2	3	2	3	1	4
Alternate Energy Development	1	3	3	3	3	5	3
Water Quality and Quantity	5	3	3	3	3	2	4
Wildlife and Fish	5	2	3	3	3	1	4
Land Management Plans	2	3	3	3	4	2	4
Total	18	13	15	14	16	11	19

The alternatives considered and the evaluation process used extensive public input and Federal interdisciplinary coordination. Recognized authorities on the existing resources and geothermal development were consulted. State agencies, private organizations, and individuals were solicited for input and all possible means including use of communications media, private meetings, workshops, etc., were used to involve as many publics as possible. These efforts effectively satisfy the requirements of sections 101 and 102(1) of the National Environmental Policy Act of 1969.

VII. THE SELECTED ALTERNATIVE

The selected alternative is ALTERNATIVE 7 and is based upon the evaluation of all alternatives in the preceding section (VI). This alternative has integrated many substantive comments received and reflects this input in the following allocation:

Approve leasing on 178,620 acres (37% of the IPGA).
Deny leasing on 94,316 acres (19% of the IPGA).
Defer leasing at this time on 215,095 acres (44% of the IPGA).

This alternative incorporates two areas of major concern expressed by reviewers of the Draft Environmental Impact Statement. These were (1) Yellowstone National Park—A two mile buffer strip was added along the western boundary of the Park and deferred from leasing. This area will allow initiation of the monitoring program (see letter of technical assistance, U.S. Geological Survey, Section IX). (2) Wildlife and Fish—additional protection was given to fisheries in Warm River and Moose Creek. A ¼ mile buffer was added around Henrys Lake Flat to protect birds of prey habitat. Following current grizzly bear habitat management guidelines, some area was shifted from deferred to leasing category.

Lands will be available for leasing only after the Secretary of Interior determines the following:

— that an exploitable geothermal resource exists within the IPGA based upon research or tests such as drilling, geophysical and geochemical data interpretation or other indicators.

— exploitation of the potential geothermal resource in the Island Park Area will not adversely affect the unique thermal features of Yellowstone National Park.

— development would not adversely affect habitat of threatened or endangered wildlife.

— any potential air pollution from hydrogen sulphide or other noxious gases can be controlled so as not to adversely affect soil, water, vegetation, or air quality in areas of human habitation.

Any geothermal leasing or development of the 178,620 acres recommended for leasing will be administered as explained in the Introduction and Management Requirements, Constraints and Mitigating Measures sections of this environmental impact statement (sections I and VIII).

The selected alternative incorporates the concerns and advise of the interagency participants (Yellowstone National Park, U.S. Geological Survey, U.S. Fish and Wildlife Service, Forest Service, Bureau of Land Management). The recommendation adequately protects the resources managed by the two surface managing agencies (USDA-Forest Service and USDI-Bureau of Land Management). Because there is utmost concern for the protection and preservation of hydrothermal features within Yellowstone National Park, geothermal leases within the IPGA will be issued only after those concerns are addressed to the satisfaction of the Secretary of the Interior.

VIII. MANAGEMENT REQUIREMENTS, CONSTRAINTS, AND MITIGATING MEASURES

These requirements, constraints, and mitigating measures apply to geothermal leasing considered anywhere within the IPGA. They will be used as guidelines for specific lease stipulations if and when geothermal leasing/development becomes a reality. Considerations like width of stream protective zones, distance of noise from human use, location of drilling/construction sites from existing roads or other developments, etc. must be determined on a case by case or site by site basis.

Geothermal exploration operations, including geophysical surveys and the drilling of shallow temperature gradient holes to depths of 2,000 feet, entail only minor surface disturbance. Operations are permitted by the Area Geothermal Supervisor (AGS), U.S. Geological Survey, after receiving archeological, biological and/or other surface clearances from the appropriate surface management agency (Forest Service or Bureau of Land Management).

Major surface disturbing operations, which include deep test or development well drilling and construction and operation of production and utilization facilities, require public review of a Plan of Operations. Interested parties are notified and encouraged to attend site inspections and to comment on the proposed operation. The AGS prepares an Environmental Assessment on the proposed action to identify the potential environmental impacts and recommend mitigating measures. Serious consideration is given to all public comments in the assessment. Recommended mitigating measures of the Environmental Assessment are adopted as special conditions of approval of the Plan of Operation. Following joint Plan of Operation approval by the AGS and appropriate surface management agency, a permit may be issued by the AGS authorizing commencement of activities.

Mitigation of environmental impacts stemming from geothermal exploration and development will be accomplished by enforcing federal, state, and local laws and regulations; geothermal exploration and leasing regulations; geothermal operating regulations; Geothermal Resources Operational Orders (GRO's); lease and land use stipulations (see Appendix K for example lease form); and by applying existing, developing, and still to be developed technologies. If applicable standards cannot be met, construction will be delayed pending solution of the problems.

Although the number of geothermal installations in the world is limited, considerable technical and operational information is known. Drilling methods and techniques for handling high pressure fluids have been transferred, with appropriate modification, from the petroleum industry to the geothermal industry. Knowledge of environmental causes, effects, and remedial or preventive measures specifically relating to geothermal development ranges from adequate to limited.

Some known environmental impacts can be prevented. Others can be anticipated and environmental protection planned. Certain impacts can only be hypothesized. Contingencies included under general regulations may provide a means for corrective action in the event hypothetical impacts become a reality. If unacceptable environmental impacts cannot be corrected, development will not be permitted.

If a significant geothermal resource is discovered in the area, development will probably occur slowly over several years, for technical, economic, and environmental reasons. A prolonged development period tends to be a mitigating measure because problems discovered in initial operations may be solved in succeeding operations. If problems develop which cannot be satisfactorily solved, regulations require shut-down of operations until corrective action is taken.

Monitoring is required for potential impacts of exploration, development, and production of geothermal resources. Short-term impacts such as those on noise and air quality will be monitored by the lessee under supervision of the U.S. Geological Survey. Monitoring changes that cannot be attributed to leases will be the responsibility of the surface managing agency. Monitoring activities must be initiated prior to development so that impacts can be analyzed before and after assessment.

EXPLORATION

Noise, dust and vegetation crushing due to off-road vehicle (ORV) travel—Travel will be restricted to existing roads as much as possible. Off-road travel will be coordinated with the surface land managing agency to avoid disturbing wildlife during important periods in their life cycles. ORV travel will be excluded from stream courses and areas of ephemeral surface flow.

Explosives and seismic exploration—No blasting will be allowed in marshes or near open bodies of water, springs, or known sensitive habitats. These activities will not take place in areas used by sensitive wildlife species during breeding or other important periods in the life cycle. To offset the increased risk of fire, the following will be incorporated into site selection and planning efforts: an increased level of detection (lookouts, aircraft, etc.); adequate communication; education of personnel involved; enforcement of all laws, regulations and guidelines; and close coordination with the surface managing agency to avoid periods of high fire danger.

Clearing access routes—Proper planning and site selection is effective mitigation. Use of natural breaks in vegetation (crests and ridges) is advantageous, while surface water and riparian habitat will be avoided. Minimum vegetation will be cleared. If clearing or brushing of vegetation is deemed necessary, the dozer blade will be set at a minimum of 6 inches above the ground. Temporary access routes, will be reclaimed to as near original condition as possible. This may require scarification, reseeding, fertilization, etc. Routes will be physically and administratively closed after drilling is completed. To reduce fire hazard, prevention coordination with the surface managing agency and an approved fire plan will be required.

Increased noise—Mufflers on the drill rig engine will reduce noise. However, special problems with unique wildlife may arise on a site-specific basis. Additional muffling or alternative site selection may be required. Insofar as possible, operations will be kept well back from residences, recreation sites, administrative sites, recreation roads, and wilderness access points.

Noise limitations must conform, as an initial minimum, to the regulations issued by the U.S. Geological Survey for geothermal operations on Federal lands: i.e. not to exceed 65 db(A) at the lease boundary or one-half mile form the source, whichever is greater.

Preparation of drilling area—Proper site selection will minimize most soil/vegetation disturbance and/or modification. Sites will be located away from surface water to prevent pollution from spills, soil erosion, etc.

Discharge of drilling wastes, mud, etc.— Drill cutting will be disposed of by either one of two methods: (1) complete removal to an approved disposal site, or (2) raked-out on the ground at the drill site to a depth not exceeding 6 inches. Geothermal fluids or toxic substances will be held in temporary holding ponds until proper disposal is arranged.

Increased human presence—Human presence will be temporary and localized in the vicinity of the drill site. Complete mitigation is impossible; however, proper education of crews will reduce human-wildlife conflicts and lessen impacts on wildlife populations.

Drilling of shallow holes—Interaquifer transfer of waters with different qualities through encased holes will not be allowed.

Camping and housing personnel—Chosen sites should minimize disturbance of soil/vegetation, surface waters, and wildlife. Bivouacs will not be allowed in important wildlife habitats during critical periods of important species life cycles: for example, waterfowl concentration areas during migration, near raptor nests during the nesting and fledgling periods, etc. Streamside and riparian habitat locations will be discouraged. Camp sanitation plans will not allow litter and garbage to be scattered. Bear-proof containers will be required and all litter and garbage will be removed daily. Self-contained chemical toilets will be discharged into appropriate facilities. Fire prevention plans and fuel treatment around camps will be coordinated with the surface land managing agency.

TEST DRILLING

General construction—Construction is not specific to any particular phase, although construction impacts commonly begin in the test drilling phase. These include roads, drill pads and sumps, foundations for buildings, parking lots, and storage areas. Impacts have been identified for each phase, however, mitigation measures apply to impacts associated with construction in all phases.

The most effective mitigation for direct impacts to soil/vegetation, water resources, fish and wildlife or resource management structures is proper planning and site selection. Important and/or sensitive habitats have been excluded or deferred from leasing (certain big game winter ranges, swan wintering areas, critical portions of migration routes, etc.) Excessive road building will be prevented. Timing to avoid conflicts with important parts of wildlife life cycles will be stressed. Adequate standards for road and pad construction will be observed: case-by-case modifications will be necessary for cut slopes, berm size, run-off channelizations, slopes, etc.

Flat terrain for roads will diminish cut and fill and visual scars. Slopes over 30 percent will be avoided if possible. Natural drainage patterns of surface and shallow subsurface water will not be altered.

Stream crossings and diversions of flowing water will be kept to a minimum. Unstable soils will be avoided, and topsoil will be retained for use in revegetation and maintenance operations.

Construction patterns will be designed to conserve the "edge effect" and avoid critical or sensitive patches of vegetation. Single routes of approach to sites will be encouraged to minimize soil/vegetation modification and decrease the area affected.

Snags and islands of vegetation important to wildlife will be retained. Close coordination with the surface management agency will be required to achieve this objective.

Site inspection to appraise construction techniques will be necessary. Excessive dust generation, as evidenced by dust plumes and dust coverage of vegetation, will be mitigated by oiling or watering.

Buffer strips will be left around nests of uncommon raptorial birds. To coordinate mitigating measures the surface management agency will be consulted whenever nests are discovered. Similar protection will be extended to other wildlife species if population trends indicate the need.

Measures to reduce fire hazards include building fuel breaks between slash and surrounding areas and piling slash immediately after it is created. In some cases it will be necessary to designate additional areas where slash can be piled. The amount of slash on the ground can be minimized by burning and extending the burning season (night burning, wetting down the area, using extra men and equipment, etc.). Finally, prompt removal of merchantable logs and available cull material will be required to decrease the amount of combustible material on the ground.

Revegetation programs will be instituted as soon as feasible to hasten natural soil stabilization. Revegetation will be coordinated with the surface management agency in order to choose the proper species composition, fertilizer, cultivation, etc.

Lease terms will require protection of both known archaeological sites and any sites that may be discovered during geothermal development. Federal agencies will consult with qualified archaeologists on methods of protecting high value sites for future use. All significant archaeological values will be protected by inclusion of stipulations in geothermal leases.

1. The Lessee will comply with all Federal laws pertaining to the protection of archaeological, paleontological and historical values, including but not limited to the Antiquities Act (16 U.S.C. 431-433) and the Historic Preservation Act of 1966. Prior to disturbance of the surface, or entry on the land for any purpose other than "casual use" (as that term is defined in 43 CFR 3209.0-5), the Lessee will be required to have a survey made of all archaeological, paleontological and historical values in those areas of the lease which the Lessee proposes for surface disturbance, occupancy, or development. The archaeologist making such survey must be acceptable to the Authorized Officer, and must furnish to the Authorized Officer and the Area Geothermal Supervisor a certified statement setting out the steps taken in the survey and the findings thereof as to the existence of any such values. If the statement indicates the existence of such values which might be disturbed, the Lessee shall take such steps to protect and preserve those values as may be required by the Authorized Officer and the Area Geothermal Supervisor, or by such other officer as may be designated by the Secretary of the Interior. These steps may include protective measures such as complete avoidance of the site, relocation of proposed facilities, or salvage of the objects in accordance with applicable laws and regulations. The Authorized Officer in this case is a designated representative of either surface managing agency.
2. Upon discovery of cultural sites or objects, development will be halted pending determination of the significance of the discovery.
3. Use of existing roads will be encouraged to prevent inadvertent damage to archaeological resources.
4. Movement of equipment over known subsurface archaeological sites will be minimized. Necessary crossings will require placement of planking, earth mounding, and use of rubber-tipped equipment to minimize ground disturbance.
5. If archaeological areas of high use potential are discovered, planning will keep permanent scars and damage from nearby development out of view of visitors.

Road and drill pad construction—Planning should locate drill pads so that several will be close to or on one road. Since drill pads are large, general construction mitigations apply. Fire breaks should be incorporated into transportation routes.

Herbicidal control of unwanted vegetation—Herbicide use will be coordinated with the surface management agency. The choice of chemicals, application rates, restrictions, etc. will follow Federal, State, and local laws, regulations, and guidelines.

Possible discharge of drilling wastes, muds, geothermal fluids, etc.—Mitigation is best achieved by proper sump construction, maintenance, testing, and disposal. Unstable soils, landslides, surface water drainage pathways, steep topography, and other high hazard locations will be avoided. Sump walls must be strong enough to withstand minor earthquakes and moderate erosive forces of the weather. Sumps will have an impervious lining to prevent infiltration of the contents into adjacent surface, shallow and deep groundwater. Sumps will be of adequate capacity to accommodate drilling wastes, geothermal fluids and natural discharges or runoff resulting from rain or snow. Chemical agents must be kept on hand to neutralize the pH or alter the chemistry of the liquids in the event of leakage.

When a sump contains toxic mud, drilling wastes, or geothermal fluids, a strong fence will be built to prevent animals from reaching the sumps. During drilling and prior to disposal, detailed chemical analysis of all wastes, mud, and fluids will be made.

Contaminated water will only be discharged on the surface into holding ponds designed to safely contain such water. Contaminated water may be reinjected into the producing reservoir from which it was withdrawn or into other underground reservoirs to the extent such injection is consistent with applicable laws and regulations. In Idaho, geothermal fluids discharged into any underground waters have to be as high in quality as the receiving waters.

Toxic substances will be hauled to an appropriate dump site or left in the sump. Lessee will be required to comply with appropriate laws, USGS regulations and EPA guidelines in disposal of toxic substances or hazardous wastes.

Wildlife dispersals to surrounding habitat—Wildlife dispersal will be lessened by minimizing the area affected, reducing associated impacts, and adhering to other mitigating measures.

Increased vehicular traffic—Proper planning of road locations will minimize vehicular traffic.

Increased noise—Diesel engines for drilling rigs and producing wells will be muffled. Drilling and construction will be timed to avoid periods of breeding and nesting of important wildlife species. For example, drilling and testing will be shut down during the breeding cycle of trumpeter swans, bald eagles, big game calving and fawning, etc. This will follow a very intensive biological survey on a site-by-site basis and coordination with the surface management agency. Additional muffling or other alternatives may be developed on a case-by-case basis. Proper planning to incorporate topography and vegetation will also attenuate increased noise levels. Operations will be kept away from residences, administrative sites, recreation areas, and wilderness access points.

Erosion—See General construction above. In addition filter strips of natural vegetation will be left between disturbed soil and drainage bottoms to aid in preventing stream sedimentation. Strip widths will be determined by the surface managing agencies.

Improper disposal of food-related garbage and other waste—Strict sanitation guidelines will be followd to prevent modifying nutrient cycles and wildlife feeding habits. In areas occupied by grizzly bears, bear-proof containers will be provided and accumulation of refuse will not be allowed.

Equipment maintenance (discharge of detergents, compounds, oil and gas, etc.)—Proper maintenance procedures will effectively mitigate any potential pollution. Any spills or discharges should immediately be cleaned up and the area inspected for damage to terrestrial and aquatic habitats. Further rehabilitation will be coordinated with the surface managing agency.

Blooie line operation—Mitigation for noise requires adequate muffling discussed above. Separators will remove foreign particles from the discharge.

Production testing—Mitigation for noise is discussed above. Barring accidents, no uncontrolled discharge of geothermal effluents will be permitted. Analysis of the effluent will be conducted as specified by the GRO's. Surface discharge will be considered only after a period of testing under full flow conditions. After the quality has been assured, it may be possible to use geothermal waters for beneficial purposes. If a danger of toxicity exists, testing will cease during periods of local weather anomolies (temperature inversions, heavy rain or snowfall, etc.). Hot liquid will be stored in the sump reservoir for evaporative loss to the atmosphere. Proper planning and timing of testing will utilize periods of atmospheric ventilation and avoid critical events in animal life cycles. Steam and gas venting to the atmosphere will be analyzed for constituents and appropriate control methods applied. Normally this will be removal of H_2S by scrubbing to reduce odor impacts.

Well blowout—GRO order #2 covers blowout prevention equipment and procedures. Blowouts can be prevented by proper site selection, use of adequately strong casing material, and appropriate drilling procedures (maintaining proper drill mud temperatures, mud densities, etc.). Advanced planning for equipment and trained personnel can provide rapid control of blowouts. Blowout risk will be minimized by well monitoring practices designed to assure early detection of casing leaks and/or cement failures. Thorough and timely cleanup of blowout spills will lessen impacts.

Abandonment of wells—Unsuccessful wells will be abandoned and the site reclaimed. GRO order #3 covers the procedures required for well abandonment. In general, the hole must be filled with concrete and above-ground structures removed. Operations are of such limited nature that adherence to mitigation measures for increased noise, human presence, erosion, and general construction will minimize impacts. Landscape rehabilitation and revegetation plans will be closely coordinated with the surface management agency.

Increased human access—Public safety and security of geothermal facilities, as well as wildlife management considerations, may require closure or control of some roads and areas. Advanced planning on a site-by-site basis and coordination with Federal and State resource managing agencies are critical to effectively mitigate access impacts and to possibly derive benefits.

Man-made features—Facilities will be located and designed to blend into the forested background. Techniques for reducing contrast include designing buildings with low profiles and selecting paint colors that harmonize with trees, rocks, and other elements of the natural landscape. Use of existing roads and transmission lines wherever possible will help minimize impacts. New access roads will be less conspicuous if designed to follow the natural contour. The same principle will be applied to well and building sites. Irregularly shaped sites are less distracting to the eye and blend with their natural backdrops sooner upon abandonment. Clumps of vegetation will be left within cleared areas to break the contrast of geometrical structures with the irregular shapes of terrain and vegetation. Abandoned roads and the cleared area around wells and sumps will be scarified and replanted with native vegetation after completion of drilling and construction activities. Well pads may be reshaped to present a more natural appearance.

Visual quality standards described in Section II will be considered in any development of IPGA geothermal resources. Landscaping requirements necessary to protect visual resources will be formulated on a site-by-site basis as individual lease applications are reviewed. Geothermal development will be kept out of sight of all developed recreation sites.

CONSTRUCTION AND DEVELOPMENT

Construction of additional roads, drilling pads, sumps, buildings, etc.—See general construction and previous phases. Generally, complete mitigation is impossible for the modification of land, or for the physical occupation of the land by buildings. The measures available include: reducing noise, allaying dust, and choosing a time of construction to avoid interfering with the sensitive portion of animal life cycles, etc. Revegetation of all cleared areas and road cuts will begin at once, particularly on steep slopes. Runoff control structures will be designed and located so water can be directed onto energy-dissipating rocks or ground. In some cases it may be feasible to pond this water in an impermeable or slow draining basin so that local wildlife may obtain a water supply. Storage areas and parking lots will be consolidated and the number of roads minimized. A single large building will be preferred to a number of small buildings. A number of buildings will be clustered. Impediments to migration or critical social behavior of wildlife (elk migration corridors, breeding areas) will be particularly avoided.

Power plant and facilities—Mitigation measures discussed under general construction and previous phases apply here as well. Dewatering for excavation will not be allowed to adversely influence flows of nearby springs, streams, and/or wells. Disposal of pumped water will follow erosion mitigating measures, and flooding of land surfaces will not be allowed if damage to terrestrial and/or aquatic ecosystems is possible.

Transmission lines—Mitigation for general construction impacts and previous phases also apply here. Proper planning of corridors will reduce impacts to wildlife. Transmission lines will utilize existing corridors or follow existing roads or clearings. If lines pass through habitat critical to important wildlife species, the right of way should be closed to access by humans during critical events in the species life cycle. Coordination with the surface managing agency is essential to this planning.

Transmission line poles and towers should be no taller than necessary for support or for a minimum wire height. Power lines near waterfowl concentrations or local flyways will be avoided. Pole and insulator construction will be such that electrocution of raptors and other perching birds is prevented. Facilities such as transformers or switching stations should be situated in places where minimum erosion and wildlife disturbance will occur.

Pipelines—Mitigations for construction have already been discussed. Steam pipes will be located so that large animal migration or regular feeding is possible. Expansion loops may provide access if the loops are vertical. Pipe burial may be necessary in rare instances.

Increased demand for social, health, education services and housing—The geothermal leasing program presents a problem because no one is certain exactly what or how much to prepare for. The key will be to continually update information on the progress of exploration and test drilling and to launch community preparation programs when exploration and test drilling change to construction and development.

At lessee's expense, communities which are likely to receive population increases from geothermal leasing will be given detailed plans for development timing and changes in employment. These should be updated frequently and the actual number and residential location of employees monitored to verify predictions.

A massive boom in development should be avoided by slowing the employment increase when communities are in danger of being overwhelmed.

The general relationship between local government officials and lessees should be worked out before leases are granted. The lease should contain wording to reinforce this relationship. It is in the long range interest of both to be in a cooperative rather than adversary position.

OPERATION

Power plant—Generally, operation of a geothermal field increases continuous noise, discharge of geothermal fluids, operation of machinery, construction, human activity—all of the characteristics of an industrial complex. Mitigation has been discussed under previous phases. Improving technology, increasing efficiency of power plants, and using excess heat for non-electrical purposes (space heating, greenhouses, etc.) could further minimize impacts such as thermal pollution. Extraction of ground water for cooling and/or make-up water will not be allowed to **irreparably alter** flows to nearby springs, streams, and/or wells. Water impounded, diverted, or withdrawn by pumping will not be allowed to interfere with downstream uses.

Cooling towers, transmission lines and pipelines—Mitigation is discussed under previous sections. Human access will be strictly controlled to prevent human-wildlife conflicts. Coordination with the surface management agencies is critical.

Reinjection—Contamination and/or modification of surface and groundwater aquifers may be avoided by casing the injection well to a depth that will prevent penetration of an aquifer. Reinjection will not be conducted in zones where faults have been detected, and where upward leakage of injected fluids will cause movement of unstable soil and earth materials. To prevent formation fracture, fracture gradients will be determined prior to reinjection.

Release of gases and vapors—If discharged gases and/or vapors produce acid rain, monitoring of terrestrial and aquatic ecosystems will be required to determine changes and provide mitigating measures. Shutdown of operations will be required if satisfactory mitigation measures are not available.

Increased demand for social, health, educational services and housing—Facilities developed during the construction and development phase will be more than adequate to meet the needs of geothermal employees and families during operation.

PROTECTION OF AIR QUALITY

During each phase of development compliance with all Federal and state rules and regulations concerning the altering of ambient air quality standards will be required. Monitoring the air quality conditions will be required to ensure the integrity of air quality. The release of non-condensible gases (H_2S, NOx, SO_2, CH_4, NH_3, among others) will be tolerated only as long as ambient air quality standards are not exceeded. Surpassing these standards will require prompt correction of the offending action or device. The immediate shutdown of the operation will result when a solution to the problem is not at once available. For toxic gases (e.g. H_2S, SO_2, etc.) the appropriate safety devices (gas detecting meters, masks, resuscitators) will be on hand, and emergency evacuation plans will be made known to workers.

The lessee or operator shall provide a contingency plan to safeguard workers in the drilling area and all persons in areas of human habitation adjacent to the drilling areas. The contingency plan will include:

(a) control procedures for accidental spills and discharges
(b) safety equipment
(c) training of personnel
(d) evacuation plans

The contingency plan must be approved by the Area Geothermal Supervisor, U.S. Geological Survey.

Yellowstone National Park geothermal features must be considered.

YELLOWSTONE NATIONAL PARK

Because existing data do not provide definite evidence either for or against hydrologic communication between Yellowstone's thermal features and possible thermal waters outside the Park, external geothermal developments must provide a monitoring system that ensures early recognition of possible interference between them.

The following monitoring program will be required, and shall be initiated when deemed necessary by the Secretary of the Interior:

1. Gauging stations will be established on Boundary Creek, the Bechler River, and selected suitable individual hot springs to monitor discharge, chloride content, temperatures, and total convective thermal output; Little Firehole Meadows will be searched for thermal features suitable for monitoring, and, if deemed appropriate, observations will be initiated there.

2. One or more deep monitoring holes will be drilled within the deferred strip (the extended Yellowstone KGRA), prior to any large-scale production, to depths comparable to any newly discovered reservoir and preferably into the same rock strata that contain the reservoir. Tentative locations are: (1) about two miles south of West Yellowstone, in Sec. 10, T14S, R5E (if the discovered field is north of the Continental Divide), or (2) south of the Continental Divide, perhaps in Secs. 14 or 23, T13N, R45E, or even farther south (if a reservoir is discovered south of the Divide). "Slimhole" drilling and complete coring is perferred for initial holes, but deep drilling with heavy equipment may be necessary depending on conditions encountered.

3. The Geological Survey research drill holes Y-7 and Y-8 in the north part of Upper Geyser Basin will be monitored.

All geothermal fluids extracted and used in the IPGA will be reinjected into the reservoir from which they were extracted to minimize loss of reservoir pressure.

If extraction of geothermal fluids from the IPGA significantly influences pressures, chloride concentrations, or temperature of the monitored features, operations will be suspended either until the influences are eliminated or until they are clearly conterebalanced by a tier or reinjection wells in the area of deferred leasing approximately two miles west of the Park boundary. Sufficient injection in this area should provide a high-pressure barrier, preventing eastward propagation of declining reservoir pressures.

IX. CONSULTATION WITH OTHERS

The need to prepare an environmental statement for geothermal leasing in the Island Park area was agreed upon at an interagency meeting held in Boise, Idaho on May 7, 1975. Representatives from the U.S. Geological Survey, Bureau of Land Management, U.S. Forest Service, U.S. Fish and Wildlife Service and National Park Service attended the meeting and discussed consequences of a geothermal leasing program in the Island Park area. It was agreed at this meeting that the Targhee National Forest would serve as the lead agency for this interagency effort.

Another interagency meeting was held in Idaho Falls in January 1977. This meeting established commitments and level of involvement for each of the participating agencies. The following agencies agreed to provide specific information and involvement into the environmental statement effort:

U.S. Forest Service
- Gallatin National Forest
- Targhee National Forest (lead agency)

Bureau of Land Management
- Idaho Falls District

National Park Service
- Yellowstone National Park

U.S. Fish and Wildlife Service
- Ecological Services

U.S. Geological Survey
- Conservation Division
- Geologic Division
- Water Resources Division

Each participating agency has provided personnel to comprise the multi-disciplinary study team. These team members have served as key representatives for their agency.

Public involvement has been a continuous activity. It includes the giving and receiving of information relevant to geothermal development in the area of consideration. The following is the sequence of public involvement in the environmental statement process to date:

Activity	When
Announced intent to prepare an environmental statement and identified who was involved (News Media)	January 1977
Distributed information brochure (brief) with response form for comments or concerns. Approximately 800 copies distributed	May-August 1977
Mailed notification of public involvement workshop in Rexburg, Idaho, March 18, 1978. Approximately 700 copies distributed	February 1978
Island Park Geothermal Workshop held at Madison Junior High School, Rexburg, Idaho	March 18, 1978
Informal contacts with various public segments, state agency representatives, and congressional delegates	Concurrently

The draft environmental impact statement was released to interested parties on March 21, 1979. Eleven hundred copies were sent to individuals, lease applicants, environmental groups, energy developers, elected officials, state and federal offices, various news media, and to local forest resource users. The official deadline for the submission of comments on the draft was May 21, 1979, however, most comments received after that date are included in this final statement. Comments to the draft EIS are reproduced in this document (Appendix N.).

A computer program (two-way contingency table) was used to analyze the comments to the draft EIS. Several variables were identified about the comments and their possible significance to the goethermal leasing proposal. The following tables identify the geographic distribution and alternative favored from all the comments received.

TABLE 44. ENTITY PROVIDING COMMENTS AND GEOGRAPHIC DISTRIBUTION

Entity	Northeast	Southeast	Midwest	Northwest	Southwest	Totals
Energy Developer[1]	1	1	0	1	11	14
State or Local Government	0	0	0	17	1	18
Federal Government	0	2	0	5	2	9
Environmental Group	0	2	0	4	0	6
General Public	0	0	1	7	9	17
Other[2]	0	0	0	5	2	7
Totals:	1	5	1	39	25	71

[1] Oil and gas company, nuclear power proponent, or company/individual involved in leasing for minerals/energy development

[2] Local business/organization

TABLE 45. ALTERNATIVE FAVORED BY ENTITY

	Energy Developer	State/Local Government	Federal Government	Environmental Group	General Public	Other	Total
Favor Alt. 1	0	2	0	2	4	0	9
2	1	0	0	0	0	0	1
3	0	3	1	3	2	1	10
4	0	0	1	0	0	0	1
5	0	1	0	0	1	0	2
6	9	0	0	0	5	1	15

From 22 different issues/concerns, the most numerous comments were for the following: a need for energy in the United States; wildlife (for both threatened and endangered and other species); Yellowstone National Park; quality of air and water; and socio-economic aspects of goethermal development. Other issues/concerns expressed in smaller numbers were:

- Energy conservation/alternative energy sources
- Cultural values
- Recreation
- Fishing
- Energy from IPGA not needed
- Unknown geothermal resource in IPGA
- Balanced concern for resources
- Resource conflicts
- Industrialization of national forests
- Withdrawal of federal lands from minerals/energy development
- Government institutional barriers to geothermal development
- Government leasing delays
- Geologic hazards

The comments received (Appendix N.) were used in three ways in preparation of the first EIS: (1) many comments suggested, directly or indirectly, important considerations for the proposal. These helped develop the Evaluation Criteria (section III). (2) Suggestions were used to develop Alternative 7 which is the selected alternative. (3) Specific points or weaknesses identified in the draft EIS have been clarified or amended (see responses to comments in Appendix N.)

Many Federal, State, and local agencies not already mentioned have provided consultation and/or contribution to the preparation of this statement. They include:

FEDERAL

Environmental Protection Agency
Department of Energy
National Oceanic and Atmospheric Administration
Advisory Council on Historic Preservation
Department of the Interior

- Bureau of Reclamation
- Bonneville Power Administration
- Bureau of Mines

STATE AND LOCAL

IDAHO

- Fish and Game Department
- Department of Health and Welfare, Division of Environment
- Department of Water Resources
- Department of Parks and Recreation
- Department of Lands
- State Archaeologist
- Public Utilities Commission
- Division of Budget, Policy Planning and Coordination
- Historic Preservation Officer
- Office of Energy
- Attorney General's Office

MONTANA

- Energy Office
- Department of Health and Environmental Science
- Historical Society
- Department of Natural Resources and Conservation
- Bureau of Mines and Geology

WYOMING

- Game and Fish Department
- Geological Survey

INFORMATION RECEIVED UNDER CONTRACT WITH CONSULTING FIRMS

EDAW, Inc. .... Fort Collins, CO
Western Environmental Research Associates .... Pocatello, ID

Many interested groups and individuals have provided consultation. They include:

GROUPS

Fall River Rural Electric Cooperative, Inc. .... Ashton, ID
Forsgren, Perkins & Associates .... Rexburg, ID
Idaho Conservation League .... Boise, ID
Idaho Environmental Council .... Idaho Falls, ID
Outdoors Unlimited, Inc.—Sawtelle Chapter .... St. Anthony, ID
The Montana Wilderness Association .... Helena, MT
Idaho Geothermal Corporation .... St. Anthony, ID
Occidental Geothermal, Inc. .... Bakersfield, CA
Union Oil of California .... Santa Rosa, CA
Audubon Society—Snake River Chapter .... Idaho Falls, ID

Ralph Maughan .... Pocatello, ID
Ray Breuninger .... Helena, MT
Marian Boulter .... Rexburg, ID
Keith E. Brown .... Canyon Creek, MT
Craig Carver .... Denver, CO
Eddie Chew .... Idaho Falls, ID
Phil Choate .... Rexburg, ID
Vernon Christoffersen .... Tetonia, ID
Eugene V. Ciancanelli .... San Diego, CA
Gary L. Davidson .... Idaho Falls, ID
Mark Dublin .... Idaho Falls, ID
Sandy Enyeart .... Idaho Falls, ID
Beth Gorringe .... St. Anthony, ID
Russell Hillman .... St. Anthony, ID
Roger D. Hoggan .... Rexburg, ID
Klem K. Kennedy .... Idaho Falls, ID
Steven Knapp .... Ashton, ID
Michael McSorely .... Pocatello, ID
William G. Miller .... St. Anthony, ID
C.F. Murer .... Denver, CO
Deborah Parrott .... Victor, ID
Ralph V. Pehrson .... Boise, ID
Chris H. Peterson .... Idaho Falls, ID
Robert Ruud .... St. Anthony, ID
Fred Schmidt .... Butte, MT
Glan Sharp .... Squirrel, ID
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P.A. Smith .... San Francisco, CA
Bob Stenner .... Pocatello, ID
Jacquelyn Sullivan .... Idaho Falls, ID
Jack Thomas .... Island Park, ID
Mrs. Jack Thomas .... Island Park, ID
Ryan Tibbitts .... Rexburg, ID
Gerald Vaughan .... Bakersfield, CA
Jennifer Whipple .... Arcata, CA
Calvin H. Wickham .... Ashton, ID
Ed Williams .... Rexburg, ID
Charlie Woodward .... Victor, ID
A.D. Zierold .... Boise, ID

UNITED STATES
DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY
Office of Geochemistry and Geophysics
345 Middlefield Road, MS18
Menlo Park, California 94025

April 27, 1979

MEMORANDUM

To: Distribution

From: Robert L. Christiansen and Donald E. White

Subject: Response of U. S. Geological Survey Geothermal Research Program personnel to Draft Environmental Statement of the Island Park Geothermal Area (IPGA)

This memo is written in response to the request of David M. Jay, Forest Supervisor of Targhee National Forest, for comments or suggestions on the subject Draft Statement; it is intended as technical assistance and does not constitute the Geological Survey's formal review of the Draft Environmental Statement.

We wish to suggest that further measures be included in the Statement in order to assure that any geothermal production that might result from exploration in the IPGA would not affect the major hydrothermal features of Yellowstone National Park. Although it is our considered judgement that such effects would be unlikely, it is important that a cautious approach be included in eventual production strategies, both to monitor possible changes and to counteract them if they should be detected. We, therefore, propose that alternative 3 of the Draft Statement be changed to include a strip for deferred leasing along the western boundary of Yellowstone National Park and that a program be included to place deep wells for monitoring and possible injection within that strip.

Our proposed changes to the Draft Statement follow. First is a suggested modification to alternative 3 (p. 81). Next we present a statement to replace the section of the Draft Statement on page 123 concerning Yellowstone National Park. Finally, we give our rationale in support of specific aspects of the proposal.

On Fig. 17, p. 81. Transfer the strip on the east side of IPGA (shown on the Draft Statement maps as "Yellowstone KGRA") from a mixture of leasing and deferred leasing to totally deferred leasing; extend this two-section-wide strip of deferred leasing north and south to provide a complete buffer zone adjacent to the Park.

Regarding point 3 above, the alternate holes suggested are in better condition and probably are as satisfactory for monitoring as the reactivated Y-1 in western Upper Basin, suggested in the Draft Statement; all of these research holes are too shallow and too subject to continuing changes of nearby springs and geysers to provide reliable monitoring data by themselves.

If commercial geothermal resources should be found to exist in the IPGA, the suggested strategy aims for early recognition of any declining reservoir pressure that might be propagated eastward, thereby diverting deep Yellowstone geyser water westward rather than upward and thus interrupting the natural geyser supply. We consider deep communication of fluid pressures between the Island Park area and the Yellowstone caldera to be unlikely, but it cannot be ruled out by any available evidence. If some pressure communication is demonstrated, the initial effects will become evident through our proposed monitoring system long before a wave of declining pressure can be transmitted to the geyser basins. It should be noted that a discovery well within the IPGA with only limited testing and discharge of fluids cannot possibly affect the geysers of Yellowstone National Park. A significant and more-than-local decline in reservoir pressure can occur only after at least 5 to 10 production wells are drilled and produced long enough to demonstrate productivity, which is necessary to justify construction of a power plant. Normally at least two to three years are required to drill the 5 to 10 required production wells and another five years to construct the power plant. The easier parts (items 1 and 3) of our proposed monitoring system should be initiated as soon as the first lease sales are approved, and one or more deep monitoring wells should be drilled adjacent to the Park boundary immediately after a new discovery becomes evident and before five or more production wells are drilled.

Limited testing of each newly completed well should be permitted in order to test initial productivity. All liquid effluent from sustained testing of production wells should be reinjected into the reservoir, thereby minimizing any wave of pressure decline that could be transmitted eastward. One or more of the early industry-drilled wells should be withheld from production testing to monitor immediate effects of this production and reinjection. Wells of low productivity are suitable for such monitoring.

On p. 123, "Yellowstone National Park", restate as follows:

Because existing data do not provide definitive evidence either for or against hydrologic communication between Yellowstone's thermal features and possible thermal waters outside the Park, external geothermal developments must provide a monitoring system that insures early recognition of possible interference between them. The following monitoring program will be required if a commercial geothermal resource is discovered within the IPGA:

1. Gauging stations will be established on Boundary Creek, the Bechler River, and selected suitable individual hot springs to monitor discharge, chloride content, temperatures, and total convective thermal output; Little Firehole Meadows will be searched for thermal features suitable for monitoring, and, if deemed appropriate, observations will be initiated there.
2. One or more deep monitoring holes will be drilled within the deferred strip (the extended Yellowstone KGRA), prior to any large-scale production, to depths comparable to any newly discovered reservoir and preferably into the same rock strata that contain the reservoir. Suggested locations are: (1) about two miles south of West Yellowstone, in Sec. 10, T14S, R5E (if the discovered field is north of the Continental Divide), or (2) south of the Continental Divide, perhaps in Secs. 14 or 23, T13N, R45E, or even farther south (if a reservoir is discovered south of the Divide). "Slim-hole" drilling and complete coring is urged for initial holes, but deep drilling with heavy equipment may be necessary depending on conditions encountered.
3. U.S.G.S. research drill holes Y-7 and Y-8 in the north part of Upper Geyser Basin will be monitored.

All geothermal fluids extracted and used in the IPGA will be reinjected into the reservoir from which they were extracted to minimize loss of reservoir pressure.

If extraction of geothermal fluids from the IPGA significantly influences pressures, chloride concentrations, or temperatures of the monitored features, operations should be suspended either until the influences are eliminated or until they are clearly counterbalanced by a tier of reinjection wells in the area of deferred leasing approximately 2 miles west of the Park boundary. Sufficient injection in this area should provide a high-pressure barrier, preventing eastward propagation of declining reservoir pressures.

Regarding point 1 above, little attention has been given to the Little Firehole Meadows area, which is located midway between Upper Geyser Basin and the IPGA and might contain thermal features especially sensitive for monitoring.

If it becomes necessary to drill a tier of injection wells in the deferred-leasing area west of the Yellowstone Park boundary, industry should probably have the option of injecting some cold water from local sources of shallow groundwater in addition to production effluent. The production wells and power plant may be considerably west of the Park boundary and at lower altitudes. Our interest is to prevent significant eastward propagation of declining pressure; the immediate source of any required injection water, whether hot or cold, is here of secondary concern.

Robert L. Christiansen
Coordinator, Geothermal
Research Program

Donald E. White
Senior Advisor, Geothermal
Research Program

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Targhee National Forest
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United States Department of the Interior

FISH AND WILDLIFE SERVICE

MAILING ADDRESS:
Post Office Box 25486
Denver Federal Center
Denver, Colorado 80225

STREET LOCATION:
10597 West Sixth Avenue
Lakewood, Colorado
Across From Federal Center

IN REPLY REFER TO:

F.S. R-4 RECEIVED JUL 31 1978 REGIONAL FORESTER

FA/SE/Coop.--Federal--FS
Island Park Geothermal Leasing Area

JUL 27 1978

F. S. R-4 RECEIVED JUL 31 1978 WILDLIFE MANAGEMENT

Mr. Vern Hamre
Regional Forester
U.S. Forest Service
324 25th Street
Ogden, UT 84401

Dear Mr. Hamre:

This is our official response to your request of June 6, 1978, for formal consultation on the effects of geothermal leasing within the Targhee and Gallatin National Forests on the threatened grizzly bear. We have conducted a threshold examination as prescribed in the Interagency Cooperation Regulations of January 4, 1978.

The impacts of geothermal leasing in the Island Park Geothermal Area (IPGA) will increase as the various phases of exploration progress towards full development of the geothermal resource, if one is found and determined to be commercially valuable for development. Accordingly, our biological opinion is based on the accumulative effects of the sequential phases of exploration and development.

It is our biological opinion that:

(1) Geothermal leasing in the IPGA outside the boundaries of the proposed critical habitat for the grizzly (Federal Register Vol. 41, No. 215), is not likely to jeopardize the continued existence of the grizzly bear or destroy or adversely modify its habitat.

(2) Geothermal leasing within the proposed critical habitat (Federal Register Vol. 4, No. 215) as it encompasses all associated activities of the casual use phase and exploratory phase up to but not including deep-well drilling is not likely to jeopardize the continued existence of the grizzly or destroy or adversely modify its habitat.

(3) Insufficient information exists to provide a biological opinion on the advanced phases of geothermal exploration (deep-well drilling

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and subsequent field development) that may occur within proposed grizzly bear critical habitat, should a productive geothermal reservoir be located. Our opinion is based on the following considerations.

Although most of the IPGA is within the general distribution of the grizzly bear in the Yellowstone ecosystem, sightings of grizzlies in areas outside the proposed critical habitat are infrequent. The proposed U.S. Fish and Wildlife Service critical habitat encompasses those areas considered by the Forest Service to be essential to the grizzly as well as areas which may be needed for recovery. Thus leasing and its associated activities outside the proposed critical habitat area should not adversely affect the grizzly bear.

Inside the proposed critical habitat area, impacts of geothermal leasing may increase with successive exploration phases until a threshold is reached beyond which adverse modification of the habitat may occur. Activities of the casual use phase and early stages of the exploration phase (activities up through the drilling of shallow temperature gradient holes) should not adversely affect the grizzly. Activities up to the point of deep-well drilling generally involve small crews with vehicular activity restricted to established roads and trails and are of short duration (one to two weeks). The environmental impact of drill temperature gradient holes (holes usually less than 500 feet) is only slightly greater than ground reconnaissance and generally requires no site preparation.

The impacts of deep-well drilling and subsequent geothermal development may have adverse effects on the grizzly. Wells are currently drilled to a depth of about 10,000 feet and involve large, highly-engineered drill sites. One to five wells may be expected for finding and testing geothermal fluids. Existing access roads may be improved to accommodate the heavy equipment. Since existing roads often approach chosen sites within one to two miles, and exploration wells are normally one quarter mile to one half mile apart, about three to five miles of new road may be necessary for one exploratory effort of deep-well drilling. Each of the drilling operations will require a level drill pad of about one to three acres and a mud sump (varying from less than one hundred to several thousand square meters on the surface down to a depth of from five to ten feet) for temporary storage of drilling mud and possibly storage of geothermal resource effluent. A crew of 20 to 24 is generally required for drilling operations. Should the exploratory wells prove productive and valuable for commercial development, the full impacts of plant facilities, feeder pipelines, power transmission lines, additional roads and human occupation would be realized.

Without a knowledge of where productive geothermal reservoirs lie, should any exist in the IPGA, and where deep-well drilling is anticipated, a biological opinion on deep-well drilling and full field development within proposed critical habitat cannot be made. Should an operator, after evaluating the results from shallow temperature gradient holes, decide that deep well drilling is feasible he would submit a Plan of Operation and the appropriate Notice of Intent to conduct deep well exploration operations. At this point formal consultation should be reinitiated, a site specific analysis made, and a biological opinion given. While advanced geothermal exploration may or may not be detrimental to the grizzly, early phases of exploration within proposed critical habitat are recognized as being valuable in the assessment of the geothermal resource potential in the IPGA. It is also recognized that of all the leased land on which exploration may be initiated only those relatively few leases having the greatest potential are likely to undergo development, and exploration will leave no lasting environmental effects on the majority of those leases which do not reach the development stage.

Leasing alternatives as outlined in the draft Island Park Geothermal Environmental Impact Statement present varying degrees of impacts to the grizzly. Alternative 3 would have the least short-range impact (excluding Alternative 1-No Leasing). Essential grizzly habitat as defined and identified by the Forest Service is either removed from leasing or deferred as well as portions of the proposed critical habitat not included in the Forest Service designation.

Alternative 5 is similar to Alternative 3 with the exception that areas deferred from leasing in Alternative 3 would be leased with surface occupancy restrictions. Activities in areas with surface occupancy restrictions under this alternative are consistent with our opinion (allows exploration activities up to but not including deep well drilling).

Alternative 4 invokes a "true" non-surface occupancy restriction which includes all Forest Service delineated essential habitat. However, directional drilling from the outside perimeter of these areas would affect proposed critical habitat. Areas of particular concern would be south and southeast boundaries of the IPGA below Yellowstone National Park. Alternatives 2 and 6 are the least desirable. In all alternatives, deep-well drilling and subsequent development of the geothermal resource within proposed critical habitat would require reinitiation of formal consultation.

This completes the formal consultation process on geothermal leasing in the IPGA. We appreciate your cooperation and interest in meeting our joint consultation responsibilities.

Sincerely yours,

Marvin L. Duncan

Regional Director

X. INDEX

APPENDIX A. CHEMICAL ANALYSES OF THERMAL SPRINGS NEAR THE ISLAND PARK GEOTHERMAL AREA

(mg/l unless noted)

Spring name and/or location (all in Idaho except one) / Parameter	Ashton Hot Spring 9N-42E-23 dac	Unnamed spring near Coyote Creek, Wyoming 47N-118W-28	Big Springs 14N-44E-34 bbb	Warm River Spring 10N-44E-10 aba	Unnamed spring near mouth of Warm River 9N-43E-15 ddc	Unnamed spring near Sawmill Creek 9N-45E-6 ddd
Date Sampled	9/6/77	9/20/77	9/8/77	9/21/77	9/21/77	9/21/77
Discharge, gal/min.	2	1	92,200	90,000	2	8
Water Temp. °C	39.5	17.0	11.8	10.3	16.3	13.5
As, ug/l	13	0	—	1	8	1
HCO_3	87	92	73	48	120	150
B, ug/l	40	10	60	120	40	4
Ca	1.4	22	7.3	6.0	20	38
Cl	3.3	1.2	3.2	6.9	5.2	1.8
F	2.4	2.0	3.6	2.2	1.4	1.4
Hardness, total	4	66	21	21	65	120
Fe, ug/l	40	20	—	30	60	20
Li, ug/l	50	30	—	60	80	20
Mg	0.1	2.8	0.7	1.4	3.7	7.1
Mn, ug/l	10	0	—	0	0	0
NO_2 & NO_3 as N dissolved	0.26	0.14	0.03	0.21	0.85	0.15
pH (field)	7.9	8.2	6.7	6.8	6.8	6.6
P total as p	0.04	0.01	0.00	0.11	0.03	0.01
K	1.6	1.1	3.0	1.4	1.2	1.5
TDS	116	123	117	91	163	177
SiO_2	22	37	46	32	39	43
Na	37	9.3	15	14	24	7.4
SO_4^2	3.9	1.2	2.2	1.9	4.9	1.9
Zn, ug/l	10	0	—	20	0	0

Source: Unpublished records of the U.S. Geological Survey

APPENDIX B. CHEMICAL ANALYSES OF SELECTED WELLS AND SPRINGS (mg/l unless noted)

Well location, Spring name and/or location (locations by township, range section) / Chemical Parameter	MONTANA			IDAHO			
	Unnamed spring source of the South Fork Madison River 14S-5E-19 aba	Black Sand Spring 13S-5E-31	Well in West Yellowstone 13S-5E-34	Well near Continental Divide 15N-43E-13 bca	Well, north of and near north edge of caldera 13N-43E-15 adc	Well inside of and north of center of caldera 12N-44E-20 adb	Osborne Springs 11N-42E-5 bdc
Date of Sampling	9/7/77	9/7/77	9/7/77	9/8/77	9/8/77	7/24/75	6/8/74
Water Temp °C	4.8	9.5	8.3	12.3	8.5	7.5	5.5
Geohydrologic unit	rhyolitic flows and tuffs	obsidian sands and rhyolitic flows	obsidian sand	alluvial and glacial materials	rhyolitic flows and tuffs	basalt	basalt
pH (field)	6.6	6.8	7.3	6.9	6.7	6.9	7.3
HCO_3	18	36	44	220	53	46	59
B, ug/l	6	70	60	—	9	—	—
Ca	5.2	5.9	5.7	50	11	7.4	7.6
Cl	0.5	4.7	4.4	1.6	1.0	0.7	1.5
F	1.4	3.8	3.8	0.1	0.5	1.4	1.3
Hardness, total	17	18	18	190	39	40	—
Mg	1.0	0.8	1.0	15	2.7	5.2	3.0
NO_2 and NO_3 as N dissolved	0.01	0.01	0.01	0.00	0.02	0.63	0.05
K	1.5	2.0	1.9	1.0	1.6	1.2	2.1
TDS	46	85	88	200	81	86	—
SiO_2	24	37	33	14	30	37	—
Na	2.2	12	15	1.7	4.3	4.8	5.3
SO_4^2	0.9	0.9	0.9	4.4	3.0	5.0	2.9

Sources: 1974 and 1975 data from R.L. Whitehead, 1978; other data from unpublished records of the U.S. Geological Survey.

APPENDIX C. CHEMICAL ANALYSES OF HOT WATER FROM SELECTED GEYSER BASINS[1] IN YELLOWSTONE NATIONAL PARK
(mg/l; Tr = Trace)

	Lower Geyser Basin (24 analyses from 9 springs)	Midway Geyser Basin (7 analyses from 1 spring)	Upper Geyser Basin (23 analyses from 6 springs)	Shoshone Geyser Basin (2 analyses from 2 springs)
Temperature ° C	65-95	63-92	70-boiling	92, 93
pH (lab)	6.8-9.23	7.5-8.45	3.45-9.78	—
SiO_2 (lab)	175-412	221-303	128-456	280-305
Al	0-2.1	<0.1-1.2	0-7.9	0.3-4
Fe	0-2	0-1.8	0-1.2	Tr-<0.1
Ca	Tr-18	<0.1-3	0-9	Tr-1.0
Mg	0-2.3	0-2.2	0-1.4	0.9 (one analysis)
Na	85-366	382-419	37-460	250-322
K	9.5-21	12-33	6.9-40	13-23.5
Li	0.5-3.8	2.0-2.8	0.16-7.0	0.9-1.2
NH_4	0.5 (one analysis)	0.01 (one analysis)	0.01,0.21 (2 analyses)	—
HCO_3	136-310	527-562	0-621	445 (one analysis)
CO_3	0-106	0-20	0-103	—
SO_4	14-68	18-34	8-231	35-48
Cl	52-370	270-290	1-466	125-200
F	10-25	18-24	0-35	16, 23
B	0.6-5.1	2.5-5.0	0.02-7.6	1.8-4.6
As	0-3.6	2.0-2.3	0.45-2.5	0.53 (one analysis)

[1] Basins are in a north-south band roughly 12 miles from the east boundary of the IPGA.

Source: Rowe, J.J., R.O. Fournier, and G.W. Morey, 1973.

APPENDIX D. CHEMICAL ANALYSES OF HENRYS FORK TRIBUTARIES[1] (mg/l unless noted)

	Buffalo River	Warm River	Robinson Creek	Conant Creek[2]
Date sampled	9/9/77	9/19/77	9/19/77	9/29/77
Water Temp °C	8.3	11.8	11.3	8.0
DO	8.0	—	—	8.0
pH (field)	7.1	8.6	8.8	7.9
HCO_3	83	56	74	84
B, ug/l	60	110	160	—
Ca	6.4	10	12	20
Cl	3.0	6.0	8.2	0.9
F	2.7	2.3	2.2	0.5
Hardness, total	21	32	42	69
Mg	1.1	1.7	2.8	4.6
NO_2 and NO_3 as N dissolved	0.07	0.08	0.08	0.06
P total as P	0.00	0.01	0.00	0.03
K	2.6	1.6	2.1	0.9
TDS	115	102	120	95
SiO_2	40	36	39	21
Na	16	15	15	3.4
SO_4	2.2	1.2	1.6	1.6

[1] These are in Wyoming and Idaho; (refer to map 5); samples taken at or near mouth of each stream
[2] Sampled where Conant Creek leaves the Targhee National Forest, roughly 14 miles from mouth

Source: Unpublished records of the U.S. Geological Survey

Species	Seasonal occurrence[1]	Abundance[2]	Number of habitats & successional stages used for: Reproduction	Feeding	Total number of habitats species uses
Downy Woodpecker	P	C	19	22	22
*Black-backed 3-toed Woodpecker	M	R	14	16	16
*Northern 3-toed Woodpecker	P	U	13	15	15
Eastern Kingbird	S	C	18	19	19
Western Kingbird	S	C	15	17	17
Say's Phoebe	S	C	6	6	8
Western Tanager	S	C	19	21	21
Hammond Flycatcher	S	C	14	19	19
Dusky Flycatcher	S	C	14	18	18
Western Wood Pee-wee	S	C	13	18	18
Olive-sided Flycatcher	P	C	11	22	22
Horned Lark	S	C	1	7	7
Violet-green Swallow	S	C	17	18	21
Tree Swallow	S	C	18	21	24
Bank Swallow	S	C	3	17	17
Rough-winged Swallow	S	C	4	16	17
Barn Swallow	S	C	13	16	16
Cliff Swallow	S	C	4	21	21
Gray Jay	P	C	14	19	19
Stellar's Jay	P	C	13	20	20
Black-billed Magpie	P	C	15	21	21
Common Raven	P	C	15	22	23
Common Crow	P	C	15	19	20
Clark's Nutcracker	P	C	11	16	16
Black-capped Chickadee	P	C	20	25	25
Mountain Chickadee	P	C	19	21	21
White-breasted Nuthatch	P	C	13	15	15
Red-breasted Nuthatch	P	C	16	18	18
Brown Creeper	P	C	12	14	14
Dipper	P	C	18	12	20
House Wren	S	C	15	15	18
Long-billed Marsh Wren	S	C	3	3	3
Canyon Wren	P	C	8	14	15
Rock Wren	S	C	8	10	11
Gray Catbird	S	U	15	16	16
American Robin	S	C	23	26	26
Hermitt Thrush	S	C	13	18	18
Mountain Bluebird	S	C	16	21	26
Townsend's Solitaire	P	C	15	19	20
Golden-crowned Kinglet	P	C	8	14	14
Ruby-crowned Kinglet	P	C	12	16	16
Cedar Waxwing	S	C	13	14	14
*Loggerhead Shrike	S	U	2	10	10
Starling	P	C	8	8	10
Solitary Vireo	S	C	16	20	20
*Warbling Vireo	S	R	10	11	11
Orange-crowned Warbler	S	R	12	14	14
*Yellow Warbler	S	C	5	5	5
Yellow-rumped Warbler	S	C	18	23	23
MacGillvary's Warbler	S	C	14	14	14
Common Yellowthroat	S	C	5	9	9
*Yellow-breasted Chat	S	U	5	16	16
Wilson's Warbler	S	C	7	7	7
House Sparrow	P	C	5	6	7

Species	Seasonal occurrence[1]	Abundance[2]	Number of habitats & successional stages used for: Reproduction	Feeding	Total number of habitats species uses
Western Meadowlark	S	C	6	7	7
Yellow-headed Blackbird	S	C	2	6	6
Red-winged Blackbird	S	C	5	7	7
Northern Oriole	S	C	13	14	14
Brewer's Blackbird	S	C	13	15	15
Brown-headed Cowbird	S	C	19	21	21
Lazuli Bunting	S	U	14	16	16
Evening Grosbeak	P	C	14	19	19
Cassin's Finch	S	C	11	19	19
House Finch	P	C	15	19	19
Pine Grosbeak	P	C	10	16	16
Black Rosy Finch	P	U	6	16	17
Pine Siskin	P	C	14	22	22
American Goldfinch	P	C	15	19	19
Red Crosbill	P	C	12	16	16
Green-tailed Towhee	M	C	5	11	11
Rufous-sided Towhee	S	U	18	19	19
Savannah Sparrow	S	C	1	1	1
*Vesper Sparrow	S	C	4	4	4
Sage Sparrow	S	U	1	6	6
Dark-eyed Junco	P	C	17	18	18
Chipping Sparrow	S	C	20	23	23
Brewer's Sparrow	S	C	2	5	5
White-crowned Sparrow	S	C	16	23	24
Fox Sparrow	S	C	12	17	17
Lincoln's Sparrow	S	C	5	11	11
Song Sparrow	P	C	15	18	18
MAMMALS					
Masked shrew	P	U	13	13	13
Vagrant shrew	P	C	24	24	24
Northern water shrew	P	U	18	19	19
Little brown myotis	S	C	14	22	23
Yuma myotis	S	U	4	6	6
Long-eared myotis	S	C	10	18	19
*Long-legged myotis	S	C	10	18	19
Small-footed myotis	S	C	5	8	9
*Fringed myotis	S	U	13	15	16
*California myotis	S	U	17	13	20
Silver-haired bat	S	C	10	18	19
Big brown bat	S	C	12	23	25
Hoary bat	S	C	15	23	26
*Western big-eared bat	S	C	4	5	6
Pika	P	C	3	5	5
Mountain Cottontail	P	C	8	9	10
Snowshoe hare	P	C	17	15	18
White-tailed jackrabbit	P	C	2	4	4
Least chipmunk	P	C	18	19	19
Yellowpine chipmunk	P	U	23	25	25
Yellow-bellied marmot	P	C	11	13	13
Richardson's ground squirrel	P	C	1	2	2
*Uinta ground squirrel	P	U	4	5	5
Columbian ground squirrel	P	U	16	17	17
Mantled ground squirrel	P	C	19	24	24
Red squirrel	P	C	16	18	18

APPENDIX E. WILDLIFE SPECIES ORIENTATION TO HABITATS

Species	Seasonal occurrence[1]	Abundance[2]	Number of habitats & successional stages used for: Reproduction	Feeding	Total number of habitats species uses
*Golden Eagle	P	R	14	29	29
*Bald Eagle	P	U	16	23	23
*Marsh Hawk	P	U	7	9	10
*Osprey	S	C	17	2	17
*Prairie Falcon	S	U	2	6	7
*Peregrine Falcon	M	R	0	17	17
*Merlin	S	U	14	23	23
*American Kestrel	P	C	19	22	25
Blue Grouse	P	C	17	25	25
Ruffed Grouse	P	C	17	20	20
*Sharp-tailed Grouse	P	R	7	8	8
*Sage Grouse	S	C	1	6	6
Sandhill Crane	S	C	3	14	14
Virginia Rail	S	U	3	11	11
Sora	S	C	3	10	10
American Coot	P	C	5	13	13
Killdeer	S	C	5	16	16
*Mountain Plover	M	R	2	2	2
Common Snipe	S	C	5	14	14
Long-billed Curlew	S	U	1	7	7
Spotted Sandpiper	S	C	5	11	11
Solitary Sandpiper	M	R	5	15	15
Greater Yellowlegs	M	U	0	7	7
Willet	S	C	3	12	12
American Avocet	S	C	5	12	12
Wilson's Phalarope	S	C	2	3	3
California Gull	S	C	3	11	11
Ring-billed Gull	S	C	3	16	16
Caspian Tern	M	R	0	1	1
Rock Dove	P	C	12	13	15
Mourning Dove	P	C	15	13	17
*Barn Owl	P	U	12	14	17
*Screech Owl	P	U	19	24	24
Flammulated Owl	P	R	14	13	16
Great Horned Owl	P	C	15	22	24
*Snowy Owl	W	R	0	8	8
*Pygmy Owl	P	R	16	24	24
*Burrowing Owl	S	U	2	4	4
*Barred Owl	M	U	15	19	19
*Long-eared Owl	S	U	18	23	23
*Short-eared Owl	P	U	9	13	14
*Saw-whet Owl	P	R	17	20	20
*Great Gray Owl	S	R	6	6	9
Gyrfalcon	W	R	0	7	7
Poor-will	S	C	2	7	7
Common Nighthawk	S	C	17	21	22
Calliope Hummingbird	S	C	11	17	18
Broad-tailed Hummingbird	M	R	10	12	12
Belted Kingfisher	P	C	14	16	17
Common Flicker	P	C	15	21	21
*Lewis Woodpecker	S	C	18	21	21
Yellow-bellied Sapsucker	S	C	15	15	15
*Williamson's Sapsucker	S	U	12	12	12
*Hairy Woodpecker	P	C	16	19	19

Species	Seasonal occurrence[1]	Abundance[2]	Number of habitats & successional stages used for: Reproduction	Feeding	Total number of habitats species uses
AMPHIBIANS					
Tiger Salamander	P	C	16	16	17
Western Toad	P	U	9	9	9
Chorus Frog	P	C	6	6	6
Spotted Frog	P	C	15	15	15
Leopard Frog	P	C	19	19	19
REPTILES					
Sagebrush Lizard	P	U	7	8	9
Western Skink	P	U	18	18	18
Northern Aligator Lizard	P	U	10	11	12
*Rubber Boa[3]	P	U	16	19	21
Racer	P	C	17	20	20
Gopher Snake	P	C	25	25	25
Common Garter Snake	P	C	22	23	23
Western Garter Snake	P	C	11	16	16
BIRDS					
Common Loon	M	R	9	13	13
Eared Grebe	S	C	4	4	4
*Western Grebe	M	C	9	13	13
Great Blue Heron	S	C	14	16	19
*Black-crowned Night Heron	S	U	5	5	5
*American Bittern	S	C	2	4	4
Whistling Swan	M	R	0	16	16
*Trumpeter Swan	P	C	16	19	19
Canada Goose	P	C	6	11	12
Snow Goose	M	R	0	8	8
Mallard	S	C	15	22	23
Gadwall	S	C	3	15	15
Pintail	S	C	5	16	16
Green-winged Teal	S	C	4	14	14
Blue-winged Teal	S	C	2	12	12
Cinnamon Teal	S	C	3	10	10
American Widgeon (Baldpate)	S	C	7	15	15
Northern Shoveler	S	C	3	15	15
Readhead	S	C	3	16	16
Ring-necked Duck	S	U	5	21	21
*Canvasback	M	C	1	11	11
Lesser Scaup	S	C	7	19	19
Common Goldeneye	M	U	17	17	18
Bufflehead	S	U	13	15	17
Ruddy Duck	S	U	10	18	18
Common Merganser	P	U	17	17	20
Turkey Vulture	S	C	16	25	25
*Goshawk	P	U	11	21	21
*Sharp-shinned Hawk	P	U	16	23	23
*Cooper's Hawk	S	U	15	24	24
Red-tailed Hawk	P	C	17	27	27
*Swainson's Hawk	S	U	16	21	21
Rough-legged Hawk	W	C	0	4	4
*Ferruginous Hawk	S	R	1	4	5

[1], [2], [3] See footnotes at end of Appendix

Species	Seasonal occurrence[1]	Abundance[2]	Number of habitats & successional stages used for: Reproduction	Feeding	Total number of habitats species uses
Northern flying squirrel	P	U	13	12	13
Northern pocket gopher	P	C	24	24	24
Beaver	P	C	5	23	24
Deer mouse	P	C	31	31	31
Busy-tailed woodrat	P	C	22	23	24
Boreal red-backed vole	P	C	12	12	12
Mountain vole	P	U	20	20	20
Meadow vole	P	C	7	7	7
Long-tailed vole	P	C	21	20	21
Sagebrush vole	P	U	2	2	2
Muskrat	P	C	7	10	10
Western jumping mouse	P	C	16	17	17
Porcupine	P	C	19	23	25
Coyote	P	C	25	30	30
Red fox	P	U	18	23	24
*Northern Rocky Mountain wolf	P	R	?	26	27
Black bear	P	C	17	31	31
*Grizzly bear	P	R	18	27	27
Raccoon	P	U	19	23	24
Marten	P	U	9	16	16
*Fisher	P	R	15	20	21
Short-tailed weasel	P	C	13	16	16
Long-tailed weasel	P	C	30	30	30
Mink	P	C	25	26	26
*Wolverine	P	R	9	17	17
Badger	P	C	13	16	16
Striped skunk	P	C	16	18	18
River otter	P	U	21	21	21
Cougar	P	R	17	25	26
*Canada lynx	P	R	12	19	19
*Bobcat	P	C	21	25	26
Elk (Wapiti)	P	C	16	24	24
Mule deer	P	C	15	23	23
Pronghorn	S	U	3	5	5
Moose	P	C	11	25	25

FOOTNOTES

[1] P = permanent resident; S = summer resident; M = migrant; W = winter resident.

[2] C = common—occurs in many localities in large numbers
U = uncommon—occurs in several localities in small numbers
R = rare—highly localized; restricted by scarcity of habitat and/or low numbers.

[3] * = species of special interest and concern as listed by the U.S. Department of the Interior (1973), Wyoming Game and Fish Department (1978), Montana Department of Game and Fish (1978), Idaho Department of Fish and Game (1978), and the National Audubon Society (1977).

APPENDIX F. MIGRANT AND ACCIDENTALLY OCCURRING WILDLIFE SPECIES ON THE ISLAND PARK GEOTHERMAL AREA.

Arctic Loon
Red-necked Grebe
Pied-billed Grebe
White Pelican
Double-breasted Cormorant
Mute Swan
White-fronted Goose
Ross' Goose
Greater Scaup
Barrow's Goldeneye
Hooded Merganser
Red-breasted Merganser
Harlans Hawk
Broad-winged Hawk
Hawk Owl
Black-bellied Plover
Lesser Yellowlegs
Least Sandpiper
Western Sandpiper
Long-billed Dowitcher
Black-necked Stilt
Northern Phalarope
Herring Gull
Franklin's Gull
Bonaparte's Gull
Forester's Tern
Black Tern
Common Tern
Yellow-billed Cuckoo
White-throated Swift
Varied Thrush
Water Pipit
Bohemian Waxwing
Northern Shrike
Townsend's Warbler
Bison

APPENDIX G. EFFECT OF POWER PLANT DEVELOPMENT ON POPULATION

The following six tables give an example of the population increase that may be created by the construction and operation of two 50 megawatt geothermal power plants. The tables show population increases related to direct employment requirements at the plants over thirteen years, which includes the four development phases of exploration, test drilling, construction, and operation. Each table represents two power plants at a different location within the IPGA. The zones in the table headings designate the location of the plants and correspond to the zones shown in the socio-economic analysis zones map (map 20). Each table assumes that both plants would be constructed in one zone simultaneously. A computer program was prepared to generate the six tables.

The column headings of all tables are the same. The following is an explanation of each column heading from left to right:

YEAR—This is the years of development.

DIRECT EMPLOYMENT—The actual employment required in each year for the two power plants.

INMIGRANT FACTOR—The percentage, expressed as a decimal, of direct employment which will come from outside the IPGA.

INMIGRANT NUMBER—The number of employees which will come from outside the IPGA.

AVERAGE FAMILY SIZE MULTIPLIER—Measures the increase in population created by the families of the direct employees. Note that this factor increases during operation (years 5-13). More operation phase employees are expected to have their families in the area due to longer term employment.

INDIRECT MULTIPLIER—Measures the increase in population that would be created by the demand for supporting services required by plant employees. This multiplier effect is due to the needs of these workers and families for housing, food, and services. These needs stimulate further economic growth and population increase.

TOTAL POPULATION—The total population increase expected to be created by the two plants.

The right eight columns represent how the TOTAL POPULATION is expected to be distributed among the communities within and adjacent to the IPGA.

ST. ANTHONY FACTOR—The percentage of TOTAL POPULATION, expressed as a decimal, expected to move into the community of St. Anthony, Idaho.

ST. ANTHONY TOTAL—The number of people expected to move into St. Anthony, Idaho.

ASHTON FACTOR—The percentage of TOTAL POPULATION, expressed as a decimal, expected to move into the community of Ashton, Idaho.

ASHTON TOTAL—The number of people expected to move into Ashton, Idaho.

WEST YELLOWSTONE FACTOR—The percentage of TOTAL POPULATION, expressed as a decimal, expected to move into the community of West Yellowstone, Montana.

WEST YELLOWSTONE TOTAL—The number of people expected to move into West Yellowstone, Montana.

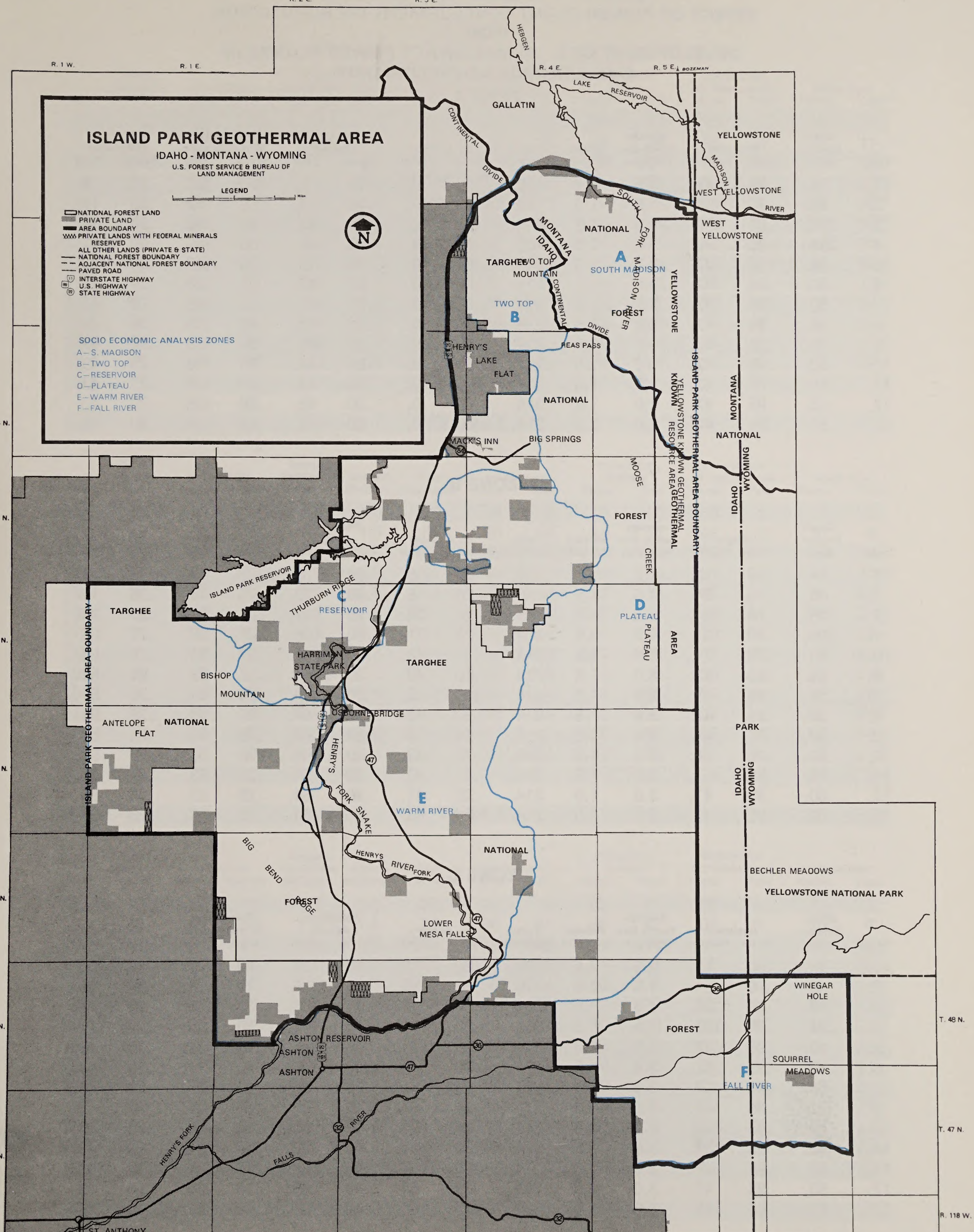
ISLAND PARK FACTOR—The percentage of TOTAL POPULATION, expressed as a decimal, expected to move into the community of Island Park, Idaho.

ISLAND PARK TOTAL—The number of people expected to move into Island Park, Idaho.

As an example, refer to the second row of the Zone A table. In year 2, direct employment is expected to be 48 people, 80 percent of whom are expected to come from outside the IPGA. Family size and indirect services are each expected to increase population about 50 percent over direct employment for a total population increase of 86. (38 x 1.5 x 1.5 = 86). This population increase will be distributed as follows:

0 to St. Anthony, Idaho
20 percent (17 people) to Ashton, Idaho
60 percent (52 people) to West Yellowstone, Montana
20 percent (17 people) to Island Park, Idaho

MAP 21. SOCIO-ECONOMIC ANALYSIS ZONE



ISLAND PARK GEOTHERMAL STUDY
EFFECT OF POWER PLANT DEVELOPMENT ON POPULATION
FOR
DEVELOPMENT OF 2 50 MEGAWATT POWER PLANTS IN SIMULTANEOUS DEVELOPMENT

ZONE A

Year	Direct Employ-Ment	Inmigrant Factor	Inmigrant Number	Average Family Size Multiplier	Indirect Multiplier	Total Population	St. Anthony Factor	St. Anthony Total	Ashton Factor	Ashton Total	W. Yellowstone Factor	W. Yellowstone Total	Island Park Factor	Island Park Total
1.	14.	.90	13.	1.5	1.5	28.	.00	0.	.20	6.	.60	17.	.20	6.
2.	48.	.80	38.	1.5	1.5	86.	.00	0.	.20	17.	.60	52.	.20	17.
3.	248.	.80	198.	1.5	1.5	446.	.00	0.	.20	89.	.60	268.	.20	89.
4.	224.	.80	179.	1.5	1.5	403.	.00	0.	.20	81.	.60	242.	.20	81.
5.	50.	.95	47.	3.0	1.5	214.	.00	0.	.20	43.	.60	128.	.20	43.
6.	50.	.95	47.	3.0	1.5	214.	.00	0.	.20	43.	.60	128.	.20	43.
7.	50.	.95	47.	3.0	1.5	214.	.00	0.	.20	43.	.60	128.	.20	43.
8.	50.	.95	47.	3.0	1.5	214.	.00	0.	.20	43.	.60	128.	.20	43.
9.	50.	.95	47.	3.0	1.5	214.	.00	0.	.20	43.	.60	128.	.20	43.
10.	50.	.95	47.	3.0	1.5	214.	.00	0.	.20	43.	.60	128.	.20	43.
11.	50.	.95	47.	3.0	1.5	214.	.00	0.	.20	43.	.60	128.	.20	43.
12.	50.	.95	47.	3.0	1.5	214.	.00	0.	.20	43.	.60	128.	.20	43.
13.	50.	.95	47.	3.0	1.5	214.	.00	0.	.20	43.	.60	128.	.20	43.

ZONE B

Year	Direct Employ-Ment	Inmigrant Factor	Inmigrant Number	Average Family Size Multiplier	Indirect Multiplier	Total Population	St. Anthony Factor	St. Anthony Total	Ashton Factor	Ashton Total	W. Yellowstone Factor	W. Yellowstone Total	Island Park Factor	Island Park Total
1.	14.	.90	13.	1.5	1.5	28.	.20	6.	.30	9.	.25	7.	.25	7.
2.	48.	.70	34.	1.5	1.5	76.	.20	15.	.30	23.	.25	19.	.25	19.
3.	248.	.70	174.	1.5	1.5	391.	.20	78.	.30	117.	.25	98.	.25	98.
4.	224.	.70	157.	1.5	1.5	353.	.20	71.	.30	106.	.25	88.	.25	88.
5.	50.	.95	47.	3.0	1.5	214.	.20	43.	.30	64.	.25	53.	.25	53.
6.	50.	.95	47.	3.0	1.5	214.	.20	43.	.30	64.	.25	53.	.25	53.
7.	50.	.95	47.	3.0	1.5	214.	.20	43.	.30	64.	.25	53.	.25	53.
8.	50.	.95	47.	3.0	1.5	214.	.20	43.	.30	64.	.25	53.	.25	53.
9.	50.	.95	47.	3.0	1.5	214.	.20	43.	.30	64.	.25	53.	.25	53.
10.	50.	.95	47.	3.0	1.5	214.	.20	43.	.30	64.	.25	53.	.25	53.
11.	50.	.95	47.	3.0	1.5	214.	.20	43.	.30	64.	.25	53.	.25	53.
12.	50.	.95	47.	3.0	1.5	214.	.20	43.	.30	64.	.25	53.	.25	53.
13.	50.	.95	47.	3.0	1.5	214.	.20	43.	.30	64.	.25	53.	.25	53.

ZONE C

Year	Direct Employ-Ment	Inmigrant Factor	Inmigrant Number	Average Family Size Multiplier	Indirect Multiplier	Total Population	St. Anthony Factor	St. Anthony Total	Ashton Factor	Ashton Total	W. Yellowstone Factor	W. Yellowstone Total	Island Park Factor	Island Park Total
1.	14.	.90	13.	1.5	1.5	28.	.30	9.	.40	11.	.10	3.	.20	6.
2.	48.	.70	34.	1.5	1.5	76.	.30	23.	.40	30.	.10	8.	.20	15.
3.	248.	.70	174.	1.5	1.5	391.	.30	117.	.40	156.	.10	39.	.20	78.
4.	224.	.70	157.	1.5	1.5	353.	.30	106.	.40	141.	.10	35.	.20	71.
5.	50.	.95	47.	3.0	1.5	214.	.30	64.	.40	85.	.10	21.	.20	43.
6.	50.	.95	47.	3.0	1.5	214.	.30	64.	.40	85.	.10	21.	.20	43.
7.	50.	.95	47.	3.0	1.5	214.	.30	64.	.40	85.	.10	21.	.20	43.
8.	50.	.95	47.	3.0	1.5	214.	.30	64.	.40	85.	.10	21.	.20	43.
9.	50.	.95	47.	3.0	1.5	214.	.30	64.	.40	85.	.10	21.	.20	43.
10.	50.	.95	47.	3.0	1.5	214.	.30	64.	.40	85.	.10	21.	.20	43.
11.	50.	.95	47.	3.0	1.5	214.	.30	64.	.40	85.	.10	21.	.20	43.
12.	50.	.95	47.	3.0	1.5	214.	.30	64.	.40	85.	.10	21.	.20	43.
13.	50.	.95	47.	3.0	1.5	214.	.30	64.	.40	85.	.10	21.	.20	43.

ZONE D

Year	Diract Employ-Ment	Inmigrant Factor	Inmigrant Numbar	Avaraga Family Siza Multipliar	Indiract Multipliar	Total Population	Population Distribution St. Anthony Factor	St. Anthony Total	Ashton Factor	Ashton Total	W. Yallowstona Factor	W. Yallowstona Total	Island Park Factor	Island Park Total
1.	14.	.90	13.	1.5	1.5	28.	.35	10.	.35	10.	.15	4.	.15	4.
2.	48.	.70	34.	1.5	1.5	76.	.35	26.	.35	26.	.15	11.	.15	11.
3.	248.	.70	174.	1.5	1.5	391.	.35	137.	.35	137.	.15	59.	.15	59.
4.	224.	.70	157.	1.5	1.5	353.	.35	123.	.35	123.	.15	53.	.15	53.
5.	50.	.95	47.	3.0	1.5	214.	.35	75.	.35	75.	.15	32.	.15	32.
6.	50.	.95	47.	3.0	1.5	214.	.35	75.	.35	75.	.15	32.	.15	32.
7.	50.	.95	47.	3.0	1.5	214.	.35	75.	.35	75.	.15	32.	.15	32.
8.	50.	.95	47.	3.0	1.5	214.	.35	75.	.35	75.	.15	32.	.15	32.
9.	50.	.95	47.	3.0	1.5	214.	.35	75.	.35	75.	.15	32.	.15	32.
10.	50.	.95	47.	3.0	1.5	214.	.35	75.	.35	75.	.15	32.	.15	32.
11.	50.	.95	47.	3.0	1.5	214.	.35	75.	.35	75.	.15	32.	.15	32.
12.	50.	.95	47.	3.0	1.5	214.	.35	75.	.35	75.	.15	32.	.15	32.
13.	50.	.95	47.	3.0	1.5	214.	.35	75.	.35	75.	.15	32.	.15	32.

ZONE E

Year	Diract Employ-Ment	Inmigrant Factor	Inmigrant Numbar	Average Family Size Multipliar	Indiract Multiplier	Total Population	Population Distribution St. Anthony Factor	St. Anthony Total	Ashton Factor	Ashton Total	W. Yallowstone Factor	W. Yallowstone Total	Island Park Factor	Island Park Total
1.	14.	.90	13.	1.5	1.5	28.	.30	9.	.55	16.	.05	1.	.10	3.
2.	48.	.60	29.	1.5	1.5	65.	.30	19.	.55	36.	.05	3.	.10	6.
3.	248.	.60	149.	1.5	1.5	335.	.30	100.	.55	184.	.05	17.	.10	33.
4.	224.	.60	134.	1.5	1.5	302.	.30	91.	.55	166.	.05	15.	.10	30.
5.	50.	.95	47.	3.0	1.5	214.	.30	64.	.55	118.	.05	11.	.10	21.
6.	50.	.95	47.	3.0	1.5	214.	.30	64.	.55	118.	.05	11.	.10	21.
7.	50.	.95	47.	3.0	1.5	214.	.30	64.	.55	118.	.05	11.	.10	21.
8.	50.	.95	47.	3.0	1.5	214.	.30	64.	.55	118.	.05	11.	.10	21.
9.	50.	.95	47.	3.0	1.5	214.	.30	64.	.55	118.	.05	11.	.10	21.
10.	50.	.95	47.	3.0	1.5	214.	.30	64.	.55	118.	.05	11.	.10	21.
11.	50.	.95	47.	3.0	1.5	214.	.30	64.	.55	118.	.05	11.	.10	21.
12.	50.	.95	47.	3.0	1.5	214.	.30	64.	.55	118.	.05	11.	.10	21.
13.	50.	.95	47.	3.0	1.5	214.	.30	64.	.55	118.	.05	11.	.10	21.

ZONE F

Year	Direct Employ-Mant	Inmigrant Factor	Inmigrant Number	Avarage Family Size Multiplier	Indiract Multipliar	Total Population	Population Distribution St. Anthony Factor	St. Anthony Total	Ashton Factor	Ashton Total	W. Yallowstone Factor	W. Yallowstone Total	Island Park Factor	Island Park Total
1.	14.	.90	13.	1.5	1.5	28.	.30	9.	.60	17.	.00	0.	.10	3.
2.	48.	.65	31.	1.5	1.5	70.	.30	21.	.60	42.	.00	0.	.10	7.
3.	248.	.65	161.	1.5	1.5	363.	.30	109.	.60	218.	.00	0.	.10	36.
4.	224.	.65	146.	1.5	1.5	328.	.30	98.	.60	197.	.00	0.	.10	33.
5.	50.	.95	47.	3.0	1.5	214.	.30	64.	.60	128.	.00	0.	.10	21.
6.	50.	.95	47.	3.0	1.5	214.	.30	64.	.60	128.	.00	0.	.10	21.
7.	50.	.95	47.	3.0	1.5	214.	.30	64.	.60	128.	.00	0.	.10	21.
8.	50.	.95	47.	3.0	1.5	214.	.30	64.	.60	128.	.00	0.	.10	21.
9.	50.	.95	47.	3.0	1.5	214.	.30	64.	.60	128.	.00	0.	.10	21.
10.	50.	.95	47.	3.0	1.5	214.	.30	64.	.60	128.	.00	0.	.10	21.
11.	50.	.95	47.	3.0	1.5	214.	.30	64.	.60	128.	.00	0.	.10	21.
12.	50.	.95	47.	3.0	1.5	214.	.30	64.	.60	128.	.00	0.	.10	21.
13.	50.	.95	47.	3.0	1.5	214.	.30	64.	.60	128.	.00	0.	.10	21.

APPENDIX H. EMPLOYMENT CATEGORIES AND SPENDING

The following four tables estimate the spending that would be created by personnel employed in two fifty megawatt geothermal power plants. Each table represents a phase of geothermal development from exploration to operation of the power plants. The last table reflects spending during the operation phase, which is representative of the long-term employment and spending per year created by operation of the two plants.

The column headings are the same for each table. At the left side of each table is a column labeled "Category". These are the categories of personnel required for the phase. The middle column lists the number of personnel required for each category of employment. The spending of all employees per year in the category is listed in the right column. Spending is estimated at 1977 wage levels.

EMPLOYMENT CATEGORIES AND SPENDING
FOR TWO FIFTY MEGAWATT GEOTHERMAL POWER PLANTS

DURING THE EXPLORATION PHASE

Category	Number of People Employed	Spending of Employees Per Year
Various Specialists	8	$22,800
Drillers	6	26,450
Total for Phase	14	$49,250

TEST DRILLING

Category	Number of People Employed	Spending of Employees Per Year
Geologist	6	$ 34,000
Landman	4	16,600
Drillers	12	105,800
Truck Drivers	4	39,400
Administrative	4	31,600
Geophysicists	4	25,400
Drill Rig Foremen	4	46,600
Laborers	8	52,600
Geochemists	2	25,400
Total for Phase	48	$377,400

CONSTRUCTION AND DEVELOPMENT

Category	Number of People Employed	Spending of Employees Per Year
Engineers	10	$ 18,600
Inspectors	6	17,800
Foremen	10	116,600
Pipefitters	18	210,000
Millwrights	8	81,600
Instrument Technicians	6	53,000
Truck Drivers	8	79,000
Timekeepers	2	13,200
Common Laborers	18	118,200
Surveyors	2	17,000
Superintendents	2	23,400
Electricians	10	116,600
Welders	10	111,800
Iron Workers	8	85,600
Concrete Workers	12	118,400
Carpenters	8	77,800
Insulation Installers	8	66,400
Sheetmetel Workers	8	70,600
Plumbers	8	93,332
Tilesetters	4	35,200
Painters	8	85,600
Machinists	4	40,800
Riggers	6	56,000
Crane Operators	4	40,800
Warehousemen	4	50,600
Administration	8	63,000
Total for Phase	200	$1,860,932

OPERATION

Category	Number of People Employed	Spending of Employees Per Year
Plant Supervisors	2	$ 25,400
Plant Operators	22	259,600
Instrument Technicians	2	17,600
Welders	2	22,400
Laborers	4	26,200
Shift Foremen	8	93,400
Mechanical Engineers	2	25,400
Machinists	2	20,400
Pipefitters	2	23,400
Electricians	2	23,400
Administrative	2	15,800
Total for Phase	50	$553,000

APPENDIX I. POTENTIAL SOCIAL IMPACTS OF GEOTHERMAL DEVELOPMENT

Three principle questions are considered in regard to geothermal development:

1. Do local residents' attitudes change after development is begun?
2. Do local residents enjoy greater employment because of the development, and do they have the skills needed for the jobs available?
3. Will the local governments have the financial ability to provide extra services needed because of possible geothermal development?

In determining if local residents' attitudes change after development is begun, it is worthwhile to analyze the example of Colstrip, Montana.

In 1970 Colstrip, Montana was a community of about 200 persons. In 1972 construction of units 1 and 2 of Colstrip Electrical Generating Plant began. By 1975 the population of the town was estimated to be about 3,000 people. Colstrip had severe impact in terms of population growth.

Colstrip is an isolated community. It is 35 miles from Interstate 94 and 38 miles from Forsyth, a town of 3,000 population. Billings or Miles City, Montana, the area's trade and service centers, are over two hours driving time. Services in Colstrip, especially commercial and entertainment facilities, are severely limited. The town has had much to do just to keep basic services at an acceptable level.

In 1975 a study was completed on Colstrip by the Old West Regional Commission. The purpose of this study was to learn something of the effects which large scale construction projects have on small communities. A household survey from 148 households in Colstrip was conducted by the Old West Regional Commission's consultant, Mountain West Research, Inc. This represented a 14.8% sample of total households.

The longtime residents of Colstrip were asked a few questions about how they felt about the effects which the construction of Colstrip units 1 and 2 were having on the community and its residents. When asked whether the effects of the construction were the same, better or worse than they expected most (66.7%) answered the same; 13.9% felt the effects were better than expected and 19.4% felt they were worse than expected. The reason given most frequently for thinking the effects were better than expected was desirable people arriving; given by 40% of the respondents. The reasons given most frequently for thinking effects were worse than expected was inadequacy of community facilities, given by 28.6% of the respondents.

When asked whether they were glad or unhappy that the project was there at all, a great majority of respondents (86.1%) said that they were glad. The reason most frequently given for being glad the project was under way in Colstrip was, "job opportunities" (58% of the glad respondents). The reason most frequently given for being unhappy about the project was increased population (60% of the unhappy respondents). There was no apparent differences in opinion according to respondent households, education, income, occupation or length of residence.

With regard to geothermal development on the IPGA, the location, magnitude, and timing of the geothermal development are the major attributes that determine impact. The location of a geothermal development will be important to the distribution of social impacts among neighboring communities. The most important cause of social impacts will be the magnitude of the geothermal development.

As an example of the employment opportunities that may be created by geothermal development in the IPGA, refer to appendix H. These tables show the employment requirements for two 50 megawatt geothermal power plants. A brief review of these tables show that many positions available at the geothermal development can use local people with a brief amount of training.

The communities that receive the greatest fiscal impacts and most rapid percentage increases in population also experience the greatest difficulty finding the money to keep the quality of their public services in step with the population increase. This simple analysis does not apply to the IPGA because two of the potential impacted towns are not typical communities. Island Park and West Yellowstone are seasonal resort communities. The town of Island Park has no budget. West Yellowstone's overnight population grows from its off season low of about 800 to more than 6,000 in the peak of the summer, with over 12,000 people in town during a peak July day.

The present budget for each of the four towns is listed in the following table. The higher per capita expenditure rate in West Yellowstone reflects the seasonal tourist economy.

TOWN BUDGETS

	1977-78 Budget	Estimated Per Capita Budget
St. Anthony, Idaho	$476,401	$152
Ashton, Idaho	202,414	$162
Island Park, Idaho	0	0
West Yellowstone, Montana	186,335	218

The public officials interviewed generally felt optimistic about their ability to cope with growth. St. Anthony received as many workers and their families during the construction of the Teton Dam in the early 70's.

Because population has been increasing slowly in the recent past, each of the towns is in a generally sound fiscal situation. The tax burden in St. Anthony is carried primarily by the residents since there is no major industry in the town. In contrast, West Yellowstone's major burden is carried by the tourist related businesses.

The cost of geothermal development to the towns will be borne in part by the return of income from the leases. It is difficult to estimate the quantity or predict that it will be a significant amount. Most of the lease applications are noncompetitive, if granted they will only bring in $1.00 per acre per year until a geothermal resource is found and developed. The distribution of this money once it returns to the state varies from state to state. In Idaho at least 5% of the original income is guaranteed to return to the county of origin. The actual amount to the affected communities will vary and depends to some extent on discretionary decisions at the state level. For noncompetitive leases the income to the communities in the IPGA will probably not be substantial until after the construction peak has been reached and passed.

The fiscal impacts on the communities can be summarized as follows:

Geothermal development may cause fiscal strain for St. Anthony and Ashton during the construction phase, but the long-term impact of operations of the development will be more manageable due to lower employment levels. Island Park is a more serious problem. Present controversy over a proposed sewage system and the lack of a town budget or service delivery capability are problems that will be accentuated by geothermal development.

West Yellowstone is best equipped by a tradition of fluctuating population to cope with short term construction period demands of geothermal development.

The greatest assistance other than monetary that can be given the communities to assist them with their fiscal policy is early and continuous information on what will happen, what is happening and what has happened with regard to each lease and geothermal development.

References:

EDAW Inc., Island Park Geothermal Energy Development-Social and Economic Assessment, Dec., 1977.

Old West Regional Commission, Construction Worker Profile, Colstrip and Forsyth, Montana, Dec., 1975.

APPENDIX J. SPACE HEATING CONSIDERATIONS FOR WEST YELLOWSTONE, MONTANA

West Yellowstone appears to be the most promising community in or near the IPGA for geothermal space heating due to its location and relatively high population density. This appendix discusses some of the factors which are important when considering geothermal space heating. These are:

Cost of wells
Cost of pipes, pumps, meters, valves, storage tanks
Operation and maintenance expense
Temperature of the geothermal fluid
Flow conditions of the geothermal fluid
Distance of geothermal fluid transmission
Total population of the area to be heated
Population density
Heating system installation costs
Cost of heat from alternative energy sources
Institutional deterrents

The largest costs for geothermal energy production are the initial costs of the producing wells. Well costs are mainly a function of depth. Geothermal wells currently (1977) cost about $300,000 per kilometer (about $100 per foot). The depth to 90°C-150°C (194°F-302°F) geothermal resources suitable for heating is estimated by the U.S. Geological Survey to be 1 to 1½ kilometers (3280-4920 feet) in most instances. Operating and maintenance expenses including well redrilling and pumping costs will usually be small in proportion to the initial cost of the wells.

The distance of geothermal fluid transmission will be a limiting factor for non-electric applications of geothermal energy. Transmission distances for existing geothermal applications are short, rarely exceeding 15 kilometers (9.32 miles). Although oil and gas can be economically piped over thousands of miles, the economic limitations for geothermal fluids will probably be less than 100 miles because of the low energy content of the fluid. Fuel oil contains about 100 times more energy per unit volume than hot water.

The total population of the area to be heated influences heating costs in two ways. First, with increasing population, economies of scale are realized in the piping for the distribution network. For example, pipe weight and costs increase near linearly with diameter while flow capacity increases with the square of the diameter. A minimum district size of 1,000 dwelling units or equivalent, will probably be required for economic feasibility. Second, increasing population reduces cost per dwelling unit heated associated with the investment in wells up to the point at which the maximum well flow is fully utilized.

Population density is one of the most important factors affecting heating costs. Increased population density reduces heating costs through reducing the average length of pipe run. With very high population densities such as large multi-story apartment buildings, economies of scale are realized in the distribution system through the use of large diameter pipe.

The cost of installing geothermal heating systems in established residential and commercial areas will generally be higher than in new developments. Trenching costs will be higher because existing streets and sidewalks must be dug up and replaced. Indirect routing of geothermal heating lines around existing sewer and water lines will also increase installation costs. Based on limited data from Iceland, construction costs for geothermal heating systems in established areas will be 10 to 30% higher than costs in new areas.

The retrofitting costs for replacing existing heating systems in residential and commercial buildings with hot water heating systems will be a deterrent to geothermal hot water heating. Retrofitting is estimated to cost $500 to $2,000 per dwelling unit. The lower part of the cost range would apply to the conversion of an existing forced air hot water system.

At the present time heat from geothermal sources would probably not be competitive with heat from electricity or coal in the West Yellowstone area. As costs of fuel from these energy sources continue to rise, geothermal space heating may become more competitive.

Institutional deterrents to widespread non-electric applications of geothermal energy will probably be significant. These include acquisition of rights-of-way for pipeline, the need to organize concentrated markets and price competition from the conventional fuels.

The greatest problem with geothermal heating in West Yellowstone is the small number of potential heating units. The large initial investment would require at least 1,000 homes or commercial buildings or a combination of the two for geothermal heat to be competitive with present fuels and to be economically feasible.

References:

Geothermal Energy Potential For District & Process Heating in the U.S.—An Economic Analysis, Bloomster et al, Batelle Laboratories, August, 1977.

Island Park Geothermal Energy Development-Social and Economic Assessment, EDAW Inc., December 25, 1977.

Form 3200–21
(May 1974)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Serial Number

USGS – KGRA Determination:

GEOTHERMAL 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 leasable 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) *Readjustments* – 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 OISPOSAL OF PROOUCTS – 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. OILIGENT EXPLORATION – In the manner required by tbe 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

APPENDIX K LEASE FORM

the minimum expenditures required to qualify the operations on the leased lands es diligent exploration under the regulations.

Sec. 14. PROTECTION OF THE ENVIRONMENT (LANO, AIR ANO 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 weter 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 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. OIRECTIONAL ORILLING – 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. OVERRIOING ROYALTIES – The Lesaee 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. REAOJUSTMENT OF TERMS AND CONOITIONS – 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. REMEOIES 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 occuring 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 ANO 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] (Oate)	______________________ (Date)

GPO 853-471

APPENDIX L. GEOTHERMAL LEASES ON PRIVATE AND STATE LANDS IN THE ISLAND PARK GEOTHERMAL AREA (IPGA)

Idaho

Township - Range - Section (acreage where known)

Private

14N-44E-8 (120 ac.)
-9 (480 ac.)
-16 (600 ac.)
-17 (320 ac.)

13N-43E-23
-25 (280 ac.)
-26 (320 ac.)

13N-44E-31 (240 ac.)
-32 (40 ac.)

12N-44E-5 (160 ac.)
-6 (3 leases) (160 ac.)
-7 (360 ac.)
-8 (480 ac.)
-9 (300 ac.)
-10 (280 ac.)
-17 (160 ac.)
-20 (40 ac.)

11N-41E-14
-15
-17
-18 (2 leases)
-19 (2 leases)
-20
-29
-30
-31 (2 leases)
-32
(roughly 2985 ac.)

9N-42E-1 (280 ac.)
-6 (560 ac.)
-7 (360 ac.)
-10 (40 ac.)
-11 (120 ac.)
-14 (83.2 ac.)
-17 (240 ac.)
-18 (240 ac.)
-19 (40 ac.)

9N-43E-10 (310 ac.)
-11 (2 leases) (600 ac.)
-12 (2 leases) (200 ac.)
-14 (320 ac.)
-15 (2 leases) (620 ac.)
-16 (120 ac.)
-18 (120 ac.)
-19 (2 leases) (101.01 ac.)
-21 (40 ac.)

9N-44E-25 (nearly 80 ac.)

Township - Range - Section (acreage)

State Lands

13N-44E-4 (80 ac.)
-9 (160 ac.)
-10 (320 ac.)
-16 (640 ac.)
-19 (262 ac.)
-30 (320 ac.)
-36 (640 ac.)

13N-43E-16 (640 ac.)
-36 (640 ac.)

13N-42E-36 (640 ac.)

12N-42E-16 (640 ac.)
-36 (323 ac.)

12N-43E-16 (640 ac.)
-36 (640 ac.)

12N-44E-16 (160 ac.)

11N-43E-16 (640 ac.)
-36 (640 ac.)

11N-42E-16 (640 ac.)
-36 (640 ac.)

11N-41E-16 (640 ac.)
-36 (640 ac.)

10N-43E-16 (640 ac.)
-36 (640 ac.)

10N-44E-16 (640 ac.)

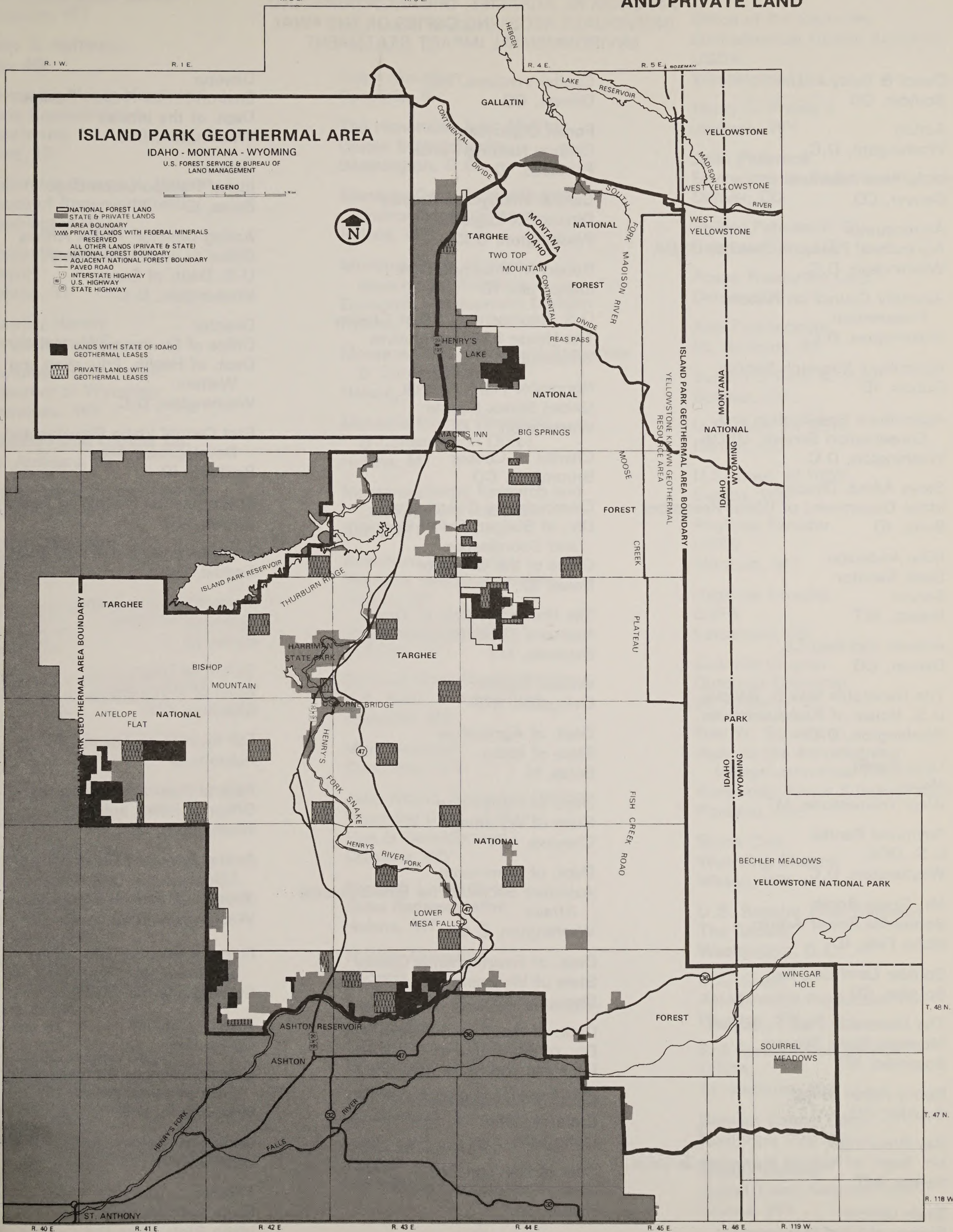
9N-43E-16 (400 ac.)

TOTAL FOR STATE LANDS: 12, 905 acres leased

TOTAL FOR PRIVATE LANDS: roughly 11,800 acres leased

GRAND TOTAL: 24,705 acres leased

22. GEOTHERMAL LEASES ON STATE AND PRIVATE LAND



APPENDIX M. AGENCIES, ORGANIZATIONS AND INDIVIDUALS RECEIVING COPIES OF THE FINAL ENVIRONMENTAL IMPACT STATEMENT

Denzil & Betty Acklin
Boulder, CO

Action
Washington, D.C.

M.N. Moe Adelman
Denver, CO

Adminstrator
Agricultural Research Service, USDA
Washington, D.C.

Advisory Council on Historic Preservation
Washington, D.C.

Agriculture Research Service
Dubois, ID

Agricultural Stabilization and Conservation Service, USDA
Washington, D.C.

Steve Allred, Director
Idaho Department of Water Resources
Boise, ID

Mike Anderson
State Senator
Senate
Helena, MT

Atlantic Richfield Co.
Denver, CO

The Honorable Max S. Baucus
U.S. House of Representatives
Washington, D.C.

Larry Benfit
Mayor
West Yellowstone, MT

Raymond Berube
U.S. DOE
Washington, D.C.

Mr. Gregg Booth
Bonneville Power Admin.
Idaho Falls, ID

Boulder Land Co., Inc.
Boulder, CO

The Honorable Paul F. Boylan
Montana State Senator
Bozeman, MT

Nancy Alden Bragg
Boulder, CO

Ray Breuninger
Mt. Dept. of Natural Resources & Cons.
Helena, MT

State Director
Bureau of Land Management
Boise, ID

Capital Ventures, Inc.
Denver, CO

Forest Supervisor
Caribou National Forest
Pocatello, ID

Central Intelligence Agency
Director of Logistics
Washington, D.C.

Robert N. Chappell, DOE
Idaho Falls, ID

U.S. Representative Dick Cheney
The House f Representatives
Washington, D.C.

Honorable Frank Church
United States Senate
Washington, D.C.

Charles H. Cooper
Broomfield, CO

Clearinghouse Coordinator
Div. of Budget, Policy Planning and Coordination
Office of the Governor
Boise, ID

The Honorable Dale H. Davis
Montana State Representative
Belgrade, MT

William DeBoer
Livingston, MT

Dept. of Agriculture
State of Idaho
Boise, Id

Dept. of Agriculture
State of Wyoming
Cheyene, WY

Dept. of Commerce
Assistant Secretary for Environmental Affairs
Washington, D.C.

Dept. of Environmental Quality
State of Wyoming
Cheyene, WY

Dept. of Health and Welfare
Div. of Environment
Pocatello and Boise, ID

Dept. of Fish and Game
State of Idaho
Idaho Falls, ID

Dept of Fish and Game
State of Montana
Helena, MT

Dept. of Parks and Recreation
State of Idaho
Boise, ID

Director
Environmental Project Review
Dept. of the Interior
Washington, D.C.

Director
Idaho Transportation Dept.
Boise, ID

Acting Director, NEPA Affairs
Office of the Environment
U.S. Dept. of Energy
Washington, D.C.

Director
Office of Environmental Affairs
Dept. of Health, Education and Welfare
Washington, D.C.

East Central Idaho Planning and Development Assn.
Rexburg, ID

Environmental Protection Agency
Denver, CO

Environmental Protection Agency
Seattle, WA

Honorable John Evans
Governor of Idaho
Boise, ID

Executive Dept.
State of Wyoming
Cheyene, WY

Fall River Rural Electric Co-op
Ashton, ID

Federal Railroad Administration
Office of Policy and Plans
Washington, D.C.

Acting Assistant General Counsel for Litigation and Environmental Protection Federal Trade Commission
Washington, D.C.

Fremont Outdoor Education and Recreation, Inc.
St. Anthony, ID

Joel L. Frykman
Ogden, UT

General Services Administration Environmental Affairs Div.
Washington, D.C.

Geological Survey of Wyoming
Laramie, WY

Thomas J. Green
State Archaeologist
Idaho State Historical Society
Boise, ID

Van K. Haderlie, State
Conservationist
Soil Conservation Service
Bozeman, MT

John A. Hafterson
Elko, NV

Honorable Melvin Hammond
State Representative
Statehouse
Boise, ID

Honorable George V. Hansen
House of Representatives
Washington, D.C.

Honorable Jim Harrell
Mayor
Ashton, ID

Dorothy Harvey
Manitowoc, WS

Honorable Ed Hershler
Governor of Wyoming
Cheyenne, WY

Edward Hines Lumber Co.
St. Anthony, ID

Idaho Environmental Council
Idaho Falls, ID

Idaho Lands Dept.
Statehouse
Boise, ID

Idaho Office of Energy
Statehouse
Boise, ID

Honorable Thomas L. Judge
Governor of Montana
Helena, MT

Dr. G.T. Kien, M.D.
Elko, NV

Joe Kirn
Denver, CO

Robert Lavington
Denver, CO

The Honorable Everett R. Lensink
Montana State Senator
Bozeman, MT

Dave LeRoy
Attorney General's Office
Statehouse
Boise, ID

Louisiana-Pacific Corp.
Rexburg, ID

William W. Lyons
Naturita, CO

Honorable James A. McClure
U.S. Senate
Washington, D.C.

Glen McKay
Mayor of Island Park
Island Park, ID

Michael R. McSorley
Pocatello, ID

Ralph Maughan
Pocatello, ID

The Honorable John Melcher
United States Senate
Washington, D.C.

Montana Dept. of Health and
Environmental Science
Helena, MT

Montana Dept. of Inter-
government Relations
Economic Development Division
Helena, MT

Montana Dept. of Natural Resources
& Conservation
Helena, MT

Montana Energy Research
& Conservation Office
Helena, MT

Montana Energy Research and
Development Institute
Butte, MT

Attention: Ken Korte
Montana Historical Society
Helena, MT

Moore and Company
Littleton, CO

National Agricultural Library
U.S. Dept. of Agriculture
Bettsville, MD

Mark Newman
Sundance, WY

John Niland, Executive Director
Wyoming Dept. of Econ.
Plan & Development
Cheyene, WY

Kenneth L. Nordtvedt
State Representative
Helena, MT

Nuclear Dynamics
Phoenix, AZ

Office of the Assistant Secretary
of Defense
Department of Defense
Washington, D.C.

Office of Economic Opportunity
Washington, D.C.

Office of Equal Opportunity
USDA
Washington, D.C.

Office of the General Counsel
USDA
Washington, D.C.

Office of the Secretary
Environmental Quality Activities
USDA
Washington, D.C.

Henry C. Phibbs II
Jackson, WY

John Philbrook
Environmental Protection Agency
Denver, CO

Phillips Petroleum Co.
Salt Lake City, UT

Power Resources Corp.
Denver, CO

Ann Puddicombe
St. Anthony, ID

Vernon & Beth A. Pugh
Boulder, CO

U.S. Dept. of HEW
Denver, CO

U.S. Dept. of HEW
Seattle, WA

Regional Forester
USFS
Missoula, MT

Regional Forester
USFS
Lakewood, CO

Sawtelle Chapter
Outdoors Unlimited
St. Anthony, ID

Dan W. Schausten
Asst. to the Administrator
Intergovernmental Relations
Bonneville Power Administration
Portland, OR

Sierra Club
Wyoming Chapter
Wilson, WY

U.S. Senator Allan Simpson
The Senate
Washington, D.C.

P.A. Smith
ANADARKO Production Co.
Houston, TX

Soil Conservation Service
USDA
St. Anthony, ID

Stewart Captial Corp.
New York City, NY

Superintendent
Grand Teton National Park
Moose, WY

Superintendent
National Park Service
Yellowstone National Park
Mammoth HQ., WY

Honorable Steven Symms
House of Representatives
Washington, D.C.

Trout Unlimited
Bozeman, MT

U.S. Dept. of Agriculture
Office of the Secretary
Washington, D.C.

U.S. Dept. of Agriculture
Science and Education Admin.
Beltsville, MD

U.S. Dept. of Agriculture
Soil Conservation Service
Boise, ID

U.S. Dept. of Health, Education
and Welfare-Public Health Service
Atlanta, GA

U.S. Dept. of Health, Education and
Welfare
Denver, CO

U.S. Dept. of Interior
Washington, D.C.

U.S. Dept. of the Treasury
Washington, D.C.

U.S. Senator Malcolm Wallop
The Senate
Wshington, D.C.

Water Resources Council
Washington, D.C.

WESTFORNET
Ogden, UT

The Wilderness Society
Boise, ID

Wildlife Management Institute
Washington, D.C.

The Wildlife Society
Idaho Chapter
Boise, ID

Betty Wilson
Boulder, CO

Senator Bob Wilson
Sacramento, CA

John J. Wilson
Denver, CO.

Wyoming Recreation Commission
Cheyenne, WY

Wyoming State Engineer's Office
Cheyenne, WY

Betty N. Wilson
1900 Bluebell
Boulder, CO 80302

April 29, 1979

U. S. Department of Agriculture
Forest Service
Targhee National Forest
420 Bridge St.
St. Anthony, ID 83495

Attn: David M. Jay, Forest Supervisor

Dear Sir:

I wish to add my thoughts to statements made regarding Geothermal leasing at Island Park area.

When bears, grizzly bears, kill people more often than polio in the United States, why do you think it necessary to make a sanctuary for them in any area near people? You know they are shot in Yellowstone Park, so are they an endangered species? If they are, are they endangered enough?

If Idaho's local residents in the actual Island Park area prefer the leasing to begin, why don't you make a start at once! Idaho has.

Surely even you must know how badly we need Geothermal steam electricity generation. How else will we avoid total dependence on a vanishing fossil fuels supply? Coal is so dirty and environmentally damaging in comparison to geothermal, solar, or ocean tide systems. Nuclear systems are so little understood as to be a dangerous mystery, while geothermal has been at work at Larderello, Italy since 1904 with no violent or transient damage to the countryside or its animal, bird, or vegetable residents.

With all the uses Island Park Caldera's terrain has endured rather safely, what harm do you anticipate from geothermally produced electricity?

You have to agree that geothermal is the very best use for that area, otherwise would not pre-emption already have taken place? You cannot move a geo heat source but you can move a sheep, camp, or cattle corral. Why not let natural conditions determine how to go. If it's hot, then it's not for housing or grizzly bear pasture. With black bears being killed year round, why worry about them till state seasons change?

Will there really be public hearings, I mean accessible public hearings, not some woodshed a million miles from anywhere? Please advise that one nearest to my home at once. (1)

What priority has the American taxpayer on your descending order of importance? Seems to me he's last after the Buffalo nickel.

One final question for you, just who will decide whether applications become leases? What are his qualifications, connections, and where can he be reached by mail and telephone? (2)

page 2 David M. Jay April 29, 1979

Leasing whatever area qualified people want to explore seems to me to present advantages unknown to you at this time.

If you are in San Francisco as you see the Golden Gate Bridge back-dropped by the "City of Seven Hills'" many lights, please think of Geysers, California where most of metropolitan San Francisco's electricity is produced. Pacific Gas and Electric's plant there is our country's only, only one. Perhaps you will help change that.

Two million acres for grizzlees is enough. Yellowstone will suffice. Don't turn out the light in Idaho.

Let's lease 1974 to 1979 not 1984, Big Brother.

Sincerely,

Betty N. Wilson

Betty N. Wilson

BETTY N. WILSON

1. At this time, no hearings are planned.

2. The responsible officials listed on page i of the EIS are responsible for the decision of land available for leasing. The Secretary of the Interior is responsible for issuing and administering the leases.

1445 N. 10 St.
Manitowoc, Wis. 54220
May 11, 1979

David M. Jay
Forest Supervisor
Targhee National Forest
420 N. Bridge St.
St. Anthony, Idaho, 83445

Dear Mr. Jay:

I appreciate this opportunity to comment on the Draft Environmental Statement of the Island Park Geothermal Area, Idaho, Montana, Wyoming. Please include these comments in the record.

I support Alternative #1 - NO LEASING - for the following reasons:

There are too many serious unknown and undeterminable factors in geothermal resource development in itself, and in its direct and indirect impacts on both the Island Park area and on Yellowstone Park geysers and wildlife,to allow exploration and development at this time in this place. The need for this power has not been demonstrated nor, in this Draft EIS, has the Forest Service addressed alternative power supply and economic opportunities. The No Leasing Alternative, as opposed to five alternatives for exploration and/or development, appears to be predicated on the acceptance of geothermal development in the area and on belief that this development could be monitored on public lands and not on private. My objection is that the Forest Service is not presenting as economic alternatives, two products of the public lands, namely recreation and pulp mill production of timber, in conjunction with already developing power sources in the region. Consequently, the Draft EIS is misleading.

Alternatives I see are protecting this very valuable wildlife and recreation resource area associated with Yellowstone Park for these uses at all costs and further developing geothermal sites at Imperial Valley, Los Alamos (Valle Caldera), and in Nevada. I have no confidence that the Forest Service will have any greater success at controlling geothermal development impacts on these public lands than it had controlling phosphate ore strip mining on Caribou National Forest south of Island Park.

I would like to comment on specific issues.

A. Association with resources in Yellowstone National Park.

1. Geothermal resources

Protection of the geysers was the basis for the establishment of Yellowstone Park in 1871. The enjoyment of these natural features as well as the wildlife is the primary basis for the enormous popularity of the Park today.

Being in such close proximity to Yellowstone National Park, underground interconnections of water and geothermal and seismic activity between Island and Yellowstone Park areas cannot be determined with certainty and, ultimately, indirect impacts on Yellowstone's resources cannot be avoided. It is my belief that activities connected with various techniques of exploration and development of geothermal energy do not lend themselves to predictable consequences for neighboring resources. At this time, the risk is too great.

2. Association with wildlife resources.

The State of the Art of determining interdependencies of wildlife species on a composite of habitats in a region is only beginning. Total territorial requirements for all mammal and bird species using the Yellowstone -Island Park area cannot be determined. For the Grizzly bear, wolverine, cougar, Canada lynx, bobcat, northern Rocky Mountain wolf, Golden Eagle, Bald Eagle, Marsh hawk, osprey, Prairie falcon, Peregrine falcon, species of hawk, owl, Upland game birds and bats, which are already of special concern to management agencies, the further attrition of habitat may be critical for their survival in this area.

These and other wildlife species enrich the enjoyment of the visitor in Yellowstone National Park.

It is wholly unrealistic for the Forest Service to take a position that it has or will use the power to contain the expanded development of geothermal sites. The whole pattern of geothermal development involves the opening up of new drill sites when others are depleted. The only protection of the many wildlife species existing in the Island Park- Yellowstone Park area is no exploration and no development to begin with at this time. 100 years down the line, the country may not need geothermal energy and may desperately need an Island Park - Yellowstone Park sanctuary.

Of great importance to many individuals will be possible impacts on the aquatic environments of Yellowstone rivers. and lakes. Fishing is a high priority to thousands of Yellowstone Park visitors. Changes in water quality from ground water disturbances or from air pollution are an unwarranted risk.

B. Character and Value of the Island Park area.

As explained in the Draft EIS, this area is still relatively undeveloped. A few small towns, National Forest and BLM lands, both private and Agency developed campsites for enjoyment of the stream and reservoir fishing opportunities, hunting activities and high winter snowmobile use of old Forest Service logging roads, tourist services, sheep and cattle grazing, logging, some manufacturing, and headquarters for State and Federal employees make up the way of life!

Recreation use of the area increases in summer from local sources but also from spillover from broad-based recreation use of the western Montana, northwest Wyoming, and Idaho outdoor resources. Joint highways 20 and 191 connect Idaho falls and southern Idaho to West Yellowstone and Bozeman,Montana - the major north/south highway in eastern Idaho and it runs through Island Park. This is the connecting highway for fishing the epitome of fly fishing - the Madison River (Montana) and all other outstanding National Forest and National Park outdoor resources in this Northern Rocky Mountain region.

As a State, Idaho is second to none in the quality of its wildlands resources in this nation: forests, wild rivers, wildlife. Yet it has been unable or unwilling to determine means to protect these or to develop an economic base for their use. Magnificent streams have been destroyed by dredge mining for gold and rubies; spawning sources for Pacific Ocean salmon have been destroyed from siltation from logging; highly productive meandering meadow streams - unique in the country, valley basins, and forest lands all harboring valuable wildlife and fish resources are being lost to phosphate ore mining developments*; oil exploration and developments threaten Grays Lake National Wildlife Refuge and valuable wildlife resources on the Idaho/Wyoming border. Now, adding greater attrition to this State's irreplaceable wildlife and recreation resources, comes proposed geothermal development

And, all this takes place at a time when the economic returns to the State from hunting, fishing, associated recreation, and management of these has been the second highest in the State budget. All this takes place when national recreation statistics show for 1978:

Type of Recreation	Number of People (millions)	% Population
Hunting	32.6	19
Fishing	91.0	53
ORV	43.6	25
Hiking/Back packing . .	48.1	28
Snowmobiling	13.8	8

*While forests are strip mined and canyoned at great pace, millions of tons of the phosphate ore mined is stored around the country pending a favorable market!

And shows:

Sport Fishing and Hunting 1950-1976

License Sales	No. People - 1950 (millions)	No. - 1976 (millions)
Fish License Sales	15.3	34.9
Cost to Anglers	$34,000,000	$155,000,000
Hunting License Sales	12.6	25.3
Cost to Hunters	$38,000,000	$164,000,000
Duck Stamps Sold	1,955,000,000	2,170,000,000

And shows:

Recreation Vehicle Sales	1961	1977
Camp Trailers	18,000	53,900
Truck Campers	15,800	31,900
Motor Homes (1965)	4,700	160,200
Travel Trailers	28,800	167,900
Pick-up Covers (1970)	91,700	211,700

C. Changes in the Character and Values of Island Park

Exploration for geothermal energy sources in this area are likely to be successful. Development of these energy sources is highly probable. The consequence of the introduction into the Island Park of - cities, highways, roads, new accesses, power lines, associated development structures, new housing, introduction of new populations,(temporary or permanent), jobs benefitting outsiders, locals paying taxes for increased services - will effectively change the area's quality for recreation and for wildlife. Despite assurances of the Forest Service that development will be controlled - any mineral development, such as geothermal, is exponential in impact. The urban development it creates in turn creates demand for increased geothermal energy production. For wildlife and existing type recreation this is a no win proposition - for now or for 100 years down the line.

D. Wildlife Resources in the Island Park area

Today, our public lands provide the only significant areas for habitat protection. These public lands, because of their topographic, vegetative, land type, and planned management features, are our guarantee that some representations of the spctrum of our nation's wildlife resources will remain a permanent part of our heritage. To paraphrase a TV comic: "What we'll have is what you now see"

Wildlife is a renewable resource only so long (as) and to the degree its habitat requirements are being met. A black backed-3-toed-Woodpecker woodpecker is not there because of happenstance. And this Woodpecker, in the economy of nature, needs protection as well as the grizzly! So do all the 5 amphibians, the 8 reptiles, the 179 species of birds, and the

61 species of mammals who find and utilize varieties of habitat types in the Island Park area. According to Appendix E. "Wildlife Species Orientation to Habitats" in the Draft EIS, individual species use as many as 31 different types of habitat for their survival: completing their life cycle, locating food, cover and water.

What this statement is saying is that in the IPGA area, for each of the animal, bird, reptile and amphibian species existing there, the land topography, vegetative mixtures, altitudinal variations, different forms of water-ponds, wetlands, marshes, streams, rivers, lakes - all contribute the intermix of habitat in demand.

What this is saying is that a Golden eagle, using 29 habitat types, depends upon the prey species of bird, rodent, reptile, small mammal for its survival which, in turn, is dependent upon the varying habitats being present for each particular prey. The technology of determining how many, and which ones of these 29 types is expendable, or which will tip the scale for survival of the Golden eagle in that area, is not yet available.

What this is saying is, that in the past when wildlife was forced out of habitat areas, it was possible to locate elsewhere. Today, with our nation so developed, existing habitat is already occupied to optimum carrying capacity and species moving in must occupy periphery and frequently less desireable areas where the variety of habitat types is missing. Hence, many species cannot survive.

While we have management agencies responsible for public resources on our public lands, their Multiple Use mandates put constraints on protecting wildlife and its habitat requirements. In addition, an Agency such as the Forest Service has neither staff or funds or expertise to follow through in protecting species when development occurs. This Agency cannot yet do this in logging operations; it cannot do this under conditions of varying land and water disturbances of geothermal development, nor even in control of drill site locations.*

Wildlife specialists are only beginning to comprehend the requisite conditions under which our wildlife heritage survives and the magnitude of ecological disruption man's land developments create. It is up to a public, then, who values wildlife, to make choices in saying that the satisfaction of human needs can be met in ways which do not sacrifice irreplaceable wildlife existence.

* For the grizzly bear, the specialists have stated that 136,000 acres, or 25% of the IPGA is critical habitat. The degree of protection of the 27 utilized habitat types in the IPGA, under geothermal development, cannot be guaranteed.

Relative to development of the IPGA, a number of questions are to be asked which are not discussed in the Draft EIS but which will arise if and when geothermal development activity shows its impacts.

1. In view of the massive degree of ecological disruption taking place - area wide - today, in States like Idaho, for mineral and energy developments, what is the cumulative effect on wildlife and stream resources likely to be in a perspective of loss of wildlife from:
   a. phosphate ore strip/canyon mining in S.E.Idaho on National Forest, BLM, State and private lands which was a significant wildlife resource area.(terrestrial water oriented and aquatic species)
   b. oil and gas exploration and development in this same region and around Grays Lake National Wildlife Refuge, and along the Idaho/Wyoming border
   c. excessive logging in the past in Idaho's National Forests where the return of all wildlife species will take up to 100 years, some lost forever with logging of old growth forest
   d. modifications of rivers and streams and their riparian ecosystems from dredge mining of hundredes of streams; from destruction of spawning tributaries for Pacific ocean Salmon and steelhead, such as the S. Fork Salmon River, from uncontrolled logging and siltation of the aquatic habitat; from dams and overappropriation of water in the Snake River.
   e. geothermal development at IPGA

2. Is the Island Park Geothermal Area expendable for wildlife and stream resources in this perspective as well as in a perspective of alternative choice?

3. In an area (IPGA) where wildlife survival conditions vary from status of Rare and Endangered, Threatened, disappearing, unable to relocate, migratory area dependence, habitat requirements too diverse, no funds to evaluate habitat - on which side of the fence will managing agencies attempt to salvage species?
   - Only the Peregrine falcon, Northern Bald Eagle, Northern Rocky Mountain wolf, Grizzly bear?
   - Trumpeter swan, sharp-tailed grouse, ferruginous hawk, prairie falcon?
   - Wolverine, Canada lynx, fisher, pine marten?
   - Elk and deer?
   - Upland Game birds and waterfowl?
   - or the Fringed, Long-legged, or California myotis or Yellow-breasted Chat?

   There is no "guaranteed" safety for habitat even under the Endangered Species Act today - let alone habitat protection for non-threatened species in their diversity.

4. Where development alternatives exist, on what basis is wildlife habitat preservation assured?

E. Stream Resources

A major thrust of the Carter Administration Water Policy is directed at river and stream protection. The nation's waters have taken on importance for their varieties of recreation use. In all development proposals, the public lands managing agencies are required to consider stream protection as well as alternatives to developments which will impact these resources. Along with this are Executive Orders to protect wetlands and floodplains within the area of jurisdiction.

The Forest Service has pointed out the qualities and importance of streams and their fish production and uses in the IPGA. "The Sport fishery in Henrys Fork on the IPGA attracts fishermen from throughout the nation. With annual use of nearly 95,000 angler days (valued at nearly 1.4 million dollars annually), and a catch of 175,00 salmonids (mostly trout) in 1973, this reach of Henrys Fork is possibly the most important stream in the State of Idaho". Henrys Fork of the Snake River is the major drainage system with the IPGA and as a combination of high natural fertility and phsycial characteristics, it provides for an outstanding cold water fishery. Twenty four other streams in IPGA were evaluated as fisheries. All offer opportunities in meeting the increasing demand for fishing streams today.

The Forest Service has also spelled out the interlocking relationships of supporting and spawning streams, such as the S. Fork Madison River and others to fishery sport in Hebgen Lake and the Island Park Reservoir.

Associations of these rivers with riparian wildlife use, in watershed, in wetlands perpetuation are not dealt with directly but are implied in the listing and discussions of wildlife species associated with water oriented habitat.

It is my opinion that the same criterea to be applied to the issues on wildlife protection, apply to stream and wetlands protection:

1. The value of these resources to a nation, to Idaho, and to the future on recreation and economic terms.

2. The increasing rarity of such resources in the perspective of stream degradation, attrition, and lost productivity already in the State.

3. The existing inability of streams to meet the productivity demanded by a fishing public today. We've come to a point where fish caught have to be put back: the sport is in the challenge!

4. The incapability of the managing agencies to adequately protect stream quality and quantity under conditions of geothermal development in the area. For various reasons, these Agencies have failed under other developments in

the past. Laws, regulations, obligations nothwithstanding, there is insufficient reason to suppose that management of these resources,in this area,under these conditions of development will be any more successful.

F. Agency Failure to Deal with Alternatives to Geothermal Development

The Forest Service Draft EIS on Geothermal Development in the Island Park area falls short of the needed socio-economic presentation required for decision making by the public. While the Agency ably presents the existing job spectrum, population spread, and related information, it then stops short in incorporataing alternatives relating directly to its timber and recreation resources for economic productivity in the area: development of pulp mills for National Forest timber and expanded recreation opportunities. With both "products" of National Forest lands already providing significant economic returns to the State economy, it would seem that the Agency should pursue different alternatives which take advantage of the availability of these resources. For example: production for use of dead timber. Outlets for this resource are only suggested as existing. In addition, markets for tops and discarded tree portions for greater utilization of the timber resource need to be considered.

The Forest Service also neglected to present alternatives already existing or being developed for energy. At the very time exploration and development of energy resources is taking place at many levels of supply throughout the Rocky Mountains and the west, there are no figures explaining the related importance of these to geothermal development at Island Park. (1)

Either by oversight or purposeful default, this information is ommitted, yet it is a relevant and necessary factor in public decision making. Inasmuch as the Forest Service, Region IV, is right in the midst of involvement of oil and gas exploration and development in the Rocky Mountain "rift" on Forest lands, and is privy to information on other sources of energy potential in the region, the failure to include alternative energy options is misleading to the public. It creates a "bias" for geothermal energy development without justifying a need.

A great problem for a local public is in knowing what is coming down the pike. Fair trade-offs cannot be made on the basis of incomplete information. If the EIS process does not obligate the consideration of other information pertinent to an issue, this should be stated.

A public can trade-off resources unncecessarily, losing income related to resources for years. Very valuable Forest* land and its continuing wildlife productivity was traded off in the development of phosphate ore under impressions its exploitation was critical then, only to find millions of tons were and are stored pending favorable markets!

*Caribou National Forest

DOROTHY HARVEY

1. An evaluation of this type is not within the scope of this EIS.

G. Since there are many questions to be asked about Geothermal Development which relate to impacts on IPGA which cannot be dealt with briefly and adequately in this comment, they will be listed as this commentator sees them as issues.

1. With imperfections of technologies unresolved, particularly for liquid dominated type of hydrothermal reservoirs, which is the geothermal type most likely available for development in the IPGA, alternate site areas need to be examined and developed first. "Geofluids in these type reservoirs are difficult to utilize - witness the long period of development of the extensive hot-brine fields in the Imperial Valley- Salton Sea area of southern California", according to "Geothermal Energy Development", John C, Rowley, Associate Division Leader, Los Alamos Scientific Laboratry, U. of California, at Los Alamos.*

Dr. Rowley further states that each geothermal resource type has problems associated with its development, some specific to that type, some common to all types. Problems exist with poor accessibility of the most promising source regions; lack of established, economic technologies for conversion and utilization of heat; high risk in exploring for promising new fields together with high costs both for exploration and the development of extraction technologies.

Specifically, there are problems related to present drilling technology, and corrosion and scaling problems associated with the use of natural hot water reservoirs. "Highly saline and mineral-laden brines result from the fact that solubility of most minerals increases with the temperature of the water in the reservoir. Water hot enought to be valuable for commercial exploitation is usually highly mineralized and so is high corrosive to most common metals that would ordinarily be used to construct surface piping and conversion equipment. Furthermore, the fluids can depost large quantities of silica, carbonates, and other compounds as their thermal energy is removed".*

The entire field of high temperature electronics associated with geothermal energy - geopressured, hot water, vapor dominated and hot, dry rock - involves formidable and largely unsolved technologies. "Even with the development of suitable temperature-hardened electronics, there is still a need to extend the temperature capabilities, develop new ideas and discover new techniques to sense the down hole parameters needed for geothermal well-logging and experimental monitoring in their high-temperature, corrosive environments." *

"In looking to practical control of corrosion effects by geothermal brines, control of corrosion, erosion and scaling can be achieved to some extent by surface treatment of the fluid."

* Physics Today - January 1977

2. What statements like this are telling us WE ARE DEALING WITH:

a. Uncertainties; underground resource; location; type of geothermal resource available for development; unresolved technologies for development; unresolved issues of disposal of fluids; unknown impacts from pollution in air, on land surfaces, and in waterways; undeterminable impacts on wildlife habitat and aquatic environments; length of time unknown for development, and growth of development, or permanent alteration of the uses of Island Park.

b. We are also dealing with enormous uncertainties as to the effects of all these aspects of development on all natural resources in Yellowstone Park: surface, air, water, geothermal resources.

C. Such disruptions, by the very magnitude of unknowns about the resource, itself, its development and its impacts, appears to be beyond the scope of environmental protection of any or all managing agencies, and their laws and regulations. For we are going back in time - hundreds of thousands of years.

The adaptability of vegetative cover over areas of thermal activity close to the earth's surface has taken place over thousands of years of evolution as has the wildlife and stream environmental accommodations. Neither restoration technologies, for vegetation recovery or wildlife use, exist. Where are adequate funds to come from for restoration of possible chemically altered soil and water? What restoration is possible, in what time frame, and for what purposes 100 years hence?

It is my opinion that NO LEASING for geothermal development should be the position taken by the Forest Service. All alternatives for production of energy and for economic development of the Island Park area have not been explored - either by the Federal government or by the populace. Since resources to be affected by geothermal development both in Island Park and in Yellowstone Park belong to the nation's public, the protection of resources highly valued by them need to be considered above what are considered immediate energy needs - with geothermal energy what is at hand. The greater benefits for the greater number of citizens are to be found through no geothermal development here.

Dorothy Harvey

Denzil Acklin
3943 15th St.
Boulder, Colorado 80302

April 29, 1979

U.S. Department of Agriculture
Forest Service
Targhee National Forest
420 Bridge St.
St. Anthony, ID 83495

Attn: David M. Jay, Forest Supervisor

Dear Sir:

I feel it's necessary to let the Forest Service know that they are not alone in wanting what's best for the Island Park, Idaho area.

What's best is what's best for the lower forty eight states is apparent: let the area be leased, explored, evaluated, and power brought on as quickly as possible for we are hurting for energy nationally.

Self-renewing, a clean power source, so little disturbance to the land, really space use efficient. All those apply to Geothermal steam produced electricity. No train-loads of ashes, no diesel tankers, no costly rail lines to maintain, so why not get started issuing leases? Helicopter serviced power lines are common in my also mountainous state.

Bears, birds, sheep, cattle, deer, elk rodents, wildcats are not threatened by the energy shortage. I am! And so is every American, so get on with the program.

Who will make the decision to lease? How was he or them chosen? How can I contact him? Please furnish names, addresses, telephone numbers, so that I may do so. (1)

Go with Alternative six (6) or just let the professional geologist select the area to explore for Geothermal product on the basis of geological excellence.

Do rise above petty politics and think big. It is up to you.

Lease Please!

Yours truly,

Denzil Acklin

Denzil Acklin

Betty Acklin

P.S. Why the delay?

DENZIL & BETTY

1. The responsible officials listed on page i of the EIS are responsible for the decision of land available for leasing. The Secretary of the Interior is responsible for issuing and administering the leases.

VERNON PUGH

Vernon Pugh
4293 Graham Ct
Boulder, Co 80303

May 18,1979

Mr. David M. Jay
Forest Supervisor
Targhee National Forest

Enclosed you will find what I feel are pertinent comments and questions to your environmental impact statement for leasing and development of Geothermal resources in the Island Park Geothermal Area.

I feel it is necessary to develop to the maximum any possible source of energy. This has been underlined by the recent critical developments in the oil and gas situation in the Country.

I think it is time you people get the lead out and begin to be more responsive to the needs and rights of people and not be so concerned about bears and minor surface disruptions.

As far as I can see there is sufficient protection for ground surfaces built in under the normal Federal regulations for operation on Geothermal leases. Geothermal Energy is the cleanest energy I can think of and should by developed wherever possible in preference to coal or nuclear power. I know it can't completely replace them but it can certainly be a valaable additional source of energy.

I think that if the conservationists have their way there won't be a damn thing done about solving the Country's energy problems if it means disturbing a stick or stone in some animals habitat.. I'm not an advocate of tearing up our environment but I also think that there can be a balance between our needs.

I think that leasing for Geothermal Energy should be allowed anywhere outside Yellowstone park. The Geology itself has to be the determinant factor in development. The subsurface structures cannot be moved and you have to develop where they are found not at the pleasure of over zealous conservationists who feel that surface features should be the only consideration.

Yellowstone Park has been set aside to protect the natural environment for the animals and people native to the Island Park Area. There will never be any development in the Park itself. This is a huge area that provides plenty of space for bears and other wildlife. If the conservationists have their way anywhere a bear might roam than that spot is inviolate and can't be touched. I say this is Bull Hockey.

No one has shown me proof that,other areas where geothermal energy has been developed properly, has had an adverse effect on wildlife.

I believe that alternative #6 appears to be the only logical alternative since it would allow development to take place where the subsurface geology dictates. The othere appear to cut across geological areas with no regard for subsurface conditions.

It seems to me that it would certainly be easier to adjust surface conditions than subsurface formations. Geothermal energy is where you find it. The surface of Island Park Area is presently being used for logging, cattle grazing, hunting, bird hunting, fishing and real estate development to mention a few of the current uses. Why not Geothermal exploration?

What is the best use of the area. You can make a case out for anything if you try hard enough. If there is commercial geothermal power in certain areas of Island Park than I would think that the develppment of this power would certainly be as important to the country as other activities going on at present in the area.

There is plenty of area in Yellowstone Park for Grizzlies. YOur report indicates that black bear populations are high in spite of year yound hunting. With as little disturbance as geothermal exploration would create I see no proof that Grixzlies would become extinct in the Island Park Area.

I would like to close with a few questions that came to mind while going through your report.

1. Will there be public hearings held before your final statement is adopted? (1)
2. Who will make the decisions on what areas are leased for Geothermal exploration? Some names please. (2)
3. The peport apparantly indicates that most of the local people favor Geothermal development. Who specifically is againat it? (3)
4. Why so much concern for Grizzlies when they have to be shot in Yellowstone Park when they become a danger to tourists?

I'm not advocating doing away with wildlife but there can be a good solid working relationship between people and animals. I believe that geothermal energy wherever it can be found should be developed as an additional source of power. I don't think you can argue with the need. If you fail to allow a source of power, so desparately needed, to be developed because you are more concerned about the possible minor disruption of bears or bird nests than I hope that you have to explain to the taxpayers of this country why you adopt this attitude.

Sincerely yours,

Vernon Pugh

1. At this time, no public hearings are planned.

2. The responsible officials listed on page i of the EIS are responsible for the decision of land available for leasing. The Secretary of the Interior is responsible for issuing and administering the leases.

3. See other comments received.

Charles H. Cooper
1060 Laurel
Broomfield, Co. 80020

Broomfield, Colo.
May 8, 1979

U.S. Department of Agriculture
Forest Service
Targhee National Forest
420 Bridge St.
St. Anthony, Id. 83495

Attention: David M. Jay

Dear Sir:

In refernce to the Draft Environmental Impact Statement, Island Park Leasing, Development Geothermal Resources, Comment Invitation.

With our nation in such an energy shortage, it is necessary that everything possible be done to explore every means for energy. Island Park, Idaho area should be leased as soon as possible so that it maybe explored and evaluated for energy. What is the delay?

The bears have Yellowstone National Park. I do not feel it necssary that Island Park be set aside for them.

Who makes the decision as the leasing of this land? (1)

Will there be a public hearing? (2)

If so I'm interested in knowing when and where.

Yours truly

Charles H. Cooper

CHARLES H. COOPER

1. The responsible officials listed on page i of the EIS are responsible for the decision of land available for leasing. The Secretary of the Interior is responsible for issuing and administering the leases.

2. At this time, no public hearings are planned.

Box 111
Naturita, Colo 81422
May 10, 1979

U.S Dept of Agriculture
Targhee National Forest
420 N. Bridge st
St. Anthony, Idaho 83445

Dear Sir:

I would like to offer the following comment on the Draft Environmental Statement of the Island Park Geothermal Area.

Alternative #6 is the only one that makes sense from a geologic point of view. The subsurface geology has to be developed where it occurs.

Yours truly,
William Lyons
William W. Lyons

CROOK COUNTY MEDICAL CENTER
P. O. Box 158
Sundance, Wyoming 82729
(307) 283-1212

Mark Newman, M.D.

April 20, 1979

Dear Mr. Jay,

I think you are making a terrible mistake by attempting to analyze and calculate the possible economic value of the Island Park Geothermal Area. I don't think any of us has any business tampering with an area so close to Yellowstone. There are psychological human needs beyond calculation that are being satisfied, indeed have been satisfied for over one hundred years, by having Yellowstone's adjacent boundary areas remaining wild, untouched, and undeveloped. The matter at hand cannot be broken down into dollars and acres. To do so misses the whole point.

We run the risk of suffocating ourselves by encroaching on that which we hold sacred. We don't have to tap the IPGA. We can spend a little more elsewhere, or change our energy consumption pattern.

Sincerely,
Mark Newman

Ann Puddicombe
115 East Main #4
St. Anthony, ID 83445
April 20, 1979

Mr. David Jay
Supervisor
Targhee National Forest
420 North Bridge Street
St. Anthony, ID 83445

Dear Mr. Jay:

According to your evaluation criteria on page 76 of the IPGA DES, "a high degree of public acceptance of a proposal is desired." I am NOT submitting an acceptance.

Of the alternatives provided, I choose alternative one requesting no leasing for geothermal energy in the IPGA.

My first area of concern is about the concept of a potential factory being built on national forest lands. Unlike coal or gas installations which are short lived and CAN (although not always accomplished) reclaim the land to a natural state, a geothermal plant will require permanent structures and a lease of 75-100 years. Even federal structures (administrative facilities) are not built with such permanence.

The idea of a factory (plant) on public forest lands is a question of large dimensions.

These large dimensions are evidenced by the great impacts such a plant will have on EVERY resource. This is made quite evident in the final tables at the end of the DES. Can a forest truly function as "multiple use" with a factory that guarantees to conflict and impact every single resource of a forest? The final impression of the report is that the total forest will function around a geothermal plant, not the plant around the forest.

Secondly, I question the benefit of a geothermal plant in Island Park. The most practical benefit of a geothermal plant is "space heating." Yet the entire IPGA is sparsely populated.

Total in nearby towns	5,296
Total in county	10,523
Predicted total in county by the year 2000	15,483

Is heat for 15,483 people worth a plant that will impact a forest for 100 years?

Indications also appear that existing geothermal sources would be low in temperature thereby producing only a few of the benefits listed on page 9.

Although the RPA directs the Forest Service to provide alternative technologies to the current fossil and mineral energy sources (page 76), I do not consider a geothermal plant in the IPGA, at this point in time, as a feasible, critical or necessary option.

The NEPA of 1969 which precedes RPA also states that:

> (b) In order to carry out the policy set forth in this act, it is the continuing responsibility of the Federal Government to use all practicable means, consistent with other essential considerations of national policy, to improve and coordinate Federal plans, functions, programs, and resources to the end that the Nation may --
>
> (2) assure for all Americans safe, healthful, productive and esthetically and culturally pleasing surroundings;
>
> (3) attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;

I feel that a geothermal plant in Island Park violates the intent of other laws. In my opinion, a geothermal plant provides for one part of the law, but conflicts with many more.

If a forest is to continue as a coordinating agency for multiple use resources, a geothermal plant is not feasible.

In summary, I do not support geothermal exploration (which also causes quite a few impacts) nor a geothermal plant in the Island Park area. Nor do I feel that such a plant would be worth the impact on resources to benefit such a small community.

The idea of a factory installation (a small, polluting city) on forest lands is new and should be very carefully reviewed before any final decisions are made.

Thank you for your consideration of my comments.

Ann Puddicombe

Ann Puddicombe

4/5/79

David Eay
Forest Supervisor
Targhee National Forest
420 N. Bridge St.-
St. Anthony, Idaho- 83445

Dear Sir:-

I do not believe it would be in The best interests of the people- The environment, or the Forest itself to Allow any exploration in or around the Yellowstone National Park, or for a 20 Mile Radius from it.-

Sincerely

William DeBoer
1428 W. Park
Livingston, Mt. 59047

P.O. Box 951
Elko, Nevada 89801
May 5, 1979

Dear Supervisor:

Regarding your Draft Environmental Statement of the Island Park Geothermal Area, I wish to go on record opposing such development. I feel it is unnecessary and just another impact on wildlife populations already in jeopardy due to logging roads that were never closed after their use was finished; continued sheep grazing in critical grizzly bear habitat with resulting continued conflicts + loss of more grizzlies! The same results will be manifest if additional roads were allowed into geothermal areas.

I, therefore, favor very strongly Alternative #1 " No Leasing."

Thank you,

G.T. Klein, MD.

Michael R. McSorley
357 Franklin
Pocatello, ID 83201

March 29, 1979

USDA Forest Service
Mr. David M. Jay
Targhee National Forest
420 N. Bridge Street
St. Anthony, ID 83445

Dear Mr. Jay:

Following are my comments on the Draft Environmental Statement of the Island Park Geothermal Area:

1) I support alternative number three (3) as I believe this best supports both the possibility of limited geothermal exploration and allows minimal interference with wildlife and aesthetics.

2) While there is a complete list of species available for wildlife and birds, the species list for fish is sorely lacking. The "game fish" are readily identified but the others are just listed by a general name, i.e., suckers, shiners, dace, and sculpin. I would like to remind the Forest Service that these species are also part of the aquatic ecosystem and deserve recognition to the species level. There are taxonomic keys readily available to identify all species in the study area.

TARGHEE NF
Units: 1 2 3 4 5 6
MAR 30 79
Action | To | Info
Supv.
Planner
TM - PC
RM-WS-WL
Promise Card

Sincerely,

Michael R. McSorley

TARGHEE NF
Units: 1 2 3 4 5 6
JUN 01 79
Action | To | Info
Supv.
Planner
TM - PC
RM-W/S-WL
B&L
Engineer
A.O.
Cont.-Proc.
B&F
Resources
Personnel
Off. Serv.
Promise Card

May 31, 1979

David Jay, Supervisor
Targhee National Forest
420 North Bridge St.
St. Anthony, Idaho 83445

Dear Mr. Jay:

Please accept these comments on the Island Park Geothermal DES.

It is difficult to comment on this issue as the potential magnitude of the geothermal resource present, if at all, is so uncertain. Impacts could range from trivial to enormous.

In view of the proximity of the area to two of the nation's greatest national parks, Yellowstone and Grand Teton, however extreme caution should be the watchword. One of the reasons for establishing America's first national park was to protect the geothermal features. Any activity that would tend to damage them by means of power development would be an insult of the worst kind -- insensitivity typical of 19th Century America.

Because private investment via leasing and exploration involves substantial capital, a private firm will undoubtedly fight having a project shut down because damage is occurring to geothermal features in Yellowstone (even though shut-down seems assured in the DES). It may prove politically infeasible to protect Yellowstone once a multi-million dollar production facility has been built. In addition, fairness to private industry would dictate that the government not sell or lease a resource which it may not be able to provide. For these reasons, I suggest that the Dept. of Interior conduct all geothermal drilling, testing, etc. in the Island Park Geothermal Area to determine the magnitude of the resource and the liklihood of adverse impacts on the nearby national parks.

This proposal above (not included in the DES) represents my suggestion for the future of the IPGA.

I might say that while the DES is pretty and lavish almost all of the data directly related to the environmental impacts is totally subjective. Quantification of subjective judgments (even to decimal points), makes it no less subjective. Until more hard data is gathered, I suggest that all exploration and testing be conducted by the Dept. of Interior, not by private lease-holders. All applications to lease should be denied.

In the event that leases are granted, none should be granted with surface occupancy in areas to be designated as Class I or II grizzly bear habitat. To do so will only create an avoidable conflict. Explore other areas in Island Park instead. After all, we don't know that the resource even exists.

Thank you for considering my comments, and please send me the FES plus notice of any decisions to lease and/or approve operations by private companies through the authority of the Forest Service or the BLM.

Sincerely,

Dr. Ralph Maughan, Box 8264, Pocatello, ID

HENRY C. PHIBBS II
ATTORNEY AT LAW
MURIE CABIN
BOX 1082
JACKSON, WYOMING 83001
307/733/5004

Forest Supervisor David M. Jay
Targhee National Forest
420 North Bridge Street
Saint Anthony, Idaho 83445

Dear Mr. Jay:

I am writing to you regarding the draft Environmental Statement for the Island Park Geothermal Area Leasing which has been prepared by your office. My comments are personal.

First, I endorse the comments submitted to you by Phil Hocker, on behalf of the Sierra Club.

Of the alternatives set forth in your dES, I support alternative #1, no leasing.

The immediate proximity of Yellowstone National Park to the proposed leasing area is a fact which should mandate a considered program of testing without any leasing, so that an adequate data base can be gathered. The potental for permanent damage to the world famous and irreplacable geothermal resources of Yellowstone is significant. The dES recognizes that geothermal developments have adversely affected other geyser basins, and admits that little or no sound information is presently available regarding the harm that could be done to the geyser basins in Yellowstone. Given the known damage done to other such resources through geothermal development and the absence of data about the Yellowstone resource, I admit that I am at a loss to understand why the dES omits the alternative of a careful program of testing prior to any leasing. (1)

The technical deficiencies of the dES have been addressed by Mr. Hocker in his comments. I have the same problems with the substantive omissions and the seeming concern with structure rather than substance. The substantive issues which should have been addressed are of major national importance and the consideration of these issues should precede any consideration of action alternatives. Alternative #1, all nine lines of it, does not constitute a scientific and analytic basis for comparing a no leasing or testing without leasing alternative. (2)

With regard to the public involvement cited in the document, I question whether a workshop with citizens in Idaho can be considered a realistic method of public input in light of the importance of this issue to the American people. The interested public is the American people, who, if they could express their concern, would demand a careful program of testing without leasing to insure that the resources of Yellowstone will not be damaged.

I am aware that the preparation of this dES took a great deal of time and effort and I do not want to detract from the time and labor of those who were responsible. But the fact is that this dES falls way short of the requirements of the National Environmental Policy Act and the regulations promulgated under it. I urge you to start this process over, with a document that conforms to the requirements of law, and gives due consideration to the alternative of testing without leasing, which can determine the possibilities of geothermal development within the constraints of the Yellowstone National Park geothermal system. Nothing will be lost through such an approach, as the geothermal sources will not go away if we take the time to study them properly. Everything may be lost if you proceed to lease wihout an adequate basis for that decision.

I appreciate the opportunity to comment on this important dES and request that you include me on your mailing list for all further releases regarding this matter.

Very truly yours,

Henry C. Phibbs II

Henry C. Phibbs II

HENRY C. PHIBBS II

1. This alternative was evaluated by the Interagency Team. It was decided that it was not a viable alternative at this time because it was out of the scope of this EIS. However, it could become a definite consideration of the Secretary of the Interior subsequent to this EIS.

2. The EIS was concise to conform with current CEQ guidelines. Extensive data and information was used in the evaluation of alternatives, effects of implementation, and management requirements, constraints, and mitigating measures. These data area available for perusal at the Supervisor's Office, Targhee National Forest.

NANCY ALDEN BRAGG
ATTORNEY AT LAW
1525 ROCKMONT CIRCLE
BOULDER, COLORADO 80303
(303) 499-3259

May 3, 1979

Mr. David M. Jay
Forest Supervisor
United States Department of Agriculture
Targhee National Forest
420 N. Bridge St.
St. Anthony, Idaho 83445

Dear Mr. Jay:

This is in response to your letter to all interested parties as of March 21, 1979, concerning the leasing and development of geothermal resources within the Island Park geothermal area. I have had a lease application pending for several years on land in the Island Park area and am concerned that all reasonable and expeditious steps be taken consistent with environmental considerations to develope our geothermal resources to the maximun extent possible.

My interest in geothermal resources stems from my commitment to see our nation's clean energy resources developed. I am disturbed to see efforts placed on other resources to such a great extent as is currently being done while geothermal development appears to be largly inhibited do to the government's neglect in this matter. Geothermal would be far preferable to coal as an energy source from the standpoint of clean air; little disruption of surface topography, and the inexhaustable nature of the resource. Of course, recent events have made clear the possible disasterous consequences of using nuclear power as an energy resource. Common sence dictates the use of a clean, safe, energy supply that will not be depleted in a few years. It is what the American public demands, and it is what our survival demands.

The environmental concerns in the development of this resource by no means override the the urgent need for such development. In fact, environmental concerns are minimal with this type of resource, especially if compared to other resources as mentioned above. More over, I understand that many types of activities are now allowed in the surface areas of the Island Park land, including logging timber, grazing cattle and sheep,water well drilling, maintenance of power lines, and snow mobiling, to name but a few. It would seem that geothermal resource development would be a higher and better use for this land than snowmobiling, and would probably be a lot less disturbing to the animals! There are many legitimate uses for our national forest land; why exclude geothermal?

Also, I understand there is some concern for the grizzly bear population. It would seem that the two million acre Yellowstone park adjacent to the area in question is a sufficient sanctuary for the bears. I doubt that the grizzlys would care about geothermal development, much less be disturbed by it. Note that the black bear population remains high even though year round hunting is permitted.

It would seem that geothermal resources must be developed where you find them. Surface uses are much easier to adjust than is the subsurface grology. It should be remembered that Yellowstone park was set aside for the very purpose of protecting the animals and that geothermal resources are not to be developed in the park in any event. Why let the animals restriot energy development outside the park?

I would appreciate it if you could provide me with the names and addresses of the people who will make the decisions on what areas are leased for geothermal development. Also, will there be public hearings? If so, when and where? Do you know of any persons who are actually opposed to geothermal development in this area? Answers to these questions would be very helpful. (1)

Yours truly,

Nancy Alden Bragg

NANCY ALDEN BRAGG

NANCY ALDEN BRAGG

1. The responsible officials listed on page i of the EIS are responsible for the decision of land available for leasing. The Secretary of the Interior is responsible for issuing and administering the leases.

double J W ENERGY company
1645 Court Place
Denver, CO 80202
303 893 2528

April 28, 1979

U. S. Department of Agriculture
Forest Service
Targhee National Forest
420 Bridge St.
St. Anthony, ID 83495

Attn: David M. Jay, Forest Supervisor

Sir:

Re Draft Environmental Impact Statement, Island Park Leasing, Development Geothermal Resources, Comment Invitation.

Who exactly are the personnel who are to make important decisions as to which areas will be leased? Please provide names and affiliations together with addresses and telephone numbers. (1)

With most of the Idaho local people in favor of or simply unconcerned about Geothermal Development, why has there been such an unconscionably long delay in getting these applications processed into leases so that reasonable action can be had? Soon to be 6 years and no results! Do you plan proper public hearings before the final Environmental Statement is published? If so, where in the Denver area?

I know of no animals who are taxed to feed, warm, house, and clothe humans and with a clean power source available, let us not confuse priorities and shackle the ENERGY PROVIDERS of this country. Yellowstone Park is refuge enough for sanctuary seeking grizzly bears. No development is planned in the Park. I know of no Geothermal Power Plant that operates because of your actions, but several proposed that are sidetracked because of your ivory-tower agency's actions.

There is nothing more repugnant to a taxed investor than an impregnable bureaucracy's delaying an event long overdue, namely lease issuing in Island Park. Yellowstone has become a rich man's playhouse because there are so few roads. Why make it more of the same?

H_2S has been known in that area since Coulter's Hell evolved volcanically and bears, moose, wolves, plants, etc., seem to have endured.

Greater use and preference for clean Geothermal Power to replace Nuclear and Fossil fueled power makes more sense than locking industry out of a job-starved state. Idaho state has already leased adjacent acreages creating a crazy quilt of yes-no lease lands. Thus it is imperative to promptly issue leases.

Having traveled in 1975 backcountry roads to investigate this Idaho area on foot and by motor car, it seems strange to see sheep, cattle, horses, bear, deer, elk, fish, and other wild-life getting such blind protection. Have you ever seen a Geothermal power plant at close range? If not, visit the area of Geysers, California. When I did it was almost impossible to realize a megawatt power plant providing 75% of metro San Francisco's needs existed in such pristine surroundings. Ranching and farming co-exist with flora, fauna and hippies in that area with no known

Jay - 2 - 28 Apr 79

hazard to flowers or flower-people.

Snowmobilers destructively vie with native game and real estate development as water wells, power lines, forest roads, highways are built and maintained. Once they built a railroad there. Still a twelve month open season on black bear continues. How and why will Geothermal end it all?

I have found regulations governing federal leases, for no matter what, to be highly protective and effectively so. Now let's move on!

Perhaps you are like the comic strip character who is always being run over by stampeding buffalo just unaware of the shrieking need to cleanly replace fossil fuels in power generation.

Moot describes your questioning whether Geothermal is a best use for Island Park-Caldera areas. Commercial power can be obtained and snowmobilers so destructive of environmental balance can find other areas to deafen and destroy wilderness denizens.

Possible open leasing or modified open leasing would be best, for then engineers and entrepreneurs could be able to make comprehensive area evaluations. Your alternatives, other than number six, are unrealistic and ignore the economics to cut through geothermal development areas and, in the light of dire need, can be judged ludicrous attempts to justify untenable positions.

Energy is where one finds it and it's all tainted, taint yours, taint mine, and taint enough to fill the need. Taint necessary to say more, but please do disabuse yourselves of these many misapprehensions demonstrated in this environmental statement.

Quasi-seriously speaking, if sufficient energy sources to maintain our standard of living are not available, grizzly bear coats my be the ultimate human insulator.

Sincerely,

John J. Wilson
President

DOUBLE J W ENERGY COMPANY

1. The responsible officials listed on page i of the EIS are responsible for the decision of land available for leasing. The Secretary of the Interior is responsible for issuing and administering the leases.

M. N. Moe ADELMAN

98 South Emerson • Denver, Colorado 80209
(303) 778-7889

May 11, 1979

Mr. David M. Jay
Forest Supervisor
TARGHEE NATIONAL FOREST
420 North Bridge Street
St. Anthony, Idaho 83445

Dear Mr. Jay:

In reference to your letter of March 21, 1979, wanting more reasons and information pertaining to reasons for the Government to lease lands to create energy from known Geothermal areas.

The Government has for years been doing research, mapping, environmental studies, wildlife, and etc., spending millions of dollars. Yet, many Geothermal minded companies have made studies, and have made available their thoughts and ideas to your division, and the need of this energy, nothing definite has been done by your department. As you must know by now, that the energy crunch is very serious, and that Geothermal energy that is just waiting to be put to use is still being studied by your department.

There is only one way to go, and that is to issue leases on these known areas, let the Geothermal oriented companies evaluated them, show these figures to your department and when these facts are made known, then and only then can your department evaluate the pluses or minuses as to what is more important, energy or a black bear.

I recommend that all the Government acreage of the Island Park Geothermal Area be opened to leasing and evaluated by people with Geothermal experience as soon as possible. You and your department know that if and when this was done, it would take from five to ten years to develop any energy from such a project. If your department had any know how about Geothermal needs, these leases would have been issued years ago, and these vast amounts of energy would now be in use, and millions of barrels of oil would be saved.

Yours truly,

M. N. Adelman

M. N. Moe Adelman

MNA/foa
cc: Secretary of Energy James R. Schlesinger
Senator McClure of Idaho
Senator William Armstrong

Oil & Gas Leases . Production • Minerals . Royalties . Bought and Sold
Mining Leases . Claims Bought – Sold or Merged into Stock Companies

3c

ROBERT W. LAVINGTON *Certified Professional Geologist*

761 Steele Street
Denver, Colorado 80206

May 11, 1979

David M. Jay, Supervisor
Targhee National Forest
420 N. Bridge Street
St. Anthony, Idaho 83445

Re: Draft EIS Island Park
Geothermal Area

Dear Mr. Jay:

The Island Park Caldera, from a Geologic standpoint, represents one of the most attractive areas for Geothermal exploration and development in the U. S., located adjacent to an active Geothermal area and easily accessible topographically. These facts should be the major consideration in any land use determination.

Exploration and development of a geothermal source has the least impact of any energy form except solar. It is clean, non-polluting, and utilizes less surface area than most other sources. With oil shortages, and nuclear mishaps, it is in the best interest of the public that geothermal energy sources be exploited.

There is no reason, based on the facts in the DEIS, and present surface use, to restrict any portion of the Island Park Area from leasing and/or exploration. In fact, Geothermal exploration would be much more acceptable than some of the present uses, and most certainly compatible with all of them.

Since the Geothermal Leasing Act became effective, January 1, 1974, delay after delay by various groups have obstructed exploration. The continual talk of developing alternate energy sources is just that - it is time to cease talking and commence the action. Island Park can and should be where this begins.

Yours very truly,

Robert W. Lavington

xc: James Schlesinger
Dept. of Energy
Senator McClure

Joe Kirn

CONSULTING GEOLOGIST

1645 COURT PLACE, SUITE 201
DENVER, COLORADO 80202
(303) 629-5115

April 30, 1979

Targhee National Forest
420 North Bridge Street
St. Anthony, Idaho 83445

Attention: Mr. David M. Jay
Forest Supervisor

RE: Draft Environmental
Impact Statement
Island Park Geothermal Area

Dear Sir;

In reply to the recently published Island Park Environmental Impact Statement I wish to state the following reasons in support of alternative No. 6 - 100% Leasing of the Island Park Area.

1.) It is necessary to drill for and develop resources where they exist, not where they are wished to be. Alternative No. 6 of the report is the only choice that takes into account the geology of the area by allowing geothermal leasing where the proper conditions for geothermal potential exist. A restricted leasing program would hamper development of this resource by making it impracticle and unfeasible. The full potential of the area could never be realised under a restricted leasing program.

2.) Geothermal power has proven to be safe and non-polluting and is probably one of the most viable energy resources as yet undeveloped in this country. It should be developed with due haste.

3.) It is necessary for this country to develop all sources of energy available to lessen our depencence on importing oil from foreign countries.

4.) Having over 20 years experience in the oil industry around both drilling rigs and producing wells, I know that such activity is not harmful to wild animal life. I have watched many deer and elk wander by active drilling rigs, paying little or no attention to them.

Very truly yours,

Joe Kirn

JK/mkc

NUCLEAR DYNAMICS

P O BOX 20766 PHOENIX, ARIZONA 85036 2871 SKY HARBOR BLVD. 602/267-0581

JOE F. WALTON — VICE CHAIRMAN OF THE BOARD, GENERAL LEGAL COUNSEL

May 11, 1979

David M. Jay, Forest Supervisor
Targhee National Forest
420 N. Bridge St.
St. Anthony, Idaho 83445

Dear Mr. Jay:

It has come to my attention that the Forest Service has invited comments as to the proposed environmental statement regarding Island Park Geothermal Area.

The last twelve years of my life have been dedicated to the proposition that the predominance of any nation is in direct proportion to the availability of energy sources and the production and utilization of energy.

Notwithstanding my company's direct involvement in uranium exploration and coal production, I feel that the development of geothermal energy as a clean power source must, wherever possible, take preference to gas, oil, coal or nuclear power sources.

It is my firm belief that except for the reservation of the Yellowstone National Park, priority consideration looking to the development of geothermal energy sources should be given to promoting geothermal development in all public lands which disclose geological parameters justifying exploration.

I sincerely hope that the government position will promote the development of geothermal energy sources by giving a priority to geologic considerations in determining the boundaries of lands subject to leasehold exploration for their development of geothermal sites.

Very sincerely,

Joe F. Walton

JFW/mda

Joel L. Frykman
CONSULTING FORESTER
1067 HENDERSON DRIVE
OGDEN, UTAH 84404

March 29, 1979

Mr. David M. Jay
Forest Supervisor
Targhee National Forest
420 N. Bridge Street
St. Anthony, Idaho 83445

Dear Mr. Jay:

The criteria for leasing for geothermal resources should be that 100 percent of the potential area should be leased with such surface occupancy restrictions as may be necessary for human habitation, developed recreation sites that cannot be replaced, highways or other important roads that cannot be conveniently replaced in a different location, limited areas for the sandhill crane and trumpeter swan feeding and nesting areas, Big Springs, and within 100 feet of Island Park reservoir and 500 feet of the falls. The objective should be to do whatever is reasonably possible to encourage the development of geothermal resources, not to find ways to delay or stop it.

As far as industrial development that could result from this use of energy resources, there are numerous natural openings and clearings as shown by your cover photo with which I am familiar, also that could readily be the sites of such industrial development as might occur.

The cover photo, an excellent one, reveals what appears to be serious bark beetle damage. From a scenic standpoint this is more damaging than anything else you might do. It is also very damaging to a valuable resource and indicates a failure by management to fulfill its obligations in fully managing the resources for which it is responsible to the American people. However, this could be an old photograph and you have done better.

Sincerely yours,

JOEL L. FRYKMAN
Consulting Forester

IDAHO STUD MILL
DIVISION OF
EDWARD HINES LUMBER CO.
P. O. BOX 167
ST. ANTHONY, IDAHO 83445
AREA CODE 208 - 624-3445

May 17, 1979

Mr. David M. Jay
Forest Supervisor
Targhee National Forest
420 N. Bridge St.
St. Anthony, Idaho 83445

Re: Island Park Geothermal Area - Draft Environmental Statement

Dear Mr. Jay:

Idaho Stud Mill would like to take this opportunity to comment on the Draft Environmental Statement for leasing and development of the Island Park Geothermal Area.

A great deal of time, effort, and finances has obviously been invested in the compilation of this document. The results are indeed impressive. The maps are clear and concise, the pictures are beautiful, and the charts are informative.

There are several areas which we would like to address. There is throughout the major portion of the E.S. the general intonation that development of IPGA would lead to impacts that are mostly undesirable. This is true only to those with tunnel vision who are unwilling to assess the total resource situation. In view of our present energy situation and the projections that it will get much worse before it gets better, our nation must reassess our values. We must eliminate the stigma that has become attached to development and industrial endeavors since the mid-60's. Development in a proper and prudent manner is compatible with most all other resource uses and activities.

Wildlife, aesthetics, and recreation are most definitely areas to be considered and protected within reason. However, necessities must receive first priority and amenities must follow after. We failed to find in the E.S. a projection of local or national needs over the next several years. This is a major shortcoming. (1)

Map #1 of the IPGA shows "private" land within the area. It fails to distinguish state holdings from true private ownership. (2) Nowhere in the E.S. is there any indication that appropriate state officials were contacted relative to Idaho's geo-thermal or mineral development plans for state ownership. However, eight employees of the Idaho Fish and Game were listed in Appendix M as having made contribution to the E.S. Is there an imbalance of consideration here? (3)

RED ARROW T.M. PRECISION® KD 12%

Mr. David M. Jay -2- May 17, 1979

The E.S. gives the impression that the majority of the IPGA acreage could be developed. This misconception should be clarified with projections of actual total acres and percentages of the total area to be disturbed or developed under each alternative. We suspect the percentage of land area actually disturbed would be extremely small, even with the unlimited exploration alternative. (4)

We ask that as you choose a final alternative you seriously consider the true needs of our nation which must be fulfilled. Either alternative #6 or a modification of #6 toward #5 would be our recommended direction.

Thank you for this opportunity to make comment.

Sincerely yours,

Gordon D. Wilson
General Manager

GDW:ikb

IDAHO STUD MILL

1. The generic nature of this EIS and the lack of information about the resource make realistic projections of this type impossible at this time.

2. This has been clarified in Map 1.

3. No. Officials from other agencies were consulted throughout the process.

4. Since no precise proposal has been made, it is impossible to adequately assess this impact.

Louisiana-Pacific Corporation

April 12, 1979

P.O. Box 185
Rexburg, Idaho 83440
208/356-5489

Mr. David Jay
Forest Supervisor
Targhee National Forest
420 N. Bridge St.
St. Anthony, ID 83445

Re: Draft Environmental Statement of the Island Park Geothermal Area.

Dear Mr. Jay:

This letter is written in response to your above referenced environmental statement.

At this time it appears there is no evidence that a commercial geothermal resource is present in the IPGA. To determine this will require some form of systematic exploratory drilling.

Although your proposed alternatives addresses the issue from no leasing to full leasing, I believe that a logical alternative would be an initial exploratory phase followed by review and evaluation then implimentation of a final program based on knowledge gained through the initial phase and management goals. Your alternative three most closely resembles this. However, it would appear the area is too restrictive to permit systematic exploration.

Specific points I wish to comment on concerning information presented in your report are:

1. No specific alternative was recommended. I feel a report of this nature should make a recommendation.
2. The general tone of the report is oriented toward the protection of wildlife. This should be a consideration, but not at the expense of other uses. There should be an economic balance or justification between all uses.
3. Two pictures of geothermal activity are shown on pages 7 and 8. An aerial photo of a complete geothermal complex would have been helpful to a reviewer to be able to grasp the magnitude of such an operation.
4. The picture of the West Slopes of the Tetons on page 82 should have been omitted from the report. It is outside the IPGA and would definitely produce negative bias on the part of a reviewer who is unfamiliar with the area. (1)

LOUISIANA-PACIFIC CORPORATION

1. This area is visible from portions of the IPGA.

-2-

5. It appears the picture on page 42 is not on the IPGA. The picture has merit in that it shows a given use that could be affected. The picture is misleading in that it presents the impression of Alpine fragile soils.

6. Competitive and non-competitive leasing is not adequately defined. From information presented it would appear that the only area in the IPGA that would receive competition is the corridor adjacent to Yellowstone Park. I have been advised that if two or more applications for leasing are received on an area it is classified as a KGRA and would then require competitive leasing which assures taxpayers of the greatest return. (2)

7. The numbers presented in tables 36 through 41 do accomplish a rating comparison between alternatives. From this data I am unable to determine what the impact on the 15 various items would be. How much is water quality lowered? How much is the annual harvest reduced? (3)

8. Appendix E needs better definition. Does this table represent the number of habitats available for different species to use or does it represent the habitats that the various species actually use? (4)

9. Three State of Idaho agencies administer approximately 25,000 acrea in the IPGA. This acreage is referred to as private. It is apparent that the State has considerable imput and data in this report, but no reference is made to their management objectives. (5) (6)

A great deal of time and effort was involved in assembling the data in your report. The presentation based on an unknown resource was extremely difficult. I feel that the people responsible for this report should be complimented.

Sincerely,

Paul Wenner

Paul Wenner

2. Your interpretation is correct.

3. Specific, quantified impacts such as these cannot be made at this time since no precise proposal has been made. When lessees present plans of operations for specific sites, these types of impacts will be more thoroughly evaluated.

4. Appendix E indicates the number of different habitats each species uses for feeding and reproduction. In many cases, the same habitat is used for both purposes. The different habitats available are in Table 15, page 44 of the draft statement.

5. This has been clarified on Map 1.

6. Management objectives and direction have been integrated into the EIS (Section II, Wildlife).

PHILLIPS PETROLEUM COMPANY
SALT LAKE CITY, UTAH 84110
BOX 239 TELEPHONE: 801 364-2083

NATURAL RESOURCES GROUP
Energy Minerals Division
Geothermal Operations

May 15, 1979

Forest Supervisor
Targhee National Forest
420 N. Bridge Street
St. Anthony, Id. 83445

Attention: Mr. D.J. Jay

Gentlemen:

We have received and reviewed the Draft Environmental Statement of the Island Park Geothermal Area, and submit for your consideration the following comments and questions:

1. Page 8. "Installation of underground pipes would increase pipeline costs by about 25%." This is an extreme understatement. It will realistically cost at least 100% more to bury steam pipelines. Trenches must be dug, pipe and insulation must be cathodically protected, removed earth must be replaced and recompacted to prevent erosion, re-vegetation of the affected pipeline route must be performed, and markers and signs labeling the route must be installed. The incremental cost of materials alone is 25%. The incremental cost of labor for the above items will be at least 75 - 200%.

2. Page 22. "Several hundred wells are in the IPGA. Except those in the Ashton Area, most are concentrated along streams in areas of summer home development." The Ashton Area is not within the boundary of the IPGA (See Map 4). Table 26 (p. 71) indicates 1,300 people living in Ashton, in 1975. It would appear that most of the several hundred wells in the "IPGA/Ashton" area are for Ashton, and not for the IPGA. How many of these wells are within the boundary of the IPGA? Why is Ashton discussed here? Is the subsurface location of their wells within the IPGA boundary? Or, do their wells provide water and service to establishments within the IPGA? Is there available tracer study data which would indicate the direction and magnitude of ground water flow from the IPGA toward Ashton? (1)

(2)

3. Page 66. Table 24. "Geysers Geothermal Area." This data appears to be in error. Sound levels generally follow an inverse square law. Thus, sound level measurements at 25 feet and 1,500 feet from these three types of operations should exhibit some form of mathematical proportionality. But these data lack any correlation. For example, the data show that muffled test wells and steam line vents have the same sound level at 25 feet; but at 1,500 feet the sound level of the muffled test well is 35% less, and the sound level of the steam line vent is only 10% less.

PHILLIPS PETROLEUM COMPANY

1. This has been corrected in the final EIS.

2. This has been corrected in the final EIS

Forest Supervisor
Mr. D.J. Jay
May 15, 1979
Page two

4. Page 88. Resource: Soil
Phase: Exploration

Activity: "Explosives..." Explosives would not be used for seismic exploration in an area with volcanic geology. (3)

5. Page 88. Resource: Soil
Phase: Exploration
Activity: "Drilling of shallow... holes"
Change: "Clearing of access" Drilling of shallow holes does not require clearing of access. These holes are generally drilled within 50 feet of an existing roadway. (4)

6. Page 88. Resource: Soil
Phase: Exploration
Activity: "Camping and Housing of Personnel"
Impact: "Localized Soil Compaction" A three-man crew sleeping in a trailer does not significantly compact the soil. This is an extremely misleading statement. (5)

7. Page 88. Resource: Water
Phase: Exploration
Activity: Explosives and seismic exploration
Change: Fracturing of bedrock
Impact: "Temporary alteration of ground water flow with reduction in spring flow and stream flows" Explosives would not be used in an area with volcanic geology. This change and associated impact will not occur. (6)

8. Page 88 Resource: Water
Phase: Test Drilling
Impact: "Streams: bank alteration, diversions, siltation, chemical quality degradation ..." Does not the State have any regulations prohibiting such high-impact activities? Drill pads and sumps are not constructed next to a stream bank. (7)

9. Page 91. Resource: Air
Phase: All
Change: Release of gases, vapors and toxic liquids
Impact: "Air Quality degradation (H_2S, NO_x, NH_3, CH_4, SO_2)" Sulfur dioxide gas is a combustion product. The only combustion source would be a drilling rig's (12)

PHILLIPS PETROLEUM COMPANY

3. Corrected in the final EIS.

4. Changes in the wording have been made.

5. This has been deleted in the final EIS.

6. This change and impact could occur in areas with sedimentary geology.

7. The land managing agency is responsible for regulating activities that may cause these types of impact.

12. See introductory paragraph to Potential Impacts table in final EIS.

Forest Supervisor
Mr. D.J. Jay
May 15, 1979
Page three

diesel engines. Diesel is a low-sulfur fuel. SO_2 emissions will be negligable. Hydrogen sulfide emissions can be controlled with available technology. Emissions would be very low.

10. Page 92. Resource: Vegetation
Phase: Exploration
Explosives will not be used in seismic exploration. Vegetation disturbance certainly will be less than one acre; in fact, it will be less than 300 square feet. There is no "preparation" of a shallow gradient hole drill site, other than parking the drill truck in a fairly flat available location. Also, there are no "discharges of drilling wastes, mud, geothermal fluids, chemicals, etc." No sumps are excavated. All such fluids circulate through a steel tank. Upon completion of drilling, all fluids are hauled to a dump site. This is clearly stated at the back of the DES, on pages 118 and 119. (12)

11. Page 94. Resource: Archaeological/...
Phase: Test drilling
Impact: "Obliteration of ... sites"
There are federals prohibiting the occurance of this impact. (12)

12. Page 94. Resource: Recreation
Phase: Exploration
Activity: Aerial Surveys
Change: Increased aircraft noise
This activity is misrepresented. Aerial surveys are few, and are conducted quickly, with one pass over a large area. No significant impact will occur. (8)

13. Page 94. Resource: Recreation
Phase: All
Impact: "Distracting ..., disturbing ..., eliminates..., unhealthy ..."
It should be clearly stated that these impacts, for each 100 mW plant plus all associated geothermal wells and operation, will affect only 0.4% of the total Island Park Geothermal Area Federal public lands available for leasing. (9)

PHILLIPS PETROLEUM COMPANY

12. See introductory paragraph to Potential Impacts table in final EIS.

8. This has been deleted from final EIS.

9. See introductory paragraph to Potential Impacts table in final EIS.

Forest Supervisor
Mr. D.J. Jay
May 15, 1979
Page four

14. Page 102. Resource: Wilderness and ...
Phase: Test drilling
Activity: Drilling ...
Change: Release of ...
Impact: "Unpleasant odors will alter wilderness air quality"
The only unpleasant odor which would be released would be H_2S. There are available control techniques to significantly reduce this emission. It is extremely unlikely that Yellowstone National Park will be in any way impacted by these highly-controlled emissions. In fact, it is possible that the H_2S emissions from Yellowstone's mud pots, fumaroles, and rest rooms will have a more significant impact on the environment than will geothermal operations in the IPGA.

15. Page 109. "Water Quality" - "Stream turbidity will occur when large areas are cleared and graded...." Large areas will not be cleared and graded into streams. Laws prohibit such operations. (12)

16. Page 109. "Fisheries" - Well pads are not located so close to streams that "chemical or hot water spills" would "adversely affect the aquatic environment." This potential impact is also regulated by law. (12)

17. Page 109. "Timber Production" - "Loss of timber fields..." On page 87 you state that a maximum of "180 acres is cleared ..." for a geothermal plant of 100 mW size. On page 1 you state that 488,031 acres are in the IPGA. Thus, maximum timber production loss will be less than 0.04% per 100 mW plant. This is not a significant environmental impact. And on page 61 you state "Many areas examined in 1976 contained nearly 70% dead trees, and some 80%." Any adverse impact on timber production would not be caused by geothermal development. This section of Table 34 should be deleted. (10)

PHILLIPS PETROLEUM COMPANY

12. See introductory paragraph to Potential Impacts table in final EIS.

10. When a timber site is allocated to development of geothermal energy, it loses its capability to produce wood fiber. The total amount of timber volume lost is dependent on the amount of land cleared and the type and quality of timber removed from production.

Forest Supervisor
Mr. D.J. Jay
May 15, 1979
Page five

18. Page 109. "Visual Quality" and "Recreation". Although the associated statements of impact are true, they are also misleading in that they do not reflect the magnitude of impact. Direct impacts due to land clearing will be less than 0.04% of the IPGA, per 100 mW plant. And these direct impacts are distributed over a 2000 acre (see page 87) lease, which constitutes only 0.40% of the total IPGA. Also, most recreation, and associated visual impact, occur only within a few miles of a main roadway (see page 38, Map 7). (12)

In general, the Draft Environmental Statement of the Island Park Geothermal Area has been carefully and thoughtfully prepared, and contains a large volume of information useful to both the public and industry.

We recommend that Table 33 (pp. 88-108) be modified, eliminating the misleading "potential impacts" that could not occur unless there existed no "management requirements, constraints, and mitigating measures." Further, we recommend the addition of a column following "Impact", in Table 33, titled "mitigating measures," with summary information from Part VII (Management requirements, constraints, and mitigating measures). This would allow the reader to quickly and easily evaluate the potential for occurance of each impact for any given geothermal operations activity.

We also recommend that Table 34 (page 109) include a discussion of the magnitude of these adverse impacts which cannot be avoided. (11)

We appreciate the opportunity to comment on the Draft, and request your careful consideration of the above items of concern.

Cordially,

Steven R. Crest

Steven R. Crest
Environmental Affairs Coordinator

SRC/yl

PHILLIPS PETROLEUM COMPANY

12. See introductory paragraph to Potential Impacts table in final EIS.

11. Since no precise proposal has been made, it is impossible to adequately discuss or evaluate the magnitude of impacts.

CAPITAL VENTURES, INC.

1645 Court Place Ste. #201 - Denver, Colorado 80202 (303) 629-5115

April 30, 1979

David M. Jay
420 North Bridge Street
St. Anthony, Idaho 83445

Dear Mr. Jay,

I have two questions that are not covered in the documents of the Draft Environmental Impact Statement on the Island Park Area.

1.) Will there be any public hearings on this matter before being put into final form? (1)

2.) Who specifically are the individuals who will make the dicision regarding which land is leased and which is not? (2)

I would like a prompt answer on these questions if possible.

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	B&F	
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	Personnel	
	Off. Serv.	
Promise Card		

Mickey

Very truly yours,

Christian F. Murer

CFM/mkc

CAPITAL VENTURES, INC.

1. At this time, no public hearings are planned.

2. The responsible officials listed on page i of the EIS are responsible for the decision of land available for leasing. The Secretary of the Interior is responsible for issuing and administering the leases.

CAPITAL VENTURES, INC.

555 17TH STREET • DENVER, COLORADO 80202 TELEPHONE 303/255-2556

April 26, 1979

David M. Jay
Targhee National Forest
420 N. Bridge Street
St. Anthony, Idaho 83445

Gentlemen:

After a careful review of the Draft Environmental Statement of the Island Park Geothermal Area, I would like to comment on the six alternatives.

Alternative 1 - No Leasing would of course be totally contrary to the interest of the people of the country who need domestic development of natural resources, particularly in the field of energy at this time. It would also be completely unfair to the geothermal applicants who have put their good money up under the Geothermal Leasing Act in 1974 and have had their funds on deposit since that time awaiting government action.

Alternative 2 - I participated in the workshop and feel the hasty map each of the groups produced was rather arbitrary and seem to protect the grizzly bear habitat and scenic view along the principal highway. There was no regard for the geologic potential as the no leasing land cuts right across the central caldera that should be available.

Alternative 3 4 and 5 are simply variations of the same deal since deferred, no surface occupancy, or surface occupancy restriction, each mean no exploration or development would happen. The south boundry of leasing in each of these alternatives seems to be related to the migration route for deer and elk. Geothermal leasing and development will offer no more resistance to migration than highways or rivers do now. The restriction on the south end of the IPGA does not make sense at all. (1)

David M. Jay
Targhee National Forest
April 26, 1979
Page 2

Alternative 6 - should read "lease any Federal Lands applied for under the Geothermal Leasing Act". As an explorationist I am confident that the entire area will not be geothermaly productive and therefor the threat of vast geothermal development is not likely. As an explorationist, I also know we must look where the geology appears favorable and only when the economic risks make sense. Leases should be granted when they are requested - only a few locations will probably get tested and if the exploration should be successful in a particular area then by all means this would probably be the "highest and best use for the land" in productive areas. Lease the land - I'll bet the bears could care less.

Very truly yours,

Christian F. Murer

CFM/lkb

CAPITAL VENTURES

1. The no leasing and deferred designations along the south end resulted primarily from considerations for trumpeter swan, grizzly bear, major streams, and big game winter ranges.

[redacted] capital corporation
485 MADISON AVENUE/NEW YORK,N.Y.10022/(212)758-3494

May 18, 1979

Mr. David M. Jay
Forest Supervisor
Targhee National Forest
420 North Bridge Street
St. Anthony, Idaho 83445

Dear Mr. Jay:

Stewart Capital represents a dozen or so individuals who hold lease applications in the IPGA. We have retained the services of Dr. Alan C. Buck to respond to your Draft Environmental Statement and are pleased to enclose his comments. I trust you will find them helpful.

Would you please list officially as interested parties for purposes of receiving further communiques not only ourselves, but:

Dr. Alan C. Buck
6073 Naura Street
Cypress, California 90630

and

Mr. Eugene V. Ciancanelli
12352 Escala Drive
San Diego, California 92128

Yours very truly,

STEWART CAPITAL CORPORATION

Alexander S. Bowers
President

ASB/s
Enc.

May 14, 1979

Mr. David M. Jay
Forest Supervisor
Targhee National Forest
420 North Bridge Street
St. Anthony, Idaho 83445

Dear Mr. Jay:

Your recent DES for the Island Park Geothermal Area (IPGA), solicited comments from various agencies and the concerned public. I am responding as a representative of the Geothermal industry and specifically as the environmental consultant for the Stewart Capital Corporation of New York, a representative of lease applicants in the IPGA.

First let me complement you and your staff for a job well done. I believe that the IPGA document is a model for the BLM and Forest Service; you have produced the best DES I have seen. It is beautifully illustrated, clear and concise is its style and foremat, and above all writted in a knowledgable and literate manner. The scenarios developed, the statements and conclusions are well founded and documented. Your objective evaluations indicate you are not exclusively directed by timber or grazing interests but are clearly responsive to the desires of the people and the management objectives of the Forest.

Unfortunately, all important documents seem to have a malice of their own; editorial errors and "typos" seem to persist no matter how carefully edited. One really glaring error has occurred in the IPGA statement. Page 117, the second resource, Water has a total which should be 12.48. Column 7 shows a total for Resource No. 2 (Water) as 2.48! This must be a "typo" because the total for all resources equals 77.82 and that is correct if Resource 2 is 12.48. Similar numeric errors exist on page 114, Resources 5 and 6, but the magnitudes of error are of little consequence. (1)

The United States has a goal of Energy Independence. In support of that goal, various policies and acts were implemented to promote the development of geothermal power. Geothermal energy cannot generally be stored or stockpiled; it should be used prudently and expeditiously. If left untapped, many untapped geothermal deposits will eventually decay or may

STEWART CAPITAL CORPORATION

1. The corrections have been made in the final EIS.

even become hazardous, with a resulting loss to our energy budgets and our economy.

In discussing the consequences of geothermal exploration and ultimate development of viable steam for electrical generation, one might point out that there are several secondary consequences of the final production of 100 megawatts of electricity. This means energy for 100,000 people; economic, reliable electric power that does not consume oil or coal! Alternatively, that same 100 megawatts can fuel one or more energy intensive industries which would add to our Gross National Product as well as the local economy.

The 100 megawatts envisioned for IPGA would replace two or more mid-sized nuclear power plants and even the most unknowledgable person would grant distinct environmental advantages to geothermal versus nuclear power. Certainly geothermal power appears to have economic and environmental advantages over hi- sulfur coal, expensive and undependable foreign oil and the attractive but as yet unrealized solar power. Thus it might be realistic to compare geothermal power and other available power sources on a theoretical basis, and having enumerated the economic or environmental advantages of geothermal power, one must simply accept the conclusion that our geothermal resources should be developed promptly regardless of their location.

Having once accepted the premise that geothermal energy does provide some relief from the U.S. energy crunch, and that geothermal energy is economically advantageous and environmentally preferable (to certain other energy sources) we must then proceed to develope that energy in a timely and conscientious manner.

A geothermal power plant cannot be sited in an "ideal location." The electical generating facilities must be close to the source of the steam. Equally unfortunate is the fact that geothermal steam can't be found "just anywhere." Like oil shale retorting and coal mining, if geothermal energy is to be utilized, it must be developed at the source. Regardless of the sensitivity of an area, the geothermal energy consumer must simply cope with the problems of development in the area.

Geothermal developers, like most of our nation, are environmentally conscientious. We recognize the sanctity of certain areas, both the unique and the aesthetic. We are anxious to preserve plant and animal species that are threatened by the more insidious encroachments of man. And we are dedicated to the preservation of air and water quality.

We are equally dedicated to the development of economic, reliable energy for Americans. Geothermal developers can provide both the energy and the environmental protection needed to satisfy the public. The geothermal industry has demonstrated in the past a willingness to cooperate with all

environmentally oriented groups. Because of some site spcific knowledge geothermal geologists and environmentalists have even led the way in suggesting the preservation of certain unique geological features (Medicine Lake Draft Mgmt. Plan - responses from Alan C. Buck and Eugene V. Ciancanelli).

Assume that America does want energy independence and that geothermal development promotes this policy. With the conviction, born of experience, that geothermal energy can be developed with only negligible environmental impacts, the Stewart Capital Corporation (New York) supports Alternative Two as the management/leasing plan for the Island Park Geothermal Area.

The various clauses and sections promulgated in the Department of Interior Standard Geothermal Resource Lease (pp 154 and 155) provide a broad base from which to implement any type of environmental protection. The terms of the lease, compiled with the cooperative attitudes of the developer allow the various disciplines to express their environmental concerns for geological, botanical, zoological and socio-economic sensitivities. The cautious and stepwise approach to geothermal exploration and development allows the application of new technology as well as accepted methods of mitigating environmental hazards. Conscientious and conservative specifications and stipulations accompany each step leading to the ultimate construction of a geothermal power plant. These same specifications and stipulations are monitored and accounted for, thus providing an assurance that environmental hazards are eliminated or minimized. Stewart Capital asks only for the opportunity to cooperate in making the Island Park Geothermal Area, a model for the industry. Let the geothermal industry demonstrates its abilities and its conscience in developing the energy that is so important to all Americans.

The Stewart Capital Corporation (New York) has a second choice among the Alternatives presented in the IPGA. Alternative Five would seem to provide an IPGA management protocol which allows carefully regulated exploration, production and development of geothermal energy. This same Alternative Five dedicates 18% of the total IPGA acreage to sensitive environmental qualities (no leasing on 18%) but allows 40% of the acreage to be leased under carefully developed "surface occupancy restrictions." Some 42% of the IPGA acreage is non-sensitive land. Thus 82% of the total acreage could be leased under the careful guidance of the Forest Supervisor, the USGS, and other contributors to the NEPA. Alternative Five is definitely a desirable management plan and in fact runs a very close second to Alternative Two. Alternative Two is favored only because, being unequivocal and definitive regarding leasing, it eliminates much of the red tape and delay which might accompany implementation of Alternative Five.

In review, the Stewart Capital Corporation appreciates the opportunity to review the IPGA Draft Environmental Statement. Stewart Capital promotes Alternative Two as being an ideal and popular management plan. Alternative Five is a second choice. We feel either plan will satisfy the goals of an energy and environmentally conscious public and the dedicated staff of the U. S. Forest Service and the Bureau of Land Management.

Thank you,

Alan C. Buck

Alan C. Buck, Ph.D.

Boulder Land Company, Inc.
Suite 207
Number 75 Manhattan Drive
Boulder, Colorado 80303
494-1000

DEAR MR JAY,

THIS LETTER IS IN REGARD TO THE ISLAND PARK GEOTHERMAL AREA OUTSIDE YELLOWSTONE PARK.

I BELEIVE THAT GEOTHERMAL ENERGY DEVELOPMENT MAY BE A GOOD ALTERNATIVE ENERGY RESOURSE IN SOFAR AS IT A CLEAN SOURCE.

I ALSO BELIEVE THAT IN THIS DAY AND AGE WE NEED TO EXPLORE EVERY POSSIBLE ENERGY RESOURSE WE HAVE EVEN IF IT MEANS TAKING A LONG HARD LOOK AT THE ECOLOGY OF AN AREA

MY QUESTIONS AT THIS POINT ARE HOW CAN I SUBMIT INPUT TO THE GEOTHERMAL DEVELOPMENT QUESTION BEFORE A FINAL ENVIRONMENTAL IMPACT STATEMENT IS PUBLISHED AND EXACTLY WHO WILL BE MAKING DECISIONS ON WHAT AREAS ARE LEASED FOR GEOTHERMAL DEVELOPMENT (1)

THANK YOU.

SINCERLY,
PAUL J. ROR[illegible]

B.L.C.

1. The responsible officials listed on page i of the EIS are responsible for the decision of land available for leasing. The Secretary of the Interior is responsible for issuing and administering the leases.

POWERCO

POWER RESOURCES CORPORATION

May 15, 1979

David M. Jay
Forest Supervisor
Targhee National Forest
420 N. Bridge Street
St. Anthony ID 83445

Dear Sir:

The following comments are offered with regard to geothermal leasing in the Island Park Geothermal Area:

In view of the current energy situation within the United States, it is timely to make every effort towards exploring and developing alternative energy sources. Geothermal power is a clean source of energy, and if geothermal resources can not be developed within areas set aside as "natural environments", such as National Parks, then extra effort should be made to allow for exploration and development in favorable locations outside these restricted areas.

In response to those who question whether geothermal production is the best use of the area in question: it is reasonable to state that development of geothermal resources in any area where such resources are located is one of the best possible uses of that area. Other activity areas (such as recreation) may be located within localities where geothermal resources do not exist. The location of other activity areas can be rearranged and relocated -- geothermal resources cannot.

The surface of the Island Park area has, over the years, been used for many purposes such as logging, grazing, hunting, roadbuilding, etc. We therefore see no reason why development of geothermal resources should not be allowed; particularly in view of the fact that geothermal leases contain built-in protection for land surfaces in accordance with the normal federal regulations. The other mentioned activities may continue. Further, it is our opinion that geothermal leasing should be allowed in all areas of the United States outside the National Parks.

We would also like to request answers to the following questions:

Will public hearings be held before the environmental statement is published? (1)

• 1660 South Albion, Suite 827 • Denver, Colorado 80222 • 303-759-5660

Page 2

Who makes the decisions as to which areas will be leased for geothermal development? Names and addresses, please. (2)

The draft of the statement indicated that most of the local people were in favor of geothermal development. Who, then, are those against?

Sincerely,

POWER RESOURCES CORPORATION

Robert V. Bailey

Robert V. Bailey, President

RVB:gk

POWER RESOURCES CORPORATION

1. At this time, no public hearings are planned.

2. The responsible officials listed on page i of the EIS are responsible for the decision of land available for leasing. The Secretary of the Interior is responsible for issuing and administering the leases.

Moore
and company

May 16, 1979

Mr. David M. Jay
Forest Supervisor
United States Department of Agriculture
Targhee National Forest
420 N. Bridge St.
St. Anthony, Idaho 83445

Dear Mr. Jay:

I am writing in response to your letter dated March 21, 1979, concerning the leasing and development of geothermal resources within the Island Park geothermal area.

I have been astonished that the development of our nation's clean energy resources has taken so long in a period when energy consciousness is the watchword. Obviously geothermal resources provide an answer to these needs as long as the environmental considerations are also met. Since this appears to be your area of expertise, I hereby wish to emphasize several points.

Nearby Yellowstone Park represents approximately two million acres of protected environmental land to assure the beauty and protection of not only the wildlife but also of land of exquisite character. We cannot set aside all land in the face of progress. The Island Park area is already used for real estate development, hunting, fishing, snowmobiling, hiking, camping, logging, grazing, waterwell drilling, electrical power-lines, etc. It would seem that geothermal resource development would provide a much more productive use for the future of our society than many of the above functions which are destructive to the environment.

Further, there seems to be concern for the grizzly bears. Do you realize they are actually shot inside Yellowstone when they become a hazard to the tourists. I would think that they will naturally find refuge just like the black bear has for years, even though openly hunted. Actually there appears to be very adequate protection built in for the environment through the normal federal regulations for operations in geothermal leases.

Geothermal resources must be developed where they are found. No

200 West Littleton Blvd., Littleton, Colorado 80120 / 798-9411

2

one is recommending any development in Yellowstone Park because everything should be in its place! Conversely the beauty of Yellowstone Park cannot be allowed to influence the development of alternative sources of power in other geothermal fields of our country. Why let our emotions restrict development of an energy source outside the park that has little disruptive effect on the surface, while coal, long noted for its disruptive influence, is allowed. Also, I am sure you have noted the recent disastrous consequences of nuclear power. Need I say more?

I would be interested in having a list of people who will be responsible for this decision, what people might be opposed to such activity (since most people seem in favor of geothermal development), (1) and when and where public hearings will be held in regard to this matter. (2)

I must say I am thoroughly impressed with the depth of study and professionalism shown in the Draft Environmental Impact Statement and appreciate your efforts. All things considered, please note I am strongly in favor of allowing geothermal resource leases in the Island Park area.

Very truly yours,

S. P. Wasserstein

SPW/pw

MOORE & COMPANY

1. The responsible officials listed on page i of the EIS are responsible for the decision of land available for leasing. The Secretary of the Interior is responsible for issuing and administering the leases.

2. At this time, no public hearings are planned.

AtlanticRichfieldCompany

555 17th Street
Denver, Colorado 80202
Telephone 303 575 7577

J. R. Mitchell
Public Lands Coordinator

TARGHEE NF
Units: 1 2 3 4 5 6
MAY 29 '79

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	E&F	
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	Personnel	
	Off. Serv.	
Promise Card		

May 21, 1979

Mr. David M. Jay
Forest Supervisor
Targhee National Forest
420 North Brid Street
St. Anthony, ID 83445

Re: Island Park Geothermal Area

Dear Mr. Jay:

Atlantic Richfield Company appreciates the opportunity to present comments to the Forest Service and the Bureau of Land Management (BLM) on the Draft Environmental Statement (DES) for the Island Park Geothermal Area (IPGA) in the Targhee National Forest.

We are becoming increasingly concerned about the escalation in the rate in which federal lands are being withdrawn from public multiple use. Such withdrawals limit federal acreage accessible for potential energy and mineral exploration and development. Besides protecting the wilderness, the Federal Government should consider the development of energy and mineral resources and reconcile these and other public lands use needs in a manner in which ultimately serves the best interests of the nation.

Although there may be a few adverse impacts, as listed on page 109 of the DES, resulting from the exploration and development of the geothermal potential in the IPGA, the impacts on the area and the Nation by not developing this potential resource could be even greater. Continued federal land withdrawals, such as proposed by Alternatives 1 through 5, could have longterm negative consequences on the availability of energy resources in the United States since much of the Nation's resource potential is on federal land. Improved technology and a greater sense of responsibility for the land has lessened the impacts resulting

from such exploration and development. Also, the need for these sources of energy cannot be underestimated.

Construction of other major energy projects such as the development of the North Slope oilfield and the 800-mile Trans-Alaska pipeline have been built with minimal damage to the area and little, if any, permanent disturbance of the wildlife. The IPGA could and would be developed with the same respect for the land and wildlife. It also appears that the community around the IPGA has a positive attitude toward the development of geothermal energy. As stated on Page 74 of the DES, "The general opinion was the geothermal development would boost the economy and provide a possible way to keep electric rates from rising." Further, proposed utility lines are to be concentrated along existing use paths, thereby limiting the impact of the area of transporting power.

Atlantic Richfield Company endorses the concept of multiple use of public lands. The public interest is best served when ecologically and economically prudent exploration and production activities are allowed to coesixt with other land uses. Exploration for and development of energy resources will expand our domestic energy supply, improve local and national economies, increase employment, and help reduce U.S. dependence on foreign oil imports. Such usage of public lands would also be consistent with the mandate of President Carter and the Congress to search out and develop new domestic energy sources.

We recommend that the Forest Service and the BLM recognize the need for the development of this valuable geothermal resource and consider the implementation of Alternative 6 as the best use for the land and in the best interest of the surrounding communities.

Again, we appreciate the opportunity to present our comments to the Forest Service and the BLM on the Draft Environmental Statement for the Island Park Geothermal Area. If any additional information is required, please contact us.

Sincerely,

J. R. Mitchell

J. R. Mitchell

MULTIPLE-USE

SAWTELLE CHAPTER

OUTDOORS UNLIMITED

P O BOX 167

ST ANTHONY, IDAHO 83445

April 20, 1979

Mr. David M. Jay
Forest Supervisor
Targhee National Forest
St. Anthony, Idaho 83445

Re: Draft Environmental Statement of the Island Park Geothermal Area

Dear Mr. Jay:

Sawtelle Chapter of Outdoors Unlimited wishes to comment on the Island Park Geothermal Area Environmental Statement. We represent directly 84 members and 300 affiliate members in S.E. Idaho. Our commodity and amenity interests are closely tied to the Island Park area. Our common desire is to see prudent development and use of resources found on federal lands.

The stated purpose of the draft statement (page 1) was to: (1) present a description of the existing or affected environment; (2) show a range of alternatives for geothermal leasing; and (3) consider the possible effects of implementing a leasing program.

After careful review of the draft statement, we have general comments relating to the stated purposes listed above by item.

Item 1 - Present a description..... This was done superbly in the document. The pictures and write-up is really overdone, but will serve as an information base for all other resource studies in the area. There is an obvious fascination with the present inferring that non-use is good, and that use brings change which is bad. This is typical of most government resource studies in the last decade. "Impact" is always adverse.

The Known Geothermal Resource Area (KGRA) is referred to in relation to the IPGA (Yellowstone KGRA - 42,400 acres; Island Park KGRA - 28,350 acres) on pages ii and 8. However, no maps or description is given placing the KGRA in the IPGA. The alternatives maps show the area directly west of the Yellowstone Park Boundary as the "Yellowstone KGRA," but the acreage doesn't measure up. Question is, where are these areas and what is their relationship to the whole? (1)

Some of the photos such as on page 42 (sheep grazing) and page 82 (West Slopes) appear to be out of the IPGA area, and conducive to an anti-use/development bias.

Item 2 - Show a range of alternatives..... An adequate array is presented recognizing a final choice will be a combination of two or more alternative philosophies.

Item 3 - Possible effects of implementing...... This item leaves a lot of loose ends, misleading impressions, and floating assumptions.

The overview of the booklet seems to be definition of a large land mass where it is assumed there may be extensive geothermal potential. The impression imparted by the writeup is one of possible widespread development on a large scale with accumulative adverse impacts on the environment. The report seems to force the entire geothermal question into an "either/or" situation whereby any development is bad and the status quo (no development) is good. Then in the summary on page 118, you reveal that discovery and development, if any, will be carefully controlled to prevent or minimize adverse

SAWTELLE CHAPTER OUTDOORS UNLIMITED

1. The Yellowstone KGRA (42,400 acres) is correctly located on the maps. The Island Park KGRA (28,350 acres) is a quilt-work design of overlapping lease applications distributed throughout the IPGA.

Mr. David M. Jay -2- April 20, 1979

environmental impacts, thus nullifying largely all the previous adverse detailed scare impacts that were stressed. The result then is not a neutral balanced position, but a booklet that leaves the impression that we the public are about to be ripped off by geothermal activities and if we believe in God, mother, and apple pie, we should register a protest.

What the report fails to state adequately is:

1. A national need for energy exists.
2. Geothermal water, heat, electricity will be beneficial to farm, factory, city, and home environments.
3. Since the geothermal resource is an unknown, a real need exists for exploration to better assess the resource and its potential.
4. That probable development potential is low. World geothermal development is minimum, but the report infers IPGA development and impact could be extensive and all encompassing.
5. There is no practical comparison of conventional versus geothermal developments or impacts. (Colstrip versus two, 50 megawatt geothermal plants is no comparison.) There seems to be no IPGA perspective.
6. That professional agency management can control geothermal development in terms of magnitude and impact adequately.
7. That resources on the IPGA (particularly wildlife) are far more manageable and compatible than the adverse impact statements infer.
8. That an informed and aware public can and will tolerate prudent management of resources where benefits to the public can be demonstrated.

The No Surface Occupancy Restrictions descriptions are confusing and stated differently between Alternatives 4 and 5. This could stand clarification. (2)

Was the State of Idaho consulted for geothermal data and opinion? Because of their extensive inholdings in the IPGA, their posture and management intentions are important. (3)

The wildlife aspects of the report seem to be dominant and overstated in regards to the probable geothermal potential on the IPGA. One gets the feeling the wheel of balance is weighted heavily in favor of wildlife. When compared to the inferred intensive development possibilities, a negative exploration/development opinion is the likely result for most lay observers. We're sure this was not the intention of the writers. It should be better explained.

In summary, Sawtelle Chapter feels the geothermal resource must be defined through lease, exploration, test drilling, and evaluation. When the resource potential is more of a known factor, prudent construction, development, and operation should take place if feasible. The exploration and development must be done in a manner that offers reasonable protection to the environment. There will be impact, of course, but it can be minimized and managed. Some credibility must be given to the good judgment of the energy industry. They are not going to cover the IPGA with test wells and development if there is no potential for rational development.

We recommend a combination alternative (alternative 5 and 6 combination). The open lease areas can be maximized. The no lease and lease with surface occupancy restrictions can be minimized to be responsive to site specific problems such as slope hazards and unstable soils.

Mr. David M. Jay -3- April 20, 1979

Obviously there is risk in geothermal exploration, but there is far more risk in doing nothing. We encourage an aggressive and active leasing, exploration, test drilling, and evaluation program. If the potential exists for a viable geothermal program, let's get on with it. We feel planned geothermal development is compatible with a full array of other resource uses.

Sincerely,

Rem Kohrt

Rem Kohrt, Secretary
Sawtelle Chapter
Outdoors Unlimited

RK:ikb

cc: Senator James McClure
Senator Frank Church
Representative George Hansen
Representative Steve Symms
Fremont County Board of Commissioners

2. This has been clarified in the final EIS.

3. The State of Idaho's input has been integrated into the DES and final EIS.

Chairman, Box 458, Wilson, Wyoming 83014

WYOMING CHAPTER SIERRA CLUB

18 May 1979

Forest Supervisor David M. Jay
Targhee National Forest
420 North Bridge Street
Saint Anthony, Idaho 83445

Dear Mr. Jay:

re: ISLAND PARK GEOTHERMAL AREA LEASING D.E.S.:

The following comments are submitted on behalf of the Sierra Club. They are also endorsed by the Friends of the Earth.

ALTERNATIVES:

Of the alternatives listed, Sierra Club et al. support the adoption of Alternative #1: No Leasing.

We suggest that an additional important Alternative has been omitted from the draft E.S.: the conduct of further testing and research in the IPGA without leasing.

RESEARCH NEEDS:

It is probable that any geothermal energy sources in the IPGA are interrelated with those of Yellowstone National Park. Both flows of heat and of subterranean water may be involved, and extraction through development in the IPGA may well have adverse effects on the world-renowned features of Yellowstone.

According to YNP personnel, "Geothermal developments have adversely affected other major geyser basins in the world." Discussion of possible effects on the Park in the dES is brief, vague, and generally admits ignorance. This ignorance should be remedied through further research before any issuance of leases is permitted.

Other volcanically-affected areas of Idaho contain major subsurface water flows of up to seventy-five miles. Yet the dES proposes that effects on Yellowstone Park will be monitored only if a resource is developed within five miles of the Park boundary. Other developments would not even be granted the courtesy of monitoring, according to the dES.

"Not blind opposition to progress, but opposition to blind progress."

WYOMING CHAPTER SIERRA CLUB

Geothermal:Jay, 18May79 p2:

LEASING AS METHOD:

It will be argued that the issuance of leases is intended to serve as a vehicle to generate new data, with the costs being borne by the lessee, rather than by the public.

This is an unwise approach. The issuance of leases and the encouragement of private investment in exploration and development serves to create a conflict between the investor's interest and the public's concern over the protection of Yellowstone National Park and other values. It does not guarantee that the specific information most needed for a sound public decision will, in fact, be forthcoming. The dES proposal that exploration and development proceed until an effect on Yellowstone is actually observed, creates the likelihood of upwards of $50,000,000 being invested in a production facility whose effects on the Park will not be known until the plant is in operation...subject to an unknown risk of shutdown.

Fairness to private industry and investors requires that the Government not sell a resource which it may not be in a position to provide. The Government should conduct research, including carefully-controlled test drilling, at public expense, to determine whether the IPGA contains a resource which is independent of the treasured features of Yellowstone National Park. Only if such an independent resource is found, and it is concluded that the Park will not suffer in any way from development, should leasing on the IPGA be considered. (1)

ADDITIONAL LEASING CONSTRAINTS:

No leases should be issued for areas designated as essential grizzly bear habitat. Leasing with surface occupancy restrictions should not be permitted on these areas; lengthy experience with surface occupancy restrictions in oil/gas leasing has shown that they create a logical contradiction which results in serious administrative problems during the duration of the lease.

No lands on the Targhee National Forest within Wyoming should be leased. These lands should be retained in their present undeveloped state for eventual inclusion in the expansion of Grand Teton National Park.

1. This alternative was evaluated by the Interagency Team. It was decided that it was not a viable alternative at this time because it was out of the scope of this EIS. However, it could become a definite consideration of the Secretary of the Interior subsequent to the EIS.

Geothermal:Jay, 18May79 p3:

ADEQUACY OF THE DRAFT ENVIRONMENTAL STATEMENT:

Although this is the most lavish and expensively-printed EIS this reviewer has seen, the basic data submitted are vague, qualitative rather than quantitative, and inadequate for intelligent decision-making.

NEPA regulations, 43CFR 1502.16, demand a "scientific and analytic basis for the comparisons..." of alternatives. That basis is not presented. The colorful matrices with two-decimal-place weightings (Tables 36-41) merely institutionalize a mass of subjective judgements, not supported by scientific data. (2)

The entire evaluation process only serves to compare different courses of action; no absolute data are given on the benefits versus costs, both social and environmental, of any of the leasing programs discussed. The no-leasing alternative is not even included in the matrices, since the absolute values of leasing are never addressed.

The two-paragraph description of Alternative #1 (p.77) is biased against consideration of this path. The discussion of possible development of private resources is calculated to further that bias, and is irrelevant since it is not demonstrated that private development is related to the courses of action covered in the dES. Overall, this presentation of Alternative #1 is aggressively deficient and violates the spirit and letter of NEPA.

No estimates of the total energy yield expected as a result of leasing the IPGA are given. This is the central datum in weighing the benefits of development versus the hazards, yet it is absent. (3)

Discussion of surface water effects omits thorough consideration of problems of spillage of drilling muds, geothermal brines, and steam condensate. This has been a recurrent problem at The Geysers field in California and is typical of geothermal fields. Effects on fishery and waterfowl could be expected to be severe. (4)

In the absence of needed estimates in the dES, it is worth noting that California's The Geysers generates about 500 megawatts of electricity. It will continue to do this for a few decades before the geothermal sources are exhausted. The United States total energy need for Year 2000 is estimated at the equivalent of 3 to 5 million megawatts electricity equivalent. Thus _if_ the IPGA could be developed to equal The Geysers (wholly speculative) it would provide 0.0125% of the Nation's energy, in return for a severe and presently unknown endangering of the irreplaceable wonders of Yellowstone National Park.

WYOMING CHAPTER SIERRA CLUB

2. The EIS was concise to conform with the current CEQ guidelines. Extensive data and information was used in the evaluation of alternatives, effects of implementation, and management requirements, constraints, and migitating measures. These data are available for perusal at the Supervisor's Office, Targhee National Forest.

3. Since no precise proposal has been made, it is impossible to adequately estimate this concern.

4. Pages 88, 89, and 90 of the draft EIS discussed the potential effects of spills and condensate. Effects on fisheries and waterfowl were discussed on pages 95, 100, and 101. When a lessee plans to drill, construct a road, or do additional work on his lease, he must prepare a detailed plan of operation. This plan will review and evaluate in depth the potential adverse effects and mitigating measures. After careful review and evaluation, the United States Geological Survey and United States Forest Service will approve, modify, or disapprove the plan. This plan and review will more adequately address specific questions since it wil be site specific. See Section VIII of the final EIS.

Geothermal:Jay, 18May79 p4:

In fact, it is highly unlikely that the IPGA could yield as much energy as The Geysers, and the risk-reward ratio is more unfavorable than that figure suggests.

CONCLUSION:

This dES is an impressive example of the accumulation of a great deal of lush photography, colored graphs and tables, all printed nicely on glossy paper, but lacking in the basic data needed to address the fundamental concerns raised by the proposed actions.

Sierra Club recommends that a new Alternative, of further research without leasing, be studied in a new E.S. which omits the pretty pictures and includes the needed factual data.

Thank you for the opportunity to comment. Please send me a copy of the new version of the E.S., and notice of any decision planned by the USFS/BLM on this issue.

Sincerely,

Philip M. Hocker

Philip M. Hocker, Chairman, Wyoming Chapter
for: The Sierra Club

and, for: Mr. Howie Wolke, Wyoming Representative
Friends of the Earth.

cc: National Park Service
National Parks & Conservation Association
Sierra Club staff

IDAHO CHAPTER

THE WILDLIFE SOCIETY

NATIONAL HEADQUARTERS
SUITE S176
3900 WISCONSIN AVE. N.W.
WASHINGTON, D.C. 20016

May 18, 1979

Mr. David M. Jay
Forest Supervisor
Targhee National Forest
420 N. Bridge Street
St. Anthony, Idaho 83445

Dear Mr. Jay,

Dean Carrier, President of the Idaho Chapter, The Wildlife Society asked the committee listed below to review the Draft Environmental Statement of the Island Park Geothermal Area. Comments on this Draft are enclosed.

I trust our comments will be helpful and fully considered as you prepare the final E.I.S. Thank you for the opportunity to review this document.

Sincerely,

James F. Gore

James F. Gore, Chairman
Environmental Issues Committee
10658 Winterhawk
Boise, Idaho 83705

Review Committee:

Joe Rose
Roy Heberger
Joyce Gebhardt
Rich Howard
James Gore

Enclosure

Review of Draft Environmental Statement for
Island Park Geothermal Area Targhee National Forest,
Idaho, Montana and Wyoming (ER-79/322)

General Comments

The geothermal resources and potentials for development in the IPGA are essentially unknown at the present. For that reason, partially, the draft EIS lacks the detail required for an in-depth and comprehensive evaluation of potential impacts adverse to present fish, wildlife, and habitat values. The section concerning potential impacts to the various resources of the project area would be easier to understand with a complete narrative description of impacts. Presently, it is difficult to quickly locate a specific item of concern; once located, the description of impacts is too general and sometimes too vague.

Formal consulation for threatened or endangered species should be reinitiated as testing and development become site specific, because the present biologicial opinion addresses only the early phases or general effects of resource development.

Specific Comments

Summary, page iii, item III. Environmental effects - Under the heading, "Potential Effects" certain items are listed which are difficult to classify as effects or impacts on the natural environment. The list follows:

1. Increased employment relative to the extent of discovery and development;
2. Additional energy for electricity, space heating and other industrial/agricultural uses;
3. Royalty payments and rent to Federal Government;
4. Increased tax base for effected counties; and
5. Social and economic stress from increased population.

We urge that these be listed under a separate major summary heading (i.e. IV) as Socio-economic impacts/effects. At least, arrange the "Potential Effects" with more concern for effects/impacts on the natural environment. "Increased employment..." is presently the first item and "Modification of wildlife habitat" is presently the last item.

Page xiv and List of Maps page 22 Water Resources. A map should be inserted showing the major flowing waters in the IPGA specifically including those water courses listed in Table 6, Page 29 and Table 19, Page 58. The exact location of these water courses is germane to a discussion of site-specific impacts and general areas which should be classified as "no lease" areas. Several of the streams listed are Class I Streams (Ref: 1978 Stream Evaluation Map, State of Idaho). (1)

Page 6, Paragraph 4, line 2 and picture caption page 7. An apparent contradiction exists between the text and the picture caption:

"In some cases a drill rig...." vs "... large drill rigs are used...."

Are larger drill rigs used frequently or infrequently? (2)

Page 10, Landtypes and soils, Paragraph 1, lines 5-6.

"... no surface water network is found in this area.."

To where, specifically in the IPGA does this statement refer? To our knowledge, the IPGA is a network of flowing surface waters. (3)

The last two sentences on this page are the same.

Pictures throughout the DEIS - some have captions, others do not. Consistency is lacking.

Page 22, Paragraph 4, last line, and Map 4 - If a substantial geothermal resource is located near an area where seismic disturbances are highly probable, eventual development whould include careful evaluation of construction with seismicity in mind.

Page 31, last paragraph - The sample size for measurement of turbidity appears small.

Page 32, last paragraph - The last three words should be deleted. Animals are not primary producers and as such do not consume nutrients such as nitrogen and phosphorous directly. Nitrogen and phosphorous are very likely in a metabolic pool with phosphorous being the limiting nutrient to plant life. If nitrogen becomes limiting before phosphorous, then nitrogen fixing blue-green may appear. Certain blue-green algae are unique to oilgotrophic waters and are not indicators of enrichment. (4)

Page 33, Paragraph 5, last line - Although pesticide or herbicide residues were not detected in select streams in the IPGA, residues would very likely be detectible in aquatic organisms known for their ability to concentrate toxic substances.

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THE WILDLIFE SOCIETY

1. The maps in the map pack show all the major flowing waters in the IPGA. All Class I streams were given "no lease" protection, and site-specific impacts to all streams will be evaluated in depth when the lessee submits a plan of operation.

2. No.

3. The statement refers to the interior of the caldera. This land is well drained, and except after rainstorms and snowmelt, there is no well defined network of surface waters.

4. Changes were made in the text.

Page 42, Paragraph 1, lines 1-2 - Wildlife communities do not "...result from" ... vegetation patterns. They may be distributed relative to vegetative patterns and other factors.

Vegetative patterns (not "designs") in IPGA do not appear homogeneous. They are very likely heterogeneous as are most patterns of floral and faunal distribution.

Page 44, Paragraph 1, line 1 - Insert "behavioral" before the word "adaptability."

Page 45, Table 16 - We suggest the work "known" be inserted above the word "harvest."

Page 55, Paragraph 4, line 2 - The phrase "...but none nested..." re: Peregrine falcons is somewhat over confident. We suggest "...but no nesting was observed or reported..." The IPGA is a vast area, and falcon distribution is very likely super-dispersed. (5)

Page 55, Paragraph 5 - The southern and northern races of bald eagles are no longer separated on the federal list of threatened and endangered species. The word "Northern" should be omitted from the reference to bald eagle. (6)

Page 59, Paragraph 2, line 1 - Insert the word "major" before the word "streams." (7)

Page 60 text and Table 20 - The methodology for sampling benthic macroinvertebrates in select flowing waters of the IPGA is not clearly stated. Methodology, sampling, design, and degree of macroinvertebrate identification are important when diversity indices or a treatment/control approach are used. Examples follow:

1. A treatment/control sampling design requires that upstream and downstream stations are similar with respect to substrate, flow, temperature, morphometry, enrichment, and percent shading.

2. Sample size should be adequate to detect change or difference and should be indicated in the text.

3. The kind of diversity index calcaluted should be so named in the text, and actual diversity index values should be included in Table 20.

4. Computations of diversity indices are strongly influenced by the degree of effort that goes into the identification of benthic macroinvertebrates. Some indication of taxonomic levels to which organisms were identified should be included in the text, and tabular data on their estimated densities should be included in Table 20 or another table.

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THE WILDLIFE SOCIETY

5. Suggestion incorporated.

6. Suggestion incorporated.

7. Suggestion incorporated.

5. The subjective criteria used to determine the abritrary classifications of excellent, good, and fair, with respect to evaluating calculated diversity indices, should be clearly stated in the text.

6. Actual values of diversity indices should be used in Table 20.

7. Actual biomass determinations should be used in Table 20. (8)

Page 67-Transportation - Posted road closures will require enforcement in order to be effective.

Page 72, Table 28 - Units (i.e. number of persons) should be inserted at the top of the table or in the table caption (eg. See Table 29). (9)

Page 74 - Public Issues and Attitudes - The sample size of interviewees needs to be more clearly stated. Presently it is unclear as to whether the 11 people were the interviewers or interviewees. The value of an "estimated response" is unclear because information about the panel of "5 knowledgeable people" who estimated theoretical responses is lacking. The type of information needed about the panel members should include the interest groups represented (public, private, professional, lay, etc.) and personal profiles. (10)

Pages 77 to 86 - Alternatives - While alternative 1 would be least damaging to habitat and the biota of the IPGA, we concur that implementation of exploration and development on private lands would likely occur, resulting in less efficient resource use than if development were to occur on public lands. Alternative 6 is as unrealistic as alternative 1.

While alternative 2 provides a buffer strip along both side of Henrys' Fork of the Snake River, portions of other high quality streams are not so protected. Examples include Buffalo River, Moose Creek, Madison River, Warm River, Robinson Creek, and Snow Creek. Under this alternative the areas where leasing for geothermal exploration and development would be allowed, overlap with habitat of the grizzly bear (Moose Creek Plateau and Fish Creek Road areas), the sandhill crane (north of Gerrit, Idaho, and west of Eccles, Idaho), trumpeter swan (Buffalo River, south of Eccles, Idaho, and Madison River), and sage grouse (west and southwest portions of the IPGA).

With these riparian and wildlife habitat overlaps in mind, we reviewed proposed alternative 3. This alternative took into consideration wildlife habitat at the cost of wide buffer strips along Henrys' Fork, of the alternatives listed, this is our perferred choice.

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THE WILDLIFE SOCIETY

8. Specific details in methodology, sampling, identification, and actual values are in the report from the USFS Aquatic Ecosystems lab on file with the Targhee National Forest.

9. Suggestion incorporated.

10. This information is within the report referenced at the end of page 74 of the draft EIS.

However, we suggest another alternative which combines attributes of proposed alternatives 2 and 3 with fish, wildlife, habitat, and visual resource values referred to earlier in the text of the DEIS. Our suggested alternative listed below, would accomplish the following resource objectives: (11)

1. Retention of the wide buffer strip along Henrys' Fork;
2. Deferred activity along the Madison River, and portions of Snow Creek and the Robinson River.
3. Protection of additional grizzly habitat in northeastern and southeastern portions of the IPGA;
4. Protection or deferment of activity in habitat used by elk, moose, trumpeter swan, sandhill crane, and sage grouse;
5. Deferred activity on deer and elk migration routes in western and southeastern portions of the IPGA;
6. Retention of areas of high visual quality; and
7. Prevention or determent of activity on several areas with high probability for geologic hazards.

Page 99, Table 33 - The definition of impacts to threatened and endangered species is too vague to be of much value. An explicit description of the effects to these species should be presented here. (12)

Page 55 indicates that the bald eagle, peregrine falcon, gray wolf, and grizzly bear are known to occur in the IPGA. However, the Forest Service has consulted only on the grizzly bear under Section 7 of the Endangered Species Act of 1973. Section 402.04 (a)(1) of the Interagency Cooperation Regulations (50 CFR 402/43 FR 870) states that "it is the responsibility of each Federal agency to review its activities or programs and to identify any such activity or program that may affect listed species or their habitat." If a "may affect" determination is made, formal consultation should be initiated. If a "no affect" determination is made, no consultation is required unless requested by the Fish and Wildlife Service. The DEIS does not make a statement indicating that a may affect or no effect determination has been made by the Forest Service for the listed species. The Forest Service determination should be documented in the DEIS with a presentation of the data and rationale used to support the may affect or no effect decision. It is our understanding that the Forest Service has determined that the bald eagle, peregrine falcon, and gray wolf will not be affected based on the Forest Service's decision not to lease lands in the IPGA that would lead to impacts on these species.

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THE WILDLIFE SOCIETY

11. Suggestions were incorporated into alternative 7.

12. This EIS is broad in scope. Specific roads, drill sites, and other improvements will be reviewed when the lessee prepares a plan of operation. This review will allow an explicit evaluation of the effects on threatened and endangered species on a site-specific basis.

If this statement or a similar one cannot be made in the DEIS or information exists which indicates that additional endangered or threatened species may be affected, formal consultation should be initiated. (13)

The bald eagle and peregrine falcon may be adversely impacted by toxic effluents if a blow-out affected the feeding areas. The geothermal resource is of the "hot water" nature, which has the potential to chemically or thermally pollute the watershed in the event of a blow-out. Either eliminating the fish-food source or directly poisoning these raptors through the food chain will adversely affect these sensitive species. A discussion of these threats should be included in this section. (14)

The above adverse effects may also apply to the trumpeter swan, a sensitive resident of the IPGA. Potential impacts to this species should be identified clearly.

Page 112, Table 36 - "Endangered" is twice misspelled. This should be corrected.

THE WILDLIFE SOCIETY

13. In all alternatives except number six, no lands vital to the existence of these species will be leased. In essence, a "no effect" determination has been made. In addition, during the review of plans of operation, full consideration will be given to threatened and endangered species and their habitat. If this evaluation indicates that other effects may or will occur, formal consultation will be initiated.

14. Those threats are summarized on pages 97 and 99, of the draft EIS.

Wildlife Management Institute

709 Wire Building, 1000 Vermont Ave., N.W., Washington, D.C. 20005 • 202 / 347-1774

April 23, 1979

Mr. David M. Jay
Forest Supervisor
Targhee National Forest
420 N. Bridge Street
St. Anthony, Idaho 83445

Dear Mr. Jay:

The Wildlife Management Institute is pleased to comment on ISLAND PARK GEOTHERMAL AREA, DRAFT ENVIRONMENTAL STATEMENT, Targhee National Forest; Idaho, Montana, Wyoming.

The draft is well done and covers the problems and mitigations that may be necessary.

We prefer Alternative 3, from a wildlife viewpoint. Your calculations indicate this alternative will have the least effect on wildlife and fisheries. We also prefer it because it places many of the riparian areas in the no-lease classification.

Our second choice is Alternative 4, although less protection is provided to riparian areas and big game migration routes.

A concise explanation of the environmental numbers presented from Table 36 on is needed. It takes some time for a reviewer to determine that the lowest numerical value is the least damaging to the environment. (1)

On page 119, Test Drilling, 6th paragraph, the term "Wherever feasible" is used in snag coordination. We suggest that this language be eliminated from the report, because it is an escape clause to allow people to avoid doing what should be done in land management. (2)

These remarks have been coordinated with William B. Morse, the Institute's Western Representative.

Sincerely,

Daniel A. Poole

Daniel A. Poole
President

DAP:lbb

DEDICATED TO WILDLIFE SINCE 1911

WILDLIFE MANAGEMENT INSTITUTE

1. This change has been made.

2. Change made in final.

Anadarko
PRODUCTION COMPANY

A Panhandle Eastern Company

2777 Allen Parkway • P. O. Box 1330 • Houston, Texas 77001

May 1, 1979

Mr. David M. Jay
Forest Supervisor
Targhee National Forest
420 N. Bridge St.
St. Anthony, Idaho 83445

Dear Mr. Jay:

I would like to compliment you and your staff for a well perpared environmental analysis of the Island Park Caldera Geothermal Area. I found the results of your study quite informative.

In reference to your letter of March 21, 1979, I feel the following should be considered in reference to items one and two:

1. Special consideration should be given to specific areas which would be more likely to or have a greater potential for geothermal development. This would be a more practical approach as it would eliminate acreage that would not require any consideration and possibly make land use decisions somewhat easier.

2. Many of the potential impacts referenced in the report (pages 88-108) can be reduced or completely mitigated with reponsible state-of-the-art applications of exploration and development techniques. This should be considered when sensitive land use decisions are to be made.

I had the pleasure of participating in the drafting of the Island Park Geothermal Area Environmental Statement as a member of the Chevron Resources Company. I am now employed by the Anadarko Production Company and would appreciate being informed of any developments or decisions made concerning the Island Park Area.

Yours truly,

P. A. Smith

P. A. Smith
Geothermal Field
Supervisor

PAS:dwm

Idaho Environmental Council

P.O. Box 1708
Idaho Falls, Idaho 83401

David M. Jay, Supervisor
Targhee National Forest
420 N. Bridge St.
St. Anthony, Idaho 83445

May 22, 1979

Island Park Geothermal DEIS

Dear Mr. Jay;

I apologize for being a couple days late with these comments, but hope that you will still consider them.

The Island Park Geothermal Area (IPGA) includes some highly valuable wildlife habitat. Of the vertebrates, the DEIS indicates the presence of 179 birds, 61 mammals, 8 reptiles, and 5 amphibians (p 42). Among these are 3 Endangered species (wolf, peregrine falcon, and bald eagle) and 1 Threatened species (grizzly bear), as discussed on page 55. Several of the other species present are of special concern to the Idaho, Wyoming, and Montana Fish & Game Departments; these include wolverine, fisher, bobcat, lynx, prairie falcon, ferruginous hawk, trumpeter swan, and sharp-tailed grouse for Idaho F&G.

Some areas of the IPGA are particularly valuable for wildlife; eg., "The Reas Pass and Vinegar Hole areas have highly productive forest understories, open wet meadows, bogs, swamps and potholes." (p 55).

As indicated on page 109 under "Adverse Impacts which Cannot be Avoided", the impacts of geothermal energy development on wildlife, fisheries, and water quality are not trivial.

Alternative 3 considered in the DEIS would prohibit leasing on some of the areas, and would defer some of the areas, where geothermal development would be likely to damage surface resources, especially wildlife. The rest of the IPGA, some 207,000 acres, would be open for leasing.

We recommend the choice of a modified alternative 3. Namely, do away with the "deferred" category and instead just simply adopt "no leasing" in those areas. While we do not know a great deal about the geothermal resource's potential use for human energy purposes, we do know with certainty the high wildlife values that exist. We agree with leaving the 207,000 acres open for leasing as proposed in alternative 3.

The DEIS itself is very attractive, but perhaps a bit too exorbitant.

Sincerely,

Gerald A. Jayne

Gerald A. Jayne
Board of Directors

cc: Dennis Baird, IEC President
Ralph Maughan

FALL RIVER
Rural Electric Cooperative, Inc.

714 MAIN STREET • ASHTON, IDAHO 83420 • 208—652-7431

May 17, 1979

Mr. David Jay
Forest Supervisor
Targhee National Forest
St. Anthony, ID 83445

RE: Draft Environmental Statement of Island Park Geothermal Area

Dear Mr. Jay:

Considering the nature and scope of the project, Fall River Rural Electric Cooperative, Inc. finds the Draft Environmental Statement of the Island Park Geothermal Area a very descriptive, comprehensive document.

Like all environmental statements it resists change and makes many assumptions based on personal opinion of what is normal and what is impact.

For example, the statement, "Construction of geothermal facilities in the I.P.G.A. will introduce an industrial atmosphere into a national forest that has historically been used largely for timber production, recreation, and other purposes generally requiring part-time human occupancy. Some of these lands will be occupied for 25 to 100 years" is an attempt to establish priority by traditional use. Since industry already exists in this area by other names and all the impacts listed for geothermal development are present in varying amounts in the Island Park and Yellowstone areas, we would conclude the amount rather than type of impact should be the primary concern, and this amount may be more or less, are added to the present impact, according to priority of use and the extent of the resource.

Therefore, it is our belief the control and method of test drilling and development will influence the impact and value of this resource to the extent that conclusions based on other areas are premature.

Fall River Rural Electric would suggest it would be beneficial to the public to compare land use in relation to the impact and value of different leasing, test drilling, and development plans.

It is our opinion that if competitive leasing and private drilling is done, large segments of public land will be controlled by the large energy corporation and the the primary interest will be speculation, not energy production.

We cannot believe any control of public land is justifiable for the purpose of speculation and have repeatedly requested some type of cooperative test

drilling to establish the nature and extent of this resource with the results of these tests as public information.

At the same time we have advocated non-competitive leasing and controlled development to reduce speculation and monopolization.

In summary, we believe the Draft Statement to be an excellent document but reflecting a reluctance to change even in the face of an energy crisis.

We believe a list of the lease applicants with a comparison of different options on leasing, test drilling, and development would be more beneficial in evaluating geothermal development needs and impacts than broad statements of impacts that will not be known until the resource is explored.

Sincerely,

FALL RIVER RURAL ELECTRIC

Calvin H. Wickham

Calvin H. Wickham
General Manager

CHW/rs

cc: Senator Frank Church
Senator James McClure
Representative George Hansen
Representative Steve Symms

FREMONT OUTDOOR EDUCATION & RECREATION, INC.

BONNIE M. HAWKES
Secretary
Phone 208–624-3390

249 WEST 4th NORTH
ST. ANTHONY, IDAHO 83445

P. BLAINE HAWKES
Director
Phone 208–624-3193

April 26, 1979

David M. Jay
Forest Supervisor
Targhee National Forest
420 N. Bridge Street
St. Anthony, Id. 83445

Dear Mr. Jay; *

Thank you for sending us a copy of the Draft Environmental Statement for leasing and development of geothermal resources within the Island Park Geothermal Area. Your proposal is of great interest to us and we have made a careful study of the material in this draft.

We have decided on three of the alternatives and will list them in order of preference. Our choices are as follows:

1st choice is Alternative # 3

2nd choice is Alternative # 5

3rd choice is Alternative # 2

With the apparent threat of energy supply in our country we think it wise to do some exploration as suggested in # 3 but hold off on more fragile area of our public land until we see what is really going to happen with some part of the whole thing.

If we really do have an energy source and it can be utilized to the benefit of the public - fine - but proceed with some caution. We believe in multi-use of all our public lands with caution and precaution being the guidelines.

We will be interested in following your decisions in this matter.

Sincerely,

P. Blaine Hawkes

P. Blaine Hawkes

Explore the Rocky Mountain Northwest with mobile travel units, canoes, horses and hikes

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TROUT UNLIMITED

4/11/79
Bozeman, Mt

Mr. David M. Jay, Forest Supervisor
Targhee National Forest
420 N. Bridge St
St. Anthony, Idaho 83445

Re: Draft EIS on Island Park Geothermal Area

Dear Mr Jay:

I am writing you to express the deep concern that our organization has to proposed development of the subject geothermal area. Any development of these waters that could even remotely cause adverse impacts on the geyser activity in Yellowstone National Park would be a disaster! Protection and preservation of our nation's oldest national park must remain the number one priority regardless the possible economic benefits that may accrue to potential geothermal developments.

The Montana Council of Trout Unlimited has over 500 members in Montana.

Sincerely yours
Robert J. Foukal
State Council Director
Trout Unlimited

Robert J. Foukal
2020 A-1 South Rouse
Bozeman, Montana 59715

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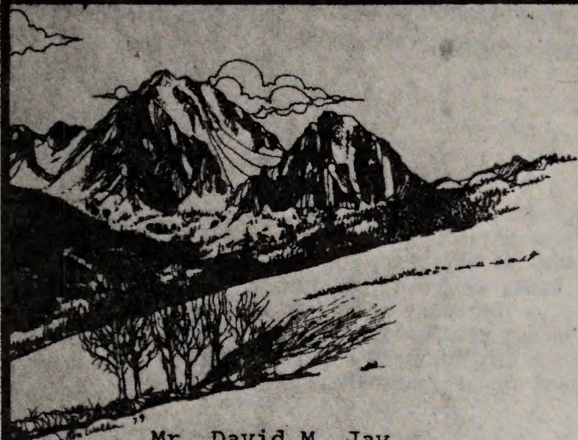

The Wilderness Society

Idaho Regional Office
Box 1661 / Boise, Idaho 83701 / (208) 342-8635

May 18, 1979

Mr. David M. Jay
Forest Supervisor
Targhee National Forest
420 N. Bridge Street
St. Anthony, Idaho 83445

Dear Mr. Jay

In response to the Island Park Geothermal Area DES, The Wilderness Society cannot support a geothermal leasing program at this time.

We do not feel confident that the potential adverse effects of developed geothermal activity have been sufficiently analyzed. For example, page 123 of the DES states that "no existing data identifies a connection between Yellowstone National Park geothermal features" and those outside the Park. The DES responds by offering a monitoring system once development has occurred. What happens once the huge expense has been invested for development to learn later that there is a severe threat to the geothermal resource inside the Park? Will all activity cease? We doubt that. The sensitive geologic splendor protected within the bounds of Yellowstone deserve the utmost care and priority consideration. In other words, no development should take place until research categorically proves that no impact will occur on the Park's resources.

We are also concerned for the grizzly bear and the threat mineral laden water imposes on waterfowl. Further, Idaho conservationists support the efforts of our Wyoming collegues to gain national park recognition for the west slope of the Teton Range. We must oppose leasing in this area until such time as Congress has made a judgement on its future management.

We can only accept non-extractive exploratory activity by the U. S. Geological Survey. In this way, answers to the aforementioned concerns, and numerous others, can be obtained deliberately and cautiously without needless adverse resource impact.

Sincerely,

Steven E. Payne
Idaho Representative

"IN WILDNESS IS THE PRESERVATION OF THE WORLD" — Thoreau

41

STATE OF IDAHO

DEPARTMENT OF FISH AND GAME

REGION 6
1515 LINCOLN ROAD
IDAHO FALLS, IDAHO 83401

May 11, 1979

Mr. David M. Jay
Forest Supervisor
Targhee National Forest
420 North Bridge Street
St. Anthony, Idaho 83445

Dear David: Re: Island Park Geothermal EIS

We are pleased to comment on the Draft Environmental Statement of the Island Park Geothermal Area.

Section VII, page 118, appears to offer adequate protection from adverse environmental impacts. Lease terms, current State water quality standards and other protective measures mentioned should protect surface waters from most foreseeable problems associated with geothermal development. A prime concern, geothermal development on the many scattered private and State lands in the area, will still come under State water quality standards.

After careful consideration, we have ranked the alternatives in order of their preference so far as the welfare of fisheries and wildlife populations are concerned. Other than Alternative 1 there is some impact on wildlife. However, to put the quantitative degree on it is rather difficult until we see more detailed plans for the individual installation. Alternative 1, No Leasing, is obviously best for wildlife. Alternative 3, which precludes considerable area from leasing due to further study, is next best. Alternative 2 protects more miles of stream, but leaves the Big Bend Ridge, an important wildlife area, unprotected.

There are several errors and omissions in the Recreation Map; namely: yellow coloring for Moose Creek is mislocated; Henrys Lake Outlet, where it traverses the National Forest, is misplaced and unrecognized as an important fishing stream, even though it receives more recreational use than Moose Creek; and the following waters should also be classified as receiving moderate to heavy recreational use (a) the lower two miles of Elk Creek (b) Buffalo River below US 191-20 (c) Henrys Fork and Island Park Reservoir from McCrea Bridge (1)

to Bills' Island (d) all remaining reaches of Henrys Fork within the Island Park Geothermal Area and (e) all of Warm River, Robinson Creek and Fall River.

The Draft Environmental Impact Statement gives considerable coverage of the fish and wildlife habitat and populations in the Island Park Geothermal area. The report adequately covers the impact geothermal development could have on these important populations. This effort in thoroughly describing the fish and wildlife values in this report is recognized and appreciated.

Sincerely,

DEPARTMENT OF FISH AND GAME
Joseph C. Greenley, Director

Tom Reinecker
Regional Supervisor
Region 6

cc: State Clearinghouse - 00492210
US Fish and Wildlife Service
Bureau of Program Coordination
Bureau of Wildlife
Bureau of Fisheries
Paul Jeppson
Robert Sherwood

IDAHO DEPARTMENT OF FISH AND GAME

1. This information has been incorporated into the final EIS.

COOPERATIVE EXTENSION SERVICE

University of Idaho
College of Agriculture
In Cooperation with the
U.S. Department of Agriculture
P. O. Box 4044
Pocatello, ID 83201

April 11, 1979

Mr. David M. Jay
Forest Supervisor
Targhee National Forest
420 N. Bridge Street
St. Anthony, ID 83445

Dear Mr. Jay:

Thank you very much for sending me a copy of the draft Environmental Statement of the Island Park Geothermal Area. I have read the draft statement and found it to be very well put together.

I do have two concerns that are touched on briefly in the E.I.S. On Page 120, a brief mention is given to herbicidal control of unwanted vegetation. This point is not clear as to what is meant; whether it is for the existing vegetation on the development site or for something else. May I request that it be made more specific. (1)

I would also request that some mention be made of noxious weed control for the land disturbed by geothermal development. May I recommend that the final statement contain an arrangement with the County Extension Agricultural Agent for noxious weed control.

Second concern: on page 122, under the section of Construction and Development, mention is made between the relationship of local government officials and leasees. May I recommend that the Forest Service take the lead and formalize this suggestion and set up the working structure before the leases are granted, thereby, having a formalized structure already prepared (i.e. a task force representing county, city, state, and federal agencies and business, and industry) to handle the expected impacts.

Respectfully,

"J" Clair Wixom
CRD Specialist

JCW:mn

cc: T. Chester
J. Hanson
R. Hillman
F. Jacobs

The University of Idaho is an Equal Opportunity/Affirmative Action Employer.

COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF IDAHO

1. Herbicides will most likely be used on and around roads, drill pads, sump, buildings, etc. Existing vegetation in most cases will be cleared by means other than chemicals. On these disturbed lands, unwanted vegetation (high brush, noxious weeds, etc.) will most likely be controlled with Federal and State approved herbicides. The County Extension Agent will be consulted in the coordination process.

State of Idaho
DEPARTMENT OF WATER RESOURCES
STATE OFFICE, 373 W. Franklin Street, Boise, Idaho

JOHN V. EVANS
Governor

C. STEPHEN ALLRED
Director

Mailing address:
Statehouse
Boise, Idaho 83720
(208) 384-2215

May 15, 1979

Ms. Michelle Liebel, Coordinator
State Clearinghouse
Hall of Mirrors; 2nd Floor West
Statehouse
Boise, ID 83720

RE: Island Park Geothermal Area

Dear Ms. Liebel:

The Department of Water Resources supports Alternative 3 of the identified alternatives. It offers immediate protection to those areas where geothermal development is most likely to result in severe environmental degradation. The environmental statement points out that almost nothing is known about the geothermal resource. Alternative 3 defers action on 40 percent of the lands until data can be gathered so that more informed decisions can be made.

Specific comments are as follows:

P. 7 At some time, production testing of the well will have to be done. This will involve pump testing the well for several weeks.

P. 20 Some mention should be made of the probable resource temperatures based on "geothermometers." Significant differences in environmental hazards occur if the resource is hot water or steam. ①

P. 20-22 There seems to be a contradiction in stating that Island Park is in the highest seismic risk category on a national level, yet is conspicuous by its lack of seismicity. ②

P. 32 Whitehead's data are valuable, but incomplete. The data can be interpreted in several different ways.

P. 33 It is too simplistic to state that blue-green algae are indicators of eutrophication. Temperature is only one factor in algae development, others could easily be as important in these reservoirs, although probably not increased circulation.

STATE OF IDAHO DEPARTMENT OF WATER RESOURCES
(FRANK SHERMAN)

1. Geothermometer studies have been conducted at only one thermal spring near the IPGA. The US Geological Survey's opinion is that the calculated geothermometers for this area are probably unreliable (USGS Circular 790, 1978, page 73.)

2. No discrepancy was intended in the draft EIS. The Island Park caldera area, excluding the West Yellowstone, Montana area, is, when compared with areas in Yellowstone National Park and near Hebgen Lake, Montana, relatively aseismic. The West Yellowstone, Montana area, however, is recognized as a seismically active area.

P. 52-53 The duck harvest predictions do not seem consistent.

P. 100-101 Many of these impacts are speculative at best. Geothermal water from the Boise area contains no significant chemical contaminants that would impact on the fisheries resource. More data on the Island Park geothermal resource must be gathered (or reported) before intelligent assessments can be made concerning the probable environmental consequences of development. (3)

Sincerely,

Frank B. Sherman

FRANK B. SHERMAN
Supervisor, Environmental Section

FBS:sjl

3. Text has been corrected.

IDAHO DEPARTMENT of PARKS & RECREATION

Statehouse Mail 2177 Warm Springs Ave. Boise Idaho 83720 (208) 384 · 2154

Dale R. Christiansen, Director
R. P. Peterson, Deputy Director

John V. Evans, Governor

April 16, 1979

Mr. David M. Jay
Forest Supervisor
Targhee National Forest
420 N. Bridge St.
St. Anthony, ID 83445

Re. - Draft ES - Island Park Geothermal Area

Dear Mr. Jay:

Upon preliminary review of the proposed Environmental Statement for a geothermal area in Island Park, the following comments are offered.

We would suggest that the alternatives show a no leasing opportunity for geothermal drilling along the stretch of the Henry's Fork River from its outlet at Henry's Lake downstream to Warm River. We would recommend that, as a minimum, this corridor be approximately one to two miles wide. We would suggest that the Big Springs corridor, Warm River, and Falls River, also be included within this no lease area. ①

For Alternative #4, we would recommend a lease with no service occupancy restrictions shown for all segments that are of high visual quality as shown on Page 65. This should include the river corridors referenced above, also.

Of particular interest to us is the possibility of thermal pollution into these quality trout streams. Because of this concern, we recommend that if there is any possibility at all of a thermal heated ground water seepage into the springs that feed the Henry's Fork, Fall River and Warm River, that these areas, for an appropriate distance from the river, not be available for leasing. ②

We thank you for the opportunity to review this draft copy.

Sincerely,

DALE R. CHRISTIANSEN
DIRECTOR

William G. Hagdorn, Chief
Comprehensive Planning Bureau

EQUAL OPPORTUNITY EMPLOYER

jm

IDAHO DEPARTMENT OF PARKS & RECREATION

1. The width of strips along stream courses is based upon geology, vegetation, landtypes, fisheries, and other resource considerations.

2. These concerns will be dealt with in depth when reviewing plans of operation on a site-specific basis. See Section VIII.

E.C.I.P.D.A.

E.C.I.P.D.A.

EAST-CENTRAL IDAHO PLANNING AND DEVELOPMENT ASSOCIATION, INC.
12 NORTH CENTER • REXBURG, IDAHO 83440
P.O. BOX 330 • 356-4524

Member Counties

Bonneville
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Custer
Fremont
Jefferson
Lemhi
Madison
Teton

15 May 1979

Mr. John Beland, Resource Coordinator
Targhee National Forest
420 North Bridge Street
St. Anthony, Idaho 83445

Dear Mr. Beland;

This is a staff review of the Draft Enviromental Statment on the Island Park Geothermal Area. It has been distributed to our Executive Committee. They have decided to make an official comment after reviewing the final Enviromental Statement. As a preface to our specific comments and questions on the Draft some clarification may be useful. Within its ability East-Central Idaho Planning and Development Association promotes that economic activity which it consideres beneficial to residents of the counties it serves. The association supports development of the Island Park Geothermal resource insofar as it does not harm the existing economy and lifestyles of this area. The Association believes that development will be economically beneficial with the management program you propose in your draft ES.

Sincerely,

DARRELL L. BREMNER
Economic Planner

DLB:lm

"An Equal Opportunity Employer"

This review of the Island Park Geothermal Area (IPGA) Draft EIS covers five major concerns and several minor questions.

1. The Draft included the most significant alternatives. The evaluation criteria are adequate and complete.

2. There was too little quantification of impacts. The Draft states at length that a lot of impacts could occur, and briefly that most will be mitigated. With quantified or qualified impacts the Draft and its reviewers could have concentrated on the major issues and impacts as suggested by the recently revised Council on Environmental Quality regulations. If you are operating from too little data and another EIS will be done after gradient test wells are drilled across the IPGA this should be stated clearly.

The tone of the first 117 pages is that all land in the IPGA will be developed, with mainly negative impacts unless specifically forbidden or deferred. Yet your Appendixes on Employment and Social impacts look at development of about 200 acres from the total 144,000 in the Island Park Geothermal Area (IPGA). Page 7 states, "Development of a large geothermal field involves clearing and grading for access roads, well drilling pads and pipelines. Well pads are from one-half to two acres. Between five and 25 wells are usually required... Pipeline clearings need only be wide enough to accomodate equipment needed for their construction and fire safety." 25 two acre well pads would need 50 acres. Given that roads and pipelines will be as short as possible, 100 acres for a power plant seems reasonable. Appendixes G and H (pages 144 and 150) use two plants to predict development impact. Thus the total federal land use from geothermal development is about 200 acres.

If all land in the two known Geothermal Resource Areas were developed that would be 15% of the total IPGA area. Is this more likely than development of only two plants? Map number 1 (at least) should show the location of the Island Park Known Geothermal Resource Area. (1)

There is a geological structure map but no indication that any structures are more likely to have geothermal potential than are others. Such indication if possible would be useful in evaluating alternatives or quantifying impacts.

It is stated on page 1 of the Draft that, "the social structure and economies of several communities could be significantly effected." In table 36 page 112 socio-economic effects receive one of the lowest ratings of any resouce on all alternatives. Table 33 page 103 does not quantify impacts and Appendixes G,H,I, show minor impacts. What justifies the page 1 statement? (2)

3. The EIS is a predictive decision making tool. In this era of rising energy costs it seems that this EIS should weigh the state of geothermal technology, market factors, and energy costs to predict how much and how rapidly the IPGA would be developed. Thus I believe that a Cost Benefit Analysis should have been included, as would be indicated by the language of the National Environmental Policy Act. (3)

Why is there no discussion of potential industrial developments using geothermal heat? Page 9 lists the uses of such heat. Page 152 states that heat is seldom piped more than 9.32 miles. This implies that if use of geothermal head develops, most will occur within the IPGA. If such industry could be developed it would add more economic benefits than electrical generation alone. (4)

E.C.I.P.D.A.

1. No level of development was indicated in the draft. The unknown quantity or quality of the resource prohibits this evaluation.

2. "**Significant**" is deleted from the final geothermal EIS.

3. Page 1 of the draft indicated a benefit/cost analysis was not within the scope of the EIS. The lack of knowledge of the geothermal resource prevents assessment of the magnitude of development.

4. Page 8 and 9 of the draft EIS discussed the uses of geothermal resources. Non-electrical application of a geothermal resource is considered impractical in the IPGA.

E.C.I.P.D.A.

4. Most Impacts seem adverse, especially in Table 33 (page 88). Could there be beneficial impacts? For example, improved access to hunting and timber; more knowledge of geothermal processes and how to develop them as power source; new industries in the IPGA attracted by the power available; and conversion to campsites of test well drill pads due to be reclaimed. If there are beneficial impacts how would they be measured on Table 33-41, your evaluation of alternatives? If a major adverse impact is rated 1 then a major benefit should be rated -1. (5)

There should be more discussion of the possible phasing of development. One sentence under mitigation (page 118) is not sufficient. The Draft sounds like construction will occur simultaneously and rapidly on the entire IPGA. (6)

5. There were many good points to the draft. First it was very attractive, especially the pictures. Use of color made most maps very clear. The data base on affected environment was extensive. The section on mitigation Chapter VII covered most impacts and listed reasonable ways to handle them. It was good that you tried to keep the Draft brief.

The following are minor questions:

Soci-Economic Chapter II

Does the population projection (page 71) include the impact of geothermal development? If not, the geothermal related population should be shown in the same table rather than in a separate appendix. (7)

The draft shows past incomes on page 73. I feel it should also project incomes with the impact of geothermal development included. Both existing and projected incomes should be compared to a benchmark preferably national per capita income in the same periods. (8)

With the IPGA's relation to Yellowstone National Park and current recreation use (pages 37, 39, 40, and 50) and projected tourism growth (page 39) how do you justify non-growth in the service economy (page 72), which includes tourist services? (9)

Alternatives Considered Chapter IV

What criteria was used to determine which area should be recommended for no leasing? (10)

Evaluation Chapter VI

The measure, "Weighted Resource Values" is used to evaluate alternatives (page 110). How was this criteria determine? Was that past, present or future value or a combination of the three? (11)

Why isn't a section on irreversible and irredeemable resource commitments included as NEPA suggests?

Could endangered species and grizzly bear habitat be shown clearly on each alternatives map? This might help with evaluation. (12)

5. There are some socio-economic benefits of geothermal development. These are listed in the Effects of Implementation section.

6. A computer program was developed to simulate the effect of phased power plant development on population. A portion of the output of this program is presented in the Appendix. The total output, which includes phasing, is on file at the Targhee National Forest Supervisor's Office, St. Anthony, Idaho.

7. The population projections were developed from Population and Employment Forecast — State of Idaho, July, 1976, p.p. 254-260. This does not include population increases due to geothermal development.

8. Since the magnitude of development is not known, change in per capita income created by geothermal development cannot be determined. A comparison to existing per capita incomes is presented in the Affected Environment section.

9. This may be a deficiency. These figures were quoted directly from Population and Employment Forecast — State of Idaho, July, 1976, p.p. 254-260. More recent data has been developed through refinement of the model. The results of this refinement were released in Population and Employment Forecast — State of Idaho — Series 2 — Projections 1975-2000, July, 1978. An employment forecast from the July 1978 refinement has replaced table 28 inthe final EIS (Affected Environment section).

10. Criteria for no leasing is explained in the discussion of each alternative.

11. The evaluators considered a combination of the three.

12. We believe this would have confused rather than helped the evaluation.

Why weren't unavoidable adverse impacts more prominently displayed? Usually they are in their own chapter. Again quantities, or at least qualification i.e. slight to severe would be helpful. (13)

If it is unavoidable that some animals will leave the IPGA during development, is ther adequate carrying capacity for them outside the IPGA? Would the animals be less likely to be driven out of the IPGA if specified areas were explored or developed in a designed pattern? (14) (15)

Revegetation of drilling sites is discussed on page 150 under General Construction which applies to all phases. It says revegetation will occur with proper species composition, fertilizer, cultivation, etc. Yet page 109 lists an unavoidable adverse impact on timber as "(retarded growth) unless fertilizer is applied." Since fertilizer will be applies why list this adverse impact? (16)

In appendix I, development of Colstrip and the IPGA was compared. Colstrip residents were favorable to the development. But this was an unfortunate comparision for two reasons. (1)Colstrip is resented by many environmentalists as having severe adverse environmental effects. (2) It was not demonstrated that the magnitude of impacts will be comparable. For instance, Colstrip's population increased from 200 to 3000 in three years or 1500%. The IPGA population will go from 5,296 to 5,522 (248 people) in three years, a 5% change then population will decline.

Mitigation Chapter XI

It is practical to save topsoil removed during development and replace it during site rehabilitation?
Would provisions for no surface occupancy protect habitat and other surface resource values as defined on page 80? The Draft suggests they be protected by deferred development. (17)

We would like to see more discussion of reinjection of geothermal water as a mitigation tool, primarily its potential in the different development phases. The term general construction is referenced several times in Chapter VII. It should be made easier to find in the text. (18)

E.C.I.P.D.A.

13. Table 34 in the draft lists the probable unavoidable adverse impacts. They are no longer in their own chapter.

14. The carrying capacity on lands within and outside the IPGA cannot be qualified at this time. It can be reasonably assumed that under current management conditions on these lands, any additional increase in the numbers of animals will stress the existing populations. However, this undoubtedly varies considerably depending upon the species in question, seasonal site-specific management situations, etc.

15. Yes, however, this can only be best answered on a site-specific basis when more information is available on the proposed action and the exact habitat affected.

16. This is corrected in the final EIS.

17. Surface resource values would be protected by no-surface occupancy or deferred leasing.

18. This is more adequately addressed in the final EIS.

State Of Idaho

DIVISION OF BUDGET, POLICY PLANNING AND COORDINATION

EXECUTIVE OFFICE OF THE GOVERNOR

JOHN V. EVANS
Governor

MANAGEMENT SYSTEMS BUREAU
STATE CLEARINGHOUSE
MAY 18, 1979

Statehouse
Boise, Idaho 83720

DAVID JAY, FOREST SUPERVISOR
TARGHEE NATIONAL FOREST
420 NORTH BRIDGE ST.
ST.ANTHONY, IDAHO 83445

RE: ISLAND PARK GEOTHERMAL AREA DEIS
OUR SAI# 00580530

MR. JAY,

THE STATE CLEARINGHOUSE IS FORWARDING THE EXTENSIVE COMMENTS RECEIVED CONCERNING ISLAND PARK GEOTHERMAL AREA DEIS. THE FOLLOWING AGENCIES WERE SUPPLIED COPIES OF THE DEIS AND WERE ASKED TO REVIEW AND COMMENT:

REGION IV DEVELOPMENT ASSOC, TWIN FALLS
EAST CENTRAL IDAHO PLANNING & DEVELOPMENT ASSOC, REXBURG
IDAHO DEPT OF AGRICULTURE
" " " P.U.C.
" OFFICE OF ENERGY
" DEPT OF FISH & GAME
" DEPT OF LANDS
" " " PARKS & RECREATION
" " " WATER RESOURCES
" " " HEALTH & WELFARE-ENVIRONMENT DIVISION
NATURAL RESOURCES BUREAU//DIVISION OF BUDGET, POLICY PLANNING & COORDINATION

IN THE REVIEW COMMENTS ATTACHED, ALTERNATIVES 3 & 5 ARE MOST FREQUENTLY CITED AS OFFERING THE MOST COMPREHENSIVE & IMMEDIATE PROPOSED MEASURES FOR DEALING WITH ENVIRONMENTAL IMPACTS OF GEOTHERMAL DEVELOPMENT. ECIPDA, THE OFFICE OF ENERGY, AND THE DEPARTMENTS OF FISH & GAME, WATER RESOURCES, HEALTH & WELFARE-DIVISION OF ENVIRONMENT AND AGRICULTURE HAVE FURTHER DETAILED AREAS OF CONCERN IN THE DRAFT, AS HAS THE BUREAU OF NATURAL RESOURCES.

AS IS EVIDENT FROM THE RESPONSE TO THE INITIAL EIS, REVIEWING AGENCIES INDICATED INTEREST & CONCERN IN THE DEVELOPMENT OF GEOTHERMAL RESOURCES. YOU ARE URGED TO INCORPORATE THESE SUGGESTIONS INTO YOUR FINAL EIS. YOUR CONTINUED COOPERATION & ASSISTANCE IN THE ENVIRONMENTAL REVIEW PROCEDURES MAKE OUR REVIEW EFFORTS MEANINGFUL.

SINCERELY,

PAM DEMO-RYBUS
STATE CLEARINGHOUSE COORDINATOR

CC:PCUNNINGHAM;NATRESBUR

EQUAL OPPORTUNITY EMPLOYER

STATE OF IDAHO

DEPARTMENT OF HEALTH AND WELFARE

DIVISION OF ENVIRONMENT
Statehouse
Boise, Idaho 83720

May 11, 1979

Mr. David M. Jay
Forest Supervisor
Targhee National Forest
420 N. Bridge St.
St. Anthony, Idaho 83445

Dear Mr. Jay:

The Division of Environment, Department of Health and Welfare has reviewed the draft Environmental Statement of the Island Park Geothermal Area.

To comply with your request for standards which apply in deciding which alternative to select we wish to call your attention to the following:

1. *Rules and Regulations For The Control of Air Pollution in Idaho.* Permits to operate issued under authority of these regulations will possibly be issued with the following conditions:

   (a) Restriction of Hydrogen Sulfide (H_2S) emissions to 15 or 20 ppm (parts per million).

   (b) Sulfur dioxide (SO_2) emission limitation of 500 ppm (on the basis of report - probably not necessary).

   The quantity of emissions appears to be insignificant and a PSD (Prevention of Significant Deterioration) review will probably not be necessary. However, should the emission of particulates or SO_2 increase, such a review may be required.

EQUAL OPPORTUNITY EMPLOYER

Mr. David M. Jay Page 2 May 11, 1979

There are being considered regulations on fugitive dust which may be in effect by the time development is begun. This regulation would require measuring dust upwind and downwind of the source with an allowable limit specified. Parties interested in developing the area should inquire as to the status of the new fugitive dust regulation.

2. A National Pollutant Discharge Elimination System (NPDES) permit administered by the Environmental Protection Agency (E.P.A.) would be required for each discharge. These discharges must be in compliance with *Idaho's Water Quality Standards &, Wastewater Treatment Requirements.*

We also wish to submit the following specific comments.

pp. 5-8. This synopsis of geothermal development should include a summary of environmental impacts and wastes produced during each phase of development.

Table 33, p. 88 and following. This table of impacts of geothermal leasing should include an additional column listing the preventive or mitigative practices which should be applied to minimize or abate the impact of each activity. This should include reference to specific laws or rules which govern the activity.

Chapter VII, p. 118 and following. This Chapter should be revised to identify specific laws which apply to the particular activity. Mitigative measures should be incorporated into Table 33 as indicated above. This information will assist local managers in providing adequate protection of resources in the Island Park KGRA.

Thank you for the opportunity to comment on this statement. For further information you may contact the Pocatello Division of Environment Office - Phone 233-6170, Ext. 291.

Sincerely,

Lee W. Stokes, Ph. D.
Administrator

LWS/bg

Encls. Idaho Water Quality Standards and Wastewater Treatment Requirements
Rules & Regulations For The Control of Air Pollution in Idaho

State Of Idaho

DIVISION OF BUDGET, POLICY PLANNING AND COORDINATION

EXECUTIVE OFFICE OF THE GOVERNOR

STATE CLEARINGHOUSE

JOHN V. EVANS
Governor

Statehouse
Boise, Idaho 83720

TO: Natural Resources Bureau
STATEHOUSE MAIL

DATE: APRIL 5, 1979

FROM: State Clearinghouse
Hall of Mirrors; 2nd Floor West
Statehouse
Boise, Idaho 83720
(208) 384-3351

RE: BLM: ISLAND PARK GEOTHERMAL AREA

SAI# 00492210

The enclosed DRAFT EIS is referred to you for review and comment in accordance with U.S. Office of Management & Budget Circular A-95. If your agency has an interest in this document, please comment and/or check the appropriate box(es) & return this memo with your comments to the State Clearinghouse NO LATER THAN 5/15/79

___ NO COMMENT

___ CONTACTED APPLICANT

___ I HAVE PREVIOUSLY RECEIVED INFORMATION ON THIS PROJECT

___ I SUPPORT THIS PROJECT

_x_ COMMENTS-
(x) COMMENTS ATTACHED

Reviewer Signature [signature] DATE May 15, '79

Title Chief, Natural Resources Bureau

EQUAL OPPORTUNITY EMPLOYER

Alternative 3 appears to be the most reasonable alternative for the Island Park KGRA. The selection of the alternative is made since we are dealing with a relatively new resource whose environmental impacts are not fully known. I would encourage that any development within the guidelines of Alternative 3 make use of existing transportation networks and thereby minimizing adverse environmental impacts. Finally, I believe that any development of geothermal resources should not be allowed in the area adjoining Harriman State Park or in the more sensitive fisheries and wildlife habitats such as Buffalo River, Moose Creek or the Henrys Fork.

STATE OF IDAHO

DEPARTMENT OF HEALTH AND WELFARE

DIVISION OF ENVIRONMENT
636 Pershing
Pocatello, Idaho 83201

April 23, 1979

Mr. David M. Jay, Forest Supervisor
Targhee National Forest
420 N. Bridge Street
St. Anthony, Idaho 83445

Dear Mr. Jay:

Following are our comments on the Draft Environmental Statement of the Island Park Geothermal Area:

1. As most geothermal activity outlined in the draft statement would constitute a discharge to surface waters of the State of Idaho, a National Pollutant Discharge Elimination System permit as administered under the Environmental Protection Agenyc would be required for each discharge.

2. Any such discharge would come under the rules of the State of Idaho's Water Quality Standards (copy enclosed). We believe this shouldbe mentioned in the Statement.

If you have any questions regarding this matter, please contact this office at 233-6170 ext. 291.

Sincerely,

Michael R. McSorley
Michael R. McSorley
Sr. Environmental Quality Specialist

MRM/mb
Enclosure

EQUAL OPPORTUNITY EMPLOYER

State of Idaho

DIVISION OF BUDGET, POLICY PLANNING AND COORDINATION

EXECUTIVE OFFICE OF THE GOVERNOR

STATE CLEARINGHOUSE

JOHN V. EVANS
Governor

Statehouse
Boise, Idaho 83720

TO: DEPARTMENT OF AGRICULTURE
STATEHOUSE MAIL

DATE: APRIL 5 1979

FROM: State Clearinghouse
Hall of Mirrors; 2nd Floor West
Statehouse
Boise, Idaho 83720
(208) 384-3351

RE: BLM: ISLAND PARK GEOTHERMAL AREA

SAI# 00492210

The enclosed DRAFT EIS is referred to you for review and comment in accordance with U.S. Office of Management & Budget Circular A-95. If your agency has an interest in this document, please comment and/or check the appropriate box(es) & return this memo with your comments to the State Clearinghouse NO LATER THAN 5/15/79

___ NO COMMENT

___ CONTACTED APPLICANT

THE BLM INDICATES YOUR AGENCY HAS ALREADY REC'D A COPY OF THIS DEIS. PLEASE PROVIDE COMMENTS ON THIS FORM DIRECTLY TO THE STATE CLEARINGHOUSE.

___ I HAVE PREVIOUSLY RECEIVED INFORMATION ON THIS PROJECT

___ I SUPPORT THIS PROJECT

X COMMENTS-
( ) COMMENTS ATTACHED

DEIS was attractively presented with appropriate options. Alternatives #3 + #5 are preferred in that order

Reviewer Signature [signature] DATE 4/9/79

Title Management Unit

EQUAL OPPORTUNITY EMPLOYER

JOHN V. EVANS
Governor

L. KIRK HALL
Director

State Of Idaho
OFFICE OF ENERGY
STATEHOUSE
BOISE, IDAHO 83720
(208) 384-3800

April 5, 1979

David M. Jay
Forest Supervisor
Targhee National Forest
St. Anthony, Idaho 83445

Dear Mr. Jay:

After reviewing the Draft Environmental Impact Statement for Geothermal Leasing and Development in Island Park, I would like to make the following suggestions and recommendations:

1) The classification of areas for lease with no surface occupancy is unacceptable. Any area so classified is essentially closed to exploration. Directional drilling is not realistic. These areas should either be classified for lease under restrictions or unleaseable.

2) Leasing lands with surface occupancy restrictions is a practical, environmentally sound and institutionally logical procedure. But restricting exploration of these lease areas to nondisruptive surface exploration, and gradient test holes from existing roads is too restrictive. Exploration drilling should be allowed from existing roads and in areas which have been logged. Exploration drilling can be conducted in restricted areas with minimal environmental disturbance if present logging areas are used. Such exploration areas can easily be rehabilitated as part of the reforestation process. Clear cut areas and logging spur roads provide excellent sites for locating exploration drilling equipment.

3) Any further exploration beyond the initial well or production drilling should be subject to site specific analysis under the NEPA process.

4) Surface occupancy restrictions should not deter exploration activities unless said activities conflict with higher value uses.

In general, by allowing exploration drilling occupancy in areas which have been recently logged, minimal impacts to the environment and maximum exploration results can be achieved without conflict.

Of the five leasing scenarios proposed in the Draft EIS, option five is the most realistic leasing procedure. By expanding the definition of surface occupancy restrictions to allow for exploration drilling in logged over areas, leasing option five will be a very acceptable alternative. I believe the geothermal industry would be amendable to this form of leasing.

Sincerely,

David McClain

David McClain
Geothermal Resource Coordinator

DMc:da

MONTANA HISTORICAL SOCIETY

HISTORIC PRESERVATION OFFICE

225 NORTH ROBERTS STREET • (406) 449-4584 • HELENA, MONTANA 59601

June 11, 1979

Mr. David M. Jay, Forest Supervisor
USDA Targhee National Forest
420 N. Bridge Street
St. Anthony, Idaho 83445

RE: Island Park
Geothermal Area

Dear Mr. Jay:

Thank you for the opportunity to review the DEIS on Island Park. On page 120 you stipulate the measures to be followed to protect historic and cultural properties. You might add that Executive Order 11593 requires inventory and evaluation prior to project implementation. You should comply with 36CFR800 which details the procedures for protecting historic and cultural properties.

I will look forward to the opportunity to review and comment on the surveys for cultural resources in the Montana portion of the geothermal area.

Sincerely,

Ken Korte
State Historic Preservation Officer

KK/EV/prb

JUN 1 '79

STATE OF MONTANA

DEPARTMENT OF
FISH AND GAME

Helena, MT 59601
April 16, 1979

Mr. David M. Jay, Supervisor
Targhee National Forest
420 N. Bridge St.
St. Anthony, Idaho 83445

Dear Mr. Jay:

We have reviewed the Island Park geothermal area EIS prepared by the U. S. Forest Service. We find the environmental impact statement to be rather general; however, its coverage appears to be adequate. It is our belief that the Forest Service has done a satisfactory job of presenting the potential impacts and the most significant alternatives. The list of management requirements, constraints and mitigating measures identified in that impact statement appears to be complete.

When site-specific analyses are in order the Montana Department of Fish and Game expects and desires to work directly with the U. S. Forest Service and the lessee to select specific sites for further exploration and possible development. It is essential that we have the opportunity to arrive at firm understandings regarding mitigation and compensation as these sites proceed toward development.

It is also our feeling in the case of extremely important fish or wildlife areas that the opportunity to place such sites off-limits to development be retained. As you probably know, some of the identified geothermal potential areas immediately north of Yellowstone Park have exceptional wildlife values and must be protected at all costs.

In conclusion, we thank you for providing us the opportunity to review and comment on this EIS.

Sincerely,

James A. Posewitz, Administrator
Ecological Services Division

JAP/sd

cc: LeRoy Ellig
Kerry Constan

M E M O R A N D U M

TO: Robert E. Sundin, Director, Department of Environmental Quality

THROUGH: Randolph Wood, Administrator, Air Quality Division

FROM: Woody Russell, District Engineer, Air Quality Division

SUBJECT: Review of Draft EIS of the Island Park Geothermal Area

DATE: May 9, 1979

Comments regarding this draft EIS will concern two areas: (1) existing ambient air quality and (2) potential impact on the ambient quality resulting from leasing, exploration, testing, and production.

(1) In regards to the existing air quality and as stated in the EIS, the U.S. Geological Survey conducted air quality surveys in the fall of 1977 and the summer of 1978. A discussion of the air quality and a table summary of the data collected is presented on pages 15-16 of said statement. However, this section on air quality is lacking in detail. One is unable to ascertain the location of the sampling stations and the activity (i.e. background, industrial, people, etc.) monitored. The concentrations of the pollutants monitored are summarized for the two survey periods but data specific to each site is not available. The variation in pollutant concentrations between survey periods was not explained.

The potential effects of leasing, exploration, testing, and development of geothermal sites on the ambient air quality are listed on page 91 of the statement. In summary it states that short term and/or long term degradation of the air quality will occur depending on the activity at the time. No quantitative analysis of the pollutant concentrations resulting from these activities has been conducted.

(2) The Division of Air Quality believes that a detailed description of the existing air quality be included in the EIS and that means to monitor the air quality during exploration and testing of geothermal sites be instituted either by the leasee or leasor.

STATE OF WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY, AIR QUALITY DIVISION (MEMO FROM WOODY RUSSELL)

1. Details of the 1977 and 1978 sampling work are on file in the Supervisor's Office of the Targhee National Forest, St. Anthony, Idaho.

2. Existing laws require air quality monitoring during early phases of development including exploration and testing.

STATE OF WYOMING

ED HERSCHLER
GOVERNOR

State Conservation Commission

2219 CAREY AVENUE PHONE (307) 777-7321 CHEYENNE, WYOMING 82002

STAFF:

COMMISSION MEMBERS

May 2, 1979

M E M O R A N D U M

TO: Don Daiss, Assistant Commissioner of Agriculture

FROM: Timothy J. Kautza, District Program Consultant

SUBJECT: DRAFT ENVIRONMENTAL STATEMENT OF THE ISLAND PARK GEOTHERMAL AREA

I have reviewed the above named subject and offer the following comments for your consideration.

Why were the participants of the Geothermal Workshop offered only two choices for the division of lands for geothermal use? I think the approach used to acquire public involvement is good. However, the participants should have been allowed to determine "lands for leasing with no surface occupancy restrictions" and "lands for leasing with no surface occupancy" also. I suggest that another workshoo be held before the printing of the "Final" Environmental Statement and that these additional choices be included as land use options.

I think the Environmental Statement is very attractive. The use of color throughout is eye-appealing; however, I believe that the use of color is unnecessary. Those people concerned with the conservation of our natural resources will review Environmental Statements printed in black and white. The public is clamoring for a halt of excessive government spending. The use of color: some unnecessary, although beautiful, photographs; and the high quality of paper is, in my mind, in excess of what would adequately provide the public with the needed information.

Thank you for the opportunity to comment on this document.

TJK:mn

PROTECT OUR HERITAGE
through the
Conservation of Wyoming's Natural Resources

THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

Wyoming Recreation Commission

OFFICE OF THE WYOMING STATE ARCHEOLOGIST

DEPARTMENT OF ANTHROPOLOGY
LARAMIE, WYOMING 82071

UNIVERSITY OF WYOMING
TELEPHONE: 766-6334

JAN L. WILSON
Acting Director
777-7695

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Rawlins 82301
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ALBERT PILCH
1800 Morse Lee
Evanston 82930

April 16, 1979

David M. Jay
Forest Supervisor
Targhee National Forest
420 N. Bridge St.
St. Anthony, Idaho 83445

Dear Mr. Jay:

A file search was conducted by the Office of the Wyoming State Archeologist for the Wyoming portion of the proposed Island Park Geothermal Area. Our records show no comprehensive cultural resource survey of the area. Four sites were previously recorded by the Forest Service: 48TE905, 48TE906, 48TE907, and 48TE908. These sites are located in T47N, R118W. Site density is high in the northwestern portion of the state, we therefore recommend a complete cultural inventory of the Island Park Geothermal Area in Wyoming by a qualified archeologist.

Sincerely,

Thomas K. Larson
Associate State Archeologist

TKL/rl

THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

Game and Fish Department

CHEYENNE, WYOMING 82002

EARL M. THOMAS
DIRECTOR

May 15, 1979

Mr. David M. Jay, Forest Supervisor
Targhee National Forest
420 N. Bridge Street
St. Anthony, Idaho 83445

DES 255: Island Park
Geothermal Area

Dear Mr. Jay:

A review of the DES for Island Park Geothermal Area development indicates that comments we offered on the preliminary draft document were considered in drafting this document. The subject DES is considerably better than most we have reviewed. It provides a good condensed description of impacts, for each of the alternatives considered, foregoing selection of a preferred alternative pending the completion of a final environmental impact statement. The document is easy to read and understand. The wildlife matrix format allowed presentation of a large amount of data in a small space and helped cut down on the volume of the document. The analysis of potential impacts was excellent—it was thorough, concise, and easily understood.

Specific Comments:

Page 37. Why is hunting not included with recreation? (1)

Page 94. Use of explosives in exploration may cause adverse impacts to recreation by causing elk to move from open hunting areas to Yellowstone Park, if exploration occurs too near hunting season.

Page 95. There should be no camping or housing of exploration personnel on Forest Service lands unless the areas used are completely cleaned up and replanted after use.

We question the weighting of environmental effects if only the Wyoming portion of the Targhee National Forest were considered, but for the entire geothermal area they are probably correct.

For the Wyoming portion of the DES region, Alternative 1, "no leasing" would be least detrimental to wildlife. Alternatives 2, 3, and 5, in that order, are next best for wildlife. Considering the distribution of grizzly bear shown

Mr. David M. Jay
May 15, 1979
Page 2

on Page 56, Alternative 2 may be most logical. Alternative 3, which provides a buffer around the Falls River and defers leasing in Wyoming, would be acceptable from the standpoint of effects on aquatic wildlife, but needs modification for grizzly habitat protection. Alternative 5 also includes essential grizzly bear habitat. Leasing in Wyoming in areas shown in Alternatives 3 and 5 will adversely impact elk, moose, ruffed grouse, and blue grouse.

One positive feature of this development is that warm water ponds could create winter swan habitat, a habitat feature that the Mid-Continental Trumpeter Swan Management Plan notes is seriously lacking in this area. This has potential as a mitigation method.

Thank you for the opportunity to review this DES in the interest of the wildlife resource. If we may be of further assistance, do not hesitate to contact us.

Sincerely,

W. Donald Dexter

W. DONALD DEXTER, ASSISTANT DIRECTOR
WYOMING GAME AND FISH DEPARTMENT

WDD/HBM/mlr

cc: Game Div.
Fish Div.
State Planning Coordinator
File

WYOMING GAME AND FISH DEPARTMENT

1. Hunting was included in the wildlife section for each group of hunted animals because the source document listed these data with these wildlife groups. Harvest and demand (hunter days) are recreational benefits and can be included under recreation.

WYOMING
EXECUTIVE DEPARTMENT
CHEYENNE

ED HERSCHLER
GOVERNOR

TARGHEE NF	
Units: 1 2 3 4 5 6	
MAY 29 '79	

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	Personnel	
	Off. Serv.	
Promise Card		

May 21, 1979

Mr. David M. Jay
Forest Supervisor
Targhee National Forest
420 N. Bridge Street
St. Anthony, Idaho 83445

Dear Mr. Jay:

The draft environmental statement of the Island Park Geothermal Area has been reviewed by our interested state agencies. Copies of agency comments are enclosed for your consideration. The close proximity of the Island Park Area to Yellowstone and Grand Teton National Parks and adjacent wilderness areas makes the potential development of geothermal resources in the area an extremely sensitive issue. We encourage full consideration of the known surface resource values, and recommend complete inventories on a case-by-case basis for each leasing decision. Such inventories would insure that resource values which are currently unknown or ill-defined would be documented and potential impacts could then be assessed in a timely manner. (1)

Thank you for the opportunity to review and comment on this document.

Yours sincerely,

Dick Hartman

Dick Hartman
State Planning Coordinator

DH/pct

attachments

WYOMING STATE PLANNING COORDINATOR
(DICK HARTMAN)

1. Additional resource inventory work will be done when an area is leased and plans of operation are submitted.

DANIEL N. MILLER, JR.
DIRECTOR AND STATE GEOLOGIST
DEPUTY DIRECTOR AND STAFF GEOLOGIST
GARY B. GLASS
STAFF GEOLOGISTS
RODNEY H. DE BRUIN
W. DAN HAUSEL
DAVID R. LAGESON
ALAN J. VER PLOEG
TECHNICAL EDITOR
DAVID A. COPELAND

THE GEOLOGICAL SURVEY OF WYOMING
UNIVERSITY OF WYOMING
BOX 3008, UNIVERSITY STATION
LARAMIE, WYOMING 82071

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(307) 742-2054
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BAYARD D. REA, CASPER

May 15, 1979

Mr. Dick Hartman
State Planning Coordinator
Wyoming State Clearinghouse
2320 Capitol Avenue
Cheyenne, WY 82002

Dear Mr. Hartman:

I have reviewed the Draft Environmental Statement of the Island Park Geothermal Area Idaho-Montana-Wyoming, (I.D. No. 79-120D). I have only one comment on this study: Open-File Report 78-798 published by the U.S.G.S. in February of 1979 and entitled "Seismic Monitoring at the Geysers Geothermal Field, California", states that the present level of seismicity at the Geysers appears to be higher than the pre-production level and is higher and more constant than the seismicity of the surrounding region. Geodetic measurements suggest that the geothermal reservoir is being compressed both vertically and horizontally at rates of several centimeters per year as fluid pressures are lowered by production. Since the Island Park Geothermal Area is also located in a high risk seismic zone, it seems possible that production of geothermal resources could induce increased seismicity in this region also. (1)

If your office or another agency would like us to reexamine any part of this report for any specific purpose, please don't hesitate to ask.

Sincerely,

Rodney H. De Bruin

Rodney H. De Bruin
Staff Geologist

RHD:mm

Geology--Interpreting the past to provide for the future

RODNEY H. DeBRUIN

1. According to the U.S. Environmental Protection Agency, the possibility of injection — induced earthquakes may be alleviated by minimizing the difference between the injection pressure and the original pore pressure of the reservoir fluids, particularly if there is a fault near the injection area.

MAY 21 1979

THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

Wyoming Recreation Commission

604 EAST 25TH STREET CHEYENNE, WYOMING 82002

JAN L. WILSON
Director
777-7695

May 18, 1979

Mr. Richard Hartman
State Planning Coordinator
2320 Capitol Avenue
Cheyenne, Wyoming 82002

RE: Draft ES, 79-120D
Island Park Geothermal Area

Dear Mr. Hartman:

Thank you for the opportunity to review this draft environmental statement of the Island Park Geothermal area.

In order to properly evaluate this draft ES, I will need to see the "overview" cultural survey filed in the Supervisor's Office, Targhee National Forest, St. Anthony, Idaho. The edited version of this report is both inadequate and inaccurate. John Jacob Astor, not Andrew Henry, financed the earliest overland trek through the study area. Wilson Price Hunt headed the westward excursion in 1811 and not in 1810 as stated on page 36. Moreover, John Colter on his solitary excursion of 1807-1808 passed within proximity of the study area observing spectacular thermal activity.

The map coordinates, contained within the ES, also appear in error. According to those provided, namely T48N, T47N, R119W, the study area is outside Wyoming borders.

A review by Associate State Archeologist Thomas K. Larson indicated that archeological site density is high in the northwestern portion of the state, and therefore recommended a complete cultural inventory of the Island Park Geothermal Area in Wyoming by a qualified archeologist.

Cordially,

John F. Carlson

John F. Carlson, Chief
Resources Division

JFC:klm
Attachment

79-120D
APR 13 1979

THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

State Engineer's Office

BARRETT BUILDING CHEYENNE, WYOMING 82002

April 12, 1979

Mr. Dick Hartman
State Planning Coordinator
2320 Capitol Avenue
Cheyenne, Wyoming 82002

Re: 79 - 120 D
April 3, 1979

Dear Dick:

A review of the Draft Environmental Statement of the Island Park Geothermal Area - Idaho-Montana-Wyoming, was made by our Ground-water expert, Richard Stockdale, who found no serious concern. He suggests that there should perhaps be a reminder that permits for thermal wells are required by this office.

Yours very truly,

William Long

WILLIAM LONG
Deputy State Engineer

WL/llw

MEMBERS:
Ray Johnson
William Campbell

California State Senate

TERRY GOULD
Consultant
SUSAN DUNCAN
Secretary
Room 145
1116 9th Street
Sacramento, CA 95814
(916) 323-0417

SELECT COMMITTEE ON
FISH AND GAME WILDLIFE
CHAIRMAN

BOB WILSON
SENATOR
THIRTY-NINTH DISTRICT

TARGHEE NF						
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	Off. Serv.	
Promise Card		

May 30, 1979

David M. Jay, Forest Supervisor
Targhee National Forest
420 North Bridge Street
St. Anthony, Idaho 83445

Dear Mr. Jay:

I have reviewed your Draft Environmental Impact Statement for the Island Park Geothermal Area. I find all your alternative leasing proposals unsatisfactory, with the exception of allowing no geothermal development at all, as these alternatives would allow drilling along the borders of Yellowstone Park. In addition, I am opposed to opening up such a large area to geothermal development as there would be major impacts from such development on the fish and wildlife resources in the area.

My chief concern is with the proposed safeguards against the potential destruction of Yellowstone National Park's major geothermal areas resulting from drilling within five miles of the park. Your geologists cannot tell what would be the impact of such drilling. They do not know if the Yellowstone underground geothermal reservoir is interconnected and extends outside the park's boundary. The proposed means of monitoring the effect of drilling by using two test wells is wholly inadequate. Natural geothermal water systems are erratic: the test wells might not show any major pressure or chloride changes when suddenly, the main geysers begin to disappear due to unknown factors caused by geothermal extraction.

Yellowstone Park's geysers are one of our most precious national assets. No commercial geothermal operations should be allowed that may threaten the geyser basins.

I request that all areas contiguous to Yellowstone National Park be withdrawn from consideration as potential geothermal energy sources. Other areas should also be withdrawn from leasing because of impacts on underground water, elk herds, and grizzly bear populations. Most of the major rivers in this area such as the Henry's Fork of the Snake, Warm River, and Bechler River are largely spring-fed and might be effected by any changes in the underground water system.

Sincerely,

Bob Wilson

BOB WILSON

BW:sld

cc: The Honorable Robert Bergland
Secretary of Agriculture
Washington, D. C. 20240

The Honorable Cecil Andrus
Secretary of the Interior
Washington, D. C. 20240

COMMENTS TO THE DEPARTMENT OF THE INTERIOR'S LETTER

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

TARGHEE NF
Units: 1 2 3 4 5 6
JUN 11 '79

Action	To	Info
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	Resources	
	Personnel	
	Off. Serv.	
Premise Card		

JUN 8 1979

In Reply Refer To:
ER-79/322

Mr. David M. Jay
Forest Supervisor
Targhee National Forest
420 North Bridge Street
St. Anthony, Idaho 83445

Dear Mr. Jay:

We have reviewed the draft environmental statement (DES) for Island Park Geothermal Area (IPGA), Targhee National Forest, Idaho, sent to us on March 21, 1979. We note that this is issued as a lead agency statement to cover geothermal leasing actions of both the Forest Service and this Department and that staff from several of our bureaus participated in its preparation. In this regard we have the following principal concerns:

- discussion of potential impacts on Yellowstone National Park (YNP) should be amplified,
- additional alternatives available to this Department should be added,
- the level of activities expected and the impacts that would result should be quantified, and
- future National Environmental Policy Act (NEPA) review points should be clearly identified.

Some of these shortcomings were evidently a failure on our part rather than yours, and we will work with your staff to overcome these in preparation of the final statement.

The world's first national park, Yellowstone, was designated a World Heritage Site by the World Heritage Committee of United Nations Educational, Scientific and Cultural Organization (UNESCO) in 1978. UNESCO also designated YNP as part of the International Biosphere Reserve which recognizes the global value of its natural ecosystems and gene pool. These three designations for Yellowstone - National Park, World Heritage Site, and International Biosphere Reserve - combine to give the area the highest possible recognition of its significance to the world. Any man-caused threat to the integrity of its thermal resources is totally unacceptable, both nationally and internationally. Any geothermal exploration or development outside YNP must recognize its unique value on a world-wide basis.

Although commercial geothermal development in other areas of the world have had profound effects on geyser basins, the draft statement makes no mention of this. Geyser Valley in New Zealand was totally destroyed as a natural discharge area when the Wairakei geothermal area was developed. Before this action, Geyser Valley ranked fifth among the major geyser areas of the world. In addition, production from Wairakei also affected another thermal area thought to be independent with no connection at depths which would simultaneously affect the pressure of both systems. As a result, both areas have been destroyed as a national resource and reference line for understanding hydrothermal systems. The Beowawa Geysers area of Nevada was once second to Yellowstone on the North American Continent in the 1940's and 1950's when geothermal exploration was begun. Wells were drilled and permitted to discharge, but not converted to commercial use; by 1961 all springs and geysers had ceased flowing. Similar destruction of the geyser area at Steamboat Springs, Nevada, occurred after geothermal exploration between 1950 and the early 1960's. Of ten world-ranked geyser areas, only three including Yellowstone, are essentially undisturbed; four of ten have been adversely affected by man's activities; and at least three of these major areas and several minor ones have seen the total destruction of their geysers. Thus, the statement must clearly point out that, unless geothermal exploration and development is very carefully planned, monitored, and controlled, irreversible damage to the geothermal regime at YNP is a distinct possibility. (1)

The alternatives included in the draft statement appear to be guided entirely by surface resources and Forest Service management concerns. Consideration of the mineral or geothermal resource, the proximity of YNP, and uncertainties as to the geothermal system in this area lead to other viable alternatives which we would like discussed. These include leasing only in the area of the Island Park Caldera, adding a north-south buffer strip at least two miles wide outside the west boundary of YNP, and deferral of leasing in the IPGA until we have more information as to the extent of the geothermal resource and possible relationships to the geothermal regime at YNP.

DEPT. OF THE INTERIOR

1. Considerably more information about Yellowstone National Park has been incorporated into Sections II, III, IV, V, VIII and the Appendix.

Additional information as to the geothermal resource could be acquired through reliance on industry tests on private lands in the area or through Federal research and tests in the area. Finally, a combination of Alternatives 2 and 3 would provide increased consideration of fish, wildlife, habitat, and visual resource values; this is discussed in more detail in the attached specific comments. These alternatives and their environmental impacts should be added to the statement. (2)

It is noted that the bald eagle, peregrine falcon, gray wolf, and grizzly bear are known to occur in the IPGA. However, the Forest Service has consulted only on the grizzly bear under Section 7 of the Endangered Species Act of 1973. The DES does not clearly indicate that a "may affect" or "no affect" determination has been made by the Forest Service for the other listed species. It is our understanding that the Forest Service has determined that the bald eagle, peregrine falcon, and gray wolf will not be affected based on the Forest Service's decision not to lease lands in the IPGA that would lead to impacts on these species. If this explanation is true, it should be in the final environmental statement (FES); otherwise, formal consultation must be initiated prior to any leasing. (3)

The bald eagle and peregrine falcon may be adversely impacted by toxic effluents if a blow-out affected the feeding areas. The geothermal resource is of the "hot water" nature, which has the potential to chemically or thermally pollute the watershed in the event of a blow-out. Either eliminating the fish-food source or directly poisoning these raptors through the food chain will adversely affect these endangered species. These adverse effects may also apply to the trumpeter swan, a sensitive resident of the IPGA. A discussion of these threats should be included in the statement.

The statement should specifically describe probable impacts, and mitigation to reduce adverse impacts, to areas having special scenic, recreation, and cultural value. Examples are Big Springs, a potential National Landmark, and high-quality fishing streams and lakes. Impacts and mitigation measures relative to YNP should be described in more detail. (4)

We note that the DES emphasizes salvage as a mitigation measure to reduce adverse impacts on historic and archeological resources. Avoidance or protection of archeological resources is far preferable to salvage, and often less costly and time-consuming. Salvage as a form of mitigation should only be carried out when it has been demonstrated that there are no

DEPT. OF THE INTERIOR

2. These concerns have been incorporated into Alternative 7.

3. This has been corrected in Section V of the FEIS.

4. This information has been added to Section V.

alternatives to damaging the resources. We suggest this point be clarified.

(5) The statement should include a more complete discussion of future plans for identification, evaluation, and protection of properties in the area that may be eligible for inclusion in the National Register, under 36 CFR 800, as amended (Federal Register, January 30, 1979). There should be further consultation with the State Historic Preservation Officer, under 36 CFR 800.4, to specify the types of surveys to be done and the survey methods to be employed. It would be useful for the Forest Service to have regional predictive surveys conducted prior to leasing, in order to identify the potential for archeological resources and further aid in decisions on land suitability for leasing purposes.

(6) We suggest that the Evaluation Criteria, Section III, be revised in order to clarify agency roles (shown on page 3) and sequential decision points. This could also serve to highlight future NEPA review points after leasing. The Department of the Interior views the environmental statement, not as an all-inclusive decision document, but as one of possibly several management reports available to the decisionmaker. In addition to environmental considerations, the decisionmaker may also be guided by policy, legal, economic, and political goals. However, we do not attempt to evaluate these in the environmental statement. We are highly cognizant of national and local energy needs, but any leasing activities will be predicated on a thorough technical evaluation as to possible risks to the YNP geothermal system. These two policy factors will weigh most heavily in our leasing decision.

In view of the uncertainties and risk to the geothermal system at YNP, this Department will take an extremely cautious approach on any activities toward geothermal development in the IPGA. We have reviewed the stipulations and mitigation proposed and have several additional measures to be included. These, and a possible monitoring program, are provided (Attachment A) for inclusion in the FES. These would be applicable to research or test drilling as well as exploration and development. We obviously will not authorize any geothermal exploration or development in this area without adequate safeguards and evidence that the activities will not jeopardize the geothermal regime at YNP.

(7) It might be helpful to reviewers if the FES for the Geothermal Leasing Program (Department of the Interior, 1973) was

DEPT. OF THE INTERIOR

5. Section VIII of the Final EIS considers much more than salvage to protect cultural resource values.

6. The text has been revised.

7. This information has been added to Sections III, IV, V, and VII of the FEIS.

5

referenced as a source of background information as to regulations, procedures, development, and cumulative impacts. The recent DES for the Navy Coso Geothermal Development Program (U.S. Navy, 1979) provides an excellent summary of geothermal development methods, impacts, and possible problems.

We would like to work closely with your staff to ensure that the final statement meets our needs for future decisions as to geothermal leasing in this area. We believe that a field meeting would be helpful in this regard and suggest June 14 and 15 as possible dates. Please confirm this with Tom Loomis ([202] 343-2118) of my staff, and he will arrange for appropriate Bureau representation. (8)

Sincerely,

Larry E. Meierotto
Assistant SECRETARY

Enclosures

DEPT. OF THE INTERIOR

8. This information has been added.

Attachment A

Additional Stipulations
and
Monitoring Program

All geothermal fluids extracted and used in the IPGA will be reinjected into the reservoir from which they were extracted to minimize loss of reservoir pressure.

If extraction of geothermal fluids from the IPGA significantly influences pressures, chloride concentrations, or temperature of the monitored features, operations will be suspended either until the influences are eliminated or until they are clearly counterbalanced by a tier or reinjection wells in the area of deferred leasing approximately two miles west of the Park boundary. Sufficient injection in this area should provide a high-pressure barrier, preventing eastward propagation of declining reservoir pressures.

Because existing data do not provide definitive evidence either for or against hydrologic communication between Yellowstone's thermal features and possible thermal waters outside the Park, external geothermal developments must provide a monitoring system that ensures early recognition of possible interference between them. The following monitoring program will be required prior to any deep well geothermal testing in the IPGA:

1. Gauging stations will be established on Boundary Creek, the Bechler River, and selected suitable individual hot springs to monitor discharge, chloride content, temperatures, and total convective thermal output; Little Firehole Meadows will be searched for thermal features suitable for monitoring, and, if deemed appropriate, observations will be initiated there.

2. One or more deep monitoring holes will be drilled within the deferred strip (the extended Yellowstone KGRA), prior to any large-scale production, to depths comparable to any newly discovered reservoir and preferably into the same rock strata that contain the reservoir. Tentative locations are: (1) about two miles south of West Yellowstone, in Sec. 10, T14S, R5E (if the discovered field is north of the Continental Divide), or (2) south of theContinental Divide, perhaps in Secs. 14 or 23, T13N, R45E, or even farther south (if a reservoir is discovered south of the Divide). "Slimhole" drilling and complete coring is preferred for initial holes, but deep drilling with heavy equipment may be necessary depending on conditions encountered.

3. The Geological Survey research drill holes Y-7 and Y-8 in the north part of Upper Geyser Basin will be monitored.

Regarding point 1 above, little attention has been given to the Little Firehole Meadows area, which is located midway between Upper Geyser Basin and the IPGA and might contain thermal features especially sensitive for monitoring.

Regarding point 3 above, the alternate holes suggested are in better condition and probably are as satisfactory for monitoring as the reactivated Y-1 in western Upper Basin, suggested in the draft statement; all of these research holes are too shallow and too subject to continuing changes of nearby springs and geysers to provide reliable monitoring data by themselves.

If commercial geothermal resources should be found to exist in the IPGA, the suggested strategy aims for early recognition of any declining reservoir pressure that might be propagated eastward, thereby diverting deep Yellowstone geyser water westward rather than upward and thus interrupting the natural geyser supply. We consider deep communication of fluid pressures between the Island Park area and the Yellowstone caldera to be unlikely, but it cannot be ruled out by any available evidence. If some pressure communication is demonstrated, the initial effects will become evident through our proposed monitoring system long before a wave of declining pressure can be transmitted to the geyser basins. It should be noted that a discovery well within the IPGA with only limited testing and discharge of fluids cannot possibly affect the geysers of Yellowstone National Park. A significant and more-than-local decline in reservoir pressure can occur only after at least 5 to 10 production wells are drilled and produced long enough to demonstrate productivity, which is necessary to justify construction of a power plant. Normally, at least 2 to 3 years are required to drill the 5 to 10 required production wells and another 5 years to construct the power plant. The easier parts (items 1 and 3) of our proposed monitoring system should be initiated as soon as the first lease sales are approved. One or more deep monitoring wells should be drilled in the area between any discovery wells and Yellowstone National Park and baseline records established prior to initiating production.

Limited testing of each newly completed well should be permitted in order to test initial productivity. All liquid effluent from sustained testing of production wells should be reinjected into the reservoir, thereby minimizing any wave of pressure decline that could be transmitted eastward. One or more of the early industry-drilled wells should be withheld from production testing to monitor immediate effects of this production and reinjection. Wells of low productivity are suitable for such monitoring.

If it becomes necessary to drill a tier of injection wells in the deferred-leasing area west of the Yellowstone Park boundary, industry should probably have the option of injecting some cold water from local sources of shallow ground water in addition to production effluent. The production wells and power plant may be considerably west of the Park boundary and at lower altitudes. Our interest would be to prevent significant eastward propagation of declining pressure; the immediate source of any required injection water, whether hot or cold, would be of secondary concern.

Attachment B

Specific Comments

Summary, page iii, item III. Environmental effects -

Under the heading, "Potential Effects" certain items are listed which are difficult to classify as effects or impacts on the natural environment. These include: (9)

1. Increased employment relative to the extent of discovery and development;

2. Additional energy for electricity, space heating, and other industrial/agricultural uses;

3. Royalty payments and rent to Federal Government;

4. Increased tax base for effected counties; and

5. Social and economic stress from increased population.

Page xiv and List of Maps; page 22, Water Resources.

A map should be inserted showing the major flowing waters in in the IPGA specifically including those water courses listed in Table 6, page 29, and Table 19, page 58. The exact location of these water courses is germane to a discussion of site-specific impacts and general areas which should be classified as "no lease" areas. Several of the streams listed are Class I Streams (Ref: 1978 Stream Evaluation Map, State of Idaho). (10)

Page 8.

The reference to the Island Park KGRA should be clarified; it does not appear on any of the maps. Apparently, it consists of area(s) where multiple lease applications indicate competitive interest. (11)

Page 22, paragraph 1.

The extraction of large quantities of fluid from the subsurface creates a potential for subsidence regardless of the rock type. Interestingly, The Geysers, which is underlain by a variety of relatively competent lithologic units, has undergone subsidence due to steam production. (12)

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9. Item III deals with the "Social" as well as the Natural Environment

10. The maps in the separate map pack show all the major flowing waters in the IPGA. All Class I streams were given "no lease" protection and site-specific impacts to all streams will be evaluated in depth if and when a lessee submits a plan of operation.

11. This has been clarified.

12. The discussion of subsidence has been modified.

Page 22, paragraph 4, last line, and Map 4.

If a substantial geothermal resource is located near an area where seismic disturbance are highly probable, eventual development should include careful evaluation of construction with seismicity in mind.

Page 25.

It is stated that the recommended limit for fluoride is 2.4 mg/l; this assertion should be accompanied by the annual average of the maximum daily air temperatures for the project location, inasmuch as the maximum contaminant levels for fluoride are based on this factor (40 CFR 141, 40 FR 59565, and 41 FR 28402). (13)

Page 31, last paragraph.

The sample size for measurement of turbidity appears small.

Page 32, last paragraph.

The last three words should be deleted. Animals are not primary producers and, as such, do not consume nutrients such as nitrogen and phosphorous directly. Nitrogen and phosphorous are very likely in a metabolic pool with phosphorous being the limiting nutrient to plant life. If nitrogen becomes limiting before phosphorous, then nitrogen fixing blue-green may appear. Certain blue-green algae are unique to oilgotrophic waters and are not indicators of enrichment. (14)

Page 33, paragraph 5, last line.

Although pesticide or herbicide residues were not detected in select streams in the IPGA, residues would very likely be detectable in aquatic organisms known for their ability to concentrate toxic substances.

Page 42, paragraph 1, lines 1-2.

Wildlife communities do not ". . . result from" . . . vegetation patterns. They may be distributed relative to vegetative patterns and other factors.

Vegetative patterns (not "designs") in IPGA do not appear homogeneous. They are very likely heterogeneous as are most patterns of floral and faunal distribution; hence the need for metameter transformations.

- 2 -

DEPT. OF THE INTERIOR

13. No site-specific proposal has been made. These data are not available at this time. This parameter will be required if and when plans of operation are reviewed.

14. Suggestion incorporated.

Page 44, paragraph 1, line 1.

Insert "behavioral" before the word "adaptability."

Page 45, Table 16.

We suggest the word "known" be inserted above the word "harvest."

Page 55, paragraph 4, line 2.

(15) The phrase ". . . but none nested . . ." re: Peregrine falcons is somewhat over confident. We suggest ". . . but no nesting was observed or reported. . . " The IPGA is a vast area, and falcon distribution is very likely super-dispersed or binomial.

Page 55, paragraph 5.

(16) The southern and northern races of bald eagles are no longer separated on the Federal list of threatened and endangered species. The word "Northern" should be omitted from the reference to bald eagle.

Page 59, paragraph 2, line 1.

(17) Insert the words "major or select" before the word "streams."

Page 60 text and Table 20.

The methodology for sampling benthic macroinvertebrates in select flowing waters of the IPGA is not clearly stated. Methodology, sampling, design, and degree of macroinvertebrate identification are important when diversity indices or a treatment/control approach are used. Examples follow:

1. A treatment/control sampling design requires that upstream and downstream stations are similar with respect to substrate, flow, temperature, morphometry, enrichment, and percent shading.

2. Sample size should be adequate to detect change or difference and should be indicated in the text.

3. The kind of diversity index calculated should be so named in the text, and actual diversity index values should be included in Table 20.

4. Computations of diversity indices are strongly influenced by the degree of effort that goes into the identification of benthic

- 3 -

DEPT. OF THE INTERIOR

15. Suggestion incorporated.

16. Suggestion incorporated.

17. Suggestion incorporated.

macroinvertebrates. Some indication of taxonomic levels to which organisms were identified should be included in the text, and tabular data on their estimated densities should be included in Table 20 or another table.

5. The subjective criteria used to determine the arbitrary classifications of excellent, good, and fair, with respect to evaluating calculated diversity indices, should be clearly stated in the text.

6. Actual values of diversity indices should be used in Table 20.

7. Actual biomass determinations should be used in Table 20. (18)

Page 67 - Transportation.

Posted road closures will require enforcement in order to be effective.

Page 72, Table 28.

Units (i.e. number of persons) should be inserted at the top of the table or in the table caption (e.g. see Table 29). (19)

Page 74 - Public Issues and Attitudes.

The sample size of interviewees needs to be more clearly stated. Presently, it is unclear as to whether the 11 people were the interviewers or interviewees. The value of an "estimated response" is unclear because information about the panel of "5 knowledgeable people" who estimated theoretical responses is lacking. The type of information needed about the panel members should include the interest groups represented (public, private, professional, lay, etc.) and personal profiles. (20)

Pages 77 to 86 - Alternatives.

While Alternative 2 provides a buffer strip along both sides of Henrys' Fork of the Snake River, portions of other high quality streams are not so protected. Examples include Buffalo River, Moose Creek, Madison River, Warm River, Robinson Creek, and Snow Creek. Under this alternative the areas where leasing for geothermal exploration and development would be allowed, overlap with habitat of the grizzly bear (Moose Creek Plateau and

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18. Details on methodology, sampling, identification and actual values are in the report from the Aquatic Ecosystem Lab and is on file with the Targhee National Forest.

19. Suggestion incorporated.

20. This information is within the report referenced at teh end of the discussion.

Fish Creek Road areas), the sandhill crane (north of Gerrit, Idaho, and west of Eccles, Idaho), trumpeter swan (Buffalo River, south of Eccles, Idaho, and Madison River), and sage grouse (west and southwest portions of the IPGA).

Alternative 3, on the other hand, takes into consideration wildlife habitat at the cost of wide buffer strips along Henrys' Fork.

(21) We suggest evaluation of a combination of Alternatives 2 and 3. This will provide consideration of fish, wildlife, habitat, and visual resource values referred to earlier in the text of the DEIS. This alternative would accomplish the following resource objectives:

1. Retention of the wide buffer strip along Henrys' Fork;
2. Deferred activity along the Madison River, and portions of Snow Creek and the Robinson River;
3. Protection of additional grizzly habitat in northeastern and southeastern portions of the IPGA:
4. Protection or deferment of activity in habitat used by elk, moose, trumpeter swan, sandhill crane, and sage grouse;
5. Deferred activity on deer and elk migration routes in western and southeastern portions of the IPGA:
6. Retention of areas with high visual quality; and
7. Prevention or deferment of activity on several areas with high probability for geologic hazards.

Page 78, Alternative 2.

It would be useful to summarize the reasons for designating the no-leasing areas. The participants in the Geothermal Workshops and the interests represented by the participants should also be given.

Page 82, Alternative 4.

To issue no-surface-occupancy leases in the area defined on the map (p. 83) would not be practical since the maximum horizontal

DEPT. OF THE INTERIOR

21. These suggestions are incorporated into Alternative 7 and have been coordinated with the U.S. Fish and Wildlife Service representative to the EIS.

distance that can be economically covered by directional drilling is about one-quarter of a mile. Therefore, the majority of the no-surface-occupancy leases could not be produced. (22)

Page 84, Alternative 5.

The surface-occupancy restrictions need to be clearly defined. Proposed geothermal operations are environmentally evaluated by the USGS under NEPA.

Page 86, Alternative 6.

Leasing all Federal lands does not necessarily assume that geothermal leasing and development is the highest and best use of the IPGA. Rather, geothermal operations could be considered an acceptable use of the IPGA lands, consistent with the multiple use concept. (23)

Page 99, Table 33.

The definition of impacts to threatened and endangered species is too vague to be of value. An explicit description of the effects to these species should be presented here. (24)

Page 119, paragraph 1. (25)

Noise limitations must conform to GS regulations.

Page 120, paragraph 2. (26)

Identify the "other special interest values of high significance."

Page 120, paragraph 3. (27)

Item 6 under measures to be taken should be changed; stipulations are directed toward lessee, not lessor.

Page 120, paragraph 9.

Emphasize that lessees will be required to comply with appropriate laws, GS regulations, and EPA guidelines in disposal of toxic substances or hazardous wastes. (28)

Page 121.

Under "well blowout," it is not clear what is required of the lessee or operator. (29)

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22. We recognize this, but were requested by several lease applicants to let them decide where and where not to accept leases under this alternative.

23. This has been clarified.

24. This EIS is broad in Scope. Specific roads, drill sites, etc. will be reviewed if and when a lessee submits a plan of operation. This review will allow an explicit evaluation of the effects on threatened and endangered species on a site-specific basis.

25. Corrected.

26. This discussion has been modified.

27. This has been revised.

28. Suggestion incorporated.

29. Additional reference has been added.

Page 122.

Under "increased demand for social . . .", responsibilities are not clear. Except for the lessee providing detailed plans for development timing and changes in employment, this section is suggestive of other than enforceable mitigation. (30)

Page 123, paragraph 1.

The assessment of reinjection of geothermal fluids should address determination of formation fracture gradients and restriction of injection pressures to safe maximums to prevent unplanned hydraulic fracturing and resultant loss of control of fluids. (31)

DEPT. OF THE INTERIOR

30. We believe such considerations should be made to protect and help local communities plan for timely adjustments of facilities, goods and services.

31. Suggestion incorporated.

May 18, 1979

Mr David M. Jay
Forest Supervisor
Targhee National Forest
420 North Bridge Street
St. Anthony, Idaho 83445

Dear Dave:

I have the following comments to offer on your draft ES for the Island Park Geothermal Area.

Evaluation Criteria

These criteria did not help me make an evaluation of the alternatives. They appear to be very general and motherhood. One suggested evaluation criteria: To resolve future leasing direction to the maximum extent and place the minimum amount of land in a study category.

It was difficult to determine how or what criteria were used in developing and evaluating the alternatives. (1)

Alternatives

Alternative 3 - This alternative does not appear acceptable from a management standpoint. 40% of the land is placed in a non-decision status.

Alternative 4 - "Leasing with no surface occupancy" and "leasing with no surface occupancy restrictions" have different meanings but are used interchangeably in this alternative. (2)

Alternatives 4 and 5 - I had a hard time telling the difference between "no surface occupancy" and "surface occupancy restrictions" in the evaluation section. It was hard to visualize the reported major spread in eviromental effects if the restrictions were applied as stated. The fact that the no lease land in Alternative 5 have restricted occupancy requirements in Alternative 4 adds fuel to this concern.

Alternatives 3 and 5 - It appears that most of the deferred land under Alternative 3 is the same as the restricted occupancy land under Alternative 5. If this is true, then the reason for the similar environmental effects is not evident. Such analysis indicates the restrictions are so strong they make Alternative 5 basically equal to Alternative 3.

Based on my interpetation:
- Alternative 3 contains an excess of non-decision land (40%) and
- Alternative 5 requirements appear overly restrictive
therefore I support Alternative 4.

A more complete statement of each alternative's description, criteria and management constraints would have been helpfull.

General

As I understand it, Land Use Plans have been approved for most of the area. It would strengthen this statement to quote the direction given in these plans. For example, under Visuals it is stated that "Visual resource management goals have been established". If such goals have been established through the LUPs it would strengthen your statement to say so. This approach was used effectively under Utilities. LUP's direction should also help in establishing specific criteria for various zones or units within the area. (3)

One-third of your report is basics - affected environment. Why limit this statement to geothermal? Why not include other energy -gas and oil- and the distribution of such energy? (4)

As a taxpayer, I resent the very finished, slick paper - color picture, presentation of a document which is a "draft". It indicates two things; high cost and you would resist changing it regardless of public input.

Photos add much, but in this case the color prints point out that we still don't know how to manage timber to prevent brown forests.

Sincerely,

John A. Hafterson
Humboldt National Forest
976 Mountain City Highway
Elko, Nevada 89801

JOHN A. HAFTERSON
HUMBOLDT NATIONAL FOREST

1. These criteria have been developed further and clarified.

2. This has been clarified.

3. Reference to land management plans and their direction has been made in the introduction.

4. It is not within the scope of this statement. Detailed information on the resource would be necessary to make any realistic evaluation of this type.

UNITED STATES DEPARTMENT OF AGRICULTURE
OFFICE OF THE SECRETARY
WASHINGTON D.C. 20250

OFFICE OF EQUAL OPPORTUNITY

MAY 2 - 1979

IN REPLY REFER TO: 8140 Supplement 8

SUBJECT: Draft Environmental Impact Statement, Island Park Geothermal Area, Targhee National Forest, Idaho

TO: David M. Jay
Forest Supervisor

THRU: William D. Williams, Associate
Deputy Chief for Administration
Forest Service

Thank you for the opportunity of reviewing this Draft Statement. It appears as if you have identified adequately the major socioeconomic effects of alternative actions (pp.69-75, 103-108, 113-117 and Appendix I, Social Impacts).

We note that the population and impact analyses do not directly identify minority group populations potentially affected by the possible actions. Census data suggests that approximately 2.6 percent of the population of Freemont County is minority. We recommend that in the Final Statement the Forest Service identify any potentially adverse impacts upon minority persons and assure itself that any such impacts would not be experienced disproportionately as compared to the population as a whole. (1)

JAMES FRAZIER
Director

TARGHEE NF
Units: 1 2 3 4 5 6
JUN 01 '79

Action	To	Info
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	Off. Serv.	

Promise Card

USDA — OEO

1. Statement has been added to the final EIS.

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

REGION VIII
FEDERAL OFFICE BUILDING
19TH AND STOUT STREETS
DENVER, COLORADO 80294

April 25, 1979

OFFICE OF THE
PRINCIPAL REGIONAL OFFICIAL

Mr. David M. Jay
Forest Supervisor
Targhee National Forest
420 N. Bridge Street
St. Anthony, Idaho 83445

Dear Mr. Jay:

This will acknowledge receipt of your draft EIS for the leasing and development of geothermal resources within the Island Park Geothermal Area.

We have reviewed the report and believe you have adequately addressed the impacts expected to result. We have no other comments at this time.

Sincerely yours,

Thomas E. Moore

Thomas E. Moore, P.E.
Director, ROFEC
Regional Environmental Officer

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION X
1200 SIXTH AVENUE
SEATTLE, WASHINGTON 98101

REPLY TO ATTN OF: M/S 443

MAY 21 1979

David M. Jay, Forest Supervisor
Targhee National Forest
420 N. Bridge Street
St. Anthony, Idaho 83445

Dear Mr. Jay:

We have completed our review of the draft environmental impact statement for Island Park Geothermal Leasing and Development. The EIS is clear, concise, and well written. The excellent use of the photographs and graphics in the DEIS greatly helps in understanding the existing environment and the alternatives. The matrices used for impacts and alternatives are also helpful as aids to understanding. Since there is very little data available on geothermal resources in the area, however, the EIS is of limited usefulness for quantifying impacts of the alternatives.

Of the alternatives presented, we support the approach of Alternative 3, in which key streams and wildlife habitat areas have been closed to leasing, and other sensitive areas have been deferred pending the development of more information. We do not believe other alternatives offer adequate assurance that important environmental values can be protected.

We believe, however, that even Alternative 3 may be too ambitious a program considering the limited data on the quality of the geothermal waters in the area and the potential impacts of development on groundwater and surface water. It would appear that a more limited leasing program would be advisable. This would provide an improved data base to better define areas suitable and unsuitable for leasing and development, based on environmental constraints. Specifically, we recommend deferment from leasing as the wisest present course for the seismically active area in the north of the unit in the Madison River drainage, for areas with surface or groundwaters with present or potential use as drinking water supplies, and for a buffer area for the airshed of Yellowstone National Park. (1) (2)

Since data needed to more clearly predict environmental impacts of development will not be available till after test drilling, we suggest that

ENVIRONMENTAL PROTECTION AGENCY
(ALEXANDRA SMITH)

1. This restriction for deferment would cover most of the IPGA. Existing state and Federal laws and regulations will protect present and future drinking water supplies.

2. The proposal in the final EIS includes this suggestion.

-2-

one or more EIS's be prepared at that time, prior to field development. We believe this would provide for greater public and agency involvement as additional restrictions are developed to guarantee adequate environmental protection.

Specific Comments

1. Seismicity. On page 20, it is stated that the Island Park area is not a seismic risk area, in contrast to surrounding areas. However, on page 22, the Island Park area is said to be in a mapped zone where high intensity seismic disturbances with major damage can be expected. This inconsistency should be resolved. The EIS should also discuss the possibility of induced seismicity due to withdrawal or reinjection of geothermal fluids. (3)

2. Groundwater. Limited information is presented on the quality of geothermal and other groundwaters in the Island Park area. However, Appendix C shows that geothermal waters from western Yellowstone National Park are far in excess of established drinking water standards for several elements including arsenic, chloride, flouride, pH, and iron. In addition, comparison with Appendices B and D shows that geothermal water quality values are far above values for local ground and/or surface waters for HCO_3, K, SiO_2, Na, and SO_4. There appears to be potential for contamination of aquifers or surface waters important as sources of drinking water, especially as a result of seismic activity. This potential should be more fully evaluated in the EIS. (4)

3. Mitigation. There should be more information on what types of constraints will be placed on the exploration, testing, and production phases. There should be a minimum level of groundwater monitoring specified. There should also be minimum requirements for pond lining to prevent migration of drilling muds and produced water. Minimum data should be obtained to determine if produced water could be considered toxic. (5)

4. Additional Permits. If development proceeds, it may be necessary for developers to obtain both water pollution discharge permits and air quality permits issued by EPA under authority of the Clean Water Act and the Clean Air Act.

5. Air Quality. Degradation of air quality would occur in the Island Park Geothermal Area if developed. As stated in the DEIS, there would be short term increases in particulates from construction and problems from the release of noxious and odorous gases such as hydrogen sulfide.

E.P.A.

3. No discrepancy was intended in the DEIS. The Island Park caldera area, excluding the West Yellowstone, Montana area, is, when compared with areas in Yellowstone National Park and near Hebgen Lake, Montana, relatively aseismic. The West Yellowstone, Montana area, however, is recognized as a sesmically active area. For seismicity considerations associated with geothermal fluid reinjection, see response to letter dated May 15, 1979, from the Geological Survey of Wyoming (Rodney DeBruin) [response drawn from EPA document EPA-600/7-78-101, page 89, paragraph 4].

4. Thermal water of Yellowstone National Park may be different in quality from the IPGA. Compliance with state and Federal rules and regulations concerning the reinjection of geothermal water will be required to safeguard groundwater and surface sources of drinking water.

5. This suggestion has been incorporated into Section VIII of the final EIS.

There also would be increases in SO_2 emissions and humidity. There exists the possibility of the formation of ozone and acid rain downwind of the development sites. This would impact Yellowstone National Park. The impacts on Yellowstone Park should be substantiated from an air quality, noise and visual standpoint. Therefore, we recommend that a mitigating non-leasing buffer zone be established to protect the Park and its amenities. The width of this buffer zone should be determined by testing. Any proposed leasing that could potentially impact Yellowstone National Park should be approached with extreme caution. Sufficient data should be collected to fully understand the potential impacts and necessary mitigations should be adopted. (6)

6. Economic and Technological Feasibility. Page 76 of the DEIS points out one of the criteria identified for the "development of viable alternatives for geothermal leasing stated that alternatives should: be economically and technologically feasible." Yet, page 1 states the DEIS "does not consider" either the "economic feasibility of geothermal electrical power production" nor the "benefit-cost analysis of geothermal development on a regional or statewide basis." These two statements appear to be inconsistent. How could the economic and technological feasibility of an alternative have been determined if there was no determination made of the economic viability and technological feasibility of its uses, and no benefit-cost analysis has been completed on the development of the resource?

The only discussion on the uses of the energy in the DEIS is in generic terms. Without a more complete understanding of the uses of the energy, the reader cannot fully understand the impacts of any but the no action alternative. The secondary impacts on air and water quality, wildlife and visual resources from the associated uses of the power may overshadow the primary impacts from developing the resource. Therefore, it is necessary to discuss as fully as possible the range of potential secondary impacts.

Will the development of the Island Park Geothermal resources make a significant contribution to western energy needs? As presented, the development could cause significant environmental degradation to a largely pristine area adjacent to a national park. What are the tradeoffs? If a power plant were to be built, what area would it likely service? Would the development of this energy resource in fact be used as a substitute for existing fossil fuel sources in fulfilling present energy demand? Or will it merely create new demands to develop the local area rather than (7)

E.P.A.

6. This concern is incorporated into the final EIS.

7. The quantity of energy that may be produced from the IPGA is presently unknown. Therefore, these questions are impossible to answer.

servicing existing demand areas? These questions and tradeoffs need to be addressed in the EIS if the reader is to understand the energy benefits relative to the economic, environmental and social costs.

It would also be useful to know whether revenues from leasing are earmarked for any special uses, such as monitoring or mitigation measures.

8. Decision Criteria. The decision criteria on page 76 do not specifically address the need for substantial guarantees that air and water quality and wildlife and fish habitat will be protected. In view of the potential for significant adverse impacts on these resources, we believe additional decision criteria should be included to ensure a decision responsive to environmental values. (8)

9. Range of Alternatives. With the exception of the "public workshop" alternative, about which very little information is presented, all the viable alternatives propose the same basic acreage available for leasing without special restrictions. This acreage appears to have been previously decided on, and alternative acreages are not seriously considered in the EIS. We believe an alternative with more limited acreage available for leasing is necessary to provide an adequate degree of environmental protection while data is being collected, to permit better informed leasing decisions at a later date. The deferred or restricted areas in Alternatives 3, 4, and 5 appear to be based primarily on wildlife and fisheries habitat consideration. We believe additional consideration should be given to drinking water, especially groundwater, and to air quality in Yellowstone National Park. (9)

Based on our concerns for potential pollution of groundwater and other significant adverse environmental impacts, as discussed above, and limited information presented in the EIS on the quality of geothermal waters and on potential secondary impacts of development, the Environmental Protection Agency has rated this draft EIS ER-2. ER (Environmental Reservations) indicates that EPA has reservations concerning the environmental effects of certain aspects of the proposed action. EPA believes that further study of suggested alternatives or modifications is required. Category 2 (Insufficient Information) indicates that the draft EIS does not, in EPA's opinion, contain sufficient information to fully assess the environmental impact of the proposed action.

EPA's rating will be published in the Federal Register in accordance with our responsibility to inform the public of our views on proposed Federal actions under Section 309 of the Clean Air Act, as amended.

Thank you for the opportunity to review this environmental statement. If you have questions or would like to discuss these comments, please feel free to contact me or Craig Partridge of my staff at (206) 442-1285 or (FTS) 399-1285.

Sincerely,

Alexandra B. Smith

Alexandra B. Smith, Chief
Environmental Evaluation Branch

E.P.A

8. The revised section, Evaluation Criteria, included the major considerations for determining the selected alternative or proposal.

9. The selected alternative incorporates these concerns.

(USDA — SCS, DATED MAY 15, 1979)

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Room 345, 304 North 8th Street, Boise, Idaho 83702

May 15, 1979

David M. Jay
Targhee National Forest
420 N. Bridge St.
St. Anthony, Idaho 83445

Dear Mr. Jay:

My staff has reviewed the Draft Environmental Impact Statement for leasing and development of geothermal resources within the Island Park Geothermal Area and have the following comments:

1. The last sentence on page 10 is a duplication of the previous sentence.
2. Areas with known avalanche slide paths should be shown on the Geologic Hazard Map since human activity will exist in the IPGA throughout the winter season. (1)
3. It seems logical that the "sloshing effect", referred to on page 22 under Seismicity, should also apply to the Island Park Reservoir as well as Henry's Lake. (2)
4. On page 22, under the Water Resource Section, it may be advisable to note difficulty experienced by the City of Ashton in drilling a successful well to augment their municipal water supply.

This document is exceptionally well prepared and we compliment you on a job well done.

Thank you for the opportunity to review and comment on this Draft Environmental Impact Statement.

Sincerely,

Creighton N. Gilbert (Acting)
Amos I. Garrison, Jr.
State Conservationist

1. This has been corrected.

2. Yes, if a large disturbance occurred near Henrys Lake or south of it, sloshing of water would probably take place in Island Park Reservoir.

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
CENTER FOR DISEASE CONTROL
ATLANTA, GEORGIA 30333
TELEPHONE: (404) 633-3311

May 11, 1979

Mr. David M. Jay
Forest Supervisor
Targhee National Forest
420 N. Bridge Street
St. Anthony, Idaho 83445

Dear Mr. Jay:

We have reviewed the draft environmental statement of the Island Park Geothermal Area, Idaho, Montana, and Wyoming. We are responding on behalf of the Public Health Service.

While we recognize the need for pursuing alternative energy sources, we hold some concerns with the proposals for geothermal exploration as presented in this EIS. In all likelihood, construction of large geothermal facilities will be forthcoming, and this will introduce an industrial atmosphere into a national forest with national parks in close proximity.

Even though new energy production in the U.S. is warranted, careful consideration should be given to the preservation of our other natural resources. This draft statement does not address the amount of geothermal energy speculated as compared to the feasibility of equivalent energy production from alternative sources. This may be impossible; however, the adverse impacts listed which cannot be avoided, in addition to the potential impacts described in an area such as Island Park Geothermal Area and Yellow Stone National Park, are critical trade-offs. It would be devastating to alter or contaminate large tracts of prized natural resources only to discover later the project is not feasible. Furthermore, since knowledge of environmental causes, effects, and remedial or preventive measures specifically relating to geothermal development "ranges from adequate to limited," it would be prudent to choose as the preferred alternative the smallest area exploration project possible to establish necessary data by which to assess the feasibility of geothermal energy production. If a source demonstration proves that expected trade-offs are acceptable for the price of energy, and appropriate mitigation measures are planned, then further development could be seriously considered.

Evaluating the alternatives as proposed, alternatives 3 and 5 would have the most favorable impact upon the environment. We agree that it may be very desirable to designate no leasing areas or to defer certain lands from leasing where geothermal resource development could have significant adverse impacts on surface resource values. No leasing areas should include those lands that provide groundwater recharge for any sole source aquifers. (1)

Any testing or leased production drilling should include safeguards to protect the potability of aquifers being used in the region for drinking water. The safeguards to be implemented should be described. All chemicals and toxic liquids used in drilling and maintenance operations that have the potential for surface water and groundwater contamination should be identified along with a brief description of their potential effect. (2)

It is important that erosion control measures such as settling basins or holding ponds be provided at each drilling area. These basins could be designed in such a way to minimize any effects of surface erosion and possible chemical spills that could adversely impact receiving waters. Any discharge from holding ponds, power plant facilities, etc. must not affect the maintenance and attainment of applicable water quality standards of the receiving stream or water body.

In addition to meeting local and EPA regulations regarding toxic substances (p. 119-120), the applicability of the Corps of Engineers permitting requirement under Section 404, P.L. 95-200, regarding the discharge of fill into navigable waters or adjacent wetlands, should be noted in the final EIS. The final statement also should state if the proposed plan has been prepared in accordance with Executive Order 11990, Protection of Wetlands. (3)

The statement projects that by 1985, 1.5 million visitors will enter the park and a high percentage of these visitors will traverse the Island Park Geothermal Area. It is known that noncondensable gases are formed in the vapor phase of a geothermal source. Releases of these gases from accidents or malfunctioning parts could cause serious consequences to workers or visitors in or around the site. We feel this DEIS should discuss the type and potential health effects of the gases and vapors associated with these types of operation and the type of preventive measures to be employed. Also absent from this document is the discussion of potential presence or release of radioactive substances in either water or air. (4)

The recommended format for a DEIS, as described in the Federal Register of June 9, 1978, "National Environmental Policy Act - Implementation of Procedural Provisions; Final Regulations" provides for an assessment of alternatives including the proposed action. Since it will be difficult for some reviewers to make a comparative analysis without the benefit of a proposed alternative selected by experts, and because new or modified decision criteria may be developed after receiving comments, we suggest that the final statement be prepared as a draft and reviewers be given ample opportunity to critique the selected alternative. (5)

Thank you for the opportunity of reviewing this document. We would appreciate receiving two copies of the final statement.

Sincerely yours,

Frank S. Lisella, Ph.D.
Chief, Environmental Affairs Group
Environmental Health Services Division
Bureau of State Services

DEPT. OF HEW

1. This is addressed under the Test Drilling subsection of the Management Requirements, Constraints, and Mitigating Measures section.

2. Addressed under General Construction and Erosion in the Test Drilling subsection of Section VIII.

3. Change made in text under Evaluation Criteria.

4. The programmatic nature of this EIS and unknown quantity or quality of a geothermal resource makes this consideration unrealistic.

5. Reasons for no preferred alternative in the draft EIS were explained in the Introduction and in Evaluation of the Alternatives sections.

Advisory Council On Historic Preservation

1522 K Street N.W.
Washington D.C.
20005

Reply to: P. O. Box 25085
Denver, Colorado 80225

RESPONSE NF

Units:	1	2	3	4	5	6

MAY 29 '79

Action	To	Info
	Supv.	
	Planner	
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	P.M.	
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	Contr.	
	ELP	
	Resources	
	Personnel	
	Off. Serv.	
	File and Record	

May 23, 1979

Mr. David M. Jay
Forest Supervisor
Targhee National Forest
420 North Bridge Street
St. Anthony, Idaho 83445

Dear Mr. Jay:

The Council has reviewed your draft environmental impact statement for the Island Park Geothermal Area circulated for comment pursuant to Section 102(2)(C) of the National Environmental Policy Act. We note that the undertaking may affect prehistoric and historic cultural properties eligible for inclusion in the National Register of Historic Places. Circulation of a draft environmental impact statement, however, does not fulfill your agency's responsibilities under Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. Sec. 470f, as amended, 90 Stat. 1320). (1)

Prior to the approval of the expenditure of any Federal funds or prior to the granting of any license, permit, or other approval for an undertaking, Federal agencies must afford the Council an opportunity to comment on the effect of the undertaking on properties included in or eligible for inclusion in the National Register in accordance with the Council's regulations, "Protection of Historic and Cultural Properties" (36 CFR Part 800)(enclosed). Until these requirements are met, the Council considers the draft environmental statement incomplete in its treatment of historical, archaeological, architectural, and cultural resources. You should obtain the Council's substantive comments through the process outlined in 36 CFR Section 800.9. These comments should then be incorporated into any subsequent documents prepared to meet requirements under the National Environmental Policy Act. (2)

Mrs. Jane King of the Council's Denver office may be contacted at (303) 234-4946 for further assistance.

Sincerely,

Louis S. Wall
Chief, Western Office
of Review and Compliance

Enclosure

ADVISORY COUNCIL ON HISTORIC PRESERVATION

1. To our knowledge the proposed action does not include leasing in any areas eligible or considered for inclusion in the National Register of Historic Places.

2. Section VIII of the Final EIS is much more specific as to the requirements of a potential lessee for the protection of historic and cultural properties.

The following two letters were received after the formal commenting period. They were a result of a meeting between US Forest Service Chief Max Peterson and a group of citizens in West Yellowstone, Montana on September 10, 1979. Chief Peterson personally requested written comments from the group and indicated that their concerns would be responded to in the final EIS.

September 24, 1979

Mr. R. Max Peterson
U.S. Forest Service
Department of Agriculture
Washington, D.C. 20250

Dear Sir:

We would like to thank you for meeting with us when you visited West Yellowstone on September 10, 1979. It was a pleasure to sit down and talk about the Island Park Geothermal Area. The following input are concerns which were discussed by us and with you at that meeting. We feel that the Draft Environmental Statement was quite inadequate in it's report. These concerns are very valid and we hope they will be more scientifically researched, accessing the impacts of the Island Park Geothermal Area more properly to the area of the Hebgen Lake Basin.

1) Air - There should be increases in particulates in the atmosphere, from the development of the Island Park Geothermal Area. Also there should be a release of noxious and odorous gases as hydrogen sulfide, (H_2S). This ought to be addressed in the Environmental Statement, for we have been told that the escapage of steam will produce large amounts of H_2S into this basin, endangering the health of everyone. Also, what are the consequences when this escapage happens on a 30° below zero day? (1)

2) Climate - There is no mention of the effects of the most important factor in our environment due to geothermal development. Will geothermal exploration, development and/or operation, effect the climate in as much as the humidity, chill factor, snowfall, rainfall, cloud cover, or pollution or vapor inversions? (2)

3) Water - There should be mention to the potential dangers to the ground water table, due to the reinjection of geothermal water or by any earthquake activity. (3)

4) Earthquakes - The Environmental Study should state if drilling will induce earthquakes or state what would be the impacts on drilling or drilling plants if an earthquake occured in the Island Park Geothermal Area? (4)

5) Recreation - What will be the impacts on any geothermal drilling or drilling plants on the current recreation of the area, (snowmobiling, camping, hiking, etc.)? (5)

These are just a few of our concerns which we feel should be looked at much closer before making the final decision. We feel that there has been a total lack of public involvement of this area and that the impacts of the Island Park Geothermal Area effect West Yellowstone and Hebgen Lake very significantly. There has been only one meeting, July 30, 1979, in which the Environmental Statement was discussed, far after the study had been researched. We feel that Section 1506.6 of the Environmental Policy Protection Act has not been met. Please consider our concerns as input into the final decision and we wish that the study will be more scientifically researched and the data be brought out for the public to obtain knowledge on.

Thank you for this opportunity and the meeting of September 30, 1979.

Sincerely:

Tony Brenn [signature] | Larry Binfet [signature]
Pete Gray [signature] | Bill Howell [signature]
David Rie [signature]

WEST YELLOWSTONE CONCERNED

1. See page 94. Although the release of noxious gases is associated with the steam type of geothermal resource, it is suspected by Dr. Donald White (personal communication; US Geological Survey, Menlo Park, CA) that the more common hot water system would occur in the IPGA. If this is so, then releases of water vapor and gases would be minimized because of the type of technology necessary to extract the energy from the hot water. Gases and water vapor escaping during any phase of development must comply with the acceptable levels for emissions set by the state and Federal governments. (see Section VIII, page 129).

2. See page 94. Climatic alteration will not be tolerated. The phase of geothermal development that will have the least influence on climate is the exploration phase; the degree to which the later phases may influence climate is not known at this time. The nature of the resource (steam or hot water) will determine this.

3. See page 127 and page 129. The integrity of aquifers that supply drinking water is protected by law and will be ensured by proper drilling practices and state of the art design in deep well installation and completion. Exchanges of the geothermal fluids will occur many thousands of feet below the near surface aquifer that would supply water to West Yellowstone and proper well design will keep mineralized water from mixing with potable supplies. Reinjection near earthquake areas would be done far from active faults; proper selection of sites and design of plants and associated structures will protect aquifers.

4. See page 129. The portion of the IPGA that would be most severely disturbed by a major earthquake is the area near West Yellowstone, MT. It is for this reason that the Secretary of the Interior will carefully evaluate any proposed leasing around West Yellowstone. If geothermal plants and wells were located in an earthquake prone area, destruction of pipelines, wells and structures could occur during an earthquake of large magnitude.

5. See page 97 for possible effects of geothermal development on current recreation.

Post Office Box 98
West Yellowstone, Montana 59758
September 26, 1979

Mr. R. Max Peterson
United States Forest Service
Department of Agriculture
Washington, D. C. 20250

Dear Max:

I enjoyed meeting you on your recent visit to West Yellowstone during the International Fish & Wildlife Agencies Convention. It is a real pleasure to be able to sit down and exchange ideas with those people who will make decisions and help solve the problems which affect our area.

In line with what was discussed when we visited, this letter is to amplify my specific areas of concern regarding the environmental impact statement pertaining to proposed geothermal development in the Island Park Geothermal Area.

It is my feeling that the Draft EIS fails to address properly the following specific areas of concern:

I. CLIMATE

A. The Draft EIS fails to address any of the probable changes in the climate assuming development of geothermal resources in the IPGA. This, in spite of the fact that it is well known that such areas as power plants, cities and construction sites all create a measurable affect to climate on the downwind side of such activities. This possibility is not even addressed in the effects of the Implementation Section of the Draft EIS. (1)

B. The Draft EIS states that no data is available regarding winter weather, even though it is obvious that geothermal exploration and production would be a year-round activity. This data is available as the Forest Service in West Yellowstone takes U. S. Weather Service observations year round reported to the U. S. Weather Service under the code "WEY". (2)

C. Some of the data in the Implementation Section of the Draft EIS is simply erroneous. On page 13 it states: "Since 1967, wind speeds (in the IPGA) from June to September have commonly been below 10 mph." This is fiction. It is a rare day in this area between June and September that there is a wind lower than 10 mph. Commonly, the wind starts at approximately noon and is active until sunset, usually blowing from 180° to 240° at approximately 10 to (3)

PETER W. GRAY

1. See page 94, Section V (Effects of Implementation) These effects would occur in a variable sized area from time to time, depending on atmospheric conditions and the magnitude of releases from geothermal operations. If the geothermal resource is a steam type (unlikely), the probability of releases of gases and water vapor would be high, and consequently the chances for localized adverse effects would be high. If the resource is a hot water type, releases to the atmosphere would be minimal and effects few or negligible.

2. The Draft EIS does not state that "no data is available regarding winter weather". For the West Yellowstone area, temperature, precipitation and snow depth (and water equvalent) are shown in Figures 4 and 5 (page 14) and in Table 2 (page 15—see Black Bear, MT in this table).

3. The wind speeds given on page 13 apply to the Buffalo Ranger Station of the Targhee National Forest, located across from Pond's Lodge, Idaho. The Draft does not intend to imply that these are the wind speeds in West Yellowstone.

Mr. R. Max Peterson
September 26, 1979
Page 2

20 knots June to September. This does not include convection winds associated with occasional thunderstorms during the summer months. I can speak to this personally as I hold a U. S. Weather Service Observers Certificate for use in my duties at the West Yellowstone airport.

D. This particular portion of the Draft EIS fails completely to evaluate effects on climate by geothermal exploration, construction, development and operation. Some valid questions which should be considered are: (4)

1. If there is an increase in humidity and particulate matter suspension in the area due to geothermal development, how will this affect:

a. Marketability of the area for snowmobiling in the winter due to high wind chill factor resulting from an increase in humidity.

b. Will snowfall increase in the winter and if so, what are the effects to residents of the increased cost of snow removal?

c. How will the increased occurrence of rain, snow and fog due to particulate matter affect the economics of airport operation summer and/or winter?

d. With the potential increase in cloud cover, would the area suffer a lower attractiveness for tourism, the only industry of the Hebgen Lake Basin?

e. The Draft EIS notes that inversions are common in the West Yellowstone vicinity. What are the effects of this climatic fact on the area in the event of pollution in the form of noxious gasses escaping from wellheads? (5)

f. If there is higher cloud cover, humidity and corresponding increase in precipitation, what results will this have on the vegetation in the area, as well as water flow in area rivers and streams? How will this affect fishing and tourism? (6)

Those who drafted the Draft EIS failed to include a meteorologist on their staff. More data must be gathered before these questions can even be addressed. The Draft EIS simply does not make a statement at all regarding the effects of geothermal development on this crucial part of our environment.

4. See Section V, page 94 of the FEIS. Climate changes are indicated. The specific quantity of possible climate changes is unknown to all participants and collaborators. Protection of West Yellowstone and other areas is discussed on page 129.

5. See page 90 and page 129. Gases heavier than air would not escape during an inversion. This applies most importantly to H_2S. However, during any type of geothermal operation, monitoring of emissions and discharges would be required by State and Federal law. Through such monitoring adverse conditions would be made known to the proper authorities who could impose a suspension of operations during times when hazards are presented to nearby residents.

6. Increased precipitation would result in a probable increase in stream flow. How great this might be is not known, if there would be any increase in precitation. If the effect is a small increase, fishing and tourism would not be influenced. There would be no expected change in vegetation.

Mr. R. Max Peterson
September 26, 1979
Page 3

II. WATER RESOURCES

A. There is no doubt that the City of West Yellowstone in the future will construct a city water system. If geothermal development becomes a reality, what are the effects on subterranean water supplies? Will the mineral and chemical content increase to levels that are unacceptable for utilization as municipal drinking water? (7)

B. Fully 30% of the visitors to the IPGA are attracted by the high caliber of fishing that can be found now. Water quality is important to the fish that live in the lakes, streams and rivers around the IPGA. Adverse effect to the fish population will have a detrimental effect on the quality of the fishing in the area. Any decline in the fishing must make the IPGA less attractive as a destination resort. The Draft EIS does not address this problem. (8)

III. FISHERIES

A. If there is an increase in water temperature or turbidity, how will this affect the insect life in the area upon which the fish depend for food? Will it affect either the amount of production of insect life or when they are produced? This is important to the area as certain insect hatches are an attraction to fishermen from all over the world, e.g. the Green Drake Hatch on Henry's Fork or the Salmon Fly Hatch on the Lower Madison River. (9)

IV. SEISMIC ACTIVITY

A. With geothermal development in the IPGA and the subsequent reingesting of used water into subsurface strata, will there be an increase in seismic activity in the IPGA? This was experienced in Denver during the reinjection of liquid waste material from the Rocky Mountain Arsenal. This caused numerous earth tremors of varying magnitudes in the Denver area. Can we expect a similar occurrence in the IPGA? (10)

V. NON-COMPLIANCE WITH ENVIRONMENTAL IMPACT STATEMENT REGULATIONS

A. Most importantly, no input was solicited from the West Yellowstone area during any part of the research prior to the writing of the Draft EIS. This is in clear violation of the performance mandated by the National Environmental Policy Act. The only input offered the citizens of West Yellowstone during any part of the environmental statement process was an input period from March 21 through May 21, 1979, when comments were solicited on an already published draft environmental impact statement. This was an unfortunate choice of input period which fully demonstrates that those who wrote the Draft (11)

7. See page 127 and page 129. The integrity of aquifers that supply drinking water is protected by law and will be ensured by proper drilling practices and state of the art design in deep well installation and completion. Exchanges of the geothermal fluids will occur many thousands of feet below the near surfact aquifer that would supply water to West Yellowstone and proper well design will keep mineralized water from mixing with potable supplies.

8. See pages 124, 125, and 127. A monitoring system will be established on the surface water system to provide adequate protection to the fisheries in the IPGA. Corrective measures will be enforced by authorities if it is found that fish populations are threatened.

9. See page 103 for possible effects to fisheries. Section VIII, page 124 discusses general mitigation, constraints, etc. to protect this resource.

10. See page 129. The area around West Yellowstone is seismically active. If geothermal development occurs anywhere in this region, reinjection of cooled geothermal fluids should be done far from any active faults. Such a restriction on the location of reinjection will minimize the chances for earthquakes. Early geothermal exploration activities should be combined with micro-seismic monitoring. These studies establish the levels of natural background seismicity, locate areas unsuitable for reinjection, and help to reveal the nature and magnitude of potential seismic hazards that may pertain to geothermal development.

11. This is not correct.

EIS have no knowledge of the West Yellowstone area or economy. The Forest Service solicited information at a time when very few, if any, people were in the area to generate input. Citizens who are permanent residents of the area are utilizing the only vacation opportunity of the year and part-time residents are in the process of opening their businesses for the summer.

B. Why is St. Anthony featured in photographs and in socio-economic research in the Draft EIS when it is situated approximately 20 miles from the boundaries and 75 miles from the northern portions of the IPGA? It seems to me that it would be as pertinent to do a breakdown on Salt Lake City! The problem is one of emphasis; the statement fails to address potential problems at the most likely points of effect. (12)

If I, as a non-scientific person in just thinking about this a little bit, can raise just these few questions which have not been assessed by the Draft EIS, how many other questions can be developed by specialists in the various fields of impact? In other words, Max, does this document do the job that it is mandated to do by law, namely assessing the impact of a given activity on a specific area? There is no question in my mind that it fails abominably.

I don't know what the affects of proposed drilling in the IPGA will be, but I feel that on reading any environmental impact statement addressing the subject that I should have a clear understanding of what the affects would be. Since this document fails in answering my questions, I think it must be redone.

Kindly share with me your thoughts on the comments I have provided you.

Sincerely yours,

PETER W. GRAY
Treasurer, West Yellowstone Chamber of Commerce

PWG:cmb

cc: Mr. David Jay

12. Fremont County, not St. Anthony statistics are most prevalent in the EIS. West Yellowstone was certainly not neglected although less than 10% of the IPGA is in Montana.

Allison, J.L., and D.H. Green, 1974, Idaho's gateway to Yellowstone—the Island Park story: Island Park—Gateway Publishing Co.

Arbib, R., 1977, The blue list for 1978: American Birds, vol. 31, #6, pgs. 1087-1096.

Canter, L.W., 1977, Environmental impact assessment, McGraw Hill Book Co.

EDAW, Inc., 1977, Island Park geothermal energy development—social and economic assessment: EDAW, Inc., Ft. Collins, Colorado.

Flath, D.L., 1978, Nongame species of special interest or concern: mammals, bids, reptiles, amphibians, fishes: Wildlife Division, Montana Dept. of Fish and Game.

Hamilton, W., 1960, Late Cenozoic tectonics and volcanism of the Yellowstone region, Wyoming, Montana and Idaho, in Billings Geological Society, 11th Annual Field Conference, 7-10 Sept. 1960, West Yellowstone earthquake area, p. 92-105.

1965, Geology and petrogenesis of the Island Park Caldera of rhyolite and basalt, eastern Idaho: US Geological Survey Professional Paper 504-C.

Keefer, W.R., 1971, The geologic story of Yellowstone National Park: US Geological Survey Bulletin 1347.

Kruger, P and C. Otte, 1973, Geothermal energy-resources, production, stimulation: Stanford Univ. Press.

Love, J.D., 1956, Geologic map of Teton County, Wyoming in Wyoming Geological Association, Jackson Hole Field Conference Guidebook.

Pacific Northwest River Basins Commission, 1970, Columbia-North Pacific Region framework study of water and related lands, Appendix V—Water Resources

Peterson, D.L., and I.J. Witkind, 1975, Preliminary results of a gravity survey of the Henrys Lake quadrangle, Idaho and Montana: US Geological Survey Journal of Research, vol. 3, #2, p. 223-228.

Phillips, K.J., and J.A. De Filippi, 1976, A matrix approach for determining wastewater management impacts: Journal of Water Pollution Control Federation, vol. 48 #7, pgs. 1759-1765.

Rocky Mountain Mineral Law Foundation, 1977, Proceedings, Geothermal resources development institute.

Rowe, J.J., R.O., Fournier, G.W. Morey, 1973, Chemical analysis of thermal waters in Yellowstone National Park, Wyoming, 1960-1965: US Geological Survey Bulletin 1303.

State of Idaho Fish and Game Dept., 1978, A plan for the future management of Idaho's fish and wildlife resources, volume 1: goals, objectives and policies, 1975-1999.

State of Wyoming Game and Fish Dept., 1977, Current status and inventory of wildlife in Wyoming.

Trewartha, Glenn T, 1965, An introduction to climate: McGraw Hill Book Co., NY.

US Dept. of Agriculture, Rural Electrification Administration, 1975, Suggested practices for reducing raptor losses on powerlines: Bulletin.

1975, Powerline contacts by eagles and other large birds: Bulletin 61-10.

US Dept. of Commerce, 1973, Monthly normals of temperature, precipitation, and heating and cooling degree days, 1941-1970, for Idaho and Montana.

US Environmental Protection Agency, 1977, Approval and promulgation of state implementation plans, sub-chapter C, air programs: Federal Register, vol. 42, #212, Nov. 3, 1977, p. 57459-57461.

US Forest Service, 1976, Final environmental statement and land management plan, west slope of the Tetons planning unit, Targhee National Forest

US Forest Service, 1978, Final environmental statement and land management plan, Island Park planning unit, Targhee National Forest

1978, Draft environmental statement, geothermal leasing and development on part of the Gifford Pinchot National Forest.

1978, Final environmental statement, geothermal development Breitenbush area, Willamette and Mt. Hood National Forests.

US Dept. of the Interior, Bureau of Sports Fisheries and Wildlife, 1973, Threatened wildlife of the US (Red Book)

US Dept. of Transportation, 1974, Standard specifications for construction of roads and bridges on federal highway projects, FP-74.

US Geological Survey, 1964, The Hebgen Lake, Montana earthquake of August 17, 1959; US Geological Survey Professional Paper 435.

US Geological Survey, 1976, Water Resources Data for Idaho, Water Year 1975.

Whitehead, R.L., 1978, Water resources of the upper Henrys Fork basin in eastern Idaho: Water Information Bulletin No. 46, State of Idaho Dept. of Water Resources.

Witkind I.J., P.A. Hoskins, V.L. Lindsey, and E.L. MItchell, 1972, Folio of the Henrys Lake Quadrangle, Idaho, Montana: US Geological Survey map I-781-A, C, D, E, and I.

Witkind, Irving J., 1975, A proposed glacial history of the Henrys Lake Basin, Idaho: Journal of Research of the US Geological Survey, vol. 3, #1, p. 67-76.

Wilson, S.H., 1976, Possible conflict between the Interests of Tourism and Geothermal Power Development, Proceedings of the 2nd UN Symposium on the Development and Utilization of Geothermal Resources; San Francisco, May 20-29, 1975, p. 2463.

APPENDIX P. SIGNIFICANT CONTRIBUTIONS TO THE ENVIRONMENTAL IMPACT STATEMENT PROCESS WERE RECEIVED FROM THE FOLLOWING PEOPLE:

Name	Qualification
U.S. Forest Service	
Boise National Forest	
Ted Mullin	Geologist
Gallatin National Forest	
Claude Coffin	Supervisory Forester
Phil Cowan	Energy Coordinator
Carl Davis	Soil Scientist
Steve Glasser	Hydrologist
Jerry Light	Wildlife Biologist
Ralph Meyer	District Ranger
John Sandmeyer	Long Range Planner
National Forests in Texas	
Dale Bounds	Visual Information Specialist
Sawtooth National Recreation Area	
Harry Young	Geologist
Shoshone National Forest	
Steve Mealey	Wildlife Biologist
Targhee National Forest	
Bart Andreasen	Landscape Architect
Mickey Beland	Resource Coordinator
Craig Cortwright	Silviculturist
Robert L. Davis	Hydrologist
Marie Douglass	Typist
John Ferebauer	Economist
Larry Gorringe	Engineer
Dave Griffel	Wildlife Biologist
Eva Hedge	Office Services Supervisor
Richard Heninger	Forest (minerals)
David M. Jay	Forest Supervisor
Wayne Jenkins	Forestry Technician
Sara J. Johnson, Ph.D	Wildlife Biologist
Mark Kary	Range Conservationist
Kenneth R. Keck	Forester
John Maupin	Fuels Management Specialist
John M. McGee, Ph.D	Wildlife Biologist
Emma Lou Moss	Typist
Timothy Murphy	Archaeologist
Paul Oakes	Soil Scientist
George Olson	Forest Supervisor
Ned Pence	District Ranger
Gary Rahm	District Resource Assistant
Robert Riley	Forest (timber)
Stephen M. Rushton	Branch Chief, Recreation and Lands
Stan Szczepanowski	Hydrologist
Robert Williams	Planner
Dave Winn, Ph.D	Wildlife Biologist
Marvin Wolfe	Silviculturist
U.S. Geological Survey	
Robert L. Christiansen, Ph.D	Geologist
David Fach	Physical Scientist
Robert Kent	Environmental Scientist
Robert Lewis	Hydrologist
Donald E. White, Ph.D	Geologist
Richard L. Whitehead	Hydrologist
Robert Whitham	Geologist

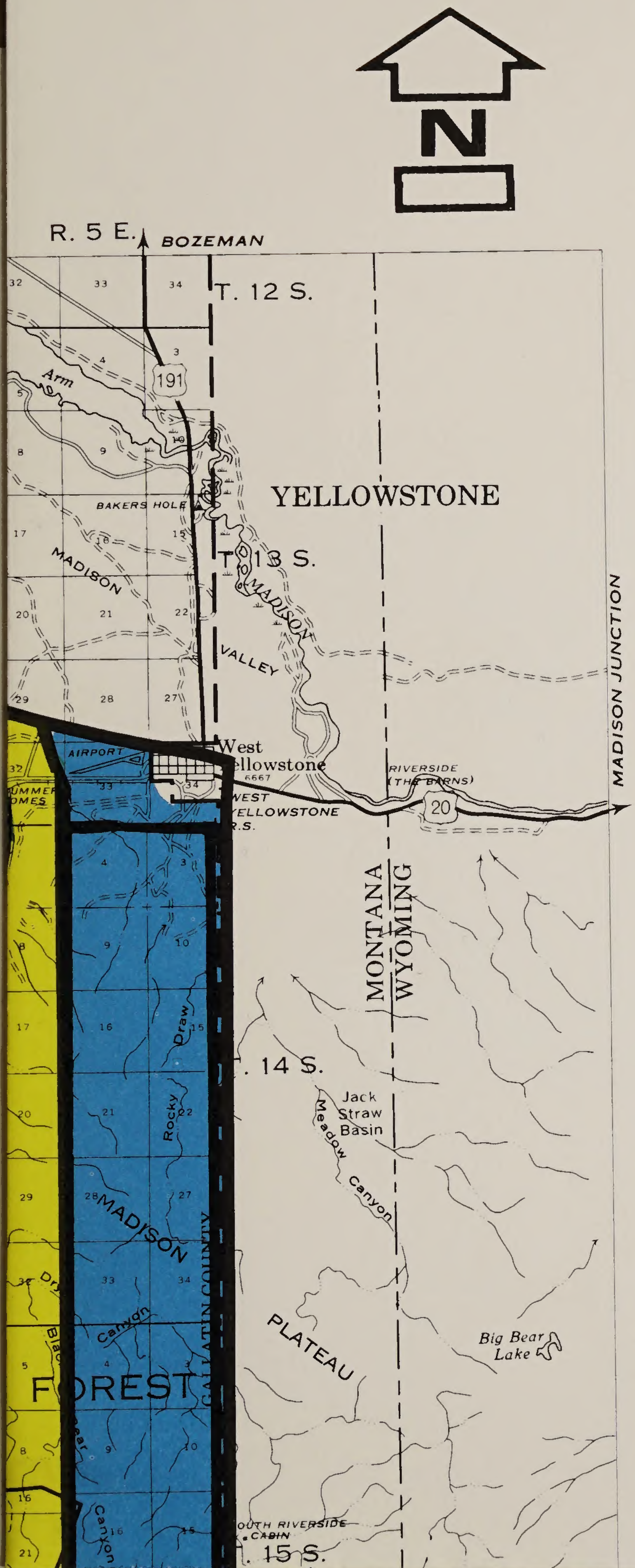
Bureau of Land Management
- Doug Causey .... Geologist
- John Davis .... Chief of Planning and Environmental Coordination
- Gale Green .... Forester
- Hal Isaacson .... Assistant District Manager
- Dave Kissel .... Landscape Architect
- Marc Whiser .... Range Conservationist

National Park Service (Yellowstone National Park)
- Edmund J. Bucknall .... Resource Management Specialist
- Roderick Hutchison .... Geologist
- Richard Knight, Ph.D .... Project Leader, Interagency Grizzly Bear Study Team
- Mary Meagher, Ph.D .... Chief Research Biologist
- Alan Mebane .... Chief Park Naturalist

U.S. Fish and Wildlife Service
- Roy Heberger .... Wildlife Biologist
- Richard Howard .... Wildlife Biologist
- Robert Rainville .... Fisheries Biologist

Department of Energy
- Robert Chappel .... Project Engineer
- John Griffith .... Chief of Research and Engineering
- Susan Spencer .... Environmental Engineer

State Agencies:
- Wyoming
  - Game and Fish
    - John Erickson .... Fisheries Biologist
    - Harry Harju, Ph.D .... Staff Biologist for Environmental Affairs
    - Garvice Roby .... Wildlife Biologist
    - Michael Stone .... Staff Fisheries Biologist
- Montana
  - Fish and Game
    - Dennis Flath, Ph.D .... Head, Northern Rocky Mountain Wolf Recovery Team
    - Arnold Foss .... Regional Game Manager
    - Dick Vincent .... Fisheries Biologist
  - Bureau of Mines and Geology
    - John Sonderegger .... Hydrogeologist
- Idaho
  - Fish and Game
    - Joe Curry .... Senior Conservation Officer
    - Frank DeShon .... Assistant Regional Game Manager
    - Paul Jeppson .... Regional Fisheries Biologist
    - Bruce Penske .... Conservation Officer
    - Tom Reinecker .... Regional Supervisor
    - Brent Ritchie .... Big Game Biologist
    - Robert Sherwood .... Regional Game Manager
    - Greg Tourtlotte .... Conservation Officer
  - Department of Parks and Recreation
    - Bill Hagdorn .... Chief, Planning Division
  - Individuals
    - Remington Kohrt .... Forester (Industrial)
    - Monte Later .... Merchant
    - Jerry Reynolds .... Magistrate, Fremont County, Idaho
    - Robert Smith, Ph.D .... Geophysicist, Univ. of Utah


N
R. 5 E.
BOZEMAN
T. 12 S.
191
YELLOWSTONE
BAKERS HOLE
MADISON
T. 13 S.
MADISON
VALLEY
MADISON JUNCTION
AIRPORT
West Yellowstone
6667
WEST YELLOWSTONE R.S.
RIVERSIDE (THE BARNS)
20
MONTANA
WYOMING
Draw
Rocky
T. 14 S.
Jack Straw Basin
Meadow Canyon
MADISON
Canyon
PLATEAU
Big Bear Lake
FOREST
GALLATIN COUNTY
Canyon
SOUTH RIVERSIDE CABIN
T. 15 S.

Bureau of Land Management
- Doug Causey .... Geologist
- John Davis .... Chief of Planning and Environmental Coordination
- Gale Green .... Forester
- Hal Isaacson .... Assistant District Manager
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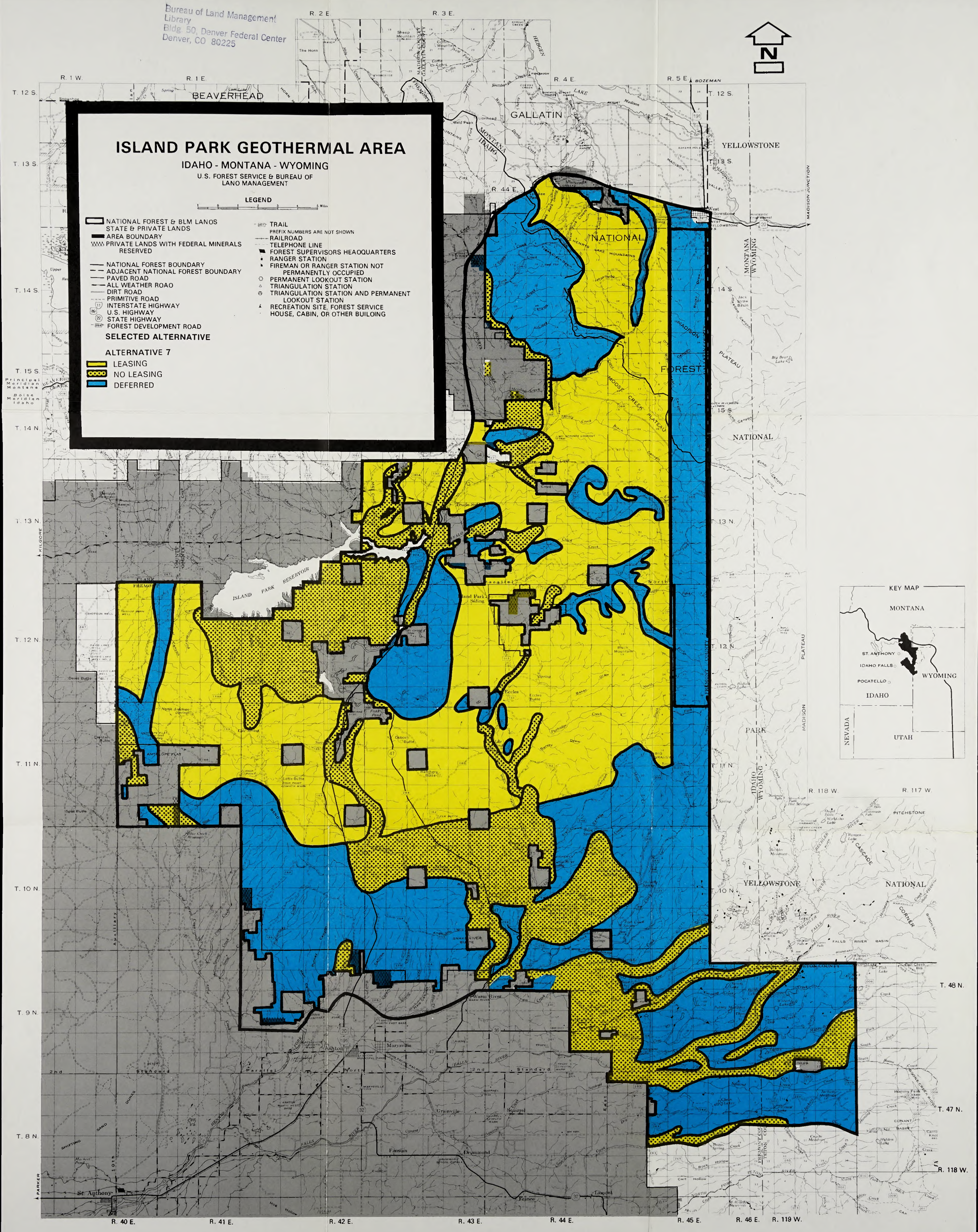
ISLAND PARK GEOTHERMAL AREA
IDAHO - MONTANA - WYOMING
U.S. FOREST SERVICE & BUREAU OF LAND MANAGEMENT
LEGEND
NATIONAL FOREST & BLM LANDS
STATE & PRIVATE LANDS
AREA BOUNDARY
PRIVATE LANDS WITH FEDERAL MINERALS RESERVED
NATIONAL FOREST BOUNDARY
ADJACENT NATIONAL FOREST BOUNDARY
PAVED ROAD
ALL WEATHER ROAD
DIRT ROAD
PRIMITIVE ROAD
INTERSTATE HIGHWAY
U.S. HIGHWAY
STATE HIGHWAY
FOREST DEVELOPMENT ROAD
TRAIL
PREFIX NUMBERS ARE NOT SHOWN
RAILROAD
TELEPHONE LINE
FOREST SUPERVISORS HEADQUARTERS
RANGER STATION
FIREMAN OR RANGER STATION NOT PERMANENTLY OCCUPIED
PERMANENT LOOKOUT STATION
TRIANGULATION STATION
TRIANGULATION STATION AND PERMANENT LOOKOUT STATION
RECREATION SITE, FOREST SERVICE
HOUSE, CABIN, OR OTHER BUILDING
SELECTED ALTERNATIVE
ALTERNATIVE 7
LEASING
NO LEASING
DEFERRED
N
KEY MAP
MONTANA
ST. ANTHONY
IDAHO FALLS
POCATELLO
IDAHO
WYOMING
NEVADA
UTAH
BEAVERHEAD
GALLATIN
NATIONAL
FOREST
YELLOWSTONE
NATIONAL
PARK
ISLAND PARK RESERVOIR
MOOSE CREEK PLATEAU
MADISON PLATEAU
PITCHSTONE PLATEAU
CASCADE CORNER
West Yellowstone
Island Park Siding
St. Anthony
Ashton
Marysville
Warm River
Drummond
Farnum
Chester
R. 1 W.
R. 1 E.
R. 2 E.
R. 3 E.
R. 4 E.
R. 5 E.
R. 44 E.
R. 40 E.
R. 41 E.
R. 42 E.
R. 43 E.
R. 44 E.
R. 45 E.
R. 46 E.
R. 119 W.
R. 118 W.
R. 117 W.
T. 12 S.
T. 13 S.
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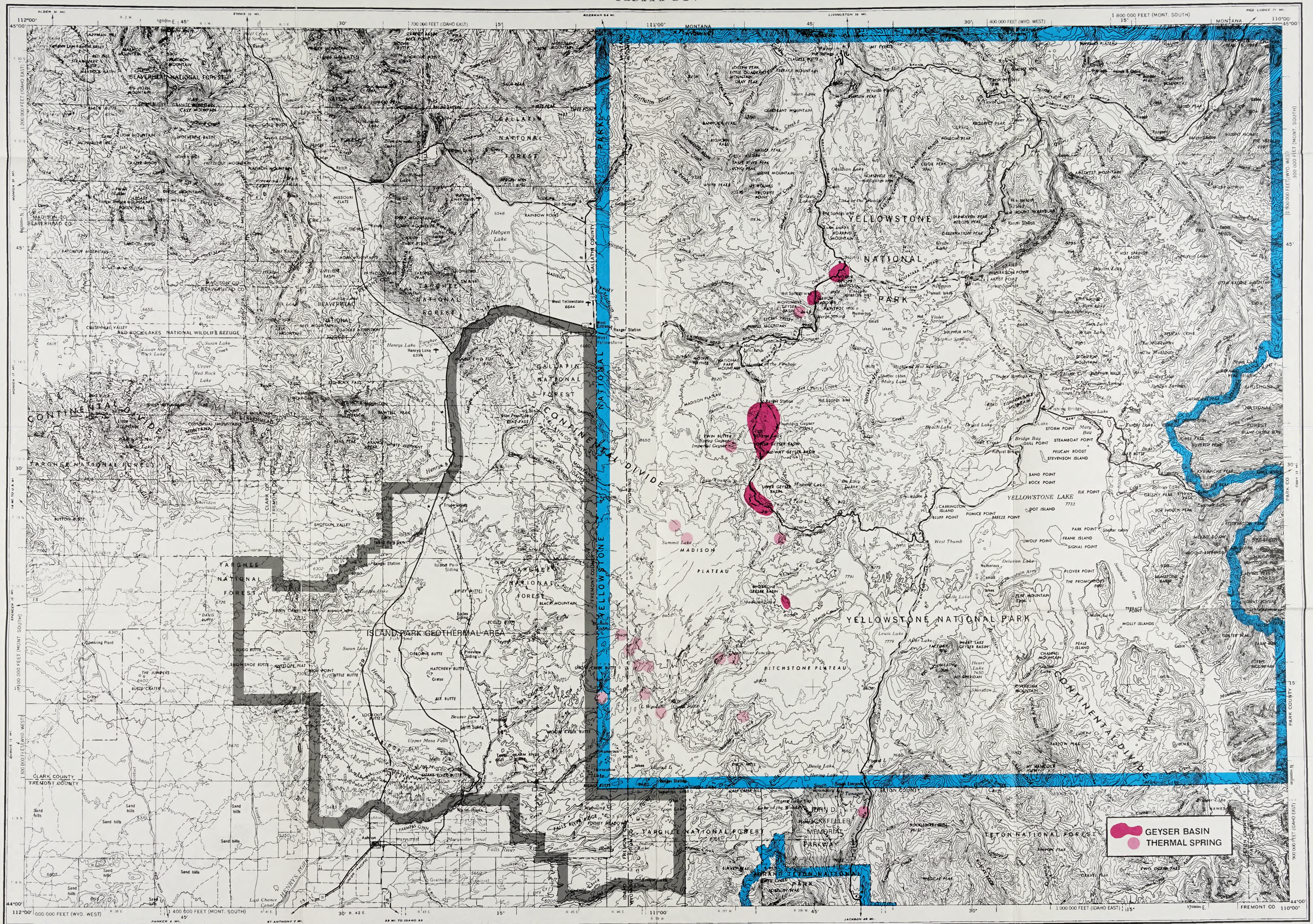

Prepared by the Army Map Service (ASSX), Corps of Engineers, U.S. Army, Washington, D.C. Compiled in 1955 by photogrammetric methods and from United States quadrangles, 1:62,500, 1950. Planimetric detail revised by photo-planimetric methods. Horizontal and vertical control by USGS, USC&GS, and USCE. Photography field annotated 1955. Limited revision by U.S. Geological Survey 1967.

100,000-foot grids based on Wyoming coordinate system, west zone, Idaho coordinate system, east zone and Montana coordinate system, south zone

10,000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

LEGEND
ROAD DATA 1955 PARTIALLY REVISED 1967
Figures in red denote approximate distances in miles between stars

POPULATED PLACES: Over 500,000 LOS ANGELES; 100,000 to 500,000 OMAHA; 25,000 to 100,000 GALVESTON; 5,000 to 25,000 Laramie; 1,000 to 5,000 Grand Coulee; Less than 1,000 Sun Valley

RAILROADS: Standard gauge; Narrow gauge (Single track, Double or Multiple)

BOUNDARIES: International; State; County; Park or reservation

ROADS: Hard surface, heavy duty — More than two lanes wide; Two lanes wide; Federal route marker. Hard surface, medium duty — More than two lanes wide; Two lanes wide; State route marker. Improved light duty; Unimproved dirt; Trail

Landplane airport; Landing area; Seaplane airport; Seaplane anchorage; Woods-brushwood

Landmarks: School; Church; Other; Horizontal control point; Spot elevation in feet; Marsh or swamp; Intermittent or dry stream; Power line

Approximate road alinement

Scale 1:250,000

CONTOUR INTERVAL 200 FEET
TRANSVERSE MERCATOR PROJECTION

FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR WASHINGTON, D.C. 20242

LOCATION DIAGRAM

RELIABILITY DIAGRAM

SECTIONIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D.C.—1967

ASHTON, IDAHO; MONT.; WYO.
1955
LIMITED REVISION 1967