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Office File

MASTER

PROJECT DEVELOPMENT PLAN
FOR
EAST MESA GEOTHERMAL TEST CENTER

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Prepared for

Energy Research and Development Administration

Washington, D.C.

by

Bureau of Reclamation
Department of the Interior
Washington, D.C.

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LIST OF EXHIBITS

1. SUMMARY

A. Objectives

To design and construct a test facility for geothermal energy systems and components designed for moderate temperature/low salinity geothermal fluids available at the East Mesa site in the Imperial Valley of California. This facility will be named the East Mesa Geothermal Test Center.

The overall objective will be met by a three-phase project that will:

- Expand the present facilities of the Bureau of Reclamation's water desalination operation at East Mesa to accommodate limited-scale geothermal energy conversion equipment testing by 1 December 1975. This facility will be able to support some small-scale test operations during the expansion process.
- Construct additional test facilities adjacent to the present East Mesa test site to provide greater geothermal energy conversion test capacity in July 1977.
- Construct and operate a 10 MWe geothermal electrical Demonstration Experiment at the East Mesa Geothermal Test Center by September 1979.

B. Background

The national geothermal energy program requires a series of test centers at a range of available types of geothermal energy resource sites to facilitate testing of conversion systems and components developed by industry, universities and other agencies under realistic field conditions.

The moderate temperature/low salinity geothermal reservoir at East Mesa, near El Centro in the Imperial Valley of California, has been under development as a water desalting demonstration project by the Bureau of Reclamation of the Department of the Interior since 1971.

Extensive studies of this reservoir are being conducted by the Bureau, and four producing test wells and one injection well have been drilled. The site now has support services, laboratories, warehouse and office space, surface plumbing and two desalting plants.

While these facilities were designed as a field laboratory for desalting studies, they have the capability of being used for other purposes. The East Mesa site provides a setting at which various types of geothermal energy conversion equipment and materials can be tested under field conditions using actual geothermal fluids. The Bureau of Reclamation has made the site available to public, private, and academic scientists as a field laboratory, and a number of tests of electrical power-oriented systems and components have already been conducted.

The facilities now available at the East Mesa site are relatively limited. Extensive utilization of the site as a geothermal energy program test center will require the drilling of additional wells and the construction of additional facilities.

C. Technical Plan

The technical plan for the development of the East Mesa test site is in keeping with the recommendations of the TRW Phase 0 study sponsored by NSF. The Bureau of Reclamation proposes to develop the Test Center in a three-phase project that will permit achievement of the Phase 0 objectives:

- Phase 1A: Expansion of the present East Mesa test facilties.
- Phase 1B: Construction of additional test facilities adjacent to the present East Mesa operations.
- Phase 2: Construction and operation of a 10 MWe geothermal-powered electrical generating plant.

The detailed planning in the PDP is concentrated primarily on Phase 1A. Completion of the Phase 1B and 2 plans must await the results of the on-going review of the two Phase 0 study reports (TRW and Bechtel Corporation), reconciliation of differences, and approval of

the overall plan by ERDA. Because limited Test Center operations can be started almost immediately, this PDP also includes planning for test center operations and management (see Management section).

The Bureau of Reclamation will continue to operate its desalting program in accordance with its assigned mission while the Test Center is under development and in operation. The Bureau's Test Center Site Manager will be responsible to Bureau management for both the operation of the Test Center for the geothermal energy program and for the operation of the desalting program.

1. Phase 1A, Expansion of Present Facilities

The first phase in the development of the Test Center will be an eight month effort; assuming a start on 1 March 1975, the expanded facilities will be operational on approximately 1 December 1975. Eight individual tasks have been planned for Phase 1A:

Task 1 — Facility Design and Contracting. The overall facility design for the first phase expansion of the East Mesa facility will be completed in six weeks through the coordinated efforts of the Bureau's Lower Colorado Region design staff and possibly an A&E contractor now working on the desalting mission. Many of the specifications required can be adapted from work already performed. Contracting for the remaining tasks, and procurement of the required equipment and materials, is expected to start within two weeks of project initiation.

Task 2 — Reperforation of Three Wells. To increase the flow of geothermal fluids from the existing wells, three wells will be reperforated by a contractor. Approximately one week per well will be required for the work.

Task 3 — Roads and Paved Areas. To provide better access to the site and test pads for the anticipated increased traffic, the entrance road and areas around the test pads will be paved.

Typical specifications are available; existing surveys can be upgraded rapidly. A contractor will complete the work in two months without interfering with on-going activities.

Task 4 — Support Services. Additional telephone, electrical service, sanitary facilities, cooling water, etc., will be provided by several contractors over a seven and one-half month period.

Task 5 — Security Fencing. The present fence will be extended to enclose the expanded areas. The new fencing will be installed in stages as the work proceeds.

Task 6 — Pipelines and Plumbing. Additional pipelines and plumbing will be installed from two wells to the test area to increase the geothermal fluid flow capacity. Existing specifications can be adapted for this purpose. The installation contractor will require approximately six months for this work.

Task 7 — Shop and Laboratory. A prefabricated building will be erected to provide expanded shop and laboratory facilities designed for both Phase 1A and Phase 1B activities. Present shop and laboratory space will be modified for offices for the Test Center staff and test operators.

Task 8 — Drill Two Wells. Two additional wells will be drilled to provide increased geothermal fluid flow and increased reinjection capacity. The production wells will have larger diameter casings than the present wells to facilitate downhole experiments. Because of the long lead time, procurement actions for well casing will be started at project initiation. The procurement lead time, and the heavy schedules of well drilling contractors, necessitate scheduling the well drilling for a six-month period, although the actual work will require not more than six weeks.

2. Phase 1B, Construction of Additional Facilities

The second part of the first phase of the project will include construction of additional test pads; additional wells, pipelines and plumbing; completion of office and warehousing space; and extension of support services to the new area adjacent to the present operation. Detailed plans must await completion of the Phase 0 studies. Five major areas of activity have been identified:

- o Bureau preparation of the RFP and contracting for the Phase 1B design (3 months).
- o Phase 1B design by A&E contractor (6 months).
- o Long lead time procurement initiation by the Bureau.
- o RFP and contracting for construction (3 months).
- o Construction by contract (17 months).

3. Phase 2, Demonstration Experiment

Planning for the 10 MWe Demonstration Experiment must await the results of the ERDA Phase 0 evaluation. A tentative schedule has been estimated from the TRW Phase 0 report:

- o Start work on design criteria - October 1975 (10 months)
- o Start detailed planning - July 1976 (8 months)
- o Demonstration Experiment on-line - September 1979

D. Management Plan

Three organizations will be involved in the planning, implementation and operation of the East Mesa Test Center:

- o Bureau of Reclamation
- o ERDA
- o A Test Center Panel made up of representatives of the Bureau of Reclamation, ERDA, NSF, and the geothermal research community outside these agencies

1. Management of Test Center Development

The Bureau of Reclamation will manage the development of the Test Center and will provide a Site Manager who will be responsible

for site development, and desalting and geothermal energy test operations. After the initial site planning, most of the site implementation activities will be performed on contract. The Bureau will provide procurement and contract monitoring services, on-site contractor support, and other housekeeping fuctions. The Site Manager will report to the Director of the Bureau's Lower Colorado Region, which will provide technical and procurement support. Additional technical support will be available from the Bureau's Engineering and Research Center in Denver.

ERDA will provide overall policy guidelines for the development of the Test Center, will participate in the initial planning, and will approve the development budget.

2. Management of Test Center Operations

The Bureau's Site Manager will be responsible for Test Center operations, assisted by Deputy Managers for Testing, and Well Field and Reservoir Management. The Bureau will have a Deputy Manager for the desalting program who will not be involved in the geothermal energy conversion test program, except for interfaces between the two programs.

Site management will provide procurement and contract monitoring services, on-site support for test operators, laboratory services, other housekeeping functions, well field and reservoir management, and will be responsible for piping of geothermal fluids, and the provision of utilities, to the test pads.

Agencies performing tests will be responsible for set up of test equipment, conducting tests, security of proprietary equipment and data, and removal of equipment after test completion. The details of the interface between the user and the Test Center, and the costs to be borne by the user (including laboratory services) will be negotiated for each test operation.

ERDA will provide overall policy guidelines for Test Center operations as part of the national geothermal program. It will approve

the annual operating plan reflected in the PDP updating, and will review and approve the budget submitted by the Test Center manager via Bureau channels.

The Test Center Panel, with a membership of five or six, will have primary responsibility for selection of users of the Test Center, assignment of priorities and establishment of schedules.

The Bureau of Reclamation's desalting mission is necessarily a part of Test Center operations. The Bureau will provide well capacity and other facilities to meet its basic requirements with its own funds. Any excess capacity from these wells will be made available to the Test Center Panel. The Bureau will require some minimum priority for peak load periods for supplementary fluids from other wells. These requirements will be scheduled by the Test Center Panel.

The Site Manager will submit monthly letter-type progress reports, financial expenditure reports and long lead time procurement reports to ERDA and the Bureau during Test Center implementation. Quarterly reports will be submitted covering test operations, facility utilization and facility adequacy for its mission.

Progress reviews including Test Center, Bureau and ERDA management and members of the geothermal community will be held semi-annually during the implementation and operations of the Test Center.

ERDA, in coordination with the Site Manager, will publish a Technical Facilities Planning Report during implementation to inform potential users of the plans and schedules, and permit them to start planning for Test Center use. The Site Manager will prepare a Facility Description report for potential users describing the capacity of each test site, procedures for test operations proposals, services to be provided by the Test Center, responsibilities of the users, etc.

When the Test Center is in operation, users will submit Test Plan Reports to the Site Manager after proposal approval, but prior to the start of operations. These will describe planned tests, required brine flow rates and schedules, support requirements, etc., in sufficient detail to permit efficient site utilization. The Site Manager will

publish reports on tests conducted at the Test Center; proprietary information will be protected.

The Bureau will operate a Public Information Office for the Test Center. The Test Center will be operated in accordance with the Freedom of Information Act.

E. Procurement and Contracting Plan

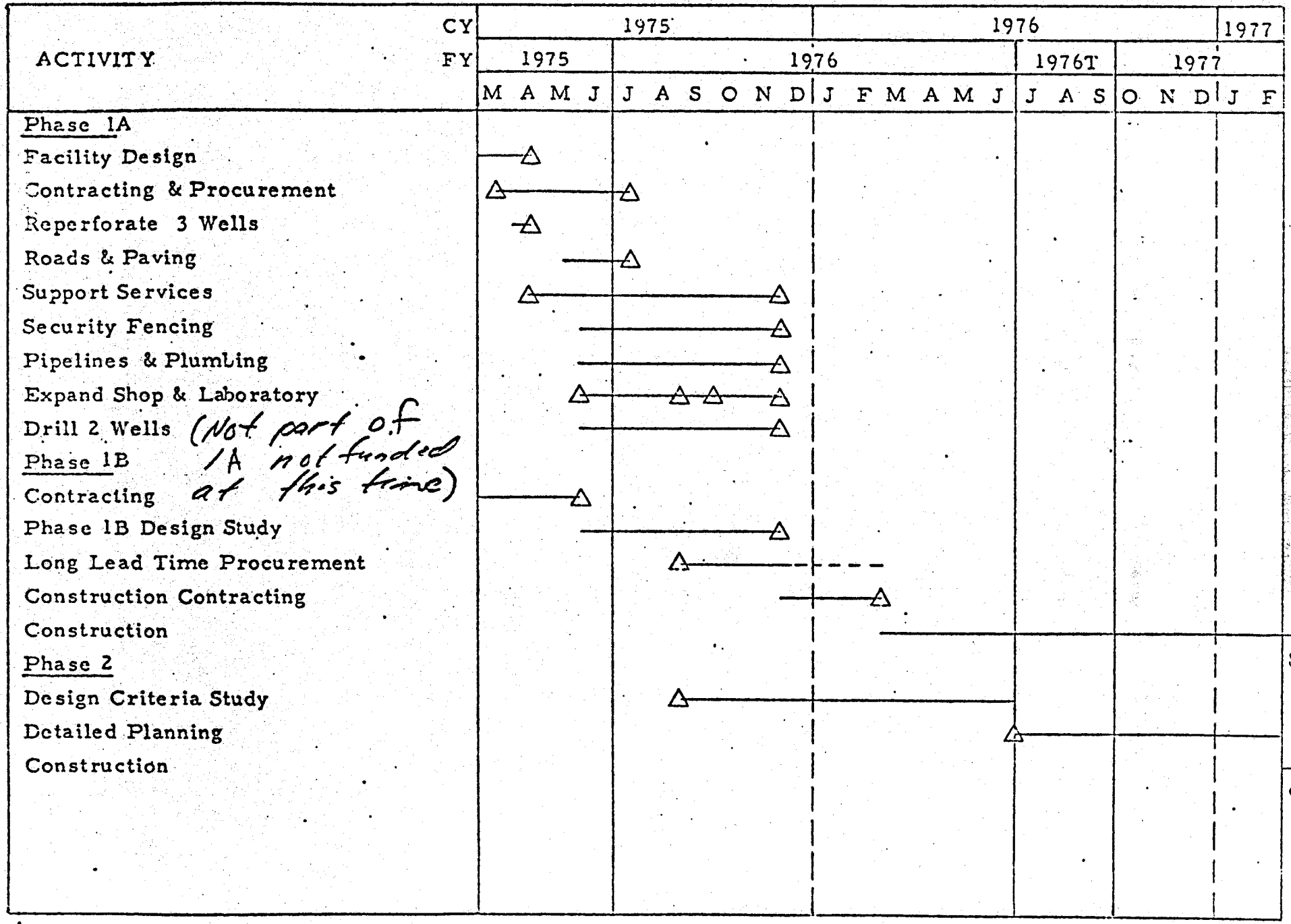
Procurement and contracting will be governed by Federal Procurement Regulations (41 CFR), supplemented by Department of Interior regulations and Bureau of Reclamation Instruction Supplements. Unless a clear necessity for non-competitive procurement can be justified under these regulations, all major procurement and contracting in the implementation and operation of the Test Center will be competitive. ERDA will be invited to participate, at its option, in decisions to contract, RFP and source list preparation, Evaluation Board reviews of proposals, and decisions on contract format and negotiations.

The objective of Test Center patent policy will be the maximum encouragement of industrial and other user participation in the national geothermal energy program. Department of Interior patent regulations will apply. The Bureau of Reclamation patent articles will be used in contracting.

F. Scheduling and Key Milestones

The project schedule, with key milestones indicated, is presented in Figure 1. The Phase 1A schedule is regarded as firm; Phase 1B and 2 schedules are presented in outline form only, and are tentative, subject to detailed planning upon completion of the Phase 0 studies by ERDA. Phase 2 planning for the Demonstration Experiment is largely independent of the Phase 1A and 1B activities. It is subject to decisions by ERDA at the end of the Phase 0 evaluation (approximately 4QFY75) and during Phase 1A and 1B. Implementation of Phase 2, if decisions are favorable, may be the responsibility of the Bureau of Reclamation or of another agency selected by ERDA.

FIGURE 1 - PROJECT SCHEDULE AND MILESTONE



Key milestones for the project, assuming a start date of March 1975, are:

1. Phase 1A
   - o Start of Procurement actions - 15 March 1975
   - o Completion of facility design - 15 April 1975
   - o Completion of well reperforation (3 wells) - 15 April 1975
   - o Start expansion of support services - 15 April 1975
   - o Completion of road and paving - 15 July 1975
   - o Start erection of laboratory and shop building - 1 June 1975
   - o Completion of building - 1 September 1975
   - o Completion of laboratory installation - 1 October 1975
   - o Completion of installation of shop equipment - 1 December 1975
   - o Completion of well drilling and well head equipment installation; completion of support services, plumbing and pipelines, and security fencing - 1 December 1975
2. Phase 1B (tentative)
   - o Design contract award - 1 June 1975
   - o Start long lead time procurement - 1 September 1975
   - o Completion of Phase 1B design - 1 December 1975
   - o Award Phase 1B construction contract - 1 March 1976
   - o Completion of Phase 1B construction - 1 August 1975
3. Phase 2 (tentative)
   - o Award design criteria contract - 1 September 1975
   - o Award Phase 2 detailed planning contract - 1 June 1976
   - o 10 MWe power plant on-line - September 1979

G. Budget

The required budget for Test Center development and operation funding by ERDA is summarized in Table 1. Details are presented in Section VII, Resource Requirements. The Phase 1A budget projections are regarded as firm. Phase 1B and 2 budget figures are preliminary, subject to change when these phases of the project are planned in detail after the completion of the Phase 0 studies by ERDA.

H. Staffing Plan

The key staff of the Test Center will be the Site Manager and two Deputy Site Managers:

- Acting Site Manager, Mr. S. H. Suemoto. In charge of Test Center implementation and all Test Center operations, including Bureau of Reclamation desalting program. Consultant to Test Center Panel. Reports to Director, Lower Colorado Region, Bureau of Reclamation.
- Acting Deputy Site Manager, Test Operations, Mr. J. L. Featherstone. Assists Site Manager in Test Center implementation. Responsible for day-to-day operation of test pads, laboratory and shop facilities, etc.; Test Center maintenance and housekeeping (Bureau and contractor personnel). Reports to Site Manager.
- Deputy Site Manager, Reservoir and Well Field Operations, Mr. K. E. Mathis. Assists Site Manager in Test Center implementation. Responsible for operation of wells, well-head installations and pipelines; monitors geothermal fluid usage, schedules fluid flows; maintains well-head installation; advises Site Manager on status of geothermal fluid requirements and adequacy of supply. Reports to Site Manager.

I. Facilities Plan

The present facilities of the East Mesa site (offices, laboratory, shops, warehouse) will be utilized by test operations during the Phase 1A implementation. Phase 1A construction will provide a new laboratory,

TABLE 1 - SUMMARY OF ESTIMATED BUDGET

	Cost (Thousands of $)		
	FY75	FY76	FY77-FY79
Phase 1A Initial Expansion	$1,513	$ 890	0
Phase 1B Additional Facilities	0	1,927	0
Total Phase 1A and Phase 1B	$1,513	$ 2,817	0
Test Center Annual Contracted Operating Cost at Phase 1 Capability level	*	*	300**
Phase 2 Demonstration Experiment	-	-	$19,470***

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* Included in Phase 1A and 1B budgets for FY75 and FY76.

** Does not include Bureau of Reclamation direct staffing and staff-related costs. See Section VII for detail.

*** Estimate extracted from TRW Phase 0 Report; Bureau of Reclamation cannot provide detailed estimates until ERDA defines Phase 2; see Section VII.

shop and additional warehousing space. Upon completion of this structure, part of the present office/shop/warehouse structure will be converted to additional office space for Center staff. The present laboratory will be converted to offices to Test Center users.

J. Project Risks

Phase 1A technical, schedule and costs risks are regarded as low. The on-going experience of the Bureau of Reclamation with the East Mesa desalting program has provided a firm basis for Test Center development and cost and time estimates.

Risks involved in Phases 1B and 2 cannot be assessed until completion of the Phase 0 study by ERDA permits development of detailed plans, schedules and cost estimates.

The risk of early depletion of the East Mesa geothermal energy resources has been evaluated as low. Preliminary calculations indicate a useful life of not less than 100 years at the planned rate of usage for Test Center operations. These evaluations are continuing.

K. Utilization Plan

The East Mesa Geothermal Test Center will provide a geothermal energy conversion test facility (moderate temperature/low salinity fluids) for all qualified users as selected and scheduled by the Test Center Panel.

Information on Test Center planning, facilities and proposal procedure will be disseminated to the geothermal community via a Planning Report and Facility Description report to be published prior to the completion of Phase 1A construction.

Users will participate in Test Center operational planning via the Test Center Panel, and technical meetings and symposia. Reports on Test Center usage will be published.

II. BACKGROUND

A. Relationship to National Geothermal Energy Program

The goal of the national geothermal energy program is to provide the knowledge and technology base required to solve the major problems inhibiting the growth of geothermal energy in the U. S., and to accelerate the development of commercial applications of geothermal energy in such a manner that maximum use can be made of available resources.

The basic strategy of the national geothermal energy program will be one of relatively short-term government involvement on a high level of activity, with the private sector expected to assume an increasing role, and a greater share of the risk, as the national research program begins to pay off. Thus, the national geothermal energy research program places a major emphasis on a strong and continuing working relationship between government activities and the geothermal energy industry.

Specifically, the national program is directed toward: (1) providing the necessary technological advances to improve the economics of geothermal power production, (2) expanding the knowledge of recoverable resources of geothermal energy, and (3) providing carefully researched policy actions to assist in resolving environmental, legal and institutional problems.

The Phase 0 studies of the geothermal energy program supported by the National Science Foundation (NSF) have indicated that one major area in which the governmental activities can contribute to the acceleration of the geothermal energy utilization program, and to the involvement of industry in this program, is the provision of test centers at which geothermal energy systems and their components developed outside the government can be tested under realistic field conditions. A number of types of geothermal resources are potentially available in the U.S., including dry steam, hot brines, moderate temperature/low salinity fluids, geopressured reservoirs, hot rock formations, and magmatic deposits. The NSF Phase 0 studies indicate a requirement

for government-established test centers at a range of available types of geothermal energy resource sites to facilitate testing of systems and components developed by industry, academic organizations and others.

The Inter-Agency Task Force on Geothermal Energy has recommended that facilities be developed that will provide the capability to test and evaluate new technology and components. This test and evaluation would be conducted under actual field conditions with producing geothermal wells. Facility operations would be directed at involving engineers, analysts, technicians and managers from industry so they can gain direct geothermal experience.

The East Mesa site, in the Imperial Valley of California near El Centro, is a moderate temperature/low salinity geothermal resource that is now used by the Bureau of Reclamation of the Department of the Interior as a test and demonstration site for the application of geothermal energy to the desalting of water. Studies have estimated that the East Mesa site geothermal reservoir can provide sufficient energy for at least one hundred years of testing and small to moderate size demonstration power plan applications.

B. East Mesa Test Site

The Bureau of Reclamation is currently investigating the geothermal resources of the Imperial Valley. The primary objectives of this program are to demonstrate the feasibility of desalting geothermal fluids for development of necessary high quality water supplies, and to investigate the concurrent production of electric energy. These investigations are being conducted under the authority of the Federal Reclamation Laws (Act of June 17, 1902, 32 Stat. 388, and acts amendatory thereof, and supplementary thereto), the Colorado River Basin Project Act (Public Law 90-537, 82 Stat. 885, September 20, 1968), and the Colorado River Basin Salinity Control Act (Public Law 93-320, 88 Stat. 266, June 24, 1974).

In 1968 the Bureau of Reclamation initiated support of geothermal resource investigations in the Imperial Valley by providing financial aid

to the University of California, Riverside (UCR). In 1971 the Bureau began active participation in these investigations by drilling a number of temperature test holes in the East Mesa area. The Bureau's April 1971 Geothermal Resources Status Report described the geothermal potential of the area and indicated that substantial quantities of saline water with a high heat content are stored in the ground water basin. Eight important thermal anomalies, including four on Bureau of Reclamation withdrawn land, were identified in the Imperial Vally on the basis of shallow drilling and geophysical surveys. Of these anomalies on Bureau withdrawn land, the East Mesa anomaly had one of the highest thermal gradients and was selected for drilling a deep test well.

In July and August of 1972, deep geothermal test well Mesa 6-1 was drilled. Fluids produced from this well have been used to conduct temperature, pressure, flow rate, chemical and desalting tests. A second deep well, Mesa 6-2, was drilled 1,475 feet west of Mesa 6-1 in August 1973 to a depth of 6,005 feet. A resistivity survey extending across the East Mesa anomaly and a microseismic monitoring survey were accomplished in 1973. An archeological survey has been made covering the entire East Mesa Known Geothermal Resource Area (KGRA). The drilling of three additional deep test holes was accomplished during the spring and summer of 1974. These wells are Mesa 5-1, which is scheduled to be an injection well, and Mesa 8-1 and Mesa 31-1, which are to be test production wells. Results of this drilling have helped to define the East Mesa geothermal field.

Bureau of Reclamation activities involve a continued program of investigation and development of the East Mesa field. Additional appraisal, investigation and delineation of other geothermal anomalies are scheduled. An extensive reservoir engineering study of the East Mesa geothermal field is in progress to determine the extent of the reservoir, source of the fluid, and its production capabilities. This study is expected to be completed by FY 1976.

who is doing this?

Perhaps Denver.

Two test desalting units were designed and erected at the East Mesa test site in the spring of 1973 specifically for desalting geothermal fluids. Each unit was designed for the production of 20,000 to 50,000 gallons per day of product water. The units have been test operated, producing substantial quantities of high quality water. Recently a 900-hour essentially continuous test run was successfully completed on one of the units with no silica scale forming in the heat transfer tubes.

Using the two desalting test units, developmental studies are being conducted on the economic conversion of geothermal energy to useful products. In these studies it will be necessary to cope with particular problems that may arise due to the corrosion, erosion and scaling tendencies of geothermal brines. Minerals in the geothermal brine may tend to scale equipment as the brine cools. Particles entrained by the moving fluids at high velocity may have strong eroding characteristics. This erosion, plus the corrosiveness of the hot brines, requires that special emphasis be placed on resistant yet economical construction materials. Chemical pre-treatment of the geothermal fluid upstream of the distillation plant will be studied for possible improvement of any scaling or corrosion characteristics in the geothermal fluids. Early development efforts have been directed toward the disposal of the wastes from the distillation plant, and these studies are continuing. Injection studies will be made to determine the filtering requirements, possible chemistry constraints, and the acceptance of the receiving geological formation.

Data collected from operation of the test desalting plant will be used to prepare conceptual designs of larger plants. A prototype desalting plant is proposed for construction beginning in late FY 1976, with completion scheduled in FY 1978. The type of plant, size and possible incorporation of power facilities will be determined from a thorough analysis of data obtained from the test units.

A microearthquake monitoring program will be continued as production and injection wells are operated to establish patterns of seismic activity. Level surveys will be made at intervals to monitor possible surface subsidence.

The East Mesa test site provides a setting at which various types of equipment and materials can be tested under field conditions using actual geothermal fluids. The Bureau of Reclamation has made this site available to public, private and academic scientists as a field laboratory. A number of tests of electrical power-oriented components and systems have already been conducted at the site.

The East Mesa site now has five wells, support services, laboratories, warehouse and office space, surface plumbing and two desalting test plants. While the facilities were designed as a field laboratory for desalting studies, as indicated above, they have the capability of being used for other purposes. However, extensive utilization of the East Mesa site for geothermal energy system and component testing will require the construction of additional facilities.

C. Relationship to Other Geothermal Test Sites

The East Mesa test site can provide a resource for field testing, under realistic conditions, of systems, equipment and components designed to operate with moderate temperature/low salinity fluids. It is seen as one of a series of test centers, developed as a part of the national geothermal energy program, to provide the required facilities for testing systems, equipment and components designed to operate with various types of geothermal energy fluids. Thus, the East Mesa Geothermal Test Center will be a coordinated unit in the national program's group of test centers.

III. TECHNICAL PLAN

A. Research Approach

The NSF Phase 0 study for the geothermal program recommended that the East Mesa site be developed into a geothermal test center for moderate temperature/low salinity fluids with two primary objectives: (1) provision of a test facility for geothermal energy conversion systems and components requiring the available type of fluid, and (2) provision of a site for 10 MWe geothermal energy conversion demonstration plant.

The approach to the development of the East Mesa Geothermal Test Center described herein is in keeping with the recommendations of the Phase 0 study. The Bureau of Reclamation proposes to develop the East Mesa Geothermal Test Center in a three-phase project that will permit achievement of the NSF Phase 0 defined objectives:

- Phase 1A: Expansion of the present East Mesa facility to permit small-scale testing of geothermal energy components by December 1975 (testing on a limited scale is already possible, as noted in the Background discussion above; the Phase 1A effort is directed toward a rapid moderate-scale expansion of the existing facility to accommodate more experiments and to provide for greater flow of geothermal fluids).
- Phase 1B: Construction of additional test pads, laboratory and office space, and expanded support facilities and drilling of two additional wells adjacent to the present test site by September 1977 (this will provide for a larger-scale expansion of the present facilities and for an increased supply of geothermal fluids).
- Phase 2: Construction and operation of a 10 MWe geothermal electrical power plant Demonstration Experiment by September 1979.

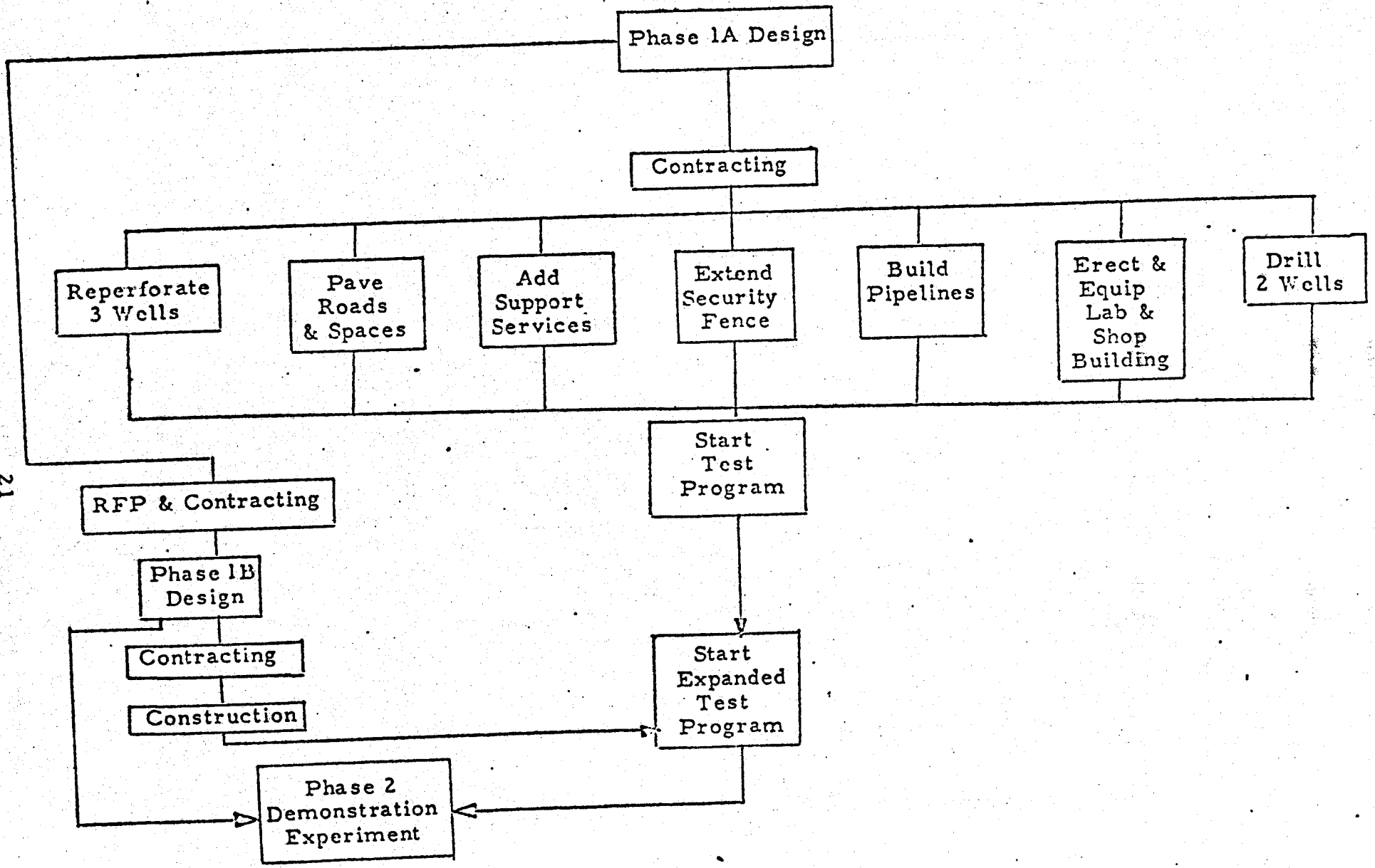
The detailed planning in this PDP is concentrated primarily on the first two years of effort in the development of the East Mesa Geothermal Test Center. It is the Bureau of Reclamation's understanding that ERDA will complete its Phase 0 effort by an analysis of the two initial Phase 0 studies to reconcile differences, and to develop definitive overall plans for the total national geothermal energy effort, including the required test centers. The specific objectives to be attained in the development of the East Mesa Geothermal Test Center will be reexamined during this study. Should this final portion of the work on the Phase 0 of the national program require that any of the planning described herein be changed, this can readily be accomplished because of the manner in which the project has been phased. It is the Bureau's understanding that planning for the Phase 2 Demonstration Experiment is still fluid; accordingly, only a broad outline of the major steps required to develop the 10 MWe Demonstration Experiment are described herein.

The overall flow of the plan for the development of the East Mesa Geothermal Test Center is diagrammed in Figure 2. The timing of the individual steps of each phase, insofar as they can be foreseen at the present time and with major emphasis on Phase 1A, has been presented in Figure 1. Major milestones and decision points are also indicated in Figure 1.

Because the operation of the Test Center can be started almost immediately at a relatively low capacity, with a considerable increase in capacity with the completion of the Phase 1A initial expansion, it has been necessary to plan for both the development of the Test Center and its method of operation in this PDP.

The East Mesa present facilities will be available for limited test operations immediately upon the approval of this PDP. The Bureau of Reclamation will operate the site, and provide a Test Center Site Manager, a Test Operations Deputy Manager and a Deputy Manager for Well Field and Reservoir Management. It will continue to operate its desalting program in accordance with its assigned mission while the Test Center is under development and in operation. The Test Center

FIGURE 2 - PROJECT FLOW DIAGRAM



Site Manager will be responsible to the Bureau management for both the operation of the Test Center in the geothermal energy program activities and for the operation of the desalting program.

In its role in the management of the Test Center, the Bureau will provide housekeeping and site support facilities, and overall management of the site. Agencies requiring the use of the Test Center for geothermal energy systems and component testing will be expected to set up their own equipment, run their own test operations, collect their own data and remove the equipment when the test operations are completed. Scheduling of test pads and the use of geothermal fluids will be the responsibility of a Test Center Panel as is discussed in detail in the next section of this PDP, Management Plan.

B. Criteria for Task Assignments

Task assignments in the proposed project are described in two parts: (1) during the implementation of the Test Center development plan, and (2) during Test Center operations. During both of these periods the Bureau of Reclamation will have the role of site manager for the East Mesa Geothermal Test Center, and will be involved in the management and operation of its own water desalting program at the facility. The specific role of the Bureau during each of the two periods is described below.

1. Facility Development

During the development of the East Mesa facility into a Geothermal Test Center, the Bureau of Reclamation will be involved primarily with contract monitoring and site support. The major portion of the tasks involved in the development of the new facility, other than a portion of the initial planning, will be contracted. One of the Bureau's objectives in the project is to expand the geothermal industry by involving the present and potential industrial firms and universities participating in geothermal research and development in the design and development of the Test Center.

At the present time, the Bureau has an ongoing contract with Bechtel Corporation covering facility design for the desalting program.

If necessary, the Bureau believes that it will be possible to modify this contract so that the contractor's activities can include a portion of the preliminary planning for the Phase 1A expansion to take advantage of the familiarity of the present contractor with the facility. The remainder of the effort in designing the initial upgrading of the facility into a Test Center will be provided by Bureau personnel who have been performing engineering design tasks for the East Mesa facility as part of the Bureau's desalting program. This sharing of responsibility for the initial planning of the Phase 1A effort, utilizing personnel already familiar with the site capacity, characteristics and operations, will permit completion of this initial task in approximately six weeks and enable the start of contracting for the remainder of the task of Phase 1A approximately two weeks after the start of project activities.

It is expected that the remainder of the tasks of Phase 1A will be contracted. Those tasks that involve specific skills related to geothermal energy conversion (well drilling and reperforation, etc.) will be contracted to firms already in, or with an indicated interest in, the geothermal energy industry. Other routine tasks (road paving, security fencing, etc.) will be contracted on a normal low-bid basis.

The major portion of the tasks in Phases 1B and 2 will be contracted, primarily to firms in the geothermal energy area. The only major exception anticipated at present is the procurement of well casings. Because of the long-lead time for well casing delivery, it is anticipated that the Bureau of Reclamation Lower Colorado Regional Headquarters Procurement Office will initiate procurement action for well casings as soon as specific sizes and quantities are known for at least the Phase 1A and Phase 1B anticipated requirements.

2. Test Center Operations

The Bureau of Reclamation will participate in the operation of the Test Center primarily as a management agency, although the provision of a single, Bureau-operated central analytical laboratory to be available to all Test Center users on a cost reimbursement basis is included in the operational plan.

The Bureau expects to contract for the major portion of the required support services during Test Center operations.

C. Project Task Breakdown

1. Phase 1A, Expansion of Present Facilities

The first series of tasks of the project has been planned as an eight-month effort; assuming a start on March 1, 1975, the expanded facilities for the start of larger-scale test operations will be ready by December 1, 1975. Eight individual task activities have been identified for this phase of the work:

- o Design for facility upgrading and contracting and procurement for implementation
- o Reperforation of three existing wells
- o Constructiona and paving of roads and work areas
- o Installation of additional security fencing
- o Installation of additional pipelines, plumbing, etc., to make additional feed water available at the test site from wells Mesa 6-2 and 8-1
- o Expansion of on-site shop and laboratory facilities
- o Drilling of two additional wells

a. Facility Design and Contracting

This task will develop the required overall design for the initial expansion of the East Mesa facility into a Geothermal Test Center, and the specifications required for the contracting of other tasks and the procurement of equipment and supplies. Performance of this task in a six-week period will be greatly facilitated by the Bureau's previous planning for expansion of its desalting activities at East Mesa. Thus, initial planning for reperforation of existing wells and drilling of new wells, road construction and paving, additional support services, pipelines and plumbing, shops and laboratories, etc., has been started, and can be adapted to the Test Center design problem rapidly. Many specifications for equipment and construction work to be performed are already available or can be adapted from previous work at the Bureau's Lower Colorado Regional Office and the Engineering and Research Center

in Denver. The availability of these specifications will permit an immediate start on the procurement of well casings, valves and other plumbing supplies to minimize the delivery time on these long-lead time items. Specifications for shop and laboratory equipment are also available.

Utilizing the services of an architectural engineering firm already under contract to the Bureau for design work at the East Mesa site and the design staffs of the Bureau's Lower Colorado Regional Office and Engineering and Research Center as required, the overall design for the Phase 1A expanded facility and the specifications for the individual tasks will be developed in six weeks. It is expected that initial procurement activity by the Regional Procurement Office will start within two weeks of the initiation of the Phase 1A effort, and will be essentially completed in approximately four months.

b. Reperforation of Three Wells

To provide for additional flow of geothermal fluids for downhole pump tests and other test activities, and for the disposal of spent fluids, three of the four existing wells in the East Mesa field, Mesa 6-1, 6-2 and 8-1, will be reperforated. Specifications for the required work are already available, and it is expected that this work can start approximately four weeks after the initiation of the project (includes contracting). Well reperforation, utilizing standard shaped-charge methods, is expected to require no more than one week per well.

c. Roads and Paved Areas

To handle the increased traffic to the site and provide better access than is now available to the existing and potential test pad spaces, it will be necessary to pave the entrance road to the site and to pave working and maneuvering areas around the test pads. This task will be performed by a road contractor. Basic surveys of the entrance road and a portion of the other areas to be paved are already available; a Bureau survey team is available and can complete the required surveys within approximately two weeks. Typical specifications for the paving are already available. It is expected that the contractor's paving activities can start approximately two and one-half months after project

initiation, and will be completed, including grading, subsurface and wear coat, in approximately two months on a schedule that will not interfere with the normal East Mesa site activities or the other activities required in the implementation of the Phase 1A plan.

d. Support Services

This task involves the expansion of the basic support services for the increased test capacity at the site, including telephone, electrical power, sanitary facilities, cooling water, etc. Specifications for the required facilities will be developed as part of Task 1. It is anticipated that all work will be performed on contract, utilizing local firms.

This task has been scheduled to start approximately six weeks after initiation of the project, and to extend throughout the Phase 1A activities in such a manner that installations are made as required during the performance of the work on the other tasks. The only long-lead time problem anticipated is the acquisition of the transformer for the increased electrical power supply; this will be provided by the local utility company on a schedule to be determined as early as possible in the Task 1 work.

e. Security Fencing

Expansion of the present test site into the Test Center during Phase 1A will require the provision of extensions to the existing security fence to enclose the added test areas, maneuvering spaces and other facilities. Specifications for the required security fencing will be prepared after the completion of the initial design; it is anticipated that the security fencing will be installed in stages as the expansion work proceeds. The start of installation is expected at approximately three months after the initiation of the project, with completion of all fencing to be scheduled for the end of the eight-month center expansion period.

f. Pipelines, Plumbing, etc.

Additional pipelines and the associated valves, connectors, etc., will be required to increase the geothermal fluid flow capacity from wells Mesa 6-2 and 8-1 to the expanded test site. The design of the required facilities will be prepared during the Task 1 effort. Surveys for existing pipeline routes are already available; if additional routes are required, the necessary surveys will be made by the Bureau survey team. Pipe, valve and other equipment specifications for previous work at the East Mesa Facility can be adapted. Installation work will be performed on contract.

The installation of pipelines and other equipment is scheduled to start on 1 June 1975, with completion by 1 December 1975.

g. Shop and Laboratory Facilities

The expanded shop and laboratory facilities to be constructed and equipped during the Phase 1A work will be designed and located to support the full-scale operational Test Center of Phase 1B also. The present shop and laboratory facilities will continue in operation to support interim test operations and the Bureau's desalting mission until the new facility is ready. Present equipment will then be moved to the new structure, and the existing facilities will be converted to office space for the Test Center staff (permanent building) and organizations conducting tests (trailer presently housing laboratory) in the Phase 1B effort.

The new facility will be planned around a standard prefabricated building (Butler Building or equivalent) to be erected by a contractor. Simple installation of additional equipment will be performed by the Test Center staff; complex installations will be contracted.

Estimated milestones are:

- o June 1, 1975 - Start building erection.
- o September 1, 1975 - Building, HVAC, electrical work, plumbing, etc., completed.
- o October 1, 1975 - Present shop and laboratory equipment move completed.
- o December 1, 1975 - New equipment installation completed.

h. Drill Two Wells

Two additional wells will be drilled during Phase 1A to provide for increased flow of geothermal fluids and additional reinjection capacity for the added test sites. The wells may be slant drilled, starting at a point close to the existing and planned test pads to minimize above-ground plumbing. Production well casings larger than those used in the present East Mesa wells will be installed to provide additional flexibility for downhole studies. The wells will be drilled on contract by a firm experienced with geothermal operations.

Well drilling, including installation of the necessary well head equipment, has been scheduled for the period between 1 June and 1 December 1975. Although this process will not require more than six weeks, flexibility has been built into the schedule in recognition of lead time required for well casing and valve deliveries and the heavy work loads of well drilling contractors.

2. Phase 1B, Construction of Additional Facilities

Phase 1B of the project will involve the construction of additional test pads, the necessary pipelines and plumbing, completion of the office and warehousing space, expansion of support facilities for the new test area, and the drilling of some additional wells.

Detailed planning for Phase 1B is contingent upon the completion of the ERDA Phase 0 effort that will reconcile any significant differences between the two portions of the initial Phase 0 studies. Accordingly, definitive task planning for the construction of the necessary additional facilities for the Test Center cannot be completed at this time. Five major areas of activity have been identified, however, and the basic framework for their timing has been established:

- Preparation of RFP's, evaluation of proposals, negotiation of contract for Phase 1B design (3 months)
- Phase 1B design by A&E contractor (6 months)
- Long lead-time procurement initiation (3 months minimum)
- RFP and contractor selection for construction contracts (3 months)
- Construction (17 months)

a. Design Contracting Procedures

Preparation of the RFP for the design contract for Phase 1B will be initiated at the start of project activity (assumed to be March 1, 1975 in coordination with the facility upgrading design activities of Phase 1A. RFP preparation will be the responsibility of the Lower Colorado Region Office of the Bureau, utilizing many of the same staff involved in the Phase 1A design work. The Regional Procurement Office will provide the required support.

The proposal evaluation and contractor selection will be by a selection board established at the Regional Office. If necessary, one or more consultants from the geothermal community (not involved in the contract bidding) will be members of this board. ERDA will be invited to participate in the board activities if it so desires.

Contract negotiation will be the responsibility of the Bureau's Regional Procurement Office. Contract award has tentatively been scheduled for June 1, 1975.

b. Phase 1B Design

The Phase 1B design contract will be awarded to an A& E firm with experience in the geothermal area. Contractor supervision will be the responsibility of the Test Center Site Manager, with the technical support of the Regional Office Design Division and the Engineering and Research Center in Denver, if necessary.

Phase 1B design work is tentatively scheduled to start on June 1, 1975 with design completion scheduled for December 1, 1975.

c. Long Lead Time Procurement

Because of the long lead times involved in the procurement of well casing, valves and other specialized equipment, the Bureau's Regional Procurement Office will work closely with the design contractor to establish the necessary specifications as early as possible in the design study.

Procurement actions for these items will be started as early as possible. Tentatively, planning calls for the initiation of long lead time procurement after three months of design effort, on approximately September 1, 1975.

d. Construction Contracting

The construction contract RFP will be developed as the final output of the Phase 1B design work and should be ready for release approximately December 1, 1975. A period of three months has been estimated as necessary for the receipt of proposals, bid evaluation and the contract negotiation process. Contract award is expected on March 1, 1976. Tentatively, the construction process has been estimated as requiring 17 months, in accordance with the schedule presented in the TRW Phase 0 report. This scheduling is subject to adjustment upon completion of the Phase 0 studies and the Phase 1B design study.

3. Phase 2 Demonstration Experiment

Planning for the 10 MWe geothermal power plant Demonstration Experiment will be based upon the results of the NSF/ERDA Phase 0 studies. Accordingly, only tentative outline milestones for Phase 2 of the East Mesa Geothermal Test Center participation in this POCE can be developed at this time. Decisions on the Phase 2 work will be made at the completion of the NSF/ERDA Phase 0 studies (approximately 4QFY75) and during the Phase 1A and Phase 1B work. Implementation of Phase 2, if decisions are favorable, may be the responsibility of the Bureau of Reclamation or of another agency selected by ERDA.

On the basis of planning data available in the TRW Phase 0 study, it is estimated that the start of work on the design criteria for Demonstration Experiment will be approximately October 1, 1975; it will require about ten months of effort. Phase 2 detailed planning is expected to start in approximately July 1976, and require about eight months. The Demonstration 10MWe Plant is expected to be on-line approximately September 1979.

D. Environmental Impact Statement

An Environmental Impact Statement (EIS) has been filed for the East Mesa site concerning the operation of the facilities, drilling of wells, testing of geothermal brines, and disposal of brines through reinjection. This EIS will cover the planned activities of Phase 1A. It will be updated as required when the detailed planning and projections for Phase 1B and 2 are completed.

E. Project Risks

The Bureau of Reclamation is highly confident of its ability to meet the scheduled date for on-line operation of the Phase 1A expanded Test Center of December 1, 1975 if the project is started on the projected March 1, 1975 date. The concerted effort required to prepare specifications, RFP's, RFQ's and invitations to bid, evaluate bids, and negotiate contracts will be facilitated by the use of existing specifications, surveys, etc., developed for the Bureau's East Mesa desalting program, as described above. Cost estimates presented in Section VIII, Resource Requirements, are based on recent comparable activities in the desalting program, and are considered realistic. Overall, the Phase 1A risk is regarded as low.

Phase 1B planned activities are similar to those of Phase 1A. The outline scheduling and estimated costs are considered realistic for the program anticipated. However, since the detailed planning for the Phase 1B expansion of the Test Center and the Phase 2 Demonstration Experiment must await the completion of the NSF/ERDA Phase 0 studies, firm risk statements cannot be made at this time.

The risk of early depletion of the geothermal energy resources in the East Mesa field has been evaluated as low. Preliminary calculations indicate that the reservoir life will be not less than 100 years at the planned rate of usage for the Test Center Phases 1A and 1B operations. The restriction on energy extraction is expected to be based on the rate of geothermal brine production rather than reservoir life; more wells may be required for activity levels beyond those presently anticipated. Evaluation of the capacity of the reservoir for larger scale applications will be part of the Bureau's on-going program at East Mesa.

IV. MANAGEMENT PLAN

A. Relationships of ERDA and Bureau of Reclamation

1. Project Approvals and Coordination

Project approval, planning, interfaces and coordination will involve three management levels within the Bureau of Reclamation on one hand, and the Energy Research and Development Adminstration's Solar, Geothermal and Advanced Energy Research Directorate on the other:

- o General interagency agreements on coordinated program planning and funding will be effected between the Assistant Administrator for Solar, Geothermal and Advanced Energy Research of ERDA and the Commissioner of Reclamation.
- o Approval authority for the overall program plan and the annual operating plans will be coordinated between the Director, Division of Geothermal Energy Research of ERDA and the Lower Colorado Regional Director of the Bureau of Reclamation.
- o Preparation of the project plan and the annual operating plans, technical coordination, and day-to-day management coordination between ERDA and the Bureau of Reclamation will be effected between the Bureau of Reclamation Site Manager and the ERDA Program Manager.

2. Access by ERDA

All work done on the project will be conducted at the East Mesa Geothermal Desalting Test Facility in California under the site management of the Bureau of Reclamation. ERDA personnel and their associates will have free access to the site at all times. Some restrictions on access to tests of proprietary equipment by industrial firms may be necessary.

3. PDP Updating

This Project Development Plan (PDP) presents ERDA with the Bureau of Reclamation's overall planning for the initial steps in

the development of the East Mesa Geothermal Test Center. Because the PDP has been prepared prior to the completion of the Phase 0 study of overall project directions and preliminary plans, it has not been possible to include detailed schedules for the Phase 1B Test Center planning and implementation and the Phase 2 Demonstration Experiment, herein. This PDP will be updated to provide the required detailed scheduling, milestones, personnel requirements, cost estimates, etc., as soon as the Phase 0 study has been completed, evaluated by ERDA(and/or NSF), and coordinated with the Bureau of Reclamation. The PDP will be updated as required thereafter on at least an annual basis.

B. Management Approach

Three organizations will be involved in the planning, implementation and operation of the East Mesa Geothermal Test Facility:

- o Bureau of Reclamation of the Department of the Interior.
- o Division of Geothermal Energy Research, Energy Research and Development Administration.
- o An East Mesa Geothermal Test Center Panel, made up of representatives of ERDA, the Bureau of Reclamation, NSF, and the geothermal research community outside these agencies.

1. Management of Test Center Development

The Bureau of Reclamation will have the management role during site implementation. It will be responsible for site planning, in coordination with ERDA and participants from the geothermal community. It will provide procurement and contract monitoring services, on-site contractor support, and other housekeeping functions. The Bureau will be responsible for dissemination of information on the site facilities and capabilities, and for general Public Information Office functions (see below). The Bureau will continue its responsibilities with respect to the water desalination program now in operation at the East Mesa site.

Bureau of Reclamation project management during Phase 1A of the Test Center development will be the responsibility of a Site Manager, who will report to the Bureau's Lower Colorado Regional Director (headquartered at Boulder City, Nevada). The Regional Office will provide technical and procurement support to the Site Manager through its organization at Boulder City and additional technical support, as required, through the Bureau's Engineering and Research Center in Denver. The organization of the Lower Colorado Regional Office is diagrammed in Figure 3. Project organization during the Phase 1A facility expansion is charted in Figure 4.

ERDA will provide overall policy guidelines for the development of the Test Center, will participate in the initial project planning via approval of this PDP, and will approve the development budget.

2. Management of Test Center Operations

a. Bureau of Reclamation's Role

The Bureau of Reclamation will have the Test Center operational management role upon the start of test operations (see Figure 5). It will continue to provide procurement and contract monitoring services as necessary, on-site contractor support, and other housekeeping functions, and will manage the well field and reservoir. The Site Manager will be responsible for ongoing assessment of the adequacy of the available test and support facilities and the supply of geothermal fluid, and for evaluation of the capacity of the Test Center to support test operations.

The site management will be responsible for the piping of geothermal fluids, and the provision of electrical power and other utilities to the test pads. The agencies utilizing the Test Center will be responsible for setting up the test equipment, operation of the tests and removal of equipment after test completion. The details of the interface between the Test Center and the user in the connection of piping, utilities, etc., and the division of costs between the Test Center and the user, will be negotiated for each test operation. The Test Center will provide chemical

FIGURE 3 - LOWER COLORADO REGION ORGANIZATION

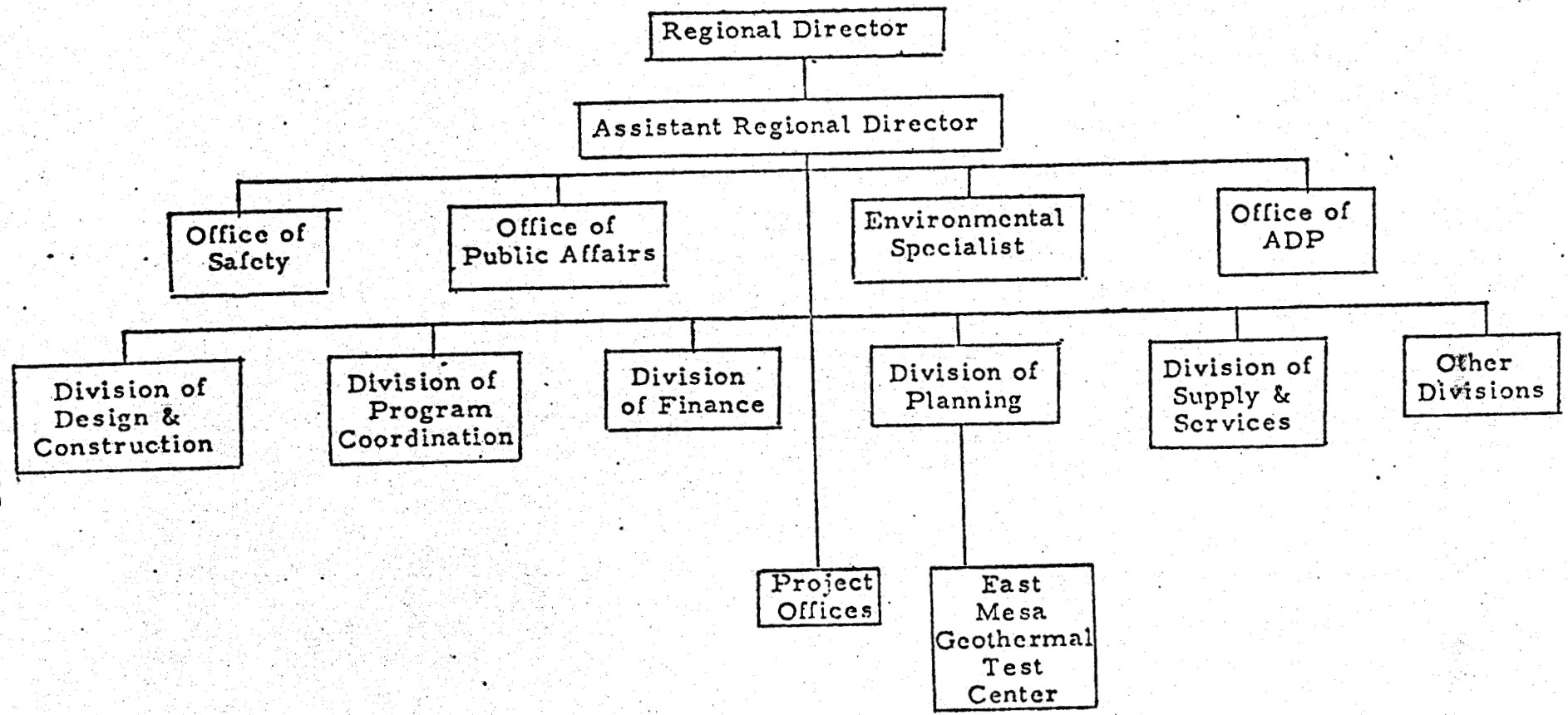


FIGURE 4 - PROJECT ORGANIZATION DURING TEST CENTER DEVELOPMENT

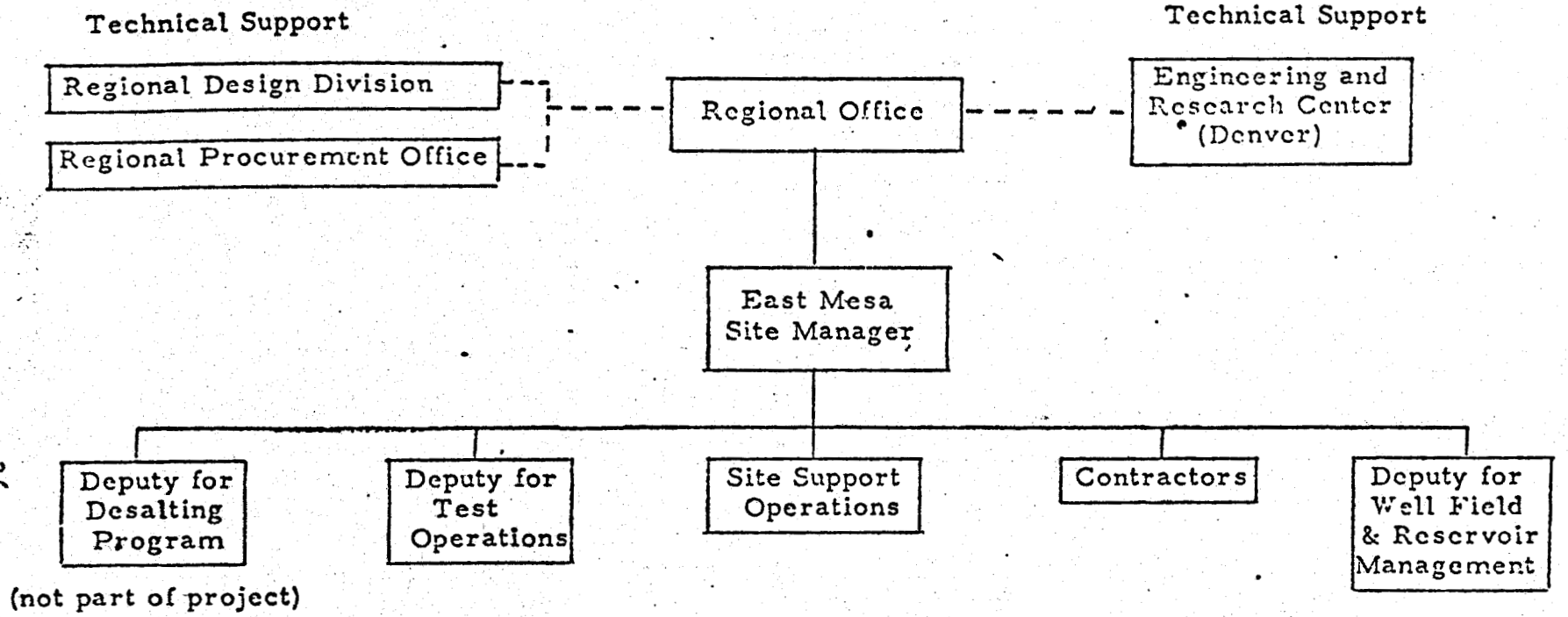
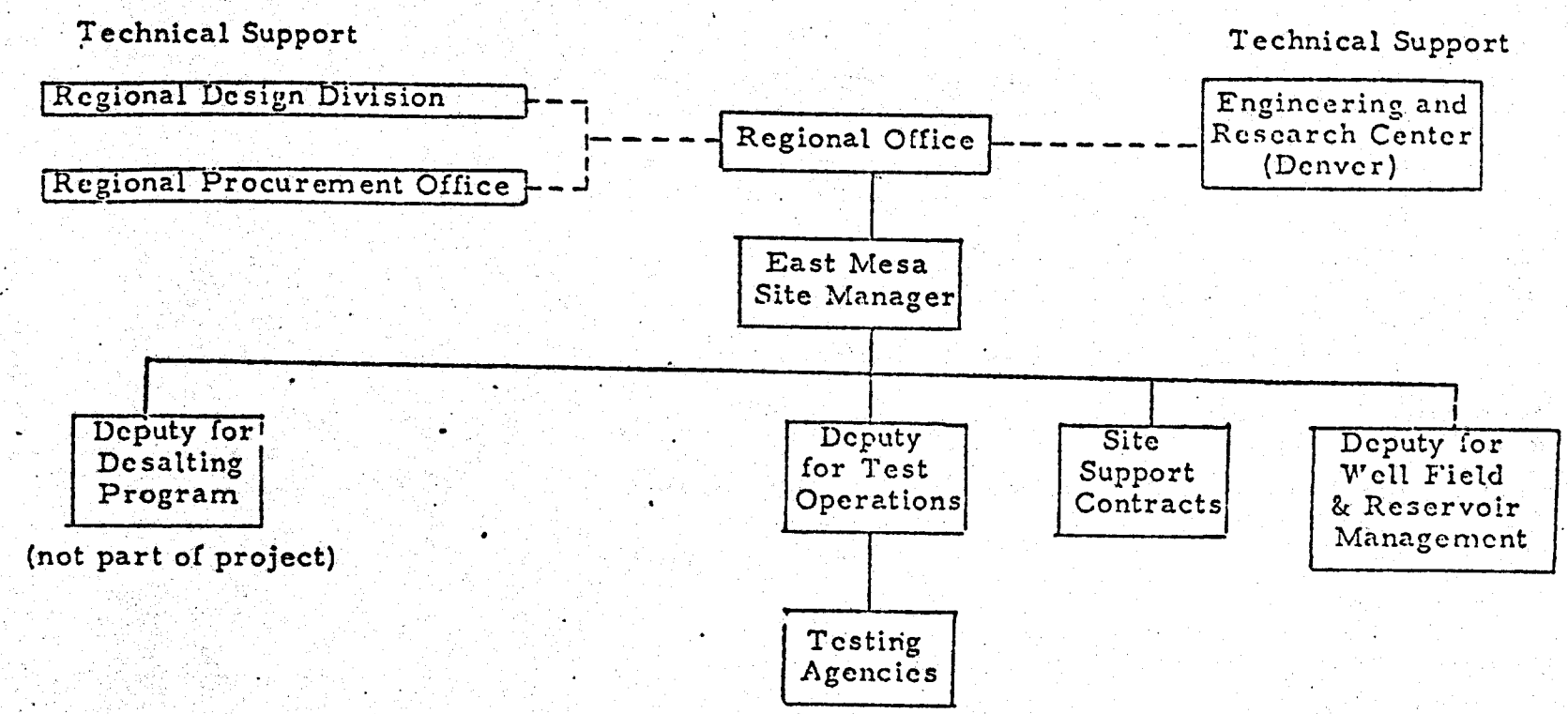


FIGURE 5 - PROJECT ORGANIZATION DURING TEST CENTER OPERATIONS



laboratory services in the Test Center laboratory and on-site shop services, warehousing space, etc., on a cost-reimbursable basis to be negotiated in each instance.

b. ERDA Role

During Test Center operations, ERDA will provide overall policy guidelines as part of the national geothermal program. It will approve the annual operating plan reflected in the PDP updating, and will review and approve the budget submitted by the Test Center Site Manager via Bureau channels.

c. Test Center Panel Role

The Test Center Panel membership will be drawn from respected members of the geothermal community. A membership of six is planned, including representatives of:

- ERDA
- NSF
- Bureau of Reclamation
- Industry (e.g., a member nominated by the Geothermal Industrial Advisory Group)
- Academic Community
- Government, outside the above agencies.

The Test Center Site Manager will function in an advisory role to the Panel. Criteria for Panel membership, in addition to a primary interest in geothermal development, should include ability to attend Panel meetings as frequently as necessary.

The Test Center Panel will have primary responsibility for selection of users of the test facilities, assignment of priorities and scheduling of test facility use. The panel will have specific responsibilities:

- To develop a test program to be conducted at the Test Center in support of the national geothermal effort, coordinated with the Bureau of Reclamation water desalination program. This will include assignment of priorities for all users of the Test Center.

- o To encourage researchers and research organizations to prepare proposals for use of the Test Center facilities.
- o To select the potential projects that will best fit the approved test program.
- o To coordinate with the Site Manager, ERDA, the Bureau of Reclamation and others in evaluating the adequacy of the facilities of the Test Center.

The East Mesa test site was developed in support of the mission of the Bureau of Reclamation in developing methods for desalination of water; it will be necessary that the Bureau's program be included in the overall test program to be conducted at the Test Center. The Bureau will provide the well capacity and other facilities to meet its basic requirements for the desalting program with its own funds. Any excess capacity available from these wells will be available to the Test Center Panel for inclusion in its scheduling of facility usage. The Bureau may require some minimum priority for comparatively rare peak load periods for supplementary fluids from other wells. These requirements will be scheduled by the Test Center Panel, which will coordinate the utilization of well field capacity to optimize both the desalting and other test activities at the East Mesa Geothermal Test Center.

C. Reporting and Review

The Bureau of Reclamation Site Manager will submit monthly progress reports on the site implementation activities to ERDA and Bureau management. These will be brief letter-type reports detailing activities for the previous month, problems encountered and planned routes to their solutions, and plans for the following month's activities. Monthly financial expenditure reports will be submitted with the monthly progress reports. Reports on the status of long-lead time items required in facility implementation or upgrading will be submitted monthly. These will include discussions of anticipated delays in delivery, and descriptions of expediting actions taken to minimize critical item delivery delays.

Once the East Mesa Geothermal Test Center is in operation, the Site Manager will submit quarterly progress reports on test activities at the facility and monthly financial expenditure reports to the same agencies.

1. Progress Reviews

Semi-annual progress reviews will be held during both the implementation and operational phases of the Center. These will be face-to-face meetings between the Test Center management, ERDA Program Managers and their associates, Bureau of Reclamation personnel, the Test Center Panel, and will include members of the geothermal energy and water desalination program communities.

During Test Center implementation, program reviews will be detailed techical discussions of the progress in each of the project tasks, and will discuss technical accomplishments, problems encountered or anticipated, and planned routes to their solution.

Once the Test Center is in operation and the various users are conducting their test operations, the program reviews will cover such topics as the efficiency of utilization of the test facility; the adequacy of the facility for the tests proposed; potential conflicts between users and the routes to the resolution of these conflicts by the Test Center Panel; requirements for additional facilities and additional or enlarged wells for greater brine flow rates; environmental problems in spent brine disposal, etc.

2. Technical Reports

During the Test Center implementation phase, a Technical Facilities Planning Report will be prepared by ERDA in coordination with the Bureau of Reclamation Site Manager. This report will present sufficient details of the facilities plan to enable potential users to start planning their test programs.

The Bureau of Reclamation Site Manager will be responsible for the preparation of a Facility Description report for potential users of the center prior to its initial operations. This report will present the

specific technical capacity of each test site for user test operations, and will detail procedures for test operation proposals and approval, services to be provided by the Test Center, responsibilities of the user with respect to test operations and dismantling of test equipment, user and Test Center responsibilities with respect to environmental controls, etc.

Once the Test Center is in operation, users will be required to submit Test Plan Reports to the Site Manager after approval of test proposals, but prior to the start of test operations. These will be detailed descriptions of the planned tests, including requirements for brine flow rates and schedules, support facilities, planned test times, etc. After completion of test operations, users will be required to submit a Test Result Report to the Site Manager. The Bureau of Reclamation Site Manager will be responsible for publication of user reports, under the free disclosure policy to be established for the Test Center; proprietary information will be protected. The Test Center will be operated in keeping with the requirements of the Freedom of Information Act, and all data developed through its use, except for necessarily proprietary information, will be disseminated freely to the geothermal energy development community and the public.

D. Public Information Office Activities

The Bureau of Reclamation will be responsible for the operation of a Public Information Office for the East Mesa Geothermal Test Center. This office will answer non-technical inquiries from the general public on the operation of the Test Center, and will arrange visits to the Test Center for interested groups. Technical inquiries received by the Public Information Office will be referred to the appropriate group in the site management office for reply. Inquiries from Congress and high ranking officials will be answered by the Public Information Office, with the assistance of the Site Manager, if possible. Copies of the inquiries and of the replies will be forwarded to ERDA and the Bureau of Reclamation immediately. Inquiries from Congress or high ranking officials which the Site Manager feels should not be answered at the site level will be referred to ERDA and/or the Bureau of Reclamation for reply.

The National Geothermal Test Center will be operated in accordance with the Freedom of Information Act.

E. Protection of Proprietary Information

Any proprietary information so labeled in test proposals, test plan reports, or reports on the results of testing by users will be protected. The Test Center management will evaluate all user requests for designation of information as proprietary on a case-by-case basis, applying the appropriate procurement regulation rules in determining the validity of proprietary information protection requests. When proprietary equipment is under test during Center operations, security will be the responsibility of the testing agency. The Test Center management will not schedule visits to test areas at which equipment is designated as proprietary by the user.

V. PROCUREMENT AND CONTRACTING PLAN

A. Procurement Regulations

The Bureau of Reclamation's procurement and contracting policy and procedures are promulgated in the Federal Procurement Regulations (41 CFR) issued by the General Services Administration. The Department of the Interior issues Interior Procurement Regulations to provide additional instructions and guidance necessary to supplement the basic procurement regulations. Reclamation Instruction Supplements are also issued as required to provide operating instructions and guidance.

1. Competitive Procurement Policy

Unless a clear necessity for non-competitive procurement can be shown to exist, on the basis of requirements of the appropriate procurement regulations, all procurement of materials and services (including study contracting) by the East Mesa Geothermal Test Center will be competitive.

If competitive procurement of materials or services is not feasible, and the requirements for sole source procurement in the appropriate procurement regulations can be complied with, sole source procurements can be utilized. Decisions to use sole source procurement will be made on a case-by-case basis by the Bureau. Concurrence of the ERDA Program Manager will be sought for each major sole source procurement.

2. Patent Policy

The objective of the Test Center patent policy will be the maximum encouragement of industrial and other user participation in the National Geothermal Energy Program. The industrial and academic communities will be encouraged to utilize the facilities of the East Mesa Geothermal Test Center for testing of both proprietary and non-proprietary geothermal energy converion systems and components, as scheduled by the Test Center Panel, on a non-restrictive patent basis. The specific patent regulations to be applied are those of the Department of Interior. The Bureau of Reclamation patent articles will be used in contracting.

3. Make-or-Buy Policy

In accordance with the stated objective of the national geothermal energy program to involve industry to the maximum possible extent in program operations, the Bureau of Reclamation, as site manager, will award contracts to industry for various activities in the implementation and operation of the Test Center. All Test Center implementation functions, aside from those assigned to the Bureau of Reclamation or ERDA in the previous sections of this PDP, will be performed on contract unless site management, in coordination with ERDA and the Bureau of Reclamation, determines that the function must be performed in-house. All major construction, equipment fabrication, etc., will be performed on contract except in emergencies or when it can be shown that the best available capability is in-house. In the latter case, concurrence of ERDA and the Bureau of Reclamation will be sought for major in-house work if time permits.

B. Contracting

The Bureau of Reclamation technical study and design contracting procedure starts with the preparation of the scope of work statement for the RFP by the technical personnel involved. The Procurement Office provides the necessary "boiler plate" sections and the specific terms and provisions for the contract.

Bidders' source lists are compiled from Bureau files and by advertising in Commerce Business Daily. The Bureau is presently establishing a computerized source list for technical contracting.

Technical proposals are reviewed by an Evaluation Board appointed by the Regional Director. (Cost proposals are reviewed separately.) Membership may include government employees who are not in the Bureau and consultants if specialized technical knowledge not available in the Bureau is considered desirable for the evaluation. The Evaluation Board is provided with a set of instructions for proposal evaluation, including rating formats. The Board rates the technical proposals in order of qualifications, and reports its findings to the Contracting Officer. The Contracting Officer starts negotiations, based

on available funding or estimated costs, with the most qualified bidder as rated by the Board; if these are not successful, he proceeds to the next highest rated bidder, etc.

Contract formats (fixed price, cost plus fixed fee, etc.) are selected on the basis of the individual procurement. Firm fixed price contracts are usually used in purchases of materials and equipment. Study and design contracts are more frequently one of the cost reimbursable types.

Major contracts for equipment and supplies and for construction are established by procedures similar to those described above. The Bureau's Lower Colorado Regional Procurement Office handles research and supply purchasing contracts; other contracts, such as for well drilling or construction, are established by the Region's Construction Division.

In most cases, Bureau of Reclamation contracting is competitive. However, the Bureau is authorized to purchase materials without competition up to $250, and to purchase on telephone bid up to $5,000. Such contracts between $5,000 and $10,000 require written quotations, but the contractual document can be a Purchase Order, which permits rapid procurement.

The Bureau will establish procedures for notifying ERDA well in advance of anticipated contracting milestones for the East Mesa Geothermal Test Center (RFP preparation, bidders' list compilation, Evaluation Board appointment, etc.). ERDA may participate in any of these procurement activities if it so desires.

C. First Year Contracting Plan

The following contracts are anticipated to be awarded in the first year for Phase 1A of the Test Center implementation:

Item Contracted	Start Date*	Anticipated Cost
Well Reperforation	Apr. 1, 75	$ 50,000
Support Services (several contracts)	Apr. 15, 75	60,000
Roads and Paving	May 15, 75	85,000
Fencing	June 1, 75	10,000
Pipelines and Plumbing	June 1, 75	120,000
Shop and Lab (several contracts; includes permanent equipment at $180,000)	June 1, 75	330,000
Well Drilling	June 1, 75	600,000
Phase 1B Design & Coordination	Apr. 1, 75	125,000
Total First Year Contracting		$ 1,380,000

* Assuming a project start in March 1975.

VI. TECHNOLOGY TRANSFER AND UTILIZATION PLAN

A. Potential Users

The prime objective of the establishment of the East Mesa Geothermal Test Center is to provide a capability for test and evaluation of new components and systems for geothermal energy applications under field operating conditions. The facilities of the Test Center will be available to all qualified users from industry, universities, and State and Federal agencies approved by the Test Center Panel.

Proposals for use of the Test Center's facilities will be reviewed and approved by the Test Center Panel for industrial, university, or government funded projects that have system or component hardware ready for test. Proposals for funding of research and development efforts leading to the development of hardware for testing will be submitted to appropriate governmental or private agencies; if testing at the East Mesa Geothermal Test Center is anticipated, advance notice may be submitted to the Test Center Panel for long-term scheduling of facilities use. However, priorities for utilization of test facilities will be determined on a case-by-case basis by the Panel, considering the requirements of both the national geothermal energy program and the Bureau of Reclamation water desalination program.

B. Dissemination of Information

The Bureau of Reclamation Site Manager, in coordination with ERDA, will be responsible for dissemination of information on the planned capabilities of the East Mesa Geothermal Test Center during its implementation; on the available facilities, requirements for use, and procedures for proposal submittal prior to the activation of the Test Center; and continually thereafter during Test Center operation.

Test reports, except for proprietary information (see above) will be disseminated to the geothermal energy development community by the Site Manager. Such reports will be available to the public through the National Technical Information Service (NTIS).

Technical meetings and symposia, and geothermal testing and environmental control workshops will be scheduled for discussion of the program and dissemination of information on its operations.

VII. RESOURCE REQUIREMENTS

A. Budget Summary

The required funding for Phases 1A and 1B of the East Mesa Geothermal Test Center for FY75 and FY76, and for the operation of the Test Center for user tests of geothermal energy system components during FY75 and FY76, is presented in Table 2. Budget detail is presented in Tables 3 through 5. The FY75 budget is regarded as firm. The FY76 budget is based on the development of the Test Center to the level of capability described for Phase 1 in the TRW Phase 0 report. The FY76 budget includes funding to complete that portion of Phase 1A not covered by the FY75 budget and all of Phase 1B.

Detailed budget estimates for the Phase 2 10MWe geothermal electric Demonstration Experiment cannot be prepared until the ERDA/NSF analysis of the Phase 0 studies have been completed and the requirements for the power plant have been defined. A tentative Phase 2 construction schedule and budget, totalling funding requirements for the two-year TRW accelerated project (extracted from the TRW Phase 0 report) is presented in Figure 6. The contract costs for Test Center Operation, Maintenance and Replacement (OM&R) are estimated for FY77 - FY79 in Table 5 during this period. These costs will cover Test Center Operation at the TRW Phase 1 level of capability, except for Bureau of Reclamation staffing and related costs (travel, publications, etc.). These costs beyond the end of the Phase 1B completion cannot be estimated until ERDA plans for Phase 2 assignments have been made.

B. Staffing

The key staff of the Test Center will be the Site Manager and two Deputy Site Managers:

- Site Manager, Mr. S. H. Suemoto. In charge of Test Center implementation and all Test Center Operations, including Bureau of Reclamation desalting program.
- Deputy Site Manager, Test Operations, Mr. J. L. Featherstone. Assists Site Manager in Test Center implementation. Responsible for day-to-day operation

of test pads, laboratory and shop facilities, etc.; Test Center maintenance and housekeeping (Bureau and contractor personnel). Reports to Site Manager.

- Deputy Site Manager, Reservoir and Well Field Operations, Mr. K. E. Mathis. Assists Site Manager in Test Center implementation. Responsible for operation of wells, well-head installations and pipelines; monitors geothermal fluid usage, schedules fluid flows; maintains well-head installation; advises Site Manager on status of geothermal fluid requirements and adequacy of supply. Reports to Site Manager.

C. Facilities

The present facilities of the East Mesa site (offices, laboratory, shops, warehouse) will be utilized by test operators during the Phase 1A implementation activities. Phase 1A construction will provide a new laboratory, shop and additional warehousing space in a prefabricated building to be located in the area selected for the Phase 1B expansion approximately 1,000 feet from the present site. Upon completion of this structure, part of the present office/shop/warehouse structure will be converted to additional office space for Center staff. The present trailer housing the laboratory will be converted to office space for test operators.

TABLE 2 - ESTIMATED BUDGET

	Cost (Thousands of $)		
	FY75	FY76	Total Phases 1A and 1B
A. Salaries and Wages*	$ 45	$ 50	$ 95
1. Senior Staff	21	66	87
2. Other Professional	16	48	64
3. Clerical/Technical			
B. Staff Benefits		(Included in A)	
C. Total Salaries, Wages, Benefits	$ 82	$ 164	$ 246
D. Permanent Equipment (Lab and Shop)	$ 180	15	195
E. Expendable Equipment & Supplies	25	10	35
F. Travel	8	22	30
1. Domestic*	0	0	0
2. Foreign			
G. Publications	4	4	8
H. Computer Costs (Direct)	1	2	3
I. Other Costs (contracts; see Tables 4 and 5)	1,200	2,575	3,775
J. Total Direct Costs	$ 1,500	$ 2,792	$ 4,292
K. Indirect Costs (15% of C)	13	25	38
L. Total NSF Costs	$ 1,513	$ 2,817	$ 4,330

* Detail in Table 3

180 + 1200 = 1380 in T4 # 2812/M

$45,000 = 33750
4/3

2812 x 12 = 33750

33750/1.30 = 26,000

TABLE 3 - BUDGET DETAIL

	(man months)		
	FY75	FY76	FY77-FY79
Salaries and Wages			
1. Senior Staff	16	18	*
2. Other Professionals	15	47	*
3. Clerical/Technical	12	36	*
Travel (Domestic only)		Dollars	
- One trip per month, Engineering Research Center, Denver to Site (technical support for design work) at $300	1,200	3,600	*
- One trip bimonthly, Test Center personnel (Misc. travel re implementation) at $300	3,000	7,200	*
- One trip per week, Region Hq., Boulder City, Nev. to site (technical support for design work, supervision, inspection, etc.) at $200	3,600	10,400	*
- Bi-annual Site Manager Trip to Washington for Test Center Panel Meeting at $600	600	1,200	*
Total Travel	$8,400	$22,400	*

* Cannot be estimated until Phase 2 decisions are made.

TABLE 4 - ESTIMATED CONTRACT AND PERMANENT EQUIPMENT COSTS, PHASES 1A AND 1B

Description	Cost (Thousands of $) FY75	FY76	TOTAL
Phase 1A			
Roads and Paving	$ 85	$ 0	$ 85
Service Facilities (Sewer, Elect., Water)	60	40	100
Lab and Shop Building	150	0	150
Lab and Shop Equipment*	180	0	180
Pipelines	120	125	245
Well Reperforation	50	0	50
Fencing	10	0	10
Well Drilling (1 slant production, 1 injection)	600	600	1,200
Coordination	25	25	50
Phase 1B Design	100	100	200
Subtotal, Phase 1A	$ 1,380	$ 890	$ 2,270
Phase 1B			
Test Pads, Office Space, Support Services	0	60	60
Fencing	0	15	15
Well Drilling (2 slant production)	0	1,200	1,200
Reservoir Analysis	0	50	50
Preliminary Phase 2 Design	0	200	200
Subtotal, Phase 1B	$ 0	$ 1,525	$ 1,525
Total, Phases 1A and 1B	$ 1,380	$ 2,415	$ 3,795

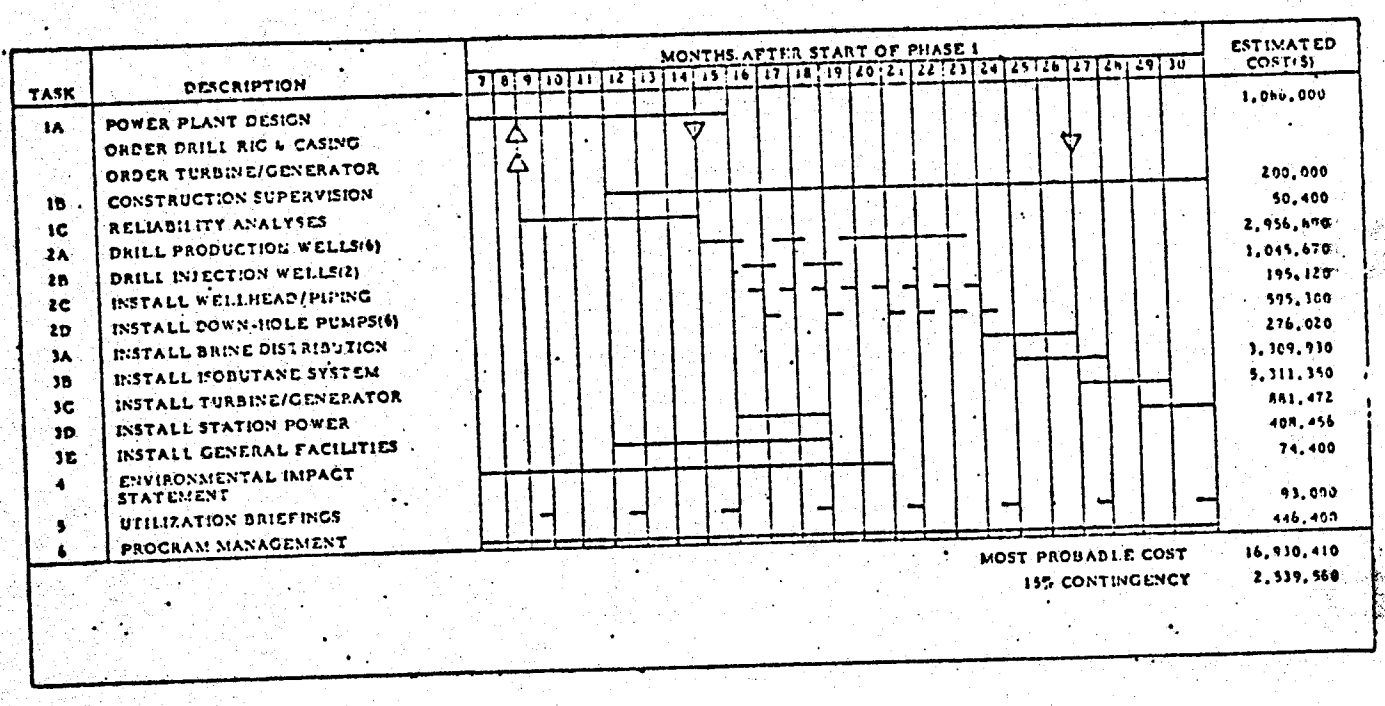
* Permanent Equipment (line D) in Budget of Table 2; all other costs are Contracts (line I).

TABLE 5 - ESTIMATED OPERATIONS, MAINTENANCE AND REPLACEMENT (OM&R) COSTS

Item	Cost (Thousands of $)* FY76	Annual, Starting FY77
Personnel	$ 40	$ 160
Security	30	30
Laboratory Supplies	15	15
Shop Facilities	20	20
Pipeline Maintenance ($1,000/mile)	5	5
Well Maintenance (painting, cleaning)	15	15
Road Maintenance ($500/mile)	2	2
Telephone	4	4
Electricity (lights, machinery, water pumps)	10	10
Facility Maintenance (sewer, building, janitor)	10	10
Water Supply (pumps, maintenance)	7	7
Drinking Water	2	2
Total Annual Cost	$ 160	~~$ 300~~ 280

* Contracts and Purchased Supplies and Services; included in Line I of Budget Table 2, FY76

FIGURE 6 - PHASE 2 DEMONSTRATION EXPERIMENT PRELIMINARY SCHEDULE AND COST ESTIMATE*



TASK	DESCRIPTION	ESTIMATED COST($)
1A	POWER PLANT DESIGN	1,080,000
	ORDER DRILL RIG & CASING	
	ORDER TURBINE/GENERATOR	200,000
1B	CONSTRUCTION SUPERVISION	50,400
1C	RELIABILITY ANALYSES	2,956,670
2A	DRILL PRODUCTION WELLS(6)	1,045,670
2B	DRILL INJECTION WELLS(2)	195,120
2C	INSTALL WELLHEAD/PIPING	595,100
2D	INSTALL DOWN-HOLE PUMPS(6)	276,020
3A	INSTALL BRINE DISTRIBUTION	3,309,930
3B	INSTALL ISOBUTANE SYSTEM	5,311,350
3C	INSTALL TURBINE/GENERATOR	881,472
3D	INSTALL STATION POWER	408,456
3E	INSTALL GENERAL FACILITIES	74,400
4	ENVIRONMENTAL IMPACT STATEMENT	93,000
5	UTILIZATION BRIEFINGS	446,400
6	PROGRAM MANAGEMENT	
	MOST PROBABLE COST	16,930,410
	15% CONTINGENCY	2,539,560

* Extracted from TRW Phase 0 Report, "Experimental Geothermal Research Facilities Study (Phase 0)" Volume 1, Final Report No. 26405-6001-RU-00, TRW Systems Group of TRW Inc., 31 December 1974.

VIII. PERSONNEL RESUMES

Resumes of the background and experience of key personnel will be provided, if required.