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VALE GEO PARK
USER COUPLED GASOHOL PLANT
RESERVOIR CONFIRMATION
PROGRAM

VOLUME I
TECHNICAL PROPOSAL
SCAP NO. DE-SC07-80-ID12139

Submitted By:

Technology International, Inc.

1009 Grant Street

Denver, Colorado 80203

September 15, 1980

TECHNOLOGY INTERNATIONAL, INC.
Suite 303
1009 Grant Street
Denver, CO 80203

September 11, 1980

User Coupled Drilling Program
Evaluation Committee
Department of Energy
Idaho Operations Office
550 Second Street
Idaho Falls, ID 83401

RE: SCAP NO. DE-SC07-80-ID12139

Gentlemen:

We appreciate your consideration of our proposal, and, of course, hope that you find it both intriguing and complete. Please note that this well , if funded, would greatly stimulate development of a KGRA with excellent resource potential and particular value to a major agricultural region.

As described herein, the proposer has been devoting substantial time to development of a number of aspects of technical and institutional nature in preparation for a Vale Geo Park Fuel Alcohol Plant. There are a number of potential future development capital options, including committed equity from the proposer and a notably strong major investment banker. Award of this would stimulate not only the proposed project at Vale, but would also act as an ideal pathfinder project for near term replication at other sites.

The proposer fully intends to complete a geothermal fuel alcohol plant at its Vale Geo Park site, rather than to simply end up with a "dead end" and useless hydrothermal resource. Your careful evaluation will be much appreciated.

Cordailly,

Stephen M. Munson
Chief Executive Officer

lja

Appendix A

SAMPLE DOE PROPOSAL COVER PAGE
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. 10 of 10

Date of Submission September 15, 1980

Technology International, Inc.
Name of Organization (principal participant if a team of organizations)

A small business corporation.
Organizational Classifications

Suite 303, 1009 Grant Street, Denver, CO 80203
Address of Organization

Vale Geo Park User Coupled Gasohol Plant Reservoir Confirmation Program
Title of Proposed Project

Maximum Funds requested from DOE $1,324,000 Total Cost of Project Through Flow Testing $1,472,000

Location of Site Vale Hot Springs KGRA, near Vale, Oregon

Proposed Project Duration (in months) 15 Months

Proposed Starting Date As Soon As Possible (February, 1981)

Project Manager Stephen M. Munson

Position and Title President

Telephone (w/area code) 303-832-8215

Permission for Outside Evaluation Yes X No ___

This proposal is for drilling a(n)

Production Well X Injection Well X Other ___

(Check other if for only testing a well).

Flow Testing is Referenced on Page 100

Variable Cost-Share Plan is Referenced on Page 151.

Statement of Intent is Referenced on Page Third From Front.

Appendix C

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.

The proposed end use for this direct utilization program is a 4,500,000 gallon per year fuel alcohol "Gasohol" plant. This plant will utilize proven, "off-the-shelf" technology which is being marketed to the public through a subsidiary of the proposer by the name of Ethanol International, Inc. The plant will utilize local waste agricultural crops as the feedstock substrate. The plant will be located on the proposer owned Geo Park industrial park site located 0.5 miles north of the proposer owned geothermal leaseblock in the Vale KGRA as depicted on the map on page 6 of this proposal.

The geothermal energy will be used to provide cooking, distillation and byproduct feed drying energy for plant operation which will provide all non-electric energy needs for the operation.

If the proposed well is successful, there is a distinct possibilit that the town of Vale will wish to purchase low temperature effluent for a small space heating project. The proposer also has developed some plans for greenhouse and aquacultural projects at the site. However, because of the byproduct aquaculture feed and CO_2 inter-related project uses planne neither lower temperature use is considerd desirable without development of the fuel alcohol facility at the Geo Park site. If the project is successful, the proposer will intend to sell energy from future wells to other Geo Park tenants at temperature ranges at least as high as required by the Gasohol plant.

Signed: ______________________
Technology International, Inc.
Proposer

Signed: ______________________
Ethanol International, Inc.
User

C. SUMMARY

The proposed project provides for second stage surface explorations, deep well drilling, testing; completion and reservoir confirmations work designed to interface with proposer cost share work and DOE geophysical work under PRDA DE-RA03-80RA50121 entitled Proposal For A Site Specific Engineering, Marketing and Economic Study of a 4,500,000 Gallon Geothermal Fuel Alcohol Plant For The Vale Geo Park Site Near Vale, Oregon which was recently awarded to the proposer.

This project is basically designed so that if the 1,500 foot exploration hole required of the proposer under the PRDA is not of sufficient productive output, as it in all likelihood will not be, then this User Coupled project will provide for a full scale production hole and reservoir confirmation through the expected levels of two deeper reservoir formations.

This User Coupled Confirmation Drilling Program proposal is designed to assist in the near term development of the moderate temperature hydrothermal resource believed to exist at the Vale Hot Springs KGRA which have been extensively studied by the U.S. Geologic Survey and others. This project is proposed to first confirm the existence of the Vale KGRA moderate temperature hydrothermal resource which would then be coupled to the proposed Vale Geo Park Geothermal Gasohol Plant which the proposer initially believes to be economically viable, and which is clearly and demonstrably technically feasible. Certain as yet incompletely studied questions related to the project would be answered under the PRDA contract (for evaluation by both the proposer and DOE User Coupled project evaluators) prior to both startup of this User Coupled proposed project and issuance of the PRDA Final Report.

The proposed resource consists of approximately one-eighth of the KGRA surface land area and is superbly located in what the proposer believes to be the highest quality location in the Vale KGRA.

The proposer is a five-year old renewable energy holding company with substantial business interests related to geothermal energy development and several aspects of the emerging fuel alcohol "Gasohol" industry. In addition to its geothermal resource development activities, the proposer is developing a number of Gasohol plants which will variously utilize geothermal, biomass, or coal as the fuel sources which plants feature proven "off-the-shelf" technology developed directly from long experience with the more sophisticated beverage alcohol distillation industry. The plant technology featured by proposer features completely proven and available technology which requires only site specific feedstock or related adaptations and fuel system adaptations to render it fully viable and cost effective. The proposer project team consists of a notably experienced full capability organization.

The proposer project has already received widespread media coverage concerning development of the Geo Park concept and the recent PRDA award. The project has demonstrated strong regional support at all governmental levels which favor a successful development of the proposer site. These factors together insure that development of a successful project at the site will greatly help to facilitate increased economic use of moderate temperature hydrothermal resources. It will help to create an industry without need of similar Federal support in the later portion of this decade.

Media attention generated by this Geo Park Gasohol Project will do much to positively promote development of a viable and continuing infra-structure of technical support and financing institutions and mechanisms capable of supporting a viable hydrothermal resource-based industry.

TABLE OF CONTENTS

TABLE OF CONTENTS CONTINUED

TABLE OF CONTENTS CONTINUED

FIGURE TABLE

FIGURE TABLE CONTINUED

1.0 RESOURCE POTENTIAL AND TECHNICAL PLANNING OVERVIEW

1.1 DESCRIPTION OF THE TOTAL GEOTHERMAL PROJECT

1.1.1 A description of the geoscientific exploration program which is to precede the site selection for the deep exploration/production hole is provided in Section 1.2.3 below, and will not be repeated here. Based upon the results of the geoscientific survey and proposer-paid PRDA 1500' hole, the management team of this project will consult with its geothermal consultant, Dr. Tsvi Meidav, and will formulate a final drilling strategy plan. That plan would be submitted to DOE for review and approval prior to the initiation of contract negotiations with the drilling and other sub-contractors. If the drilling plan is approved by the DOE, TI and its technical management team will meet with the major sub-contractors for this project to review the revised project plan and drilling strategy, and to prepare a revised budget plan within the available budget.

1.1.2 The drilling program, as presently envisioned, is described in Section 4.1.2. It is anticipated that it would be modified in light of the results of the geoscientific survey.

1.1.3 The testing program is described in Section 4.1.3. It would include the normal drawdown, pressure buildup (recovery) tests in both the Kromsient and quasi-steady-state modes. Analysis of the flow rates, temperature, enthalpy and chemical characteristics of the produced fluids would be utilized to determine the level of success of the project in terms of the stated goals. Utilization plans will be finalized based upon the actual test results.

1.2 RESOURCE POTENTIAL ASSESSMENT

1.2.1 EXISTING INFORMATION

A considerable amount of geoscientific and geothermal data exists for the Vale area, resulting in its classification as a KGRA (Godwin et al, 1971), as shown in Figure 1. The geothermal leasehold owned by Technology International lies astride the high heat flow zone as identified by the State of Oregon from thermal gradient data (Figure 2). The location of the TI leases, with the heat flow data superimposed, is shown in Figure 3. A large number of studies of the geothermal characteristics of the Vale area have been published or open-filed by various State of Oregon, federal and university organizations (Blackwell et al, 1978; Bowen and Peterson, 1970; Bowen et al, 1978; Hull 1975a; Hull, 1975b; Hull et al, 1977; Renner et al, 1978; Lilley, 1977). A considerable body of geological mapping has been conducted in the area (Lilley, 1977; Larson and Couch, 1975; Kittleman, 1975). Recently, a considerable body of geophysical data and analysis has been published by Oregon State University for the Vale-Owyhee region, as part of an extramural USGS grant (Couch, 1977; Couch and Baker, 1977). Results of the hydrogeochemical and geothermal resource assessment for the Vale area have been summarized by the U.S. Geological Survey in circulars 729 and 790.

The Vale Hot Springs are contiguous to the northern boundary of the larger TI lease block shown in Figure 3. Waring (1965) has measured a temperature of 198 degrees F (92 degrees C), and a flow rate of 20 gpm at the springs. A well drilled for a hot water supply for a swimming pool, drilled a few hundred feet to the southeast of the Vale Hot Springs, is boiling at the surface (97 degrees C), with a reported bottomhole temperature of 121 degrees C (250 degrees F).

Chemical geothermometry analyses of the hot springs in the area (USGS circulars 726 and 790) indicate a minimum reservoir temperature of 152 degrees C, using the silica geothermometer, 157 degrees C for the Na-K-Ca thermometer, ranging up to 200 degrees C (392 degrees F), for the sulfate isotope thermometer. It must be borne in mind that all chemical geothermometers reflect, at best, the base temperature of the reservoir from which the hot water leaks to the surface. They provide no information about any potentially higher temperature

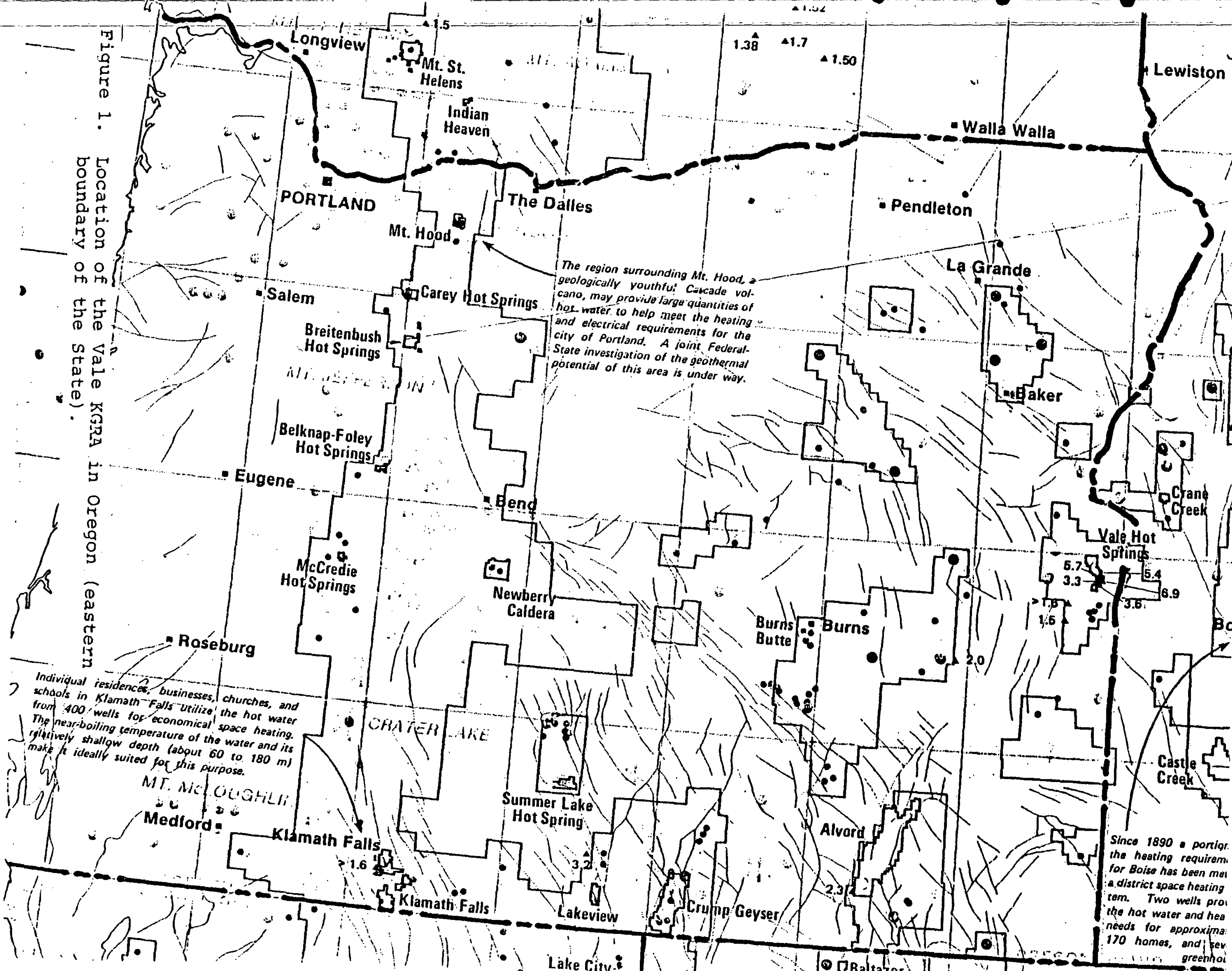


Figure 1. Location of the Vale KGRA in Oregon (eastern boundary of the State).

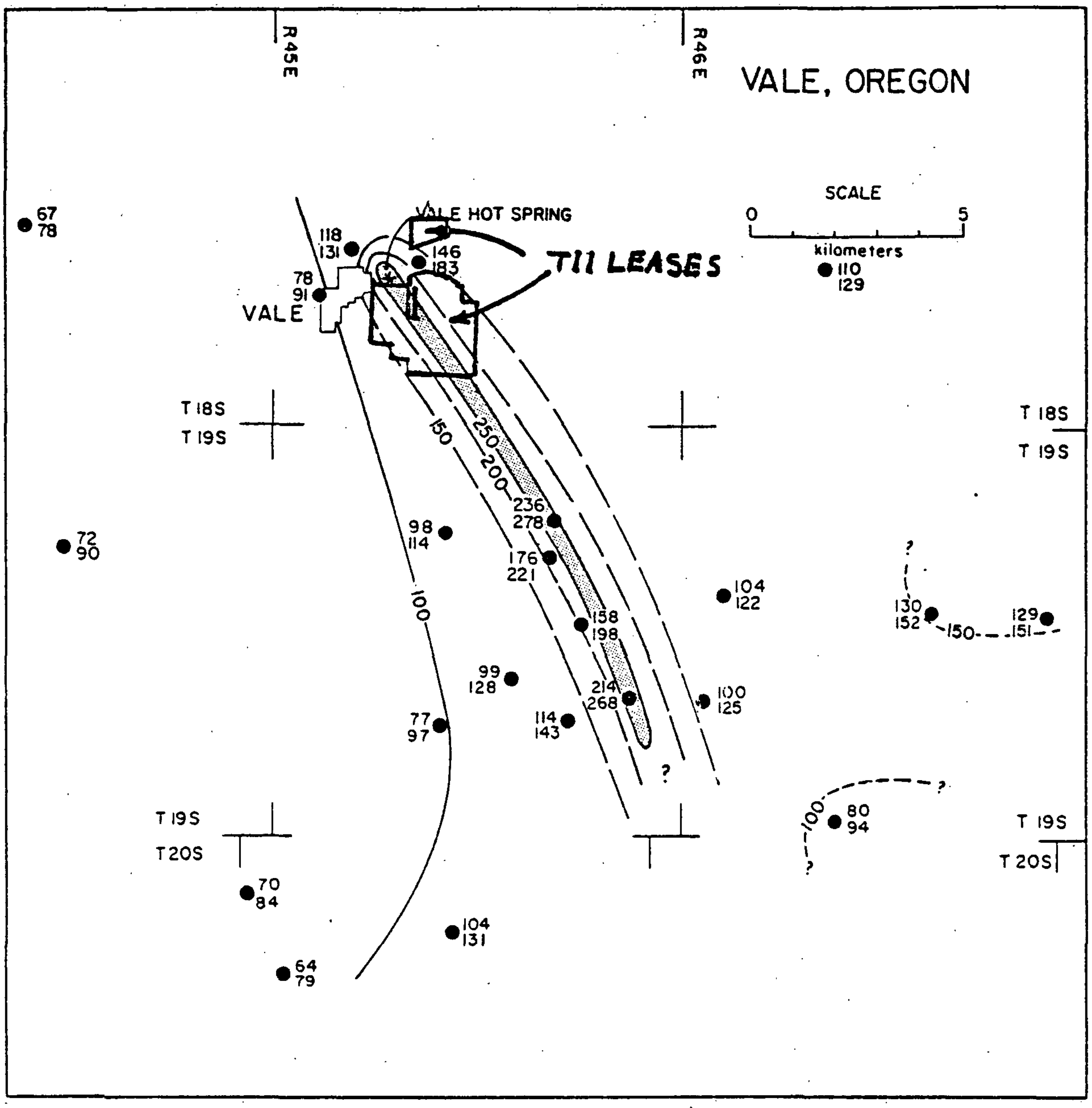


FIGURE 2 Heat flow in the Vale area, in relation to the TII property. Heat flow values are in mW/m^2, (Blackwell et al, 1978)

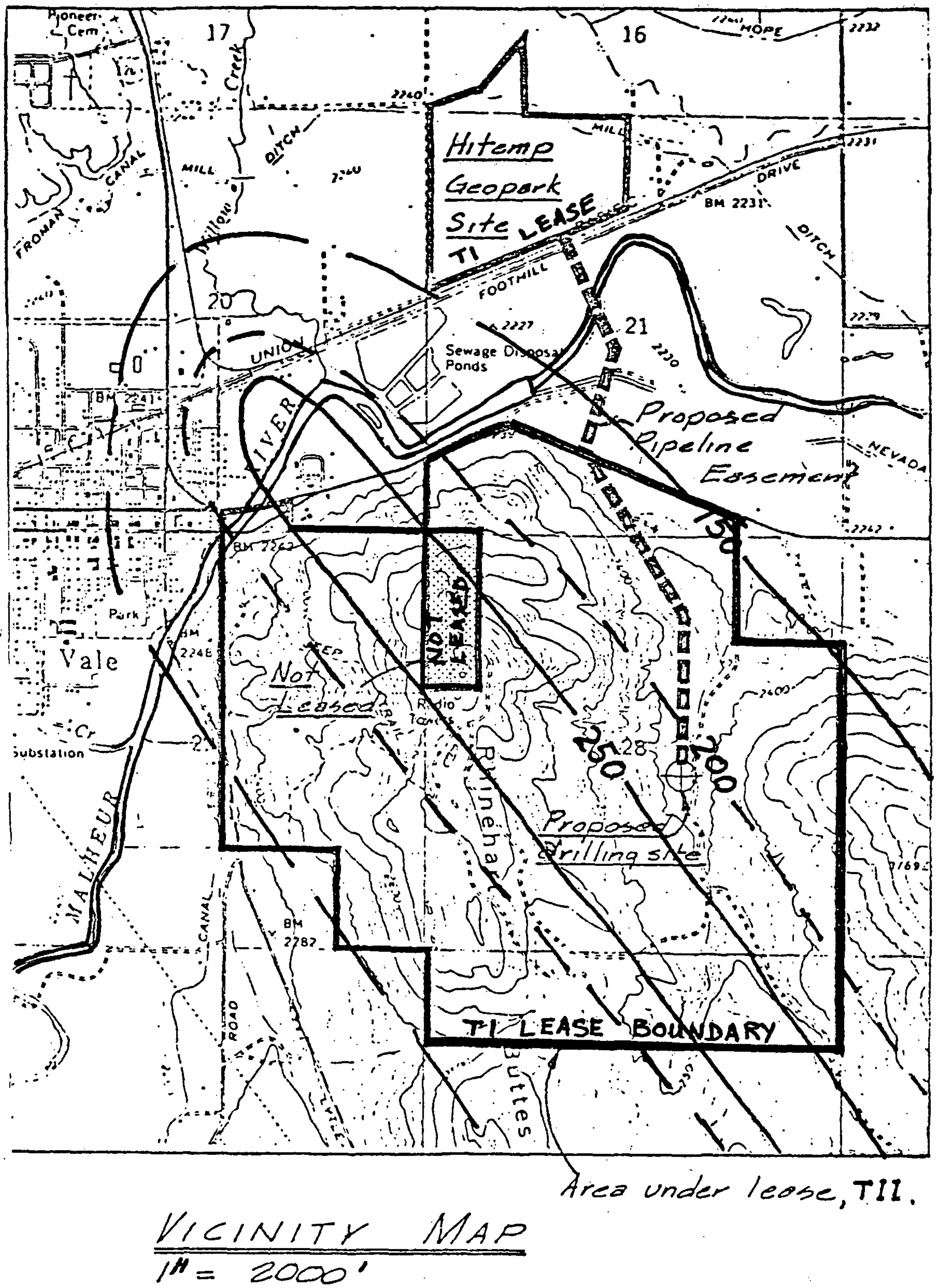


FIGURE 3 Map of the Technology International leases near Vale, Oregon, with heat flow contours in mW/m^2 superimposed (heat flow data source: State of Oregon).

reservoir which underlies the leaky reservoir and which provides heating of shallower reservoirs through conductive heating.

The regional heat flow map (Figure 4) shows that a large area around Vale is characterized by an anomalously high heat flow, centered around Vale itself. From the size of the high heat flow zone, the U.S. Geological Survey estimated that 8.7×10^{18} calories are in storage at reservoir depths in the Vale area. Based upon the available data, the U.S.G.S. concluded that the Vale area has a potential for electrical power production of 870 MW for 30 years. The MITRE corporation (Trehan et al, 1978) developed a detailed geothermal development scenario for Vale, under contract to the DOE. The scenario developed by MITRE suggests that the first 50 MW plant may come on stream by 1988, reaching a total of 800 MW on line by 2004.

The lease block held by Technology International is in a particularly favorable location from a point of view of likelihood of occurrence of a commercial geothermal resource under it, at least for direct heat uses, even though no wells have been drilled on the property as yet. The basis for this judgement stems from geological, geophysical and inferred hydrogeological data. The leasehold is dominated by the Rhinehart Buttes, an uplifted block of rock, which covers some 70% of the property, trending southeast, along the same axis of the high heat flow zone (Figure 3). The Buttes contain the silicified remains of now extinct hot springs. General experience suggests that silica deposition from hot springs is normally associated with geothermal systems whose reservoir temperature is 180 degrees C or greater. However, fossil hydrothermal silica deposits in themselves cannot be considered conclusive evidence without independent supportive data. That supportive data is manifested by the presently ongoing thermal spring activity and the heat flow data.

The complete Bouguer gravity maps of the region (Couch, 1977, Figure 5) corroborates that the Rhinehart Buttes is a horst block, supporting the geological evidence. An integration of gravity data with seismic reflection data obtained by the Oregon State University team (Couch, 1977), resulted in a northeasterly crustal section across Vale (Figure 6), showing the deduced rock densities. Figure 7 (from Couch, 1977) provides an interpretation of the local geology to a depth of about 5 km (3 miles), based upon the combined geological and geophysical data for the area.

SPECIAL PAPER NO. 4

FIGURE 4

HEAT FLOW MAP of OREGON

by Blackwell, D.D.; Hull, D.A.; Bowen, R.G.; and Steele, J.L.

1978

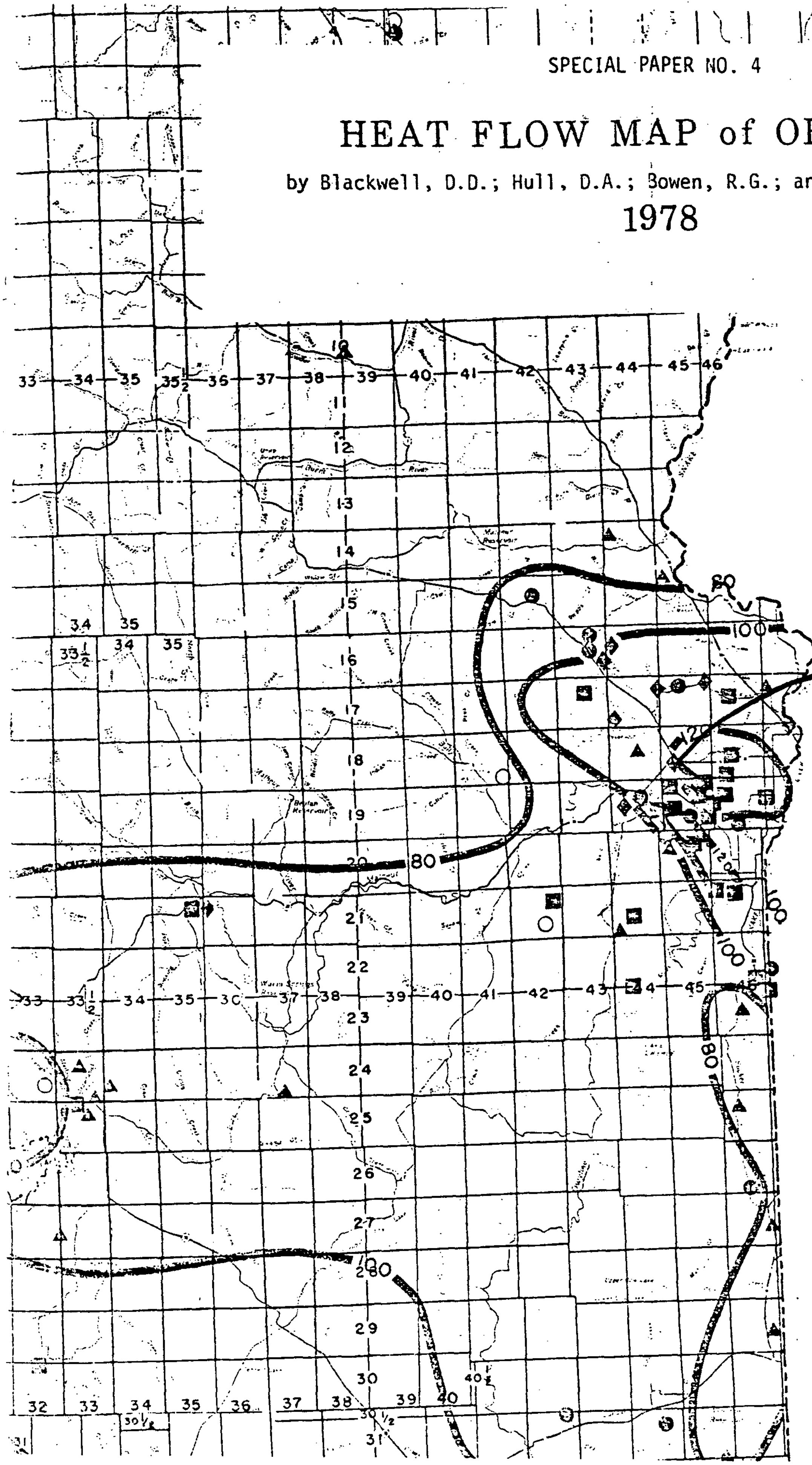


Fig. 4

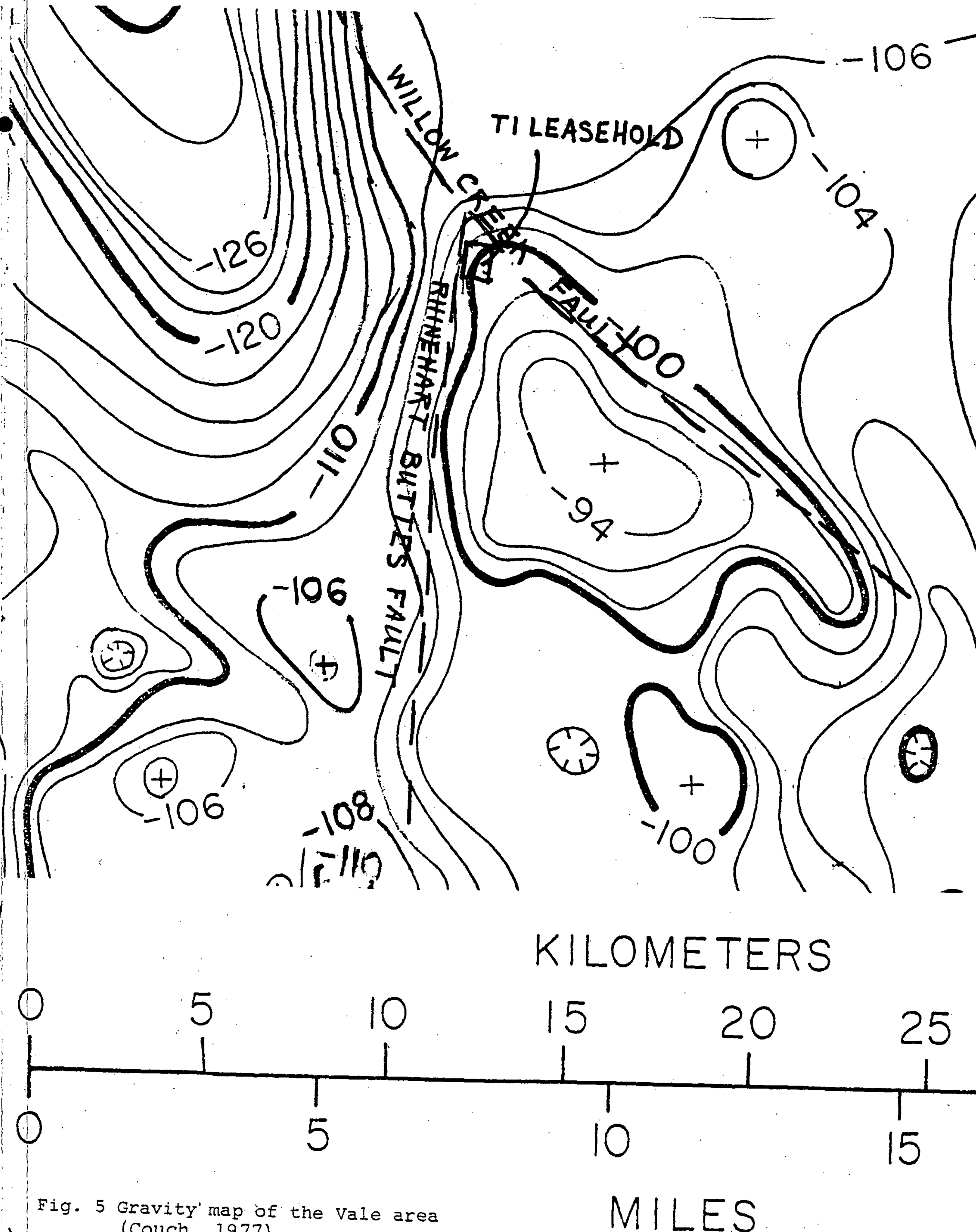


Fig. 5 Gravity map of the Vale area (Couch, 1977)

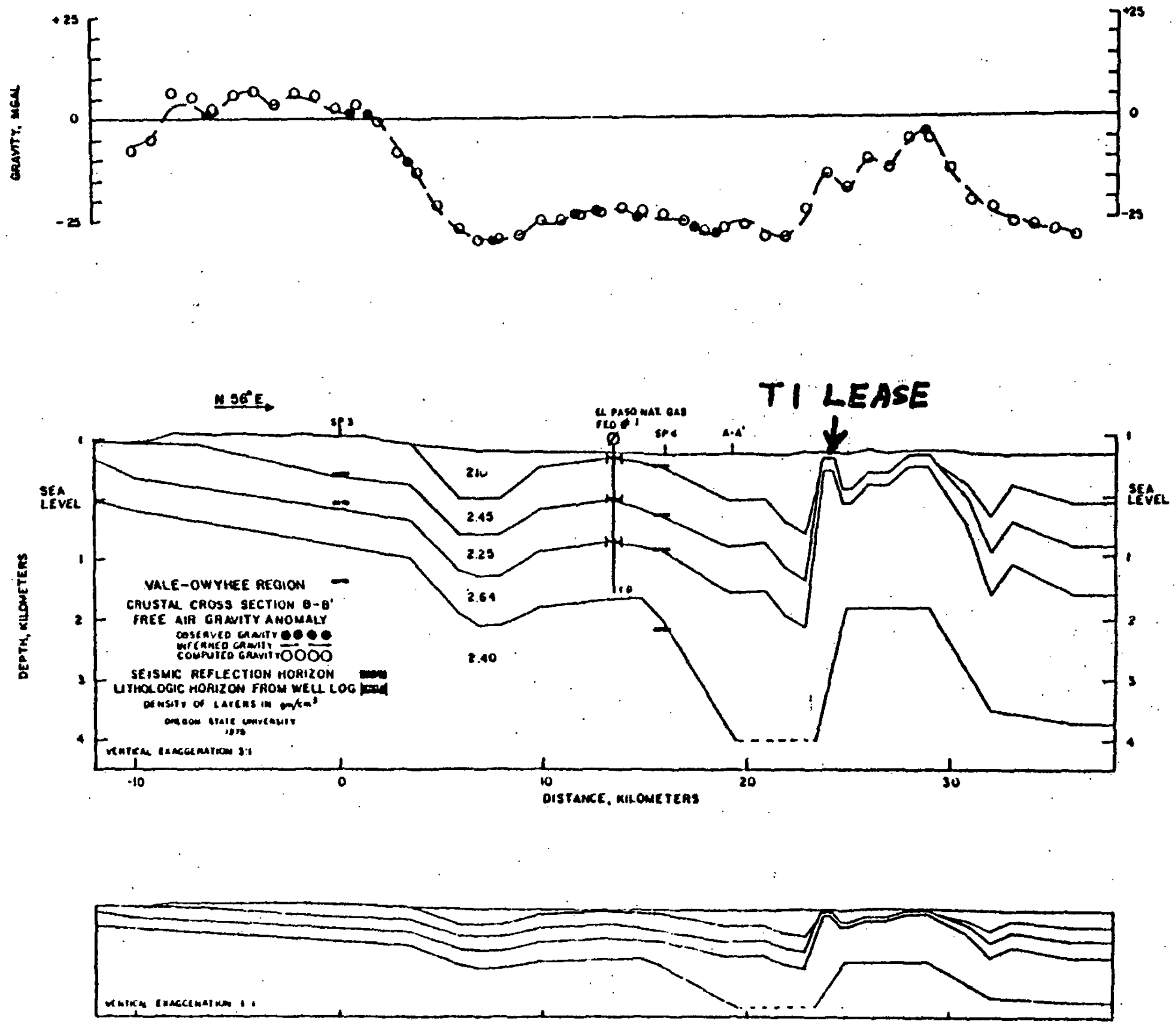
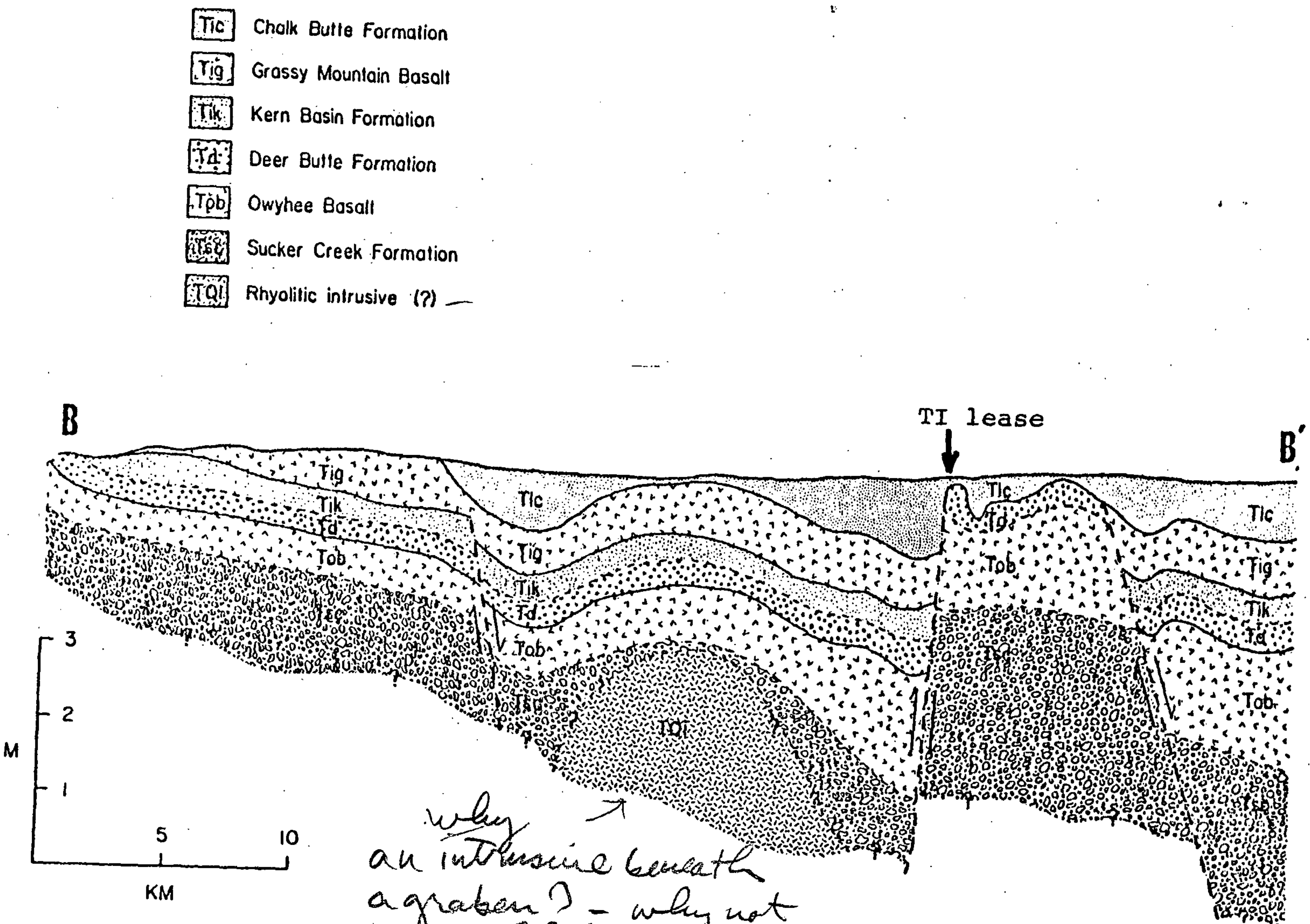


Figure 6. Geophysical cross section across Vale, SW-NE (Couch, 1977)



why an intrusive beneath a graben? - why not beneath the horst?

Figure 7. Geological cross-section, Northeasterly trending, across Vale (Couch,1977)

Models of the hydrothermal convection system in the Vale area may be inferred from the combined set of geological-geophysical and geochemical data. We tentatively suggest that the Rhinehart horst acts as a conduit for thermal water rising from a depth of about 4 km. The bounding faults act as conduits, along which hot water ascends from depth. There is probably no local magma chamber in the area, as evidenced from the depth to the Curie Point data, which is greater than 11 km at Vale (Couch, 1977). Instead, we hypothesize that the origin of the hydrothermal fluid in the TI lease area is from a downdip gravity flow of meteoric water, which descends into the subsurface on the mountainous region to the west, flowing downdip to the Rhinehart Buttes. At the Buttes, the water-bearing strata are stopped against the uplifted, impermeable rhyolitic intrusive. The water, having been heated and expanded in its eastward flow, rises along the permeable Rhinehart Fault, and spreads laterally into the Owyhee Basalt or other permeable strata, creating a number of geothermal reservoirs. These vertically stacked reservoirs decrease in temperature upward, because of conductive cooling and dilution by local downward flow of cold groundwater. Hence, it is reasonable to assume that at least two reservoirs of distinct temperature and chemistry may be encountered in the Vale area.

The depth to the reservoir which currently leaks to the surface in the Vale area is determined from the conductive heat flow data available in the area. A large number of holes, drilled for either uranium exploration or specifically for thermal gradient measurements, are available, as shown in Figure 2. These holes have been drilled to a depth varying from a few tens of meters to over 100 meters. Only the conductive gradient portion of each graph was utilized in the construction of the thermal gradient and heat flow maps. Thermal gradients in the TI lease area may be interp~~e~~olated from the data in Figure 2. They suggest that a gradient of 150-200 degrees C/km may be anticipated in the area of the TI leases. Hence, temperatures adequate for the operation of an ethanol plant may be encountered at a depth as shallow as 1500 feet. sp

A hole to a depth of 1500 feet will be drilled as part of a cooperative agreement between TI and DOE. The results of that program will be available to TI prior to the final selection of a drill site for the program which is outlined in this proposal.

As part of this proposed project, we intend to drill a deep exploration/production hole to a depth as great as 6500 feet, to tap any deeper geothermal aquifers which may occur in the Owyhee Basalt Formation, at a depth much greater than the geothermal aquifer which is believed to be present in the shallower Upper Idaho Group Formation or the Grassy Mountain Basalt Formation. It is likely that a hole of that depth would encounter a higher resource temperature than the 1500 foot hole which is about to be drilled shortly, thus ensuring a greater probability of success of the whole project.

1.2.2 Subsurface Geology

No detailed subsurface geology is available of the prospect as yet. This will be accomplished as part of the first phase of the exploration activity by TI in the PRDA. A general geological cross-section may be presently inferred from the few oil and gas test wells in the region, combined with the more recently completed geophysical studies by Couch (1977).

The anticipated stratigraphic column in the lease area, from top to bottom is as follows:

1. <u>Upper Idaho Group - Chalk Butte Formation</u>. This uppermost

layer consists of loosely consolidated tuffaceous conglomerate, sandstone and siltstone with lesser amounts of ash, fresh water limestone and diatomite. Deltaic features are dominant low in the section; and fluvial deposits with patchy diatomites and ?? limestones are present high in the section. Minor basalt flows of less than 10 meters in thickness may occur within the section (Beaulieu, 1972)[1]

The thickness of this formation is likely to be variable in the TII lease area, because of the horst effect. ?? Based upon Couch's compilation (1977) the thickness of the Chalk Butte Formation is estimated to be less than 200 meters at the Rhinhart Buttes, i.e., on top of the uplifted block, and over 500 meters on both flanks. Based upon the geophysical evidence, the amount of throw on the west side of the horst is likely to be greater than on the east side, amounting to as much as 1000 meters (3280 feet).

2. Grassy Mountain Basalt

The Grassy Mountain Basalt underlies the Chalk Butte Formation in the Rhinehart Buttes area. This formation consists of numerous basalt flows brown-gray to olive-green aphanitic to porphyritic olivine basalt interbedded with a variety of tuffaceous sediments of flurial and lacustrine origin (Beaulieu, 1972). The flows vary from 3 to 30 meters in thickness, and

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1. Beaulieu, John, 1972, Geologic Formations Of Eastern Oregon, Bull. 73, State of Oregon, Dept. of Geology & Mineral Industries, Portland.

the unit as a whole is 150 to 300 meters (500' to 1000') thick. The interbedded volcanic sediments consist primarily of vitric sandstone. The lowermost section within the formation consists of light-gray pumice, lapilli tuff, yellow-gray firable arkosic sandstone and volcanic conglomerates.

3. Kern Basin Formation

The Kern Basin Formation is assumed to exist on the flanks of the horst, but may be absent in the strata underlying the horst ~~it~~self (Couch, 1977).

How ?

The Kern Formation consists of loosely consolidated fluvial and lacustrine, tuffaceous, arkosic sandstone and siltstone with subordinate amounts of bedded tuff, ash, and massive breccia. Conglomerate derived from the underlying Deer Butte Formation and pumice lapilli tuff are common low in the formation. Arkosic sandstone is more common high in the formation. The thickness of this formation is not expected to exceed 600' in the prospect area.

4. Deer Butte Formation

The Deer Butte Formation consists of a series of soft tuffaceous siltstones, volcanic carbonaceous shales and altered vitric sandstones which grade into massive arkosic sandstone and well-cemented rhyolite-granite conglomerate high in the section. Total section thickness varies from 1000'to 2000' in general, but may extend beyond those limits locally. Thin olivine basalt flows and laharic breccia are locally developed in the middle of the section (Beaulieu, 1975).

5. Owyhee Basalt

The Owyhee Basalt Formation consists of a series of basalt flows. Colors range from dark gray and black to dusty red and scattered interbeds of tuff and ash are indicative of contemporaneous explosive volcanism in the area.

The total depth to the bottom of the Owyhee Basalt Formation is likely to exceed the proposed drilling depth. Hence, none of the deeper formations (Sucker Creek) are described here.

It is conceivable that a shallow geothermal reservoir is located in the Chalk Butte or Grassy Mountain Formations off the flanks of the horst, but may extend into the Owyhee Basalt within the horst area. The possibility of a dual-stacked reservoir system will be evaluated.

More detailed geochemical sampling and analysis may permit the determination of the source of the hydrothermal leakage manifestations in the spacings in the area.

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1.2.3 EXPLORATION TO BE CONDUCTED PRIOR TO THIS PROJECT

TI will conduct a comprehensive geoscientific and shallow drilling program prior to the initiation of the deep hole exploration program which is described in this proposal. The activities which are to be carried out by TI, as part of a cost-sharing program with the DOE (June, 1980 PRDA) include the following:

1. Data gathering and analysis

   A large body of geoscientific data exists for the Vale area. This data is to be gathered from the Oregon Division of Mines and Geology in Portland, the universities which were engaged in studies in the area, the U.S. Geological Survey, and private companies. This data will be gathered and analyzed. with what objectives or to answer which questions?

2. Aerial Photogeology and ground geology

   An analysis of aerial photographs will ? maybe permit a definition of faults and fracture zones. Ground geological reconnaissance will be conducted to identify features viewed on the photographs and map hydrothermally-related phenomena.

3. Hydrogeochemical survey

   Samples of thermal and cold springs will be collected for the lease area and the surrounding area. The samples will be analyzed at a commercial laboratory for the major and some minor constituents. An interpretation of the hydrothermal regime will be made, including refinement of postulated reservoir temperatures, and identification of probable zones of infiltration and upflow and the modeling of the geothermal system, in combination with the heat flow data.

4. <u>Thermal gradient survey</u>

Three to five thermal gradient holes to a depth of 100-300' will be drilled on the property to allow a more precise definition of the shape of the convection pattern of hot water in the subsurface. This data, in combination with the geological and geochemical data, will be utilized to model the hydrothermal system.

5. <u>Exploration hole drilling</u>

The thermal gradient drilling, in combination with the other data, will provide the necessary information as to the best location for the drilling of a full-diameter exploration hole. It is currently believed that the exploration hole depth required will be in the range of 500-600 meters. If the hole proves to be hot and productive, it will be completed as a regular production well. If not, it will be logged geologically and thermally, to provide additional data for assessment of the resource, and may be utilized as a reinjection hole in the program delineated in this proposal.

6. <u>Well testing</u>

The completed exploration well will be tested. A temperature log will be produced. The chemistry of water and gases will be analyzed. Flow rates will be determined.

7. <u>Final report</u>

Results of the geoscientific data of the TI-DOE cost-shared project will be summarized in a report describing all of the project's findings.

2.0 END USE

The proposed end use for this hydrothermal resource is a fuel alcohol "Gasohol" plant with an annual capacity of 4,500,000 gallons to be located on the proposer owned Vale KGRA Geo Park site.

2.1 OVERVIEW OF ETHANOL PRODUCTION PROCESS DESCRIPTION

The production process to be employed in the proposed plant includes some processes to be specially adapted for use with the hydrothermal resource. These site specific adaptations include a geothermally run continuous cooker process, geothermal adaptations and hookups for the distillation equipment and a geothermal byproduct feed drying system. These and other related adaptations are to be specifically developed under the Geothermal Gasohol PRDA recently awarded to the proposer. This work will all be completed and submitted to the DOE User Coupled project manager for evaluation and review prior to initiation of the User Coupled project and considerably prior to the due date for the PRDA Final Report.

As a result of the above situation, the proposed ethanol plant process flow schematics contained herein depict typical plant designs which the proposer currently markets for sale to industry. An exact configuration for the geothermally adapted system is not included pending the related in-house results of the PRDA study which are estimated to be available in February, 1981.

Process Flow Charts included herein are listed below and follow as inclusions under Section 2.1.2 Process Design Schematics. The process design schematics discussed in 2.1.2 include:

Under Section 2.1.2, approximate geothermal energy requirements are listed for the major process steps. Energy requirements are presented with temperature and flow rates and are tabulated in BTU's per hour.

2.1.1 PLANT SIZE, FEEDSTOCKS, AND PROCESS DESCRIPTION

The proposed end use will be a fuel alcohol "Gasohol" plant capable of producing approximately 4,500,000 gallons per year of fuel grade 198 (+) proof ethanol. The equipment will primarily include components of the Model 4500 plant size which is currently being marketed to the public by Ethanol International, Inc., a wholly owned subsidiary of the proposer. After completing a six-month market evaluation test period, Ethanol International, Inc. very recently began sending quotations out to potential plant purchasers. That subsidiary now has sent out quotations on more than One Hundred and Eighty Million Dollars ($180,000,000) of potential fuel alcohol plant sales to potential purchasers throughout the United States.

It is presently planned that major components for the end use plant will be purchased from a fabricator in California which has built distillation components and full beverage alcohol plants for more than twenty years. Since fuel alcohol plants are basically just less sophisticated forms of beverage alcohol plants, and since the proposed plant will use all standard items (except for special geothermal adaptations which will be based on available technology) this end use clearly is based upon proven technology which can be put into service with a minimum of startup difficulties. Those portions of the process requiring special adaptations will be designed under the PRDA awarded the proposer and submitted for DOE review in late January, 1981.

The end use Gasohol plant is being adapted for site specific use from standard designs to utilize several interesting site specific feedstock sources. These include potato wastes, cull potatoes, and sugar beet tailings, in addition to more traditional feedstocks available in the high agribusiness production Snake River Plain region such as corn, sugar beets, and barley. Analysis by Dr. Pearce Lyons and Oregon State University under the proposer PRDA will set the final design for the plant based upon feedstock availability and preparation equipment requirements.

The Gasohol plant will require 220 bushels per hour of corn feedstock or its equivalent and will produce approximately 625 gallons per hour of 198 (+) proof fuel alcohol and approximately 3,630 pounds per hour of high protein byproduct feed on a dry weight basis (from corn feedstock). Considerably different amounts of byproduct feeds result from non-corn feedstocks which questions will be addressed in the proposer PRDA. What follows is a 4,500,000 gallon fuel alcohol plant process description configured as such plants are being marketed by the proposer subsidiary.

Feedstock Preparation

Grain is taken from the bulk grain storage facility and ground in a hammermill to a size that will pass through a 20 mesh screen, and conveyed to a grain surge hopper. The ground grain is then transferred to a slurry mixing tank at a rate of 220 bushels per hour where it is mixed with liquid slops and water. The slops volume will be about one-third of the total slops-water volume.

Liquefaction

The resulting grain slurry is pumped into a pipe with mixing sections where a sodium hydroxide solution is added to adjust the pH of the solution to a pH which is best for action of the liquefaction enzyme. The liquefaction enzyme is then added to the solution. Since heat is necessary to free starch in the grain, heat is added to the slurry to raise the slurry temperature to at least 210°F. The slurry is held for a short while in the continuous cooker and is then cooled to 200°F to 210°F and held in a holding tank so the liquification enzyme has time to convert the starch to sugar.

<u>Saccharification</u>

The sugars are not yet easily converted to ethanol by yeasts. To correct this situation, the slurry is cooled to about 140° F, a dilute hydrochloric acid is added to bring pH down, and a glucoamylase is added to further convert the sugars in the solution to glucose. The slurry is held in a saccharification hold tank to allow time for the amylase to break down the sugars. The slurry is continuously agitated during liquefaction and saccharification steps to assure good contact with the enzymes.

Heat loads vary considerably during the heating-cooling cycle required prior to fermentation.

<u>Fermentation</u>

The slurry, now containing glucose, is cooled to 90°F, yeast is added and the slurry is pumped to tanks where fermentation takes place. Fermentation is allowed to proceed until the glucose is converted to ethanol. The final ethanol concentration is at least ten per cent by volume in the resulting beer which is an ethanol-water-grain slurry.

Four fermentation tanks are used so that the contents of one tank are always being distilled while another of the tanks is being filled or cleaned, and the other two are in various stages of fermentation. The tanks are sized so that each one holds a quantity of beer sufficient for 24 hours operation of distillation system. Since fermentation is exothermic, the beer is constantly circulated through external heat exchangers to control the temperature for optimum ethanol production.

Distillation

The ethanol is separated from the beer in a double column distillation unit. This is accomplished by heating the beer as it comes from the fermenter and injecting it into the stripping column to vaporize the ethanol (and part of the water). The temperature at the bottom of the stripping column must be equal to the boiling temperature of water at the column bottom pressure in order to remove the ethanol from the water. This is expected to be about 225°F at 4 psig.

The vapor is then contacted with liquid on each tray of the stripping column so that its ethanol concentration is increased. At the top of the stripping column, vapor is piped to the bottom of the rectifying column, and the liquid vapor contacting is repeated until the ethanol concentration reaches the azeotropic concentration - 192 proof. Approximately 15,000 BTUs per gallon of ethanol produced are required to separate the ethanol from the mash feed.

Azeotropic Distillation

The ethanol concentration cannot be increased above 192 proof in a conventional distillation process, so the overhead vapor from the rectifying column is fed into an azeotropic distillation system. Here, benzene is added to the ethanol-water mixture to break the azeotrope. The benzene-ethanol-water mixture can be separated by conventional distillation so that 99+ per cent ethanol is drawn off the bottom of the dehydration column. The overhead stream from the dehydration column contains ethanol, water and benzene. This stream is piped to a decanter, then to the benzene stripper column where the benzene is recovered, and the water and ethanol are returned to the rectifier for recycling. The bottom of the dehydration column must be kept at boiling temperature of ethanol and the bottom of the benzene stripper must be kept above the boiling point of benzene, about 190°F. Approximately 10,000 BTUs per gallon of anhydrous ethanol will be used in the anhydrous separation process.

Ethanol Product

The essentially pure ethanol removed from the bottom of the dehydration column is denatured and piped to the product storage tanks.

Byproduct Feed

Removing the ethanol from the beer in the stripping column leaves a grain-water slurry to be drawn off the bottom of the column. This stream also contains the yeast produced in the fermentation process. The solids in the stream contain approximately 30 per cent protein on a dry matter basis and will be used for animal feed.

Byproduct Drying

If the byproduct is not to be fed quickly as wet stillage, then in order to prevent spoilage of the nutrients in the stillage during long-term storage, the slurry must be dried to about 12 per cent moisture by weight. This requires the removal of about 40,000 pounds per hour of water and would require approximately 40 x 10^6 BTU/hr of water to evaporate at atmospheric pressure.

Heat Requirements Summary in BTU/HR

The exact heat requirement of the plant depends upon an evaluation of the capital cost of heat conserving drying equipment, the fouling characteristics of the geothermal water, the feedstocks used to make the alcohol, and the cost of the geothermal energy.

2.1.2 PROCESS DESIGNS SCHEMATICS WITH ENERGY USE

The plant process design schematics follow Figures 9A through 12 . Listed in Figure 13 are the process steps with predicted energy requirements. Figure 8 shows approximate hydrothermal fluid temperatures and flow rates.

These calculations are based upon process needs with the expected actual resource flow characteristics taken into account. The cooking process is the one place where preheating seems practical and hence the place where hot water can be used in significant amounts through heat exchange equipment after the steam/water phase separation. The actual proposed cook process

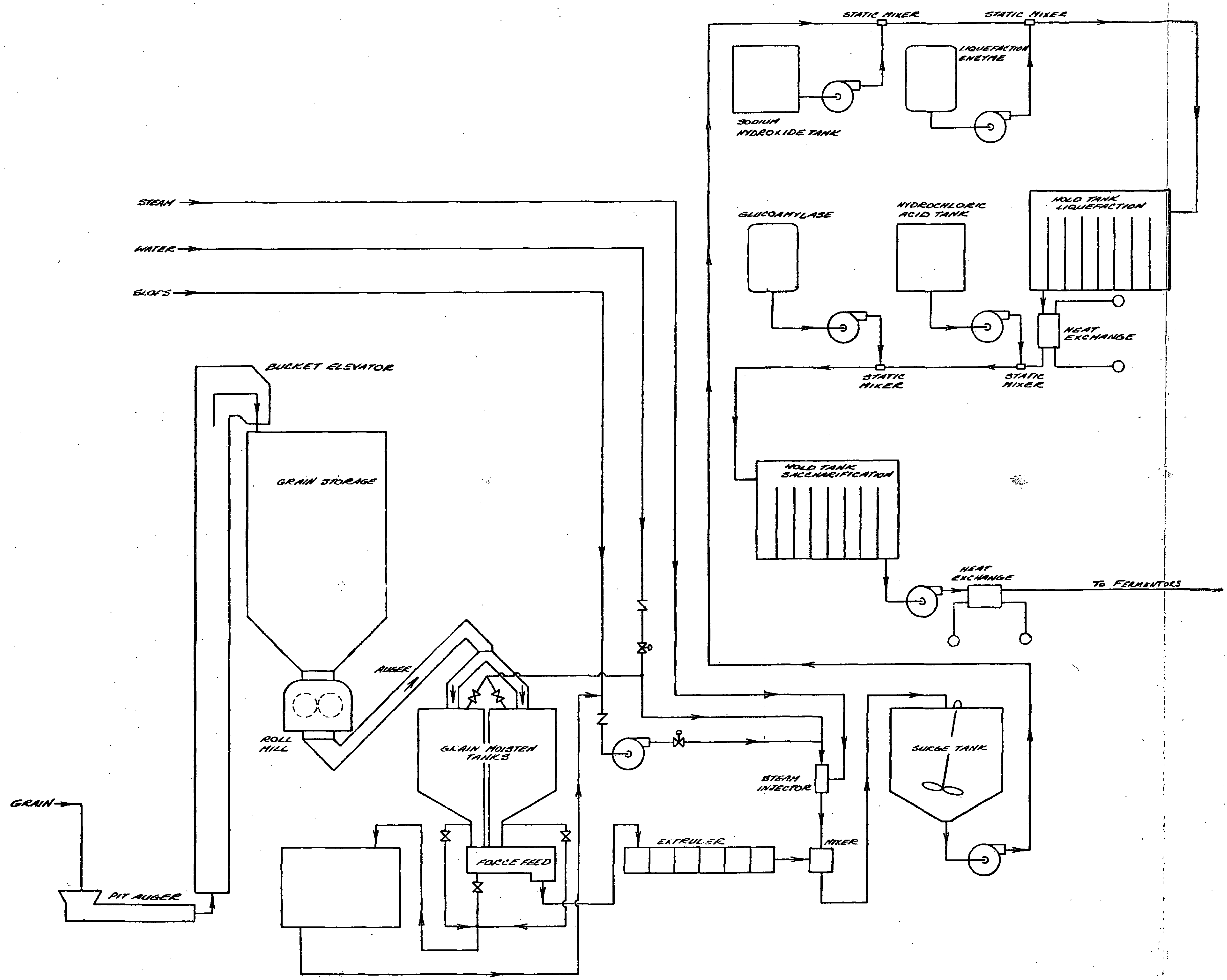
ENERGY REQUIREMENTS*

PROCESS REQUIREMENTS	Total BTU/Hr Required	Hydrothermal Steam @ 235°F	Hydrothermal Water @ 235°F
Cooking	5.0×10^6		5.0×10^6
Distillation (190 Proof)	8.5×10^6	7.4×10^6	1.1×10^6
Azeotropic Distillation	5.6×10^6	5.6×10^6	
By-Product Evaporation and Drying	20.0×10^6	20.0×10^6	
Miscellaneous Heat and Cleaning	1.0×10^6		1.0×10^6
	40.0×10^6	33.0×10^6	7.1×10^6
NON-PROCESS REQUIREMENTS			
Lifting From Resource (5000')	2.0×10^6		
Conductive Heat Loss (Well)	0.4×10^6		
Conductive Heat Loss (Transfer Pipe)	0.4×10^6		
Flashing & Process Losses	9.7×10^6		
	12.5×10^6		
TOTAL WITHDRAWN		52.6×10^6 BTU/Hr	

*Data on requirements and temperatures from (---PRDA---)

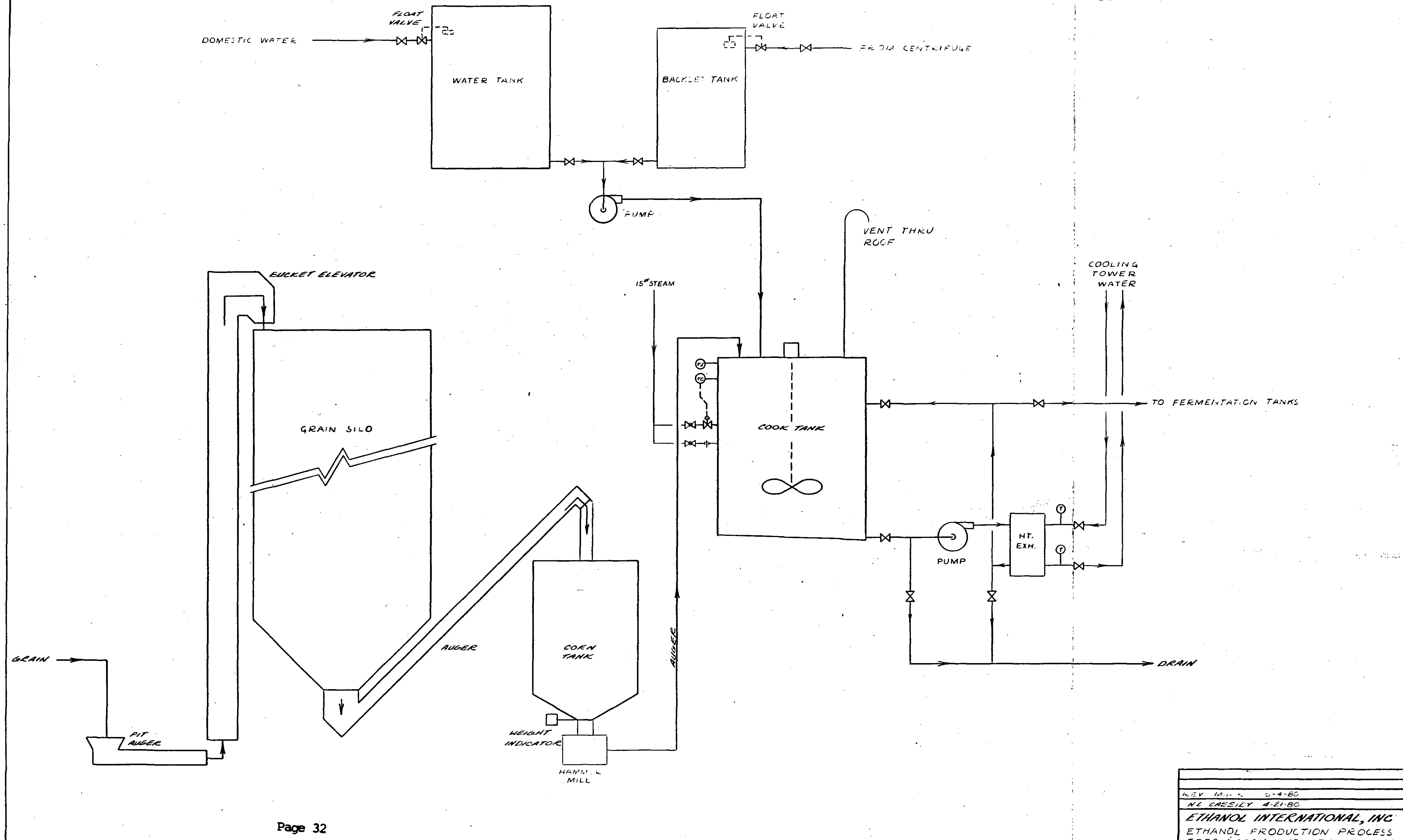
FIGURE 8

FIGURE 9A



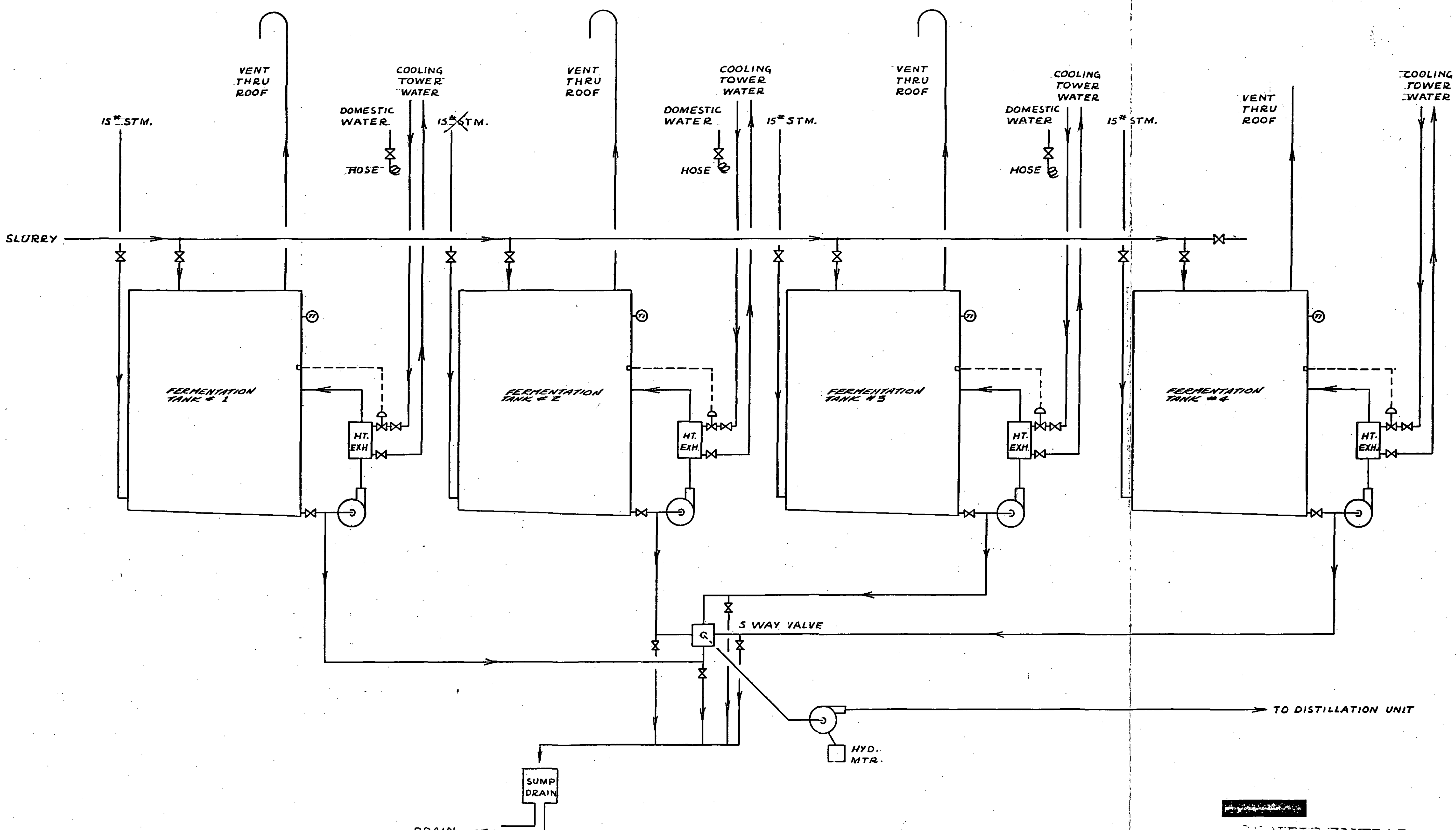
FUEL ALCOHOL PLANT PROCESS FLOW CHART
PROCESS UTILIZING TYPICAL EXTRUSION COOKING SYSTEM
NL CASSIDY 5-10-80
Ethanol International, Inc. 5350 South D.T.C. Parkway Englewood, Colorado 80111

FIGURE 9



FLOAT VALVE
DOMESTIC WATER
WATER TANK
FLOAT VALVE
FROM CENTRIFUGE
BACKSET TANK
PUMP
VENT THRU ROOF
BUCKET ELEVATOR
15# STEAM
COOLING TOWER WATER
GRAIN SILO
COOK TANK
TO FERMENTATION TANKS
HT. EXH.
PUMP
AUGER
CORN TANK
AUGER
GRAIN
DRAIN
PIT AUGER
WEIGHT INDICATOR
HAMMER MILL
NL CASSILY 4-21-80
ETHANOL INTERNATIONAL, INC
ETHANOL PRODUCTION PROCESS
FEED & COOK SCHEMATIC DIAGRAM

FIGURE 10



[redacted]

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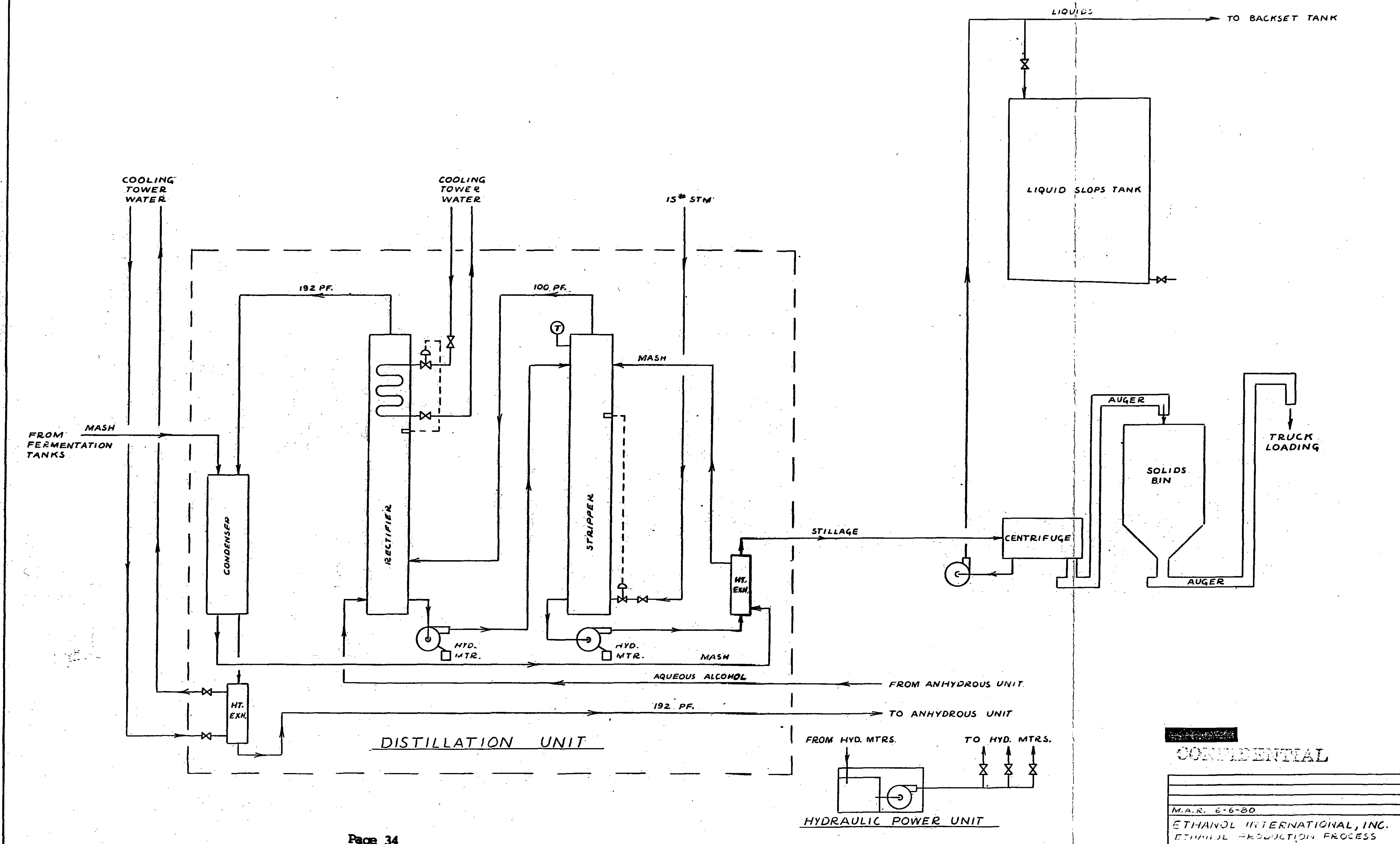
M.A.R. REV. 6-4-80
N.L CASSIDY 6-6-80
ETHANOL INTERNATIONAL, INC.
ETHANOL PRODUCTION PROCESS
FERMENTATION SCHEMATIC DIAGRAM

FIGURE 11



LIQUIDS
TO BACKSET TANK
LIQUID SLOPS TANK
COOLING TOWER WATER
COOLING TOWER WATER
15# STM
192 PF.
100 PF.
MASH
FROM FERMENTATION TANKS
MASH
CONDENSER
RECTIFIER
STRIPPER
HT. EXH.
STILLAGE
CENTRIFUGE
AUGER
SOLIDS BIN
AUGER
TRUCK LOADING
HYD. MTR.
HYD. MTR.
MASH
AQUEOUS ALCOHOL
FROM ANHYDROUS UNIT
192 PF.
TO ANHYDROUS UNIT
HT. EXH.
DISTILLATION UNIT
FROM HYD. MTRS.
TO HYD. MTRS.
HYDRAULIC POWER UNIT
[redacted]
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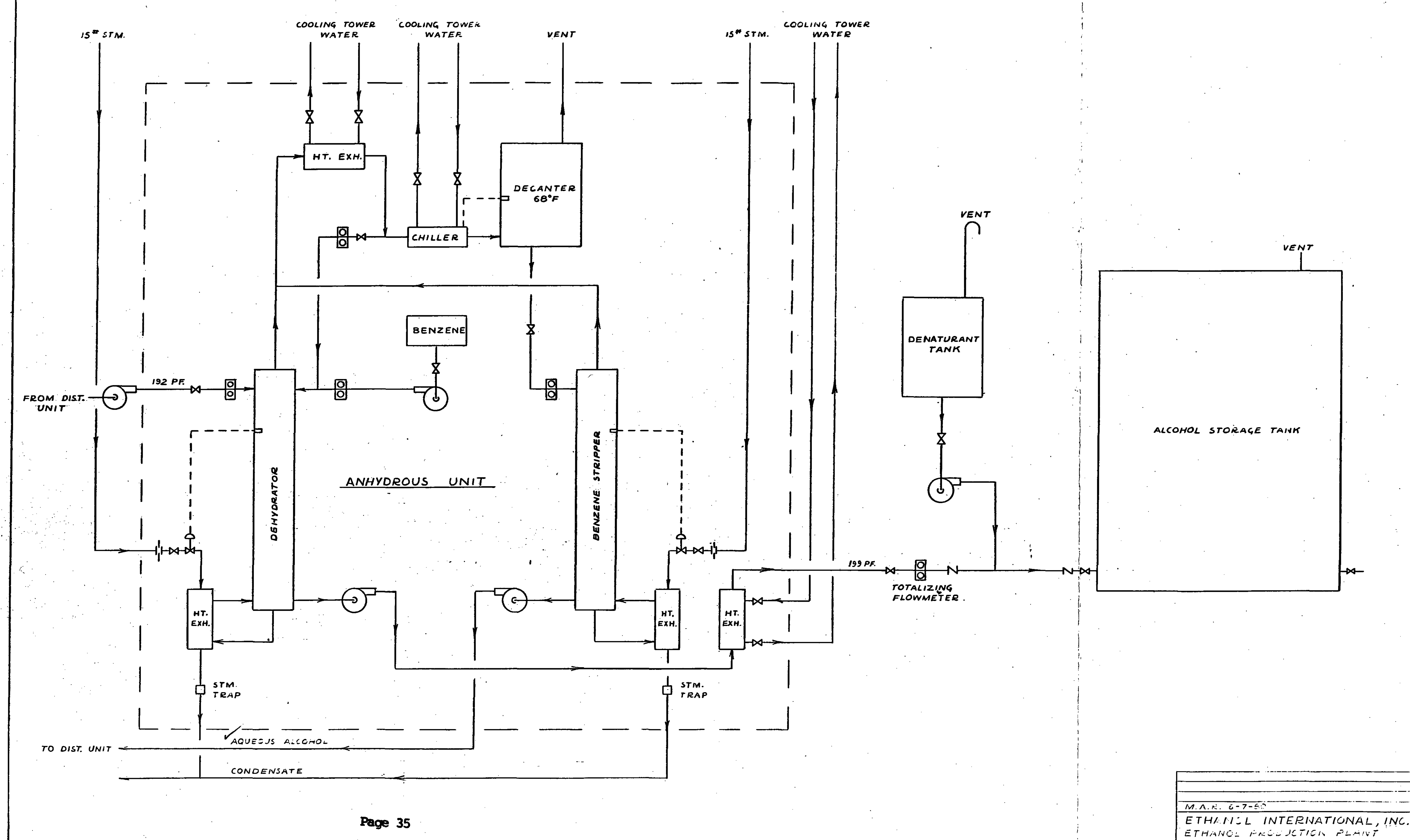
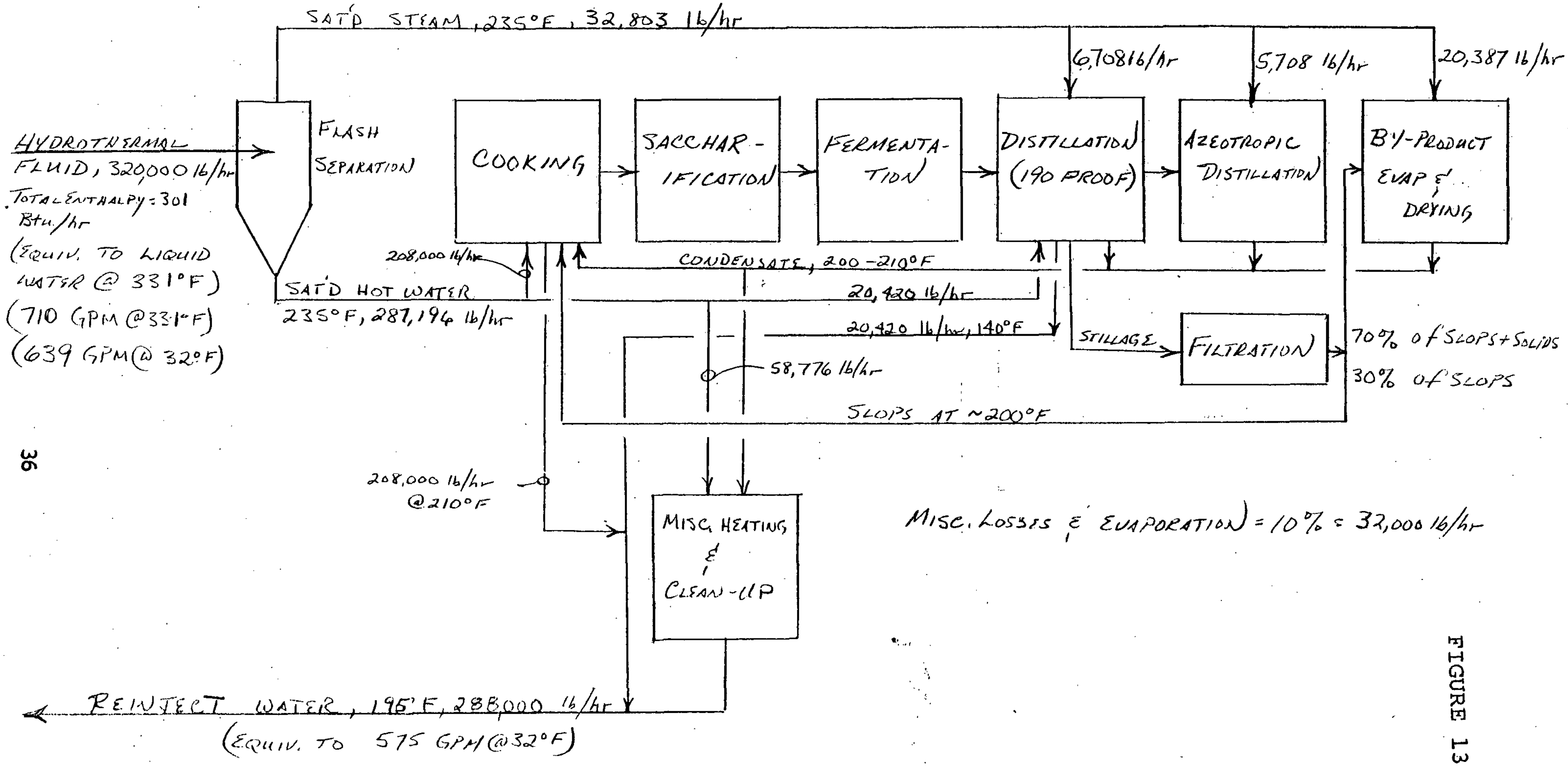
M.A.R. 6-6-80
ETHANOL INTERNATIONAL, INC.
ETHANOL PRODUCTION PROCESS
DISTILLATION SCHEMATIC DIAGRAM

FIGURE 12


15# STM.
COOLING TOWER WATER
COOLING TOWER WATER
VENT
15# STM.
COOLING TOWER WATER
HT. EXH.
DECANTER 68°F
CHILLER
VENT
VENT
BENZENE
DENATURANT TANK
192 PF.
FROM DIST. UNIT
DEHYDRATOR
ANHYDROUS UNIT
BENZENE STRIPPER
ALCOHOL STORAGE TANK
199 PF.
TOTALIZING FLOWMETER
HT. EXH.
HT. EXH.
HT. EXH.
STM. TRAP
STM. TRAP
AQUEOUS ALCOHOL
TO DIST. UNIT
CONDENSATE
INTERNATIONAL, INC.
ETHANOL
DIAGRAM



PROCESS SCHEMATIC - TENTATIVE
W/ ENERGY REQUIREMENTS/SOURCES

FIGURE 13

will be continuous cooking which will be adapted under the PRDA as was described in section 2.1.1.

As described the geothermal continuous cooker system will be developed under the PRDA. The energy requirements are, on the average, approximately equal to the average batch cook energy requirements. The continuous cooker will be used because it is also standard equipment and because use of batch cooking has some large peak load requirements which are less desirable from systems efficiency standpoints.

The byproduct drying system will be designed under the PRDA and will be available for in-house and DOE evaluation by late January, 1981. Approximate energy requirements are known however and are listed above in the energy requirements chart.

2.1.3 Process Energy Requirements And Plot

A plot showing the process energy requirements for the user-coupled ethanol production plant is presented as Figure 14 . Energy usages are distributed between the five major energy consuming process steps.

As a basis for sizing the proposed user-coupled ethanol plant, it has been estimated that the geothermal reservoir should be capable of producing approximately 320,000 pounds per hour of water at 340^{0}F from the 5,500 foot level of a proposed 6,500 well. Pending further exploratory work, these parameters are best estimates based currently available data.

After accounting for energy requirements and losses entailed in delivery of this water to the enthanol plant site, it is anticipated that the hydrothermal fluid will consist of a two phase mixture of steam and water at approximately 260^{0}F. Tentatively, this mixture will be expanded to approximately 9psig to yield steam and hot water at 235^{0}F.

The previously discussed PRDA contract includes comprehensive analysis of the engineering and economic trade-offs to determine the optimum investments in heat exchange equipment versus hydrothermal resource capacity. Therefore, exact ratios and desired temperatures of steam and water cannot presently be defined. Further, the specific types and arrangements of heat exchange equipment for closed loop (indirect)

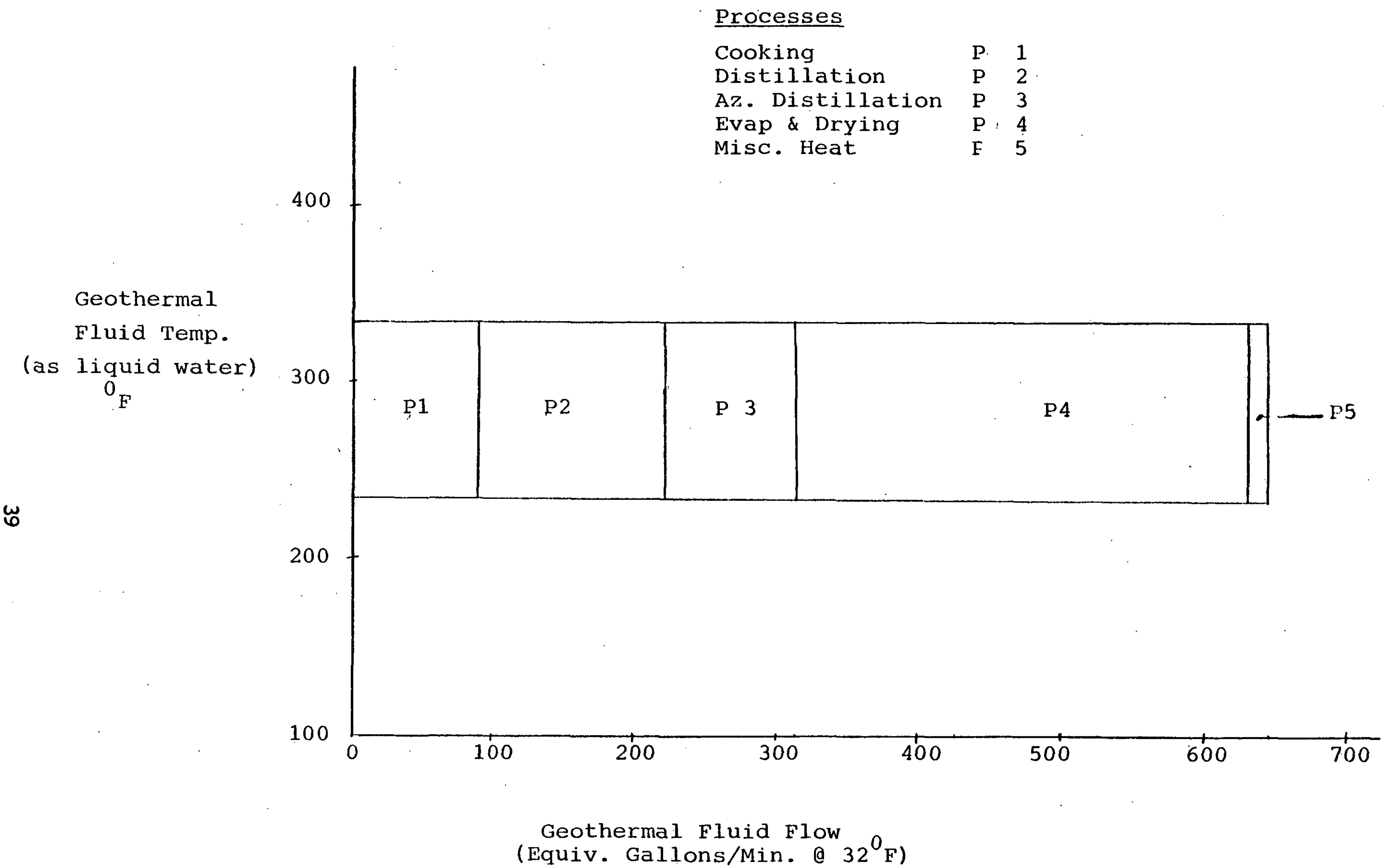


FIGURE 14

Process Energy Requirement

heating, heat recycing, etc. will be more precisely defined when data are available regarding the hydrothermal fluid impurities.

The minimum usable temperature (235^{0}F) on which this proposal is based,is predicated on the minimum temperature of about 225^{0}F required in those process steps where steam will most likely be used as the heating media. As previously emphasized, this temperature may shift up or down depending on the results of heat exchanger costs analysis. Shifts in the base temperature will primarily effect the ratio of steam to water.

A further variable to be studied in the PRDA contract is the total heat requirement. It was estimated that the total heat requirement could range from a minimum of 24.1 x 10^6 to 68.6 x 10^6 BTU/Hr, depending upon the extent to which heat recovery exchangers and vapor recompression equipment prove economical.

The proposed cost share plot , is therefore, developed on the premise that complete success from the geothermal resource is represented by a flow of 640 GPM (320,000 pounds per hour) at 331^{0}F wellhead temperature which will yield the expected nominal process heat requirement of 40/1 x 10^6 BTU/Hr. It is estimated that at 30% of the specified energy availability, or at fluid wellhead temperatures below

235^0F, the venture would be considered totally unsuccessful for the purposes of supplying a user-coupled ethanol production facility.

2.1.4 PREDICTED UTILIZATION FACTOR

The proposed ethanol production facility will be designed to operate 24 hours per day 330 days per year which represents 90% utilization.

2.1.5 PREDICTED AVERAGE GROSS HYDROTHERMAL ENERGY USE

Assuming the 90% utilization factor at a nominal plant energy requirement of 40.1×10^6 BTU/Hr, the plant energy consumption will be 3.18×10^{11} BTU/Yr. If this energy were supplied by steam boilers at 80% overall thermal efficiency, the fuel requirement would be 3.97×10^{11} BTU/Yr. This fuel requirement is equivalent to 67.5 million barrels of fuel oil per year.

Estimates of non-process losses and heat content of the reinjected hydrothermal fluid show that the net heat withdrawn from the geothermal resourse will approximately 4.16×10^{11} BTU/Yr.

2.1.6 Description of Major Energy System Components

There are three major component systems in the fuel alcohol plant which will utilize hydrothermal energy. The major components are:

1. Continuous Cooking System
2. Distillery and Anhydrous Alcohol System
3. Byproduct Drying System

Continuous Cooking System (Corn)

1. Slurry (mixing) tank, materials of construction are stainless steel fitted with turbine type agitators driven by explosion proof, 3 phase, 60 Hz, 230/460 volt motors. Enzyme and water metering components are included, construction is of stainless steel.

2. Continuous cooking system complete with positive displacement pump driven by a TEFC, 3 phase, 60 Hz, 230/460 volt hand operated variable speed drive, steam injector, check valves, automatic steam valve, temperature controller, back pressure valve and flash chamber. All product wetted surfaces are of stainless steel.

3. Starch conversion tanks fitted with turbine type agitators driven by TEFC, 3 phase, 60 Hz, 230/460 volt motors. External heat exchangers of tube in shell design. Enzyme and water metering equipment, pumps with TEFC, 3 phase, 60 Hz, 230/460 motors. Product wetted surfaces of stainless steel.

Utilities Required:

Fresh Water:	Approximately 20 gallons per bushel
Slops:	Back sloping up to 30 per cent

Electrical: Approximately 145 HP

Cooling Water: Approximately 900 GPM @ 80°F

Steam or Hot Water: Approximately 11 x 10^6 Btu/hr (5 x 10^6 Btu/hr with preheated make-up water)

Raw Material: Approximately 220 bushels per hour corn (or equivalent)

* Suitable for other feedstocks and fuels with modifications to process, as planned under proposed PRDA project.

<u>Double Column Distillery With Economizer</u>

1. Stripping Column of stainless steel construction (60 inch).

2. Rectifying Column of stainless steel construction (60 inch).

3. Dephlegmater with stainless steel shell and tube sheets, copper tubes and mild steel water boxes. Tube in shell design.

4. Float tank of stainless steel construction.

5. Vacuum/pressure bottles of stainless steel construction.

6. Steam sparger of stainless steel construction.

7. Preheater tube in tube design of stainless steel construction.

8. Pumps for reflux to stripping column, (reflux to) rectifying column, fusel oil and product all centrifugal design with explosion proof motor, 3 phase, 60 Hz, 230/460 volt.

9. Vent cooler, tube in shell design, copper tubes with stainless steel shell and tube sheets.

10. Product cooler plate type unit, product wetted sur-

faces of stainless steel.

11. Fusel oil cooler, tube in shell design with copper tubes and stainless steel shell.

12. Flowmeters for feed, refluxes, fusel oil and product; proof tester for product as well as thermometers and gauges for monitoring critical process points.

13. Automatic valves for steam and product as well as automatic controls.

<u>Utilities Required</u>:

Electrical:	Approximately 35 HP
Steam:	Approximately 9.5 x 10^6 Btu/hr without distillation economizer 8.5 x 10^6 Btu/hr with Economizer)
Cooling Water:	Approximately 600 GPM @ 80°F

<u>Process Streams</u>:

Feed:	Approximately 6,250 GPH @ 10 per cent alcohol by volume
Product:	Approximately 600 GPH @ 190° proof
Slops:	Approximately 135,000 gallons per day with 8 per cent to 10 per cent solids.

Anhydrous Alcohol System

1. Dehydrating and benzene stripping columns are of stainless steel construction.

2. Dephlegmater tube in shell design with stainless steel shell and tube sheets, copper tubes and mile steel water boxes.

3. Benzene decantor of stainless steel construction.

4. Reboilers for dehydrating and benzene columns are of tube in shell design with stainless steel tube sheets, copper tubes and mild steel shells.

5. Coolers are furnished for product and low alcohol streams.

6. Thermometers and gauges for monitoring critical process points.

7. Flowmeters for product, feed, benzene and reflux and stripping column are furnished.

8. Pumps with explosion proof motors for product, reflux and return are provided with 3 phase, 60 Hz, 230/460 volt connections.

Utilities Required:

Electrical:	Approximately 7½ HP
Cooling Water:	Approximately 800 GPM @ 80°F
Steam:	Approximately 5.6×10^6 Btu/hr
Product:	198°+ proof is guaranteed with a feed of 190° proof.

2.1.7 FLUID DISPOSAL SYSTEM DESIGN

The design of the fluid disposal system will be prepared in a preliminary fashion at the time of the site selection for the deep exploration/production hole, and will be revised after the completion of the initial tests of the well.

Ideally, the 1500' hole planned to be drilled and completed prior to the start of this project would be sufficiently close to the deeper hole planned for this project. In that case, it would serve the dual purpose of a monitoring well during well testing and of a disposal well after the end of well testing. The probability that the 1500' hole would be located in the proximity of the best site for deep drilling is high, because the 1500' hole will be located in the area deemed to be most promising for encountering the geothermal reservoir at its shallowest, based upon preceding geological, geochemical and temperature gradient drilling in the area.

The 1500' well will be adequate as a disposal site during long term testing, or for reinjection of that liquid portion of the water which is not utilized for heating at the alcohol plant site.

If any substantial amount of water would have to be disposed of at the plant site, after extraction of heat, an evaluation of the quantity and quality of fluid to be disposed would have to be evaluated The possibility of disposal of the waste water via evaporation ponds, discharge into the nearby river on reinjection at a depth below the fresh water aquifer would have to be determined in light of the chemistry of the water, quantity and the appropriate regulations which govern disposal of that water.

3.0 FINANCIAL FEASIBILITY

The financial feasibility of this project rests upon the very intriguing economics of fuel alcohol production. The financial information which follows incorporates data included in the successful proposed PRDA submission. Figures have been modified to assume that a deep well must be drilled at the site if the 1,500 foot well to be drilled by the proposer under the PRDA does not produce sufficient temperatures or flow rates for the fuel alcohol plant.

3.1 PROJECT CAPITAL REQUIREMENTS

The estimated total project capital requirements for this project after the user coupled deep well program has been initiated will increase within an estimated range of additional capital costs. Project capital requirements are listed below based upon two different assumptions. At the minimum end of the range it is assumed that drilling will proceed smoothly and the drilling contingency funds will not be required, that an expensive new drilling site will not be required, that an expensive reinjection well ($200,000) will not be required and that certain other estimates will be at the minimum estimated levels also. The top end of the estimated range assumes just the opposite and comprises the estimated maximum levels of total project expenditures. These cost estimates start with the PRDA recently awarded the proposer and include all resource costs through reservoir confirmation in addition to estimated end user related project costs.

Cost Category:	Estimated Minimum	Estimated Maximum
PRDA DOE Study Share Cost	$ 123,183	$ 123,183
PRDA Proposer Paid Exploration Well	134,640	134,640
User Coupled Production Program	1,067,770	1,472,146
Geo Park Transmission Pipeline	300,000	300,000
Two Phase Separation System	50,000	50,000
Gasohol Plant Cost (In Place)	4,275,000	4,275,000
Estimated Capital Costs	$5,950,600	$6,355,000

Project financing costs assumptions are included in the estimated cash flow means statement included under section 3.3 below.

3.2 PROJECTED REPLACEMENT COSTS

Based upon plant depreciation charges the proposer will be allowing approximately $610,700 to allow for plant replacement plus total miscellaneous expenses of $360,000. The allowance for geothermal equipment depreciation is approximately $105,000 plus total cost of geothermal energy as an expense item is estimated at approximately $230,000. These amounts are considered to be substantially in excess of expected costs of all replacement and maintenance functions. Refer to section 3.3.

3.2.1 FUEL ALCOHOL MARKETING AND ECONOMICS

Fuel alcohol is, of course, a segmented market product. Various proofs of alcohol have various uses. By way of example, 100 proof fuel alcohol may be turbo-injected into the air injection system of diesel engines using commercially available off-the-shelf products, and then replace 30 per cent to 40 per cent of engine requirements.

There is an emerging major market for Gasohol composed of 90 per cent gasoline and 10 per cent 199+ proof fuel alcohol. In fact, a recent Department of Energy forecast stated that 4.3 per cent of the 1981 gasoline consumption in the United States would be supplied by the emerging Gasohol industry. Today, the United States consumes about 110 billion gallons of gasoline annually. At a 10 per cent ratio, this represents a potential market for 11 billion gallons of fuel alcohol. Virtually all automobiles can utilize 20 per cent Gasohol with few, if any, minor adjustments. This means that the current market for fuel alcohol, as a gasoline mixing agent alone is 22 billion gallons.

Brazil estimates that 300,000 new vehicles will be built and sold this year to operate on straight 190 proof alcohol. Manufactureres of the higher compression vehicles include Ford Brazil. Starting problems have been solved in a variety of ways from use of preheaters to small cheap ether or gasoline startup injection systems. General Motors has announced publicly available multi-fuel engines for 1981. Other special engine companies and racing users have been utilizing alcohol fuels for years. In fact, the main tanks in the Ford autos of the 1920's and early 1930's were alcohol fuel tanks and the reserve was designed for gasoline. Lack of tax incentives equal to the hydrocarbon industry killed the growing alcohol industry at that time. Those tax incentives are in place now and, in fact, were extended at the Federal level to 1992.

3.3 PROJECTED ANNUAL OPERATING COSTS

The figures listed below are revised projected cash flow and income statement estimates which have been somewhat changed from the earlier PRDA proposal. The most significant change is the increased geothermal well cost estimate to reflect a well cost as proposed herein which is increased over the well cost estimate of $400,000 which was arbitrarily included in the PRDA.

The first two years of operation are estimated with two assumptions. In the first instance under "Minimum Costs" it is assumed that the well costs do not require expenditure of contingency amounts listed in the user coupled proposal. The second two year estimates entitled "Maximum Costs" assume that all contingency costs described will be utilized. Both cases assume that DOE will pay 20 per cent of production well and reinjection well costs (if required).

FIGURE 15

TECHNOLOGY INTERNATIONAL, INC.

PRELIMINARY CASH FLOW AND INCOME STATEMENT ESTIMATES FOR PROPOSED GEOTHERMAL FUEL ALCOHOL PLANT

(All Dollars in Thousands)

	Minimum Costs		Maximum Costs	
CAPITAL COST REQUIREMENTS:	Year One	Year Two	Year One	Year Two
PRDA Proposer Paid Exploration Well	$ 134	$ 134	$ 134	$ 134
User Coupled Production Well Cost (1)	1,068	1,068	1,472	1,472
Geo Park Transmission Line and Separation	350	350	350	350
Gasohol Plant Cost (In Place) (2)	4,275	4,275	4,275	4,275
	$ 5,827	$ 5,827	$ 6,231	$ 6,231
CORN FEEDSTOCK COST (PER GALLON):				
Corn Cost Per Bushel (3)	$ 2.60	$ 2.60	$ 2.60	$ 2.60
Less: Byproduct Credit (4)	1.10	1.10	1.10	1.10
Net Feedstock Cost per Bushel	1.50	1.50	1.50	1.50
Divide by Alcohol per Bushel	2.5	2.5	2.5	2.5
Net Feedstock Cost per Gallon	$ 0.60	$ 0.60	$ 0.60	$ 0.60
ANNUAL ALCOHOL OUTPUT (Gallons):	4,500	4,500	4,500	4,500
Multiply by: Sales Price per Gallon (5)	1.80	1.80	1.80	1.80
Gross Revenues	8,100	8,100	8,100	8,100
Less: Distribution Costs (6)	405	405	405	405
PRODUCER'S GROSS REVENUES	$ 7,695	$ 7,695	$ 7,695	$ 7,695
LESS: OPERATING EXPENSES:				
Feedstock Costs	2,700	2,700	2,700	2,700
Electric and Fuel (Geothermal)	270	270	270	270
Enzymes and Yeast (8)	360	360	360	360
Property Tax, Ins., Bond, Misc.	360	360	360	360
Labor Charges (9)	405	405	405	405
TOTAL OPERATING EXPENSES	$ 4,095	4,095	$ 4,095	$ 4,095
INCOME BEFORE DEBT SERVICE	3,600	3,600	3,600	3,600
Less: Interest (10)	446	446	487	487
Less: Principal	227	227	248	248
NET PRE-TAX INCOME	2,927	2,927	2,865	2,865
Plus: Principal	227	227	248	248
Less: Plant Depreciation (7 yr.) (11)	611	611	611	611
Less: Geothermal Equipment Depreciation (10 yr.)	105	105	105	105
TAXABLE INCOME	2,438	2,438	2,397	2,397
Less: Assumed Taxes (40%)	975	975	958	958
TOTAL	1,463	1,463	1,439	1,439
Plus: Geothermal Investment Tax Credit (12)	262	--	262	--
Plus: Plant Investment Tax Credit	855	--	855	--
NET AFTER TAX INCOME	$ 2,580	$ 1,463	$ 2,556	$ 1,439

Refer to footnotes on following page.

NOTES

1. As per User Coupled proposal without and with contingencies.

2. $.95 per gallon of ethanol = 4,275,000.

3. Dry corn consists of shucked kernels that have been dried to 12 per cent moisture.

4. Byproduct credit includes the drying process of the feed grains to 12 per cent moisture by volume.

5. Burns Brothers Inc., a Portland gasoline diesel distributor buys gasohol from ADM Decatur, Illinois and Georgia Pacific, Gellingham, Washington for $1.80/gallon FOB the plant.

6. Burns Brothers estimate $.07 a gallon distribution cost from Bellingham, Washington to Portland. The distance from Vale to Portland is longer. Estimated $.01 per gallon increase per year in delivery charges due to rising oil prices.

7. Estimated savings from geothermal of $.08 per gallon of alcohol produced over 1979 natural gas cost. 1982 natural gas prices are expected to be much higher. No annual increase in cost of fuel.

8. Includes 15 people at $25,000 a year plus benefits. This figure is probably high.

9. This assumes 10 per cent equity and debt service on the balance: 15 year loan at 7.5 per cent interest annually from Oregon State Alternative Renewable Energy Low Interest Loan Program.

10. Depreciation assumes plant life of 7 years and geothermal well head and delivery system life of 10 years.

11. Windfall profit legislation included a 25 per cent investment tax credit for geothermal and 20 per cent on alternative energy equipment. Not clear to proposer yet what amount of geothermal ITC is available. This estimate is pending CPA ruling.

3.4 POTENTIAL IMPACT OF TOTAL PROJECT — Fantasy!!

The potential impact of the proposed project could in fact be enormous. It is concievable that with the estimated economic advantages associated with this project a very significant amount of the total fuel alcohol demand for that region could be produced at the site.

To produce 4,500,000 gallons of fuel alcohol will require approximately one sixth of estimated available starch and sugar crops within the three county area closest to the facility. This is an area considerably smaller than the probable ultimate feedstock supply region, particularly as a result of the Geo Park existing railroad frontage and access.

It is conceivable that a developed geothermal Geo Park infrastructure at that site could grow to twenty times the size of the proposed plant and incorporate feedstock brought by rail from the north in the eastern Washington grain and potato growing region as well as from farther east in the Snake River Plain. This is not a particularly farfetched possibility, witness the fact that the Brady Hot Springs geothermal dehydration plant processes onions shipped from central and south-central California.

A gasohol complex at the Geo Park site could grow to a size producing ninety million (90,000,000) gallons of fuel alcohol per year. This amount of alcohol would be sufficient for an output of Nine Hundred Million (900,000,000) gallons of gasohol at a 10 percent fuel alcohol mixture level.

The states of Oregon and Washington alone consumed 3.4 Billion gallons of gasoline (not including diesel, heating oil and aviation fuel), in 1979. Thus the site could handily meet about 25 percent of the 10 percent gasohol needs of those two states. The two states could now utilize the output from 75.6 plants of the size proposed herin as a commercial scale demonstration. When California gasoline requirements are included (there are good transportation routes to California from the site and Idaho figures were not available), the region could absorb a total of 331 plants of the size proposed herein. If gasohol were to go to a 20 percent fuel alcohol mixture, then the market potential would of course double.

To produce such output levels it would require an estimated 20 production wells of the output contemplated herein which number of wells could conceivably fit on close to 40 acre centers on the proposer owned geothermal leasehold. There would be adequate room for such an output complex on the proposer owned 110 acre Geothermal Park site.

The proposer has recently begun discussions with regional fuel suppliers to gain letters of intent which would lead to fuel alcoho supply contracts. On the following page, listed as Figure 15B is a letter from Burns Bros., Inc., of Portland, Oregon for 1,000,000 gallons of fuel alcohol. The company operates a group of retail outlets and acts as a jobber to other retail outlets. Other letters are expected as discussions continue.

At the present time, Burns Bros. is paying $1.80 per gallon for 199+ proof fuel alcoho, F.O.B. the Georgia Pacific plant at Bellingham, Washington and, interestingly enough, also procuring supplies F.O.B. the ADM plant in Illinois at a similar price. There have been accounts of retailers paying close to $2.00 per gallon delivered, and a developing market in Illinois for 180 to 190 proof in the range of $1.65 per gallon.

BYPRODUCT FEED MARKETS AND ECONOMICS

The various byproduct feed contents and values are very important to total fuel alcohol plant economics. While the proposer has a considerable body of information on byproduct characteristics from cereal grains, particularly distillers dried grains, considerably less is known about potatoes and sugar beet characteristics and their value after distillery processes. Information is particulary scarce on probable pricing levels for wet stillage feeds.

There is a very large potential market for concentrated animal feeds in the region of the proposed plant as shown

BURNS BROS. TRUCK STATIONS • AUTOMOTIVE JOBBERS WAREHOUSE
BURNS BROS. WHOLESALE TIRE WAREHOUSES • SECURITY CHAIN CO.
BURNS BROS. INTERNATIONAL • RESTAURANTS

BURNS BROS., INC.
621 S. E. UNION AVENUE • PORTLAND, OREGON 97214
Telephone 503 238-7393
Telex 36-0250 BURNS INT PTL

April 22, 1980

Mr. Steven Munson
Ethanol International, Inc.
5350 South Denver Tech. Center Parkway
Inglewood, Colorado 80111

Dear Steve:

We are pleased to hear the progress of Ethanol International in the development of alcohol fuel production equipment.

To support our aggressive wholesale and retail alcohol fuels division, we feel our needs would be for 1 million gallons annually of fuel grade 200° ethanol. Burns Bros., Inc. would enter into supply agreements along these lines providing the alcohol is priced competitively.

It was nice talking with you last Thursday, and I wish your company the greatest success.

Sincerely,

BURNS BROS., INC.

Steven R Anderson

STEVEN R. ANDERSON
Operations Manager

SRA/tm

Figure 15B

below in a chart covering a portion of nearby counties

County	Cattle	Hogs
Washington	54,295	1,731
Payette	45,555	2,033
Gem	36,164	1,601
Canyon	134,473	5,599

The Ida-Ore Federal Regional Planning and Development Association lists six commercial feedlots within a 25 mile radius of the site and 16 commercial feedlot within 100 miles of the Upper Treasure Valley area.

A table will be prepared in the PRDA listing at least 10 regional distillers grains feed content values, moisture levels, mixed feed formulas and pricing levels around the nation. This information will be indexed against the current substrate prices at both farm level and central delivery point. This information will be very useful in the economic analysis for byproduct pricing.

4.0 PROJECT MANAGEMENT AND DETAILED TECHNICAL PLANNING

4.1 Detailed Statement of Work By Task

Task 1. Financial

TI 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

TI shall prepare and submit an Environmental Report within 60 days of contract award. The Environmental Report will be prepared in accordance with guidelines provided by DOE and will address "site-specific" information relating to the project.

DOE shall determine if an Environmental Assessment is required based on the submitted Environmental Report. DOE shall prepare the Environmental Assessment with input from the participant if an assessment is required.

The participant shall coordinate with and provide information to local, state, and federal agencies, as necessary, to insure compliance with all other environmental requirements.

The participant is responsible for obtaining all required permits, leases, and other documentation in order to complete the geothermal project. At the request of DOE, the participant shall provide DOE copies of documentation pertaining to the acquisition of the rights to the geothermal resource. Completion of this task constitutes completion of Milestone #2.

Task 3. Exploration

TI, with the support of Meidav Associates and other consultants, shall review the results of the geoscientific survey which would have been completed by this time as a result of the cooperative cost-shared PRDA project which is expected to start in October, 1980, and will present the results of data analysis to the DOE. This assessment will include an evaluation of the geological, hydrological and thermal characteristics of the resource, as determined from the previous exploration program.

Within 15 working days of receipt of TI's report, the DOE and TI shall discuss and review the data. A mutual agreement must be reached between the DOE and TI 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.

Concurrently with this task, or within 30 working days of the completion of this task, the participant shall discuss and review with DOE the selection of a production well drill site. A mutual written agreement between DOE and the participant must be reached concerning the location of the drill site. Completion of this task constitutes completion of Milestone #4.

Task 4. <u>Drilling and Logging</u>

A. TI, 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 15 working days, DOE shall indicate concurrence or request modifications to the specification and/or program.

B. The participant, 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. The participant shall select a drilling subcontractor, with DOE concurrence. The proposed drilling subcontract shall be submitted for DOE review and approval. Within 15 working days, DOE shall indicate approval or request modifications to the subcontract.

3) Supervise the drilling of the production well, in accordance with the detailed Drilling Program and specifications. Periodically, the participant or his 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, bottom hole 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 3 working days or the completion of the well, DOE and the participant shall discuss and review the data. A mutual written agreement between DOE and the participant 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. TI, with support from appropriate consultants, shall:

1) Provide for necessary flow testing services.

2) Update the Flow Test Plan. The plan shall be submitted to DOE for review and approval. Within 3 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 reservoir yield and production life. The well testing and other available data shall be prepared and presented to DOE. Within 5 working days, DOE and the participant shall discuss and review the well test results. A mutual, written agreement between DOE and the participant must be reached to determine a future course of action. This agreement constitutes project Milestone #6.

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

It is probable that the 1500' hole drilled in the earlier phase of the exploration program will serve as an adequate injection well. An evaluation of the feasibility of using that well for injection purposes will be made at the time. An appropriate budget will be set aside for the drilling of an injection well if the 1500' well is considered unacceptable for any reason.

Task 7. <u>Determination of Cost Share</u>

DOE and the participant shall review all test results and costs and determine the DOE and participant cost shares. The basis for the determination of the cost shares shall be the variable cost share

plan of the Cooperative Agreement. Modifications to the cost share plan may be negotiated if necessary. Determination of the cost share constitutes project Milestone #7.

Task 8. Project Management

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

In addition to close general coordination with DOE, immediate and full disclosure of problem areas to DOE is required, so that timely corrective action may be taken with DOE support, if necessary.

Task 9. Reporting

The reports identified on the attached DOE Form CR-537, Reporting Requirements Checklist, will be submitted as indicated.

Task 10. Dissemination of Information

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

TI 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.

With regard to written and oral public information, the participant is expected to:

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. <u>DOE Conferences</u>

Occasionally, the participant or its representative may attend geothermal technology conferences at DOE's request. Participation in these conferences shall be reimbursed by DOE, if prior written approval is obtained from the Contracting Officer.

4.1.1 PRE-DRILLING EXPLORATION

The pre-drilling exploration program has been described in the foregoing paragraph 1.2.3. It will be completed prior to the start of this project, and a final report will be ready for evaluation probably by May, 1981. The results of that project will be submitted to the DOE for evaluation and comments.

4.1.2 DRILLING PROGRAM

4.1.2.1 INTRODUCTION

Technology International, Inc. (TII) has a geothermal lease on 745 acres located in Township 18 South, Range 45 East, Willamette Meridian, Sections 16, 20, 21, 28, 29, and 33. The elevation of the site is 2400 feet.

This report will be based on the proposed drilling site found in Section 28 (map 1). The site was built by Magma Power Corporation and may be used for the project. On the other hand, if pre-drilling investigations and other considerations suggest that this site is not the most suitable for exploration/production drilling, a contingency plan for an alternate site preparation is discussed below.

The objective of this project is to drill an exploration well to a depth of 6500 $\pm$ feet to evaluate the geothermal potential of the Technology International, Inc. held lease for the direct heat uses further enumerated elsewhere in this proposal.

The proposal contains a discussion of needs, methods of study, service companies, and projected cost for the drilling project.

4.1.2.2 ACCESS

The discussion below is predicated upon the assumption that the existing drill site location would be found to be acceptable after the completion of the geoscientific survey which is to precede the final drill site location. Hence, the discussion below and the cost estimates must be considered as tentative. A contingency cost plan is provided further on in case the available drill site is not the most suitable. The following cost plan should be viewed as illustrative only.

The TII lease is bordered by an asphalt highway. A well-maintained packed gravel road leads from the highway to the proposed site. This road is approximately ½ mile in length and of sufficient width to allow access by equipment trucks. Some maintenance and dust control is to be expected.

A local contractor will be used for maintenance as needed.

4.1.2.3 LOCATION REPAIR

The proposed drilling site is 125 feet wide and 200 feet long and in good condition. The surface is packed sandy loam. A layer of gravel will be spread over this surface.

After the drilling rig and support equipment are in place, drainage ditches will be dug to route fluids to the sump. A local contractor will be used for location repair.

4.1.2.3 SUMP

A 195,000 gallon reserve pit (sump) is in place. The sump will hold drilling fluids and cuttings while drilling and hydrothermal fluids while testing. Some repair will be done to assure that no loss of sump fluids can occur.

4.1.2.4 CELLAR

The original cellar, now in place, will be reconditioned. It is 10 feet in diameter and 5 feet deep. An 18 inch conductor pipe is in place and will be removed to allow placement of the 30 inch conductor pipe. If needed, a wooden retaining wall will be built to protect the wellhead and blow out prevention equipment from wall collapse.

4.1.2.5 SITE AND ACCESS MAINTENANCE COST

Plan A

Based upon the tentative assumption that the existing available drill site would prove to be the best location for a production drill hole. In that case, the cost of drill site preparation would be nominal, as shown in Volume II, the financial proposal.

Plan B

4.1.2.6 ALTERNATIVE SITE PREPARATION

If the geoscientific investigations preceding the selection of a drill site indicate that another site has a higher probability of success than the site shown in Figure 3, it would not be possible to predict at this time that cost of site and access road preparation would. A sum of money adequate for new site preparation, including access road, pit and sump, has been set aside, as shown in Volume II, for the purpose of permitting the project to drill at any site within the project area.

4.1.2.7 DRILLING PROGRAM

This drilling plan takes into account the general lithologic log of the area, which has been discussed elsewhere in this proposal (see section on subsurface geology).

1. A 30 inch conductor pipe will be set to 30 feet.

2. When the rig is in place and operating, pick up a 17½ inch bit. Drill 17½ inch hole to 125+ feet. Open 17½ inch hole to 26 inches. Run a 20 inch conductor pipe to 125+ feet. Cement and install a flange for a 20 inch Annular Preventer. A test of the annular preventer will be carried out to assure its operation, if high pressure hydrothermal fluids are encountered, in preventing a blowout.

3. Pick up 17½ inch bit and drill to 1500+ feet. If significant competent rock is not being penetrated at this depth, casing will be set in the first 25 feet of competent rock encountered. This will be determined by the well-site geologist and drilling supervisor. Penetration rate and cuttings analysis will be used as indicators of rock, competency.

4. Run 13 3/8 inch casing at 1500+ feet or to that depth which was required to encounter competent rock. A plain Guide Shoe and centralizer will be placed on the first section of casing. A differential Float Collar will be placed two (2) sections above the shoe. A centralizer will be placed every 120 feet from 1420 feet to 100 feet, for a total of 12 centralizers. (Refer to Casing and Cementing sections.)

fill annulus w/ cement from the surface!

NO!

After cementing, wait for 8 hours after plug bumps before slacking off. If the cement does not reach the surface dump sand down the annulus, before slacking off, until casing is filled to surface. Remove the 20 inch Annular Preventer and install a 13 3/8 inch WKM 600 Series Casing Head. Test to 150 psi for 15 minutes and record results on tour sheet. Install a 12 inch 900 Series Double Shafler Gate and Hydrill for 15 minutes and log on tour sheet. Notify proper agencies that the above blow-out prevention equipment is installed. They will witness the test.

5. Drill 12¼ inch hole, with mud, to the top of the projected reservoir. Run 9 5/8 inch casing with a Plain Guide Shoe on the first section, a Differential Float Collar on the second section and centralizers every 120 feet from 4000 feet to 1420 feet, for a total of 23 centralizers. (Refer to Casing and Cementing Sections.)

If loss of circulation occurs while drilling the 12¼ inch hole, there will be an evaluation to determine if a hot water zone has been penetrated. This is to take place before drilling can proceed. Testing will be done with a Kuster KPG Temperature Recorder and/or other methods deemed necessary by well-site personnel.

This should be agreed to by DOE rep's.

Loss of circulation above the 12¼ inch hole will be evaluated by well-site personnel. Cement plugs may be used to control these upper zones. This is to protect ground water from contamination by loss of circulation material.

6. After setting 9 5/8 inch casing with a WKM Expansion Spool, as directed, and a 10 inch Ansi 600 Series WKM power Seal Gate, reinstall blow-out prevention equipment.

7. Drill out of 9 5/8 inch shoe with 8 3/4 inch bit. Change from mud system to fresh water to protect hydrothermal reservoir. Drill 500 feet into reservoir, 6500± feet. to projected total depth.

8. Run a 7 inch slotted liner and hang liner at 3800± feet using a Baker Simplex Liner Hanger. Flow test and run logs as directed.

9. The drilling program is conservatively designed to go as deep as 6500 feet. This would permit the testing of the Owyhee Basalt Formation, in case the shallower geothermal aquifer, anticipated to be encountered within the Chalk Butte Formation or the Grassy Mountain Formation, turns out to be disappointing in terms of temperature or indicated potential productivity.

An on-site decision will be made by TI's supervisory personnel as to the feasibility of continuing drilling to the 6500 limit, if the shallower geothermal aquifer proves to be less than satisfactory.

w/DOE concurrence

4.1.2.8 RIG SELECTION

Rig Capacity

Rig size - ~~5000 to~~ 8000 feet depth capacity
Weight range - 280,000 pounds derrick capacity
Sub-base - 17 feet for accommodation of BOP equipment
Pumps (mud) - two 500 horse power to supply 1800 pounds pump pressure
Circulation system - 250 barrel minimum, mud storage and mixing system.
Accumulator - 80 gallon minimum, for BOP equipment. Sand line drum on rig.

The Atlantic Oil Company has been identified as a potential sub-contractor for the drilling task.

Atlantic Oil Company, Rig 15, is a National T-32 rig. This rig was selected to fulfill the above requirements. Atlantic Oil Company has supplied drilling rigs and crews to geothermal projects in the western United Seates. Their personnel are experienced in the geothermal industry. The equipment has been tested in the drilling of many wells.

Atlantic Oil Company will supply drill pipe, drilling collars, some BOP equipment and a rig supervisor. Their personnel are well trained in drilling techniquies and equipment maintenance. Down time from equipment failure is not expected to cause a time or cost override.

This selection is only tentative. At the time of project commencement, a reevaluation will be made of the drilling contractor. Depending upon the price, availability and experience, a final evaluation will be made regarding drilling contractor selection.

4.1.2.9 BOREHOLE CONFIGURATION

Hole diameters and casing positions are discussed in the sections entitled Drilling Program and Casing Program. (See Figures 1 and 2.)

4.1.2.10 Method of Completion

All casing, except 7 inch slotted liner, will be cemented to surface. Casing and cement were chosen for their ability to withstand projected hole temperatures and hydrothermal fluid corrosive conditions.

The 7 inch slotted liner will be hung at 3800$\pm$ feet to a depth of 6500$\pm$ feet or shallower depth with a Baker Liner Simplex Hanger. This is further discussed in the section entitled Casing Program.

4.1.2.11 DRILLING FLUID PROGRAM

Drilling Fluid Properties

Projected Mud Properties - Surface to 4000 ± feet

Low lime mud	1 to 3 pounds per barrel
Plastic viscosity	15 to 25
Yield point	5 to 15
Gel	0 to 0, 0 to 2
Weight	8.8 to 9.3 pounds per gallon
Water loss	15cc or less

Care must be taken to insure a proper yield point. this will allow proper cleaning of the 17½ inch and 12¼ inch holes. If high temperature gelatin occurs, the low lime drilling fluid will be changed to a Resinex based drilling fluid. The Resinex system is a temperature stabilization product which presents no environmental hazards. Water will be used to thin the drilling fluid to maintain the desired mud property range. why not Quebracho or generic equivalent?

Projected Mud Properties - 4000 ± feet to 6500 ± feet

Clear water will be used to drill into the geothermal reservoir and to assure uncontaminated fluids while testing. On the other hand, if cutting returns are unsatisfactory, a light foaming agent will be added.

Magcobar, a subsidiary of Dresser Industries, was contacted for the drilling fluid program becaus of their experience in the geothermal industry. Magcobar has supplied the drilling fluid for many projects, both steam and hot water, in the western United States.

A mud engineer will be assigned to the project. He will be responsible for testing the drilling fluid and ordering supplies for the site. He will also be responsible for a complete morning report to be given to the drilling supervisor.

4.1.2.12 Solids Control

Solids control equipment will be used to remove sand, silt and other solids from the drilling fluid. This results in equipment protection, drilling fluid properties control, and assists in lithology identification of formations.

Brant, Incorporated of Woodland, California was contacted for equipment needs. Their equipment is compatible with rig equipment and has been used by Magcobar on other projects. Periodic inspection will assure the equipment is operating at contracted specifications.

4.1.2.13 DRILLING FLUID PROGRAM POTENTIAL SUB-CONTRACTORS

Dresser - Magcobar
P.O. Box 1254
West Sacramento, California 95691

Hole conditions encountered while drilling will dictate the drilling fluid requirements. Loss of circulation and/or wall caving are unknown factors at this time, which could increase the overall cost of the drilling fluid.

Solids Control Equipment Cost

Brant, Inc.
78 Beejay Way
Woodland, California 95695

4.1.2.14 CASING AND CEMENTING PROGRAM

Casing

Armco Steel Corporation produces a geothermal grade casing used in many geothermal projects. The casing strength and its resistance to corrosion were factors considered in choosing Armco products. Armco or equivalent quality will be utilized in this project.

Cement

B.J. Cementing Service, a subsidiary of Hughes, Inc., has been involved in geothermal projects throughout the western United States. Their knowledge of cement characteristics when exposed to geothermal hold conditions will assure an excellent cementing job. B.J. Cementing is available as a sub-contractor, but final cementation sub-contractor will be made at the time of contract start.

Casing Tool Service

Bill's Casing Tong Service of Marysville, California has the specialized equipment and trained personnel needed to run casing efficiently and safely. They have expressed willingness to act as sub-contractor on this project.

Size	Interval	Length	Description	Tension	Collapse	Burst
30"	Conductor	30'	Heavywall ¼"			
20"	Conductor	125'	94#/K-55, BT&C	1488	520	2110
13 3/8"	KB/1500'	1500'	61#/K-55, BT&C	962	1470	3090
9 5/8"	KB/4000'	4000' 194,000 lb	36#/K-55, BT&C	564	2020	3520
7"	3800'/4500'	2700'	29#/K-55, BT&C Slotted 2½" X ¼"	415	4320	4980

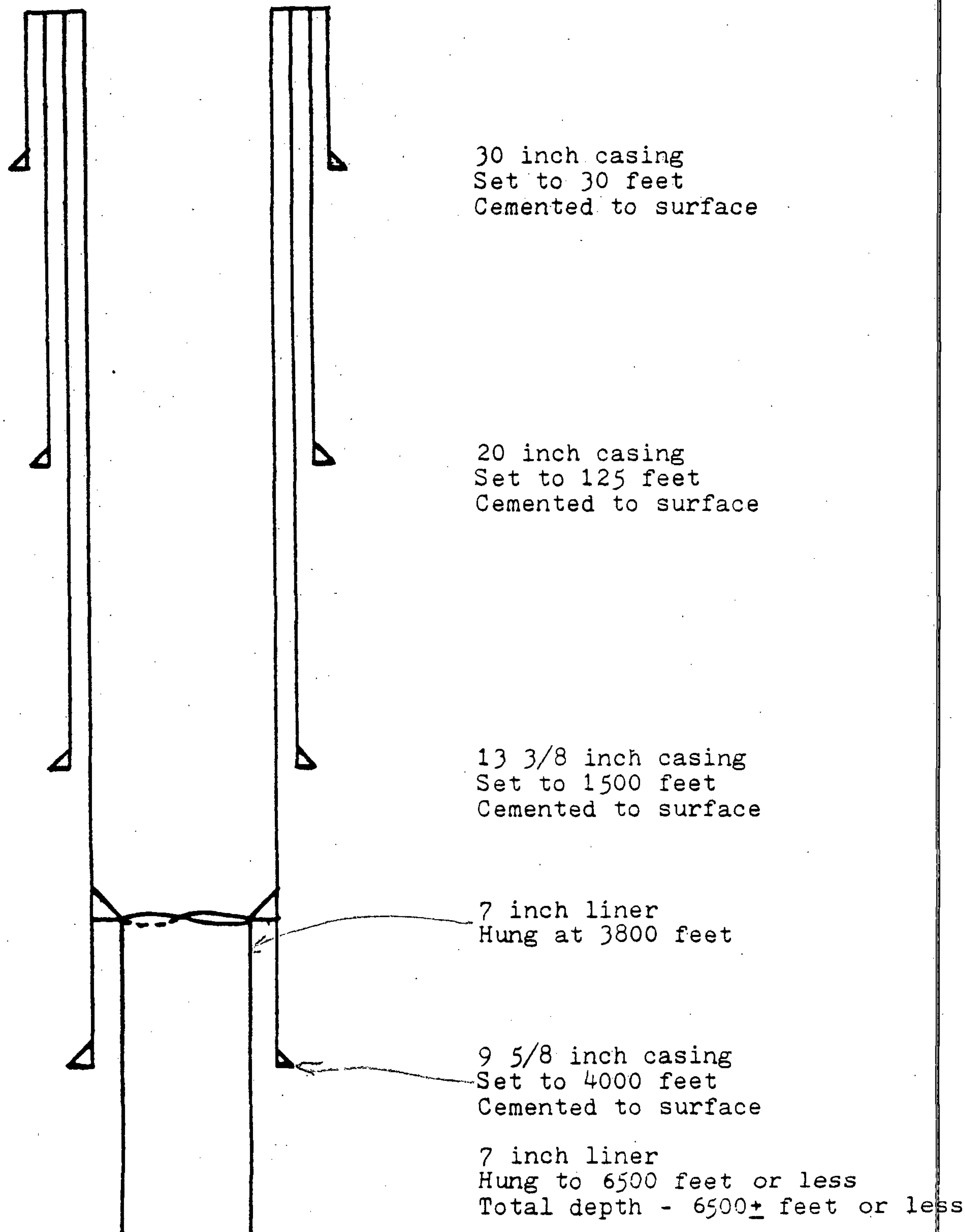
BT&C - Buttress Thread and Collars

Baker Model A, Simplex Liner Hanger for 7 inch slotted liner

FIGURE 16

FIGURE 17

Casing Design



4.1.2.15 Casing and Cement Program for One Stage Cement Job
30 Feet of 30 Inch Conductor Pipe

Casing Program

Casing size - 30 inches

Casing to be set flush with bottom of cellar floor

Surface to 30 feet - casing has ¼ inch heavy gauge wall,
Commercial grade

Casing Hardware

Shoe type - none
Float collar - none
Centralizers - none

Cement Type and Volume

Commercial ready mix - Victor grade

Displacement

Surface to 30 feet - poured from surface

Wellhead Equipment Requirements

None

Casing and Cement Program for One Stage Cement Job
125 Feet of 20 Inch Casing

Casing Program

Casing size - 20 inches
Casing to be set 1 to 3 feet above collar level
Surface to 125 feet - casing 94 pounds, K-55, BT and C

Casing Hardware

Shoe type - Weld-on guide shoe
Float collar - none
Centralizers - none

Cement Type and Volume

Class G neat with 3% Calcium Chloride
Slurry weight - 15.8 pounds per gallon
Slurry yield - 1.15 Per sack
Slurry volume - 282 cubic feet
Accelerate for 8 hours WOC time
Minimum volume - 245 sacks based on a 26 inch hole with 50% excess

Displacement

Displace with water at 8 barrels/minute
Plug flow

Wellhead Equipment Requirements

Flange for 20 inch Hydrill

Casing and Cement Program for One Stage Cement Job
1500 Feet of 13 3/8 Inch Casing

Casing Program

Casing size - 13 3/8 inches
Casing to be set 1 to 3 feet above total depth
Drill floor to 1500 feet - casing 61 pounds, K-55, BT and C

Casing Hardware

Shoe type - Plain guide shoe
Float collar - Differential fill float collar
Centralizers - 12
Pipe lock - bottom 3 joints

Cement Type and Volume

Posmix (1:1) plus 35% silica flour and 2% gel 4% R11
Slurry weight - 13.8 pounds per gallon
Slurry yield - 2.75 per sack
Slurry Volume - 1498 cubic feet based on a 17½ inch hole with 35% excess.
Accelerate for 8 hours WOC time
Good * Pre-flush - water volume 10 barrels ahead of 10 barrel mud flush

Displacement

Displace with mud at 8 barrels/minute
Lammater flow until plug bumps
Limit over displacement to 5 barrels

Wellhead Equipment Requirements

13 3/8 inch casing head, WKM 600 Series

Casing and Cement Program for One Stage Cement Job
4000 Feet of 9 5/8 Inch Casing

Casing Program

Casing size - 9 5/7 inches ?
Casing to be set 1 to 3 feet above total depth — based on thermal expansion of steel involved.
Drill floor to 4000 feet - casing 36 pounds, K-55, BT and C

Casing Hardware

Shoe type - Plain guide shoe
Float collar - Differential fill float collar
Centralizers - 23
Pipe look - bottom 3 joints

Cement Tyoe and Volume

Posmix (1:1) plus 35% silica flour and 2% gel 4% R11
Slurry weight - 13.8 pounds per gallon
Slurry yield - 2.75 per sack
Slurry volume - 1811 cubic feet based on a 12¼ inch hole with 35% excess
Pre-flush - water volume 10 barrels ahead of 10 barrel mud flush

Displacement

Displace with mud at 8 barrels/minute
Lammater flow until plug bumps
Limit over displacement to 5 barrels

Wellhead Equipment Requirements

WKM expansion spool
Master Valve
Cross over spool

Casing and Cement Program for One Stage Cement Job
2700 Feet of 7 Inch Liner

Casing Program

Liner size - 7 inches
Solid casing - now to be determined
Slotted casing - by production zone, slotted 2½ X ¼ inches
Casing to be hung from 3800 feet to 6500 feet with Baker
Simplex Liner Hanger
Casing 29 pounds, K-55, BT and C

Casing Hardware

Shoe type - plain guide shoe
Float collars - none
Centralizers - 2 Baker Line Centralizers

Cement Type and Volume

None

Displacement

None

Wellhead Equipment Requirements

Completion wellhead

4.1.2.16 SUPPORT SERVICES AND EQUIPMENT

Directional Drilling

Directional drilling is not planned for the project at this time. Hole angle will be kept to less than 3 degrees by varying the weight on bit and RPM. A Kuster Survey Instrument will be used for surveys during drilling. A directional drilling program will be proposed when, and if, it is required.

Fluid Sampling

Fluid samples will be collected by the mud loggers or well-site geologist. Several sample points will be chosen. Samples will be available for study.

Borehole Logging

Electrical Logging Requirements

1. Cement Bond - Variable Density - Wave Train
   Surface to 4000 feet
2. Formation Density - Gamma Ray
   Surface to 6500 feet
3. High resolution Temperature Log (2 runs)
   Surface to 6500 feet
4. Dual Induction - Spherically Focused Long 6500 feet

Electrical logs will be run to further the understanding of the region. By comparing electric logs with the mud log, lithology, formation tops, temperature gradients and related information can be compiled. This information will be used

4.1.2.17 WELL DEVELOPMENT

If a possible hydrothermal reservoir is penetrated in the $17\frac{1}{2}$ inch or $12\frac{1}{4}$ inch holes, a test will be run before drilling can continue. A Kuster K.P.G. Temperature Instrument will be used to determine fluid levels and reservoir temperature. Results of this test will determine whether drilling will continue or a full reservoir test will be run.

After the production reservoir has been penetrated and drilled to the projected depth, a full reservoir test will take place. A description of the testing procedure is found in the section of this report titled Well Testing.

If reservoir stimulation is required, compressed air or nitrogen will be used. However, due to the fractured nature of the production reservoir, basalt stimulation is not expected to be required.

4.1.2.18 WELLHEAD EQUIPMENT

The following wellhead equipment designs have been chosen for their thermal stability and resistance to corrosion. This equipment has been tested and is in current use in the Geysers geothermal region, California. The projected reservoir and production characteristics are well within the safety margins of this equipment.

Each design allows for the replacement of defective parts with a minimum of time loss. The completion wellhead could be dismantled by one man using a small crane.

H and H Oil Tools of Rio Vista, California supplies this equipment to drilling sites throughout the western United States. Their equipment is used in both oil and gas and geothermal regions.

FIGURE 18

BOPE FOR 20 INCH CASING

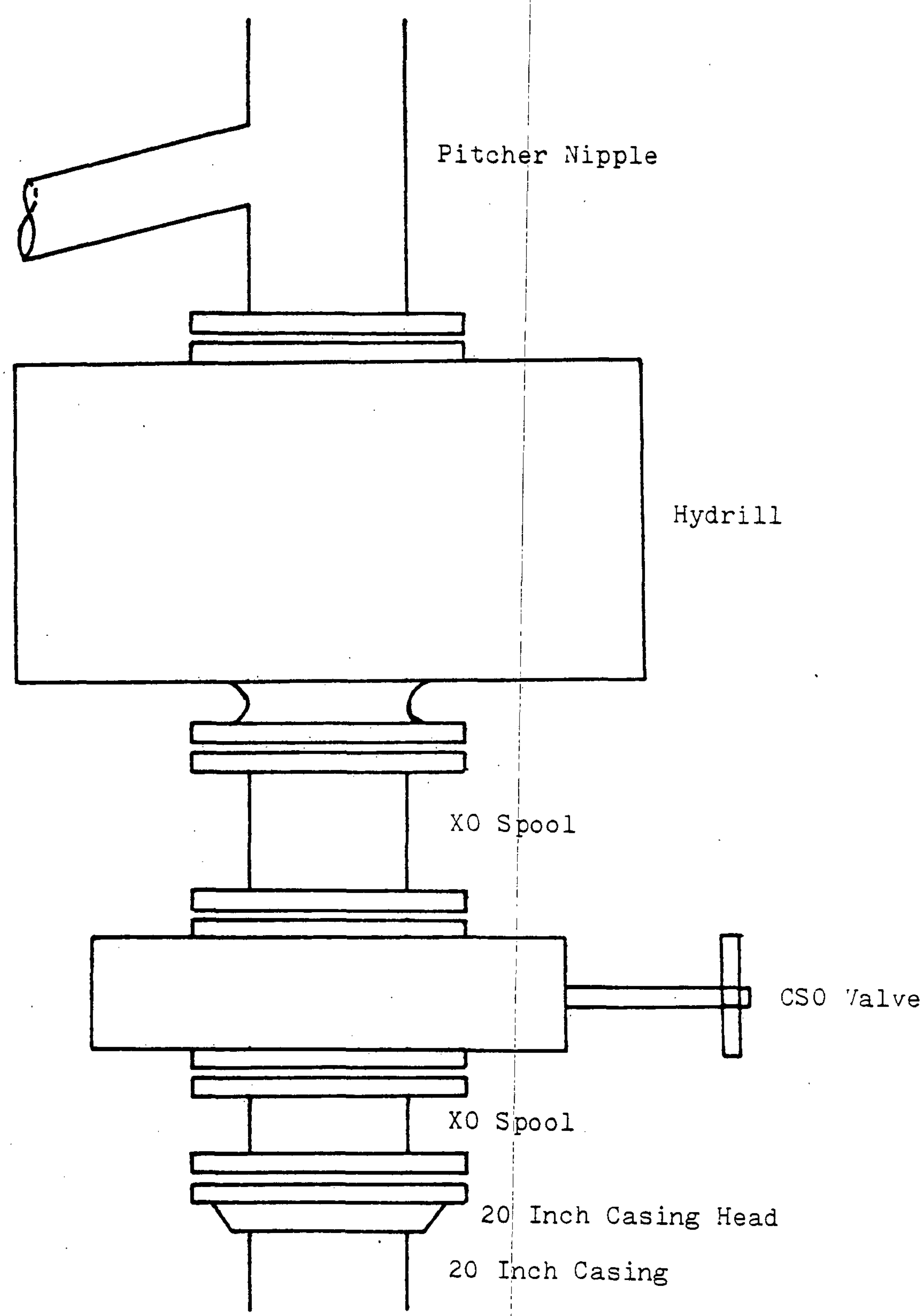


FIGURE 19

BOPE FOR 13 3/8 INCH CASING

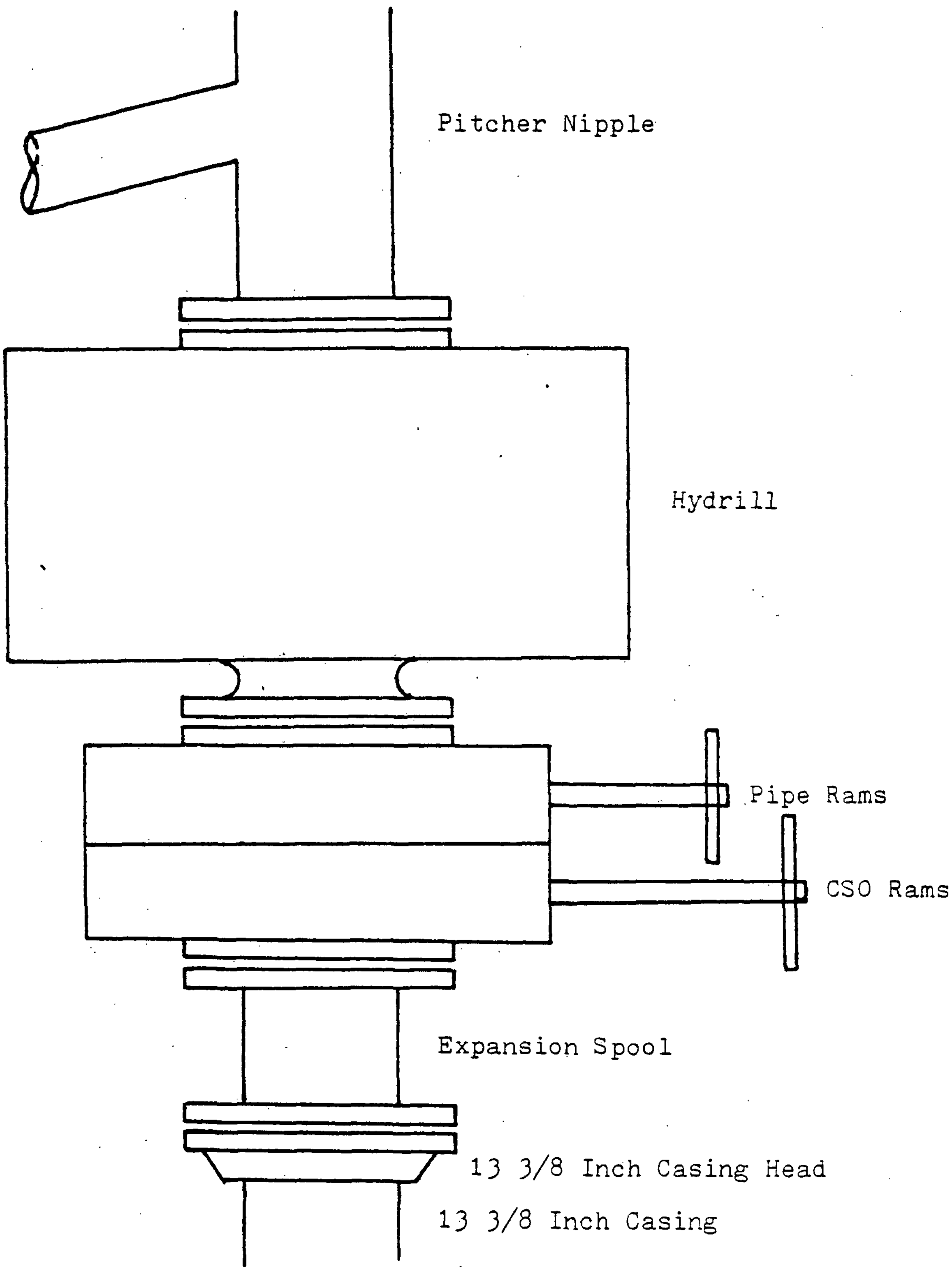


FIGURE 20

BOPE FOR 9 5/8 INCH CASING

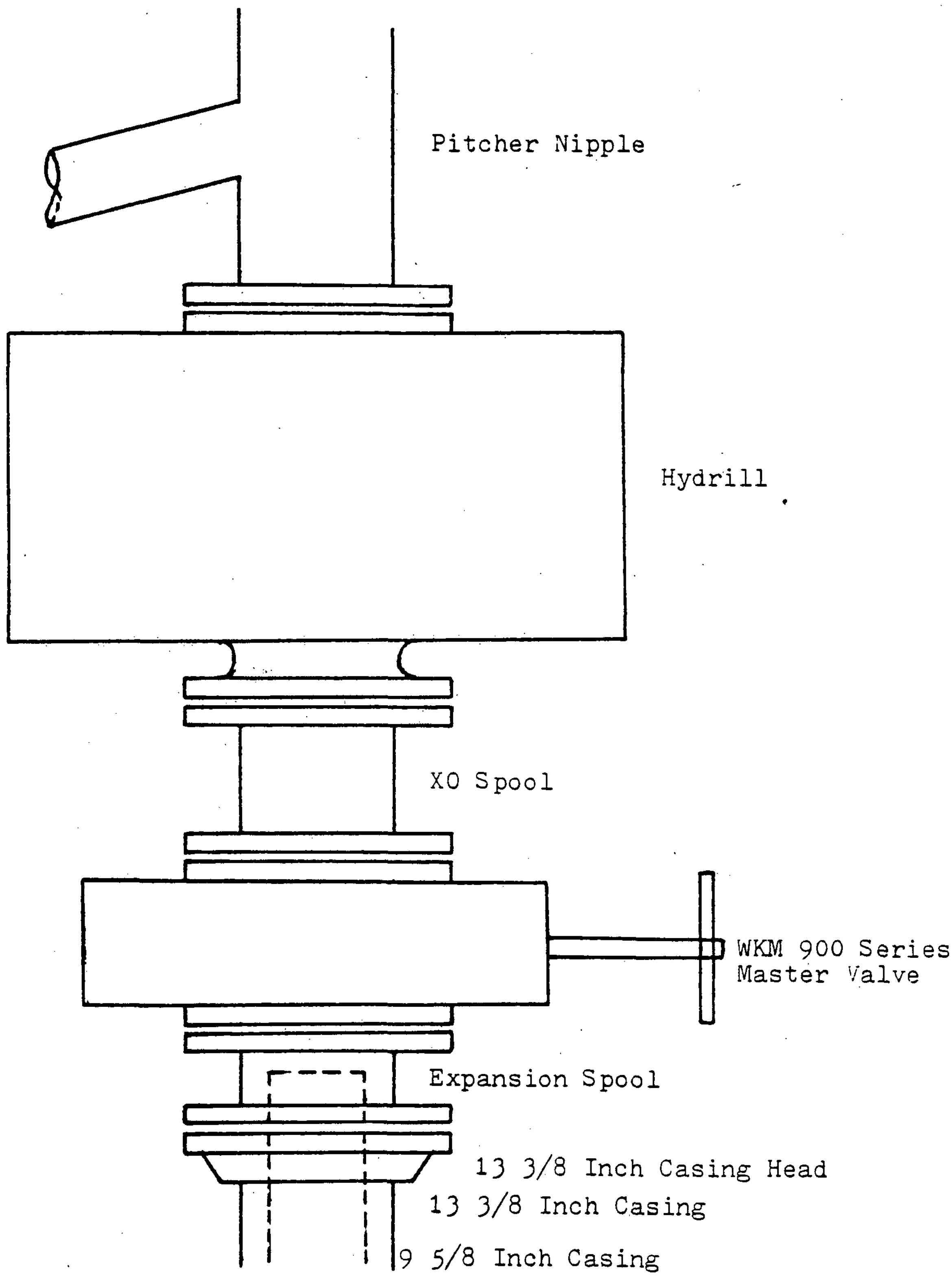
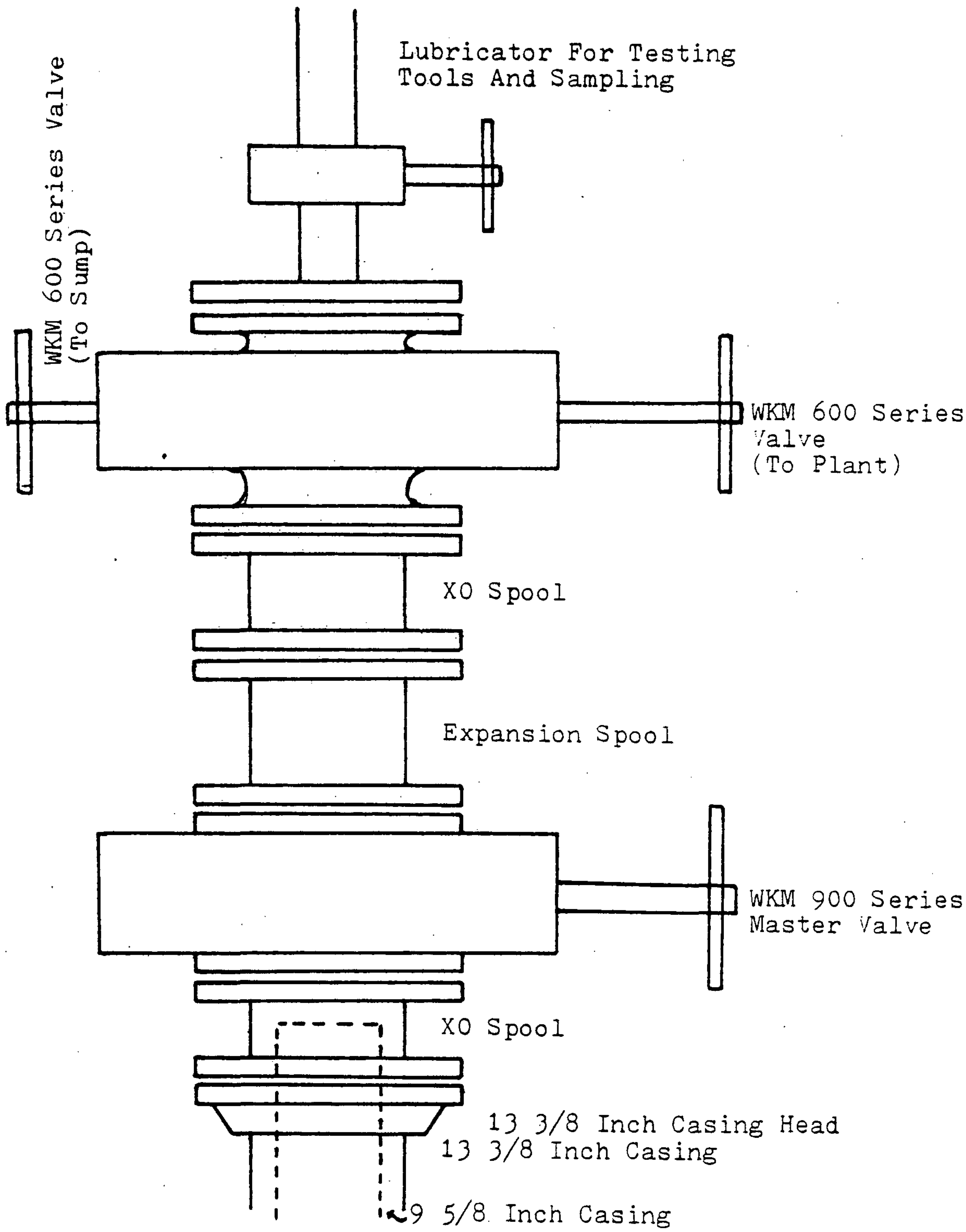


FIGURE 21

9 5/8 INCH COMPLETION WELLHEAD DESIGN



DRILL BITS

Soft and hard rock bits will be needed for the project. The majority of the drilling will be considered soft rock. Sediments, tuff and volcanic breccia are expected to predominate the upper section of the hole. These lithologies will be drilled with a soft rock bit. If a basalt lens or flow is encountered, a hard rock bit will be needed. The final drilling of the basalt reservoir will be with a hard rock bit.

Security bits are known for their versatility and reliability. These bits are used in oil and gas and geothermal drilling world wide. The bits will be delivered to the drilling site at no charge and unused bits will be returned for credit.

4.1.2.19 LOSS OF CIRCULATION PROCEDURE

The possibility exists of a loss of circulation zone in the $17\frac{1}{2}$ inch and/or $12\frac{1}{4}$ inch holes. In the event of loss of circulation, an evaluation will determine whether a hydrothermal reservoir has been penetrated. This evaluation will take place before drilling can resume.

If it is determined that the loss of circulation zone is not a reservoir, steps will be taken to seal it before drilling resumes. If the zone is restricted and there is only a small loss of fluid, loss of circulation material will be used. This material includes cotton seed hulls, walnut hulls and plastic bits. Other materials may be used as necessary. A cement plug will be pumped into the zone if it is found to be extensive and a large amount of fluid is lost. After the cement has set, it will be drilled out and tested for loss of circulation. Drilling will continue once circulation has been restored.

After the potential reservoir is reached, drilling will continue even with loss of circulation. The drilling fluid at this depth will be clear water to alleviate contamination of the reservoir. When drilling is completed, a full reservoir test will take place.

DRILLING PARAMETERS

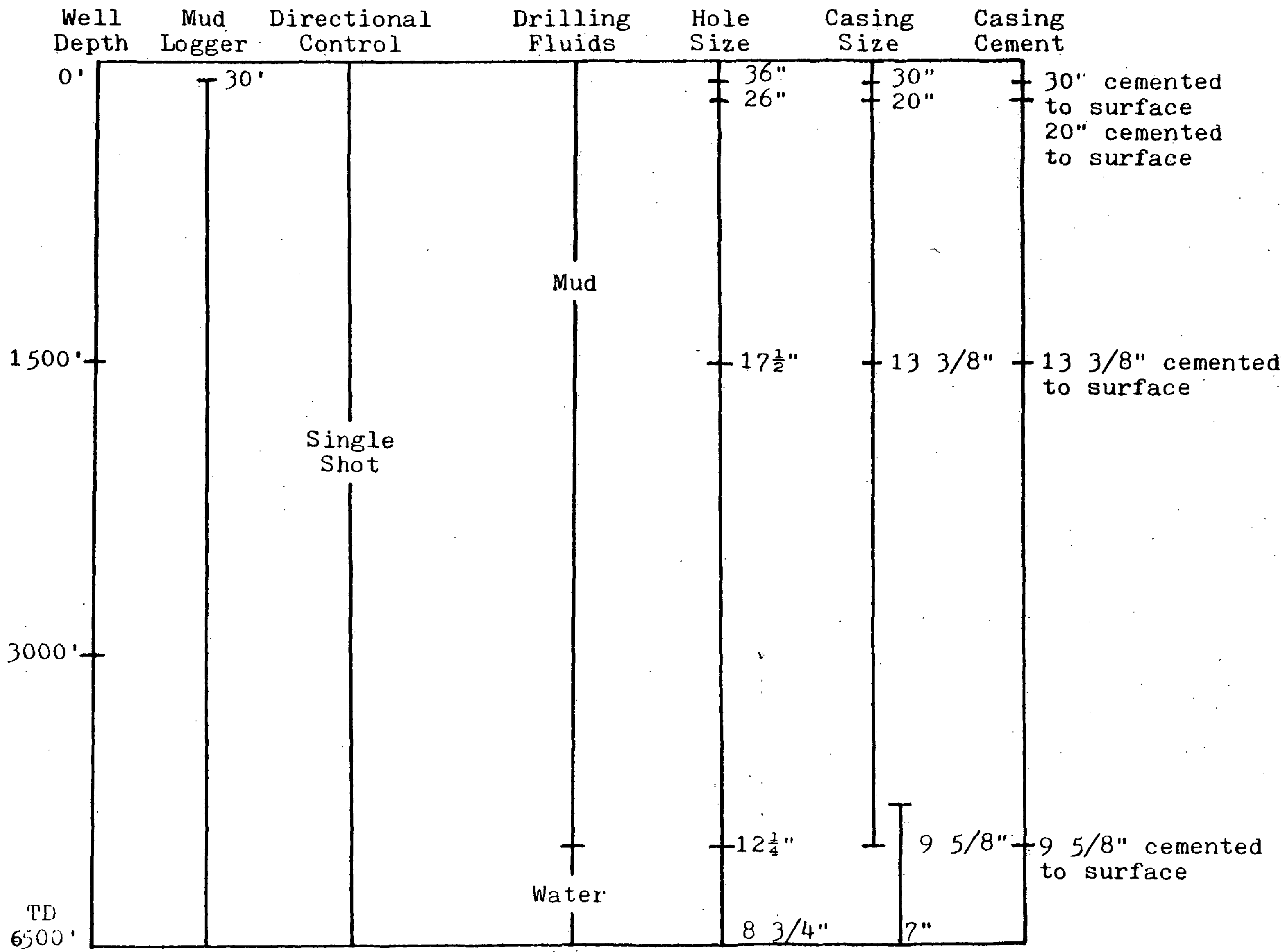


FIGURE 22

PROGRAM SUMMARY

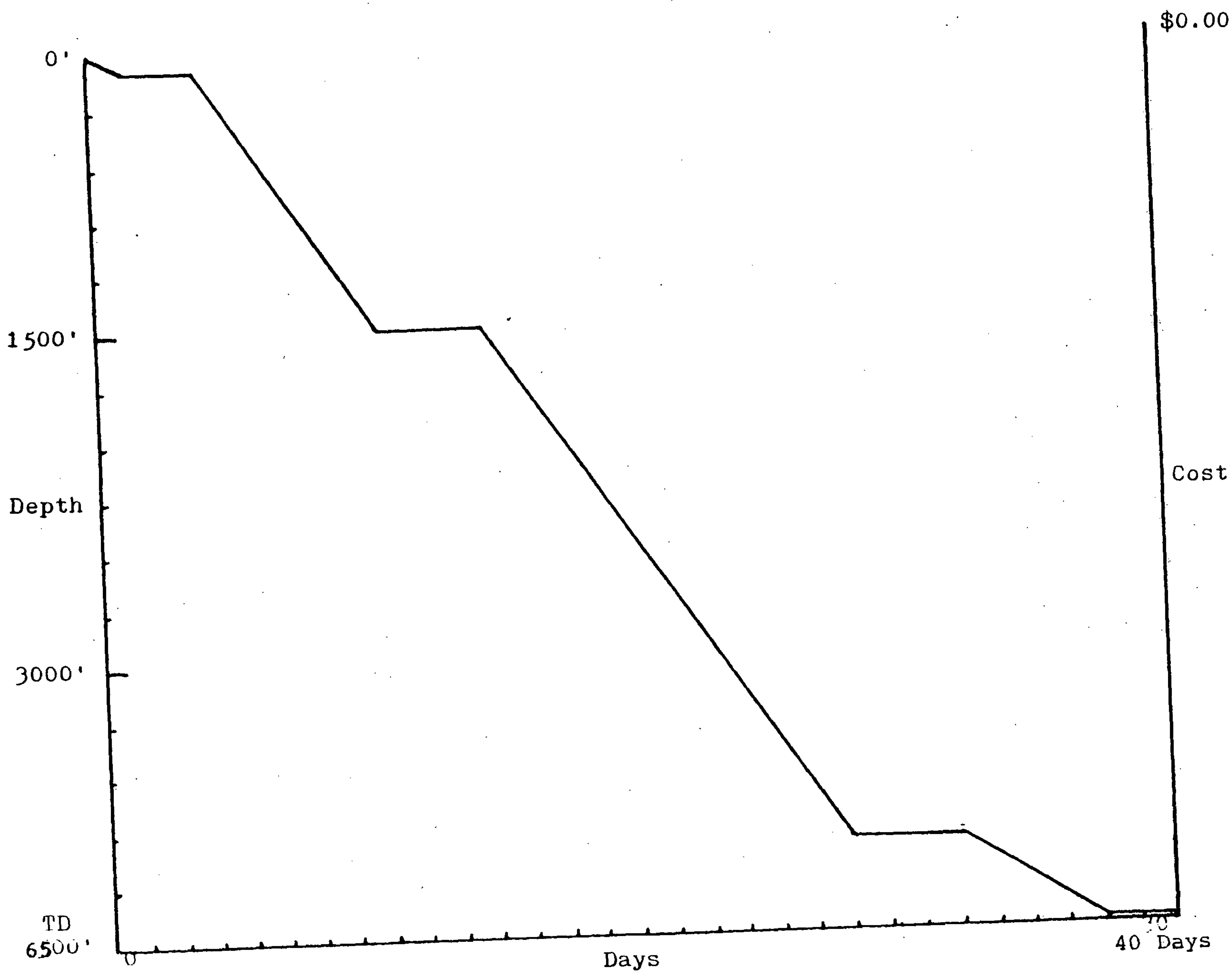


FIGURE 23

4.1.2.20 Reinjection

It is impossible to determine the need for reinjection prior to having tested the reservoir. Assuming that fluid disposal will be required, the 500-600 meter hole that is planned to be drilled on the site during the exploration phase of the engineering, marketing and economic study (D)E PRDA-RA03-80RA50121, now under final contract negotiation), may be utilized for as the disposal well. In that case, the only added cost would be that of the surface plumbing to connect the two wells.

A sum of money is set aside for the environmental assessment and the reinjection engineering, construction and testing.

4.1.2.21 GEOTHERMAL WELL TESTING PROGRAM

Introduction

The testing and evaluation program described herein is directed to a normally pressured reservoir. The producing interval is assumed to be known from logs and confirmed by spinner surveys. A site specific test plan will be developed as additional information becomes available during the drilling and completion phase.

Objectives

Testing a geothermal hot water well should accomplish the following objectives:

A. Evaluate the producing capabilities of the reservoir (aquifer). The well should be produced at variable rates to establish well characteristics. Surface measurements of mass flow, temperature, and pressure should be monitored. One or more pressure gauges should be monitored. This data will be used to estimate formation transmissivity, productivity index (PI), and formation damage.

B. Determine properties of the produced fluids. This includes chemical composition, dissolved solids, PH, temperature, and pressure. This data will be helpful in making fluid comparisons between wells to determine aquifer continuity, corrosivity and scaling potentials.

C. Estimate reservoir configuration. Ideally, a well test would provide estimates of long-term producing capability. Unfortunately, the duration of most well tests preclude such estimates unless the reservoir is very small. The well test should be conducted to sample a reasonable drainage area. If any boundaries are located within this area, the pressure buildup analysis should detect it. If the producing information is a fractured reservoir, then an indication of the well decline rate may be evaluated during a long-term test.

Procedure

The test procedure is designed to be straightforward to accomplish the stated objectives. A final test procedure will be developed for the actual conditions encountered. The test plan involves a short-term testing phase and a long-term testing phase.

Three short-term flow tests (about twenty-four hours each) should be conducted at three different flow rates. This will give the production efficiency information and confirmation of formation properties. A long-term test (about thirty days) is desirable to get a representative well performance history. Normally, wells completed in fractured reservoirs have rapid initial decline rates. It may be possible to evaluate this with a long-term test.

A. Flow Diagram and Equipment Layout. Figure 1 shows a schematic of the test system and the data collection points. Exact sizes and equipment specifications will be defined when the final test plan is develpoed. The test system assumes that seven inch casing is run and that there is sufficient space in the annulus to run bottom-hole pressure and temperature gauges. For the short-term tests, bottom-hole "Amerada-Type" pressure gauges are considered. However, the availability of paro-scientific or Hewlett Packard gauges would be examined, if the project is approved. The meter run will be sized later, but a four inch meter run should be sufficient for the anticipated flow rates. A throttling valve is provided to maintain single phase flow. An orifice meter is recommended for reliability and simplicity. Effluent from the well is assumed to be discharged into an approved sump. For a long-term test, an injection well will be necessary.

B. Test Procedure. The well should be cleaned of all drilling fluids prior to the test. Data obtained from the well cleanup will be used to design the specific well test plan and equipment specifications.

1. measure shut-in temperature, pressure, and statuc fluid level. Measure height of wellhead flange from ground level.

2. Run wireline pressure and temperature gauges into the well. Stimulate well into production and monitor bottom hole pressure every minute. Produce well for twenty-four hours or until stabilized output is achieved for twenty-four hours. Measure flow rate and height of wellhead flanges.

3. Shut-in the well and observe pressure build-up for time period equal to stabilized flow period. A fluid level should be taken at the end of the shut-in period to compare with pre-test levels.

4. Re-test well at wider valve openings, to establish characteristics at different flow rates. Follow procedure in Steps 2 and 3. Just prior to final shut-in, a fluid sample should be drawn from the well. Sample the liquids, steam and non-condensable gases.

5. Prior to performing a long-term test, the results of the short-term tests should be analyzed. In particular, the need for an injection well should be addressed. The cost of a long-term test should be developed based on the experience from the short-term tests. Any conclusions related to long-term reservoir performance that require verification during a long-term test should also be addressed. There is also the possibility that tests of surface equipment, such as separators, rock catchers, and screw expanders, could be conducted during the long-term test. This would serve to utilize the geothermal fluids for some useful endeavor.

6. The final report should contain all of the findings collected during the short-term and long-term tests. Conclusions on long-term well and reservoir performance will be made and a development plan for the reservoir will be presented.

7. <u>Precision</u>: standard precision of Kuster gauges (after calibration) is in the range of $\pm$ 1^{0}F and $\pm$ 0.1 psi. Platinum resistance thermometers may be used, if readily available at the time. Their precision is $\pm$ 0.1^{0}C.

8. <u>Analysis procedures:</u> The literature is replete with articles on drawdown and buildup tests from which reservoir characteristics are determined. Pressure fall off techniques (Horner plots) and pressure buildup methods are described in many papers. (F. Whittmore, 1979; James 1970, Earlougher, 1977; Witherspoon et al 1978). If the 1500' well, to be drilled during the preceding phase, taps the geothermal reservoir, an interference test may be conducted (Witherspoon et al 1978).

9. References cited:

Earlougher R.C., 1977, Advances in well test anaylsis, Soc. of pet. Eng. Monograph 5

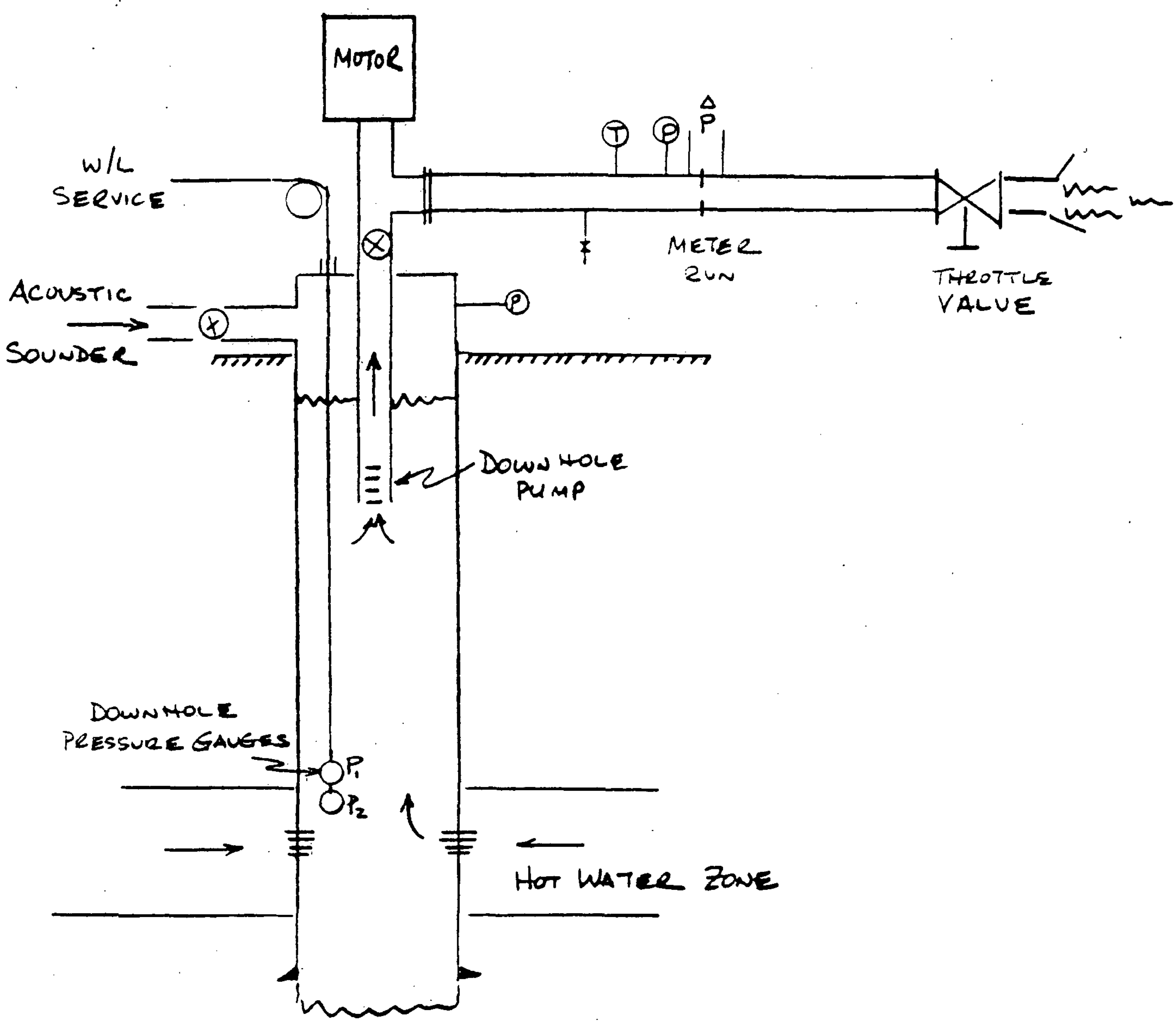
James, C.R., 1970, factors controlling borehole performance
Geothermics special issue 2 V.2

Witherspoon, P.A., Narasinhan T.N., and McEdwards D.G., 1978
Results of interference tests from two geothermal reservoirs JPT, Jan., 1978

Whittmore A.J., 1979, Well testing in a liquid dominated two phase reservoir, GRC trans. V3:781-4

FIGURE 24

FLOW DIAGRAM & EQUIPMENT LAYOUT GEOTHERMAL WELL TESTING PROGRAM



4.1.2.23 WELL ABANDONMENT PROCEDURES

Proper well abandonment procedures are defined by federal, state and county regulations. In case of need to abandon the hole, because of no success, we will plug 300 feet of the hole with cement, covering 150' of the open hole below the casing shoe, and 150' into the casing. We will then fill the casing with mud to 35' from the top and put another cement plug of 35' in length to the top. We will then cut the pipe near the ground surface and weld it shut. All of the above is subject to further approval by the various regulations cited.

4.2 ORGANIZATIONAL PLAN

The organizational plan is shown in Figure
Three major sets of activities are associated with this project:

1. Management, financial and administrative.
2. Geoscientific studies, drilling and well performance evaluation.
3. Final evaluation of alcohol plant design, based upon the results of the program.

Mr. Stephen Munson, president of Technology International will assume the overall project managment responsibility as well as direct management of the financial and alcohol plant engineering activities. Mr. Munson will be assisted by Dr. Meidav in the overall supervision of the Drilling-related and well performance evaluation activites. A number of potential sub-contractors for the drilling engineering, well site logging, mud logging, geophysical logging, cementation services and well testing will be employed. A number of organizations have been contacted, and a tentative team of sub-contractors has been identified. Their resumes and experience are attached to this proposal. All of these companies have expressed willingness to provide their services to this project.

Management Process

A. The proposer's standard management processes which apply to the performance of programs of this magnitude include strong reliance on the delegation of responsibility and authority to managers in each discipline area, adherence to the concept of

FIGURE 25

DOE PROGRAM OFFICER

TECHNOLOGY INTERNATIONAL
PROJECT MANAGER
STEPHEN MUNSON

PRDA GEOTHERMAL GASOHOL PROJECT STUDY

FOLLOW-ON ALCOHOL PLANT CONSTRUCTION AND OPERATION

FINANCIAL, INSTITUTIONAL AND ADMINISTRATIVE

STEPHEN MUNSON

- PROJECT ADMINISTRATION
  STAFF
- FINANCIAL
  - -COOPERS AND LYBRAND OR EQUIVALENT CPA
  - -STAFF CONTROL
- INSTITUTIONAL STAFF
- PLANT DESIGN
  - -SELCH PLUS OTHER STAFF
- PLANT CONSTRUCTION
  - -CONTRACTOR TO BE SELECTED
- PLANT AND FIELD OPERATION
  - -ALLTECH PLUS STAFF
  - -MEIDAV (FIELD CONSULTING)

DRILLING AND TECHNICAL CONTROL

DR. TSVI MEIDAV

- EXPLORATION
  MEIDAV ASSOCIATES
- DRILLING ENGINEERING
  G.E.C
- DRILLING
  (Contractor to be selected)
- MUD LOGGING
  G.E.C. AND ENERGYLOG
- CEMENTATION
  B.J. CEMENTING SERVICE
- BOREHOLE GEOPHYSICAL LOGGING
  SCHLUMBERGER (OR EQUAL)
- WELL PERFORMANCE TESTING
  THERMOSOURCE (OR EQUAL)

USER-COUPLED CONFIRMATION DRILLING PROGRAM

TECHNOLOGY INTERNATIONAL ORGANIZATION

management by objectives, and utilization of a steering committee approach to periodic program review and direction.

In recognition of the necessity for minimizing administrative costs, the organization established for performance of this study is intentionally compact and streamlined. Each participant will be assigned clearly specified objectives which relate directly to the overall objective of the program. Because of the small size of the functional organization, a minimum level of formality in internal reporting and directive procedures is possible.

B. The company procedures to be used in implementing management of this program will be, as indicated above, relatively simplified due to the need for only two levels of supervision. A Steering Committee, consisting of the task managers and chaired by the program manager, will meet weekly (in the case of remotely located managers, a conference call will be arranged) to assign and re-define tasks, monitor progress against each milestone, review draft and finished reports and make required decisions on any significant redirection of program efforts. Scheduled meetings of individuals within each discipline area group will not be required, inasmuch as these individuals will work closely together on a day-to-day basis.

C. One benefit of the compactness of the functional organization and the clearly defined work breakdown structure is that mathematical or simulation models will not be required for determination of critical paths or evaluation of cost effectiveness within each task.

D. Regarding the methods of specification generation and control: specifications against which sub-contractors will perform will be prepared at company headquarters. Subcontract specifications for consulting work and for the well drilling activity will follow established industry standard formats.

Depending upon the degree to which specified subcontracts or equipment items are crucial to the outcome of the project, draft specifications will be subjected to the review and critique procedures for quality control and technical review, both internally and for DOE approval, as described in the Statement of Work (4.1).

E. Each discipline manager will monitor the performance of individuals within his group and sub-contractors under his discipline area. The manager will exercise direct control over these activities and will emphasize favorable or unfavorable variances from planned progress at the weekly review meeting.

F. Program progress review, as stated above, will be conducted internally through the use of weekly steering committee meetings, including at least weekly communication with remote participants. During each weekly review, the progress against schedule milestones and the actual costs incurred will be compared with the planned progress and costs for identification of variances. Progress of remote participants will be reviewed at least monthly during visits by the program manager to the

remote location, or by the discipline task manager, to the program management office.

During the review meeting preceding each monthly progress report to the DOE program officer, the contract management summary report will be updated.

G. Inasmuch as one of the important products from this program will be the Final Report, the principal requirement for quality control will be to ensure accuracy and clarity in each element of each task. Each draft report on any portion of the activity will be simultaneously reviewed by the discipline task or subtask manager and a second member of the group who is at least conversant with the topic of the subject report. A revised draft of each report will then be reviewed and critiqued by one of the other discipline area managers and the program manager to identify any problems with lack of clarity or relevance to the overall program objectives. This dual review technique will give adequate assurance that the compiled program progress reports are internally consistent and accurate in their conclusions.

H. The technical review methods and schedules are adequately covered by the preceding discussions.

I. Documentation control will be a primary function of the program manager, who will maintain a central file for data and reports arranged by discipline and milestone classification.

J. Sub-contractor control will be the primary responsibility of the Drilling and Technical Control Manager. Variances in

subcontractor performance will be identified and corrected rapidly through the weekly progress review procedures described above.

Contract Change Control Procedures

The program manager will advise the DOE program officer in writing immediately regarding any perceived requirements for contract change or modification. Standard DOE procedures will be followed to incorporate required changes in the program contract. The program officer will be consulted regarding any questions which arise in the implementation of contract changes.

4.3 MAJOR CONSULTANTS AND MAJOR SUB-CONTRACTORS

Geothermal Resource Assessment and Drilling and Well Testing Supervision

Dr. Tsvi Meidav is the senior scientist and project manager for Meidav Associates, the subcontractor for resource assessment. Dr. Meidav's educational training includes:

B. A., 1954, geology, Washington University, St. Louis, MO;
M. A., 1956, geophysics, Washington University, St. Louis, MO.
Ph. D., 1960, geophysics, Washington University, St. Louis, MO.
Dr. Meidav has over 20 years of experience in the area of natural resources, exploration and development. He started his career as a ground water geophysicist.

Dr. Meidav became a staff geophysicist with the Geophysical Institute of Israel in 1960. In that capacity, he worked in the areas of petroleum geophysics, engineering geophysics, and ground water exploration. After a senior geophysicist position with Huntec, Ltd., of Toronto, Canada, in 1967 Dr. Meidav joined the staff of the University of California at Riverside as an associate professor of Geophysics. Together with Dr. Robert Rex, later president of Republic Geothermal who joined the university at the same time, Dr. Meidav commenced a set of geophysical investigations of the Imperial Valley geothermal potential. These studies have helped in defining the geothermal resources of the Imperial Valley and attracted the attention of various private and public organizations to the geothermal potential of the region.

In 1970, Dr. Meidav was invited to join the United Nations Headquarters in New York as a special technical advisor on geothermal energy. For a period of three years, he served as a technical coordinator of the United Nations activities in the development of geothermal energy in various developing countries. In that capacity, he conducted field surveys to determine the feasibility of carrying out full-fledged investigations, drew up general exploration plans for countries, negotiated on behalf of the United Nations the level of participation of the various governments in the execution of the project, and supervised the technical execution of the required service.

In 1974, Dr. Meidav departed from the United Nations and formed his own consulting organization, Geonomics, Inc. Geonomics specialized in geothermal surveys, concentrating primarily on geophysical and socio-economic evaluations. Under his direction, the company conducted surveys of geothermal resources in all of the Western States where geothermal resources were being explored at the time, as well as in a number of other countries. Geonomics conducted a successful survey in the Island of San Miguel, Azores, in the Atlantic Ocean, which resulted in the discovery of a geothermal field there. Other surveys conducted by the company include Honduras, Israel, and elsewhere. Vicissitudes of the geothermal consulting markets created financial difficulties for Geonomics, resulting in its cessation of activity at the end of 1977.

Since 1978, Dr. Meidav has been active as a senior consultant for a number of organizations. In that capacity, he has been engaged in economic evaluations, formulation of exploration plans and supervision of geothermal field activities. Dr. Meidav currently heads an organization by the name of Meidav Associates, headquartered at 1419 Broadway, Oakland, California. He has published more than 50 papers in the area of geothermal resources and related fields.

EnergyLog: Mud Logging Specialists

EnergyLog of Sacaramento, California was contacted to supply a mud logging unit for the project. EnergyLog has worked in the Sacramento Valley, San Joaquin Valley and Ventura Basin. More importantly, they have been involved in geothermal projects in California, Nevada and the Ore-Ida project in Ontario, Oregon, located 12 miles south of Vale, Oregon. The same mud loggers who worked on the Ore-Ida project may be assigned to the Vale project. Their understanding of the geology of this region will be invaluable in the drilling of this well.

Ben Cahill - President, EnergyLog

Ben Cahill graduated from the University of the Pacific in 1956 with a B.S. in Geology. He worked for Exploration Logging, U.S.A. from 1956 to mid 1977, with his last three years as the Area Supervisor, Western United States. He is a member of the National A.A.P.G., Pacific Section A.A.P.G., the San Joaquin Geological Society, the Northern California chapter of

the American Petroleum Institute and is past president of the Sacramento Petroleum Association. He is a registered geologist in the state of California.

Alex A. Morgan - Logging Geologist

Alex Morgan is a 1973 University of California, Davis graduate with a B.S. in Geology. He was formerly employed by United Geophysical and has been with EnergyLog for two years. He was assigned to the Ore-Ida geothermal project.

Ross A. Brunetti - Logging Geologist

Ross Brunetti is a 1975 University of California, Riverside graduate with a B.S. in Geology. He is trained in hard rock geology (volcanic) and has worked on several geothermal projects in California, Nevada and Oregon over the last five years. He was a logging geologist on the Ore-Ida project.

RESUME

Louis E. Capuano, Jr.
Vice President - Operations
ThermaSource, Incorporated
P.O. Box 1236
Santa Rosa, California 95402

Mr. Capuano has ten years of drilling engineering experience on oil, natural gas and geothermal wells. During the past eight months, he has operated a geothermal drilling consulting service. His clients have included Thermogenics, Inc., Occidental Petroleum, Rogers Engineering and Anadarko Production Company. He has provided service such as direct drilling rig supervision, development of drilling programs, permit acquisition, and drilling rig equipment selection. His work has been on domestic and foreign locations. The drilling workshop sponsored by the Geothermal Resources Council was led by Mr. Capuano. He has also authored technical papers on Geothermal drilling in the Geysers Field.

Prior to starting his consulting business, Mr. Capuano was the Drilling Manager for Thermogenics, Inc. for two years. He was responsible for all drilling related activities and supervision of field personnel. Before that Mr. Capuano spent three years with Aminoil USA (Signal Oil and Gas) in Santa Rosa, California. His duties included planning and supervising drilling activity, well site selection and construction, and permit acquisition.

Before moving to Santa Rosa, Mr. Capuano was a drilling engineer with Signal Oil and Gas in Lafayette, Louisiana. His primary duties were rig supervision and on-site drilling optimization. During these four years, he gained experience with several different types and sizes of drilling and workover rigs. Also he worked on all different types of well completions including producers, injectors, duals, and conventionals.

Mr. Capuano received a B.S. degree in Petroleum Engineering from the University of Southwestern Louisiana in 1971. He is a member of the Society of Petroleum Engineers, and Geothermal Resources Council.

<u>RESUME</u>

William L. Godare
President
ThermaSource, Incorporated
P.O. Box 1236
Santa Rosa, California 95402

Mr. Godare has a broad background of experience related to geothermal applications for production hardware and field equipment. Under his direction, the latest state of the art equipment for geothermal wellhead assemblies, gathering systems valves, steam separators, and well test units have been designed, manufactured and implemented for field use. His field of expertise and involvement also includes other high temperature applications such as steam injection and in-situ coal gasifications.

Mr. Godare was most recently the Product Manager of Geothermal Systems at W-K-M Division in Shreveport, Louisiana. He had total project responsibility for research and product engineering, market planning, and domestic and international sales coordination. Under his direction the product line expanded and grew into a multi-million dollar market situation.

Mr. Godare's prior experience included the design and operational responsibilities for various organic turbine power systems with Sundstrand Corporation in Rockford, Illinois. He later joined Aerojet Nuclear Company in Idaho Falls, Idaho where he was the lead engineer for the design of a single wellhead binary cycle power plant. Mr. Godare also led the effort for the first successful installation and feasability test for an electric motor driven downhole pump in a geothermal well.

Mr. Godare attended Wabash Valley College, the University of Florida, and Indiana State University majoring in Mechanical Engineering and Mathematics. He attended graduate school at the University of Illinois. He is a member of the Geothermal Resources Council, the ASME, and is a Vice-Chairman of the Geothermal Resources Committee within the ASTM.

Geothermal Exploration Consulting Corporation

Geothermal Exploration Consulting Corporation (G.E.C. Corp.) was organized in March, 1980 by personnel trained in the various disciplines required to develop a geothermal project; drilling, geology, safety, etc. Before joining G.E.C. Corporation, our personnel worked on oil and gas, steam, hot water, and hot dry rock. Mr. Miller helped develop several of the drilling techniques now used in the Geysers geothermal region, California. Mr. Hinson was instrumental in the understanding and identification of the geology of the Geysers and its relationship to drilling and steam production. G.E.C. Corporation offers the only safety equipment and safety training courses specifically designed for geothermal operations. This includes a slide presentation which covers the safety considerations of geothermal drilling and production work.

Samples of G.E.C. Experience

NO. C-001

Area	Geysers Geothermal Region
Objective	Training of drilling and production personnel in safety aspects of work concerning hydrogen sulfide.
Methods Used	Research of available information, development of training course and safety equipment trailers.
Results	On-going training in the Geysers region. Developed the only safety training and safety equipment specifically used in geothermal operations.

Case Studies

NO. I-001

Area and Size	640 acres near Boise, ID
Objective	To develop a full field development project for direct use of geothermal fluids.
Methods Used	Geologic mapping, research, of existing holes, drilling of four (4) deep holes for production.
Results	In progress.

NO. U-001

Area and Size	40 acres near Roosevelt Hot Springs, Utah.
Objective	To develop a drilling program which includes high pressure steam zone control.
Methods Used	Drilling of shallow production hole to determine productibility of lease. Special consideration of high pressure formation.
Results	In progress.

NO. U-002

Area and Size	A few thousand acres near Roosevelt Hot Springs, Utah.
Objective	Develop a full field exploration program for electrical plant using geothermal energy.
Methods Used	Geologic mapping, seismic studies, temperature gradient holes, electrical methods, geothermometry.
Results	In progress.

Partial List of Clients

Union Oil Company of California
Union Geothermal Division
Fonshill Investments
Technology International, Inc.
R.B. Montgomery Drilling Co.
Shell Oil Co.
Aras International, Ltd.
Geothermal Power Corporation
Operating Engineers Union

RESUME

Criss Hinson
President
Geothermal Exploration Consulting Corporation
P.O. Box 518
Cobb, California 95426

Mr. Hinson received a B.A. in Geology from California State University at Sonoma and attended graduate school at California State University at San Diego. He received his certification in Hydrogen Sulfide Safety from the Petroleum Training Service of the University of Southwestern Louisiana. He is a Red Cross certified instructor of Standard First Aid Multimedia System and Cardiopulmonary Resuscitation Modular System.

Mr. Hinson's professional activities for the last nine years have been oriented in oil, natural gas and geothermal geology. For the past five years he has specialized in the geology of the Geysers geothermal region in California. He has taught courses in hydrogen sulfide safety to well-site and production personnel.

Mr. Hinson was most recently a senior member of R.F. Smith Corporation. He worked as a well-site geologist and was responsible for the training of new personnel. Since forming Geothermal Exploration Consulting Corporation, his responsibilities have included designing and producing a geothermal safety film and training course in hydrogen sulfide safety. He is also involved in the compilation of drilling programs, feasibility studies and environmental assessments.

RESUME

Halvie Miller
Vice President - Drilling
Geothermal Exploration Consulting Corporation
P.O. Box 518
Cobb, California 95426

Mr. Miller attended Georgia Technological Institue wh
majored in Architectural Engineering. He has also a
University of Texas, Petroleum Training Institute.

Mr. Miller has been involved with all phases of the c
industry for eighteen years. He has worked on oil an
jects throughout the western United States and for th
years in the Geysers geothermal region in California.
assisted in developing rig equipment and drilling tec
geothermal operations.

Mr. Miller was most recently a supervisor for Atlanti
Company. His responsibilities included personnel man
equipment inspection and repair, site construction an
control. Since joining Geothermal Exploration Consul
poration, his duties have included project management
pilation of drilling programs and budgets, equipment
and feasibility studies.

5.0 THE WORK SCHEDULE

The work schedule for this project is shown in Figure 25A. It is to be read together with the detailed statement of work (paragraph 4.1).

Task 1. Contract negotiation and financial plan, would be carried out by the project manager, in conjunction with the DOE contract officer. It is planned to last for 30 days and be concluded on Day 30 (see chart).

Task 2. The environmental and institutional evaluation will consist of a review of the environmental report which was prepared earlier, as part of the PRDA-supported project, and submittal to the DOE for review and approval. It will be started on Day 1 and completed on Day 45.

Task 3. The exploration program would consist, in this case, of an internal review of the reports prepared for the PRDA-supported project and submittal to the DOE for review, in preparation for the site selection meeting with the DOE. This activity will start on Day 30 and be completed 30 days later, on Day 60.

Task 4. The well site selection and drilling would be conducted after a field visit by the senior technical team of TI and DOE to the site, and on-site review of the data, the local topography, water supply, and various environmental and legal rules and regulations. The first two

weeks, starting on Day 30, will be devoted to an in-house review, followed by a field visit by the entire advisory body, both DOE's and TI's, followed by a written agreement on drilling strategy. This task will be completed by Day 90.

Task 4. The drilling task consists of a number of sub-tasks. Based upon the technical review committee recommendations, bid specifications will be finalized. Concurrently, a number of eligible drilling companies will be alerted to the impending bid solicitation. The bid specifications will be finalized by the senior technical team assembled by TI for the purpose and submitted to the DOE for review and approval. This task will be conducted between Day 90 and 120 from project start. Upon approval of the bid specifications by the DOE, the bid will be sent to interested qualified companies, with responses due by Day 150. A contract will be negotiated with the successful company by Day 180. Hopefully, although totally uncertainly, the successful bidder would be able to mobilize almost immediately. It must be pointed out here that this may be optimistic, and the entire program beyond the contract award may slide backward by the amount of delay in the start of drilling.

TI will supervise the various sub-contractors through its own in-house administrative team as well as the services of Dr. Tsvi Meidav, its geothermal consultant. In case of any difficulties in the course of drilling, or findings which require modifications in the drilling plan, TI will hold conference calls with the DOE's technical team to insure uninterrupted work flow. Copies of drilling reports, lithologic data, thermometric measurements, and any special surveys will be routinely routed to the DOE team to keep it abreast of the project's progress.

Task 5. Well Testing

Both transient and long term tests will be conducted. The pulse testing, of 24-hour duration, will provide information on well efficiency, reservoir indication of reservoir temperature, and fluid chemistry. Long term tests will be conducted until equilibrium is established or is indicated. It is anticipated that a 30-day test would be adequate for long term testing. The duration of the well testing program is anticipated to be 45 days, starting on Day 195 and ending on Day 240. This would be the 5th project milestone, as indicated on the Work Plan chart.

Task 6. Injection Well Decision

The decision whether the 1500' hole, which will be on site by the time that this program starts, is adequate

for the purpose and whether an additional injection well is needed, will be decided at this point. The possibility of disposing the remaining fluid in a non-injection manner will be evaluated and submitted to the DOE for review and approval. If no additional injection well is needed, this task will be completed within 30 days, on Day 285. If an injection well is needed, the cycle of specification, approval, bidding and drilling will be repeated, adding about 120 days to this program, terminating in Day 405, approximately.

Task 7. The <u>determination of cost sharing</u> would be jointly conducted by DOE and the company based upon an evaluation of the well test results.

The tasks of project management, reporting and dissemination of information are continuous throughout the project. Specific milestones and decision points are shown in the work schedule as inverted pyramids.

WORK PLAN

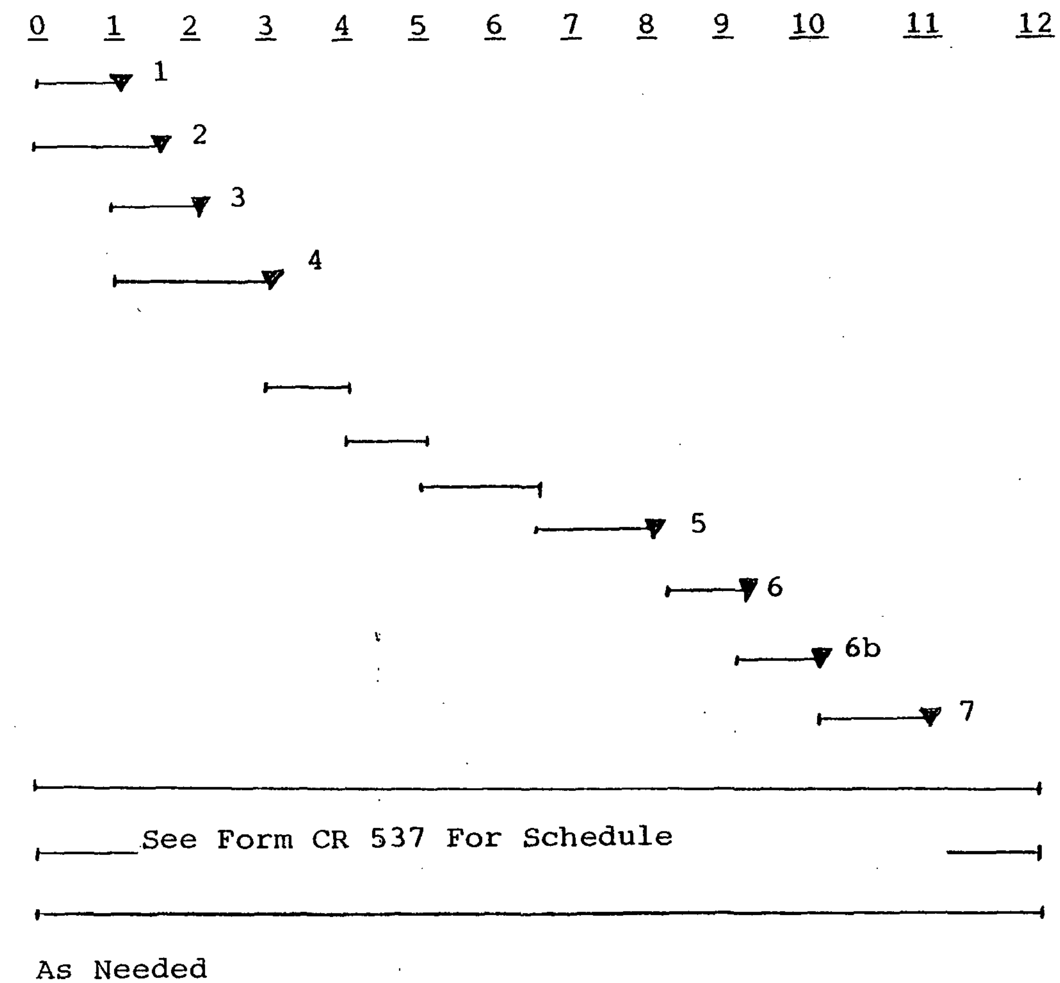
(Months From Start)

Task

1. Financial
2. Environmental[1]
3. Exploration[1]

   Well Site Selection

4. Drilling and Logging
   - Bid Specification
   - Issue Bids
   - Negotiate Contracts
   - Drilling
5. Flow Testing
6. Injection Well Decision
7. Determination of Cost Share
8. Project Management
9. Reporting
10. Dissemination of Information
11. DOE Conferences



▼ Milestone

1) These Tasks consist of a review of work which will be completed prior to the start of this project.

FIGURE 25 A

FIGURE 26

U. S. DEPARTMENT OF ENERGY

REPORTING REQUIREMENTS CHECKLIST

DOE Form CR-537
(1-78)

(See Instructions on Reverse)

FORM APPROVED
OMB NO. 38R-0190

1. IDENTIFICATION	2. OBLIGATION INSTRUMENT:

3. REPORTING REQUIREMENTS

A. PROJECT MANAGEMENT	Frequency	B. TECHNICAL INFORMATION REPORTING	Frequency
1. ☒ Management Plan	O	1. ☐ Notice of Energy RD&D Project (SSIE)	
2. ☐ Milestone Schedule & Status Report		2. ☒ Technical Progress Report	A
3. ☐ Cost Plan		3. ☐ Topical Report	
4. ☐ Manpower Plan		4. ☒ Final Technical Report	F
5. ☒ Contract Management Summary Report	M	C. PMS/MINI-PMS	
6. ☒ Project Status Report	M	1. Cost Performance Report	
7. ☐ Cost Management Report		☐ Format 1 WBS	
8. ☐ Manpower Management Report		☐ Format 2 Functional	
9. ☒ Conference Record	A	☐ Format 3 Baseline	
10. ☐ Hot Line Report		☐ Format 5 Problem Analysis	
		2. ☐ Cost/Schedule Status Report	
		3. ☐ Management Control System Description	
		4. ☐ Summary System Description	
		5. ☐ WBS Dictionary	

FREQUENCY CODES:
A – As Required
C – Contract Change
F – Final (End of Contract)
M – Monthly
O – One Time (Soon After Contract Award)
Q – Quarterly
S – Semi-Annually
X – Mandatory for Delivery with Proposals/Bid
Y – Yearly or Upon Contract Renewal

4. SPECIAL INSTRUCTIONS

A.5 and 6 - Due within 15 days after end of calendar month.

B.2. - Due within 15 days after completion of milestones for exploration, drill site selection, and flow test.

b.4.- A draft of the Final Technical Report shall be submitted for review to the Contracting Officer at least 4 weeks prior to the final due date. Comments resulting from this review shall be resolved and the report revised accordingly prior to final submission to DOE. The Final Technical Report shall be submitted with a camera-ready copy.

See page 2 for other reports and deliverables that are required.

5. ATTACHED HEREWITH:

☐ Report Distribution List ☐
☐ WBS/Reporting Category ☐

6. PREPARED BY (Signature and date):	7. REVIEWED BY (Signature and date):

ADDITIONAL REPORTS AND DELIVERABLE REQUIREMENTS

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, 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 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 this data is to be provided to DOE for reservoir assessment. The government will use this 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 this data is to be provided to DOE.

REPORTING REQUIREMENTS CHECKLIST

PURPOSE

A checklist to identify and communicate additional reporting requirements which are not otherwise set forth in the General Purpose clauses of DOE contracts and agreements. It will be included as part of the contract or agreement. This form will be completed for each proposed contract or agreement and can be modified as required in Special Instructions to adapt it to a specific situation.

INSTRUCTIONS

Item 1 – Enter the title as indicated in the Procurement Request, Interagency Agreement, or initiating memorandum.

Item 2 – Enter the identification number of the Procurement Request or Interagency Agreement, the date of the memorandum, and contract number after award.

Item 3 – Check spaces to indicate plans and reports required. For each reporting requirement checked, indicate frequency of delivery in column provided using one of the frequency codes shown.

3.A.1 *Management Plan* – The contractor's plan to manage the effort described in the statement of work or similar document. It will contain management methodologies, control systems, and procedures he will use. Includes milestones and other planning schedules, organizational identification and descriptions, and special and critical plans, such as test plans, plans for handling of Government owned property. Work breakdown structures, key personnel identification, and methods for monitoring progress toward objectives may be required.

3.A.2 *Milestone Schedule and Status Report* – The contractor's milestone schedule for all work breakdown structure items, line items, or deliverables specified in the contract. Updated periodically (usually monthly) with status, progress toward completion, and percent completion of each line item and of the total contract.

3.A.3 *Cost Plan* – A baseline plan for incurring costs on a contract or agreement to measure progress in terms of cost; update and forecast contract fund requirements; plan funding changes; and develop fund requirements and budget estimates.

3.A.4 *Manpower Plan* – A baseline plan to allocate manpower to each reporting category identified in the contract or agreement.

3.A.5 *Contract Management Summary Report* – A single-page graphic presentation of integrated cost, major milestones, and manpower for rapid visual analysis and trend forecasting.

3.A.6 *Project Status Report* – A periodic report to communicate to DOE management an assessment of contract status, to explain variances and problems, and to discuss any other areas of concern or achievements.

3.A.7 *Cost Management Report* – A periodic report of the status of costs compared to the Cost Plan. Data is used to: report actual and projected accrued costs; evaluate performance against plan; identify actual and potential problem areas; construct cost experience for projects and budgeting efforts; and, to verify the reasonableness of contractors' invoices.

3.A.8 *Manpower Management Report* – A periodic report of the status of actual and projected manpower expenditure against the Manpower Plan. Data is used to evaluate performance against plan; identify actual and potential problem areas; and to construct manpower experience for projections and planning efforts.

3.A.9 *Conference Record* – Documentation of the contractor's understanding of significant decisions, direction or redirection or required actions resulting from any meeting with DOE representatives.

3.A.10 *Hot Line Report* – A hardcopy report by the fastest means available, (TWX, etc) documenting critical problems, emergency situations, and important technical breakthroughs.

3.B.1 *Notice of Energy R&D Project* – A formatted, two-page report to provide information on unclassified DOE R&D projects for dissemination to the scientific, technical, and industrial communities and to the public. Also provides information to the Smithsonian Scientific Information Exchange.

3.B.2 *Technical Progress Report* – A formal, structured technical report, submitted periodically to communicate project results for dissemination to Government agencies, the scientific, technical and industrial communities and the public.

3.B.3 *Topical Report* – A special technical report prepared when a project has reached a point at which a major milestone or a significant phase has been completed, when unexpected results have been achieved, when it is logical to summarize results achieved, or when a new scientific or technological finding is deemed to warrant prompt publication.

3.B.4 *Final Technical Report* – Technical Progress Report reporting final results of DOE supported RD&D and scientific projects.

3.C *PMS/Mini-PMS*

1) *Cost Performance Report (PMS Application)*

Format 1 – Reports current period and cumulative budget, actual costs and earned value data by work breakdown structure elements. Identifies cost and schedule variances and provides contractor's estimate to complete comparisons to budgets.

Format 2 – Reports current period and cumulative budget, actual costs, and earned value data by contractor functional elements.

Format 3 – Provides periodic updating to the established performance measurement baseline. Incorporates authorized contract changes and internal re-planning into the performance measurement baseline.

Format 5 – Provides a narrative analysis of contract variances.

2) *Cost/Schedule Report (Mini-PMS Application)*– Periodic, usually monthly, report of cumulative budget, actual costs and earned value by summary work breakdown structure elements. Identifies cost and schedule variances and provides contractor's estimate to complete comparisons to budgets.

3) *System Description (PMS Application)* – Contractor's description of the management control system to be used in performing contract work. Must address all elements of the PMS criteria.

4) *Summary System Description (Mini-PMS Application)* – Contractor's summarized description of the management control system to be used in performing contract work.

5) *WBS Dictionary* – Lists and defines work breakdown structure. For more detailed instructions see PMS Manual.

Frequency Codes – Each code must have an identified time period (i.e., As Required 4-5 days after event occurrence). These time periods are suggested in the solicitation and negotiated at contract award.

Item 4 – Identify any special reporting requirements not indicated in Item 3 and/or qualifiers to those selected. (Use additional sheets as necessary.)

Item 5 – Check appropriate blocks.

Report Distribution List – A comprehensive informative listing of reports by frequency of submission, addresses and number of copies for each addressee.

Reporting Categories (level of detail) – An identification by WBS level of task elements for which reporting will be required by DOE.

Item 6 – Signature of person or persons preparing the checklist and the date prepared. Preparation is by person or persons responsible for preparation of Procurement Request or Statement of Work.

Item 7 – Signature of the person reviewing the checklist and date reviewed.

*U.S. GOVERNMENT PRINTING OFFICE: 1978--281-130/514

6.0 PERSONNEL AND ORGANIZATION EXPERIENCE

6.1 RELATED COMPANY PROJECTS AND PROGRAMS

The proposing company, Technology International, Inc., a Delaware corporation, was organized in 1976 specifically to carry on alternative technology renewable energy projects in the United States. A considerable amount of time and capital was utilized in the evaluation of a number of potential renewable energy resource related areas.

Ultimately the company elected to concentrate upon the development of geothermal energy projects since evaluation demonstrated its cost effective and ecologically acceptable characteristics to be superior to other renewable energy resource possibilities.

Additional evaluation and available data indicated that the largest portion of known resources at economically viable depths were of sub-electrical generation temperatures. Accordingly, the company began to review available process and space heat use information and to correlate potential use information with known resource information.

6.2 GEOTHERMAL DIRECT USE RELATED DEVELOPMENTS

The company approach to development became a program of acquisition of geothermal properties, offering potential for direct use applications together with a concentrated effort to educate private and public decision makers to the large potential of geothermal direct use projects. A number of attractive

leaseholds have been acquired which hold great promise for process heat, space heating and related projects.

Included in the company portfolio of high potential properties are the Vale leasehold and Geo Park, several high probability leaseholds with railroad frontage in Utah, a letter of intent granting certain rights to a high production sub-electric temperature well and large acreage in Nevada and a number of other properties and prospective properties including Hot Lake Hotel, the largest old continuously geothermally heated structure in the United States which is now listed on the National Register of Historic Places. The hotel is slated for a later complete restoration project. It is the opinion of management that all, save one, of these prospects have good potential for geothermal fuel alcohol production plants.

The company is presently negotiating for additional geothermal sites where the proposed project could be replicated with technical adaptation concerning substrate availability and resource characteristics. The proposed Vale project is envisioned as the first of a number of such plants at various locations.

One of the near term planned activities, as described elsewhere in this proposal, is the cost share production-size exploration hole which will be drilled by the Company under the management of sub-contractor Meidav Associates. A drilling plan is enclosed on the following page as Figure 28 .

Company management and its staff and its consultants have operated a geothermal direct space heating system for the past two

EXPLORATION-HOLE GENERAL DRILLING PLAN, TI LEASE, VALE

The following is a general plan for the drilling of a 1500' production-size well at Vale, Oregon.

1. Prepare site, mud-pit, water supply, etc.
2. Drill open hole to 60' with 20-22" diameter bit. Case with 16" surface casing and cement to surface.
3. Weld flange for valve and BOP. Install BOP.
4. Drill open hole 14½" diameter inside the 16" casing to total depth, if drilling conditions permit.
5. Carry out geophysical logging of the hole, including thermal, SP, long-normal or lateral resistivity, gamma ray and acoustic logs, if possible.
6. In case of cave-ins, lost circulation zones at a shallow depth, case with 12" to the surface. Drill with 10½" diameter bit to T.D. and case with 7" slotted liner.
7. If no problems of cave-ins occur, case with a 10" O.D. to bottom, using a slotted liner at the production interval.
8. Install valves, separator, testing equipment.
9. Lay line to disposal sump.
10. Stimulate and produce well.
11. Test well productivity for two weeks, including drawdown and buildup tests.
12. Carry out corrosivity and scaling tests.
13. Prepare final well evaluation report, including flow rates, temperatures, chemistry and engineering characteristics.

years and have developed considerable expertise in the evaluation and engineering of geothermal direct use projects including geothermal food processing plant, related chemical plant design and engineering and even geothermal space heating system design with requisite heat exchange requirements.

At the present time the company has in excess of Nine Million Dollars of assets at market value. It has a signed letter of intent from R.G. Dickinson, a large regional investment banking firm, headquartered in the Midwest, to either underwrite the company with a "firm" $4,000,000 public stock offering, or to alternatively raise between $16,000,000 and $21,000,000 in a large private placement (joint venture) financing which they believe is quite possible. The letter from the proposer's new investment banker follow. The proposer recently changed bankers because of the much larger size afforded by R.G. Dickinson.

6.3 FUEL ALCOHOL RELATED DEVELOPMENTS

During early 1978, the company began evaluating the potential for the use of geothermal as the energy input for fuel alcohol plants. Independent preliminary evaluation work led to a decision to own and operate a number of joint venture geothermal fuel alcohol plants.

FIGUIRE 29

R. G. DICKINSON & CO.

MAIN OFFICE
910 GRAND AVENUE
DES MOINES, IOWA 50308
(515) 247-8100

MEMBER
MIDWEST STOCK EXCHANGE

ALGONA
AMES
CARROLL
CHICAGO
CLINTON
FOREST CITY
FORT DODGE
KEARNEY
KEOKUK
LOS ANGELES
MARSHALLTOWN
OMAHA
RED OAK
TOPEKA
WEST DES MOINES
WICHITA

September 9, 1980

Mr. Stephen M. Munson, President
Technology International, Inc.
1009 Grant Street
Denver, CO 80203

Dear Mr. Munson:

As we have discussed, R. G. Dickinson & Co. (hereinafter called "RGD") is interested in acting as the managing underwriter of a proposed primary offering of approximately $4 million of Common Stock of Technology International, Inc. (hereinafter called "TII"). Additionally, RGD is interested in working with TII in satisfying future financing needs.

Over the past twenty-five years, RGD has been fortunate to have had the opportunity to provide various financial services to an increasing number of corporations. Our professional staff is experienced in all areas of corporate finance, including raising capital privately and publicly; merger, acquisition and related activities; corporate appraisals for various purposes; and tax shelters.

Members of our staff have successfully completed long-term debt placements ranging in size from $750,000 to $22 million; industrial revenue bond financings ranging in size from $350,000 to $4.5 million; and secured debt transactions. Until recently, the public market has been closed for all practical purposes to most small and medium size companies. However, the strength of our sales organization and syndicate department has enabled us to manage or co-manage public offerings totalling in excess of $68 million over the past twelve months. One of the underwritings recently managed by RGD was a $5 million S-18 registration for American Gasohol Refiners, Inc., a producer of ethanol, headquartered in Wichita, Kansas. This underwriting was completed on a firm basis and was syndicated nationally. We believe the public equity market will continue to be receptive to certain small and medium size companies for the balance of this calendar year.

In the merger field, we have been active in all facets of this vital corporate area. RGD has initiated several transactions (ranging in size from several hundred thousand dollars to in excess of $12 million), assisted in negotiations and in certain instances, obtained the related financing. We have been retained to locate businesses for purchase and to represent sellers in negotiations for the sale of corporations. Due to the increasing focus on the terms of transactions and the fairness to shareholders, our corporate finance professionals have been asked by Boards of Directors to express "fairness opinions" which have been included with the proxy statements filed with the Securities and Exchange Commission. We are also experienced in the tender area and are uniquely qualified to respond to these specialized problems. Our activity and resulting success in the merger area provides us with the requisite experience to be of meaningful assistance on a very broad basis.

The appraisal area is perhaps the most confidential portion of our work, particularly with respect to the work performed for private companies. We are extremely proud of our ever-expanding reputation in this field and have rendered numerous opinions for ESOT's, estate and gift tax purposes, and buy-sell arrangements.

Joe Griffiths and I have reviewed the financial statements, corporate plan, management biographies and feasibility studies you have provided, and considering this material and the information you presented in our conference in Des Moines on September 5 and our various telephone conversations, we believe your proposed ethanol project is feasible and, in light of current market conditions, can be financed. We intend to further consult with you concerning the various alternative methods available to accomplish this financing, including a possible private placement of approximately $6 million of equity capital and a stand-by commitment of $10 to $15 million for future capital requirements. Our initial review of your overall corporate needs also indicates that some form of partnership vehicle would be appropriate to finance certain of your projects, including geothermal drilling activities and the development of the Hot Lake Hotel property.

This corporate finance consultation is undertaken by us in anticipation of the successful completion of a public offering or private placement, whichever we jointly agree is most desirable, and as compensation for this service, in addition to any cash fees paid for placing the securities, we would expect a 4% equity interest in TII to be issued to RGD and/or certain

officers thereof. We currently anticipate a public underwriting is the best method to proceed, and unless we mutually agree that the private placement is more advantageous, we propose the following:

1) RGD would need to complete a thorough due dilligence examination of all relevant information and individuals concerned.

2) Management of TII and its attorneys would be responsible for the drafting of an S-18 registration statement with a view to filing with the Securities and Exchange Commission. We are prepared to work with you in the preparation of the necessary documents for the filing.

3) RGD would, prior to the filing of the registration statement, undertake preliminary discussions with other prospective underwriters to determine the possibility of underwriting the issue on a "firm" basis.

4) RGD would, subsequent to the filing of the registration statement, assuming we are successful in (2) above, undertake preliminary negotiations to form and manage a group of underwriters to purchase the stock from TII for offering to the public. Immediately prior to the time the registration statement is expected to become effective, we and the other several underwriters will enter into a firm commitment underwriting agreement with TII.

5) The actual public offering price, gross underwriting discount and resultant proceeds to TII would be established through agreement between TII and ourselves shortly prior to the offering. We anticipate that an underwriting group would require a gross underwriting discount of approximately 9% of the public offering price depending upon market conditions at the time of the offering and the difficulties encountered in building a demand for the issue.

Mr. Stephen M. Munson, President
September 9, 1980
Page Four

6) The underwriting agreement would provide, among other things, that TII would bear the expenses customarily borne by an issuer, including their counsel's fees, accountant's fees, printing expenses, SEC and NASD filing and registration fees, transfer agent and registrar fees, and "Blue Sky" filing and legal fees. The underwriters would pay their own expenses including the fees of their counsel and costs of public advertisement of the financing.

7) The underwriting agreement would further provide for customary representations and warranties by TII and for TII to indemnify the underwriters and their controlling persons against certain liabilities, including liabilities under the Securities Act of 1933.

8) TII will issue RGD and/or certain officers thereof, as discussed above, warrants to purchase 4% of the Common Stock to be outstanding at the conclusion of the offering at 120% of the public offering price. Said warrants are to expire no sooner than five years from the effective date of the proposed underwriting.

The proposal outlined above represents our thinking in light of our present knowledge of TII's business and current securities market conditions, although we believe that in the absence of adverse changes in the foregoing, an offering consistent with the above proposal can in all probability be accomplished.

This letter does not constitute an agreement to underwrite these securities or perform any other services, or an agreement to enter into any such agreement, but reflects our present intention of proceeding to work with you on the proposed financing, and we look forward to doing so.

Very truly yours,

R. G. DICKINSON & CO.

William K. Schroff
Vice President, Corporate Finance

Technology International, Inc. accepts the foregoing and authorizes R. G. Dickinson & Co. to pursue the proposed financing.

BY: ______________________
Stephen M. Munson, President
Technology International, Inc.

DATE: ______________________

WKS:gh

During the early development process, the company retained the consulting services of Dr. Paul Middaugh, a professor of microbiology at South Dakota State. In fact, Dr. Middaugh was in charge of the now famous Washington Mall still which is now operated on the South Dakota State campus. Dr. Middaugh has become a major spokesman for the fuel alcohol industry nationwide. The company is on quite good terms with him and seeks his advice on research related matters from time to time.

6.4 GASOHOL PLANT SALES

From the determination to own and operate a number of company plants together with private investors the company also decided to design, market and provide customer support for a line of commercial turnkey fuel alcohol plants.

The Company accordingly has hired in-house staff with catalytic cracking plant and thermodynamic engineering specialization experience, chemical engineering plant multi-product design and production experience and various other related disciplines. A number of microbiologist and biochemist candidates are being evaluated for hiring as this proposal is being submitted. The Company is in final negotiation for certain distillery management services from a notably experienced group of distillation plant managers who have formed a management service group. They will act as "in-house" management support to full time staff personnel.

The company has sold several 200,000 gallon per year and a 400,000 gallon per year turnkey plant which is being fabricated by a proven western United States distillation equipment manufacturer.

That 400,000 gallon plant in Nevada is planned to use geothermal energy as the input source and corn as feedstock. A nationwide equipment dealership is being established, based upon a combination of an in house technical sales organization and the 250 member existing dealership network of one of the peripheral equipment suppliers to the company.

The proposer offers a line of six sizes of turnkey fuel alcohol plants for sale to the public which plants have the following rated annual capacity: 200,000; 400,000; 600,000; and 1,500,000; 3,000,000; and 4,500,000 gallons of anhydrous alcohol. Having just completed a six-month market evaluation test, the proposer sales subsidiary has recently given out more than $180,000,000 of plant quotations to potential purchasers across the United States. All plants carry performance quarantees, and the proposer offers installation and startup training to purchasers. A copy of a standard major component quotation follows.

6.5 PROPOSER-OWNED PLANT PROJECTS

The proposer is also planning to develop a series of company owned and operated fuel alcohol plants at various sites in the United States of which a number of them will be run with geothermal energy. The investment banker to the proposer is convinced that a significant number of such plants are financeable. In fact, the proposer is planning in excess of Forty-five Million (45,000,000) gallons of alcohol plant capacity to be brought on line over the next two and one half years. The Vale Geo Park project is planned to be the second, third, or fourth proposer owned plant to be brought on line and the first of its plants to be run on geothermal energy.

6.6 ROCKY MOUNTAIN GASOHOL CENTER

The proposer has recently acquired a site north of Denver, Colorado, with existing buildings, laboratory space, water, electricity, storage bins, "grain leg", staff housing, waste lagoon, and feedlot for byproduct feed trials. The site is being named the Rocky Mountain Fuel Gasohol Center. A plot map of the site follows, as well as several pictures of the site which should receive planning approval in September, 1980.

The Rocky Mountain Gasohol Center will start with 200,000 gallons of capacity and expansion will move to 1,500,000 gallons of capacity. The proven process distillation equipment is in storage;pending planning approval, the plant will be in operation within two or three months.

Mr. Bert Hawkins, a probable proposer partner in the Vale Geo Park production plant, has been actively working on feedstock procurement in the project area. The enclosed letter, Figure clearly demonstrates the level of interest in this project by potential sugar beet feedstock suppliers.

In short, the proposing organization has substantial history in both the areas of geothermal energy direct use and fuel alcohol projects. As described in the personnel management plan and financial sections, the company has supported its major interest in geothermal and fuel alcohol plants as the major emphasis of its entire developmental efforts. The company has

ETHANOL INTERNATIONAL, INC.
1009 Grant Street
Denver, CO
("Seller")

FIGURE 30

EQUIPMENT PURCHASE AGREEMENT

NAME ("Buyer"): ______________________ **PHONE:** __________

ADDRESS: ______________________

PRODUCT DESCRIPTION: MODEL 4500 FUEL ALCOHOL: WITH 60-INCH COLUMNS AND DEHYDRATION SYSTEM (198 (+) PROOF)

MAJOR ITEMS/COST SCHEDULE:	**COST:**
1. Corn Preparation and Starch Conversion Equipment	$ 523,600
2. Fermentation, Production, Storage, and Slops Tank, External Cooler, Pump	1,019,150
3. Double Column Distillery (190 Proof)	215,800
4. Distillery Energy Economizer	20,200
5. Dehydration Distillery (198 (+) Proof)	202,400
6. Support Including Gas Boiler, Cooling Tower, Pumps, Compressor	372,650
7.	
BUDGET PRICE BEFORE INSTALLATION	2,353,800
8. ESTIMATED: Foundations, Structures, Electrical, Piping, Installation (California Union Rates, No Building or Grain Storage)	950,000

PAYMENT SCHEDULE: SEE PAGE 3

ESTIMATED COMPLETION DATE: ______________________

RANGE OF DATES FOR TRAINING: ______________________

BUYER'S INITIALS ________ **DATE** ________ **SELLER** ________

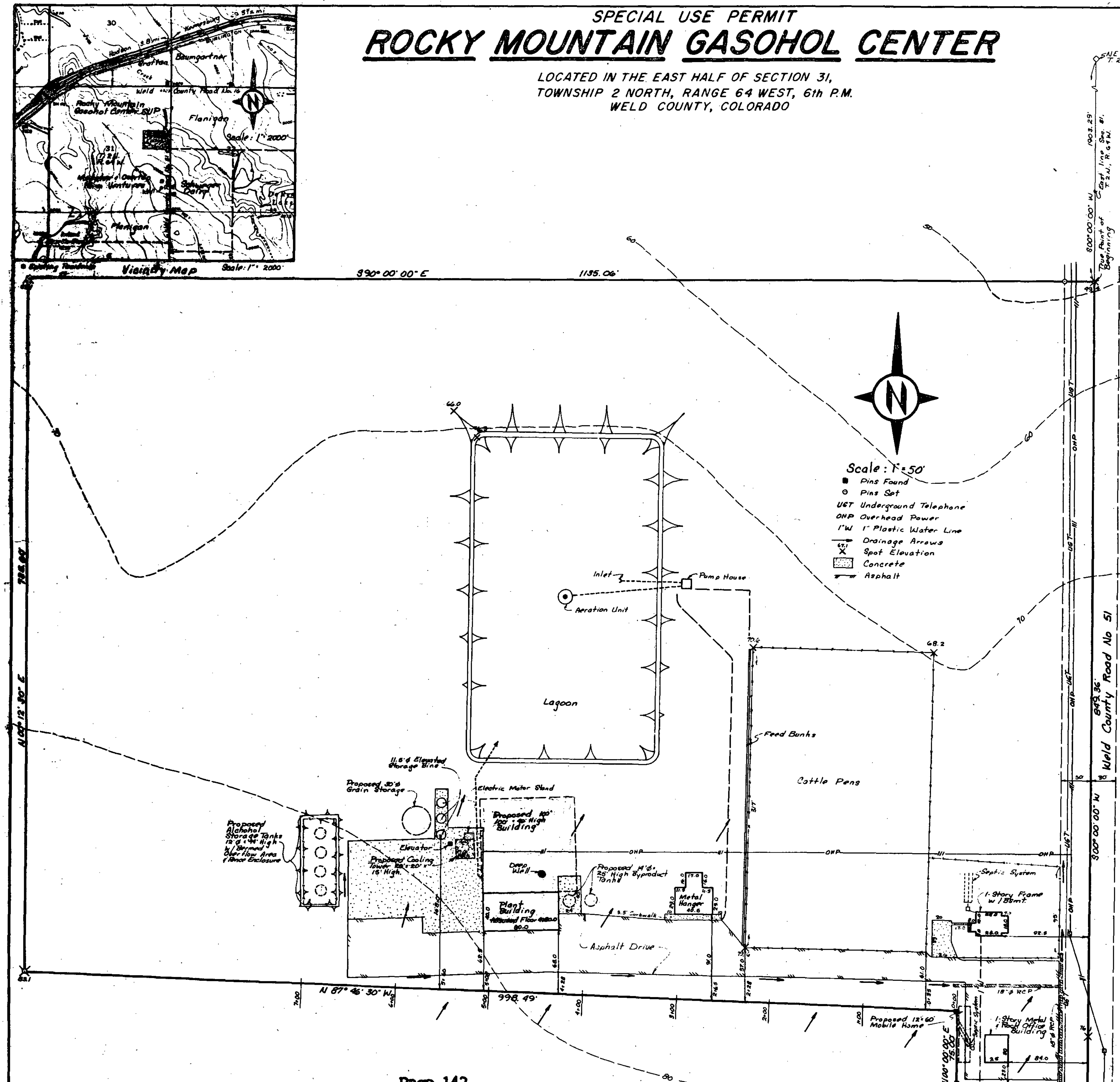
Page 1 **of** ____ **Pages**

FIGURE 31

SPECIAL USE PERMIT

ROCKY MOUNTAIN GASOHOL CENTER

LOCATED IN THE EAST HALF OF SECTION 31,
TOWNSHIP 2 NORTH, RANGE 64 WEST, 6th P.M.
WELD COUNTY, COLORADO



LEGAL DESCRIPTION

A TRACT OF LAND LOCATED IN THE EAST HALF OF SECTION 31, TOWNSHIP 2 NORTH, RANGE 64 WEST OF THE 6th P.M., WELD COUNTY, COLORADO AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:
BEGINNING AT THE NORTHEAST CORNER OF SAID SECTION 31 AND CONSIDERING THE EAST LINE OF SAID SECTION 31 TO BEAR SOUTH 00° 00' 00" WEST AND WITH ALL OTHER BEARINGS CONTAINED HEREIN RELATIVE THERETO: THENCE SOUTH 00° 00' 00" WEST ALONG THE EAST LINE OF SAID SECTION 31, 1903.29 FEET TO THE TRUE POINT OF BEGINNING;
THENCE CONTINUING SOUTH 00° 00' 00" WEST, 849.36 FEET;
THENCE NORTH 90° 00' 00" WEST, 140.00 FEET;
THENCE NORTH 00° 00' 00" EAST, 75.00 FEET;
THENCE NORTH 87° 46' 30" WEST, 998.49 FEET;
THENCE NORTH 00° 12' 30" EAST, 735.60 FEET;
THENCE SOUTH 90° 00' 00" EAST, 1135.06 FEET TO THE TRUE POINT OF BEGINNING. SAID TRACT OF LAND CONTAINS 20.000 ACRES.

SURVEYOR'S CERTIFICATE

I DO HEREBY CERTIFY THAT UNDER MY PERSONAL SUPERVISION, THIS PLAT AND LEGAL DESCRIPTION WERE PREPARED ON JULY 30, 1980

GERALD B. McRAE, PROFESSIONAL ENGINEER AND LAND SURVEYOR, COLORADO REGISTRATION NO. 6616

PLANNING COMMISSION CERTIFICATE

THIS IS TO CERTIFY THAT THE WELD COUNTY PLANNING COMMISSION HAS CERTIFIED AND DOES HEREBY RECOMMEND TO THE BOARD OF COUNTY COMMISSIONERS, WELD COUNTY, COLORADO FOR THEIR CONFIRMATION, APPROVAL AND ADOPTION, THIS SPECIAL USE PERMIT AS SHOWN AND DESCRIBED HEREON THIS______DAY OF_______________, 1980.

CHAIRMAN, WELD COUNTY PLANNING COMMISSION

BOARD OF COUNTY COMMISSIONER'S CERTIFICATE

THIS IS TO CERTIFY THAT THE BOARD OF COUNTY COMMISSIONER'S, WELD COUNTY, COLORADO DOES HEREBY CONFIRM AND ADOPT THIS SPECIAL USE PERMIT AND DEVELOPMENT STANDARDS AS SHOWN AND DESCRIBED HEREON THIS____DAY OF__________, 1980.

CHAIRMAN, BOARD OF COUNTY COMMISSIONERS

ATTEST: ____________________
COUNTY CLERK

BY: ____________________
DEPUTY

RECORDED BY: ________________ DATE: __________
COUNTY RECORDER

PROPERTY OWNER'S APPROVAL

THE UNDERSIGNED MAJOR PROPERTY OWNER WITHIN THIS SPECIAL USE PERMIT DOES HEREBY AGREE TO THE DEVELOPMENT STANDARDS AS DESCRIBED HEREON THIS_______DAY OF_______________,A.D., 1980.

DISTRICTS

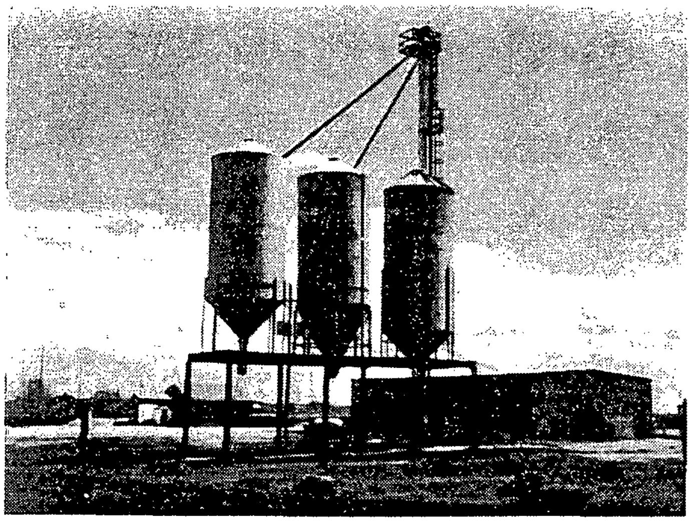
WATER: CENTRAL COLORADO WATER CONSERVANCY DISTRICT
GREELEY, COLORADO
SCHOOL: RE 3 J
AIMS COMMUNITY COLLEGE
FIRE: HUDSON FIRE DISTRICT

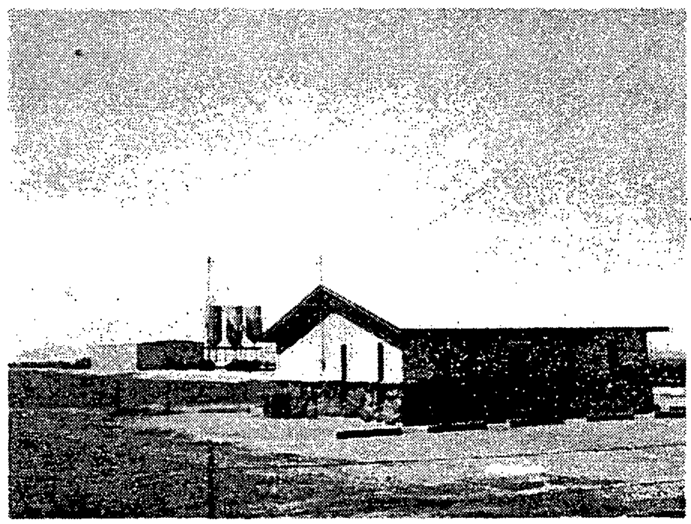
UTILITIES

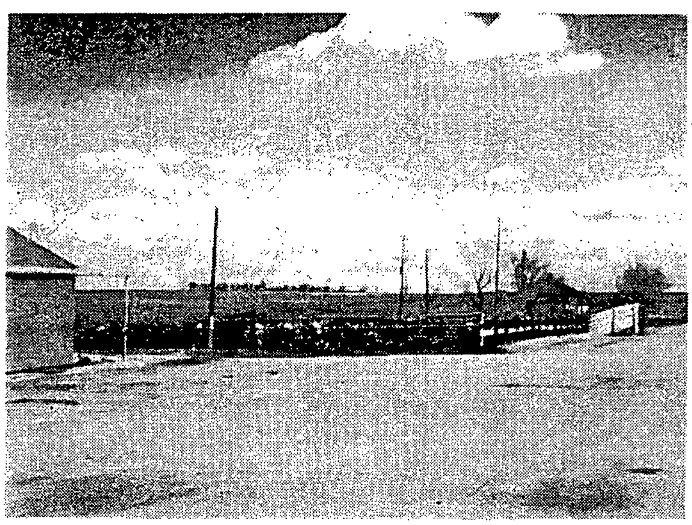
SEWER: SEPTIC TANK & LEACH FIELD
GAS: PROPANE
ELECTRICITY: UNION REA, BRIGHTON, CO.
TELEPHONE: MOUNTAIN BELL
DOMESTIC WATER: WELL

McRAE & SHORT, INC. 1227 - 8th Avenue Greeley, Colorado 80631 80087

FIGURE 32







ROCKY MOUNTAIN GASOHOL CENTER

FIGURE 33

THE AMALGAMATED SUGAR COMPANY

P. O. BOX 250 NAMPA, IDAHO 83651

June 2, 1980

To whom it may concern:

There have been preliminary talks between The Amalgamated Sugar Company and Mr. Bert Hawkins in regard to the sale of beet tailings for alcohol production.

At this time there is not a definite contract or sales agreement concerning the beet tailings, but we are interested and would be agreeable to further talks.

The Nyssa, Oregon plant produced 15,450 tons of tailings during the 1979-80 campaign. The Nampa, Idaho plant produced 18,400 tons during the same period.

We are trying to recover all the tailings possible and re-introduce them into our factories. Nampa has a recovery system now and one is being installed at Nyssa. Last year Nampa's system was in operation so the 1979-80 production of tailings should be representative of future volume. Nyssa will probably produce 65% to 75% of the 1979-80 tonnage in the future. Of course, as the price of sugar increases we expect farmers to grow more sugarbeets. The greater the tonnage processed through the factories, the greater the tonnage of tailings.

R. G. Larson

R. G. Larson
Treasure Valley District Manager

RGL/ms

a number of existing and planned research and evaluation efforts underway, including those of resource evaluation, technical and economic and marketing nature. In fact, many of the developmental efforts of the Company thus far pre-dated the existence of the geothermal direct use and fuel alcohol industries. The proposer brings to this project a number of directly related unique capabilities which lend real strength to the proposed drilling project.

7.0 RESUMES, KEY STAFF PERSONNEL AND NON-GEOTHERMAL CONSULTANTS

The resumes of geothermal related technical consultants and probable sub-contractors are listed in section 4.3. This section lists the key non-geothermal staff personnel and consulting personnel.

Stephen Munson, project manager, is the 36-year-old Founder and Chief Executive Officer of Technology International, Inc., which was organized in 1976 to carry out alternative technology renewable energy projects. Mr. Munson has been trained in energy project investment banking in the Corporate Finance Department of Dillon, Read & Company, Inc., New York. Projects included financial analysis of the Northern Border Group Arctic Gas Pipeline, the Coal Gasification Project near Beulah, North Dakota. He has acted as an independent business consultant and worked for McNeil Investments, real estate syndicators, while in graduate school.

Mr. Munson was formerly a United States Army Infantry Captain, NATO Land South East and U.S. Army Europe. He received an M.B.A. (Finance Specialization) from Stanford University in 1974 and an M.A. in political science (International Development) also from Stanford University in the same year. He was the Executive Director of the Oregon House Task Force on Pollution (1969-1970) and is a committed advocate of ecologically sound renewable energy development. Mr. Munson was recently selected as Colorado State Coordinator for the National Alcohol Fuel

Producers Association and is an industry advisory board member with responsibilities in fuel alcohol standards development and public relations.

As elsewhere described, Mr. Munson will be relying upon certain of the retained geothermal related consultants, potential sub-contractors, and by the probable drilling date, staff geothermal personnel including certain of the above for drilling advice of a technical nature.

Dr. Pearce Lyons is the recently resigned Executive Vice President of Biocon (US), Inc. He received a Bachelor's Degree in Science with a double first in Chemistry and Biochemistry from Dublin University in 1968. He has a Masters in Brewing Technology and a Ph.D. in Yeast Fermentation from the University of Birmingham, England. From 1971 to 1974, he was the Research and Production Director of Irish Distillers, and then joined Biocon in England as Managing Director.

Biocon was organized 12 years ago by a group of distillers and brewers to produce enzymes and other products for the distillery and brewing industry, and to give consultation to the industry worldwide. The company has offices in 17 countries and laboratories in a number of them. They have pioneered in the production of fuel alcohol in Ireland, England, Brazil and North America. They have published information available. The proposed program manager, Mr. Munson, is a featured speaker at the well-known Biocon Fuel Alcohol Seminars.

Dr. Lyons resigned from Biocon to found a new management consulting and fuel alcohol services firm named Alltech, which is located in Lexington, Kentucky. The proposer is in the final stages of negotiating a broad services and reciprocal services and sales agreement with Alltech under which the broad distillation operational experience of that firm will be made fully available to the proposer on a long term basis. This agreement will add strength to the proposer organization matched only by major distillery companies. Dr. Lyons will be working on the proposer PRDA.

Mr. Glenn Selch is a chemical engineer on the technical staff of the proposer. He received a chemical engineering degree in 1956 from the University of Colorado. He has more than 20 years of industrial experience, including five years as plant superintendent and manager of a chemical production plant which produced specialty organic chemicals, and management of up to 70 employees for a Syntex Corporation subsidiary.

Mr. Selch was supervisor of an advanced propellant development group and was responsible for the development of high energy solid propellants and process techniques while with Hercules, Inc. He presented major papers to classified sessions of national conferences and the final report of a two-year phase became a reference document used industrywide. He served as a Lieutenant in the U.S. Army Corps of Engineers. He is a member of a number of professional societies and has many years experience selecting manufacturing equipment for a variety of industrial projects.

Mr. Selch will be working on the proposer PRDA as well.

Mr. Bert Hawkins is a probable part-owner of the proposed plant. Mr. Hawkins owns Clover Creek Cattle Company and served as a World War II fighter pilot. He has chaired the American National Cattleman's Association Animal Health Committee and is on the Board of Directors of the American National Cattleman's Association. He is a past president of the Oregon Cattleman's Association and has served on numerous local, state and national advisory and policy-making boards and committees. His most recent honorarium was selection as National Commercial Cattleman of the Year by the U.S. Beef Improvement Federation.

8.0 TECHNICAL PLANNING

To make this proposal more usable as an operating document and to facilitate a close coordination of project objectives, project management and specific work tasks, this section is generally described under section 1.0, and then very carefully detailed in section 4.0 in task by task format.

9.0 VARIABLE COST SHARE PLAN

The total cost of this proposed resource confirmation project is $1,472,000.

The capacity of the user-coupled ethanol production facility will approximate a linear function of extractable energy (assuming no supplementary energy source is added), but the capital cost per unit capacity will increase logarithmically with decreasing capacity. This is illustrated in Figure 34 which plots plant capital cost per unit capacity versus plant capacity. This plot is based on the "six-tenths factor" method which is described by the equation:

$$C_n = r^{0.6} C$$

where

C_n = "New" plant cost
r = Ratio of "new" plant capacity to base capacity
C = Cost of "base" capacity plant

(Ref: Chemical Engineers' Handbook, Perry & Chilton, 5th Ed., p. 25-16)

Since the user-coupled plant cost will increase logarithmically with decreased resource availability, it is rational to balance this added cost against a similarly logarithmic cost-sharing relationship.

Because of the non-linear relationship between user costs and energy availability from the hydrothermal resource, the proposers cost share formula is most clearly presented by a plot showing available energy as a percent of total requirements versus proposers' cost share as a percent of total cost. This plot is presented in Figure 35.

A tabulas grid relating resource energy availability to ethanol plant requirements is shown in Figure 36. Energy available for use will be determined by measuring total wellhead flow of hydrothermal fluid (steam plus water) in pounds per hour and average fluid enthalpy in BTU's per pound. (Temperature of steam and water can be related to enthalpy through standard steam tables)

The upper limits of wellhead enthalpy and flow are based upon the average predicted well production capacity from preliminary exploration and known nearby geothermal measurements.

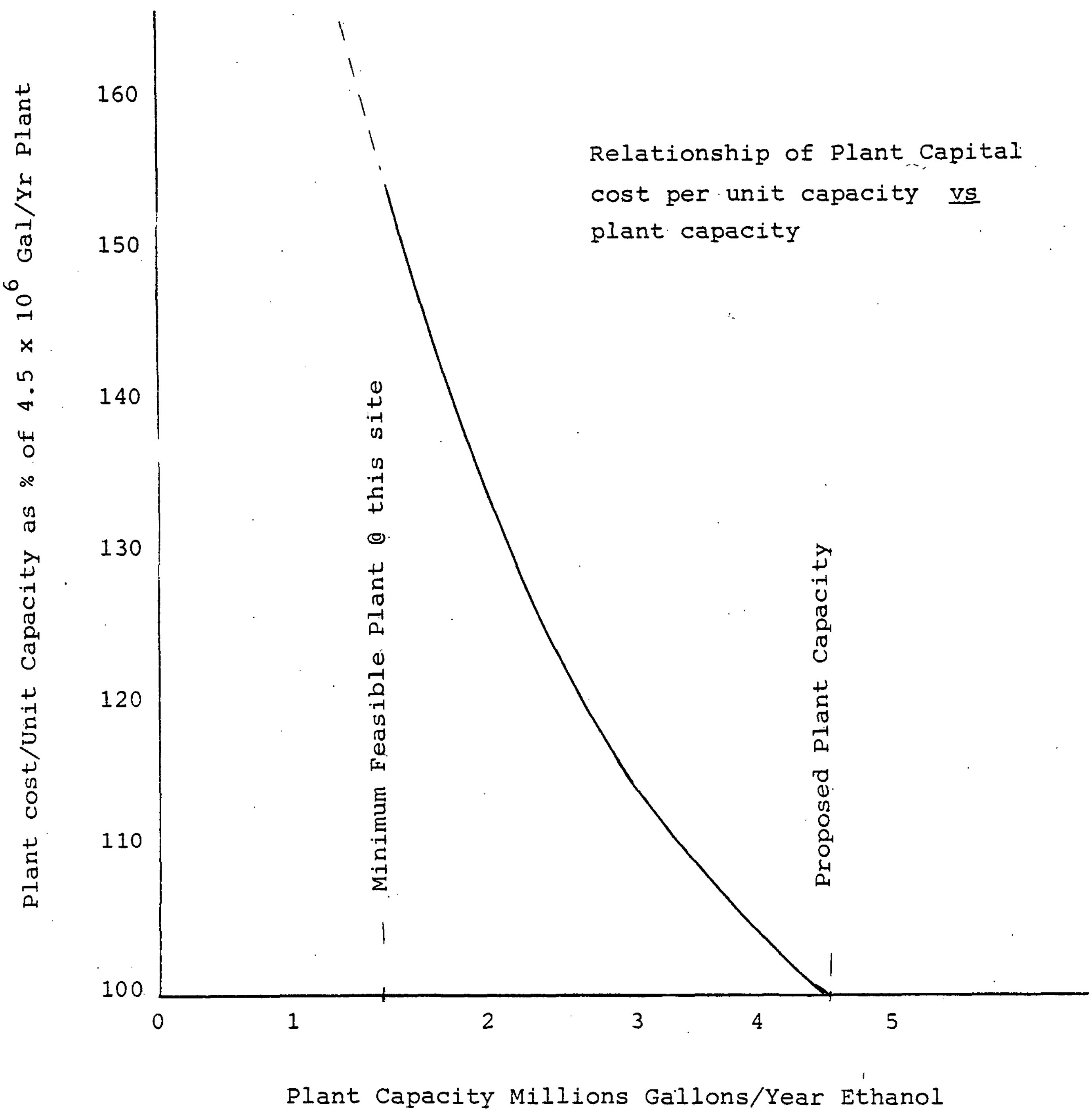
The lower limit of acceptable enthalpy is equivalent to water temperature of 235^0F, and is based on the estimate that heat exchanger maximum economical sizes will be reached when the temperature "approach" is approximately 10^0F *. The nominal temperatures required in the 190 proof distillation, by-product drying, and azeotropic distillation steps are 225^0F, 215^0F, and 190^0F respectively. It is not economical to flash steam at several different temperatures for these separate processes. Again, pending further analysis, it is assumed that heat exchanger economics will dictate steam-to-water rather than water-to-water heaters at these points.

* Temperature "approach" is the temperature difference between inlet heating media and outlet heated fluid in a countercurrent heater.

The lower limit of hydrothermal fluid flow is selected to correspond to the minimum plant capacity (1.35×10^6 gal/yr ethanol), consistent with acceptable feedstock procurement contracts and product marketability. This capacity is 30% of the nominal design capacity of 4.5×10^6 gal/yr ethanol.

The chemical properties of the hyrothermal fluid have not been factored into the cost-sharing formula because the chemical quality of the resource is predicted to be in the acceptable range and the PRDA study contract will include evaluation of heat transfer modes and construction materials required to accomodate any quality of hyrothermal fluid within the expected range of analysis, which evaluation will be available for use by late January, 1981.

FIGURE 34



Relationship of Plant Capital cost per unit capacity vs plant capacity

Proposers Cost Share Plot

FIGURE 35

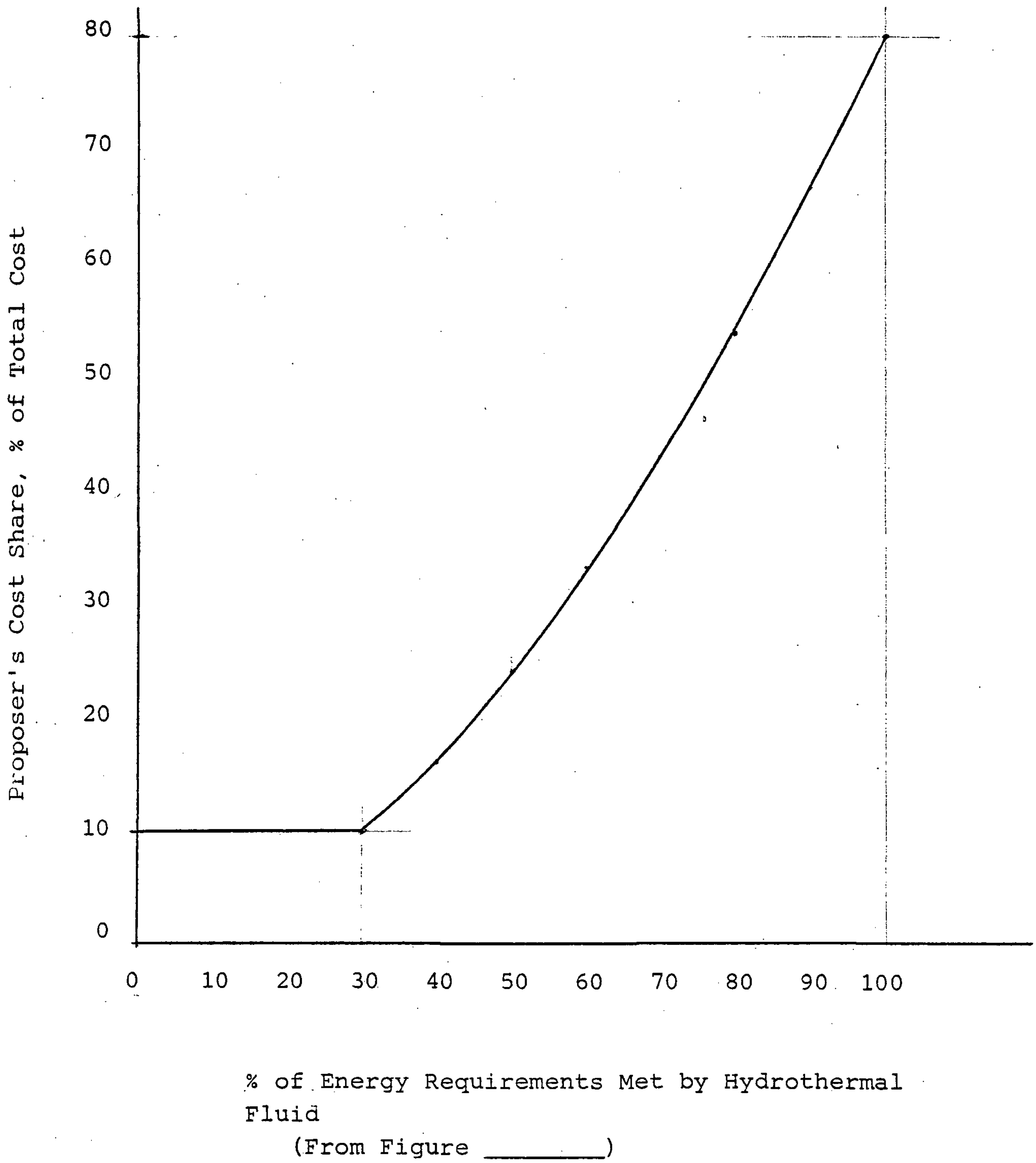


FIGURE 36

Wellhead Flow, Thousands of Pounds/Hour

Fluid Enthalpy, BTU/Pound

Acceptable "unsuccessful"

	≤120	121-140	141-160	161-180	181-200	201-220	221-240	241-260	261-280	281-300	≥320
≤203	0	3	6	9	12	15	18	21	24	27	30%
204-214	4	8	11	15	18	22	26	29	33	36	38
215-225	8	12	16	19	23	27	31	33	38	42	46
226-236	13	17	21	25	29	34	38	42	46	50	54
237-247	17	21	26	30	35	39	43	48	52	57	61
248-258	21	26	30	35	40	45	49	54	59	63	68
259 - 269	26	31	36	41	46	51	56	62	66	71	76
270-280	30	35	41	46	52	57	62	68	73	79	84
281 291	34	40	46	51	57	63	69	75	80	86	92
≥ 302	38%	44	50	57	63	69	75	81	88	94	100

Body of Chart is % of Energy

Requirement Met by Conditions Shown

10.0 ENVIRONMENTAL, LEGAL, AND SOCIAL CONCERNS

A project of the magnitude of this proposal must always be considered within the framework of a number of institutional factors. While a number of important factors have been partially addressed by the activities of the proposer to date, there remain other institutional relationships which need to be evaluated and descrubed by the project team under this direct application study.

10.1 Social Concerns

The proposed project has already been through a significant social acceptability screening process during the Malheur Country planning commission and county court zoning change discussions. The proposer successfully petitioned for a geothermal based industrial park zone change for its "Geo Park" site on the railroad 0.6 miles from the company geothermal leasehold. The above site is understood by the proposer to be the largest industrial park site approved to date in malheur county and the only one granted to specifically develop the geothermal potential of the area. Several favorable newspaper articles follow on Figure 37. A considerable amount of work has gone into development of this project already.

The proposed project is fully compatible with the stated objectives of the Oregon statewide land use planning commission and with certain published planning documents of the region relating the need to develop its geothermal potential as an

Daily Argus Observer 8-27-79

EDITORIAL OPINION

We vote yea, too

"I'm willing to cast my lot on the chance this will work."

The speaker was Joe Hobson, Malheur County Planning Commission member. He had just finished casting his 'yea' vote to approve 100 acres of land northeast of Vale for a proposed geothermal industrial park.

Hobson, along with four other members of the planning commission gave their consent to the zone change from F-2 (general farm use) to M-1 (industrial). Commissioner Bill Yost was absent but provided in writing his agreement with the proposal.

John Bishop, the sole dissenter on the commission, expressed reservations concerning the project. We understand his reservations. Placing 100 acres of land in one corporation's hands would appear to be putting a lot of eggs in one basket.

Stephen Munson, president of Technology International, Inc., of La Grande, told the group the proposal requires 100 acres to practically implement a geothermal industrial park.

Hobson expressed a concern that the La Grande firm would follow in the steps of a predecessor who talked about developing the geothermal potential but did little toward that end. In essence, they were full of hot air, not hot water.

Munson replied his company has plans to start drilling within 12 to 15 months on land considered to be some of the best in the United States for direct application usage.

If the temperature of the geothermal proves to be as hot as estimates show, Munson said the energy will be utilized in direct application — quite possibly in businesses dealing with agricultural processing. If the resource exists at a lesser temperature the La Grande man suggested greenhouses and acquacultural set-ups are two viable alternatives. Gasohol production is a third possibility Munson mentioned.

Munson is optimistic the geothermal potential will pan out, thus attracting agriculturally-based industries to Malheur County.

We're willing to cast our lot with the proposal, like Hobson, hoping it won't be another hot air venture. The boost such an undertaking could provide to the county, and possibly to the city of Vale, is great. We've heard time and time again of the potential, we're anxious to see Munson's company work toward turning that potential into reality.

We agree with the safeguard the planning commission built into their approval. Should development not be pursued and potential users not materialize within 36 months, the land will revert back to general farm use. It's a condition Munson said he can live with comfortably. It's one we feel might lend an added incentive to development of the resource and the industrial park.

Hot water may be vital to the economic future of Malheur County. Certainly in this era of growing energy shortages, all alternative resources should be pursued vigorously. We applaud the commission's willingness to take a chance, on ~~what~~ at least appears to be a sure bet.

We look for Munson's hot water to be hot water, not hot air.

Daily Argus Observer 9-28-79

Geothermal industrial park site before County Court Monday

VALE—Final approval on a zone change involving 100 acres of land northeast of Vale will come before the Malheur County Court Monday evening.

The public hearing has been slated for 8 p.m. in the city council chambers of Vale City Hall.

The zone change proposal was initially submitted to the Malheur County Planning Commission in July by Stephen Munson, president of the LaGrande-based firm of Technology International, Inc. Munson, whose company is involved in the development of geothermal energy, has proposed the creation of a 100-acre geothermal industrial park outside of Vale.

His company currently holds leases on 200-acres of land which Munson said will be drilled for geothermal. He explained to the planning commission the geothermal would be utilized for direct application, and emphasized the industrial park must be on line in order to attract potential industries.

The commission rendered an affirmative response to the proposal during their August meeting, voting 5-1 in favor of the zone change. Under the proposal the land would change from F-2 (general farm use) to M-1 (industrial).

ecologically sound alternative to reliance upon hyrocarbon resources. A significant part of the area suffers from a lack of acceptable employment opportunities, both for adults and youngsters entering the work force.

The development of a geothermal fuel alcohol plant at Vale was discussed on more than one occasion during the Geo Park zoning discussions. The consensus of opinion was that a fuel alcohol plant could not only provide a boost to the local economy but that it would create additional agricultural product marketing alternatives, beneficial high protein animal feeds and vitally needed regional farm fuel alternatives, all beneficial factors for this agriculturally based community.

Senior elected officials of the town commented that they would not be opposed to development of the Geo Park (about a mile from the city limits) which is across a fontage road and railroad from the underutilized city sewage lagoon. In fact, it was stated that when the project was sufficiently progressed, the city would consider a proposal to include possible use of the city lagoons. It might consider annexation to provide Geo Park services and increase the tax base.

10.2 Legal

Legally, the proposer currently owns the private ownership geothermal leasehold as described on the map Figure and as more fully described in the property description which follows. The proposer also owns the Geo Park industrial development site subject to its existing land sales contract from Mathew Jordan. The approved Geo Park industrial site will not remove high production agricultural land from the local farming base.

Specific manpower requirements, including job descriptions and preferred experience and education levels will be included in the final PRDA report. It is expected the majority of plant operation personnel will be local community members who will be trained to operate the proposed plant.

10.3 Drilling Permit

The Company has applied for temperature gradient permits and, upon notification of a successful proposal, will post the required bonds and receive the drilling permits as per the Department of Geology and Mineral Industries letter of March 27, 1980. Deep well permits are now being applied for.

The proposed drilling program will meed all of the stringent environmental safeguards imposed by the state of Oregon upon drilling programs with respect to water contamination, flow-out prevention, noise pollution and required abandonment procedures.

GEOTHERMAL LEASEHOLD PROPERTY DESCRIPTION

Land in Malheur County, Oregon, as follows:

In Twp. 18 S., R. 45 E.,W.M.:
Sec. 28: SE¼NW¼, NE¼NW¼, Lots 2, 3, 4, 5, 6, 7, 9, 10, 11 and 12.

Sec. 29: S½S½NE¼, NE¼NE¼, N½SE¼NE¼, NE¼SW¼NE¼, NW¼NE¼.

Sec. 33: Lot 1.

In summary, a number of barriers to development have been overcome. There are additional problems to solve, including development of an energy cascaded space heating system, complete understanding of the step-by-step approach to a low interest state loan and the necessary ATF permit requirements. All of these will be the subject of evaluation under this study and the results reported in the conclusions.

10.4 ENVIRONMENTAL FACTORS

Technology International, Inc., owns geothermal leasehold on approximately 745 acres, primarily on the Rhinehart Buttes, situated to the north of the town of Vale, Oregon. It is the intent of the Company to use part of the Program Research and Development Announcement Funds to comply with the State of Oregon Geothermal Lease Regulations and submit an environmental impact study. This study will consider the historical and archaeological uses of the lands, potential noise and odor pollution, potential impact on local flora and fauna, the climate, geology, and seismology of the area, aesthetics, and potential socio-economic impact upon the community, and make affirmative recommendations for offsetting adverse factors, if any.

The team management will research further into the historical uses of the lands. A preliminary search of the Rhinehart Buttes found no caves, burial mounds, rubbish mounds, shells, or pottery as evidence of early settlers. However, more recently, the plains area was used by early cowboys and ranchers for grazing their sheep and cattle. The company will deal properly with archaeological considerations, if such evidence should be discovered.

Malheur County is on the edge of an agriculturally fertile belt known as the Snake River Plain. Agriculture and food processing are the major industries in the county. Half the regional source of income is generated by self-employed farmers. The company has planted hay and alfalfa on its industrial park site; however, approximately ten acres of the 110 acre site are too alkaline to produce crops. It is this section of land that the company first intends to evaluate for a future plant site. The Company will continue to plant the remaining Geo Park acreage to crops.

The Rhinehart Buttes, located approximately 0.6 mile south of the Geo Park, are mostly covered with Intermountain Shrubs, Big Sagebrush, Bluebunch Wheatgrass and Squirrel Tail. Preliminary research of the Buttes does not find evidence of wildlife, although domestic horses graze the hillside. The study will evaluate the impact of a wellfield on this acreage.

The Malheur River runs north and east between the Geo Park site and the Leasehold for approximately sixteen miles before entering the Snake River. This river is exceptionally muddy because its major use is irrigation. There is almost no recreational fishing along this stream. The PRDA will study the potential impact from possible use of the river water for ethanol processes and the potential impact of shallow wells for process water on the Geo Park site. Reinjection wells will also be evaluated at the industrial park site. The team will study the climate, hyrology and seasonal wind directions before planning positive flood control, pollution and odor controls (if any are required).

There is one existing road up the Rhinehard Buttes. Once the geologic and geochemical analyses have been completed, and the well location is decided upon, the company will attempt to use existing roads where suitable. Any new access will be evaluated to cause minimal disturbance to the land and vegetation. All permanent construction and permanent structures on the land will be aesthetically acceptable and make use of the natural lora for landscaping.

In 1970, the population of Malheur County was 23,169 - a population density figure of 2.4 persons per square mile. The town of Fale had a popoulation of 1,680 and the trend has shown slow movement from the rural areas to urban centers. Although company studies are incomplete, they suggest that the trend will remain the same. The company anticipates only a small permanent work force of approximately fifteen persons to operate the ethanol plant and field. This work force would have a small impact on the community.

It is anticipated that the drilling contractor will transport crews to the well site, and temporary housing will be established locally or rented. The schedule for the PRDA drilling could be completed by late January, 1981.

The Company will evaluate the impact on the housing industry in Vale, in the event all anticipated 15 plant employees require new permanent residences. John Johnson is a stockholder in the proposer and Chairman of the Melheur Country Economic Development Task Force. He will evaluate impact of the geothermal plant on the market values of the homes in the area and the possibility of a Geothermal Space Heating District for the Vale area.

No major significant requirements are anticipated from local community services. However, the company will evaluate the waste water disposal systems already available. The under-utilized sewage lagoons are a short distance from the industrial park site, and the company will compare the use of the existing lagoons to its own pond system. The Company will compare drawing water for its industrial processes directly from the Melheur River to drilling shallow water wells for additional water.

Technology International has allocated adequate proposal funds for a thorough environment impact study and to evaluate offsetting affirmative measures to be employed, if deemed necessary by study results.

11.0 PROGRAM POLICY AND PREFERENCE FACTORS

11.1 GEOGRAPHIC LOCATION

There are a number of significant factors which argue for selection of this User Coupled Direct Use Drilling Proposal. Since DOE is tasked with developing a broad number of projects in terms of geographic location, it makes a great deal of sense to select the top rated unproven resource prospect in a given major geographic region for development under this program. According to the earlier referenced U.S. Geologic Survey Circular 790, the proposer-owned Vale KGRA property represents the top rated geothermal resource in a many state geographic region. This is a fact which reflects the extremely high accord given the Vale KGRA by a number of independent researchers. It is time that this resource be drilled, and its full scale development commenced for the good of the region and nation.

In other words, it makes sense to get the top undeveloped prospect in a given area going now, this time, with this program, then get number two or three going the next time the User Coupled comes out. This will make for a rational, logical, development pattern.

11.2 POTENTIAL FOR DEVELOPMENTAL EXPANSION

As was earlier described under Section 2.0, the proposer leasehold alone could be developed to produce an estimated Ninety Million Gallons of fuel alcohol production. Furthermore, the proposer leasehold represents only one-eighth of the KGRA geographic area.

If a first developmental well were proven under this program, there are substantial additional major resource companies with expensive and expansive leaseholds in that KGRA.

There are a substantial number of other leases in the area which date back to the period 1974 and 1975, including Republic Geothermal and Union Oil of California, which would probably be developed or at least sub-leased for active direct use development if a successful deep well were proven under this User Coupled proposal.

Additionally, since this proposer considers its Vale project to be its number one developmental priority, whereas others are deeply involved in other sites already, funding of this User Coupled proposal would tend to extend the number of active drilling development companies both at Vale and at other quality sites owned by the proposer.

The list of other leaseholders at the Vale prospect include the following:

FEDERAL LEASE OWNERS IN VALE AREA

Date	Number of Acres	Amount Bid	Lessee
1974	1,347	$ 13,800	Republic Geothermal
1975	2,566	41,500	Union Oil of California
1975	1,920	31,000	Union Oil of California
1975	2,560	7,700	Geothermal Resources Int'l
1976	1,280	27,000	Union Oil of California
1976	2,245	47,400	Union Oil of California
1976	2,003	2,300	Amax Exploration, Inc.
	TOTAL	$170,700	

11.3 VARIETY OF END USE PROJECTS

Given the unique dual Geothermal and Gasohol businesses of the proposer and its singular orientation to direct use projects over its years of growth to date, there exists a unique opportunity to develop a variety of end use projects at some very interesting sites which have been highly rated by the U.S.G.S. and DOE for sometime. This proposal has been submitted by a proposer with a long standing and single-minded dedication to direct use development. Award of this direct use drilling program would represent a major development in its recent growth and achievement of a long planned objective by a company with the ability to bring a number of direct use projects on-line. The proposer has achieved a certain "critical mass" in its growth and is, as is demonstrated clearly in Section 6.0 letter from its major underwriting firm, in a position to develop a substantial number of direct use geothermal projects at various sites in the near future.

11.4 MOST BANG FOR THE BUCK

Given the great energy potential of the Vale site, it would be very difficult to imagine another situation anywhere offering such a great potential "bang for the buck" for DOE dollars to be expended. It is demonstrably possible that eight times Ninety Million gallons of geothermal fuel alcohol production could be brought on line for the mere initital expenditure by

DOE of 20 per cent of the minimum funds requested, or approximately $200,000, truly one of the great risk/reward ratios that this proposing firm has seen in any business of any sort. Just this one proposed well alone could put on-line in excess of Forty Million BTU's per hour continuously for at least 30 years for an expenditure of as little as $200,000 on behalf of DOE which funds could clearly be the critical funds in stimulating development of an entire geothermal direct use infra-structure by private industry in the highly productive Snake River Plain region.

003
Copy 5

VALE GEO PARK
USER COUPLED GASOHOL PLANT
RESERVOIR CONFIRMATION PROGRAM

VOLUME II
BUSINESS PROPOSAL
SCAP NO. DE-SC07-80-ID12139

Submitted By:
Technology, International, Inc.
1009 Grant Street
Denver, Colorado 80203

September 15, 1980

TECHNOLOGY INTERNATIONAL, INC.
Suite 303
1009 Grant Street
Denver, CO 80203

September 11, 1980

User Coupled Drilling Program
Evaluation Committee
Department of Energy
Idaho Operations Office
550 Second Street
Idaho Falls, ID 83401

RE: SCAP NO. DE-SC07-80-ID12139

Gentlemen:

We appreciate your consideration of our proposal, and, of course, hope that you find it both intriguing and complete. Please note that this well, if funded, would greatly stimulate development of a KGRA with excellent resource potential and particular value to a major agricultural region.

As described herein, the proposer has been devoting substantial time to development of a number of aspects of technical and institutional nature in preparation for a Vale Geo Park Fuel Alcohol Plant. There are a number of potential future development capital options, including committed equity from the proposer and a notably strong major investment banker. Award of this would stimulate not only the proposed project at Vale, but would also act as an ideal pathfinder project for near term replication at other sites.

The proposer fully intends to complete a geothermal fuel alcohol plant at its Vale Geo Park site, rather than to simply end up with a "dead end" and useless hydrothermal resource. Your careful evaluation will be much appreciated.

Cordailly,

Stephen M. Munson

Stephen M. Munson
Chief Executive Officer

lja

Appendix B

SAMPLE DOE PROPOSAL COVER PAGE
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. 5 of 10

Date of Submission September 15, 1980

Technology International, Inc.
Name of Organization (principal participant if a team of organizations)

A Small Business Corporation.
Organizational Classifications

Suite 303, 1009 Grant Street, Denver, CO 80203
Address of Organization

Vale Geo Park User Coupled Gasohol Plant Reservoir Confirmation Program
Title of Proposed Project

Maximum Funds requested From DOE $1,324,000 Total Cost of Project Through Flow Testing $1,472,000

Location of Site Vale Hot Springs KGRA, near Vale, Oregon

Proposed Project Duration (in months) 15 Months

Requested Starting Date As Soon As Possible (February, 1981)

Official Contact for Negotiations Stephen M. Munson

Position and Title President

Telephone (w/area code) 303-832-8215

Effective Period of Proposal 200 days

AUTHORIZED OFFICIAL

Signature [signature]

Name Typed Stephen M. Munson

Title President Date September 10, 1980

Please Check Small Business X Disadvantaged Business ___ Other ___

Appendix C

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.

The proposed end use for this direct utilization program is a 4,500,000 gallon per year fuel alcohol "Gasohol" plant. This plant will utilize proven, "off-the-shelf" technology which is being marketed to the public through a subsidiary of the proposer by the name of Ethanol International, Inc. The plant will utilize local waste agricultural crops as the feedstock substrate. The plant will be located on the proposer owned Geo Park industrial park site located 0.5 miles north of the proposer owned geothermal leaseblock in the Vale KGRA as depicted on the map on page of this proposal.

The geothermal energy will be used to provide cooking, distillation, and byproduct feed drying energy for plant operation which will provide all non-electric energy needs for the operation.

If the proposed well is successful, there is a distinct possibility that the town of Vale will wish to purchase low temperature effluent for a small space heating project. The proposer also has developed some plans for greenhouse and aquacultural projects at the site. However, because of the byproduct aquaculture feed and CO_2 inter-related project uses planned neither lower temperature use is considerd desirable without development of the fuel alcohol facility at the Geo Park's site. If the project is successful, the proposer will intend to sell energy from future wells to other Geo Park tenants at temperature ranges at least as high as required by the Gasohol plant.

Signed: [signature]
Technology International, Inc.
Proposer

Signed: [signature]
Ethanol International, Inc.
User

C. SUMMARY

The proposed project provides for second stage surface explorations, deep well drilling, testing; completion and reservoir confirmations work designed to interface with proposer cost share work and DOE geophysical work under PRDA DE-RA03-80RA50121 entitled Proposal For A Site Specific Engineering, Marketing and Economic Study of a 4,500,000 Gallon Geothermal Fuel Alcohol Plant For The Vale Geo Park Site Near Vale, Oregon which was recently awarded to the proposer.

This project is basically designed so that if the 1,500 foot exploration hole required of the proposer under the PRDA is not of sufficient productive output, as it in all likelihood will not be, then this User Coupled project will provide for a full scale production hole and reservoir confirmation through the expected levels of two deeper reservoir formations.

This User Coupled Confirmation Drilling Program proposal is designed to assist in the near term development of the moderate temperature hydrothermal resource believed to exist at the Vale Hot Springs KGRA which have been extensively studied by the U.S. Geologic Survey and others. This project is proposed to first confirm the existence of the Vale KGRA moderate temperature hydrothermal resource which would then be coupled to the proposed Vale Geo Park Geothermal Gasohol Plant which the proposer initially believes to be economically viable, and which is clearly and demonstrably technically feasible. Certain as yet incompletely studied questions related to the project would be answered under the PRDA contract (for evaluation by both the proposer and DOE User Coupled project evaluators) prior to both startup of this User Coupled proposed project and issuance of the PRDA Final Report.

The proposer resource consists of approximately one-eighth of the KGRA surface land area and is superbly located in what the proposer believes to be the highest quality location in the Vale KGRA.

The proposer is a five-year old renewable energy holding company with substantial business interests related to geothermal energy development and several aspects of the emerging fuel alcohol "Gasohol" industry. In addition to its geothermal resource development activities, the proposer is developing a number of Gasohol plants which will variously utilize geothermal, biomass, or coal as the fuel sources which plants feature proven "off-the-shelf" technology developed directly from long experience with the more sophisticated beverage alcohol distillation industry. The plant technology featured by proposer features completely proven and available technology which requires only site specific feedstock or related adaptations and fuel system adaptations to render it fully viable and cost effective. The proposer project team consists of a notably experienced full capability organization.

The proposer project has already received widespread media coverage concerning development of the Geo Park concept and the recent PRDA award. The project has demonstrated strong regional support at all governmental levels which favor a successful development of the proposer site. These factors together insure that development of a successful project at the site will greatly help to facilitate increased economic use of moderate temperature hydrothermal resources. It will help to create an industry without need of similar Federal support in the later portion of this decade.

Media attention generated by this Geo Park Gasohol Project will do much to positively promote development of a viable and continuing infra-structure of technical support and financing institutions and mechanisms capable of supporting a viable hydrothermal resource-based industry.

TABLE OF CONTENTS

TABLE OF CONTENTS CONTINUED

1.0 PROJECT COST AND BUDGET SUMMARY

The cost data for the proposed project is contained in the Form 60 which follows together with Schedules E-1 to E-4. Schedule E-2 is followed by many detailed cost breakouts specifically listed on the schedules which follow it. The budget summary is included by tasks or staff time per task as appropriate.

1.1 PROJECT FINANCIAL PLAN

The estimated maximum proposer share of this project is $1,177,711 assuming all contingency costs are required. This amount will be met either out of the upcoming offering or, more probably, out of a tax shelter drilling partnership either with or without a DOE geothermal loan guarantee. The attached letter in Section 1.3 from the proposer's major investment banker describes the present very strong position of the proposer with respect to major future financings. The investment banker, R.G. Dickinson is a major firm which has a past record of major financings considerably larger than the funds required by this project. The proposer is very confident that it can satisfy any post award investigation into its ability to meet financing needs under this proposal. The proposer is planning to complete its $4,000,000 public offering or much larger private placement prior to year end or the very first of next year. A present $300,000 private placement is currently proceeding very well.

Appendix I

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. 2	NO. OF PAGES 24

NAME OF OFFEROR: TECHNOLOGY INTERNATIONAL, INC.	SUPPLIES AND/OR SERVICES TO BE FURNISHED: Geothermal Well Drilling and Related Services	
HOME OFFICE ADDRESS: 1009 Grant Street, Denver, CO 80203		
DIVISION(S) AND LOCATION(S) WHERE WORK IS TO BE PERFORMED: Vale, OR; Denver, CO	TOTAL AMOUNT OF PROPOSAL: $ 1,472,147	GOV'T SOLICITATION NO. SCAP NO. DE-SC07-80-ID12139

DETAIL DESCRIPTION OF COST ELEMENTS

			EST COST ($)	TOTAL EST COST[1]	REFERENCE[2]
1. DIRECT MATERIAL (Itemize on Exhibit A)					
a. PURCHASED PARTS				291,592	E-1
b. SUBCONTRACTED ITEMS				959,266	E-2
c. OTHER—(1) RAW MATERIAL					Plus
(2) YOUR STANDARD COMMERCIAL ITEMS					Schedules
(3) INTERDIVISIONAL TRANSFERS (At other than cost)					
TOTAL DIRECT MATERIAL					
2. MATERIAL OVERHEAD[3] (Rate %X$ base =)					
3. DIRECT LABOR (Specify)	ESTIMATED HOURS	RATE/HOUR	EST COST ($)		
				44,467	E-3
TOTAL DIRECT LABOR					
4. LABOR OVERHEAD (Specify Department or Cost Center)[3]	O.H. RATE	X BASE =	EST COST ($)		
	.50			22,234	E-3
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				7,850	E-4
b. PER DIEM OR SUBSISTENCE				15,545	E-4
TOTAL TRAVEL					
8. CONSULTANTS (Identify—purpose—rate)			EST COST ($)		
TOTAL CONSULTANTS					
9. OTHER DIRECT COSTS (Itemize on Exhibit A)					
10. TOTAL DIRECT COST AND OVERHEAD					
11. GENERAL AND ADMINISTRATIVE EXPENSE (Rate 10 % of cost element Nos.)[3]				131,187	
12. ROYALTIES[4]					
13. TOTAL ESTIMATED COST				1,472,147	
14. FEE OR PROFIT				-0-	
15. TOTAL ESTIMATED COST AND FEE OR PROFIT					

OPTIONAL FORM 60
October 1971
General Services Administration
FPR 1-16.806

This proposal is submitted for use in connection with and in response to *(Describe RFP, etc.)*

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	SIGNATURE
Stephen M. Munson, President Technology International, Inc.	Stephen M. Munson

NAME OF FIRM	DATE OF SUBMISSION
TECHNOLOGY INTERNATIONAL, INC.	9/15/1980

EXHIBIT A—SUPPORTING SCHEDULE *(Specify. If more space is needed, use reverse)*

COST EL NO.	ITEM DESCRIPTION *(See footnote 5)*	EST COST *($)*
	Refer To Following Pages : E-1, E-2, E-3, and E-4	
	Plus Attachments To E-2	
	Plan Budget Summary 21-24	

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	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? We have been awarded a PRDA June, 1980

☐ YES ☐ NO *(If yes, identify.)*: (?) Contract not get sent to proposer.

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)

SCHEDULE E-1

PURCHASED PARTS BY TASK

TASK	DESCRIPTION	AMOUNT
1	Telephone, etc.	$ 100
2		
3	Printing and Telephone	400
4	Telephone	200
	Drilling Fluids	16,000
	Solids Control	5,000
	Directional Control	4,000
	Wellhead Equipment	31,020
	Bits	42,238
	Casing	146,690
5	Materials	2,000
	Gauges, Cranes	32,650
	Long-term Test equipment	7,400
6	Telephone	100
7		
8	Telephone and Copying	1,800
9		
10	Printing	2,000
		$ 291,598

SCHEDULE E-2

SUBCONTRACTED ITEMS BY TASKS

TASK	AMOUNT	SUB-CONTRACTOR
1		
2	$ 1,600	Environmental Consultant
	1,200	Meidav Associates
3	2,000	Meidav Associates
4	9,200	Meidav Associates
	31,500	G.E.C. Corporation
	~~216,000~~	Drilling Sub-contractor
	150,000*	New Site Preparation
	95,000	Cementation Service Co.
	28,490	Geophysical Logging Co.
5	8,700	Therma Source or Equivalent
	2,000	Meidav Associates
6	2,000	Meidav Associates
7		
8		
9	7,200	Meidav Associates
10		
	204,376	Contingencies
	$759,266	
	200,000	New injection well plus plumbing, if needed
	$959,266	

* Assuming that the existing site is unusable. The preparation of the existing site will cost only $14,547.

RIG COST

Atlantic Oil Company
P.O. Box 497
Paramont, California 90723

Rig transportation to and from site	$ 25,000.00
Rig operation - $170.00/hour for 30 day drilling program	191,000.00
Rig supervision - $500.00/24 hour day	15,000.00
	$231,000.00

Bits, Monel Drill Collar and special equipment will be supplied by operator.

Fuel for the rig will be supplied by a local distributor and paid for by Atlantic Oil Company.

CASING PROGRAM COST

Armco Steel Corporation
P.O. Box 1028
133 W. Kentucky Avenue
Woodland, California 95695

30 inch conductor pipe

This casing will be supplied by a local contractor. A bid of $3600.00 was received which included drilling the hole, pipe, cement and removal of 18 inch pipe now in cellar.

20 inch Armco casing - 125 feet

$18.15/foot (94 pounds)		$2268.75
Plain Guide Shoe		1207.00
	Total	$3475.75

13 3/8 inch Armco casing - 1500 feet

$29.49/foot (61 pounds)		$44,235.00
Plain Guide Shoe		251.00
Float collar		546.00
Centralizers - 12 @ $72.00 each		864.00
Baker Lock - 4 boxes @ $15.00/box		60.00
	Total	$45,956.00

9 5/8 inch Armco casing - 4000 feet

$15.21/foot (36 pounds)		$60,840.00
Plain Guide Shoe		187.00
Differential float collar		391.00
Centralizers - 23 @ $50.00 each		1,150.00
Baker Lock - 4 boxes @ $15.00/box		60.00
	Total	$62,628.00

7 inch Armco liner - 2700 feet

$10.89/foot (29 pounds)		$ 29,403.00
Plain Guide Shoe		113.00
Centralizers - 3 @ $39.00 each		117.00
Baker Simplex Liner Hanger - 1		2,500.00
1000 miles @ $.90/mile		900.00
Hanger running tool		490.00
8 hours @ $26.00/hour		208.00
1000 miles @ $.90/mile		900.00
	Total	$ 34,631.00

Bill's Casing Tong Service
P.O. Box 1723
Marysville, California 95901

20 inch casing tool

$550.00/day - 1 day (Casing run by rig personnel)	$550.00

13 3/8 inch casing service - 1500 feet

Manual back-up casing tool		$ 255.00
Pick-up machine		300.00
$.04/foot		210.00
Clamp-on thread protector		60.00
$.02/foot		30.00
Hydraulic tongs		325.00
$.13/foot		195.00
Power tong operator - 6 hours @ $20.00/hour		120.00
Power tong truck - 600 miles @ $1.00/mile		600.00
Pick-up machine truck - 600 miles @ $1.25/mile		750.00
	Total	$2,845.00

9 5/8 inch casing service - 4000 feet

Manual back-up casing tool	$ 150.00
Pick-up machine	300.00
$.11/foot	440.00
Clamp-on thread protector	60.00
$.02 /foot	80.00
Hydraulic tongs	275.00
$.11/foot	440.00
Power tong operator - 8 hours @ $20.00/hour	160.00
Power tong truck - 600 miles @ $1.00/mile	600.00
Pick-up machine truck - 600 miles @ $1.25/mile	750.00
	$3,255.00

7 inch liner casing service - 2700 feet

Hydraulic tongs	$ 250.00
$.10/foot	270.00
Clamp-on thread protector	60.00
$.02/foot	54.00
Power tong operator - 8 hours @ $20.00/hour	160.00
Power tong truck - 600 miles @ $1.00/mile	600.00
Pick-up machine truck - 600 miles @ $1.25/mile	750.00
Total	$2,044.00

Welder - 40 hours @ $32.00/hour $1,280.00

CEMENTING PROGRAM COST

B.J. - Hughes, Inc.
B.J. Cementing Service
80 BeeJay Way
Woodland, California 95695

20 inch casing

Cost includes mileage, 1 truck, cement, supervisor and related equipment.

$15,000.00

13 3/8 inch casing

Cost includes mileage, 1 truck, cement, supervisor and related equipment.

$30,000.00

9 5/8 inch casing

Cost includes mileage, 2 trucks, cement, supervisor and related equipment.

$50,000.00

Cost for 30 inch conductor cementing is included in section dealing with cellar repair.

Mixing, pumping and cementing head equipment are supplied by the cement contractor.

SUPPORT SERVICES AND EQUIPMENT COST

Directional Control

Kuster Survey Instruments
Kuster Company
2900 E. 29th Street
P.O. Box 738
Long Beach, California 90807

Kuster Survey Tool - 40 days @ $100.00/day (Rig Operated)	$4,000.00

Electrical Logging

Schlumberger Well Services
517 Houston Street
west Sacramento, California 95691

Cement Bond Log - Surface to 4000 feet

Service charge	$2,500.00
Mileage - 1400 miles @ $1.85/mile	2,600.00
Crew time - 12 hours @ 12.00/hour	1,020.00
Hostile environment charge	750.00
Tool protection insurance	55.00
Total	$6,925.00

Additional Logs - Surface to 6500 feet

Formation Density Log service charge	$4,740.00
Dual Induction Log service charge	7,300.00
Temperature Log - 2 runs	5,500.00
Mileage - 1400 miles @ $1.85/mile	2,600.00
Crew Time - 24 hours @ $12.00/hour	2,040.00
Hostile environment charge	750.00
Tool protection insurance	55.00
Total	$22,985.00

Mud Logging

EnergyLog
3227 Second Avenue
Sacramento, California 95817

Rig up/rig down		$ 550.00
40 days logging @ $510.00/day		20,400.00
Resistivity - in and out		1,600.00
Pit volume indicators - 3		1,600.00
Temperature - in and out		1,200.00
Hydrogen Sulfide detector		1,200.00
Trucking charge - trailer		800.00
Travel charge - loggers		1,140.00
	Total	$ 28,490.00

WELLHEAD EQUIPMENT COST

H and H Oil Tools
Church and Airport Roads
Rio Vista, California 95471

20 inch BOPE

Flange, pitcher nipple and Hydrill bag - 5 days @ $150.00/day	$ 750.00
Delivery charge - 700 miles @ $1.50/mile	1,050.00
Total	$1,800.00

13 3/8 inch BOPE

WKM casing head	$3,036.00
Delivery charge - 700 miles @ $1.50/mile	1,050.00
Total	$4,086.00

9 5/8 inch BOPE

WKM alignment bowl	$ 1,671.00
WKM expansion spool and pack off	2,363.00
WKM 900 Series Master Valve	12,000.00
Delivery charge - 700 miles at $1.50/mile	1,050.00
Total	$17,084.00

Completion design

Remove 9 5/8 inch BOPE and add WKM Flow T with two 3 inch WKM 600 Series Seal Type Valve	$6,500.00
Delivery charge - 700 miles @ $1.50/mile	1,050.00
Total	$7,550.00

Miscellaneous pipe and fittings	$500.00

DRILL BIT COST

Ottwell Tool Company
3109 San Antonio Street
Bakersfield, California 93308

26 inch hole opener	$3,170.00
17½ inch bits	
Mill Tooth bits - 2 @ $4,200.00/bit	$8,400.00
Tungsten Carbide Insert bit - 1	10,707.00
Total	$19,107.00
12¼ inch bits	
Mill Tooth bits - 3 @ $1,413.00/bit	$4,239.00
Tungsten Carbide Insert bit - 1	5,121.00
Total	$9,360.00
8 3/4 inch bits	
Mill Tooth bits - 2 @ $981.00/bit	$ 1,962.00
Tungsten Carbide Insert bit - 1	2,615.00
4 8 3/4" bits @ $981.00/bit	3,924.00
Total	$ 8,501.00

PROJECT COST

Well-site management

Site and access maintenance and repair (Plan A)

Access	$1,572.00
Site	6,275.00
Sump	2,500.00
Cellar	4,200.00
Site and access road construction (Plant B)	14,547.00
	$150,000.00

Rig	$231,000.00
Drilling fluids	$ 16,000.00
Solids control	$ 5,000.00

Casing

20 inch		$ 3,475.00
13 3/8 inch		45,956.00
9 5/8 inch		62,628.00
7 inch		34,631.00
	Total	$146,690.00

Casing tong service

20 inch		$ 550.00
13 3/8 inch		2,845.00
9 5/8 inch		3,255.00
7 inch		2,224.00
	Total	$ 8.874.00

Welding	$ 1,280.00

Cement

20 inch		$15,000.00
13 3/8 inch		30,000.00
9 5/8 incy		50,000.00
	Total	$95,000.00

Directional control $ 4,000.00

Electrical logging

Cement bond		$ 6,925.00
other		22,985.00
	Total	$ 28,490.00

Wellhead equipment

20 inch		$1,800.00
13 3/8 inch		4,086.00
9 5/8 inch		17,084.00
Completion		7,550.00
Miscellaneous Fittings		500.00
	Total	$31,020.00

Bits

26 inch		$ 3,170.00
17½ inch		19,107.00
12¼ inch		9,360.00
8 3/4 inch		8,501.00
Tax		2,100.00
	Total	$42,238.00

Total cost of drilling sub-contracts	
Plan A (Use existing drilling site)	$682,049.00
Plan B (develop a new drill site)	817,504.00
25% (of plan B) contingency	204,376.00
Grand Total	$1,021,880.00

* Prices as of September 1, 1980

The 25% contingency is added to cover any unknown factors

Schedule and Budget

The cost of the short-term testing is estimated at $45,170.00. Long-term testing, assuming ninety days, is estimated at $21,090.00. The major cost item is wireline services. If the well operator has access to these services within his organization, significant cost savings could result.

During the short-term tests, two technicians are required plus a supervisory engineer. All manpower charges begin when the men depart for the well site and conclude upon their return. The long-term test will require two men for set-up and initial monitoring (about two days); then only periodic checks will be required until the well is shut-in. Special alarm systems can be installed and telemetered to a central station for corrective action. Justification of such a system will depend on length of the test.

FIGURE 1

COST ESTIMATE

GEOTHERMAL WELL TESTING PROGRAM

I. Short-Term Test (three flow periods)	
A. Materials (meter run, throttling valve, anchors, and all connections	$ 2,000.00
B. Direct Labor	
2 Technicians @ $250.00/day for 9 days	4,500.00
1 Engineer @ $350.00/day for 12 days	4,200.00
C. Contract Services	
Wireline service (pressure and temperature gauges and acoustic sounder)	31,000.00
Transportation	1,250.00
Cranes	400.00
D. Other	
Subsistence @ $60.00/day	1,620.00
Travel for Engineer	400.00
SUB-TOTAL	$ 45,170.00
II. Long-Term Test (ninety day flow)	
A. Materials	0
B. Direct Labor	
2 Technicians @ $250.00/day for 8 days	4,000.00
1 Engineer @ $350.00/day for 15 days	5,250.00
Well Surveillance by Pumper @ $100.00/day for 26 days	2,600.00
C. Contract Services	
Wireline service	6,000.00
Transportation	1,000.00
Cranes	400.00
D. Other	
Subsistence @ $60.00/day	1,440.00
Travel for Engineer	400.00
SUB-TOTAL	$ 21,090.00
PROGRAM TOTAL	$ 66,260.00

SCHEDULE E-3

TASK	AMOUNT	HOURS
1	$ 2,123.00	88
2	--	
3	800.00	80
4	8,667.52	408
5	1,628.00	80
6	3,065.12	124
7	3,023.20	120
8	19,151.00	720
9	2,600.00	520
10	3,409.20	200
	$ 44,467.04 (Direct Salaries)	
	22,233.52 (Overhead)	
	$ 66,700.56 (Total)	

SCHEDULE E-4

TRAVEL COSTS BY TASK

TASK	TRAVEL	PER DIEM
1	$ 300	$ 275
2	500	500
3	250	250
4	3,000	11,200
5	800	900
6	1,200	720
7	--	--
8	--	--
9	800	600
10	1,200	1,000
	$ 7,850	$ 15,545

FINANCIAL BUDGET SUMMARY BY TASK

Task Number	Task Name and Person	Hours	Rate	Total
1	Administration:			
	Stephen Munson	40	$ 34.88	$ 1,395.20
	Administrative Assistant	24	20.35	488.40
	Secretary	24	10.00	240.00
				$ 2,123.00
	Travel: $300			
	Per Diem: $275			
	Telephone: $100			
2	Environmental:			
	Consultant	40	$ 40.00	$ 1,600.00
	Meidav	24	50.00	1,200.00
				$ 2,800.00
	Travel: $250			
	Per Diem: $250			
	Travel: $250			
	Per Diem: $250			
3	Geoscientific:			
	Meidav	40	$ 50.00	$ 2,000.00
	Geologist	40	26.00	1,040.00
	Draftsman	40	10.00	400.00
	Secretary	40	10.00	400.00
				$ 3,840.00
	Travel: $300			
	Per Diem $300			
	Printing: $300			
	Telephone: $100			
4	Site Selection:			
	Stephen Munson	40	$ 34.88	$ 1,395.00
	Staff Engineer	24	20.35	488.40
	Secretary	24	10.00	240.00
				$ 2,123.60
	Consultants:			
	Meidav	40	50.00	$ 2,000.00
	Halvey Miller	40	50.00	2,000.00
				$ 4,000.00
	Travel: $1,000			
	Per Diem: $ 800			
	Telephone $ 200			

Task Number	Task Name and Person	Hours	Rate	Total
4(cont.)	Drilling Specification:			
	Drilling Engineer	80	$ 50.00	$ 4,000.00
	Draftsman	40	10.00	400.00
	Meidav	24	50.00	1,200.00
				$ 5,600.00
	Staff Engineer	24	20.35	488.40
	Project Manager	24	34.88	837.12
				$ 1,325.52
	Bidding, Evaluation and Contracting, and Supervision			
	Stephen Munson	80	$ 34.88	$ 2,790.40
	Administrator	80	20.35	1,628.00
	Secretary	40	10.00	400.00
				$ 4,818.00
	Travel: $500			
	Telephone: $200			
	Per Diem: $400			
	Drilling Services:			
	MA Technical Supervision	120	$ 50.00	$ 6,000.00
	Drilling Engineer	300	50.00	15,000.00
	Wellsite Geologist	300	35.00	10,500.00
	Drilling Contractor			216,000.00
	Plan A: Clean Existing Site			14,547.00
	Plan B: Prepare New Site			150,000.00
	Drilling Fluids			16,000.00
	Solids Control			5,000.00
	Casing			146,690.00
	Casing Tong Service			8,874.00
	Welding			1,280.00
	Cement			95,000.00
	Directional Control			4,000.00
	Geophysical Logging			28,490.00
	Wellhead Equipment			31,020.00
	Bits			42,238.00
	Contingency, 25% of Plan B			204,376.00
	Contractors per Diem			10,000.00
	Travel			1,500.00
				$1,006,515.00
5	Well Testing: Short-Term			
	Material			$ 2,000.00
	Personnel			8,700.00
	Contract Services (gauges, cranes, etc.)			32,650.00
	Per Diem and Travel			1,820.00
			Testing Company	$45,170.00

Task Number	Task Name and Person	Hours	Rate	Total
5(cont.)	Meidav	40	$ 50.00	$ 2,000.00
	Per Diem		5 x 60	300.00
	Travel			400.00
				$ 2,700.00
	TI Engineer	80	$ 20.35	$ 1,628.00
	Per Diem		10 x 60	600.00
	Travel			400.00
				$ 1,000.00
	Long Term Test:			
	Labor			$ 11,850.00
	Contract Services			7,400.00
	Subsistence			1,440.00
	Travel			400.00
				$ 21,090.00
6	Injection Well Decision:			
	Stephen Munson	24	$ 34.88	$ 837.12
	Senior Engineer	40	20.35	814.00
	Secretary	40	10.00	400.00
	Draftsman	20	10.00	200.00
	Meidav	40	50.00	2,000.00
				$ 3,065.12
	Travel		3 x 400	$ 1,200.00
	Per Diem		3 x 4 x 60	720.00
				$ 1,920.00
	Plan B: If new well must be drilled: set aside $200,000 for drilling ($135,000) and ($65,000) for interconnecting plumbing.			
7	Determination of Cost Sharing:			
	Stephen Munson	40	$ 34.88	$ 1,395.20
	Financial V.P.	40	20.35	814.00
	Senior Engineer	40	20.35	814.00
				$ 3,023.20
8	Project Management:			
	Stephen Munson	200	$ 34.88	$ 6,976.00
	Administrative Assistant	500	20.35	10,175.00
	Secretary	200	10.00	2,000.00
				$ 19,151.00

Telephone: $1,000
Xerox, etc: $ 800

Task Number	Task Name and Person	Hours	Rate	Total
9	Reporting:			
	Draftsman	80	$ 10.00	$ 800.00
	Secretary	160	10.00	1,600.00
	Editor	80	15.00	1,200.00
				$2,600.00
	Meidav Associates	200	$ 38.00	$7,200.00
	Travel: $800			
	Per Ciem: $600			
10	Dissemination of Information:			
	Stephen Munson	40	$ 34.88	$1,395.20
	Senior Engineer	40	20.35	814.00
	Secretary	80	10.00	800.00
	Draftsman	40	10.00	400.00
				$3,409.20
	Printing: $2,000			
	Travel: $1,200			
	Per Diem: $1,000			

1.2 COST CONTROLS AND MANAGEMENT SYSTEMS

The project manager and staff will meet regularly with DOE as is provided in Volume I to report on the current project financial situation. A PERT, computer based, activities and cost analysis program will be used, costs entered on a daily basis and an analysis package used to compare current costs to estimated costs on an ongoing basis on the proposer computer.

Appropriate adjustments in the project duration or other developments will be made as necessary. The project manager, together with technical support personnel, will continually monitor the on-going cost analysis PERT program and adjustments or go/no-go decisions and recommendations will be made based upon the monitored output from both a cost and technical progress basis.

If substantial variances from projected costs appear, then the DOE contract officer will immediately be contacted by project officer, Mr. Munson, and appropriate actions will be taken related to changes or go/no-go decisions in addition to the regular reports and progress meetings listed in the management and control sections of Volume I.

1.3 FINANCIAL DATA ON PROPOSER

The proposing organization, Technology International, Inc., has been in business since being organized as a Delaware corporation in 1976.

A copy of recent unaudited financial statements are included on the following two pages, Figures 2 and 3 . As with most development stage companies, due primarily to, in the opinion of management, overly restrictive accounting policies, assets must be shown at cost, rather than market value.

While the balance sheet does not show a large net worth, the nine shareholders of the company have thus far put a total of approximately $900,000 at risk in the form of both equity and loans. Another factor which affects the balance sheet is the fact that most of the corporate liabilities are made up of loans to be repaid to shareholders <u>only</u> out of the proceeds of a public stock offering and back salaries due (primarily to the founder), similarly due <u>only</u> out of the proceeds of a public stock offering. Thus, most of the liabilities are to be paid <u>only</u> if there is a public stock offering.

Additionally, despite the present balance sheet asset level, based upon a number of valuation appraisals, the <u>Company has in excess of $9,000,000 of assets at appraised market value</u>.

The Company has raised capital in the past, as required, to meet its obligations and, in fact, in recent months has raised in excess of $300,000 to support development, with another $300,000 in the process of being raised as of submission date. The Company has generated revenues from fuel alcohol plant sales and anticipates additional revenues in the future.

The Company has a signed letter of intent from a major investment banking underwriting firm, R.G. Dickinson, to carry

TECHNOLOGY INTERNATIONAL, INC., AND SUBSIDIARIES
UNAUDITED ESTIMATED CONSOLIDATED BALANCE SHEET AS OF 7/15/80
BASED UPON DRAFT OF AUDITED FINANCIALS AS OF 11/30/79

ASSETS	Estimated As Of 7/15/80
Cash	$ 28,250
Receivable-Engineering	2,500
Receivable-Commissions	29,750
Receivable-Equipment Payments	100,250
Deposits-Current	2,051
Deposits-Non-Current	8,988
Leasehold Acquisitions	130,000
Land Improvements	224,136
Building Improvements	361,237
Geothermal Property-The Geysers	825,000
Equipment and Antiques	55,240
Accumulated Depreciation	(10,317)
Organizational Expenses	230
Deferred Offering Costs	21,000
TOTAL ASSETS	$1,778,315

LIABILITIES	Estimated As Of 7/15/80
Commissions Payable	$ 6,105
Equipment Payable	100,250
Accounts Payable (Including Legal)	43,175
Notes Payable (Roth, Stiles, Hotel)	240,000
Accrued Interest	20,000
Accrued Taxes	16,000
Accrued Payroll	163,349
Bank Note Payable With Interest	27,000
Notes Payable:	
Chess, Hartstein	146,000
Garza	7,000
Williams	6,000
Murdoch & Co.	50,000
Green	79,950
Gibbons	44,320
Garretson	5,000
Munson	41,426
Auto Loan	4,500
Mendive Jordan Property	88,162
TOTAL LIABILITIES	$1,088,237

EQUITY

Common Stock	$ 69,400
Plus: Additional Paid In Capital	1,319,798
Less: Net Loss Development Stage Operations	(699,120)
TOTAL EQUITY	$ 690,078

FIGURE 2

TECHNOLOGY INTERNATIONAL, INC., AND SUBSIDIARIES
UNAUDITED ESTIMATED CONSOLIDATED INCOME STATEMENT AT 7/15/80
(FROM STARTUP TO 7/15/80)

OPERATING INCOME

Engineering Study Revenues Earned		$ 14,000
Commission Revenues Earned		14,000
Equipment Payments to Date		13,000
	TOTAL	$ 41,000
Non-Operating Income		$ 8,940
	TOTAL INCOME	$ 49,940

EXPENSES

Commission Expense		$ 3,595
Salaries		169,849
Payroll Taxes		16,307
Travel, Auto, Entertainment		106,276
Legal, Accounting		80,099
Consulting and Other Contract Services		55,940
Telephone and Postage		40,678
Other Rental Expenses		30,910
Supplies and Office Expense		27,435
Abandoned Lease Rights		31,137
Insurance		17,831
Interest		79,228
Amortization		394
Depreciation		10,317
Taxes and Licenses		16,136
Other Expenses		11,468
Promotion and Advertising		39,925
Utilities		11,065
Agricultural Income		470
	TOTAL EXPENSES	$749,060
NET LOSS DEVELOPMENT STAGE OPERATIONS		$699,120

FIGURE 3

out either a $4,000,000 public stock offering or an additional $16,000,000 to $21,000,000 private placement on behalf of Technology International. A copy of the letter from that underwriter is also included herein as Figure 4 . That general understanding is in the process of being refined slightly. This letter represents a usual "letter of intent" in the investment banking business.

The proposer has demonstrated in the past, in numerous activities, its ability to furnish the financial support required for its projects and development. It is clearly at the level of financing required by this drilling proposal to meet its commitments under this proposal.

The Company recently changed investment bankers when it was asked to consider a relationship with R.G. Dickinson, which is a major "regional house" headquartered in the Midwest, but with offices nationwide. This firm is much larger than the previous banker as is evidenced by its ability to carry out a "firm" underwriting for the Company, as opposed to a "best efforts" offering. The Company is convinced that this firm will be able to raise substantially more funds than will be required for this entire project, both wells and Gasohol plant, and well within the required time limits of this project. The Company is both flattered and pleased with this major investment banking relationship.

FIGURE 4

R. G. DICKINSON & CO.

MAIN OFFICE
910 GRAND AVENUE
DES MOINES, IOWA 50308
(515) 247-8100

MEMBER
MIDWEST STOCK EXCHANGE

ALGONA
AMES
CARROLL
CHICAGO
CLINTON
FOREST CITY
FORT DODGE
KEARNEY
KEOKUK
LOS ANGELES
MARSHALLTOWN
OMAHA
RED OAK
TOPEKA
WEST DES MOINES
WICHITA

September 9, 1980

Mr. Stephen M. Munson, President
Technology International, Inc.
1009 Grant Street
Denver, CO 80203

Dear Mr. Munson:

As we have discussed, R. G. Dickinson & Co. (hereinafter called "RGD") is interested in acting as the managing underwriter of a proposed primary offering of approximately $4 million of Common Stock of Technology International, Inc. (hereinafter called "TII"). Additionally, RGD is interested in working with TII in satisfying future financing needs.

Over the past twenty-five years, RGD has been fortunate to have had the opportunity to provide various financial services to an increasing number of corporations. Our professional staff is experienced in all areas of corporate finance, including raising capital privately and publicly; merger, acquisition and related activities; corporate appraisals for various purposes; and tax shelters.

Members of our staff have successfully completed long-term debt placements ranging in size from $750,000 to $22 million; industrial revenue bond financings ranging in size from $350,000 to $4.5 million; and secured debt transactions. Until recently, the public market has been closed for all practical purposes to most small and medium size companies. However, the strength of our sales organization and syndicate department has enabled us to manage or co-manage public offerings totalling in excess of $68 million over the past twelve months. One of the underwritings recently managed by RGD was a $5 million S-18 registration for American Gasohol Refiners, Inc., a producer of ethanol, headquartered in Wichita, Kansas. This underwriting was completed on a firm basis and was syndicated nationally. We believe the public equity market will continue to be receptive to certain small and medium size companies for the balance of this calendar year.

In the merger field, we have been active in all facets of this vital corporate area. RGD has initiated several transactions (ranging in size from several hundred thousand dollars to in excess of $12 million), assisted in negotiations and in certain instances, obtained the related financing. We have been retained to locate businesses for purchase and to represent sellers in negotiations for the sale of corporations. Due to the increasing focus on the terms of transactions and the fairness to shareholders, our corporate finance professionals have been asked by Boards of Directors to express "fairness opinions" which have been included with the proxy statements filed with the Securities and Exchange Commission. We are also experienced in the tender area and are uniquely qualified to respond to these specialized problems. Our activity and resulting success in the merger area provides us with the requisite experience to be of meaningful assistance on a very broad basis.

The appraisal area is perhaps the most confidential portion of our work, particularly with respect to the work performed for private companies. We are extremely proud of our ever-expanding reputation in this field and have rendered numerous opinions for ESOT's, estate and gift tax purposes, and buy-sell arrangements.

Joe Griffiths and I have reviewed the financial statements, corporate plan, management biographies and feasibility studies you have provided, and considering this material and the information you presented in our conference in Des Moines on September 5 and our various telephone conversations, we believe your proposed ethanol project is feasible and, in light of current market conditions, can be financed. We intend to further consult with you concerning the various alternative methods available to accomplish this financing, including a possible private placement of approximately $6 million of equity capital and a stand-by commitment of $10 to $15 million for future capital requirements. Our initial review of your overall corporate needs also indicates that some form of partnership vehicle would be appropriate to finance certain of your projects, including geothermal drilling activities and the development of the Hot Lake Hotel property.

This corporate finance consultation is undertaken by us in anticipation of the successful completion of a public offering or private placement, whichever we jointly agree is most desirable, and as compensation for this service, in addition to any cash fees paid for placing the securities, we would expect a 4% equity interest in TII to be issued to RGD and/or certain officers thereof. We currently anticipate a public underwriting is the best method to proceed, and unless we mutually agree that the private placement is more advantageous, we propose the following:

1) RGD would need to complete a thorough due dilligence examination of all relevant information and individuals concerned.

2) Management of TII and its attorneys would be responsible for the drafting of an S-18 registration statement with a view to filing with the Securities and Exchange Commission. We are prepared to work with you in the preparation of the necessary documents for the filing.

3) RGD would, prior to the filing of the registration statement, undertake preliminary discussions with other prospective underwriters to determine the possibility of underwriting the issue on a "firm" basis.

4) RGD would, subsequent to the filing of the registration statement, assuming we are successful in (2) above, undertake preliminary negotiations to form and manage a group of underwriters to purchase the stock from TII for offering to the public. Immediately prior to the time the registration statement is expected to become effective, we and the other several underwriters will enter into a firm commitment underwriting agreement with TII.

5) The actual public offering price, gross underwriting discount and resultant proceeds to TII would be established through agreement between TII and ourselves shortly prior to the offering. We anticipate that an underwriting group would require a gross underwriting discount of approximately 9% of the public offering price depending upon market conditions at the time of the offering and the difficulties encountered in building a demand for the issue.

6) The underwriting agreement would provide, among other things, that TII would bear the expenses customarily borne by an issuer, including their counsel's fees, accountant's fees, printing expenses, SEC and NASD filing and registration fees, transfer agent and registrar fees, and "Blue Sky" filing and legal fees. The underwriters would pay their own expenses including the fees of their counsel and costs of public advertisement of the financing.

7) The underwriting agreement would further provide for customary representations and warranties by TII and for TII to indemnify the underwriters and their controlling persons against certain liabilities, including liabilities under the Securities Act of 1933.

8) TII will issue RGD and/or certain officers thereof, as discussed above, warrants to purchase 4% of the Common Stock to be outstanding at the conclusion of the offering at 120% of the public offering price. Said warrants are to expire no sooner than five years from the effective date of the proposed underwriting.

The proposal outlined above represents our thinking in light of our present knowledge of TII's business and current securities market conditions, although we believe that in the absence of adverse changes in the foregoing, an offering consistent with the above proposal can in all probability be accomplished.

This letter does not constitute an agreement to underwrite these securities or perform any other services, or an agreement to enter into any such agreement, but reflects our present intention of proceeding to work with you on the proposed financing, and we look forward to doing so.

Very truly yours,

R. G. DICKINSON & CO.

William K. Schroff
Vice President, Corporate Finance

Technology International, Inc. accepts the foregoing and authorizes R. G. Dickinson & Co. to pursue the proposed financing.

BY: ______________________
Stephen M. Munson, President
Technology International, Inc.

DATE: ______________________

WKS:gh

1.4 PROPOSING ENTITY

1.4A RELATED COMPANY PROJECTS AND PROGRAMS

The proposing company, Technology International, Inc., a Delaware corporation, was organized in 1976 specifically to carry on alternative technology renewable energy projects in the United States. A considerable amount of time and capital was utilized in the evaluation of a number of potential renewable energy resource related areas.

Ultimately the company elected to concentrate upon the development of geothermal energy projects since evaluation demonstrated its cost effective and ecologically acceptable characteristics to be superior to other renewable energy resource possibilities.

Additional evaluation and available data indicated that the largest portion of known resources at economically viable depths were of sub-electrical generation temperatures. Accordingly, the company began to review available process and space heat use information and to correlate potential use information with known resource information.

1.4B GEOTHERMAL DIRECT USE RELATED DEVELOPMENTS

The company approach to development became a program of acquisition of geothermal properties, offering potential for direct use applications together with a concentrated effort to educate private and public decision makers to the large potential of geothermal direct use projects. A number of attractive leaseholds have been acquired which hold great promise for process heat, space heating and related projects.

Included in the company portfolio of high potential properties are the Vale leasehold and Geo Park, several high probability leaseholds with railroad frontage in Utah, a letter of intent granting certain rights to a high production sub-electric temperature well and large acreage in Nevada and a number of other properties and prospective properties including Hot Lake Hotel, the largest old continuously geothermally heated structure in the United States which is now listed on the National Register of Historic Places. The hotel is slated for a later complete restoration project. It is the opinion of management that all, save one, of these prospects have good potential for geothermal fuel alcohol production plants.

The company is presently negotiating for additional geothermal sites where the proposed project could be replicated with technical adaptation concerning substrate availability and resource characteristics. The proposed Vale project is envisioned as the first of a number of such plants at various locations.

One of the near term planned activities, as described elsewhere in this proposal, is the cost share production-size exploration hole which will be drilled by the Company under the management of sub-contractor Meidav Associates. A drilling plan is enclosed on the following page as Figure 5 .

Company management and its staff and its consultants have operated a geothermal direct space heating system for the past two

FIGURE 5

EXPLORATION-HOLE GENERAL DRILLING PLAN, TI LEASE, VALE

The following is a general plan for the drilling of a 1500' production-size well at Vale, Oregon.

1. Prepare site, mud-pit, water supply, etc.
2. Drill open hole to 60' with 20-22" diameter bit. Case with 16" surface casing and cement to surface.
3. Weld flange for valve and BOP. Install BOP.
4. Drill open hole 14½" diameter inside the 16" casing to total depth, if drilling conditions permit.
5. Carry out geophysical logging of the hole, including thermal, SP, long-normal or lateral resistivity, gamma ray and acoustic logs, if possible.
6. In case of cave-ins, lost circulation zones at a shallow depth, case with 12" to the surface. Drill with 10½" diameter bit to T.D. and case with 7" slotted liner.
7. If no problems of cave-ins occur, case with a 10" O.D. to bottom, using a slotted liner at the production interval.
8. Install valves, separator, testing equipment.
9. Lay line to disposal sump.
10. Stimulate and produce well.
11. Test well productivity for two weeks, including drawdown and buildup tests.
12. Carry out corrosivity and scaling tests.
13. Prepare final well evaluation report, including flow rates, temperatures, chemistry and engineering characteristics.

years and have developed considerable expertise in the evaluation and engineering of geothermal direct use projects including geothermal food processing plant, related chemical plant design and engineering and even geothermal space heating system design with requisite heat exchange requirements.

At the present time the company has in excess of Nine Million Dollars of assets at market value. It has a signed letter of intent from R.G. Dickinson, a large regional investment banking firm, headquartered in the Midwest, to either underwrite the company with a "firm" $4,000,000 public stock offering, or to alternatively raise between $16,000,000 and $21,000,000 in a large private placement (joint venture) financing which they believe is quite possible. For ~~a~~ copy of the letter from the proposer's new investment banker see p. 31. The proposer recently changed bankers because of the much larger size afforded by R.G. Dickinson.

1.4C FUEL ALCOHOL RELATED DEVELOPMENTS

During early 1978, the company began evaluating the potential for the use of geothermal as the energy input for fuel alcohol plants. Independent preliminary evaluation work led to a decision to own and operate a number of joint venture geothermal fuel alcohol plants.

During the early development process, the company retained the consulting services of Dr. Paul Middaugh, a professor of microbiology at South Dakota State. In fact, Dr. Middaugh was in charge of the now famous Washington Mall still which is now operated on the South Dakota State campus. Dr. Middaugh has become a major spokesman for the fuel alcohol industry nationwide. The company is on quite good terms with him and seeks his advice on research related matters from time to time.

1.4D GASOHOL PLANT SALES

From the determination to own and operate a number of company plants together with private investors the company also decided to design, market and provide customer support for a line of commercial turnkey fuel alcohol plants.

The Company accordingly has hired in-house staff with catalytic cracking plant and thermodynamic engineering specialization experience, chemical engineering plant multi-product design and production experience and various other related disciplines. A number of microbiologist and biochemist candidates are being evaluated for hiring as this proposal is being submitted. The Company is in final negotiation for certain distillery management services from a notably experienced group of distillation plant managers who have formed a management service group. They will act as "in-house" management support to full time staff personnel.

The company has sold several 200,000 gallon per year and a 400,000 gallon per year turnkey plant which is being fabricated by a proven western United States distillation equipment manufacturer.

That 400,000 gallon plant in Nevada is planned to use geothermal energy as the input source and corn as feedstock. A nationwide equipment dealership is being established, based upon a combination of an in house technical sales organization and the 250 member existing dealership network of one of the peripheral equipment suppliers to the company.

The proposer offers a line of six sizes of turnkey fuel alcohol plants for sale to the public which plants have the following rated annual capacity: 200,000; 400,000; 600,000; and 1,500,000; 3,000,000; and 4,500,000 gallons of anhydrous alcohol. Having just completed a six-month market evaluation test, the proposer sales subsidiary has recently given out more than $180,000,000 of plant quotations to potential purchasers across the United States. All plants carry performance quarantees, and the proposer offers installation and startup training to purchasers. A copy of a standard major component quotation follows.

1.4E <u>PROPOSER-OWNED PLANT PROJECTS</u>

The proposer is also planning to develop a series of company owned and operated fuel alcohol plants at various sites in the United States of which a number of them will be run with geothermal energy. The investment banker to the proposer is convinced that a significant number of such plants are financeable. In fact, the proposer is planning in excess of Forty-five Million (45,000,000) gallons of alcohol plant capacity to be brought on line over the next two and one half years. The Vale Geo Park project is planned to be the second, third, or fourth proposer

ETHANOL INTERNATIONAL, INC.
1009 Grant Street
Denver, CO
("Seller")

FIGURE 6

EQUIPMENT PURCHASE AGREEMENT

NAME ("Buyer"): ______________________ PHONE: __________

ADDRESS: ______________________

PRODUCT DESCRIPTION: MODEL 4500 FUEL ALCOHOL: WITH 60-INCH COLUMNS AND DEHYDRATION SYSTEM (198 (+) PROOF)

MAJOR ITEMS/COST SCHEDULE:		COST:
1.	Corn Preparation and Starch Conversion Equipment	$ 523,600
2.	Fermentation, Production, Storage, and Slops Tank, External Cooler, Pump	1,019,150
3.	Double Column Distillery (190 Proof)	215,800
4.	Distillery Energy Economizer	20,200
5.	Dehydration Distillery (198 (+) Proof)	202,400
6.	Support Including Gas Boiler, Cooling Tower, Pumps, Compressor	372,650
7.		
	BUDGET PRICE BEFORE INSTALLATION	2,353,800
8.	ESTIMATED: Foundations, Structures, Electrical, Piping, Installation (California Union Rates, No Building or Grain Storage)	950,000

PAYMENT SCHEDULE: **SEE PAGE** 3

ESTIMATED COMPLETION DATE: ______________________

RANGE OF DATES FOR TRAINING: ______________________

BUYER'S INITIALS **DATE** SELLER

owned plant to be brought on line and the first of its plants to be run on geothermal energy.

1.4F ROCKY MOUNTAIN GASOHOL CENTER

The proposer has recently acquired a site north of Denver, Colorado, with existing buildings, laboratory space, water, electricity, storage bins, "grain leg", staff housing, waste lagoon, and feedlot for byproduct feed trials. The site is being named the Rocky Mountain Gasohol Center. A plot map of the site follows, as well as several pictures of the site which should receive planning approval in September, 1980.

The Rocky Mountain Gasohol Center will start with 200,000 gallons of capacity and expansion will move to 1,500,000 gallons of capacity. The proven process distillation equipment is in storage;pending planning approval, the plant will be in operation within two or three months.

Mr. Bert Hawkins, a probable proposer partner in the Vale Geo Park production plant, has been actively working on feedstock procurement in the project area. The enclosed letter, Figure 8 clearly demonstrates the level of interest in this project by potential sugar beet feedstock suppliers.

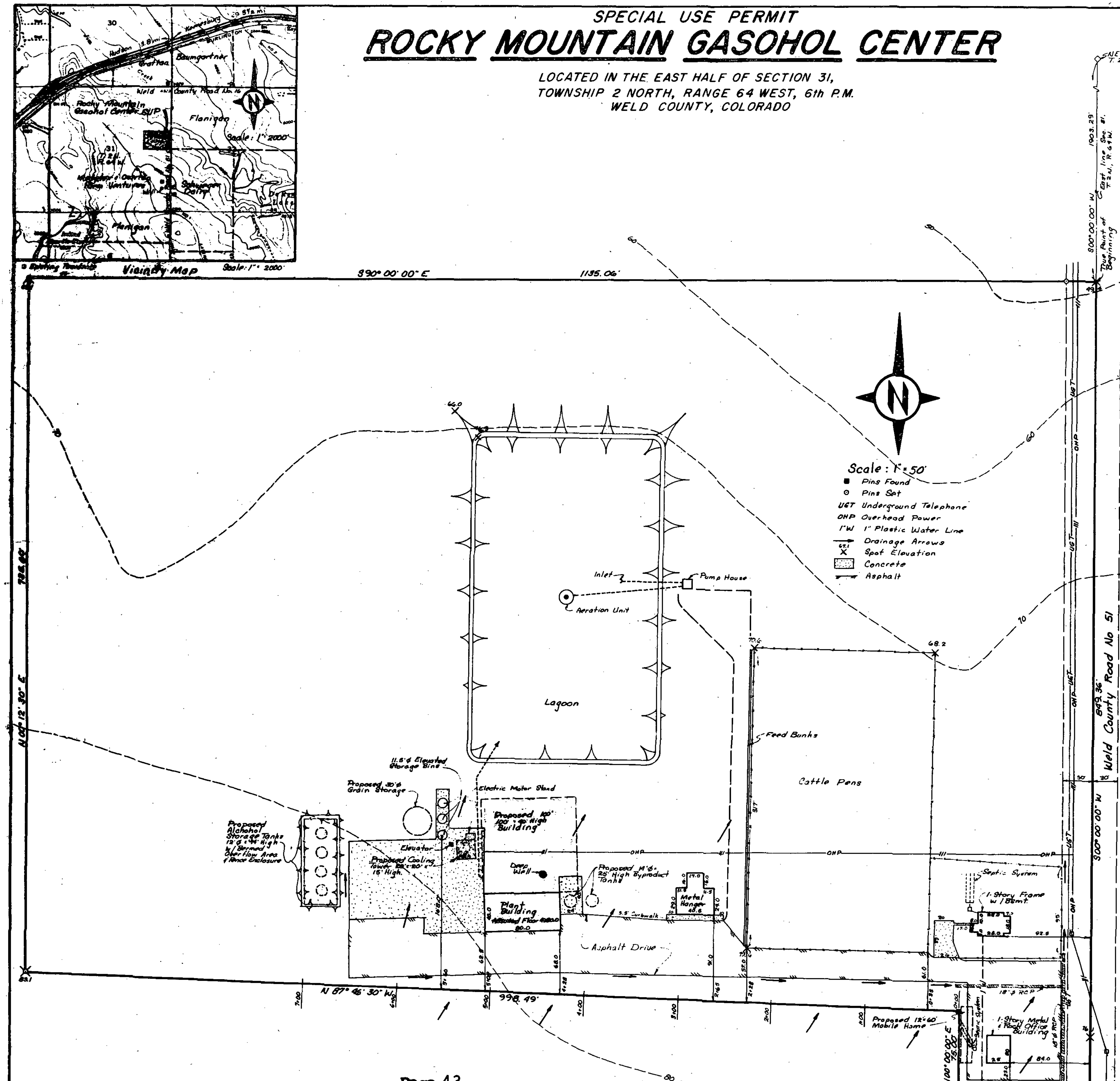
In short, the proposing organization has substantial history in both the areas of geothermal energy direct use and fuel alcohol projects. As described in the personnel management plan and financial sections, the company has supported its major interest in geothermal and fuel alcohol plants as the major emphasis of its entire developmental efforts. The company has

FIGURE 7

SPECIAL USE PERMIT

ROCKY MOUNTAIN GASOHOL CENTER

LOCATED IN THE EAST HALF OF SECTION 31,
TOWNSHIP 2 NORTH, RANGE 64 WEST, 6th P.M.
WELD COUNTY, COLORADO



LEGAL DESCRIPTION

A TRACT OF LAND LOCATED IN THE EAST HALF OF SECTION 31, TOWNSHIP 2 NORTH, RANGE 64 WEST OF THE 6th P.M., WELD COUNTY, COLORADO AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:
BEGINNING AT THE NORTHEAST CORNER OF SAID SECTION 31 AND CONSIDERING THE EAST LINE OF SAID SECTION 31 TO BEAR SOUTH 00° 00' 00" WEST AND WITH ALL OTHER BEARINGS CONTAINED HEREIN RELATIVE THERETO: THENCE SOUTH 00° 00' 00" WEST ALONG THE EAST LINE OF SAID SECTION 31, 1903.29 FEET TO THE TRUE POINT OF BEGINNING;
THENCE CONTINUING SOUTH 00° 00' 00" WEST, 849.36 FEET;
THENCE NORTH 90° 00' 00" WEST, 140.00 FEET;
THENCE NORTH 00° 00' 00" EAST, 75.00 FEET;
THENCE NORTH 87° 46' 30" WEST, 998.49 FEET;
THENCE NORTH 00° 12' 30" EAST, 735.60 FEET;
THENCE SOUTH 90° 00' 00" EAST, 1135.06 FEET TO THE TRUE POINT OF BEGINNING. SAID TRACT OF LAND CONTAINS 20.000 ACRES.

SURVEYOR'S CERTIFICATE

I DO HEREBY CERTIFY THAT UNDER MY PERSONAL SUPERVISION, THIS PLAT AND LEGAL DESCRIPTION WERE PREPARED ON JULY 30, 1980

____
GERALD B. McRAE, PROFESSIONAL ENGINEER AND LAND SURVEYOR, COLORADO REGISTRATION NO. 6616

PLANNING COMMISSION CERTIFICATE

THIS IS TO CERTIFY THAT THE WELD COUNTY PLANNING COMMISSION HAS CERTIFIED AND DOES HEREBY RECOMMEND TO THE BOARD OF COUNTY COMMISSIONERS, WELD COUNTY, COLORADO FOR THEIR CONFIRMATION, APPROVAL AND ADOPTION, THIS SPECIAL USE PERMIT AS SHOWN AND DESCRIBED HEREON THIS______DAY OF______________, 1980.

____
CHAIRMAN, WELD COUNTY PLANNING COMMISSION

BOARD OF COUNTY COMMISSIONER'S CERTIFICATE

THIS IS TO CERTIFY THAT THE BOARD OF COUNTY COMMISSIONER'S, WELD COUNTY, COLORADO DOES HEREBY CONFIRM AND ADOPT THIS SPECIAL USE PERMIT AND DEVELOPMENT STANDARDS AS SHOWN AND DESCRIBED HEREON THIS___DAY OF__________, 1980.

____
CHAIRMAN, BOARD OF COUNTY COMMISSIONERS

ATTEST: ______________________________
COUNTY CLERK

BY: ______________________________
DEPUTY

RECORDED BY: ____________________ DATE: ____________
COUNTY RECORDER

PROPERTY OWNER'S APPROVAL

THE UNDERSIGNED MAJOR PROPERTY OWNER WITHIN THIS SPECIAL USE PERMIT DOES HEREBY AGREE TO THE DEVELOPMENT STANDARDS AS DESCRIBED HEREON THIS_______DAY OF______________, A.D., 1980.

____

DISTRICTS

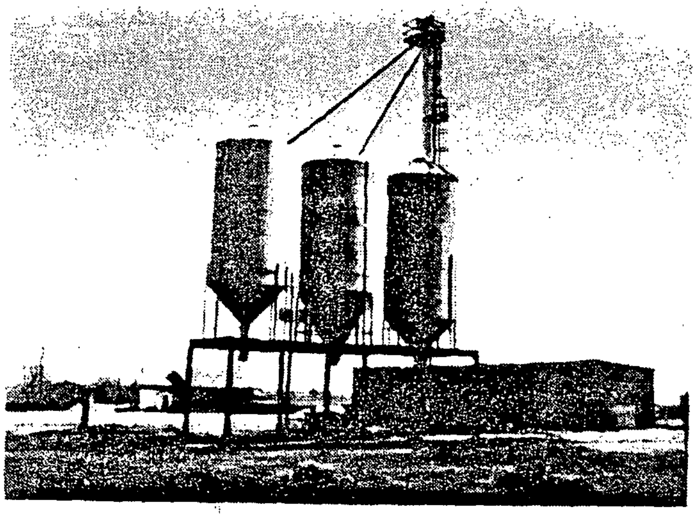
WATER: CENTRAL COLORADO WATER CONSERVANCY DISTRICT
GREELEY, COLORADO
SCHOOL: RE 3 J
AIMS COMMUNITY COLLEGE
FIRE: HUDSON FIRE DISTRICT

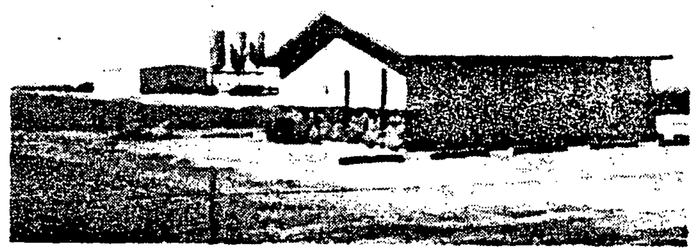
UTILITIES

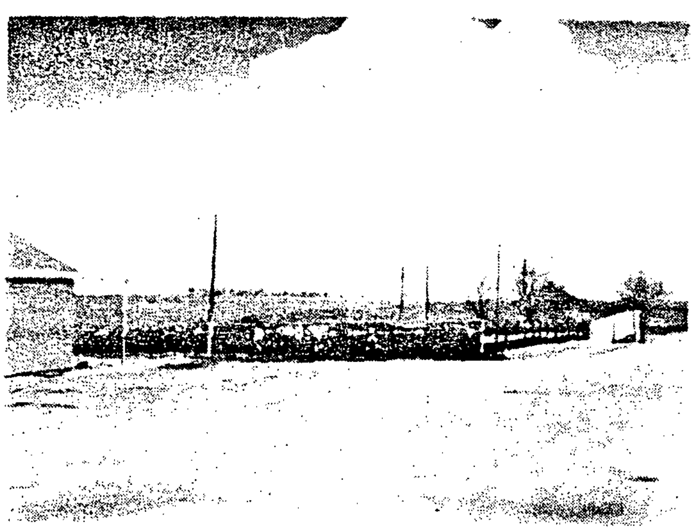
SEWER: SEPTIC TANK & LEACH FIELD
GAS: PROPANE
ELECTRICITY: UNION REA, BRIGHTON, CO.
TELEPHONE: MOUNTAIN BELL
DOMESTIC WATER: WELL

McRAE & SHORT, INC. 1227 - 8th Avenue Greeley, Colorado 80631 80087

FIGURE 8







ROCKY MOUNTAIN GASOHOL CENTER

FIGURE 9

THE AMALGAMATED SUGAR COMPANY

P. O. BOX 250 NAMPA, IDAHO 83651

June 2, 1980

To whom it may concern:

There have been preliminary talks between The Amalgamated Sugar Company and Mr. Bert Hawkins in regard to the sale of beet tailings for alcohol production.

At this time there is not a definite contract or sales agreement concerning the beet tailings, but we are interested and would be agreeable to further talks.

The Nyssa, Oregon plant produced 15,450 tons of tailings during the 1979-80 campaign. The Nampa, Idaho plant produced 18,400 tons during the same period.

We are trying to recover all the tailings possible and re-introduce them into our factories. Nampa has a recovery system now and one is being installed at Nyssa. Last year Nampa's system was in operation so the 1979-80 production of tailings should be representative of future volume. Nyssa will probably produce 65% to 75% of the 1979-80 tonnage in the future. Of course, as the price of sugar increases we expect farmers to grow more sugarbeets. The greater the tonnage processed through the factories, the greater the tonnage of tailings.

R. G. Larson
R. G. Larson
Treasure Valley District Manager

RGL/ms

a number of existing and planned research and evaluation efforts underway, including those of resource evaluation, technical and economic and marketing nature. In fact, many of the developmental efforts of the Company thus far pre-dated the existence of the geothermal direct use and fuel alcohol industries. The proposer brings to this project a number of directly related unique capabilities which lend real strength to the proposed drilling project.

As of proposal submission, the Company was owned by eight persons with a total of close to $900,000 at risk and an asset base at appraised value exceeding $9,000,000. An additional $300,000 is now being raised in a private placement. By the date of project startup, the Company will either be owned 40 per cent by the public or the recipient of a large additional private placement of between $16,000,000 and $21,000,000.

1.5 GOVERNMENT CONTRACTS

The proposer was recently awarded a DOE Direct Use PRDA #DE-RA03-80RA50121, which was submitted June 5, 1980. As of submission date of this User Coupled proposal a contract had not been received by the Company.

Appendix O

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 Delaware.

3. EQUAL OPPORTUNITY

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, (X) 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, ( ) 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.
(PRDA contract not received yet)

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br:3C-A-12

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.

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 None ________________.

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.)

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)

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: ID94-2389587

____

8. DISCLOSURE STATEMENT - COST ACCOUNTING PRACTICES AND CERTIFICATION

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.

(X) 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

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

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.

(X) 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

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.

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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 [signature]

President
(Title)

Technology International, Inc.

Appendix P

OMB Approval No. 29–R0218

FEDERAL ASSISTANCE

SECTION I—APPLICANT/RECIPIENT DATA

1. TYPE OF ACTION (Mark appropriate box)	☐ PREAPPLICATION ☒ APPLICATION ☐ NOTIFICATION OF INTENT (Opt.) ☐ REPORT OF FEDERAL ACTION	
2. APPLICANT'S APPLICATION	a. NUMBER: 2	b. DATE (Year month day): 19 80 9 10
Leave Blank		
3. STATE APPLICATION IDENTIFIER	a. NUMBER	b. DATE ASSIGNED (Year month day): 19

4. LEGAL APPLICANT/RECIPIENT

- a. Applicant Name : Technology International, Inc.
- b. Organization Unit :
- c. Street/P.O. Box : 1009 Grant Street
- d. City : Denver
- e. County : Denver
- f. State : Colorado
- g. ZIP Code: 80203
- h. Contact Person (Name & telephone No.) : Steve Munson (303-832-8215)

5. FEDERAL EMPLOYER IDENTIFICATION NO. ID94-2389587

6. PROGRAM (From Federal Catalog)
DE-SC07-80ID12139
a. NUMBER: 41 • CFR
b. TITLE: User Coupled Confirmation Drilling Program

7. TITLE AND DESCRIPTION OF APPLICANT'S PROJECT
User Coupled Confirmation Drilling Program
Vale Geo Park Geothermal 4,500,000 Gal Gasohol Plant Reservoir Confirmation Cost-Shared Drilling Program

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): Small Business
Enter appropriate letter: K

9. TYPE OF ASSISTANCE
A–Basic Grant; B–Supplemental Grant; C–Loan; D–Insurance; E–Other
Enter appropriate letter(s): A

10. AREA OF PROJECT IMPACT (Names of cities, counties, States, etc.)
Oregon, Idaho, Washington

11. ESTIMATED NUMBER OF PERSONS BENEFITING 4,600(+)

12. TYPE OF APPLICATION
A–New; B–Renewal; C–Revision; D–Continuation; E–Augmentation
Enter appropriate letter: A

13. PROPOSED FUNDING	
a. FEDERAL	$1,324,932.00
b. APPLICANT	147,215.00
c. STATE	.00
d. LOCAL	.00
e. OTHER	.00
f. TOTAL	$ .00

14. CONGRESSIONAL DISTRICTS OF: a. APPLICANT: Al Ullman; b. PROJECT: Al Ullman

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):
Enter appropriate letter(s):

16. PROJECT START DATE (Year month day): 19

17. PROJECT DURATION: Months

18. ESTIMATED DATE TO BE SUBMITTED TO FEDERAL AGENCY ▶ (Year month day): 19 80 9 15

19. EXISTING FEDERAL IDENTIFICATION NUMBER NA

20. FEDERAL AGENCY TO RECEIVE REQUEST (Name, City, State, ZIP code)
Department of Energy, Idaho Falls, ID 83401

21. REMARKS ADDED ☐ Yes ☒ No

If well is failure.

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) ☐ ☐
(2) ☐ ☐
(3) ☐ ☐

23. CERTIFYING REPRESENTATIVE
a. TYPED NAME AND TITLE: Stephen Munson, President
b. SIGNATURE: [signature]
c. DATE SIGNED (Year month day): 19 80 9 10

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.)