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Mark Wiffow

SUSITNA HYDROELECTRIC PROJECT

MID REPORT

TO

GOVERNOR JAY S. HAMMOND

AND

THE LEGISLATURE
OF THE
STATE OF ALASKA

MARCH, 1981

ALASKA POWER AUTHORITY

SUSITNA HYDROELECTRIC PROJECT

Preliminary Report On the Continuation of Feasibility Studies

Submitted to the Alaska Legislature
and Governor Hammond

March 30, 1981

Alaska Power Authority

ALASKA POWER AUTHORITY

1980 YEAR-END STATUS REPORT

ALASKA POWER AUTHORITY

1980 YEAR-END STATUS REPORT

About the Power Authority

The Power Authority is a public corporation made up of a five member Board of Directors who are appointed by the Governor and approved by the Legislature. Its offices are in Anchorage where a staff of seventeen conduct the day-to-day business of the Authority. The Power Authority was initially staffed in January 1978. The present members of the Board of Directors are Mr. Charles Conway, Chairman; Mr. Arnold Espe, Vice Chairman; Mr. Robert Weeden; Mr. Thomas Kelly; and Commissioner Charles Webber, an ex officio member.

The role of the Power Authority is to identify, evaluate and develop electrical power production facilities utilizing the most appropriate technology from among those that are commercially available (except nuclear power generation). The Power Authority's degree of involvement varies depending upon local desires and capabilities. While power project facilities recommended for development can be financed, constructed, owned and operated by the Authority, in many cases involvement is confined to financing alone, or just to the early phases of project evaluation and development.

By its nature as a public corporation, the Power Authority is eligible subject to IRS regulations to sell bonds whose interest to bondholders is tax free. This status lowers the cost of debt capital.

Complimenting the Authority's power development role are two specific programs that it administers, the Power Project Loan Fund and the Power Production Cost Assistance Program.

The Power Project Loan Fund

The Legislature has appropriated to the Power Authority $33,805,000 specifically for loans for power project development since 1978. Loans to individual utilities approved to date include:

1. Alaska Electric Light & Power Company in Juneau for Salmon Creek and distribution system improvements - $1,500,000.

2. Ketchikan Public Utilities for the Swan Lake Project - $21,850,000.

3. Thomas Bay Power Commission for the Lake Tyee Project - $180,000.

4. Kodiak Electric Association for the Terror Lake Project - $3,150,000.

5. Kodiak Electric Association for the Port Lions Project $290,000.

6. Iliamna/Newhalen Electric Cooperative for diesel generation and system development - $300,000.

7. City of Wrangell for diesel generator overhaul - $45,000.

8. City of King Cove for diesel generator purchase - $200,000.

9. City of Akutan for purchase of a 200 KW hydro turbine generator - $125,641.

The Power Production Cost Assistance Program

The Legislature in 1980 created a separate fund from which to pay a portion of the power production costs of eligible electric utilities. Assistance is provided to a utility if its actual power production costs exceed a certain threshhold level established by a legislatively mandated formula.

The program funding was reduced by Governor Hammond from $2.851 million to $1.451 million. The Alaska Public Utilities Commission determines utility eligibility and power production costs, and it determines state assistance per kilowatt-hour of sales for individual utilities. The Power Authority makes disbursements of assistance funds to eligible utilities based upon power production assistance determined by the Commission and statements of sales to eligible customers submitted by the eligible utilities. The program became operational in late October of 1980. The reduced funding of the program is currently estimated to be sufficient to provide full assistance to eligible utility customers until April of 1981. Unless supplemental funding of the program is provided by April 1981, the level of assistance will be reduced. The program will be terminated unless FY'82 funding is appropriated. To date nine utilities, serving over 60 communities, have applied for assistance.

The Planning and Development Process

For certain projects, legislation dictates a multi-step process leading to power facility construction. The Authority first performs a reconnaissance study to assess the electrical energy needs of a community or region and to identify the power production alternatives available to satisfy those needs. The reconnaissance study serves as the basis for recommending more detailed data collection activities, resource assessments or detailed feasibility studies of one or more specific power project alternatives. Reconnaissance study results are used to guide Power Authority budget requests and reports are provided to the Legislature, the Administration and to the communities involved.

As a subsequent step, the Authority performs feasibility studies to obtain detailed information and analyze the technical, economic and environmental aspects of a particular project or program previously recommended in a reconnaissance study. In identifying the preferred project or program for a community or region, the Authority considers all available energy alternatives in terms

of cost, technical suitability, environmental impact, and local preferences. Feasibility studies are accomplished at a level of detail comparable to that required for license applications submitted to the Federal Energy Regulatory Commission.

Accompanying the feasibility report is a plan of finance that compares project financing alternatives and recommends the most appropriate means to insure project financing while minimizing state assistance. When state financial assistance is recommended, the plan of finance identifies the estimated value of the state assistance, whether it comes in the form of a subordinated loan, loan guarantees, equity contribution or other means.

The Power Authority submits feasibility reports and accompanying plans of finance to the Legislature. Concurrently the reports are reviewed by the Division of Budget and Management, and this review is also submitted to the Legislature. The Authority cannot proceed with advanced engineering or design of a proposed new project until the Legislature enacts law authorizing the project. This sequential development process of reconnaissance study, feasibility study, finance plan, Division of Budget and Management review and legislative authorization is required for new projects that will generate more than 1.5 megawatts of power and that either (1) require a state appropriation or (2) is based on a plan of finance that requires the issuance of general obligation bonds or other pledge of the credit of the state. Specifically excepted from this criterion are certain projects which the Legislature has already acted upon and which are identified in Section 48 of HCS CSSB 438.

The Overall Power Development Situation

Sources of Generation

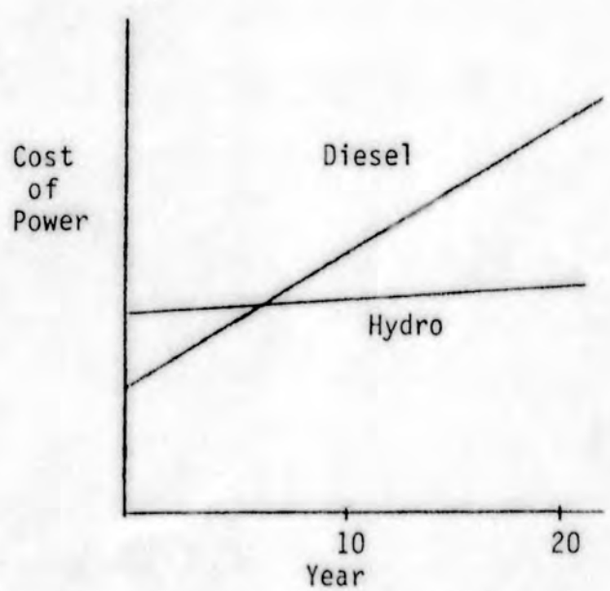
In 1979, the last year for which data has been compiled, statewide electrical generation totalled 4.8 billion kilowatt hours. There were five sources of that energy: gas (56%), oil (18%), coal (11%), hydroelectric (9%) and wood pulp (6%). The state is fortunate to have its own ample supplies of each of these energy sources. While all are present, however, some are more vulnerable than others to cost escalation and federal regulation. It has been the general recommendation of the Power Authority for Alaska to gradually move away from energy sources over which the state has relatively little control with respect to supply and/or price. This equates to a preference for those energy sources that are relatively insulated from inflation, from extreme competition, and from price pressure in lower 48 or international markets. Specifically, these are hydroelectric, coal, and perhaps wind and wood depending on technological advances. The actual preferred energy source varies among localities and over time, being a function of the extent of energy demand, transportation and fuel costs, local expertise and the proximity to energy sources.

Economic and Financial Feasibility

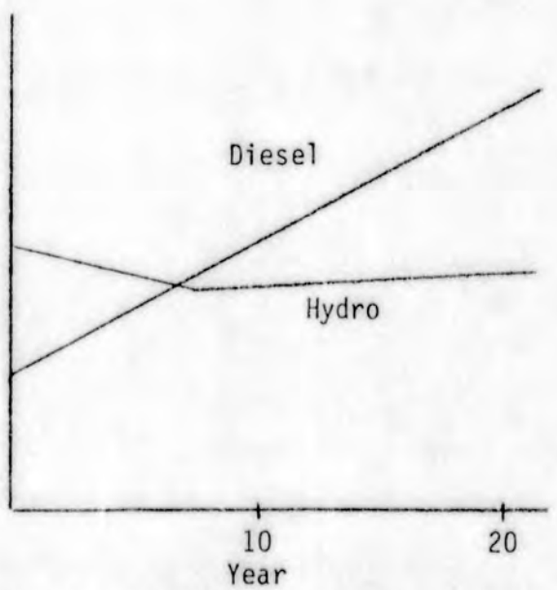
The Authority has found that while life cycle economic cost analyses often identify one generation alternative as the most preferred, financing constraints often argue against the most cost effective project. This is unfortunate because the project selected on the basis of short-term financing considerations often will result in greater costs over the long run.

The problem is most severe when comparing hydroelectric projects against oil or gas-fueled generation alternatives. The hydroelectric project is characterized by high front-end construction costs, relatively insignificant on-going operation and maintenance costs and a useful life of 100 years or more. Such a project's exposure to inflationary cost increases is extremely limited once the construction is complete. Another characteristic of hydroelectric power is the relative difficulty of matching the project's output to the market area requirements. This is the case because the project site characteristics often dictate the scale of cost effective development. The diesel generator or oil or gas turbine, on the other hand, has on-going operation, maintenance and fuel costs that become much more significant than the initial capital cost. The project's life ranges between 20 and 30 years. The exposure to inflation and to relative increases in the price of fuel is extreme. These projects can typically be added in small increments to closely match the growth in power requirements.

The present day bond market is such that the cost of borrowing the required construction capital makes hydroelectric development appear unattractive due to the resultant high cost of energy in the early years of project operation relative to the fossil-fuel alternative. This is further compounded in those cases where the immediate market area energy requirements are less than the hydroelectric project's potential output.



CASE 1. WITH FULL UTILIZATION OF THE HYDRO OUTPUT, HYDRO POWER COSTS INCREASE MUCH SLOWER THAN DIESEL DUE TO ITS LIMITED EXPOSURE TO INFLATION AND FUEL COST ESCALATION.



CASE 2. EXCESSIVE SHORT TERM HYDRO POWER COSTS ARE EXACERBATED WHEN THERE IS SURPLUS ENERGY IN THE EARLY YEARS. HYDRO COST OF POWER FALLS AS SALES INCREASE, UNTIL FULL UTILIZATION IS REACHED.

Despite the financing problem, the longer term perspective of a life cycle economic analysis often shows the hydroelectric project to be clearly superior to the diesel generator or oil or gas turbine. This situation suggests an important and timely role for state intervention. From the perspective of insuring long-term, stable priced and secure electrical power, the state can provide a mechanism to alleviate the immediate financing problem and thereby encourage development of the most cost effective long term solutions. The means for this state intervention include the issuance of revenue bonds of the Power Authority which may be guaranteed or partially guaranteed by the state; the issuance of general obligation bonds of the state; leveraged leasing; appropriations from the general fund for loans, equity investment, or debt service payment; and any combination of the above financing arrangements.

The purpose of the state assistance in whichever form is to lower the cost of borrowed capital for construction of projects and the cost of energy to consumers in the critical first years of project operation. It will also assist development of renewable energy projects and permit stable economic development.

Project Status Summary

Following is a summary of current Power Authority activities and the status of various power projects. Included is information on the location of the project or study, current status, size of project (if applicable), and the Power Authority's role. This role varies among several functions:

* Grant and loan administration
* Program management of reconnaissance level studies
* Revenue bond or other financing
* Project management where a specific project is in planning and development
* Technical assistance

ALASKA POWER AUTHORITY

Project/Study	Location	Status	Size	Power Authority Role
AEL&P Transmission Improvements	Juneau	Completed	N/A	Power Project Loan
Akutan Hydro	Akutan	Feasibility Study and Preliminary Design Complete	190 KW	Power Project Loan and Technical Assistance
Port Lions Hydro	Kodiak Island	Design Underway	200 KW	Power Project Loan
Swan Lake Hydro	Ketchikan	Under Construction	22 MW	Power Project Loan and Construction Financing
Tyee Lake Hydro	Petersburg, Wrangell, and Kake	Final Design, License Pending	20 MW	Project Management
Diesel Generators	Iliamna/ Newhalen Wrangell King Cove		N/A	Power Project Loan Power Project Loan Power Project Loan
Salmon Creek Hydro Rehabilitation	Juneau		N/A	Power Project Loan
Black Bear Lake Hydro	Klawock, Craig, and Hydaburg	Detailed Feasibility Studies Underway	5 MW	Project Management
Wood Waste Generation	Hoonah	Feasibility Assessment Underway	2.7 MW	Program Management
Haines Hydropower	Haines, Skagway	Feasibility Assessment Complete	2.5 - 5.4 MW	Program Management
Susitna Hydro	Fairbanks, Anchorage, Kenai Peninsula, Glennallen, and Valdez	Detailed Feasibility Studies Underway	1,500 MW	Project Management

ALASKA POWER AUTHORITY

Project/Study	Location	Status	Size	Power Authority Role
Railbelt Intertie	Fairbanks, Anchorage	Detailed Feasibility Studies and Route Selection Underway	N/A	Project Management
Terror Lake Hydro	Kodiak	Final Design, License Pending	20 MW	Power Project Loan and Construction Financing
Lake Elva Hydro	Dillingham	Detailed Feasibility Studies Underway	1.5 MW	Project Management
Brevig Mission Distribution System	Brevig Mission	Work in Progress	N/A	Grant Administration
District Heating System	Fairbanks	Feasibility Study Underway	N/A	Grant Administration
Nushagak Waste Heat Study	Dillingham	Design Pending	N/A	Grant Administration
Wood-Fired Heating System	Noatak	Design Underway	N/A	Grant Administration
Geothermal Development	Kotzebue	Site Investigations Underway	N/A	Program Management (RSA to DEPD)
Geothermal Development	Unalaska	Site Investigations Underway	N/A	Program Management (RSA to DEPD)
Reconnaissance Studies	Tanana, Cordova, Sitka, Angoon, Shungnak, Kiana, Ambler, Scammon Bay, King Cove, Goodnews Bay, Togiak, Grayling, Kaltag, Savoonga, White Mountain, Elim, Sand Point, Akhiok, Larsen Bay, Old Harbor, Ouzinkie, Russian	Studies Underway	N/A	Program Management

ALASKA POWER AUTHORITY

Project/Study	Location	Status	Size	Power Authority Role
Reconnaissance Studies (continued)	Mission, Sheldon Point, Hughes, Buckland, Koyukuk, Crooked Creek, Chuathbaluk, Stony River, Sleetmute, Red Devil, Takotna, Telida, and Nikolai			
Waste Heat Demonstration	Rural Villages	Site Selection	N/A	Project Management
Northwest Alaska Coal Assessment	Kobuk River Valley, Seward Peninsula, Norton Sound Coast, Point Hope, and Point Lay	Feasibility Assessment Underway	N/A	Program Management
Wind Power Demonstration	Unalakleet	Pre-construction Activities Underway	N/A	Program Management (RSA to DEPD)
Wind Power Demonstration	Skagway	Pre-construction Activities Underway	N/A	Program Management (RSA to DEPD)
Power Production Cost Assistance	AVEC, THREA, other Villages	Program Underway	N/A	Program Administration
Tazimina River Hydro	Bristol Bay	Stream Gauging	18 MW	Project Management
Reconnaissance Studies	Nome, Kotzebue, Bethel, Dillingham, Kake, Angoon, Hoonah, Klawock Haines, and Skagway	Studies Complete	N/A	Program Management
Solomon Gulch Hydro	Valdez, Glennallen	Under Construction	12 MW	Construction Financing

ALASKA POWER AUTHORITY

March 27, 1981

The Honorable Hugh Malone
Alaska State Legislature
Pouch V
Juneau, Alaska 99811

Dear Representative Malone:

AS 44.83.320 requires that by March 30, 1981 the Alaska Power Authority submit to the Governor and the Legislature a preliminary report recommending whether work should continue on the Susitna River Hydroelectric Project. The intent of the report is not to recommend for or against the construction of Susitna. Rather it is a mid-project report which summarizes the findings of the first years efforts of the 2½ year feasibility study.

Based on present knowledge, there appears to be no obvious environmental impacts so serious as to recommend curtailment of the planning process. Futhermore, based on conservative assumptions there appears to be ample economic justification to further warrant the completion of the present program.

At its March 1981 meeting, the Board of Directors voted unanimously to recommend completion of the Susitna feasibility study. Transmitted herewith are the Boards findings.

Sincerely,

Eric P. Yould

Eric P. Yould
Executive Director

THE BOARD OF DIRECTORS RECOMMENDATION

ON THE

SUSITNA HYDROELECTRIC PROJECT

MID REPORT

TO

GOVERNOR JAY S. HAMMOND

AND

THE LEGISLATURE

OF THE

STATE OF ALASKA

MARCH, 1981

ALASKA POWER AUTHORITY

ALASKA POWER AUTHORITY

333 WEST 4th AVENUE - SUITE 31 - ANCHORAGE, ALASKA 99501

Phone: (907) 277-7641
(907) 276-2715

March 25, 1981

The Honorable Jay S. Hammond
Governor
Pouch A
Juneau, Alaska 99811

Dear Governor Hammond:

Legislation requires that the Alaska Power Authority, by March 30, 1981, prepare and submit a preliminary report recommending whether work should continue on the Susitna Hydroelectric Project Feasibility Studies. With this letter, I am transmitting that report along with a recommendation to continue the feasibility study program.

In preparing our recommendation, the Board of Directors was guided by four primary considerations: the need for the project, seismic risk, environmental impact and economic justification. We have also been guided by the very valuable advice of the Power Authority's Susitna External Review Panel members who have also concluded that the proposed project shows sufficient promise for the future welfare of Alaska that it is clearly desirable to continue the studies. Our preliminary findings are as follows:

Based on the information available to date, it is very likely that Railbelt area power requirements over the next 30 years will necessitate new capacity approximately equal to, or greater than, the capacity of the proposed Susitna Project.

While the Upper Susitna River Basin is a seismically active area, there is ample reason to believe that structures can be built to safely withstand the worst conceivable earthquake forces that can be anticipated at the dam sites.

Based on presently available information, there is no anticipated environmental impact so adverse that the feasibility study program should be terminated prior to its scheduled completion.

Based on a very conservative Susitna Project cost estimate and reasonable assumptions relating to thermal generation costs, the Susitna Project is more cost effective over the long term than providing the same amount of power by alternative means.

It should be emphasized that these findings, in keeping with the status of the feasibility study program, are preliminary in nature. While the Board is confident in making this recommendation to continue the feasibility studies, our conclusions regarding project feasibility will not be reached until April, 1982.

Sincerely,

Charles Conway
Chairman of the Board

Thomas Kelly

Charles Webber

Robert Weeden

Arnold Espe

Enclosure: As stated

ALASKA POWER AUTHORITY

EXECUTIVE SUMMARY

Contained in this executive summary (of Susitna Hydroelectric Project, Preliminary Report on the Continuation of Feasibility Studies,) is an overview of the tentative findings by the Alaska Power Authority regarding the advisability of developing the hydropower potential of the Susitna River to meet the energy needs of Alaska's "railbelt" region. These findings are being transmitted to the Governor and Legislature of the State of Alaska as a statutory requirement under AS 44.83.320. It is not the intent of this effort to recommend for or against the construction of Susitna; rather, this is a mid-report which summarizes the findings of the first years efforts of this 2½ year feasibility study. Presented, then, are the criteria by which the Power Authority has conducted this mid-evaluation, and finally, the rational by which the Power Authority Board of Directors has concluded that the Susitna studies warrant completion.

• The Susitna studies are a 2½ year effort designed to establish whether or not the Susitna River hydropower potential should be developed to meet the electrical energy needs of Alaska's railbelt. Project funding is from the State of Alaska, and project evaluation is the responsibility of the Alaska Power Authority. Checks and balances have been built into the study process to insure an objective assessment of the project. In December 1979, the Power Authority entered into a $27.5 million contract with Acres American Incorporated to conduct the assessment of developing Susitna's hydropower potential. In the event that the 30-month study concludes that the project should be constructed and the Legislature concurs, the study would support a license application to the Federal Energy Regulatory Commission for project construction. To insure objectivity in the study, the following measures have been taken:

* A Legislative Oversight Committee was established to oversee the project and to independently analyze alternatives to Susitna.

* The University of Alaska through the Institute of Social and Economic Research (ISER) was given the independent task of developing the electrical energy projections against which Susitna would be evaluated.

* The Governors Office was appropriated $1.5 million to conduct an alternative energy assessment to Susitna. This study has been contracted to Battelle Pacific Northwest and is scheduled for completion in April 1982. In addition, a number of smaller subcontracts have been let to advise the Governor's Office on other aspects of railbelt energy development.

* The Power Authority has contracted separately with the Alaska Department of Fish and Game to collect data on fish and wildlife that might be affected by the project. Recreational and archaeological assessments have similarly been contracted to the University of Alaska.

* A public participation office has been developed within the Power Authority to keep people informed on all aspects of the study, but also to insure that the public has a voice in the direction and scope of the studies. In conducting this program, the Power Authority is striving to maintain a non-committal attitude toward the project until all data can be evaluated and disseminated for public review.

* A Susitna Steering Committee consisting of 13 federal and state governmental agencies has been established to advise the Power Authority on their concerns. While this committee acts in an advisory role, many of them will ultimately exercise jurisdictional control through the permitting process.

* A Policy Board within the Acres organization meets periodically to insure corporate attention is focussed on the project and has broad powers to act in cases where assistance to the Power Authority or the project manager is necessary. In addition, the Acres project manager is assisted by Internal Review Consultants who are not directly involved in the project, but who have achieved eminence within their respective disciplines within Acres.

* An External Review Board has been established by the Power Authority consisting of scientists, engineers, and biologists to advise Acres directly on various technical aspects of the project.

* Finally, outside of the independent review provided to the Board of Directors by the Power Authority staff, the Board has its own independent Board of Consultants to advise on all aspects of the project. Contained in this report is their recommendation on whether the Susitna studies warrant completion based on their review of the data gathered during the previous year.

• From a historical prospective, the efforts presently being undertaken by the Power Authority follow many years of interest in developing the hydropower potential of the Upper Susitna River Basin. Early assessments were conducted by both the Corps of Engineers and Bureau of Reclamation throughout the 1940's and 1950's. The most definitive recommendations were offered by the Bureau of Reclamation when in 1961 they recommended to Congress that Devil Canyon and Denali be developed as a first stage of an eventual four dam development ultimately to include dams at Watana and Vee as well. The economics of this

four dam development capable of producing twice the electricity presently consumed in the railbelt today was undercut when cheap natural gas was discovered in Cook Inlet. With the establishment of the OPEC Cartel in 1973, the economics of Susitna once again became apparent. Thus as a response to Congressional request, the Corps of Engineers reassessed the Susitna project in 1975 and recommended to Congress in 1976 that a two dam system consisting of Devil Canyon and a high Watana was economically justified and that it would develop 95% of the energy of the Bureau's four dam basin development but at the expense of only 59% of the area to be inundated by the Bureau's proposed four dams. The Alaska Congressional Delegation, however, warned Alaskans that the State should not look to the federal government to develop Susitna and advised that the State take the necessary steps to bring it forward under State sponsorship. After attempts to establish a cooperative program with the Corps of Engineers for Susitna's analysis, the State through the Power Authority ultimately chose the private sector for Susitna's feasibility assessment using Acres American Incorporated. This 2½ year study will culminate with a recommendation on construction in June 1982. It is important to note that even the federal government would have conducted the studies presently being undertaken by the Power Authority before a construction decision could have been reached.

- There are four issues that merit close review in deciding whether the Susitna feasibility studies should continue. The issues have been posed as questions, and an affirmative answer to any one would indicate that the program should be stopped or redirected. The questions are as follows:

  * Are peak load requirements forecasted over the 30-year planning horizon so low that no major addition to the railbelt power generation system is required?

  * Is the seismic risk associated with the project area sufficiently great so that the hydroelectric potential cannot be developed safely?

  * Are the anticipated environmental losses unacceptable irrespective of other considerations?

  * Is there an alternative set of projects that can be found to meet electrical energy demand forecasts through the year 2010 at a cost significantly below that of the Susitna project?

In many respects a negative finding for either of the first two questions is of little value in that economics as posed in the fourth question is the overriding factor. For instance, while it might be determined that structures can be built to withstand the seismic loading anticipated, the cost of such structures, may render the project uneconomic in comparison to other energy alternatives. Similarly, an evaluation on

the need for generation capacity does not necessarily address the economics of displacing thermal fuels such as coal, oil, and gas. A fifth criteria that the Power Authority originally considered using would have dealt with project financing. The Authority concluded, however, that economic feasibility based on a life cycle analysis did not necessarily mean that the project could be financed by the private money market. This acknowledges that over its economic life, while Susitna may be significantly less expensive than its most viable competitor, if investors are not assured that sufficient revenues can be generated in the early years to pay debt service, then financing could not be secured. The Alaska Legislature has realized this problem with smaller hydropower projects and hence has required the Power Authority to devise project by project financing schemes that would have the State providing the added degree of security needed for successful financing in the private market. During the present legislative session, however, both the Governor and the Legislature are considering establishing a blanket financing program that will provide sufficient security to insure financing of all economically feasible projects. For these reasons, the Power Authority felt that it could not make a recommendation even in the event that private financing was not assured.

- The plan of development upon which the Board of Directors recommendations are based is, in general concept, that devised by the Corps of Engineers in 1976. A number of alternative basin developments were analyzed during the previous year with the result being a reaffirmation of the Devil Canyon - High Watana plan. Project features and staging are different than that offered by the Corps, but the basic major features are unchanged. Watana would be an 800 + foot high earthfill structure with an underground powerhouse and a contiguous chute spillway. Devil Canyon would be a concrete thin arch dam roughly 650 feet high with underground powerhouse and three spillways. Double circuit, double tower 345 KV transmission lines would bring power to the Anchorage/Fairbanks load centers. Project development would take place in three stages consisting of 400 MW of capacity at Watana, initially, followed by, and as energy demand dictates, additions of another 400 MW at Watana and then the eventual construction of 400 MW at Devil Canyon for a total of 1200 MW of power capable of producing 6.2 billion kwh average annual energy. This is roughly twice the energy presently consumed in the railbelt.

- Following are summaries of the rationale by which the Power Authority has concluded that there is sufficient justification to warrant completion of the Susitna feasibility studies:

  * From the standpoint of peak load requirements, it appears that even with very conservative assumptions on load growth that Susitna's capacity will be needed. If a much more moderate demand materializes, Susitna alone will not be capable of meeting demands within the planning horizon between today and the year 2010. The Institute of Social

and Economic Research (ISER) of the University of Alaska was assigned the task by the Legislature of predicting future energy demands. From an historical standpoint, between 1940 and 1978 utility electric sales in the railbelt grew at an average annual rate of 15.2 percent, with the period in the 1970's showing a growth rate of 11.7 percent, with a trend toward a decline in annual rates during the latter years of that decade. Within the railbelt today, the utilities, national defense and self-supplied industrial demand is roughly 3.1 billion kwh (rough equivalent to half the potential of the Devil Canyon and Watana plan). For the sake of projecting Susitna's market, it was assumed that Susitna would provide all utility needs, only a third of the military demands and none of the self-supplied industrial. Based on these base case assumptions, ISER ran an econometric model that attempted to project "end use" demand. Based on various combinations of foreseeable economic growth and government expenditures, the ISER model projected thirty year annual utility growth rates ranging from 2.8 percent to 6.1 percent with 4.1 percent as the most likely. This resulted in a year 2010 low forecast of 6.2 billion kwh, a mid forecast of 8.9 billion kwh, and a high forecast of 15.9 billion kwh. These forecasts are significantly lower than forecasts devised by the Corps of Engineers and by ISER in earlier studies. As mentioned earlier, the average annual energy of Susitna is estimated to be 6.2 billion kwh. Based on the above energy demands, the life expectancy of existing and projected generation to be added before a possible Susitna, and necessary reserve margins, railbelt capacity additions required under the low, mid, and high forecasts result in 1040 MW, 1550 MW, and 3025 MW respectively for the year 2010. Year 1995 capacity requirements for the same set of forecasts result in capacity additions of 0 MW, 300 MW, and 750 MW respectively. Susitna would be developed in three stages of 400 MW each for a total of 1200 MW. Based on the above forecast of demand, it was concluded that the peak load requirements within the railbelt warranted the amount of power that Susitna could provide.

* Although seismically active, it appears that safe structures can be built in the Upper Susitna. There are two primary sources from which earthquakes may eminate in the Upper Susitna region. These sources consist of surface faults which occur when two adjacent tectonic plates slide past one another horizontally, and deep seeded faults which occur when tectonic plates collide with one subsiding beneath the other. Within the project area there are three zones of interest. The first are the known boundary faults which isolate the plate upon which the Susitna River resides. These boundary faults are the Denali fault to the north (40 miles from either project) and the Castel Mountain fault

farther to the south. A second source of faulting is in the subduction zone 50 KM beneath the dams and is caused by the pacific plate diving below the plate upon which Susitna rests. A third source of potential earthquakes could come from smaller surface features in the more immediate vicinity of the projects. These latter features could be the result of stress releases caused by buildup during movement along the boundary faults or subduction zone. Although of potentially lesser magnitude of energy release, the proximity of local faults to the projects could result in their controlling project design. However, based on field investigations to date, it appears that both the subduction zone and boundary faults will provide the controlling design. Of the numerous surficial "features" (not faults) in close proximity to the damsites which have been examined, none at this point in time would appear to be "active" and thus capable of creating a more conservative design criteria than that suggested by the boundary faults or subduction zone, both of which are capable of producing 8.5 Richter magnitude earthquakes. During the ensuing field season, the major efforts within the seismic program will be oriented toward further investigation of local surface features to insure that a more stringent design criteria is not warranted. For the purposes of this study, the economic analysis has been based on a cost estimate that would reflect the added cost needed to protect against the most severe case. There is also the high possibility of "reservoir induced seismicity", which occurs primarily during the initial filling of the reservoirs. However, these events would have occurred even without the project development and would not be greater than the project design earthquake. Based on worldwide experience in dam earthquake design and the known forces at play in the Upper Susitna, it is our conclusion that both Devil Canyon and Watana can be safely constructed. The seismic risk associated with the project area, based on current knowledge is not so great that the hydroelectric potential cannot be safely developed.

* The environmental studies to date, although preliminary at this point, have revealed no impacts of such a magnitude as to warrant abandonment of the present Susitna feasibility studies. Significant efforts are underway to fully account for the present environmental setting both in the Upper Susitna and in areas which may be impacted downstream. This includes efforts not only to identify fish and wildlife resources, but also the habitat in which they exist. The dams would not cut off any traditional spawning migration, however, changes in the character of the river below the dams may alter the habitat for survival of young salmon spawned in lower tributaries. These changes may be deleterious

or beneficial to salmon fry. Whether positive or negative, the overall change in the Cook Inlet salmon fishery, absent mitigation, will probably be slight. Although it is suspected that resident fish species in the project area are limited, the annual drawdown cycle at the Watana reservoir would be sufficiently great to preclude meaningful population enhancement there. The stable water level behind Devil Canyon suggests the possibility of enhancing and introducing new resident species. While there will be an impact on wildlife species as a direct result of the project, the loss does not appear great. Of perhaps more significant concern is the impact that could be imparted as a result of human pressures in an area of presently little use. Measures can be taken, of course, to restrict access and manage the wildlife. The upcoming field season and impact assessment will allow a better understanding of project impacts in relation to power benefits.

* Based on conservative assumptions regarding costs of Susitna and other viable alternatives, there appears to be sufficient economic justification to warrant completion of the studies. The cost estimates used for Susitna are not the most likely costs, but instead are estimates of the highest possible costs, given the uncertainty that presently exists in this early stage of development. In fact, some of the additional costs included for this feasibility check would result in increased power from the project, yet no attendant benefits have been claimed. For purposes of comparison, the costs of a thermal plan and of a Susitna plan were projected for a sixty year period and then discounted to give a total present worth of plan costs. This comparison was made under five different sets of assumptions regarding the cost of thermal projects and fuels. Under each set of assumptions and using the upper limit cost estimate for Susitna, the Susitna development is estimated to be more cost effective than the most likely plan without Susitna. However, if there were no restrictions on either the availability or utilization of natural gas for power generation, and if the cost of gas rose at an annual constant dollar rate of 2 percent, and if the cost of coal rose no faster than the rate of inflation, then there would be little or no economic benefit in the Susitna plan. Given the known reserves, projected use rates, and estimated more likely fuel cost increases, there is little likelihood that this breakeven thermal scenario would occur. Based on this preliminary check of economic feasibility, the Susitna study program should continue.

• The present Internal Revenue Service codes make it very difficult to finance all of the Susitna project based on project security alone. Certain measures can be taken, however, to strengthen investor

confidence thus generating the necessary outside capital. The most obvious measures entail a State guarantee of Power Authority bonds, or converting the existing REA Cooperative utilities into municipal utilities, thus making the project eligible for long term power sales contracts and tax exempt financing. Other state measures could entail equity contributions or subordinate loans. No attempt has been made to evaluate the probability of total or partial state financing for Susitna. The State's ability to finance Susitna makes it possible to virtually dictate the cost of power to consumers. The effect of such a decision by the State could have both positive and adverse impacts. Not knowing what the State's posture will be toward providing additional security for Susitna, the Power Authority is working to pass a national hydropower program that will insure tax exempt financing regardless of the ultimate recipients of power. This effort may or may not be successful.

March 20, 1981

Mr. Charles Conway
Chairman of the Board
Alaska Power Authority
333 West 4th Avenue, Suite 31
Anchorage, Alaska 99501

Dear Mr. Conway:

The External Review Panel met with representatives of the Alaska Power Authority Board of Directors and its staff and representatives of Acres American in San Francisco on March 20, 1981 to discuss the feasibility studies for the Susitna Hydroelectric Project. Prior to the meeting, Panel members studied Acres reports on Review of Available hydrology Material, Review of Previous Design Development Studies and Reports and Project Overview. A first draft of the report from the Alaska Power Authority to the Governor and Legislature was reviewed before the meeting and a second draft was received during the meeting. APA staff members briefed the Panel on the draft report and the Acres representative presented an update of feasibility study events since the January, 1981 meeting.

This letter expresses the Panel's opinion whether, based on information available on four critical issues, the feasibility studies should continue to completion in April, 1982, or be terminated now. The Panel concurs that the four critical issues concern the power demand forecast, seismic risk, environmental impacts and economic feasibility. Our present opinions concerning these issues are summarized below.

The load forecasts have an inherent assumption of continued growth in the commercial market for electricity, and implied expansion in the service sector of the Rail Belt economy. If the economy develops in this manner, and real electric rates do not increase substantially and there is no major change in conservation, then the range of forecasts suggested by ISER seems reasonable.

The Susitna Project is probably competitive on a direct economic basis with power generated from coal. Insufficient information is available at this time to evaluate the attactiveness of the Susitna Project vis-a-vis other alternatives such as gas or tidal power.

Based on the field investigations completed to date, both the Watana and Devil Canyon sites appear to be well suited for the hydroelectric developments proposed. The initial studies have defined the general site and rock conditions at the sites and the general seismic geology of the area in which the proposed dams are to be constructed. The seismic design requirements appear to be well within the state-of-the-art for construction of facilities of this type. Important geologic features have also been recognized which merit further attention and investigation programs have been proposed which are well conceived and should provide a sound basis for feasibility design and cost estimates as well as insuring an ample level of seismic safety.

Some excellent studies are under way concerning ecologic conditions in the Susitna basin and possible environmental effects of hydro development. Above the dams there will be inundation of habitats occupied seasonally by moose, caribou, bears, and various lesser species, and there will be modification of the stream flow below the dams which could affect the habitats of salmon, moose and waterfowl. On-going studies should be continued, with amplification of hydrological studies in the Susitna River to better understand possible downstream effects on flora, fauna and the riverbed itself. Based on present knowledge however, there are no obvious environmental threats so serious as to suggest abandonment of continued planning for the hydro project.

Thus in non-economic terms, Alaska is fortunate to have the hydroelectric power potential in areas where the technical, social and environmental impacts appear to be of a manageable nature. The potential for developing renewable, non-polluting hydroelectric power has definite advantages which, though the economic implications require detailed study, are not always amenable to direct economic evaluation.

In summary, it appears that definite answers cannot yet be given to all of the issues involved in evaluating the geotechnical, environmental, economic and market aspects of developing the Susitna Project. However, we believe that the work accomplished to date shows sufficient promise for the future welfare and interests of Alaska and that it is clearly desirable to continue the present studies, supplemented by appropriate additional investigations, to their 1982 completion date.

Sincerely yours,

Merlin D. Copen

Jacob H. Douma

A. Starker Leopold

Absent but responded
Andrew H. Merritt

Dennis M. Rohan

H. Bolton Seed

DON U. DEERE AND ANDREW H. MERRITT, INC.
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12 March, 1981

Alaska Power Authority
Attn: Mr. David Wozniak
333 West 4th Avenue
Anchorage, Alaska 99501

Susitna Hydroelectric Project:
Continuation of Feasibility Study

Dear Mr. Wozniak:

As you are aware, I will not be able to attend the meeting in California as part of the External Review Panel because of a prior commitment. The purpose of this meeting is for the Panel to present its opinion on whether the feasibility study for Susitna should be carried to its April 1982 Phase I completion or terminated on or about the end of March 1981.

The objectives of this meeting will deal with power demand forecasts, seismicity, environmental impact, and economic feasibility. I have received a substantial number of documents from Acres, the interim seismicity report from Woodward Clyde, and APA's draft report to the Governor and Legislature. Because I will not be present for any final presentation of information in California or for the Panel's internal discussions, I would like to offer some brief comments on the geotechnical aspects of the feasibility study as well as the matter of continuation of the work. It is my intention that the sense of this letter could be used where appropriate in the Panel Report of the meeting. With regard to your letter of 5 March 1981 concerning the vehicle by which to advise the Board on the continue/discontinue issue, our panel should reference the Authority's report as being an indication that we have read all pertinent documentation on the subject. Our report will almost certainly follow the same format.

TWX (OR TELEX)
(ANSWERBACK GEODUD GAIN)
810 825 2365

CABLE ADDRESS: (GEODUD) GAINESVILLE, FLORIDA

1. GEOTECHNICAL CONSIDERATIONS

Based upon the field geotechnical investigations completed to date, both the Watana and Devil Canyon sites appear to be well suited for the hydroelectric developments proposed. The initial studies have defined the general soil and rock conditions and have recognized some important geologic features that merit further attention. Acres has proposed a field program for 1981 which will provide the essential elements for feasibility design and cost estimates. Their plan is well-conceived and the results should provide a high level of confidence in the final cost estimates.

2. CONTINUATION OF FEASIBILITY STUDIES

The APA and Acres reports on continuation of the studies clearly point out the status of the work and present convincing arguments concerning the positive benefits of at least Susitna Stage I and II with regards reasonable future power demand. I also agree with their conclusion that the dams can be designed to withstand the ground accelerations caused by earthquakes generated along the Denali Fault or Benioff Zone. Such design aspects are well within the state-of-the-art.

It is also recognized that the environmental studies along the river and within the proposed reservoir are still in their infancy and definite conclusions cannot be reached at this time. It is apparent that APA is conducting an extensive environmental program and I feel confident that your efforts will provide the necessary information required for a well-informed opinion upon the environmental impact of the proposed projects. With regards the economic feasibility, further information is still required. In non-economic terms, Alaska is fortunate to have the hydroelectric power potential in areas where the social and environmental impacts appear, at present, to be of a manageable nature. Certainly in these days of concern about the pollution aspects of, for example, a coal fired thermal plant, as well as depletion of natural resources, the alternative of renewable non-polluting hydroelectric power has

definite advantages which are not always amenable to economic analysis.

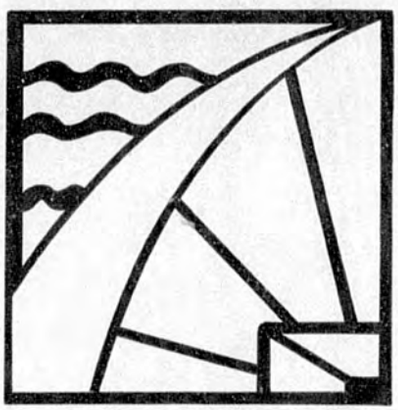
In summary, it appears that definite answers cannot yet be given to most of the items mentioned above. This is not because of a lack of priority but rather than the solution requires a complex study of many factors presently being undertaken by more than one organization. I believe that the work in progress will provide the answers required in a timely manner. It is my opinion that the feasibility study should continue to its 1982 completion date to provide sufficient time to complete the assigned tasks rather than imposing a premature halt to the project because of a lack of final conclusions to complex matters.

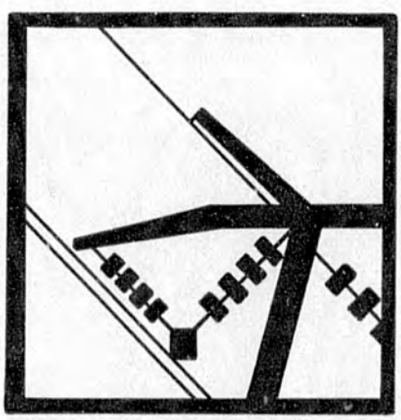
Yours truly,

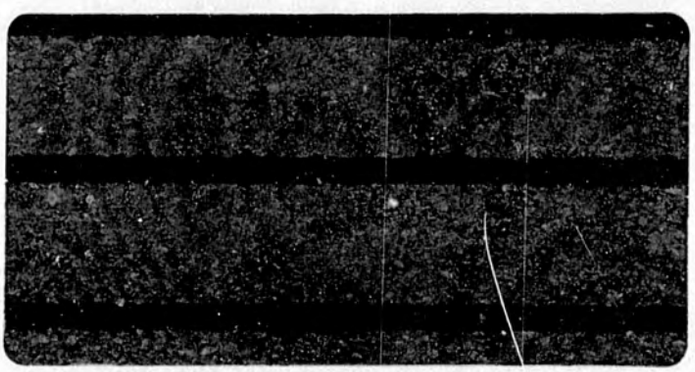
Andrew H. Merritt
AHM:e

ALASKA POWER AUTHORITY

SUSITNA HYDROELECTRIC PROJECT







ACRES

ALASKA POWER AUTHORITY

SUSITNA HYDROELECTRIC PROJECT

PROJECT OVERVIEW

MARCH 26, 1981

BY

ACRES AMERICAN INCORPORATED
LIBERTY BANK BUILDING, MAIN AT COURT
BUFFALO, NEW YORK 14202

ALASKA POWER AUTHORITY

SUSITNA HYDROELECTRIC PROJECT

PROJECT OVERVIEW

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PROJECT OVERVIEW

SUSITNA HYDROELECTRIC PROJECT

1 - INTRODUCTION

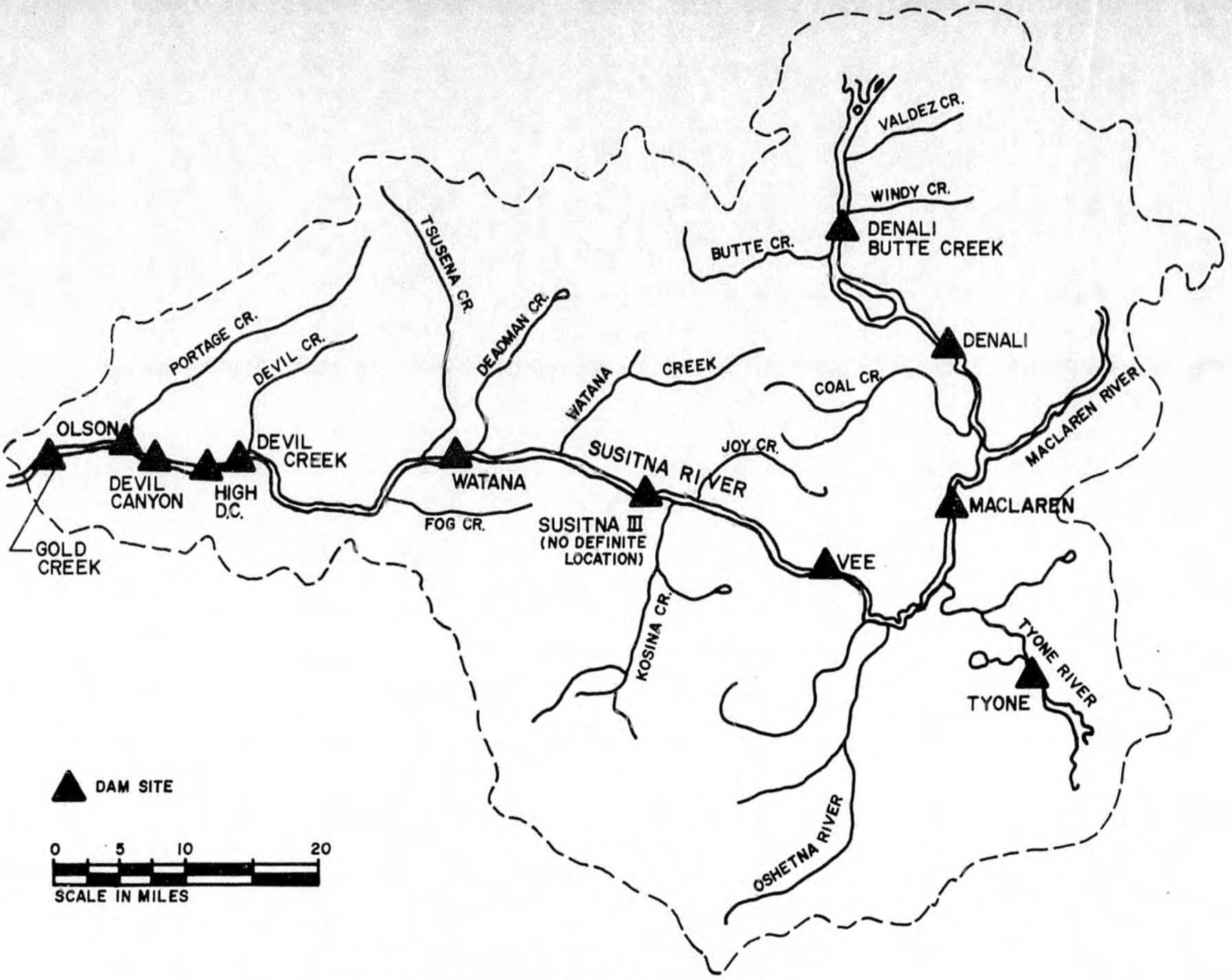
Acres American Incorporated (Acres) was commissioned by the Alaska Power Authority (Power Authority) on December 19, 1979, to conduct a detailed feasibility study of the Susitna Hydroelectric Project, evaluate the environmental consequences of any proposed development, and prepare a license application to be filed with the Federal Energy Regulatory Commission (FERC) in the event that the State of Alaska regards filing such an application as being in its best interests.

If development ever takes place in the Susitna River Basin (see Figure 1 for a basin map annotated to show potential dam sites), it is likely that extensive, costly and lengthy construction activity will occur there. Benefits of long-term and relatively low-cost electrical energy may be possible. Yet, permanent alteration of the environmental setting in the Basin will be inevitable.

The basis for a decision to proceed with the Susitna Hydroelectric Project requires that a variety of scientific, engineering, financial and economic disciplines be brought together. Investigations and analysis in each of these areas must necessarily be thorough and, further, should be consistent with state-of-the-art techniques. Documentation of these activities tends to be voluminous as well as highly technical in nature. The purpose of this Project Overview is to provide a review of all major aspects of the project and its objectives, determining in principle whether these can be met. In effect, it brings together complex issues and detailed technical results so that decision makers within the State of Alaska and interested members of the public can assess results achieved to date and determine what the future course of action should be with respect to the Susitna Hydroelectric Project.

Succeeding sections are arranged to present the framework within which the Susitna Study is conducted and the preliminary results achieved after the first full year of effort. Section 2 describes the decision process which requires two reports which the Power Authority must make to the Legislature. The nature and the role of the Power Authority are addressed in Section 3. After a brief history of the Susitna Project is presented at Section 4, Sections 5 through 13 consider technical, economic, environmental and marketing aspects. An introduction to the important public participation program follows at Section 14. Licensing and permitting is described in Section 15. Financial matters, including financial risks, are discussed in Sections 16 and 17. Section 18 describes the organizational arrangements necessary for effective project implementation. A final section (19) reviews the implications of proceeding with the work after the first decision point on March 31, 1981.

A detailed appendix to this overview has been prepared. It contains a complete chapter to correspond to each of the sections appearing herein. Copies of the detailed appendix have been furnished to the Power Authority and to its external review panel.



LOCATION OF DAM SITES PROPOSED
BY OTHERS

FIGURE 1

In addition to this project overview, a second major document bears upon the March 31, 1981, decision process. The Development Selection Report (some of which is encapsulated in Sections 7, 8 and 9 below) provides the detailed basis upon which a recommendation has been made by Acres to APA regarding the proposed site on which the 1981 program will focus.

2 - THE DECISION PROCESS

Two important decision points have been designated by HCSSB 294. This legislation requires that the Power Authority, by March 30, 1981, submit a preliminary report to the Governor and to the State Legislature "recommending whether work should continue on the project." A second decision point, also explicitly legislated, occurs in April 1982, when the Power Authority must submit a second report recommending whether work should continue on the Susitna Hydroelectric Project and other viable alternatives. It is important to note that neither of these decision points is intended to produce a commitment to construct a project. Indeed, construction of dams and other facilities in the river channel is not possible until or unless an FERC license is awarded.

In addition to work being accomplished by the Acres team, several other ongoing activities bear upon the decision making process. A separate comprehensive study of alternative means of satisfying future Railbelt energy and load projections will be accomplished by an independent consulting firm under contract to the State of Alaska. The Susitna project will represent one of many possible alternatives considered in that effort. Other alternatives include, but are not necessarily limited to, thermal energy (particularly coal fired, since Alaska is richly endowed with significant undeveloped coal resources), wind, solar, non-Susitna hydropower, and tidal power (for which a preliminary assessment of potentials and constraints is now underway). In addition, the Power Authority has contracted with a major consulting firm specializing in electrical transmission to consider an intertie between Anchorage and Fairbanks. This latter project may be beneficial irrespective of whether the Susitna River Basin is ever developed, but the results of the study will necessarily be important to the analysis of transmission facilities required for a Susitna Project.

3 - ALASKA POWER AUTHORITY

The Power Authority was created in 1976, by action of the State Legislature, as an autonomous branch of the Alaska Department of Commerce and Economic Development. The basic mission of this agency is to develop energy generation projects (excluding nuclear) in an economical manner. Governed by a Board of Directors, the Power Authority employs an Executive Director and a staff which carry out day-to-day activities. Directors of Engineering, Finance, and Public Participation assist the Executive Director in performing his functions. The

staff also includes a full-time Native Inspector, an Administrative Assistant, and Project Engineers and other supporting personnel. An organization chart is provided as Figure 2.

As of the end of 1980, the Power Authority was engaged in six reconnaissance studies, four design projects, two license application submittals, five construction projects, and eleven feasibility studies (Susitna being the largest).

Procedures adopted by the Power Authority for the Susitna study include the formation of a Steering Committee to ensure that interested State and Federal Agencies are kept informed throughout the course of the work and to provide a vehicle whereby their concerns and recommendations can be taken into account as the study progresses. Heavy emphasis is also placed on the opinions and concerns of the public, and an aggressive Public Participation Program is conducted.

4 - HISTORY OF THE SUSITNA PROJECT

Because of its strategic location between Anchorage and Fairbanks, the Susitna River has long been regarded as worthy of consideration for development of its hydroelectric potential. Shortly after World War II, the U.S. Bureau of Reclamation (USBR) did an initial Territory-wide reconnaissance, noting the vast hydroelectric potential in Alaska, and placing particular emphasis upon the perceived advantages of a Susitna Hydroelectric Project.

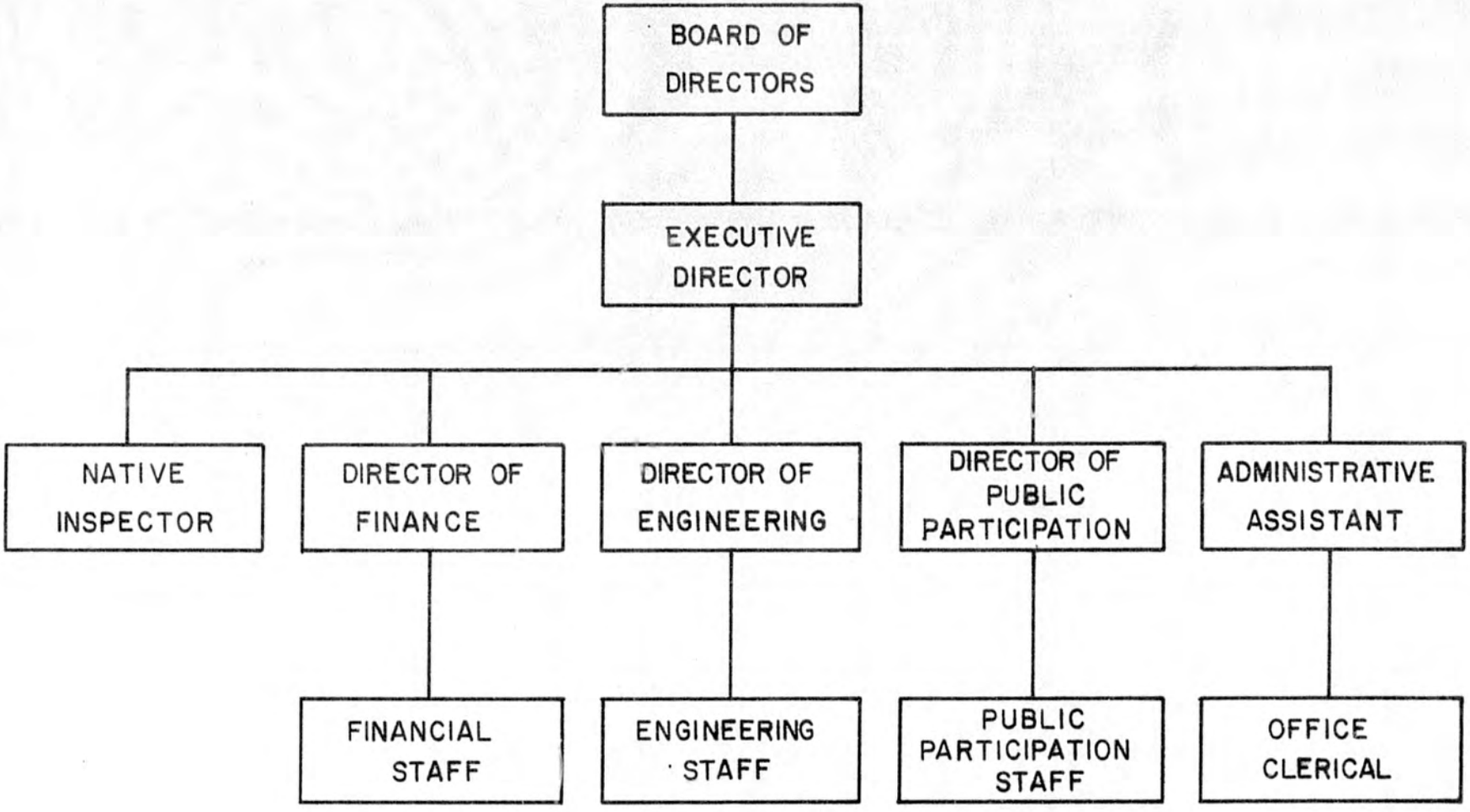
The U.S. Department of Interior (of which USBR was a part) undertook geotechnical and other field investigations and, in 1961, proposed authorization of a two-dam system on the Susitna River. This report was later updated in 1974 by the Alaska Power Administration (also then a part of DOI) and the desirability of proceeding with the project was reaffirmed.

The U.S. Army Corps of Engineers (COE) was also active in hydropower investigations in Alaska in the 1950's and 1960's. Focusing its initial attention on the Rampart Project on the Yukon River, the COE found by the early 1970's that the environmental consequences and limited market for Rampart power militated against its development. The 1973 energy crisis rekindled interest in hydropower development and the COE was commissioned by the U.S. Congress in 1974 to conduct a pre-feasibility study of the Susitna Project. The results of this effort were first referred to the Office of Management and Budget in 1976. Further geotechnical work followed and a new COE report was issued in 1979.

The State of Alaska itself commissioned an assessment of the Susitna Project by the Henry J. Kaiser Company in 1974.

Although differences appeared in the various proposed development schemes, all of the foregoing organizations were unanimous in recommending that Susitna hydroelectric potential be developed.

After the Power Authority was formed, the State of Alaska elected to proceed independently with a major feasibility study. A detailed Plan of Study was distributed widely in February 1980. Subsequent modifications, some of which



ALASKA POWER AUTHORITY ORGANIZATION

FIGURE 2

were occasioned by statements of public concerns, were directed by the Power Authority itself as well as by the State Legislature. Salient features of the Plan as it now stands are these:

- The development of electrical energy demand forecasts has been accomplished independently by the Institute for Social and Economic Research (ISER), University of Alaska.

- The study of alternatives, as noted earlier, is being accomplished separately from the Susitna Study.

- The Public Participation Program is handled by the Power Authority itself rather than by Acres as originally proposed.

- Major tasks have been designated to handle each facet of the work. These tasks include such activities as load forecasting, surveys and field support activities, hydrology, seismic studies, geotechnical investigations, design studies, environmental studies, transmission studies, development of cost estimates and schedules, licensing activities, finance and marketing studies, public participation and administration. Each task is further subdivided into subtasks so that more than 150 separately defined study activities will be completed prior to submitting a license application to FERC in June 1982--if affirmative decisions are made at the March 1981 and April 1982 milestones.

5 - ECONOMIC SCENARIOS AND PARAMETERS

The viability of a Susitna Hydroelectric Project depends to a great extent on the costs of generating electrical energy by alternative means. Thus, for example, if the cost of natural gas from the Cook Inlet area rises more rapidly in future years than the general inflation rate, it is likely that utilities will turn to sources other than gas for future expansion of generating systems. Hydropower might then enjoy a more favorable position. Conversely, if certain fuel prices rise less rapidly than the general inflation rate, hydropower may not necessarily represent an economical choice for future system expansion.

Other factors will also affect Susitna viability. For example, demographic variables, energy demand, unit labor costs, other commodity prices, overall price inflation, and interest and discount rates must be projected. An economic analysis was conducted so that, to the extent possible, logical and non-contradictory views of the world would emerge. No matter how carefully such an analysis is conducted, however, it is necessarily imprecise simply because it depends upon the prediction of an uncertain future. Thus a range of values bounding each selected parameter was selected as the basis for testing the sensitivity of a Susitna Project to possible deviations from most likely values.

Forecasts of world energy balances indicate a worldwide shortfall in oil supplies within ten years. By 1990, the United States is expected to be importing 16 percent of its energy needs (an improvement over the 22 percent level of 1978). It is likely that fossil fuel prices in the U.S. will continue

to escalate at rates on the order of two to four percent above the overall inflation rate. Gas and oil price escalation will be at the upper end of this range, with coal escalation somewhat less. Fuel prices in Alaska will generally reflect market prices in the United States and abroad, less the cost of getting Alaskan fuels to the market.

Insofar as prospects for economic growth in Alaska are concerned, three different economic scenarios were developed by ISER. The lowest assumes only modest population and employment growths at just over two percent. The highest forecasts these values at closer to four percent. If the volume of State government expenditures varies significantly from current levels, these ranges will be broadened.

Opportunity values and escalation rates in Alaska in dollars per million Btu (where a Btu is a unit of energy) were selected as follows:

	$/Million Btu Opportunity Value (1980 Dollars)	1980 - 2005 Escalation in Excess of Normal Inflation
Natural Gas	$2.00	3.98%
Coal	$1.15	2.93%
Oil	$4.00	3.58%

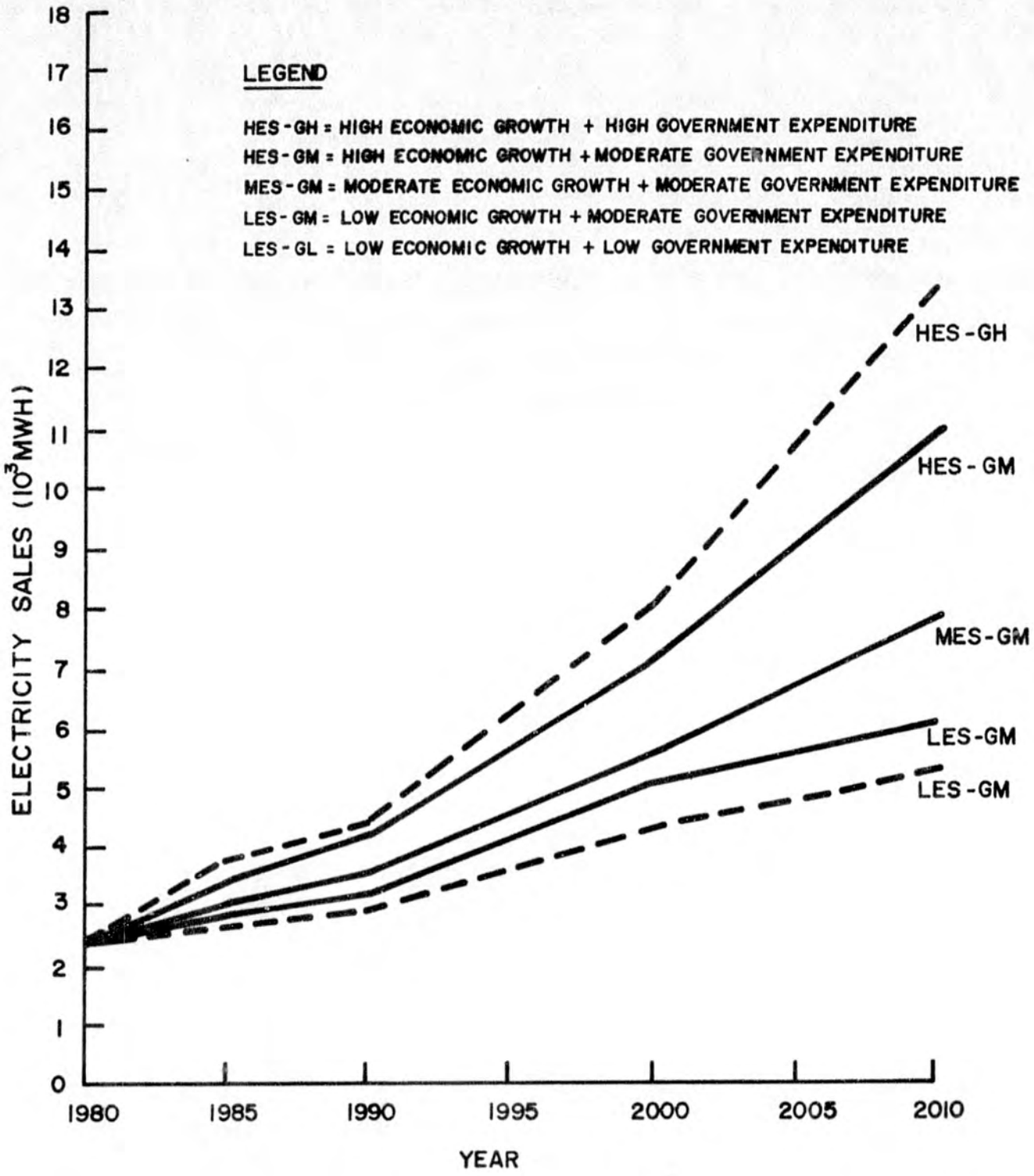
Exclusive of inflation, a real interest and discount rate of three percent was adopted as most likely.

6 - MARKET AREA AND POWER DEMAND FORECASTS

The forecasting methodology employed by ISER relied upon an end-use model rather than on the extrapolation of past trends as the basis for projecting future demand. As its name implies, an end-use model considers electricity consumption in terms of end use in various sectors of the economy. In the residential sector, for example, electricity consumption is largely attributed to space heating, refrigerators, water heaters, lights, cooking ranges, and certain other major appliances. Knowledge of the number, type, and expected changes in households can lead to assessment of future residential demand for electricity.

The annual growth in total Railbelt Utility Sales ranged from 2.8 percent to 6.1 percent in the lowest and highest economic growth scenarios respectively. These values may be compared to an actual average annual rate of 15.2 percent for the period 1940 to 1978 and to 11.7 percent for the 1970's. Figure 3 illustrates alternate demand forecasts.

Peak load forecasts were derived by applying historical load patterns by sector to the ISER demand forecasts. Peak loads are expected to increase at approximately the same percentage as total electrical energy demand for each of the selected ranges.



ALTERNATIVE UTILITY SALES FORECASTS

FIGURE 3

If more extreme measures are taken (probably through legislative action rather than voluntary efforts), some potential for further energy conservation and for load management could lead to a lower forecast than the lowest noted above. An extreme low forecast was selected for sensitivity tests in later analysis.

7 - SUSITNA BASIN STUDIES

During the past year, a massive field data collection effort got underway. Operating primarily out of a base camp constructed at the Watana site, investigative teams were engaged in environmental data collection, survey activities, geotechnical exploration, geological mapping, seismological investigations and hydrological and climatological data collection.

7.1 - Hydrology

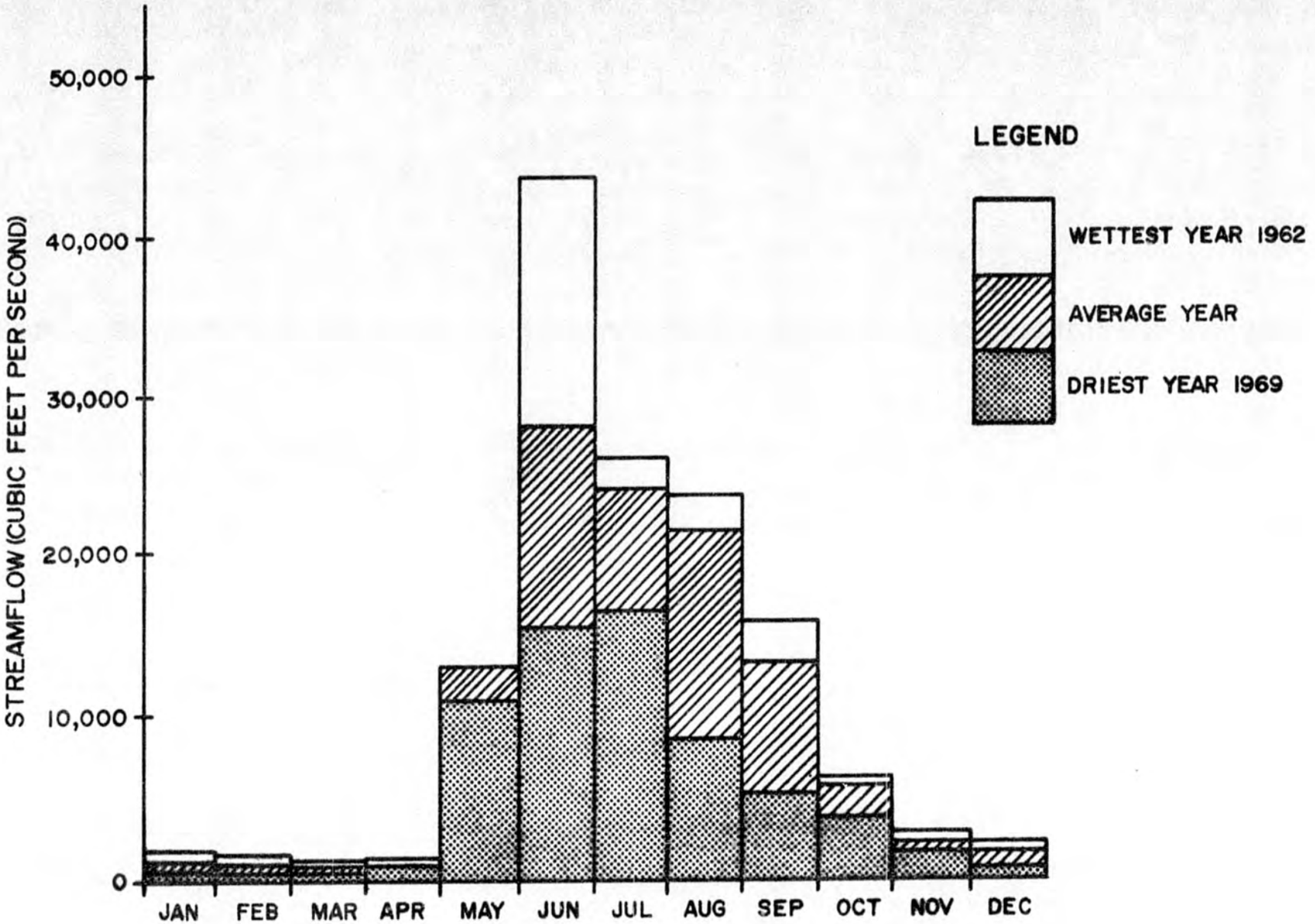
Gaging stations and weather monitoring stations were added to the network which had been installed and operated by State and Federal agencies in prior years. Information collected at new stations has been useful in correlating data obtained there with longer term records at older stations.

The Susitna River exhibits two distinct seasons of flow. High spring and summer flows (produced by snow and glacial melt and heavy rainfall) contribute about 90 percent of the annual total between May and October. The winter flow is relatively low and most of the smaller tributaries do not sustain flow during the coldest months. Figure 4 illustrates flow data at Gold Creek. Based on data collected to date, initial determinations have been made of probable maximum floods (the theoretical maximum which could be produced given the physical nature of the Susitna Basin) and design floods (1 in 10,000 year events) which must be safely passed by dams that might be constructed on the Susitna. In addition, of course, hydrological data was used to estimate probable average and firm energy outputs from potential developments. It is worth noting that less than 20 percent of the total Susitna River flow into Cook Inlet is contributed by the Susitna and its tributaries above Gold Creek. Significant contributions downstream occur from the Chulitna, Talkeetna, and Yentna Rivers. Figure 5 displays percentage composition of total flow by major tributary.

Ice formation, both in potential reservoirs and downstream of possible dams, continues to be studied, for it must be dealt with during construction and its impacts during operation must be determined.

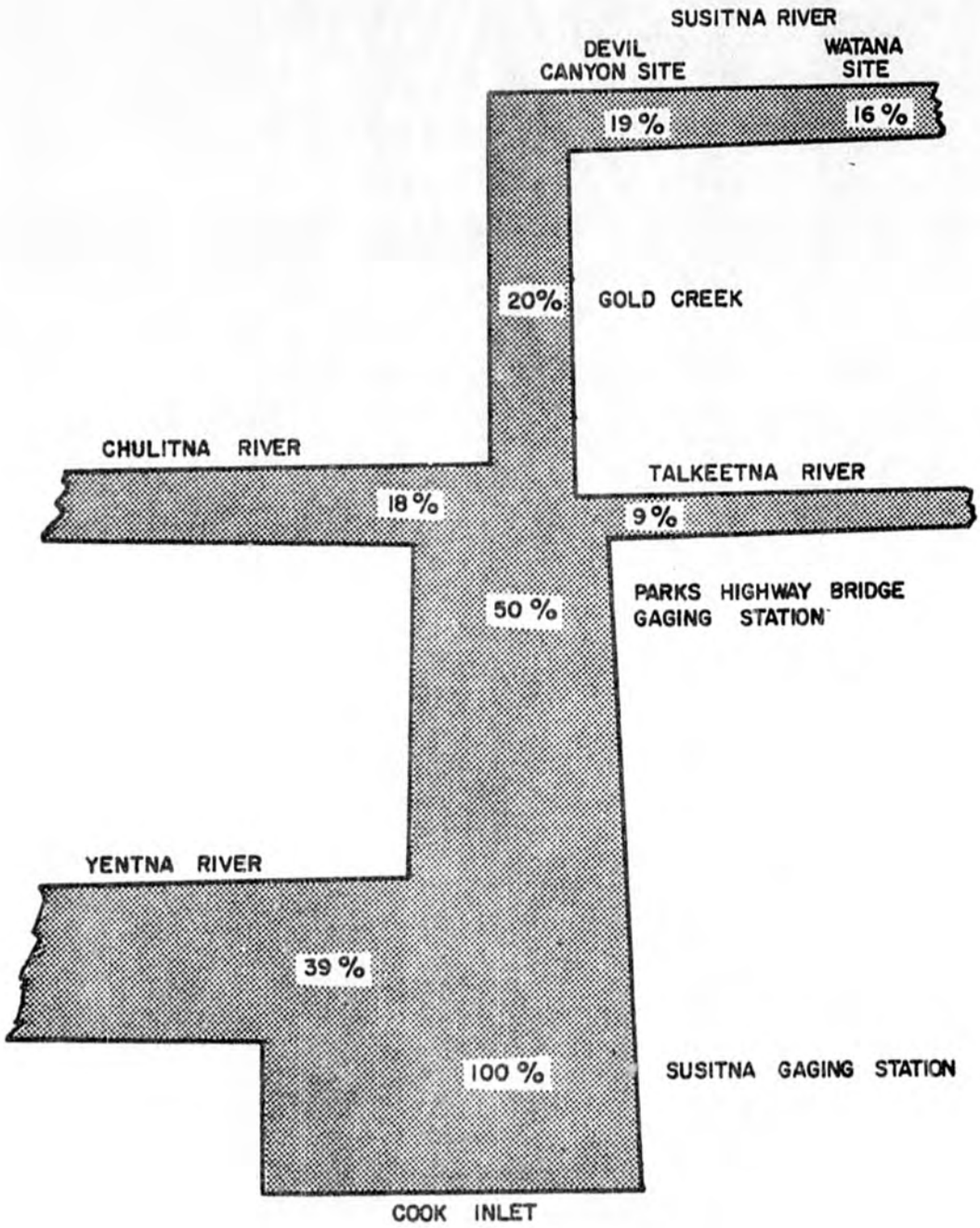
7.2 - Site Exploration and Geology

The Susitna Basin has a complex geology. Studies have been made of the region in general and detailed information was collected at particular dam sites and potential sites (borrow areas) for materials with which to construct the project. Three core holes per site were drilled at Watana and Devil Canyon during 1980; 15 auger holes were placed to explore borrow



SEASONAL DISTRIBUTIONS OF FLOW IN THE SUSITNA RIVER AT GOLD CREEK

FIGURE 4



AVERAGE ANNUAL FLOW DISTRIBUTION
WITHIN THE SUSITNA RIVER BASIN

FIGURE 5

areas; and approximately 28,000 feet of seismic lines were run. While geotechnical data gathered to date has generally confirmed the suitability of Watana and Devil Canyon sites for dam construction, a geotechnical program has been designed for 1981 further to define the nature of the sites and to answer questions about certain subsurface features which could influence the type and precise location of dams and other project features.

7.3 - Seismic Considerations

The Upper Susitna River Basin is a seismically active area. Thus, a major seismic program was started in 1980. A microseismic network of 10 stations was installed and operated to collect microearthquake data for the region. Potential faults and lineaments were identified by air and ground reconnaissance, satellite imagery, airborne remote sensing and aerial photography. A detailed screening of all identified features resulted in the selection of 13 for further study in 1981.

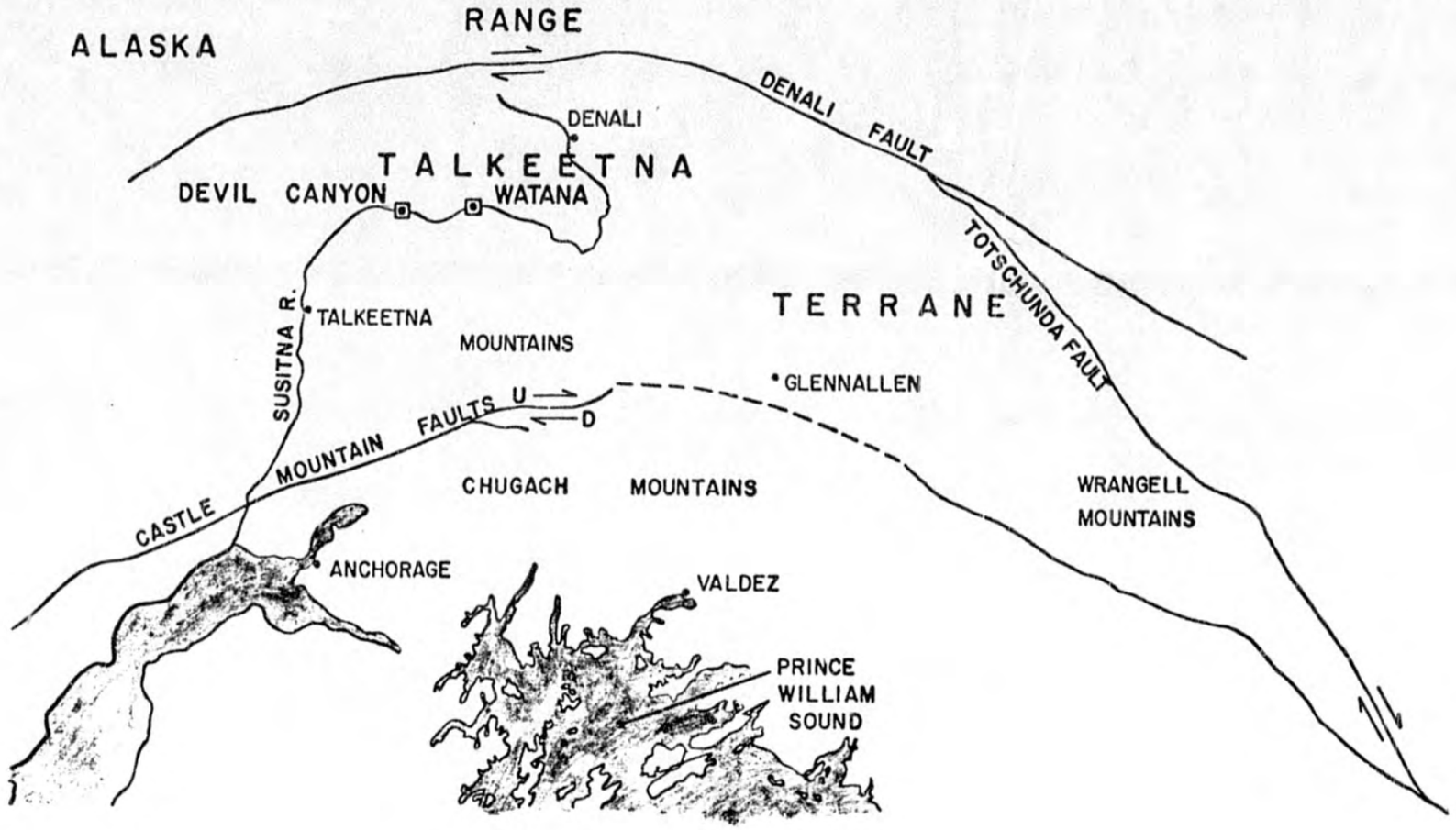
On the basis of the current state of knowledge, the Denali Fault (65 km north of the sites) and the Benioff Zone (60 km underground below the sites) are regarded as the most likely severe seismic hazards. Figure 6 illustrates the seismic setting. Initial estimates of maximum credible earthquakes from these features suggest a magnitude of 8.5 on the Richter Scale. Dam design to safely withstand ground accelerations associated with such an event is within the state of the art.

A study of Reservoir Induced Seismicity (RIS) was also initiated in 1980. RIS may be caused by the increased weight of water in a new reservoir or by lubrication and hydraulic action upon highly stressed rock. Based on evidence gathered to date, an RIS event will not exceed the maximum credible earthquake that could be associated with a fault. Thus, RIS is not likely to affect the determination of design earthquakes.

7.4 - Dam Site Selection

A total of 12 dam sites was considered in the site selection process (See Figure 1). By combination of two or more sites as a system, the total basin potential can be developed in a variety of ways. A detailed screening of individual sites and logical combinations of sites permitted elimination of those whose relative costs were high or whose obvious environmental disadvantages were large. Preliminary layouts were developed for each of the most promising sites.

Candidates selected for further analysis in generation planning and for more thorough environmental consideration included (1) the Watana and Devil Canyon dam sites (the combination found most suitable by the COE in the 1976 and 1979 studies); (2) High Devil Canyon (favored by Kaiser in 1974) and Vee; and (3) a combination of a Watana dam, a relatively low re-regulation dam midway between Watana and Devil Canyon and a tunnel from the low dam with a downstream portal near Devil Canyon. Within these groups, further



SUSITNA PROJECT SEISMIC SETTING

FIGURE 6

variations were studied in terms of alternative dam types and heights and possible schedule variations.

8 - GENERATION EXPANSION PLAN

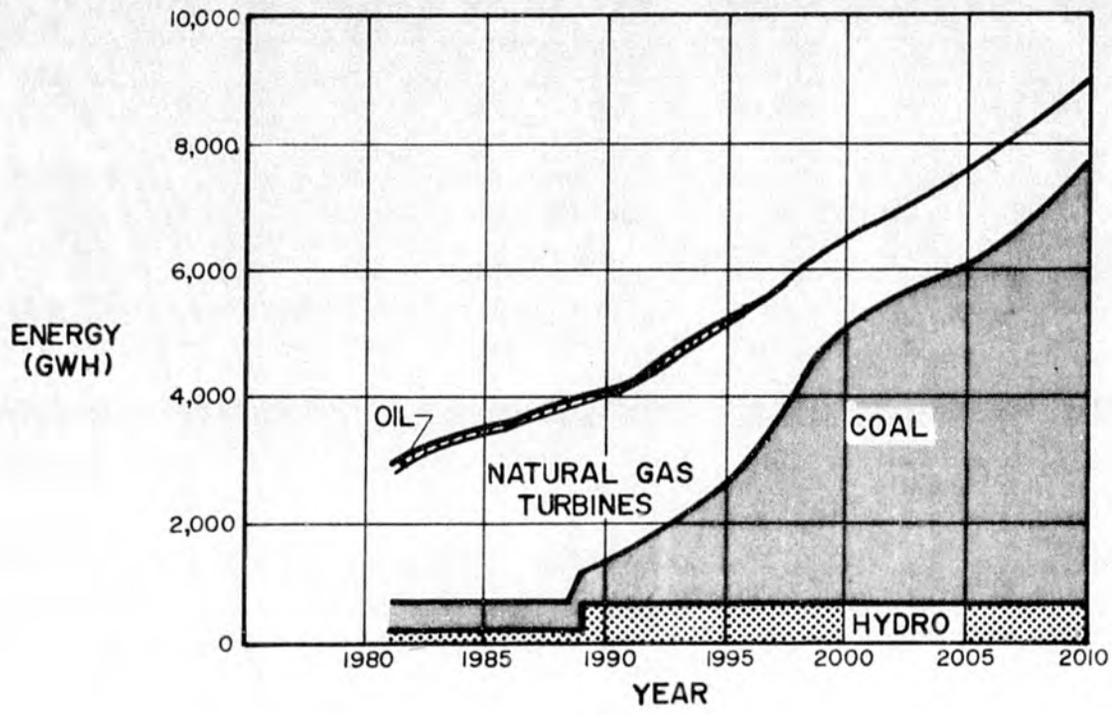
The current generation system in the Railbelt is primarily based upon thermal power. Natural gas is used heavily in the Anchorage area, oil fired units predominate in Fairbanks, and several small coal-fired plants operate at Healy and in the Fairbanks area. Hydroelectric energy, primarily from the Eklutna project, also contributes a small portion of the current Railbelt electric generation.

The present system will evolve in future years as demand increases and as old units reach the end of their useful lives. Regardless of whether or not a Susitna Project is ever developed, new system additions will be needed. For planning purposes, it was assumed that the Bradley Lake Project (now being pursued by the COE) and certain thermal units now under construction will be on line by the early 1990's. New capacity is necessary after 1992, but the amount and type to be added in any particular year will vary as a function of the demand and peak load forecasts.

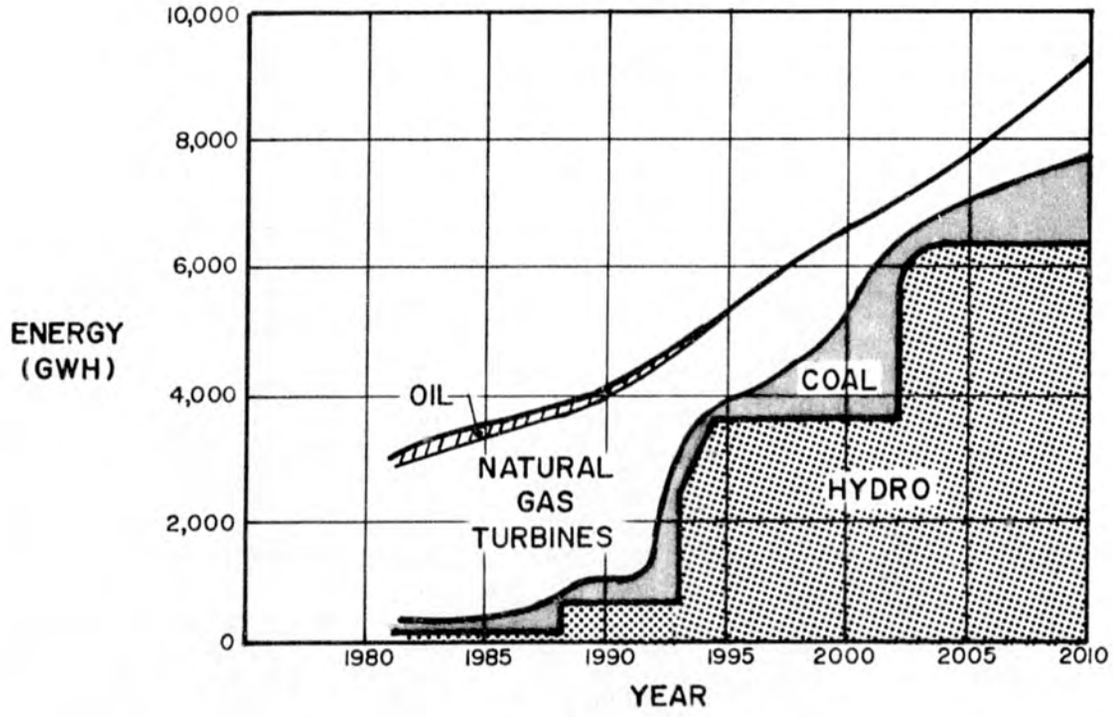
A generation planning exercise was conducted to determine how each of the potential Susitna developments might fit into future Railbelt generation systems. The General Electric Optimized Generation Program (OGP) was the primary tool used for this purpose. In addition to Susitna and present and planned capacity, major alternatives including coal-fired plants, gas turbines, gas-fired combined-cycle plants, and the ten best non-Susitna hydroelectric sites were considered as candidates for future expansion. On an economic basis, it was determined that Watana/Devil Canyon, High Devil Canyon/Vee, and Watana/Tunnel all produced total generation system present worth costs which were less than the least cost system without Susitna. Of the total sets considered, the Watana-Devil Canyon combination was favored economically. In the case of the most likely ISER forecast, the most appropriate time to bring an initial 400 MW Watana project on line was found to be 1993. Figure 7 provides a system energy comparison for the mid-load forecast for a base case thermal system and for a Watana/Devil Canyon development (Susitna 3AE).

Although somewhat higher in cost and lower in total energy production, the Watana-Tunnel combination was found to be a viable option in comparison to the best non-Susitna system. Some environmental advantages may be ascribable to the tunnel project, particularly since it offers an opportunity to preserve the Devil Canyon gorge essentially in its natural state. It is important to note, however, that the Watana dam project is a necessary first stage in the tunnel concept just as it is in the Watana-Devil Canyon combination.

Preliminary studies of tidal power potential have commenced. Tidal power development, if found feasible, would necessarily lag the earliest possible Susitna development simply because time-consuming detailed environmental and engineering investigations would have to be undertaken before a license application could be submitted to the FERC. Tidal power characteristics and



THERMAL



SUSITNA 3AE

SYSTEM ENERGY COMPARISON
MID LOAD FORECAST

FIGURE 7

costs will be available by mid-1981 as an input to the independently conducted Railbelt Alternatives Study. For generation planning purposes in the Susitna study, it has been assumed that tidal power generation is not available in 1993 when Watana could be brought on line economically.

A series of sensitivity tests was run to determine how variations in key parameters would affect the choice of favored plans. These tests generally demonstrated that the Watana-Devil Canyon development is the most cost effective alternative among Susitna Basin plans through a reasonable range of fuel costs, fuel escalation rates, real interest rates, and the like.

9 - SUSITNA HYDROELECTRIC DEVELOPMENT

Based on the generation planning studies and preliminary environmental analysis, the developments selected for primary study and design activities during 1981 are at Watana and Devil Canyon. Should continuing analysis of the tunnel, particularly in the environmental area, confirm clear advantages which in the opinion of the State of Alaska offset the higher costs and lower energy associated with that scheme, a shift to that plan can be accommodated because the Watana development is a common first stage for both plans.

The conceptual design for Watana presently consists of a rockfill dam with maximum height of 870 feet and with upstream and downstream slopes sufficiently flat to withstand the maximum credible earthquake. The spillway arrangement must be such as to discharge design floods (1 in 10,000 year events) without damage. It must also permit safe discharge of the maximum probable flood. In addition, spillway design must be such that nitrogen entrainment downstream is kept within acceptable limits for fish survival.

The conceptual design for Devil Canyon currently includes a thin-arch concrete dam approximately 650 feet high. Spillways at Devil Canyon must meet the same criteria as noted above for Watana.

Alternative arrangements for the major dams and spillway structures remain to be studied further to optimize the design of each development.

Intake structures at both dams will be designed with multi-level draw-off arrangements to facilitate selection of desired downstream water quality. Underground powerhouses are currently planned at both dams, though surface facilities can be accommodated if geotechnical and economic investigations indicate that such facilities are preferable to underground caverns. As currently conceived, the initial installation at Watana will develop about 400 MW of power and the facility will be planned to permit installation of an additional 400 MW after downstream regulation is provided (either by a Devil Canyon reservoir or by construction of a somewhat smaller dam midway between Watana and Devil Canyon, as is required in the tunnel concept).

Alternative access routes have been defined and public workshops were held in March, 1981, to solicit comments. One of the routes under consideration would

offer controlled access since its terminus would be at the Alaska Railroad rather than at an existing highway.

Current studies indicate that it is possible to complete the Watana dam by 1993 if both an FERC license to construct the dam and access roads are available by 1985. Alternatively, construction equipment may be brought into the site overland from the Denali highway in the winter of 1985 and access road work may parallel on-site construction with some cost penalty.

The Devil Canyon dam can be brought on-line within about 6 1/2 years after the start of construction if access routes exist at that time.

A transmission line study is currently underway. This work is being coordinated with the study team involved in the ongoing intertie study. As currently envisaged, transmission facilities would parallel the Susitna River from the dam sites to Gold Creek, at which point lines would extend north and south to Fairbanks and Anchorage, respectively.

10 - ENVIRONMENTAL PROGRAM

A major environmental investigation program got underway in 1980. In addition to necessary exhaustive field data collection, effort was devoted in particular to two other major components: (1) addressing major environmental concerns including those expressed by government agencies (at Federal, State, and local level) and the general public, and (2) environmental participation in the design process with a view toward avoiding or minimizing impacts by making design decisions which account for environmental concerns from the start.

The environmental studies are divided into nine specific study components:

- Fisheries
- Wildlife
- Land Use
- Archaeological (Cultural Resources)
- Recreation
- Plant Ecology
- Corridor Selection
- Socioeconomic (See paragraph 11 below)
- Management and Coordination

At least one more year of data must be collected in each area before detailed impact statements can be prepared and proposals developed as appropriate for mitigative measures. Even so, no evidence has been discovered to date to indicate environmental impacts which are so severe as to conclusively rule out the possibility of developing the Susitna River for hydroelectric power production.

Certain environmental impacts on fisheries experienced at other major hydroelectric projects will be absent from or less severe at the Susitna Project if it is ever constructed. These include:

(a) No direct blockage of fish migration or escape will result from the dam itself.

(b) No significant river diversions resulting in low flows in the diverted river will occur for the Watana-Devil Canyon combination.

(c) Regulation is being factored into design to eliminate significant daily fluctuations in flow.

(d) Nitrogen entrainment will not be increased by numerous sequential reservoirs such as are found on the Columbia River. In addition, design studies will incorporate the latest available technology to reduce the occurrence of such phenomena.

11 - ANALYSIS OF SOCIOECONOMIC IMPACTS

A major socioeconomic study program was launched in 1980 with the objectives of describing existing socioeconomic conditions, forecasting future conditions if no Susitna Project is built, and determining which conditions are most likely to be impacted by a Susitna development.

Major efforts have been devoted to development of socioeconomic profiles during 1980. The 1981 work will focus upon preliminary assessments of impacts which implementation of the recommended development plan could cause.

12 - ECONOMIC FEASIBILITY AND NET ECONOMIC BENEFITS

The analysis of the net economic benefits of the recommended development plan is being developed within the framework of traditional methodology. The general procedure considers the total costs associated with the project (construction, operation, maintenance, transmission, etc.). Benefits are the avoided costs of providing the equivalent power and energy from the next best alternative generating source.

A preliminary life-cycle cost analysis has been conducted for the recommended development plan as well as for other alternatives surviving the initial site screening process. This economic analysis assumed a three percent discount rate in real terms (i.e., the cost of money is assumed to be three percent higher than actual inflation rates during the planning period). In 1980 dollars, the present value costs of the recommended hydroelectric development (operated in the Railbelt System during a 60 year period for economic analysis) were less than the costs of the best thermal generation alternative.

More precise values for life-cycle net benefits will be determined as cost estimates are developed in detail for the optimized development plan in 1981.

13 - POWER AND ENERGY MARKETING

Whereas it can be shown that the Susitna Hydroelectric Project would be economical in the long term, it is nonetheless true that the relatively high capital cost of a major hydroelectric power development can lead to difficulties in financing the project or in marketing power and energy during the first few years of operation.

Preliminary financial studies have been conducted to determine the probable nature and extent of the problem of high front-end loading as well as to identify potential strategies for alleviating this. These studies will continue in 1981. Insofar as marketing is concerned, it must be assumed that the maximum price which Railbelt Utilites would pay at any given time for Susitna power and energy is equal to or less than the avoided cost of producing power and energy by the best available alternate means.

In the initial year of operation deliveries from Susitna will replace power and energy generated by existing thermal power plant and the avoided cost will be related to fuel, operating and maintenance expense. Only when the existing capacity reaches the point of needing replacement or new demand emerges, with which this existing capacity cannot cope, will it be possible to edge the Susitna price of energy up to the full cost.

The ongoing studies will deal with practical arrangements which can be made with the Railbelt Utilities to achieve equitable marketing terms under which Susitna energy can be introduced to meet a substantial portion of future system needs.

14 - PUBLIC PARTICIPATION PROGRAM

An aggressive public participation program was initiated for the Susitna Hydroelectric Project. Conducted directly by the Power Authority, major objectives are:

- To distribute information to the public,
- To solicit information from the public, and
- To ensure that public input is fully considered in the decision-making process.

Community meetings, workshops, an action system to ensure that response is provided to every comment or question written by the public, newsletters and mailing lists are vehicles by which these objectives are satisfied.

Of particular note is the fact that public comment and concern has directly influenced the course of the Susitna study. Such major changes from original study plans as the commissioning of a separate and independent alternatives study, the addition of a sociocultural study and an increased level of study for alternative developments in the Susitna Basin were largely prompted by public concerns.

The high level of activity in the Public Participation Program is expected to continue throughout the course of the study.

15 - LICENSING AND PERMITTING PROCEDURES

Regulatory requirements at Federal, State and local levels tend to be voluminous, complex, and time-consuming for any major power development. For the first several years, satisfaction of regulatory requirements will be the controlling factor on the schedule for final completion of a Susitna project.

The most significant initial regulatory requirement is the necessity to obtain a license from the Federal Energy Regulatory Commission (FERC). Should project feasibility be established and a decision made to proceed with the work, current plans call for submittal of an application in mid-1982 and for receipt of a license by 1985.

A detailed analysis of licensing and permitting requirements was conducted early in the course of the work in 1980 and a blueprint was drawn up to ensure that critical regulatory schedules can be met.

16 - FINANCIAL FEASIBILITY ANALYSIS

Financial analysis and risk assessment has been initiated but only carried forward to a limited extent pending the selection of the preferred development plan and the availability of appropriate capital costs of construction. One purpose of the preliminary financial feasibility analysis has been to establish the "envelope" within which the staging, design and operating configurations of Susitna are amenable to market financing based upon reasonable assumptions concerning financial markets and the inclinations of investors over the next 20 to 30 years.

A computer model, developed earlier for financial analysis of major capital intensive projects, has been tailored specifically to meet the unique requirements of Susitna. Using this model, it is possible to analyze the effect on financial feasibility resulting from variations in input assumptions. These inputs include phasing of major project stages, scheduling of construction outlays, energy and power production during initial years, pricing and revenues, returns on investment, contingency provisions, debt requirements, taxes, and financial market conditions. There has been close correlation with work carried out on generation planning, employing the OGP-5 modeling capability (as described in Paragraph 8).

Preliminary financial analysis indicates that viable options do exist for funding the project with various levels of involvement of the State of Alaska. Work during 1981/82 will focus on financial feasibility of the optimized development selection and will proceed in close collaboration with the financial consultants selected by the Power Authority at the end of 1980.

17 - SECURITY OF PROJECT COST AND REVENUE STRUCTURE

Decision makers responsible for public policy and for action within the financial and credit markets, as well as those at regulatory agencies, must be confident that the probability of unforeseen events seriously distorting the objectives of the Power Authority and its planners is sufficiently remote that government and private investors should commit substantial financial resources to the Susitna Project. A detailed risk analysis will be made of the various influences and possibilities, no matter how remote, that might impact the security of the project cost structure and its revenue flow. In particular, consideration will be given to risks, and to the formulation of contingency plans, applicable to:

- Potential variations in capital costs
- Cost escalation
- Cost overruns
- Delays
- Events leading to noncompletion
- Serious outages during operation
- Failure of revenue from power resources
- Regulatory issues

Arising from the study of project cost and revenue structure will be consideration of the need for completion and/or other guarantees and revenue assurance requirements. The aim will be to develop strategies and procedures which will minimize risk in each category and provide for an acceptable balance of residual exposure and benefit for the financing entities which might be involved in the Project.

18 - ORGANIZATION AND MANAGEMENT

Project control structures, policies and procedures have been developed and put in place to ensure that continuing project activities are in the best interests of the State of Alaska and its populace. The Executive Director of the Power Authority serves as Project Manager for the State of Alaska. He is assisted in turn by a project staff which includes Assistant Project Managers for Technical Output and Schedule and for Budget and Finance. A Project Engineer within the Power Authority devotes his full-time attention to monitoring and coordinating project work.

Within the Acres organization, a Project Manager is responsible for direction of the activities of a large group of technical personnel. He is assisted by a Deputy Project Manager, a Technical Study Director, and a Resident Manager (in Anchorage).

External Review Panels have been established both at the Power Authority's level and at Acres' level to provide an independent check on the adequacy and accuracy of completed and proposed study activities.

Major subcontractors assisting Acres in the performance of its work include:

- R&M Consultants, Incorporated
- Cook Inlet Region Incorporated in association with Holmes and Narver
- Terrestrial Environmental Specialists
- Woodward Clyde Consultants
- Frank Moolin and Associates
- Robert W. Retherford Associates
- Other Alaskan firms providing transportation, supplies, and logistical support

19 - IMPLICATIONS OF PROCEEDING

The Governor of Alaska and the State Legislature will receive a report on or before March 30, 1981, wherein the Power Authority must recommend whether work should continue on the Susitna Hydroelectric Project. The Power Authority has selected four particular issues for detailed consideration. Conclusive proof that any one of these issues presents an insurmountable barrier would lead to a recommendation by the Power Authority to terminate the study. Briefly summarized, the issues are as follows:

- Are the forecasts too low to require any major generation additions over the next 30 years?

- Are seismic risks so great that safe development cannot occur?

- Are anticipated environmental losses unacceptable?

- Is there a significantly lower-cost set of alternatives which will satisfy demand forecasts through the year 2010?

No barriers have been discovered during the initial year of study which would lead to an affirmative answer to any of the listed questions. Even so, definitive answers have not yet been developed for all of the issues. Continuing the study would provide the State with an opportunity to make sound decisions in the future as to whether Susitna hydroelectric potential should ultimately be developed. Terminating study efforts at this time would result in avoiding the significant costs of further investigation and analysis on Susitna.