GL00801

Magic H.S.
Revised Proposal

To: Attorney George Wingerson
Legal Operations
Idaho Operations Office
Department of Energy

From:
Energy Resource Generatus, Inc.
7671 Hansom Drive
Oakland, Ca 94605

SUBJECT: Restructure of MAGIC RESOURCE INVESTORS, Partnership to ENERGY RESOURCE GENERATUS, INC, Idaho Corporation.

The legal structure of the entity submitting the documents for SCAP No. DE-SC07-80ID12139, User-Coupled Confirmation Drilling Program was MAGIC RESOURCE INVESTORS, a California Partnership. Mr. Jerold R. Kirkman was the General Manager and General Partner of this entity. Since that time Mr. Kirkman has completed negotiations and taken over the transfer of all interests from the other four limited partners. The replacement of these LIMITED PARTNERS have been with GENERAL PARTNERS that have strengthened the entire project as they not only bring to the organization additional operational support and technology immediately applicable to the project; but represent the entity for the final utilization of the end use of the Drilling Program. Namely, the Construction and Operations of the ALcohol complex and planned Agricultural Complex.

During the course of strengthening the Legal entity for the Functional Operation of the Partnership, Council has recommended that the Partnership structure be altered to that of a Corporation. Establishment of a Corporation will finalize and control past potential obligations of any envolvements of the partners and provide a stronger Legal entity for the Drilling Program as well as ultimate END USERS of the Land and Geothermal Resource.

An Idaho Corporation will be the Entity for the Signing of the Contract instead of a Partnership. This Corporation will be ENERGY RESOURCE GENERATUS, INC. (ERG) instead of MAGIC RESOURCE INVESTORS. As provided to you in a separate document, the Corporation will be composed of Jerold R. Kirkman, and GEOTHERMAL AGRICULTURAL SYSTEMS, INC. a California Corporation. Geothermal Agricultural Systems, Inc. (GAS) is composed of Agricultural Growth Industries, Inc. (Dr. Richard H. Matherson) and MAR-BIL ENTERPRISES, (W.E.Henderickson, & M. Zeisloft). The latter two being California entities.

Legal Council recommends that this will be a stronger entity for the entire project as all matters relating to the MAGIC HOT SPRINGS LANDING Site will be controlled through one body. Accounting, legal and operational activities will be more readily controlled, audited and traced.

As shown in back up documents, the principles bring more to the organization than the previous partners. Direct envolvement and experience is provided from considerable previous envolvement and knowledge relating to Geothermal Direct Use Applications. The previous partners had limited status, where the new partners are directly active through technology and operational experience in the Geothermal Industry.

Preliminary Negotiations between the Contracting Office of D.O.E and Magic Resource Investors indicate that there is concern relating to the costs that GRUY FEDERAL has presented. Concern has also been shown about the experience of GRUY in the Oil and Gas fields more than in Geothermal work. GRUY has indicated that they will not alter or reduce their costs. We agree that after review that it appears that some of these costs could be lowered. It is therefore the concern and final necessity for the betterment of the Project to alter this condition. It is further understood that it was the intent to sub-contract much of the geophysical work anyway.

Therefore, cost effectiveness can be accomplished by the New Corporation directing the project with qualified Subcontractors as EUREKA RESOURCE ASSOCIATES, ECOVIEW, CROSTHWAITE, WHITE doing the contracted work that would have been accomplished by the same procedures as GRUY at considerable savings or more accomplished for the same costs. Direct contract prices for sub tasks will be provided without overhead mark up as previously presented by Gruy.

EUREKA RESOURCE ASSOCIATES has considerable more experience directly in the Geothermal field for the necessary functions as compared to GRUY. The other Contractors provide additional experience directly working in volcanic conditions similar to the geological conditions of this location. We are thus able to broaden the scope of the Exploration task to obtain more information prior to ultimate drilling of the Final well.

It should be emphasized that the END USER of the resource is now becoming envolved with the planning, exploration, development and operations of the resource. This will naturally have an effect on the total costs of the entire project. Total cost effectiveness can be demonstrated to prevent duplication or unrelated unnecessary activities that are often the result of several engineering and consulting groups envolved without a MASTER PLAN which has already been established.

This early and complete envolvement of the END USER provides a more acceptable MASTER PLAN and provides an economic advantage for the ultimate OPERATIONS and success of the total project.

MAGIC RESOURCE INVESTORS
P. O. BOX 1328
SUN VALLEY, IDAHO 83353

September 15, 1980

Ms. Nina Ussery, SEP Secretary
Department of Energy
Idaho Operations Office
550 Second Street, Room No. 119
Idaho Falls, Idaho 83401

Re: SCAP No. DE-SC07-80ID12139, User-Coupled Confirmation
Drilling Program

Dear Ms. Ussery:

Our proposal for a cooperative agreement award under the User-Coupled Confirmation Drilling Program is submitted in ten copies as required by the SCAP. Separate volumes are provided for the technical and business proposals.

We appreciate DOE's interest in involving industry in the development of energy resources. In order to assure a strong technical and management team for this effort, Magic Resource Investors proposes to subcontract most of the work to Gruy Federal, Inc., a small business firm that has performed a significant amount of geothermal work for DOE.

In submitting this proposal we have utilized the proposal check list provided with the SCAP and have fully considered amendment No. 001, dated July 16, 1980. This proposal is valid for 200 days as specified in the SCAP.

Since Gruy Federal has been involved in developing the proposal, please feel free to contact Mr. Jack Duree with technical volume questions or Mr. Gayland Daugherty with business volume questions. They may be reached at 713/785-9200.

I will be responsible for all negotiations and company commitments arising from this proposal. My telephone number is 208/726-8241.

Sincerely,

Jerold R. Kirkman
General Manager

JRK/jr

VOLUME I - TECHNICAL PROPOSAL
SUBMITTED TO THE
DEPARTMENT OF ENERGY
IDAHO OPERATIONS OFFICE

USER-COUPLED CONFIRMATION DRILLING PROGRAM
SCAP No. DE-SC07-80ID12139

Copy No. 6 of 10

Date of Submission September 15, 1980

EARTH RESOURCE GENERATORS, INC
MAGIC RESOURCE INVESTORS
Name of Organization (principal participant if a team of organizations)

PROFIT (CORPORATION)
Profit (partnership)
Organizational Classifications

7671 HANSOM DR, OAKLAND CA 94605
P.O. Box 1328, Sun Valley, Idaho 83353
Address of Organization

Magic Hot Springs Landing User-Coupled Confirmation Drilling Project
Title of Proposed Project

Maximum Funds Requested from DOE $928,444 $1,088,395

Total Cost of Project Through Flow Testing $1,031,604 $1,209,328

Location of Site Magic Hot Springs Landing, Blaine County, Idaho

Proposed Project Duration (in months) 14

Proposed Starting Date January 15, 1981

Project Manager Jack T. Duree RICHARD H. MATHERSON, MARY G. ZEISLOFT (CO-MANAGERS)

Position and Title Senior Managing Engineer

Telephone (w/ area code) 713/785-9200 415/632-1698

Permission for Outside Evaluation Yes x No ____

This proposal is for drilling a(n)

Production Well x Injection Well ____ Other x

(Check other if for only testing a well).

Flow Testing is Referenced on Page 130.

Variable Cost-Share Plan is Referenced on Page 132.

Statement of Intent is Referenced on Page ii.

2. STATEMENT OF INTENT

DESCRIPTION OF PROPOSED FUTURE DEVELOPMENT

Briefly describe below your proposed end use for the geothermal resource should a successful geothermal well be drilled. Include in your description the following information:

a. Location of the utilization facility.

b. Description of the end use of the geothermal fluid and the utilization facility.

c. Whether or not you will sell the energy to other users.

E.R.G.

Magic Resource Investors, a California partnership, with J.R. Kirkman a General Manager and Western Resource Recovery Inc. with Henry Schutte President propose to develop Magic Hot Springs, located at the north end of Magic Reservoir in Blaine County, Idaho, as follows:

A two million gallon per year ethanol plant would be constructed and put into operation. The heat requirements for the ethanol production process would be provided by geothermal fluids discovered as a result of drilling at the site. The ethanol plant would also be capable of producing a by product known as Distillers Dried Grain (DDG). Further development might include but would not be limited to greenhouses, aquaculture (catfish) and silvaculture (evergreen)

It is not contemplated that energy would be sold to other users.

If is further understood that the above proposal is contingent upon the demonstrated availability of geothermal fluids at the desired temperature [redacted], flow rate [redacted] and chemical composition. And also that the economic climate at the time of proving of the well is such that the development would be warrented.

Signed ______________________
Proposer J.R. Kirkman
Magic Resource Investors

Signed Henry W. Schutte
Potential User Henry W. Schutte
Western Resource Recovery Inc.

3. SUMMARY

The objective of the Magic Hot Springs Landing user-coupled confirmation drilling project is to establish the geothermal resource adequate to provide the energy requirement of a 2 + (PLUS) 2-million-gallon-per-year ethanol distillation plant. The project is located at Magic Hot Springs Landing, Blaine County, Idaho.

To be a success, the confirmation well must produce a [redacted] gallons per minute water at [redacted] The water will be cascaded through multiple uses in future development of an industrial park, but a single end-use ethanol plant is the basis for feasibility projections for the project.

Magic Resource Investors is joined in this proposal by two private investors, Messrs. Robert Gorham and John Wedum. All required work will be performed by E.R.G. & SUBCONTRACTORS Gruy Federal, Inc. under a cost-plus-a-fixed fee subcontract arrangement. [redacted]as an extensive background in performing contracts for DOE, including geothermal work. They will directly provide engineering, supervisory, and administrative services and provide for required field services by placement and management of subcontracts.

Magic Hot Springs was originally a thermal spring but now is an artesian well flowing 66 gal/min of 165°F water. It discharges directly into Magic Reservoir. The water quality is such that no disposal well is foreseen or included in the plan. If one becomes necessary, it will be subject to negotiation.

Geological evidence indicates that this spring and most others in the area are controlled by faults and/or fracture zones. Evidence also indicates that the Magic Hot Springs locale is the intersection of at least two fault systems.

Geochemical geothermometers indicate that the Magic Hot Springs waters have been at higher temperatures than other thermal waters in the area. Other data indicate the water may have reached temperatures as high as 392°F.

2 million gallons per year or more

EARTH RESOURCE GENERATUS, INC, an Idaho Corporation.

All required work will be directed by ERG and sub contract the Geothermal exploration, drilling, and logging to known reputable entities as shown through previous geothermal work: EUREKA RESOURCE ASSOCIATES, INC., ECOVIEW, CROSTHWAITE, WHITE.

ERG will direct the engineering, supervisory and administrative services. R.H.Matherson through his corporation of AGRICULTURAL GROWTH INDUSTRIES has had experience working on several Government Geothermal contracts. (PDS's & PONS).

The technical plan for the project consists of an exploration program to provide field confirmation of faulting, geophysical surveys to locate the faults in the subsurface, three temperature gradient holes to provide three-dimensional heat flow data, and selection of an optimum drill site for the confirmation well. The preliminary drilling, logging, and testing programs provide for a 3,000-foot production well with downhole logging and flow testing to meet DOE specifications and provide data for determining the cost-share payment.

4. CONTENTS

NOTE: Sections of this proposal are numbered to correspond with the topics listed under "Volume I - Technical Proposal," page 7 of the SCAP.

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TABLES

5. RESOURCE POTENTIAL - TECHNICAL AND ECONOMIC FEASIBILITY

5.a GENERAL DESCRIPTION OF TOTAL PROJECT

The objective of the User-Coupled Confirmation Drilling Project is to prove up and prepare for commercialization the geothermal resource known to exist at the Magic Hot Springs site located on the north end of Magic Reservoir, Blaine County, Idaho.

The Magic Hot Springs area is in northwestern Blaine County, Idaho, (Fig. 1) near the center of the four-county area of Blaine, Camas, Gooding, and Lincoln counties in south central Idaho which comprises the Wood River Resource Area (WRRA).

The Hot Springs area is named for a historic artesian hot spring near the north end of Magic Reservoir (Fig. 2). It is conveniently accessible by state highways 68 and 75 (U.S. 93).

Magic Reservoir, on the Big Wood River, is located within Blaine County but supplies irrigation water for farm lands primarily in Lincoln County to the south. It is also a major recreation area which is used for boating and fishing in the spring, summer, and fall. The Hot Springs boat landing is the major access point for recreational users of the reservoir.

The land surrounding the reservoir and Hot Springs Landing is typical of high desert rangeland of the Snake River Plain. It is sparsely populated and is primarily used for grazing and recreation.

In and around Magic Hot Springs Landing, Magic Resources Investors (MRI) have assembled a block of fee land containing approximately 212 acres (Fig. 3), and have filed applications with BLM for leases on an additional 1,960 acres.

The topography at Hot Springs Landing and northward is gentle to moderately rolling, and level to rolling along the shores of Magic Reservoir to the

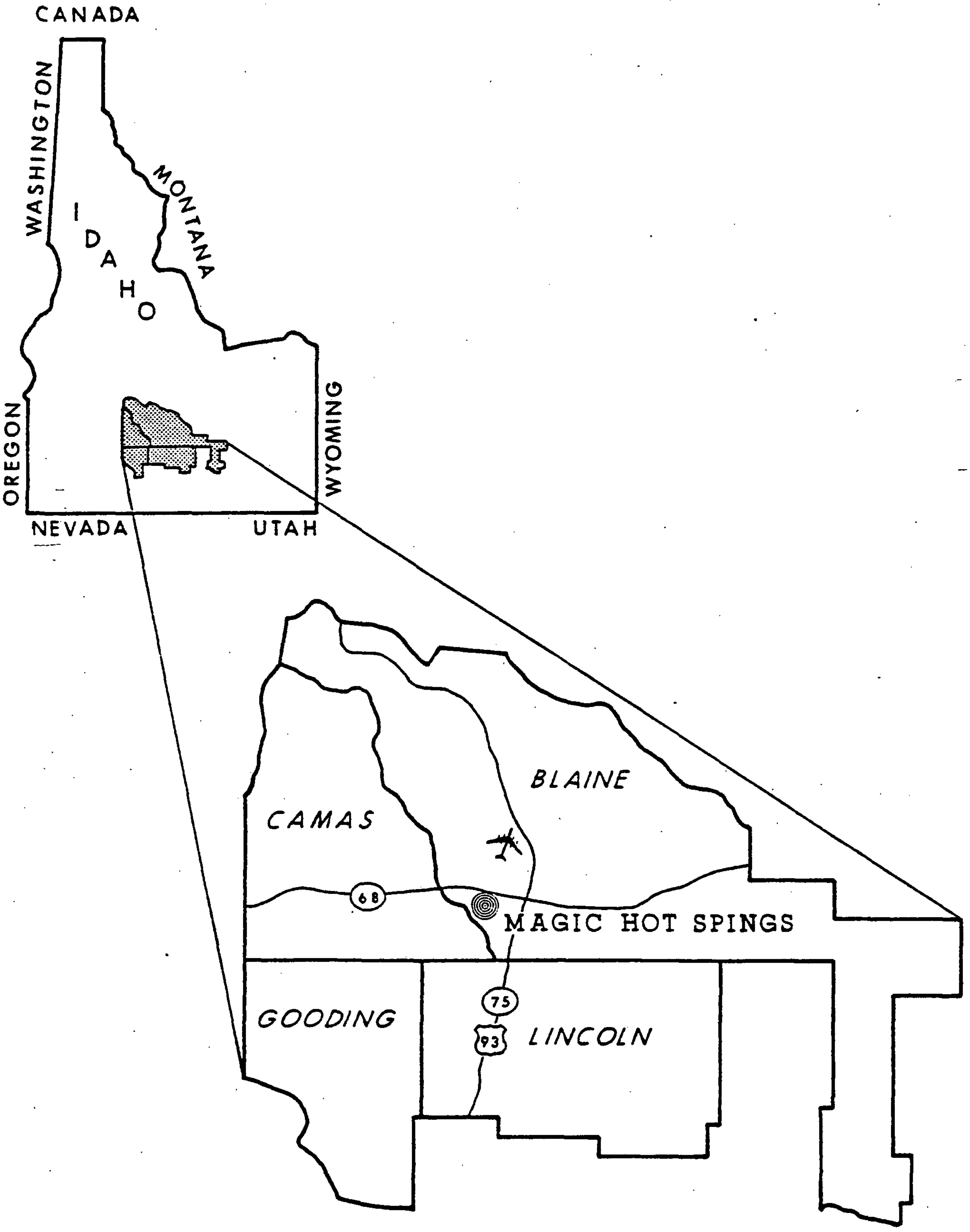


Figure 1--Location map of Magic Hot Springs in four-county Wood River Resource area, south-central Idaho.

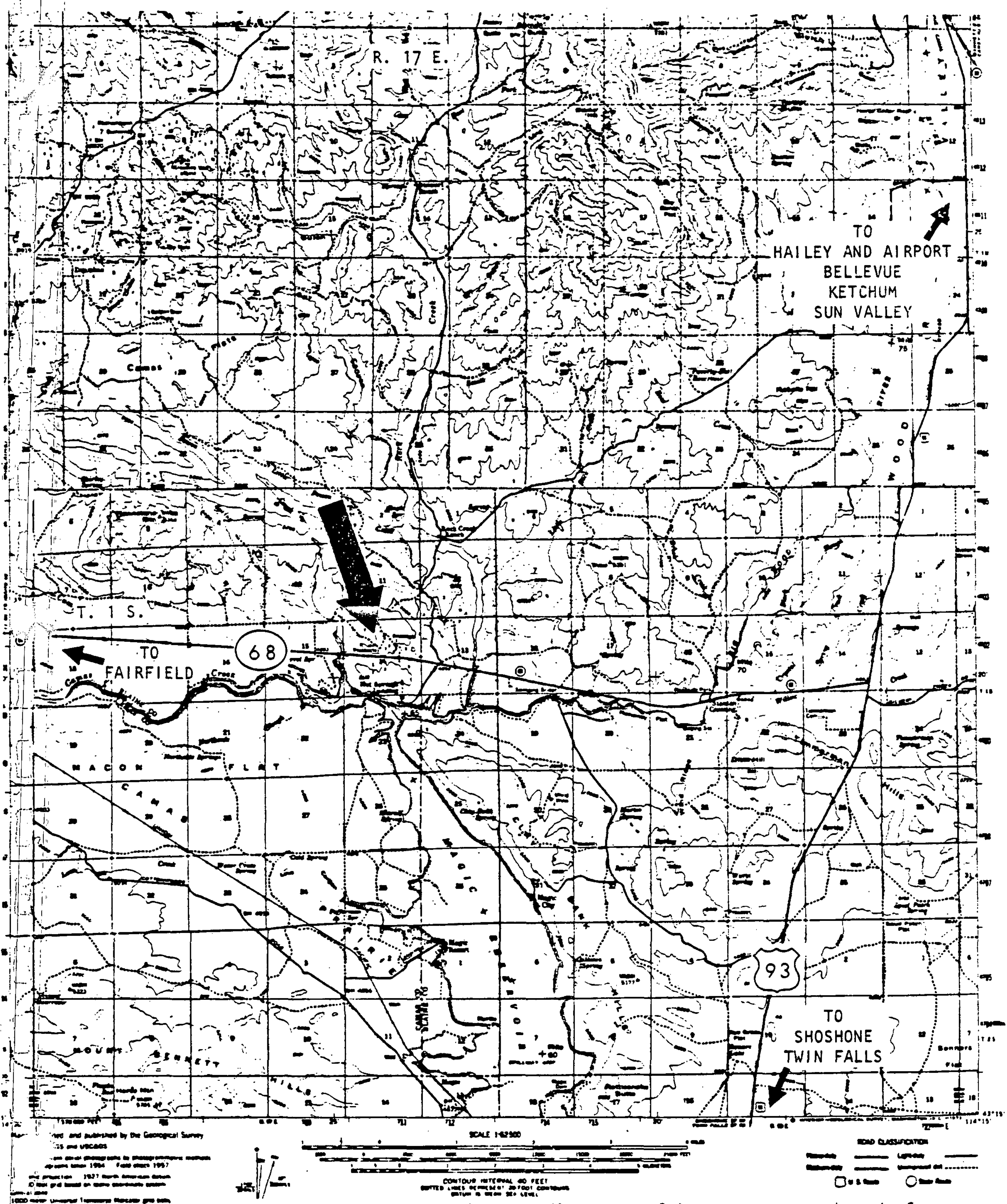


Figure 2--Location of Hot Springs Landing area of interest at north end of Magic Reservoir and confluence of Big Wood River and Camas Creek, Blaine County, Idaho.

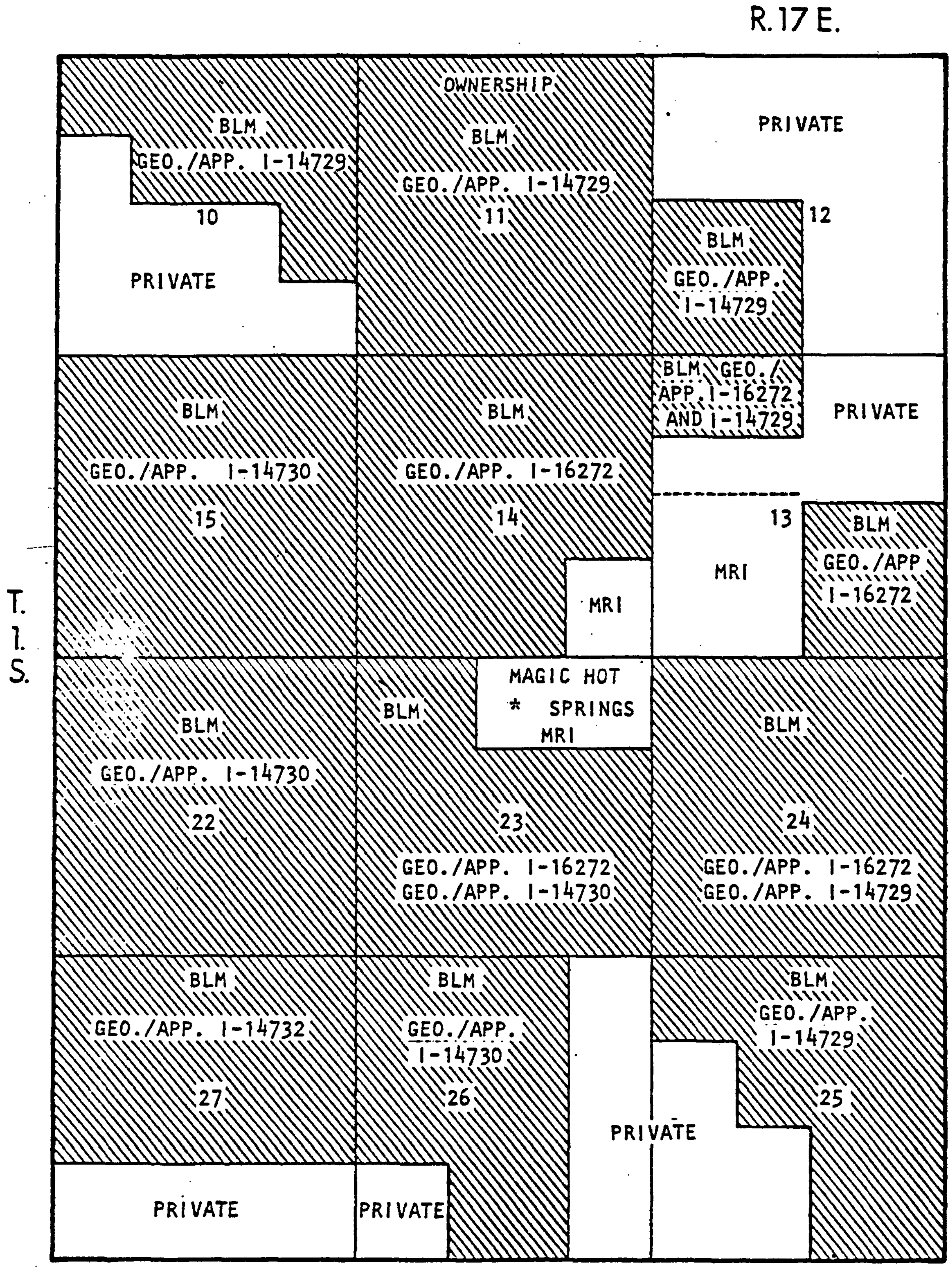


Figure 3 -- Plat of MRI applications for BLM leases and sections containing MRI fee land.

south. Elevations in the immediate area average approximately 1524 meters (5,000 feet).

As summarized in Table 1, the climate at Magic Reservoir is semi-arid with warm summers and moderate winters. Like the topography, the climate is within a transition zone between the Snake River Plain to the south and the intermountain valleys and foothills of the Smoky Mountains to the north, thence northward into the rugged Bitterroot Mountains.

The four counties immediately surrounding Magic Hot Springs have a 1980 population estimate of 23,900, of which 44 percent resides in Blaine County. Blaine County's population is concentrated along the Wood River between Ketchum and Hailey. The other counties in the Wood River area are rural in character with Gooding County accounting for 38 percent of the population, Lincoln County 14 percent, and Camas County 4 percent.

The population growth of Blaine County is greater than the other counties. Between 1960 and 1970 Blaine County gained 39 percent in population, while the other three counties lost 29 percent. Between 1970 and 1980 Blaine County had an estimated population increase of 80 percent while the other three counties have estimated increases of less than 5 percent. Population forecast for the four counties is shown in Table 2.

Table 2
Wood River Area
Population Forecast (1978)

	1970	1975	1980	1985	1990	1995	2000
Blaine	5,740	7,750	10,390	12,100	14,090	16,500	19,370
Camas	720	860	940	940	860	770	750
Gooding	8,640	8,350	9,110	9,780	10,280	10,460	10,670
Lincoln	3,050	3,020	3,460	3,320	3,160	3,170	3,250

TABLE 1

CLIMATOLOGICAL DATA FOR MAGIC RESERVOIR HOT SPRINGS

Station	Hailey	Fairfield	Richfield
Elevation (feet)	5,328	5,065	4,306
Years of record	59	20	44
Average daily temperature (°F)			
January minimum	6.7	3.21	11.1
January maximum	30.6	27.6	29.9
July minimum	49.5	46.0	50.7
July maximum	86.5	84.6	87.4
Lowest temperature of record	-36	-38	-40
Highest temperature of record	109	100	105
Average annual days			
Maximum of 90° of more	19	13	19
Minimum of 32° or less	191	211	188
Growing season*	94	68	105
Average precipitation (inches)			
Annual precipitation	14.53	15.64	9.64
Annual snowfall	88.5	83.2	35.4
January precipitation	2.11	2.91	1.41
July precipitation	0.41	0.25	0.26
Average annual number of days with precipitation			
0.10 inches or more	40	44	39
0.50 inches or more	8	10	6
Degree days	8,070	8,575	7,306

*The average number of days between mean last 32°F Temperature in spring and mean first 32°F in fall--that is, the average freeze-free period.

Source: Idaho Climatological Summary Data by Counties. National Weather Service Climatology in Cooperation with the Idaho Department of Commerce and Development, Boise, October 1971.

Agriculture is the major industry of the area. Blaine County's economy is dependent on agriculture and recreation. Camas, Gooding, and Lincoln Counties are economically dependent on agriculture. Approximately half of the cropland produces hay; most of the remainder produces grain and potatoes, with small percentages in other crops such as barley, silage, and sugar beets. Livestock and livestock products account for a large share of farm operations. Grazing permits on public lands are an important part of most ranch operations. Grazing land is primarily in federal ownership and includes approximately 82 percent of the landin the four-county area.

Hot Springs is also located within the eastern portion of an area designated as the Camas Prairie geothermal area because of the large number of hot springs and the geothermal resource potential.

With the highest surface temperature of any well in the Camas Prairie Geothermal Area, Magic Hot Springs has been the subject of several studies that document the presence and potential of the resource. Noteworthy among these is Idaho Department of Water Resources Water Information Bulletin No. 30, Part 7, Geothermal Investigations in Idaho, "Geochemistry and Geological Setting of the Thermal Waters of the Camas Prairie Area, Blaine and Camas Counties, Idaho." This study (Mitchell, 1976) reports a marked difference in chemistry between Magic Hot Springs and other thermal waters of the Camas Prairie. This chemical difference indicates that Magic Hot Springs thermal waters have been at higher temperatures than other thermal waters of the area, or that the reservoir rocks for Magic Hot Springs are chemically or mineralogically different from the thermal aquifers in the Camas Prairie. Table 3 lists the water chemistry of Magic Hot Springs.

U.S. Geological Survey Circular 790, Assessment of Geothermal Resources in the United States, 1978, (Muffler, 1978) shows that the Magic Reservoir area has significantly greater resource potential than that of other geothermal areas in the Wood River Resource Area. Circular 790 reports an estimated mean reservoir temperature of 149°C (300°F) which is of the same order of magniture as the known reservoir temperatures at the Raft River Geothermal Test Site.

TABLE 3

CHEMICAL ANALYSIS OF MAGIC HOT SPRINGS
(Chemical Constituents in milligrams per liter)

Sample Collection Date	7-21-72
Discharge (GPM)	250
Temperature (°C)	72
Silica (Si)	105
Calcium (Ca)	20.0
Magnesium (Mg)	0.10
Sodium (Na)	321
Potassium (K)	23
Bicarbonate (HCO_3)	735
Carbonate (CO_3)	0
Sulfate (SO_4)	54
Phosphate (P)	.01
Chloride (Cl)	85
Fluoride (F)	10
Nitrate (NO_3)	.56
TDS	1,213
pH	6.9

Source: Idaho Department of Water Resources
Bull. 30, Part 9, 1979.

The discharge of Magic Hot Springs well (Mitchell, 1976) is approximately 250 liters per minute (66 gal/min). Ross (1976) reports that before drilling, the original warm spring discharged approximately 492 liters per minute (130 gal/min). Reliable geochemical thermometers indicate subsurface temperatures of 115°C to 150°C (239°F to 300°F).

As shown in Table 4, Magic Hot Springs water also shows a marked difference in chemistry relative to Guyer, Clarenden, and Hailey Hot Springs to the north. The proximity of Magic Hot Springs to Magic Reservoir could mean a possibility of mixing of the thermal with nonthermal waters. Because the well at Magic Hot Springs is cased only to a depth of 12.5 meters (41 feet), leakage from Magic Reservoir is very likely entering the thermal conduit system that supplies the well. Mitchell (1976) considered this condition and developed a mixing model calculation which indicates that the hot water component of this mixed water may have reached temperatures as high as 200°C (392°F) with cold water making up 70 percent of the total.

Even if mixing is not taking place, the geochemical geothermometers listed in Table 4 indicate higher aquifer temperatures at Magic Hot Springs than at Guyer or Clarenden.

The geological center of the Hot Springs hydrothermal system remains untested in spite of the fact the location clearly has great geothermal resource potential.

The first phase in developing the full potential of this known geothermal resource, as defined by ERC MRI's response to SCAP No. DE-SC07-80ID12139, is the design and completion of an engineering and geological program to (a) conduct a detailed exploration study of the fault systems, using field geology and supporting data such as aerial photos, a detailed geophysical survey, and a network of thermal gradient measurement holes; (b) drilling and logging of a 3000-foot confirmation test well to assess the geothermal resource at depth; and (c) flow testing of that confirmation well over a period of time and in a manner sufficient for quantitative and qualitative evaluation of the resource with respect to initial primary use.

TABLE 4

GEOTHERMOMETER TEMPERATURES

Springs or Well Identification	Discharge l/m	Known Temp. °C F	Aquifer Temperature Predicted by Geochemical Thermometry, °C*							
			T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8
Guyer Hot Springs 4N 17 E 15 aac	1,000	71 159.8°	128	125	9	101	88	88	64	88
Clarenden H. S. 3N 17 E 27 deb	100	47 116.4	125	122	6	97	87	45	53	87
Hailey Hot Springs 2N 18 E 18 dbb	70	59 138.2								
Magic Hot Springs Landing 1 S 17 E 23 aab	10	72 161.6	139	135	19	113	174	172	148	99

T_1 = Silica temperature assuming quartz equilibrium and conductive cooling (no steam loss)

T_2 = Silica temperature assuming quartz equilibrium and adiabatic expansion at constant enthalpy (maximum steam loss)

T_3 = Silica temperature assuming equilibrium with amorphous silica

T_4 = Silica temperature assuming equilibrium with chalcedony and conductive cooling (no steam loss)

T_5 = Na-K-Ca temperature

T_6 = Na-K-Ca temperature corrected for PCO_2

T_7 = Na-K-Ca temperature corrected for Mg

T_8 = Na-K temperature

Source: Idaho Department of Water Resources
Bull. 30, Part 9, 1979

The engineering/geological program and supporting economic data is the subject of this proposal. It is described in detail in appropriate sections herein.

The geothermal fluid will be initially utilized by an ethanol plant with a capacity of 2 2+ million gallons per year. ERG MRI intends to begin commercialization of the geothermal resource and initiate an ~~industrial~~ AGRICULTURAL Complex ~~park development~~ by constructing the ethanol plant with private capital. This plant could be followed by a series of secondary uses after primary users have extracted the high-temperature energy.

EAG
MRI considered other locations in the Wood River Resource Area for developing industrial park and recreational facilities, but selected the Hot Springs area because its geothermal and geological characteristics are very promising for development of a high-grade geothermal resource.

Geological evidence from all surveys indicates one or more series of faults passing through or intersecting in the area immediately north of the Magic Reservoir.

The relationship of faults and springs (including hot springs) in the hilly and mountainous regions is well recognized. Several hot springs to the north are aligned with a north-trending linear fracture that passes through Magic Hot Springs. Other linear features occur, with springs, aligned in other directions. Every indication is that these are surface expressions of fault systems that control the circulation of thermal waters.

Any possible large thermal reservoir at Magic Reservoir is probably structurally controlled by large faults. Fracture permeability may allow sufficient circulation and recharge to allow large volumes of water if the fault system can be penetrated by drilling. The thermal water geochemistry and drilling history, as well as the young volcanic geology at Magic Hot Springs, shows definite promise of hotter water with deeper drilling.

Igneous rocks from Cretaceous through Holocene age occur in and around the granitic area, providing several heat sources at various depths. These rocks range in composition from granitic to basaltic, and in texture from granitic to rhyolitic.

A heat flow of 3 HFU, which is twice the normal (1.5 HFU) for the United States, is typical of this area (Brott and others, 1976). This high heat flow is typical of the granitic Idaho batholith (Blackwell, 1973) and is high enough to indicate that thermal waters could be reaching maximum temperatures, as predicted by geochemical thermometry, through deep circulation.

The heat flow in the Magic Hot Springs area may be related to Cretaceous granitic rocks of the Idaho batholith, which are known to underlie younger volcanic rocks north of Magic Reservoir. High heat flow may also be due to the area's marginal position relative to the Snake River Plain. A buried stock or sill, perhaps related to the Holocene basalt flows south of Magic Reservoir, could conceivably underlie the area as a local high-intensity heat source (Mitchell, 1976).

Mitchell (1976) reports temperatures between 150°C and 200°C (300-392°F) might be found by deep drilling at Magic Hot Springs. Thermal waters may be circulating to depths approaching 1,800 to 2,500 meters along faults.

slc

The MRI technical plan in this proposal includes a confirmation well (production test well) drilled to a depth of 3,000 feet at a location where it will intersect the largest number of deep fault planes or fractures. The confirmation well will be flow tested with pressure drawndown and buildup measurements sufficient to assess the geothermal potential in quantitative terms.

Magic Resource Investors and two individual investors bring to the proposed project a net worth of about $7 million. With this substantial worth no difficulty is anticipated in obtaining loans for the non-DOE-funded cost of the exploration, drilling, and testing program. Total cost of the program through testing is estimated in the vicinity of $1.2 million.

Following the reservoir confirmation tests in this proposal, and subject to their outcome, a 2 2+ million gal/yr ethanol plant will be constructed with private capital on ERG MRI acreage to utilize the initial heat energy in the geothermal waters. Since the primary use will not extract all of the energy from the geothermal fluid, this plant could be followed by other users in cascading use of the resource.

Assessment of an ethanol distillation plant as initial end user of the geothermal resource is favorable with respect to attraction of private capital and commitment of that capital to this project, on the basis of market determination, feedstock supply and cost, availability of feedstocks, by-product utilization and economic return, and the area's overall ability to support and maintain an ethanol distillation facility of one and two 2+ million gallons per year capacity.

Extensive research and discussion has gone into the financial and economic feasibility aspects of this proposal. As discussed in more detail in other parts of the proposal, there is a likelihood that the geothermal resource can be cascaded for several uses. However, the principal study has been limited to an ethanol plant. Income statements, cash flow projections, and loan amortization considerations have been developed assuming 25 percent and 50 percent discounts from equivalent No. 2 fuel oil cost. Obviously the return is better with the 25 percent discount and indicates payback in the range of three to five years.

WESTPHAL ALCOHOL EQUIPMENT

The proposed plant facility consists of prefabricated units built by Rocky Mountain ethanol Systems, Inc. The design has already been tested and proved by operations in other locales.

Westphal - will provide construction oversight and recommend management of the ethanol plant, while Geothermal Agricultural Systems (GAS) will have immediate and direct responsibility for management of the entire [redacted] project. Westphal - is an Idaho corporation formed by the Westphal USA Corporation and International Stills, Inc. Descriptions of these two companies follow here. [redacted]

Georg Westphal Ing.K.G., specializing in systems technique and equipment engineering and manufacturing, was founded in 1926 by Georg Westphal. In the early years, the main work consisted of copper smithing, and in 1928 the first pot still was built. Since then, the company has specialized in the engineering of alcohol stills and the manufacture of equipment. The Westphal company is unique because its engineering capabilities are directly transformed into ethanol producing equipment in its own manufacturing facilities. In other words, the theoretical knowledge is put into actual operating plants and the facility has thereby integrated both aspects to the full benefit of the customer.

Since its early years, the Westphal company has been a leader in the technology pertaining to starch conversion and alcohol distillation. Helmut Westphal, son of the founder, took over the operations and plant in 1960. Being raised around the company gave him his practical exposure and an early and complete understanding of the design, engineering and manufacture of ethanol equipment. Helmut Westphal studied several systems techniques and mechanical engineering in Berlin, and graduated a certified engineer in 1958. For the next two years, he worked in Berlin under Professor Misselhorn at the National Institute for Fermentation Techniques and Biotechnology. Here he received his intensive training in alcohol production and the use of proper technology. He aggressively pursued new ideas in advanced equipment design and for better energy efficiency. While his competition kept on building older vat type stills, not very energy efficient, Mr. Westphal spent most of his time trying to develop innovative techniques. The big breakthrough came in 1976, when the first fully automated continuous cooking process was designed and built. The results were unheard of in the industry: Energy savings of 80% in the cooking process alone. During the next two years, the technology was refined and five plants, producing from one to three million gallons annually, were built in Europe.

In 1978, the Westphal company was approached by the Brazilian government, which desired Westphal's advanced technology for ethanol plants to be built in that country. The negotiations were completed at the end of the year. Since January 1979, some 500 million gallons per year production facilities have been built in Brazil using exclusive Westphal technology.

Today, Westphal and its Brazilian partners deliver 85% of all equipment sold for ethanol production. Helmut Westphal's son, Stefan, has enrolled at the University to study systems techniques and mechanical engineering, to be able to take over as the third generation of his family in the ethanol field.

International Stills, Inc. (ISI), of Lake City, Minnesota, is a Minnesota-based corporation with offices in Indianapolis, Indianna and representatives in California, Oregon, Mississippi and Illinois. ISI was incorporated in March 1980 for the advancement of feasibility and economic studies, engineering, sales and service of equipment for ethanol production. The five officers of the corporation bring together proven backgrounds in sales, engineering, construction and finance. ISI's parent company, Georg Westphal Ing.K.G. of West Germany, has 50 years of leadership in the ethanol industry. ISI's commitment is to provide the best technology and energy balance at an affordable price, as well as to service for its clients.

~~E-2-b~~

5.b.(1) Geological Description of Resource

Magic Hot Springs was originally an artesian thermal spring flowing 97°F water at 130 gal/min. It now is an artesian well producing 165°F water at a rate of 66 gal/min, drilled to a depth of 260 feet and cased to about 41 feet. The presence of the hot spring has been known since earliest settlement of the area.

The produced water is relatively fresh, containing 1,215 ppm total dissolved solids including 85 ppm of chlorides. It is postulated to be a mixture of deeper geothermal water and seepage from Magic Reservoir.

Although a number of geological and geothermal resource studies have included the Magic Hot Springs site and Magic Reservoir area, detailed geology of the area is not well known. The Magic Hot Springs site is the highest temperature thermal well in the area, but the origins of its water are not proved, and the controlling geological structure and conditions are not tested.

On the other hand a sufficient volume of literature exists to provide grounds for opinions and hypotheses with high probability of accuracy.

Noteworthy contributions to this proposal are the publications by Walde (1959), Walde, Powers and Marshall (1963), Smith (1966), Mitchell (September, 1976), Bennett and Remker (1979), and USGS Water-Supply Papers 1478 (Smith, 1959) and 1609 (Walton, 1962).

In addition, Mr. John Anderson, Idaho Department of Water Resources, has carefully examined the area and shared his knowledge with MRI and GFI.

A comprehensive review of the geology and geothermal potential is reported in David W. McClain and William B. Eastlake (1980), Magic Hot Springs, Idaho, Site-Specific Development Analysis, Idaho Office of Energy, Office of the Governor, under DOE grant No. DE-FG51080RA50083, Region X office, Seattle, Washington.

Material from Mitchell (1976), Anderson, and McClain/Eastlake is used freely without further credit in this proposal.

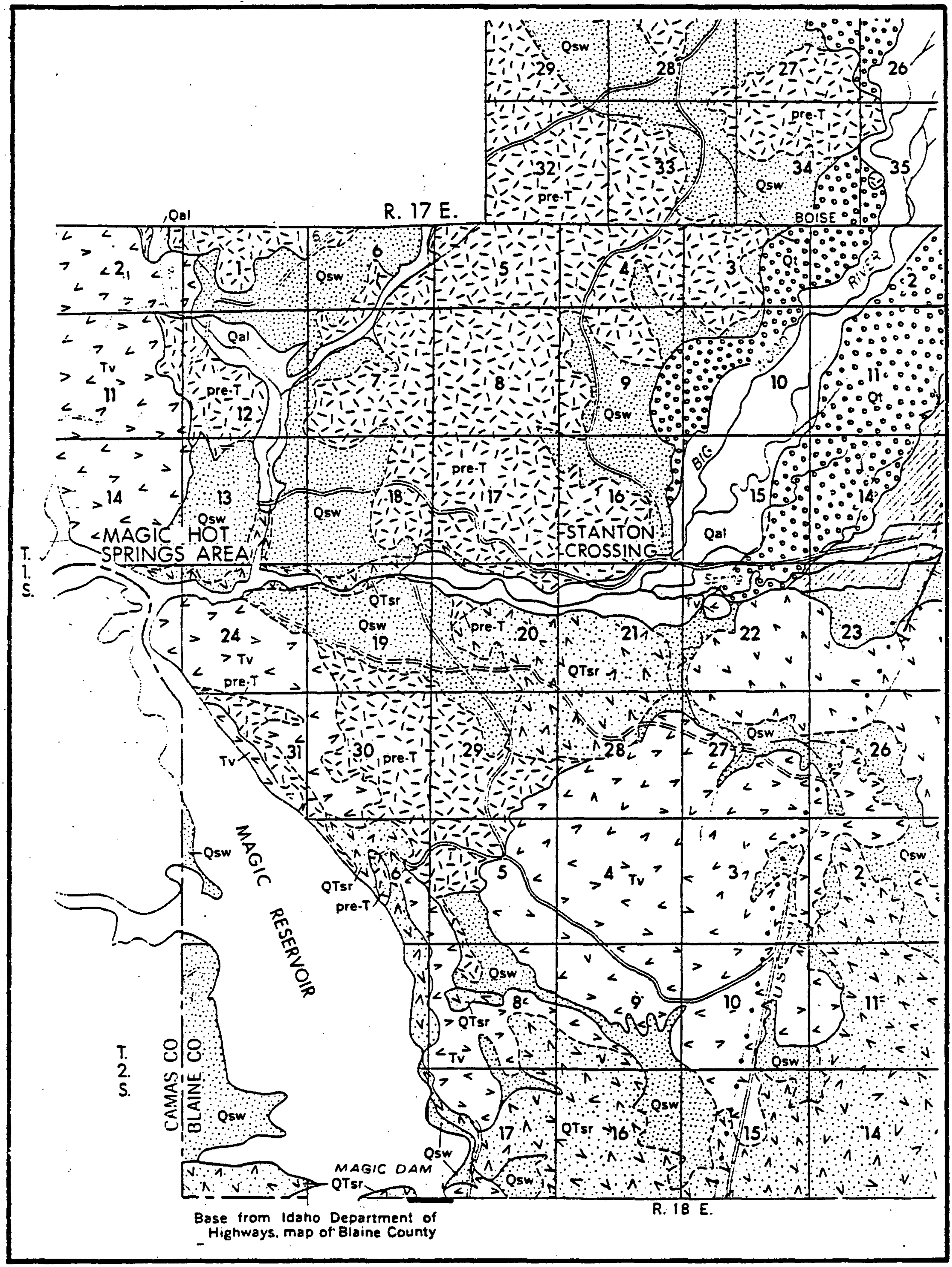
Magic Reservoir is located in the northern edge of the Snake River plain adjacent to the southern border zone of the Idaho batholith. It lies, therefore, in a region of structural, stratigraphic, volcanic, and tectonic complexity.

The Idaho batholith, has an area of more than 16,000 square miles and is located just south of the convergence of two great arcuate segments of the Nevadan orogenic belt in eastern Idaho. It is composed mainly of quartz monzonite, with marginal facies to the south and southwest of granodiorite formed by alteration of the original rock by rising solutions rich in silica, potash, feldspar, biotite, and sphene. The batholith contains many younger intrusions believed to have been emplaced either at the close of the Laramide orogeny or in mid-Tertiary time.

The Snake River plain is possibly a rim syncline to the batholith. It is a region of widespread volcanism in the Miocene-Pliocene phase of Central Rocky Mountain development, and extensive basaltic intrusion and rhyolite flows during the Pliocene.

Multiple local and regional sources of sensible heat from hot rocks and radiogenic heat from younger intrusive rocks are postulated to exist in the Magic Reservoir area, although at unknown depths.

The generalized geology of the area west of Magic Reservoir is shown in Fig. 4, from Smith (1959). The stratigraphic section of the area is shown in Fig. 5, compiled from two sources, as indicated. The Magic Hot Springs site at the north end of Magic Reservoir lies within a generally north-south and thence southeasterly belt of early Tertiary extrusive and pyroclastic rocks (Tv, ranging in composition from rhyolite to basalt but here consisting of basalt) that occurs within or locally marginal to older pre-Tertiary rocks (pre-T) of the batholith. Compare the rock symbols in sections 2, 11, 14, and 24 to those in sections 12 and 30.



Base from Idaho Department of Highways, map of Blaine County

Figure 4 --Generalized geology of western portion, middle Big Wood River - Silver Creek area, Blaine County, Idaho.

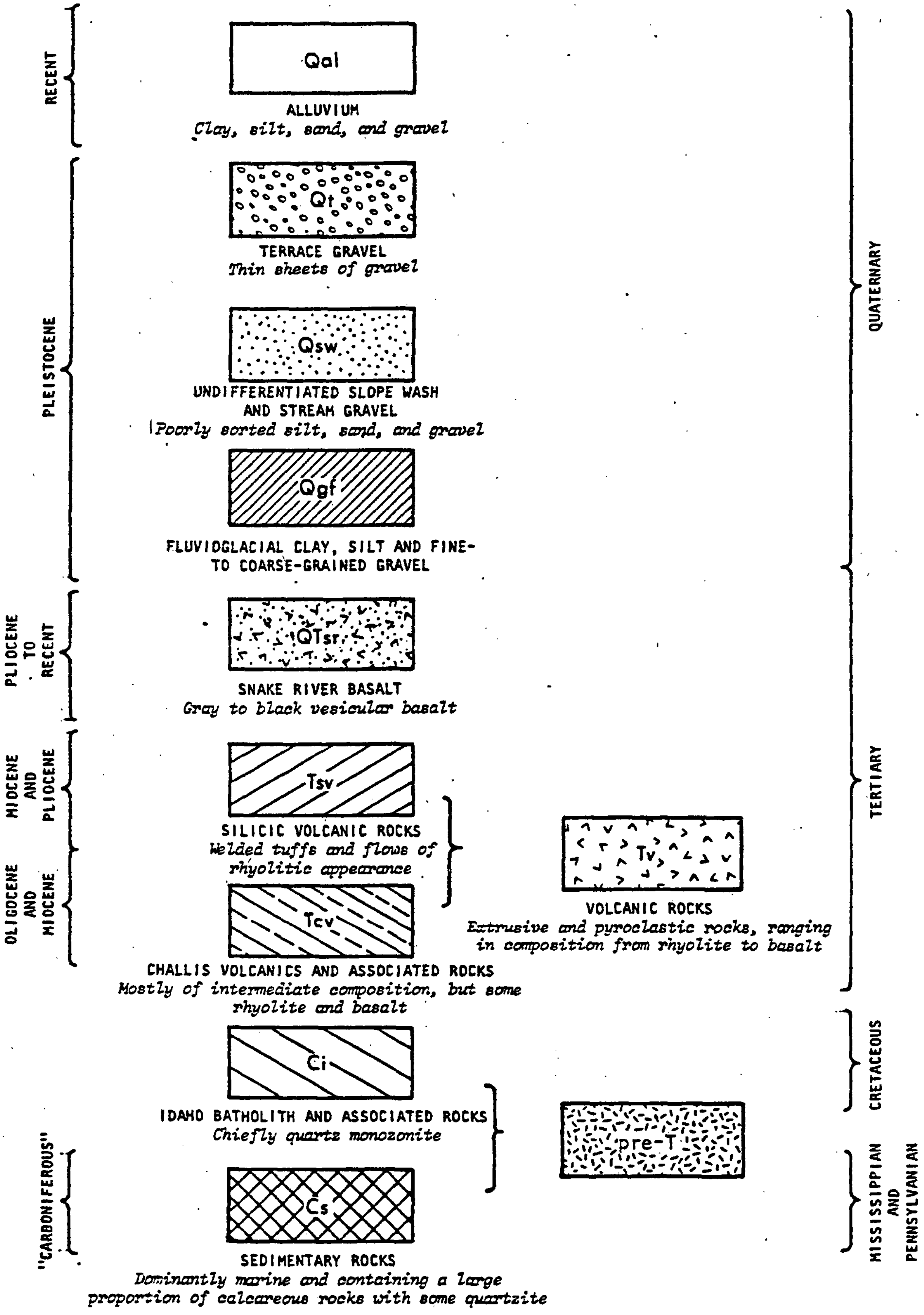


Figure 5 -- Stratigraphic units in Magic Reservoir Area, Blaine and Camas Counties, Idaho. Compiled from U.S.G.S. Water Supply Papers 1478 and 1609.

A major unconformity and weathered or altered zone that widely exists between the two rock types might provide a favorable zone of subsurface water movement.

Geological formation and their water-bearing properties are listed in Table 5. Two important shallow aquifers are the Early Pleistocene fluvioglacial sediments (Qgf) and the Snake River basalt (Qtsr). The fluvioglacial sediments are restricted to the outwash plain of the Big Wood River to the east. The Snake River basalt area of Magic Hot Springs is not recognized at the Magic Hot Springs site.

Extensive faulting is recognized in the Magic Reservoir area and is believed to be the controlling factor in the occurence of geothermal springs here and elsewhere in the southern border zone of the batholith, as at Ketchum. Other faults are believed to determine the occurrence of numerous springs north and northwest of Magic Hot Springs.

A good summary of the occurrence and importance of faulting in this area is provided by McClain and Eastlake, from Mitchell (1976) and others.

"Several major structural features are known to converge in the general area of Magic Hot Springs. The north trending Wood River Valley intersects the Snake River Plain in the general vicinity of Magic Reservoir. Also, the east-west trending Camas Prairie intersects the north trending Wood River Valley at Magic Reservoir. These major features are structurally controlled and faulting in the area has an en-echelon relationship to the Camas Prairie and Wood River Valley.

"Smith (1966) referred to the Camas Prairie Basin to the immediate west of Magic Hot Springs as a graben, and found evidence for fault control in the Mount Bennett Hills. This east-west trending range is a complexly faulted horst consisting of Cretaceous and Miocene age rocks.

"The Mount Bennett Hills (southwest of Magic Hot Springs) are tilted south and plunge eastward beneath the Pliocene and Pleistocene volcanic and

BLE 5
GEOLOGIC FORMATIONS AND THEIR WATER-BEARING PROPERTIES
(From U.S. Geological Survey Water Paper No. 1478)

Period	Epoch	Formation and map symbol	Thickness, feet	Physical character and areal distribution	Water-bearing properties
Quaternary	Recent	Alluvium Qual	0-10±	Silt, sand, and gravel underlying the channel and flood plain of the Big Wood River; chiefly of reworked fluvioglacial sediments derived from the headwater area of the Big Wood River.	Permeability generally high; gravel yields water copiously to shallow dug wells, especially where pumping induces recharge from the river.
	Pleistocene	Terrace gravel Qt	Undetermined	Sand, gravel, cobbles, and boulders in thin deposits on stream terraces. Consists chiefly of reworked older fluvioglacial material; poorly sorted to moderately well sorted.	Contains unconfined water at shallow depth in south part of basin, but is unimportant as an aquifer because it is thin.
		Slope wash and gravel, undifferentiated Qsw	Undetermined	Silt, sand, and gravel, poorly sorted, with angular fragments; at some places interfingers with stream gravel; elsewhere overlies old pediment slopes; occurs around border of basin and along Rock Creek.	A minor aquifer, tapped locally by domestic and stock wells; occupies small recharge areas where precipitation and surface water percolate into the ground.
		Fluvioglacial sediments Qgf	300±	Clay, silt, sand, and pebble- to cobble-sized gravel deposited by streams and lakes; underlies most of the basin floor. Grades from poorly sorted coarse material on the north to interbedded clay and well-sorted sand and gravel south of the Boise baseline. Mantled at some places by topsoil.	The most productive aquifer and the immediate source of nearly all the ground water that is used in area; yields both unconfined and confined water abundantly to wells and springs; receives recharge readily north of the Boise baseline; the beds of clay beneath the southern part of the basin are confining layers over artesian aquifers.
Tertiary	Pliocene	Snake River basalt QTsr	50-250±	Olivine basalt, light-gray to black, fine-grained, drusy to vesicular, jointed; contains zones of broken basalt, cinders, and interflow sediments; crops out between Gannett and Picabo and at the southeastern and southwestern outlets from the basin.	Important aquifer and the conduit through which much ground water leaves the basin by underflow; sedimentary interflow beds, especially, transmit large quantities of ground water, yields water plentifully to wells between Gannet and Picabo.
	Miocene(?)	Volcanic rocks Tv	Undetermined	Extrusive rocks ranging in composition from rhyolite to basalt; unconformably overlie older rocks; considerably jointed. In some places individual flows are separated by thin sedimentary beds; crop out in Picabo Hills and along northeastern border of basin.	The extrusive rocks, where jointed and overlying relatively impermeable sedimentary beds, yield small amounts of water to springs; have comparatively low porosity and permeability and store little ground water except locally.
Pre-Tertiary		Sedimentary and granitic rocks pre-T	Undetermined	Sedimentary rocks, well indurated, folded and faulted; intruded by stocks of granodiorite and quartz monzonite; crop out in mountains that border the basin and extend beneath it at unknown depth.	Tightly cemented and low in permeability and porosity; generally poor water-bearing rocks except where they contain joints and other fractures; under favorable conditions ground water is transmitted through the permeable zones and is discharged through springs; important chiefly as impermeable basement rocks.

sedimentary rocks near Magic Reservoir. Smith mapped numerous northwest trending en-echelon faults in the Mount Bennett Hills and Magic Reservoir area. These faults are probably early Pleistocene age (Smith, 1966) with nearly vertical movements and generally downthrown blocks to the north. Smith reports displacement in excess of 300 meters (984 feet) in the Mount Bennett Hill area.

"Bennett and Rember (1979) mapped a major north trending fault extending from the Snake River Plain north into the Sawtooth Mountains which have an en-echelon relationship with the Wood River Valley. Malde (1963) mapped several northwest trending near vertical faults with largely dip slips down to the north. These faults have a general en-echelon relationship with the Mount Bennett Hills and Camas Prairie to the west of Magic Hot Springs.

"Mitchell's (1976) interpretation of Landsat false color infrared satellite imagery revealed several linear features near Magic Reservoir. Mitchell identified a major east-west linear at Magic Hot Springs which could represent the surface expression of a major fault. Mitchell identified this linear as the Magic Hot Springs Fault. This linear intersects the Clay Banks fault (Smith, 1966) at the location of Magic Hot Springs.

"A north trending linear feature which intersects Magic Hot Springs is aligned with several hot springs north of Magic Reservoir. This linear has an en-echelon relationship with the Wood River Valley and is a probable surface expression of major vault which could control the circulation of thermal waters as is indicated by the numerous faults.

"Both linear features intersect at Magic Hot Springs. The dip slip direction of any faults associated with these linear features is undetermined. It is probable that the east-west trending linear identified by Mitchell is a near vertical normal fault with the downthrown block to the north. This relationship would be consistent with the dip slip of the northwest trending faults of the Clay Bank Hills. The north trending linear feature is probably a near vertical fault with the downthrown block to the east. More detailed geological mapping is needed to clarify the structural relation-

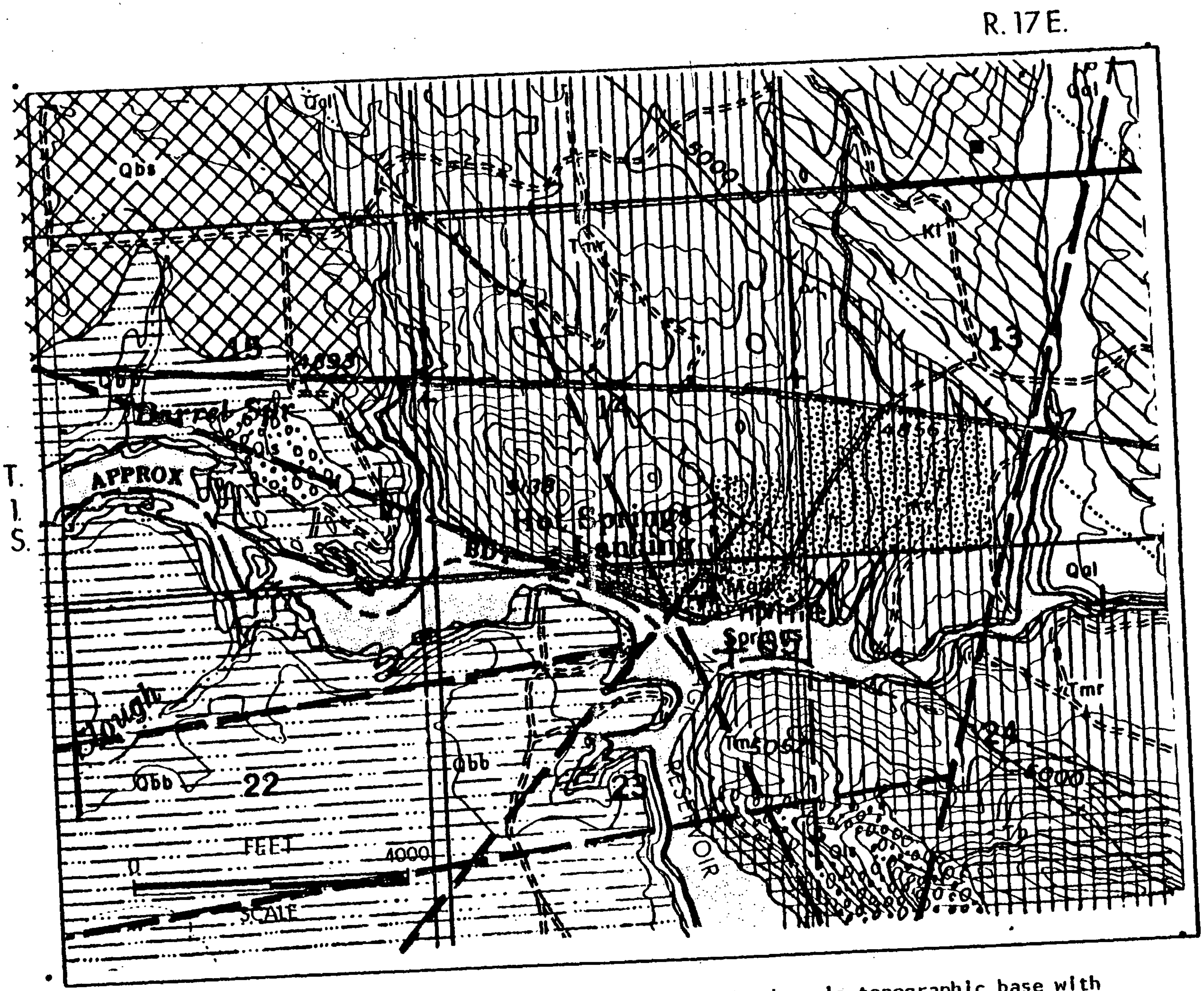


Figure 6 --Location of MRI acreage on Bellevue Quadrangle topographic base with 40-foot contour interval.

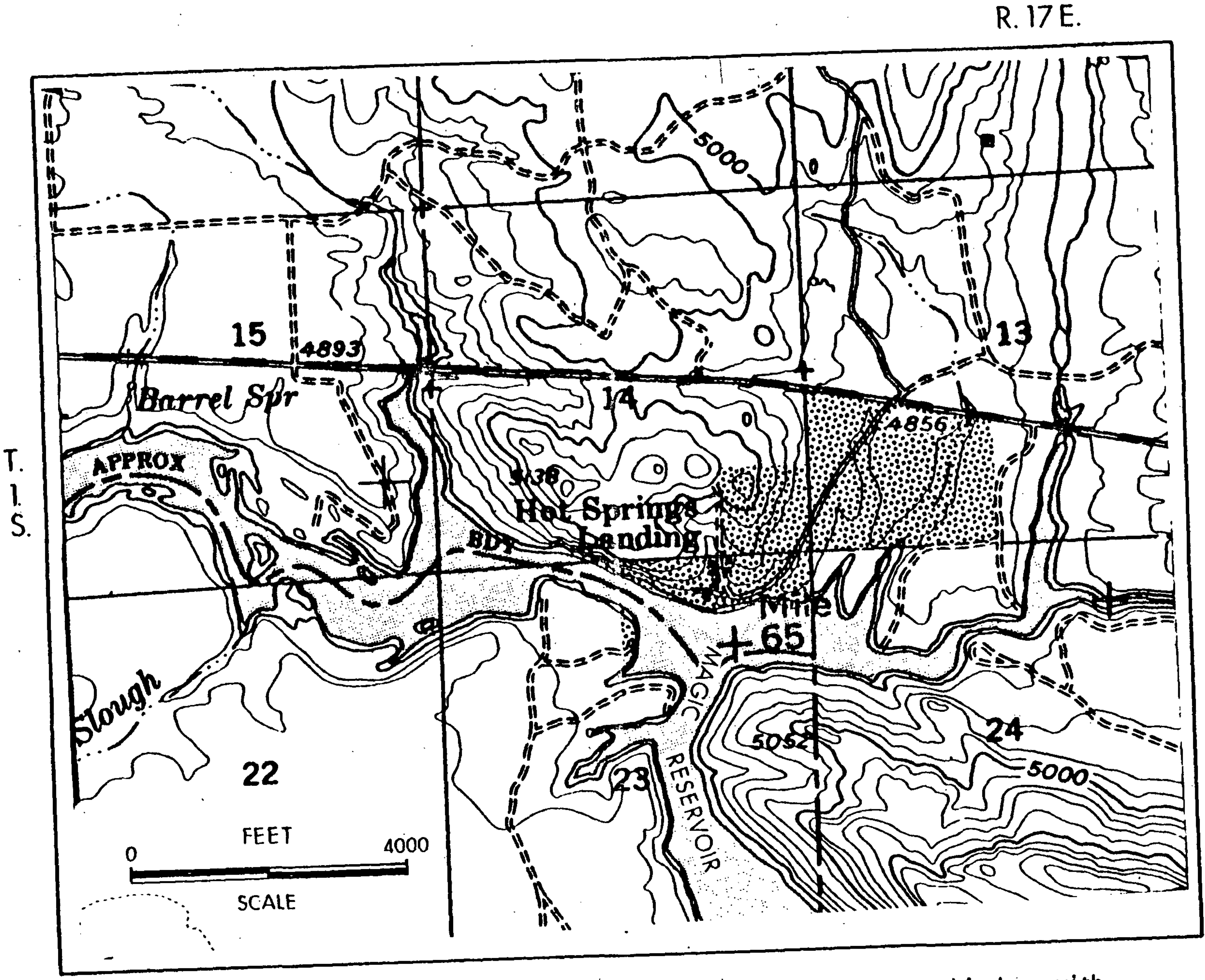


Figure 6 --Location of MRI acreage on Bellevue Quadrangle topographic base with 40-foot contour interval.

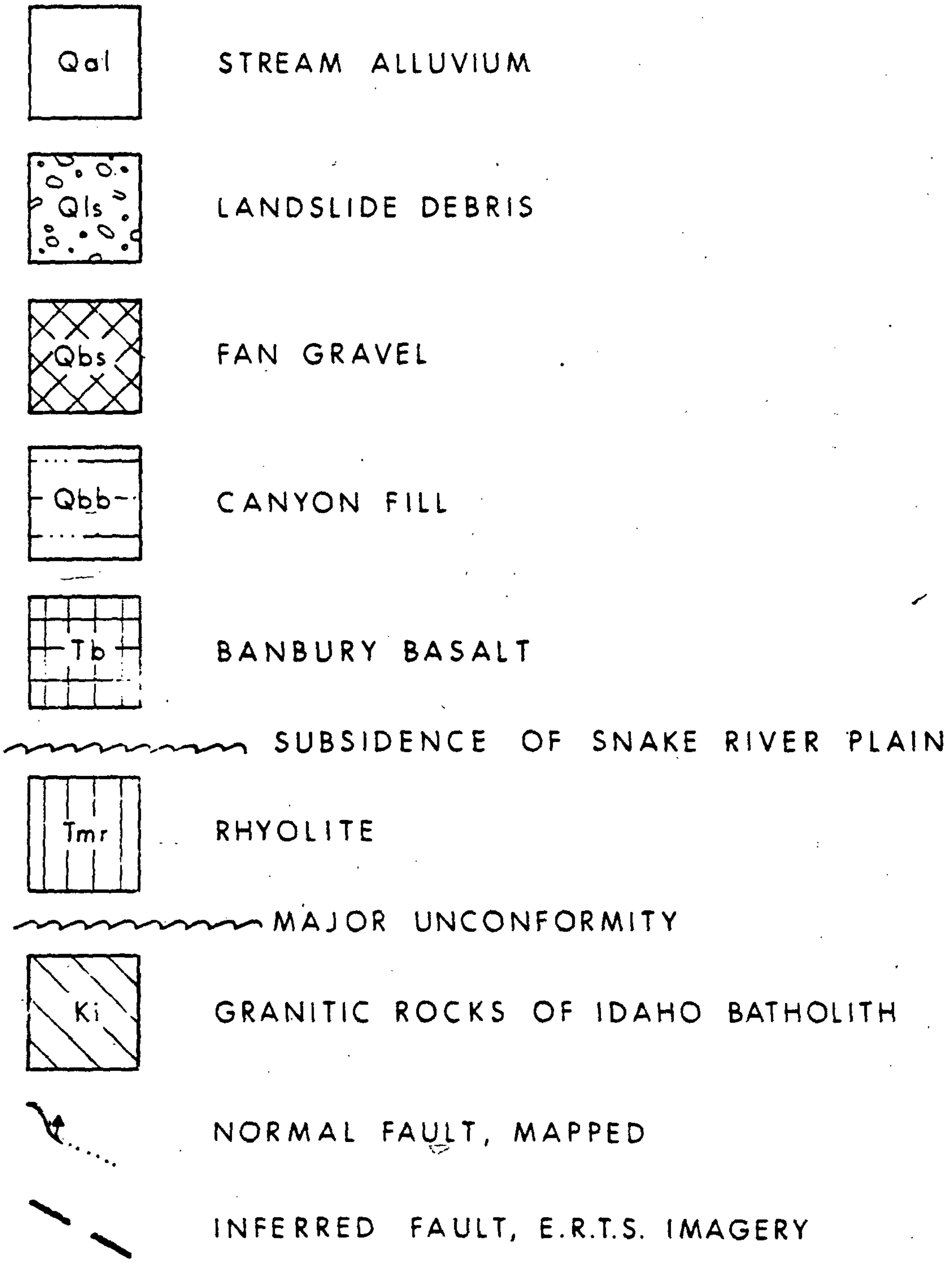


Figure 7 -- Description of Rock Units from Malde, Powers, and Marshall (1963), modified by John Anderson 1980. Accompanies Anderson geologic overlay

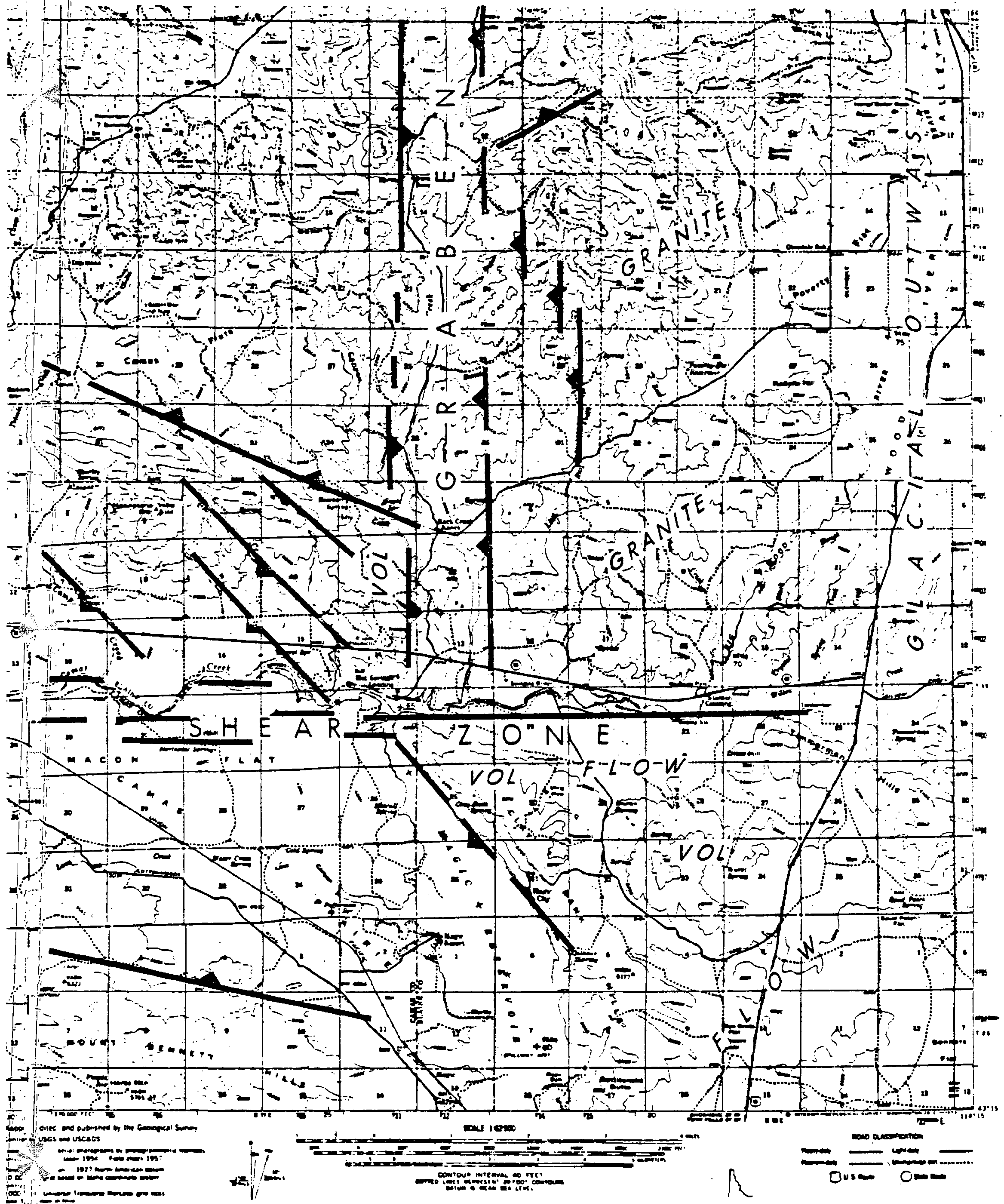


Figure 8.--Possible fault systems interpreted from reconnaissance geology, Gruy Federal, Inc.

All geological evidence indicates the presence of a high-grade geothermal resource in the Magic Hot Springs locale.

The unknown negative factor, of course, is whether the fracture permeability of the fault zones has been reduced by secondary crystallization or diagenesis.

As described elsewhere (section 5.a.), the lithology and structural geology of the area surrounding Magic Hot Springs indicate favorable conditions for the occurrence of geothermal resources. A heat flow of 3 HFU, which is twice that considered normal (1.5 HFU) for the United States, is typical of this area (Brott and others, 1976). This above normal heat flow is typical of the granitic Idaho batholith (Blackwell, 1973) and makes it reasonable to expect that thermal waters could be reaching the maximum temperatures predicted by geochemical thermometry through deep circulation.

5.b.(2) End Uses

(i) Overall Plan.

The schematic (Fig. 9) shows the overall layout for the entire proposed development including the ethanol plant. For the user-coupled proposal the only process being considered is the ethanol plant, 650 COW DAIRY, SPECIALTY CHEESE PLANT, AND WARM WATER FISH IN CASCADED WATER SYSTEM FOLLOWING A THERMOPHILIC METHANE SYSTEM.

(ii) Energy Requirement.

The energy requirement for the ethanol process [redacted] WILL DEPEND ON RESULTS OF FLOW & TEMP & THE SIZE OF 2 MILLION OR MORE WILL BE FINALIZED. hour. The [redacted] temperature and flow rate required to accomplish this are [redacted] Further, the chemical composition of the resource must be such that heat required by the process can be provided by flashing the hydrothermal fluid to steam. A margin of 75 gal/min is required for heat loss and well decline, for a total of 615 gal/min.

The potential greenhouses, catfish raceway, and soil-warming irrigation system shown on the schematic as potential secondary uses of geothermal energy are not part of this project. The area and heating requirements for greenhouses will depend on further economic analysis and the successful completion of the ethanol project. The construction of catfish raceways will probably depend on the successful completion of the ethanol plant. The size and flow of the raceway will be dependent on the flow rate and temperature of the shallow wells to be drilled to supply blending water. The underground soil warming/irrigiation system is meant primarily for disposal and esthetics. Any economic advantage would be only incidental.

(iii) Predicted Utilization Factor

The ethanol plant will operate 24 hours per day, 360 days per year, which gives a [redacted]

For the user-coupled proposal the process being considered will be an ethanol plant, a 650 cow dairy, a specialty cheese plant and coordinated manure handling and feed systems.

The final energy requirements for the ethanol plant and adjoining agricultural complex will depend on the results of flow and temperature of the final well inorder to properly size the ethanol plant at 2 million gallons or more.

No greenhouses or slil warming systems considered at this time.

The ethanol plant will operate 24 hours per day with usual 330 day production and potential maintencance schedule of downtime of 35 days per year.

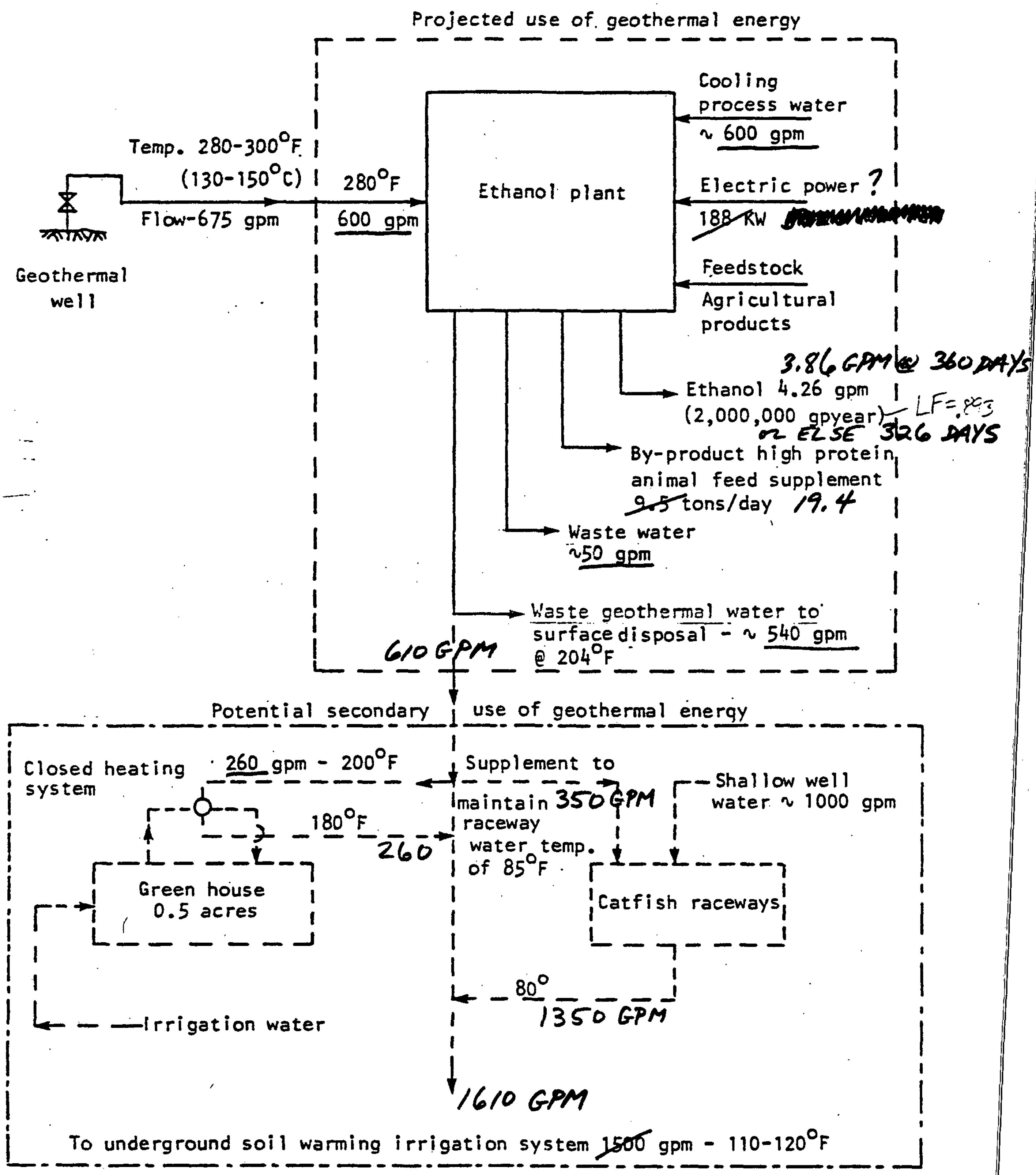


Figure 9 -- Schematic of projected end use, Magic Hot Springs geothermal well.

(iv) Gross Annual Energy Consumption

Predicted average gross annual energy consumption of the ethanol plant that will met through the use of hydrothermal energy will be [redacted] per year.

(v) Energy System Components

The major energy system components are:

1. Drilled and cased hydrothermal well, 3,000 to 4,000 feet deep, with controls.

2. Pump to supply 675 gal/min at sufficient heat.

3. Hydrothermal supply line to the ethanol plant.

(vi) Existing Energy System

The existing energy system is a 260-foot well that is cased to a reported depth of 41 feet. The well flows artesian 136 gal/min at 163°F.

If an ethanol plant is put into operation at the site, the existing well might be utilized by some of the other planned processes, such as ~~greenhouses~~ and fish farms, specialty cheese, Dairy & manure system

The produced water disposal system will be subject to review when the chemical content of the produced water is known. If the water is low in mineral content, surface disposal will be feasible (natural drainage or irrigation). If the water is found to be too highly mineralized, reinjection into subsurface zones, preferably the producing interval, would be needed. The disposal system will be subject to State approval in any event.

5b.(3) FINANCIAL FEASIBILITY

Determination of the financial feasibility of the entire project through end use requires analysis of both the geothermal energy economics and the end use. The proposed geothermal system requires the siting, drilling, completion and testing of a 3,000-ft well. Assuming that the well is sufficiently successful, an ethanol distillation plant with a production capacity of approximately 2 ~~million~~ 2 million plus gallons per year will be sited adjacent to the well. Very low cost surface disposal of the geothermal fluid exiting from the ethanol plant is planned based on evaluation of available information from the present well on site.

In the future, the geothermal fluid might be cascaded from the ethanol plant through greenhouses DAIRY to an aquaculture raceway and then to a nursery operation. However, these additional uses are not sufficiently certain to include them with the ethanol plant in the base load geothermal economics.

The financial feasibility of the proposed geothermal system is determined largely from income and cash flow projections for the economic life of the geothermal investment. These estimated earnings and cash flows are evaluated by themselves and also, when combined with the investment outlay, permit calculation of two other important financial measures--return on investment and payback period. We will comment on the adequacy of these four financial yardsticks--profitability, cash flow, return on investment, and payback period--for the proposed investment after developing the project financial data.

The financial representation of the proposed geothermal system as an investor might see it requires making several assumptions. The following assumptions are realistic and consistent with the proposer's financing expectations:

1. Economic life of well - ~~10~~ 20 years (same as ethanol plant)
2. Geothermal system capitalized - $1,250,000
3. Non-exploratory well and pump capital - $750,000

4. Well flow rate - 675 gal/min
5. Wellhead temperature - 280°F or higher
6. Operating expense, labor and maintenance - 10% of non-exploratory well and pump capital
7. Overhead - 5% of non-exploratory well and pump capital
8. Depreciation - straight line
9. Interest rate - 16% for loan amortized over the ~~10~~ 15 year life
10. Composite income tax rate - 50%
11. End user - 2 million gallon/year ethanol plant 2 MILLION GALS
12. Energy load - 1.94 x 10^{11} BTUs/year OK, ~ ~~80,000~~ 97,000 BTU/GAL
13. Non-geothermal energy source - No. 2 fuel oil
14. Geothermal energy price (to be negotiated) - 25% to 50% discount off No. 2 fuel oil price of \$5.60/10^6 BTUs
15. Well cost - full cost before any cost-sharing

A few of these assumptions warrant additional discussion to make their reasonability clear. The well life assumption is tied to the ethanol facility and market. If the life were forecast based on the known geologic and hot spring data, the projected life probably would be longer. However, the ethanol plant life is estimated at ~~10~~ 20 years, and the ethanol market and technology are not sufficiently predictable to permit inclusion of a replacement plant for a second ~~10~~-year span.

The operating and overhead expenses are based on a percentage of capital. Since the geothermal system capital includes siting and flow-testing costs, we have eliminated these exploratory items to arrive at a well and pump capital figure that is a fairer basis for estimation of expenses.

It is possible that the investors would choose to make somewhat different assumptions regarding depreciation method and intangible treatment. They also may negotiate a shorter loan life or some form of balloon repayment schedule. However, our assumptions represent a base case which other treatments would only improve.

The energy load and price are critical assumptions since they together are

@ ~ 97,000 BTU/GAL

determinants of the geothermal revenue. The energy load is based on the energy requirements of a 2-million-gallon batch basis ethanol plant. The value of the geothermal energy is yet to be negotiated between Magic Resource Investors and Western Resource Recovery. It is anticipated that the negotiated price will result in geothermal Btu's at a 25% to 50% discount from no. 2 fuel oil. Although this range is fairly wide, it provides a basis for evaluation of the financial feasibility of the geothermal investment at the two ends of the range.

Income statements, cash flow projections, and loan amortization based on these assumptions are shown in Tables 6 and 7. Table 6 assumes that the geothermal energy is sold at a 50% discount from no. 2 fuel oil; Table 7 assumes only a 25% discount. The income statements and cash flow projections suggest that the proposed geothermal project is financially feasible. With the exception of the first year when the project is under construction and generates no income, after-tax profits and positive operating cash flow are shown in every year at both the 25% and 50% discounts. This can be seen from the lines captioned "Profit After Taxes" and "Cash Generated" on the two exhibits. In addition "Cash Generated" in each year after the first year is sufficient to pay the scheduled loan amortization that would be required for a level-payment loan. (Compare the "Cash Generated" line on each exhibit with the "Loan Amortization" line.) "Profits Before Taxes" appear to provide satisfactory coverage of interest to satisfy lenders, although at a 50% discount the interest coverage and the cash generation do not provide much of a safety margin (compare the Table 6 "Profits Before Taxes" line to the "Interest" line for years 2 through 7).

The indicated Payback Period is fully acceptable with the 25% discount but is somewhat marginal for the 50% discount level. Payback compares the cumulative cash inflow to the cumulative cash investment outlay to determine when you have your money back. Let us assume an investment outlay of about $1.5 million consisting of a $1.25 million well, $0.1 million contingency, $0.1 million loss in construction year, and $0.05 million working capital. Cumulative addition of the "Cash Generation" starting with year

See next page

THERE WILL BE NO PRICE STATED FOR THE VALUE OF THE GEOTHERMAL WATERS AS THE PROFITS DERIVED THEREFROM WILL BE INTERNAL C~~L~~OST ACCOUNTING FOR THE OPERATING CORPORATION. THE DEVELOPERS OF THE GEOTHERMAL WELL ARE NOW ALSO THE OPERATORS SO THAT ALL COST SAVINGS WILL BE INTERNAL TO MAKE THE PRODUCTION COSTS OF THE END PRODUCTS, ALCOHOL ETC THUS BEING THE VEHICLE THAT IS GETTING THE FINANCIAL ADVANTAGE.

DUE THE THE INTERNAL SAVINGS OF THE HEAT SOURCE FOR THE PRODUCTION OF ALCOHOL THE PAY BACK PERIOD WILL SHOW AN ADVANTAGE IN THE OVERALL OPERATING BUDGET.

TABLE 6

INCOME STATEMENT AND CASH FLOW (000s)
ASSUMING 50% DISCOUNT FROM NO. 2 FUEL OIL EQUIVALENT

GT SALES

Year	1	2	3	4	5	6	7	8	9	10	11
Revenue	$	$543	$543	$543	$543	$543	$543	$543	$543	$543	$543
Operating expense, labor, and maintenance		75	75	75	75	75	75	75	75	75	75
Depreciation		125	125	125	125	125	125	125	125	125	125
Overhead @ 5%		38	38	38	38	38	38	38	38	38	38
Intangibles W/O											
Interest expense	100	200	191	180	167	152	135	116	93	66	36
Profit before taxes	(100)	105	114	125	138	153	170	189	212	239	269
Income tax	(50)	53	57	62	69	76	85	95	106	120	134
Tax credits:											
Ordinary (10%)		53	57	15							
Energy (15%)				47	69	72					
Profit after taxes	(50)	105	114	125	138	149	85	94	106	119	135
Plus: non-cash charges											
Depreciation		125	125	125	125	125	125	125	125	125	125
Intangibles											
Cash generated	$(50)	$230	$239	$250	$263	$274	$210	$219	$231	$244	$260
Note:											
Loan amortization	$ -	$ 59	$ 68	$79	$91	$106	$123	$143	$166	$192	$223
Loan balance (end yr.)	1250	1191	1123	1044	953	847	724	581	415	223	-

TABLE 7

INCOME STATEMENT AND CASH FLOW (000s)
ASSUMING 25% DISCOUNT FROM NO. 2 FUEL OIL EQUIVALENT

Year	1	2	3	4	5	6	7	8	9	10	11
G.T. H_2O SALES											
Revenue	$	$815	$815	$815	$815	$815	$815	$815	$815	$815	$815
Operating expense, labor, and maintenance		75	75	75	75	75	75	75	75	75	75
Depreciation		125	125	125	125	125	125	125	125	125	125
Overhead @ 5%		38	38	38	38	38	38	38	38	38	38
Intangibles W/O											
Interest Expense	100	200	191	180	167	152	135	115	93	66	36
Profit before taxes	(100)	377	386	397	410	425	442	461	484	511	541
Income tax	(50)	188	193	198	205	213	221	230	242	256	271
Tax credits											
Ordinary		125									
Energy		63	125								
Profit after taxes	(50)	377	318	199	205	212	221	231	242	255	270
Plus: non-cash charges											
Depreciation		125	125	125	125	125	125	125	125	125	125
Intangibles											
Cash generated	$(50)	$502	$443	$324	$330	$337	$346	$356	$367	$380	$395
Note:											
Loan amortization	$	$ 59	$ 68	$ 79	$ 91	$106	$123	$143	$166	$192	$223
Loan balance (end yr.)	1250	1191	1123	1044	953	847	724	581	415	223	-

2 reaches a total of $1.5 million in year 5 for the 25% discount (Table 7) and early in year 8 with the 50% discount. Thus, the [redacted] for the [redacted], but is [redacted] Again the 50% discount produce somewhat marginal results.

What?

Using the discounted cash flow internal rate of return approach yields essentially the same analytic evaluation. The "Cash Generated" as shown on the exhibits is net of interest expense. Typically the internal rate of return is calculated from cash flows excluding the cost of financing, since the rate of return is presumed to cover the cost of capital. If we remove the after-tax impact of the interest expense from the "Cash Generated", we can relate the adjusted cash flows to the initial investment and determine the DCF internal rate of return (IRR). The result of these calculations for the proposed geothermal system is a 17% IRR for the 50% discount example and a 30% IRR for the 25% discount. Given the cost of money in the foreseeable future, the 17% IRR is a little low and the 30% IRR is fully adequate.

The financial feasibility of the ethanol end use depends upon many factors including availability of feedstock, an affordable source of energy, and a stable year-round market for the ethanol that will be produced. A study was prepared by Dr. Arthur C. Rathburn of Rathburn and Associates, Twin Falls, Idaho for the proposers which investigated feasibility questions including feedstock, ethanol market, ethanol technology, ethanol process cost and economics, environmental aspects and regional impacts. His conclusion was favorable to establishment of an ethanol plant in the region. This conclusion corroborates the implied business feasibility of the ethanol direct-use application that is intended by Western Resource Recovery.

of factors that mandate alcohol in all gasoline fuels." The study further noted that "the improved volatility of gasohol fuel provides added driver satisfaction through easier starting of the vehicle, especially in cold weather."

In the region around Magic Reservoir only a few stations have tested the marketing of gasohol. These stations are pleased with customer response, even at a higher price, because of increased mileage-per-gallon performance and the fact that they are using a product that utilizes less foreign oil.

These stations were purchasing their alcohol for $2.02 per gallon and mixing it at 1 part to 10 parts unleaded gasoline. They all expressed a desire to purchase larger volumes, and felt that a price of $1.70 to $1.80 a gallon would allow them sufficient profit to install full-time gasohol pumps.

The local and regional distributors contacted for the MRI study expressed real interest in obtaining a marketing agreement with a local distillation plant. We find no reason to doubt the Iowa Development Commission's summary that "A potential market for gasohol does exist and up to 10 percent of the consumers in the market could be expected to use the product on a regular or occasional basis."

The first user OF to commit to the Magic Hot Springs geothermal AGRICULTURAL COMPLEX ~~development~~ WILL BE THE DEVELOPER. ~~project is Western Resource~~ Recovery, Inc., which intends to produce fuel-grade ethanol (180 to 190 proof) at the Magic Hot Springs site and transport this product to its facility being developed near Twin Falls for dehydration. Fuel-grade ethanol would have a value to the Western Resource Recovery, Inc. of approximately 12 cents per gallon less than anhydrous ethanol.

2. Feedstock Supply

Feedstock costs are the most critical factor indetermining feasibility.

Two major ethanol processes are in current use: cellulose and carbohydrate. The cellulose process can use any vegetable fiber, such as corn stalks or wood chips, which are inexpensive and easily available. However, the state of the art does not allow feasible operation under most situations. The production of ethanol from fruits, vegetables, or grains high in starch or sugars (carbohydrates) is as old as the making of distilled beverages, and this process is the one to be utilized.

Availability of feedstocks is somewhat limited by the remoteness of the proposed site from the lower elevations in the Snake River Plateau and the short growing season (80-85 days). Sugar beets, corn, and potatoes are not readily available in the Magic Hot Springs area. As a result, the best feedstocks are wheat, barley, oats and cheese whey. Potatoe byproduct cake is available

a) Cheese whey - Two cheese plants are located in the Lincoln, Blaine, and Camas County area; one at Carey, 28 miles to the east, and the other at Richfield, about 45 miles to the southwest. Their combined production is approximately 300,000 lb of whey per day, averaging about 6 percent solids. This whey could be obtained at a very advantageous price, though it would have to be transported a considerable distance. Present contracts held by Western Resource Recovery for whey for similar plants in Southern Idaho are for one cent per hundredweight; therefore, it should be possible to deliver the whey to the Magic Hot Springs site for about $4.20 per ton. During the anticipated down time of the ethanol plant, the whey could be dumped in the desert, where much of it is now disposed of.

   The cheese whey would produce approximately 328,500 gallons of ethanol. per year if scheduled as a portion of the production as described in the Rathburn Study

b) Grains - Blaine and Camas Counties are major producers of grains. The 1976 production in bushels was:

Crop	Blaine Co.	Camas Co.
Wheat	265,800	200,300
Barley	442,400	481,400

Oats grow well in the area and offer an additional potential source of feedstock.

If a straight grain plant is used, 400,000 bushels of barley would be needed. If whey is utilized, 286,600 bushels of barley would be needed annually.

The best combination of feedstocks for the area would be 54,750 tons of whey annually at a cost of $229,950 plus 268,600 bushels of barley annually at a cost of $604,350. This would result in a per-gallon cost for feedstock of $0.83.

3. By-Product Utilization

The two major by-products of ethanol production are a high-protein animal feed and CO_2. In plants of under 10 million gallons it is not feasible to try to recover the CO_2 produced. The only use foreseen for the CO_2 from this project is to vent it directly into greenhouses.

High-protein animal feed (protein percentage varies depending upon feedstocks) is a high-value product that can be used at up to 30% in beef rations and 50% for hogs. The by-product leaves the ethanol plant with a high moisture content, and it is produced in high volume.

The moisture problem could create extra expense. If the by-product is to be sold off site, it must be dewatered and dried. Drying could add approximately 13 cents per gallon of ethanol to the operating expenses. This is not a loss, however, because the expense would be recovered through the sale of the dried product. Also, the use of geothermal heat for drying the by-product almost eliminates the added operating expense, which amounts to

(i) Feasibility of an Ethanol Plant at Magic Hot Springs Site*

A site-specific study was conducted for the Magic Hot Springs site to determine if an ethanol plant would be warranted.

1. Market Determination

A sizable market for ethanol exists outside of its use as an additive for gasoline, but that market is now adequately served by established distillation plants. Any new plant must look to outlets for "gasohol," and that outlook is favorable.

The potential volume of anhydrous ethanol that could be utilized in America (using a 10% alcohol - 90% gasoline mix) is far beyond the production capability of the country with the present technology. The 10% figure is conservative, considering that all new American automobiles are capable of burning a 20% anhydrous ethanol mixture with no carburetor adjustment. In addition, many studies are under way to produce engines that will more effectively use 100% anhydrous ethanol.

Gasohol is giving excellent customer satisfaction in Idaho, as in other areas where market tests have been carried out. Stations introducing "gasohol" can expect increases in sales volume in excess of 200 percent. Documented comments from actual users have substantiated previous performance testing (better overall performance) and again point out the desire of users to continue using the product.

This last point, increased performance, has been the conclusion of many recent studies. A study (1979) by the Nebraska Agriculture Products Industrial Utilization Committee stated, "Increased octane number, positive volume change, and reduced fuel consumption are indeed a triumvirate

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*Condensed from a study by Dr. Arthur C. Rathburn of Rathburn and Associates, Twin Falls, Idaho, for MRI.

only 2 to 3 cents per gallon.

A steadily growing market exists for high-protein supplements such as soybean meal in south central Idaho, because the dairy industry, a major user of high-protein feeds, is growing at a rapid rate. At present, soybean meal is selling for around $190 per ton in the area. This would make the DDG (distiller's dried grain by-products) from the proposed ethanol plant worth $114 per ton on an equivalent nutritional basis. Table 8 shows the typical nutrient composition of distiller's feeds. ok

4. Capital Costs

The most readily available and most economical ehtanol distillation facility is the prefabricated unit built by Rocky Mountain Ethanol Systems, Inc. These units also have a good history of dependability. The present basic price of a unit adequate for the needs of a 2 million gallon per year plant is approximately $1,540,000. See Next Page!

The Rocky Mountain Ethanol Systems units compare very favorably with other plant cost, averaging $2.50 per gallon of annual capacity, or a capital outlay of $5,000,000.

Rocky Mountain Ethanol Systems, Inc. has an operating still near Rupert, Idaho, producing 190-proof ethanol. The anhydrous tower is now being installed. The plant uses a batch process rather than continuous flow. Though more labor-intensive, this system is more widely used and field-proven. The plant is fabricated of mild steel and has a life expectancy of 10 years.

5. Availability of Services

Transportation - The site is located near Idaho State Highway 68. U.S. Highway 75 is five miles to the west. Both are maintained year-round and are rarely closed during the winter months. The site is not served by rail, but a Union Pacific rail spur (Shoshone-Fairfield spur) lies

See Next Page

4. CAPITAL COSTS

The information as quoted on page 39 is not as reliable and realistic as that provided by the WESTPHAL SYSTEM. Westphal System has been reviewed by E.G.&G. (ED DI BELLO GROUP) relating to the Idaho-Agricultural Growth Industries complex at the Raft River site. This data was compiled for the Geothermal Loan Guarantee Program. Review of the Westphal system has been made by E.G &G. on behalf of this project. The information may be used here for the efficiency of the system presented.

Our analysis shows that under our working conditions and with regards to the combination with Geothermal heat that the system is more efficient than that originally presented on page 39. Westphal has provided equipment to Brazil for the production of 500,000,000 gallon production per year facilities in 1979. 700,000,000 gallon facilities are being constructed in 1980-1981 in Brazil in addition to the 500,000,000.

We find this system much more efficient.

TABLE 8

TYPICAL NUTRIENT COMPOSITION OF DISTILLERS' FEEDS

	Wheat		Barley		Corn		Potatoes
	DDG	DDGS	DDG	DDG	DDS	DDGS	D.D. residue
				percent			
Dry matter	93.4	92.5	92.0	93.8	93.3	92.5	95.7
Ash	3.0	4.1	1.8	2.2	7.5	4.6	6.7
Crude fiber	12.7	9.8	10.1	12.6	3.6	9.1	20.6
Ether extract	5.9	6.3	11.6	9.3	9.3	10.3	3.1
N-free extract	40.4	40.3	40.8	41.9	43.6	41.4	42.4
Protein (N x 6.25)	31.3	32.0	27.7	27.8	29.4	27.0	22.9
Energy:							
Cattle TDN	73.6	75.2	63.6	79.0	80.3	80.2	61.0
Sheep TDN	77.7	78.5	65.1	76.6	84.0	69.4	61.8
Swine TDN	84.1	85.2	67.7	92.5	79.7	94.3	74.6

Source: National Academy of Sciences, Atlas of Nutritional Data on United States and Canadian Feeds, 1971.

approximately 3 miles to the southwest. The railroad has recently shown increased interest in developing new industry in south central Idaho.

Electrical power - A three-phase electrical power transmission line runs east and west to the north of the site. No difficulty is seen in bringing sufficient power to the site.

Fire protection - Fire protection would have to be planned in site development facilities.

Police protection - Very little routine police protection could be expected from existing agencies. However, the plant will be operated on a 24-hour basis and personnel will be on site.

Availability of labor - The plant will not require a large labor force. A plant manager will carry out the day-to-day management functions. Most of the administrative duties will be carried on at Western Resource Recovery's corporate office in Twin Falls.

Two men per shift will operate and maintain the plant. These men will need mechanical skills. The area has an agricultural and lumbering oriented economy, and these skills are not difficult to locate.

6. Environmental Restrictions

A geothermally powered distillation plant creates no environmental hazards to the area. No air pollutants are produced to create emission problems. Only water and CO_2 are produced and water pollution could be prevented by proper planning.

WILL be CONTROLLED

~~The geothermal fluids themselves are sufficiently free of pollutants to be returned directly (after cooling) to Magic Reservoir. The stillage water, however, will be loaded with suspended solids and will need to be run through an aeration pond, which should reduce the BOD load to around 200 ppm, and then be sprayed on the adjoining rangeland. Though this may~~

See Bottom of Next Page.

create some odors, the site is isolated from any habitation and no problem should develop.

7. Other Governmental Restrictions

The site is located in a county-zoned "Rectreational District" because of the location of the hot spring and its proximity to Magic Reservoir. In the past, land developments within designated recreational areas in Blaine County have met considerable resistance to redesignation. This site, however, is far removed from the other recreational areas in the county. In addition, county planning and zoning officials and county commissioners indicate enthusiasm for the establishment of an industry in the area. At this point it appears that little opposition would be shown toward an application for rezoning.

8. Conclusion

The present situation both locally and nationally seems favorable to the establishment of an ethanol plant at Magic Hot Springs. All factors investigated in this study seem to indicate no major obstacles to the establishment of a plant.

The effluent from the alcohol plant will be biologicall controlled by feeding part of the liquid to the animals. The rest will be combined in a thermophilic methane system for the control of all wastes, both from the alcohol and dairy inorder to control and eliminate odor that would arise from lagoon action. The effluent from the methane system is sterile and will be used for irrigation.

c. REFERENCES

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6.a.(1) STATEMENT OF WORK

The following statements of work listed by task are proposed by EARTH ~~Magic~~ Resource Generators (ERG) ~~Resource Investors (MRI)~~ in fulfillment of a cooperative agreement under the User-Coupled Confirmation Drilling Program as set forth in the Solicitation for Cooperative Agreement No. DE-SC07-80ID12139, August 15 (amended to September 15), 1980.

Task 1. Financial

EARTH Resource Generators Inc ~~Magic Resource Investors~~ shall confirm all financial arrangements for implementation of the project and provide DOE with evidence that project financing is sufficient to complete the project. Completion of this task constitutes completion of Milestone #1.

Task 2. Environmental and Institutional

E.R.G.

MRI shall submit an Environmental Report within 60 days of contract award, prepared in accordance with guidelines to be provided by DOE and addressing "site-specific" information relating to the project. MRI shall assist DOE in preparation of an Environmental Assessment if an Assessment is required based on the Environmental Report.

All permits, leases, and other documentation required for this geothermal project shall be acquired and provided to DOE by ERG MRI. During the course of work under this Agreement, ERG MRI shall coordinate with and provide information to local, state, and federal agencies, as necessary, to ensure compliance with all environmental requirements additional to the DOE guidelines. Completion of this task constitutes completion of Milestone #2.

Task 3. Exploration

A. E&G MRI, with support from appropriate consultants, shall:

1) Conduct the following exploration work:

   a. Field geology surveys and detailed site work to locate, confirm, measure, map, and project surface faults and fractures in and around the Magic Hot Springs Landing area sufficient to assess the probable existence of fault planes and/or fracture zones in the subsurface.

   b. Conduct a geophysical survey of approximately 20 linear miles with methods and instrumentation best suited to identify, locate, and map subsurface faults and fractures in the Magic Hot Springs Landing area, sufficient to assess the probable existence and location of fault planes and/or fracture zones for selection of an optimum drill site to penetrate such fault planes and/or fractures within a 3,000-foot depth of the surface location.

   c. Compile and analyze all available hydrologic and geochemical data from existing wells, springs, and aquifers sufficient to assess the probabilities of connected or nonconnected flow into the Magic Hot Springs Landing subterranean area, and related water qualities and quantities.

2) Analyze and interpret all exploration data and present both the data and the results to DOE.

3) Based on the exploration data:

THREE OR MORE

a. Select three thermal gradient drill sites.

b. Prepare bid specifications and select a drilling subcontractor to drill the thermal gradient wells. The bid specifications and drilling subcontracts shall be submitted for DOE review and approval prior to award.

c. Obtain bids for the drilling of the thermal gradient wells.

d. Review the bids submitted and award a subcontract to the successful bidder.

e. Drill three thermal gradient wells in accordance with the bid specifications.

f. Obtain thermal gradient and lithology logs during drilling and continue gradient monitoring during the period of temperature stabilization subsequent to drilling.

ERG,

B. MRI, with the support of appropriate consultants, shall:

1) Evaluate the data obtained in Tasks 3A 1-3 and other available assessment data, in order to define the hydrological and geological features of the resource with emphasis on resource location and depth. These data shall be provided to DOE as soon as they are acquired during Task 3A 1-3 in order to minimize the time required for DOE review.

2) Within ten working days of the completion of Task 3B 1, DOE and ERG MRI shall discuss and review the data. A mutual

written agreement between DOE and MRI must be reached concerning the adequacy of the exploration data for selecting a resource confirmation drill site and the potential need for additional data prior to proceeding with the next task. Completion of this task constitutes completion of Milestone #3.

3) Concurrently with Task 3B 2, ~~or~~ within ten working days of the completion of this task, ERG MRI shall discuss and review with DOE the selection of a production well drill site. A mutual written agreement between DOE and ERG MRI must be reached concerning the location of the drill site. Completion of this task constitutes completion of Milestone #4.

Task 4. Drilling and Logging

A. ERG MRI, with support from appropriate consultants, shall:

1) Provide for necessary drilling supervision services.

2) Update the preliminary Drilling Program, which will include well location, drilling techniques, well and wellhead design, anticipated rig type, drilling fluid program, logging requirements, etc. Temporary requirements, such as reserve pits, mud pits, equipment storage areas, noise abatement, blowout prevention, utility services, and other standard well drilling practices, shall be considered and addressed in the drilling plan. DOE shall be advised of the contents of the Drilling Program during its preparation.

3) Prepare the bid specifications and submit the Drilling Program and specification to DOE for review and approval. Within ten working days, DOE shall indicate concurrence or

request modifications to the specifications and/or program.

B. ELC MRI, with support from appropriate consultants, shall:

1) Issue the drilling specification to drilling companies for bid.

2) Review the well bids and inspect (if necessary) the bidders' drilling equipment. ELC MRI shall select a drilling subcontractor, with DOE concurrence. The proposed drilling subcontract shall be submitted for DOE review and approval. Within ten working days, DOE shall indicate approval or request modications to the subcontract.

3) Supervise the drilling of the production well, in accordance with the detailed Drilling Program and specifications. Periodically, ELC MRI or its designated representative and DOE shall confer, so that decisions concerning the drilling operation can be made in a timely manner.

4) Collect fluid samples, cutting samples, well logs, bottomhole and gradient temperature data and perform all other tests consistent with industry practice and the Drilling Program. Strata suitable for reinjection will be noted during drilling.

5) All data concerning the well shall be forwarded to DOE as soon as they are acquired in order to minimize the time required for DOE review.

6) Within ten working days of the completion of the well, DOE and ELC MRI shall discuss and review the data. A mutual written agreement between DOE and ELC MRI must be reached prior to proceeding with the next task. Completion of this task constitutes completion of Milestone #5.

Task 5. <u>Flow Testing</u>

A. EAG MRI, with support from appropriate consultants, shall:

1) Provide for necessary flow testing services.

2) Update the Flow Test Plan and submit to DOE for review and approval; within ten working days, DOE shall indicate concurrence or request modifications to the plan.

3) Carry out a comprehensive well and reservoir test program in general accordance with the Flow Test Plan.

4) Assimilate the test data taken during the well test and estimate the well's productive capacity and production characteristics. The well testing and other available data shall be prepared and presented to DOE. Within ten working days, DOE and MRI shall discuss and review the well test results. A mutual, written agreement between DOE and EAG MRI must be reached to determine a future course of action. This agreement constitutes project Milestone #6.

Task 6 <u>Injection Well Drilling</u>

A. If an injection well is deemed to be necessary by mutual agreement between DOE and EAG MRI, a prognosis and drilling program, similar to the updated and approved Drilling Program for the initial confirmation well, shall be prepared by EAG MRI and submitted to DOE for approval (reference Task 4A 1-3).

B. EAG MRI shall, with appropriate consultants, conduct all operations necessary to drill the injection well and prepare it for use, including the performance of duties set forth in Task 4B 1-6 as modified in the approved injection well Drilling Program.

C. DOE and MRI explicitly recognize that an injection well is not foreseen to be necessary at initiation of the Cooperative Agreement, and that the costs, proposed budget, and proposed work schedule do not include an injection well; therefore, following a mutual agreement between DOE and ERG MRI of the necessity to drill an injection well and prior to commencement of any work, DOE and MRI shall adjust the basis of cost-share agreement (Task 7 of the Cooperative Agreement) to include the additional costs of the injection well program and additional fee to Gruy Federal.

Task 7. Determination of Cost-Share

DOE and ERG MRI, together with Subcontractors Gruy Federal, Inc. (GFI) technical participation, shall review all test results and costs and determine the DOE and ERG MRI cost shares. The basis for the determination of the cost shares shall be the variable cost share plan contained in Section _______ (to be filled in) of the Cooperative Agreement (the basis for which is set forth in Section 8, Variable Cost-Share Plan, in this proposal) as modified, if necessary, under the terms of Task 6, Injection Well Drilling. Determination of the cost share constitutes project milestone #7.

Task 8. Project Management

ERG MRI shall manage the project in a prudent and workmanlike manner consistent with successfully completing the Statement of Work. Management controls shall include technical assessment, budget assessment, and schedule assessment, as described in the proposal.

ERG MRI shall maintain continuous monitoring of cost versus performance for comparison to baseline projections of each cost and performance item.

ERG MRI shall prepare and maintain in current status, in a format acceptable to

DOE, management charts and diagrams that show all phases of overall work plan and schedule and financial plan. These diagrams will include time allowance for DOE review and approval of plans and reports, and for policy decisions. They shall also be used for coordination between ~~Gray Federal and other~~ contractors and principals in the program. ERG MRI shall maintain close coordination with DOE and shall make immediate and full disclosure of problem areas in order that corrective action may be taken with DOE support, if necessary.

Task 9. Reporting

ERG
MRI shall meet and satisfy the reporting requirements of DOE Form CR-537 in SCAP No. DE-SC07-80ID12139, consisting of the following:

Reporting Requirement	Frequency
A. PROJECT MANAGEMENT	
1. Management Plan	one time - soon after contract award
2. Contract Management Summary Report	monthly - due 15 days after end of calendar month
3. Project Status Report	monthly - due 15 days after end of calendar month
4. Conference Record	as required
B. TECHNICAL INFORMATION REPORTING	
1. Technical Progress Report	as required

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General Management proposes to use a Project Task Force teams approach to accomplish the highly coordinated management effort required for this unique development. Use of Project Task Force Teams combined with Legal, Financial, and a Board of Consultants approach is very successful for commercial technical projects. This teaming technique, which is considered a proprietary management method combines the best possible expertise with firm management control at modest cost.

Consultants are selected for their specific knowledge and experience in a required technical discipline, with heavy emphasis on plant process engineering, microbiology, agronomy, animal husbandry, safety and hazard considerations during construction and operations. This selection process allows some of this country's leading experts to be utilized for a logical problem identification and solving commitment as required. The selection of individual Consultants to a Board of Consultants is the responsibility of the General Manager, a person who is skilled in interpretive requirements, technology, construction, operations, and information organizing. The General Manager is assisted in this by the individual Project Managers; and engineering coordination groups.

The Board of Consultants will report to the Project Manager; however, some of their data will be submitted to the Project Review Committee in order that the Committee might guide the Board's study effort. The Board consultants will be individually emp;oyed for periods of a few days to several weeks depending on the tasks assigned. Some of the consultants on the Board have already been identified and selected; others will be added as the planning and initial tasks are completed.

F. 2. b. MANAGEMENT PLAN

The Project Management Plan serves as a guide to facilitate conscious decisions in project and financial planning for this Project. The plan defines the project objectives, the project organizational and management system, the project controls and documents, the project baseline costs, and schedules through completion of development.

Planning for the project will be embodied in the development of a detailed Work Breakdown Structure (WBS). The WBS divides and subdivides the project activities into smaller, more manageable tasks that are amenable to reasonably accurate cost and schedule estimates; these tasks are combined to provide an overall cost and schedule estimate for the project. This management plan is classified as a "dynamic plan" in that it will be kept current by periodic updates, as needed changes are identified, and as downstream tasks become more definitive. This WBS breakdown will be submitted to DOE as soon as possible following agreement signing.

F. 2. c. MANAGEMENT RESPONSIBILITIES

F. 2. c. 1. GENERAL MANAGER (Co General Managers)

~~THe Idaho a Agricultural Growth Industries Raft River Project General Manager will have prime responsibility for~~:

1. Resolving interface areas of the Systems Managers;
2. Approval of solicitation documents, and proposed contracts, or contract changes exceeding $500.00. Our experience indicates that the judgement of the Systems Managers will be sufficient in this area for amounts up to $500.00; however, it is our experience that an ultimate single focus of responsibility is the best assurance of commercial success. As such the General Manager will review and approve any financial expenditures in excess of $500.00. In a well managed commercial venture it is necessary that someone be responsible for all financial expenditures, even though they are apparently minor portions

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of overall project costs. At the risk of being trite, "A stitch in time saves nine."

3. Approval of design and operational criteria;
4. Approval of acceptance testing of major equipment and facilities;
5. Participation in project review meetings; and
6. Interfacing with the DOE Project Manager.

F. 2. c. 2. ~~SYSTEMS~~ CO- MANAGERS

The ~~Systems~~ CO- Managers Shall:

1. Act as the General Manager's deligated representatives to provide overall project management and control, technical surveillance, project status evaluations, coordination of subcontracts, and liaison with involved agencies in their respective areas;
2. Solicit contracts for design engineering and construction management services;
3. Solicit, evaluate and provide bid comparisons with recommendations to the General Manager for contract awards and conditions of contract;
4. Recommend for approval all project design and construction drawings and specifications, procurement actions, construction, equipment installation, and acceptance inspections and testing;
5. Recommend for approval all proposed changes in design or construction;
6. Coordinate systems and procedures of the project with those required by DOE;
7. Prepare reports as required by the General Manager and DOE;
8. Participate in project review meetings; and
9. Maintain project files.

F. 2. c. 3. MANAGERS

The managers for alcohol, energy, ~~swine~~, dairy, feed, ~~and~~ CHEESE & methane shall:

1. Act as the Project Managers' delegated representatives to provide overall project management methodology and controls,

technical surveillance, and project status evaluations in their respective areas;

2. Evaluate bid comparisons with recommendations to the Project Managers for award; and
3. Recommend for approval all systems design integration and construction drawings and specifications.

F. 2. c. 4. DESIGN ENGINEERING FIRMS

The two selected design engineering firms (one reporting to each System Manager unless a single firm can demonstrate capability in both major areas) shall:

1. Prepare drawings and specifications for construction of all civil, electrical, process, and mechanical work;
2. Provide the Project Managers with engineering assistance with respect to procurement in evaluating bids and selecting suppliers of major equipment and the construction contractor in periodic shop inspections, and witnessing tests related to fabrication, shop assembly, and delivery;
3. Prepare procurement packages; including drawings and specifications, for the long-lead-time equipment items;
4. Prepare and maintain an up-to-date design and procurement schedule;
5. Provide inputs to the Project Managers as required for reporting requirements;
6. Review and approve vendor submittals;
7. Assist the major equipment vendors in testing and start-up;
8. Prepare operation and maintenance manuals;
9. Prepare as-built drawings; and
10. Maintain drawing and specification control.

F. 2. c. 5. CONSTRUCTION MANAGER

The overall Construction Manager for the project shall:

1. Provide services as requested by the General Manager for assistance in the overall management and control of the construction phase of the project; including scheduling, cost control, and general administration;

2. Provide construction surveillance to ensure conformance with contract drawings and specifications;
3. Prepare and maintain an up-to-date progress and expenditure schedule;
4. Provide inputs for reporting to DOE as required;
5. Evaluate and recommend for approval all proposed change orders;
6. Perform and record construction inspectors acceptance tests;
7. Assist the General Manager in the coordination of the testing and start-up of the project;
8. Determine and certify progress and quantities of work completed as provided under the construction contract documents, and make recommendations to the Project Manager for progress and final payments;
9. Participate in project review meeting; and
10. Coordinate safety program requirements for all phases of the project construction to ensure that contractors are responsible for safety.

F. 2. c. 6. CONSTRUCTION CONTRACTOR

The selected Construction Contractor shall:

1. Be responsible directly to the Construction Manager;
2. Provide all required on-site construction services and materials and install all equipment with vendor assistance as required. Permanent personnel may be selected to work on the installation of ~~Swine and~~ CHEESE + Dairy equipment in order to become acquainted with its maintenance and operations.
3. Perform all required inspections and acceptance testing;
4. Prepare and maintain an up-to-date construction schedule, including expenditures;
5. Provide inputs to reports as requested;
6. Participate in project review meetings;
7. Prepare cost estimates for possible changes or cost control;
8. Administer fixed-price construction service subcontracts and construction materials procurements;
9. Review the project design for constructability and make recommendations for improvements and/or cost savings; and

10. Provide safety inspection of prime and subcontract work.

F. 2. d. 1. PROJECT CONTROLS - GENERAL

The Project Managers will have overall direction of the project as delegated by the General Manager and with the approval of the General Manager. The Project Managers will have authority to accomplish all administration, logistic and technical requirements of the project, and to coordinate work on the project with other project team members.

Actual Project performance will be measured against the project objectives established by the Work Breakdown Structure, Project Schedule, and Project Budget. Monthly comparison of actual versus planned work will be made, analysis will be made of any variance, and appropriate corrective action will be initiated where necessary.

F. 2. d. 2. TECHNICAL CHANGE CONTROL

Overall control of policy and major program revision lies with the Project Technical Control Board (PTCB). The object of the PTCB is to assure that all changes in the project scope, design, schedule, and/or cost are properly reviewed and approved. Although the PTCB has the authority to implement changes which do not change project costs, all recommendations which affect costs shall be approved by the General Manager with the consultation of the General Manager's technical, financial, and legal advisors.

The PTCB will be comprised of:

a. The Project General Manager (tie breaking vote),
b. The Energy Systems Manager (one vote),
c. The Agricultural Systems Manager (one vote),
d. THe member of the contracted organization involved (one vote, advisory only).

The party requesting consideration of a proposed change shall prepare and submit to the PTCB through the appropriate Project Manager a written request describing the proposed change and its technical and scheduling impact.

The affected Project Manager shall:

a. Evaluate the Proposed change;

b. Prepare an independent technical and schedule impact evaluation;

c. Make a recommendation to the PTCB as to the disposition of theproposed changes; and

d. Provide overall coordination and appropriate documentation of approved changes.

F. 2. d. 3. COST AND SCHEDULE CONTROL

The General Manager shall finalize integrated cost and schedule control systems. The purpose of the system is to review, report and control the project costs and schedule against the baselines established in the cost plan.

The WBS has established the method of budgeting and collecting costs at the various levels and has outlined the work to be performed. Work packages identified in the WBS are released by a Work Authorization (WA) document which must contain:

a. Planned starting and ending points that are consistent within the time phase schedule.

b. Calendarized budgets expressed in labor hours and material dollars estimates, as appropriate for measurement of performance.

c. Work Authorization number to which labor and material must be charged.

The accounting system will summarize cost data from the lowest level of the WBS and provides for the collection, identification, and reporting of actual costs. The charge numbers assigned by the Work Authorization document/work package will accumulate the elements of costs incurred.

Significant cost variances must be investigated, and the cause determined and explained by the responsible party. The monthly report will assure that such variances are identified at an early date and corrective action is taken.

F. 2. d. 4. DRAWING CONTROL

All changes to project drawings will be contained in Engineering Change

Orders (ECO's). ECO's will be prepared by the project personnel as:

a. The result of a field design change required for constructability and generated by the Resident Engineer;

b. An engineering change required for operability or maintainability; or,

c. A correction of inconsistencies in the drawings.

For changes involving PTCB action, the ECO will be issued upon completion of the PTCB approval cycle. The ECO will be numbered and distributed to the appropriate project personnel. The original will be sent to the appropriate Project Manager who will check the ECO and note on the affected drawing that an ECO has been issued against the drawing. A drawing will not be revised until five ECO's are issued against it, or the changes significantly alter the drawing. Any copies of a drawing with an ECO issued against it will have a copy of the ECO attatched. One copy will be included in a change order to the construction contract. The Project Manager will retain one copy of all ECO's. At the completion of all work included on a drawing, all ECO's will be incorporated to bring the drawing to "as-built" status.

F. 2. d. 5. SPECIFICATION CONTROL

Specifications shall be modified on "as needed" basis to procure or manufacture hardware. All specification changes will be reviewed by the Project Manager via a Document Revision Request (DRR). A specification update, by incorporation of approved DRRs, will be used as necessary to maintain suitable working documents for procurement or manufacturing.

F. 2. e. SUPPORT AVAILABILITY

The primary administrative support for this project will be provided by necessary contracted qualified Legal, Financial, and Management Support services. This is further backed up by a Board of Consultants with these same areas of expertise.

Computer services will be used through the facilities of Agricultural Growth Industries, Inc. for cost analysis, budgeting as well as technological scientific programs for production control, breeding

~~F.M~~

and genetic records, feed and nutritional formulation, and operational monitoring and data storage.

CONFIDENTIAL

Geothermal Agricultural System, Inc

Management support will be provided by ~~Agricultural Growth Industries, Inc.~~ (AGI) California, Westphal - and the Georg Westphal Company of West Germany. Engineering and consulting support will be provided by existing contractual obligations and others as necessary.

AHJ AGRICULTURAL GROWTH INDUSTRIES, INC

Reporting Requirement	Frequency
2. Final Technical Report	final, at end of contract
C. ADDITIONAL	
1. Environmental Report	An environmental report describing the potential environmental effects of the proposed project must be submitted to DOE after execution of the agreement and prior to drilling. One time only only, submit 4 copies.
2. Milestone Schedule	A time frame schedule defining trackable milestones used to measure progress in terms of schedule. This is to be submitted upon contract execution. One time only, submit 4 copies.
3. Well Cuttings	Three sample bags (3" x 5") of well cuttings will be collected as required by DOE. The cuttings will be filed and available to the public after well completion.
4. Logs	A copy of all logs is to be transmitted to DOE as available.
5. Daily Drilling Reports	A daily record shall be kept on the IADC Official Standard Daily Drilling report or other form standard to the drilling industry. The general remarks section

Reporting Requirement	Frequency
	shall contain an accurate record of hole conditions and work performed and time required for all work to the nearest quarter hour. A copy of the Daily Drilling report shall be provided. Daily verbal communication may be required to transmit this information. An additional daily record form may be required for transmittal.
6. Test Data	A copy of test data and of the analysis of these data is to be provided to DOE for reservoir assessment. The government will use these data for an independent evaluation to determine the degree of success of the well for purposes of determining the government cost-share.
7. Final Cost Report	A cost report submitted at program completion summarizing estimated and actual costs. This report will show the DOE cost share as evaluated by the previously negotiated variable-cost-share formula criteria. Submit 4 copies.
8. Fluid Samples	as required by DOE.

9. Exploration Data	A copy of the exploration data and the analysis of these data is to be provided to DOE.

Task 10. Dissemination of Information

Throughout the project, MRI and Gruy Federal shall prepare press releases and business and technical articles for trade journals as appropriate. DOE concurrence shall be obtained on all information prepared for public release prior to the release of this information.

MRI shall design and erect a sign in good taste and of appropriate construction at the facility, which will define the project objective and parties to the project.

ERG & Subcontractors

With regard to written and oral public information, MRI and Gruy Federal shall:

A. include appropriate recognition of the roles of the principal parties involved in work performed under this Agreement;

B. avoid statements or implications that the Department of Energy endorses any process or product arising out of the contract, without advance approval of the Contracting Officer;

C. provide DOE one copy of news releases, information folders, brochures, advertisements, technical papers, and magazine or newspaper articles pertaining to work performed under the Agreement;

D. advise the Contracting Officer of news media or public reactions to work performed under the Agreement.

Task 11. DOE Conferences

ERG & Subcontractors

MRI and Gruy Federal shall make available any project personnel requested by DOE to attend technical meetings, and shall also encourage and strive for oral and written reports, as requested in such meetings, that merit publication in professional journals.

6.a.(2) ORGANIZATIONAL ELEMENTS

EARTH RESOURCE GENERATUS, INC (ERG) an the SUBCONTRACTORS will be

MRI and its financial associates, Robert B. Gorham and John A. Wedum, have assigned Gruy Federal, Inc. the RESPONSIBLE responsibility for siting, drilling, and testing the geothermal well for the Magic Hot Springs Landing confirmation drilling program. ~~Gruy Federal has accepted this assignment on behalf of the Gruy Companies and will assure that the resources of the Gruy Companies will be made available for this program as required.~~

See Next Page

~~Figure 10 shows the three Gruy operating companies under Gruy Enterprises, with their founding dates, principal officers, and office locations. The Gruy Companies employ approximately 200 full-time persons plus a varying number of consultants and contract field personnel. During the past 30 years, they have completed more than 5,000 jobs pertaining to petroleum and other earth resources in 16 nations.~~

~~All the human and technical resources of the Gruy Companies can be made available for a particular task through Mr. Lane, president of Gruy Federal, Inc.~~

(i) Project Management Organization

ERG

MRI thoroughly understands the necessity to conduct the User-Coupled Confirmation Drilling Program in a prudent, safe, cost-effective, and productive manner that not only achieves the technical and socioeconomic objectives of the program but also remains unencumbered by adverse political reaction and publicity that could result from careless or mediocre performance.

We do not seek this work with a casual attitude toward its performance. We have designated a team of senior individuals each of whom is a professional

6.a.(2) ORGANIZATIONAL ELEMENTS

EARTH RESOURCE GENERATUS, INC. (ERG) and the subcontractors will be responsible for siting, drillint, and testing the geothermal well for the Magic Hot Springs Landing confirmation drilling program. ERG is a newly organized Corporation whose equity is owned, controlled and operated by GEOTHERMAL AGRICULTURAL SYSTEMS, INC, and Jerold R. Kirkman. GEOTHERMAL AGRICULTURAL SYSTEMS, INC., is owned by AGRICULTURAL GROWTH INDUSTRIES, INC (Dr. Richard H. Matherson) and MAR-BIL ENTERPRISES (W.E. Henderickson and Martha L. Zeisloft).

Dr. Matherson, W.E.Henderickson and M. Zeisloft will jointly be responsible for oversight management and operational direction of the complete project.

The plan is to subcontract the following:

- GEOLOGY with Dr. Craig White, Dept. Geology, Idaho State, Boise.
- HYDROLOGY AND WELL DRILLING OVERSIGHT with Jerry Crosthwaite
- GEOPHYSICS AND GEOLOGICAL REVIEW with EUREKA RESOURCE ASSOCIATES, INC. Computer modeling, and data review.
- ENVIRONMENTAL AND INSTITUTIONAL with ECOVIEW - DR. James Nielson
- Other sub contractors will be contracted for well drilling and logging. Direct Supervision of these subcontractors will be under Eureka Resource, J. Crosthwaite, and ERG.
- ADVISORY BOARD with D.O.E., Jon Zeisloft, U.U.R.I., Dr. Montgomery, Univ. Calif., Berkeley, Leonard A. Fisher, LAFCO (Heat balance Evaluations)

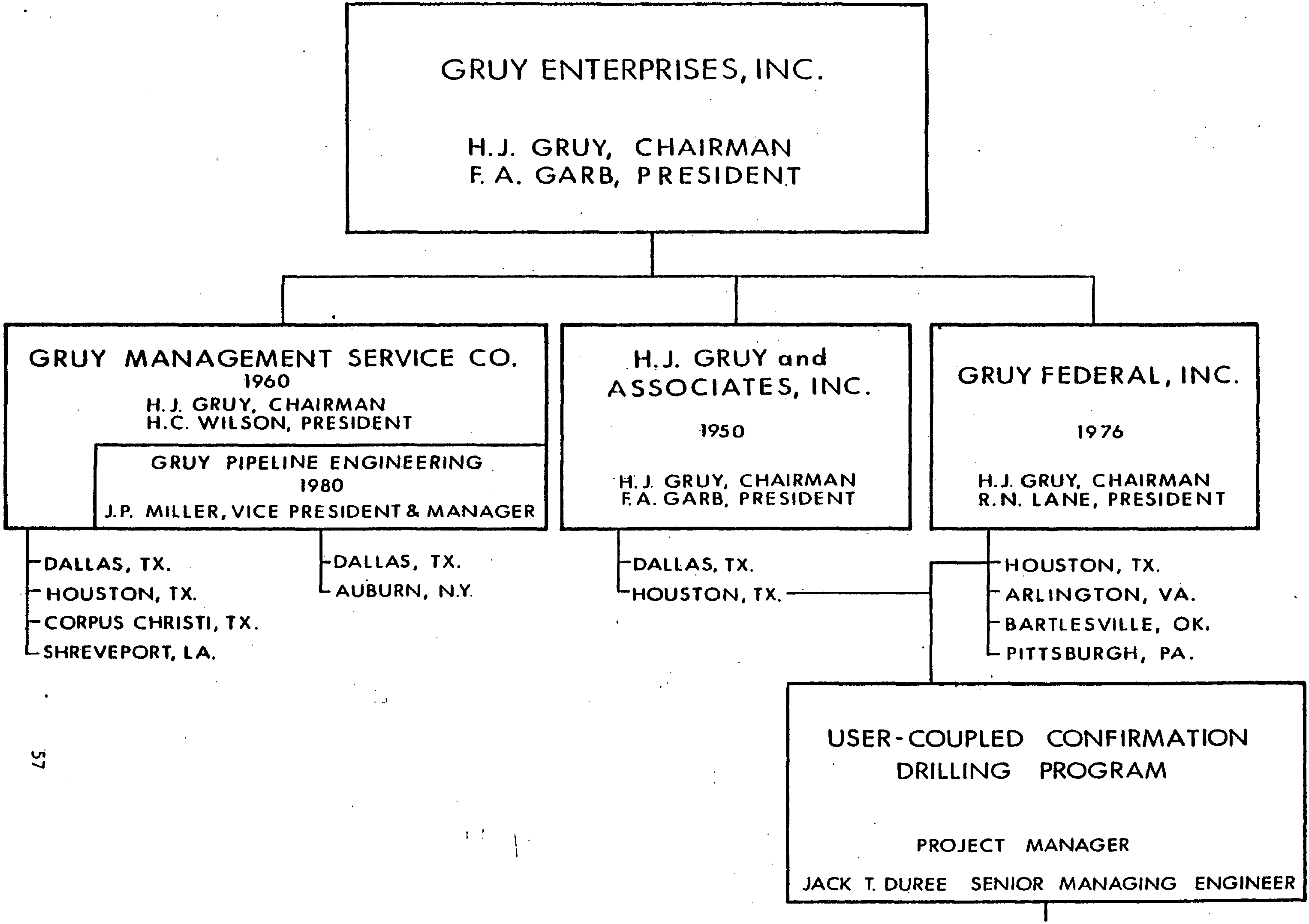
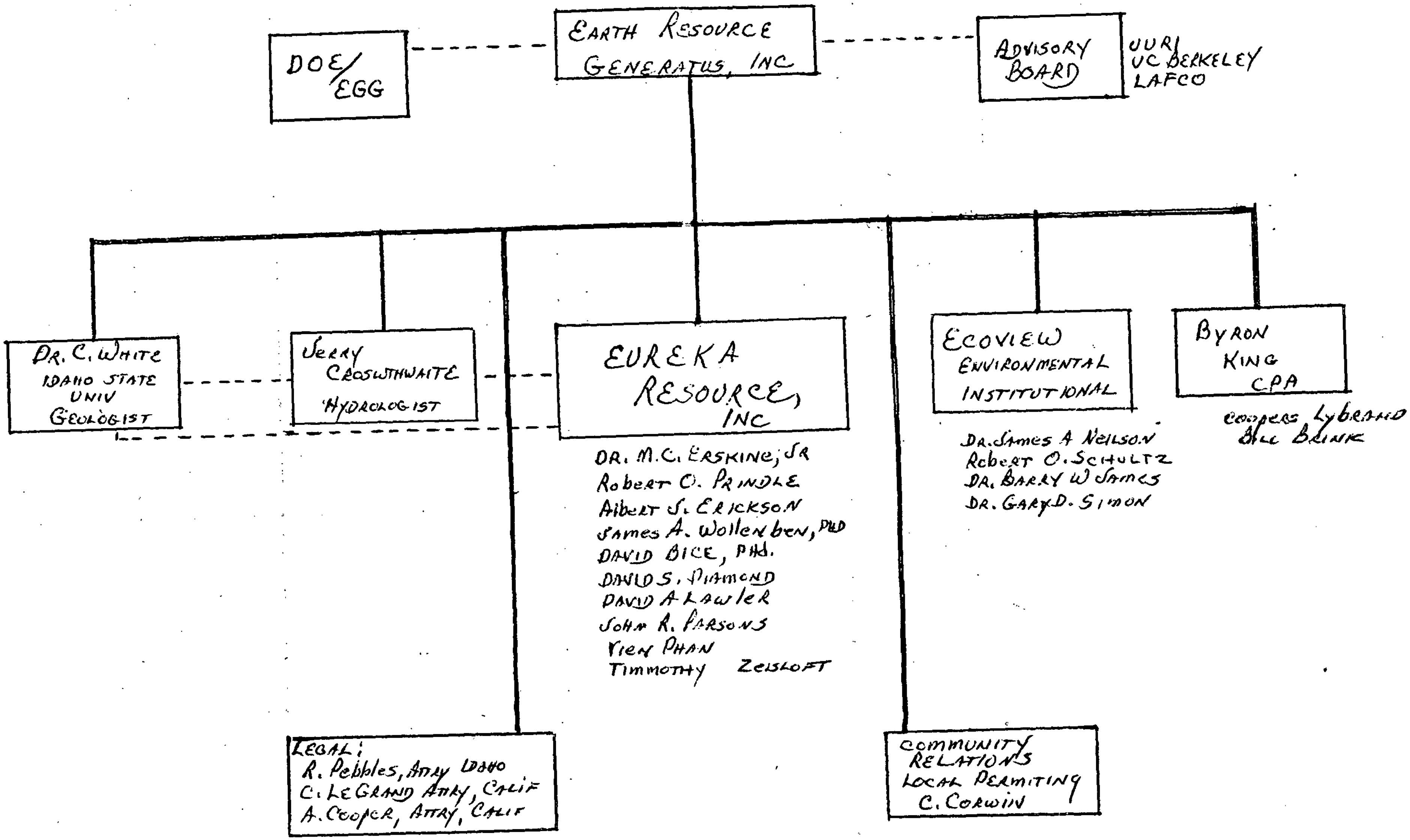


Figure 10 --Gruy Companies organization chart

See Figure 11


DOE/EGG
EARTH RESOURCE GENERATUS, INC
ADVISORY BOARD
UURI
UC BERKELEY
LAFCO
DR. C. WHITE
IDAHO STATE UNIV
GEOLOGIST
JERRY CROSWTHWAITE
HYDROLOGIST
EUREKA RESOURCE, INC
DR. M.C. ERSKINE; SR
Robert O. PRINDLE
Albert J. ERICKSON
James A. Wollenben, PhD
DAVID BICE, PhD.
DAVID S. DIAMOND
DAVID A LAWLER
JOHN R. PARSONS
VIEN PHAN
TIMMOTHY ZEISLOFT
ECOVIEW
ENVIRONMENTAL
INSTITUTIONAL
DR. JAMES A NEILSON
Robert O. SCHULTZ
DR. BARRY W JAMES
DR. GARY D. SIMON
BYRON KING CPA
coopers Lybrand
Bill Brink
LEGAL:
R. Pebbles, Atty Idaho
C. LEGRAND Atty, Calif
A. Cooper, Atty, Calif
COMMUNITY RELATIONS
LOCAL PERMITING
C. CORWIN

earth scientist or engineer who has served the Gruy Companies well on a number of relevant or related projects.

ERG & Subcontractors

The functional management organization established by MRI and Gruy Federal, Inc. (GFI) for this geothermal confirmation drilling project is shown in Fig. 11. Mr. Duree of SUBCONTRACTORS GFI heads a project staff under Mr. Kirkman of MRI. This staff consists of seven teams, six of which are led by senior personnel. The technical support team leader will be assigned at a later date.

Excepting Mr. Charles Corwin, who comes to GFI's staff as a consultant for the Magic Hot Springs Landing confirmation drilling project from the position of chief engineer for Kirkman Realty Company in Ketchum, Idaho, each person in the project organization is a full-time employee of Gruy Federal. No additional persons will have to be hired.

Organization of the GFI Administrative and Financial Office for the project is shown in Fig. 12. Costs of support functions by this office are not charged directly to the project, but are covered by application of the G and A rate.

Mr. Kirkman will not receive salary or fee from this project. Mr. Corwin will be paid a standard consulting rate for the actual time he works, on the basis of a weekly time sheet approved by the Project Manager.

All key technical and support people are under the supervision of the Project Manager. They are the lead engineers or scientists: Corwin, Lohse, Radford, Langston, and Kumar. They are responsible for their individual team performance and report directly to the Project Manager; Daugherty in Administration and Finance operates independently of the project but is responsible for timely and accurate record keeping and reporting.

In the event that DOE or MRI cannot get satisfactory response from the Project Manager, appropriate contact can be made directly with R. N. Lane, president of Gruy Federal, Inc.

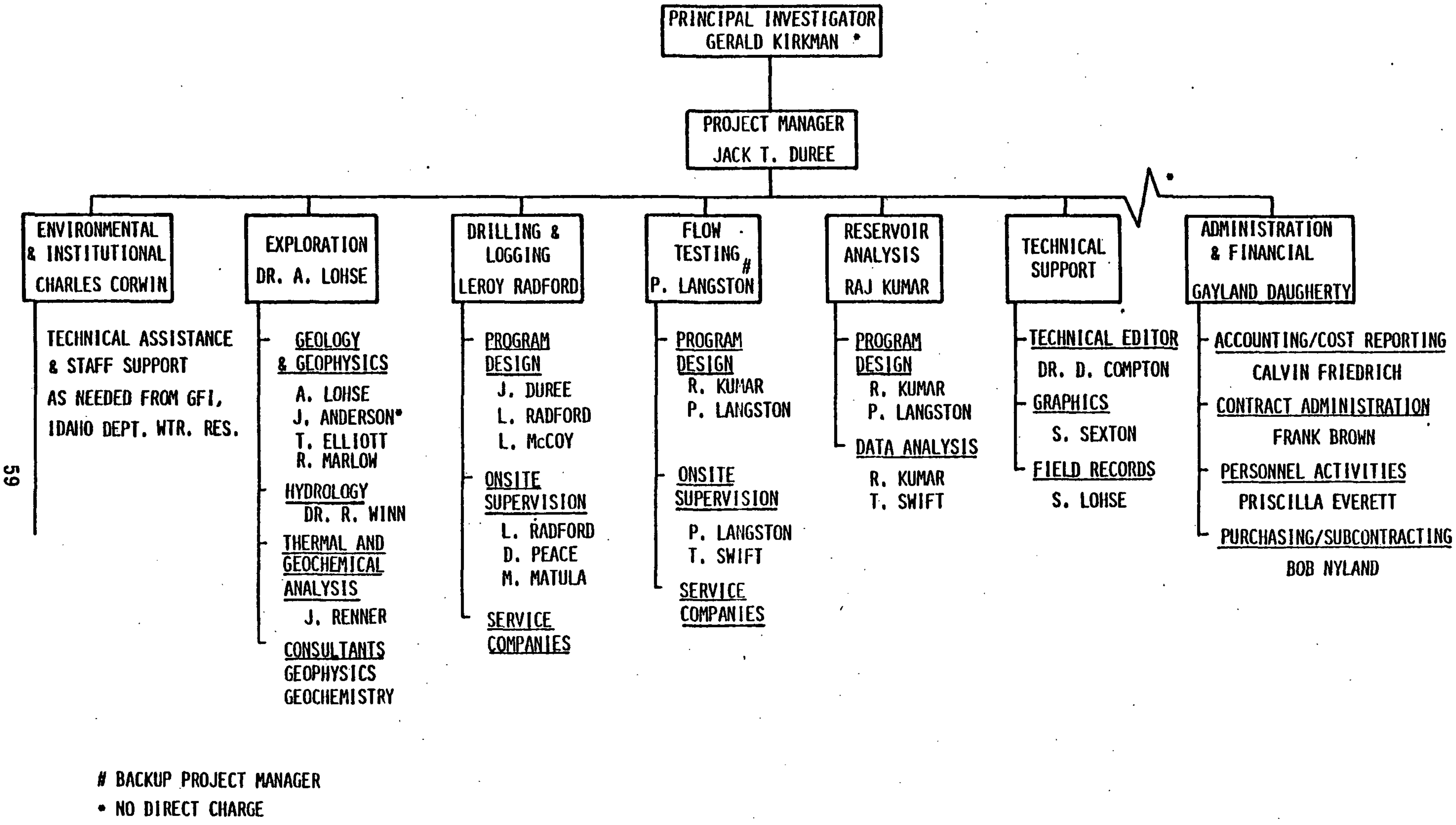
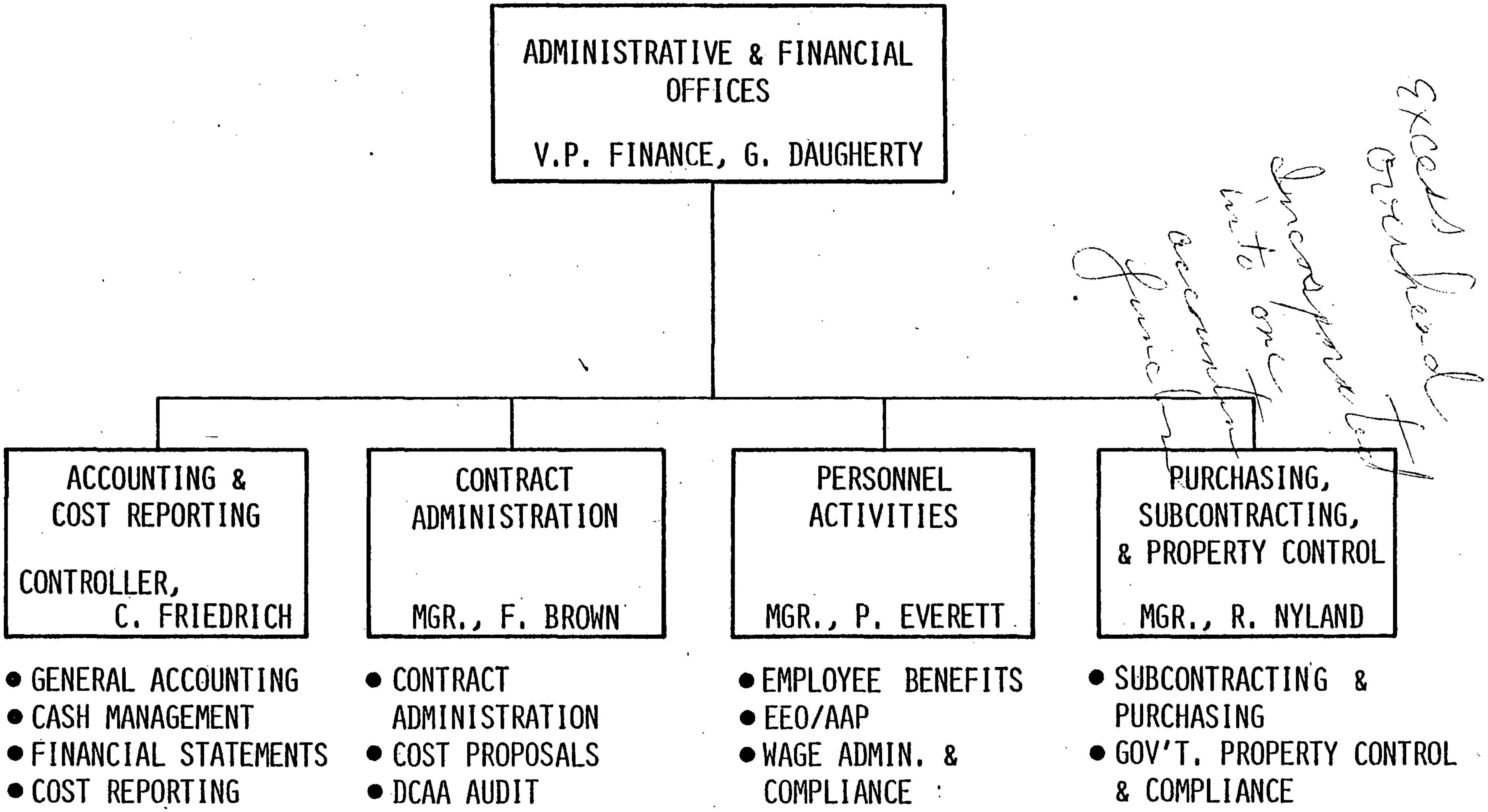


Figure 11--Magic Resource Investors and Gruy Federal management organization chart, User-Coupled Confirmation Drilling Program.

SERVICES COMPENSATED BY G & A RATE APPLICATION
EXCEPT IN FULFILLMENT OF TASK-SPECIFIC FUNCTIONS



Excess overhead incorporated into one accounting function

Figure 12--Organization and management, Gruy Federal administrative and financial offices.

(ii) Project Manager

~~Jack T. Duree, Senior Engineer for GFI and Senior Managing Engineer for confirmation drilling program work,~~ is designated Project Manager, responsible for technical and administrative performance and accomplishment of all goals. This includes meeting short- and long-term work schedules, providing all reporting and deliverables, and achieving the budget. ~~Mr. Duree will be MRI's point of contact with DOE~~ for all technical and support work.

~~Mr. Duree's professional experience includes five years as manager of engineering for geothermal exploitation in the Philippines, during which time 103 geothermal wells were drilled to provide steam for four 110-megawatt generating plants. Before being assigned to the Philippines, Mr. Duree was manager for all reservoir engineering and exploitation geology for Union Oil Company's operations in Canada and Alaska.~~

The Project Manager will manage the project under a systems management program based upon (a) detailed technical and financial planning, control, and reporting; (b) clearly defined lateral and vertical delegation of authorities and responsibilities; and (c) accountability for individual and total performance.

This management program will include:

- time-scaled PERT/CPM network analysis of milestones to be accomplished with paths of work to be followed leading to responsible job completion;
- time-phased expenditure plan consisting of a set of baseline charts of

    - projected average rate of expenditure (straight-line)
    - projected average rate of commitment (stair-stepped)
    - weekly/monthly incremental expenditure
    - weekly/monthly incremental commitment;

- work breakdown structure comparing percent of physical progress of individual jobs between milestones with percent of allocated expenditure per job;

- job descriptions reflecting responsibilities, authorities, reporting procedures and position within overall program management;

- weekly staff meetings between work groups and/or teams and team leaders, to measure progress and coordinate future work, utilizing comparison of work progress and time-phased expenditure plan; identifying any problem areas that might require timely corrective action; and adjusting workloads or refocusing activity as necessary to maintain productivity commensurate with schedules, rates of expenditure, and fulfillment of short-term and long-term goals;

- monthly management meetings between team leaders and the Program Manager, utilizing the same procedures as the weekly meetings and open invitation always extended to other levels of MRI and GFI corporate management; and

- monthly meetings between the Program Manager and all appropriate levels of management in MRI and Gruy Federal, with lower levels of project management in attendance as requested.

Monitoring and management of the project includes weekly reports by the GFI Business Office to the Project Manager of incremental and cumulative man-hours, expenditures, and commitments.

(iii) Lead Technical Positions

Lead persons for the technical work are:

ERG AS NEEDED FOR LOCAL

Charles Corwin, consultant to ~~GFI, is responsible for environmental and~~ institutional matters in fulfillment of Task 2. ~~He will be assisted by Gruy Federal personnel and the guidelines~~ of the Idaho Department of Water Resources. Mr. Corwin is a licensed civil engineer with 10 years' experience in construction, engineering, and environmental planning. He resides in Blaine County, Idaho.

~~Dr. Alan Lohse is GFI's executive vice president and principal scientist. He has more than 25 years of experience including 16 years in industry, principally with the Shell Oil and Monsanto Companies, and 9 years of directing contract research for the Corps of Engineers, U.S. Coast Guard, Energy Research and Development Administration, Environmental Protection Agency, Bureau of Mines, Department of Energy, and other Federal agencies. He has worked in all U.S. petroleum provinces, including the Rocky Mountain basins, and in many mining areas of central Mexico such as Catorce, San Luis Potosi, Charcas, and Zaragoza.~~

~~LeRoy Radford, GFI's senior engineer for drilling technology, will supervise all drilling and logging. Mr. Radford is a graduate geological engineer from the University of Oklahoma in 1941, and is a Registered Professional Engineer in Texas and Oklahoma. His experience is worldwide, including most of the continental United States and the Rocky Mountains, and includes the supervision of drilling more than 1000 wells. He was GFI's field superintendent for the Atlantic Coastal Plain geothermal drilling program.~~

Mr. Radford and his staff of onsite drilling supervisors, Marvin Matula and Dwight Peace, represent almost 100 years of cumulative experience in drilling, testing, and completion in all areas of the Free World, including many wells with temperatures in excess of 400°F and pressure gradients approaching 0.9 psi per foot, or approximately twice the hydrostatic gradient.

Paul Langston, senior drilling supervisor, is in charge of flow testing and conducting the well/reservoir test designed in conjunction with Mr. Kumar and Mr. Duree. Mr. Langston is a graduate engineer with 31 years' experience in all phases of field work from roughneck to operations manager. He has worked around the world, including supervision of deep geothermal wells in Texas, Louisiana, Venezuela, Near East, Indonesia, and Norway. Mr. Langston supervised a portion of Gruy Federal's testing of geopressured-geothermal wells in the Gulf Coast.

Raj Kumar, a senior petroleum engineer with GFI, will head the reservoir analysis program. Mr. Kumar conducted reservoir and economic studies for two years with the Oil and Natural Gas Commission in India before coming to the United States to complete his M.S. in management science and engineering. He joined the Gruy Companies in 1977 after two years of applying his economic and computer programming expertise in oil and gas production. Mr. Kumar's work for Gruy includes extensive work in pressure transient analysis and reserve estimation. He is currently project manager for GFI's gas well testing using flow tests and pressure transient data to evaluate the effectiveness of stimulation techniques in Devonian shales. Mr. Kumar works closely with the Gruy Companies' Research and Development group under Dr. James H. Hartsock, Senior Vice President, in developing and applying advanced calculation and interpretative methods to reservoir testing.

~~Gayland Daugherty is the Financial Services Manager for the confirmation drilling program. He is vice president of finance for GFI, responsible for accounting, contract administration, subcontract procurement, and personnel administration. He works closely with the Project Manager, providing him with weekly estimates of expenditures so that funding can be controlled and reported accurately. GFI's cost control procedures are computerized and provide excellent data on a weekly basis.~~

(iv) Manpower Assignments by Tasks

Table 9 lists specific manpower assignments and accountabilities by Task as set forth in the Statement of Work, Section 6.a.(1).

TABLE 9

MANPOWER ASSIGNMENTS BY TASK

Task 1: Financial

- • J. Kirkman #
- G. Daugherty ∇

Task 2: Environmental and Institutional

- • C. Corwin
- J. Duree and staff
- IDWR #

Task 3: Exploration

- • A. Lohse
- J. Anderson
- T. Elliott
- R. Winn
- J. Renner
- R. Marlow
- UURI #

Task 4: Drilling and Logging

- • L. Radford
- D. Peace
- M. Matula
- L. McCoy

Task 5: Flow Testing

- • P. Langston
- R. Kumar
- T. Swift

Task 6: Injection Well Drilling

- • L. Radford
- D. Peace
- M. Matula

Task 7: Determination of Cost Share

- • J. Kirkman
- G. Daugherty ∇
- J. Duree and staff

Task 8: Project Management

- • J. Duree and staff

Task 9: Reporting

- • J. Duree and staff

Task 10: Dissemination of Information

- • J. Kirkman - news media #
- • J. Duree and staff - technical papers

\# no direct charge

∇ direct charge for task-specific functions

• lead

6.a.(3) Consultants and Contractors

Table 10 lists the consultants and contractors proposed to be used for the Magic Hot Springs Landing reservoir confirmation project, and their function in the project.

Mr. Corwin, as a longtime consultant to MRI, is a principal in developing the Magic Hot Springs Landing project to the present stage of readiness for the DOE reservoir confirmation program. He is thoroughly familiar with the region, the area, and all local facilities and resources. Mr. Corwin will join the MRI CONSULTANTS Project Management staff as consultant to ~~GFI~~ ERG in order to work hand-in-hand with the total technical and financial support organization.

All Contractors listed in Table 10 will be obtained on the basis of best price with respect to availability and experience.

ERG GFI is thoroughly familiar with the qualifications of each type of service contractor customary to the oil and gas and geothermal industries, and also with those extra capabilities that set apart the leaders in each type of service work. We shall strive to obtain those leading companies. We are also aware of the requirement for and shall be prepared for a post-project audit.

6.a.(4) Work Schedule

The Magic Hot Springs Landing reservoir confirmation project is expected to be completed within ~~14~~ 12 consecutive months if the project can commence in time to avoid restrictive winter weather and conflict between our necessary housing and supportive requirements, on the one hand, and the commitment of similar services to winter visitors throughout the area, on the other.

The most suitable period for outdoor work is approximately April 1 to November 1. This period will be utilized if the contract can commence January 15, 1981, following a September 15, 1980, submittal. During that period, work is expected to proceed along the paths from milestone to

TABLE 10

CONSULTANTS AND CONTRACTORS PROPOSED FOR PROJECT

Name or Use	Position	Function
Charles Corwin Dr. James Nielson (Ecoview)	Team Leader, Environmental and Institutional. Consultant to ERG ~~MRI/GFI. Resident of Blaine County, Idaho.~~	Fulfill institutional considerations pertaining to right of access, leases, ownership, rights to use of water and related resources; prepare Environmental Report; Task 3. Further, assist all field operations as required in permits, local contractor resources, site preparation, cleanup, etc.; Tasks 3, 4, 5, 6.
Land Surveyor	Local licensed surveyor	Survey geophysical lines, test hole and production well sites.
Geophysical Survey	Contractor/consultant	Conduct geophysical surveys along preselected tracks, maintain quality control, provide completed job with interpretations. At this point we are discussing methodologies with Seiscom Delta, a major worldwide geophysical company whose work is well known to GFI.
Sign preparation	Local sign manufacturer and painter	Prepare and install appropriate sign(s) in test site area as specified by MRI.
Prepare thermal gradient holes	Drilling contractor	Drill and complete thermal gradient holes as specified.
Log thermal gradient holes	Well testing contractor	Provide equipment and operators; log thermal gradient holes with downhole equipment and methods specified by ERG MRI; repeat each hole three times over period of monitoring; provide data satisfactory for analysis.
Site preparation	Local bulldozer operator	Provide equipment and operator to prepare sites for test holes and production well; restore all sites as prescribed, support geophysical equipment if necessary.

TABLE 10
continued

Name or Use	Position	Function
Drill and complete production test well	Drilling contractor	According to prognosis, drill and complete the reservoir confirmation well maintaining MRI ElG environmental and safety standards; provide, maintain, and operate equipment during period of contract performance without lost time; provide satisfactory onsite supervision; other duties as specified in the contract or conventional to the industry.
Tool rental	Tool rental service company	Provide tools necessary to production well drilling and testing; deliver and service as required.
Mud logging	Mud logging service company	Provide and operate mud logging unit as specified.
Downhole logging	Wireline downhole logging service company	Provide and operate tools necessary to obtain downhole logs specified.
Water analyses	Chemical analysis service company	Conduct water analyses as specified within prescribed ranges of accuracy and tolerance; report results in conventional form or as specified, together with detailed descriptions of analytical methods sufficient for third party inquiry of methodologies and results.

milestone as shown graphically in the Project PERT/CPM* Network Plan, included in the pocket inside the back cover of this proposal.

All project schedule diagrams are time-scaled in 7-day project weeks, and all times are given in weeks.

The project work schedule is shown on three other diagrams in addition to the PERT/CPM Network Plan. These are:

- Project Milestone Schedule, Part A (Fig. 13) showing project dates for completion and reporting of Tasks and Milestones from beginning to end, without an injection (disposal) well,
- Project Milestone Schedule, Part B (Fig. 14) showing project dates for completion and reporting of Task 6, Injection Well Drilling, if Task 6 becomes necessary,
- Project Milestone Schedule, Part C (Fig. 15) showing dates for completion of Task 9, Reporting, and fulfillment of the schedule for all reporting and deliverables.

In summary, the project is expected to be conducted as shown on the PERT/CPM plan, and on Milestone Schedules A and C (without injection well) or B and C (with injection well).

As shown in the PERT chart legend, boxes on the chart represent project milestones, or work accomplished. These milestones can be cross-referenced to the proposal Table of Contents and to the Tasks in the Statement of Work. The arrows connecting the boxes represent activity necessary to achieve the milestones. Numbers on the activity arrows are the time estimates in project weeks for completing the work. These estimates are best guesses, arrived at in consultation with team members.

The PERT/CPM Network Plan is also a logic diagram of the project.

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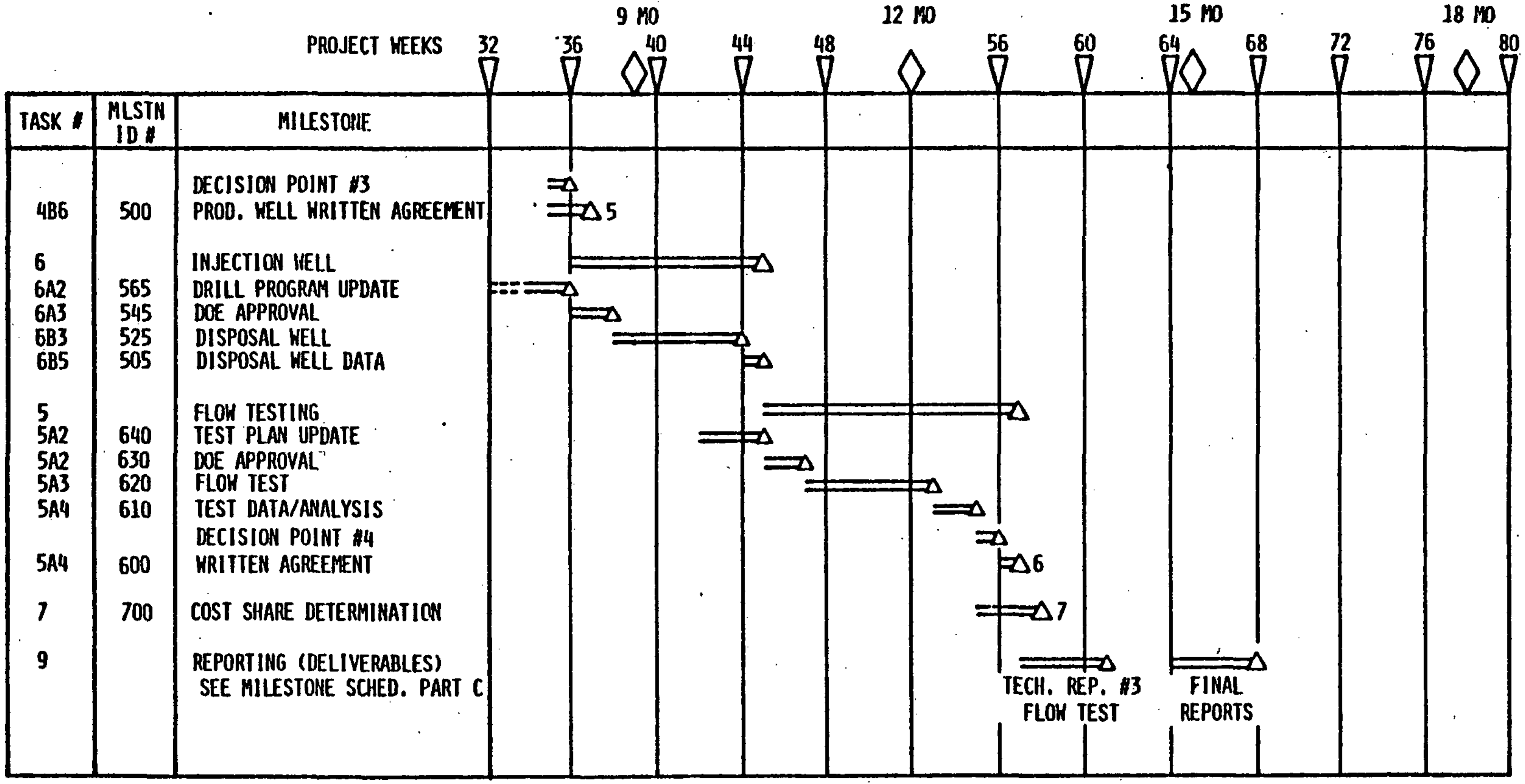
*Project Evaluation and Review Technique/Critical Path Method

MRI MAGIC HOT SPRINGS LANDING USER-COUPLED CONFIRMATION DRILLING PROJECT
PROJECT MILESTONE SCHEDULE - PART B
TASK 6 - INJECTION WELL NECESSARY



TASK #	MLSTN ID #	MILESTONE
		DECISION POINT #3
4B6	500	PROD. WELL WRITTEN AGREEMENT
6		INJECTION WELL
6A2	565	DRILL PROGRAM UPDATE
6A3	545	DOE APPROVAL
6B3	525	DISPOSAL WELL
6B5	505	DISPOSAL WELL DATA
5		FLOW TESTING
5A2	640	TEST PLAN UPDATE
5A2	630	DOE APPROVAL
5A3	620	FLOW TEST
5A4	610	TEST DATA/ANALYSIS
		DECISION POINT #4
5A4	600	WRITTEN AGREEMENT
7	700	COST SHARE DETERMINATION
9		REPORTING (DELIVERABLES) SEE MILESTONE SCHED. PART C

Figure 14--Project Milestone Schedule - Part B - Task 6 - Injection Well Necessary.

MRI MAGIC HOT SPRINGS LANDING USER-COUPLED CONFIRMATION DRILLING PROJECT
PROJECT MILESTONE SCHEDULE - PART C
TASK 9 - REPORTING AND DELIVERABLES

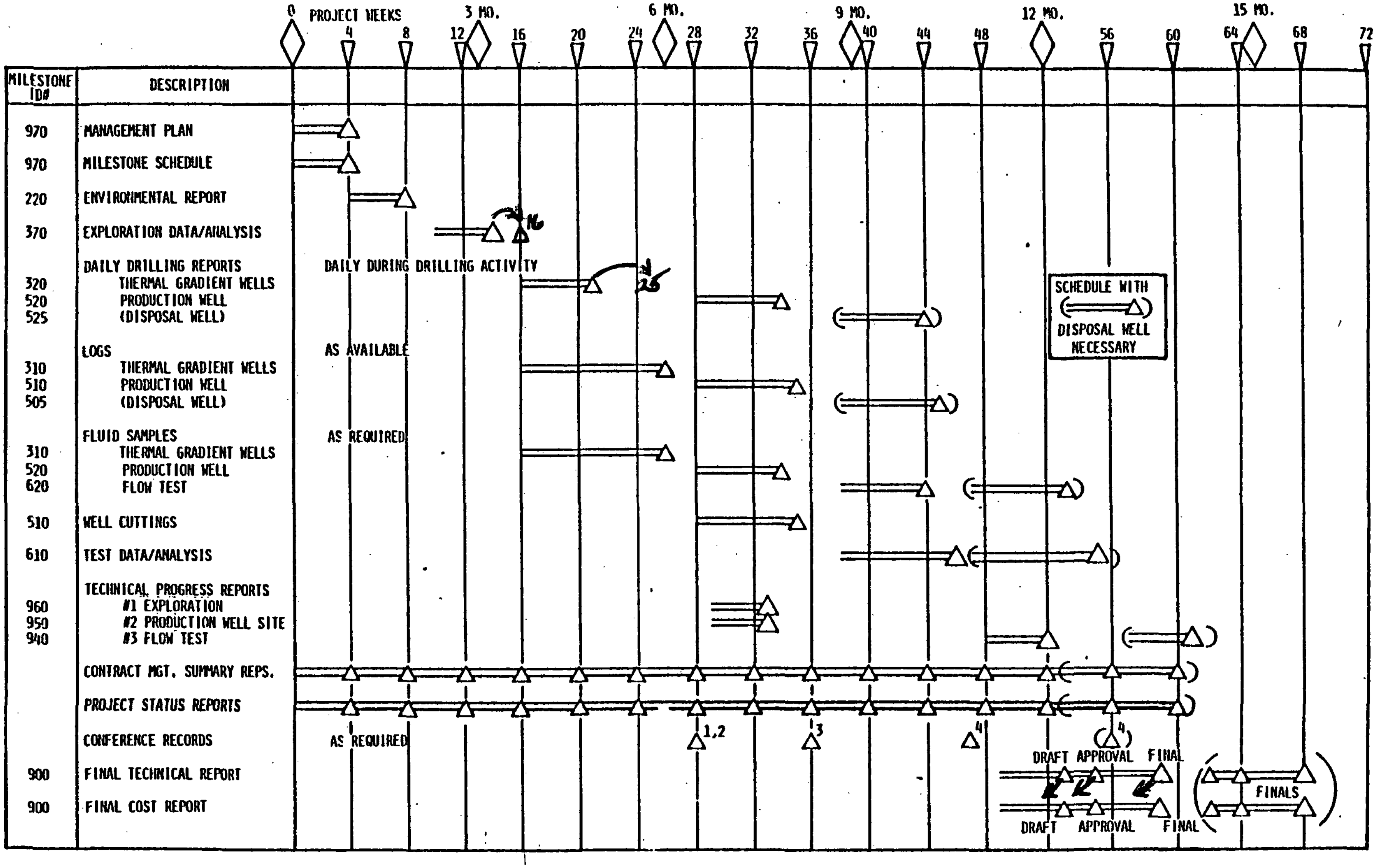


Figure 15--Project Milestone Schedule - Part C - Task 9 - Reporting and Deliverables.

Milestone triangles and activity bars on the Milestone Schedules are the equivalents of boxes and arrows on the PERT chart.

Each PERT chart milestone box contains three numbers or identifiers:

- The number in the lower right corner is the milestone identification number based on the seven major milestones described in the Statement of Work (see Section 6.2.(1)). The notation uses 100 for milestone 1, 200 for milestone 2, etc., to accommodate intermediate and minor accomplishments.

- The number at the upper right corner is the expected cumulative project time of completion of that milestone (the optimum time). From milestone #640 to project completion, the numbers below the slashes are expected later completion times for each milestone should the injection well option become necessary.

- The Milestone Schedule Part A (Fig. 13) is based on PERT chart time without the injection well option; the entire program is estimated at 56 ~~59~~ weeks to completion, final reports delivered. Milestone Schedule Part B (Fig. 14) is based on PERT chart time with the injection well option.

- The number at the lower left corner is the Statement of Work Task number, which cross-references with the Milestone Schedules.

A brief description of the Magic Hot Springs Landing geothermal project as plotted on the PERT chart follows.

Task 1 of this project is complete with the confirmation of the Financial Arrangements, milestone #100, at ~~4~~ 8 weeks.

Task 2, Environmental/Institutional, is complete at ~~10~~ 10 weeks with DOE approval, milestone #200, of the Environmental Report and the lease, permit, and rights arrangements.

TIME EXTENSION FOR REFINEMENT AND GREATER ANALYSIS OF DATA

Review of the time schedule presented on page 71a indicates that the period for review of all data necessary for the determination of test and final wells may be a little brief for the maximum evaluation of all data and the optimum determination of the well sites. Therefore, it is recommended that a two to four week period be inserted in the time frome between the 16th and 25th weeks. This would only be done if further review of available data was agreed upon by Earth Resource Generatus (ERG) and THe DEPARTMENT OF ENERGY (DOE).

Task 3, Exploration, is complete at 28 weeks with the Exploration Data Adequacy Written Agreement, milestone #300, and the Production Well Site Written Agreement, milestone #400. This task includes acquiring and analyzing the exploration data, selecting the thermal gradient drill sites, and submitting these with the bid specifications and proposed subcontracts for DOE approval, milestone #340 at 18 weeks. After approval, the thermal gradient wells are drilled and monitored, the data collected, analyzed, delivered, and passed through Decision Point #1 at 27 weeks to the Exploration Written Agreement, #300. (28 weeks)

Simultaneously, and using from the analysis of the thermal gradient data, a site will be selected for the production well, milestone #410 at 23 weeks. This selection will be passed through Decision Point #2 at 28 weeks to the Well Site Agreement, #400. Should either Decision Point result in a "no-go" decision, the agreement will be terminated at 27 weeks. Should both decisions be "yes-go", the decisions and data will input to the production well phase of the project, along with early Task 4 work.

Task 4 begins with updating the Production Well Drill Program, milestone #560 at 25 weeks, following thermal gradient data delivery and production well site selection from Task 3. The updated program, bid specifications, and proposed subcontracts are submitted for DOE approval, milestone #540 at 27 weeks. Following approval, this work, combined with Task 3 data and decisions, feeds into drilling and completion of the production well, milestone #520 at 33 weeks. The production well data are delivered into Decision Point #3 and on to the Production Well Written Agreement, milestone #500 at 36 weeks, which completes Task 4

Following delivery of the production well data and Decision Point #3, Task 5 begins with updating the Flow Test Plan and tentatively arranging for testing services. This will be carried out simultaneously with production well completion and data delivery. This plan and the tentative arrangements are submitted for DOE approval, milestone #630 at 36 weeks. After approval, the flow test is initiated at 36 weeks and completed at 42 weeks, milestone #620. The flow test data are analyzed and delivered at 44 weeks, milestone #610, and passed through Decision Point #4 at 45 weeks to the Flow Test Written Agreement, milestone #600, at 46 weeks. This completes Task 5.

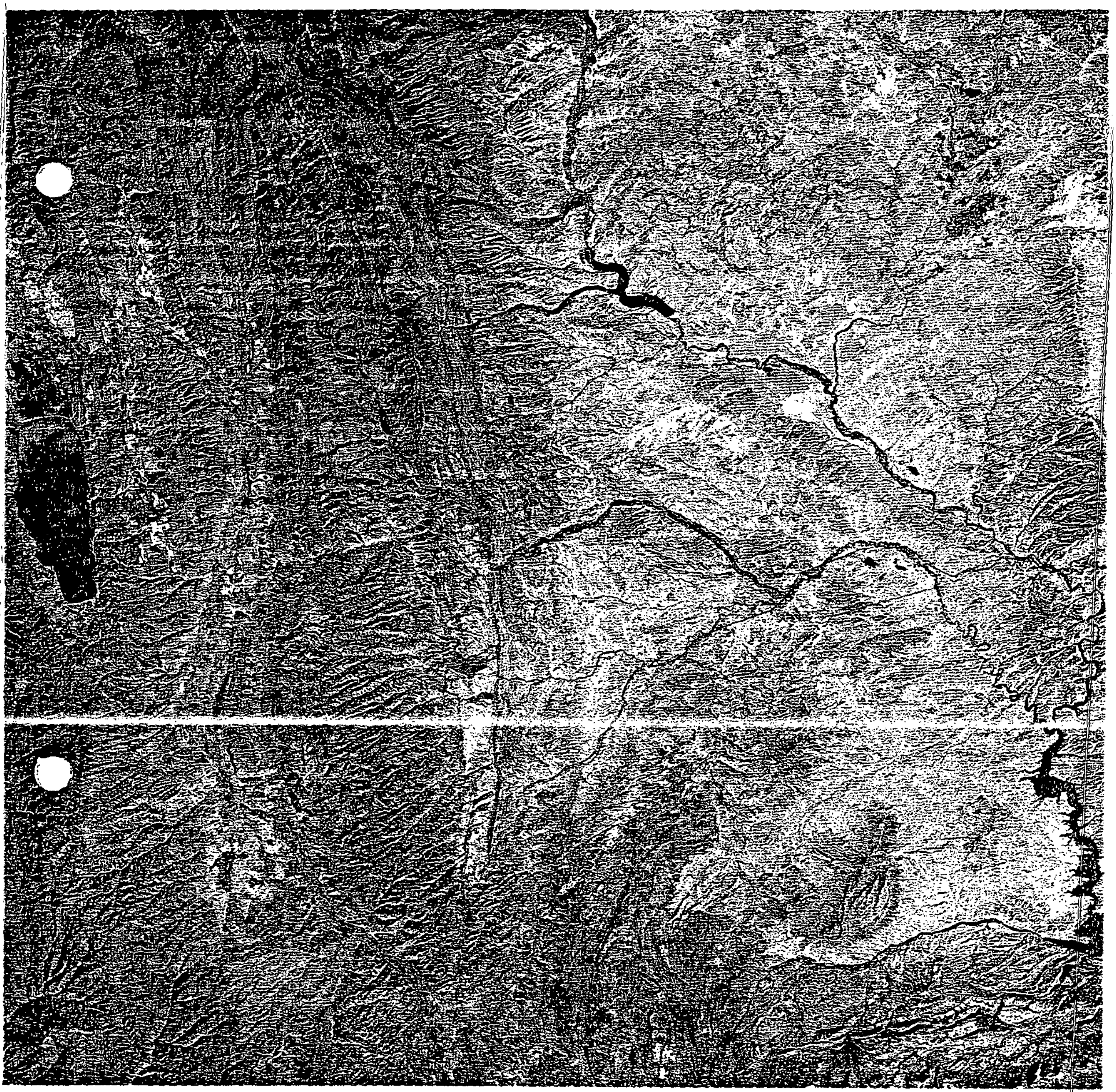
Task 6, Injection Well, is built into the project as an optional task. Should it become necessary to go to subsurface disposal, the disposal well module (see insert in PERT chart) will be inserted at 36 weeks, immediately before milestone #640. This will back up all completion dates from this point by 9 weeks. (See Milestone Schedule Part B, Fig. 14, for schedule details.)

Task 7, the Determination of Cost Shares, begins at 44 weeks with the input of the test data, the decisions from the Test Agreement, and the data and decisions from all previous tasks and Written Agreements. Task 7 should be complete by 48 weeks, milestone #700.

The Final Draft Technical and Cost Reports will synthesize the data and decisions from all previous task work, Technical Progress Reports, and the Cost Share Determination. The drafts should be delivered by 52 weeks and, following DOE approval, the final reports should be delivered at 58 weeks. With the injection well module inserted into the schedule, final reports and project completion would be at 67 weeks.

ERC MRI will use the PERT/CPM and the Milestone Schedules for continuous monitoring and assessment of project progress, funds and labor expenditure, and reporting.

Funding and manpower estimates are coordinated with these schedules and milestones, and are easily planned and monitored along with progress. For reporting purposes a summary version of the Milestone Schedule is included with the monthly letter report; both charts are revised and updated as necessary.



Digitally enhanced Landsat image of the Utah-Wyoming Overthrust

Exploration Consultants
Geologists-Geophysicists

EUREKA Resource Associates, Inc.

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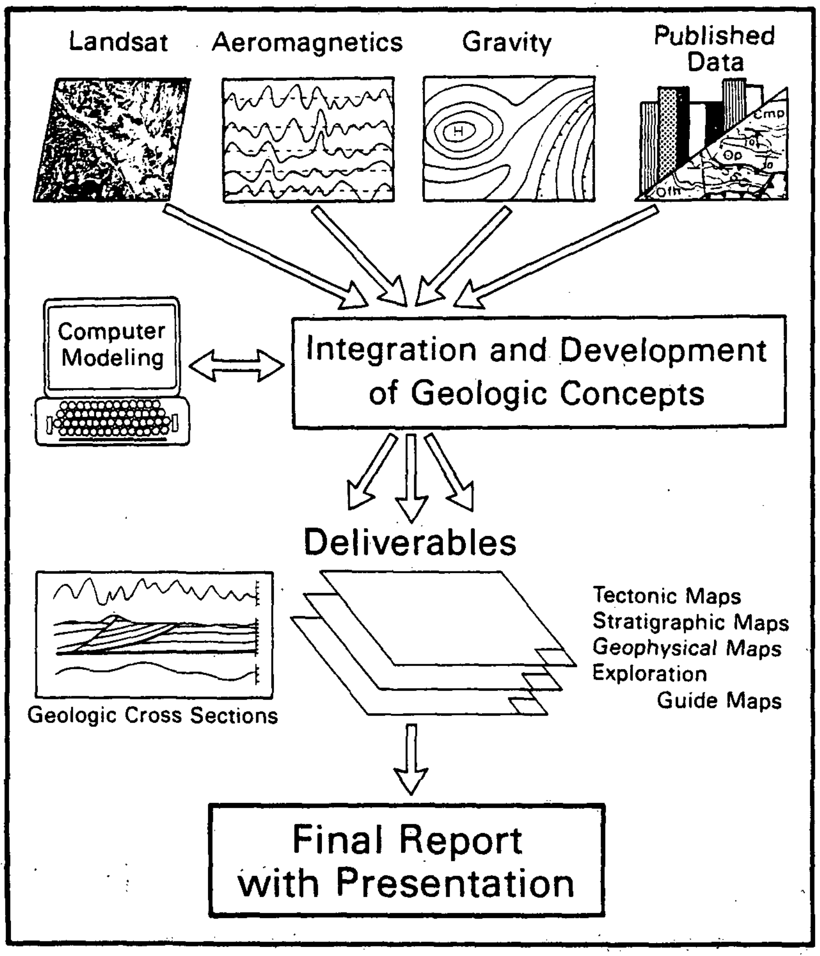


Eureka's integrated studies draw on many types of data which are synthesized in the final report and deliverables.

Integrated Approach

Basic data Eureka gathers for a typical project are:

- Digitally enhanced Landsat imagery, processed and printed by the most advanced methods available.
- Custom-flown aeromagnetic surveys, processed to produce the most accurate representation of surface and subsurface magnetic bodies.
- Carefully edited published gravity data (supplemented with measurements taken by Eureka), gridded and contoured to produce precise profiles and maps.
- All relevant studies and data on the project area, including well data, meticulously researched and reviewed.
- Our intensive geologic analysis is guided by (1) Eureka's interactive gravity and magnetic computer modeling, and (2) evolving conceptual geologic models, to produce a coherent interpretation of the project area's geologic structure and resource potential, including specific targets.

→

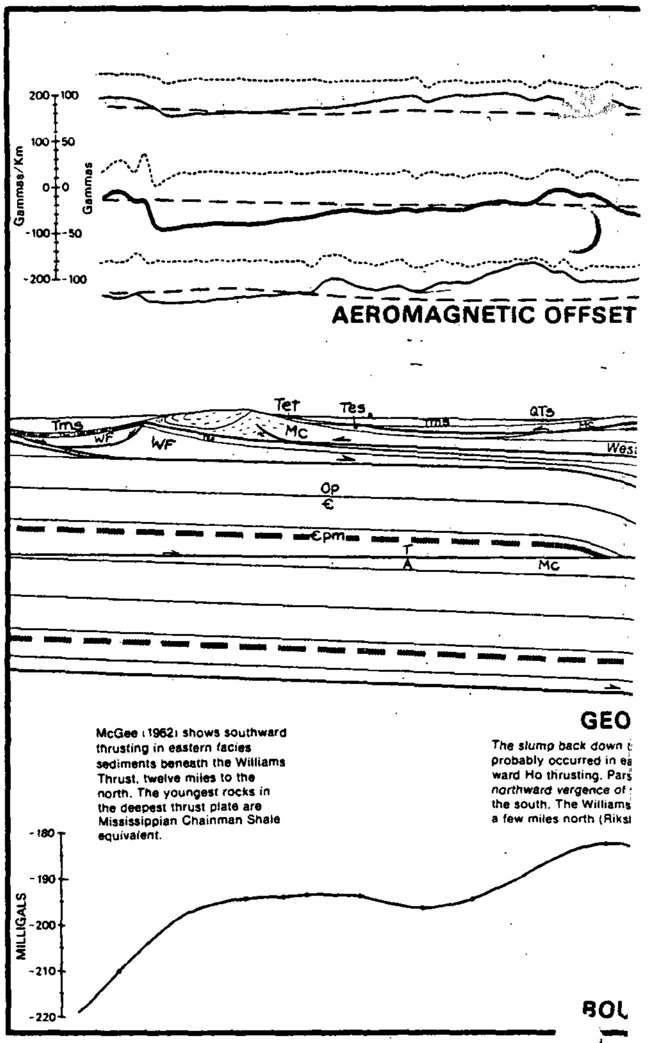
Sample cross section from Basin-Range petroleum study, as delivered to clients. Aeromagnetic and gravity profiles along the line of the section guide the geologic interpretations.

EUREKA

Eureka Resource Associates, Inc., specializes in providing integrated resource evaluation surveys to the petroleum, geothermal, and mineral industries for use in reconnaissance exploration.

Employing a unique multidisciplinary approach, Eureka develops cost-effective regional interpretations that enable our clients to choose and evaluate specific targets prior to more intensive study.

Eureka's broad-based methodology ranges from basic geology and geophysics to the most sophisticated satellite image interpretation and computer modeling, applied in the context of the latest advances in plate tectonic theory.



Aeromagnetic and Gravity Surveys

Eureka specializes in designing and executing high-resolution (up to 0.1 gamma sensitivity), diurnally corrected aeromagnetic surveys. Survey specifications such as flight-line lengths and spacings, tie lines, and elevation control (drape-flown or constant barometric) are tailored to suit clients' requirements.

Eureka's field crews routinely make hundreds of gravity measurements in critical parts of many project areas; these additions to the often sparse published gravity data are invaluable to careful modeling.

For each survey, meticulous editing and state-of-the-art gridding, contouring, filtering, and surface display routines provide maximum versatility in presenting and interpreting the geophysical information.

Computer Modeling

Eureka's recently expanded interactive computer facilities produce easily interpreted, quickly modified representations of subsurface structure, allowing us to model gravity and magnetic data economically and with high precision.

The real-time nature of Eureka's two-dimensional modeling enables the interpreter to use other data sets (regional and local geology, imagery interpretation, drill hole data, other geophysical data); this results in far more advanced interpretations than gravity and aeromagnetic data alone would permit.

Digitally Enhanced Landsat Imagery

Taking into account such factors as sun angle, vegetation type and density, and cloud cover, Eureka selects the images best suited to structural mapping from the EROS data bank.

These images are digitally processed to produce detailed, high-resolution scenes that are easier to interpret for geologic content than the standard EROS optical enlargements to the same scale. Then color-composite photographic enlargements are made, resulting in a vivid, high-contrast image far superior to the conventional EROS image.

In addition to supplying digitally enhanced Landsat imagery along with our energy exploration surveys, Eureka supplies individual frames covering any area our clients may specify.

Gravity map overlay to Landsat imagery permits close comparison of geophysical anomalies and geologic structure.

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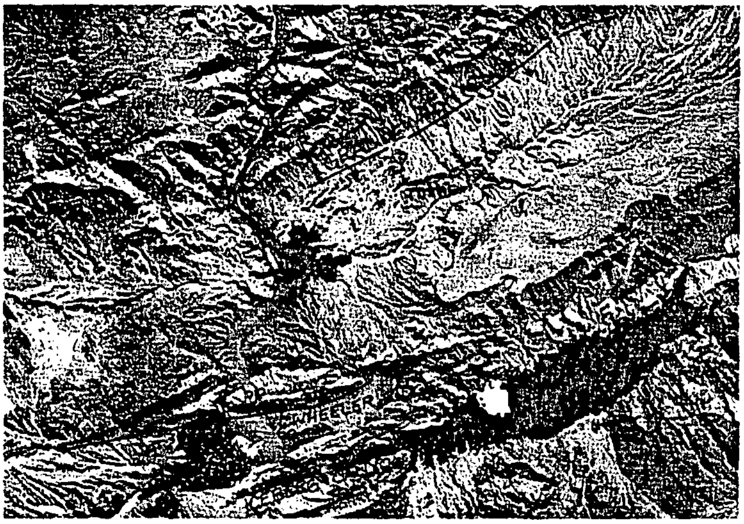
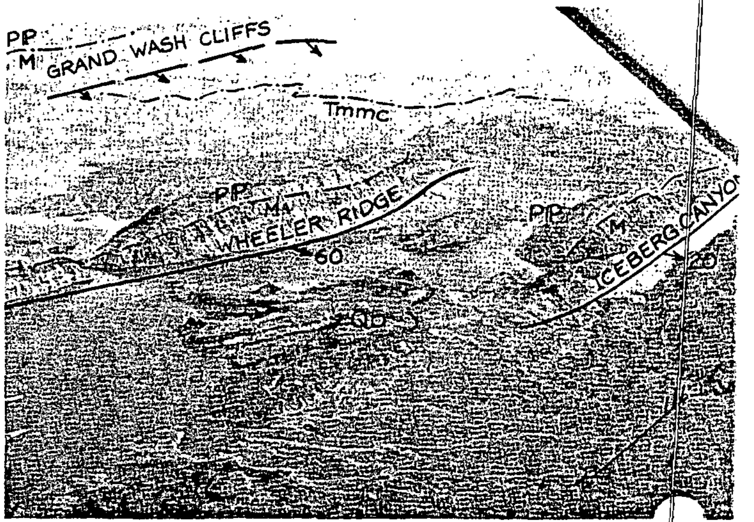
Low-altitude aerial reconnaissance (right) by Eureka geoscientists enhances Landsat interpretation (left) where crucial relationships have not been mapped in detail.



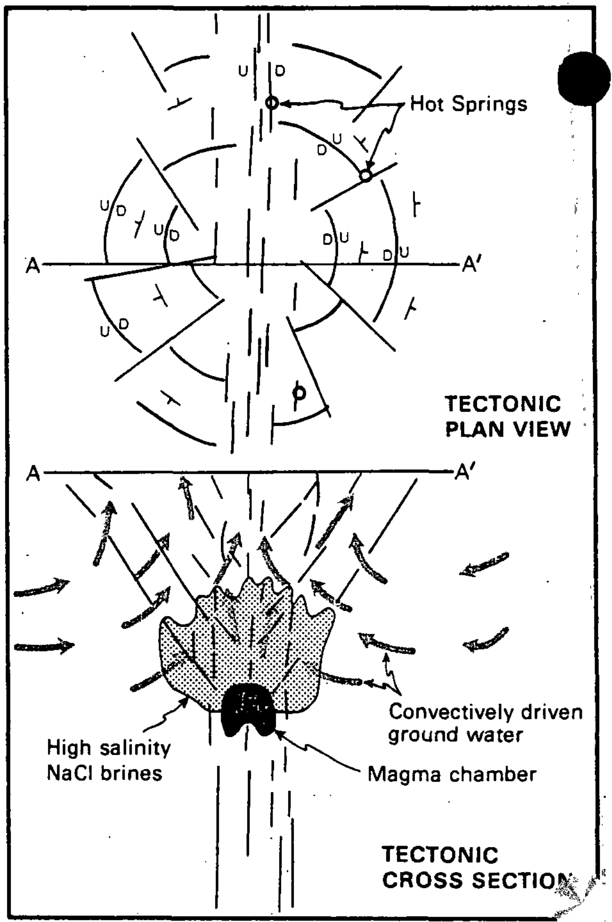


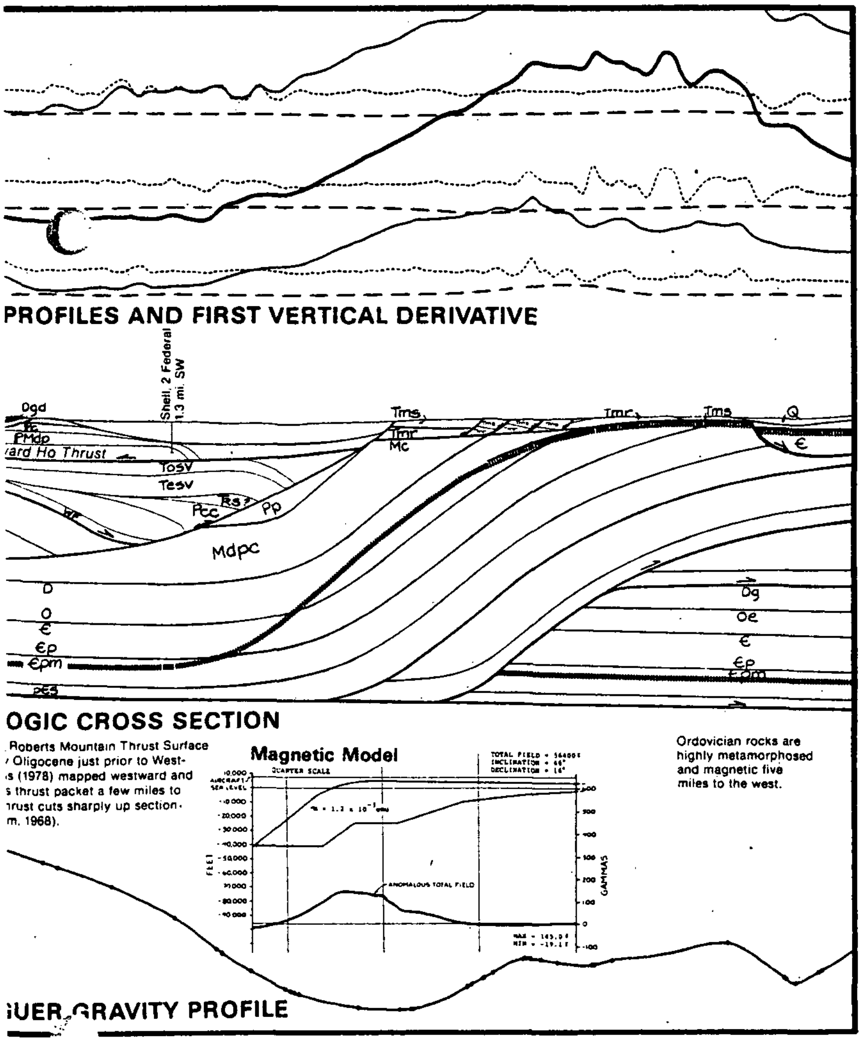
-The Company

Eureka's professional staff is a highly motivated group of geoscientists experienced in many aspects of exploration surveys: structural geology, potential field geophysics, stratigraphy, petrology, data processing, and cartography. Their combined skills include expertise in data acquisition and reduction, experience in synthesizing several types of data, and the knowledge and imagination required to apply new concepts and models to geologically complex regions.

Founded in 1976, the company now has more than 30 employees and serves a wide range of clients in the exploration industry with both proprietary and group participation surveys.

Model intrusive geothermal system. Landsat interpretation of fracture patterns helps identify targets. →





Sample List of Deliverables
(Petroleum Study)

- Composite Prospect Map. Summarizes conclusions on hydrocarbon potential and target locations. Scale 1:192,000.
- Landsat images. Color-composite, digitally enhanced images that completely cover the project area. Scale 1:192,000, suitable as base for overlaying other deliverables.
- Tectonic map. Compilation of critical geologic and geophysical interpretations. Scale 1:192,000.
- Cross sections. A set of cross sections showing final interpretations of subsurface geology, plotted along with potential field data profiles. Scale 1:96,000.
- Isopach maps. Present-day thicknesses of selected strata. Scale 1:192,000.
- Well Location Map. With available formation tops. Scale 1:192,000.
- Final Report in two volumes. Discusses fully the data and interpretations, and presents reduced copies of the plates and cross sections.
- One-day oral presentation at time of delivery.

Resumé's

David A. Lawler, Geologist, earned his B.A. and M.S. in Paleontology from the University of California at Berkeley. Before coming to Eureka, he was involved in Resource Analysis of Planning Units with the Bureau of Land Management, U.S. Department of the Interior, Winnemucca and Carson City Districts. At Eureka, he specializes in the stratigraphic aspects of frontier basin studies.

* * *

John R. Parsons, Chief Cartographer, supervises the cartographic and drafting operations at Eureka Resource Associates. He is responsible for compiling and managing cartographic resources, as well as for the design and production of Eureka's various graphic presentations. He earned a B.S. in Natural Resources from the University of California at Davis and an M.A. in Geography from the University of Kansas, specializing in cartography. His studies and interests center on making the map a more useful tool for communication through improved design.

* * *

Vien Phan, Senior Data Analyst, received his B.S. in Mechanical Engineering from Laval University, Quebec, and his M.S. in Mathematics from the University of Texas at Austin. Before coming to Eureka, he served as a consultant in computer programming and data analysis at the University of California at Berkeley. At Eureka, Mr. Phan oversees the application of computer technology for the purpose of reducing, analyzing, and presenting geophysical data in a form that is usable by Eureka's geologists and geophysicists. He is also responsible for data archive management and documentation.

CLIENT LIST

Aerial Surveys, Inc.
Altex Oil Corporation
Amerada Hess
Aminoil, U.S.A.
Amoco Production Company
Anadarko Production Company
Apache Corporation
Argonaut Energy Corporation
Atlantic Richfield Company
Bank of Montreal (California)
Champlin Petroleum Company
Chevron Resources Company
Cities Service Company
Dow Chemical, U.S.A.
Dumm Steam Company
Earth Satellite Corporation
Elf Aquitaine Oil and Gas
Exxon Company
Getty Oil Company
Gold Fields Mining Corporation
Gulf Oil Exploration & Production
Home Petroleum Company
Hunt Oil Company
Knight Royalty Corporation
Lear Petroleum Exploration, Inc.
Marathon Oil Company
Oxy Petroleum, Inc.
Pacific Energy and Minerals
Patrick Petroleum Company
Phillips Petroleum Company
Roseland Oil & Gas, Inc.
Sohio Petroleum Company
Sunmark
Sunoco Energy Development Company
Terra Resources, Inc.
Texaco, Inc.
U.S. Geological Survey (through Aerial Surveys, Inc.)
Wexpro Company

* * *

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EUREKA Resource Associates, Inc.
Exploration Consultants

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PROFESSIONAL STAFF

The President of Eureka is M. C. Erskine, Jr., an internationally recognized exploration geologist. Dr. Erskine was educated at the Colorado School of Mines (Geological Engineer in Mining Geology) and the University of California at Berkeley (M.S. in Geochemical Exploration and Ph.D. in Geophysical Exploration). He has extensive experience in geothermal, mineral, and petroleum exploration. Dr. Erskine served as chief geologist and director of geologic exploration for Earth Satellite Corporation, and directed exploration in Alaska and Wisconsin for the Minerals Department of Humble Oil and Refining Company. Dr. Erskine is a registered professional geologist in the State of California.

* * *

Robert O. Prindle, Vice President, received his B.S. in Geological Sciences from the University of California at Berkeley, and attended graduate school at the University of Southern California. He has a broad background in managing geothermal and petroleum exploration programs and in interpreting geophysical data. Mr. Prindle was formerly associated with Earth Satellite Corporation where he was involved in a number of base metal and geothermal exploration programs in the western United States and Brazil. Prior to that, he worked for Geometrics and Varian Associates where he was involved in planning surveys and the geological interpretation of aeromagnetic data.

* * *

Albert J. Erickson, Senior Geophysicist, earned his B.S. in Physics at Brown University and his Ph.D. in Geophysics at the Massachusetts Institute of Technology and the Woods Hole Oceanographic Institution. His experience includes the theoretical investigation of heat transfer by mechanical means, measurement of heat flow in deep ocean bore holes, and practical geothermal exploration in many parts of the world. Prior to joining Eureka, Dr. Erickson was employed by Geonomics, Inc. where he was responsible for the acquisition and interpretation of DC electrical resistivity and magnetotelluric data. At Eureka, he is responsible for the reduction and interpretation of geophysical data, and the integration of these geophysical interpretations with other types of geological data.

James A. Wolleben, Senior Geologist, earned his B.S. in Geology from the University of Southern Mississippi, his M.S. in Geology from Louisiana State University, and his Ph.D. in Geology from the University of Texas at Austin. He has years of experience in stratigraphy, sedimentology, and structural geology, and has worked extensively in the southwestern United States and Mexico. Prior to joining Eureka, Dr. Wolleben was a Senior Project Geologist at Gulf Research and Development. At Eureka, he is responsible for the integration and interpretation of sedimentologic, stratigraphic, and structural data.

* * *

David Bice, Geologist, received his A.B. and M.A. in Geology from the University of California at Berkeley, and has recently finished working on his Ph.D. in Geology. His experience includes volcanology and correlation of subsurface-to-surface geology for geothermal energy development in Nicaragua while employed for the California Energy Company. He also was involved in overseeing the initial development of a stibnite prospect in Nicaragua for ROTOWA, S.A. Prior to coming to Eureka, Dr. Bice was a software consultant for United Scientific Corporation. He has also worked as an engineering geologist for the U.S. Forest Service and Woodward Clyde Consultants. At Eureka, he is involved in structural interpretation for frontier basin studies and geothermal exploration projects.

* * *

David S. Diamond earned his B.A. in Geology from the University of California at Berkeley. He has had experience in geologic mapping and field work in east-central California, as well as in preparing and testing samples in the Rock Mechanics Laboratory of the University. As a geologist at Eureka, Mr. Diamond develops cross sections using published geologic references, Landsat imagery, and computer modeling of aeromagnetic and gravity data. He assists in the development of isopach maps from published drill hole data, and also aids in the preparation of reports and coordinates the production of plates and maps with the cartography staff.

RESUME

NAME: Timothy Dean Zeisloft

ADDRESS: Rt. 2 P.O. Box 482 Crescent Br. Golden Co. 80401

TELEPHONE: (303) 642 7720

PERSONAL DATA: Single, 5 Ft. 11 In., 190 lbs, good health; 26 years old.

EXPERIENCE:

1981	COLO. SCHOOL OF MINES, Golden, Colo., Masters Degree pending in geophysics.
Nov. 1979 to present	MICROGEOPHYSICS CORP., Wheatridge, Colo., B. Dorman, Supervisor. Geophysicist - Acquisition and interpretation of electrical data. Duties include design, construction and use of field equipment, design and modification of software and interpretation of data.
July 1978 Oct. 1979 200 W. [illegible] Rd. ([illegible]) 247-7251 (325-0857)	NEWMONT EXPLORATION LTD., Tucson, Az., M.J. Davidson, Supervisor. Geophysicist - Acquisition of gravity, Schlumberger, I.P., and EMP data; testing of prototype digital EM systems; modification of EM systems; development of geophysical and system software and data processing.
Sept. 1977 May 1978	Colo. School of Mines, Golden, Colo., Mike M. McGrath, Supervisor. Computer consultant - Debugging of Fortran programs; general consulting for Basic, Fortran and operating systems on PDP-10 computer.
May 1977 Aug. 1977	OCCIDENTAL GEOTHERMAL, Bakersfield, Ca., R. Crewdson, Supervisor. Acquisition of gravity, magnetics and temperature data. Surveying of gravity stations by theodolite and altimeter.
Sept. 1976 July 1978	Colo. School of Mines, Graduate student in geophysics. Courses included Fourier analysis, tensor analysis, communication theory and a electrical prospecting. Thesis topic - Magnetotellurics.
Jan. 1976 Aug 1976	GROUP SEVEN INC., Golden, Colo., J. Jordan, Supervisor. Geophysicist - Acquisition of Schlumberger and TDEM data; experience with squid magnetometers.
May 1975 Aug 1975	ARCO, Dallas Texas L. Fahle, Supervisor. Field geophysicist - Experience in all parts of reflection seismic acquisition.
1971-1795	Colo. School of Mines B.S. Awarded Dec. 1975 in engineering geophysics.

CHARLES H. CORWIN

Keep!

Areas of Expertise

Civil engineering
Environmental planning
Land and lease matters

Mr. Corwin is a consultant to Gruy Federal, Inc.

He received a B.S. in applied arts from Arizona State University in 1958, a B.S. in civil engineering from the University of New Hampshire in 1965, and an M.S. in civil engineering from the University of Southern California in 1970.

From 1955 to 1975 Mr. Corwin served as an officer in the U.S. Air Force. Approximately one-half of his time was devoted to civil engineering duties, including a tour as base engineer in Southeast Asia during the Vietnam conflict.

After leaving the Air Force, Mr. Corwin worked as an engineer for the consulting firm of JVB Engineers, Inc., a civil engineering firm with several offices in the State of Idaho. During that time his principal assignment was on the design of a municipal water system.

Since 1979 Mr. Corwin has been an engineering consultant and has worked on the Magic Hot Springs project since the land was purchased by MRI. He has also served as a county commissioner for Blaine County.

Mr. Corwin is a member of the National Society of Professional Engineers and an associate member of the American Society of Civil Engineers, and is a Registered Professional Engineer in the State of New Hampshire.

JEROLD R. KIRKMAN

Keep!

Areas of Expertise

Developmental planning
Real estate development

Mr. Kirkman is general manager of Magic Resources Investors, president of J. R. Kirkman Development Inc., and owner of J. R. Construction Co.

He studied business administration at Idaho State University for two years in 1968 and 1969.

Mr. Kirkman has ten years' experience in business in the Sun Valley area. In 1970 he founded J. R. Construction Co., a home-building and general construction firm, which by the mid-1970s was the largest company of its kind in the Sun Valley area. Later he established J. R. Kirkman Development Inc., planning and building new subdivisions and conducting research and development in other related fields.

At present he is general manager of Magic Resources Investors, in charge of development and geothermal field research.

ECOVIEW Environmental Consultants

Senior Consultant and Management Coordinator:

NEILSON, JAMES A., Plant Ecology and Environmental Consultant, University of California, B.S. 1947. University of California, M.A. 1961. University of California, Ph.D. 1963. Self employed agricultural production and marketing management 1947-61. Associate Professor of Biology, Wilberforce University, Ohio, 1964-65. Chemistry Department of Biology and Dean of College of Liberal Arts, Wilberforce University, 1965. Associate Director of Cooperative Education for Biology and Physical Science, Antioch College, Ohio, 1966-67. Project Botanist, Icefield Ranges Research Project, Yukon Territory, 1967. Self employed as educational consultant and management, 1968-69. Assistant Research Ecologist, Institute of Ecology, University of California, Davis, 1969-present. Founder and President of Ecoview Environmental Consultants, 1969-present.

Societies and Affiliations:

AAAS, Sigma Xi, Botanical Society of America; Ecological Society of America; Arctic Institute of North America; Alpha Zeta; California Native Plant Society.

Research, Interests and Professional Activities:

Ecological research of the preservation, maintenance and restoration of native vegetation in the Lake Tahoe Basin; Vegetation survey of the Lake Tahoe Basin, including Flora; Environmental Impact Studies and Techniques throughout central California; Environmental Inventory and analysis of the Walnut Creek Watershed, Contra Costa County. Impact of Urbanization on Vegetation in the Tahoe Basin. Instructor: the Vegetation of California. Investigations of plant communities and soil-water-plant relationships on glaciated soils in the Sierra Nevada and St. Elias Ranges of western U. S. Ecology of root systems of plants of California annual range type growing in competition. Taxonomy and ecology of short-podded lupines in California. Plant exploration in Yukon Territory of Canada.

Pertinent Publications (21):

1973. "An Environmental Inventory of the Walnut Creek Drainage," senior consultant and editor. 400 pp. U. S. Army Corps of Engineers.

1973. "Some Environmental Aspects of the Napa Valley Wine Producing Area." Senior consultant and editor. 75 pp. County of Napa.

1973. "Environmental Impacts on the biota of Strawberry Point Spit and Lagoon." A report to Karl Treffinger and Associates. San Francisco.

1974. "Environmental Impacts of Geothermal Development of Pacific Energy Corp. and Geothermal Kinetics Systems, Inc., Leaseholds at The Geysers, California." 205 pp. Sonoma County Planning Department.

[illegible] Environmental Consultants

Senior Consultant:

BARRY, W. JAMES, Soils and Environmental Horticulture, B.S. Soil Science, University of Nevada, 1963. M.S. Environmental Horticulture, University of California, 1966. Ph.D. Plant Ecology, University of California, 1972. Surveying and Engineering, 1956-63. Landscape architect, 1964-66. Research technician, environmental horticulture, 1966-68. Landscape Design and Consultant, 1969-71. Environmental Specialist, California Department of Parks and Recreation, 1971-present; Ecological Consultant, 1971-present.

Societies and Affiliations:

Ecological Society of America, California Botanical Society, American Society for Horticultural Science, Soil Science Society of America, California Horticulture Society.

Research, Interests and Professional Activities:

Environmental analysis of natural ecosystems for public use; use of fire to maintain native grasses on State Park lands. Propagation of native and horticultural plants for ornamental use. The ecology of quaking aspen; Regional and Recreational Area planning.

Publications:

1968. "Vegetative Propagation of Quaking Aspen," California Agriculture, 22:14-17.

1971. "Quaking Aspen, *Populus tremuloides* Michaux; an Ecological Approach." Ph.D. thesis.

1971. "An Environmental Impact Statement for Oakwood Properties; A study of land capability and water quality." Associate consultant and soils specialist. 60 pp. Raymond Vail and Associates, Fair Oaks, California.

1972. "A Landscape Design and Native Planting Materials for Tahoe Alpine Development." Tahoe City, California. Associate consultant.

1972. "A Water Quality and Land Capability Study of Cameron Park Ranchos (Buell Ranch), El Dorado County, California." Associate consultant and soils specialist. 52 pp. Raymond Vail and Associates, Fair Oaks, California.

1972. "The California Prairie," special publication, California State Department of Resources.

1972. "An Environmental Impact Report for Burbank Heights Senior Citizens Housing Development." City of Sebastopol, California. Associate consultant and soils analysis.

1974. "Environmental Impacts of Geothermal Development of Pacific Energy Corp. and Geothermal Kinetics Systems, Inc., Leaseholds at The Geysers, California. 205 pp. Sonoma County Planning Department.

Associate Investigator:

SCHULTZ, ROBERT O. Human ecology and natural Resource Management, University of California B. A. 1970, University of California M. S. 1973. Research Assistant, University of California 1970-1972. Research Associate, California State Dept. of Water Resources 1972. Project Director and Senior Research Ecologist, Environmental Management Framework Development 1972-73. Co-founder LANDSHAFT Environmental Consultants 1973-present. Associate Consultant, ECOVIEW Environmental Consultants 1973-present.

Societies, Affiliations and Awards:

Predoctoral Fellowship in Natural Resources.

Research, Interests and Professional Activities:

Land use planning, including environmental inventory, land capability multiuse plan formulation; environmental impact assessment. Natural resource management, including inventory accounting, systems model development analysis, interpretation and conservation and open space management. Residential development planning, including site planning, environmental design, low energy housing. Advisor to Sacramento County Environmental Task Force; Advisor to Shoshone Nation, lecturer and instructor, environmental short courses and workshops, U. C. Davis.

Pertainant Publications: (21)

1973. "Environmental and Resource Analysis Techniques" in a critique of water and related land resources planning, California State Dept. of Water Resources.

1973. A comprehensive Framework for Assessing the Environmental and Social Impact of Development (in manuscript).

1973. Environmental Impact Report: Proposed Water Storage Facility, Dept. of Public Works, City of Fairfield, California with L. R. Elliott.

1974. Environmental Impact Report: Waterman Water Treatment Plant, Nelson Hill Reservoir and Related Water Transmission Lines. City of Fairfield, California, Dept. of Public Works and Dept. of Environmental Affairs with L. R. Elliott.

1974. Environmental Impact Report: Water-Sewer-Drainage Element, City of Fairfield, California, Dept. of Environmental Affairs.

1975. Environmental Impact Report: Extension of Water Services to Cordelia Growth center, City of Fairfield, California, Dept.of Public Works and Dept. of Environmental Affairs with L. R. Elliott.

Associate Consultant:

SIMON, GARY D., Microbiology and Environmental Analysis. B.A. Microbiology, Indiana University, 1970. PhDc. Environmental Analysis (Quantitative Policy Analysis), University of California, present. Research assistant, Eli Lilly and Co., Indiana, 1968. Teaching assistant, University of Indiana, 1969-1971. Research Assistant, University of California at Davis, 1971. Consultant to A.E.C. Laboratory, U.C. Davis, 1972. Legislative analyst, California State Assembly, 1973-74. Senior Consultant, California State Assembly, 1974-present.

Societies, Affiliations, Honors and Awards:

Sigma Xi, AAAS, Am. Soc. for Microbiology, Phi Beta Kappa, Phi Eta Sigma, Bayard Floyd four-year academic scholarship, Indiana University, 1966-1970. Honors Research Grant, Indiana University, 1968-1970. Sigma Xi outstanding undergraduate research project award, 1970.

Research, Intersts, and Professional Activities:

Research in microbiology, human ecology and environmental policy analysis; research on governmental energy policy and its application to public interest, technical reports on energy issues, bill drafting and analysis.

Pertinent Publications (8):

1971. "Growth and Morphological Characteristics of a Species of Flexibacter," senior author with David White, Archiv fur Mikrobiologie 78: 1-16.

1972. "Growth, Cell Division, and Fragmentation in a Species of Flexibacter," co-author with Jocelyn C. Poos, F. Rudolf Turner, David White, Karen Bacon, and Carl Russell, J. of Bacteriology 112: 1387-1395.

1972. "A Bibliography of Selected Materials on Energy and the Environment," prepared under contract to AEC Radiobiology Laboratory, University of California at Davis, November 1972, 55 pp.

June 1973. "Electric Utility Growth: A Comparative Study in Decisionmaking in PG&E and SMUD," prepared under grant to University of California at Davis.

June 17, 1974. The Walrus Said: A Technical Report of the Staff to the Assembly Planning, Land Use, and Energy Committee, with E. E. Varanini, M. Green, and D. Sanders.

CONFIDENTIAL

DR. RICHARD H. MATHERSON
7671 Hansom Drive
Oakland, California 94605

(415) 632-1698

Dr. Richard H. Matherson - Agricultural Growth Industries, Inc., University of California, B. S. Chemistry and Microbiology; Studies for Ph D in Anatomy; Research in Orthopedics, Engineering and Law; Honorary Doctorate, University of Seoul, Korea. Dr. Matherson is a Food Processing Technologist, Equipment Developer and Manufacturer, Electronics implementation, and Nutritional Researcher. Dr. Matherson is presently President and Chairman of Board of Ferma International, a holding company for:

- Agricultural Growth Industries, Inc. - President and Founder Development and Manufacturing Corporation on Food Processing Equipment.
- Xerodyne, Inc. - Founder, former President and Chairman of the Board, now a Director on the Board, Microwave and Freeze drying of foods.
- FFMC Ltd. (Canada), President. Engineering and plant processing design.
- Westland Foods, Inc. - Technical Research Director. Microwave processing of pork products.
- Modern Dehydration Food System, President - Dehydration of fruit, onions, and garlic. Freeze drying with osmovac treatment.
- Greenfeed International Ltd. (Canada), President and Co-founder. Agricultural research foundation - Agronomy and nutrition.
- Speed-N-Sport - Electronic and motorcycle manufacturer and sales.
- Wings Foods - Director, food packaging equipment and spiceblending.
- Ag-Gro Ex Sales - President. Exporter and importer of processing equipment.

Advisor to Hydro-Gardens, Inc. Manufacturers of hydroponic and farming nutrients.

Advisory to the Department of Agriculture, Alberta, Canada.

Direct involvement in the design, construction, and/or modernization

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erson. Use for any purpose other than that
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and/or Dr. Richard H. Matherson, in writing,
is expressly prohibited.

of food processing plants in the United States and 6 major plants in Canada in the last 8 years.

Former Technical Liason with A.H. Robins Pharmaceutical Company.

Former President of Visutronics Corporation of America - Scientific, technical, and occupational training systems.

RESEARCH, INTERESTS AND PROFESSIONAL ACTIVITIES - Food processing dehydration, pharmaceutical processing, freeze drying, microwave processing of food, cryogenic food processing and pharmaceuticals, equipment engineering and manufacturing for processing of agricultural products, occupational teaching and training management, electronic instrumentation development and manufacturing for food processing.

Senior Technical Advisor on PRDA contract for Non-Electrical Agri-business Applications Using Geothermal Energy - Geonomics, Inc.; Agribusiness advisor on DOE Mountain Home Geothermal Project; Agribusiness advisor and designer for DOE Kelley Hot Springs, Geothermal Agricultural Complex (KHSAC).

Agricultural Growth Industries, Inc. (AGI) and/or Dr. Richard H. Matherson have been a pioneer in the production of energy efficient and biologically cascaded (an Eco system in miniature) of high quality, low cost animal feed and human food on this continent, the orient, and a number of third world countries. The combination of energy efficient human agricultural growth technology with renewable, so called, low grade energy resources result in a synergism far exceeding the independent capabilities of either organization.

AGI and/or Dr. Richard H. Matherson has also been involved in sub contract consultant to Geonomics, Lake County Geothermal Agricultural Complex and Geothermal Power Corporation - Kelly Hot Springs Geothermal Agricultural Systems. None of these contracts exceeding $100,000, therefore, further requirements of contract numbers, official administrators, etc., are not applicable.

CONFIDENTIAL

Dr. Richard H. Matherson;

Richard H. Matherson, President of Agricultural Growth Industries, a California Corporation, and other corporations. has been active in the food industry for many years. He has been a developer of major foor processing equipment and total systems. These systems are primarily in the food and medical industry; but also overlap into electronics, and other manufacturing areas such as plastics. His major areas of interest have been in food processing, dehydration, pharmaceutical processing, freeze drying, refrigeration, microwave processing of food, cryogenic food processing and pharmaceuticals, equipment engineering and manufacturing for processing of agricultural products, occupational teaching and training equipment, electronic instrumentation development, and manufacturing for food processing.

R. H. Matherson has been active in the design, engineering, prototype development, construction and equipment development for twenty years. These areas have been primarily in the food and pharmaceutical industry. He has been involved in the direct management of large numbers of people through the companies developed, as well as the marketing of same.

R. H. Matherson has also been an advisor to the Canadian Government and Department of Agriculture for the Province of Alberta. During that time, he provided the technology and assistance necessary to develop from conception to operation such facilities as follows: Meat breaking and secondary processing. Cooked convenient food operation, Microwave food processing, Dehydration, Pasta operation, Slaughter facilities, Feed lot and milling as well as Alfalfa dehydration, Rape seed oil crushing plant, Wheat Starch Gluten processing plant, Poultry and egg cracking and processing facility, portion packaging operation, Spice blending and packaging facility. Technical assistance was also provided to establish a Research and Development center at the Alberta Provincial Laboratory and to establish the back up equipment technology assistance.

Reference and confirmation of material presented may be verified by contacting the Bank of Montreal (California), Mr. John Woods. This bank is R. H. Matherson's chief contact for financing and work in the United States and Canada.

e information contained herein is deemed confidential and proprietary to Agricultural Growth Ind., Inc. and/or Dr. Richard H. Matherson. Use for any purpose other than that specified by Agricultural Growth Ind., Inc. and/or Dr. Richard H. Matherson, in writing, is expressly prohibited.

RESUME

CONFIDENTIAL

MARTHA L. ZEISLOFT
P. O. BOX 1107
COLFAX, CALIFORNIA 95713

(916) 346-2651

EXPERIENCE

January 1972 to Present

Principal Partner in Mar-Bil Enterprises, a partnership business involved in land sales, and development, sales of Capital Equipment for Milking Parlors and Freestall Housing for Dairy Cows. Sales of Capital Equipment for Swine Confinement Housing, involving all areas of swine animal growing. Sales of Capital Equipment for Grain Mills, elevators, conveyors and feeding systems for Livestock. Her responsibility is Chief Executive Officer, Controller, Book-keeping and Office Management.

June 1963 to January 1972

Super Tread Company. Wholesale, retail and Commercial Truck and Auto Tire Sales and Service firm. This firm pioneered the Bandag Retreading System in the Western States, and also introduced Bridgestone (Japanese) tires into the United States market.

Was responsible and chief Function was as Controller, Book-keeper, Office Manager.

April 1943 to June 1963

House-wife, Home-maker, Mother of four children and Confidant.

April 1940 to April 1943

Marshall and Marshall Law Firm
Legal stenographer for the entire firm

June 1937 to April 1943

The Eavy Company - Wholesale Grocery company with sales to company owned Super Markets and Individually owned smaller grocery stores.
Chief Billing Clerk and Inventory Pricing.

PERSONAL

Married: Four Children
Health: Very Good

AFFILIATIONS

Women In Agriculture

RESUME

CONFIDENTIAL

WILLIAM E. HENDERICKSON
3910 Orangewood Drive
Fair Oaks, California

EXPERIENCE

January 1973 to Present:

Partner in Mar-Bil Enterprises, a Partnership business involved in land sales, and development, sales of Capital Equipment for Milking Parlors and Freestall Housing for Dairy Cows. Sales of Capital Equipment for Swine Confinement Housing, encompassing all stages of swine animal growing. Sales of Capital Equipment for grain mills, elevators, conveyors and feeding systems for Livestock.

August 1971 to January 1973

Served as the President of Super Tread Co., Inc. A Multi-million Dollar Tire Company involved in Marketing heavy duty truck and industrial tires and also operated a Bandag Retreading system for all size and types of tires. This tire firm pioneered the Bandag tire retreading system in the Western States and also introduced the Japanese tires to the United States markets throughout Northern California and Nevada. Active in all phases of management. Concurrently served on the Board of Directors for F - B Truckline - a 2 million dollar Trucking Co. Headquartered in Salt Lake City, Utah and serving States west of the Mississippi River.

1957 to 1972

Super Tread Company, a partnership, wholesale, retail and Commercial truck and auto tire sales and service firm. This firm was the predecessor to the Super Tread Co., Inc. Was one of the two General Partners who formed the Company and built it into a 2 million Dollar Company.

1953 to 1957

United States Air Force GS-10 Section Chief - Maintenance and Logistics for Lockheed F - 104 abd F -94 fighter aircraft. Responsible for engineering, planning, operative maintenance, design and data dissemination under a Branch Chief.

WILLIAM E. HENDERICKSON

CONFIDENTIAL

1943 to 1953

United States Air Force - Captain. Single and Multi-engine aircraft pilot. Accrued more than 2,500 hours of flight time in single and multi-engine land and sea aircraft, while serving as a flight instructor in the Air Training Command and as aircraft commander in the Air Sea Rescue Command.

1941 to 1943

United States Airforce Civilian Service - Aircraft Mechanic.

EDUCATION:

Sacramento City College
Aircraft Engineering

PERSONAL

Married: Three Children
Health: Very Good

RESUME

MARVIN G. ZEISLOFT
P. O. BOX 1107
COLFAX, CALIFORNIA 95713
(916) 346-2651

CONFIDENTIAL

EXPERIENCE

September 1973 to Present

Territory Manager and Manufacturers Representative for eight Western States.

Responsible for selecting, establishing, training and assisting Companie's Dealers. Offers expert assistance and consultation in sales, contracting, planning, design, and construction of new and remodled Grain and Livestock Housing Facilities, to meet the most demanding requirements for costs, space, labor savings and efficient production of pork, milk and beef.
Since 1977 has been very active in selecting equipment and designing facilities for use by Agri-Business at low, medium and high temperature Geothermal Resource locations in the Western United States.
The Company Manufacture Capital equipment for feeding, handling, and housing of Beef Cattle, Dairy Cows and Swine, Milking Systems, Commercial grain elevators, Grain cleaners, and Conveyors.

August 1971 to September 1973

Served as the President of Transport Maintenance and Leasing Company. A Utah Corporation. Simultaneously served on the Board of Directors of F - B Truck Lines Incorporated - a multi-million dollar Utah Corporation. While Serving as the President of Transport Maintenance and Leasing was responsible for maintaining in accordance with the Department of Transportation rules and regulations a fleet of 500 semi trailers and 50 truck tractors. This equipment operated in all states west of the Mississippi River under Interstate Commerce Commission rules and regulations. During this time was responsible for selecting and purchase of new equipment, with individual contracts for the purchase in excess of $1,250,000. Oversaw the operation of five maintenance terminals located in California, Oregon, Utah, and Colorado. Instigated Corporate policy, and controlled fiscal monitary, income and expenditures. Generally speaking - Was the President and Chief Executive Officer of this Multi-Million Dollar Company.

1957 to 1971

Super Tread Corporation, Sacramento, California. General Partner and Chief Executive Officer. Wholesale, retail and commercial

CONFIDENTIAL

full time truck and auto tire sales and services. Pioneered "Bandage" tire retread system. Operated and also introduced first Japanese tires to the United States Markets throughout Northern California and Nevada. Active in all phases of management.

1962 to 1970

Concurrent with the above endeavor. Plumfield Farms, Sacramento. California. Owner-operator of 235 acre fruit farming enterprise, consisting of plums, pears, oranges, and grapes. Growing, planting, harvesting and market development.

1952 to 1957

United States Air Force, GS-12 Branch Chief maintenance and logistic. Lockheed fighter aircraft and nuclear bombers. Responsible for engineering planning, operative maintenance, design and data dissemination.

1946 to 1951

United States Air Force, Service, Aircraft Mechanic.

1940 to 1945

United States Army Aircorps.

United States Air Force Training Courses

Air Material Command
Certificate of Training
Conference Leading - 23 July 1953

Sacramento Air Material Command
Certificate of Training
Public Speaking - 7 April 1954

Weapons Air Development Command
United States Air Force
Office for Aircraft Nuclear Products
A.N.P. Nuclear Science Course - 26 April 1955

Air University - United States Air Force
Air Command and Staff College
Weapons Orientation Course - 20 January 1956

PROFESSIONAL AFFILIATIONS

Member Gideons International - President - Auburn California Camp 1973-74

PERSONAL

Married: 4 children Health: Good

RESUME

E. G. (Jerry) Crosthwaite
8821 Churchill Road
Boise, ID 83709

September 1, 1980

Profession

Hydrologist

Experience

Twenty-eight years with the Water Resources Division of the U.S. Geological Survey of which more than 25 years of that time was in Idaho. I retired from the USGS on December 29, 1978 and since then have been working as a consultant in groundwater and geothermal hydrology. I intend to continue only part-time work.

My duties as a Supervisory Hydrologist the last few years with the Survey were to assist project chiefs in planning and execution of projects, and in determining methods of investigational procedure to carry out complex hydrologic studies. I also served as Project Chief on assigned projects, reviewed and criticized reports and papers prepared by colleagues, trained and directed personnel, maintained liaison with subordinates and supervisors, met with State and Federal officials and the general public on water resource matters.

From early in 1975 to the end of 1978 I worked in the Survey's Geothermal Research Program doing exploratory drilling and geothermal evaluation of the Raft River Area of Idaho, served as the Survey's drilling advisor on the deep core drilling project at the Idaho National Engineering Lab, and did stable isotope sampling in eastern Idaho.

My specialties are resource evaluation, reservoir engineering, and drilling and testing wells in both volcanic and granular rock terrains.

Since leaving the Survey have done water supply and well site evaluations, well testing, and hydrologic evaluations.

Recent Clients (partial list)

EG&G Idaho, Inc.
P.O. Box 1625
Idaho Falls, ID 83415

CH2M-Hill
700 Clearwater Lane
Boise, ID 83707

Boise Geothermal
649 W. Idaho
Boise, ID 83702

Iowa Beef Processors
Box 810
Dakota City, Nebraska 68731

The Nature Conservancy
Western Regional Office
San Francisco, California

Professional Organizations

Registered Geologist, State of Idaho, No. 6
Secretary of Idaho State Board of Registration for Professional Geologists
Registered Geologist, State of California, No. 2556
Idaho Association of Professional Geologists
National Water Well Association, Technical Division
American Institute of Professional Geologists, Charter Member
Geological Society of America

Education

Bachelor of Arts, U.C.L.A., 1950

Personal Data

Soc. Sec. No.: 720 03 4791
Birth date: 10/18/18
Physical condition: Good
Marital status: Married, two children

Professional References

Ralph Norvitch
Associate Chief
Water Resources Division
U.S. Geological Survey
P.O. Box 036
Boise, Idaho 83726

Paul Williams, Chief
Environmental Geology Branch
U.S. Geological Survey
Denver Federal Center
Lakewood, Colorado 80225

Don Mabey
Rm 468 Post Office Bldg.
U.S. Geological Survey
Salt Lake City, Utah 84101

Dr. Monte Wilson
Department of Geology
Boise State University
Boise, ID 83725

Dr. Clayton Nichols
U.S. Department of Energy
2nd & Holmes
Idaho Falls, ID 83401

Frank Sherman
Idaho Department of Water
Resources
Fourth and Fort Street
Boise, ID 83702

Bibliography

Crosthwaite, E.G., 1979, Geohydrology of the Raft River geothermal area, Idaho-Utah; with a section on the geothermal resource: in review.

Crosthwaite, E.G., 1979, Chemical quality of ground water related to geothermal investigations in the Teton River area, Eastern Idaho: in review.

Crosthwaite, E.G., 1978, Disposal of waste fluid at a geothermal development site: presented at American Geophysical Union Symposium on Water Problems related to Energy Development, April, Miami Beach.

Crosthwaite, E.G., 1976, Basic data from five core holes in the Raft River geothermal area, Cassia County, Idaho: U.S. Geol. Survey open-file rept., 15 p.

Crosthwaite, E.G., 1975, Preliminary data for thirty-four auger holes in the Raft River Valley, February 13-March 8, 1974: U.S. Geol. Survey open-file rept., 20 p.

Crosthwaite, E.G., 1974, Basic ground-water data for the Moscow Basin, Idaho: U.S. Geol. Survey open-file rept., 74 p., 5 figs.

Crosthwaite, E.G., 1974, A Progress report on results of test-drilling and ground-water investigations of the Snake Plain aquifer, southeastern Idaho: Part 3 - Lake Walcott-Bonanza Lake area: U.S. Geol. Survey open-file report, 45 p., 7 figs. Proposed to publish as a Water Information Bulletin by Idaho Department of Water Administration Bulletin No. 38, 28 p., 7 figs.

Crosthwaite, E.G., 1973, A progress report on results of test-drilling and ground-water investigation of the Snake Plain aquifer, southeastern Idaho: Part 2 - Observation wells south of Arco and west of Aberdeen: Idaho Dept. Water Administration Water Information Bulletin No. 32, 17 p., 5 figs.

Crosthwaite, E.G., 1973, A Progress report on results of test-drilling and ground-water investigations of the Snake Plain aquifer, southeastern Idaho: Part 1 - the Mud Lake region, 1969-70: Idaho Dept. Water Administration Water Information Bulletin No. 32, 43 p., 6 figs.

Bibliography (cont'd)

Crosthwaite, E.G., Thomas, C.A., and Dyer, K.L., 1970. Consideration for water use and management in the Big Lost River basin, Idaho; a supplemental report: U.S. Geol. Survey open-file report, 15 p., 1 fig.

____, 1970, Water Resources in the Big Lost River basin, southcentral Idaho: U.S. Geol. Survey open-file report, 109 p., 31 figs.

Crosthwaite, E.G., 1969, Water resources of Goose Creek-Rock Creek area, Idaho, Utah, and Nevada: Ida. Dept. Reclamation Water Information Bull. No. 8, 73 p., 25 figs.

______________, 1969, Results of testing well 1, June-August, 1968, at the Kooskia National Fish Hatchery: U.S. Geol. Survey administrative rept., 19 p., 6 figs.

Crosthwaite, E.G., (No date) Water budget and hydrology of the Snake River Plain: Proceedings of the Idaho State Water Conference, U. of Idaho Water Resources Research Institute (Feb. 1967)

Crosthwaite, E.G., 1969. Water resources of the Salmon Falls Creek basin, Idaho-Nevada: U.S. Geol. Survey Water Supply Paper 1879-D, 33 p., 7 figs.

______________, 1967, Memorandum report on ground-water condition at the site of the Kooskia National Fish Hatchery: U.S. Geol. Survey open-file rept., 17 p., 2 figs.

Crosthwaite, E.G., Mundorff, M.J., and Walker, E.H., 1967. Groundwater aspects of the lower Henrys Fork region, Idaho: U.S. Geol. Survey open-file report, 43 p., 9 figs. (To be published as WSP 1879-C).

Burnham, W.L., and others, 1966, Summary of ground-water conditions in Idaho, 1966: Ida. Dept. Reclamation. Water Information Bulletin No. 1.

Crosthwaite, E.G., and George, R.S., 1965, Reconnaissance of the water resources of the Upper Lemhi Valley, Lemhi County, Idaho: U.S. Geol. Survey open-file report, 40 p., 3 figs.

Bibliography (cont'd)

Crosthwaite, E.G., 1964, Geology and hydrology of the Rexburg area, Idaho: Proc. 2nd Ann. Eng. Geol. and Soils Eng. Symposium, Ida. State Univ., Pocatello, Idaho, p. 44-49, 5 figs.

Mundorf, M.J., Crosthwaite, E.G., and Kilburn, Chabot, 1964, Ground water for irrigation in the Snake River basin in Idaho: U.S. Geol. Survey Water Supply Paper 1654, 224 p., 6 pls., 54 figs.

Crosthwaite, E.G., 1963, Ground-water appraisal of Antelope and Middle Reese River Valleys, Lander County, Nevada: Ground-Water Resources--Reconnaissance Series, Report 19, Nev. Dept. Cons. & Nat. Resources, 33 p., 1 pl., 5 figs.

________________, 1963, Hydrogeology and its application to engineering problems: Proc. 1st Ann. Eng. Geol. Symposium, Ida. State Univ., Pocatello, Idaho, p. 11-16, 1 fig.

________________, 1962, Ground-water reconnaissance in Round Valley, Custer County, Idaho: U.S. Geol. Survey open-file report, 27 p., 1 fig.

________________, 1957, Ground-water possibilities south of the Snake River between Twin Falls and Pocatello, Idaho: U.S. Geol. Survey Water Supply Paper 1460-C, p. 99-145, 1 pl., 5 figs.

Littleton, R.T., and Crosthwaite, E.G., 1957, Ground-water geology of the Bruneau-Grand View area, Owyhee County, Idaho: U.S. Geol. Survey Water-Supply Paper 1460-D, p. 147-198, 1 pl., 4 figs.

Croshtwaite, E.G., 1956, Ground-water use in Idaho: U.S. Geol. Survey open-file report, 7 p.

Crosthwaite, E.G., and Scott, R.C., 1956, Ground water in the North Side Pumping Division, Minidoka Project, Minidoka County, Idaho: U.S. Geol. Survey Circ. 371, 20 p., 1 pl., 9 figs.

Crosthwaite, E.G., 1956, Records of wells and ground-water levels in western Jerome County, Idaho: U.S. Geol. Survey open-file report, 147 p., 1 pl., 2 figs.

Bibliography (cont'd)

Ferris, J.G., Burt, E.M., Stramel, G.J., and Crosthwaite, E.G., 1954, Ground water resources of southeastern Oakland County, Michigan: Mich. Geol. Survey Progress Report 16, 158 p., 6 pls., 44 figs.

Crosthwaite, E.G., 1954, Ground-water development and problems in Idaho: U.S. Geol. Survey open-file report, 17 p.

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APPENDIX I

VITA

NAME: Craig McKibben White

PLACE OF BIRTH: Bethesda, Maryland

DATE OF BIRTH: January 16, 1945

EDUCATION:

Bachelor of Arts (Geology), 1967, Earlham College
Master of Arts (Geology), 1970, University of Wisconsin
Doctor of Philosophy (Geology), 1980, University of Oregon

PROFESSIONAL EXPERIENCE:

Contract geologist, Oregon Department of Geology and Mineral Industries, 1977-1979.

Assistant Professor of Geology, Boise State University, 1980-

AREAS OF CURRENT RESEARCH INTEREST:

Geology and geochemistry of Tertiary volcanic rocks in the Oregon Cascade Range.

Geochemistry and mineralogy of layered gabbroic rocks associated with the Skaergaard intrusion in East Greenland

Petrology and volcanology of recently active volcanoes in the Cascade Range

PUBLICATIONS:

Craddock, J. C., White, C. M., and Rutford, R. H., 1969, The geology of the Eights Coast: Antarctic Journal, v. 4, p. 93-94.

McBirney, A. R., Sutter, J. F., Naslund, H. R., Sutton, K., and White, C. M., 1974, Episodic volcanism in the central Oregon Cascade Range: Geology, December, p. 585-589.

White, C. M. and McBirney, A. R., 1979, Some quantitative aspects of volcanism in the Oregon Cascades: in, Geol. Soc. America Memoir 152, p. 369-388.

White, C. M., 1980, Geology and Geochemistry of Mt. Hood Volcano: State of Oregon Department of Geology and Mineral Industries Special Paper 8, 43 p.

White, C. M., 1980, Geology of the Breitenbush Hot Springs Quadrangle: State of Oregon Department of Geology and Mineral Industries Special Paper 9, 43 p.

Abstracts

Rutford, R. H., Craddock, J. C., Armstrong, R. L., and White, C. M., 1970, Tertiary glaciation in the Jones Mountains, Antarctica: G. S. A. Abs. with Programs, v. 2, no. 7, p. 670-671.

McBirney, A. R., White, C. M., and Bow, C. M., 1976, Magmatic evolution of the central Oregon Cascades: G. S. A. Abs. with Programs, v. 8, no. 6, p. 1003-1004.

White, C. M., Geochemistry of post-glacial dacites from Mt. Hood, Oregon, Eos (Am. Geophys. Union Trans.), v. 61, no. 10, p. 110, 1980.

RESUME CONFIDENTIAL

WILLIAM R. BRINK:

Mr. Brink is Coopers & Lybrand's, San Fancisco, California, lead Consultant for west coast geothermal engagements. Coopers & Lybrand, a "big eight", international accounting firm is the most experienced in geothermal projects accounting and economic assessment. Mr. Brink will be responsible for carrying out data gathering, analysis and dissemination activities involved in planning and fulfilling Coopers & Lybrand's assigned work. Mr. Brink is an MBA graduate of Harvard University and B.S. Degrees in Psychology and Management Science from Oregon State University.

Mr. Brink is a Manager for Coopers & Lybrand's financial and management accounting staff in the San Francisco management consulting services office and lead consultant for west coast geothermal engagements. He is a generalist with experience in marketing, production control, construction management, financial feasibility investigation and systems design.

Mr. Brink is the Firm's lead consultant for business and financial assessments of Geothermal Loan Guaranty applications to D.O.E., San Francisco operations.

For a private industry client, Mr. Brink participated in a study to assess the financial and economic factors related to the non-electric utilization of a geothermal resource in an agribusiness application. Specific work included a comparison of costs and benefits between conventional and geothermal energy, economic evaluation of potential end products and markets, and an investment analysis of the project.

CONFIDENTIAL

For a foreign client, Mr. Brink designed and accomplished a national marketing survey to establish market potential and contacts for the foreign client. The survey included telephone and mail solicitation, data consolidation, analysis and evaluation.

Prior to joining Coopers & Lybrand, Mr. Brink was a consultant for an east coast firm where clients were small and medium sized businesses in need of turnaround action. Investigations, analyses and recommendations covered production, marketing, accounting, financial control, strategic planning, financial assessment, and pro forma generation.

COOPERS & LYBRAND: CONFIDENTIAL

Firm Overview

Coopers & Lybrand is an international accounting firm offering specialized services in the areas of auditing, taxation, management consulting, and actuarial, compensation and benefits. These services are offered to both the public and private sectors.

Founded 120 years ago, Coopers and Lybrand today employs over 20,000 personnel in over 350 offices around the globe. The domestic operation has approximately 7,500 employees in 79 offices. In California, Coopers & Lybrand has over 800 employees located in San Francisco, Los Angeles, Sacramento, San Diego, Oakland, Palo Alto, and Newport Beach.

Current clients, in addition to those cited previously, include Alcoa, AT&T, CBS, Conrail, Crown Zellerbach, Firestone, Ford, Johnson & Johnson, Kennecott Copper, 3M, Nabisco, PanAm, Phillip Morris, Raytheon, State Farm, Upjohn, California State Water Resources Board, Southern California Rapid Transit District, California Department of Education, City of Los Angeles, City of Oakland, and United States Departments of Justice, HUD, Energy, HEW, AID, and Transportation.

Management of Functional Disciplines

Coopers & Lybrand's three principal groups--audit, taxation and management consulting--offer a wide range of technical expertise. These include:

- Financial Auditing
- Management Auditing
- Regulatory Compliance
- Federal and State Income Tax Compliance
- Tax Planning
- Tax Auditing
- Ecomomic Analysis
- EDP Hardware Planning
- Computer Center Operations
- Telecommunications
- EDP Software Development
- Computer Modeling
- Market Assessment
- Resource Planning
- Cost Analysis
- Organization Analysis
- Financial Planning
- Public Policy Formation

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COOPERS & LYBRAND:

As a further indication of Coopers & Lybrand's experience and expertise in the areas of data systems and energy development and utilization, we have included a representative listing of our clients in geothermal, oil and gas, and public utilities industries. A full range of audit, tax, data processing and consulting services have been provided to these clients and, as such, are too numerous to list in this proposal. We stand ready, however, to provide WESTEC with information of specific projects and references for any of these clients.

REPRESENTATIVE GEOTHERMAL CLIENTS

AMAX, Inc.
Bechtel Corp.
California Energy Co., Inc.
Coury & Associates
Department of Energy, San Francisco Operations Office
Energy Research and Development Administration
Energetics Marketing & Management Associates, Ltd.
Geysers Development Corp.
International Engineering Co.
Johns-Manville Co., Inc.
Magma Power Co.
Morrison-Knudsen International Co., Inc.

Natomas Co.
Northern California Power Agency
Pacific Energy Corp.
Stearns Energy Corp.
Sun Oil Co.

Thermal Power Co.
Union Oil Company of California

REPRESENTATIVE OIL AND GAS CLIENTS

Asamera Oil, Ltd.
Atlantic Richfield Company
Bobcat Oil Company
Caldera Petroleum Company
Callon Petroleum Company
Champion Ventures
Consolidated Oil & Gas, Inc.
DEPCO
Earth Resources Company
Equity Oil & Gas Co.

CONFIDENTIAL

REPRESENTATIVE OIL AND GAS CLIENTS, Continued

Flying Diamond Oil Corporation
Gulf Oil Corporation
Jenney Oil Company, Inc.
MacMillan Ring-free Oil Company
Oxford Exploration
Parker Drilling Company

Pauley Petroleum Inc.
Phoenix Drilling Funds
Quaker State Oil Refining Corporation
Reading & Bates Offshore Drilling
Skyline Oil Company

Sun Oil Company
Sunoco Exploration Partnership
The Refinery Corporation
TOSCO
Union Oil Company of California

United Refining Company
U. S. Natural Resources Inc.
WECO Development Corporation

REPRESENTATIVE PUBLIC UTILITY CLIENTS

American Telephone and Telegraph Company and
  the Subsidiary Bell Companies
Arkansas Power & Light Company
Baltimore Gas & Electric Company
Bonneville Power Administration
Boston Edison Company
Central Louisiana Electric Company

Commonwealth Natural Gas Corporation
Continental Water Company
Delmarva Power & Light Company
El Paso Electric Company
General Public Utilities Corporation
  Jersey Central Power & Light Company
  Metropolitan Edison Company
  Pennsylvania Electric Company

Green Mountain Power Corporation
Gulf States Utilities Company
Irvington Gas Company, Inc.
Lynchburg Gas Company
Mid-Continent Telephone Corporation

Missouri Water Company
New England Electric System
  Granite State Electric Company
  Massachusetts Electric Company

CONFIDENTIAL

REPRESENTATIVE PUBLIC UTILITY CLIENTS, Continued

The Narragansett Electric Company
New England Energy System
New England Power Company
New York State Electric & Gas Corporation
Northern Indiana Fuel and Light Company, Inc.
Peoples Natural Gas Company of South Carolina, Inc.

Philadelphia Electric Company
Puget Sound Power & Light Company
Savannah Electric & Power Company
Sierra Pacific Power Company
Tampa Electric Company

Tennessee Valley Authority
United Illuminating Company
Valley Gas Company, Inc.
Virginia Electric and Power Company
Volunteer Natural Gas Company
Washington Public Power Supply System

Yankee Atomic Electric Company

CONFIDENTIAL

LEONARD A. FISHER
Registered Professional Engineer
3841 - 25th Street
San Francisco, California 94114
(415) 282-1827

SUMMARY OF EXPERIENCE

Ten years of experience in the analyses, conceptual through final design, and management of engineering projects including: thermal power and process cycles; energy use, conservation, and recovery systems; integrated multiple use applications of heat, particularly geothermal heat; cost estimation; pumping and piping systems; and facilities design.

Extensive background in technical writing involving preparation of proposals, feasibility studies, design criteria, specifications, procedures, test reports, and technical publications.

Significant recent experience in business development work in the energy field.

EDUCATION

BS, Engineering, California Institute of Technology, 1966
MSME, Thermosciences, Stanford University, 1967
MSME, Product Design, Stanford University, 1969

AWARDS

National Science Foundation Graduate Fellow, 1966-1968

Project Manager for the first prize winning project in the 1979 Engineering Excellence Awards Competition of the Consulting Engineers Association of California: "Systems and Energy Engineering, Mountain Home Geothermal Project"

Invited participant in U.S. Department of Energy sponsored workshop on "Direct Utilization of Geothermal Energy: Development of Four Educational Reports," February 1979

PUBLICATIONS

"Slurry System Economic Parameters," co-authored with Fred L. Smith and Sam F. Fogleman, Hydrotransport 4, Alberta, Canada, 1976

Author or co-author of four papers and three reports on multiple direct use applications of geothermal energy, 1977-1979. Among the subjects were the Total Energy Recovery System for Agribusiness (TERSA) and the Mountain Home Geothermal Project, an integrated livestock meat and feed production facility.

CONFIDENTIAL

LEONARD A. FISHER
Registered Professional Engineer

EMPLOYMENT HISTORY

Present: LAFCO Energy Systems Engineering; San Francisco, CA
LAFCO was established in August 1979 to provide independent consulting services in thermal and mechanical energy systems engineering in areas including: energy generation; energy use and conservation; waste heat recovery; conversion of wastes to fuels, fertilizers, and feeds; integrated energy systems for agribusiness; and new energy technology development. The following services are provided in these areas: proposal preparation; engineering/economic feasibility studies; conceptual, preliminary, and final design; cost estimation; and field engineering services.

1974-1979: International Engineering Co., Inc.; San Francisco, CA
Studies, design, and management of mechanical systems work including: geothermal power plants and gathering systems; direct uses of geothermal energy for agriculture, food processing and space conditioning; energy applications of biomass; hybrid and wood fired power cycles; solar systems; facilities design; and piping and pumping systems. Wrote design criteria and specifications for hydroelectric power plant equipment. Responsible for departmental computer work and business development activities in the energy field.

1974: L.K. Comstock Engineering Co.; San Francisco, CA
Design of piping, plumbing, and cable systems for deep sea oil drilling rigs and for process plants.

1972-1973: United Technology Center; Sunnyvale, CA
Design and development of rocket nozzle, insulation, and mechanical support equipment. Other responsibilities included parametric studies, computerization of design techniques, and test report writing.

1970-1971: Self-employed; Portola Valley, CA
Design and marketing of consumer products; consulting work included laboratory layouts and dynamic studies.

1969-1970: Raychem Corporation; Menlo Park, CA
Design and development of equipment for cryogenic products handling and product identification; field engineering work including test reports.

Exploration Consultants
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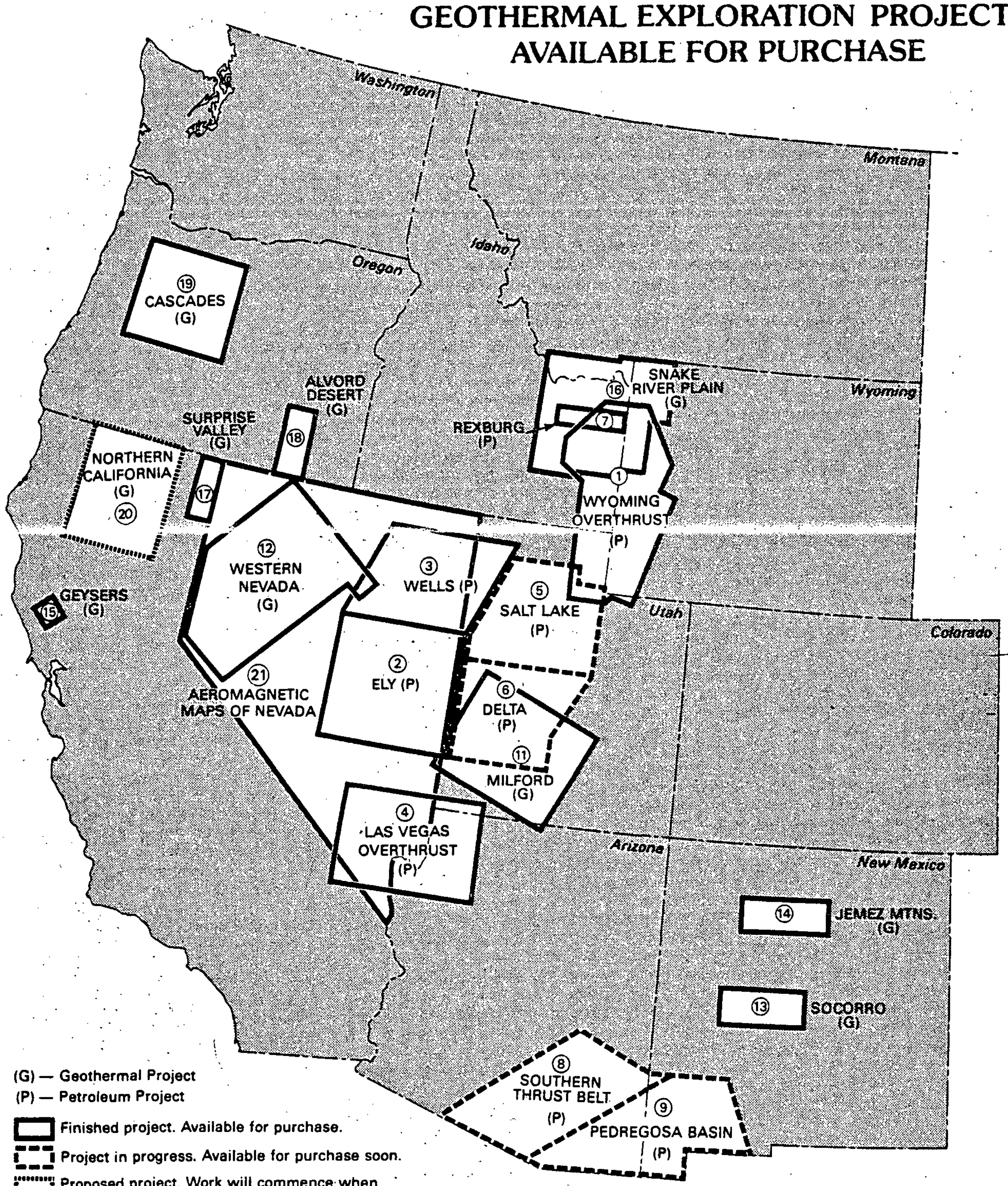
(415) 845-3800

Resource Note #88

PROPRIETARY PETROLEUM AND GEOTHERMAL EXPLORATION PROJECTS AVAILABLE FOR PURCHASE



(G) — Geothermal Project
(P) — Petroleum Project

☐ Finished project. Available for purchase.
☐ Project in progress. Available for purchase soon.
☐ Proposed project. Work will commence when minimum number of participants have joined.

Refer to accompanying table for details on projects, or write for proposal.

June 1981

MAP NO.	AREA	PROJECT NO.	EXPLANATION OF PROJECT, WITH DETAILS ON GEOPHYSICAL DATA AND DELIVERABLES*	PRICE AND DELIVERY DETAILS
			PETROLEUM PROJECTS	
1	Wyoming Overthrust	7029	Tectonic analysis based on Landsat imagery, 8120 miles of aeromagnetics, 4260 gravity stations, 15 geologic cross sections, scale 1:125,000, composite prospect map selects structural targets, 10 enhanced Landsat images.	$45,000 or can be purchased in quarter sections for $16,000 to $21,200; aeromagnetic contour map or depth to basement purchased separately for $16,400. Delivery 3 weeks.
2	Ely, Nevada	8066	Integrated study of Eastern Basin Range for petroleum exploration. Eight geologic cross sections, tectonic and composite prospect maps. 4000 line miles of aeromagnetics, 5833 gravity stations, scales 1:96,000, 1:192,000. Six enhanced Landsat images, 6 isopach maps.	$45,000 or purchase in pairs of cross sections for $18,000.
3	Wells, Nevada	8112	Integrated study of Eastern Basin Range for petroleum exploration. Seven geologic cross sections, tectonic and composite prospect maps, 3500 line miles of aeromagnetics, 2000 gravity stations, scales 1:96,000, 1:192,000, 4 enhanced Landsat images, 4 isopach maps.	$45,000 or purchase in pairs of cross sections for $18,000.
4	Las Vegas Overthrust	8106	Integrated study of the overthrust extension into southern Nevada and northern Arizona. Study will analyze structure, stratigraphy, and source/reservoir rocks. Five geologic cross sections, tectonic and composite prospect maps, 2,000 line miles of aeromagnetics, 3,200 gravity stations, scales 1:125,000 and 1:250,000.	$43,500. Prices for individual cross sections are given in the proposal.
5	Utah, Salt Lake Area (1 of 2 adjacent areas)	0138	Integrated study of the northern Hingeline in Utah. 2300 line miles of proprietary aeromagnetics, published gravity, plus 150 new stations and six geologic cross sections.	$41,000; Salt Lake and Delta areas purchased together, $69,500. Pairs of cross sections also available.
6	Utah, Delta Area (1 of 2 adjacent areas)	8104	Integrated study of the southern Hingeline in Utah. 2700 line miles of proprietary aeromagnetics, published gravity, plus 150 new stations and five geologic cross sections.	$39,000; Delta and Salt Lake areas purchased together, $69,500. Pairs of cross sections also available.
7	Rexburg, Idaho	8099	Three east-west aeromagnetic flight lines approximately 75 miles long modeled to determine thickness and approx. depth of the mafic flows and intrusions. An estimated thickness of sedimentary strata and depth to basement are shown in profile form along each flight line.	$10,000 for all three flight lines. $7,000 for two, or $4,000 for one profile.
8	Southeastern Arizona, Southern Thrust Belt (1 of 2 adjacent areas)	0154	Integrated study of the overthrust belt and southern Basin Range Province in southeastern Arizona. 3800 lines miles of proprietary aeromagnetics, published gravity plus 250 new stations, 7 geologic cross sections, tectonic map, isopach maps, lithofacies and paleoenvironmental maps, composite prospect map, and 4 enhanced Landsat images.	$54,000. Prices for individual cross sections are presented in the proposal. Can be purchased with Pedregosa Basin Area for $103,000.
9	Southwestern New Mexico, Pedregosa Basin (1 of 2 adjacent areas)	0151	Integrated study of the overthrust belt and southern Basin Range Province in southwestern New Mexico. 4000 line miles of proprietary aeromagnetics, published gravity plus 250 new stations, 8 geologic cross sections, tectonic map, isopach maps, lithofacies and paleoenvironmental maps, composite prospect map, and 3 enhanced Landsat images.	$59,500. Prices for individual cross sections are presented in the proposal. Can be purchased with Southern Thrust Belt Area for $103,000.

MAP NO.	AREA	PROJECT NO.	EXPLANATION OF PROJECT, WITH DETAILS ON GEOPHYSICAL DATA AND DELIVERABLES*	PRICE AND DELIVERY DETAILS
			GEOTHERMAL PROJECTS	
11	Milford, Utah	6007	Surface mapping and interpretation of Curie point isotherm, encompassing 11,000 sq. mi. in southwest Utah. 4,700 line miles of proprietary aeromagnetics, 1,600 gravity stations, two enhanced Landsat images, chart evaluates and rates geothermal anomalies.	$22,000. Delivery within three weeks.
12	Western Nevada	8075	Curie point isotherm and tectonic mapping of 26,600 sq.mi. area. USGS digital aeromagnetic coverage, and 1285 miles proprietary aeromagnetic data, 6658 gravity stations, three enhanced Landsat images, published water chemistry, hot spring locations, age dates of volcanic rocks and seismicity used to identify prospective targets and assign ratings to compare to an intrusive geothermal system model. Scale 1:250,000.	$22,000. Delivery within three weeks
13	Socorro, New Mexico	7055	Curie point isotherm and tectonic mapping of 4,000 sq.mi. area of the Rio Grande Rift near Socorro, N.M. 1000 line miles of proprietary aeromagnetics. Analysis of Curie point, published gravity, magnetotelluric, gravity and seismic data for prospect evaluation. Scale 1:125,000.	$15,000. Delivery within three weeks.
14	Jemez Mountains, New Mexico	8080	Tectonic and Curie point isotherm mapping of an area 4,500 sq.mi. across the Rio Grande Rift centered on the Valles Caldera. 2200 line miles of proprietary aeromagnetics, 1552 gravity stations, one enhanced Landsat image, published seismic data, water chemistry and hot spring temperature, scale 1:125,000.	$15,000. Delivery within three weeks.
15	Geysers-Clear Lake Area, California	8060	Comprehensive study of the geothermal potential of a 2800 sq.mi. area surrounding The Geysers steam field. 1900 lines of proprietary aeromagnetics processed and interpreted for Curie point isotherm and temperature gradient contour mapping. Tectonic mapping and location of large serpentinite bodies. 1,288 gravity stations used in complete Bouguer gravity map. Published seismicity, electrical resistivity, water chemistry, mercury prospects and hot spring temperatures all combine in a composite prospect map that delineates a number of prospective areas.	$39,500 or $22,000 for either north or south half of area. Delivery in three weeks.
16	Snake River Plain, Idaho-Wyoming	6012	Curie point isotherm mapping and interpretation of the results in terms of geothermal potential of eastern Idaho and northwest Wyoming. Exploration Guide Map, estimated apparent temperature gradient map, evaluating and rating of prospects.	$28,000. Delivery within three weeks.
17	Surprise Valley, NE California	4193	Geothermal evaluation and selection of prospective targets for an area of approximately 800 sq. mi. Integrated interpretation based on 700 line miles of proprietary aeromagnetics, 525 published gravity stations and 100 additional proprietary stations, one enhanced Landsat image and published geochemistry.	$15,000. Delivery within three weeks.

MAP NO.	AREA	PROJECT NO.	EXPLANATION OF PROJECT, WITH DETAILS ON GEOPHYSICAL DATA AND DELIVERABLES*	PRICE AND DELIVERY DETAILS
			GEOTHERMAL PROJECTS	
18	Alvord Desert, SE Oregon	6001	Geothermal interpretation using enhanced Landsat imagery, NASA high altitude photos, 800 proprietary gravity stations, 1000 line miles of aeromagnetics, and chemical data on hot springs. Delivers tectonic map and composite prospect map highlighting anomalies and prospects. Best prospects are rated in order of potential. Covers approximately 1800 sq. mi., scale 1:126,000.	$20,000. Delivery within three weeks.
19	Cascades, Oregon	8100	Curie point isotherm and tectonic mapping of a 14,400 sq. mi. area for geothermal prospects. 4,200 line miles of aeromagnetics, 1660 gravity stations used in interpretation. Two enhanced Landsat images, colored high altitude IR color photos used in tectonic mapping. Published water chemistry, geologic maps and geophysical data integrated into study. Scale 1:250,000.	$32,000. Delivery within three weeks.
20	Northern California Geothermal Study	0130	Integrated study utilizing Curie point isotherm, Landsat imagery, 4200 line miles of aeromagnetics, published gravity, seismicity and published water chemistry. Composite Prospect Map and table rating prospects, scale 1:250,000.	$29,500. Eureka will commence project if enough interest is shown by industry.
			AEROMAGNETIC MAPS	
21	Aeromagnetic Maps of Nevada	8107	Recontoured USGS open file composite map of Nevada (76-695) to a 5 gamma contour interval, scale 1:250,000 (transparency). Data is more useful for exploration than the original 20 gamma contour and 1:500,000 scale map	$250/map or $3000 for 18 individual maps covering the entire state. Delivery in one week.

*For a comprehensive description of any particular project, write for a detailed proposal. All projects include a final report and presentation, except for aeromagnetic contour maps when purchased separately.

Prices subject to change without notice.

Technical Publications available from Eureka:

"Sources for the Uranium in Epigenetic Sandstone Type Deposits," Erskine, 1976.
"Prelim. Geol. and Geophys. Model of Intrusive Geothermal System," Erskine, 1976.
"Determination of Curie Point Depths from Aeromagnetic Data," Erskine, 1977

[illegible]

[illegible] October 1979

[illegible] Resources Associates, Inc.

[illegible]

GEOTHERMAL PROSPECTS IN THE GEYSERS-CLEAR LAKE REGION
BASED ON
CURIE POINT DEPTH ANALYSIS AND TECTONIC MAPPING

P-8060

October 1979

ABSTRACT

Eureka Resource Associates offers a comprehensive geothermal study of a 2800 square mile area surrounding The Geysers steam field in California (Figure 1).

The project includes 1900 line miles of proprietary aeromagnetics processed and interpreted for structural data, location of large serpentinite bodies, Curie point isotherm and apparent temperature gradient mapping.

A geothermal prospect map delineates a number of attractive targets that warrant detailed ground exploration. Other supporting data for this map are a complete Bouguer gravity map (1288 stations), published seismicity, electrical resistivity, water chemistry, mercury prospects and hot springs temperatures.

Participants in the study will receive a 48 page report discussing the criteria used in selecting prospects, as well as the general data and methods used. Each client will receive a Landsat image, scale 1:125,000, and seven transparent plates that fit over the Landsat image. The plates are:

- Tectonic map of The Geysers-Clear Lake region
- Estimated depth to the Curie point temperature
- Residual aeromagnetic anomaly map
- Offset aeromagnetic profiles
- Complete Bouguer gravity map
- Apparent temperature gradient map based upon Curie point depth estimates, with geothermal well locations, hot springs and alterations
- Geothermal prospect evaluation map

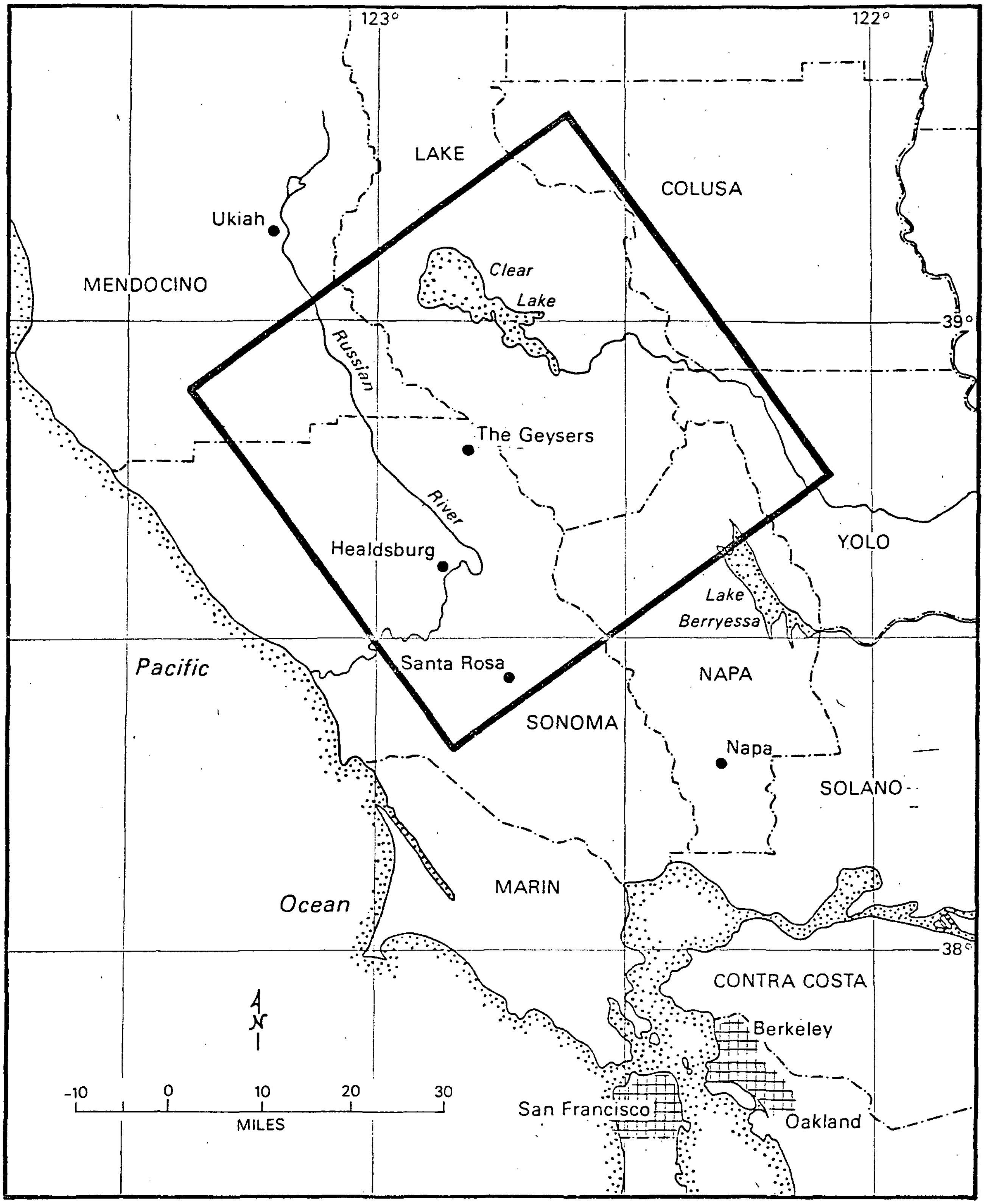


Figure 1

Geysers-Clear Lake Geothermal Study Area

The project includes a one-day presentation in Berkeley of the report and plates. At that time specific questions and prospects will be discussed.

The price for the entire area is $39,500. The north or south parts may be purchased separately for $22,000 each.

In this study, the scientists of Eureka Resource Associates combine more than 17 years experience in The Geysers, covering geophysical surveys, geochemical analyses, geologic mapping, drill hole evaluation and expert testimony.

INTRODUCTION

Although the rate of geothermal exploration in The Geysers steam field continues to increase, the more than 250 exploration and development wells drilled to date in The Geyers-Clear Lake region have failed to define the geographic limit of economic steam production. Indeed, the interpretation of regional geophysical data (Chapman, 1975; Isherwood, 1976a, b, and c; Iyer and others, 1978) suggests that the region, characterized by anomalously high crustal temperatures at relatively shallow depth, may be three or four times larger than the present production area. Some of the temperatures may be high enough to be economically interesting. Present production comes from a roughly elliptical area about 13 miles long and 6 miles wide (see location map, Figure 2.

The report and accompanying plates present a geological and geophysical basis for judging the relative merits of geothermal prospect areas in The Geysers-Clear Lake region. There is a discussion of the criteria for determining the geographic extent, and the geological, geophysical and hydrological characteristics of the presently producing Geyers steam field. Special note is taken of the evidence for, and causes of, the high heat flow and high crustal temperatures at shallow depth. Significant data for the entire Geysers-Clear Lake region, selected to evaluate the quality of particular geothermal prospects within the region, is presented. Prospect evaluation is based upon a comprehensive compilation of geological and geophysical data from both published and private sources, in the form of transparent overlays on an enhanced Landsat image, as well as a regional thermal gradient map calculated from Curie point depth estimates, and a tectonic analysis of that data.

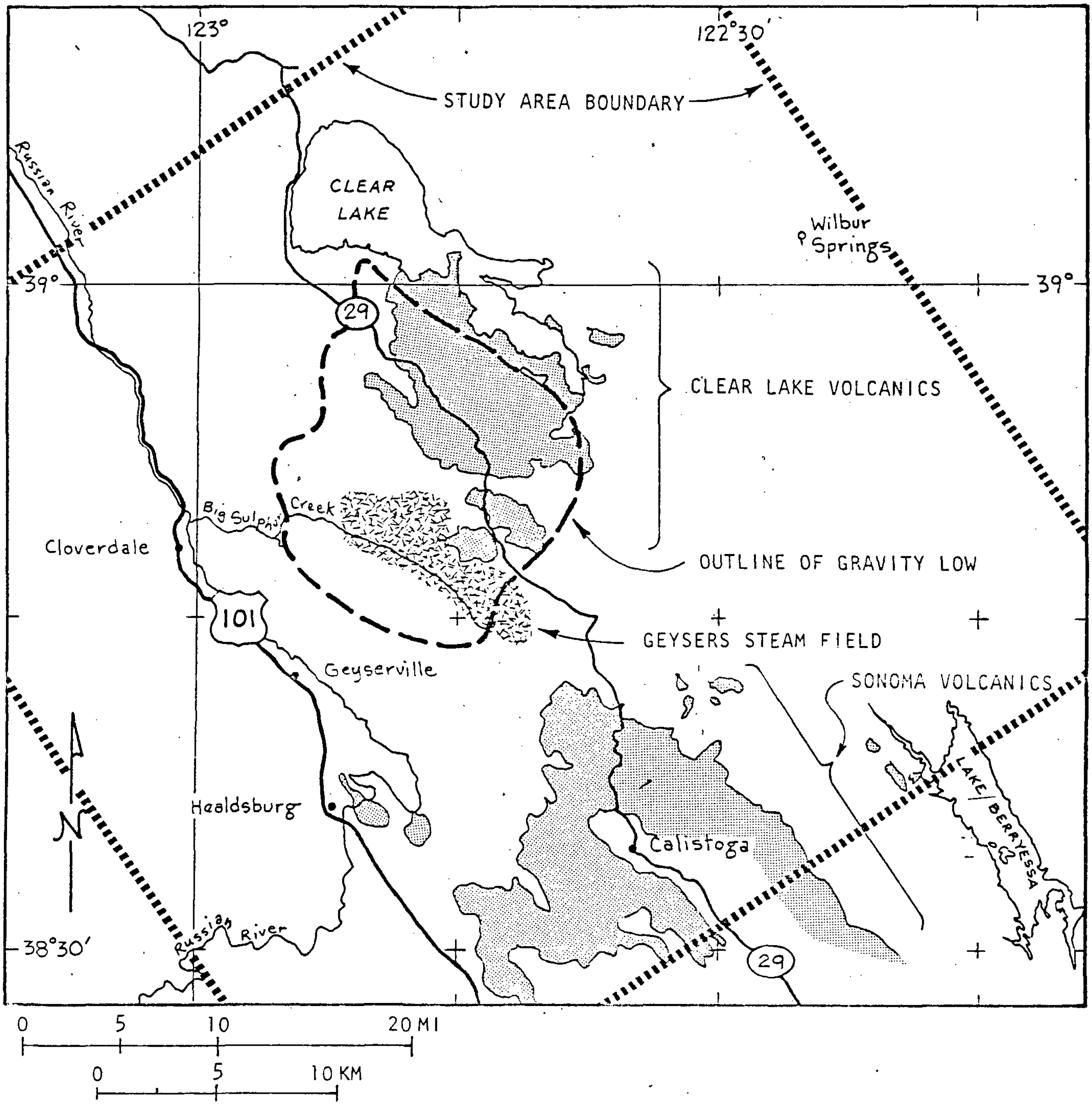


FIGURE 1

LOCATION MAP OF THE GEYSERS-CLEAR LAKE REGION SHOWING THE RELATIONSHIP BETWEEN THE STEAM FIELD, THE GRAVITY LOW, AND THE CLEAR LAKE AND SONOMA VOLCANICS. (Modified from Chapman, 1975.)

APPENDIX

The following items are taken from the final report and plates to show prospective clients examples of the deliverables.

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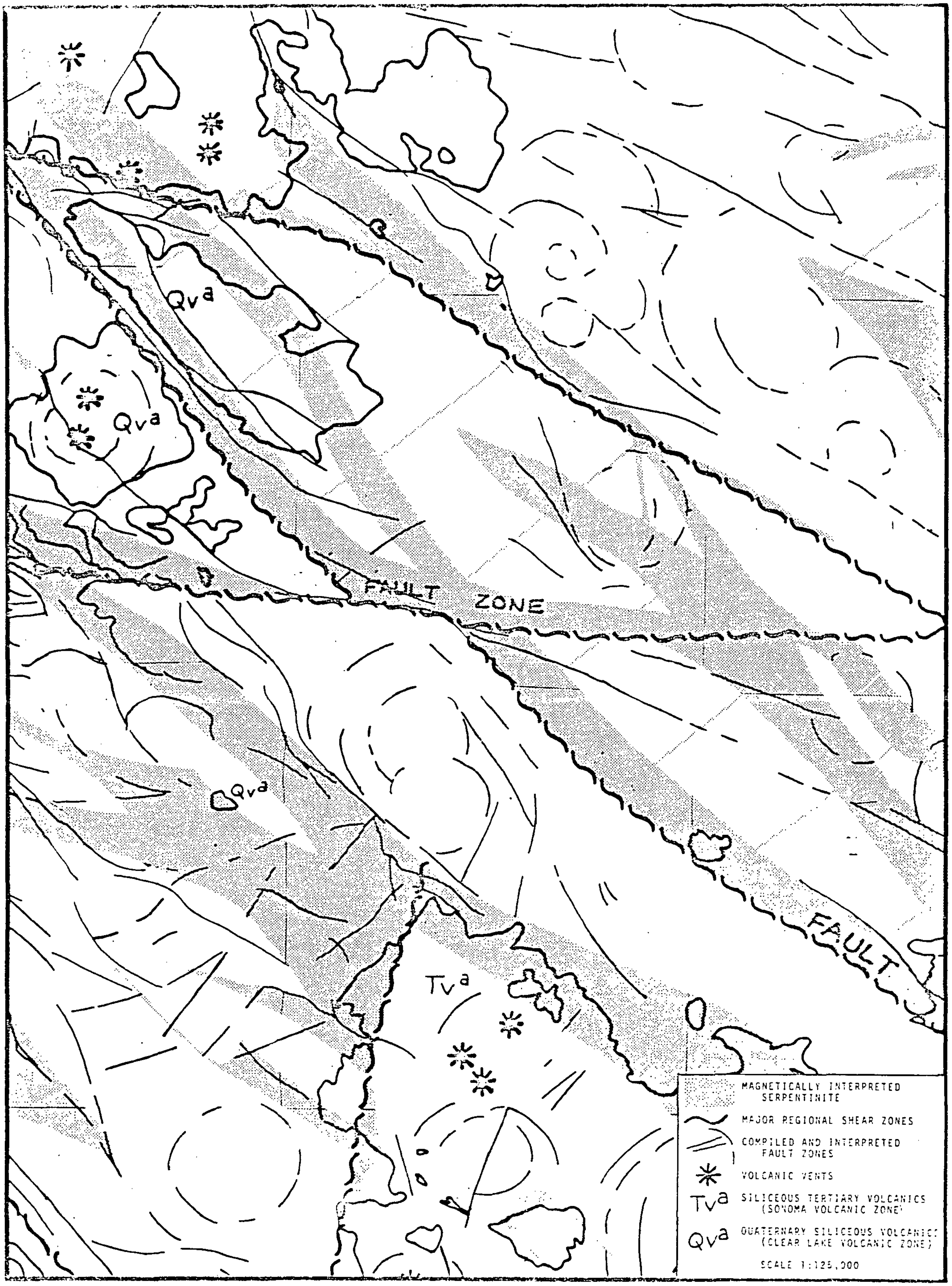
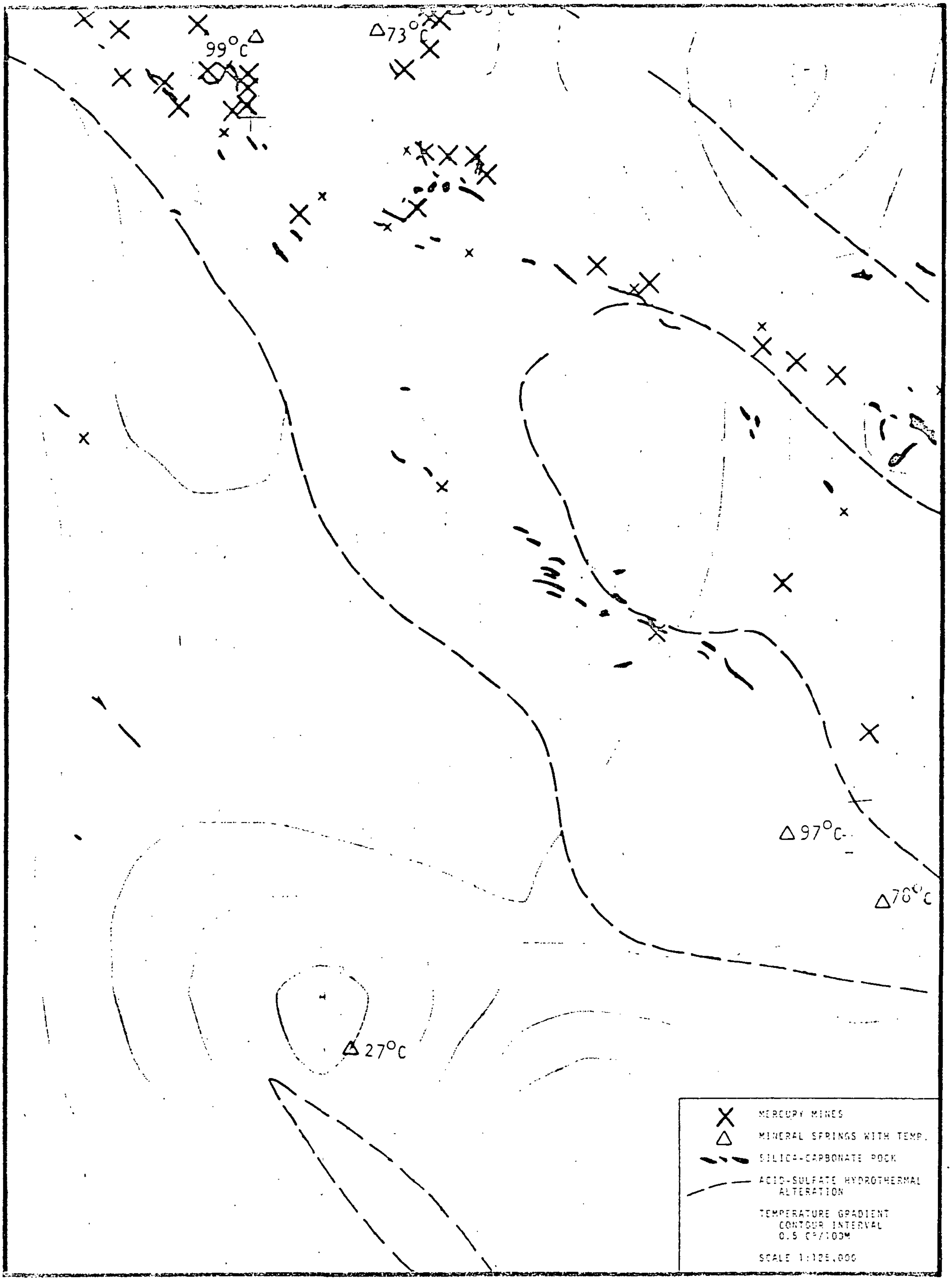


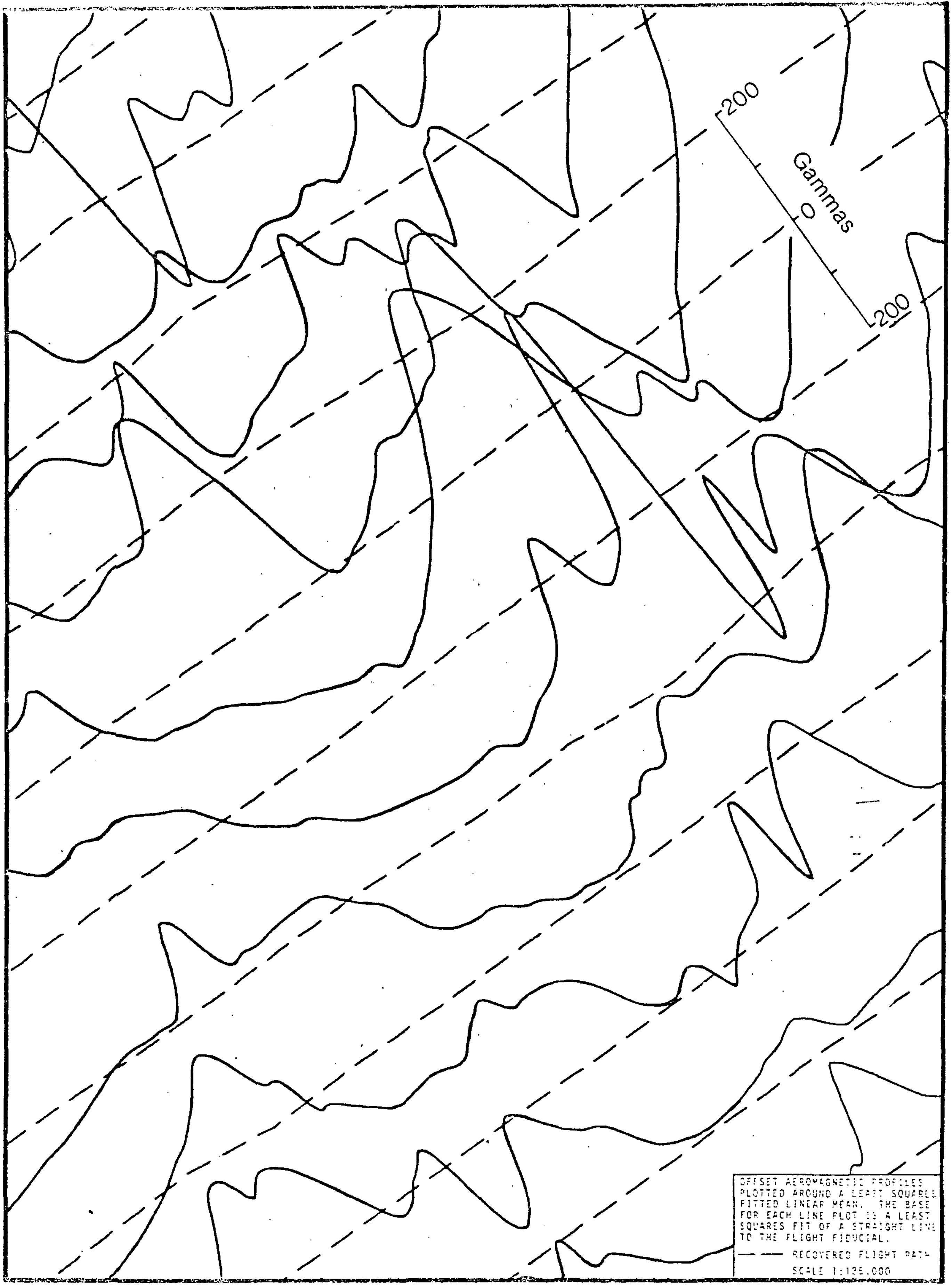
TECTONIC MAP

(Locational information removed)

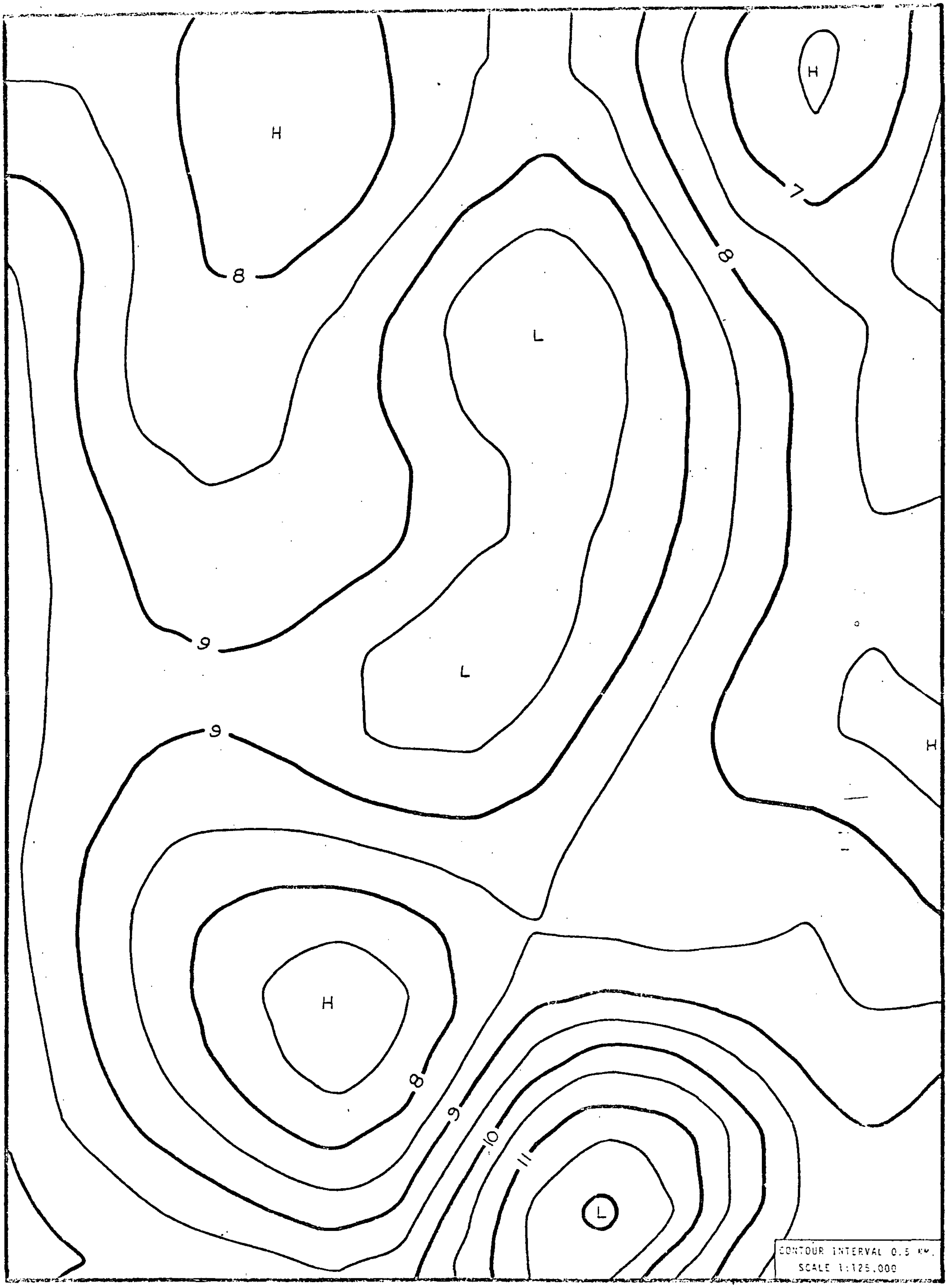


APPARENT TEMPERATURE GRADIENT MAP,
BASED UPON CURIE POINT DEPTH ESTIMATES

(Locational information and geothermal wells removed)

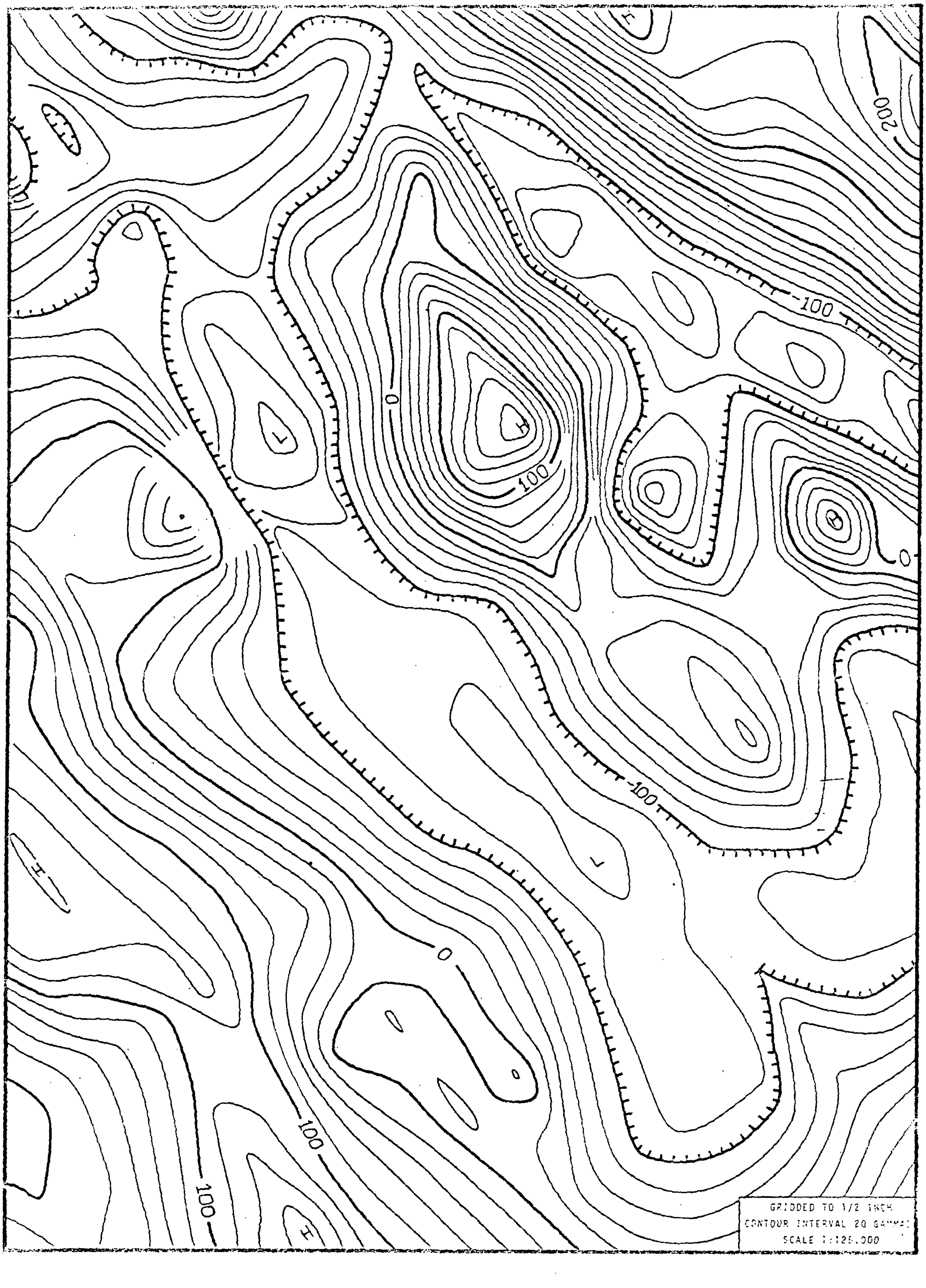


OFFSET AEROMAGNETIC PROFILES
(Locational information removed)



ESTIMATED DEPTH TO THE CURIE POINT TEMPERATURE

(Locational information removed)



RESIDUAL AEROMAGNETIC ANOMALY MAP

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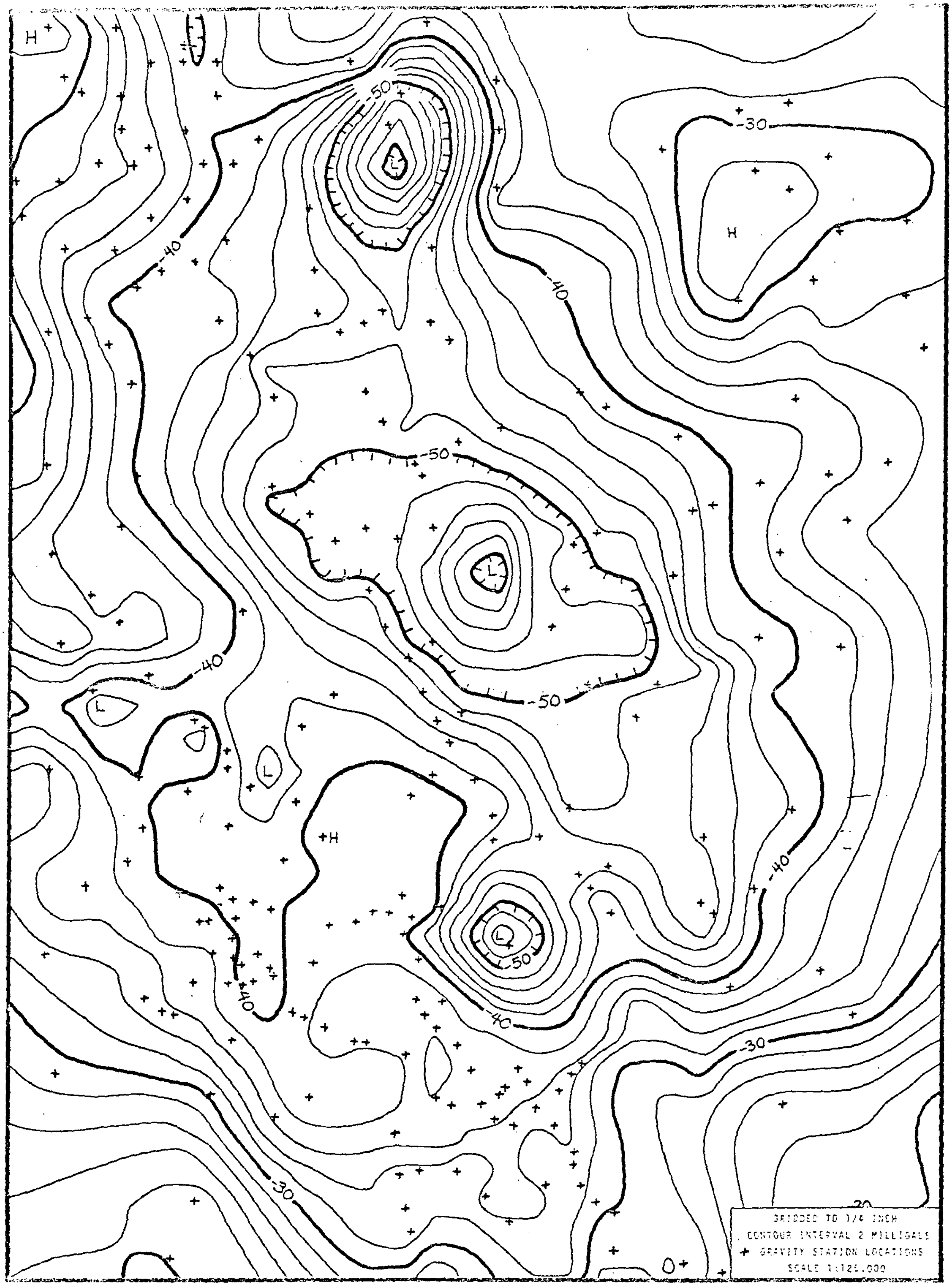
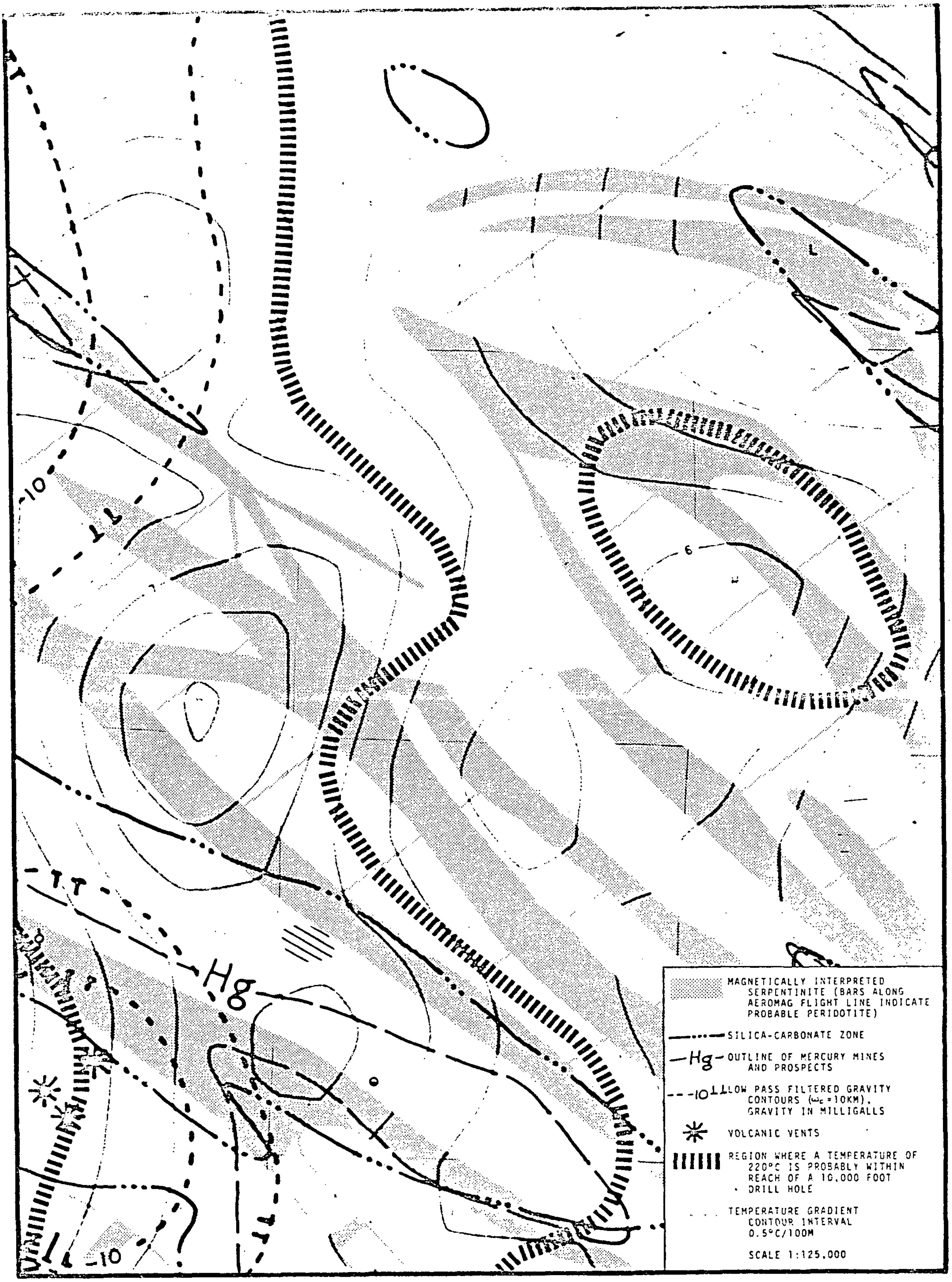


COMPLETE BOUGUER GRAVITY MAP
(Locational information removed)



GEOTHERMAL PROSPECT EVALUATION MAP

(Locational information removed)

DETERMINATION OF CURIE POINT DEPTHS
FROM AEROMAGNETIC DATA

December [illegible], 1976

Revised February 23, 1977

EUREKA Resource Associates, Inc.
[illegible] Shattuck Avenue, Suite [illegible]
Berkeley, California 94704
(415) [illegible]

DETERMINATION OF CURIE POINT DEPTHS FROM AEROMAGNETIC DATA

13 December 1976

Revised 23 February 1977

Prepared by

Eureka Resource Associates, Inc.
2161 Shattuck Avenue
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(415) 845-3800

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INTRODUCTION

In the exploration for geothermal resources, the horizontal variation in vertical temperature gradient is very important. Recent advances in the processing and interpretation of aeromagnetic data have provided a new method for determining this spatial information, based on the concept of loss of magnetism with increase in rock temperature past the Curie point. This paper considers the theory of magnetism relative to the Curie temperature and applies the concept to the mapping of the Curie isotherm over an area of geothermal or petroleum interest.

The Curie point of a material is the temperature at which the material loses its ability to retain magnetism after the energizing field is removed; that is, it is the temperature at which a material changes from ferromagnetic to paramagnetic behavior. All rocks generally contain some ferromagnetic mineral, and it is the amount of ferromagnetic mineral contained in a rock that ordinarily determines its magnetic properties.

This paper describes the methods used to calculate from aeromagnetic data the depth to the Curie point in the crust and discusses the meaning of the depth so calculated, in terms of temperature, temperature gradients, and a reasonable petrologic model of the crust. The primary method of calculation of the Curie point depth to be described is that used by Bhattacharyya and Leu (1975) to analyze the magnetic anomalies measured over Yellowstone National Park. The discussion of the meaning of the Curie point depth in terms of temperature and crustal models will be developed.

Applications of the determination of the Curie point surface in the crust to geothermal and petroleum exploration problems will also be briefly discussed.

MAGNETIC PROPERTIES OF MINERALS AND ROCKS

The physics of magnetism and magnetic minerals and rocks is described and documented in texts by Strangway (1970) and by Nagata (1961). For purposes of geophysical investigation, Nagata describes a rock as a scattering of ferromagnetic mineral grains throughout a matrix of paramagnetic and diamagnetic silicates. Further, "because of the presence of these ferromagnetic particles, the bulk of the rock shows the characteristics of ferromagnetism, such as the magnetic hysteresis and the Curie temperatures, although the intensity of magnetization may sometimes be not much more than that of paramagnetics," (Nagata, 1961, p. 126). There are very few ferromagnetic minerals, and they consist mainly of the more or less titaniferous iron oxides and the iron sulfide pyrrhotite. Some of the ferromagnetic minerals are very widely distributed in small quantities in most rock types. The spatial distribution of these minerals determines the pattern seen on aeromagnetic maps.

Table I is a list of the magnetic properties of selected minerals. Note that the susceptibility and saturation magnetization of magnetite are very much greater than those of any other minerals. Given the wide distribution of magnetite (with varying amounts of titania in solid solution), we recognize that the dominant control of the magnetic signal from the crust is in the mineral magnetite.

The Curie point of pure magnetite is 578°C, well below its melting point of about 1590°C. The presence of other metallic elements as substitutes for either the ferric or ferrous ion in the spinel structure of magnetite generally reduces the Curie point of the magnetite. The results of measurements have been summarized by Nagata (1961, p. 116-117) but the only geologically important substitution is in the series magnetite → ulvöspinel, where a combination of Fe^{+2} and Ti^{+4} replaces the Fe^{+3} of magnetite. Figure 1 is a

TABLE I

MAGNETIC PROPERTIES OF SELECTED MINERALS

	Susceptibility (weak magnetic field) emu/g	Neel or Curie Temperature C°	Saturation Magnetization
A. Diamagnetic minerals			
Quartz	-0.50×10^{-6}		
Calcite	-0.38×10^{-6}		
Gold	-0.14×10^{-6}		
B. Paramagnetic minerals			
Fayalite	$+100.0 \times 10^{-6}$	-147°	
Pyroxene	$78. \times 10^{-6}$	-233°	
Biotite	$60. \times 10^{-6}$		
Rhodochrosite	$100. \times 10^{-6}$	-241.5°	
Ilmenite (pure)	0.87×10^{-6}	-216°	
Rutile	0.07×10^{-6}		
C. Ferromagnetic minerals			
Magnetite (Fe_3O_4)	$100,000. \times 10^{-6}$	578°	92.0
Maghemite (γFe_2O_3)		545 to 675°C	83.5
Ilmenite-hematite solid solution		50 - 300°C	21.0 max.
Pyrrhotite (FeS_{1+x})		320°C	19.5 max.
Ulvöspinel		-153°C	
Hematite		680°C	~0.5

Compiled from Nagata, 1961 and Strangway, 1970.

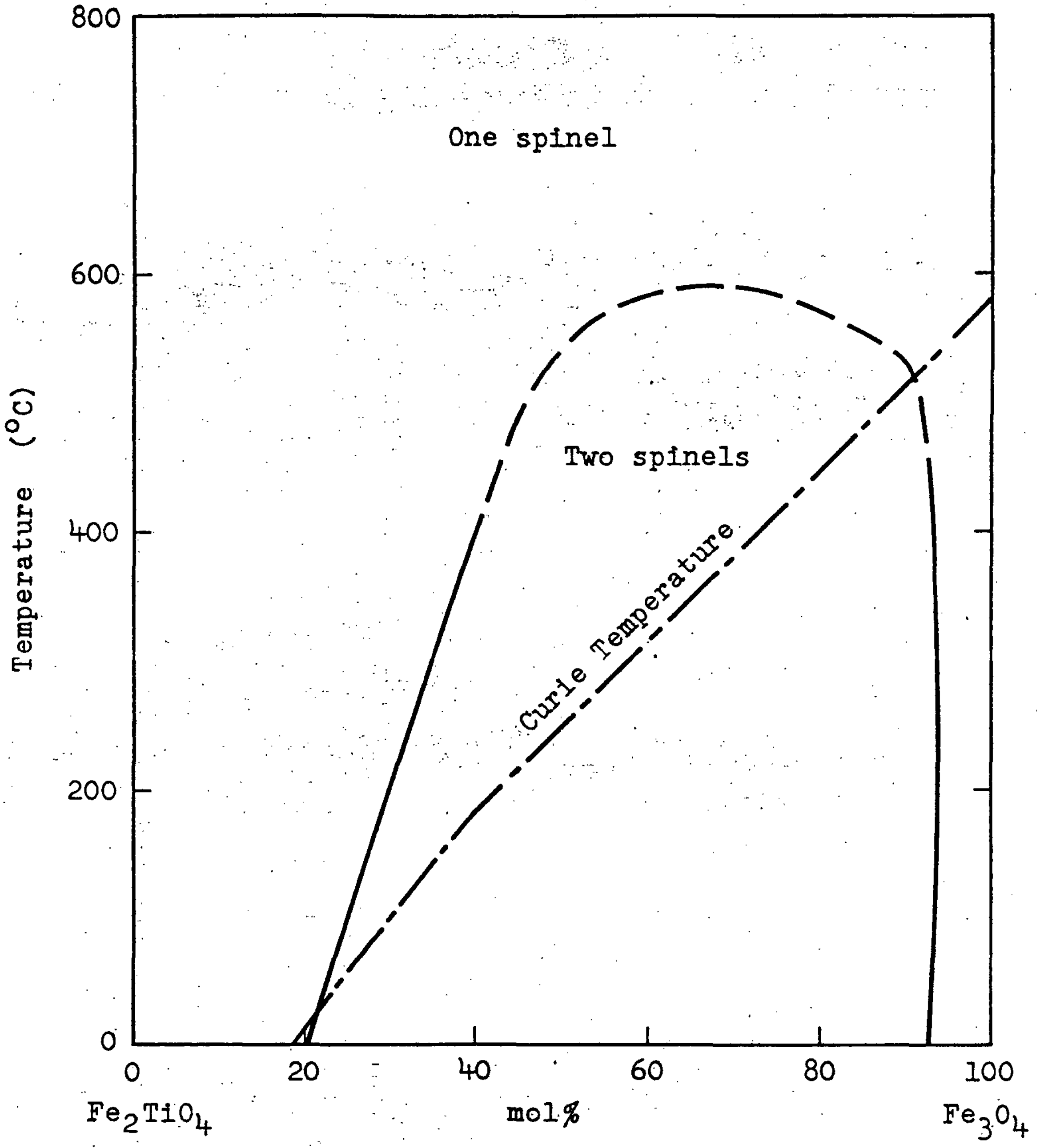


FIGURE 1
PHASE RELATIONS AND CURIE POINT
VERSUS
CHEMICAL COMPOSITION IN THE MAGNETITE-ULVÖSPINEL SERIES

(NAGATA, 1961, FIGURE 3-7 AND FIGURE 3-5) superposition of the Curie temperature versus the chemical composition in the series magnetite-ulvöspinel (Nagata, 1961, p. 82) and the subsolidus equilibrium phase diagram of the same series (Nagata, 1961, p. 84). The importance of Figure 1 may be appreciated when one realizes that the ulvöspinel end member has not been described in any mineralogy text and has only recently been recognized by x-ray microprobe analysis as a minor constituent of the magnetite of volcanic rocks. That is, since ulvöspinel exists in nature only as a minor exsolved phase from rapidly quenched melts, the magnetite end members are the dominant, in fact the only, magnetic mineral of importance in this study. The only other ferromagnetic mineral listed on Table I with a saturation magnetization approaching magnetite is maghemite. Its Curie temperature had to be estimated because maghemite inverts irreversibly to αFe_2O_3 (hematite) above temperatures of about 275°C.

At the Curie point of pure magnetite, 578°C, the equilibrium mineral assemblage in a FeO-Fe_2O_3-TiO_2 system is a mixture of relative pure ilmenite with relatively pure magnetite or relatively pure hematite, depending upon the fugacity of oxygen in the system as per

$$\underset{\text{Magnetite}}{2Fe_3O_4} + \underset{\text{Oxygen}}{\tfrac{1}{2}O_2} \longleftrightarrow \underset{\text{Hematite}}{3Fe_2O_3}$$

Since the magnetite has an inverse spinel structure with a unit cell dimension of 8.395Å and the ilmenite has a rhombohedral structure with a unit cell dimension of 5.538Å, the mutual solubility of the two minerals is very small. In plutonic igneous rocks the typical mineral association in this system is magnetite and ilmenite, or hematite and ilmenite. As noted by Strangway (1970, p. 32),

> "In many volcanic rocks the content of titanium is high, and the iron-titanium oxide minerals formed are a mixture of magnetite and ulvöspinel. As cooling proceeds, the ulvöspinel becomes mineralogically unstable and tends to oxidize to form ilmenite and magnetite. Since the ilmenite is rhombohedral and is structurally incompatible with the

> magnetite, an intimate intergrowth of magnetite and ilmenite forms. . . . . .the effect of this is to create great magnetic stability in magnetite."

The subsolidus curve for the mixture of hematite and ilmenite (Figure 2) is very like that for the titanomagnetites (Figure 1), except that the solid solution, the one mineral phase, is much more restricted at 500 - 600°C than in the former system.

The magnetic behavior of these minerals as a function of temperature has one additional feature of particular interest here. Figures 3 and 4 are plots of magnetic susceptibility of some Japanese volcanic rocks as a function of field strength, at low field strengths. In general the susceptibility of most rocks increases as a somewhat irregular function of the exciting field strength, so for interpreting aeromagnetic data it is important to measure the susceptibility of ferromagnetic rocks at or near the very weak strength of the earth's main field (~0.6 Oersteds). Figure 5 shows the effect of measuring thermomagnetic curves at various field strengths and Figure 6 shows the measurement of the susceptibility of a ferromagetic rock at 1.35 Oersteds as a function of temperature. Note how rapidly the susceptibility drops to very low values as the Curie point is reached. Note also that susceptibility actually increases as a function of temperature until the Curie point is reached at field strengths approaching the earth's main field.

The importance of these observations will be made explicit in the following discussion of models of the magnetic crust.

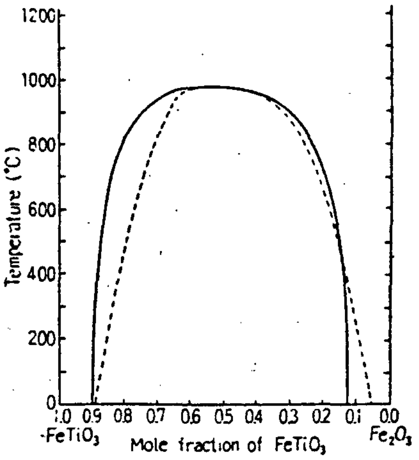


FIGURE 2

SOLVUS CURVE FOR ILMENITE-HEMATITE SOLID SOLUTION SERIES.

(Nagata, 1961, Figure 3-27)

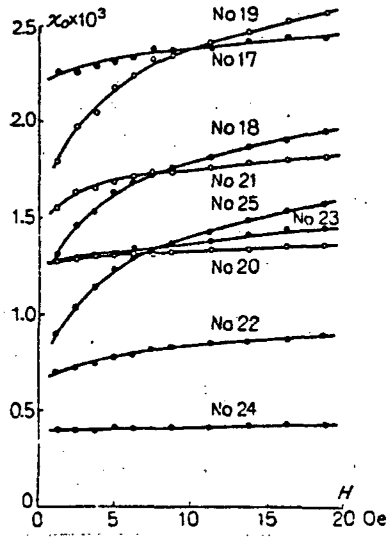


FIGURE 3

MAGNETIC SUSCEPTIBILITY OF VOLCANIC ROCKS AS DEPENDENT ON EXTERNAL MAGNETIC FIELD.

(Nagata, 1961, Figure 4-3)

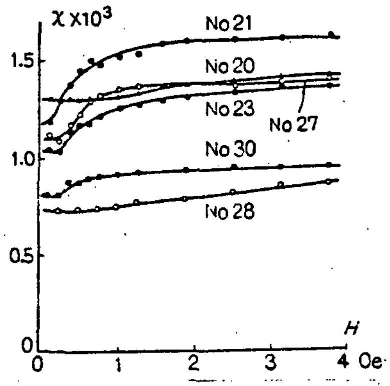


FIGURE 4

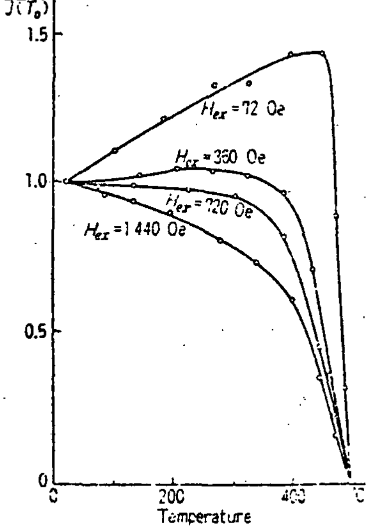
MAGNETIC SUSCEPTIBILITY OF VOLCANIC ROCKS IN WEAK MAGNETIC FIELDS.

(Nagata, 1961, Figure 4-4)

FIGURE 5

THERMOMAGNETIC CURVES IN VARIOUS MAGNETIC FIELD STRENGTHS.

(Nagata, 1961, Figure 3-19)



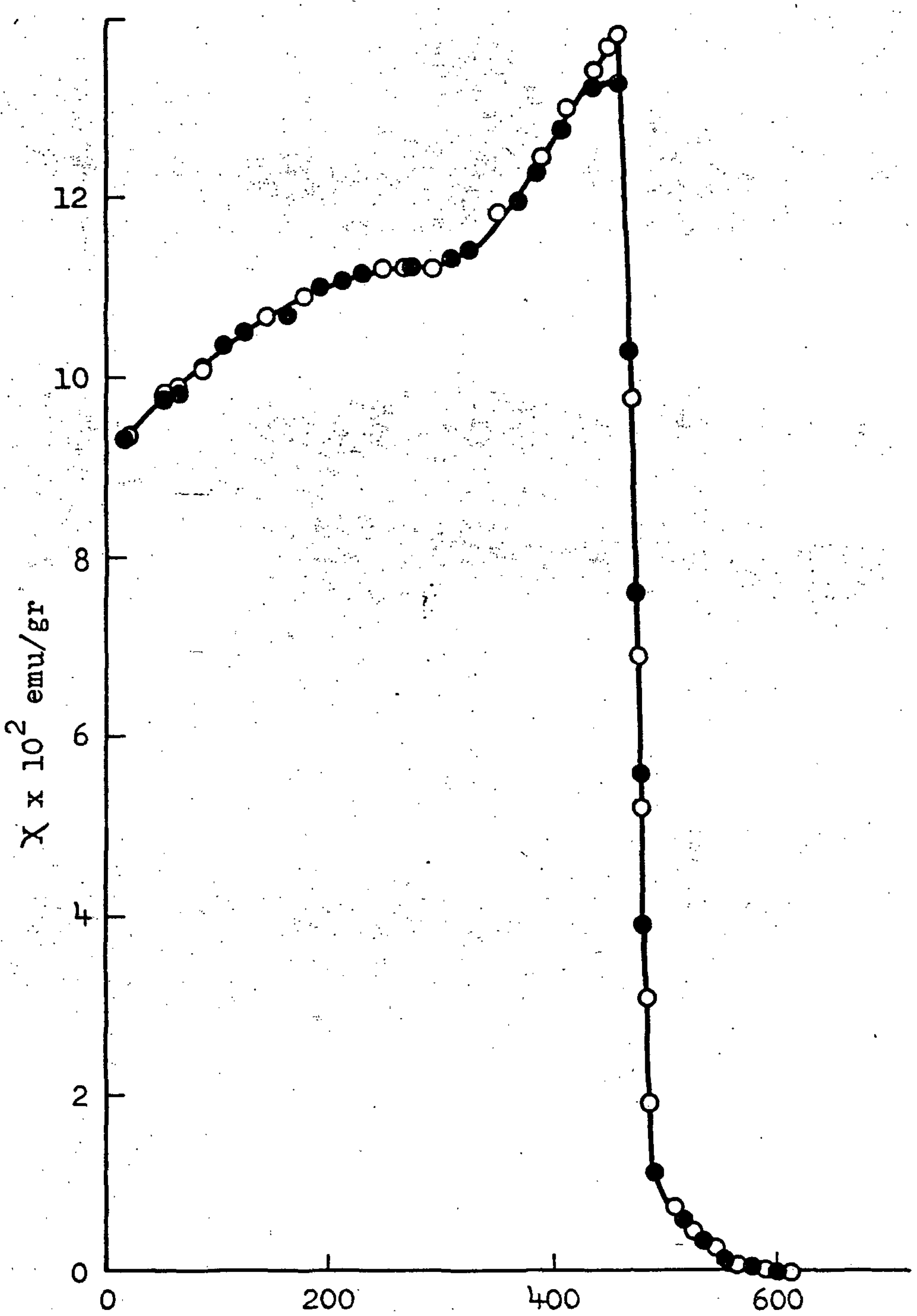


FIGURE 6

CHANGE OF MAGNETIC SUSCEPTIBILITY
WITH TEMPERATURE IN Hex = 1.35 Oe.
Sample: Haruna ferromagnetic mineral

(NAGATA, 1961, FIGURE 5-30)

MAGNETIC CRUSTAL MODELS

It is here proposed that the only mineral of magnetic significance at the base of the magnetic crust is magnetite, and that the base of the magnetic crust is determined by the Curie point (the temperature of thermal disordering) of magnetite (578°C). In defense of this proposal, we will examine briefly a thermal and petrologic model of the crust.

The temperature within the crust increases as a function of depth, as indicated on Figure 7, which is constructed from the estimates of Diment et al. (1975). The estimated thickness of the magnetic crust (compared to the petrologic crust) is indicated by the intercept of these depth temperature curves with the Curie point range, and this thickness is generally much less than the thickness of the crust estimated from seismic data. We interpret this to mean that at the Curie point depth the crust consists of average crustal material, which has an average temperature of 578°C, and which probably has been at or near that temperature for a geologically long period of time.

Figure 8 is a pressure-temperature diagram for metamorphic facies (Hietanen, 1966) from which we may deduce the metamorphic assemblage present as a function of depth in the Curie point range of crustal rocks. Using this assemblage as a guide, we can now select a magnetic crustal model. At the Curie depth in the crust, we suggest that there is a high grade metamorphic assemblage, of which the Grenville rocks of eastern Canada would be a good model. Plate I is an aeromagnetic map (scale 1/253,440) of typical high grade (muscovite-sillimanite facies) Grenville metamorphic rocks from south central Quebec, Canada.* The magnetic signature of such high grade metamorphic rocks is characteristic enough in terms of high space frequencies and amplitudes to allow mapping of the Grenville metamorphic "front" on aeromagnetic maps. Note, incidentally, that the magnetic "anomalies" on this map are characteristically much longer

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*Available upon request.

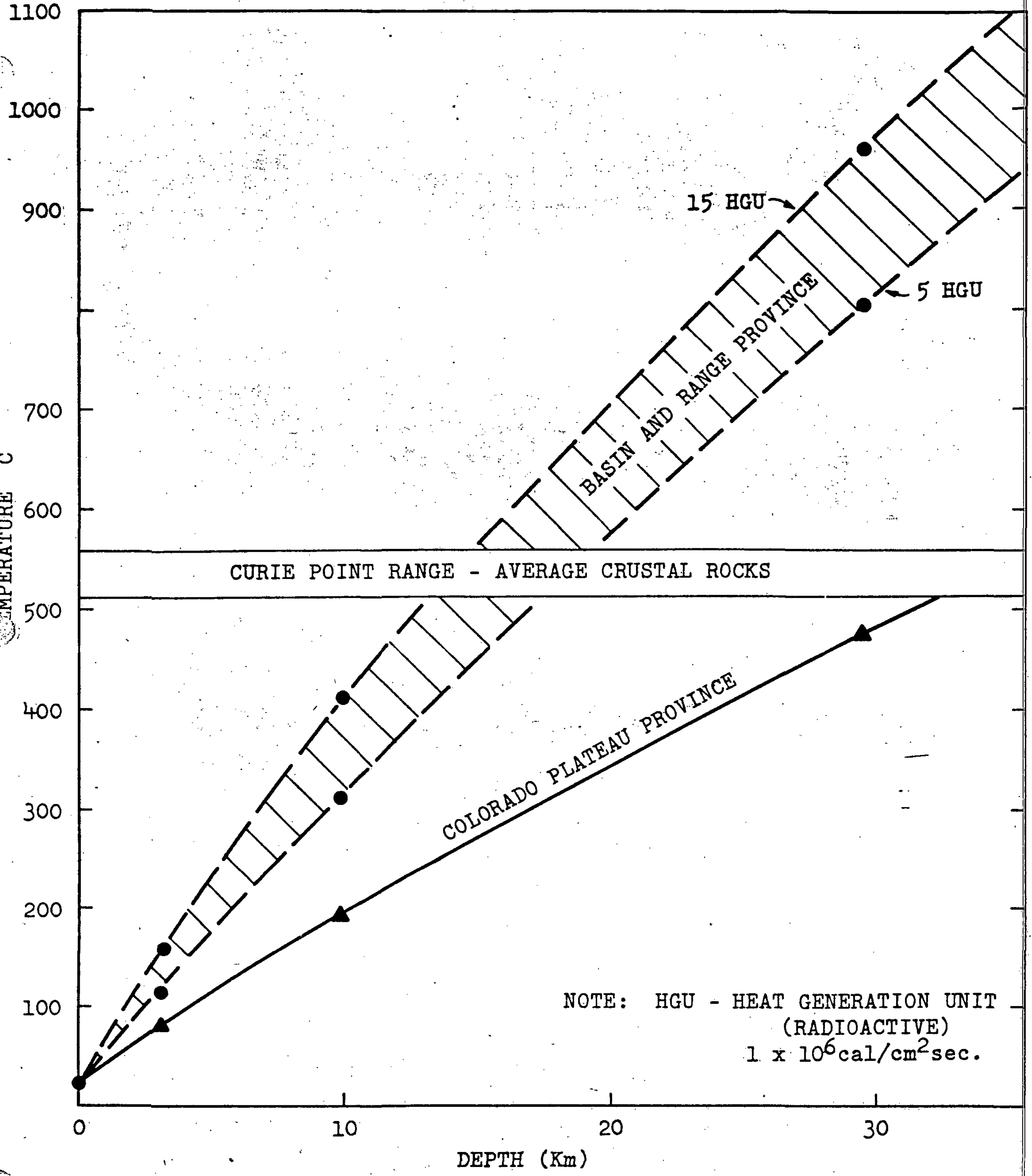


FIGURE 7

CRUSTAL DEPTH-
TEMPERATURE ESTIMATES FROM DIMENT, ET AL., 1975

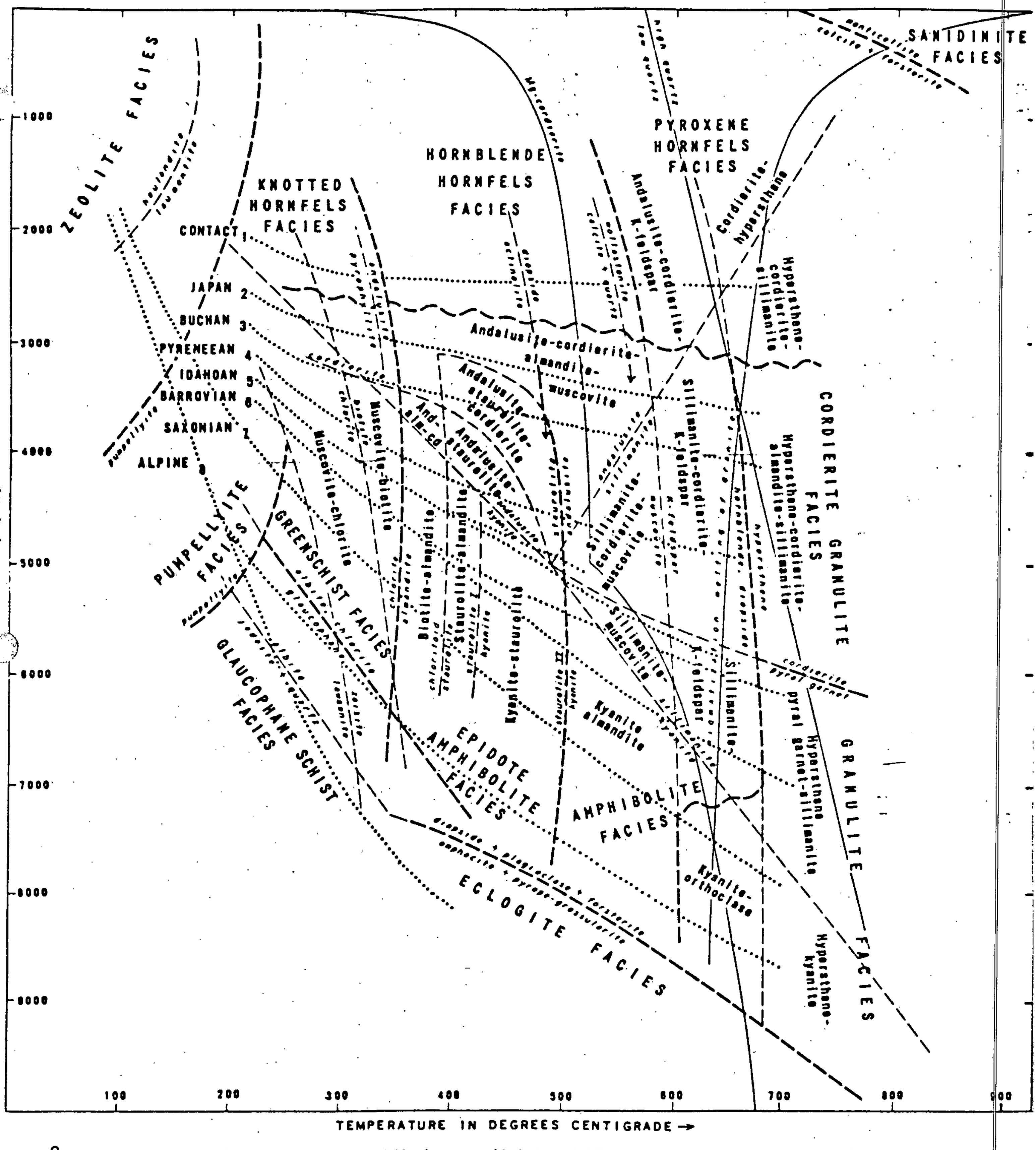


FIG. 8 —Tentative *PT* diagram showing possible stability fields of metamorphic facies and *PT* gradients in various types of metamorphism in relation to the meltin rve of the granite (Tuttle and Bowen, 1958), to the curve for low-high quartz (Yoder, 1950), and to the lower stability boundary of Mg-cordierite (Schreyer and Yoder 4). Stability boundaries of the other index minerals are inferred from field relations. Inferred stability field of staurolite is shaded. Temperature for the triple point wa hosen to satisfy field relations and the geologic thermometry for the rocks northwest of the Idaho batholith. Pressures are estimated. Wavy line shows the arbitrary limit of hornfels facies and of granulite facies. Subfacies correspond to zones in the field and are indicated by two or more diagnostic minerals (heavy print).

than they are wide; that is, that the "anomalies" are on the whole well modeled by horizontal cylinders and infinite dikes. Note also that the Grenville type metamorphic rocks are rich in magnetic signal.

We therefore suggest that at the level of the Curie point of magnetite in normal crustal rocks, active regional metamorphism to muscovite-sillimannite facies is taking place; and that in the simple metal oxide system $FeO-TiO_2-Fe_2O_3$ where reaction kinetics are not an issue, the only ferromagnetic mineral present will be magnetite. We further suggest, based upon reasonable projections from Figure 6, that the temperature indicated by the Curie point calculations described here is 500°C ± 20°C, the temperature at which the intensity of magnetization of the magnetite has fallen to about 1/10 of its maximum. Figures 9 and 10 are simplified thermal models of the crust, and on Figure 10 we have indicated diagrammatically what we think the actual and the calculated Curie point isothermal surfaces might look like.

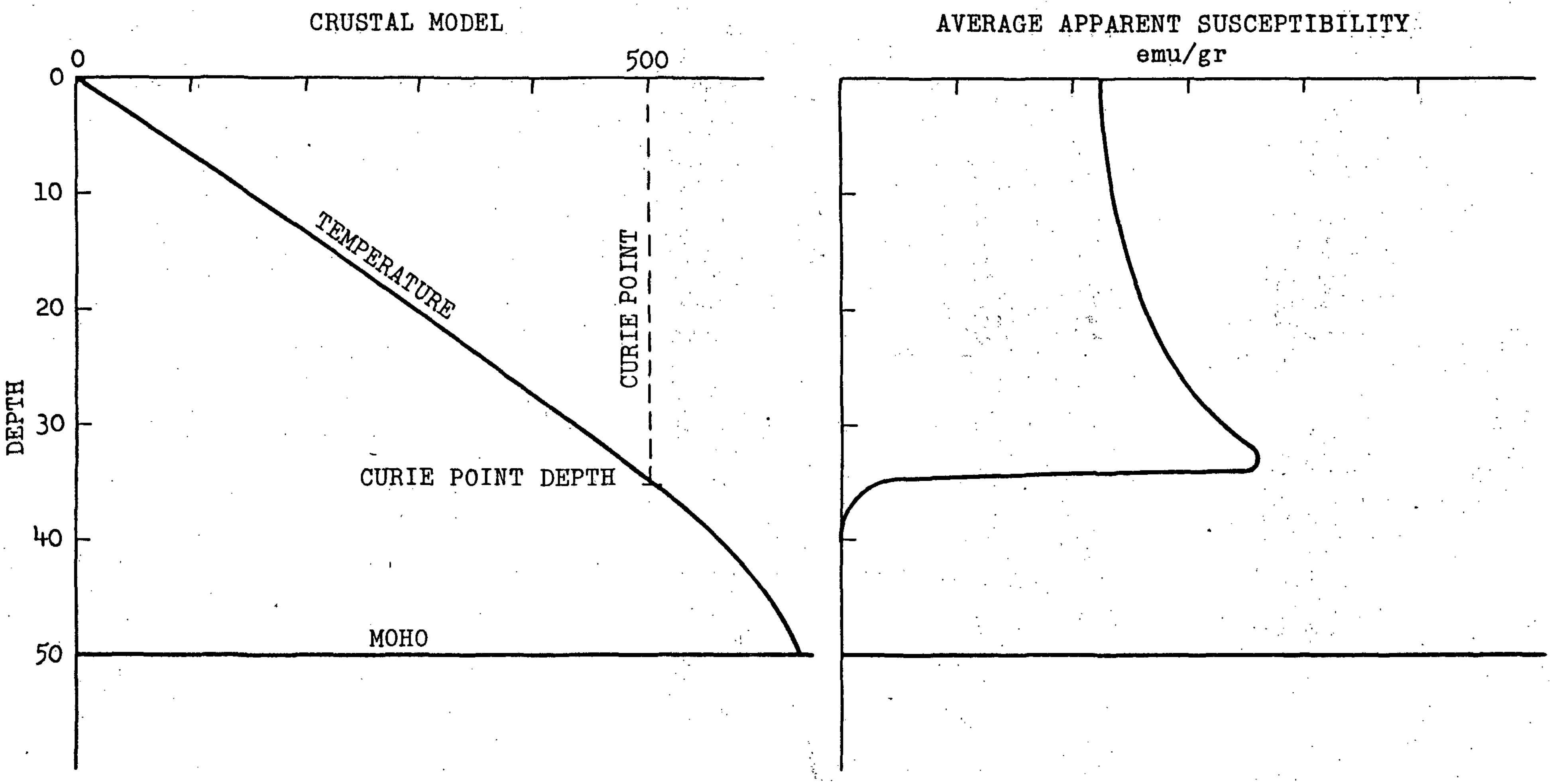


FIGURE 9
AVERAGE CRUST

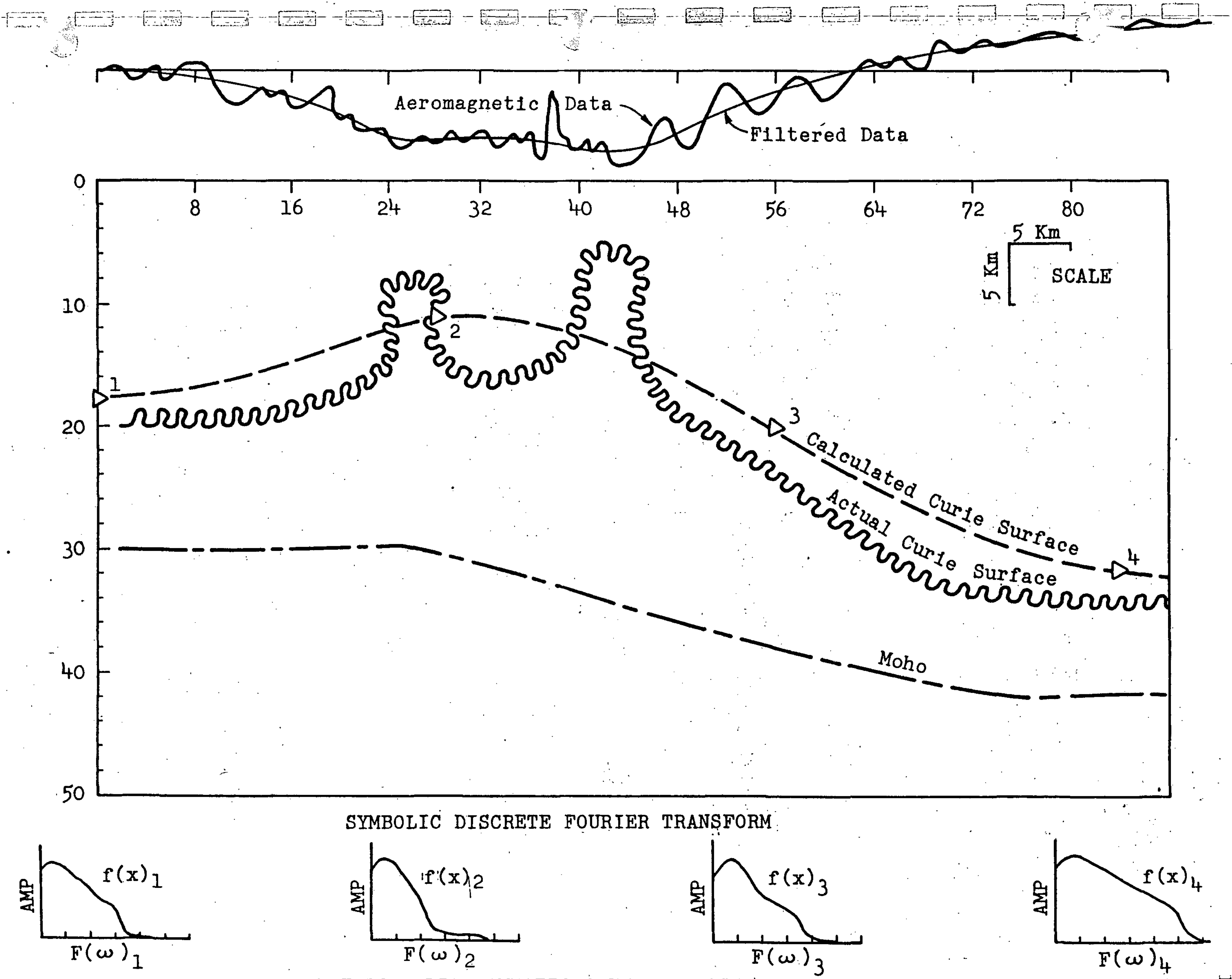


FIGURE 10 DIAGRAMMATIC CRUSTAL CROSS SECTION

DETERMINATION OF CURIE POINT DEPTHS FROM AEROMAGNETIC DATA

We estimate the depth to the Curie point in the crust by estimating the depth to the bottom of the magnetized bodies which make up the crust. In general the farther away a magnetic body (source of magnetic signal) is from the sensor, the broader is its response in space (the longer the spatial wave length of its effect). Since this effect is independent of the relative strength of magnetization of the body, it is generally used in some form or other in depth determinations from aeromagnetic data. However, the farther away a body is, the more difficult it is to estimate its distance accurately.

A summary of all the factors which must be considered in designing an aeromagnetic survey and preconditioning the resulting data prior to the actual calculation of the Curie point depth is presented in Table II. One facet of the survey design will be considered here as an example of the detail necessary in treating all these factors.

Since our primary concern in estimating the depth to the Curie point is in the quality of the low space frequency data, it is necessary to consider the sources of noise in aeromagnetic data from the point of view of space frequency content. For example, in deciding whether to drape fly the aircraft, or to fly at a constant barometric elevation, we consider that the primary noise from constant barometric flying is topographic noise. This is high frequency noise because it is near the sensor. It has very large amplitudes because the contrasts between magnetic rocks and air are large. The primary noise from drape flying is caused by the inability of the aircraft to track the relief perfectly. This noise is of very high frequency, but with good flying at relatively high altitudes, the amplitude is very small. Careful consideration of these factors shows that drape flying is desirable, with special precautions for maintaining a constant terrain clearance. In practice it is necessary that the

TABLE II

NOISE AND SIGNAL: THEIR SOURCES AND CHARACTERISTICS FOR SPACE FREQUENCY ANALYSIS

SOURCE	CHARACTERISTICS AMPLITUDE	SPACE FREQUENCY	DESIGN CONSIDERATIONS AND REMARKS
A. Data noise sources			
1. Flying height			
a. very low	large	high but variable	Atmospheric turbulence is a noise source at very low levels, particularly in rough terrain. ~1000 ft. seems a good compromise. The higher the data is flown, the more real signal is lost.
b. intermediate	↓	↓	
c. high	small	low	
2. Type of flying			
a. constant barometric			Aircraft noise is minimal
(1) Topographic noise	very large	broad freq. band	When surface rocks magnetic & topography rough, this can be very difficult.
(2) Aircraft noise	very small	very high	Filtering can handle
b. constant terrain clearance			Topographic noise is minimal
(1) Topographic noise	small	high	Filterable
(2) Aircraft noise	small	very high	Filterable
3. Flight and Tie-line Spacing	small	The flight line and tie line spacing are the fundamental frequencies	The cost of the survey goes up directly as the number of flight lines increases.
4. Flight block size	If the flight block is too small, the signal amplitude will be too low at the low frequency end.		
5. Flight azimuth	small	low	Flights at right angles to basement magnetic "grain" sample basement magnetic signatures best. Other directions tend to shift the freq. to the low end of spectrum and give too large an estimate of Curie point depth.

TABLE II - CONTINUED

SOURCE	CHARACTERISTICS		DESIGN CONSIDERATIONS AND REMARKS
	AMPLITUDE	SPACE FREQUENCY	
B. Geologic Noise Sources			
1. Earth's main field	very large	very high	Removed by subtracting the IGRF or a "regional" field
2. Large geologic blocks that extend well beyond the area of interest horizontally	large	very high	Mostly reduced by removing a 2nd 3rd order regional fit by least squares methods
3. Small near surface magnetic geologic bodies	large	low	Reduced to manageable size by zero phase shift low pass filtering
C. Signal-magnetic bodies within the crust	medium to small	low	The mean geometry of these bodies is assumed to produce the signal necessary to map the Curie point depth
D. Computational noise sources	variable	low	These are discussed in this paper, based upon the work of Bhattacharyya and Leu (1975a)

aircraft has a good differential altimeter, that there be two pilots with dual controls (one pilot to be responsible for staying on line and the other for control of terrain clearance), and a mean terrain clearance of at least 1,000 feet.

In the following pages we will concentrate on the actual Curie point analyses after the aeromagnetic data has been flown and preconditioned according to the requirements listed in Table II.

CALCULATION OF THE CURIE POINT DEPTH

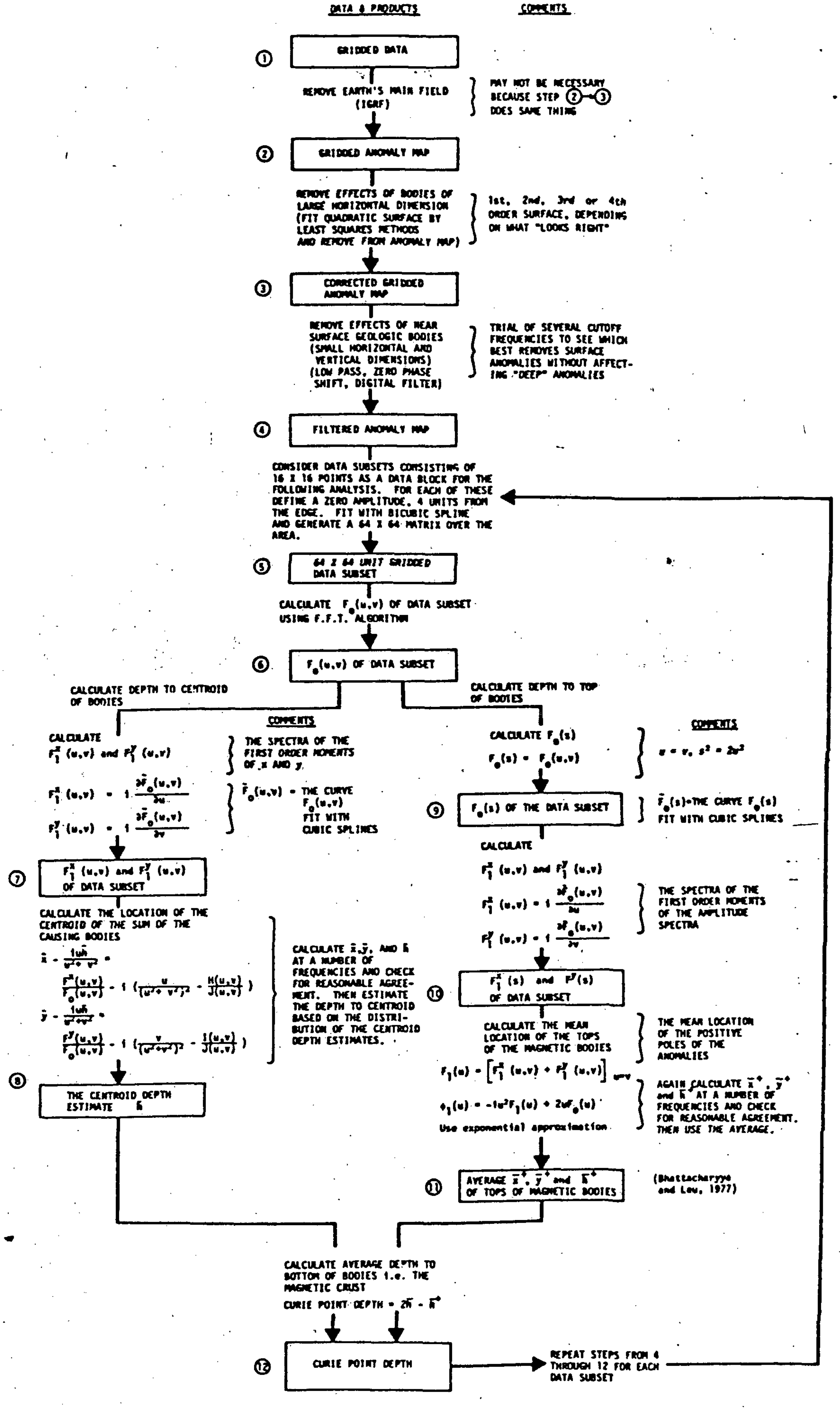
The Curie point calculation described here is based upon two papers by Bhattacharyya and Leu (1975a and 1975b). The first of these papers discusses the automatic interpretation of potential field data based upon calculation of the spectra of the moments of the anomalies and the improvement in bottom depths to be expected from such an approach when properly done. The second paper describes an application of the concepts of the first in the calculation of the depth to the Curie point from aeromagnetic data of Yellowstone. The frontispiece of this paper is a recontoured map of the Curie point isotherm for Yellowstone, calculated by Bhattacharyya and Leu (1975b), overlying an enhanced Landsat image of the Yellowstone region. The simple Landsat interpretation indicated on the overlay by dotted lines is strongly reinforced by the Curie point depth contours and suggests the value of the Curie point depth contours in guiding geothermal exploration in such an area.

Table III is a diagrammatic flow sheet of the Curie point depth calculation procedure proposed by Bhattacharyya and Leu and used on the Yellowstone data. For spectral analysis the data is divided into discrete blocks, as indicated by step 5 on Table III. In the Yellowstone analysis a square array of 16 x 16 data points, with an areal coverage of 31 kilometers by 31 kilometers was used for the basic analysis unit, with each unit overlapping surrounding units by half. They describe the procedure in the following manner.

> "Since discontinuities in data values at the edge of the area give rise to Gibbs phenomena and aliasing, it is assumed that the residual field vanishes at a point which is located at a distance of four units of data spacing from the boundary of the block. Inclusion of these points results in 18 x 18 (non equispaced) data points in the block. Bicubic splines (Bhattacharyya, 1969) are then fitted to the data in such a way that the residual field and the continuity of the first and second derivatives are maintained at each of the data points." (Bhattacharyya and Leu, 1975b)

TABLE III

FLOW DIAGRAM FOR CALCULATION OF THE CURIE POINT DEPTH DATA



The discrete Fourier Transform $F_0(u,v)$ is then obtained for this data block with the help of the fast Fourier Transform algorithm. By using a method outlined by Bhattacharyya and Leu (1975a), the spectra $F^x(u,v)$ and $F^y(u,v)$ of the first order x and y moments, respectively, of the residual field are computed.

In the block under consideration, there will be a number of bodies causing the anomalies. The mean location of the centroid of these bodies $(\overline{x}, \overline{y}, \overline{h})$ is determined with the help of the euqations of steps 7 and 8, Table III.

The frequency range in both u and v selected for this computation runs from the fundamental frequency to its fifth harmonic. For several frequencies in this region, $\overline{x}$, $\overline{y}$ and $\overline{h}$ are calculated, and the average of their values provides a good estimate of the location of the centroid. With careful choice of frequencies the accuracy of this estimate can be kept fairly high. However, it should be noted that the effect of shallow sources, unless removed completely from the data, will produce an error in the estimate.

Next, the radial spectrum $F_0(s)$ is generated by evaluating, with the help of $F_0(u,v)$, the amplitude spectrum along the line at 45° with the frequency axes. The spectra $F^x(s)$ and $F^y(s)$ of the first order x and y moments of the residual field are then computed. A combination of $F_0(s)$, $F^x(s)$ is used to determine the mean depth to the tops of magnetized bodies for the block. Again, for the sake of accuracy the range of frequency should not exceed the tenth harmonic of the fundamental frequency.

With the average location of the centroid and the mean depth to the tops of magnetized bodies known, it is simple and straightforward to calculate the mean depth to the bottoms of these bodies. The calculated depth is interpreted as the depth to the Curie point isotherm for the block.

INTERPRETATION AND APPLICATION TO EXPLORATION PROBLEMS

The shape of the Curie point isothermal surface can indicate the location and general shape of the heat source. Although the temperature of that surface is higher than the 160 to 360°C target of geothermal exploration, and the resolution of the calculated surface is low, as indicated on Figure 10, it is the trend and anomaly pattern of the surface which is most useful rather than its absolute value.

Geothermal exploration targets are identified from this surface on the assumption that near surface heat leakage from the highs on the Curie point isothermal surface is controlled by structure. Both the detail of the aeromagnetics (the higher space frequency data) and interpretation of enhanced Landsat imagery have been used in the construction of structural models to relate the heat source mapped to near surface sources, as indicated in our very simple frontispiece interpretation.

The Curie point surface can be interpreted in a similar manner to indicate where, in an otherwise cold young Tertiary basin, source rocks have been heated enough to begin the generation and migration of petroleum. It can also be used to suggest where a basin, at relatively shallow depth, might be warm enough to have only gas and carbon remaining or even only carbon remaining (Hunt, 1975).

In theory, given a temperature and a depth, a thermal gradient map could be prepared from the Curie point depth data. However, it should be realized that, while the relative values calculated may be reliable, the error bar on absolute values is probably large.

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A PRELIMINARY GEOLOGICAL AND GEOPHYSICAL MODEL OF AN INTRUSIVE GEOTHERMAL SYSTEM FOR USE IN EXPLORATION FOR AND EVALUATION OF GEOTHERMAL RESOURCES

By

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July 26, 1976

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INTRODUCTION

An accurate, simplified geological and geophysical model of the evolution of an intrusive geothermal system is useful as a guide in the interpretation of field exploration and valuation data. The model presented here is of necessity somewhat speculative because so few geothermal areas have been explored in any detail and those that have differ greatly from each other. However, there exist good data in the literature to support most of the conclusions drawn in this presentation. It is to be hoped that such a presentation as this will help clarify thinking on the meaning of the results of exploration surveys and highlight inconsistencies and gaps in the model for further investigation.

The first section of the paper will present a justification for the use of a "Porphyry Copper" model for geothermal systems of intrusive origin and the second section will discuss the model in terms of its measurable and mappable parameters such as tectonic features, geophysical variables, and chemical temperature estimates. These parameters will also be discussed in terms of the kinds of geothermal targets to be expected from any level within the system.

THE INTRUSIVE MODEL

In the discussion of a currently active geologic process which is mainly taking place within the crust (safely out of sight) it is often useful to consider a fossil analogue of the process that has been well exposed by erosion. In fact, most geologic processes have been investigated by looking at the record in the rocks as well as at currently active processes (Uniformitarianism). Little of this kind of investigation appears to have been written up in the geothermal literature.

To find a fossil analogue of the intrusive geothermal system, it is necessary to consider what recognizable aspects of the system would remain after erosional unroofing and cooling. Perhaps the most obvious remnant of <u>any</u> geothermal area should be a large volume of "hydrothermal alteration." Hydrothermal alteration is a broad concept that requires considerable description and definition, but there does exist abundant literature on the subject (see for example, Meyer and Hemley, 1967) that can be used as a guide. Table I indicates some of the hydrothermal alteration types that have been noted in geothermal areas.

Many of the large areas of hydrothermal alteration that have been mapped and which are discussed in the literature are related to base or precious metal mineralization and they are generally associated with small, usually porphyritic intermediate to siliceous, intrusive stocks - at least inferentially. One of the corollary observations of the above is that large batholiths of the "Sierran Granite" type do not appear to have large hydrothermal haloes, even in the roof zone, and the alteration appears to be nearly "dry"; that is, almost purely thermal rather than hydrothermal. Some of the best studied and best reported zones of hydrothermal alteration are related to "porphyry copper" type mineralization. In addition, the recent literature has provided some good generalized models of the porphyry copper system (Jerome, 1966; Lowell and Guilbert, 1970; Sillitoe, 1973; James, 1971; and Hollister, <u>et al</u>, 1974).

TABLE I

TYPES OF HYDROTHERMAL ALTERATION NOTED IN GEOTHERMAL AREAS

Geothermal Area	Depth	Alteration Type	Reference
1. The Big Geysers	Surface	Argillization	
	300 to 5,000'	Argillization and silication	
2. Salton Sea (Niland)	Above 1,500'	Kaolinization (argillization)	Helgeson, 1968
	1,500 to 4,000'	K-spar and Albite, some sericitization quartz veining	
	Below 4,000'	Biotitization	
3. Yellowstone	Above 180'	Argillization (Montmorillonite and Kaolinite)	White, et al, 1971
4. Lassen Park Hot Springs	Surface	Argillization (Kaolinization and Silicification)	Anderson, 1935

The three-dimensional distribution of the physical parameters indicated by these models provides the basis for predicting the response of such a system to various geophysical and geochemical measurements made at the time of its formation. One of the best of the recent papers relates the evolution of the porphyry copper at El Salvador, Chile, to an acid hot springs system (Gustafson and Hunt, 1975) in a manner that accounts well for the formation of the acid-sulfate-chloride thermal waters of volcanic origin described by White, 1957. As noted by Sillitoe, 1973 and 1975, the porphyry copper system is often, though not always, a part of the subvolcanic environment and that hydrothermal alteration and ores in the volcanic environment are probably relatable to a porphyry copper system even where little or no copper is present at the level of observation. It is these observations that make the porphyry copper model a compelling one.

We will thus proceed to investigate how far a porphyry copper analogue allows us to proceed in interpreting the data from geothermal exploration.

EVOLUTION OF A GEOTHERMAL SYSTEM

For the purposes of this discussion we will consider the evolution of a geothermal system in three separate stages:

1. Intrusion of a small siliceous to intermediate stock into a high level in the crust,
2. Separation of juvenile hydrothermal fluids from the stock as a late stage of its crystallization, and

3. Development of convectively driven meteoric water hot springs system.

This separation while convenient for discussion must not be viewed as a natural division in the development of the system because we must recognize, for example, that as soon as unusual quantities of heat are introduced into saturated permeable rocks convective cooling must begin.

Stage 1

Figure 1 shows in plan and cross section the intrusion of a small siliceous to intermediate magma to within about 5 kilometers of the surface of the crust. The size and composition of the intrusion are suggested by the porphyry copper model (Lowell and Guilbert, 1970) and by the composition of the small young extrusive bodies spatially associated with many hot springs areas. Lowell and Guilbert have presented a table which characterizes 27 major porphyry copper deposits in terms of 43 geologic and mineralogic features and then suggests a typical porphyry copper system based upon the table. The "Typical Porphyry Copper" deposit (TPC) referred to in this paper is taken from Lowell and Guilbert's 1970 Table I. The TPC igneous host rock is 1.2 kilometers (4,000 feet) by 1.8 kilometers (6,000 feet) in maximum plan dimension and consists of a passively emplaced sequence of rock compositions ranging from diorite to quartz monzonite to quartz monzonite porphyry to quartz porphyry. The passive emplacement suggests that while doming is present above many porphyries the most important means of emplacement is "replacement, stoping, and assimilation" (Lowell and Guilbert, 1970) of the wall rocks, and that the body rose in response to buoyancy forces.

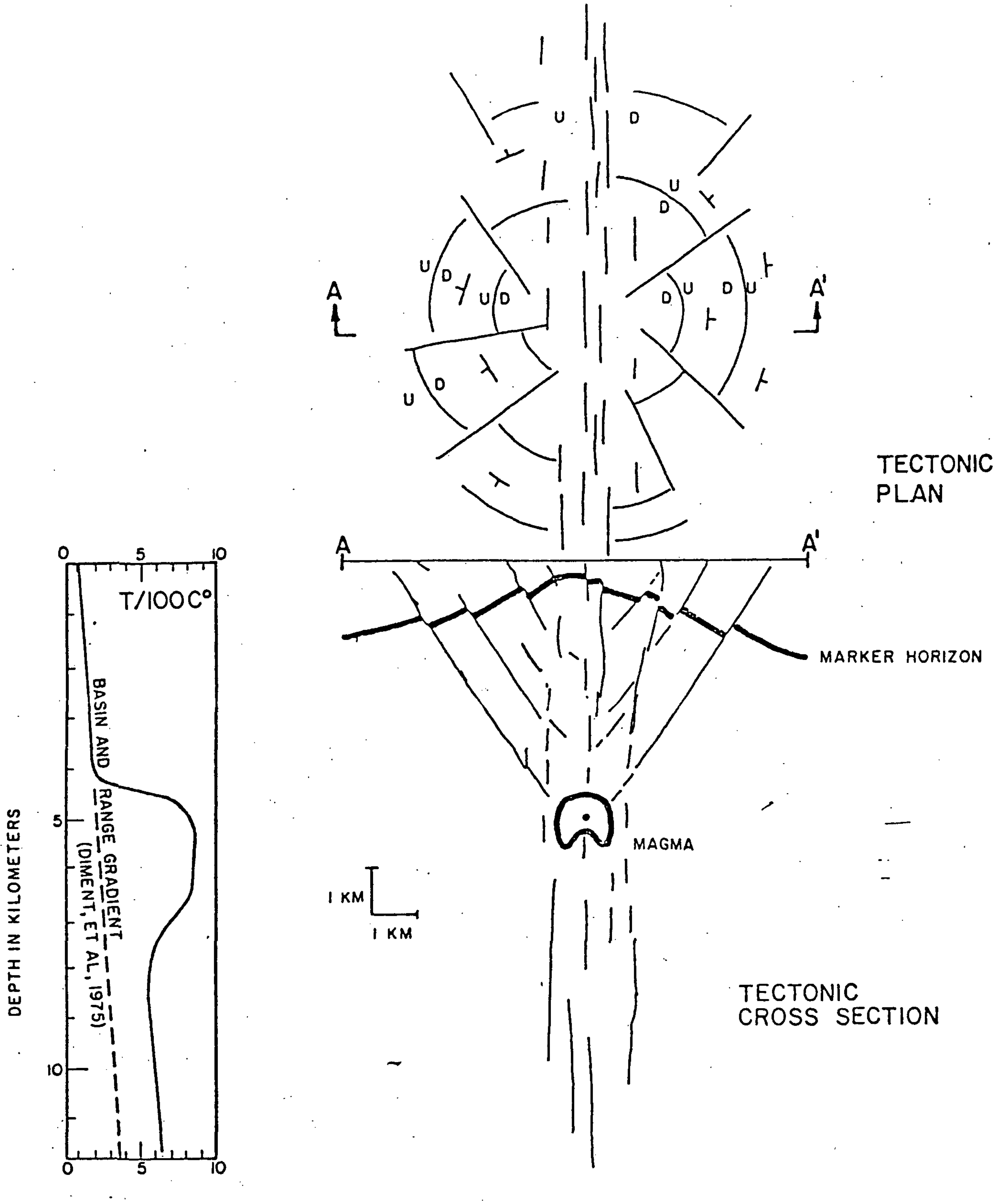

Figure 1. Model geothermal system, Stage 1, diapiric intrusion of an intermediate to siliceous magma to a high level within the crust.

The source of intrusive material is presently a matter of much debate and the depth of origin of the TPC and geothermal areas in a plate tectonic model must await, for example, the plate tectonic rationalization of the present configuration of the Basin and Range province (Rogers, et al, 1974; Hose and Taylor, 1974). However, several aspects are clear; the source is "deep" and regional scale structural preparation (deep reaching regional faults) seems necessary to allow such a small amount of magma to rise to a high level within the crust. The magma must rise under the impetus of gravity forces along these regional faults until it reaches some sort of equilibrium (passive intrusion) where buoyancy or density forces are balanced by increasing viscosity and the inertia of the wall rocks. If the magma does not stop in its ascent, a volcano or pumice dome is the product and the heat is dissipated. In some areas, for example, at Coso Hot Springs, porphyry copper extrusives may exist (Austin, 1964). These areas may have heated too little crust to be significant as geothermal areas.

The structural pattern suggested in Figure 1 is the classic antithetic dome, a concept which has much support from mapping in both epithermal mining districts and porphyry copper districts (Wisser, 1960) and very recently good theoretical support (Koide and Bhattacharji, 1975). It is the basic structural accommodation to the addition of material to a brittle crust. That the initial failure is generally brittle is perhaps a further indication of the high level of emplacement in the crust. In many places there is evidence of this radial and concentric fracture pattern, with or without visible structural relief, around hot springs areas.

The temperature model shown on Figure 1 combines the Basin and Range temperature gradient suggested by Diment, et al, 1975, with our speculations on the effect of the magma. Evidence for magma temperatures comes from fluid inclusion studies (Roedder, 1967) and thermodynamic considerations (Meyer and Hemley, 1967). We expect that the rate of magma movement may be geologically rapid but sensibly slow. The steep temperature gradient within the magma, of course, is to suggest convective heat transfer, which is also perhaps suggested by the complex pattern of petrologic compositions within the intrusion (see for example, Gustafson and Hunt, 1975).

Stage 2

Figure 2 shows the separation of a juvenile hydrothermal fluid from the crystalizing magma at a late stage of the crystallization process. The late stage separation is suggested by the existence of late unaltered, highly siliceous porphyritic dikes (Lowell and Guilbert, 1970) in TPCs and the fact that the mineralogy of the highest temperature alteration phases is very similar, if not identical, to the latest intrusive phases. Figure 3 is a schematic diagram of the alteration zoning produced by this hydrothermal fluid in the wall rocks and intrusions at the San Manuel-Kalmazoo porphyry copper (Lowell and Guilbert, 1970).

The depth temperature diagram on Figure 2 shows a series of steps within the hydrothermal fluid zone which is intended to represent convective cooling within "reaction fronts" in each of these alteration zones. Each reaction front may be pictured as a partially self-sealing front that approaches local thermodynamic equilibrium, and which is

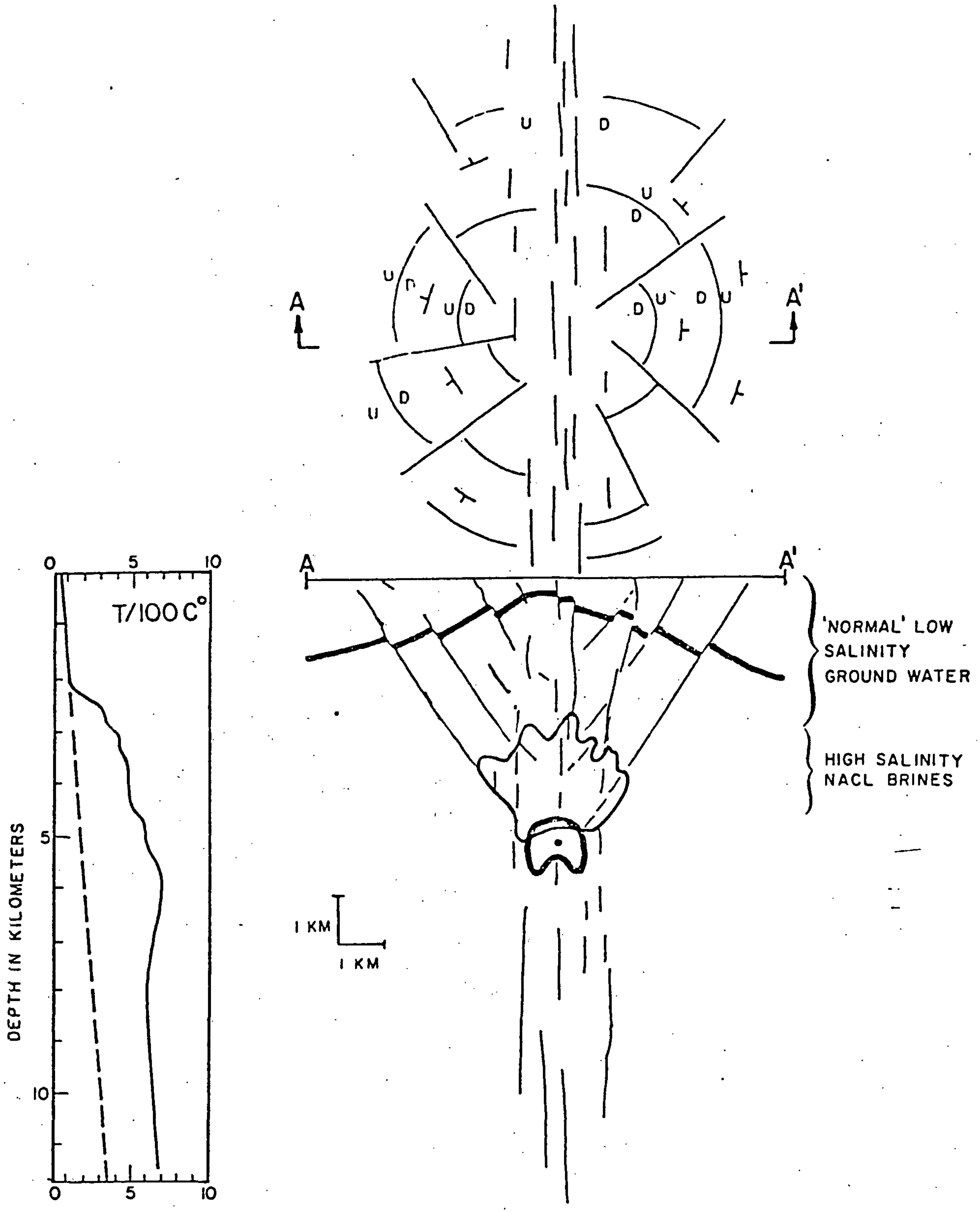

Figure 2. Model geothermal system, Stage 2, separation of a juvenile hydrothermal fluid from the crystallizing magma.

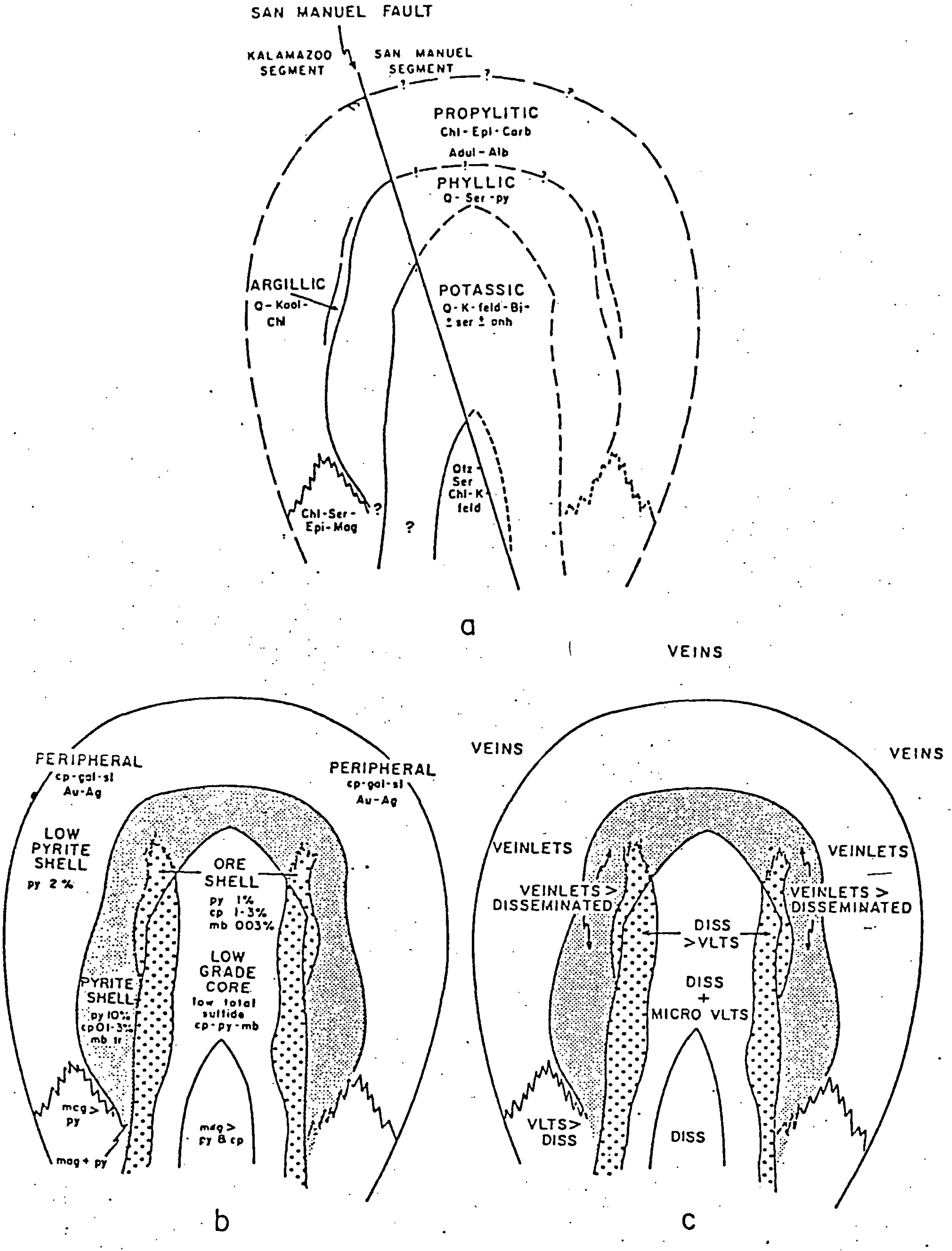

Figure 3. Concentric alteration-mineralization zones at San Manuel-Kalamazoo. (a) schematic drawing of alteration zones. Broken lines on Kalamazoo side indicate uncertain continuity or location and on San Manuel side extrapolation from Kalamazoo. (b) schematic drawing of mineralization zones. (c) schematic drawing of the occurrence of sulfides. (From Lowell and Guilbert, 1970).

enlarging itself outward at the expense of the next outer zone. Note that the outlines of the zones of penetration on Figure 2 are controlled by the structural plumbing generated by the intrusion itself, and that the particular mineralogy of the alteration zones is in part a function of the chemical composition of the wall rocks invaded. The composition of this hydrothermal fluid can be determined from chemical studies of fluid inclusions (Roedder, 1967) and of volcanic emanations (White, 1957) as well as from the thermodynamics relations of the minerals produced (Meyer and Hemley, 1967). It is perhaps best described as a NaCl brine for which the Salton Sea (Niland) geothermal area has provided some of the best data (White, Anderson, and Grubbs, 1963). The electrical resistivity of this brine is certainly less than 1 ohm-meter and perhaps as low as 0.1 ohm-meter.

The zone of quartz veining and "crackling" (Figure 3) extends from the innermost core to the propylitic alteration zone. These veinlets make up a very large portion of the rocks within the inner alteration zones but they do not represent tectonic features or a tectonic fabric. The veinlets have essentially random orientation and they die out in all directions (Gustafson and Hunt, 1975) (indicating hydrostatic load, not lithostatic). Thus except for the lack of systematic orientations, they look like tension gash veinlets. It is suggested here that these veinlets are a part of the physical response of the system to the abundant chemical alteration reactions taking place and therefore only reflect very local physical (essentially hydrostatic) response to the chemical system (therefore the lack of orientation). This is extremely important for geothermal exploration because these primary (Stage 2) alteration reactions

(Figure 4) take place over a relatively limited range of temperatures (300°C to 400°C) (Meyer and Hemley, 1967), and it is here suggested that this veining is the source of the measurable microearthquakes observed over geothermal areas and that the depth to microearthquake anomalies recorded in geothermal areas represents the depth to temperatures of 300°C to 400°C. In other words, we have available a geothermometer that gives a depth estimate.

Stage 3

The development of a convectively driven meteoric water hot springs system is illustrated on the sketches of Figure 5. This does not differ in any significant way from the genetic model of the El Salvador, Chile, porphyry copper (Figure 6) interpreted by Gustafson and Hunt (1975) from 25 man-years of geologic data. They note that the acid hot springs stage has produced abundant pyritic mineralization and argillic alteration in the uppermost levels of the mine.

The radial and concentric fracture pattern shown on Figure 5 and the alteration that is mappable at the surface related to this fracture plumbing are often recognizable in careful image interpretation. In desert regions this pattern is sometimes seen in playas on thermal imagery. The known hot springs are most often located at the intersection of a radial and a concentric fracture, the best plumbing perhaps, and only very rarely directly over the intrusive heat source. Thus, perhaps, the common experience of drilling into cooler ground beneath a hot springs area.

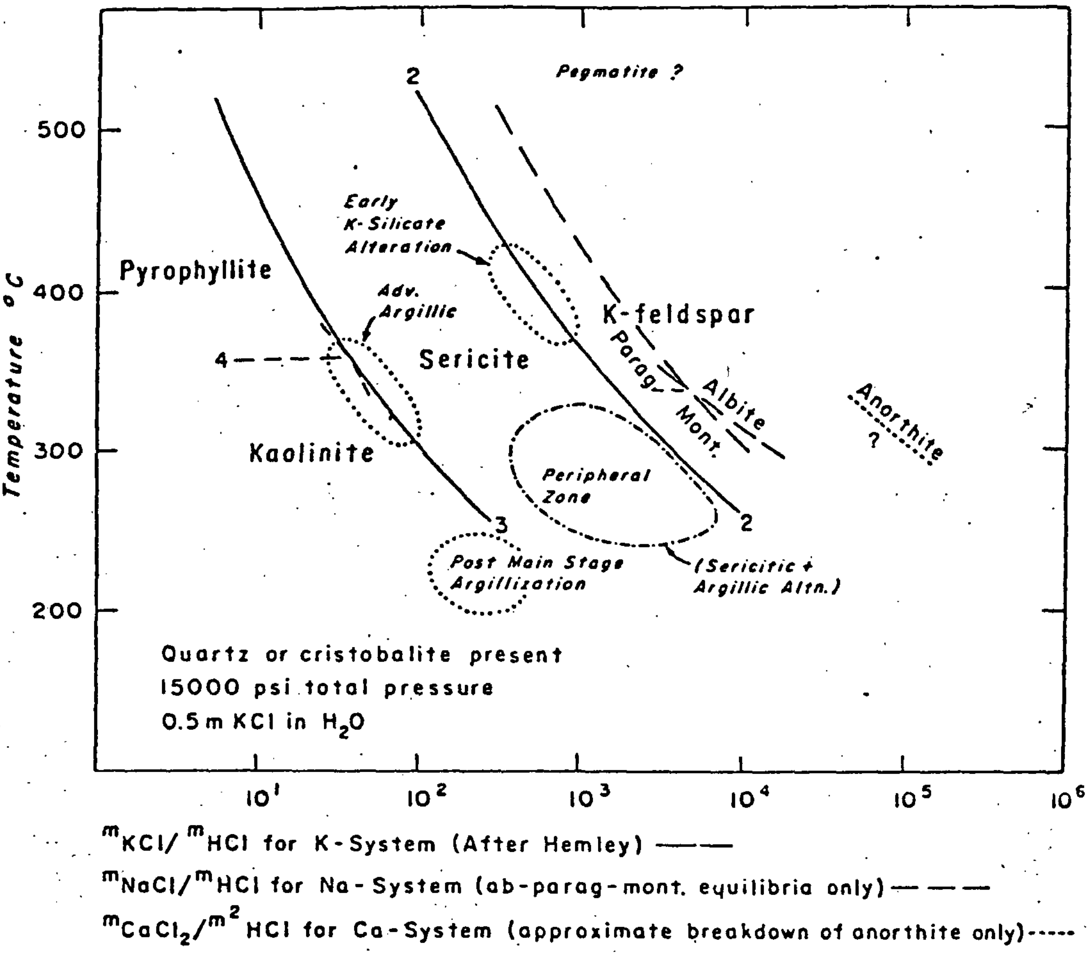

Figure 4. Experimental Reaction Equilibria for Minerals in the System K_2O-Al_2O_3-SiO_2-H_2O in 0.5 Molal KCl solution. Similar curves are also shown for albite-paragonite-Na-montmorillonite relationships and for approximate breakdown of anorthite. Appropriate reactions for lines 2, 3, and 4 are as follows:

$$\underset{\text{K-feldspar}}{3KAlSi_3O_8} + 2H^+ \rightleftharpoons \underset{\text{sericite}}{KAl_2(AlSi_3O_{10})(OH)_2} + 6SiO_2 + 2K^+ \quad (2)$$

$$\underset{\text{sericite}}{2KAl_2(AlSi_3O_{10})(OH)_2} + 2H^+ 3H_2O \rightleftharpoons \underset{\text{kaolinite}}{3Al_2Si_2O_5(OH)_4} + 2K^+ \quad (3)$$

$$\underset{\text{kaolinite}}{Al_2Si_2O_5(OH)_4} + 2SiO_2 \rightleftharpoons \underset{\text{pyrophyllite}}{Al_2Si_4O_{10}(OH)_2} + H_2O \quad (4)$$

Dotted fields suggest approximate positions (but not neccessarily ranges) of types of wall rock alteration indicated in the text, as best judged from mineral assemblages and most probable temperatures. (From Meyer and Hemley, 1967.)

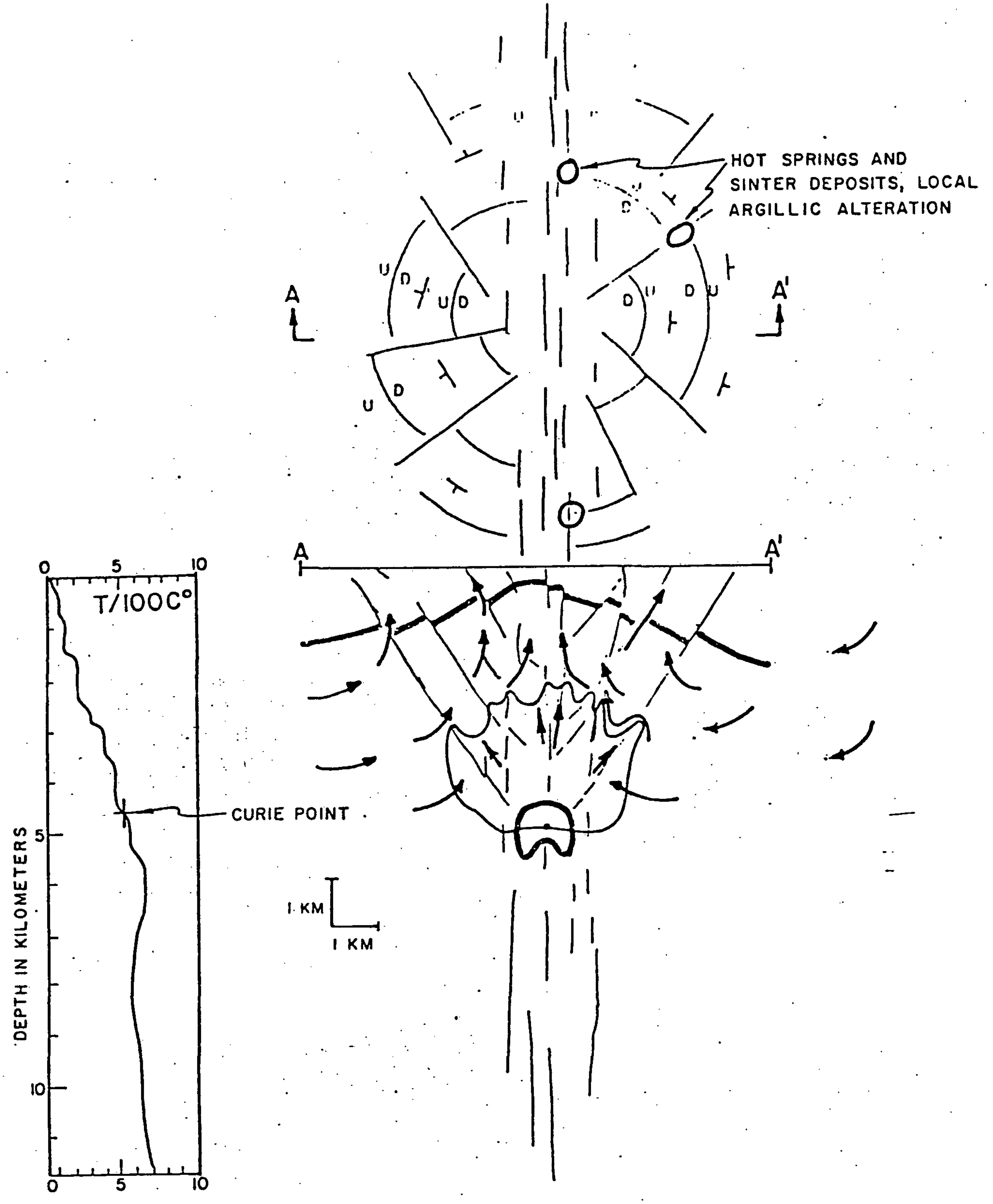

Figure 5. Model geothermal system, Stage 3, development of a convectively driven meteoric water hot springs system.

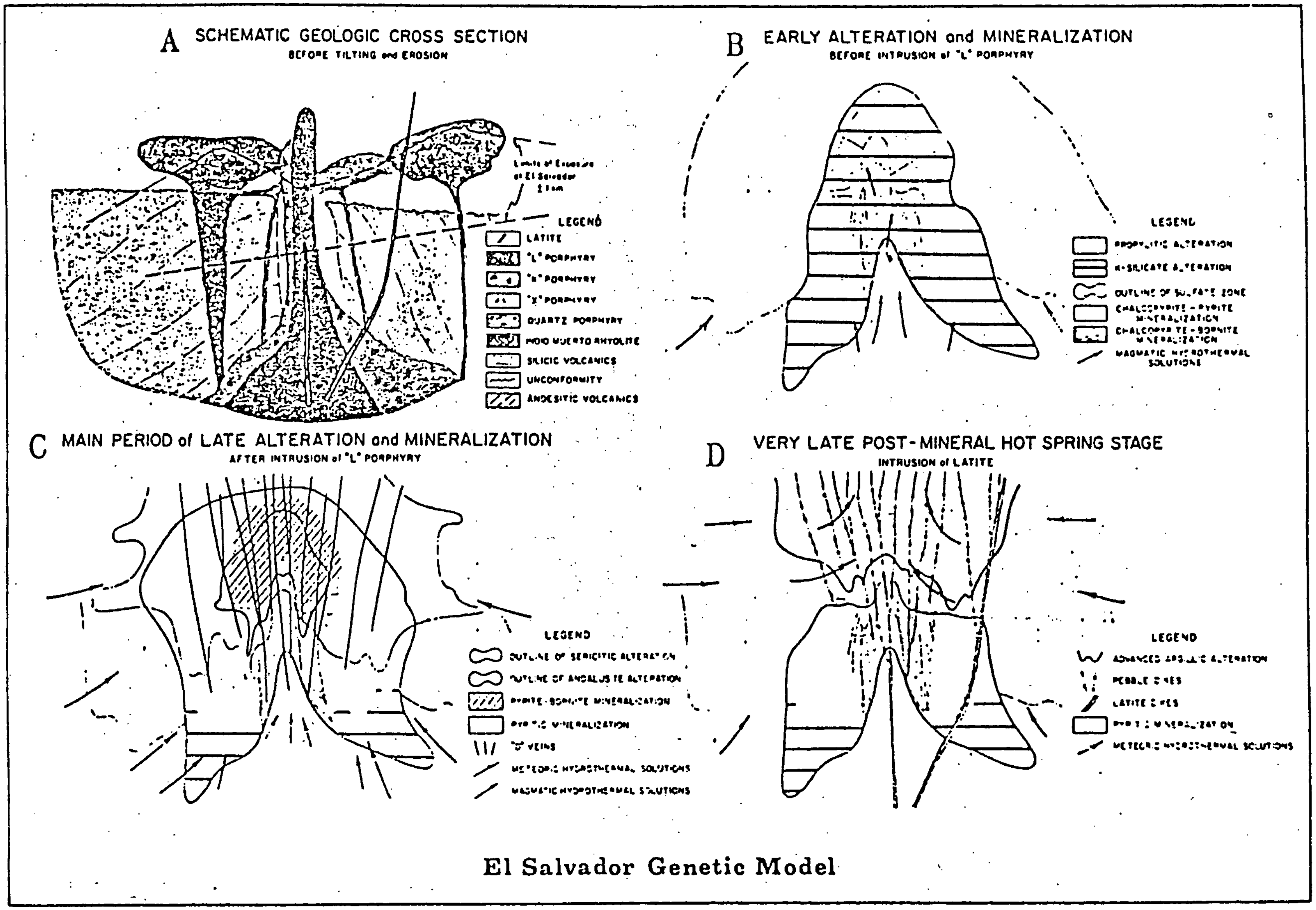

Figure 6. El Salvador Genetic Model. (From Gustafson and Hunt, 1975)

The temperature profile shown on Figure 5 is intended to indicate a number of levels of convective heat transfer within this vertical column. Figure 7 gives our interpretation of the meaning of the temperatures estimated from chemical geothermometers based upon a porphyry copper model. The suggestion here is that these temperatures could represent the temperatures from any convective level (level of approach to chemical equilibrium) within this complex system, but almost certainly some level spatially above the meteoric/juvenile water interface except where the hot springs sampled are of unusual salinity. Figure 7 suggests two other sources of temperature estimates that also give an estimate of depth to the specified temperature. The first is referred to in the previous discussions on alteration zones, veining, and crackling, and the second will be treated in the discussion on aeromagnetic interpretation. It does seem possible to build a crude temperature-depth profile of a geothermal prospect based upon chemical temperatures and geophysical surveys.

Figure 8 indicates the expected magnetic signature of a geothermal area based upon a porphyry copper model. The Salton Sea (Niland) geothermal area, for example, is a relatively simple aeromagnetic high (Griscom and Muffler, 1971) which would indicate that the zone of magnetite stability is relatively intact. We feel that the intrusive interpretation of Griscom and Muffler is much too simplistic for the data available on this system. Figure 8 also indicates the magnetic signature that we would expect from an older erosion breached system, or possibly a system intruded at a higher level.

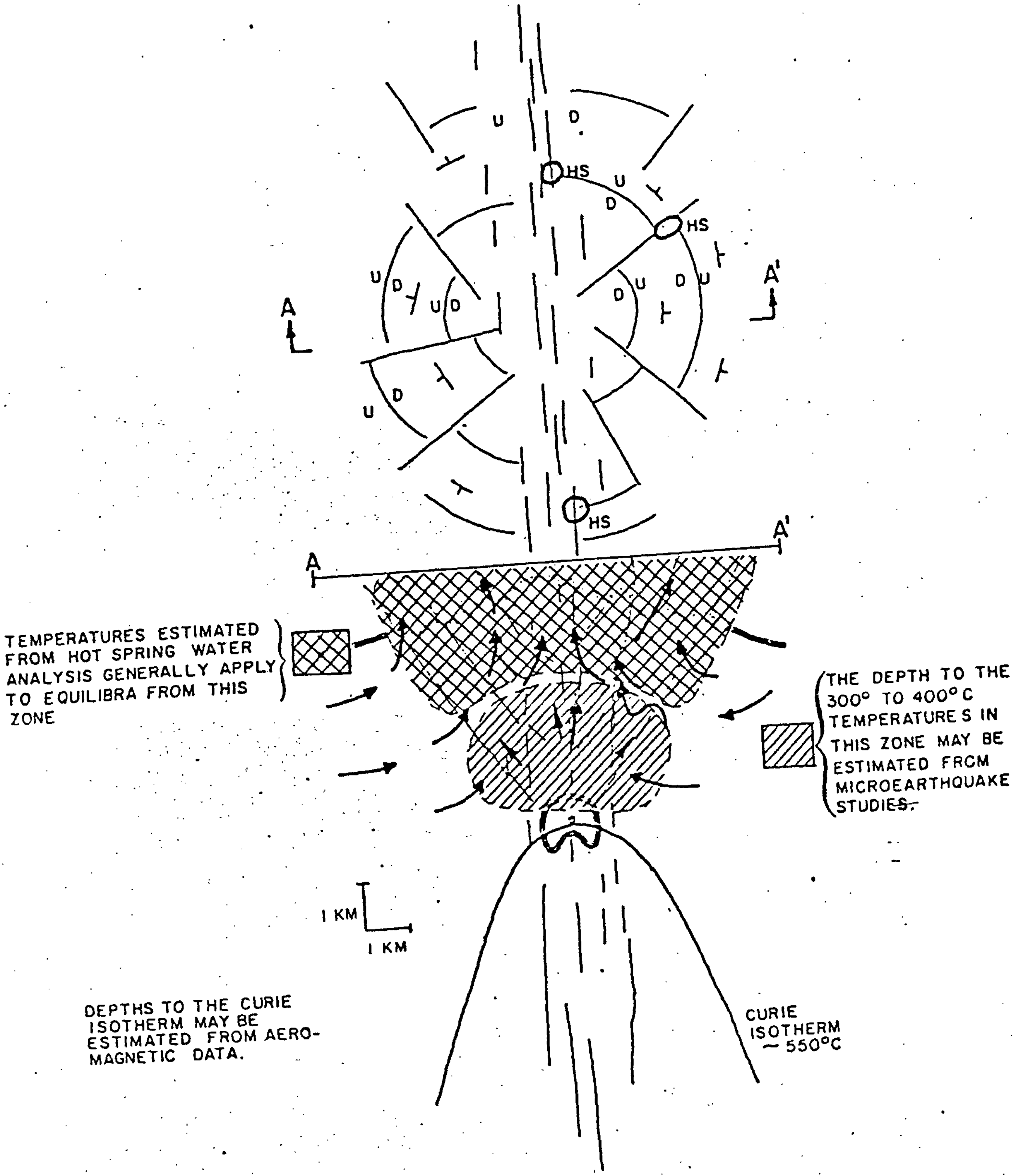

Figure 7. Model geothermal system, thermal regime and significance of temperature measurements.

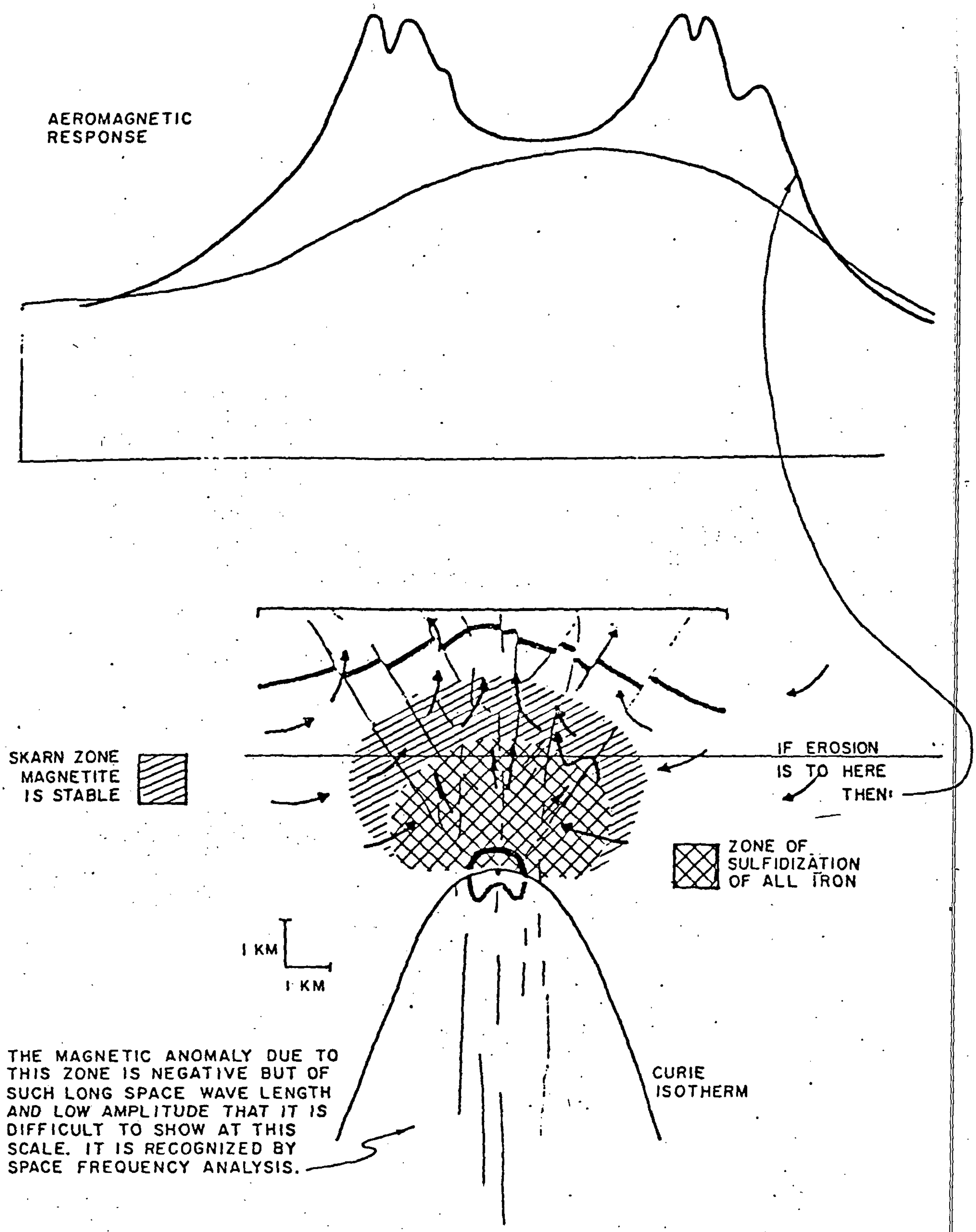

Figure 8. Model geothermal system, aeromagnetic response.

In addition, Bhattacharyya and Leu (1975) have indicated that we might expect to be able to calculate the depth to the Curie isotherm (520°C to 580°C depending upon the composition ofthe magnetite) if we had long flight lines and very carefully taken aeromagnetic data. In the case illustrated in Figure 8 we might expect a very low amplitude, long space frequency negative anomaly from the perturbation in the Curie isothermal surface. The depth to the anomaly can be calculated by modeling the particular geologic configuration or by frequency analysis of the data. In practice Bhattacharyya and Leu use both approaches.

Figure 9 indicates the results to be expected from a microearthquake survey. We suspect that the epicenter depth as indicated probably represents a mean depth to a temperature of about 350°C. Neither the depth nor the temperature can be estimated with any precision but the figures and spatial locations are useful in interpreting other data. The heat and argillic alteration of geothermal areas appear to preclude the storage of enough strain energy to produce an earthquake as large as Richter magnitude 1 even though the geothermal area is located on a seismically active fault as at the Big Geysers, California. The Big Sulfur Creek fault zone has a number of recorded earthquakes of Richter magnitude +2 or larger but none of these occurred at the Big Geysers, where Hamilton and Muffler (1972) found an anomalously large number of microearthquakes (Richter magnitudes of -2 or less). The meaning of this anomaly in terms of depth and temperature as suggested above is that at a depth of 4 ± 1 kilometers the temperature is 350°C ± 50°C.

Figure 10 indicates the model for interpreting telluric resistivity surveys and magnetotelluric depth soundings. The detectability of the

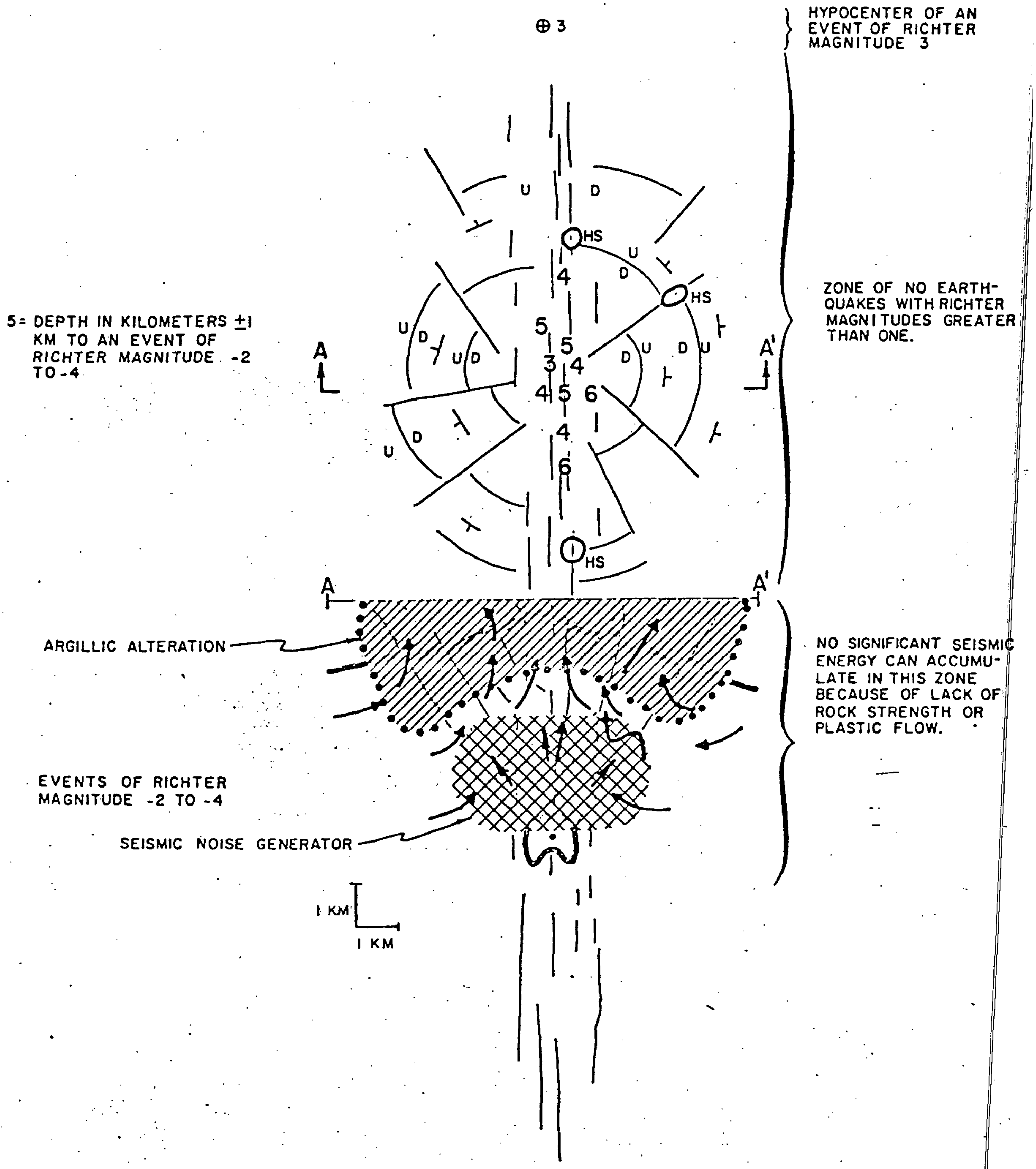

Figure 9. Model geothermal system, seismicity.

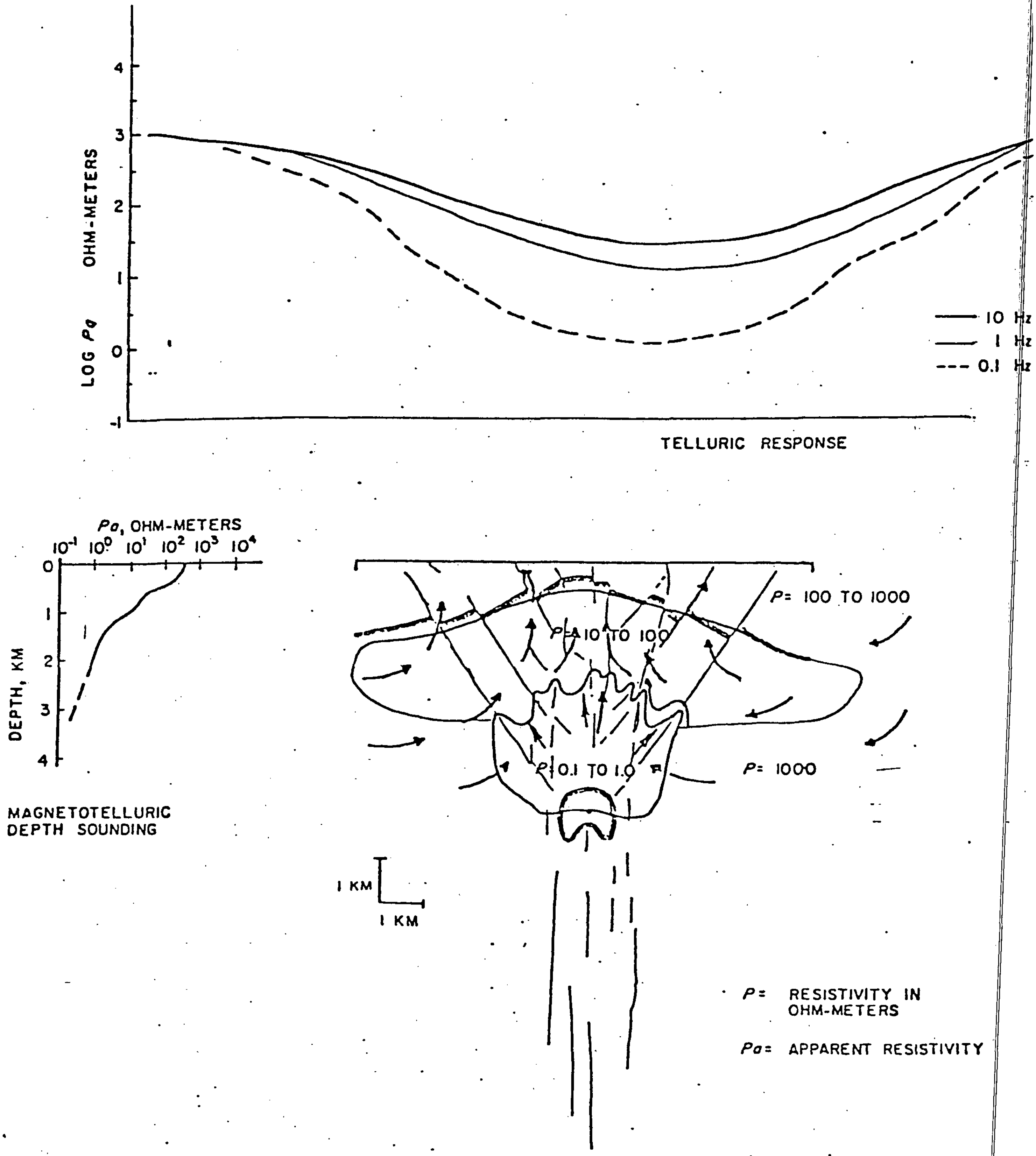

Figure 10. Model geothermal system, electrical response.

conductivity zones versus frequency is based upon simple skin-depth calculations (Stratton, 1941, p. 504) and may be too simple an analysis but the order of magnitude should be preserved. The resistivity values used are calculated from specific conductance data tabulated in White, Hem, and Waring (1963) and are for the solutions indicated at 25°C. No allowance was made for increase in conductivity with temperature.

Figure 11 is a simple density model of the system which would account for the kind of positive gravity anomaly found at the Salton Sea (Niland) geothermal area (Biehler, et al, 1964). In the Basin and Range the block boundary faults cause very steep gravity gradients and also often localize the geothermal intrusions so that gravity surveys can be difficult to interpret in terms of the simple model. Intrusions into crystalline bedrock without sedimentary cover could have negative gravity anomalies.

CONCLUSIONS

The TPC model described above explains a number of the more puzzling aspects of many geothermal areas and allows for an internally consistent interpretation of many of the kinds of data gathered in geothermal exploration and valuation. This is perhaps the best justification of such a model.

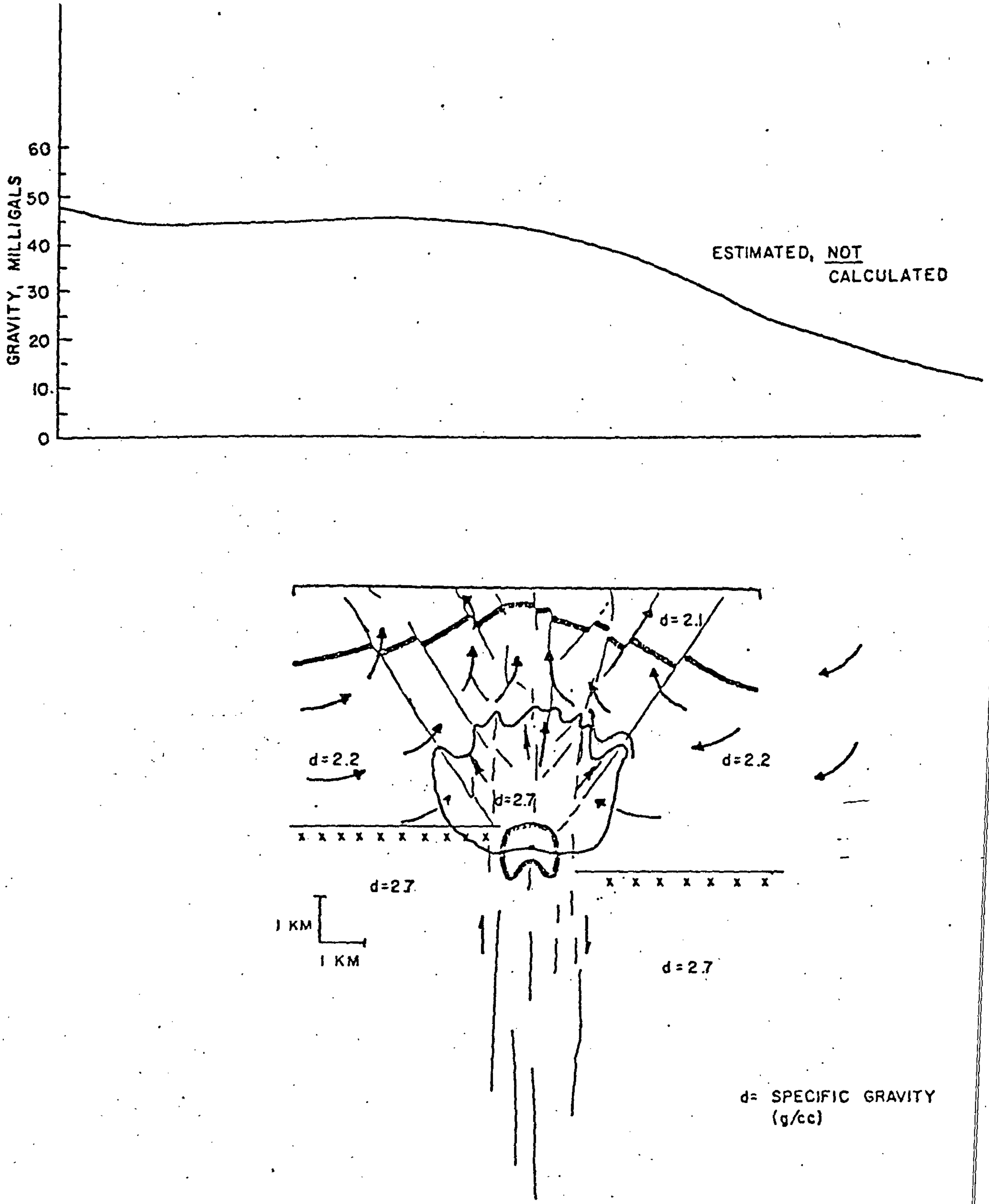

Figure 11. Model geothermal system, gravity response.

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7. TECHNICAL PLANNING

7.a EXPLORATION PLAN

The objective of the exploration plan is to obtain the data and provide the information and knowledge from which an optimum location can be selected for the confirmation well (production test well) with maximum probability of encountering multiple fault planes, fault zones, and/or fractures within the projected test well depth of 3,000 feet subsurface.

The target of the production test well is one or more subsurface zones where fracture permeability can provide circulation of geothermal waters for the well to produce sufficiently large volumes at the surface.

The exploration plan consists of six phases:

1. Detailed review of published geological data from State and Federal sources, special districts, commissions or other entities contributing to local knowledge; individual opinions, experience, and judgment of informed persons.

   Review of available literature has already commenced in the preparation of this proposal and discussion with Mr. John Anderson, Idaho Department of Water Resources, and others. It will be intensified and broadened to include all available sources and the compilation of diverse geological data and interpretations on base maps of sufficient scale to facilitate transferral of accurate locations from map to ground and vice versa.

   The work at the University of Utah Research Institute (UURI) by Strusbacker and others (1980) will be obtained as soon as posible sible. Aerial photo coverage will be obtained and analyzed.

2. Detailed field work to confirm or find, measure, and map all surface manifestations of faulting and fracturing in and around

the Magic Hot Springs area.

Two reconnaissance trips have been made into nearby locales in preparation of this proposal. Field work will be planned and conducted several miles, or as necessary, into surrounding areas to confirm or modify earlier work, discover new evidence, measure and map all criteria pertaining to faulting and fracturing and the distribution of rock types as evidence of multiple intrusions and deep fractures or vents.

3. Close-network geophysical survey through and around the area, to measure the electrical and magnetic properties of the rock and rock-fluid systems adequately to allow interpretation of the location and geometry of faults and fractures.

The dipole-dipole electrical surveys ~~widely used by Mr. Duree for geothermal investigations in the Philippines~~ are expected to be of limited use in the Magic Hot Springs area because water analysis indicates insufficient dissolved solids in the geothermal waters.

~~This matter has been discussed at length by Dr. R. E. Sheriff, Seiscom Delta senior vice president, and Dr. Alan Lohse, GFI executive vice president, and also with Mr. Leslie Denham, Seiscom Delta senior geophysicist in the Houston Operations Office.~~

Oil people
w. seismic
background

At this point we are evaluating the overall advantages of combined electromagnetic (EM) and magnetometer surveys run simultaneously on the ground with portable equipment suitable for hilly terrain, to provide economical, close-spaced grid coverage of some miles through and beyond the Magic Hot Springs site.

Numerous methods are available for EM field work and classed according to the actual measurement made, such as polarization ellipse, intensity and phase components, dip-angle measurements, and so on.

In the final selection for the geophysical survey, we will consider all factors such as source power, reliability, speed, and simplicity for field operation, on the one hand, and depth of penetration from increased source power and larger transmitting loop, on the other. We favor the methods that measure both in-phase and quadnature components because they provide more information about the anomalies, even though they are slower and require more competent operators.

The companion ground magnetometer survey will include gadiometer measurement of vertical gradients to facilitate the quantitative determination of anomaly depth, magnetic moment, shape, and location.

Again, we favor a method that entails somewhat more field work and more care in obtaining the data (e.g., magnetic cleanliness of operator, positioning of sensors, etc.), but believe these are justified by better geological results.

4. Drilling and completion of three or more thermal gradient holes to depths of 1000 feet or until drilling mud returns reach 125°F; followed by three or more borehole temperature gradient surveys per hole until temperature gradient stabilization is reached.

Locations of the three temperature gradient measurement holes will be selected to complement the geological and geophysical work and to provide a reasonably uniform geometric coverage of the acreage in order that maximum interpretation can be made of isotherm patterns as the holes are monitored.

The temperature gradient wells will be drilled with a Failing 1500 or equivalent rig. The prognosis for the proposed wells is listed in Table 12 and the schematic of the proposed wells is shown in Fig. 16. The wells will be drilled through a 7-inch surface casing set at 40 feet. A 6-1/4 inch hole will be drilled to 1000 feet or until drilling fluid returns are 125°F, whichever occurs first. A 4-1/2 inch casing string will be run to bottom and cemented to the surface.

5. Plotting of temperature survey data on base maps and cross sections, contoured for analysis of heat flow, identification of aquifers and permeable zones and lateral and vertical components of subsurface water movement toward the present hot spring and well site or elsewhere within the acreage.

6. Ongoing and final integration of all data into comprehensive analyses and displays with assessment of the distribution and location of subsurface zones of fracture permeability and recommendations on the optimum location of the confirmation well. All compilations and graphic displays will be prepared, with documentation, for presentation and third-party inspection and analysis.

TABLE 12

ERG

MRI/GFI TYPICAL TEMPERATURE GRADIENT HOLE DRILLING PROGRAM

1. Prepare road and location (size of location dependent on rig obtained).

2. Drill 12-1/4 inch hole to 45 feet. If formation at this depth is adequate as a casing seat, run and set 40 feet of 7-inch 17# H40 ST&C casing and cement to surface.

3. WOC 12 hours under pressure.

4. Drill 6-1/2 inch hole to 1000 feet or until mud return reaches 125°F, whichever occurs first. This section shall be drilled with fresh water or the minimum gel mud that will permit drilling.

5. Run and set 4-1/2 inch 9.5# H40 ST&C casing at total depth. Equip casing with 4-1/2 inch float shoe and a baffle 15 - 20 feet above shoe. Use centralizers 50 and 100 feet above shoe. Displace cement with water. Bump plug and hold pressure on casing for eight hours to prevent flowback. Use a one-plug cementing head.

6. After 12 hours, release pressure, check top of plug with wire line or drill pipe. If cement has not moved, add 4-1/2 inch casing by 2-inch pipe swage, 2 inches full opening valve, tapped bull plug and bleed valve. Release rig.

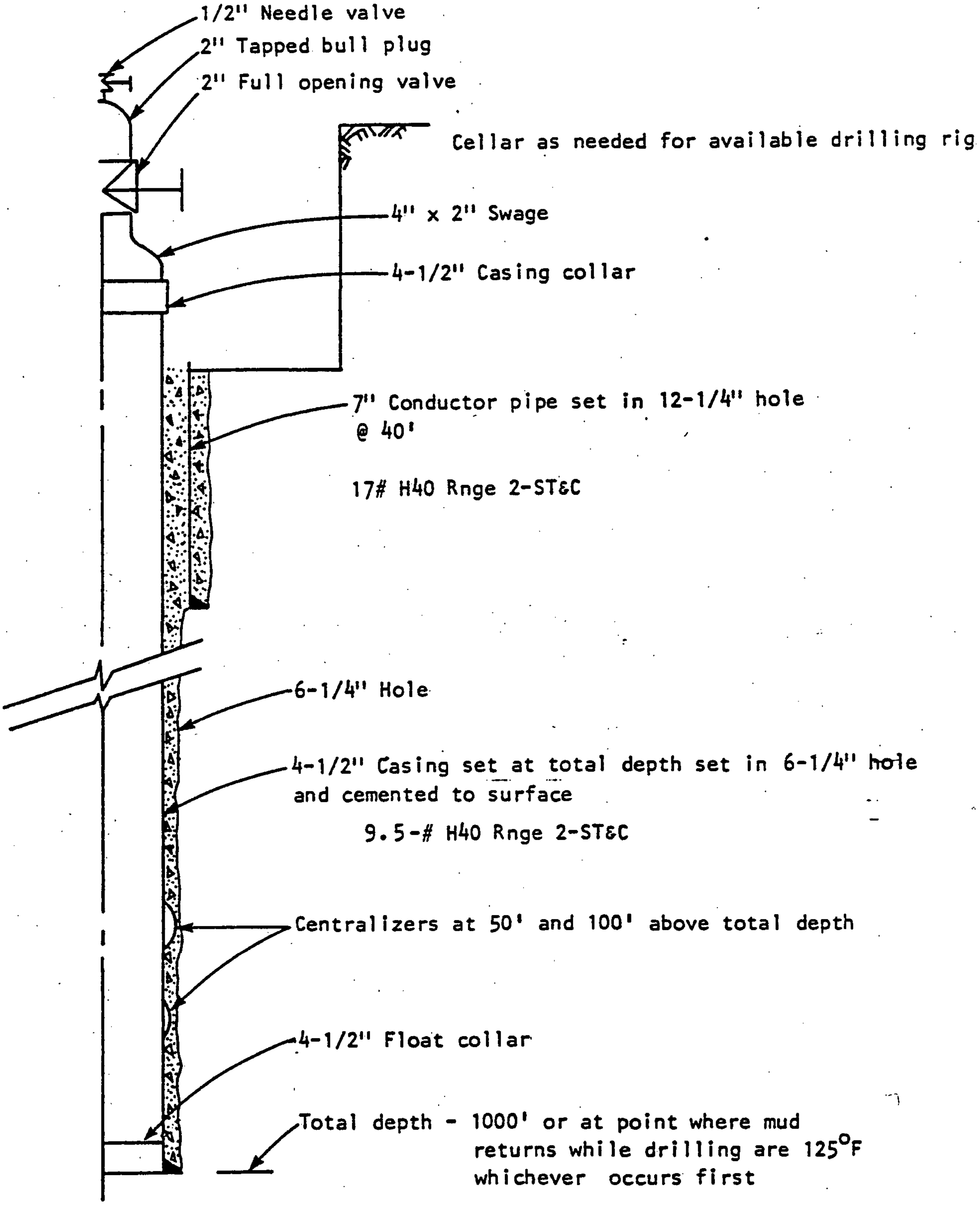

Figure 16--Schematic of typical temperature gradient hole

7.b PRELIMINARY DRILLING PROGRAM

After the exploratory program has identified a specific site and refined the drill hole conditions, a detailed drilling program will be presented, addressing the following major considerations and refined from this preliminary plan to meet all site-specific and resource-specific conditions.

Our preliminary drilling plan is presented in the production well prognosis (Table 13) and in sections 7.b 1 - 11, following.

The proposal is predicated on proving or disproving the presence of a geothermal reservoir capable of producing sufficient water to meet the energy needs of a 2,000,000 gallon per year ethanol plant. The program is designed to meet this need of 650 gal/min of water at an assumed temperature of 280°F. The 280°F water temperature is within the range predicted by geochemical thermometers, and was established as that needed to permit "cooking" of mash in the ethanol process.

The program envisions encountering a volcanic stratum sufficiently fractured to permit production equal to or exceeding this established need. The presence of fracturing is critical and the drilling program is as simple and as inexpensive as possible to determine whether such fracturing is present. The well casing program was designed to permit use of a downhole pump large enough to meet the ethanol plant needs, in the event the well does not flow naturally.

7.b.(1) Rig Selection

The production well will be drilled with a Failing 3000 or equivalent rig capable of drilling to a minimum depth of 3,000 feet. It will be equipped with a minimum of a double blowout preventer of 2,000 psi rating or higher. In addition to the blowout preventer, a 10-inch full opening 2,000-psi rated gate valve will be mounted below the blowout preventer during drilling operations. The rig will also be equipped with a rotating head

TABLE 13

DRILLING PROGRAM FOR PRODUCTION WELL

1. Build access road and location (location size and configuration will be determined by rig available).

2. Drill 17-1/2 inch hole to 100 feet with water or minimum gel mud to permit drilling.

3. Run 100 feet of 13-3/8 inch H40 48# ST&C casing and cement to surface with Portland cement.

4. WOC 12 hours under pressure.

5. Drill out cement to shoe and test with 500 psi.

6. Drill 12-1/2 inch hole to 1000 feet or mud returns at 135° whichever occurs first.

7. Run and set at total depth 9-5/8 inch J55 36# ST&C casing. Cement to surface with API grade G cement with 40% Silic's flour. Casing equipped with 9-5/8 inch guide float shoe and float collar. Centralizers 50 feet and 100 feet off bottom.

8. WOC 12 hours under pressure.

drill 8 3/4

1000 to TD

9. Set 9-5/8 inch x 10-inch flange 2000 psi casing head.

10. Drill out to shoe and test with 500 psi.

11. Drill 8-3/4 inch hole to maximum depth of 2000 feet. Anticipate lost circulation may result in a lesser depth.

12. Run and set 7-inch casing to total depth. Overlap 9-5/8 inch a minimum of ~~150~~ 200' feet.

13. Drill 6-1/4 inch hole to 3000 feet.

14. Run and set 5-inch pre-perforated liner on bottom.

while drilling below the 9-5/8 inch casing.

7.b.(2) Borehole Configuation

The schematic of the proposed well is shown in Fig. 17. The schematic shows the well equipped with pumping equipment. A conductor string of 13-3/8 inch casing will be at 100 feet in a 17-1/2 inch hole and cemented to the surface. A 12-1/4 inch hole will be drilled to 1,000 feet or until drilling fluid returns are 135°F, whichever occurs first. A 9-5/8 inch casing string will be run to total depth and cemented to the surface. An 8-3/4 inch hole will be drilled to 2,000 feet or until drilling fluid returns are 160°F, whichever occurs first. A 7-inch liner will be set at total depth overlapping into the 9-5/8 inch casing a minimum of 150 feet and cemented in place. A 6-1/4 inch hole will be drilled ahead until a total depth of 3,000 feet is reached and a 5-inch perforated liner will be run.

This program is necessarily tentative. It is anticipated that commercial production will be found in fractured volcanic strata. Such fractured sections can present lost circulation problems, making revision of the program necessary. The program outlined here is designed to permit using a downhole pump adequate to produce 500 to 1000 gal/min. The existence of an artesian spring/well indicates that some natural flow may be expected, but whether this would be a commercial-size flow is unknown. The presence of artesian flow is considered a positive factor and a shaft-driven downhole turbine pump is projected.

7.b.(3) Drilling Fluid Programs

The well will be drilled insofar as possible with water. If artesian flow or drilling problems are encountered, minimum weight gel muds will be used. The presently produced water is not highly mineralized and no adverse effects on the prospective producing interval from use of fresh water is anticipated.

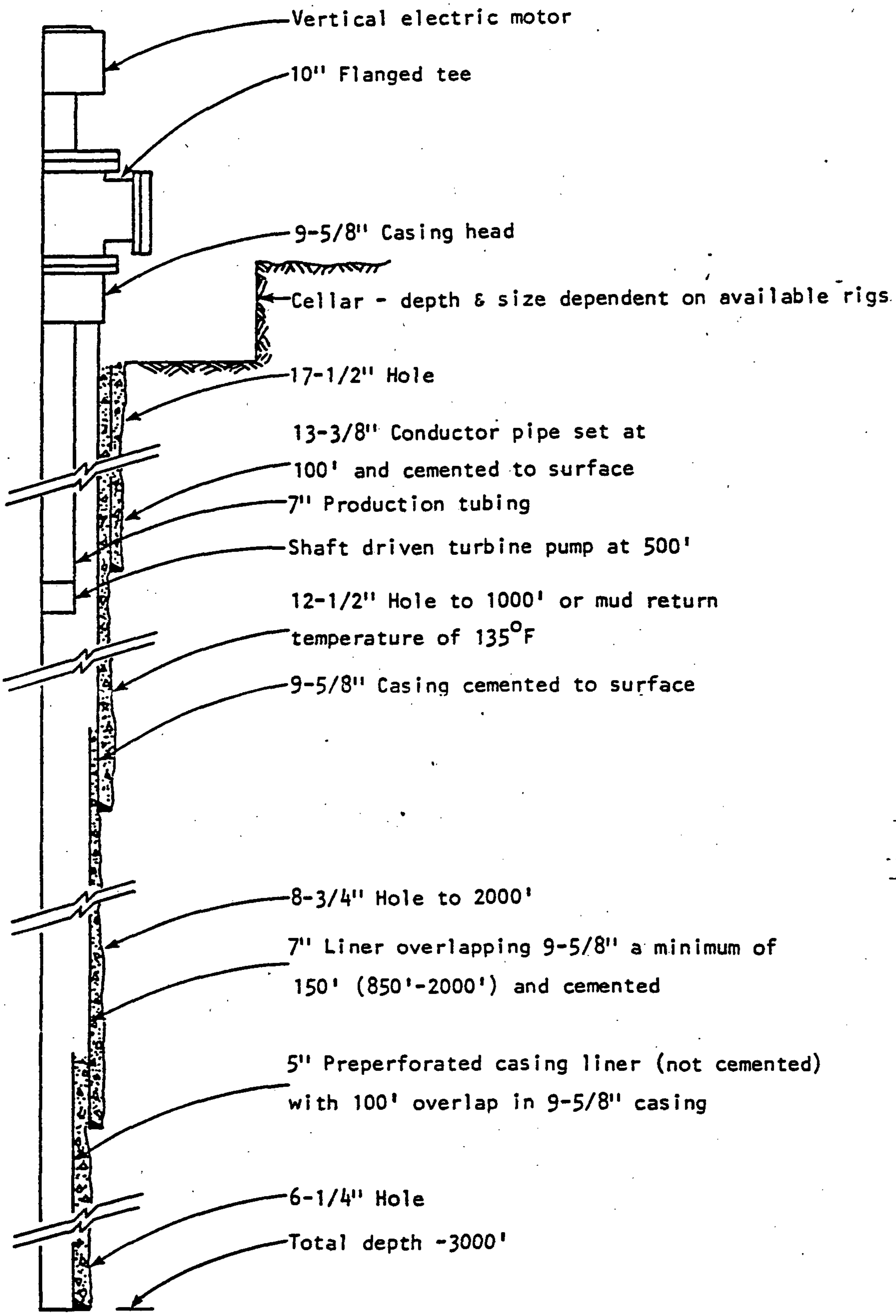

Figure 17--Schematic of planned production well.

7.b.(4) Formation Identification

A logging service will be retained on the location to record drilling operations. The following data will be recorded and plotted in graphic form:

1) drilling rate
2) bit weight
3) bit RPM
4) drilling fluid temperature
    a) into hole
    b) out of hole
5) mud return chlorides (every 50 feet)
6) mud weight
7) drilling fluid circulation rates
8) H_2S monitoring of drilling fluid (continuous)

In addition, the samples will be examined, geologically described, and plotted in graphic form.

7.b.(5) Casing Program

The casing program has been described above in the drilling section as to size and setting depth. The 13-3/8 inch conductor pipe will be API grade H40, weight 48#/foot; the 9-5/8 inch casing will be API grade J55, weight 36#/foot; the 7-inch will be grade J55, weight 20#/foot; and the 5-inch liner will be J55, weight 11.5#/foot. The water presently being produced has not caused corrosion of the surface exposed piping. The pH of the water is nearly neutral (6.9) and minimum corrosion is expected. No specific corrosion allowance has been made in the casing program; however, allowable stresses correlated into required pipe wall thickness compared to anticipated pressure would correlate to an allowance of 3/32 inches at the point of maximum pressure and greater at lesser pressures.

7.b.(6) Cementing Program

Conductor pipe in the temperature gradient holes will be cemented by the single-plug method using Portland cement. The same procedure will be used for the 4-1/2 inch casing string in the temperature gradient holes. The remaining casing strings in the production well will be cemented by the single-plug method using high temperature cement compounded from API class G cement with silica flour. Exact compounding will depend upon drilling temperatures encountered.

7.b.(7) Support Services

A mud logging unit will be used to consolidate data on drilling operations and to monitor any H_2S production, although the existing artesian hot well does not produce H_2S in noticeable quantities.

7.b.(8) Well Development

At this time no well stimulation is anticipated, in view of the geological appraisal that production in commercial quantities can be expected only if the prospective reservoir rock section is naturally fractured.

7.b.(9) Wellhead Equipment

Wellhead equipment will consist of oilfield type steel casing head or heads that will accommodate blowout preventer equipment. All will be rated at a minimum of 2,000 psi working pressure. Wellhead equipment added after completion will depend on the type of well completed. Should the well flow naturally at commercial rates, the equipment will be different from that needed for downhole pumping equipment.

7.b.(10) Description of Intended Disposal System

The produced water from the existing artesian hot well is relatively fresh (1213 ppm TDS and 85 ppm chlorides). Should the water from a deeper well exhibit the same mineral content, surface disposal should be feasible. Present artesian flow is discharging directly into Magic Reservoir.

In the event the water from a deeper well proves more highly mineralized and surface disposal is inappropriate, a disposal well would be drilled to inject this water into the producing horizon, preferably at a greater depth. The planned work reflected herein shows the drilling of a disposal well as an alternate program depending on the results obtained in drilling the producing well. An injection well would be drilled in the same manner as a producing well.

7.b.(11) Well Abandonment

Should information gathered during drilling operations show the well to be unsuccessful, it will be abandoned by placing cement plugs in the hole. Abandonment would be conducted in accordance with State requirements, to prevent migration of fluids in the well bore between permeable zones. The top 50 feet of casing would be cemented, the casing cut off below ground, and a steel plate would be welded over the top of the casing. The cellar would be filled and the site restored to the landowner's satisfaction.

7.c PRODUCTION WELL TESTING

The testing planned for a successful full-scale well can be outlined only in broad terms at this time. If the well is capable of flowing, one test procedure will be used; however, if the well does not flow and a downhole pump is required, a different procedure will be used. Even in these two postulated situations, the temperature of the produced fluid could require further changes. The following situations are discussed as illustrations and do not reflect all the testing situations that could be encountered.

1. Well flows naturally with surface temperature of produced fluid at or below 195°F. Under these conditions, water could be measured by meter, either positive displacement or orifice, or by a weir. Downhole pressure would be determined by wireline instruments.
   Suitable

2. Well flows naturally with surface temperature above 195°F. Flow of water would have to be measured under sufficient pressure to prevent flashing of part of the water before measurement. Measurement would be accomplished by a positive displacement or an orifice meter. Downhole pressures would be determined by wireline equipment. Should the produced water temperature be sufficiently in excess of 195°F, installation of a steam-water separator would be necessary with independent measurement of steam and water.

3. Well does not flow naturally and turbine pump installed, wellhead fluid temperature 195°F or less. Production measurement would be made with a positive displacement or orifice meter or a weir. Downhold fluid levels would be determined by an air tube run in the annulus between the pump tubing and casing.

4. Well does not flow naturally at commercial rates requiring pump installation and produces fluid with a wellhead temperature above 195°F. Production measurement would be by a positive displacement or orifice meter. This would be accomplished by holding sufficient back pressure to prevent flashing prior to measurement. Should the produced

temperature be sufficiently in excess of 195°, installation of a steam-water separator would be necessary with independent measurement of steam and water by orifice meters. Again, downhole pressure would be determined by an air tube.

The measurement instrumentation contemplated here is less accurate than would be used in a field research project. The entire project is designed to prove whether a full-scale well can be completed to meet the energy needs of an ethanol plant from geothermal water production. As noted in the drilling section, the production well is designed to do this as economically as possible and the same rationale was used in laying out this program. The data collection proposed here permits an evaluation of the well's producing characteristics and effective pay interval.

8. COST-SHARE PLAN

The proposed cost-share plan is based on two assumptions:

a. that the quality of the geothermal water is such that steam can be flashed using off-the-shelf equipment, and

b. that the well depth does not exceed 3,000 feet.

The proposed criteria for cost-sharing are shown in Table 14. These criteria were developed on an appraisal of degree of "success". The degree of success of the project is established in terms reflecting usable heat produced compared to that needed by the end user--in this case, a 2-million-gallon-per-year ethanol plant. Any secondary or cascading uses would subsequently be supplied with the same water having less available heat per unit of production, would tend to be seasonal, and could be viable only if the chemical content of the water is acceptable.

The measure of usable heat produced is a function of both volume and temperature of the water produced. The needs of the 2-million-gallon-per-year ethanol plant have been established at 600 gal/min of 280°F water. However, if the producing well exactly met this demand, no allowance would exist for possible decreasing well production capacity or decreasing water temperature. The nature of wells is to undergo decline in production rate with time. To allow for this decline we assumed that a completely successful well would produce water at 300°F or higher temperature at a rate of 675 gal/min or more. This is used in constructing the cost sharing matrix.

For a completely successful well the proposer would pay 80 percent of the cost of the project and the DOE 20 percent under the User-Coupled Confirmation Drilling Program, SCAP No. DE-SC07-80ID12139.

Should the well be capable of producing only 280°F water at a rate of 675 gal/min, some increase in the size of lines carrying the water, areas of

TABLE 14

PROPOSER'S COST SHARE MATRIX

Flow Rate (gpm) Wellhead Temperature (^{o}F)	<300	300-375	375-450	450-525	525-600	600-675	>675
	Percent						
<265	10	10	10	10	10	10	10
265 - 270	10	10	10	10	10	10	10
270 - 275	10	10	10	10	10	10	10
275 - 280	10	10	10	10	10	10	35
280 - 285	10	12	18	25	30	35	76
285 - 290	10	15	22	30	35	60	77
290 - 295	10	16	26	35	40	70	78
295 - 300	10	18	30	40	50	73	79
>300	10	20	35	48	62	75	80

Percentages = proposer's share of total cost

Example: completed well produces 550 gpm of 292^{o}F water

proposer's share = 40%

DOE's share = 60%

heat exchanger surfaces required, and possibly power consumption would be required. An allowance of 4 percent has been made for this, resulting in proposer's share decreasing to 76 percent. Intermediate temperatures (between 300°F and 280°F) are proportioned directly.

Should the temperature of the produced water be less than 280°F, the minimum for the process, it is assumed that additional heat would be supplied using fuel oil. Increasing the water temperature from 270°F to 280°F would amount to supplying 15 percent of the delivered heat from purchased fuel oil; for 260°F this figure would be 30 percent. Income for the project economics is based on receiving 50 to 75 percent of the equivalent cost for the same heat energy derived from fuel oil. Supplying 15 percent of the energy from fuel oil and receiving income equivalent to 50 percent of fuel oil costs for an all oil-fueled plant, the income would be reduced to 70 percent of that projected; if 30 percent were supplied by fuel oil on this basis, the income would be reduced 40 percent of that projected. For this reason, the cost sharing changes drastically to 35 percent MRI - 65 percent DOE for temperatures from 275°F to 280°F and to 10 percent MRI - 90 percent DOE at 270°F to 275°F while production rate is 675 gal/min or better.

Addressing the rate of production, the case of a productive capacity ~~of~~ only 375 gpm at 300°F was considered as the 2 million-gallon-per-year ethanol plant would consist of two parallel 1-million-gallon plants. In this case, the project investment is essentially the same and results in only one half the income considered earlier. Amortization would be longer, and schedule recognizes this by providing 35 percent MRI and 65 percent DOE funding.

The remainder of the matrix was established in a manner that generally recognizes the constraints as to temperature requirement (280°F or better) and the total heat available at different rates.

9. INSTITUTIONAL CONSIDERATIONS

In general, the ERG MRI proposed plan for confirmation drilling and long-term development of recreational and industrial facilities in and around the Magic Hot Springs area and Magic Reservoir are singularly free of institutional problems within the concerns and intent of NEPA. What questions and potential problems might arise have already been addressed by Magic Resource Investors ERG (MRI) prior to their substantial private investment in ERG MRI acreage and ongoing plans for resource development, including filing applications on all or portions of twelve sections of BLM lands, hiring the services of several consultants over a period of many months, and seeking out ~~a firm such as Gruy Federal~~ with the combination of both program design/management experience <u>and</u> hands-on field experience in oil and gas and geothermal field operations.

In addition to MRI's early assessment of institutional considerations, GFI brings to the team a comprehensive background in environmental experience (see Section 6.b(1) (iii)) and technical management and field experience (see Section 6.b(1)).

The basic socioeconomic concern of whether expanded primary industrial development (as in harvesting an earth resource) will overburden secondary support industries and tertiary community services is nonexistent in this reservoir project. It is very likely never to be a negative factor in long-term resource development in the sparsely populated region of south central Idaho, but a positive factor as a result of increased tax values, influx of professional persons in the work force, and creation of new schools and community services where these are generally nonexistent at present.

9.a. SITE AND ACCESS

ERG MRI fee land of approximately 212 acres lies within sections 13, 14, and 23 of Township 1 South, Range 17 East, Boise Baseline, Boise Meridian. The area is located principally within the southwest corner of Blaine County, with a few acres in section 23 located adjacent to the upper end of Magic Reservoir. The legal description of the two parcels constituting this acreage is given in Table 15. Figure 18 shows the land and its relation to Magic Reservoir.

MRI has filed applications on an additional 1,960 acres of BLM lands.

This reservoir confirmation drilling proposal is confined to ERG MRI fee land for purposes of all drilling. No problems of access, leases, or ownership of property exist.

The exploration program of Task 3 will, however, entail permission from one and possibly two private landowners to conduct surface geological surveys along specific routes such as road cuts and creek beds, and will entail similar surveys on BLM lands.

Also, Task 3 exploration will entail permits to conduct several miles of geophysical surveys on private lands. No problems are anticipated inasmuch as seismic shotholes with explosives are not planned at this time and all local landowners are hospitable to the project. Any denial of permission would result in rerouting of the survey line with minimal effect on the survey.

Ownership of the geothermal resource under ERG MRI fee lands is construed to lie with ERG MRI (see Exhibit 1).

TABLE 15

LEGAL DESCRIPTION OF MRI LAND

Parcel I

Township 1 South, Range 17 East, Boise Meridian, Blaine County, Idaho:

Section 13: S½SW¼
NW¼SW¼ lying south of Highway 68 (also known as Highway 20)
NE¼SW¼ lying south of Highway 68 (also known as Highway 20)

Section 14: SE¼SE¼

Section 23: NE¼NE¼ excepting that portion lying below the mean high water line of Magic Reservoir
NW¼NE¼ excepting that portion deeded for Magic Reservoir, as follows:

Beginning at a point where the flow line of Magic Reservoir to the north of Camas Creek intersects the north-south center line of Section 23, said intersection being 205.9 feet south of the north quarter corner of Section 23, the flow line of the reservoir bears S. 64°56' E., 25.00 feet; thence

S. 65°35' E., 100.00 feet; thence
S. 61°23' E., 88.6 feet; thence
S. 46°44' E., 249.2 feet; thence
N. 51°42' E., 45.1 feet; thence
N. 66°48' E., 68.3 feet; thence
S. 61°59' E., 81.5 feet; thence
S. 58°14' E., 65.6 feet; thence
S. 69°51' E., 53.5 feet; thence
N. 66°28' E., 140.4 feet; thence
S. 9°21' W., 100.2 feet; thence
S. 6°52' E., 50.4 feet; thence
S. 84°06' E., 84.3 feet; thence
S. 55°51' E., 75.7 feet; thence
S. 58°47' E., 90.9 feet; thence
S. 78°52' E., 103.5 feet; thence
N. 63°48' E., 89.9 feet; thence
N. 48°09' E., 103.7 feet; thence
S. 48°52' E., 96.4 feet to the intersection of the flow line of the reservoir with the east boundary of the above-described 40-acre tract; thence following the east boundary of said 40-acre tract, S. 00°02' E., 598.6 feet to the southeast corner of said 40-acre tract, being the 16th corner; thence

S. 88°32' W., 1177.6 feet to the intersection
of the south boundary of said 40-acre tract
with the flow line of the reservoir west of
Camas Creek; thence
N. 23°56' W., 77.1 feet; thence
N. 9°48' E., 108.7 feet; thence
N. 26°11' E., 111.8 feet; thence
N. 6°22' E., 47.5 feet; thence
N. 17°22' W., 142.8 feet; thence
N. 67°43' W., 95.6 feet; thence
N. 39°11' W., 85.7 feet to the intersection of
the flow line of the reservoir with the center
line of the above-described Section, and the
west boundary of said 40-acre tract; thence
N. 00°00' W., 532.7 feet to the point of beginning.

Also excepting therefrom:

that portion lying below the mean high water line of Magic Reservoir.

Also excepting therefrom:

A tract of land described as commencing at the northeast corner of the NW¼NE¼ of Section 23; thence

S. 89°39' W., 280 feet to a point; thence
S. 0°34' W., 635.63 feet to a point; thence
S. 89°39' W., 100 feet to the true point of
beginning; thence
N. 56° W., 125 feet to a point; thence
S. 35° W., 86 feet to a point; thence
S. 61°30' E., 175 feet to a point; thence
N. 0°34' E., 86 feet to the true point of
beginning.

Parcel II

Township 1 South, Range 17 East, Boise Meridian, Blaine County, Idaho:

Section 23: Commencing at the northeast corner of the NW¼NE¼ of said Section; thence

S. 89°39' W., 280 feet to a point; thence
S. 0°34' W., 635.63 feet to a point; thence
S. 89°39' W., 100 feet to the true point of beginning;
thence
N. 56° W., 125 feet to a point; thence
S. 35° W., 86 feet to a point; thence
S. 61°30' E., 175 feet to a point; thence
N. 0°34' E., 86 feet to the true point of beginning.

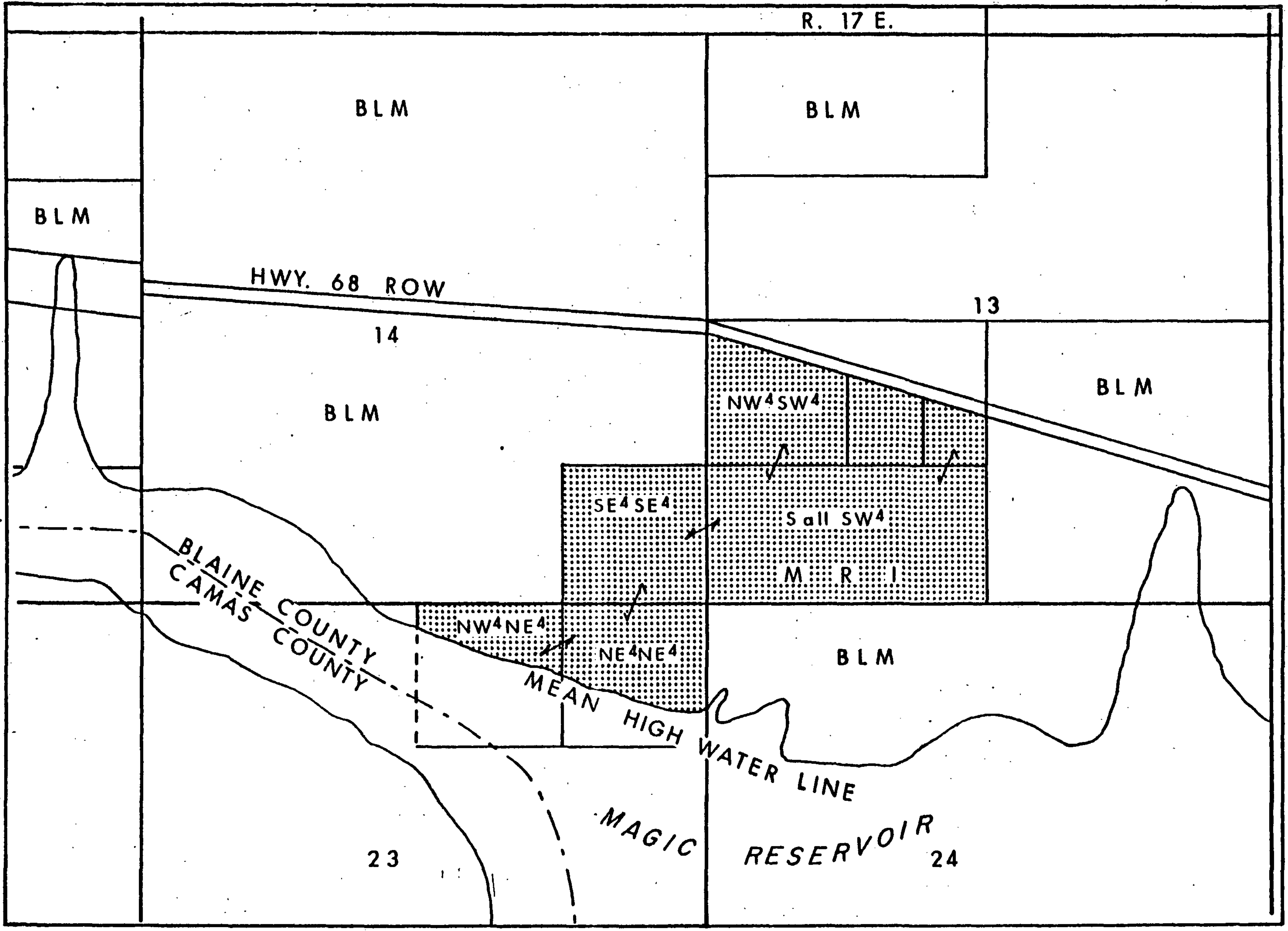

Figure 18--Map of MRI fee land, north end of Magic Reservoir, Blaine County, Idaho.

EXHIBIT 1

LAW OFFICES OF
EDWARD A. LAWSON
THE WALNUT SHELL PROFESSIONAL BUILDING
POST OFFICE BOX 1687
SUN VALLEY, IDAHO 83353
(208) 726-5657

August 27, 1980

Jerold R. Kirkman, President
J. R. Kirkman Development Company
P. O. Box 1328
Sun Valley, Idaho 83353

Re: Magic Hot Springs

Dear Mr. Kirkman:

In accordance with your request, I have examined the Magic Hot Springs property to ascertain the ownership of the geothermal resources located on the property and find that they are presently owned by Magic Resource Investors. For the purposes of this letter, geothermal resources shall have the meaning set forth in Idaho Code §47-1602. As provided in Idaho Code §57-1602, geothermal resources are declared to be <u>sui generis</u>, meaning that they are neither a mineral resource nor a water resource, although closely related and affected by water resources. In view of the foregoing, and the lack of any reservation of geothermal resources by statute in the State of Idaho as has been done with mineral rights, it is my view, based upon the common law, that the geothermal resources are automatically conveyed with the property. Accordingly, at the time that Magic Resource Investors acquired the Magic Hot Springs property, it concurrently acquired the geothermal resources appurtenant to that property.

In expressing our views set forth herein, we have relied on the August 22, 1980 letter from First American Title Insurance Company in addition to other information provided to me by you and such other matters as I have deemed relevant.

Very truly yours,

EALawson

Edward A. Lawson

EAL:ls

9.b ENVIRONMENTAL ISSUES

No troublesome or controversial environmental issues are foreseen that cannot be alleviated by prudent operations and experienced supervision. All field procedures with respect to drill sites and associated materiel will comply with local and state regulations, and the preliminary Drilling Programs for smaller-diameter thermal gradient holes and the larger-diameter production test well (and injection well, if needed) shall also comply with these requirements/regulations.

The Drilling Programs submitted to DOE will provide safeguards against contamination of surface or subsurface waters. Preliminary plans include storage of drilling fluids in plastic-lined earthen tanks during drilling of the larger-diameter well, and in similar tanks or portable metal tanks during drilling of the smaller-diameter holes.

Drill sites will be restored to original contours and soil conditions. Abandonment will consist of plugging the casing in the abandoned holes in accordance with procedures specified by the appropriate state regulatory commission. No surface manifestation or hazard to livestock or land use will be left.

Completion procedure for the production test well (and injection well, if needed) will include a standard geothermal wellhead surrounded by an appropriate enclosure. Upon completion of the temperature gradient test well, all wellhead equipment will be contained within a 4' x 4' x 4' cellar such that no surface manifestation exists except the covering steel plate.

The concern for air quality consists of (a) dust and (b) H_2S emissions.

(a) Wind-blown dust - the topography is low hills with primary vegetation of sagebrush. The weather is frequently windy, and wind-blown dust and drifting snow characterize the area. Existing roads and numerous level areas within the MRI acreage preclude creation of any significant new bare areas to increase the blowing dust.

The drilling contractor will endeavor to disturb the existing vegetation as little as possible.

(b) Hydrogen sulfide emissions - the present Hot Springs Landing well flows artesian at approximately 135 gal/min. Most of the water is discharged just above high water level at the west end of the recreation (boat launching) area. A slight H_2S odor from this discharge is occasionally detectable but does not disturb the users of the site or users of the well water. It is unlikely that H_2S emissions during drilling will be significant, but H_2S will be monitored and controlled as necessary.

Noise associated with drilling, logging, and testing operations is not a problem in the open spaces of the project area. No sensitive species or habitats are present. ?

Water quality during and after drilling is not a problem. ERG MRI met with the Department of Water Resources on June 19, 1980, to discuss the water quality matter. It was felt that if the chemistry of the geothermal fluid at depth is not significantly different from that of the water presently flowing, contamination would not be a problem and discharge could be made into the reservoir (see Exhibit 2).

It is presently anticipated that discharge will be utilized to considerable benefit to enhance the growth of trees.

9.c SAFETY

ERG MRI is fully cognizant of the necessity to conduct all aspects of the reservoir confirmation drilling project in accordance with the highest industrial standards for safeguard of life, property, and environment.

EXHIBIT 2

State of Idaho
DEPARTMENT OF WATER RESOURCES
STATE OFFICE, 450 W. State Street, Boise, Idaho

JOHN V. EVANS
Governor

C. STEPHEN ALLRED
Director

Mailing address:
Statehouse
Boise, Idaho 83720
(208) 334-4440

July 17, 1980

Mr. Charles Corwin
East Fork Road
Hailey, ID 83333

Dear Mr. Corwin:

I would like to summarize my thoughts concerning the June 19, 1980, meeting we had with Mr. Al Murray, Chief of the Water Quality Bureau, Idaho Department of Health and Welfare.

Although the meeting was informal and Mr. Murray was not reacting to an application for a discharge permit, he did set several conditions which if met, would probably allow the discharge of geothermal fluids from your proposed operation directly into Magic Reservoir. The two major constraints would be that the quality of the geothermal fluids not be significantly different from that of the water presently discharging to the reservoir and that the volume of fluid not be much greater than the 450 gallons per minute figure you mentioned. He also indicated that some kind of diffuser might be needed at the actual discharge point.

If you do not agree with my interpretation, please contact me. I look forward to working with you as you attempt to develop the geothermal resource at the Magic Landing site.

Sincerely,
Frank B. Sherman
FRANK B. SHERMAN, Supervisor
Geothermal and Environmental Section

FBS:cjs

cc: Al Murray, IDWR

September 10, 1980

NOTE: Mr. Charles Corwin advises that the 450 gal/min amount is increased to 750 gal/min, and a letter is forthcoming.

Alan Lohse
Alan Lohse
Executive Vice President, Gruy Federal, Inc.

Through its technical staff, provided primarily by Gruy Federal, Inc., MRI will design, apply, and maintain these standards throughout all field operations.

The experience of GFI's technical organization and project staff encompasses all phases of safety guidelines and compliance relevant to the reservoir confirmation project. The field drilling, logging, and testing supervisors are trained in standards established by the International Association of Drilling Contractors (IADC), which includes proper work procedures and equipment maintenance as set forth in the IADC Drilling Manual and other IADC operations and training manuals. GFI also is familiar with and observes all relevant OSHA regulations.

ERG

In 1978, GFI prepared two handbook, "Standard Test Procedure for Blowout Preventers, Choke Manifold and Accessory Equipment" and "Safety Inspection, Blowout Prevention and Control," that were approved by DOE for application to the geopressured-geothermal test and production wells in the Gulf Coast oil and gas province. GFI supervisors are thoroughly familiar with these handbooks.

Potential safety problems in the Magic Hot Springs Landing reservoir confirmation project include water and drilling-mud temperatures not exceeding the routine experience of GFI personnel, and borehole and wellhead pressures far less than routine GFI experience. No potential problems are foreseen that exceed or tax conventional industrial experience as long as prudent operations are conducted and experienced supervision is maintained.

9.d LEGAL, SOCIAL, INSTITUTIONAL ISSUES

These issues are all nonexistent, negligible, or favorable.

(1) Water supply - during drilling, ERG GFI plans to use water from the Magic Reservoir through conventional surface-laid pipelines that will be removed after operations. After drilling, a significant amount of geothermal water will be used for industrial purposes.

Because contamination of the spent geothermal fluid is unlikely, the water can be reinjected into the aquifer or discharged into Magic Reservoir with appropriate State permits. This is a sparsely populated area with very little domestic water consumption.

(2) Land - no disturbance during drilling operations. No potential exists for landslides or excessive or damaging erosion.

(3) Subsidence and seismicity - neither is expected to be a problem for either the short or long term. ?

(4) Ecology - no short- or long-term ecological disturbance is anticipated. The project will not disturb any sensitive species or habitats, and it contains no aquatic area. Deer migrate north-south and east-west through the area but not in specific corridors. No pheasants roost or nest in the area. The Idaho Department of Fish and Game will be consulted further on any question.

(5) Socioeconomics - inasmuch as the end uses of the project will utilize or add temporily to only a small percentage of the local labor force, demands on housing, school, and other community service will be insignificant. Establishment of an industrial site will be beneficial in stabilizing the local labor market, which at present is highly seasonal.

(6) Heritage resources - since this project will require A-95 review, the State Historical Society will determine whether there are any historical or archeological impacts. If any sites exist, they will be protected.

[illegible]

(7) Zoning - much of the 200 acres owned by the developer is a zoned recreation development district and the remaining portion is zoned agriculture. A comprehensive plan change and rezoning will be

required to accommodate the intended industrial usage. If existing recreational uses can be guaranteed and enhanced, rezoning can be accomplished with separation and screening of industrial from recreational uses by existing topography and future trees to be irrigated by discharge waters.

Blaine County was recently awarded a grant by the State of Idaho to study ways to facilitate geothermal development in the county. As a minimum this study will produce a recommended comprehensive plan and zoning ordinance change that will recognize known geothermal locations in the county and establish permitted uses at those locations. This study is to be completed in time for this project to benefit from the findings and recommendations.

10. PROGRAM POLICY AND PREFERRED FACTORS

The Magic Hot Springs Landing project has a very large potential for expanded development and utilization of the geothermal resource. The geological evidence is very strong that a major source of exploitable heat exists in the area from both the sensible heat of hot rocks and radiogenic heat of younger igneous rocks. Also, the geochemistry of the Magic Hot Springs waters indicates water temperatures approaching 400°F may exist. The large amount of faulting in the area can provide extensive areas of water circulation, and the major faults certainly can provide zones of circulation from depths of many thousands of feet.

Alternative fluid utilization schemes and cascaded multiple uses are planned in near-future development of the industrial park, as shown in Fig. 9, Section 5.b.(2). These uses are now being designed in a geothermal management plan under preparation by Harris, Klein, and Associates working under contract with Blaine County, July 20, 1980.* The management plan includes proposals for additions to the Blaine County Comprehensive Plan and Blaine County Zoning Ordinances, as well as details such as future site access needs, etc.

The ethanol plant will require 22.5 x 10^6 Btu/hour. The overall project is estimated to cost $1,250,000. Assuming a complete success, the DOE cost would be $250,000, or a DOE investment of 1.1¢ per Btu/hour supplied. The proposer's cost would be 4.4¢/Btu/hour.

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*Correspondence between Mr. Charles Corwin and Gruy Federal, Sept. 9, 1980.

6.b.(1) GRUY FEDERAL'S EXPERIENCE WITH RELEVANT OR RELATED PROJECTS

(i) Descriptions of Selected Projects

Selected projects are described in which Gruy Federal, Inc. has total responsibility, illustrative of our ability to organize and conduct large and complex projects.

1) Resource Assessment of Gulf Coast Geopressured-Geothermal Fairway

Technical Project Officer - R. T. Stearns 702/734-3424
DOE/Nevada Operations Office
Las Vegas, Nevada 89114

DOE Contracting Officer - Robert W. Taft 702/734-3251
DOE/Nevada Operations Office
Las Vegas, Nevada 89114

Contract No. DE-AC08-77ET28460
Awarded September 26, 1977 - closing April 30, 1980
Contract amount: $15,000,000
Contract type - cost plus a fixed fee

Gruy Federal was selected by DOE's Geothermal Division to undertake the identification, qualification, acquisition, planning, drilling and testing, and interpretation of wells in the geopressured-geothermal formations in the Texas and Louisiana Gulf Coast. Gruy was responsible for obtaining the support services required to accomplish all work at each well location and for all phases of the program. Two wells were completed and tested (Fairfax Foster Sutter No. 2 and Beulah Simon No. 2) and one is under joint operations by Gruy Federal and Tenneco (Tenneco Fee "N" No. 1). One wildcat exploration well was also taken over by Gruy Federal in Georgia, and drilled and cored into basement rocks for a geothermal test. This contract has more than 600 subcontractors; the major ones are shown below.

Progress Drilling Co.	$ 360,000
Ashey Enterprises	263,665
Smith Pipe & Supply	1,282,167

Oilquip	145,244
American Well Service	192,000
Weatherly Engineering	624,119
Tenneco	500,000
Gray Tool Co.	304,478
Delta Drilling	483,990
Sooner Pipe & Supply	257,203
Atlanta Pacific Marine	400,000
W-K-M	147,621
Halliburton	297,007
Schlumberger Well Services	214,932
Patterson Rental Tools	348,890

Engineering consultants: O'Brien-Goins Engineering, Inc.
Bill Laurence, Inc.

2) Atlantic Coastal Plain Geothermal Drilling Program

Technical Project Officer - R. T. Stearns 702/734-3424
DOE/Nevada Operations Office
Las Vegas, Nevada 89114
DOE Contracting Officer - James B. Cotter 702/734-3251
DOE/Nevada Operations Office
Las Vegas, Nevada 89114

Contract No. DE-AC08-78ET28373
Awarded April 17, 1978 - closing December 1979
Contract amount: $4,890,000

Gruy Federal completed a hydropressured geothermal exploration and evaluation project for DOE. Under this contract, Gruy supervised the drilling of fifty 1000-foot holes along the Atlantic Coastal Plain from New Jersey to northern Florida. Two 25-foot cores were taken in each test hole. Gruy Federal also did all leasing, permitting, and site-specific environmental assessment for the 50 locations. These holes were used by scientists from

Virginia Polytechnic Institute & State University to measure thermal gradients and heat conductivity, seeking to locate anomalous heat sources in the basement rocks. From results of these studies, a site was selected for a 5000-foot test well on the eastern shore of Maryland near Crisfield. This well was drilled by Gruy Federal in April 1979 to investigate possible exploitation of geothermal resources. The final report on this project was completed in October 1979.

A total of 175 subcontracts were placed by Gruy Federal. Those with a value of over $100,000 are shown below.

Energy Service Company	$ 1,071,348
Halliburton	113,000
Smith Pipe & Supply	223,589
Rowan Drilling	360,000
Oilquip	✓ 156,742

3) Palo Duro Basin Drilling Program

Technical Project Officer - Robert B. Laughon 614/424-4268
Battelle Memorial Institute
Columbus, Ohio 43201

Battelle Contracting Officer - J. W. Holcomb 614/424-4488
Officer of Nuclear Waste Isolation
Battelle Memorial Institute
Columbus, Ohio 43201

Subcontract No. E-512-01700
Awarded April 21, 1978 Completed December 1979
Contract amount: $1,740,500

Gruy Federal was selected to manage a project to drill and core two 4000-foot wells in the Palo Duro Basin. Gruy was responsible for overall project management and supervision of all services necessary to drill and core the wells from the grass roots to 4000 feet. Cores obtained from this project are to be analyzed by the Bureau of Economic Geology at The University of Texas. Approximately 8000 feet of core was delivered to the BEG under this contract.

A total of 62 subcontracts were placed during Gruy's management of the Palo Duro Basin Drilling program. Those with a value of over $75,000 are shown below.

Earth Sciences Company	$ 130,643
Megargel Drilling Company	340,000
Hycalog	80,730
Imco Services	83,812

-4) Target Reservoirs for Carbon Dioxide Flooding

Technical Project Officer - Royal Watts 304/599-7218
Morgantown Energy Technology Center
Morgantown, West Virginia 26505

DOE Contracting Officer - Bill Bowser 304/599-7241
Morgantown Energy Technology Center
Morgantown, West Virginia 26505

Contract No. DE-AC21-79MC08341
Awarded: March 5, 1979
Initial funding: $2,714,000
Contract type: cost plus a fixed fee

Gruy Federal is currently working on a DOE-funded project to select target reservoirs for tests of enhanced oil recovery by carbon dioxide flooding. The work involves evaluating the results of field tests of the method; screening carbonate reservoirs in West Texas, southeast New Mexico, and the Rocky Mountain area to select the most promising carbonate reservoirs in which to conduct additional tests; selecting specific sites for 8 to 12 test wells; supervising drilling and coring of the test wells; and interpreting the results with respect to advancing the state of the art. Pressure-coring of the first well in West Texas has been completed under this contract.

To date about 75 subcontracts have been issued during the progress of Gruy's contract. Those with a value of more than $75,000 are shown below.

Diamond Oil Well Drilling Co.	$ 124,960
Core Laboratories, Inc.	82,980

5) Collect Core Material and Log Devonian Shale Wells (EGSP)

Technical Project Officer - Charles W. Byrer 304/599-7547
Morgantown Energy Technology Center
Morgantown, West Virginia 26505

DOE Contracting Officer - Bill Bowser 304/599-7241
Morgantown Energy Technology Center
Morgantown, West Virginia 26505

Contract No. DE-AC05-79MC08382
Awarded: March 27, 1979 Estimated closing: April 1981
Current funding: $2,720,000
Contract type: cost plus a fixed fee

Gruy Federal has been awarded a contract to collect core material and geological data on the gas-bearing Devonian shales of the Appalachian region under the DOE's Eastern Gas Shales Program. The project requires the collection of cores and data from 22 wells in 11 states. Gruy Federal will be responsible for identifying specific well sites on the basis of geological and engineering data, designing each test well and the testing program, securing drilling subcontractors, supervising all drilling and coring operations, collecting and organizing the required cores and data, and synthesizing all geological, geophysical, and engineering data into a complete report on the gas potential of each test site. The objective of the project is to advance the assessment of the Devonian shales to a point where their resource potential can be utilized. The first test well under this contract has been cored and logged, the data will be available soon.

About 95 subcontracts have been placed so far. Those exceeding $75,000 are shown below.

Gordon T. Jenkins	$ 172,937
Thomas W. Angerman	105,000
Falcon Drilling Co.	100,301
The Peoples Natural Gas Co.	80,140
Christensen Diamond Projects	120,334

(ii) Company Experience On Other Relevant Projects

1) Eastern Gas Shales Testing Program

The Department of Energy, Oak Ridge/Operations, and Morgantown Energy Technology Center selected Gruy Federal to perform gas well testing in Devonian shale gas reservoirs. The work is being done in two phases. In Phase I, Gruy designed and developed a practical, cost-effective field procedure for testing Devonian shale wells and analyzing the test data according to Department of Energy specifications. Gruy has completed the field testing required under Phase I. Phase II will consist of one year of gas well testing and test analyses in support of DOE's Eastern Gas Shales program. Twenty wells which have undergone stimulation by hydraulic or explosive fracturing will be tested in Phase II.

Contract No. DE-AC21-78MC08096
Awarded April 17, 1978 Contract amount $704,200
DOE Contracting Officer: Larry Shydlosky DOE/METC 304/599-7243

2) Polymer-Enhanced Waterflood Program

Under contract to DOE/Bartlesville Energy Technology Center, Gruy Federal conducted a detailed study of the Burbank-Bartlesville sand reservoir in Osage County, Oklahoma, evaluating the results of a polymer-enhanced waterflood program for enhanced oil recovery. Gruy reviewed the geological and engineering characteristics of the Mid-Continent fields now under waterflood, determined the reservoir parameters for waterflooding, and evaluated the overall cost effectiveness of the polymer-waterflood program. Project work has been completed and the final report has been submitted.

Contract No. EW-78-C-19-0026
Awarded June 12, 1978 Contract amount $100,000
DOE Contracting Officer: Marty Lowe DOE/BETC 918/336-2400

3) <u>CO_2 Enhanced Oil Recovery</u>

DOE's Morgantown Energy Technology Center contracted with Gruy Federal to study enhanced oil recovery by carbon dioxide injection in 57 reservoirs in West Virginia. Gruy's tasks included making a detailed analysis of important reservoir parameters, evaluating potential production from these reservoirs by CO_2 injection, and interpreting the results of field tests of the method. This project is complete, and a final report was submitted in May 1979.

Contract No. EF-78-05-5602
Awarded December 12, 1977 Contract amount $100,000
DOE Contracting Officer: A. H. Frost, Jr. DOE/Oak Ridge, TN
715/483-8611

4) <u>Geothermal Direct Use Study Integration</u>

Gruy Federal has completed, under contract to DOE, a study integrating the results of 17 recently completed geothermal studies which investigated the engineering feasibility of a variety of industrial applications of geothermal energy. Gruy Federal analyzed the economics of these processes on a consistent basis and identified the geologic and thermodynamic characteristics that affect the commercial attractiveness of the various applications. The final report on the project was submitted in June 1979.

Contract No. ET-78-C-03-2072

Estimated Cost Plus Fee $72,147
DOE Contracting Officer: Robert M. Tomihiro DOE/SFO
415/273-7916

5) Resource Definition of the Eastern Geothermal Region

A Gruy Federal earth sciences team is conducting a study for the DOE aimed at defining areas of domestic geothermal potential. After completing a preliminary evaluation from available geological information, the team will identify those areas where further examination appears warranted. Gruy Federal will then conduct individual in-depth analyses of these areas to develop geologic models that could account for subsurface sources of geothermal energy and suggest specific technical approaches for verifying the models. The technical team based in Gruy Federal's Arlington office conducts this work.

Contract No. DE-AC08-78ET28373
Contract amount $350,000
DOE Contracting Officer: James B. Cotter DOE/NVO
702/734-3200
Technical Project Officer: Dr. Gerald Brophy 202/376-4898

This project continues under a new contract:

Contract No. DE-AC08-80NV/0072
Contract amount $229,204
Technical Project Officer: Joe Fione DOE/NVO
Expires October 31, 1980

(iii) Experience In Environmental Studies

Gruy Federal is familiar with environmental assessments for geothermal and many other natural resource and land use operations. We have the capability to provide either site-specific or generic information for evaluating impacts of conventional or esoteric energy-related operations. We also understand the necessity for environmental quality assurance in all field operations, and our field personnel are trained to follow the highest standards of environmental safeguard and worker safety prescribed by the International Association of Drilling Contractors, American Petroleum Institute, and the numerous state agencies with whom we have worked. We require the same standards from our contractors.

Gruy's environmental experience includes the full spectrum of data compilation, analysis, and judgment required for major energy development and commercialization programs, gained through experience in such programs as:

- site-specific environmental reports for thermal gradient measurement holes drilled and cored to approximately 1000-foot depths in eight states along the Atlantic Coastal Plain, many located in wetlands and state or federal refuges, preserves, parks, or military establishments;

- site-specific environmental report for a 5000-foot geothermal production well drilled on the Delmarva Peninsula, Maryland, adjacent to wetlands;

- site-specific environmental requirements for underground coal conversion in Wyoming, coal degasification in Pennsylvania, and tar sand in-situ combustion in Kentucky;

Gruy Federal's staff now includes personnel with experience in:

- assessment of environmental effects associated with enhanced oil recovery technologies in onshore, wetlands, and offshore provinces;

- assessment of environmental effects associated with onshore and offshore drilling;

- criteria for location of nuclear power plants;

- criteria for location of nuclear waste storage facilities;

- the Tennessee-Tombigbee Canal Project in Alabama, Tennessee, and Kentucky;

- river basin studies for flood control projects in Texas coastal environments;

Many of these programs required permitting through local county or district offices, monitoring and final reporting of field operations, and final cleanup of drill sites and other surface restoration.

The staff available within the Gruy organization and its consultants are familiar not only with basic NEPA requirements of 1969, but with a variety of formats and regulations that have evolved for reporting environmental effects and fulfilling the requirements and the intent of NEPA, such as:

- Geothermal Steam Act of 1970,
- Clean Air Act of 1970,
- Marine Protection Research and Sanctuaries Act of 1972
- Federal Water Pollution Control Act Amendments of 1972,
- Solid Waste Disposal Act of 1972
- Noise Control Act of 1972
- Coastal Zone Management Act of 1972
- Endangered Species Act of 1973
- Geothermal Energy Research, Development, and Demonstration Act of 1974
- Archeological and Historical Preservation Act of 1974
- Federal Non-Nuclear Energy Research and Development Act of 1974
- Antiquities Act of 1906
- Historic Preservation Act of 1935
- Historic Preservation Act of 1966
- Rivers and Harbors Act of 1899 (The Refuse Act)

- Fish and Wildlife Coordination Act
- FAA regulations to prevent obstruction of air commerce.

The Gruy Federal staff includes experience as principal investigator in environmental assessments especially related to the drilling of production and injection wells, and enhanced oil recovery processes in onshore, coastal, near-shore, and continental shelf environments, including probable adverse or beneficial impacts of related activities such as transportation, storage, and field operations. A significant study involving input from major coastal and offshore oil and gas operators was conducted for the Environmental Protection Agency in 1975.

The extensive activities in project design, oil and gas field operation, and pipeline applications conducted by H. J. Gruy and Associates and Gruy Management Service Company in the states of New York, Texas, Louisiana, Oklahoma, Kansas, Colorado, and California also provide many years of direct experience with specific operational procedures that must be considered in environmental assessments.

(iv) Gruy Companies Overall Experience

The Gruy Companies consist of H. J. Gruy and Associates, Gruy Management Service Company and its subsidiary Gruy Pipeline Engineering, and Gruy Federal. These companies have performed more than 5,000 technical assignments for clients all over the world, and currently are engaged in more than 200 tasks for energy producers, transporters, utilities, and the Federal government. All of these projects are considered to be prime contracts.

Table 11 lists Gruy Company clients during the past three decades, excepting recent international work. These clients range from individual oil operators to major oil companies, state and Federal agencies, and financial institutions.

TABLE 11

GRUY COMPANIES' CLIENTS
OPERATING, PRODUCING, MANAGING COMPANIES

Ada Oil Exploration Company
The Aerospace Corporation
State of Alaska
American Natural Gas Production Company
American Petrofina, Inc.
Amoco International Oil Company
Amoco U.K. Ltd.
Apco Oil Corporation
Arabian Oil Company, Ltd.
Armco Steel Corporation
Ashland Oil, Inc.
Atlantic Richfield Company
Austral Oil Company
Aztec Oil and Gas Company
Battelle Memorial Institute
Bechtel Corporation
Bordon Company
Bradco Oil & Gas Company
R. L. Burns Corporation
Buttes Gas & Oil Company
Cabot Corporation
Cenard Oil & Gas Company
C F Industries, Inc.
Jerry Chambers
Champlin Petroleum Company
Cities Service Company
Cities Service Gas Company
Cities Service Oil Company
Cleary Petroleum Corporation
Clinton Oil Company
Coastal States Gas Company
Colorado Interstate Gas Company
Commonwealth Oil Refining Company, Inc.
Continental Oil Company
Edwin L. Cox
CRA, Inc.
Crown Central Petroleum Corporation
Damson Oil Corporation
Davis Brothers Oil Company
DeCalta International Corporation
Devon Corporation
Diamond Shamrock Oil & Gas Company
Kenneth Dunn
ELF-ERAP
Energy Sources, Inc.
Ethyl Corporation
Falcon Seaboard, Inc.
Five Resources, Inc.
Forest Oil Corporation
Four M. Properties, Ltd.
Gas Council of England
Gas and Fuel Corporation of Victoria (Australia)
Gen Oil, Inc.
General American Oil Company of Texas
Geochemical Surveys, Inc.
General Electric Company
Getty Oil Company
Goodrich Operating Company, Inc.
Gulf Oil Company
Michel T. Halbouty
Harding Oil Co.
Highland Resources, Inc.
John H. Hill
The Howard Corporation
Humble Oil & Refining Company
Hunt Oil Company
Husky Oil Company
IIAPCO
L. B. Johnson Estate
Kathol Petroleum Inc.
Kerr-McGee Corporation
Kewanee Oil Company
King Resources Company
Kirby Petroleum Company
LaCoastal Petroleum Corporation
Logue & Patterson, Inc.
Lone Star Producing Company
Longhorn Producing Company
Magellan Petroleum Corporation
McCormick Oil & Gas Corporation
John W. Mecom
Mid-American Oil Company
Mitre Corporation
Mobil Oil Corporation
Monsanto Company

TABLE 11
(continued)

- Clint Murchison
- Murphy Oil
- *Ocean Drilling & Exploration Company*
- Oilwell Division, U. S. Steel
- Oleum, Inc.
- Pend Oreille Oil and Gas Company
- Phillips Petroleum Company
- Pioneer Natural Gas Company
- Prudential Funds, Inc.
- Rockefeller Brothers
- Rohm and Haas Company
- Royal Resources Company
- Shell Oil Company
- Signal Oil & Gas Company, Ltd.
- Sun Oil Company
- Tenneco Oil Company
- Tesoro Petroleum Corporation
- Texaco, Inc.
- Texas Broadcasting Corporation
- Texas City Refining, Inc.
- Texas Gas Exploration Corporation
- Texas Gas Transmission Corporation
- Texas Oil & Gas Corporation
- Texas Pacific Oil Company, Inc.
- Texas Utilities Fuel Company
- *Thurmond-McGlothlin*
- Tomlinson Oil Company, Inc.
- Transcontinental Oil Corporation
- TransOcean Oil, Inc.
- Union Carbide Corporation-Nuclear Division
- Union Oil Company of California
- U.S. Government
  - Bureau of Mines
  - Department of Energy
  - Department of Justice
  - Department of the Interior
  - Energy Research and Development Administration
  - Federal Energy Administration
  - U.S. Geological Survey
- U.S. Natural Resources, Inc.
- Van Dyke Oil Company
- Weyerhauser Company
- Zeigler Coal & Coke Company

TABLE 11
(continued)

GRUY COMPANIES' CLIENTS
FINANCIAL, INSTITUTIONAL, TRUSTEE COMPANIES

Bank of the Southwest, Houston
Bankers Trust Company, New York
Chemical Bank New York Trust Company
Continental Illinois National Bank and Trust Company of Chicago
Eastman Dillon, Union Securities & Company, New York
First City National Bank of Houston
First National Bank in Dallas
First National City Bank of New York
Fort Worth National Bank
Girard Bank, Philadelphia
Houston National Bank
Loeb Rhoades & Company
Marine Midland Grace Trust Company of New York
Mercantile National Bank of Dallas
New York Life Insurance Company
Pioneer American Insurance Company
Republic National Bank of Dallas
Southland Life Insurance Company
Texas Bank & Trust of Dallas
Texas National Bank of Commerce, Houston
Union Bank of Los Angeles
Union Trust Company, New Haven

(v) Support Facilities

Gruy Federal has a highly specialized support capability for earth science work involving

- geology, petroleum engineering, energy economics directed toward resource definition
- program design and management
- drilling
    - test, measurement or exploratory holes
    - production wells
    - injection or disposal wells
- downhole log analyses
- formation evaluation
- reservoir testing, flowing and shut-in
- reservoir test analyses.

Many of the reservoir test analyses and interpretative methods were developed by H. J. Gruy and Associates during three decades of service to the petroleum industry, during which time that company became preeminent in the field of reservoir analysis and reserves estimation for independents, major companies, and financial institutions. These programs are continually updated by the Gruy R&D group and those persons who use them in daily applications.

More than 100 specialized computer software programs are in use by the Gruy companies for reservoir analyses and their associated econometric projections. Many of these programs are in worldwide use and have become industry standards after being purchased from H. J. Gruy and Associates.

Gruy's pressure transient analyses are especially well known and widely used in onshore and offshore operations.

A number of the Gruy software programs have been successfully modified by Gruy Federal for application to nonconventional gas and geothermal reservoirs. All Gruy analytical programs, methodologies, and cumulative experience are available to Gruy Federal and to Mr. Raj Kumar and his staff for the Magic Hot Springs Landing reservoir confirmation program.

In addition to the analytical software programs, facilities in the Houston and Dallas offices include:

- complete drafting and high-speed reproduction equipment,
- direct facsimile transmission between all Gruy offices, and elsewhere in the nation, by use of a Xerox model 200 telecopier operating on a dedicated line at 2, 4, or 6 minutes per page, fully automatic 24 hours per day (dedicated number 713/780-9115),
- geological, engineering, and geotechnical libraries located in Houston and Dallas with industrial membership and priority access to the complete libraries of William Marsh Rice University and the University of Houston,
- CDC 7600 CYBERNET computer system accessed by UNITEC remote job terminals in Houston and Dallas,
- conference rooms in Houston and Dallas seating up to 60 persons, with visual aid equipment and wall-sized map boards,
- access to public and private data bases through four major time-sharing computer networks:
    - General Electric Information Services Company (GEISCO) MARK III and MARK 3000 Systems,

- System Development Corporation (SDC) ORBIT System,
- DOE/RECON Information System,
- Lockheed DIALOG.

Gruy Federal has an extensive Information Management System that includes subscription to public and private online information retrieval systems. These include the Department of Energy Technical Information Center's RECON, System Development Corporation's ORBIT, and Lockheed's DIALOG systems.

Data files containing reservoir characteristics and well data reside on the MARK 3000 system. These files are part of the Petroleum Data System (PDS) files maintained by the Information Systems Program at the University of Oklahoma. They include the oil and gas files (OILY and TEXS), the API Master Well File (API 1 and 2), and the AAPG/CSD Exploratory File (CSD 1 and 2). Gruy Federal also accesses the Petroleum Information Well History (WHCS) file containing more than one million historical and current well records.

6.b.(2) RESUMES

Resumes of persons selected for the MRI User-Coupled Reservoir Confirmation Project are included in alphabetical order.

FRANK P. BROWN, JR.

Areas of Expertise

Proposal pricing
Cost analysis and reporting
Contract administration

Frank Brown is manager of contract administration and pricing for Gruy Federal, Inc.

He received a B.B.A. in industrial management with a minor in industrial engineering in 1963 and an M.B.A. in management in 1965 from Texas Tech University.

From 1966 to 1969 Mr. Brown was employed by LTV Electrosystems and was involved in cost and budget analysis, manpower planning, forecasting, and preparation of manhour bids for the Engineering Administration department.

In 1969 he joined Tracor, Inc., working in the areas of cost control, financial analysis, program administration, and subcontract negotiations. From 1972 to 1978 Mr. Brown worked with defense-related and commercial electronic firms with responsibilities in cost proposal preparation, cost control and variance analyses, work breakdown structure preparation and program scheduling, contract negotiations and administration, and overhead forecasting.

In 1978 he joined Martin Marietta Aerospace, Orlando Division. When he left in 1980 to join Gruy Federal, he was an estimating supervisor responsible for reviewing proposals prepared by the estimating group and for the negotiation of those proposals.

At Gruy Federal, Mr. Brown is responsible for preparation of cost proposals and administering contracts, cost planning, and preparation of cost and manpower management reports.

WM. DAVID COMPTON

Areas of Expertise

Technical editing
Preparation of reports

Dr. Compton is technical editor for Gruy Federal, Inc.

He received B.S. and M.S. degrees in chemistry from North Texas State University and the Ph.D. in chemistry from The University of Texas.

After teaching for 16 years at West Texas State University, Colorado School of Mines, and Prescott College in Arizona, Dr. Compton undertook a year of study of the history of technology at Imperial College, London, earning the M.Sc. from the University of London in 1972.

In 1974 he was awarded a contract by the National Aeronautics and Space Administration to write the official NASA history of the Skylab Program. Working with one co-author, he completed this project in 1977. A summary of this work was presented at an invited symposium at a national scientific society meeting in 1979 and has since been published.

Since joining Gruy Federal in 1978, Dr. Compton has been responsible for editing and producing all of the company's contract proposals and technical reports.

CHARLES H. CORWIN

Areas of Expertise

- Civil engineering
- Environmental planning
- Land and lease matters

Mr. Corwin is a consultant to Gruy Federal, Inc.

He received a B.S. in applied arts from Arizona State University in 1958, a B.S. in civil engineering from the University of New Hampshire in 1965, and an M.S. in civil engineering from the University of Southern California in 1970.

From 1955 to 1975 Mr. Corwin served as an officer in the U.S. Air Force. Approximately one-half of his time was devoted to civil engineering duties, including a tour as base engineer in Southeast Asia during the Vietnam conflict.

After leaving the Air Force, Mr. Corwin worked as an engineer for the consulting firm of JVB Engineers, Inc., a civil engineering firm with several offices in the State of Idaho. During that time his principal assignment was on the design of a municipal water system.

Since 1979 Mr. Corwin has been an engineering consultant and has worked on the Magic Hot Springs project since the land was purchased by MRI. He has also served as a county commissioner for Blaine County.

Mr. Corwin is a member of the National Society of Professional Engineers and an associate member of the American Society of Civil Engineers, and is a Registered Professional Engineer in the State of New Hampshire.

GAYLAND DAUGHERTY

Areas of Expertise

Financial systems
Contract administration
Business functions

Gayland Daugherty, a Certified Public Accountant, is vice president of finance for Gruy Federal, Inc., responsible for accounting, contract administration, subcontract procurement, and personnel administration. Related activities include preparation of cost proposals and cost management reporting.

He received a B.B.A. in accounting from Texas Technological University in 1960 while employed as a senior accountant for H. D. Collings, Public Accountant. From 1960 through 1965 he served as an auditing officer in the U.S. Air Force, performing management audits of Air Force activities as well as audits of defense contractors in the Far East and NASA contractors at Cape Canaveral, Florida.

In 1966 and 1967 he was employed by Dow Chemical Company with responsibility for product cost accounting, fixed asset control, and in-house asset construction.

While with Tracor, Inc. from 1968 to 1977, Mr. Daugherty dealt with virtually all aspects of accounting and contracts business management pertaining to research, development, and manufacture of electronic equipment. In his assignment as corporate manager of government accounting services and Director of Systems and Controls for the Sciences and Systems Group, he coordinated all contractor interface with the Defense Contract Audit Agency, designed and implemented systems to assure compliance with regulations of the Cost Accounting Standards Board and Department of Defense Agencies, and participated in cost negotiations with the Department of Defense and other government agencies. Other duties included audit evaluations of, and cost negotiations with, potential subcontractors. He regularly critiqued cost accounting standards and regulations proposed to the Management Accounting Practices Committee of the National Association of Accountants and the Cost Accounting Standards Board.

Mr. Daugherty is a member of the National Association of Accountants, Beta Alpha Psi, and Beta Gamma Sigma.

JACK T. DUREE

Areas of Expertise

Geothermal energy utilization
Reservoir engineering
Enhanced oil recovery

Mr. Duree is a senior engineer with Gruy Federal, Inc.

He received B.S. degrees in petroleum engineering and mechanical engineering from Texas A&M University in 1942 and joined the Magnolia Petroleum Company as a design engineer, later becoming a field production engineer in Magnolia's west Texas region.

In 1947 he left Magnolia to become a field production engineer for The Pure Oil Company. After a year he was made chief production engineer for the Texas producing division; in 1960 he was transferred to Houston as division engineer for the company's southern division, which encompassed the Texas producing division plus the Gulf Coast onshore and offshore areas.

Mr. Duree was made division operations manager for Pure Oil Company's Alaska-Canada division in 1963. During his tenure the division increased net production from 6,300 to 11,500 barrels per day and instituted the first in-situ combustion project in Canada. When Pure Oil merged with Union Oil Company in 1965 he became joint account superintendent for Union Oil Co. of Canada Ltd., responsible for drilling and production for jointly-owned properties for which Union was not operator. In 1967 he became manager of engineering, responsible for all reservoir engineering and exploitation geology for Union's Canadian operations. Besides directing all exploitation drilling, Mr. Duree's group initiated various enhanced recovery projects. In 1973 he was made manager of heavy oil production, responsible for developing Union's tar-sand and heavy-oil reserves. He directed extensive drilling to define the productive area of these deposits and evaluated recovery methods and processes to upgrade the produced oil.

Mr. Duree entered the geothermal exploitation field in 1975 as manager of engineering (later vice president and manager of operations and production) for Philippine Geothermal, Inc., a subsidiary of Union Oil Company of California. He directed reservoir and design engineering and construction for a project that completed 103 geothermal wells in 2 fields on the island of Luzon, providing geothermal steam for four 110-megawatt generating plants. His responsibilities included reservoir and economic evaluations, conceptual bases for design of gathering systems, and operation of the completed systems and producing wells. One of these fields incorporates a subsurface disposal system which is among the largest ever built: two plants, each returning 350,000 barrels of water per day to the producing reservoir.

TERENCE J. ELLIOTT

Areas of Expertise

Geophysics
Seismic methods
Subsurface geology

Mr. Elliott is a senior geophysicist for H. J. Gruy and Associates, Inc.

After receiving his B.S. in geology from the University of Queensland (Australia) in 1963, he joined Marathon Petroleum Australia, Ltd., as a geophysical assistant. The following year he became an assistant well logging engineer for Welex in Brisbane, Australia, running logs and maintaining logging tools. In 1965 he worked for one year with the Continental Oil Company, interpreting and mapping seismic data for the North Sea field.

From 1966 through 1970 Mr. Elliott was employed by Seiscom-Delta, Inc., of Houston as a geophysicist responsible for developing and testing the company's seismic data processing system. He joined H. J. Gruy and Associates in 1971, contributing to field studies in the United States, the North Sea, and Indonesia. He joined D. R. McCord and Associates in Dallas later in 1971 and correlated seismic and subsurface geological data for major studies in Australia and Iran.

From 1973 until he rejoined H. J. Gruy and Associates in 1975 he was employed by Texas Pacific Oil Company as senior international geophysicist. He was responsible for all of the company's international seismic operations, as well as computer processing and interpretation and mapping of data to determine geological exploration prospects.

Mr. Elliott is in charge of H. J. Gruy and Associates' geophysical services, carrying out assignments throughout the United States.

He is a member of the Society of Exploration Geophysicists, the American Association of Petroleum Geologists, the Dallas Geological Society, and the Dallas Geophysical Society.

PRISCILLA EVERETT

Areas of Expertise

Personnel administration

Ms. Everett is a personnel specialist with Gruy Federal, Inc.

Since graduating from high school in 1975 she has been working part-time toward her bachelor's degree in business technology (personnel administration). She has completed a number of courses in management.

From 1975 to 1979 she was employed by Hooker Chemical Corporation in the personnel department, starting as a benefits clerk auditing and processing medical and dental claims, screening applicants for employment, and compiling data for Equal Employment Opportunity (EEO) reports. Promoted to personnel assistant, she assumed additional duties in salary and benefit administration. She was later made a corporation compensation assistant with responsibility for combining and auditing monthly wage and compliance data from four other subdivisions of the company.

At Gruy Federal, Ms. Everett develops and implements Affirmative Action and EEO programs to ensure compliance with current federal requirements, monitoring the status of the company's compliance and alerting management to any difficulties encountered. She also administers all the company's benefit and performance evaluation programs and personnel functions.

Ms. Everett is a member of the Houston Personnel Association and the American Society of Personnel Administration.

CALVIN H. FRIEDRICH

Areas of Expertise

Accounting management
Financial systems

Mr. Friedrich is controller for Gruy Federal, Inc.

He received his B.B.A. in accounting from The University of Texas at Austin in 1967 and worked for one year as an accountant for Tuloma Gas Products of Tulsa, Oklahoma.

In 1968 he joined the Southland Division of the St. Regis Paper Company and became manager of general accounting in 1974. Besides supervising the general accounting functions of the company, he was responsible for corporate, industrial, and governmental reporting functions, including SEC reports and the financial section of the annual stockholder's report. He joined Gruy Federal early in 1979.

Mr. Friedrich is responsible for maintaining and improving the accounting system, preparing the various cost and manpower reports for individual contracts, and preparing financial statements.

RAJ M. KUMAR

Areas of Expertise

Petroleum engineering
Economic analysis and
forecasting

Mr. Kumar is a senior petroleum engineer with Gruy Federal, Inc.

He received his B.S. degree in petroleum engineering from the Indian School of Mines in 1970. Upon graduation he worked for the Oil and Natural Gas Commission in India for two years as senior technical assistant in the production section, engaged in various production activities including reservoir studies, economic studies, evaluation, and coordination in oil field operations.

In 1973 he came to the United States to work toward an M.S. in management science and engineering at Long Island University, where he completed his work in 1975 with specialty areas of accounting, economics, computer programming, and operations research.

After two years of applying his economic expertise in oil and gas production, Mr. Kumar joined the staff of H. J. Gruy and Associates, Inc. in 1977 and came to Gruy Federal later that same year.

His work with the Gruy companies has included assisting senior petroleum engineers in pressure transient analysis and reserve estimation; development of petroleum operating cost data for 24 geographic regions and six depth classes (onshore and offshore) for the Federal Energy Agency; economic analysis of proposed and interim effluent guidelines for the onshore oil and gas producing industry for the American Petroleum Institute; and forecasting reserve additions and natural gas production to the year 2000 from conventional sources for the U.S. Energy Research and Development Administration.

Mr. Kumar is a member of the Society of Petroleum Engineers of AIME.

H. P. LANGSTON

Areas of Expertise

Drilling supervision
Production supervision

Mr. Langston is a drilling supervisor with Gruy Federal, Inc.

His oil field experience spans 31 years, roughneck to operations manager, staff and line work. His safety record is his strongest recommendation.

He received his B.S. in petroleum engineering from the University of Houston in 1952, and worked for the next four years in the southwestern U.S. and in Venezuela as production foreman, petroleum engineer, and drilling supervisor, principally for the Atlantic Refining Company of Dallas.

From 1956 to 1963 Mr. Langston worked as a drilling engineer, drilling supervisor, and superintendent in Venezuela and Argentina for Creole Petroleum and Delta Drilling Company. He then took a position with Conoco as senior petroleum engineer in the south Texas area.

After five years in private business in Mexico City, Mr. Langston was an independent drilling consultant working in Asia and the Middle East on offshore drilling projects. Among his clients were ARCO, IIAPCO, British Petroleum, Elf-Erap, Phillips, and Petroswede of Norway. In 1976 he was a management consultant with Booz Allen & Hamilton International, working with Sonatrach in Algeria.

Since 1977 Mr. Langston has continued as a consultant drilling supervisor, working with Oilfield Consultants International Ltd. of London and with REMI of Houston in the Middle East, Africa, Norway, and South America.

Mr. Langston's experience in areas of deep geothermal work includes:

Onshore	South Texas	16,000 feet	0.85 psi/ft gradient
Offshore	Venezuela	15,000	0.80
Offshore	Egypt	15,000	0.84
Offshore	Oman	16,000	0.85
Offshore	Abu Dhabi	13,500	0.80
Offshore	Iran	12,500	0.75
Offshore	Indonesia	11,000	0.70
Offshore	Norway	13,000	0.74
Onshore	Algeria	12,000	0.90
Onshore	Louisiana	17,000	0.90
Offshore	Louisiana	17,000	0.90

This geothermal-geopressure work includes completion and testing of wells and disposal of high volumes of hot brine.

He is a Registered Professional Engineer in the State of Texas.

ALAN LOHSE

Areas of Expertise

Geology and geophysics
Petroleum engineering
Natural resource evaluation and production

Dr. Lohse is executive vice president and principal scientist for Gruy Federal, Inc.

He received a Ph.D. in geology from The University of Texas in 1952 and also attended the University of Texas Law School from 1950 to 1952.

He was employed by Shell Oil Company in the exploration division from 1952 to 1958, with some special assignments to Shell's legal department and the Exploration and Production Research Laboratory.

From 1958 to 1962, Dr. Lohse worked as a consultant in coastal engineering and oil and gas exploration. In 1962 he joined the Monsanto Company as a staff geologist, studying new oil and gas trends and conducting technical and economic evaluations of mineral resources. He served as associate professor at the University of Houston from 1966 to 1971, where he taught courses in the geology of North America and field courses in Mexico. He also continued his engineering and geological consulting, which has included interpretation of areas in Central America, Australia, and West Africa.

From 1971 to early 1977, Dr. Lohse was senior scientist and manager for the Gulf Universities Research Consortium, where he dealt with environmental and economic studies and enhanced recovery technologies for oil and gas. During this time he conducted contract work for the Corps of Engineers, the U.S. Coast Guard, the Environmental Protection Agency, the Bureau of Mines, the Energy Research and Development Administration, and other Federal agencies.

Dr. Lohse served from 1971 to 1972 as a member of the Texas Governor's Nuclear Power Plant Task Force. From 1972 to 1974 he served on President Nixon's Air Quality Advisory Board. In 1976 he participated in a United Nations conference in Austria concerning world petroleum resources.

Dr. Lohse is a Certified Petroleum Geologist and a member of Sigma Gamma Epsilon, Sigma Xi, Phi Kappa Phi, the American Association of Petroleum Geologists, the Society of Petroleum Engineers of AIME, the Sociedad Geologica Mexicana, and the Houston Geological Society. He is listed in American Men of Science. He is the author of more than 60 publications and reports for the government and private industry, and is an Adjunct Professor of geology at the University of Houston.

STEPHEN A. LOHSE

Areas of Expertise

Technical project and systems analysis
Project coordination

Mr. Lohse is an engineering assistant with Gruy Federal, Inc.

He attended Raymond College, University of the Pacific, where he majored in liberal arts. He worked for three years in the public school system of Stockton, California, as a special education teaching assistant.

During 1975 and 1976 Mr. Lohse worked as a Research Assistant for the Gulf Universities Research Consortium, principally assisting in the compilation and computerization of an enhanced oil recovery data base covering some 800 oil fields.

Since he joined Gruy Federal in January 1979, Mr. Lohse's responsibilities have included monitoring drilling activity along the Texas and Louisiana Gulf Coast, screening prospective geopressured-geothermal test wells, and assisting in general engineering work. In late 1979 and early 1980 he was periodically assigned to the field, where he was responsible for detailed cost reporting and material handling for Gruy Federal's geopressured-geothermal drilling and testing program.

In April 1979 he attended an Advance Program Management course on the use of PERT/CPM management techniques, and he is now responsible for creating and updating the company's PERT/CPM Project Management Network Plans. He designed and conducted an in-house PERT/CPM training program for Gruy Federal personnel in June 1979.

RAYMOND MARLOW

<u>Areas of Expertise</u>

Well logging and log
  interpretation
Geological exploration

Mr. Marlow is a geologist with Gruy Federal, Inc.

He received his B.S. in geology from Lamar University, Beaumont, Texas, in 1978.

Upon graduation from Lamar, he joined the Welex company as a field engineer in south Texas, managing the activities of field crews conducting logging operations on oil and gas wells and uranium test holes. He was also responsible for collecting and interpreting the results, which included calculations using resistivity, sonic velocity, density, and radioactivity. His duties also encompassed evaluation of formation tests and sidewall cores.

Mr. Marlow joined Gruy Federal in 1980, and participates in all of the company's projects which require compilation and interpretation of geologic data and well log data.

MARVIN MATULA

Areas of Expertise

Drilling
Drilling supervision

Mr. Matula is a drilling supervisor for Gruy Federal, Inc.

He began working in the oil fields in 1956 as a driller's helper for Chiles Drilling Company of Corpus Christi, Texas. After service in the U.S. Army he took a position with Texaco, Inc., where he worked his way up to drilling foreman in Texaco's south Texas operations.

In 1976 and 1977 he worked for Gannet Offshore Company, repairing wells in the Gulf of Suez that had been destroyed during the Egypt-Israel fighting. On his return to the U.S., Mr. Matula worked as a drilling foreman and drilling superintendent for Good Hope Refineries of Laredo, Texas, and as a drilling consultant for Scarborough, Sawyer and Associates in Corpus Christi.

Since joining Gruy Federal in 1978, he has worked principally on the Gulf Coast Geopressured-Geothermal Program, supervising rig operations and coordinating all phases of field work with operations management.

R. L. McCOY

Areas of Expertise

Petrophysical Analyses
Geological Engineering
Economic Analyses

Mr. McCoy is staff petrophysicist for H. J. Gruy and Associates, Inc. in Houston.

After receiving a B.S. degree in petroleum geology from Mississippi State University in 1975, he joined Dresser Atlas. Upon completion of Dresser's comprehensive logging schools at the Houston Research Center, he was assigned to the southeast U.S. region for three years. During this period, he became familiar with the broad spectrum of services available to the industry as well as the various interpretive techniques used in mid-continent and Gulf Coast areas. He had qualified for the position of senior field engineer before leaving this field assignment.

Mr. McCoy served as a consultant for J. R. Butler and Co./Geoquest International for one year, performing various functions including geological engineering, reservoir characterization, and computer modeling (Monte Carlo) for risk analyses.

He joined Gruy Federal in 1978, and provided log analyses, geological engineering, and production engineering services for many of the company's projects, including geopressured-geothermal resource assessment and studies of possible subsidence problems. He joined H. J. Gruy and Associates in 1980.

Since 1977, McCoy has been attending the University of Houston where he is currently completing a M.S. program in petroleum engineering.

He is a member of several professional societies, including the Society of Petroleum Engineers of AIME, the American Association of Petroleum Geologists, the Society of Professional Well Log Analysts, and the Society of Exploration Geophysicists.

Mr. McCoy is the author or co-author of several technical papers which have been presented in the Journal of Petroleum Technology and Transactions of the Society of Professional Well Log Analysts.

ROBERT L. NYLAND

Areas of Expertise

Purchasing
Material management
Contract administration

Mr. Nyland is purchasing manager for Gruy Federal, Inc.

After attending the University of Texas he joined the staff of the Austin State School in 1958 as assistant supply officer where he served as buyer and supervised receiving, warehousing, shipping and inventory control. Average inventory value was in excess of $400,000 and consisted of items to support a 3000-bed residential facility. Material responsibilities included coordination between medical, plant maintenance, food service, educational, laundry, vendors, and other governmental agencies.

In 1966 he joined Tracor, Inc. as assistant purchasing agent for the Military Products Division, with responsibility for the purchase of components, raw materials and services. This included coordination efforts between engineering, production, quality control, vendors, and manufacturers. He directed a staff of buyers, expeditors, and clerks in order to support proposals and contracts.

Mr. Nyland joined Infotronics Corporation in 1969 as purchasing agent, responsible for the procurement of all components, raw materials and services required of the Austin manufacturing plant. He was also responsible for corporate purchasing agreements for the Austin and Houston plants as well as the Shannon, Ireland, plant. He developed corporate purchasing procedures, directed a staff of buyers and clerks, and ensured coordination with engineering, quality control, production, vendors, and manufacturers.

In 1970 he became purchase and supply officer for the Travis State School, responsible for purchasing, inventory control, receiving/shipping, warehousing, and supervision of a staff of 17 employees. This included the maintenance of a $500,000 inventory and coordination with vendors, plant maintenance, laundry, medical, educational, food service, and other state and federal agencies.

He joined the staff of Gruy Federal in 1978 as purchasing manager, responsible for the acquisition of all items and services required by the company. He is also responsible for government property and coordinating subcontracts with the appropriate government agency.

He was a charter member of the Austin Purchasing Management Association, serving two years on the Board of Directors and two years as Professional Development Chairman, and is a member of the Purchasing Management Association of Houston.

DWIGHT PEACE

Areas of Expertise

Drilling
Drilling Supervision

Mr. Peace is a drilling supervisor for Gruy Federal, Inc.

He has nearly 30 years of experience in drilling, and has worked in many oil-producing areas in the United States and foreign countries.

Mr. Peace began working in the oil fields in 1949 after completing two years of work at Southwest State College, Magnolia, Arkansas. From 1949 until 1967 he worked with several companies operating in southern Arkansas, east Texas, and Mississippi. In 1967 he went overseas as a driller for Loffland Brothers, working in Turkey, Libya, and Nigeria. Later he joined KCA as a rig superintendent. Before joining Gruy Federal in 1977, Mr. Peace worked for several years as a toolpusher for Helmerich and Payne.

With Gruy Federal, he has been supervisor for the company's Palo Duro Basin project, which involved drilling and continuously coring two 4,000-foot wells in West Texas.

LEROY RADFORD	Areas of Expertise
	Drilling operations Petroleum engineering

Mr. Radford is a senior drilling engineer with Gruy Federal, Inc.

He earned his B.S. degree in geological engineering from the University of Oklahoma in 1941.

After service in World War II and Korea, Mr. Radford joined the Magnolia Petroleum Company, remaining with the company for 17 years after its merger with Mobil Oil Corporation. His assignments with the company included drilling and production responsibilities in Texas, Oklahoma, Alaska, Indonesia, and Colombia.

From 1971 until he joined Gruy Federal in early 1978, he served as a drilling consultant to companies in Louisiana, the Philippine Islands, Iran, the North Sea, Algeria, and Pakistan. His experience includes contract negotiations, site selection, site preparation, and all aspects of drilling. Mr. Radford spent approximately three years on wildcat drilling programs in Indonesia, where pressure gradients approaching 0.9 psi/ft and temperatures in excess of 400°F at 10,000 feet are common. He also worked one year in Iran, where extreme drilling conditions are encountered, and one year on the Louisiana Gulf Coast, onshore and offshore.

During 1978 and 1979 Mr. Radford was in charge of the Geothermal Drilling Program on the Atlantic Coastal Plain, completing 50 temperature measurement holes of 1,000-foot depth from New Jersey to North Carolina. He was also the engineer in charge of drilling the deep geothermal test well at Crisfield, Maryland, which was completed and tested in the summer of 1979.

Mr. Radford is a member of the Society of Petroleum Engineers of AIME and is a Registered Professional Engineer in Texas and Oklahoma.

JOEL L. RENNER

Areas of Expertise

Geothermal resources
Coal geology
Mineral evaluation

Mr. Renner is a senior geologist with Gruy Federal, Inc.

He received his B.A. in mathematics from Carleton College in 1965 and his M.S. in geology from the University of Minnesota in 1969. He is currently completing his dissertation for the Ph.D. degree in applied earth sciences at Stanford University.

From 1970 to 1978, Mr. Renner worked for the U.S. Geological Survey in Menlo Park, California, and Denver, Colorado. With the Conservation Division at Menlo Park he conducted research on the tectonic and geologic controls of the occurrence of geothermal resources and was the division representative to the USGS geothermal research program. He was the senior author of the 1975 assessment of U.S. hydrothermal geothermal resources.

In Denver, Mr. Renner continued his research on geothermal resources, and was additionally involved with coal geology and evaluation. From 1977 to 1978 he was staff assistant for mineral evaluation in the Conservation Division, coordinating interdisciplinary review of problems relating to mineral development and representing the region in meetings with industry and with environmental and intergovernmental groups.

Since joining Gruy Federal in 1978, Mr. Renner has served as principal investigator on a number of technical studies, among them a review of the availability of groundwater for heat pumps and a comprehensive study of the geothermal resources potential of the eastern half of the United States. He has also evaluated the reservoir characteristics of geothermal resources in a series of studies on the direct use of hydrothermal energy. These studies were reviewed by Gruy Federal as part of DOE's geothermal resources development program.

Mr. Renner is vice president of the Mid-Atlantic Section of the Geothermal Resources Council and chairman of the subcommittee on definitions and nomenclature of the Geothermal Resources and Energy Committee of the American Society for Testing Materials. He is also a member of the Society of Mining Engineers of AIME, the American Association of Petroleum Geologists, and the Colorado Scientific Society. He has published a number of papers on geothermal resources in the eastern United States.

TERRY E. SWIFT

Areas of Expertise

Petroleum engineering
Computer applications

Mr. Swift is a petroleum engineer with Gruy Federal, Inc.

He received a B.S. in chemical engineering with a minor in petroleum engineering from the University of Houston in 1979.

While completing his undergraduate work, Mr. Swift gained practical experience in the application of computer methods to petroleum engineering problems. From 1975 to late 1978, he worked as a programming assistant for American Natural Gas, participating in the development of a comprehensive log analysis program and other programming projects related to petroleum engineering. From 1978 until he joined Gruy Federal in mid-1979, he was a strategic planning assistant at Natomas North America, assisting with the operation of Fortran economic models.

Since coming to Gruy Federal, Mr. Swift has participated in several of the company's projects. He assisted in the testing and evaluation of Gulf Coast geopressured-geothermal reservoirs. He has worked on the development and evaluation of an enhanced oil recovery (CO_2) data base, and has represented Gruy Federal on pressure-coring operations in West Texas and New Mexico in connection with a CO_2 injection project. He has assisted in the testing and evaluation of the geothermal potential of the Atlantic Coastal Plain, and has also been involved in a gas well testing program in fractured Devonian shale reservoirs.

ROBERT M. WINN

Areas of Expertise

Hydrology
Coal and lignite assessment

Dr. Winn is a senior geologist with H. J. Gruy and Associates, Inc.

He received a B.S. in geology in 1958, an M.S. in 1960, and a Ph.D. in 1973 in geology and hydrology from Texas Tech University.

From 1961 to 1966 he was employed by Mobil Oil Corporation, with responsibility for oilfield hydrogeological investigations for drilling, waterflooding, and water supplies for field operations.

After leaving Mobil, Dr. Winn joined the faculty of West Texas State University as an assistant professor of geology. His research activities included water table aquifer assessment for several water conservation districts in west Texas. During 1970 and 1971 he was on leave directing a study team assessing groundwater development potential for various areas in Algeria for the Algerian Ministry of Agriculture.

From 1974 to 1979, Dr. Winn was associated with Texas Instruments, Terra, Inc., and Environmental Consultants, Inc., conducting hydrological assessments of proposed and operating coal, lignite, and uranium mines; assessment and evaluation of surface and subsurface waters for flow regime conditions and control parameters; and studies on watershed management and downstream flood control for proposed river navigation projects.

COPY E OF 10
Control No. 002

PROPOSAL

EARTH RESOURCE GENERATUS, INC
MAGIC HOT SPRINGS LANDING USER-COUPLED
CONFIRMATION DRILLING PROJECT

VOLUME II: BUSINESS PROPOSAL

Submitted to
U. S. Department of Energy

In Response to
SCAP No. DE-SC07-80ID12139

by

E.R.G, INC
7671 HANSOM DR
OAKLAND, CA 94605
MAGIC RESOURCE INVESTORS
P.O. Box 1328
Sun Valley, Idaho 83353

September 15, 1980

PLEASE RETURN TO:
Jon. A. Strawn

MAGIC RESOURCE INVESTORS
P. O. BOX 1328
SUN VALLEY, IDAHO 83353

September 15, 1980

Ms. Nina Ussery, SEP Secretary
Department of Energy
Idaho Operations Office
550 Second Street, Room No. 119
Idaho Falls, Idaho 83401

Re: SCAP No. DE-SC07-80ID12139, User-Coupled Confirmation
Drilling Program

Dear Ms. Ussery:

Our proposal for a cooperative agreement award under the User-Coupled Confirmation Drilling Program is submitted in ten copies as required by the SCAP. Separate volumes are provided for the technical and business proposals.

We appreciate DOE's interest in involving industry in the development of energy resources. etc In order to assure a strong technical and management team for this effort, Magic Resource Investors proposes to subcontract most of the work to Gruy Federal, Inc., + a small business firm that has performed a significant amount of geothermal work for DOE.

In submitting this proposal we have utilized the proposal check list provided with the SCAP and have fully considered amendment No. 001, dated July 16, 1980. This proposal is valid for 200 days as specified in the SCAP.

Since Gruy Federal has been involved in developing the proposal, please feel free to contact Mr. Jack Duree with technical volume questions or Mr. Gayland Daugherty with business volume questions. They may be reached at 713/785-9200.

I will be responsible for all negotiations and company commitments arising from this proposal. My telephone number is 208/726-8241.

415/632-1698

Sincerely,

Jerold R. Kirkman
General Manager

JRK/jr

VOLUME II - BUSINESS PROPOSAL
PROJECT PROPOSAL SUBMITTED TO THE
DEPARTMENT OF ENERGY
IDAHO OPERATIONS OFFICE

USER-COUPLED CONFIRMATION DRILLING PROGRAM
SCAP No. DE-SC07-80ID12139

Copy No. 8 of 10

Date of Submission September 15, 1980

EARTH RESOURCE GENERATUS, INC
Magic Resource Investors
Name of Organization (principal participant if a team of organizations)

PROFIT (IDAHO-CORPORATION)
Profit (Partnership)
Type of Organization

7671 HANSOM DR, OAKLAND, CA 94605
P. O. Box 1328, Sun Valley, Idaho 83353
Address of Organization

Development of Geothermal Energy at Magic Hot Springs Landing, Blaine County, Idaho
Title of Proposed Project

Maximum Funds requested From DOE $1,088,395 # 928,444 Total Cost of Project # 1,031,604
Through Flow Testing $1,209,328

Location of Site Magic Hot Springs Landing, Blaine County, Idaho

Proposed Project Duration (in months) ________

Requested Starting Date January 15, 1981

Official Contact for Negotiations Jerold Kirkman RICHARD H. MATHERSON / MARVIN G. ZOISLOFT

Position and Title Manager, Magic Resource Investors CO-MANAGERS

Telephone (w/area code) (208) 726-8241 415/632-1698 916/346265

Effective Period of Proposal 200 days

AUTHORIZED OFFICIAL

Signature *

Name Typed Jerold Kirkman

Title Manager Date September 15, 1980

Please Check Small Business X Disadvantaged Business ____ Other ____

* Power of Attorney Filed at Blaine County Court House, Ketchum, Idaho.

<u>TABLE OF CONTENTS</u>

SUMMARY OF PROPOSED PROJECT

Magic Resources Investors
SCAP DE-SC07-80ID12139

SUMMARY OF PROPOSED PROJECT

The objective of the program is to establish a geothermal resource adequate to supply the energy requirements of a 2 million gallon per year ethanol plant. Location of the proposed project is at Magic Hot Springs Landing, Blaine County, Idaho.

In order to be a success, the well must be capable of producing a minimum of 675 gallons per minute of 280°F water. The water may be cascaded into other uses, but the feasibility projections are based on the single use.

$1,031,604

Estimated cost of the project is $ 1,209,328. The DOE share for a successful well is $ 241,866 206,321 or 20% of the total. For a completely unsuccessful well, the DOE share is 90%, or $ 1,088,395 928,444. Based on known data, it is unlikely that a disposal well will be required and no provision for such is included in the cost estimate. If a disposal well is required, it will be subject to negotiation.

Magic Resource Investors is being joined in this proposal by private investors, Messrs. Robert Gorham and John Wedum. All required work will be performed by Gruy Federal, Inc. under a cost-plus-fixed fee subcontract arrangement. Gruy Federal, Inc. has an extensive background in performing contracts for DOE, including geothermal work. They will directly provide engineering, supervisory, and administrative services and provide for required field services by placement and management of subcontracts.

The proposed work is divided into tasks to facilitate evaluation. Estimated task duration, labor hours, and costs are summarized in the budget summary section of this volume. The major proposed activities include:

a. Further review of available geologic data,
b. A limited geophysical program,
c. Drilling of three temperature gradient holes,
d. Drilling a production well to an estimated depth of 3,000 feet, and
e. Testing the production well.

PROJECT COST/BUDGET SUMMARY

CONTRACT PRICING PROPOSAL
(RESEARCH AND DEVELOPMENT)

Office of Management and Budget
Approval No. 29-RO184

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

PAGE NO.

NO. OF PAGES

NAME OF OFFEROR
Magic Resource Investors, Inc.

HOME OFFICE ADDRESS
P. O. Box 1328
Sun Valley, Idaho 83353

SUPPLIES AND/OR SERVICES TO BE FURNISHED
Development of Geothermal Energy at
Magic Hot Springs Landing,
Blaine County, Idaho

DIVISION(S) AND LOCATION(S) WHERE WORK IS TO BE PERFORMED
Blaine County, Idaho

TOTAL AMOUNT OF PROPOSAL
1,031,604
$ ~~1,209,328~~

GOV'T SOLICITATION NO.
SCAP DESC07-80ID12139

DETAIL DESCRIPTION OF COST ELEMENTS

			EST COST ($)	TOTAL EST COST[1]	REFERENCE[2]
1. DIRECT MATERIAL *(Itemize on Exhibit A)*					
a. PURCHASED PARTS				▨	
b. SUBCONTRACTED ITEMS 1,031,604			~~1,209,328~~	▨	
c. OTHER—*(1)* RAW MATERIAL				▨	
(2) YOUR STANDARD COMMERCIAL ITEMS				▨	
(3) INTERDIVISIONAL TRANSFERS *(At other than cost)*				▨	
TOTAL DIRECT MATERIAL			1,031,604 ~~1,209,328~~		
2. MATERIAL OVERHEAD[3] *(Rate %X$ base =)*					
3. DIRECT LABOR *(Specify)*	ESTIMATED HOURS	RATE/ HOUR	EST COST ($)	▨	
				▨	
				▨	
				▨	
				▨	
				▨	
				▨	
TOTAL DIRECT LABOR	▨	▨	▨		
4. LABOR OVERHEAD *(Specify Department or Cost Center)*[3]	O.H. RATE	X BASE =	EST COST ($)	▨	
				▨	
				▨	
				▨	
TOTAL LABOR OVERHEAD	▨	▨	▨		
5. SPECIAL TESTING *(Including field work at Government installations)*			EST COST ($)	▨	
				▨	
				▨	
				▨	
TOTAL SPECIAL TESTING			▨		
6. SPECIAL EQUIPMENT *(If direct charge) (Itemize on Exhibit A)*					
7. TRAVEL *(If direct charge) (Give details on attached Schedule)*			EST COST ($)	▨	
a. TRANSPORTATION				▨	
b. PER DIEM OR SUBSISTENCE				▨	
TOTAL TRAVEL			▨		
8. CONSULTANTS *(Identify—purpose—rate)*			EST COST ($)	▨	
				▨	
				▨	
				▨	
				▨	
TOTAL CONSULTANTS			▨		
9. OTHER DIRECT COSTS *(Itemize on Exhibit A)*				1,031,604	
10. *TOTAL DIRECT COST AND OVERHEAD*				~~1,209,328~~	
11. GENERAL AND ADMINISTRATIVE EXPENSE *(Rate % of cost element Nos.)*[3]					
12. ROYALTIES[4]					
13. *TOTAL ESTIMATED COST*				1,031,604 ~~1,209,328~~	
14. FEE OR PROFIT				1,031,604	
15. *TOTAL ESTIMATED COST AND FEE OR PROFIT*				~~1,209,328~~	

OPTIONAL FORM 60
October 1971
General Services Administration
FPR 1-16.806
5060-101

This proposal is submitted for use in connection with and in response to *(Describe RFP, etc.)*

Development of Geothermal Energy at Magic Hot Springs Landing, Blaine County, Idaho

and reflects our best estimates as of this date, in accordance with the Instructions to Offerors and the Footnotes which follow.

TYPED NAME AND TITLE
Jerold Kirkman
Manager, Magic Resource Investors, Inc.

SIGNATURE

NAME OF FIRM
EARTH RESOURCE GENERATUS, INC
Magic Resource Investors, Inc.

DATE OF SUBMISSION
September 15, 1980

EXHIBIT A—SUPPORTING SCHEDULE *(Specify. If more space is needed, use reverse)*

COST EL NO.	ITEM DESCRIPTION *(See footnote 5)*	EST COST *($)*

I. HAS ANY EXECUTIVE AGENCY OF THE UNITED STATES GOVERNMENT PERFORMED ANY REVIEW OF YOUR ACCOUNTS OR RECORDS IN CONNECTION WITH ANY OTHER GOVERNMENT PRIME CONTRACT OR SUBCONTRACT WITHIN THE PAST TWELVE MONTHS?

☐ YES ☒ NO *(If yes, identify below.)*

NAME AND ADDRESS OF REVIEWING OFFICE AND INDIVIDUAL
N/A

TELEPHONE NUMBER/EXTENSION

II. WILL YOU REQUIRE THE USE OF ANY GOVERNMENT PROPERTY IN THE PERFORMANCE OF THIS PROPOSED CONTRACT?

☐ YES ☒ NO *(If yes, identify on reverse or separate page)*

III. DO YOU REQUIRE GOVERNMENT CONTRACT FINANCING TO PERFORM THIS PROPOSED CONTRACT?

☒ YES ☐ NO *(If yes, identify.):* ☐ ADVANCE PAYMENTS ☒ PROGRESS PAYMENTS OR ☐ GUARANTEED LOANS

IV. DO YOU NOW HOLD ANY CONTRACT *(Or, do you have any independently financed (IR&D) projects)* FOR THE SAME OR SIMILAR WORK CALLED FOR BY THIS PROPOSED CONTRACT?

☐ YES ☒ NO *(If yes, identify.):*

V. DOES THIS COST SUMMARY CONFORM WITH THE COST PRINCIPLES SET FORTH IN AGENCY REGULATIONS?

☒ YES ☐ NO *(If no, explain on reverse or separate page)*

See Reverse for Instructions and Footnotes

OPTIONAL FORM 60 (10-71)

OPTIONAL FORM 60 (10-71)

★U.S. Government Printing Office: 1978—261-647/4082

CONTRACT PRICING PROPOSAL
(RESEARCH AND DEVELOPMENT)

Office of Management and Budget Approval No. 29-RO184

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

PAGE NO.

NO. OF PAGES

NAME OF OFFEROR
Gruy Federal, Inc.

HOME OFFICE ADDRESS
2500 Tanglewilde, Suite 150
Houston, Texas 77063

SUPPLIES AND/OR SERVICES TO BE FURNISHED
Development of Geothermal Energy at
Magic Hot Springs Landing,
Blaine County, Idaho

DIVISION(S) AND LOCATION(S) WHERE WORK IS TO BE PERFORMED
Houston and Field Sites

TOTAL AMOUNT OF PROPOSAL
1031604
$ ~~1,209,328~~

GOV'T SOLICITATION NO.
SCAP DESC07-80ID12139

DETAIL DESCRIPTION OF COST ELEMENTS

1. DIRECT MATERIAL *(Itemize on Exhibit A)*			EST COST ($)	TOTAL EST COST[1]	REFERENCE[2]
a. PURCHASED PARTS					
b. SUBCONTRACTED ITEMS 722,034			~~681,578~~		Exh B&C
c. OTHER—(1) RAW MATERIAL					
(2) YOUR STANDARD COMMERCIAL ITEMS					
(3) INTERDIVISIONAL TRANSFERS *(At other than cost)*					
TOTAL DIRECT MATERIAL			722,034	~~681,578~~	
2. MATERIAL OVERHEAD[3] *(Rate %X$ base=)*			19,765	19,765	Exh E&A
3. DIRECT LABOR *(Specify)*	ESTIMATED HOURS	RATE/ HOUR	EST COST ($)		
Engineering Labor	~~4,980~~		~~106,291~~		
	4,980		106,291		
				106,291	
TOTAL DIRECT LABOR				~~106,291~~	Exh B&C
4. LABOR OVERHEAD *(Specify Department or Cost Center)*[3]	O.H. RATE	X BASE=	EST COST ($)		
Engineering Overhead		27,155	~~124,901~~		
				27,155	
TOTAL LABOR OVERHEAD				~~124,901~~	Exh E&A
5. SPECIAL TESTING *(Including field work at Government installations)*			EST COST ($)		
TOTAL SPECIAL TESTING					
6. SPECIAL EQUIPMENT *(If direct charge) (Itemize on Exhibit A)*					
7. TRAVEL *(If direct charge) (Give details on attached Schedule)*			EST COST ($)		
a. TRANSPORTATION					
b. PER DIEM OR SUBSISTENCE				29,941	
TOTAL TRAVEL				~~41,635~~	Exh B&C
8. CONSULTANTS *(Identify—purpose—rate)*			EST COST ($)		
TOTAL CONSULTANTS			8,089	~~8,089~~	Exh C
9. OTHER DIRECT COSTS *(Itemize on Exhibit A)*			5,174	~~5,174~~	Exh B&C
10. *TOTAL DIRECT COST AND OVERHEAD*				~~987,433~~	918,949
11. GENERAL AND ADMINISTRATIVE EXPENSE *(Rate % of cost element Nos.)*[3]			107020	~~121,020~~	Exh E&A
12. ~~ROYALTIES~~ Intercompany			6,135	6,135	Exh C
13. *TOTAL ESTIMATED COST*			1031604	114,588	
14. FEE OR PROFIT NOTE →			-0-	94,740	-0-
15. *TOTAL ESTIMATED COST AND FEE OR PROFIT*			1	209,328	

1,031,604

OPTIONAL FORM 60
October 1971
General Services Administration
FPR 1-16.806
5060-101

This proposal is submitted for use in connection with and in response to *(Describe RFP, etc.)*

Development of Geothermal Energy at Magic Hot Springs Landing, Blaine County, Idaho

and reflects our best estimates as of this date, in accordance with the Instructions to Offerors and the Footnotes which follow.

TYPED NAME AND TITLE
Gayland E. Daugherty
Vice-President, Finance

SIGNATURE
Gayland E. Daugherty

NAME OF FIRM
Gruy Federal, Inc.

DATE OF SUBMISSION
September 15, 1980

EXHIBIT A—SUPPORTING SCHEDULE *(Specify. If more space is needed, use reverse)*

COST EL NO.	ITEM DESCRIPTION *(See footnote 5)*	EST COST ($)

I. HAS ANY EXECUTIVE AGENCY OF THE UNITED STATES GOVERNMENT PERFORMED ANY REVIEW OF YOUR ACCOUNTS OR RECORDS IN CONNECTION WITH ANY OTHER GOVERNMENT PRIME CONTRACT OR SUBCONTRACT WITHIN THE PAST TWELVE MONTHS?

☒ YES ☐ NO *(If yes, identify below.)*

NAME AND ADDRESS OF REVIEWING OFFICE AND INDIVIDUAL
DCAA, 2320 LaBranch, Houston, Texas Mr. James Bourne

TELEPHONE NUMBER/EXTENSION
713/226-4128
415/632-1696

II. WILL YOU REQUIRE THE USE OF ANY GOVERNMENT PROPERTY IN THE PERFORMANCE OF THIS PROPOSED CONTRACT?

☐ YES ☒ NO *(If yes, identify on reverse or separate page)*

III. DO YOU REQUIRE GOVERNMENT CONTRACT FINANCING TO PERFORM THIS PROPOSED CONTRACT?

☒ YES ☐ NO *(If yes, identify.):* ☐ ADVANCE PAYMENTS ☒ PROGRESS PAYMENTS OR ☐ GUARANTEED LOANS

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☐ YES ☒ NO *(If yes, identify.):*

V. DOES THIS COST SUMMARY CONFORM WITH THE COST PRINCIPLES SET FORTH IN AGENCY REGULATIONS?

☒ YES ☐ NO *(If no, explain on reverse or separate page)*

See Reverse for Instructions and Footnotes

OPTIONAL FORM 60 (10-71)

OPTIONAL FORM 60 (10-71)

☆U.S. Government Printing Office: 1978—261-647/4052

EXHIBIT A

E.R.G.

GRUY FEDERAL, INC.

USER-COUPLED CONFIRMATION DRILLING PROGRAM

Page 1 of 3

BUDGET SUMMARY

Task Identification	Task I	Task II	Task III	Task IV	Task V	Task VII	Task VIII	Task IX	Task X	Total	Form 60 Reference
Performance Period in Weeks	4	10	19	11	15	4	61	61	61		
Direct Labor by Specialty Hours											
a. Staff/Advisory	40	40	168	-	-	40	1,500	40	-	1,828	
b. Supervisory Engineer/Geologist	-	-	520	480	480	-	-	80	-	1,560	
c. Senior Engineer/Geologist	-	-	-	-	160	-	-	40	80	280	
d. Intermediate Engineer/Geologist	-	-	168	-	-	-	-	-	-	168	
e. Engineer/Geology Assistant	-	-	-	480	-	-	-	-	-	480	
f. Technical Services, Exempt	-	-	20	-	-	-	-	168	16	204	
g. Technical Services, Sr. Non-Exempt	-	-	80	40	60	40	-	80	40	340	
h. Senior Geologist	-	-	40	-	-	-	-	-	-	40	
i. Senior Geophysicist	-	-	40	-	-	-	-	-	-	40	
j. Senior Engineer	-	-	-	40	-	-	-	-	-	40	
Total Hours	40	40	1,036	1,040	700	80	1,500	408	136	4,980	Line 3
Cost											27,153
Direct Labor	1,054	1,062	20,100	16,484	15,505	1,580	41,079	7,213	2,214	106,291	Line 3
Technical Overhead	269 ~~1,476*~~	265 1,487*	5025 23,115*	4121 18,957*	4458 17,831*	395 1,817*	10270 49,377*	1803 8,295*	554 2,546*	124,901*	Line 4
Travel	-	*648 1,063	6476 8,949	7979 10,322	7776 10,568	1208 2,043	5854 8,690	-	-	2994/41,635	Line 7
Other Direct Costs	81	177	272785	372 477	114	124	500	2,916	-	5,174	Line 9
Subcontracts	-	-	235,692	368,290	77,318	-	-	-	278	681,578	Line 1b 722034
Material Handling Overhead	-	-	6,835*	10,680*	2,242*	-	-	-	8*	19,765*	Line 2
Consultants	-	8,089	-	-	-	-	-	-	-	8,089	Line 8
Total for G&A	1399 2,611	10241 11,878	311,369 295,476	412,337 425,210	107413 123,578	3307 5,564	57703 99,646	11932 18,424	3054 5,046	918,949 987,433	Line 10
G&A	653*	947*	28,457 35,457*	44,025 51,025*	14,829*	668*	14,624*	2,211*	606*	107020 121,020*	Line 11
Intercompany Support	-	-	4,059	2,076	-	-	-	-	-	6,135	Line 12
Total Estimated Cost	2,052 3,264	11,188 12,825	343,885 334,992	458,132 478,311	122,242 138,407	3,975 6,232	72,327 114,270	14,143 20,635	3,660 5,652	1031604 1,114,588	Line 13
Fixed Fee	277	1,090	28,474	40,656	11,765	530	9,713	1,755	480	94,740	Line 14
Total Estimated Price	3,541	13,915	363,466	518,967	150,172	6,762	123,983	22,390	6,132	1,209,328	Line 15
	2,052	11,188	343,885	458,132	122,242	3,975	72,327	14,143	3,660	1031,604	

*See Page

[redacted], INC.

EXHIBIT A

USER-COUPLED CONFIRMATION DRILLING PROGRAM

Page 2 of 3

BUDGET SUMMARY

* BURDEN RATE APPLICATION

	Technical Overhead			General & Administrative			Material Handling Overhead		
Task I	25% 140% x	$ 1,054 =	264 $ 1,476	25% x	$ 2,611 =	$ 653		---	
Task II	25% 140% x	1,062 =	266 1,487	25% x	3,789# =	947		---	
Task III	25% 115% x	20,100 =	5025 23,115	9,6 12% x	295,476 =	28,457 35,457	2.9% x	$ 235,602 =	$ 6,835
Task IV	25% 115% x	16,484 =	4121 18,957	9,6 12% x	425,210 =	44625 51,025	2.9% x	368,290 =	10,680
Task V	25% 115% x	15,505 =	4458 17,831	12% x	123,578 =	14,829	2.9% x	77,318 =	2,242
Task VII	25% 115% x	1,580 =	395 1,817	12% x	5,564 =	668		---	
Task VIII	25% 140% x	8,544 =	11,963 2136	25% x	20,50 =	5,127		---	
	115% x	32,535 =	37,414 8134	12% x	79,139 =	9,497		---	
	25%		49,377 10,276			14,624			
Task IX	25% 115% x	7,213 =	8,295 1804	12% x	18,424 =	2,211		---	
Task X	25% 115% x	2,214 =	2,546 554	12% x	5,046 =	606	2.9% x	278 =	8
TOTAL OVERHEAD			27,155 $124,901			107,020 $ 121,020			$ 19,765

- Total for G & A reduced by Consultant's costs ($ 11,878 - $ 8,089 = $ 3,789).

[redacted]

EXHIBIT A

Page 3 of 3

USER-COUPLED CONFIRMATION DRILLING PROGRAM
BUDGET SUMMARY
TASK DESCRIPTIONS

Task No.	Description
I	Financial Arrangements
II	Environmental and Institutional
III	Exploration - Geophysical and Heat Measurement Wells
IV	Drilling and Logging - Production Well
V	Flow Testing
VI	Injection Well Drilling
VII	Cost Share Determination
VIII	Project Management
IX	Project Reporting
X	Dissemination of Information
XI	DOE Conferences

Note: Task VI - No injection well anticipated
Task XI - To be reimbursed as required by U.S. Department of Energy

[redacted]

EXHIBIT B

BASIS OF ESTIMATE

I. Labor Hours - The labor hours proposed are based upon engineering estimates utilizing past experience from similar types of geothermal exploration programs.

II. Travel/Subsistence - Airfares and motel rates were taken from the Official Airline Guide Part I and the Official Airline Guide Travel Planner and Hotel/Motel Guide.

Motel	$ 28/day
Meals	20/day
	$ 48/day

III. Car Rental Rates - Car rental rates were taken from the Official Airline Guide Part II Ground Transportation Services with gasoline allowance and taxes added along with the 20% discount.

		Drilling Operations			Other Travel	
Rental/day OMIT		$ 26			26	OMIT
Mileage/day @ .28/mile	(250 mi)	70	50	(110 mi)	31	22
Subtotal OMIT		96	OMIT		57	
Less 20% discount OMIT		19	OMIT		11	
Subtotal OMIT		77	OMIT		46	
Tax 3% OMIT		2	OMIT		1	
Gasoline/day		16	19		7	8
		$~~95~~	69		$ ~~54~~	30

Gasoline @ $~~1.25/ga~~llon 1.50 @ 20 mi/gal.

IV. Reproductions - Xerox copies @ $.08/copy

V. Telecopier - This estimate is based upon the following:

A. $1.00/page to send/receive ~~at Houston~~ OAKLAND
B. $100/month for rental of portable telecopier
C. Six minutes per page to send/receive
D. Long distance calls for telecopier at $.50/minute
E. Calculations:

Receive from Idaho:

1. Daily drilling/testing reports, 2 pages/day X 40 days X 3 = 240 pages

Miscellaneous	=	100 pages	
Total receive		340 pages	
Send to Idaho:			
Miscellaneous	=	100 pages	
Total send		100 pages	
Grand Total			440 pages
2. 440 pages X $1.00	=	$ 440	
3. 440 pages X 6 min/page X $.50/minute	=	1,320	
4. 40 X 3÷30 = 4 months X $100	=	400	
Total telecopier	=	$2,160	

VI. Airborne Delivery - This estimate is based upon 30 data packages to/from Idaho and Houston at $41.24/package per the rates issued by Airborne. OAKLAND

VII. Communication - Long distance calls that are estimated at $.50/minute.

VIII. Maps and logs - Engineering estimates based upon past experience on similar programs.

IX. Escalation - Labor rate escalation is based upon ten percent with June 1, 1980 used as the labor rate base. All other direct costs are escalated at twelve per cent per annum.

X. Subcontracts - Subcontract amounts are based upon the technical description from the design engineer as given to subcontractor to submit bids. In some tasks, such as flow testing, "similar to" item quotes were requested as the final test equipment design would not be completed until the production well has been drilled.

Subcontract Cost Element	Basis of Cost
Permits	Idaho Dept. of Water Resources
Bonds	Marsh & McLennan Insurance-phone quote
Insurance	Marsh & McLennan Insurance-estimate
Survey	Prior experience-estimate
Sitework	Prior experience-estimate
Rig	
Heat measurement wells	Steward Brothers Drilling Co.-quote
Production well	Steward Brothers Drilling Co.-quote
Drilling fluid	Milchem Inc.-quote
Wireline & Testing	Milton Cook - quote
Wireline & Testing	Camco Wireline, Inc. -quote

[redacted] INC.

EXHIBIT B

Subcontract Cost Element	Basis of Cost
Rental items	Oil Field Rental Service Co.-price book
	Prior experience-estimate
	Grant Oil Tool Co.-quote
Cementing, Material & Service	Halliburton Services-quote
Bits	Smith Tool Co.-quote
Wellheads	Seaboard Wellhead Control, Inc.-quote
	Smith Pipe & Supply Co.-quote
Casing	Smith Pipe & Supply Co.-quote
Fuel	Prior experience-estimate
Electric logging	Schlumberger Well Services-quote
Mud logging	Tooke Engineering-quote
Temperature tests	Reservoir Data Inc.-quote
Chemical analysis	Southern Petroleum Labs-quote
Pressure tests	Camco Wireline-quote

[redacted], INC.

EXHIBIT C

TASK I SUPPORTING DATA

Direct Labor:

Classification	Bid Code	Rate	Hours	Basic Cost	Escalation Factor *	Total Cost
Staff/Advisory	100	$24.71	40	$ 988		
Total Direct Labor			40	988	1.0667	$ 1,054

Other Direct Costs:

Xerox	200 copies @ $.08	$ 16			
Communications		60			
Total Other Direct Costs			76	1.0600	81

* Midpoint - February, 1981; See page

[redacted], INC.

EXHIBIT C

TASK II SUPPORTING DATA

Direct Labor: Classification	Bid Code	Rate	Hours	Basic Cost	Escalation Factor *	Total Cost
Staff/Advisory	100	$24.71	40	$ 988		
Total Direct Labor			40	988	1.0750	$ 1,062

Travel: Transportation, Air	No. Man Trips	Round Trip Air Fare	Total			
Houston to Hailey, Idaho	1	$ 570 294	$ 570 294			
Total Air				570 294	1.0700	610 315

Transportation, Rental Car	No. Car Days	Cost Car/Day	Total			
	4	$ 54 30	$ 216 120			
Total Rental Car				216 120	1.0700	231 128

Lodging & Subsistence	No. Man Days	Cost Man/Day	Total			
Twin Falls, Idaho	4	$ 48	$ 192			
Total Lodging & Subsistence				192	1.0700	205

Incidentals	No. Man Days	Cost Man/Day	Total			
Airport Parking	4	$ 4	$ 16		Omit	
Total Incidentals				16	1.0700	17

Other Direct Costs:					
Xerox	1000 copies @ $.08	$ 80			
Communications		45			
Maps & Logs		40			
Total Other Direct Costs			165	1.0700	177

Consultants:				
240 hours @ $30/hour	$ 7,200			
1200 miles @ .30/mile	360			
Total Consultants		7,560	1.0700	8,089

* Midpoint - March, 1981; See page

[redacted], INC.

EXHIBIT C

TASK III SUPPORTING DATA

Page 1 of 3

Direct Labor:

Classification	Bid Code	Rate	Hours	Basic Cost	Escalation Factor *	Total Cost
Staff/Advisory	100	$24.71	168	$ 4,151		
Supervisory Engineer/Geologist	101	21.51	520	11,185		
Intermediate Engineer/Geologist	120	11.96	168	2,009		
Technical Services, Exempt	140	13.79	20	276		
Technical Services, Sr. Non-Exempt	200	9.90	80	792		
Total Direct Labor			956	18,413	1.0916	$ 20,100

Travel:

Transportation, Air	No. Man Trips	Round Trip Air Fare	Total			
Houston to Hailey, Idaho	3	$ 570	$ 1,710			
		294	782			
Total Air				1,710	1.0900	1,864
				782		852

Transportation, Rental Car	No. Car Days	Cost Car/Day	Total			
Hailey	40	$ 95	$ 3,800			
Total Rental Car		69	2760	3,800	1.0900	4,142
				2760		3008

Lodging & Subsistence	No. Man Days	Cost Man/Day	Total			
Twin Falls, Idaho	50	$ 48	$ 2,400			
Total Lodging & Subsistence				2,400	1.0900	2,616

Incidentals	No. Man Days	Cost Man/Day	Total			
Airport Parking	50	$ 4	$ 200			
Laundry/Telephone, Etc.	1	100	100			
Total Incidentals				300	1.0900	omit 327

Other Direct Costs:

Xerox	2000 copies @ $.08	$ 160			
Communications		60			
Maps & Logs		500			
Total Other Direct Costs			720	1.0900	785

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EXHIBIT C

TASK III SUPPORTING DATA

Page 2 of 3

		Basic Cost	Escalation Factor *	Total Cost
Subcontracts:				
Heat Measurement Well: TD-600 ± feet				
Permit		$ 100		
Bond		100		
Insurance		1,000		
Survey		250		
Sitework:				
Bulldozer 16 hrs @ $100/hr	$ 1,600			
Labor 2 men @ 6/hr/man x 32 hrs	384			
Miscellaneous	500**	2,484		
Rig:				
Mobilization	4753 $ ~~4,420~~			
Drilling ~~7~~ 8 dys @ ~~$3,570~~ 3749	29,990 ~~24,990~~	34743 ~~29,410~~		
Drilling Fluid:				
35 bags milgel @ $8.90		312**		
Rental Items:				
Elevators, 4½" 2 x 7 dys x $13/dy	$ 182**			
Water Truck, $28/ x 6 hrs x 7 dy	1,176	1,358		
Cementing & Service		5,389		
Bits:				
1 - 12½" Regular bit	$ 6,420			
1 - 6½" Button Bit	2,576	8,996**		
Casing:				
40' Casing, 8 5/8" 17# K-55 R-2 ST&C @ 815.64/c.ft.	$ 326			
680' Casing, 4½" 9.5# H-40 R-2 ST&C @ 493.47/c.ft.	3,356	3,682**		
Wellhead:				
Swage 4½" x 2"	$ 32.32			
Ballvalve, 2", 400 PSI	69.00			
Bull Plug, 2", Tapped ½"	18.45			
Needle Valve, ½"	13.60	133**		
Transportation & Freight:				
10,000 pounds @ $20/cwt		2,000		
Temperature Measurement:				
3 @ $1,000		3,000		
Plug and Abandonment:				
Sitework				
Bulldozer 8 hrs @ $100/hr	$ 800			
Labor 2 men @ 6/hr/man x 32 hrs	384			
Miscellaneous	500**	1,684		
Fuel, 250 gal/dy x 7 dys x $1/gal		1,750		
Idaho Sales & Use Tax (**) on $14,305 of 3.0%		429		
Total Heat Measurement Well		$ ~~62,077~~ 67,410 x 3 wells =		~~$186,221~~ 202,230

[redacted], INC.

EXHIBIT C

TASK III SUPPORTING DATA

Page 3 of 3

	Basic Cost	Escalation Factor *	Total Cost
Geophysical:			
Seiscom Delta	47447 $ 30,000		
Total Geophysical	47447 $ 30,000		
Total Subcontracts	$ ~~216,231~~ 249677	1.0900	$ 235,692 272,148

Intercompany Support:

[redacted]ciates, Inc.

Classification	Hours	Rate	Basic Cost	Escalation Factor *	Total Cost
Senior Geologist	40	$16.21	$ 648		
Senior Geophysicist	40	19.62	785		
Intercompany Labor	80		$ 1,433		
Overhead @ 146%			2,092		
Subtotal			$ 3,525		
G & A @ 5.5%			194		
Total Intercompany Support			$ 3,719	1.0916	$ 4,059

* Midpoint - May, 1981; See page

** *Items subject to Idaho Sales and Use Tax*

[redacted]

EXHIBIT C

TASK IV SUPPORTING DATA

Page 1 of 3

Direct Labor:

Classification	Bid Code	Rate	Hours	Basic Cost	Escalation Factor *	Total Cost
Supervisory Engineer/Geologist	101	$21.51	480	$ 10,325		
Engineer/Geologist Assistant	134	8.65	480	4,152		
Technical Services, Sr. Non-Exempt	200	9.90	40	396		
Total Direct Labor			1,000	$ 14,873	1.1083	$ 16,484

Travel:

Transportation, Air	No. Man Trips	Round Trip Air Fare	Total			
Houston/Hailey, Idaho	2	$ 570	$ 1,140			
Total Air		294	588	1,140 588	1.1100	1,265 653

Transportation, Rental Car	No. Car Days	Cost Car/Day	Total			
Hailey	40	$ 95	$ 3,800			
Total Rental Car		69	2760	3,800 2760	1.1100	4,218 3064

Lodging & Subsistence	No. Man Days	Cost Man/Day	Total			
Twin Falls, Idaho	80	$ 48	$ 3,840			
Total Lodging & Subsistence				3,840	1.1100	4,262

Incidentals	No. Man Days	Cost Man/Day	Total			
Airport Parking	80	$ 4	$ 320			
Laundry/Telephone, Etc.	2	100	200			Omit
Total Incidentals				520	1.1100	577

Other Direct Costs:

Xerox	100 Copies @ $.08	$ 80			
Communications		150			
Maps & Logs		200			
Total Other Direct Costs			430	1.1100	477

[redacted]

EXHIBIT C

TASK IV SUPPORTING DATA

Page 2 of 3

		Basic Cost	Escalation Factor *	Total Cost
Subcontracts:				
Production Well: TD 3,000 ± feet				
Permit		$ 100		
Bond ($10,000 minimum @ $10/1000)		100		
Insurance:				
Liability	$ 1,000			
Well Control 3,000' @ 1.27/ft	3,810	4,810		
Survey		250		
Sitework:				
Bulldozer 32 hrs @ $100/hr	$ 3,200			
Labor 2 men @ $6/hr/man x 80 hrs	960			
Miscellaneous	2,000**	6,160		
Rig:				
Mobilization 3 dys @ $5,210 4000	$15,630			
Drilling, Etc. 21 dys @ $3,810	80,010	84000		
Demobilization 3 dys @ $5,210	15,630	111,270	115870	
Fuel 500 gal/dy x 21 dys x $1/gal		10,500		
Drilling Fluid:				
100 bags milgel @ $8.90		890**		
Rentals:				
Pump, water, 3", Diesel 23 dys @ $30/dy	$ 690			
Pipe, Line, 2 7/8", 5000' x $.01/ft/dy x 23 dys	1,150			
Elevators:				
13 3/8" (5 dys @ $80 minimum)	80			
9 5/8" & Smaller (3 x 5 dys @ $70)	210			
Rotating Drilling Head:				
Rental (21 dys @ $110/dy)	2,310			
Extra Rubber	410			
Trailer (30 dys)	1,000			
Sanitary Facilities	2,000	7,850**		
Casing:				
100' 13 3/8" 48#, H-40, R-2 ST&C @ 2310.03/c.ft.	$ 2,313			
1000' 9 5/8" 36#, K-55, R-2 ST&C @ 1683.07/c.ft.	16,831			
2000' 7" 20#, K-55, R-2 ST&C @ 956.95/c.ft.	19,139			
1100' 5" 13#, K-55, R-2 ST&C @ 646.17/c.ft.	7,108			
(Welder cutting slots $2000)	2,000	47,391**		
Wellhead		12,974**		
BOP's (10" Shaffer Series 900 double, manual, 20 dys @ $45/dy)		900		

[redacted]NC. EXHIBIT C

TASK IV SUPPORTING DATA

Page 3 of 3

		Basic Cost	Escalation Factor *	Total Cost
Subcontracts:				
Electric Logging (IES/G-N)		$ 19,890		
Mud-Logging:				
Set-Up	$ 1,200			
Logging 21 dys @ $658	13,818			
Take-Down	1,200	16,218		
Cementing & Service		21,979**		
Bits:				
1-17 1/2" Regular	$ 14,974			
3-12 1/2" Button @ 6420	19,260			
3- 8 3/4" Button @ 3317	9,951			
2- 6 1/2" Button @ 2576	5,152	49,337**		
Electricity (Including Hook-up)		1,000		
Transportation & Freight		6,000		
Plug & Abandonment:				
Sitework:				
Bulldozer 16 hrs @ $100/hr	$ 1,600			
Labor 2 men @ $6/hr/man x 48	576			
Miscellaneous	1,000**	3,176		
Miscellaneous Rental Tools		6,500**		
Idaho Sales & Use Tax (**) on $149,921 of 3.0%		4,498		
Total Subcontract Costs		$ 331,793 335,793	1.1100	$ 368,290 373,290

Intercompany Support:

Classification	Hours	Rate		Basic Cost	Escalation Factor *	Total Cost
Senior Engineer	40	$18.05	$ 722			
Intercompany Labor	40		$ 722			
Overhead @ 146%			1,054			
Subtotal			$ 1,776			
G & A @ 5.5%			98			
Total Intercompany Support				1,874	1.1083	$ 2,076

* Midpoint—July, 1981; See page

** Items subject to Idaho Sales and Use Tax

[redacted], INC.

EXHIBIT C

TASK V SUPPORTING DATA
Page 1 of 2

Direct Labor:

Classification	Bid Code	Rate	Hours	Basic Cost	Escalation Factor *	Total Cost
Supervisory Engineer/Geologist	101	$21.51	480	$ 10,325		
Senior Engineer/Geologist	110	17.26	160	2,762		
Technical Services, Sr. Non-Exempt	200	9.90	60	594		
Total Direct Labor			700	13,681	1.1333	$ 15,505

Travel:

Transportation, Air	No. Man Trips	Round Trip Air Fare	Total			
Houston to Hailey	3	$ 570	$ 1,710			
Total Air		294	882	1,710 882	1.1400	1,949 1,005

Transportation, Rental Car	No. Car Days	Cost Car/Day	Total			
Hailey, Idaho	10	$ 54 30	$ 540 300			
Hailey, Idaho	40	95 69	3,800 2,760			
Total Rental Car				4,340 3,060	1.1400	4,948 3,488

Lodging & Subsistence	No. Man Days	Cost Man/Day	Total			
Twin Falls, Idaho	60	$ 48	$ 2,880			
Total Lodging & Subsistence				2,880	1.1400	3,283

Incidentals	No. Man Days	Cost Man/Day	Total			
Airport Parking	60	$ 4	$ 240			
Laundry/Telephone, Etc.	1	100	100		OMIT	
Total Incidentals				340	1.1400	388

Other Direct Costs:

Xerox	1000 copies @ $.08	$ 80			
Communications		20			
Total Other Direct Costs			100	1.1400	114

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EXHIBIT C

TASK V SUPPORTING DATA

Page 2 of 2

	Basic Cost	Escalation Factor *	Total Cost
Subcontracts:			
Pressure & Temperature Measurement 30 dys @ $800/dy (Wireline Trailer, Operator, Gauges)	$ 24,000		
Travel 6 dys @ $800/dy	4,800		
Miscellaneous Other Test Equipment	15,000**		
Chemical Analysis (5 samples @ $200/ea)	1,000		
Pump, 6 x 6, Diesel (4 wh x $250/wh)	1,000**		
Pipe, 6", Quick Connect 5000' @ 1.35/ft/mo	6,750**		
Trailer	1,000**		
Sanitary Facilities & Water	2,000**		
Power	1,000		
Freight & Transportation	6,000		
Fuel 150 gal/dy x 30 dys x $1/gal	4,500		
Idaho Sales & Use Tax (**) on $25,750 of 3.0%	773		
Total Subcontract Costs	$ 67,823	1.1400	$ 77,318

* Midpoint - October, 1981; See page

EXHIBIT C

TASK VI SUPPORTING DATA

No injection well is priced at this time. If required, this item will be subject to negotiation.

[redacted]

EXHIBIT C

TASK VII SUPPORTING DATA

Direct Labor:

Classification	Bid Code	Rate	Hours	Basic Cost	Escalation Factor *	Total Cost
Staff/Advisory	100	$24.71	40	$ 988		
Technical Services, Sr. Non-Exempt	200	9.90	40	396		
Total Direct Labor			80	1,384	1.1417	$ 1,580
Travel: Transportation, Air	No. Man Trips	Round Trip Air Fare	Total			
Houston to Hailey, Idaho	2	$ 570	$ 1,140			
Total Air		294	588	1,140 588	1.1500	1,311 670
Transportation, Rental Car	No. Car Days	Cost Car/Day	Total			
Hailey	6	$ 54	$ 324			
Total Rental Car		20	180	324 180	1.1500	373 207
Lodging & Subsistence	No. Man Days	Cost Man/Day	Total			
Twin Falls, Idaho	6	$ 48	$ 288			
Total Lodging & Subsistence				288	1.1500	331
Incidentals	No. Man Days	Cost Man/Day	Total			
Airport Parking	6	$ 4	$ 24			omit
Total Incidentals				24	1.1500	28
Other Direct Costs:						
Xerox	600 copies @ $.08		$ 48			
Communications			60			
Total Other Direct Costs				108	1.1500	124

* Midpoint - November, 1981; See Page

[redacted]

EXHIBIT C

TASK VIII SUPPORTING DATA

Direct Labor:

Classification	Bid Code	Rate	Hours	Basic Cost	Escalation Factor *	Total Cost
Staff/Advisory	100	$24.71	1,500	$ 37,065		
Total Direct Labor			1,500	37,065	1.1083	$ 41,079

Travel:

Transportation, Air	No. Man Trips	Round Trip Air Fare	Total			
Houston to Hailey, Idaho	6	$ 570	$ 3,420			
Total Air		294	1,764	3,420 1,764	1.1100	3,796 1,958

Transportation, Rental Car	No. Car Days	Cost Car/Day	Total			
Hailey	30	$ 95 69	$ 2,850			
Total Rental Car			2,070	2,850 2,070	1.1100	3,163 2,298

Lodging & Subsistence	No. Man Days	Cost Man/Day	Total			
Hailey	30	$ 48	$ 1,440			
Total Lodging & Subsistence				1,440	1.1100	1,598

Incidentals	No. Man Days	Cost Man/Day	Total			
Airport Parking	30	$ 4	$ 120			OMIT
Total Incidentals				120	1.1100	— 133

Other Direct Costs:

Communications			$ 450			
Total Other Direct Costs				450	1.1100	500

* Midpoint - July, 1981; See page

[redacted]INC.

EXHIBIT C

TASK IX SUPPORTING DATA

Direct Labor:

Classification	Bid Code	Rate	Hours	Basic Cost	Escalation Factor*	Total Cost
Staff/Advisory	100	$24.71	40	$ 988		
Supervisory Engineer/Geologist	101	21.51	80	1,721		
Senior Engineer/Geologist	110	17.26	40	690		
Technical Services, Exempt	140	13.79	168	2,317		
Technical Services, Sr. Non-Exempt	200	9.90	80	792		
Total Direct Labor			408	$ 6,508	1.1083	$ 7,213

Other Direct Costs:

Xerox	5,000 copies @ $.08	$ 400			
Communications		60			
Telecopier		400			
Airfreight		30			
Airborne		1,237			
Maps & Logs		500			
Total Other Direct Costs			2,627	1.1100	2,916

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* Midpoint - July, 1981; See page

[redacted]

EXHIBIT C

TASK X SUPPORTING DATA

Direct Labor: Classification	Bid Code	Rate	Hours	Basic Cost	Escalation Factor *	Total Cost
Senior Engineer/Geologist	110	$17.26	80	$ 1,381		
Technical Services, Exempt	140	13.79	16	221		
Technical Services, Sr. Non Exempt	200	9.90	40	396		
Total Direct Labor			136	1,998	1.1083	$ 2,214
Subcontracts:						
Sign Painter				$ 250		
Total Subcontracts				250	1.1100	$ 278

* Midpoint - July, 1981; See page

EXHIBIT C

TASK XI SUPPORTING DATA

To be reimbursed as required by the U.S. Department of Energy.

[redacted] INC. EXHIBIT D

ESCALATION DISCUSSION

[redacted], Inc. establishes labor bidding rates based on average rates of individuals in the various labor categories. For bidding purposes, these costs are escalated to the time performance midpoint of the work being performed with an assumption of 10% increase per year (or .0083 increase monthly). The basic rates used in this proposal were established June, 1980.

Non-labor costs used in the proposal are current as of August, 1980 and are escalated to midpoint based on a 12% annual increase. The 12% (or 1.0% monthly) reflects an assumption that current inflation rates will moderate.

[redacted] INC.

EXHIBIT D.1

ESCALATION FACTORS

Performance Midpoint		10% Labor Factor	12% Other Factor
1980	July	1.0083	--
	August	1.0167	1.0000
	September	1.0250	1.0100
	October	1.0333	1.0200
	November	1.0416	1.0300
	December	1.0500	1.0400
1981	January	1.0583	1.0500
	February	1.0667	1.0600
	March	1.0750	1.0700
	April	1.0833	1.0800
	May	1.0916	1.0900
	June	1.1000	1.1000
	July	1.1083	1.1100
	August	1.1167	1.1200
	September	1.1250	1.1300
	October	1.1333	1.1400
	November	1.1417	1.1500
	December	1.1500	1.1600
1982	January	1.1583	1.1700
	February	1.1667	1.1800

GRUY FEDERAL, INC.

EXHIBIT E

ACCOUNTING SYSTEM

Three primary overhead pools are used in Gruy Federal's overhead distribution system - Technical Overhead (labor burden), Material Handling Overhead (purchasing burden), and General and Administrative expense, including loaded proposal costs. Our presently approved distribution system will be in effect through fiscal 1981, ending March 31, 1981. At April 1, 1981, we will make a distribution change which is reflected in the pricing for fiscal 1982 and future years. Although Gruy Federal, as a Small Business, is exempt from Cost Accounting Standards, the change brings us into full compliance with such standards.

Our records are periodically audited by the Houstion Branch Office, DCAA. Mr. James Bourne (713/226-4128) is the Supervisory Auditor for our account.

A brief recap of the techniques presently used (through March 1981) and the revised system (future years), along with the rates used in pricing this proposal, are shown on the following page.

GRUY FEDERAL, INC. EXHIBIT E.1

OVERHEAD ALLOCATION SYSTEM

Our presently approved allocation system will be in effect through fiscal 1981, ending March 31, 1981. We will make a change which is reflected in the pricing for April 1981. Although exempt from the Cost Accounting Standards, this change brings us into full compliance with such standards.

Description	Current System	Rate	Revised System	Rate
Labor Base	Labor Cost charged direct to jobs and proposals		Same	
Technical Overhead (Applied to Labor Base)	Costs of supporting and maintaining the direct labor activity	140%	Same	115%
Material Handling Base	Cost of direct materials and subcontracts		Same	
Material Handling Overhead	Purchasing staff and related support costs plus accounts payable clerks and associated costs	3.3%	Purchasing staff and related support costs	2.9%
G & A Base	Total cost input less direct materials, subcontracts, Material Handling Overhead & Intercompany Purchased Labor (with transferror's overhead)		Total cost input less Intercompany Purchased Labor (with transferror's overhead)	
G & A Pool	Indirect costs with cause and benefit relationship not reasonably assignable to final or intermediate objectives. Includes loaded proposal costs	25%	Same. Includes accounts payable clerks' cost previously in Material Handling	12%

PROJECT FINANCIAL PLAN

To: Attorney George Wingerson
Legal Operations
Idaho Operations Office
Department of Energy

From:
Energy Resource Generatus, Inc.
7671 Hansom Drive
Oakland, Ca 94605

SUBJECT: Restructure of MAGIC RESOURCE INVESTORS, Partnership to ENERGY RESOURCE GENERATUS, INC, Idaho Corporation.

The legal structure of the entity submitting the documents for SCAP No. DE-SC07-80ID12139, User-Coupled Confirmation Drilling Program was MAGIC RESOURCE INVESTORS, a California Partnership. Mr. Jerold R. Kirkman was the General Manager and General Partner of this entity. Since that time Mr. Kirkman has completed negotiations and taken over the transfer of all interests from the other four limited partners. The replacement of these LIMITED PARTNERS have been with GENERAL PARTNERS that have strengthened the entire project as they not only bring to the organization additional operational support and technology immediately applicable to the project; but represent the entity for the final utilization of the end use of the Drilling Program. Namely, the Construction and Operations of the ALcohol complex and planned Agricultural Complex.

During the course of strengthening the Legal entity for the Functional Operation of the Partnership, Council has recommended that the Partnership structure be altered to that of a Corporation. Establishment of a Corporation will finalize and control past potential obligations of any envolvements of the partners and provide a stronger Legal entity for the Drilling Program as well as ultimate END USERS of the Land and Geothermal Resource.

An Idaho Corporation will be the Entity for the Signing of the Contract instead of a Partnership. This Corporation will be ENERGY RESOURCE GENERATUS, INC. (ERG) instead of MAGIC RESOURCE INVESTORS. As provided to you in a separate document, the Corporation will be composed of Jerold R. Kirkman, and GEOTHERMAL AGRICULTURAL SYSTEMS, INC. a California Corporation. Geothermal Agricultural Systems, Inc. (GAS) is composed of Agricultural Growth Industries, Inc. (Dr. Richard H. Matherson) and MAR-BIL ENTERPRISES, (W.E.Henderickson, & M. Zeisloft). The latter two being California entities.

Legal Council recommends that this will be a stronger entity for the entire project as all matters relating to the MAGIC HOT SPRINGS LANDING Site will be controlled through one body. Accounting, legal and operational activities will be more readily controlled, audited and traced.

As shown in back up documents, the principles bring more to the organization than the previous partners. Direct envolvement and experience is provided from considerable previous envolvement and knowledge relating to Geothermal Direct Use Applications. The previous partners had limited status, where the new partners are directly active through technology and operational experience in the Geothermal Industry.

Preliminary Negotiations between the Contracting Office of D.O.E and Magic Resource Investors indicate that there is concern relating to the costs that GRUY FEDERAL has presented. Concern has also been shown about the experience of GRUY in the Oil and Gas fields more than in Geothermal work. GRUY has indicated that they will not alter or reduce their costs. We agree that after review that it appears that some of these costs could be lowered. It is therefore the concern and final necessity for the betterment of the Project to alter this condition. It is further understood that it was the intent to sub-contract much of the geophysical work anyway.

Therefore, cost effectiveness can be accomplished by the New Corporation directing the project with qualified Subcontractors as EUREKA RESOURCE ASSOCIATES, ECOVIEW, CROSTHWAITE, WHITE doing the contracted work that would have been accomplished by the same procedures as GRUY at considerable savings or more accomplished for the same costs. Direct contract prices for sub tasks will be provided without overhead mark up as previously presented by Gruy.

EUREKA RESOURCE ASSOCIATES has considerable more experience directly in the Geothermal field for the necessary functions as compared to GRUY. The other Contractors provide additional experience directly working in volcanic conditions similar to the geological conditions of this location. We are thus able to broaden the scope of the Exploration task to obtain more information prior to ultimate drilling of the Final well.

It should be emphasized that the END USER of the resource is now becoming envolved with the planning, exploration, development and operations of the resource. This will naturally have an effect on the total costs of the entire project. Total cost effectiveness can be demonstrated to prevent duplication or unrelated unnecessary activities that are often the result of several engineering and consulting groups envolved without a MASTER PLAN which has already been established.

This early and complete envolvement of the END USER provides a more acceptable MASTER PLAN and provides an economic advantage for the ultimate OPERATIONS and success of the total project.

PROJECT FINANCIAL PLAN
AMOUNT AND METHOD OF FINANCING

Magic Resource Investors is being joined by two individual investors, Mr. Robert B. Gorham and Mr. John A. Wedum, in the proposed project. This combination provides a net worth base of $7 million. With this solid financial support, the investors intend to borrow the non-DOE share of profit costs from banks at the most favorable rates negotiable. In assessing economic viability an interest rate of 16% has been assumed.

Loan arrangements will take into consideration the fact that the initial loan will be a construction type loan with no operating cash flow generation to service the debt. However, construction loans are commonplace and arrangements could be made for the investors to pay the construction interest out of pocket or defer interest payments until the sale of geothermal energy commences.

In establishing an initial line of credit, provision can be made for approximately $1,250,000 based on the estimated project costs. This cumulative total is to provide $970,000 for the 80% non-DOE share for the well system (which is estimated to cost $1.21 million) $100,000 for construction loan interest, and $180,000 for initial working capital, improvements and contingencies.

Western Resource Recovery, Inc. has signed an expression of intent to construct and operate a two million gallon per year ethanol plant at the resource site if the project is successful. The heat requirements for the ethanol production will be provided by the geothermal fluids. The letter of intent signed by Western Resource Recovery, Inc. is reproduced, page 36.

In assessing financial viability of the proposed project, only the site of energy for the ethanol plant has been considered in the economics. It appears feasible that the resource could be developed for Cascaded users, adding to the financial attractiveness of development.

A major factor in determining gross revenues from development of a geothermal resource is the selling price of the energy generated. Energy will be sold at a discount from No. 2 fuel oil equivalent as an incentive for ethanol plant construction and operation. At a discount rate of between 25% and 50% from No. 2 fuel oil equivalent, the cash flow provided will allow an orderly amortization of the total loan, well within a ten year operation period.

Indications are, prior to actual drilling and testing of the well, that an injection well will not be required. However, the investors will be prepared for that possibility and will provide for the contingency of further credit to cover the 80% cost share of such a well.

DESCRIPTION OF PROPOSED FUTURE DEVELOPMENT

Briefly describe below your proposed end use for the geothermal resource should a successful geothermal well be drilled. Include in your description the following information:

a. Location of the utilization facility.

b. Description of the end use of the geothermal fluid and the utilization facility.

c. Whether or not you will sell the energy to other users.

Magic Resource Investors, a California partnership, with J.R. Kirkman a General Manager and Western Resource Recovery Inc. with Henry Schutte President propose to develop Magic Hot Springs, located at the north end of Magic Reservoir in Blaine County, Idaho, as follows:

A two million gallon per year ethanol plant would be constructed and put into operation. The heat requirements for the ethanol production process would be provided by geothermal fluids discovered as a result of drilling at the site. The ethanol plant would also be capable of producing a by product known as Distillers Dried Grain (DDG). Further development might include but would not be limited to greenhouses, aquaculture (catfish) and silvaculture (evergreen)

It is not contemplated that energy would be sold to other users.

If is further understood that the above proposal is contingent upon the demonstrat availability of geothermal fluids at the desired temperature (150 C), flow rate (675 GPM), and chemical composition. And also that the economic climate at the time of proving of the well is such that the development would be warrented.

Signed ______________________
Proposer
J.R. Kirkman
Magic Resource Investors

Signed Henry W. Schutte
Potential User
Henry W. Schutte
Western Resource Recove
Inc.

PROJECT FINANCIAL PLAN

COST CONTROLS, SCHEDULES, MANAGEMENT SYSTEMS

No costs will be charged to the project by Magic Resource Investors (MRI). Time spent by the principal investigator, Mr. Jerold Kirkman of MRI, will be donated. Similarly, no MRI indirect cost loadings will be added to the costs incurred by the lead subcontractor, Gruy Federal, Inc.

Gruy Federal will control and collect costs by task (refer to Exhibit A which reflects the estimated cost for each of the eleven tasks.) Transactions will be recorded at expense category level within each task. Gruy Federal's accounting system is designed to provide good visibility and auditability of all costs and to facilitate the application of appropriate indirect expense rates to each base utilized in its accounting system.

The project manager, Mr. Jack T. Duree, will be responsible for the initiation of each task and will also be responsible for maintaining schedule and budget. He will maintain continuous contact with the administration and financial manager, Mr. Gayland E. Daugherty, and his staff.

A significant portion of the field activities will be subcontracted to various service companies. Mr. Duree will submit requisitions for subcontracted services and materials to the purchasing and subcontracting department which is managed by Mr. Robert L. Nyland. Mr. Nyland, in cooperation with Mr. Duree, will identify sources and solicit quotes for the requirements. Selections and justifications will be made, advance approvals obtained where necessary, and orders and subcontracts placed. Mr. Duree and his field supervisor will be responsible for the performance of subcontractors.

Project status reports will be prepared and submitted monthly by Mr. Duree who will also prepare technical progress reports as required. The monthly contract management summary report (DOE Form 536) will be prepared and submitted monthly through the joint efforts of Mr. Duree and Mr. Calvin Friedrich, Controller. Gruy Federal has performed under several contracts requiring utilization of the "DOE Uniform Contractor Reporting System" and is familiar with its reporting concepts.

ORGANIZATIONAL INFORMATION

A. FINANCIAL DATA

EARTH RESOURCE GENERATUS, INC. will be the entity for the signing of the contract. At present a new Corporate structure is being formed. As indicated in Volume I and in the presented documents this corporation will be made up of GEOTHERMAL AGRICULTURAL SYSTEMS, INC., a California corporation with a recent name change, (However, in existence since 1977), and Jerold Kirkman. Financial and equity legal matters are being completed. If this document indicates that D.O.E. is agreeable for the continuation of the Co-operative agreement, then this confidential information will be finalized and immediately made available.

GEOTHERMAL AGRICULTURAL SYSTEMS, INC. is a California corporation made up of Mar-Bil Enterprises (M. Zeisloft & W.E.enderickson) and AGRICULTURAL GROWTH INDUSTRIES, INC. (California Corp.) (Richard H. Matherson et al).

ORGANIZATION INFORMATION
MAGIC RESOURCE INVESTORS

Previous

A. Financial Data.

Magic Resource Investors (MRI), a general partnership, was formed early in 1980 for the purpose of developing Magic Hot Springs Landing, Idaho, area as an industrial park. Due to the specialized nature of the partnership there have been no ongoing activities as such. The balance sheet of MRI as of August 29, 1980 is included as Table 1 . The major asset of MRI is a 200 acre tract of land adjoining Magic Resource and containing Magic Hot Springs Landing, site of the proposed production well and industrial park.

MRI will be joined in this proposed cooperative agreement by two individual investors--Messrs. John Wedum and Robert Gorham. The balance sheet of Mr. Wedum, reflecting a net worth of approximately $3.2 million as of August 1, 1980, is included as Table 2 . Mr. Gorham's balance sheet at April 30, 1980 is presented in Table 3 . It reflects a net worth in excess of $3.5 million.

B. Description of Proposing Entity.

MRI is a general partnership consisting of five principals with a significant background in financing and project development. Mr. Jerold Kirkman, principal investigator for the proposed cooperative agreement, is responsible to the MRI partners for management of the Magic Hot Springs Landing development. Mr. Kirkman, in addition to his responsibilities to MRI, is president and owner of Kirkman Construction Company and Kirkman Development Corporation. He has over eleven years of experience in construction, project financing, and development.

The following individuals are MRI partners:

1. Jerry Monkarsh:

   Mr. Monkarsh is a real estate developer with extensive holdings in several western states. Mr. Monkarsh is a partner in E.J.M. Development Company and brings 25 years of real estate development investment to MRI.

   Address: E.J.M. Development Company
   9061 Santa Monica Boulevard
   Los Angeles, California 90060
   213/878-1830

2. Eugene Monkarsh:

Mr. Monkarsh is also a real estate developer and partner with his brother Jerry Monkarsh in E.J.M. Development Company. Eugene Monkarsh brings over 20 years of experience in project financing and development management.

Address: E.J.M. Development Company
9061 Santa Monica Boulevard
Los Angeles, California 90060
213/878-1830

3. Gary Familian:

Mr. Familian is President of Familian Realty and Investment Corporation. Mr. Familian brings 10 years of experience in management to MRI.

Address: 9595 Wilshire Boulevard
Beverly Hills, California 90210
213/271-6104

4. Roy Tinker:

Mr. Tinker has 15 years banking experience in real estate financing. For the last two years, Mr. Tinker has been president of a private real estate development company.

Address: Sierra Madre Development Corp.
747 East Green Street, Suite 306
Pasadena, California 91101
213/796-6137

5. Earl Willens:

For the past 15 years Mr. Willens has been an attorney and practicing member of the California Bar. Mr. Willens is Executive Vice President of Familian Realty and Investment Corporation.

Address: 9595 Wilshire Boulevard
Beverly Hills, California 90210
213/271-6104

The general partners are being joined in the proposed cooperative agreement by two individual investors as mentioned under "Financial Data" above.

Mr. John A. Wedum has various business interests. Included in his interests, he is president of Wedum Associates, Milltown Gas Company, Midwest Gas Supply, and Minnesota Valley Recreation, Inc.

Mr. Robert B. Gorham is president of Northwest L P Gas Company and is a director of Peoples National Bank of Mora, Minnesota, Consolidated Storage, Inc., and Midwestern National Insurance. He is also involved in numerous other businesses.

C. Current or Recent Contracts.

Since MRI was only recently established to develop Magic Hot Springs Landing, it does not have a history of operations. In order to enhance the probability of success in developing the resource, MRI proposes to utilize Gruy Federal, Inc. to perform the exploration, drilling, and testing phases of the project as well as advising MRI on accounting and contracting matters. Gruy has extensive experience in contracting with DOE, particularly in geothermal drilling and testing. Gruy will subcontract drilling and other third party services but will manage the entire operation. Detailed financial, business, and contract experience information on Gruy Federal is contained in the next section of this proposal.

TABLE 1

MAGIC RESOURCE INVESTORS

BALANCE SHEET

AS OF AUGUST 29, 1980

ASSETS		
Cash in Bank	$ 2,016.77	
Capital due from Partners	3,000.00	
Land at Cost	295,325.00	
TOATL ASSETS:		$ 300,341.77
LIABILITIES		
Mortgage & Note on Land		$ 235,000.00
NET WORTH		$ 65,341.77
TOTAL:		300,341.77

Unaudited
8/29/80

TABLE 2

PERSONAL FINANCIAL STATEMENT

AUGUST 1 1980

JOHN A. WEDUM, 476 26 4568
MARY BETH WEDUM, 477 32 3674

4721 Spring Circle
Minnetonka, Minn.
55343
612 935 8055

P. O. Box 2188
Sun Valley, Idaho
83353
208 726 3923

ASSETS:		
CASH & BANK	73,466.00	
COMMERCIAL INSTRUMENTS	55,006.00	
LOANS, RECEIVABLE	542,542.00	
EQUITY INVESTMENTS	1,979.443.00	
REAL ESTATE CONTRACTS	64,654.00	
GRANTOR TRUST	401,516.00	
PREPAID TAXES	6,144.00	
HOME, MTKA, MN.	122,000.00	
PERSONAL PROPERTY	100,000.00	
	3,343,771.00	
LIABILITIES:		
NOTE, M. C. WEDUM		61,875.00
LOAN PAYABLE, MIDWEST		15,383.00
HOME MORTGAGE, MTKA, MN.		80,578.00
		157,836.00
NET WORTH:		
JOHN A, & MARY BETH WEDUM		3,185,935.00
	3,343,771.00	3,343,771.00

I CERTIFY THAT THIS STATEMENT, AN ITS SUPPORTING DOCUMENTS, ATTACH ARE TRUE AND CORRECT.

Date 8/1/80

TABLE 3
Page 1 of 2

ROBERT B. AND MARILYN GORHAM

STATEMENT OF ASSETS AND LIABILITIES

30th April, 1980

ASSETS

Cash in Bank - Personal Accounts		
Chequing	$ 1,700	
Savings	6,126	
		$ 7,826
Notes and Advances Receivable		
Peoples National Bank - Contract for Deed on Bank Building	27,100	
Oakwook Court Apartments - Advances	44,000	
Northwest Home Improvement, Inc. - Note	19,000	
		90,100
Investments		
Bonds - University of Minnesota	2,700	
Stock - Mora Country Club	300	
		3,000
Personal Real Estate		
Personal Residence - Estimated Market Value	73,000	
House for Rent - Estimated Market Value	23,000	
		96,000
Investments - Corporations and Partnerships - Schedule 1	3,413,138	3,413,138
Personal Property - Estimated Market Value	18,000	18,000
TOTAL ASSETS:		$3,628,064

LIABILITIES

Accounts Payable		
Notes Payable		
F. J. Grahn Estate	$ 5,266	
Lilian Oslin	5,724	
Estate of Frank Gorham - Unsecured	22,500	
Peoples National Bank - Unsecured	12,500	
John Wedum (CSI)	12,000	
Due to Gorhams' Inc. - Drawing Account	58,963	
		$ 116,953
EXCESS OF ASSETS OVER LIABILITIES:		$3,511,111

INVESTMENTS
30th April, 1980

Schedule 1

Corporations	Shares/Units Owned	% of Total Ownership	Basis of Valuation	Value
Gorhams' Inc.	442	34%	Estimated Market Value	$ 748,000
Gorham-Olen Mechanical, Inc.	2,000	33.3	Estimated Market Value	290,000
Morkan Motors, Inc.	415	25.0	Estimated Market Value	20,000
Northwest Natural Gas Company, Inc.	500	50.0	Estimated Market Value	62,000
Northwest Home Improvement, Inc.	500	50.0	Net Book Value	- 0 -
Peoples Bank Shares	783	12.04	Net Book Value	229,826
Peoples National Bank (voting stock)	39	.003	Net Book Value	8,190
Peoples Credit Company	7	.0009	Net Book Value	256
Apollo Capital Corporation	1,000	3.5	Net Book Value	2,493
Garland Manufacturing Corporation	29,125	3.3	Estimated Market Value	6,437
R. W. Hauser & Associates Ltd.	4,800	4.8	Appraisal,1stNW BankofMpls.	110,000
Midwest Gas Supply	12,500	33.3	Estimated Market Value	11,000
Partnerships				
Oakwood Court Apartments (120 Apartments)	1	50.0	Estimated Market Value	1,370,000
Haven Farm - 320A	1	33.3	Estimated Market Value	31,300
Peoples Real Estate	5	10.0	Net Book Value	2,000
Midwest Associates	1/2	10.0	Estimated Market Value	384,600
Gorhams' Oil	1/2	50.0	Estimated Market Value	100,000
Senty - Gorham Investments		25.0	Estimated Market Value	12,000
Midwest Energies		25.0	Estimated Market Value	25,000
				$3,413,138

GRUY FEDERAL, INC.

ORGANIZATION INFORMATION

GRUY FEDERAL, INC.

A. Financial Data.

Gruy Federal, Inc., proposed as the major subcontractor for this project, is extensively involved in work for the Department of Energy. Gruy contracts include work in geothermal-geopressured, enhanced oil recovery, enhanced gas recovery, technology transfer, modeling, and economic evaluations.

Most of Gruy's contracts and subcontracts are performed on a cost-plus-a-fixed-fee basis. Regular audits are performed by the Houston Branch Office, DCAA. In addition to the DCAA audits, Gruy's books are audited by Peterson & Nowacki, CPA's.

Gruy Federal's fiscal year ends March 31. For each of the last two years gross revenues, including field subcontracting, have been about $13,000,000. Balance sheets as of the end of each of the last three fiscal years are included as Tables 4, 5, and 6.

B. Entity Description.

Gruy Federal, Inc. was formed in 1975 for the primary purpose of performing research, development, and engineering consulting for government agencies in the field of energy. Contracts and subcontracts performed by Gruy have ranged from small studies valued at a few thousand dollars to large, integrated jobs approaching $20 million.

Gruy Federal is majority-owned by Gruy Enterprises, Inc., a small business concern. Gruy Enterprises is also the parent company of H. J. Gruy and Associates, Inc., and Gruy Management Services Company.

Since Gruy Federal is primarily involved in contracting with federal agencies, it is structured and staffed to comply fully with Federal Procurement Regulations and Companion regulations. The overall organization of the Gruy Companies is shown in Figure 1. The organization of Gruy Federal's administrative and financial offices are shown in Figure 2.

C. Current or Recent Government Contracts.

The contracts listed below are representative of Gruy Federal's current or recently completed work for the Department of Energy, either as a prime contractor or subcontractor.

1. Gulf Coast Geothermal-Geopressured

(a) Sponsoring agency: Nevada Operations Office DOE
(b) Contract No.: DE-AC08-77ET-28460
(c) Contract value: $17,909,578 - CPFF

(d) Work description: Under this contract Gruy was responsible for identifying, qualifying, acquiring, planning, completing, and testing wells in the geopressured-geothermal formations in the Texas and Louisiana Gulf Coast. Operations were performed in several wells and two (Fairfax Foster Sutter No. 2 and Southport Beulah Simon No. 2) were tested.

(e) Cost and schedule data: As wells were identified and prognosis approved,funds were added for the operations. Draft final reports have been submitted and the contract is scheduled to expire Sept. 30, 1980.

(f) Contracting Officer: Mr. James B. Cotter
702/734-3251

2. Coastal Plains Geothermal Drilling Program

(a) Sponsoring agency: Nevada Operations Office DOE
(b) Contract No.: DE-AC08-78ET28373
(c) Contract value: $4,979,762 - CPFF

(d) Work description: Gruy Federal managed the drilling of about fifty 1000-foot temperature gradient holes along the Atlantic Coastal Plains, took cores and turned the holes over to scientists from Virginia Polytechnic Institute State University. These scientists measured thermal gradients and heat sources. From results of these studies a site was selected near Crisfield, Maryland for a 5000-foot test well. Gruy drilled and tested this well to investigate possible exploration of geothermal resources.

(e) Cost and schedule data: This program was incrementally funded and expired February 28, 1980.

(f) Contracting Officer: Mr. James B. Cotter
702/734-3251

3. Target Reservoirs for Carbon Dioxide Flooding

(a) Sponsoring agency: Morgantown Energy Technology Center
U.S. Department of Energy
(b) Contract No.: DE-AC21-79MC08341
(c) Contract value: $2,714,000 - CPFF

(d) Work description: This project is to select target reservoirs for test of enhanced oil recovery by carbon dioxide flooding. The work involves evaluating the results of field tests of the method; screening carbonate reservoirs in West Texas and southeast New Mexico to select the most promising carbonate reservoirs in which to conduct additional tests; selecting specific well sites, supervising drilling and coring of the test and interpreting the results with respect to advancing the state of the art.

(e) Cost and schedule data: Two wells have been pressured cored with the results to be assembled into reports and the specific reservoirs have been identified. Two additional wells for additional reservoir testing have been planned.

(f) Contracting Officer: Mr. John J. Cunningham
304/599-7357

4. Collect Core Material and Log Devonian Shale Wells (EGSP)

(a) Sponsoring agency: Morgantown Energy Technology Center
U.S. Department of Energy

(b) Contract No.: DE-AC21-79MC08382

(c) Contract value: $2,720,000 - CPFF

(d) Work description: The scope of work covers the collection of core material and geological data on the gas-bearing Devonian shales of the Appalachian region under the DOE's Eastern Gas Shales Program. Gruy Federal has been responsible for identifying specific well sites on the basis of geological and engineering data, designing each test well and the testing program, securing drilling subcontractors, supervising all drilling and coring operations, collecting and organizing the required cores and data and synthesizing all geological, geophysical and engineering data into a complete report on the gas potential of each test site.

(e) Cost and schedule data: Wells in several states have been drilled and completed with reports being submitted. There are additional wells being planned to round out the program.

(f) Contracting Officer: Mr. John J. Cunningham
304/599-7357

5. DGE - Hydrothermal Resource Program Support

(a) Sponsoring agency: Nevada Operations Office DOE

(b) Contract No.: DE-AC08-80NV10072

(c) Contract value: $229,204 - CPFF

(d) Work description: Gruy Federal, Inc. provides multiple task support to the state-coupled resource assessment program for the eastern United States and support for the identification, evaluation, and ranking of geothermal potential for domestic military installations.

(e) Cost and schedule data: The current program has been extended and expanded to include the study support for the geothermal potential at domestic military installations.

(f) Contracting Officer: Mr. Robert W. Taft
702/734-3201

6. Technical and Public Information Tasks for Transfer Technology Activities

(a) Sponsoring agency: Bartlesville Energy Technology Center
U.S. Department of Energy

(b) Contract No.: DE-AC19-80BC10289
(c) Contract value: $120,265 - CPFF
(d) Work description: Gruy Federal, Inc. provides assistance for the transfer of technical and public information resulting from energy research, development and demonstration projects conducted at the Bartlesville Energy Technology Center and by its contractors.
(e) Cost and schedule data: Gruy Federal, Inc. is in the fifth month of the BETC Technology Transfer support program.
(f) Contracting Officer: Mr. Jo Martin Lowe
918/336-2400

7. Geopressured-Geothermal Testing Brazoria County, Texas

(a) Sponsoring agency: Fenix & Scisson
P.O. Box 15408
Las Vegas, Nevada 89114
(b) Contract No.: SC-PB-80-347
(c) Contract value: $1,049,682 - FFP
(d) Work description: Gruy Federal, Inc. is responsible for planning and conducting a comprehensive program for testing the Pleasant Bayou No. 2 geopressured-geothermal well in Brazoria County, Texas for geopressured-geothermal resource assessment.
(e) Schedule and cost data: Past drilling and test history have been analyzed and the tentative test plan has been partially evaluated.
(f) Contracting Officer: H. L. Jacocks
702/734-3481

TABLE 4

GRUY FEDERAL, INC.
BALANCE SHEET
AS OF MARCH 31, 1980

ASSETS

Current Assets		
Cash	$ 93,054	
Trade Accounts Receivable	2,174,471	
Trade Accounts Receivable - Unbilled	380,787	
Other	98,510	
Total Current Assets		$ 2,746,822
Office Equipment and Leasehold Improvements At Cost, Net of Accumulated Depreciation of $32,528		206,485
		$ 2,953,307

LIABILITIES AND STOCKHOLDERS' EQUITY

Current Liabilities		
Notes Payable to Banks	$ 150,000	
Trade Accounts Payable	2,084,816	
Accrued Liabilities	73,687	
Net Liability for Advances from Affiliates	92,620	
Federal Income Taxes Payable	49,200	
Other	5,233	
Total Current Liabilities		$ 2,455,556
Stockholders' Equity		
Common Stock, $1.00 par value 1,000,000 shares authorized, 1,000 shares issued and outstanding	1,000	
Retained Earnings	496,751	
		497,751
		$ 2,953,307

Abstracted from Financials audited by Peterson & Nowacki, CPA's.

TABLE 5

GRUY FEDERAL, INC.

BALANCE SHEET

MARCH 31, 1979

ASSETS

		TOTAL
CURRENT ASSETS		
Cash		$ 73,312
Accounts Receivable:		
Trade-Billed	$ 1,102,828	
Trade-Unbilled	184,033	
Employee Receivables	6,870	
Refunds Due	36,694	1,330,425
Total Current		1,403,737
FIXED ASSETS (Net of $8,191 depreciation)		159,864
OTHER		
Deposits and Miscellaneous	66,840	
Deferred Relocation & Recruiting	38,519	
Total Other		105,359
Total Assets		$ 1,668,960

LIABILITIES AND EQUITY

CURRENT LIABILITIES		
Accounts Payable	$ 1,030,460	
Accrued Liabilities	55,282	
Notes Payable	100,375	
Total Current		$ 1,186,117
INTERCOMPANY PAYABLES		
H.J. Gruy and Associates, Inc.	300,245	
Gruy Management Service Co.	(3,990)	
Gruy Enterprises	(48,575)	
Total Intercompany		247,680
Total Liabilities		1,433,797
EQUITY		
Capital Stock		1,000
Retained Earnings (Deficit) 3-31-78	(247,185)	
Fiscal Year Ended 3-31-79	481,348	234,163
Total Equity		235,163
Total Liabilities & Equity		$ 1,668,960

TABLE 6

GRUY FEDERAL, INC.

FINAL BALANCE SHEET

MARCH 31, 1978

ASSETS

Current Assets:			
Cash		$ 108,202	
Accounts Receivable:			
Trade-Billed	$ 34,142		
Trade-Unbilled	112,163		
Employee Receivables	811	147,116	
Total Current			$ 255,318
Fixed Assets: (Net of 1,012 accumulated depreciation)			37,317
Other:			
Deposits and Miscellaneous		7,221	
Deferred Relocation and Recruiting		12,488	
Total Other			19,709
Total Assets			$ 312,344

LIABILITIES & EQUITY

Current Liabilities:			
Accounts Payable		$ 34,798	
Accrued Liabilities		35,054	
Advance Fees on Contract		84,006	
Total Current			$ 153,858
Intercompany Payables:			
H. J. Gruy and Associates, Inc.		330,874	
Gruy Management Service Co.		73,797	
Total Intercompany			404,671
Total Liabilities			$ 558,529
Equity:			
Capital Stock		1,000	
Retained Earnings (Deficit) 3-31-77	(48,921)		
Fiscal Year Ended 3-31-78 (Deficit)	(198,264)	(247,185)	
Total Equity			(246,185)
Total Liabilities & Equity			$ 312,344

Prepared May 16, 1978

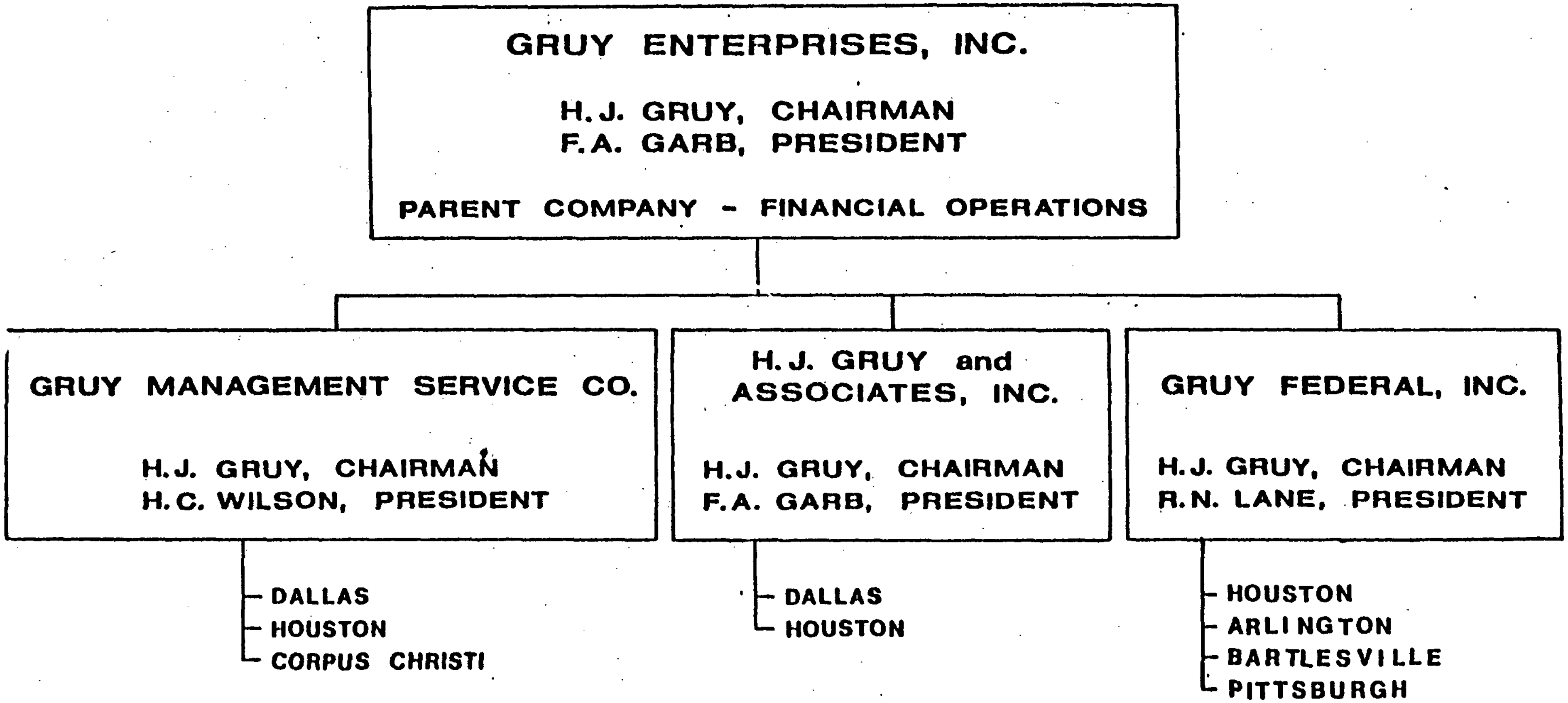
GRUY ENTERPRISES, INC.
H.J. GRUY, CHAIRMAN
F.A. GARB, PRESIDENT
PARENT COMPANY - FINANCIAL OPERATIONS
GRUY MANAGEMENT SERVICE CO.
H.J. GRUY, CHAIRMAN
H.C. WILSON, PRESIDENT
DALLAS
HOUSTON
CORPUS CHRISTI
H.J. GRUY and ASSOCIATES, INC.
H.J. GRUY, CHAIRMAN
F.A. GARB, PRESIDENT
DALLAS
HOUSTON
GRUY FEDERAL, INC.
H.J. GRUY, CHAIRMAN
R.N. LANE, PRESIDENT
HOUSTON
ARLINGTON
BARTLESVILLE
PITTSBURGH

FIGURE 1

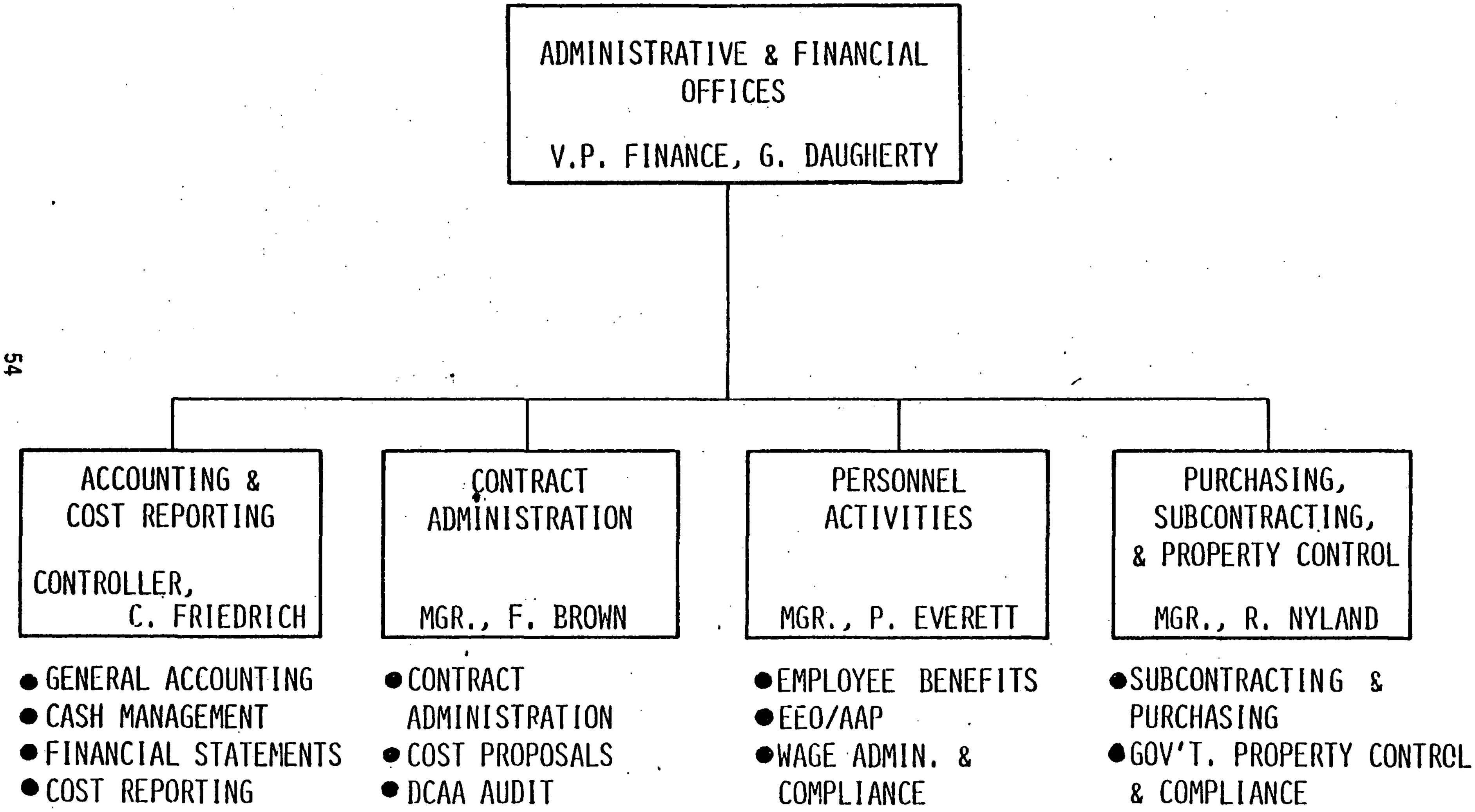

Figure 2 - Gruy Federal, Inc., Administrative and Financial Organization.

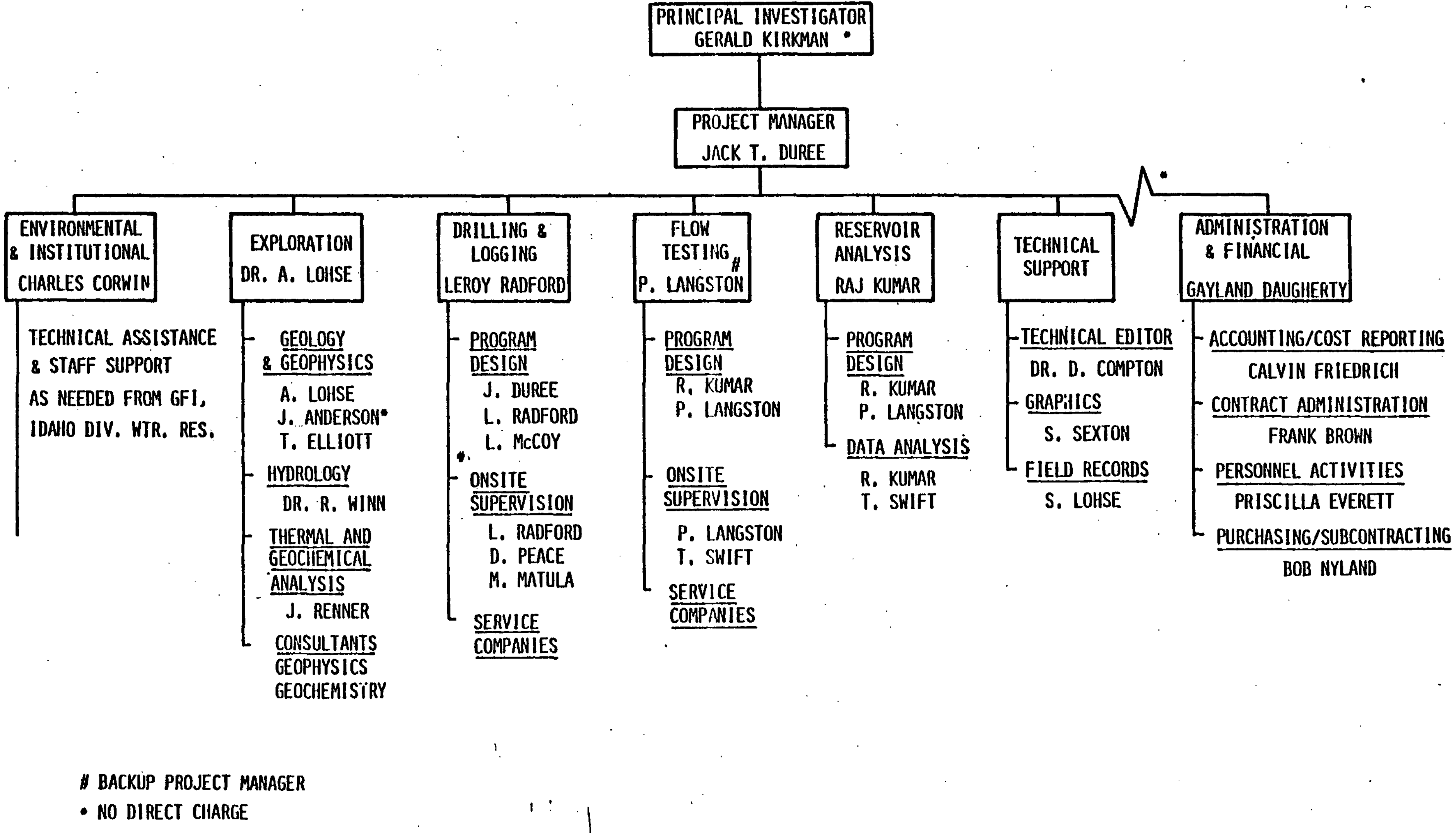

Figure 3 --Magic Resource Investors and Gruy Federal Management organization chart, User-Coupled Confirmation Drilling Program.

ADDITIONAL INFORMATION

1. Amendments. We have received and considered the following amendments to the solicitation notice:

   001 - dated July 16, 1980

2. Cooperative Agreement. Mr. Jerold Kirkman, Manager, Magic Resources Investors, Inc. is authorized to represent the Applicant in all negotiations resulting from this proposal. He will also be responsible for grant administration including approval of vouchers. Mr. Kirkman may be reached in Sun Valley, Idaho, at 208/726-8241.

3. Place of Performance. The mailing address for Magic Resource Investors is P.O. Box 1328, Sun Valley, Idaho 83353. Subcontract work will be performed by Gruy Federal, Inc. from their Houston office as well as in the field.

4. Audit Cognizance. No audit cognizance has bee assigned for Magic Resource Investors Corporation. Gruy Federal, Inc. is audited by DCAA, 2320 LaBranch, Houston, Texas (Mr. James Bourne, 713/226-4128).

5. Subcontracting. Gruy Federal, Inc., Magic Resource Investors' major subcontractor, is a small business firm. Gruy will maximize opportunities for small and disadvantaged businesses and/or Indian tribes in further subcontracting.

6. Ownership. Magic Resource Investors is a general partnership consisting of five principals. Along with MRI, two individual investors, Messrs. John Wedum and Robert Gorham have joined in this proposed cooperative agreement.

REQUIRED FORMS

REPRESENTATIONS AND CERTIFICATIONS

[Instructions: Check or complete all appropriate boxes or blanks.]

The proposer makes the following representations and certifications:

1. CONTINGENT FEE

(a) It ( ) has, (X) has not, employed or retained any company or person (other than a full-time bona fide employee working solely for the bidder) to solicit or secure this contract, and (b) it ( ) has, (X) has not, paid or agreed to pay any company or person (other than a full-time bona fide employee working solely for the bidder) any fee, commission, percentage or brokerage fee, contingent upon or resulting from the award of this contract; and agrees to furnish information relating to (a) and (b) above as requested by the Contracting Officer. (For interpretation of the representation, including the term "bona fide employee," see Code of Federal Regulations, Title 41, Subpart 1-1.5.).

2. TYPE OF ORGANIZATION

It operates as an ( ) individual, (x) partnership, ( ) joint venture, ( ) corporation, incorporated in State of ____________________.

3. EQUAL OPPORTUNITY

N/A It ( ) has, (x) has not, participated in a previous contract or subcontract subject to the Equal Opportunity Clause herein, the clause originally contained in Section 301 of Executive Order No. 10925, or the clause contained in Section 201 of Executive Order No. 11114; it ( ) has, ( ) has not, filed all required compliance reports; and representations indicating submission or required compliance reports, signed by proposed subcontractors, will be obtained prior to subcontract awards.

4. AFFIRMATIVE ACTION COMPLIANCE PROGRAM

The offeror represents that (a) it ( ) has developed and has on file, (x) has not developed and does not have on file, at each establishment an affirmative action program as required by the rules and regulations of the Secretary of Labor (41 CFR 60-1 and 60-2), or (b) ( ) has not previously had contracts subject to written affirmative action program requirements of the rules and regulations of the Secretary of Labor because (check as applicable):

____X____ offeror does not have 50 or more employees

____X____ offeror has not had a Government prime contract or subcontract of $50,000 or more.

5. EQUAL OPPORTUNITY COMPLIANCE

[Applicable to proposals exceeding $1,000,000]

The offeror represents -

a. That a full compliance review of the offeror's employment practices ( ) has, (x) has not, been conducted by an agency of the Federal Government.

N/A b. If a full compliance review has been conducted by an agency of the Federal Government, the most recent compliance review was conducted on ____________ (Date) by ____________ (Federal Agency).

c. The proposed first-tier subcontractors which will be awarded subcontracts of $1,000,000 or more are Gruy Federal, Inc. (see Reps. & Certs. attached).

Any offeror and his known first-tier subcontractors which will be awarded subcontracts of $1,000,000 or more will be subject to full, preaward equal opportunity compliance reviews before the award of the contract for the purpose of determining whether the proposer and his subcontractors are able to comply with the provisions of the Equal Opportunity article.

6. CERTIFICATION OF NONSEGREGATED FACILITIES

By the submission of this proposal, the offeror, applicant, or subcontractor certifies that it does not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. It certifies further that it will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it will not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The offeror, applicant, or subcontractor agrees that a breach of this certification is a violation of the Equal Opportunity clause in this contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, 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, creed, color, or national origin, because of habit, local custom, or otherwise. It further agrees that (except where it

6. CERTIFICATION OF NONSEGREGATED FACILITIES (Cont'd)

has obtained identical certifications from proposed subcontractors for specific time periods) it will obtain identical certifications from proposed subcontractors prior to the award of 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 notice to such proposed subcontractors (except where the proposed subcontractors have submitted identical certifications for specific time periods):

NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENT FOR CERTIFICATION OF NONSEGREGATED FACILITIES

A Certification of Nonsegregated Facilities must be submitted prior to the award of a subcontract exceeding $10,000 which is not exempt from the provisions of the Equal Opportunity clause. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semi-annually, or annually).

7. PARENT COMPANY AND EMPLOYER IDENTIFICATION NUMBER

Each proposer shall furnish the following information by filling in the appropriate blocks:

a. Is the proposer owned or controlled by a parent company as described below? ( ) Yes (x) No. (For the purpose of this proposal, a parent company is defined as one which either owns or controls the activities and basic business policies of the proposer. To own another company means the parent company must own at least a majority (more than 50 percent) of the voting rights in that company. To control another company, such ownership is not required; if another company is able to formulate, determine or veto basic business policy decisions of the proposer, such other company is considered the parent company of the proposer. This control may be exercised through the use of dominant minority voting rights, use of proxy voting, contractual arrangements, or otherwise.)

N/A

b. If the answer to a. above is "Yes", proposer shall insert in the space below the name and main office address of the parent company.

Name of Parent Company: ______________________________

____

7. PARENT COMPANY AND EMPLOYER IDENTIFICATION NUMBER (Cont'd)

'A

Main Office Address (No., Street, City, State and Zip Code)

____

____

____

____

c. Proposer shall insert in the applicable space below, if it has no parent company, its own Employer's Identification Number (E.I. No.) (Federal Social Security Number used on Employer's Quarterly Federal Tax Return, U. S. Treasury Department Form 941), or if it has a parent company, the E.I. No. of its parent company.

Employer Identification Number of Parent Company: ________________

95-3461425

8. DISCLOSURE STATEMENT - COST ACCOUNTING PRACTICES AND CERTIFICATION

X. SMALL BUSINESS EXEMPTION

Any contract in excess of $100,000 resulting from this solicitation except: (i) when the price negotiated is based on: (a) established catalog or market prices of commercial items sold in substantial quantities to the general public, or (b) prices set by law or regulations; (ii) contracts awarded to small business concerns (as defined in 1-701.1 of the Armed Services procurement regulations or FPR §1-1.701-1); or (iii) contracts which are otherwise exempt (see 4 CFR 331.30(b)) shall be subject to the requirements of the Cost Accounting Standards Board. Any offeror submitting a proposal, which, if accepted, will result in a contract subject to the requirements of the Cost Accounting Standards Board must, as a condition of contracting, submit a disclosure statment as required by regulations of the Board. The disclosure statement must be submitted as a part of the offeror's proposal under this solicitation (see (I), below) unless: (i) the offeror, together with all divisions, subsidiaries, and affiliates under common control, did not receive net awards exceeding the monetary exemption for disclosure as established by the Cost Accounting Standards Board (see (II), below); (ii) the offeror exceeded the monetary exemption in its cost accounting period immediately preceding the cost accounting period in which this proposal was submitted but, in accordance with the regulations of the Cost Accounting Standards Board, is not yet required to submit a disclosure statement (see (III), below); (iii) the offeror has already submitted a disclosure statement disclosing the practices used in connection with the pricing of this proposal

8. DISCLOSURE STATEMENT - COST ACCOUNTING PRACTICES AND CERTIFICATION (Cont'd)

contract and subcontract awards in their preceding cost accounting period did not exceed the $10 million threshold and the amount of this award will be less than $10 million. Such offerors will continue to be reponsible for maintaining the disclosure statement and following the disclosed practices on CAS covered prime contracts and subcontracts awarded during the period in which a disclosure statement was required.

( ) III. CERTIFICATE OF INTERIM EXEMPTION

The offeror hereby certifies that: (i) it first exceeded the monetary exemption for disclosure as defined in (II) above, in its cost accounting period immediately preceding the cost accounting period in which this proposal was submitted, and (ii) in accordance with the regulations of the Cost Accounting Standards Board (4 CFR 351.40(f)), it is not yet required to submit a disclosure statement. The offeror further certifies that if an award resulting from this proposal has not been made within 90 days after the end of that period, it will immediately submit a revised certificate to the Contracting Officer, in the form specified under (I), above or (IV), below, as appropriate, to verify its submission of a completed disclosure statement.

CAUTION: Offerors may not claim this exemption if they are currently required to disclose because they were awarded a CAS covered national defense prime contract or subcontract of $10 million or more in the current cost accounting period. Further, the exemption applies only in connection with proposals submitted prior to expiration of the 90-day period following the cost accounting period in which the monetary exemption was exceeded.

( ) IV. CERTIFICATE OF PREVIOUSLY SUBMITTED DISCLOSURE STATEMENT(S)

The offeror hereby certifies that the disclosure statement(s) was filed as follows:

Date of Disclosure Statement(s)	Name(s) and Address(es) of Cognizant Contracting Officer(s) Where Filed

The offeror further certifies that practices used in estimating costs in pricing this proposal are consistent with the cost accounting practices disclosed in the Disclosure Statement(s).

8. DISCLOSURE STATEMENT - COST ACCOUNTING PRACTICES AND CERTIFICATION (Cont'd)

(see (IV), below); or (iv) post-award submission has been authorized by the Contracting Officer. See 4 CFR 351.70 for submission of copy of disclosure statement to the Cost Accounting Standards Board.

CAUTION: A practice disclosed in a disclosure statement shall not, by virtue of such disclosure, be deemed to be a proper, approved, or agreed to practice for pricing proposals or accumulating and reporting contract performance cost data.

Check the appropriate box below.

( ) I. CERTIFICATE OF CONCURRENT SUBMISSION OF DISCLOSURE STATEMENT(S)

The offeror hereby certifies that he has submitted, as a part of his proposal under this solicitation, copies of the disclosure statement(s) as follows: (i) original and one copy to the cognizant Contracting Officer (Administrative Contracting Officer (ACO), see DOD Directory of Contract Administration Components (DOD 4105.59H)); and (ii) one copy to the cognizant contract auditor.

Date of Disclosure Statement(s)	Name(s) and Address(es) of Cognizant Contracting Officer(s) Where Filed

The offeror further certifies that practices used in estimating costs in pricing this proposal are consistent with the cost accounting practices disclosed in the Disclosure Statement(s).

( ) II. CERTIFICATE OF MONETARY EXEMPTION

The offeror hereby certifies that it, together with all divisions, subsidiaries, and affiliates under common control, did not receive net awards of negotiated national defense prime contracts and subcontracts subject to cost accounting standards totaling more than $10 million in its cost accounting period immediately preceding the period in which this proposal was submitted. The offeror further certifies that if its status changes prior to an award resulting from this proposal it will advise the Contracting Officer immediately.

CAUTION: Offerors who submitted a Disclosure Statement under the filing requirements previously established by the Cost Accounting Standards Board may claim this exemption only if the dollar volume of CAS covered national defense prime

9. COST ACCOUNTING STANDARDS - EXEMPTIONS FOR CONTRACTS OF $500,000 OR LESS

X. SMALL BUSINESS EXEMPTION

If this proposal is expected to result in the award of a contract of $500,000 or less, the offeror shall indicate whether the exemption to the cost accounting standards clause under the provisions of 4 CFR 331.30(b)(8) is claimed. Failure to check the box below shall mean that the resultant contract is subject to the cost accounting standards clause or that the offeror elects to comply with such clause.

( ) The offeror hereby claims an exemption from the Cost Accounting Standards clause under the provisions of 4 CFR 331.30(b)(8) and certifies that it has received notification of final acceptance of all deliverable items on (i) all prime contracts or subcontracts in excess of $500,000 which contain the Cost Accounting Standards clause, and (ii) all prime contracts or subcontracts of $500,000 or less awarded after January 1, 1975, which contain the Cost Accounting Standards clause. The offeror further certifies it will immediately notify the Contracting Officer in writing in the event it is awarded any other contract or subcontract containing the Cost Accounting Standards clause subsequent to the date of this certificate but prior to the date of any award resulting from this proposal.

10. COST ACCOUNTING STANDARDS ELIGIBILITY FOR MODIFIED CONTRACT COVERAGE

X. SMALL BUSINESS EXEMPTION

If the offeror is eligible to use the modified provisions of 4 CFR Part 332, and elects to do so, it shall indicate by checking the box below. Checking the box below shall mean that the resultant contract is subject to the Disclosure and Consistency of Cost Accounting Practices clause in lieu of the Cost Accounting Standards clause.

( ) The offeror hereby claims an exemption from the Cost Accounting Standards clause under the provisions of 4 CFR 331.30(b)(2), and certifies that it is eligible for use of the Disclosure and Consistency of Cost Accounting Practices clause because (i) during its cost accounting period immediately preceding the period in which this proposal was submitted, it received less than $10 million in awards of CAS covered national defense prime contracts and subcontracts, and (ii) the sum of such awards equaled less than 10 percent of his total sales during that cost accounting period. The offeror further certifies that if its status changes prior to an award resulting from this proposal, it will advise the Contracting Officer immediately.

CAUTION: Offerors may not claim the above eligibility for modified contract coverage if this proposal is expected to result in the award of a contract of $10 million or more or if, during their current cost accounting period, they have been awarded a single CAS-covered national defense prime contract or subcontract of $10 million or more.

11. ADDITIONAL COST ACCOUNTING STANDARDS APPLICABLE TO EXISTING CONTRACTS

X. SMALL BUSINESS EXEMPTION

The offeror shall indicate below whether award of the contemplated contract would in accordance with paragraph (a)(3) of the Cost Accounting Standards clause, require a change in its established cost accounting practices affecting existing contracts and subcontracts.

( ) Yes ( ) No

NOTE: If the offeror has checked "yes" above, and is awarded the contemplated contract, it will be required to comply with the Administration of Cost Accounting Standards clause.

12. CLEAN AIR AND WATER CERTIFICATION

(Applicable if the bid or offer exceeds $100,000, or the Contracting Officer has determined that orders under an indefinite quantity contract in any year will exceed $100,000, or a facility to be used has been the subject of a conviction under the Clean Air Act (42 U.S.C. 1857c-8(c)(1)) or the Federal Water Pollution Control Act (33 U.S.C. 1319(c)) and is listed by EPA, or is not otherwise exempt.)

The bidder or offeror certifies as follows:

(a) Any facility to be utilized in the performance of this proposed contract has ( ), has not ( ), been listed on the Environmental Protection Agency List of Violating Facilities.

(b) It will promptly notify the Contracting Officer, prior to award, of the receipt of any communication from the Director, Office of Federal Activities, Environmental Protection Agency, indicating that any facility which it proposes to use for the performance of the contract is under consideration to be listed on the EPA List of Violating Facilities.

(c) It will include substantially this certification, including this paragraph (c), in every nonexempt subcontract.

13. SMALL AND SMALL DISADVANTAGED BUSINESS CERTIFICATION

(a) The bidder or offeror certifies that it is (X) is not ( ) a small business concern as defined in accordance with Section 3 of the Small Business Act (15 U.S.C. 632).

(b) The bidder or offeror certifies that it is a small business [as set forth in (a) above] and is ( ) is not (X) owned and controlled by socially and economically disadvantaged individuals. Such a firm is defined as one -

13. SMALL AND SMALL DISADVANTAGED BUSINESS CERTIFICATION (Cont'd)

(i) which is at least 51 per centum owned by one or more such individuals or, in the case of any publicly owned business, at least 51 per centum of the stock is owned by such individuals;

(ii) whose management and daily business operations are controlled by one or more such individuals; and

(iii) which certifies concerning said ownership and control in accordance with section (c) below.

(c) The bidder or offeror certifies that it is ( ) is not (X) a minority individual(s) in accordance with (c)(i) below or that it is ( ) is not (X) socially and economically disadvantaged in accord with section (c)(ii) or (c)(iii). Socially and economically disadvantaged individuals are defined as:

(i) United States citizens who are Black Americans, Hispanic Americans, Native Americans, or other specified minorities;

(ii) any other individual found to be disadvantaged pursuant to section 8(a) of the Small Business Act (15 U.S.C. 637); or

(iii) any other individual defined as socially, and economically disadvantaged, for purposes relating to other sections of the Small Business Act.

14. WOMAN-OWNED BUSINESS

Concern is ( ) is not (X) a woman-owned business.

A woman-owned business is a business which is, at least, 51 percent owned, controlled, and operated by a woman or women. Controlled is defined as exercising the power to make policy decisions. Operated is defined as actively involved in the day-to-day management.

For the purposes of this definition, businesses which are publicly owned, joint stock associations, and business trusts are exempted. Exempted businesses may voluntarily represent that they are, or are not, woman-owned if this information is available.

15. PERCENT OF FOREIGN CONTENT

The offeror/contractor will represent (as an estimate), immediately after the award of a contract, the percent of the foreign content of the item or service being procured expressed as a percent of the contract award price (accuracy within plus or minus 5 percent is acceptable).

NOTE: No solicitation may be properly considered without these representations and certifications, and no award may be made without this form being executed.

Signed By ______________________

Jerold Kirkman

Manager, Magic Resource Investors
(Title)

Date: September 15, 1980

REPRESENTATIONS AND CERTIFICATIONS

[Instructions: Check or complete all appropriate boxes or blanks.]

The proposer makes the following representations and certifications:

1. CONTINGENT FEE

(a) It ( ) has, (x) has not, employed or retained any company or person (other than a full-time bona fide employee working solely for the bidder) to solicit or secure this contract, and (b) it ( ) has, (x) has not, paid or agreed to pay any company or person (other than a full-time bona fide employee working solely for the bidder) any fee, commission, percentage or brokerage fee, contingent upon or resulting from the award of this contract; and agrees to furnish information relating to (a) and (b) above as requested by the Contracting Officer. (For interpretation of the representation, including the term "bona fide employee," see Code of Federal Regulations, Title 41, Subpart 1-1.5.).

2. TYPE OF ORGANIZATION

It operates as an ( ) individual, ( ) partnership, ( ) joint venture, (x) corporation, incorporated in State of Texas.

3. EQUAL OPPORTUNITY

It (X) has, ( ) has not, participated in a previous contract or subcontract subject to the Equal Opportunity Clause herein, the clause originally contained in Section 301 of Executive Order No. 10925, or the clause contained in Section 201 of Executive Order No. 11114; ~~it~~ (x) has, ( ) has not, filed all required compliance reports; and representations indicating submission or required compliance reports, signed by proposed subcontractors, will be obtained prior to subcontract awards.

4. AFFIRMATIVE ACTION COMPLIANCE PROGRAM

The offeror represents that (a) it (x) has developed and has on file, ( ) has not developed and does not have on file, at each establishment an affirmative action program as required by the rules and regulations of the Secretary of Labor (41 CFR 60-1 and 60-2), or (b) ( ) has not previously had contracts subject to written affirmative action program requirements of the rules and regulations of the Secretary of Labor because (check as applicable):

________________ offeror does not have 50 or more employees

________________ offeror has not had a Government prime contract or subcontract of $50,000 or more.

5. EQUAL OPPORTUNITY COMPLIANCE

[Applicable to proposals exceeding $1,000,000]

The offeror represents -

a. That a full compliance review of the offeror's employment practices (X) has, ( ) has not, been conducted by an agency of the Federal Government.

b. If a full compliance review has been conducted by an agency of the Federal Government, the most recent compliance review was conducted on 7-16-79 (Date) by DOL-OFCCP, Houston (Federal Agency).

c. The proposed first-tier subcontractors which will be awarded subcontracts of $1,000,000 or more are N/A.

Any offeror and his known first-tier subcontractors which will be awarded subcontracts of $1,000,000 or more will be subject to full, preaward equal opportunity compliance reviews before the award of the contract for the purpose of determining whether the proposer and his subcontractors are able to comply with the provisions of the Equal Opportunity article.

6. CERTIFICATION OF NONSEGREGATED FACILITIES

By the submission of this proposal, the offeror, applicant, or subcontractor certifies that it does not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. It certifies further that it will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it will not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The offeror, applicant, or subcontractor agrees that a breach of this certification is a violation of the Equal Opportunity clause in this contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, 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, creed, color, or national origin, because of habit, local custom, or otherwise. It further agrees that (except where it

6. CERTIFICATION OF NONSEGREGATED FACILITIES (Cont'd)

has obtained identical certifications from proposed subcontractors for specific time periods) it will obtain identical certifications from proposed subcontractors prior to the award of 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 notice to such proposed subcontractors (except where the proposed subcontractors have submitted identical certifications for specific time periods):

NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENT FOR CERTIFICATION OF NONSEGREGATED FACILITIES

A Certification of Nonsegregated Facilities must be submitted prior to the award of a subcontract exceeding $10,000 which is not exempt from the provisions of the Equal Opportunity clause. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semi-annually, or annually).

7. PARENT COMPANY AND EMPLOYER IDENTIFICATION NUMBER

Each proposer shall furnish the following information by filling in the appropriate blocks:

a. Is the proposer owned or controlled by a parent company as described below? (X) Yes ( ) No. (For the purpose of this proposal, a parent company is defined as one which either owns or controls the activities and basic business policies of the proposer. To own another company means the parent company must own at least a majority (more than 50 percent) of the voting rights in that company. To control another company, such ownership is not required; if another company is able to formulate, determine or veto basic business policy decisions of the proposer, such other company is considered the parent company of the proposer. This control may be exercised through the use of dominant minority voting rights, use of proxy voting, contractual arrangements, or otherwise.)

b. If the answer to a. above is "Yes", proposer shall insert in the space below the name and main office address of the parent company.

Name of Parent Company: Gruy Enterprises, Inc.

7. PARENT COMPANY AND EMPLOYER IDENTIFICATION NUMBER (Cont'd)

Main Office Address (No., Street, City, State and Zip Code)

150 W. John W. Carpenter Frwy.
Irving, Texas 75062

c. Proposer shall insert in the applicable space below, if it has no parent company, its own Employer's Identification Number (E.I. No.) (Federal Social Security Number used on Employer's Quarterly Federal Tax Return, U. S. Treasury Department Form 941), or if it has a parent company, the E.I. No. of its parent company.

Employer Identification Number of Parent Company: 75-1498467

8. DISCLOSURE STATEMENT - COST ACCOUNTING PRACTICES AND CERTIFICATION

X Small Business Exemption

Any contract in excess of $100,000 resulting from this solicitation except: (i) when the price negotiated is based on: (a) established catalog or market prices of commercial items sold in substantial quantities to the general public, or (b) prices set by law or regulations; (ii) contracts awarded to small business concerns (as defined in 1-701.1 of the Armed Services procurement regulations or FPR §1-1.701-1); or (iii) contracts which are otherwise exempt (see 4 CFR 331.30(b)) shall be subject to the requirements of the Cost Accounting Standards Board. Any offeror submitting a proposal, which, if accepted, will result in a contract subject to the requirements of the Cost Accounting Standards Board must, as a condition of contracting, submit a disclosure statment as required by regulations of the Board. The disclosure statement must be submitted as a part of the offeror's proposal under this solicitation (see (I), below) unless: (i) the offeror, together with all divisions, subsidiaries, and affiliates under common control, did not receive net awards exceeding the monetary exemption for disclosure as established by the Cost Accounting Standards Board (see (II), below); (ii) the offeror exceeded the monetary exemption in its cost accounting period immediately preceding the cost accounting period in which this proposal was submitted but, in accordance with the regulations of the Cost Accounting Standards Board, is not yet required to submit a disclosure statement (see (III), below); (iii) the offeror has already submitted a disclosure statement disclosing the practices used in connection with the pricing of this proposal

8. DISCLOSURE STATEMENT - COST ACCOUNTING PRACTICES AND CERTIFICATION (Cont'd)

(see (IV), below); or (iv) post-award submission has been authorized by the Contracting Officer. See 4 CFR 351.70 for submission of copy of disclosure statement to the Cost Accounting Standards Board.

CAUTION: A practice disclosed in a disclosure statement shall not, by virtue of such disclosure, be deemed to be a proper, approved, or agreed to practice for pricing proposals or accumulating and reporting contract performance cost data.

Check the appropriate box below.

( ) I. CERTIFICATE OF CONCURRENT SUBMISSION OF DISCLOSURE STATEMENT(S)

The offeror hereby certifies that he has submitted, as a part of his proposal under this solicitation, copies of the disclosure statement(s) as follows: (i) original and one copy to the cognizant Contracting Officer (Administrative Contracting Officer (ACO), see DOD Directory of Contract Administration Components (DOD 4105.59H)); and (ii) one copy to the cognizant contract auditor.

Date of Disclosure Statement(s)	Name(s) and Address(es) of Cognizant Contracting Officer(s) Where Filed

The offeror further certifies that practices used in estimating costs in pricing this proposal are consistent with the cost accounting practices disclosed in the Disclosure Statement(s).

( ) II. CERTIFICATE OF MONETARY EXEMPTION

The offeror hereby certifies that it, together with all divisions, subsidiaries, and affiliates under common control, did not receive net awards of negotiated national defense prime contracts and subcontracts subject to cost accounting standards totaling more than $10 million in its cost accounting period immediately preceding the period in which this proposal was submitted. The offeror further certifies that if its status changes prior to an award resulting from this proposal it will advise the Contracting Officer immediately.

CAUTION: Offerors who submitted a Disclosure Statement under the filing requirements previously established by the Cost Accounting Standards Board may claim this exemption only if the dollar volume of CAS covered national defense prime

8. DISCLOSURE STATEMENT - COST ACCOUNTING PRACTICES AND CERTIFICATION (Cont'd)

contract and subcontract awards in their preceding cost accounting period did not exceed the $10 million threshold and the amount of this award will be less than $10 million. Such offerors will continue to be reponsible for maintaining the disclosure statement and following the disclosed practices on CAS covered prime contracts and subcontracts awarded during the period in which a disclosure statement was required.

( ) III. CERTIFICATE OF INTERIM EXEMPTION

The offeror hereby certifies that: (i) it first exceeded the monetary exemption for disclosure as defined in (II) above, in its cost accounting period immediately preceding the cost accounting period in which this proposal was submitted, and (ii) in accordance with the regulations of the Cost Accounting Standards Board (4 CFR 351.40(f)), it is not yet required to submit a disclosure statement. The offeror further certifies that if an award resulting from this proposal has not been made within 90 days after the end of that period, it will immediately submit a revised certificate to the Contracting Officer, in the form specified under (I), above or (IV), below, as appropriate, to verify its submission of a completed disclosure statement.

CAUTION: Offerors may not claim this exemption if they are currently required to disclose because they were awarded a CAS covered national defense prime contract or subcontract of $10 million or more in the current cost accounting period. Further, the exemption applies only in connection with proposals submitted prior to expiration of the 90-day period following the cost accounting period in which the monetary exemption was exceeded.

( ) IV. CERTIFICATE OF PREVIOUSLY SUBMITTED DISCLOSURE STATEMENT(S)

The offeror hereby certifies that the disclosure statement(s) was filed as follows:

Date of Disclosure Statement(s)	Name(s) and Address(es) of Cognizant Contracting Officer(s) Where Filed
____________________	____________________
	____________________

The offeror further certifies that practices used in estimating costs in pricing this proposal are consistent with the cost accounting practices disclosed in the Disclosure Statement(s).

9. COST ACCOUNTING STANDARDS - EXEMPTIONS FOR CONTRACTS OF $500,000 OR LESS

X Small Business Exemption

If this proposal is expected to result in the award of a contract of $500,000 or less, the offeror shall indicate whether the exemption to the cost accounting standards clause under the provisions of 4 CFR 331.30(b)(8) is claimed. Failure to check the box below shall mean that the resultant contract is subject to the cost accounting standards clause or that the offeror elects to comply with such clause.

( ) The offeror hereby claims an exemption from the Cost Accounting Standards clause under the provisions of 4 CFR 331.30(b)(8) and certifies that it has received notification of final acceptance of all deliverable items on (i) all prime contracts or subcontracts in excess of $500,000 which contain the Cost Accounting Standards clause, and (ii) all prime contracts or subcontracts of $500,000 or less awarded after January 1, 1975, which contain the Cost Accounting Standards clause. The offeror further certifies it will immediately notify the Contracting Officer in writing in the event it is awarded any other contract or subcontract containing the Cost Accounting Standards clause subsequent to the date of this certificate but prior to the date of any award resulting from this proposal.

10. COST ACCOUNTING STANDARDS ELIGIBILITY FOR MODIFIED CONTRACT COVERAGE

X Small Business Exemption

If the offeror is eligible to use the modified provisions of 4 CFR Part 332, and elects to do so, it shall indicate by checking the box below. Checking the box below shall mean that the resultant contract is subject to the Disclosure and Consistency of Cost Accounting Practices clause in lieu of the Cost Accounting Standards clause.

( ) The offeror hereby claims an exemption from the Cost Accounting Standards clause under the provisions of 4 CFR 331.30(b)(2), and certifies that it is eligible for use of the Disclosure and Consistency of Cost Accounting Practices clause because (i) during its cost accounting period immediately preceding the period in which this proposal was submitted, it received less than $10 million in awards of CAS covered national defense prime contracts and subcontracts, and (ii) the sum of such awards equaled less than 10 percent of his total sales during that cost accounting period. The offeror further certifies that if its status changes prior to an award resulting from this proposal, it will advise the Contracting Officer immediately.

CAUTION: Offerors may not claim the above eligibility for modified contract coverage if this proposal is expected to result in the award of a contract of $10 million or more or if, during their current cost accounting period, they have been awarded a single CAS-covered national defense prime contract or subcontract of $10 million or more.

Representations and Certifications (Cont'd)

11. ADDITIONAL COST ACCOUNTING STANDARDS APPLICABLE TO EXISTING CONTRACTS

The offeror shall indicate below whether award of the contemplated contract would in accordance with paragraph (a)(3) of the Cost Accounting Standards clause, require a change in its established cost accounting practices affecting existing contracts and subcontracts.

( ) Yes (X) No

NOTE: If the offeror has checked "yes" above, and is awarded the contemplated contract, it will be required to comply with the Administration of Cost Accounting Standards clause.

12. CLEAN AIR AND WATER CERTIFICATION

(Applicable if the bid or offer exceeds $100,000, or the Contracting Officer has determined that orders under an indefinite quantity contract in any year will exceed $100,000, or a facility to be used has been the subject of a conviction under the Clean Air Act (42 U.S.C. 1857c-8(c)(1)) or the Federal Water Pollution Control Act (33 U.S.C. 1319(c)) and is listed by EPA, or is not otherwise exempt.)

The bidder or offeror certifies as follows:

(a) Any facility to be utilized in the performance of this proposed contract has ( ), has not (X), been listed on the Environmental Protection Agency List of Violating Facilities.

(b) It will promptly notify the Contracting Officer, prior to award, of the receipt of any communication from the Director, Office of Federal Activities, Environmental Protection Agency, indicating that any facility which it proposes to use for the performance of the contract is under consideration to be listed on the EPA List of Violating Facilities.

(c) It will include substantially this certification, including this paragraph (c), in every nonexempt subcontract.

13. SMALL AND SMALL DISADVANTAGED BUSINESS CERTIFICATION

(a) The bidder or offeror certifies that it is (x) is not ( ) a small business concern as defined in accordance with Section 3 of the Small Business Act (15 U.S.C. 632).

(b) The bidder or offeror certifies that it is a small business [as set forth in (a) above] and is ( ) is not (X) owned and controlled by socially and economically disadvantaged individuals. Such a firm is defined as one -

13. SMALL AND SMALL DISADVANTAGED BUSINESS CERTIFICATION (Cont'd)

(i) which is at least 51 per centum owned by one or more such individuals or, in the case of any publicly owned business, at least 51 per centum of the stock is owned by such individuals;

(ii) whose management and daily business operations are controlled by one or more such individuals; and

(iii) which certifies concerning said ownership and control in accordance with section (c) below.

(c) The bidder or offeror certifies that it is ( ) is not (X) a minority individual(s) in accordance with (c)(i) below or that it is ( ) is not (X) socially and economically disadvantaged in accord with section (c)(ii) or (c)(iii). Socially and economically disadvantaged individuals are defined as:

(i) United States citizens who are Black Americans, Hispanic Americans, Native Americans, or other specified minorities;

(ii) any other individual found to be disadvantaged pursuant to section 8(a) of the Small Business Act (15 U.S.C. 637); or

(iii) any other individual defined as socially, and economically disadvantaged, for purposes relating to other sections of the Small Business Act.

14. WOMAN-OWNED BUSINESS

Concern is ( ) is not (X) a woman-owned business.

A woman-owned business is a business which is, at least, 51 percent owned, controlled, and operated by a woman or women. Controlled is defined as exercising the power to make policy decisions. Operated is defined as actively involved in the day-to-day management.

For the purposes of this definition, businesses which are publicly owned, joint stock associations, and business trusts are exempted. Exempted businesses may voluntarily represent that they are, or are not, woman-owned if this information is available.

15. PERCENT OF FOREIGN CONTENT

The offeror/contractor will represent (as an estimate), immediately after the award of a contract, the percent of the foreign content of the item or service being procured expressed as a percent of the contract award price (accuracy within plus or minus 5 percent is acceptable).

NOTE: No solicitation may be properly considered without these representations and certifications, and no award may be made without this form being executed.

Signed By Gayland E. Daugherty

Gayland E. Daugherty

Vice President, Finance
(Title)

Date: September 15, 1980

Appendix P

OMB Approval No. 29–R0218

FEDERAL ASSISTANCE

2. APPLICANT'S APPLICATION
a. NUMBER N/A
b. DATE Year month day 19 80 09 15

3. STATE APPLICATION IDENTIFIER
a. NUMBER N/A
b. DATE ASSIGNED Year month day 19 N/A

1. TYPE OF ACTION (Mark appropriate box)
☐ PREAPPLICATION
☒ APPLICATION
☐ NOTIFICATION OF INTENT (Opt.)
☐ REPORT OF FEDERAL ACTION

Leave Blank

SECTION I—APPLICANT/RECIPIENT DATA

4. LEGAL APPLICANT/RECIPIENT
a. Applicant Name : Magic Resource Investors
b. Organization Unit : Magic Resource Investors
c. Street/P.O. Box : P. O. Box 1328
d. City : Sun Valley
e. County : Blaine
f. State : Idaho
g. ZIP Code: 83353
h. Contact Person (Name & telephone No.) : Jerold Kirkman (208) 726-8241

5. FEDERAL EMPLOYER IDENTIFICATION NO. 95-346-1425

6. PROGRAM (From Federal Catalog)
a. NUMBER
b. TITLE User-Coupled Confirmation Drilling Program DE-SC07-80ID12139

7. TITLE AND DESCRIPTION OF APPLICANT'S PROJECT
User-Coupled Drilling Program -
Development of Geothermal Energy
At Magic Hot Springs Landing, Blaine County
Idaho

SCAP No. DE-SC07-80ID12139

8. TYPE OF APPLICANT/RECIPIENT
A–State
B–Interstate
C–Substate District
D–County
E–City
F–School District
G–Special Purpose District
H–Community Action Agency
I–Higher Educational Institution
J–Indian Tribe
K–Other (Specify): Private Partnership
Enter appropriate letter K

9. TYPE OF ASSISTANCE
A–Basic Grant
B–Supplemental Grant
C–Loan
D–Insurance
E–Other
Enter appropriate letter(s) E

10. AREA OF PROJECT IMPACT (Names of cities, counties, States, etc.)
Blaine, Camas,
Wooding & Lincoln Co., Idaho

11. ESTIMATED NUMBER OF PERSONS BENEFITING Unknown

12. TYPE OF APPLICATION
A–New
B–Renewal
C–Revision
D–Continuation
E–Augmentation
Enter appropriate letter A

13. PROPOSED FUNDING *

a. FEDERAL	$ 241,866	.00
b. APPLICANT	967,462	.00
c. STATE		.00
d. LOCAL		.00
e. OTHER		.00
f. TOTAL	$ 1,209,328	.00

14. CONGRESSIONAL DISTRICTS OF:
a. APPLICANT 2nd
b. PROJECT 2nd

15. TYPE OF CHANGE (For 12c or 12e)
A–Increase Dollars
B–Decrease Dollars
C–Increase Duration
D–Decrease Duration
E–Cancellation
F–Other (Specify): N/A
Enter appropriate letter(s)

16. PROJECT START DATE Year month day 19 80 02 01

17. PROJECT DURATION 12 Months

18. ESTIMATED DATE TO BE SUBMITTED TO FEDERAL AGENCY ▶ Year month day 19 80 09 15

19. EXISTING FEDERAL IDENTIFICATION NUMBER N/A

20. FEDERAL AGENCY TO RECEIVE REQUEST (Name, City, State, ZIP code)
DOE, Idaho Operations Office, Idaho Falls, ID 83401

21. REMARKS ADDED ☐ Yes ☒ No

SECTION II—CERTIFICATION

22. THE APPLICANT CERTIFIES THAT ▶

a. To the best of my knowledge and belief, data in this preapplication/application are true and correct, the document has been duly authorized by the governing body of the applicant and the applicant will comply with the attached assurances if the assistance is approved.

b. If required by OMB Circular A-95 this application was submitted, pursuant to instructions therein, to appropriate clearinghouses and all responses are attached:

		No response	Response attached
(1)	N/A	☐	☐
(2)		☐	☐
(3)		☐	☐

23. CERTIFYING REPRESENTATIVE
a. TYPED NAME AND TITLE Jerold Kirkman Manager
b. SIGNATURE
c. DATE SIGNED Year month day 19 80 09 15

SECTION III—FEDERAL AGENCY ACTION

24. AGENCY NAME

25. APPLICATION RECEIVED Year month day 19

26. ORGANIZATIONAL UNIT

27. ADMINISTRATIVE OFFICE

28. FEDERAL APPLICATION IDENTIFICATION

29. ADDRESS

30. FEDERAL GRANT IDENTIFICATION

31. ACTION TAKEN
☐ a. AWARDED
☐ b. REJECTED
☐ c. RETURNED FOR AMENDMENT
☐ d. DEFERRED
☐ e. WITHDRAWN

32. FUNDING

a. FEDERAL	$	.00
b. APPLICANT		.00
c. STATE		.00
d. LOCAL		.00
e. OTHER		.00
f. TOTAL	$	.00

33. ACTION DATE ▶ Year month day 19

34. STARTING DATE Year month day 19

35. CONTACT FOR ADDITIONAL INFORMATION (Name and telephone number)

36. ENDING DATE Year month day 19

37. REMARKS ADDED ☐ Yes ☐ No

38. FEDERAL AGENCY A-95 ACTION

a. In taking above action, any comments received from clearinghouses were considered. If agency response is due under provisions of Part 1, OMB Circular A-95, it has been or is being made.

b. FEDERAL AGENCY A-95 OFFICIAL (Name and telephone no.)

424–101

STANDARD FORM 424 PAGE 1 (10–75)
Prescribed by GSA, Federal Management Circular 74-7

* This assumes a fully successful well.

COOPERATIVE AGREEMENT TERMS AND CONDITIONS