SOUTH-CENTRAL RAILBELT AREA, ALASKA (HYDROELECTRIC POWER), UPPER SUSITNA RIVER BASIN

LETTER

FROM

THE SECRETARY OF THE ARMY

TRANSMITTING

A LETTER FROM THE CHIEF OF ENGINEERS, DEPARTMENT OF THE ARMY, DATED FEBRUARY 8, 1977, SUBMITTING A REPORT, TOGETHER WITH ACCOMPANYING PAPERS AND ILLUSTRATIONS, ON SOUTH-CENTRAL RAILBELT AREA, ALASKA (HYDROELECTRIC POWER), UPPER SUSITNA RIVER BASIN, IN PARTIAL RESPONSE TO A RESOLUTION OF THE COMMITTEE ON PUBLIC WORKS, UNITED STATES SENATE, ADOPTED JANUARY 18, 1972

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SOUTHCENTRAL RAILBELT AREA ALASKA
UPPER SUSITNA RIVER BASIN

INTERIM FEASIBILITY REPORT

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PART 2

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HYDROELECTRIC POWER
AND RELATED PURPOSES

U.S. ARMY · CORPS OF ENGINEERS · 1975 · BICENTENNIAL · 1775 · 200th

SECTION G

MARKETABILITY ANALYSES

UNITED STATES DEPARTMENT OF THE INTERIOR
Alaska Power Administration
Upper Susitna River Hydroelectric Studies
Report on Markets for Project Power

December 1975

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Purpose and Scope

This study will analyze the power market of an Upper Susitna hydroelectric development. Two major areas of concern will be investigated. These are:

1. Project design in relation to the use of the project power; and

2. Financial feasibility under existing repayment criteria.

Study elements include:

1. estimates of future power requirements

    a. timing
    b. magnitude
    c. load characteristics

2. estimates of future power sales and rates required for repayment

3. analysis of costs of alternative sources of power

The level of detail is that required for demonstration of project feasibility for purposes of consideration by the Congress for project authorization.

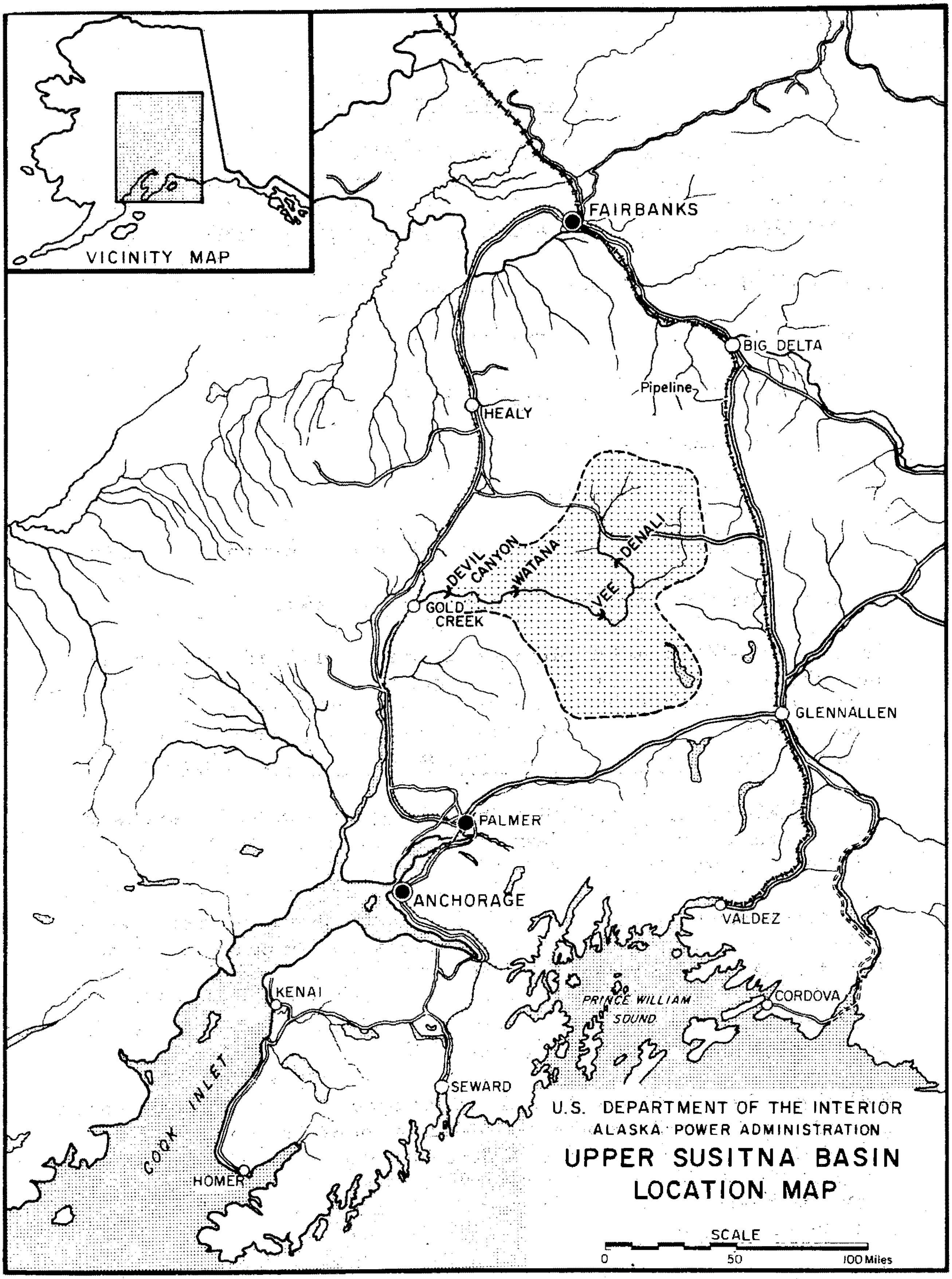
Alternative Plans for Upper Susitna Hydroelectric Development

Figure 1 shows general locations of the potential units of the Upper Susitna Project in relationship to the Alaska Railbelt. The four key Upper Susitna damsites are Devil Canyon, Watana, Vee, and Denali.

Several alternative systems for developing the Upper Susitna Project were evaluated. Table 1 summarizes data on energy and power capability for these alternative systems.

The Corps of Engineers proposes an initial development including the Devil Canyon and Watana sites. (System # 5)

System # 1 (Devil Canyon and Denali) is analogous to the intitial development plan advanced in earlier studies by the Bureau of Reclamation and APA. System # 4 is the four-dam ultimate development plan identified in previous USBR-APA studies.


VICINITY MAP
FAIRBANKS
BIG DELTA
Pipeline
HEALY
DEVIL CANYON
WATANA
DENALI
VEE
GOLD CREEK
GLENNALLEN
PALMER
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HOMER
U.S. DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
UPPER SUSITNA BASIN
LOCATION MAP
SCALE
0
50
100 Miles

Table 1. Alternative System Plans
Installed Capacity & Firm Energy

System	W.S. el. M.S.L.	P.O.L. Date	Devil Canyon Installed Capacity 1000 kw	Devil Canyon Firm Energy Million kwh	Watana Installed Capacity 1000 kw	Watana Firm Energy Million kwh	Vee Installed Capacity 1000 kw	Vee Firm Energy Million kwh	System Total Installed Capacity 1000 kw	System Total Firm Energy Million kwh	System Total Secondary Energy Million kwh
System #1											
Devil Canyon	1450	1985	580	2497							
Denali	2535	1990									
									580	2497	701
System #2											
Devil Canyon	1450	1985	600	2628							
Watana	2050	1990			470	2059					
									1070	4687	946
System #3											
Devil Canyon	1450	1985	700	3066							
Watana	2050	1990			670	2935					
Denali	2535	1995									
									1370	6001	350
System #4											
Devil Canyon	1450	1985	713	3119							
Denali	2535	1990									
Vee	2300	1995					300	1314			
Watana	1905	2000			421	1840					
									1434	6273	640
System #5											
Watana	2200	1986			792	3101					
Devil Canyon	1450	1990	776	3048							
									1568	6149	701

Notes: System #5 is the proposed initial development plan.

Data is from Corps of Engineers studies.

Previous Studies

There is a fairly substantial backlog of power system and project studies relevant to the current evaluation of the Upper Susitna River Project. A partial bibliography is appended. The previous studies most relevant to power market considerations include:

1. Advisory Committee studies completed in 1974 for the Federal Power Commission's (FPC) new Alaska Power Survey. The studies include evaluation of existing power systems and future needs through the year 2000, and the main generation and transmission alternatives available to meet the needs. The power requirement studies and alternative generation system studies for the new power survey were used extensively in the current study. The FPC summary report for its new survey is not yet available.

2. A series of utility system studies for Railbelt area utilities include assessments of loads, power costs, and generation and transmission alternatives.

3. Previous work by the Alaska Power Administration, the Bureau of Reclamation, the utility systems, and industry on studies of various plans for Railbelt transmission interconnections and the Upper Susitna hydroelectric potential. The most recent of these are the May 1974, Status Report on the Devil Canyon Project by APA and the September 1974, Reassessment Report on Upper Susitna River Hydroelectric Development prepared for the State of Alaska by the Henry J. Kaiser Company.

It should be noted that many of the studies listed in the bibliography represent a period in history when there was very little concern about energy conservation, growth, and needs for conserving oil and natural gas resources. Similarly, many of these studies reflected anticipation of long term, very low cost energy supplies. In this regard, the studies for the new power survey are considered particularly significant in that they provide a first assessment of Alaska power system needs reflecting the current concerns for energy and fuels conservation and the environment, and the rapidly increasing costs of energy in the economy.

SUMMARY

1. Studies of future power requirements prepared for the FPC Alaska Power Survey were reviewed in light of new data for the years 1973 and 1974. New estimates of power requirements through the year 2000 were prepared reflecting the best current estimates of loads that would actually be served from an interconnected Railbelt power system serving the Fairbanks-Tanana Valley area and the Anchorage-Cook Inlet area. These new estimates are summarized on Table 11.

2. Additional data was compiled for potential loads in the Copper Valley area, and a preliminary analysis of electric service from the Upper Susitna Project to this area was made. It does not appear feasible to include service to this area during initial stages of the project.

3. Available data on area load characteristics were examined in light of future system operation; estimates of monthly energy distribution were prepared for sizing project reservoirs; and an annual plant factor of 50 percent was selected for sizing project power plants.

4. Studies of alternative power sources prepared for the FPC Alaska Power Survey were reviewed in light of recent studies and trends in energy. It was concluded that oil and natural gas fired generation is not a desirable alternative for major new power supplies in the Alaska Railbelt in 1985 and later years. It is considered that coal-fired steamplants would be the most likely alternative in lieu of Susitna hydro. The power survey steamplant cost estimates were updated for comparison purposes.

5. A set of preliminary rate studies was made for use in the scoping analysis of alternative Susitna hydro development plans. These studies are premised on September 1975 plans and cost estimates do not reflect latest estimates for the final project report. The studies indicated an average rate of 19.7 mills per kilowatt hour for the Corps proposed plan of development (System #5) and average rates ranging from 20.9 to 24.5 mills for the alternative systems. The studies also indicated that alternative staging assumptions utilizing the same designs and cost estimates would narrow the range to 20.9 to 22.8 mills per kilowatthour, a difference of less than ten percent. These rates are substantially higher than present natural gas-fired generation in the Cook Inlet area, but significantly lower than current estimates for new coal-fired plants.

6. The above values were reviewed in light of the final plans and cost estimates, with the indication that the proposed plan (System #5) would have approximately a 10 percent advantage over the alternative hydro systems from the viewpoint of cost of power to the consumer.

7. APA estimates that an average rate for firm energy of 21.1 mills per kilowatthour would be required to repay costs of the project under current Federal repayment criteria. This is premised on cost estimates using January 1975 price levels and includes amortization of the investment and annual costs for operation, maintenance, and replacements. The compilations for the average firm energy rate appear on Table 21.

8. The studies reflect very rapidly changing values in energy and costs of doing business. It is estimated that increase in costs and Federal interest rate for repayment amount to over a 40 percent increase in rates for repayment as compared with conditions reported in APA's May 1974 status report on Devil Canyon. If the present costs are escalated at 5 percent per year, average rates for Upper Susitna power would likely exceed 40 mills per kilowatthour when the project is actually brought on line.

9. The changing costs for hydro development must be considered in light of the rapid changes in costs for other power producing facilities and fuels. It appears reasonable to assume that future cost escalation for hydro construction will be at a slower rate than for average energy costs in the economy. After completion, any increases in costs for the hydro power would likely be very small.

10. With the prevailing intersts rates, power rates are very sensitive to any stretch-out of construction period and the size of investment accumulated prior to start of revenues. Careful attention to staging opportunities will be needed in final design of the project.

11. APA also prepared estimates of annual costs for operation, maintenance, power markets, and interim replacements for use in the project economic and financial analysis. This date is summarized in Exhibit 2 of this report.

Throughout its history of investigations, the Upper Susitna River Project has been of interest for its central location to the Fairbanks and Anchorage areas which have Alaska's largest concentrations of population, economic activity, services, and industry. Under any plan of development, major portions of the project power would be utilized in these two areas. Additionally, the basic project transmission system servicing Anchorage and Fairbanks could provide electric service to present and future developments between the two points. Electrification of the Alaska Railroad is another possibility.

These major market areas are referred to as the Anchorage-Cook Inlet area and the Fairbanks-Tanana Valley area.

Additional potential markets are utility and industrial loads along the pipeline corridor between Delta Junction and Valdez.

Anchorage-Cook Inlet Area

Generally, this has reference to the developed areas around Upper Cook Inlet including the Anchorage area, the Kenai Peninsula, and the Matanuska and Susitna valleys. This includes most of the population and economic activity in the Matanuska-Susitna, Greater Anchorage Area, and Kenai Peninsula Boroughs.

This general area has been the focal point for most of the State's growth in terms of population, business, services, and industry since World War II. Major building of defense installations, expansion of government services, discovery and development of natural gas and oil in the Cook Inlet area, and emergence of Anchorage as the State's center of government, finance, travel, and tourism are major elements in the history of this area.

Because of its central role in business, commerce, and government, the Anchorage area is directly influenced by economic activity elsewhere in the State. Much of the buildup in anticipation of the Alyeska pipeline, much of growth related to Cook Inlet oil development, and much of the growth in State and local government services since Statehood have occurred in the immediate Anchorage vicinity. The Greater Anchorage Area Borough estimated its July 1, 1974, population at 162,500, or an increase of nearly 30% since the 1970 census. This is over 45 percent of total estimated State population in 1974.

The Matanuska-Susitna Borough includes several small cities (Palmer, Wasilla, Talkeetna) and the state's largest agricultural community. Other economic activities include a recreation industry and some light manufacturing. Much recent growth in the Borough has been in residential and recreation homes for workers in the Anchorage area. Estimated 1974 population was 9,787.

The Kenai Peninsula Borough includes the cities of Kenai, Soldatna, Homer, Seldovia, and Seward with important fisheries, oil and gas, and recreation industries. Estimated 1974 population was 13,962.

Both the Matanuska-Susitna and Kenai Peninsula Boroughs will have some urban expansion over the next few decades. Pressures for urban development would be substantially increased if the proposed surface crossings of the Knik and Turnagain Arms were constructed.

Present and proposed activities indicate likelihood of rapid growth in this general Cook Inlet area for the foreseeable future. Much of this activity is related to oil and natural gas including expansion of the refineries at Kenai, proposals for major LNG exports to the south "48" and probable additional offshore oil and gas development. The State's Capital Site Selection Committee has narrowed their search to four sites for the new capital city, of which three locations are in the Susitna Valley. The area will continue to serve as the transportation hub of westward Alaska, and tourism demands will likely continue to increase rapidly. Major local development seems probable.

Fairbanks-Tanana Valley Area

Fairbanks is Alaska's second largest city, the trade center for much of Alaska's Interior, service center for two major military bases, and site of the University of Alaska and its associated research center. Several outlying communities including Nenana, Clear, North Pole, and Delta Junction are loosely included in the "Fairbanks-Tanana Valley" area. Historically, the area is famous for its gold. Currently, it is in a major boom connected with the construction of Alyeska pipeline.

The Fairbanks-North Star Borough had an estimated 1974 population of 50,762 and the outlying communities within the power market area probably totaled about 10,000 population at that time.

It is generally felt that post-pipeline growth in the Fairbanks area will be at a slower pace than the Anchorage-Cook Inlet area. However, major future resource developments in the Interior and the North Slope would have direct impact on the Fairbanks economy.

Valdez-Glennallen

Like Fairbanks, the two communities are heavily impacted by pipeline construction, especially Valdez because of the concentration of work on the pipeline terminal. Longer range prospects probably include a more stable economy associated with the pipeline and terminal operations and the immensely valuable recreation resources of this area.

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Utility Systems and Service Areas

The electric utilities in the power market area are listed below and areas presently receiving electric service are indicated on Figure 2.

Anchorage Area -

Anchorage Municipal Light and Power (AML&P)
Chugach Electric Association (CEA)
Matanuska Electric Association (MEA)
Homer Electric Association (HEA)
Seward Electric System (SES)

Fairbanks Area -

Fairbanks Municipal Utility System (FMUS)
Golden Valley Electric Association (GVEA)

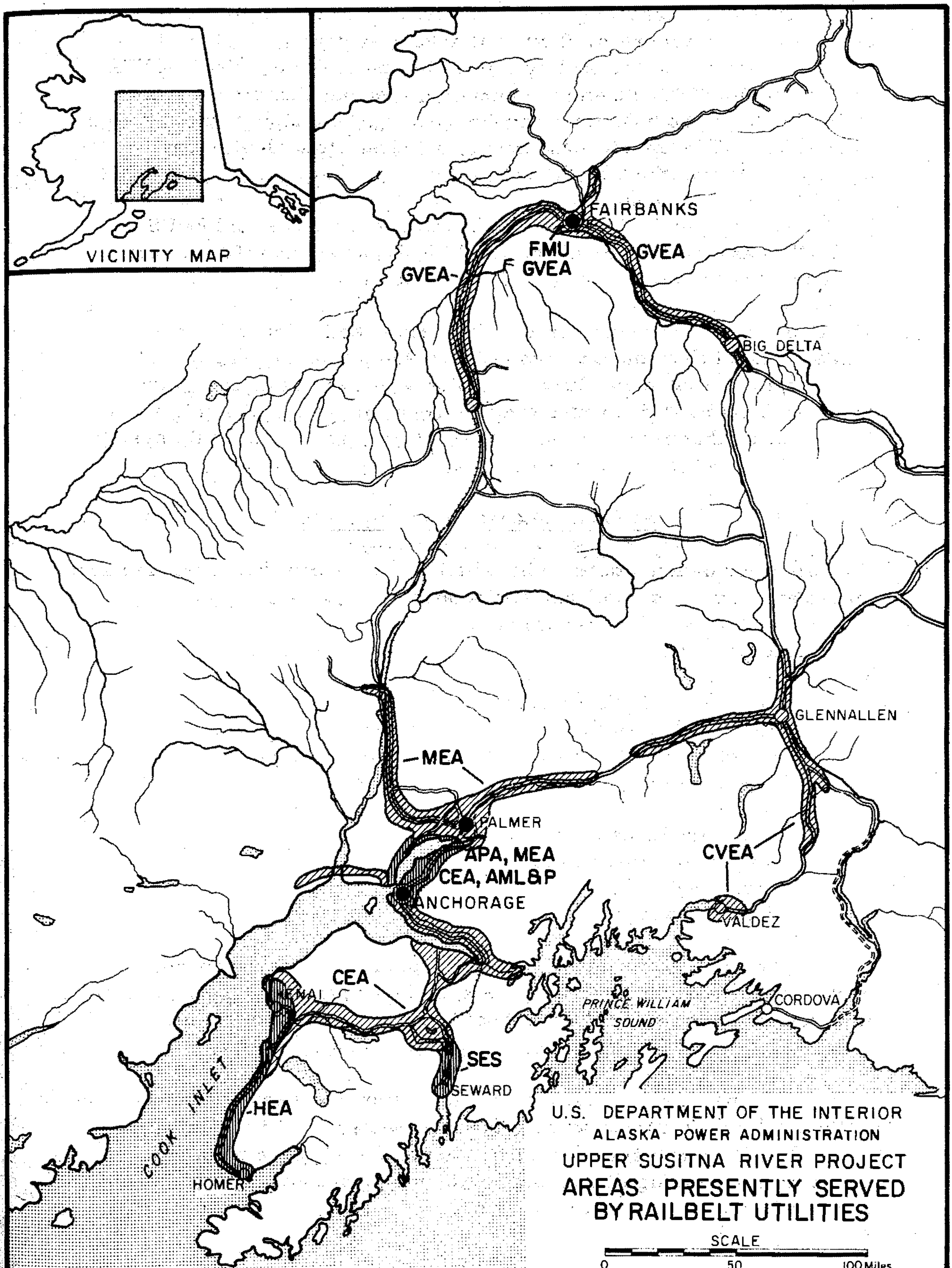
Valdez and Glennallen Area -

Copper Valley Electric Association (CVEA)

Alaska Power Administration operates the Eklutna Hydroelectric Project and markets wholesale power to CEA, AML&P, and MEA.

AML&P serves the Anchorage Municipal area. CEA supplies power to the Anchorage suburban and surrounding rural areas and provides power at wholesale rates to HEA, SES, and MEA. The HEA service area covers the western portion of the Kenai Peninsula including Seldovia, across the bay from Homer. MEA serves the town of Palmer, the surrounding rural area in the Matanuska and Susitna Valleys.

The utilities serving the Anchorage-Cook Inlet area are presently loosely interconnected through facilities of APA and CEA. An emergency tie is available between the AML&P and Anchorage area military installations. For this study it is assumed that Upper Susitna power would be delivered at a new substation on the CEA system in the vicinity of Point MacKenzie on the north side of Knik Arm, and that project power would be wheeled over the CEA system to other utilities in the general Cook Inlet area.



VICINITY MAP
FAIRBANKS
FMU
GVEA
GVEA
GVEA
BIG DELTA
GLENNALLEN
MEA
PALMER
APA, MEA
CEA, AML&P
ANCHORAGE
CVEA
VALDEZ
CEA
KENAI
PRINCE WILLIAM SOUND
CORDOVA
SES
SEWARD
COOK INLET
HEA
HOMER
U.S. DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
UPPER SUSITNA RIVER PROJECT
AREAS PRESENTLY SERVED
BY RAILBELT UTILITIES
SCALE
0
50
100 Miles

FMUS serves the Fairbanks municipal area, while GVEA provides service to the rural areas. The Fairbanks area power suppliers have the most complete power pooling agreement in the State. FMUS, GVEA, the University of Alaska and the military bases have an arrangement which includes provisions for sharing reserves and energy interchange In addition, GVEA operates the Fort Wainwright steamplant under an agreement with the army.

The delivery point for Upper Susitna power to the GVEA and FMUS systems is assumed at the existing Gold Hill substation of GVEA near Fairbanks.

The Copper Valley Electric Association serves both Glennallen and Valdez. Radial distribution lines of CVEA extend from Glennallen 30 miles north on the Copper River, 55 miles south on the Copper River to Lower Tonsina and 70 miles west on Glenn Highway. For this study, it is assumed that project power would be delivered to the CVEA system at Glenallen.

National Defense Power Systems

The six major national defense installations in the power market area are: (there are numerous smaller installations)

Anchorage area -

- Elmendorf Air Force Base
- Fort Richardson

Fairbanks area -

- Clear Air Force Base
- Eielson Air Force Base
- Fort Greeley
- Fort Wainwright

Each of the major bases has its own steamplant used for power and for central space heating source. Except for Clear Air Force Base, each is interconnected to provide power to or receive power from the local utilities.

In the past, national defense electric generation has been a major portion of the total installed capacity. With the projected stability of military sites and the growth of the utilities, the national defense installation will become a less significant part of the total generation capacity.

Industrial Power Systems

Three industrial plants on the Kenai Peninsula maintain their own powerplants, but are interconnected with the HEA system. Colliers chemical plant generates its basic power and energy needs receiving only standby capacity from HEA. Kenai Liquified Natural Gas plant buys energy from HEA, but has its own standby generation. Tesoro Refinery does both; buys from HEA and furnishes part of its own needs.

Other self-supplied industrial generators include oil platform and pipeline terminal facilities in the Cook Inlet area. The Valdez pipeline terminal will have a sizable powerplant, and most of the pumping stations on the Alyeska pipeline will have small powerplants.

Existing and Planned Generation

Table 2 provides a summary of existing generating capacity. The table was generally current as of mid-1974. The Anchorage-Cook Inlet area had a total installed capacity of 414.8 MW in 1974. Natural gas fired turbines were the predominant energy source with 341.7 MW of installed capacity. Hydroelectric capacity of 45 MW was available from two projects, Eklutna and Cooper Lake. Steam turbines comprised 14.5 MW of capacity and diesel generation, mostly in standby service accounted for the remaining 13.5 MW.

The Fairbanks-Tanana Valley area utilities had a total installed capacity of 127.7 MW in 1974. Steam turbines provided the largest block of power in the area with an installed capacity of 53.5 MW. Gas turbine generation (oil-fired) provided 42.1 MW of power and diesel generators contributed 32.1 MW to the area.

Table 2. Summary of Existing Generating Capacity

	Installed Capacity - 1000 kw				
	Hydro	Diesel IC	Gas Turbine	Steam Turbine	Total
Anchorage-Cook Inlet Area:					
Utility System	45.0	13.5	341.7	14.5	414.8
National Defense		9.3		49.5	58.8
Industrial System		10.1	2.3		12.4
Subtotal	45.0	32.9	344.0	64.0	486.0
Fairbanks-Tanana Valley Area:					
Utility System		32.1	42.1	53.5	127.7
National Defense		14.9		63.0	77.9
Subtotal		47.0	42.1	116.5	205.6
Valdez and Glennallen		6.2			6.2

Notes: The majority of the diesel generation is in standby status except at Valdez and Glennallen.

Source: 1974 Alaska Power Survey, Technical Advisory Report, Resources and Electric Power Generation, Appendix A and Alaska Electric Power Statistics, 1960-1973, APA.

Generation facilities will need to be installed to meet requirements between 1975 and 1985 when the first Susitna River hydro unit could be on the line. Current plans of the utilities include the following units:

Utilities	Planned Capacity, MW		
	1975	1976	1977
Anchorage Area:			
Chugach Electric Association (CEA)			
Unit 4	10		
Units 5 & 6	53	53	
Anchorage Municipal Light & Power (AML&P)			
Units 8 & 9	15	15	
Unit 10		40	
Fairbanks Area:			
Golden Valley Electric Association (GVEA)			
North Pole		53	53
	78	161	53

Source: Environmental impact statements, public meetings and APA personal contacts.

The AML&P 15 MW units are steam turbine heat recovery units. The remainder of the units are gas turbines. The 53 MW ratings are baseload ratings. Winter peak load ratings are 70 MW. The Anchorage area units are natural gas fired, while the Fairbanks units are oil fired.

Estimates of future power requirements indicate substantial additional capacity needs by 1985 over and above the present plans. Studies of other generation, mainly coal fired steamplants, have been made by the utilities but commitments to longer range generation with coal have not been made.

Natural gas supply contracts have been secured by Chugach Electric Association through 1998 in the Beluga area. The natural gas available under present contracts could meet the expected 1982 CEA generation needs of approximately 536 MW. 1/

CVEA recently installed 1,000 kw and 2,624 kw diesel generators at Valdez and ordered two 2,624 kw diesel electric generators for Glennallen. Studies are underway on a 6,000 kw Solomon Gulch hydro project near Valdez.

In addition to the utility plans, some new self-supplied industrial plants are planned or under construction. These include power supplies for the Alyeska pipeline terminal (oil-fired steam) and for pumping stations (small diesel plants). Electric service requirements for the pumping stations in the immediate vicinity of Glennallen and Fairbanks are to be supplied by CVEA and GVEA, respectively.

There also may be new industrial powerplants in connection with refinery expansion and the proposed new LNG plants on the Kenai Peninsula. Generally, industry has shown a willingness to purchase power from the utilities if adequate reliable supplies can be guaranteed.

1/ CEA Environmental Analysis of Proposed 230 kv Transmission Line from Teeland substation to Reed substation, page 8.

POWER REQUIREMENTS

Power requirement studies for this report included: a review of the regional power requirement studies for the new FPC Alaska Power Survey and other recent load estimates; analyses of recent trends in power consumption; and preparation of a new set of load estimates reflecting the present best estimates of future area requirements through the year 2000.

The studies also included analysis of load characteristics as needed to develop criteria for installed capacity and reservoir regulation for power production from the proposed hydroelectric development.

Power Requirements Data

This section summarizes data used in estimating future power requirements and determining criteria for energy distribution and peaking capacity for the Susitna hydroelectric development. The estimates of future requirements are premised on assumed data and annual future growth trends. Energy distribution and peaking capacity criteria are estimated from load distribution data.

Annual Requirements

Table 3 summarizes annual power requirement data for the Anchorage-Cook Inlet and Fairbanks-Tanana Valley areas for the years 1964 to 1974. The table includes: utility system annual energy requirements, annual peak load, annual load factor, and rates of increase in energy requirements; similar data for representative years for the national defense installations in the two areas; and 1972 requirements for the self-supplied industrial plants on the Kenai Peninsula.

Table 3 also includes a summation of these loads for the years 1964, 1972, and 1974 (assuming industrial loads in 1972 and 1974 are equal). The total area electrical energy requirements increased by a factor of 2.63 during the 1964-1974 period, for an average increase of just nine percent per year. The utility requirements increased at an average rate of 14.2 percent per year and exceeded 12 percent growth in all but two years of that period. Average growth was 14.5 percent and 13.2 percent for Anchorage and Fairbanks, respectively.

Table 3. Anchorage and Fairbanks Area Load Data, 1964 - 1974

Year	Energy Million Kwh	Peak Load MW	Load Factor Percent	Annual Increase Million-kwh	%
	Utility Requirements - Anchorage Area				
1964	338.2	83.6	46.1		
1965	401.0	91.9	49.8	62.8	18.6
1966	450.3	103.0	49.9	49.8	12.3
1967	497.1	112.1	50.6	46.8	10.4
1968	563.6	129.9	49.4	66.5	13.4
1969	630.5	139.6	51.6	66.9	11.9
1970	741.2	165.3	51.2	110.7	17.6
1971	887.1	189.3	53.5	145.9	19.7
1972	984.3	223.9	50.2	97.2	11.0
1973	1134.2	252.0	51.4	149.9	15.2
1974	1305.3	284.0	52.5	171.1	15.1
	Utility Requirements - Fairbanks Area				
1964	95.7	23.6	46.2		
1965	103.7	26.5	44.7	8.0	8.4
1966	115.9	27.8	47.6	12.2	11.8
1967	128.6	31.8	46.2	12.7	11.0
1968	158.2	42.7	42.2	29.6	23.0
1969	186.0	45.6	46.6	27.8	17.6
1970	231.0	57.0	46.3	45.0	24.2
1971	267.3	71.2	43.1	36.3	15.7
1972	305.5	71.9	48.4	38.2	14.3
1973	315.0	71.5	50.2	9.5	3.1
1974	330.0	82.9	45.4	15.0	4.8
	Utility Requirements - Anchorage & Fairbanks Area				
1964	433.9	107.2	64.1		
1965	504.7	118.4	48.7	70.8	16.3
1966	566.2	130.8	49.4	61.5	12.2
1967	625.7	143.9	49.6	59.5	10.5
1968	721.8	172.6	47.6	96.1	15.4
1969	816.5	185.2	50.3	94.7	13.1
1970	972.2	272.3	49.9	155.7	19.1
1971	1156.4	260.5	50.7	184.2	18.9
1972	1289.8	295.8	49.6	133.4	11.5
1973	1449.2	323.5	51.1	159.4	12.4
1974	1635.3	366.9	50.9	186.1	12.8

Table 3. Anchorage and Fairbanks Area Load Data, 1964 - 1974 (cont.)

Year	Net Million Kwh	Peak Load MW	Load Factor Percent
Self-Supplied Industry - Kenai Peninsula			
1972	54.3	9.7	53.2
National Defense - Anchorage			
1964	141	32	50.2
1972	166.5	33.9	55.9
1974	155.1	32.6	54.3
National Defense - Fairbanks			
1964	197	37	60.6
1972	203.3	41.4	55.9
1974	197.0	40.8	55.1
Total Requirements - Utility, Industrial and National Defense			
1964	772	176	50.1
1972	1,705	381	51.0
1974 1/	2,033	450	51.6

1/ Assumes Industrial loads in 1974 same as 1972.

Notes: "Anchorage" utility data reflects requirements of CEA, AML&P, MEA, HEA, and SES.
"Fairbanks" utility date reflects sum of GVEA and FMUS.

The data in Table 3 indicates that National Defense requirements have been quite stable over the period. National Defense requirements totaled 44 percent of total area requirements in 1964, but only 17 percent in 1974.

With the exception of the self-supplied industry in the Kenai Peninsula, area industrial loads are supplied by the utilities and included in the utility statistics.

Tables 4 and 5 illustrate the major components of growth in the utility requirements increase in customers and increase in use per customer. Number of customers is generally analogous to increase in area population and economic activities. Use per customer will reflect a variety of factors such as additional appliances, a general trend towards better housing and expanding business in the new suburban areas.

Table 5 shows energy use per customer and annual increased use for the period 1965 through 1973. The main observation is that the use per customer has increased significantly, and is still increasing. The Anchorage area customer averaged 5.2 percent annual increase while the Fairbanks area averaged 9.8 percent annual increase. The combined weighted annual growth was 6.2 percent.

Estimates of future power requirements presented subsequently assume this large rate of growth will not continue indefinitely, and that saturation of home appliances and conservation efforts will stabilize the per customer use.

The peak load data on Table 3 represents the sum of annual peaks from the various systems. Area total peak load would be somewhat smaller in most cases due to diversity.

The data shown on Table 3 indicated that both area load centers have a fluctuating annual utility load factor very close to 50 percent. The industry on the Kenai Peninsula has been slightly higher at 53 percent. National Defense has the highest at 55 percent. Area total load factor would be somewhat higher due to diversity.

The data in Table 3 indicates that for 1974, approximately 74 percent of the total system energy is used in the Anchorage area and 26 percent in the Fairbanks area. Comparable figures for the utility portion was 80 percent in the Anchorage area and 20 percent in the Fairbanks area.

Table 4. Utility - Sales and Customers - Railbelt Area, 1965-1973

		Residential			Commercial/Industrial			Total		
		1965	1970	1973	1965	1970	1973	1965	1970	1973
Anchorage Area										
AML&P	1000 KWH	34,656	54,518	84,000(e)	92,889	159,538	231,000(e)	133,083	222,200	325,200(e)
	Customers	6,664	8,860	11,400(e)	2,071	2,221	2,540(e)	8,742	11,233	14,100(e)
CEA	1000 KWH	111,587	198,856	287,879	49,747	99,387	174,187	164,507	309,049	483,029
	Customers	15,449	23,358	29,077	1,028	1,791	2,465	16,559	25,263	31,665
MEA	1000 KWH	17,115	29,702	52,305	16,708	19,681	29,501	33,952	49,564	82,018
	Customers	2,638	3,664	5,029	411	546	730	3,050	4,213	5,765
HEA	1000 KWH	6,176	19,290	31,848	16,749	53,845	73,943	23,855	75,000	108,407
	Customers	1,413	2,707	3,891	358	542	830	1,832	3,329	4,822
TOTAL	1000 KWH	169,534	302,366	456,032	176,093	332,451	508,631	355,397	655,813	998,654
	Customers	26,164	38,589	49,397	3,868	5,100	6,565	30,183	44,038	56,352
Fairbanks Area										
FMU	1000 KWH	16,172	23,619	27,300(e)	22,109	37,941	41,500(e)	43,962	71,408	83,000(e)
	Customers	4,147	4,443	4,500(e)	795	874	900	4,998	5,492	5,600(e)
GVEA	1000 KWH	23,142	67,123	106,882	25,850	69,064	98,744	49,357	136,486	206,108
	Customers	3,908	5,846	7,382	523	817	973	4,478	6,671	8,363
TOTAL	1000 KWH	39,314	90,742	134,182	47,959	107,005	140,244	93,319	207,894	289,108
	Customers	8,055	10,289	11,882	1,318	1,691	1,873	9,476	12,163	13,963
Railbelt Area										
TOTAL	1000 KWH	208,848	393,108	590,214	224,052	439,456	648,875	448,716	863,707	1,287,762
	Customers	34,219	48,878	61,279	5,186	6,791	8,438	39,659	56,201	70,315

(e) Estimated

Table 5. Energy Use Per Customer, 1965-1973

Units: Thousand Kilowatthours per Customer

	Residential				Commercial/Industrial				Total			
	1965	1970	1973	Annual Growth (%)	1965	1970	1973	Annual Growth (%)	1965	1970	1973	Annual Growth (%)
Anchorage Area												
AML&P	5.2	6.2	7.4	4.5	44.9	71.8	90.9	9.2	15.2	19.8	23.1	5.4
CEA	7.2	8.5	9.9	4.1	48.4	55.5	70.7	4.8	9.9	12.2	15.3	5.6
MEA	6.5	8.1	10.4	6.1	40.7	36.0	40.4	---	11.1	11.8	14.2	3.1
HEA	4.4	7.1	8.2	8.1	46.8	99.3	89.1	8.4	13.0	22.5	22.5	7.1
Average	6.3	7.8	9.2	4.9	45.5	65.2	77.5	6.9	11.8	14.9	17.7	5.2
Fairbanks Area												
FMU	3.9	5.3	6.1	5.7	27.8	43.4	46.1	6.5	8.8	13.0	14.8	6.7
GVEA	5.9	11.5	14.5	11.9	49.4	84.5	101.5	9.4	11.0	20.5	24.6	10.6
Average	4.9	8.8	11.3	11.0	36.4	63.3	74.9	9.4	9.8	17.1	20.7	9.8
Combined Area												
Average	6.1	8.0	9.6	5.8	43.2	64.7	76.9	7.5	11.3	15.4	18.3	6.2

Source: REA and APA data.

Load Distribution Data

Figure 3 shows monthly peak utility loads, 1963 to 1974, for the Anchorage-Cook Inlet and Fairbanks-Tanana Valley areas. Table 6 summarizes monthly peak data for the 1971 to 1974 period. The prominent aspect is that summer peaks are running about 60 percent of annual peak. This indicates that summer peaking requirements will not be very influential in determining capacity requirements. Winter peaks shown in the table probably reflect a combination of growth and climate differences. It is of interest that the 1973-1974 peaks in November, December, January, and February were of about the same magnitude, while January peaks the preceding two winters were very prominent.

Figure 4 shows representative weekly load curves for Anchorage area utilities. Summer and winter load shapes appear similar except that the winter show a more pronounced evening peak. The daily peaks in both summer and winter tend to be broad.

Data on Figure 4 indicates the minimum hourly load during summer ranging from 29 to 31 percent of the winter peak.

Table 7 shows representative monthly load factors. These are uniformly high throughout the year, in the range of 70 to 76 percent. It is anticipated that similar data on a weekly basis would show weekly load factors are frequently above 80 percent.

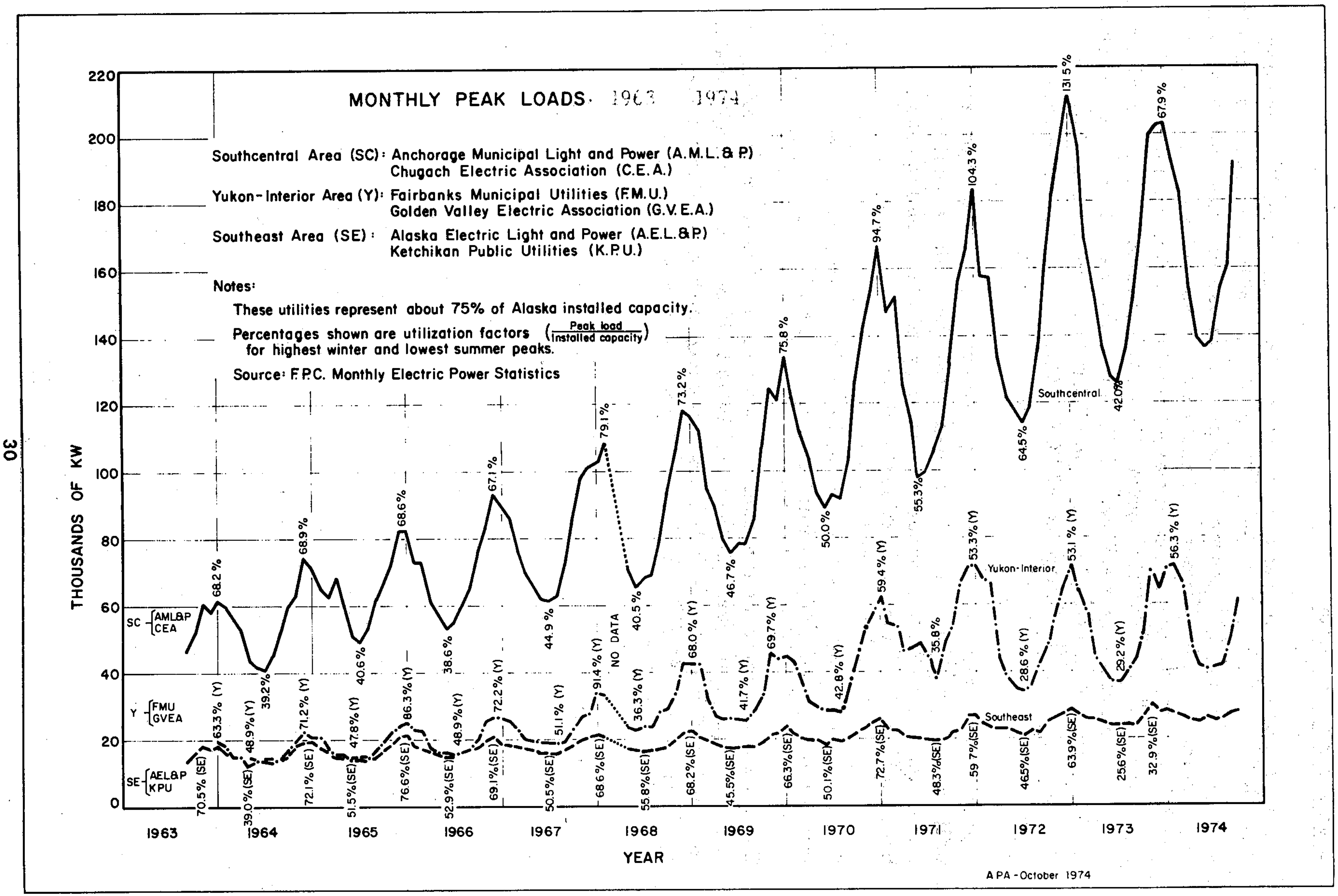

MONTHLY PEAK LOADS 1963 1974
Southcentral Area (SC): Anchorage Municipal Light and Power (A.M.L.&P.)
Chugach Electric Association (C.E.A.)
Yukon-Interior Area (Y): Fairbanks Municipal Utilities (F.M.U.)
Golden Valley Electric Association (G.V.E.A.)
Southeast Area (SE): Alaska Electric Light and Power (A.E.L.&P.)
Ketchikan Public Utilities (K.P.U.)
Notes:
These utilities represent about 75% of Alaska installed capacity.
Percentages shown are utilization factors (Peak load / Installed capacity) for highest winter and lowest summer peaks.
Source: F.P.C. Monthly Electric Power Statistics
THOUSANDS OF KW
0
20
40
60
80
100
120
140
160
180
200
220
SC AML&P CEA
Y FMU GVEA
SE AEL&P KPU
YEAR
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
68.2%
39.2%
68.9%
40.6%
68.6%
38.6%
67.1%
44.9%
79.1%
NO DATA
40.5%
73.2%
46.7%
75.8%
50.0%
94.7%
55.3%
104.3%
64.5%
131.5%
42.0%
67.9%
63.3% (Y)
48.9% (Y)
71.2% (Y)
47.8% (Y)
86.3% (Y)
48.9% (Y)
72.2% (Y)
51.1% (Y)
91.4% (Y)
36.3% (Y)
68.0% (Y)
41.7% (Y)
69.7% (Y)
42.8% (Y)
59.4% (Y)
35.8%
53.3% (Y)
28.6% (Y)
53.1% (Y)
29.2% (Y)
56.3% (Y)
70.5% (SE)
39.0% (SE)
72.1% (SE)
51.5% (SE)
76.6% (SE)
52.9% (SE)
69.1% (SE)
50.5% (SE)
68.6% (SE)
55.8% (SE)
68.2% (SE)
45.5% (SE)
66.3% (SE)
50.1% (SE)
72.7% (SE)
48.3% (SE)
59.7% (SE)
46.5% (SE)
63.9% (SE)
25.6% (SE)
32.9% (SE)
Southcentral
Yukon-Interior
Southeast
APA - October 1974

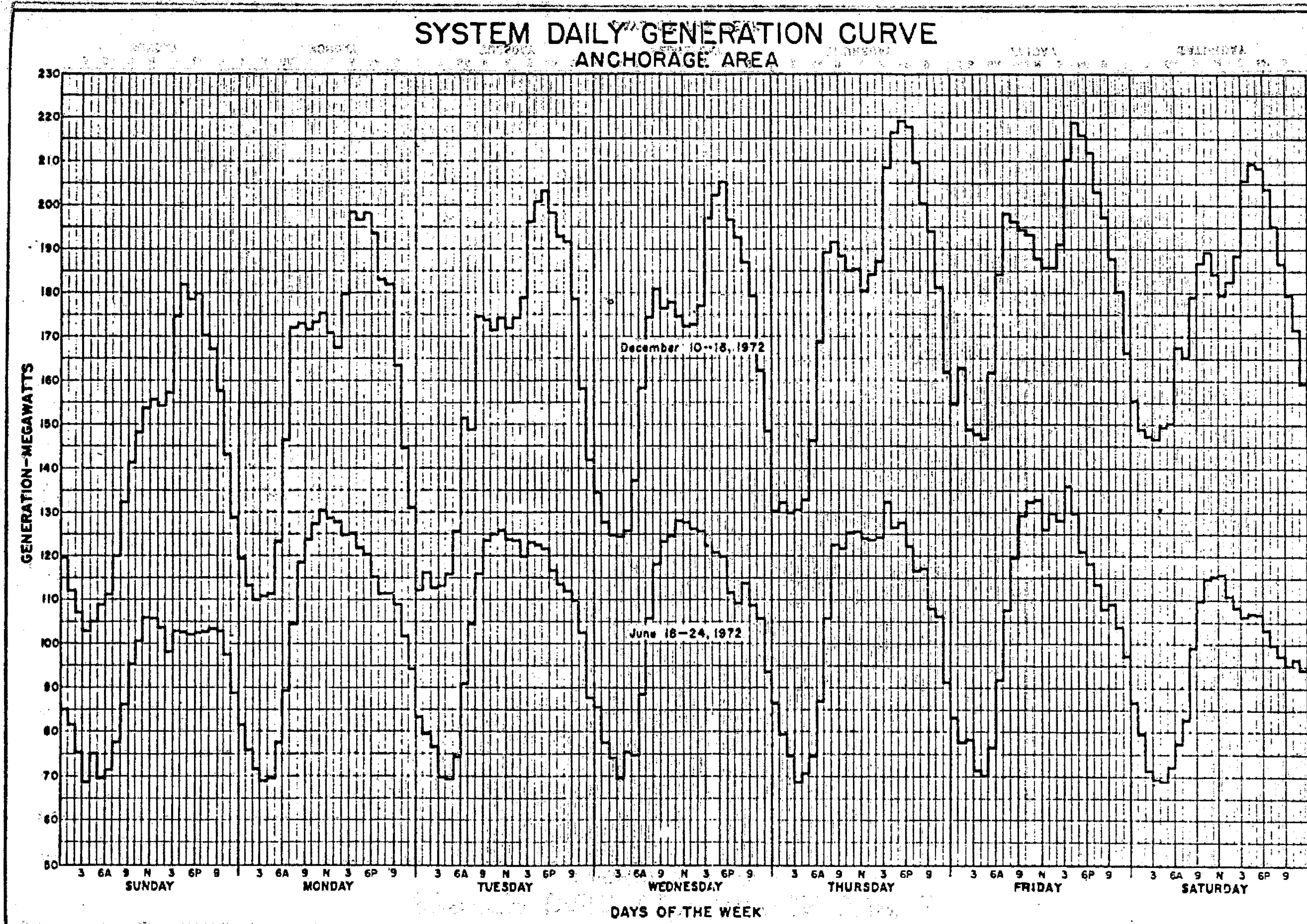
Table 6. Monthly Peak Loads, 1971 to 1974

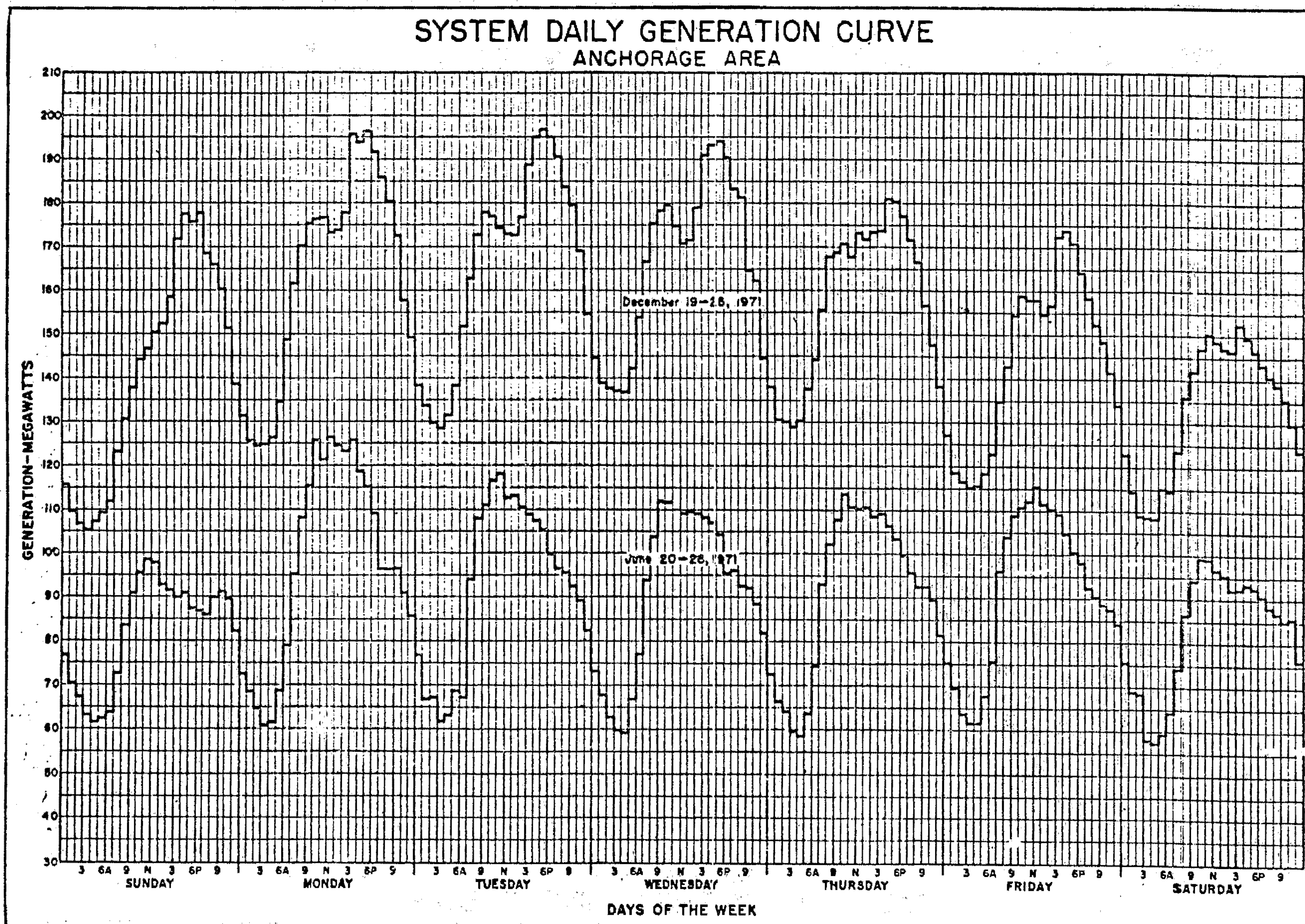
	1971 - 1972		1972 - 1973		1973 - 1974	
Month	Peak MW	% Annual Peak	Peak MW	% Annual Peak	Peak MW	% Annual Peak
July	143.6	56	146.8	52	162.8	59
Aug.	143.3	56	154.5	54	175.9	64
Sept.	161.7	63	179.6	64	194.5	71
Oct.	185.8	73	209.2	74	224.3	82
Nov.	222.8	88	236.3	83	269.6	98
Dec.	236.2	93	260.7	92	266.9	97
Jan.	254.5	100	283.0	100	274.5	100
Feb.	224.5	88	259.6	92	264.2	96
Mar.	222.8	87	225.1	80	249.4	91
Apr.	176.7	69	196.4	69	201.6	73
May	157.9	62	176.7	62	180.4	66
June	152.1	60	165.2	58	176.2	64

Note: Represents sum of loads for AML&P, CEA, FMUS, and GVEA as published in Alaska Electric Power Statistics, 1960-1973, APA, December 1974. Peaks within individual systems may have occurred at different times during the months.

69-737 O - 81 - 3

SYSTEM DAILY GENERATION CURVE
ANCHORAGE AREA


SYSTEM DAILY GENERATION CURVE
ANCHORAGE AREA
GENERATION-MEGAWATTS
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
December 10-16, 1972
June 18-24, 1972
3 6A 9 N 3 6P 9
SUNDAY
MONDAY
TUESDAY
WEDNESDAY
THURSDAY
FRIDAY
SATURDAY
DAYS OF THE WEEK



SYSTEM DAILY GENERATION CURVE
ANCHORAGE AREA
GENERATION-MEGAWATTS
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
December 19-25, 1971
June 20-26, 1971
3 6A 9 N 3 6P 9
SUNDAY
MONDAY
TUESDAY
WEDNESDAY
THURSDAY
FRIDAY
SATURDAY
DAYS OF THE WEEK

Table 7. Monthly Load Factors, 1972 and 1973

	1972			1973		
Month	Peak MW	Energy Million kwh	Monthly Load Factor	Peak MW	Energy Million kwh	Monthly Load Factor
Jan.	254.5	135.3	72	283.0	153.6	72
Feb.	224.5	115.3	76	259.6	127.5	73
Mar.	222.8	119.2	70	225.1	125.5	75
Apr.	176.7	96.6	76	196.4	105.4	75
May	157.9	87.8	75	176.7	98.5	75
June	152.1	78.5	72	165.2	87.6	74
July	146.8	76.6	70	162.8	89.8	74
Aug.	154.5	86.9	75	175.9	96.2	73
Sept.	176.9	92.9	72	194.5	100.8	72
Oct.	209.2	108.8	70	224.3	122.7	73
Nov.	236.3	124.4	73	269.6	144.6	74
Dec.	260.7	143.3	74	266.9	147.0	74

Note: Represents sum of loads for AML&P, CEA, FMUS, and GVEA as published in Alaska Electric Power Statistics, 1960-1973, APA, December 1974.

Studies for Alaska Power Survey

The power requirement studies for the new FPC Alaska Power Survey are summarized in the May 1974 report of the Technical Advisory Committee on Economic Analysis and Load Projection. These studies included review of previous reports and recent load estimates prepared for the power system in the state, analysis of present and future trends in power consumption, and regional estimates of future power requirements through the year 2000. These regional estimates were developed as a range of future requirements depending upon assumed levels of change in the Alaska population and economy. All of the estimates assumed substantial reduction in growth rates for power demands after 1980 would be achieved through conservation measures.

The power survey regional estimates included Railbelt area loads in the regional totals for the Southcentral and Yukon regions. Figure 5 shows the regional boundaries. For 1972, utility requirements immediately accessible to an interconnected Railbelt system amounted to about 96 percent of total utility loads for the two regions. Thus the regional totals are reasonably representative of Railbelt system requirements. The regional estimates also included evaluations of likely new industrial power requirements -- timber, mineral, oil and gas, etc. -- many of which would be remote from a Railbelt system, for the foreseeable future.

Table 8 summarizes regional utility system requirements for the 1960 to 1972 period as presented in the power survey. This analyses indicated Railbelt utility requirements were increasing at an average rate of 14 percent annually. In 1972, Railbelt utility loads totaled 1.3 billion kilowatthours, or about 80 percent of statewide requirements for the year.

Total 1972 Railbelt loads, including utility, national defense, and self-supplied industrial loads, were about 2 billion kilowatthours, or 77 percent of statewide total requirements for the year.

Tables 9 and 10 summarize the regional estimates from the power survey through the year 2000 for utility system requirements, and for total requirements including national defense systems and industrial requirements.

The power survey studies reflect future assumptions ranging from fairly limited to rather rapid development of the Alaska resources and economy. On the basis of the power survey mid-range estimates, expected increments in regional utility and total requirements are as follows:

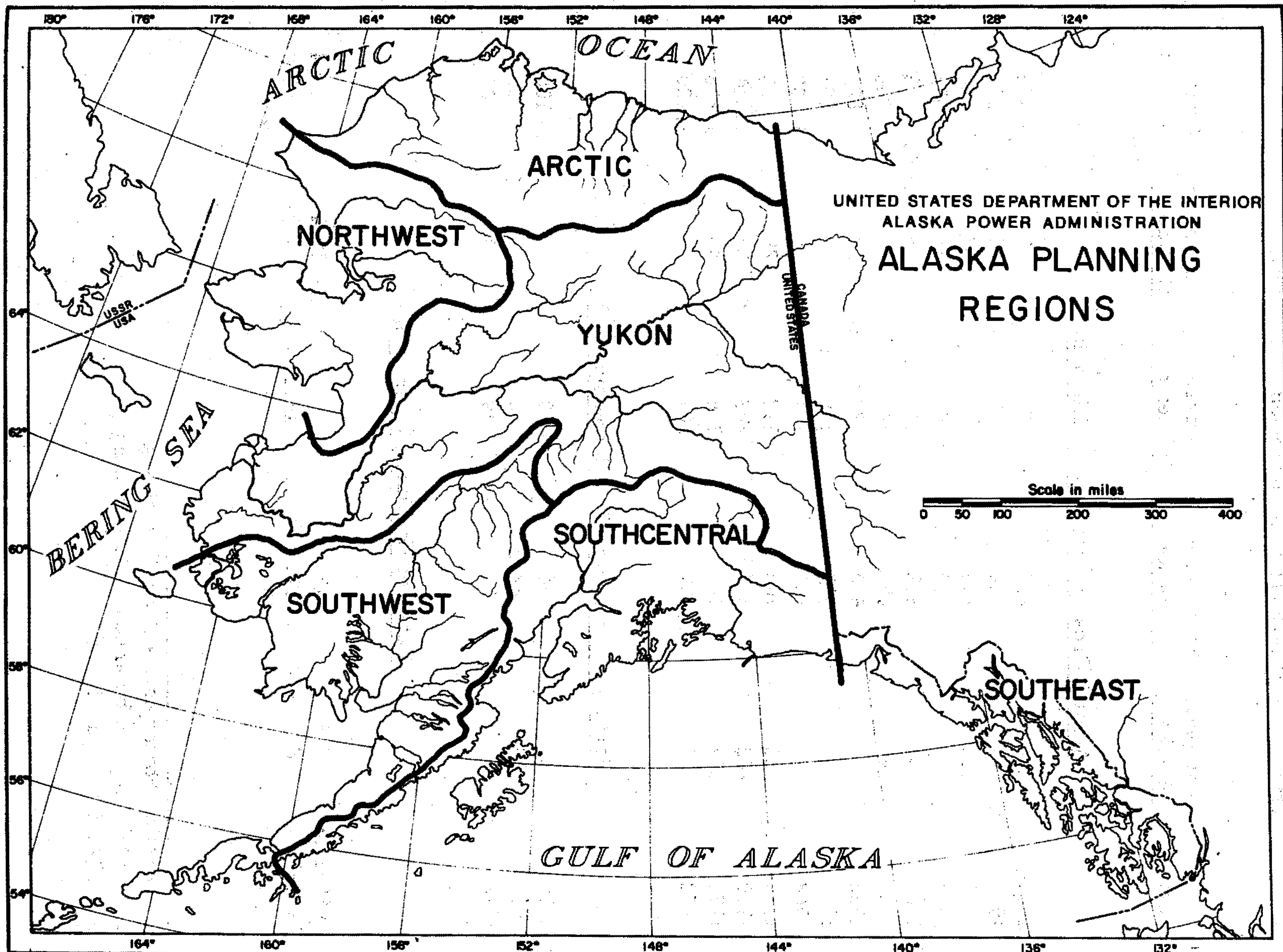

UNITED STATES DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
ALASKA PLANNING REGIONS
ARCTIC OCEAN
ARCTIC
NORTHWEST
YUKON
SOUTHCENTRAL
SOUTHWEST
SOUTHEAST
BERING SEA
GULF OF ALASKA
USSR
USA
CANADA
UNITED STATES
Scale in miles
0 50 100 200 300 400

Table 8. Utility System Requirements, 1960-1972

Year	Southeast Alaska	Southcentral Alaska	Yukon (Interior)	Remainder of State 1/	State Total 2/
		Annual Gross Generation, Million kwh			
1960	104	234	86	7	431
1961	111	264	89	11	475
1962	120	294	93	12	520
1963	129	329	102	14	573
1964	141	362	110	15	628
1965	148	452	117	17	735
1966	160	510	132	20	821
1967	165	560	145	22	891
1968	177	633	171	25	1,007
1969	185	708	198	29	1,120
1970	202	831	243	35	1,311
1971	217	990	276	43	1,526
1972 3/	229	1,037	307	46	1,620
		Portion of Statewide Requirements, (%)			
1960	24	54	20	2	100
1966	19	62	16	2	100
1972	14	64	19	3	100
		Rates of Growth, (% per year)			
1960-1966	7.5	13.9	7.5	19.1	11.4
1966-1972	6.2	12.5	15.1	14.9	12.0

1/ Arctic, Northwest, and Southwest Regions.
2/ Totals may not balance due to rounding.
3/ 1972 data preliminary.

Table 8. Utility System Requirements, 1960-1972 (Cont'd)

Other Growth Indications

Factor	Annual Growth Rate
Population growth, 1960-1972:	
1. Statewide	
Total residential population	3.0%
Total civilian population	3.7%
2. Railbelt	
Total residential population	3.6%
Total civilian population	4.5%
Railbelt area utility power requirements, 1960-1971 growth:	
1. Total requirements	
Kwh sales	14.0%
Number of customers	6.0%
Kwh/customer	7.3%
2. Residential sales	
Kwh sales	13.8%
Number of customers	6.5%
Kwh/customer	7.0%

Source: Alaska Power Survey, Technical Advisory Committee on Economic Analysis and Load Projection.

Table 9. Regional Utility Load Estimates, 1972-2000

Region	Actual Requirements 1972 Peak Demand 1000 KW	Actual Requirements 1972 Annual Energy Million KWH	Estimated Future Requirements 1980 Peak Demand 1000 KW	1980 Annual Energy Million KWH	1990 Peak Demand 1000 KW	1990 Annual Energy Million KWH	2000 Peak Demand 1000 KW	2000 Annual Energy Million KWH
			Higher Rate of Growth					
Southcentral	224	1,037	680	2,990	1,640	7,190	3,590	15,740
Yukon (Interior)	69	307	200	870	460	2,020	970	4,230
Total	293	1,344	880	3,860	2,100	9,210	4,560	19,970
			Likely Mid Range of Growth					
Southcentral			610	2,670	1,220	5,350	2,220	9,710
Yukon (Interior)			180	780	340	1,500	600	2,610
Total			790	3,450	1,560	6,850	2,820	12,320
			Lower Rate of Growth					
Southcentral			530	2,340	980	4,290	1,470	6,430
Yukon (Interior)			160	680	270	1,200	390	1,730
Total			690	3,020	1,250	5,490	1,860	8,160

Note: Estimated future peak demand based on 50 percent annual load factor.
Source: Alaska Power Survey, Technical Advisory Committee on Economic Analysis and Load Projection.

Table 10. Regional Total Load Estimate, 1972-2000

Region	Actual Requirements 1972		Estimated Future Requirements 1980		1990		2000	
	Peak Demand 1000 KW	Annual Energy Million KWH	Peak Demand 1000 KW	Annual Energy Million KWH	Peak Demand 1000 KW	Annual Energy Million KWH	Peak Demand 1000 KW	Annual Energy Million KWH
			Higher Rate of Growth					
Southcentral	317	1,465	990	5,020	5,020	30,760	7,190	40,810
Yukon (Interior)	115	542	330	1,610	760	3,980	1,390	7,000
Total	432	2,007	1,320	6,630	5,780	34,740	8,580	47,810
			Likely Mid Range of Growth					
Southcentral			790	3,790	1,530	7,400	3,040	15,300
Yukon (Interior			280	1,310	470	2,270	910	4,610
Total			1,070	5,100	2,000	9,670	3,950	19,910
			Lower Rate of Growth					
Southcentral			650	3,040	1,160	5,430	1,790	8,510
Yukon (Interior)			250	1,140	370	1,760	530	2,540
Total			900	4,180	1,530	7,190	2,320	11,050

Note: Assume 80 percent annual load factor for industrial requirements; 50 percent for utility requirements. Higher estimate includes nuclear enrichment facility in 1980's with requirements of 2.5 million kilowatts.

Source: Alaska Power Survey, Technical Advisory Committee on Economic Analysis and Load Projection.

Southcentral and Yukon
Utility Load Increments

Period	Peak Demand MW	Annual Energy Million Kwh
1972-1980	497	2,106
1980-1990	770	3,400
1990-2000	1,260	5,470

Southcentral and Yukon
Total Load Increments

Period	Peak Demand MW	Annual Energy Million Kwh
1972-1980	638	3,093
1980-1990	930	4,570
1990-2000	1,950	10,240

Factors Influencing Power Demands

This section will discuss some of the factors that will influence future power demands in the Railbelt area. In many cases, direct impact on power demands cannot be quantified with any degree of accuracy, but all of the factors will be considered in the assumptions for future requirements.

Population Change

During the 1950-60 decade Alaska's population increased some 76 percent. The following decade, although adding over 76,000 persons, the net increase was 34 percent. 1/ Increases for the Southcentral and Interior regions were 117 and 50 percent; and 114 and 16 percent respectively.

1/ This may be compared with a net increase of the far West region of 14.7 percent, the Mountain Region with 15.9 percent and the United States with 13.8 percent, Review of Business and Economic Conditions.

Alaska Population 1950 - 1970 a/ and 1974 b/

Year	Alaska	Change No.	Change %	So. Central	Change No.	Change %	Interior	Change No.	Change %
1950	128,643			50,909			23,008		
1960	226,167	97,524	75.8	108,851	58,758	117.3	49,128	26,120	113.5
1970	302,647	76,480	33.8	163,758	54,907	50.4	56,799	7,671	15.6
1974	351,159	48,986	16.2	194,569	31,777	19.4	67,315	10,516	18.5

Each year from 1960 to 1970, Alaska and the Southcentral and the Interior regions added an average of some 7,600; 5,500; and 750 persons respectively. Since 1970, these same areas are estimated to have annually averaged an increase over 12,200; 7,900; and 2,600.

These figures predate start of construction of the Alyeska pipeline. Discounting direct employment on pipeline construction, Railbelt population has been increasing at a compound rate of around 3.5 percent per year. Most planners expect continued rapid increase for at least the next few years.

Economic Growth

Population change is of course related to economic activity and employment opportunities. Historically Alaska's economy was based on furs, gold and copper. Its modern economy has relied on fisheries, forestry and government services. Presently Alaska's growth economy is being driven by the exploration and development of the northern, (primarily Arctic Slope) oil and gas fields, the construction of the Alyeska oil pipeline and transhipment facilities at Valdez; and the accompanying growth in support services and facilities at Anchorage, Fairbanks and other towns along the pipeline route. Additional impetus is coming from state

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a/ Review of Business and Economic Conditions, University of Alaska, Institute of Social, Economic and Government Research, Dec. 1971, Vol. VII, No. 5.

b/ Derived from Current Population Estimates by Census Divisions, July 1, 1974, Alaska Department of Labor, Research Division.

expenditures, construction of local infrastructure, expansion of Alaska's service industry, and activities associated with the Alaska Native Claims Settlement Act (ANCSA).

Some of these activities such as the construction of the oil pipeline and transhipment facilities have a limited time in which their effect will continue to provide economy expansion. For example, the huge pipeline construction force is expected to decline very rapidly on completion of the actual pipe laying in late 1976, and longer term employment for operating the line will involve relatively few jobs.

Other factors such as ANCSA can be expected to have very long term effects as the regional and village corporations use their capital, land and resources to economic advantage.

There are very strong pressures for expanding oil and gas exploration and development in Alaska, representing a very complex set of interests at the national, state, and local levels. Several areas on the Alaska Outer Continental Shelf and Naval Petroleum Reserve #4 are very high priorities in the national programs directed to energy self sufficiency. State interest and involvement includes possible additional leasing (Beaufort Sea and others), recognition that leasing and royalty revenues will likely be the major source of state income for the foreseeable future, and decisions on state royalty oil and gas. Some of the Native Corporations have oil and gas exploration programs underway. If reserves are found, there will be strong pressures for development for these lands too.

Generally, it must be assumed that the oil and gas developments will continue to be a major factor in the Railbelt and state economy for the foreseeable future, and that additional major oil and gas developments impacting the Railbelt are probable within the next few years, including substantial expansion of the present petrochemical industry.

Other factors which will continue to support economic growth in the Railbelt include the Capital relocation, and any further developments in other industries including tourism, forestry, mining, and agriculture.

No one is suggesting that all of the above will occur in the short term. Each, however, has a possibility and any combination of the above events must increase the population of Alaska and the energy requirements.

Changes in Use of Electric Energy

Nationally, electric energy consumption has been expanding at a compound rate of around seven percent per year. This compares with around a four percent increase in total energy use. These increases correlate with or exceed trends in national gross product and substantially exceed rates of population growth.

Many factors can be cited in at least partial explanation of these trends -- high productivity of electric energy in industry, increasing affluence, low cost of energy, and so forth.

Preliminary statistics indicate that total U.S. energy consumption during 1974 declined by about two percent and that electric energy production for the year showed no growth over 1973. This was the first full year of widespread concern for energy conservation, and results of the conservation programs are reflected in the changes. However, the changes also reflect a large increase in relative cost of energy, a deep economic recession with high unemployment and large amounts of idle industrial capacity, and generally mild winters.

For Alaska, 1974 was not a recession year. Energy consumption continued to increase rapidly in the state, including increases exceeding 12 percent in electric energy requirements for the major Railbelt utilities. Data presented previously showed that increases in electric demands for the Railbelt reflect both increases in numbers of customers and increases in use per customer.

It is reasonable to assume that electric energy will be substituted for many direct uses of oil and gas in the future. This substitution is one of the few major options available for reducing dependency on oil and natural gas.

Only very rough estimates are available on the extent to which such substitutions may be desirable. Data presented in the power survey showed electric energy accounted for only 13 percent total energy used in Alaska in 1971, and that as of 1972, over 60 percent of the state's electric requirements were derived from oil and gas. In contrast, the Pacific Northwest derives over 90 percent of its electric energy from hydro power, and electricity accounts for about 40 percent of total regional energy use. It is APA's judgement that in the long term, electric energy will provide a similarly large share of total energy requirements in the Railbelt area, if alternative power sources of coal, hydro, and nuclear are developed. Assuming no growth in overall energy use, this would involve a three-fold increase in electric energy requirements.

The cold climates, especially in the Interior, provide additional incentive to substitute electric energy for direct use of fossil fuels. For example, an all electric economy for the Fairbanks area would substantially reduce future problems with air pollution, fog, and ice fog.

1975 Estimates of Future Power Requirements

This section presents future power requirement estimates developed for the current evaluation of the Upper Susitna Project. Work for the new estimates consisted of: (1) a review of the previous data and data from the power survey in light of new data for the years 1973 and 1974; (2) consideration of current regional and sectional trends in energy and power use; and (3) preparation of a new set of load estimates reflecting this most recent data.

The new analyses generally indicate that major premises for the power survey load estimates remain valid. Changes include the update for the most recent estimates and reducing the regional estimates from the power survey to reflect areas that could be served directly from an interconnected Railbelt system. This latter step eliminated loads for remote cities and villages as well as potential industrial loads for these remote areas.

For 1973 and 1974, the Anchorage area utilities energy demand increased 15.2 percent per year and peaking requirements increased 12.6 percent per year. The Fairbanks' utilities energy demand increased only 3.9 percent while the peaking requirement increased 7.4 percent. The smaller increase in the Fairbanks area is assumed due to the large buildup in anticipation of the oil pipeline construction, and then a subsequent delay of construction start until late 1974.

The new estimates are summarized in Table 11 and Figure 6. Indicated load increments, by decade, are:

Increments of Utility Power Requirements, 1,000 KW

	1974-1980	1980-1990	1990-2000	1974-2000
Higher Estimate	440	1,140	2,280	2,280
Mid-Range	370	740	1,180	2,290
Lower Estimate	320	560	600	1,480

Increments of Total Power Requirements, 1,000 KW

	1974-1980	1980-1990	1990-2000	1974-2000
Higher Estimate	540	3,960	2,300	6,800
Mid-Range	420	800	1,500	2,720
Lower Estimate	340	600	660	1,600

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Table 11. Estimated Utility, National Defense, and Industrial Power Requirements

Type of Load	Actual Requirements 1974		Estimated Future Requirements 1980		1990		2000	
Area	Peak Demand 1000 kw	Annual Energy Million/kwh	Peak Demand 1000 kw	Annual Energy Million/kwh	Peak Demand 1000 kw	Annual Energy Million/kwh	Peak Demand 1000 kw	Annual Energy Million/kwh
National Defense								
Anchorage	33	155	35	170	40	190	45	220
Fairbanks	41	197	45	220	50	240	55	260
Total	74	352	80	390	90	430	100	480
Industrial			High Rate of Development Assumed					
Anchorage	10	45	100	710	2,910	20,390	2,920	20,460
Fairbanks 1/	--	--	--	--	--	--	--	--
			Mid-Range Development Assumed					
Anchorage			50	350	100	710	410	2,870
Fairbanks 1/			--	--	--	--	--	--
			Low Development Assumed					
Anchorage			20	140	50	350	100	710
Fairbanks 1/			--	--	--	--	--	--

1/ Rounds to less than 10 MW

Note: Industrial development does not assume pipeline pumping.

Table 11. Estimated Utility, National Defense, and Industrial Power Requirements (Cont)

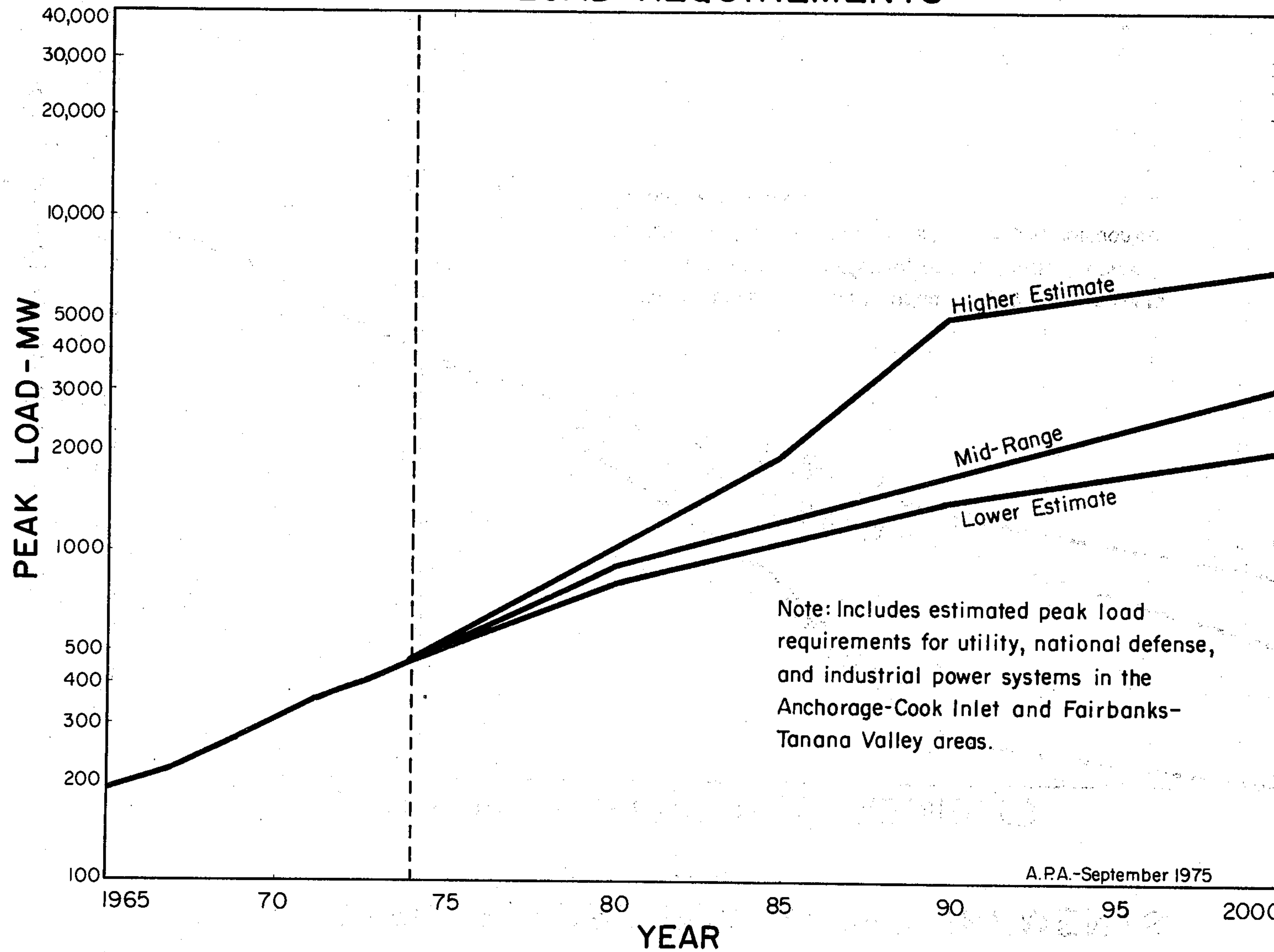
Type of Load	Actual Requirements 1974		Estimated Future Requirements 1980		1990		2000	
Area	Peak Demand 1000 kw	Annual Energy Million/kwh	Peak Demand 1000 kw	Annual Energy Million/kwh	Peak Demand 1000 kw	Annual Energy Million/kwh	Peak Demand 1000 kw	Annual Energy Million/kwh
Utilities			High Rate of Growth					
Anchorage	284	1,305	650	2,850	1,570	6,880	3,430	15,020
Fairbanks	83	330	160	700	380	1,660	800	3,500
Total	367	1,635	810	3,550	1,950	8,540	4,230	18,520
			Likely Mid-Range Growth					
Anchorage			590	2,580	1,190	5,210	2,150	9,420
Fairbanks			150	660	290	1,270	510	2,230
Total			740	3,240	1,480	6,480	2,660	11,650
			Lower Rate of Growth					
Anchorage			550	2,410	1,010	4,420	1,500	6,570
Fairbanks			140	610	240	1,050	350	1,530
Total			690	3,020	1,250	5,470	1,850	8,100

Table 11. Estimated Utility, National Defense, and Industrial Power Requirements (Cont)

Type of Load / Area	Actual Requirements 1974		Estimated Future Requirements 1980		1990		2000	
	Peak Demand 1000 kw	Annual Energy Million/kwh	Peak Demand 1000 kw	Annual Energy Million/kwh	Peak Demand 1000 kw	Annual Energy Million/kwh	Peak Demand 1000 kw	Annual Energy Million/kwh
Combined Utility, National Defense, and Industrial Power Requirements								
Higher Growth Rate								
Anchorage	327	1,505	785	3,730	4,520	27,460	6,395	35,700
Fairbanks	124	527	205	920	430	1,900	855	3,760
Total	451	2,302	990	4,650	4,950	29,360	7,250	39,460
Likely Mid-Range Growth Rate								
Anchorage			675	3,100	1,330	6,110	2,605	12,510
Fairbanks			195	880	340	1,510	565	2,490
Total			870	3,980	1,670	7,620	3,170	15,000
Lower Growth Rate								
Anchorage			605	2,720	1,100	4,960	1,645	7,500
Fairbanks			185	830	290	1,290	405	1,790
Total			790	3,550	1,390	6,250	2,050	9,290

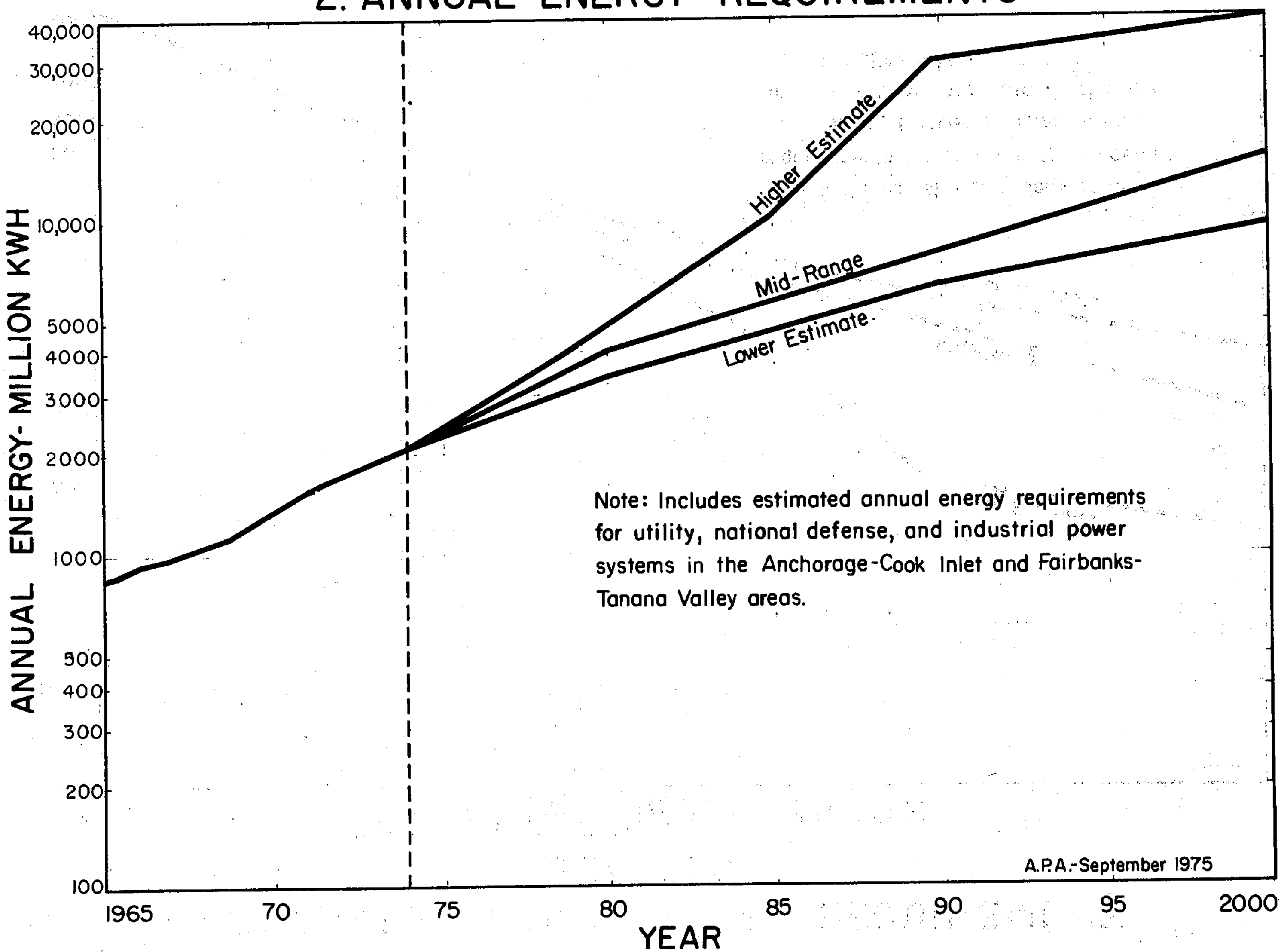
ESTIMATED FUTURE POWER REQUIREMENTS 1974-2000

I. PEAK LOAD REQUIREMENTS



ESTIMATED FUTURE POWER REQUIREMENTS
1974-2000

2. ANNUAL ENERGY REQUIREMENTS



With allowances for reserves and plant retirements, the indicated new capacity requirements by the year 2000 range from about two to eight million kilowatts with a mid-range estimate of over three million kilowatts.

Rates of increase in utility power requirements assumed for the future estimates are shown below:

Estimate	1974-1980	1980-1900	1990-2000
Higher Range	14.1%	9%	8%
Likely Mid-Range	12.4%	7%	6%
Lower Range	11.1%	6%	4%

It bears repeating that the assumed growth rates after 1980 are substantially below existing trends and that they assume substantial savings through increased efficiency in use of energy and conservation programs.

The estimates for the National Defense requirements are premised on the 1974 power use for the major bases and an assumed future growth of approximately one percent per year. These estimates are lower than presented in the power survey data, reflecting trends in 1973 and 1974.

The estimates for future utility requirements cover the same load sectors as now supplied by Alaska utility systems. This includes most light industry and industry support services. The utility estimates do not include allowances for industrial requirements for major new resource extraction and processing, new energy intensive industries, or heavy manufacturing.

The power survey studies included a review of potential new developments in the energy, mineral, and timber fields and a set of assumptions on individual developments considered likely through the year 2000. Basically, the estimates involved selecting a few developments considered most likely to occur from among the more promising potentials and rough estimates of the power requirements that would be involved. For this study, the power survey assumptions were screened to include only those developments which could be readily served from an interconnected Railbelt power system. This eliminated many potential new industrial loads listed in the Survey, particularly remote mining developments in the Yukon region.

Tables 12 and 13 summarize assumed new industrial power requirements for this report.

The basic assumptions incorporated in these new estimates are summarized below. In most cases, the assumptions are similar to those adopted for the power survey:

1. It is generally considered that the Railbelt area population will continue to grow more rapidly during the study period than the national average.

2. Utility statistics indicate individual customers' electric energy consumption has been increasing six to seven percent per year. However, all of the load estimates assume that saturation levels for many energy uses will be reached and that rates of increase for most individual uses will decline during the 1980's and 1990's. This reflects assumed effects of major efforts to increase efficiencies and conserve energy for all uses.

3. Rapid growth in the Railbelt area will continue through the balance of the 1970's, with economic activity generated by North Slope oil and gas development being a major factor.

4. Future additional energy systems, potential mineral developments, petroleum processing, and development of a petrochemical industry will all be very influential in use of electrical energy through the end of the century.

5. Major economic advances for all of Alaska and especially for the Alaska Native people should be anticipated as a result of the Alaska Native Claims Settlement Act.

6. There may be substantial substitution of electricity for direct use of oil and gas if the electricity is from other sources.

Load factors assumed were the same as for the power survey--utility systems, 50%; industrial loads, 80%; and national defense, 55%. The 50% and 55% are further supported by the data in Table 3. The 80% is an assumption based on higher utilization of generation equipment by industry. Minor differences may be reflected in the table due to combining and rounding.

The concept of range estimates presented in the power survey is continued. It attempts to balance the population and the growth factors with increasing conservation trends. The "higher" range anticipates significant new

Table 12. Assumed Industrial Development

INDUSTRY	RATE OF GROWTH	ASSUMPTION
Kenai Peninsula:		
Chemical Plant:	Low	Existing, with planned expansion by 1980, then, no change to 2000.
	Mid	Existing, larger expansion assumed by 1980, continued expansion to 2000.
	High	Existing, largest yet expansion assumed by 1980, larger expansion to 2000.
LNG Plant:	Low	Existing, with no change assumed to 2000.
	Mid	Existing, no change before 1980, steady expansion thereafter.
	High	Existing, expansion assumed before 1980 and continuing to 2000.
Refinery:		Existing, plus same assumptions as LNG plant.
Timber Processing:	Low	Small start before 1980, expansion to high value by 2000.
	Mid	Larger start before 1980, expansion to high value by 1990.
	High	Largest start before 1980, no change to 2000.

Table 12. Assumed Industrial Development

(continued)

INDUSTRY	RATE OF GROWTH	ASSUMPTION
Other Vicinities:		
Mining and Mineral Processing:	Low	Start-up after 1980, five-fold expansion by 2000.
	Mid	Start-up by 1980, five-fold expansion by 1990, double by 2000.
	High	Large start-up by 1980, double by 1990, no change to 2000.
LNG Plant:	Low	Start-up after 1980, no change to 2000.
	Mid	Start-up before 1980, no change to 2000.
	High	" " " " " " " "
Beluga Coal Gasification:	Low	Pilot project power between 1990 and 2000.
	Mid	Pilot project by 1990, full operation by 2000.
	High	Pilot project before 1980, full operation by 1990, no change to 2000.
Nuclear Fuel Enrichment:	High	Start at full operation before 1990, no change to 2000.
Timber:	Low	Start-up after 1980, full operation by 2000.
	Mid	Start-up before 1980, full operation by 1990, no change to 2000.
	High	Full operation start-up before 1980, no change thereafter.
New City:	Low	Initially loaded after 1980, load tripled by 2000.
	Mid	Initially loaded before 1980, tripled by 1990 2 1/3 expansion by 2000.
	High	Larger initial load before 1980, 2 1/3 expansion by 1990, no change to 2000.

Table 13. Estimated Industrial Power Requirements

Rate of Development	Low Range			Mid Range			High Range		
Year	1980	1990	2000	1980	1990	2000	1980	1990	2000
Anchorage Area: Kenai Peninsula:									
Chemical Plant 1/	11	11	11	12	14	16	13	16	20
LNG PLant 1/	.4	.4	.4	.4	.5	.6	.5	.6	.7
New Plant		10	10	10	10	10	10	10	10
Refinery 1/	2.2	2.2	2.2	2.2	3	4	3	4	5
Timber 1/	2	3	5	3	5	5	5	5	5
Other Vicinities:									
Coal Gasification			10		10	250	10	250	250
Mining and Mineral Processing		5	25	5	25	50	25	50	50
Nuclear Fuel Enrichment								2500	2500
Timber		5	7	5	7	7	7	7	7
New City		17	30	10	30	70	30	70	70
TOTAL (rounded)	20	50	100	50	100	410	100	2910	2920
Fairbanks Area 2/									

Industrial Capacity in MW

Source: 1974 Alaska Power Survey Technical Advisory Committee Report on Economic Analysis and Load Productions, pages 81-89.

1/ Existing Installations

2/ Timber processing and oil refinery loads totaled less than 10 MW.

energy and mineral developments from among those that appear most promising. The "lower" range generally assumes a slackening of the pace of development following the completion of the Alyeska pipeline. The "mid-range" appears to be a reasonably conservative estimate.

With the exception of the annual large load for a nuclear enrichment facility (2500 MW in the 1990 and 2000 "high range" estimates only) all of the assumed new industrial loads are considered very conservative. The main purpose of including the nuclear enrichment assumption is to illustrate that order of magnitude of loads for large energy-intensive uses.

Very rough estimates for requirements that might be anticipated for a new capital city are also included in Table 12.

The estimates do not assume major loads associated with OCS developments or very large petrochemical industries. Similarly, they do not assume rapid acceleration of mining and mineral processing.

Copper Valley Power Requirements

The Copper Valley Electric Association provides power at Valdez and Glennallen. Power requirements are relatively small, but recent rates of increase have been large because of activity related to the Alyeska pipeline and terminal construction.

Existing Situation

CVEA energy requirements have increased at an average annual rate of 10 percent from 5.6 million kwh per year in 1965, the first year CVEA served both Glennallen and Valdez, to 14.4 million kwh per year in 1974.

The 1974 peak load for the two towns was 3.5 MW. Combined installed capacity was 6.1 MW (all diesel).

CVEA recently installed 3.6 MW in Valdez and has 5.2 MW scheduled for Glennallen during 1975 with an additional 6 MW proposed for Valdez in 1976 and again in 1978. CVEA has under study a small hydro project (Solomon Gulch) and a potential intertie between Glennallen and Valdez.

Future Utility Loads

The most recent estimate of utility loads is presented in an October 1974 study prepared for CVEA.1/ The study estimated near future loads would peak at 9 MW and 46 million kwh upon construction completion of the pipeline,

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1/ Copper Valley Electric Association, Inc. 15 Year Power Cost Study Hydro/Diesel, Robert W. Retherford Associates, October, 1974.

the pipeline terminal, and an electrical interconnection between Valdez and Glennallen in 1978. The loads were estimated to level off for a few years at that time. By 1989, the study estimated the loads at 15 MW and 75 million kwh. It was envisioned that CVEA would furnish energy to the construction camp, the pipeline refrigeration station, and the utility-type loads at two oil pipeline pumping stations. Alyeska Pipeline Company estimated these loads would amount to 21.8 million kwh annually.

APA estimated CVEA power requirements based on rate of growth assumptions similar to those used for estimating the Anchorage and Fairbanks area needs. The estimates are shown in the following tabulation:

	1980		1990		2000	
Growth During Period	Energy Million kwh	Peak MW	Energy Million kwh	Peak MW	Energy Million kwh	Peak MW
High	32	7	77	18	169	38
Mid-Range	29	7	58	13	105	24
Lower	27	6	49	11	73	17

Should the Valdez area become a major manufacturing or oil processing area, the above estimates of utility loads would be much too low.

Industrial Loads

Current industrial loads include the construction camps for the pipeline terminal and pumping stations. An oil-fired steamplant will supply electric requirements and process steam at the terminal. These are relatively small loads.

The concept of using electric power for oil line pumping requirements has been advanced in previous studies. For a variety of reasons, including economics and absence of a strong area transmission system, this plan was not attractive to the pipeline company. All recognize that a substantial savings in oil could be accomplished if the pipeline were electrified, and if the power were derived from another source such as hydro or coal. Total requirements for pipeline pumping south of the Yukon River were estimated at 225,000 KW in an APA study (1969).

The concept of utilizing electricity to displace fuels would bear further attention if an Alaska route is selected for transporting natural gas from Alaska's North Slope. The substantial amount of gas needed for compressor and refrigeration stations and for liquefying the gas could be saved by substituting electric power. Informal estimates from the El Paso Natural Gas Company indicate requirements of up to 900 MW if an Alaska gas line and LNG plant were powered by electricity.

Assuming an 80 percent plant factor, this would amount to around 6 billion kilowatt hours annual energy. A large portion of the load would be at tidewater at the LNG plant.

The availability of large amounts of oil and possibly natural gas at ports on the Gulf of Alaska further suggests the possibility of establishing refineries or petroleum plants in the area.

Industrial loads associated with oil and gas pipelines and other potential industrial loads in the Prince William Sound Area have not been considered in assessments of Upper Susitna power markets and financial feasibility of the project.

Criteria for Capacity and Energy Distribution

Reservoir and powerplant capacity criteria are premised on expected use of the project to meet power demands. This section discusses the data and assumptions incorporated in the capacity criteria for the Upper Susitna Project.

The basic approach involves a set of monthly energy distribution assumptions which are used to size the project reservoirs and to determine annual firm energy production from the project. The powerplant capacity assumptions reflect the capacity needed to market the project power.

Energy Distribution

It is assumed that the energy requirements from the hydroelectric project will be proportional to total system energy requirements on a monthly basis for any given year.

Table 14 summarized 1970-1972 monthly energy distribution for the area utilities, expressed as a percent of annual energy requirements. The table also shows energy distribution assumptions used in previous hydroelectric studies in the area.

Table 14. Monthly Energy Requirements as Percent of Annual Requirements

MONTH	1961 Devil Canyon 1/	1971 Bradley Lake 2/	1970-1972 Utility Loads 3/	Recommended for Current Studies 4/
Oct.	8.9	8.3	7.9	8.0
Nov.	9.4	9.1	8.9	8.8
Dec.	10.4	11.0	10.2	9.7
Jan.	9.3	9.9	11.3	10.6
Feb.	8.1	9.0	9.2	9.0
Mar.	8.3	8.4	9.8	9.4
April	7.7	7.8	8.0	8.1
May	7.6	7.4	7.2	7.5
June	7.2	7.2	6.5	6.9
July	7.4	7.2	6.4	6.9
Aug.	7.7	7.2	7.1	7.4
Sept.	8.0	7.5	7.5	7.7
Total	100.0	100.0	100.0	100.0
SEASONAL				
Oct.-Aug.	62.1	63.5	65.3	63.6
May-Sept.	37.9	36.5	34.7	36.4

1/ USBR Feasibility report.

2/ Corps draft report, 1971

3/ Combined loads of CEA, AML&P, GVEA, FMUS, for period Oct. 1970 - Sept. 1972.

4/ Assumes total requirements consisting of 25% industrial loads and 75% of the above combined loads of the four major utilities.

For the current studies, it assumes that future load patterns will be modified somewhat as a result of industrial requirements that would tend to have a fairly even energy distribution throughout the year. As indicated on Table 14, this assumption modified seasonal distribution of energy by less than two percent.

As used in the project operation studies, firm energy capability is determined for any given combination of reservoir capacity as the amount of energy that can be delivered under critical year runoff conditions using the assumed monthly energy distribution. Under these assumptions, substantial amounts of secondary energy are available in most years, and a significant part of the reservoir capacity is used only for long term storage to increase flows in the lowest runoff years.

These methods are quite traditional for planning studies, although it is recognized operations would not follow precisely the same patterns. The project would always operate in conjunction with other thermal and hydroelectric plants in the interconnected system. Energy demands on the Susitna Project would vary because of changes in fuel supplies, generator maintenance schedules, and other factors. It is also anticipated that actual project operations would be pointed more towards maximizing annual energy production rather than long term storage to augment flows in the critical year. However, the planning study assumption provides a reasonably conservative estimate of average annual firm energy and an adequate basis for determining merits of the project.

Capacity Requirements

As discussed previously, the utility systems have had combined annual load factors slightly over 50 percent in the past few years. This is premised on non-concurrent peaks in separate systems, so actual load factors would be somewhat higher due to diversity. Data presented earlier also shows that mid-summer peaks have been running about 60 percent of mid-winter peaks, that monthly load factors generally exceed 70 percent, and that winter and summer load shapes are quite similar.

It is anticipated that there will be a trend towards somewhat higher annual load factors in the future. In addition to benefiting from any load diversity in the interconnected system, peak load management (including such action as peak load pricing) offers considerable opportunity for improving load factors, which in turn reduces overall capacity requirements for the system in any given year. For planning purposes, it is assumed that the annual system load factor will be in the range of 55 to 60 percent by the latter part of the century.

System capacity requirements would be determined by winter peak load requirements, plus allowances for reserves and unanticipated load growth. The lower summer peaks provide latitude for scheduled unit maintenance and repairs.

Daily peak load shapes for the system indicate a very small portion of the capacity is needed for very low load factor operation. It is expected that some of the gas turbine capacity which is now used essentially for base load will eventually be used mainly for peak shaving purposes; that is, it will be operating during peak load hours for the few days each year when loads approach annual peak, and operating in standby reserve for the balance of the year.

It is expected that reliability standards will be upgraded as the power systems develop. This will likely include specific provisions for maintaining spinning reserve capacity to cover possible generator outages as well as substantial improvements in system transmission reliability.

Examination of the winter daily and weekly load curves (Figure 4) indicates the base load portion is about 70 percent of total load and the peak load is about 30 percent of total load. Load factor for the peak portion is about 50 percent, and winter weekly load factors are on the order of 80 percent.

An annual plant factor of 50 percent has been selected for the Upper Susitna Project. This is largely a judgment factor reflecting the following considerations:

1. This assumption would insure capability to serve a proportional share of both peaking and energy requirements throughout the year, and adequate flexibility to meet changing conditions in any given year.

2. Any significant reduction in this capacity could materially reduce flexibility.

3. There does not appear to be a significant market for low load factor peaking capacity within the foreseeable future. There is likelihood that load management and addition of some industrial loads will increase the overall system load factor in the future, and it is expected that several existing and planned gas turbine units could eventually be used for peak shaving.

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4. It is recognized that the mode of operation for the hydro will change through time. In the initial years of operation, it is likely that the full peaking capacity would be used very infrequently. For example, the mid-range estimated system peak load for the year 2000 is 3,170 MW. Assuming load shapes similar to the current Anchorage area loads, the winter peak week would require about 2,000 MW of continuous power to cover the base loads and about 1,200 MW of peaking power. Load factors of the peak portion would be about 50 percent.

The proposed Upper Susitna hydroelectric development would provide large blocks of load factor power for the Railbelt area starting in about 1985. This section discusses alternative means of providing equivalent power supplies. It concludes that conventional coal-fired steamplants represent the most logical alternative to major hydro development for this time period.

The evaluation of alternatives is intended to help provide the basis for selecting the most appropriate course of action for meeting future demands. Reliability, prices, and environmental impacts are important aspects of such a comparison. Additionally, the range of alternatives must include only those for which technology is available (or may reasonably be expected to be available in this time frame).

Power Survey Studies

The studies for the new power survey includes fairly detailed analysis of generation costs for steamplants (coal and oil or gas-fired), gas turbines, and diesel engines. Key assumptions relative to the Railbelt were that (1) fuels suitable for use in gas turbines would be available in 1980 at a cost of from 60¢ to $1.00 per million Btu's at 1973 price levels (no inflation), and (2) that coal for steamplants would be available at a cost of from 30¢ to 60¢ per million Btu's in 1980 at 1973 prices. Table 15 summarizes the alternative generation costs presented in the survey.

Solar, wind, and tidal power were not considered as major planning alternatives.

Some very rough data on installation costs for nuclear power were presented. Most planned developments in the South "48" are in the 1000 MW class; reports at the time were indicating plant investments in the range of $500 to $600 per kilowatt; that comparable Alaska costs might be on the order of $900 to $1000 per kilowatt; and that smaller plants would likely be more costly.

Table 15. Future Generation Costs [1/]

1. Diesel-Electric (IC) Powerplants @ 50% Annual Load Factor (Public Financing)

Plant size, MW	0.2	1.0	5.0	10.0
Investment cost, $/kw	130	130	160	160
Unit generation cost, including fuels, mills/kwh:				
(Based on:	11,200 Btu/kwh		10,370 Btu/kwh)	
Fuel cost @ 20¢/gal.	30.4	25.8	23.1	21.9
Fuel cost @ 25¢/gal.	34.4	29.8	26.8	25.6
Fuel cost @ 30¢/gal.	38.4	33.8	30.5	29.3
Fuel cost @ 40¢/gal.	46.4	41.8	37.9	36.7

Notes: Costs would be higher for remote locations; alternate assumptions of private financing increases unit costs from 2.1 to 2.6 mills per kilowatthour.

2. Gas Turbine Powerplants @ 50% Annual Plant Factor (Public Financing)

Plant size, MW	20	35	50	500
Investment cost, $/kw	135	135	167	150
Unit energy costs, including fuels, mills/kwh:				
Fuel cost @ 20¢/MBtu	7.61	7.31	7.75	7.22
Fuel cost @ 30¢/MBtu	9.11	8.51	8.95	8.42
Fuel cost @ 60¢/MBtu	13.61	12.41	12.55	12.02
Fuel cost @ $1.00/MBtu	19.61	17.61	17.35	16.82
Fuel cost @ $1.41/MBtu (oil @ 20¢/gallon)	25.91	23.07	22.39	21.86

Equipment and heat rate assumptions:

20 MW open cycle, 15,000 Btu/kwh
35 MW open cycle, 13,500 Btu/kwh
50 MW regenerative cycle, 12,000 Btu/kwh

1/ Source: Advisory Committee Studies for FPC Alaska Power Survey.

Table 15. Future Generation Costs (cont.)

3. Coal-Fired Steamplants, Railbelt Area, 50% and 80% Plant Factor (Public Financing). (Assumed heat rate of 10,000 Btu/kwh)

Plant size, MW	100	200	500	1,000
Investment cost, $/kw	496	456	373	313

Unit energy costs including fuels, mills/kwh:

	50% Plant Factor Plants			
Fuel cost @ 30¢/MBtu	14.4	12.9	11.1	9.9
Fuel cost @ 60¢/MBtu	17.4	15.9	14.1	12.9

	80% Plant Factor Plants			
Fuel cost @ 30¢/MBtu	10.1	9.2	8.0	7.3
Fuel cost @ 60¢/MBtu	13.1	12.2	11.0	10.3

4. Gas-Fired Steamplants, Railbelt Area, 50% and 80% Load Factor (Public Financing). (Assumed heat rate of 10,000 Btu/kwh)

Plant size, MW	100	200	500	1,000
Investment cost, $/kw	444	409	334	280

Unit energy costs including fuels, mills/kwh:

	50% Plant Factor Plants			
Fuels @ 30¢/MBtu	13.0	11.7	10.1	9.1
Fuels @ 60¢/MBtu	16.0	14.7	13.1	12.1
Fuels @ $1.00/MBtu	20.0	18.7	17.1	16.1

	80% Plant Factor Plants			
Fuel costs @ 30¢/MBtu	9.2	8.4	7.4	6.8
Fuel costs @ 60¢/MBtu	12.2	11.4	10.4	9.8
Fuel costs @ $1.00/MBtu	16.2	15.4	14.4	13.8

Energy and Power Cost Trends

Energy and power economics are undergoing very rapid change, and these changes are extremely important in terms of new decisions on new sources of energy supply. Up until the early 1970's, most energy planning assumed that abundant, low cost energy supplies would be available on a long term basis from oil, natural gas, and nuclear fuels. Long term trends, especially since about 1950, seemed to support this assumption.

The more recent experiences, particularly since the 1973 oil embargo, provide the outlook that energy will be a precious and relatively costly commodity for the foreseeable future. Key changes include the huge increases in fuel prices, added costs for pollution control, very rapid increases in nuclear costs, and absence of any new technological break-through.

The studies for the new Alaska Power Survey reflect the start of trends towards much more costly energy supply in Alaska. Generally, these studies reflected data up through mid-1973. Events since that time indicate that most of the cost figures in the power survey are now too low. Fuel prices have continued to escalate rapidly as have costs for labor and materials.

The rapid pace of change makes many traditional cost comparisons obsolete. For example, the 1969 Alaska Power Survey and other studies at that time assumed long range generation costs using Alaska natural gas would be on the order of four mills per kilowatthour. Nationwide at that time, it was generally assumed that large nuclear and coal plants would have about the same four mill average generation cost. These figures generally became the yardsticks for measuring feasibility of new power installations.

The nuclear and coal-fired steamplants are still the major yardstick for the U.S., but is very difficult to put current values on the yardstick because of the rapid cost increase. It now appears that the minimum generation costs for large new baseload thermal plants may be in the range of 15 to 20 mills per kilowatthour for the South "48" states.

A recent Interior Department report estimated unit costs of 18.8 and 19.8 mills per kilowatthour for new baseload (70% capacity factor) nuclear and coal fired plants.[1/] This was premised on 1973 costs and 1,000 MW size plants.

1/ Energy Perspectives, USDI, 1974. Based on Project Independence studies.

That report indicated unit costs of 30 mills per kilowatthour for nuclear and 28 mills for coal if similar plants were operated at a 40 percent annual capacity factor.

In addition to rapidly increasing fuel costs, the investment costs for thermal plants have been increasing very rapidly, partly through inflation and higher rates and partly through added costs for pollution control devices. One publication indicated the following trends 1/:

Dollars per Kilowatt Installed Capacity
(Based on 1000 MW plants)

	1965	1970	1974	1984
Nuclear plants	119	222	558	850
Fossil fired steamplants	95	178	446	680

A more recent report by Edison Electric Institute indicated construction costs for coal-fired steamplants ordered in 1974 for 1979 operation would cost $525 per kilowatt. Cost of scrubbers for air pollution control amount to an additional $140-$150 per kilowatt. 2/ Smaller plants suitable for use in the Railbelt area would logically cost more.

Review of Fuel Costs and Availability

It seems certain that by 1985 Alaska's production of oil and natural gas will be a major portion of total U.S. production, and that the bulk of the Alaska production will be for export to the South "48" markets. Some cost advantage should prevail in Alaska because of the high transportation costs, however, Alaska fuel costs will certainly reflect broader national and international trends. Policies governing choice of fuels will also reflect the broader national concerns.

1/ Olds, FC; "Power Plant Capital Costs Going Out of Sight", Power Engineering, August 1974.

2/ "Utilities Hedge on Nuclear Plans; Coal Plant Prospect Brightens," Engineering News Record, August 21, 1975.

At this time, it no longer appears appropriate to assume oil and natural gas will be an available option for major power supplies in the long range where options exist to utilize other sources. If this is true, the conventional nuclear and coal-fired plants will become the most readily available alternative to development of major new hydro sources for the Railbelt.

Availability of ample supplies of coal for electric generation in the Railbelt area seems assumed as reported in the power survey. In addition to the active mine near Healy, there are active leases in the Beluga area. Development of expanded coal mining is considered very likely in the near future. It is likely that new coal mining would be primarily for export to the South "48" but opening of new mines would probably assure adequate supplies of coal for utilities use in Alaska.

Current Alaska coal production is limited to the Usibelli mine near Healy which furnishes coal to the GVEA powerplant at Healy, Fort Wainwright near Fairbanks, and Fairbanks Municipal Utility System in Fairbanks. The power survey stated mine mouth coal delivered to the Healy steamplant was 47¢ per million Btu in early 1974. Prices at the end of 1974 were as follows:

	Cents Per Million Btu	$/ton
GVEA cost at Healy powerplant	53	8.80
FMUS cost delivered to Fairbanks	85.6	14.21
Ft. Wainwright cost delivered to Fairbanks	93.2	15.46
Freight cost to Fairbanks	32.6	5.21

The cost of transportation from Healy to Fairbanks at $5.21 per ton and 8,300 Btu per pound is equivalent to 3.2 mills per kilowatthour based on 10,000 Btu/kwh.

The Federal Power Commission recently estimated the value of coal for electric generation at 60¢ per million Btu for the Fairbanks area and at 50¢ per million Btu for the Anchorage/Kenai area; in their determination of power values for the current FPC studies. 1/

1/ FPC letter of Aug. 12, 1975, to Alaska District, Corps of Engineers.

There is a wide variety of opinion on probable future cost of coal. For many years, coal prices were set a small margine above production costs to compete with low cost oil and natural gas supplies. This pricing situation has changed dramatically in recent years with the changing energy situation. The much higher prices for oil and incentives for converting from oil and gas to coal substantially increases market value of the coal.

Nationwide average prices for utility coal have increased dramatically since the early 1970's. Average price nationwide increased 57 percent in 1974 (from 51.4 to 80.9 cents per million Btu) according to FPC statistics.

The Federal Energy Administration's draft environmental impact statement on "Energy Independence Act and Related Tax Proposals" predicted a long-term price of low-sulfur coal at around $1.50/million Btu. This is premised on current price levels (no inflation), and may be too low. According to some, the price of coal will eventually rise to equal the price of oil on a cost per Btu basis, providing transportation costs are accounted for.

It seems probable that any major Alaskan coal mining would result in a pricing structure tied to the broader U.S. market, in which case Alaska should have some advantages due to transportation costs.

For purposes of this study, it is assumed that 1985 costs without inflation of utility coal for major Railbelt power supplies will be in the range of $1.00 to $1.50 per million Btu.

Fuels for conventional nuclear powerplants have also increased substantially over the past few years, but remain a comparatively small portion of average costs of nuclear generation.

Review of Available Alternatives

Coal-fired Steamplants

It is assumed that any major new coal-fired plants would be located close to mining operations, probably in the Beluga area for power supplies to the Anchorage-Cook Inlet area, and in the Healy area for power supplies to the Fairbanks-Tanana Valley. Based on relative sizes of power markets, individual plant size would likely be 500 MW or less for the Anchorage-Cook Inlet area and 200 MW or less for the Fairbanks-Tanana Valley area, and individual plants would likely have at least two units. Because of operating characteristics, and maintenance and reliability requirements, it seems unlikely that very large unit sizes (500 MW and up) could be utilized before about the year 2000.

The power survey studies included evaluations of likely costs for coal fired steamplants of 200 MW, 500 MW, and 1,000 MW capacity. The 200 MW and 500 MW sizes are considered reasonably representative of plant sizes that could be considered as alternatives to Upper Susitna power for the Fairbanks-Tanana Valley and Cook Inlet areas, respectively. Cost estimates for the 200 MW and 500 MW plants were updated for use in the current study, and the results are summarized on Table 16.

Table 16. Alternative Generation Costs for Conventional Coal-fired Steamplants

	Plant Size, MW			
	200		500	
Number of Units	2		2	
Investment Cost, Railbelt, $/kw	526		430	
Cost of Environmental Equipment $/kw	200		200	
Installed Cost	726		630	
Capital Cost, mills/kwh	14.5		12.6	
Operation and Maintenance, mills/kwh	1.6		1.3	
Fuel Cost, mills/kwh	10.0	15.0	10.0	15.0
Transmission Cost to Load Center	2.5	2.5	2.5	2.5
Total Energy Cost mills/kwh	28.6	33.6	26.4	31.4

The principle assumptions reflected in this update include:

1. Updated investment costs presented in the power survey (January 1973 price levels) to January 1975 prices used the Engineering News Record composite construction cost index. Using the Handy-Whitman steam generation plant cost index, the estimated total energy cost would be slightly higher--approximately 6 percent. The basic estimate reflects South "48" construction costs and an Alaska construction factor of 1.8.

2. Increasing the investment cost by $200 per kilowatt to reflect estimated environmental protection costs which were not specifically included in the estimate for the Alaska Power Survey. The data used in the power survey was for plants completed during the 1960's; current practice involves considerable additional expense for control of sulfur, particulates, and nitrogen oxide in stack emission and substantially increased costs for cooling water facilities.

3. Annual capital cost was determined using a 35-year life and an interest rate of 6-5/8 percent. This equals the current (FY 1976) Federal repayment rate for water projects and closely approximates a current composite of municipal and REA borrowing costs. Annual fixed charges of 8.77 percent for public, non-Federal financing were determined (including cost of money, depreciation, interim replacements, insurance and payments in lieu of taxes).

4. Operation and maintenance costs presented in this power survey were updated to July 1975 costs, using the U.S. Department of Labor Cost of Living Index. The power survey estimates reflect an Alaska cost factor of 1.50.

5. Fuel cost range of $1.00 to $1.50 per million Btu and a heat rate of 10,000 Btu per kwh.

6. Annual capacity factor of 50 percent.

7. Transmission costs are on the same basis as costs of transmitting Susitna River hydro project power to the load centers. Smaller voltage lines were assured. Distances from Beluga Lake area to Palmer area and Healy to Ester are both approximately 100 miles.

The indicated average unit cost of 26.4 to 31.4 mills per kilowatthour is intended as an assessment of alternative costs for Railbelt area power supplies from coal-fired steamplants under current cost levels.

The Federal Power Commission prepared estimates of power values for the Upper Susitna studies premised on estimates for coal-fired steam-plants for the Fairbanks and Anchorage-Kenai area. [1/] These estimates incorporate the following assumptions:

1. Interest rates of 5-7/8 percent for Federal financing; and 6.25 percent and 5.95 percent for Anchorage and Fairbanks, respectively, for public, non-Federal financing.

2. A two-unit, 150 MW plant for the Fairbanks area with fuel cost of 60¢ per million Btu and a heat rate of 12,000 Btu/kwh.

3. A three unit, 450 MW plant for the Anchorage-Kenai area with fuel costs of 50¢ per million Btu and a heat rate of 9,800 Btu/kwh.

4. The power value estimates incorporate transmission costs to the load center and a credit for the hydro based on higher availability/ reliability.

The FPC estimates were converted to an average mill rate for comparison with the other alternatives:

Fairbanks Coal-fired Alternatives

Public, non-Federal financing, 29.5 - 32.5 mills/kwh.
Federal financing (6-1/8%), 27.8 - 30.6 mills/kwh.

Anchorage-Kenai Coal-fired Alternatives

Public, non-Federal financing, 24.6 - 27.3 mills/kwh.
Federal financing (6-1/8%), 22.3 - 24.6 mills/kwh.

The above results are quite similar to the estimates based on the power survey. It is recognized that the interest rates used for FPC are somewhat lower than present Federal repayment criteria and that in other respects the two evaluations are somewhat dissimilar.

1/ FPC letter dated August 20, 1975, to Corps of Engineers.

Diesel-electric Powerplants

Several smaller towns will have no alternative but diesel electric generation until they are interconnected to a larger system.

Fuel costs remain the major cost for generation by diesel. However, equipment and construction costs have increased significantly since the power survey. Units identical to those costing $160/kw in the power survey cost $220/kw in late 1974 for 1975 delivery. 1/ Planning, engineering, and financing costs are additional. Heavy duty indoor units in the 2500 kw to 5000 kw size range are costing $300/kw, excluding site, engineering, contingencies, financing costs, and interest during construction. 2/

The following tabulation shows diesel generation costs using assumptions similar to those incorporated in the power survey studies and the more recent equipment cost data:

Plant size, MW	5.0	5.0 to 10
Type of Service	Medium duty	Heavy Duty
Heat Rate, Btu/kwh	10,370	10,000
Investment cost $/kw	270	400
Unit generation cost, including fuel, mills/kwh:		
Fuel cost @ 30¢/gal	33.3	32.8
40¢/gal	40.7	40.0
50¢/gal	48.1	47.1
60¢/gal	55.5	54.3

Assumptions include two units per plant, longer life and slightly higher efficiency for heavy duty units.

Distribution costs and losses are not included.

1/ Source: Glacier Highway Electric Association, Juneau, Alaska

2/ Source: CVEA/KPU experience

One recent study estimated diesel generation costs at 34.6 mills/kwh in 1974 based on $220/kw basic equipment costs and fuel at 33¢/gallon. 1/ Future costs for 1980 and 1985 were estimated at 58.6 and 85.4 mills/kwh assuming escalation of equipment costs at 6%/year and fuel costs at 10%/year. Actual manufacturers' cost estimates received by the same firm for similar generation equipment in July 1974 was $297/kw; considerably higher than the assumed $220/kw.

1/ R. W. Beck and Associates, Analysis of Electric System Requirements, City and Borough of Sitka, Alaska, April 1974.

Hydro

As a part of its work for the June 1967 report, Alaska Natural Resources and the Rampart Project, the Interior Department through the Bureau of Reclamation prepared an extensive inventory of Alaskan hydroelectric resources, including evaluation of potential large hydro projects that might be considered as alternatives to the Rampart proposal. The inventory with minor modification has been published in the 1969 FPC Alaska Power Survey and elsewhere.

The inventory studies, the evaluation of the few major hydroelectric potentials of Alaska (i.e., Rampart, Yukon-Taiya, Susitna, Wood Canyon, and Woodchopper) in the 1967 report, and the earlier basin and project reports of the Bureau of Reclamation are the basis of advancing Upper Susitna as the most logical major hydro development of the Alaska Railbelt at this time.

Nuclear

There are no authoritative studies of large nuclear plants for the Alaska Railbelt. There is a great deal of controversy on nuclear power -- many proponents and many opponents. APA feels that detailed evaluation would demonstrate existing nuclear technology is thoroughly adequate to assure engineering feasibility and safety for nuclear plants in the Alaska Railbelt.

However, several factors indicate nuclear power would be less attractive than coal-fired plants for near-future consideration. First is performance data on existing nuclear plants -- averaging about 70 percent machine availability nationwide because of down time for maintenance and repair and forced outages. This characteristic will improve over time, but for the present, the nuclear alternatives would probably require substantially larger system reserves.

Recent cost data indicates that for the South "48", nuclear and coal-fired costs are quite similar, with nuclear requiring a much larger initial investment. Because of higher construction costs, it is probable that nuclear power would be considerably more expensive than coal-fired power in Alaska at least for the foreseeable future.

Other Alternatives

There is a known large physical potential for tidal power development in the Cook Inlet area, but again no detailed studies are available. Tide range is considerably smaller than the better known potentials such as Passamaquoddy.

Several different concepts for developing the Cook Inlet tidal potential have been mentioned. These include a plan to drain the Inlet at the Forelands with pumped storage units to equalize output of power; and a two basin scheme which would utilize the Knik and Turnagain Arm. The latter in concept would be tied in with road or rail causeways.

Because of the interest in alternative energy sources, there is some merit to preparing a good reconnaissance of this alternative. However, considering the huge size of the work involved, the likely range of important environmental considerations, and inherent difficulty and cost of utilizing the low head available from the tide, tidal power does not constitute a reasonable alternative for determining merits of the Upper Susitna.

Similarly, geothermal power could eventually prove to be a very valuable resource for the Railbelt. Geothermal potential is considered high for the Wrangell Mountains and portions of the Alaska Range. Subsurface information is not adequate to define the resources.

Existing geothermal technology is basically limited to using the best of the resources -- preferably hot dry steam, or superheated water that can be reached at fairly shallow depth. As yet, there are no firm indications that large geothermal resources exist in Alaska that could be developed with available technology. On this basis, geothermal power cannot be considered a viable alternative at this time to major coal and hydro power.

Wind power is receiving great interest, but existing and likely near future technology is limited to small and relatively costly units. Like geothermal, the long range potential may prove very important, but wind is not a viable alternative for major new power supplies at this time.

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Part VII FINANCIAL ANALYSIS

This section presents estimates of the market for project power and evaluations of power rates needed to repay the investment in power facilities.

The Upper Susitna Project is primarily for power, though present indications are that minor portions of project costs would be allocated to other purposes, such as recreation. Preliminary estimates are that such cost allocations to other purposes would be less than one percent of the total project investment. Thus financial viability of the project becomes the essential element in demonstrating feasibility of the power development. The size of market, amount of investment, and applicable interest rate are the main factors influencing rates for power. Operation, maintenance and replacement costs are a minor part of total annual costs, so they do not influence power rates significantly. If rates needed to repay the hydro development are attractive in comparison to other alternatives that may be available, the project may be considered financially feasible.

Present Federal criteria for power producing facilities call for repayment of project costs with interest within 50 years after the unit becomes revenue producing. The applicable interest rate for Fiscal Year 1976 is 6-5/8 percent.

Market for Project Power

Previous sections presented estimates of power requirements for the interconnected Railbelt system under a range of assumptions for future development. The portion of this power market that would represent demands for project power would depend on rates of growth, changes in operating modes of other facilities, fuel policies, availability and prices, and other factors.

At the time Susitna power becomes available, the Railbelt power systems will have several hundred megawatts of capacity in oil and natural gas fired (turbine) equipment. It is assumed that because of fuel cost and other incentives, it will be desirable to place much of the gas turbine equipment in cold reserve, except for limited operation in the peak shaving mode. This is particularly true of any oil-fired equipment and the least efficient of the gas turbine equipment.

By 1985, some of the older steam-fired plants would be at or near the end of useful life and likely candidates for early retirement.

Under these conditions, it is assumed that firm demands for Susitna power would develop very rapidly.

For purposes of these preliminary rate determinations, it is assumed that the firm market for Susitna power would be up to 75 percent of the total utility requirements for the mid-range load estimates for the Anchorage-Cook Inlet and Fairbanks-Tanana Valley area. This is conservative to the extent that it does not assume any demands from the national defense or industrial load sectors. It could be optimistic if the utilities continue very heavy reliance on oil and natural gas.

Table 17 shows the 75 percent assumption in comparison with total area load estimates. As indicated on the table, 75 percent of utility requirements is equivalent to 61 to 66 percent of total area requirements during the 1985-1995 period.

It is recognized that these are oversimplified market assumptions, and that the market estimates will require continued refinement as project plans and design are prepared. If it should develop that future demands for project power are somewhat lower, it is reasonable to assume that the project would be staged over a somewhat longer period of time.

Assumptions for secondary energy sales are as follows:

1. With Devil Canyon operating alone, there is relatively little flexibility for scheduling secondary energy so the market for such energy would be limited. The Corps operation studies indicate average annual secondary energy capability of 201 MW. It is assumed that the marketable portion would be 10 MW in the first year of operation (equivalent to 86 million kilowatthours at the market), and that this market would expand in 10 MW increments to 50 MW in the fifth year of operation.

   This assumes that the secondary energy could be offered in sizable blocks with guaranteed duration of two to six months, depending on forecasts of reservoir operations, but that relatively little of this energy would be available during mid-winter.

Table 17. Assumed Market for Upper Susitna Power

Potential market for new hydroelectric power and energy (based on 75% of estimated mid-range utility requirements)

Year	Annual Peaking Requirements 1000 kw Anchorage	Fairbanks	Total	Annual Energy Requirements Million kwh Anchorage	Fairbanks	Total
1985	630	160	790	2,760	690	3,450
1986	680	170	850	2,950	740	3,690
1987	720	180	900	3,165	790	3,955
1988	770	190	960	3,395	840	4,235
1989	830	200	1,030	3,640	900	4,540
1990	890	220	1,110	3,900	960	4,860
1991	940	230	1,170	4,140	1,010	5,150
1992	1,000	240	1,240	4,400	1,070	5,470
1993	1,060	260	1,320	4,670	1,130	5,800
1994	1,130	270	1,400	4,950	1,200	6,150
1995	1,200	290	1,490	5,250	1,260	6,510

Comparison With Total Area Power Requirements

Year	Anchorage & Fairbanks requirements (Mid-range Estimates) Peak 1000 kw	Annual Energy Million kwh	Assumed Market for new Hydroelectric Power Peak 1000 kw	Annual Energy Million kwh
1985	1,220	5,560	790 (65) 1/	3,450 (62) 1/
1990	1,670	7,620	1,110 (66) 1/	4,860 (62) 1/
1995	2,300	10,680	1,490 (65) 1/	6,510 (61) 1/

1/ Percent of total area requirements.

2. With the multiple reservoir systems, it is assumed that market flexibility could be substantially enhanced and that marketing policies would be premised on maximizing annual energy production. In practice, this would likely be achieved by setting firm energy contracts close to average annual energy capability with exchanges and off-peak purchases and to meet contract commitments during low runoff years.

   The Corps operation studies indicate average annual secondary capability ranging from 40 to 108 MW for the multiple reservoir system. For purposes of the rate studies, it is assumed the full amount of the secondary energy could be marketed starting in 1990. The Corps values for secondary power were converted to annual energy and transmission losses were deducted to derive the amounts of secondary energy sales used in the rate studies:

   System #1 - 690×10^6 kwh/year sales.
   System #2 - 932×10^6 kwh/year sales.
   System #3 - 345×10^6 kwh/year sales.
   System #4 - 630×10^6 kwh/year sales.
   System #5 - 690×10^6 kwh/year sales.

3. A rate of 10 mills per kilowatthour is assumed for secondary sales.

Scoping Analysis

APA prepared a set of estimates of average power rates needed to repay costs of the alternative hydro development plans. This provided a basis for looking at the alternative plans from the viewpoint of impact on power rates. These studies were premised on preliminary designs and estimates prepared by the Corps of Engineers (dams and powerplants) and APA (transmission systems and operation and maintenance) as reported in the September 1975 draft reports of the two agencies.

These preliminary rate estimates are summarized in Table 18 and the cost assumptions incorporated in them are summarized in Table 19. Note that there have been substantial changes in the cost estimates since the September draft report as dicusssed later.

Table 18. Average Rates for Repayment for Alternative Development Plans 1/

	System Plan	Average Rates for Firm Energy (Mills/kwh)
System #1	Devil Canyon (W.S. 1450), 1985 Denali (W.S. 2535), 1990	24.5
1-A	Devil Canyon and Denali both on line, 1985 (USBR plan; Corps costs).	21.9
1-B	Same, but USBR-APA costs, Denali	20.7
System #2	Devil Canyon (W.S. 1450), 1985 Watana (W.S. 2050), 1990	21.4
2-A	Watana, 1985 Devil Canyon, 1990 (Revise order of construction)	21.0
System #3	Devil Canyon (1450), 1985 Watana (2050), 1990 Denali (2535), 1995	20.9
System #4	Devil Canyon (1450), 1985 Denali (2535), 1990 Vee (2300), 1995 Watana (1900), 2000	24.2
4-A	Devil Canyon & Denali both on line, 1985 Vee 1990 Watana, 1995 (USBR plan; Corps costs).	22.8
System #5	Watana (2200), 1986 Devil Canyon (1450), 1990	19.7

1/ Preliminary scoping analysis for September 1975 draft report; does not reflect cost changes since that time.

Table 19. Cost Summary for Alternative Systems [1]

System # 1

Unit	Devil Canyon	Denali	Total System
W. S. Elev.	(1450)	(2535)	
Completion Date	1985	1990	
	Costs - $1,000		
Power Production Facilities			
Construction Costs	389,000	231,400	
Interest During Construction	64,430	45,990	
Investment Cost	453,430	277,390	730,820
Transmission Facilities			
Construction Costs	114,100	-	
Interest During Construction	11,340	-	
Investment Cost	125,440		125,440
Total System Investment Cost			856,260
Annual Operation and Maintenance			1,538
Annual Replacement			177
Annual OM & R			1,715

1/ Costs are for preliminary scoping analyses in September 1975 draft report and do not reflect revisions since that time.

Table 19. Cost Summary for Alternative Systems 1/
(Continued)

System # 2

Unit	Devil Canyon	Watana	Total System
W. S. Elev.	(1450)	(2050)	
Completion Date	1985	1990	
Costs - $1,000			
Power Production Facilities			
Construction Costs	389,000	600,000	
Interest During Construction	64,430	119,250	
Investment Cost	453,430	719,250	1,172,680
Transmission Facilities			
Construction Costs	184,310	18,540	
Interest During Construction	18,320	1,840	
Investment Cost	202,630	20,380	223,010
Total System Investment Cost			1,395,690
Annual Operation and Maintenance			1,883
Annual Replacement			396
Annual OM & R			2,279

1/ Costs are for preliminary scoping analyses in September 1975 draft report and do not reflect revisions since that time.

Table 19. Cost of Summary for Alternative Systems 1/

(Continued)

System # 3

Unit	Devil Canyon	Watana	Denali	Total System
W. S. Elev.	(1450)	(2050)	(2535)	
Completion Date	1985	1990	1995	
Costs - $1,000				
Power Production Facilities				
Construction Costs	389,000	600,000	231,400	
Interest During Construction	64,430	119,250	45,990	
Investment Cost	453,430	719,250	277,390	1,450,070
Transmission Facilities				
Construction Costs	184,310	18,540	–	
Interest During Construction	18,320	1,840	–	
Investment Cost	202,630	20,380	–	223,010
Total System Investment Cost				1,673,080
Annual Operation and Maintenance				1,883
Annual Replacement				396
Annual OM & R				2,279

1/ Costs are for preliminary scoping analyses in September 1975 draft report and do not reflect revisions since that time.

Table 19. Cost Summary for Alternative Systems 1/
(Continued)

System # 4

Unit	Devil Canyon	Watana	Denali	Vee	Total System
W. S. Elev.	(1450)	(1905)	(2535)	(2300)	
Completion Date	1985	2000	1990	1995	
		Costs - $1,000			
Power Production Facilities					
Construction Costs	389,000	486,400	231,480	399,000	
Interest During Construction	64,430	96,670	45,990	19,300	
Investment Cost	453,430	583,070	277,390	478,300	1,792,190
Transmission Facilities					
Construction Costs	184,310	7,930	-	29,130	
Interest During Construction	18,320	790	-	2,890	
Investment Cost	202,630	8,720		32,020	243,370
Total System Investment Cost					2,035,560
Annual Operation and Maintenance					2,269
Annual Replacement					549
Annual OM & R					2,818

1/ Costs are for preliminary scoping analyses in September 1975 draft report and do not reflect revisions since that time.

Table 19. Cost Summary for Alternative Systems 1/
(Continued)

System # 5

Unit	Devil Canyon	Watana	Total System
W. S. Elev.	(1450)	(2050)	
Completion Date	1990	1986	
Costs - $1,000			
Power Production Facilities			
Construction Costs	403,000	737,000	
Interest During Construction	67,000	146,000	
Investment Cost	470,000	883,000	1,353,000
Transmission Facilities			
Construction Costs	6,000	197,000	
Interest During Construction		20,000	
Investment Cost	6,000	217,000	223,000
Total System Investment Cost			1,576,000
Annual Operation and Maintenance			1,883
Annual Replacement			396
Annual OM & R			2,279

1/ Costs are for preliminary scoping analyses in September 1975 draft report and do not reflect revisions since that time.

The method used involves calculating 1985 present worth values of investment and OM&R costs and energy sales and reducing both to equivalent annual values. Revenues from secondary energy (10 mills per kilowatthour) are deducted from equivalent annual costs. An average rate for firm energy to recover the remaining costs is then computed.

In each case, the repayment period covers 50 years after each unit becomes revenue producing under the market assumption presented earlier, the full firm energy capability of each unit could be marketed in the first year after completion. The rate determination also incorporates the market assumptions for secondary energy which were presented previously.

Table 21 summarizes the average rates for firm energy for the four systems and also illustrates effect on rates of alternate assumptions of scheduling project units.

The highest indicated rate is for System #1 (24.5 mills per kilowatthour). This reflects the very limited energy capability of a Devil Canyon Project for the first five years without upstream storage. System 1-A (21.9 mills) assumes the same design and costs, but completion of both Devil Canyon and Denali in 1985 as proposed in the USBR-APA plan. The indication is that if Devil Canyon operates for a significant time period without upstream storage, power rates would be significantly increased.

Power rates are of course very sensitive to design assumptions. The USBR estimates for Denali Dam were prepared on a very conservative design reflecting the foundation conditions at that site. This is discussed in the May 1974 Status Report. A rough update of the USBR costs to January 1975 price was made. This indicates the new Corps estimates for Denali are approximately 20 percent higher than would be derived from the Bureau estimates. System 1-B, (20.7 mills) using USBR costs updated to January 1975, indicates the added conservatism in the Corps estimate adds about 1.2 mills to the average rate.

System 2-A assumes Corps design and costs but reverses the order of construction. (Watana on line in 1985 and Devil Canyon on line in 1990.) This indicates a small reduction in average rate, again related to the limited storage capacity at Devil Canyon.

System 4-A assumes Corps design and costs completion of Devil Canyon and Denali in 1985, with Vee and Watana following at five-year intervals.

If USBR design assumptions were used for Denali, the rates for System #3, #4, and #4-A would be somewhat lower than shown on the table.

System #5 has the lowest indicated rate (19.7 mills per kilowatthour), or approximately 5 percent lower than System #1-B, #2-A, and #3.

The general conclusions from the preliminary analysis includes:

1. There appears to be several alternative development plans for the Upper Susitna that would yield approximately equivalent power rates to the consumer, and that on the basis of the power rates there is little preference as between plans.

2. The importance of upstream storage above Devil Canyon is evident.

3. The studies indicate merit to the Denali unit as a possible future addition.

Comparison with May 1974 Status Report

APA's May, 1974, Devil Canyon Status Report provides a basis for comparing recent cost changes. The development plan presented in the Status report is analogous to the Corps System #1, except that APA assumed completion of both the Devil Canyon and Denali units at the same time while the Corps System #1 assumes Denali would be completed five years after Devil Canyon.

The Status Report used January 1974 price levels and the applicable interest rates for FY 1974 which was 5-5/8 percent for repayment. The present studies are premised on the FY 1976 interest rate of 6-5/8 percent and January 1975 price levels.

The year ending January 1975 had very high rates of inflation in all segments of the economy. The Bureau of Reclamation's composite construction cost index increased 21 percent for the period.

The change in interest rates without any inflation would increase annual repayment requirements by about 18 percent. The combination of higher costs and higher interest rates represents approximately a 42 percent increase in annual costs as indicated on Table 20.

Table 20. Comparison with May 1974 Status Report

	Status Report Plan (Devil Canyon + Denali)		
Price Level	Costs as in May 1974 Status Report January 1974	Current Studies January 1975	Increase
Applicable interest rate for repayment	5-5/8%	6-5/8%	
Estimated construction cost, $ millions	597.1	724	+21%
Interest during construction $ millions	84.9	121	
Investment cost $ millions	682	845	
Annual payment, excluding OM&R, $ millions	41.0	58.1	+42%

Revised Cost Estimates

During the review process, there were some significant changes in cost assumptions for the various alternative development plans. From the viewpoint of the power market, the changes all favored System #5--that is relative cost increases for System #5 were substantially smaller than for the other alternatives under consideration.

A preliminary check was made using the new costs which indicated the following average rates for the various systems: (same system designation as Table 18)

System #5 - 20.4 mills/kwh
System #2A - 22.3 mills/kwh
System #2 - 23.0 mills/kwh
System #1B - 23.0 mills/kwh
System #3 - 23.3 mills/kwh

Again the range is relatively small, but under the latest cost assumptions, System #5 would have about 10 percent lower power rates than the next most favorable plan.

Average Rate Determination for Proposed Plan

Table 21 summarizes the estimate of average rate for firm energy needed to repay investment in the project facilities. The methods used are the same as for the scoping analysis. The indicated average rate is 21.1 mills per kilowatthour.

Note that the scoping analyses discussed previously found a 20.4 mill average rate for System #5. The difference of 0.7 mills reflects added transmission costs adopted for the proposed plan (substation in Talkeetna vicinity, switchyard near Healy, and two single circuit lines in lieu of the double circuit assumptions used in the scoping analyses).

The indicated rate for the proposed plan is significantly lower than the estimated costs of power from coal-fired steamplants. The analysis does not reflect allowance for future inflation. A rough estimate indicates that with a five percent per year cost escalation and construction schedules as contemplated in the Corps proposal, required rates for the system would exceed 40 mills per kilowatthour.

Table 21. Average Rate Determination - System #5 (Watana + Devil Canyon)

Year	Project Costs, $1000 Revenue Producing Investment	Project Costs, $1000 OM&R	1986 PW Costs $1,000 Investment	1986 PW Costs $1,000 OM&R	Project Energy Sales, Million Kwh Firm Energy	Secondary Energy	1986 PW Firm Energy	1986 PW Secondary Energy
1986	1,278,810	1829	1,278,810		3054	86	(1986 to 1989)	81
1987		"			"	172	10,431	151
1988		"			"	258		213
1989		"			"	344		266
1990	489,240	2400	378,520		4860	690	3,527	(1990 to 2040)
1991		"			5150	"	3,505	7,732
1992		"			5470	"	3,491	
1993		"			5800	"	3,472	
1994		"			6058	"	(1994 to 2040)	
							51,873	
2040								
Totals			1,657,330				76,299	8,443
Annual or Annual Equivalent			113,345	2,267			5,218	577

Average Rate Computation:

(1) Annual Costs:

	Capital	$113,345,000
	OM&R	2,267,000
	Total	$115,612,000
(2) Revenue from secondary energy @ 10 mills/kwh		- 5,770,000
(3) Required revenue from firm energy sales		$109,842,000
(4) Equivalent annual firm energy sales		5,218,000,000 kwh

(5) Average rate for repayment 109,842,000/5,218,000,000 = 21.1 mills/kwh

Power Marketing Considerations

The average rate is useful mainly as a basis for easy comparison of the proposal and the alternatives. Actual marketing contracts would likely include separate provisions for demand and energy charges and account for wheeling charges, reserve agreements, and other factors.

There are some built in inequities for any given method of pricing. Most utility systems and most large Federal systems use essentially a postage stamp rate, that is power rates set the same for all delivery points on the system. Actual costs of serving the loads vary with the distance and size and characteristics of load--it is more costly to serve a small load several miles from the power source than to serve a larger load nearby. Policies vary from system to system as to portions of "hookup" costs born by the customers.

Actual rates for the Susitna system might reflect several items of costs and revenues not identified in the project studies. For example, it is likely that considerable use of project facilities would be made over the life of the project to wheel power from other sources. Any wheeling revenues would lower overall project power rates somewhat. Conversely wheeling costs for project power delivered over non-Federal transmission lines would need to be worked into project rate schedules. This is now done under APA marketing contracts for the Snettisham Project; there are many similar situations in other Federal power systems.

Rough estimates were made on a cost-of-service basis for power delivered at Fairbanks and at Point MacKenzie under the proposed plan. These indicated that about 85 percent of the project costs (or about 17.9 of the 21.1 mills per kilowatthour average rate) is involved in producing the power (Devil Canyon and Watana units and the transmission line between Devil Canyon and Watana). The remaining 15 percent is for transmission facilities to the major load centers. If the transmission costs were charged to power delivered at the two load centers on a cost of service basis, average rates would be about 25.2 mills per kilowatthour at Fairbanks and 20.2 mills at Point MacKenzie. The difference relates to distance and size of load.

As stated elsewhere, the transmission plan to deliver project power in Anchorage would need to be worked out in the detailed post authorization studies. It would involve added costs, either through wheeling charges for project power over non-Federal lines or project transmission lines around or under Knik Arm. These costs could be about the same for alternative power sources such as the Beluga coals.

It is considered essential that scheduling of project facilities be closely tied to the marketing function.

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Market Aspects of Other Transmission Alternatives

It is reasonable to expect modifications of the project transmission system to meet changing requirements through time. The capacity of the main 345 kv and 230 kv lines could be upgraded substantially as needs arise by adding compensation and transformer capacity. Additional substations could be provided as warranted by future loads and subject to a case by case determination of economics. Similarly, extensions of the project transmission lines to serve other areas would be considered on the basis of needs, and economics, and available alternatives.

Anchorage-Cook Inlet Area

The costs in the proposed plan are premised on delivery points to substations near Talkeetna and Point MacKenzie. Rough estimates indicate similar costs for a plan with delivery points at Talkeetna, Point MacKenzie, and the existing APA Palmer substation. Thus, basically the project costs can provide delivery points on the existing CEA and APA systems north of Knik Arm, but do not include costs of delivering the power across or around the Arm.

With or without the Susitna Project, additional transmission capability is needed on the approaches to Anchorage. The CEA plan of Knik Arm loop at 230 kv is an important step in developing this capability, but additional capacity would be needed by the mid-1980's. Essentially the same problems would exist with alternative power sources such as the Beluga coals, so in this sense the solution doesn't bear on the merits of the Upper Susitna Project.

Detailed studies following project authorization would need to consider the several alternatives for providing power across Knik Arm. Costs would be worked into rate structures either through wheeling charges on non-Federal lines or project lines if needed.

Glennallen and Other Points on the Richardson Highway

Rough estimates were made for transmission systems to deliver project power to the CVEA system at Glennallen. Line distance from Palmer is approximately 136 miles.

The studies consisted of rough cost estimates for alternative 138 kv and 230 kv lines and comparison with load data presented previously. They indicated that on the basis of normal utility requirements, an intertie to Glennallen could probably not be justified until after 1990, then a line to Glennallen is included in the plans and costs for the initial development proposal.

Over the long term, it appears that a transmission loop from Palmer to Glennallen and then north along the Richardson Highway to interconnect with the CVEA system should receive further consideration.

EXHIBIT G-1

PARTIAL BIBLIOGRAPHY OF RELATED STUDIES

Partial Bibliography of Related Studies

1. Advisory Committee Reports for Federal Power Commission Alaska Power Survey:

   Report of the Executive Advisory Committee, December 1974
   Economic Analysis and Load Projections, May 1974
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3. Devil Canyon Status Report, Alaska Power Administration, May 1974.

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12. Alaska Railbelt Transmission System, working paper, Alaska Power Administration, December 1967.

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14. Central Alaska Power Study, The Ralph M. Parsons Company, undated.

15. Alaska Power Feasibility Study, The Ralph M. Parsons Company, 1962.

EXHIBIT G-2

UPPER SUSITNA RIVER HYDROELECTRIC STUDIES

REPORT ON OPERATION, MAINTENANCE,

AND REPLACEMENTS

Contents

Tables

Figures

Introduction and Summary

This paper presents estimates of the annual recurring costs for project operations and maintenance, power marketing, and replacements for the Upper Susitna hydroelectric projects.

Figure 1 shows general locations of the potential units of the Upper Susitna project in relationship to the Alaska Railbelt. The four key Upper Susitna damsites are Devil Canyon, Watana, Vee, and Denali.

Separate estimates were prepared for each of five alternative development plans or systems. The five alternatives are identified on Table 1 along with power and energy capability for each system.

The Corps of Engineers proposes an initial development consisting of the Devil Canyon and Watana sites (System #5). The high Watana dam plan is proposed to be constructed first followed by the Devil Canyon unit.

The estimates reflect APA's assumed operation plan for the project power-plants, reservoirs, and transmission lines, as well as estimated costs for power marketing and overall project administration.

Summary of Operation, Maintenance, and Replacement Costs

	Annual Operation and Maintenance $1,000	Annual Replacement $1,000	Total OM&R $1,000
System #1 - Devil Canyon and Denali	1,538	199	1,737
System #2 - Devil Canyon and Watana	1,833	453	2,286
System #3 - Devil Canyon, Watana & Denali	1,833	453	2,286
System #4 - Devil Canyon, Watana, Denali, & Vee	2,269	618	2,887
System #5 - Devil Canyon & Watana (proposed plan)	1,833	517	2,340

Table 1. Alternative System Plans
Installed Capacity & Firm Energy

System	W.S. el. M.S.L.	P.O.L. Date	Devil Canyon Installed Capacity 1000 kw	Devil Canyon Firm Energy Million kwh	Watana Installed Capacity 1000 kw	Watana Firm Energy Million kwh	Vee Installed Capacity 1000 kw	Vee Firm Energy Million kwh	System Total Installed Capacity 1000 kw	System Total Firm Energy Million kwh	System Total Secondary Energy Million kwh
System #1											
Devil Canyon	1450	1985	580	2497							
Denali	2535	1990									
									580	2497	701
System #2											
Devil Canyon	1450	1985	600	2628							
Watana	2050	1990			470	2059					
									1070	4687	946
System #3											
Devil Canyon	1450	1985	700	3066							
Watana	2050	1990			670	2935					
Denali	2535	1995									
									1370	6001	350
System #4											
Devil Canyon	1450	1985	713	3119							
Denali	2535	1990									
Vee	2300	1995					300	1314			
Watana	1905	2000			421	1840					
									1434	6273	640
System #5											
Watana	2200	1986			792	3101					
Devil Canyon	1450	1990	776	3048							
									1568	6149	701

Notes: System #5 is the proposed initial development plan.
Data is from Corps of Engineers studies.

Operation Assumptions

For purposes of this study, it is assumed the project headquarters and main operations center would be near Talkeetna or at some other equally accessible point on the system. It is recognized the remote operations center is not dependent on being adjacent to a powerplant.

This central project headquarters, would house the remote powerplant operation and dispatch center. Powerplant operation and dam and reservoir operations would be from this operation-dispatch center for each plan. Electrician/operators and mechanic/operators would be located at the powerplants to provide for routine maintenance and manual operation when required. Denali dam would be remote controlled, with a caretaker in residence at the damsite. Specialized personnel such as electronic technicians, and meter and relay repairmen would serve at the several powerplants and substations, but would work out of project headquarters.

Project administration, including supervision of power production, water scheduling, and transmission facilities, would be from project headquarters.

Major turbine and generator inspection and maintenance work would be accomplished by electricians, mechanics, engineers, other experienced APA personnel, and manufacturers' representatives as required.

Alaska Power Administration's main office would handle power marketing, accounting, personnel management, and general administrative matters.

Transmission line maintenance would be handled by two linecrews with integration of the Eklutna Project linecrew. Transmission line maintenance warehouses and parts storage yard would be located at Devil Canyon or Watana, approximately midway between Devil Canyon and Fairbanks, and at project headquarters. Members of the linecrew would be stationed along the line, transmission maintenance stations, and the major substations to provide routine line patrol and minor caretaking tasks and security around the facilities. For major maintenance work, the transmission line crew members would gather at the problem area.

Visitor facilities with provisions for self-guided tours through the powerplant would require only occasional assistance from operation personnel.

Project related recreational facilities would involve cooperation between Federal, State, and local interests and likely be maintained by a State or local entity.

Project operation, maintenance and administration would likely include the existing Eklutna Project, with a resulting net savings to the electrical consumer. Eklutna would be supervisory controlled from the main operations center with electricians/operators and mechanic/operators stationed at Eklutna. It is estimated that approximately $100,000 per year could be saved by joint operation of the Eklutna and Susitna Projects.

Marketing and Administration

The marketing and administration aspects involve three main functions:

1. Administration

    Personnel management
    Property management
    Budgeting
    Marketing policy
    Rate and repayment studies

2. Accounting

    Customer billing
    Collecting
    Accounts payable
    Financial records
    Payroll

3. Marketing

    Rate schedules
    Power sales contracts
    Operating agreements
    System reliability and coordination

Part of this work would be carried out by the project headquarters; overall administration and support services would be handled by the APA headquarters staff.

Annual Costs

The estimated costs for operation, maintenance, marketing, and administration are based on itemized estimates of personnel, equipment, supplies, and services required to accomplish the work.

Operation and maintenance requirements for Systems #2, #3, and #5 would be substantially the same. Each of the three plans has powerplants at Devil Canyon and Watana that are similar except for installed capacity (1070 MW for System #2, 1370 MW for System #3, 1568 MW for System #5). Number of units and powerplant layout is the same for the three plans, so staffing would be essentially the same for each plan. System #3 includes Denali Dam, but added O&M costs for the structure would be minor. For purposes of this study, annual operation and maintenance costs are assumed the same for the three plans.

The estimate assumes Federally classified personnel providing management and administrative functions and wage grade personnel doing the physical day-to-day technical operation and maintenance of the project. Wage rates for the classified employees are based on the middle rate within a grade. Wage grade personnel rates are based on prevailing wages in effect in the Anchorage area and reflect basic hourly rates, benefits, and overtime provisions.

Costs of supplies, equipment and personnel requirements are based on Bureau of Reclamation Guidelines, characteristics of equipment, and Alaska Power Administration operating experience on the Eklutna and Snettisham Projects in Alaska. The Eklutna project is a fully staffed facility, including a transmission linecrew, which has been operated by APA and its predecessor agency since project construction in 1955. The Snettisham Project is an isolated project, separated from Juneau load center by 45 miles of rugged terrain and water. A maintenance crew performs routine maintenance at the project site, while project operations are remotely controlled from Juneau. It is envisioned that the Upper Susitna River Basin Project would have some characteristics of both projects.

Itemized costs for operation, maintenance, marketing, and administration for the alternative plans of development are present in Table 2.

Costs by major category and number of personnel are summarized on Table 3.

Replacements

The annual replacement cost provision establishes a fund to finance major items which have a life period of less than fifty years for project repayment. The objective is to cover costs and insure financing for a timely replacement of major cost items to keep the project operating efficiently throughout its entire life.

Items covered include generator windings, communication equipment, a small percent of the transmission towers, and several items in the substation and switchyards. Items covered by routine annual maintenance costs and not covered by the replacement fund include vehicles, small buildings, camp utilities, and materials and supplies. Major features such as dams and powerplant structures are considered to have service lives longer than the 50-year project repayment period and their costs are not covered by the replacement funds.

The annual replacement cost is based on experienced data by the Bureau of Reclamation. The procedure and basic factors have been adopted by the Department of Interior. The factors developed provide a sinking fund for the various items so that by the end of the items' service life, the fund will be large enough to replace it. The same interest rate used for project repayment is used to establish the sinking fund. The Fiscal Year 1976 rate of 6-5/8 percent was established by the Department of the Treasury.

The factors apply to the entire powerplant, substation, and switchyard. They apply to the transmission towers, fixtures and conductors on the transmission system. Right-of-way and clearing costs are not included.

Table 4 presents the annual replacement factors based on 6-5/8 percent interest rate, the costs of the pertinent project feature, and the annual replacement fund for the alternative plans of development. The project costs are on a January 1975 basis. Powerplant costs are from Corps of Engineer estimates while Alaska Power Administration estimated the transmission, substation, and switchyard costs.

TABLE 2. ITEMIZED OPERATING & MAINTENANCE COST ESTIMATE

SYSTEM 1. DEVIL CANYON AND DENALI

Devil Canyon	600 MW	100 MW Future, 5 units
Denali	No Power	

Personnel

Supervisory & Classified		
Project Manager	GS-14	$ 30,000
Assistant Project Manager	GS-13	24,700
Electrical Engineer	GS-12	22,200
Mechanical Engineer	GS-12	22,200
Supply & Property	GS-9	14,500
Administrative Assistant	GS-7	12,000
Secretary	GS-5	9,600
Total Supervisory & Classified Wages		135,200
Wage Grade		
Electricians	2 @ 13.00 hr.	54,080
Mechanics	2 @ 13.00 "	54,080
Heavy Duty Equip. Operator	1 @ 13.00 "	27,040
Maintenance Man	2 @ 11.00 "	45,760
Meter Relay Mechanic	1 @ 13.00 "	27,040
Electronic Technician	1 @ 13.00 "	27,040
Powerplant Operators	6 @ 13.00 "	162,240
Ass't. Powerplant Operators	4 @ 11.00 "	91,520
Total Wage Grade Wages		488,800
Line Crew		
Foremen	2 @ 15.00 hr.	62,400
Linemen	4 @ 13.00 "	108,160
Equipment Operators	2 @ 13.00 "	54,080
Groundmen	4 @ 13.00 "	108,160
Total Line Crew Wages		332,800
C.O.L.A.--25%		33,800
Shift Differential		15,000
Sunday Pay		8,000
Overtime		25,000
Government Contributions		86,100
Longevity N. A.		--
Total Fringe Benefits for Personnel		167,900
TOTAL PERSONNEL COST		$1,124,700

TABLE 2. (Continued)--ITEMIZED OPERATION & MAINTENANCE COST ESTIMATE

SYSTEM 1--(Continued)--DEVIL CANYON AND DENALI

Miscellaneous

Telephone	$ 8,000
Official travel	15,000
Vacation travel	15,000
Supplies, Services & Maintenance--Powerplant	100,000
Supplies & Services--Vehicles & Equipment	40,000
Employee training	5,000
Line spray	20,000
Government camp maintenance	15,000
Total Miscellaneous	218,000

Equipment Operation & Maintenance, Annual Replacement Cost

	I.C.*	S.L.*	ANNUAL COST
D-8 - (1)	$90,000	10	9,000
980 - (1)	50,000	10	5,000
Maintainer - (1)	50,000	10	5,000
Pickups - (4) & (6)	36,000	7	5,200
Sedan - (1)	4,000	7	600
Lowboy - (1)	45,000	10	4,500
Dumptruck - (1)	25,000	10	2,500
Flatbed - (4) & (2)	20,000	7	3,000
Firetruck - (1)	25,000	10	2,500
Sno tracs - (2)	16,000	7	2,300
Backhoe - (1)	20,000	10	2,000
Crane, 50 ton - (1)	150,000	20	7,500
Hydraulic Crane, 20 ton - (1)	90,000	20	4,500
Line trucks - (4)	100,000	10	10,000
Total Equipment, etc.			63,600

APA main office administration, accounting, collecting, marketing expenses.	132,000
TOTAL SYSTEM 1	$1,538,300

* S.L. = Service Life
I.C. = Initial Cost

TABLE 2. (Continued)--ITEMIZED OPERATION & MAINTENANCE COST ESTIMATE

SYSTEM 2. DEVIL CANYON AND WATANA 1/

Devil Canyon	700 MW
Watana	600 MW

Personnel

Watana Supervisory Control from Devil Canyon

Increase base staff of System 1.

2 Assistant operators	@ 11.00 hr.		$ 45,760
2 Electricians	@ 13.00 "		54,080
2 Mechanics	@ 13.00 "		54,080
1 Maintenance man	@ 11.00 "		22,880
			176,800
Overtime			10,000
Government Contributions			16,000
Foreman Pay			5,000
			31,000

Miscellaneous

Vacation travel	3,000
Employee training	1,000
Supplies, Services & Materials	90,000
Supplies and Services	10,000
	104,000

Equipment

	* I.C.	* S.L.	
2 Pickups	12,000	7	2,000
1 Snow tractor	8,000	7	1,000
			3,000

APA main office administrative, accounting, collecting & marketing expense	30,000
TOTAL ADDITIONS TO SYSTEM 1	344,800
SYSTEM 1	1,538,300
TOTAL SYSTEM 2	$1,883,100

1/ Same operation and maintenance estimate used for System #2, #3, and #5.

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TABLE 2. (Continued)--ITEMIZED OPERATION & MAINTENANCE COST ESTIMATE

SYSTEM 4--DEVIL CANYON AND WATANA AND VEE

Vee 300 MW

Personnel

Add to System # 2:

1 Heavy equipment operator	@ 13.00 hr.	$ 27,040
2 Electricians	@ 13.00 "	54,080
2 Mechanics	@ 13.00 "	54,080
2 Maintenance men	@ 11.00 "	45,760
1 Operator	@ 13.00 "	27,040
1 Assistant operator	@ 11.00 "	22,900
Total Wage Grade		$ 230,900
Overtime		10,000
Government Contributions		20,800
Foreman Pay		5,000
Total Fringe Benefits		35,800

Miscellaneous

Vacation travel	6,000
Employee training	2,000
Supplies, Services and Materials--Powerplant & vehicles	50,000
Total Miscellaneous	58,000

Equipment, Operation & Maintenance, Annual Replacement Cost

D-8	9,000
Maintainer	5,000
Pickups - (4)	3,400
Dumptruck	2,500
Firetruck	2,500
Sno tracs - (2)	2,300
Backhoe	2,000
Hydraulic Crane, 20 ton	4,500
Total	31,200

APA main office administration, accounting, collecting, marketing expenses.	30,000
Total Additions to System 2	385,900
System 2	1,883,100
TOTAL SYSTEM 4	$2,269,000

TABLE 3. OPERATION AND MAINTENANCE COST SUMMARY

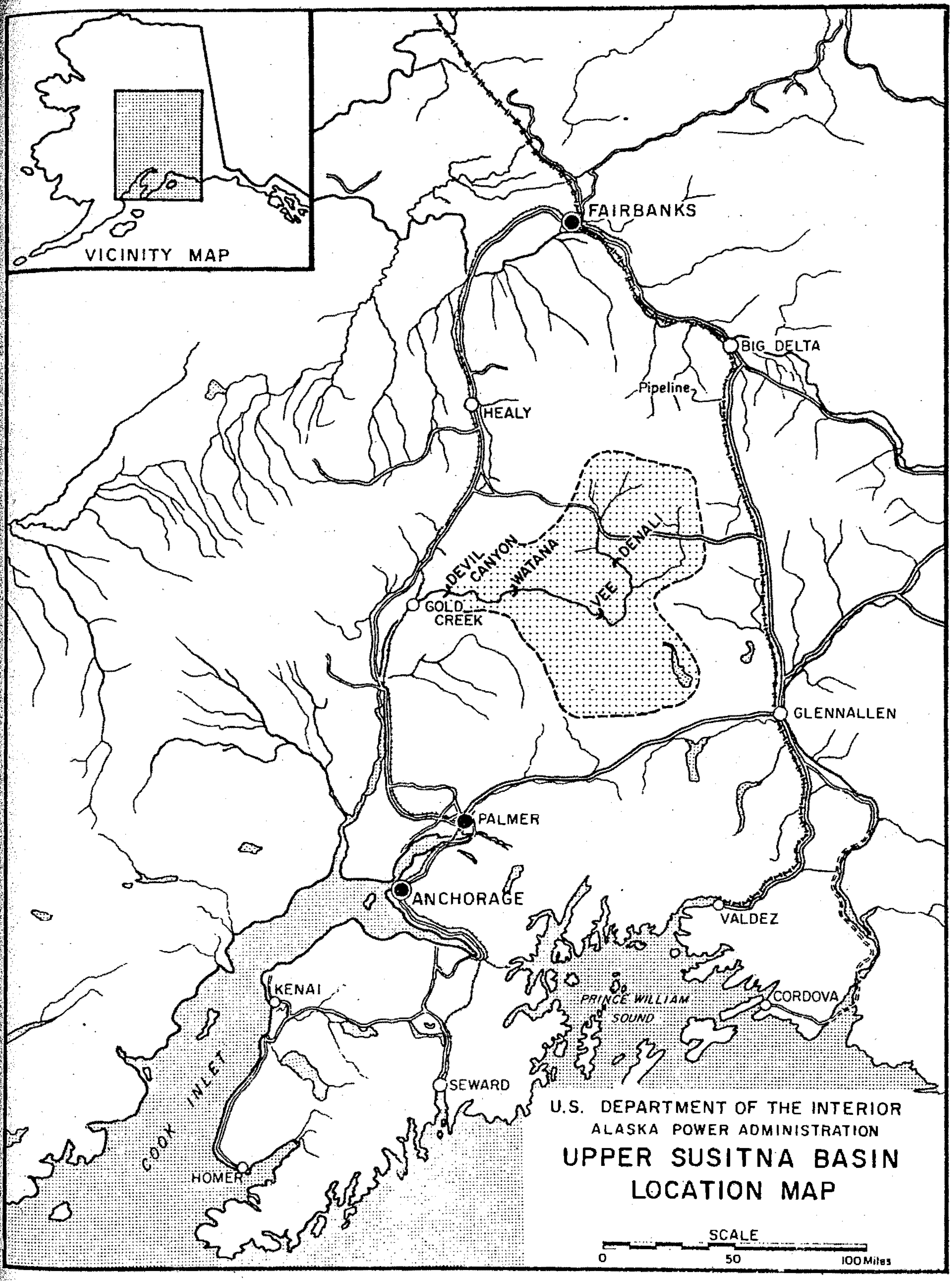
	System 1 Devil Canyon & Denali		System 2 Devil Canyon & Watana 1/		System 3 Devil Canyon, Watana & Denali		System 4 Devil Canyon, Watana, Denali, & Vee	
	Number	Dollars	Number	Dollars	Number	Dollars	Number	Dollars
Personnel:								
Direct costs, COLA, benefits, overtime		1,124,700		1,332,500		1,332,500		1,599,200
Number of classified persons	7		7		7		7	
Number of wage board persons	31		38		38		47	
Miscellaneous:								
Telephone, travel, supplies, services, training, line spray, camp maintenance		218,000		322,000		322,000		380,000
Equipment:								
Annual cost to replace		63,600		66,600		66,600		97,800
Subtotal		1,406,300		1,721,100		1,721,100		2,077,000
Marketing and Administration								
APA main office administration, accounting, collecting, marketing expense		132,000		162,000		162,000		192,000
TOTAL		1,538,300		1,883,100		1,883,100		2,269,000

1/ System 5 cost would be the same as System #2.

Table 4. Replacement Costs

Feature	Annual Replacement Factor	System #1 Devil Canyon and Denali: Cost to Construct	System #1 Devil Canyon and Denali: Annual Replacement Cost	System #2 & #3 Devil Canyon and Watana (includes Denali): Cost to Construct	System #2 & #3 Devil Canyon and Watana (includes Denali): Annual Replacement Cost	System #4 Devil Canyon, Watana, Vee and Denali: Cost to Construct	System #4 Devil Canyon, Watana, Vee and Denali: Annual Replacement Cost
Powerplant	0.0012	$128,000,000	$153,600	$283,600,000	$340,300	$404,400,000	$485,300
Transmission towers, fixtures & conductors	0.0001	85,200,000	8,500	150,000,000	15,000	163,400,000	16,300
Substations and switchyards	0.0039	9,400,000	36,700	25,100,000	97,900	29,900,000	116,600
			198,000		453,200		618,200

Feature	Annual Replacement Factor	System #5 Watana (el.2,200) and Devil Canyon: Cost to Construct	System #5 Watana (el.2,200) and Devil Canyon: Annual Replacement Cost
Powerplant	0.0012	$301,191,000	$361,400
Transmission towers, fixtures & conductors	0.0001	180,362,000	18,000
Substations and switchyards	0.0039	35,235,000	137,400
			516,800



U.S. DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION

UPPER SUSITNA BASIN LOCATION MAP

SECTION H

TRANSMISSION SYSTEM

UNITED STATES DEPARTMENT OF THE INTERIOR
Alaska Power Administration
Upper Susitna River Hydroelectric Studies
Report on Transmission System

December 1975

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Part I INTRODUCTION

Purpose and Scope

This report covers the transmission system studies by the Alaska Power Administration for the proposed Upper Susitna hydroelectric development. The studies are of pre-authorization or feasibility grade. They consist of evaluation of alternative corridor locations from the viewpoints of engineering, costs, and environment; studies of transmission systems needed for alternative project development plans; and consideration of alternative transmission technologies. These studies deal with general corridor location; the more detailed studies following project authorization would include final, on the ground route location.

The engineering and environmental evaluations for the transmission systems are parts of the same study, and Alaska Power Administration's environmental assessment for the transmission system is a companion report to this volume.

Alternative Plans for Upper Susitna Hydroelectric Development

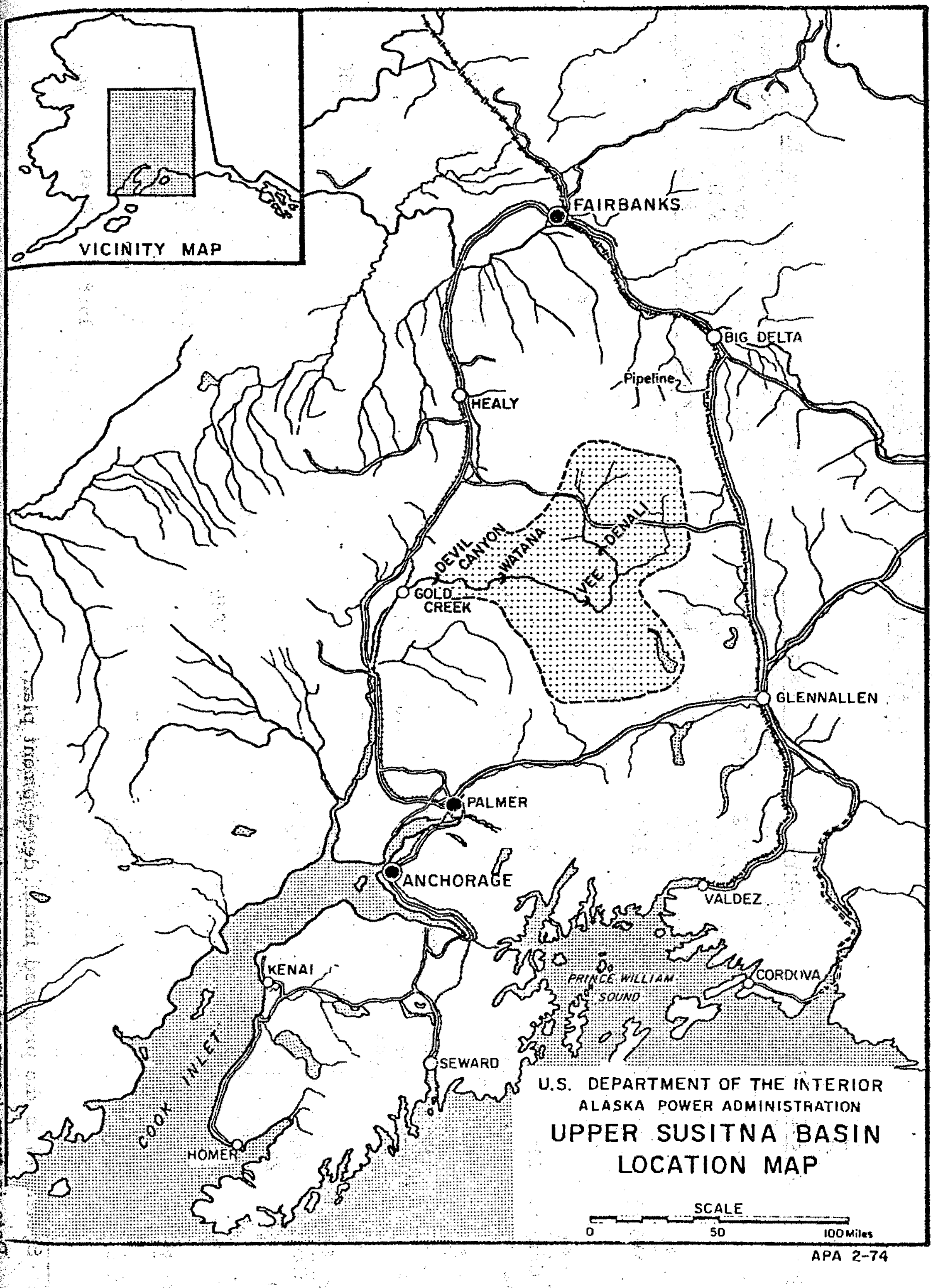
Figure 1 shows general locations of the potential units of the Upper Susitna Project in relationship to the Alaska Railbelt. The four key Upper Susitna damsites are Devil Canyon, Watana, Vee, and Denali.

The Corps of Engineers proposes an initial development including the Devil Canyon and Watana sites with the Denali site considered as a potential future stage. Table 1 summarizes data on energy and power capability and costs for this proposed plan and the principal alternative system for developing the Upper Susitna hydroelectric potential. System #5 is the Corps proposed plan.

Previous Studies

There is a fairly substantial backlog of power system and project studies relevant to the current evaluation of the Upper Susitna River Project. A partial bibliography is included in the power market report. The previous studies most relevant to power market and transmission system planning include:

1. Advisory Committee studies completed in 1974 for the Federal Power Commission's new Alaska Power Survey. The studies include evaluation of existing power systems and future needs through the year 2000, and the main generation and transmission alternatives available to meet the needs. The FPC summary report for its new survey is not yet available.


VICINITY MAP
FAIRBANKS
BIG DELTA
Pipeline
HEALY
DEVIL CANYON
WATANA
DENALI
VEE
GOLD CREEK
GLENNALLEN
PALMER
ANCHORAGE
VALDEZ
KENAI
PRINCE WILLIAM SOUND
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COOK INLET
HOMER
U.S. DEPARTMENT OF THE INTERIOR
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Alternative System Plans
Installed Capacity & Firm Energy

System	W.S. el. M.S.L.	P.O.L. Date	Devil Canyon Installed Capacity 1000 kw	Devil Canyon Firm Energy Million kwh	Watana Installed Capacity 1000 kw	Watana Firm Energy Million kwh	Vee Installed Capacity 1000 kw	Vee Firm Energy Million kwh	System Total Installed Capacity 1000 kw	System Total Firm Energy Million kwh	System Total Secondary Energy Million kwh
System #1											
Devil Canyon	1450	1985	580	2497							
Denali	2535	1990									
									580	2497	701
System #2											
Devil Canyon	1450	1985	600	2628							
Watana	2050	1990			470	2059					
									1070	4687	946
System #3											
Devil Canyon	1450	1985	700	3066							
Watana	2050	1990			670	2935					
Denali	2535	1995									
									1370	6001	350
System #4											
Devil Canyon	1450	1985	713	3119							
Denali	2535	1990									
Vee	2300	1995					300	1314			
Watana	1905	2000			421	1840					
									1434	6273	640
System #5											
Watana	2200	1986			792	3101					
Devil Canyon	1450	1990	776	3048							
									1568	6149	701

Notes: System #5 is the proposed initial development plan.

Data is from Corps of Engineers studies.

2. A series of studies for Railbelt area utilities include assessments of loads, power costs, and generation and transmission alternatives.

3. Previous work by the Alaska Power Administration, the Bureau of Reclamation, the utility systems, and industry on studies of various plans for Railbelt transmission interconnections and the Upper Susitna hydroelectric potential. The most recent of these are the May, 1974 Status Report on the Devil Canyon Project by APA and the September, 1974 Reassessment Report on Upper Susitna River Hydroelectric Development prepared for the State of Alaska by the Henry J. Kaiser Company.

It should be noted that many of the studies listed in the bibliography represent a period in history when there was very little concern about energy conservation, growth, and needs for conserving oil and natural gas resources. Similarly, many of these studies reflected anticipation of long term, very low cost energy supplies. In this regard, the studies for the new power survey are considered particularly significant in that they provide a first assessment of Alaska power system needs reflecting the current concerns for energy and fuel conservation and the environment, and the rapidly increasing costs of energy in the economy.

Acknowledgements

We have attempted to reference principal data sources in the text. The corridor studies utilized data from many different sources--USGS mapping; ERTS photo mosaics obtained through the Geophysical Institute of the University of Alaska; soils survey and snow survey information from Soil Conservation Service reports for portions of the corridors; resources maps and reports from the statewide resources inventory by the Resources Planning Team of the Federal-State Land Use Planning Commission; the State of Alaska's Regional Profile for the Southcentral Region; climate records from the National Weather Service; and other data sources.

The Bonneville Power Administration provided technical assistance in several ways: participation in the aerial and surface reconnaissance of the potential corridors; structural designs and unit costs for transmission lines and substations; consultations on the transmission environmental assessment and reviews of design and cost studies prepared by APA.

The electric utilitity systems of the Railbelt area provide the Alaska experience base for considering future transmission systems; utility personnel provided valuable assistance through consultation on their transmission system experiences and practices and on alternative plans for transmitting Susitna power to the load centers.

SUMMARY

1. The main elements of the study were: (1) evaluation of alternative corridors for locating project transmission lines considering environmental, engineering, reliability and cost aspects; (2) preparation of designs and cost estimates for the transmission systems needed for alternative project development plans.

2. The power market analyses (APA report on project power markets) show that the bulk of the project power would be utilized in Fairbanks - Tanana Valley and Anchorage - Cook Inlet areas, with smaller potential markets in the Glennallen and Valdez areas and other points along the Richardson Highway. Because of the relatively large demands, electric service to the Anchorage and Fairbanks areas is the largest single consideration in design of project transmission facilities. Service to the other areas would be added when feasible.

3. The corridor evaluation started with map identification of all potentially feasible corridors and a field reconnaissance which eliminated those for which topography, elevation, and climate factors would be unacceptable. The remaining corridors were then evaluated in more detail to determine their relative advantages and disadvantages. Much of the detail of this evaluation is presented in the APA environmental assessment of the project transmission facilities.

4. It was concluded that the most desirable corridor location would follow existing surface transportation systems whenever possible. The principle disadvantage of such location is line visibility from the existing road and rail systems. Careful attention to use of natural vegetation and topography to screen the lines, locating the lines at an appropriate distance from roads, and selection of non-reflecting materials in final route selection and design would minimize visibility problems; it is recognized that even with best location and design, portions of the line would be highly visible. Significant advantages of locating the lines near existing surface transportation systems include minimizing requirements for new access roads, savings in costs for construction and operation and maintenance, a significant improvement in reliability, and avoiding need for pioneering new corridors in presently undeveloped areas.

5. Except for constricted passes through the mountains, the proposed corridors should be considered as very broad and general locations within which many alternatives are possible for final route locations. The final route locations would be determined through detailed post authorization studies.

6. The most serious conflicts in the final route selection will likely be encountered in the Nenana Canyon route through the Alaska Range. The Fish and Wildlife Service has recommended that a route west of the Parks Highway be selected through the Nenana Canyon to minimize possible conflicts with raptor habitat. Any route through the Canyon area would involve lines visible from portions of Mount McKinley National Park and the FWS proposal would place portions of the route within park boundaries. APA considers use of the corridor through the Nenana Canyon will result in substantially less environmental damage than would the pioneering of new corridors through the Alaska Range.

7. Additional conflicts are anticipated in final route selection along the approaches to Anchorage because of the Knik Arm, and topography, and land use and ownership patterns on possible routes around Knik Arm. Cost estimates presented in this report assume delivery of project power to points on the CEA transmission system north of Knik Arm. It is recognized that the detailed studies following authorization would need to consider several alternative plans to transmit power across or around Knik Arm to Anchorage.

8. The initial set of transmission plans and estimates were prepared for use in evaluating the alternative Susitna hydroelectric development plans. It was found that conventional overhead lines at 230 kv and 345 kv would be suitable for the distances and amounts of power involved. The initial plans used double circuit lines on a single set of towers and assumed delivery points at Fairbanks and Anchorage.

9. As a result of review by area utilities, the Bonneville Power Administration, and others, the transmission plan and cost estimate for the initial hydro development plan (Watana and Devil Canyon) was modified to incorporate: the added costs for two single circuit lines in lieu of double circuit lines; an additional substation in the general vicinity of Talkeetna; and a switching station in the vicinity of Healy. The resulting transmission plan includes: two single circuit 230 kv lines from

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Watana to Devil Canyon (30 miles), two single circuit 230 kv lines from Devil Canyon to Fairbanks (198 miles) within intermediate switching station at Healy; and two single circuit 345 kv lines from Devil Canyon to points on the north shore of Knik Arm (136 miles) with an intermediate substation in the vicinity of Talkeetna. The estimated construction cost based on January 1975 price levels is $256 million. It is estimated that three years would be required for construction of the transmission facilities following completion of detailed route studies and final designs and acquisition of necessary rights-of-way.

10. Rough plans and estimates were prepared for transmission systems to deliver project power to Glennallen and other points along the Richardson Highway, and results are summarized along with economic analyses of such plans in the APA power market study.

11. Alternative transmission technologies were considered in plan selection, including DC systems and underground lines. With exsiting and likely near future technology, reliability and cost considerations appear to rule out use of underground systems for the lines under consideration. Operating characteristics of DC systems would essentially rule out their application for an initial system to distribute project power to Railbelt power markets.

12. The general corridor locations and transmission designs and estimates are considered adequate for purposes of demonstrating project feasibility.

EXISTING TRANSMISSION SYSTEMS

The power market studies make it very clear that a major part of the project power would be utilized in the Anchorage - Cook Inlet and Fairbanks - Tanana Valley areas, respectively. Additional potential power markets exist in the Glennallen and Valdez areas and along the Alyeska pipeline.

Anchorage-Cook Inlet Area

The five electric utility companies serving this area are:

Anchorage Municipal Light and Power (AML&P)
Chugach Electric Association (CEA)
Matanuska Electric Association (MEA)
Homer Electric Association (HEA)
Seward Electric System (SES)

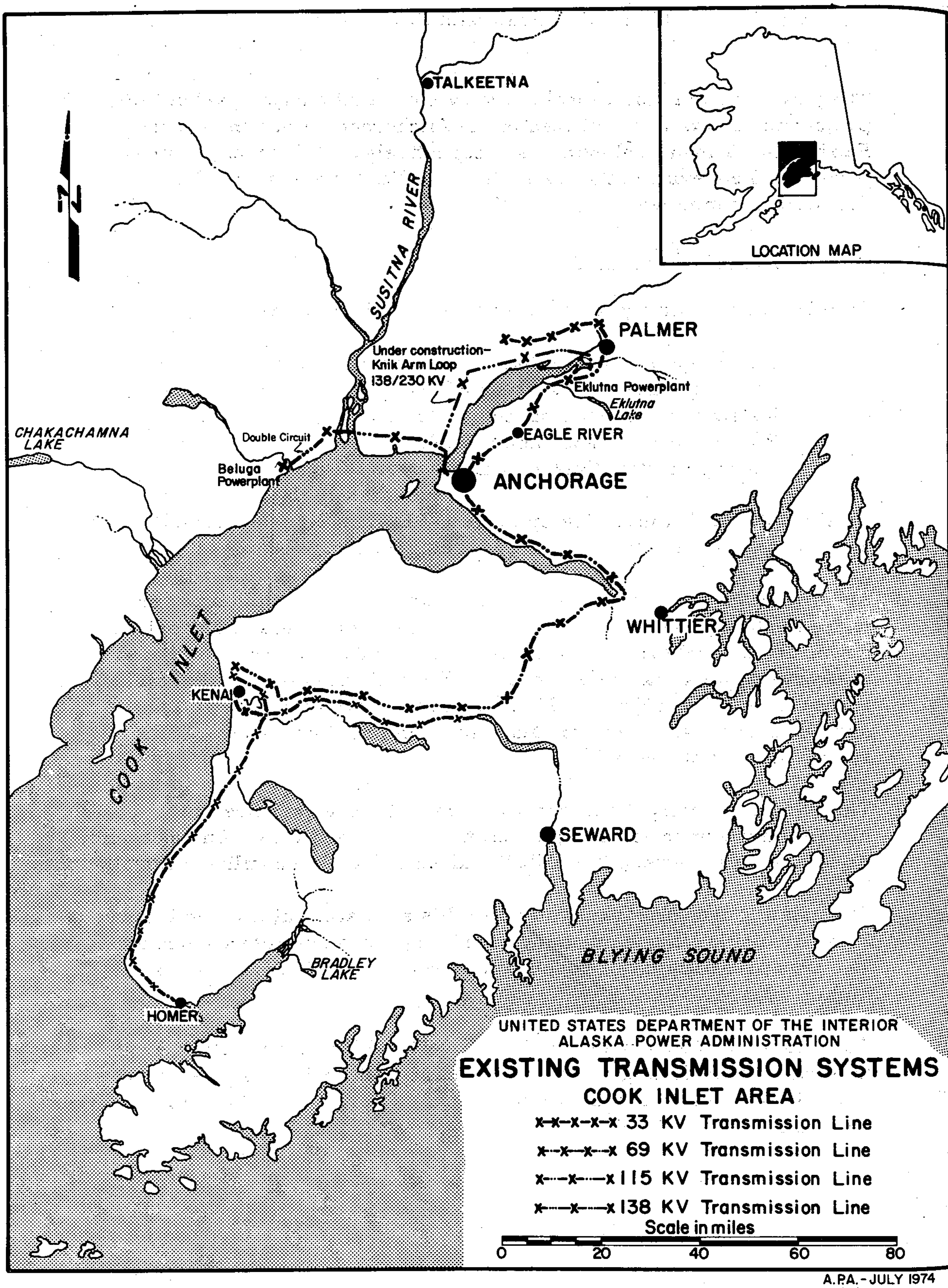
Alaska Power Administration operates the Eklutna Hydroelectric Project and markets wholesale power to CEA, AML&P, and MEA.

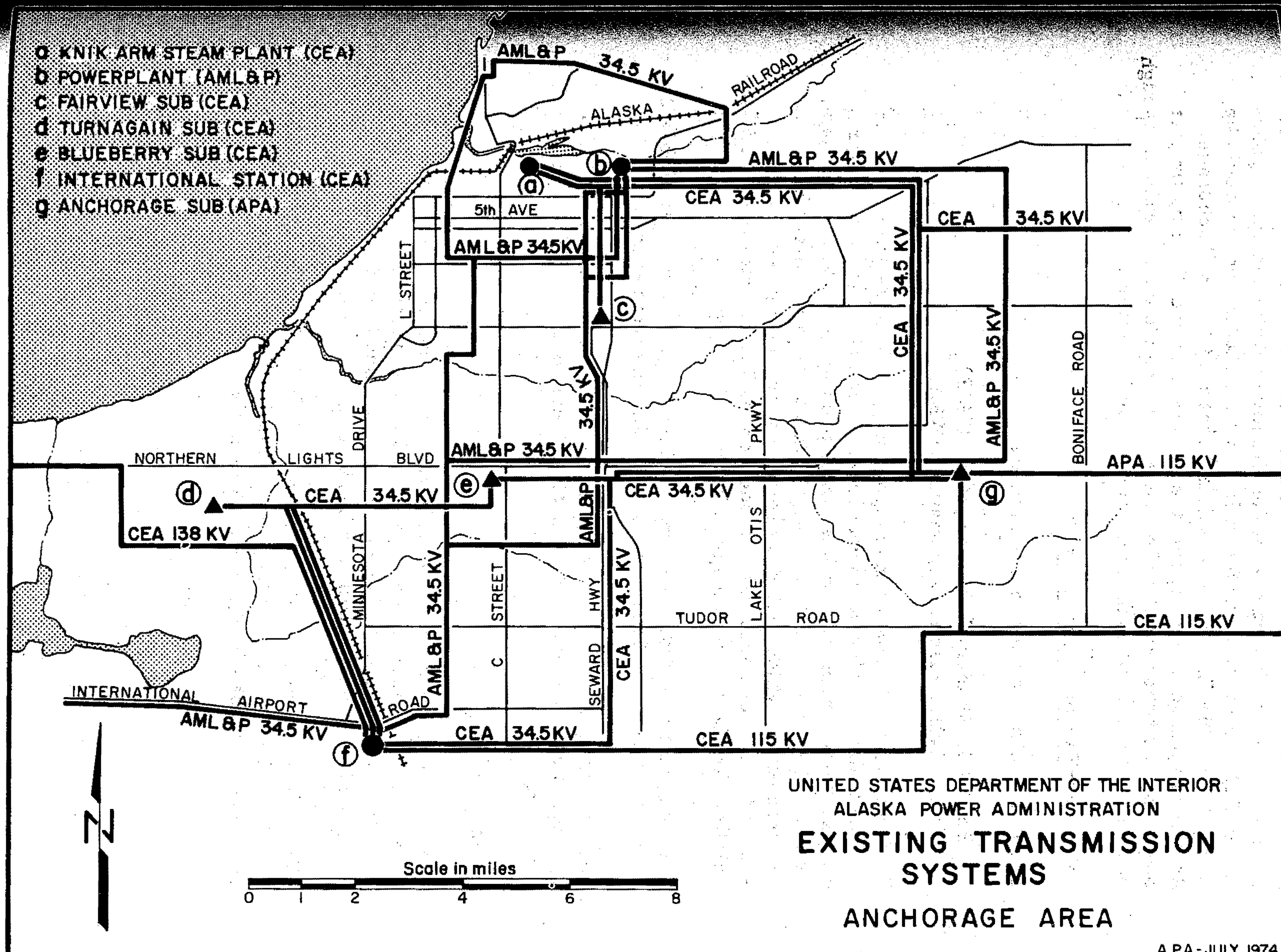
AML&P serves the Anchorage Municipal area. CEA supplies power to the Anchorage suburban and surrounding rural areas and provides power at wholesale rates to HEA, SES, and MEA. The HEA service area covers the western portion of the Kenai Peninsula including Seldovia, across the bay from Homer. MEA serves the town of Palmer and the surrounding rural area in the Matanuska and Susitna Valleys. SES serves the city of Seward.

The utilities serving the Anchorage-Cook Inlet area are presently loosely interconnected through facilities of APA and CEA. An emergency tie is available between the AML&P and Anchorage area military installations.

The existing transmission systems in this area are indicated on Figures 2 and 3. Table 2 has a summary of existing lines and interconnections. The area presently has a total of about 545 circuit miles at 33 kv or higher voltage.

CEA has under construction a 230 kv overhead line around Knik Arm to Anchorage including interconnections with the MEA and APA systems. The initial phase is now under construction; initial operation will be at 138 kv.


TALKEETNA
SUSITNA RIVER
LOCATION MAP
PALMER
Under construction-
Knik Arm Loop
138/230 KV
Eklutna Powerplant
Eklutna Lake
EAGLE RIVER
CHAKACHAMNA LAKE
Double Circuit
Beluga Powerplant
ANCHORAGE
WHITTIER
COOK INLET
KENAI
SEWARD
BLYING SOUND
BRADLEY LAKE
HOMER
UNITED STATES DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
EXISTING TRANSMISSION SYSTEMS
COOK INLET AREA
33 KV Transmission Line
69 KV Transmission Line
115 KV Transmission Line
138 KV Transmission Line
Scale in miles
0 20 40 60 80
A.P.A. - JULY 1974


a KNIK ARM STEAM PLANT (CEA)
b POWERPLANT (AML&P)
c FAIRVIEW SUB (CEA)
d TURNAGAIN SUB (CEA)
e BLUEBERRY SUB (CEA)
f INTERNATIONAL STATION (CEA)
g ANCHORAGE SUB (APA)
AML&P 34.5 KV
RAILROAD
ALASKA
AML&P 34.5 KV
CEA 34.5 KV
5th AVE
CEA 34.5 KV
AML&P 34.5KV
L STREET
CEA 34.5 KV
AML&P 34.5 KV
34.5 KV
BONIFACE ROAD
PKWY
DRIVE
NORTHERN LIGHTS BLVD
AML&P 34.5 KV
APA 115 KV
CEA 34.5 KV
CEA 34.5 KV
AML&P
CEA 138 KV
MINNESOTA
AML&P 34.5 KV
C STREET
SEWARD HWY
CEA 34.5 KV
LAKE OTIS
TUDOR ROAD
CEA 115 KV
INTERNATIONAL AIRPORT ROAD
AML&P 34.5 KV
CEA 34.5 KV
CEA 115 KV
N
Scale in miles
0 1 2 4 6 8
UNITED STATES DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
EXISTING TRANSMISSION SYSTEMS
ANCHORAGE AREA
A.P.A.- JULY 1974

For purposes of this study, it is assumed that Susitna power would be made available at a substation in the vicinity of Talkeetna and at points on the CEA 230 kv loop around Knik Arm, and that the power would be wheeled over the CEA and APA Eklutna systems to serve Anchorage. As discussed later in the report, the actual plan for delivering project power in the Anchorage-Cook Inlet area will need to be determined through detailed systems studies following project authorization.

Fairbanks-Tanana Valley Area

The two electric utilities in this area are:

Fairbanks Municipal Utility System (FMUS)
Golden Valley Electric Association (GVEA)

FMUS serves the Fairbanks municipal area, while GVEA provides service to the suburban and rural areas. The Fairbanks area power suppliers have the most complete power pooling agreement in the State. FMUS, GVEA, the University of Alaska and the military bases have an arrangement which includes provisions for sharing reserves and energy interchange accounts. In addition, GVEA operates the Fort Wainwright steamplant under an agreement with the army.

The existing transmission systems are indicated on Figure 4; Table 2 includes a summary of the lines and existing interconnections.

The delivery point for Upper Susitna power to the GVEA and FMUS systems is assumed at the existing Gold Hill substation of GVEA near Fairbanks.

Glennallen and Valdez

The Copper Valley Electric Association serves both Glennallen and Valdez. Radial distribution lines of CVEA extend from Glennallen 30 miles north on the Copper River, 55 miles south on the Copper River to Lower Tonsina and 70 miles west on Glenn Highway.

CVEA has given some consideration to a 115 kv intertie between Valdez and Glennallen. For this study, it is assumed that project power would be delivered to the CVEA system at Glennallen.

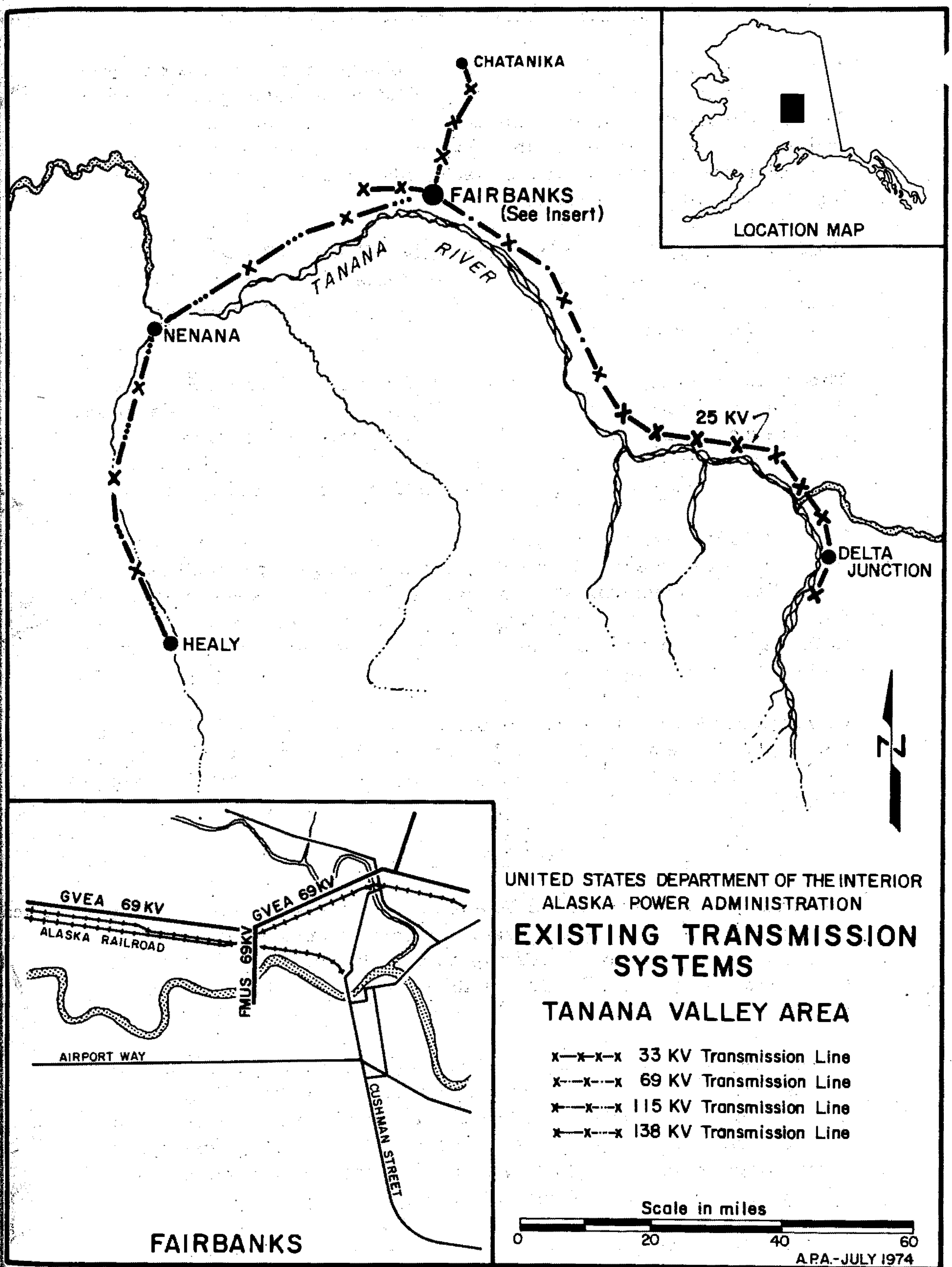
Transmission Lines and Major Interconnections
(Note: Lines under 33 kv not included)

		Transmission Lines			Interconnections [1/]	
Area	Owner	Designation	KV	Mileage	With	Substation
Fairbanks	GVEA	Healy-Gold Hill	138	104	U.of Alaska	University
		Gold Hill-Johnson Rd.	69	45	Ft.Wainwright	Ft.Wainwright
		Zehnder-Fox	69	8	Eielson AFB	Eielson
		Misc. within City	69	3	Ft. Greely	Highway Park
		Gold Hill-Murphy Dome	34.5	24	FMU	Zehnder
		Fox-Pilot Bluff	34.5	18		
	FMU	Muni. Pwr. Plt.-Zehnder	69	1	Ft.Wainwright (See GVEA)	19th Street
Anchorage-Cook Inlet	MEA	Eagle River Tap-Walter Pipple	115	3/4	APA	Palmer
		Palmer-NW Knik Arm Sym.	34.5	42	APA	Reed
		Palmer-Lucas-Reed	34.5	18	APA	Eagle River
	APA	Eklutna-Palmer	115	15	AML&P	Anchorage
		Eklutna-Reed-Eagle River-Anchorage	115	32	CEA	Anchorage
					Elmendorf	Anchorage
	AML&P	Anchorage APA Sub-City System	34.5	23-1/3	(See APA)	

(cont.) **Transmission Lines and Major Interconnections**
(Note: Lines under 33 kv not included)

		Transmission Lines			Interconnection 1/	
Area	Owner	Designation	KV	Mileage	With	Substation
Anchorage-Cook Inlet (cont.)	CEA	Beluga-International	138	52 (incl. 4 mi.submarine)	(See APA and HEA)	
		Anchorage APA Sub-Bernice Lake 2/	115	165-$\frac{1}{4}$		
		Cooper Lake-Quartz Creek	69	6		
		3 Lines to Soldotna 3/	69	86		
		Misc. within Anchorage	34.5	31		
	HEA	Kasilof Sub-Homer	69	61	CEA	Kasilof
		Kenai Area Line	33	12-$\frac{1}{2}$		

1/ Listed only once under substation ownership (National Defense-owned substations are listed under the interconnected utility).
2/ Incl. Tudor Sub. - International and spur line to Portage. Quartz Creek-Bernice Lake portion leased from HEA.
3/ Leased from HEA: Soldotna-Quartz Creek, Soldotna-Bernice Lake, Soldotna-Kasilof.


CHATANIKA
FAIRBANKS
(See Insert)
NENANA
TANANA RIVER
25 KV
DELTA JUNCTION
HEALY
LOCATION MAP
GVEA 69 KV
ALASKA RAILROAD
GVEA 69KV
FMUS 69KV
AIRPORT WAY
CUSHMAN STREET
FAIRBANKS
UNITED STATES DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
EXISTING TRANSMISSION SYSTEMS
TANANA VALLEY AREA
x—x—x—x 33 KV Transmission Line
x---x---x 69 KV Transmission Line
x---x---x 115 KV Transmission Line
x---x---x 138 KV Transmission Line
Scale in miles
0 20 40 60
A.P.A.-JULY 1974

This portion of the transmission study evaluates alternative corridors for transmission facilities to deliver project power to the power markets. The term "corridor" means general location of transmission facilities, and the studies are intended to show relative merits of alternative transmission corridors from the viewpoints of the environment, engineering, economics, and reliability.

Width of corridor is not defined precisely. The actual right-of-way needed is fairly narrow. Except where limited by specific physical or environmental considerations, the corridors themselves should be considered several miles wide.

The major mountain ranges--Alaska, Talkeetna, and Chugach--limit the range of choice in corridors (See Figure 5). The higher elevations in these mountains are completely unsuitable for transmission lines, and there are relatively few low-elevation passes through these ranges. Away from the mountains, a wide range of locations could be considered.

Figure 6 illustrates on a very broad scale, the alternatives for locating the lines. From the project south to the Anchorage area, the heart of the Talkeetna mountains can be avoided by corridors which generally follow the Susitna River Valley (Susitna Corridor) or ones that pass to the east of the mountains and approach Anchorage from the Matanuska Valley (Matanuska Corridors).

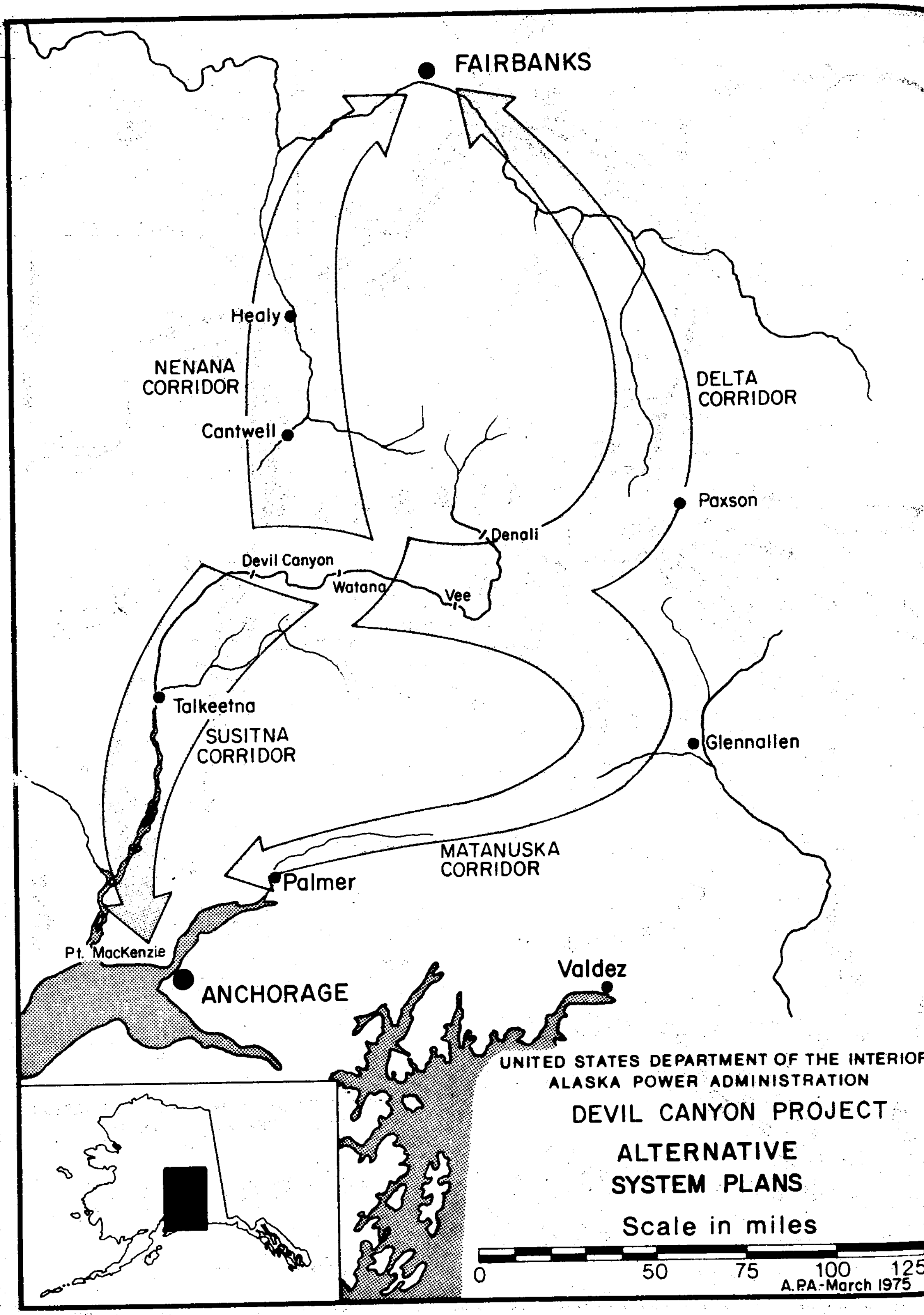
From the project north to the Fairbanks area, the options for crossing the Alaska Range are limited to the pases in the Nenana River drainage (Nenana Corridor) or to the east generally along the Richardson Highway (Delta Corridor).

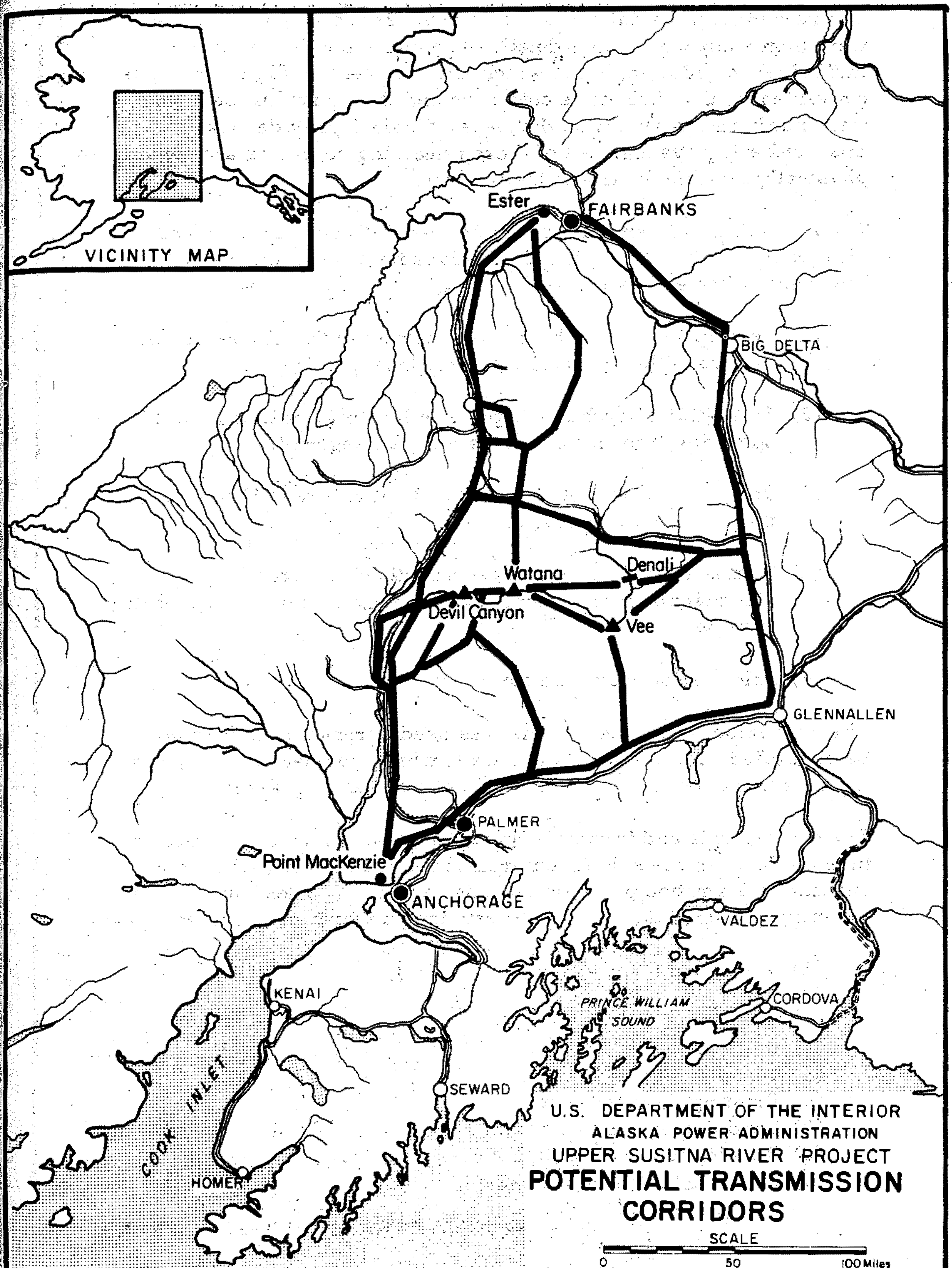
Method of Evaluation

A preliminary identification of potential corridors was made utilizing large scale topographic maps and photo mosaics prepared from satellite photography. This involved primarily identifying potentially feasible passes through the mountains. Figure 7 indicates the corridors identified in this step.

The second step involved an aerial reconnaissance to determine which of these corridors were actually feasible for constructing lines. Several were found to have "fatal flaws" or characteristics that would preclude their use for transmission lines. Reasons for eliminating corridors at this stage included completely unsuitable topography, obstruction by major glaciers, or excessive elevations.


UNITED STATES DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
THE RAILBELT
Scale - Miles
0
25
50
75
A.P.A.-JULY 1975
LOCATION MAP
N
FAIRBANKS
Ester
Tanana River
Chena River
GOLDSTREAM HILLS
Nenana
Nenana River
Wood River
Salcha River
Alyeska Pipeline
Shaw Creek
Alaska Railroad
Big Delta
Delta Junction
Healy
Moody Cr.
MOODY PASS
Yanert Fk.
Dean Cr.
WELLS PASS
Nenana Canyon
Nenana R.
ALASKA RANGE
Delta River
Donnelly Dome
ISABEL PASS
Summit Lake
Paxson
MT. McKINLEY NATIONAL PARK
Cantwell
Monahan Flats
Anchorage-Fairbanks Hwy
BROAD PASS
Brushkana Cr.
Denali Hwy
Butte Cr.
Chulitna River
Chulitna
Devil Canyon
Deadman Cr.
Watana
Denali
Maclaren River
Paxson Lake
Richardson Hwy
DENALI STATE PARK
Gold Creek
Susitna River
Vee
Gulkana R.
Disappointment Cr.
Prairie Cr.
Talkeetna River
Talkeetna
TALKEETNA MTS
Lake Louise
Sourdough
Copper River
WRANGELL MTS
Gulkana
L. Nelchina R.
SLIDE MTN
Glennallen
Tazlina River
Tazlina Lake
Copper Center
TAHNETA PASS
Glenn Hwy
Sutton
Matanuska River
Susitna River
Nancy
PALMER
CHUGACH MTS
Point MacKenzie
ANCHORAGE
COOK INLET


FAIRBANKS
Healy
NENANA
CORRIDOR
Cantwell
DELTA
CORRIDOR
Paxson
Denali
Devil Canyon
Watana
Vee
Talkeetna
SUSITNA
CORRIDOR
Glennallen
MATANUSKA
CORRIDOR
Palmer
Pt. MacKenzie
ANCHORAGE
Valdez
UNITED STATES DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
DEVIL CANYON PROJECT
ALTERNATIVE
SYSTEM PLANS
Scale in miles
0
50
75
100
125
A.P.A.-March 1975


VICINITY MAP
Ester
FAIRBANKS
BIG DELTA
Watana
Denali
Devil Canyon
Vee
GLENNALLEN
PALMER
Point MacKenzie
ANCHORAGE
VALDEZ
KENAI
PRINCE WILLIAM SOUND
CORDOVA
SEWARD
COOK INLET
HOMER
U.S. DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
UPPER SUSITNA RIVER PROJECT
POTENTIAL TRANSMISSION CORRIDORS
SCALE
0
50
100 Miles

The remaining potential corridors, which are indicated on Figure 8, were then analyzed in more detail. The basis for the analysis was individual corridor segments which are indicated on Figure 9. For convenience, the alternative corridors and the individual segments were numbered as shown on the maps. Table 3 provides a key to this numbering system. All of these remaining corridors are considered physically feasible for transmission lines.

The evaluation is intended to identify the relative advantages and disadvantages of utilizing the alternatives for transmission lines. The steps in the evaluation were:

(1) Description and inventory by segment of the key resources that would be impacted by a transmission line.

(2) Evaluation of probable impacts of locating, building, and operating transmission lines for each segment.

(3) Determination of relative cost and reliability for lines utilizing the alternative corridors.

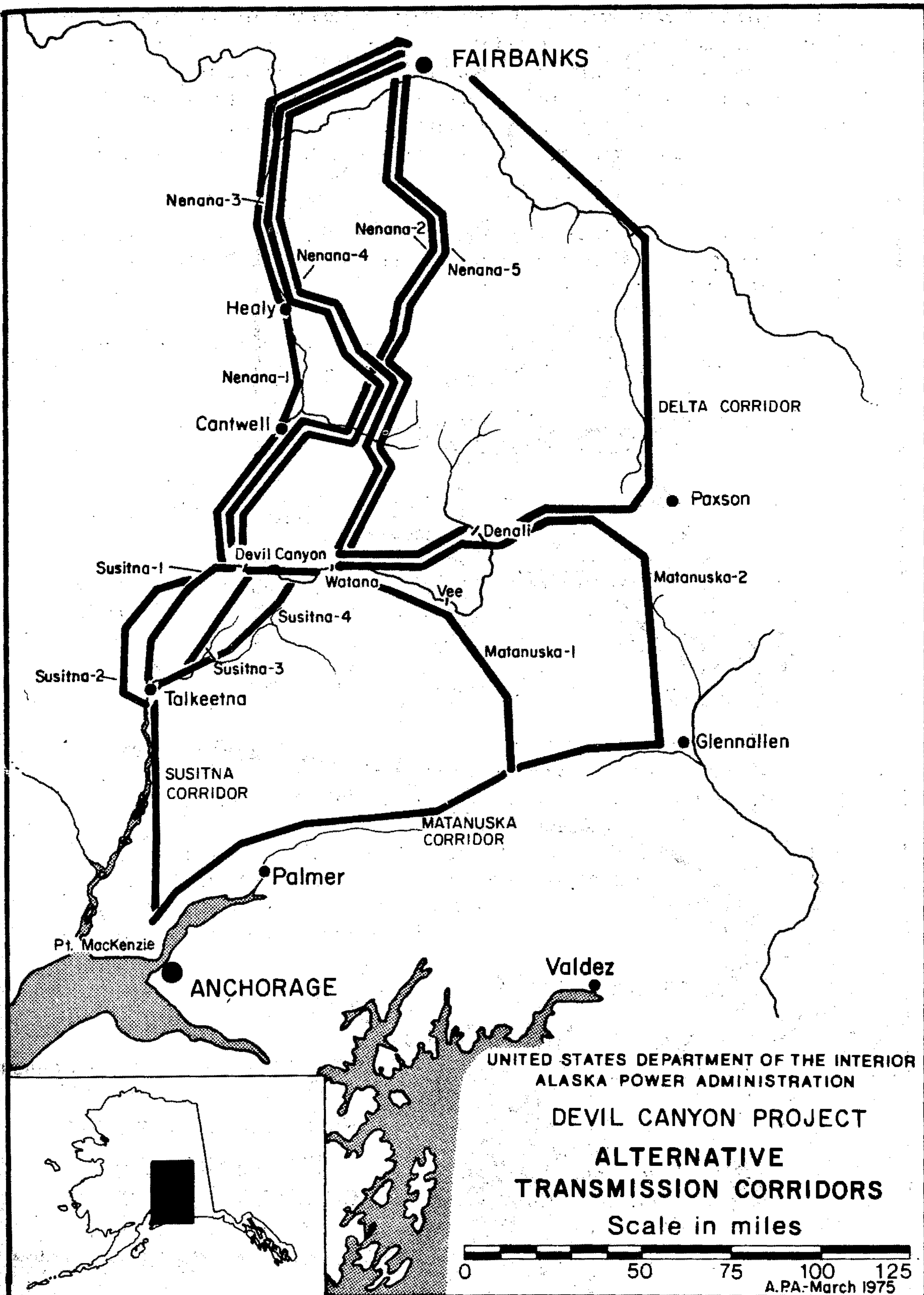
(4) Summarization of advantages and disadvantages from the viewpoint of environment, engineering, costs, and reliability of service.

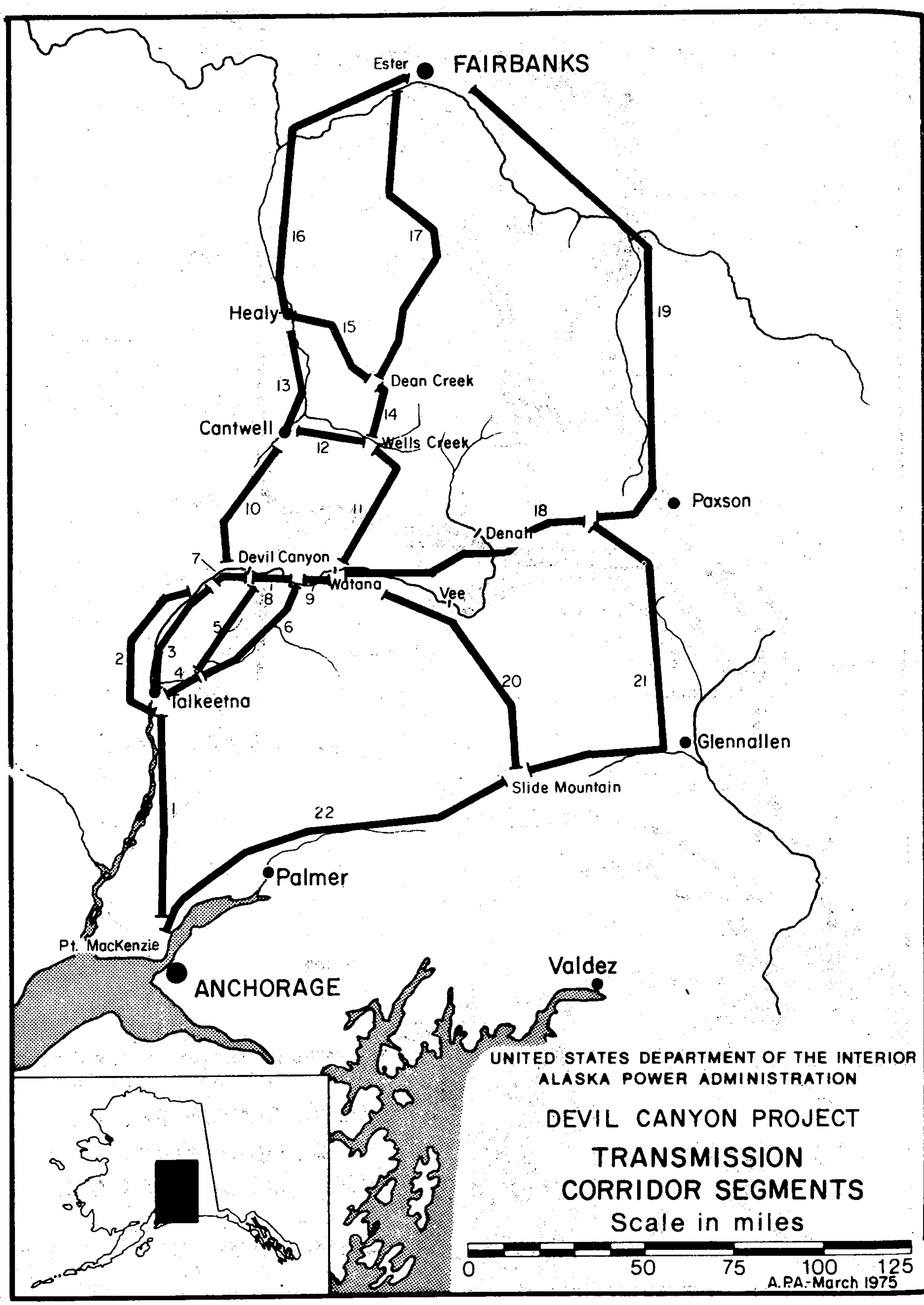
(5) Selection of preferred corridors.

The comparisons between alternatives used parameters that could be quantified, such as length and cost, while judgment ranking was used for those parameters that could not be readily quantified.

The descriptions and inventory and evaluation of impacts are reported in more detail in the A.P.A. environmental assessment, with only summary information presented in this report. The description and inventory grouped data and interpretations under nine broad categories:

(1) Topography and Geology
(2) Soils
(3) Vegetation
(4) Wildlife
(5) Climate
(6) Existing Developments
(7) Land Ownership and Status
(8) Relation to Existing Rights of Way
(9) Scenic Quality and Recreation


FAIRBANKS
Nenana-3
Nenana-2
Nenana-4
Nenana-5
Healy
Nenana-1
Cantwell
DELTA CORRIDOR
Paxson
Denali
Devil Canyon
Susitna-1
Watana
Vee
Matanuska-2
Susitna-4
Matanuska-1
Susitna-3
Susitna-2
Talkeetna
Glennallen
SUSITNA CORRIDOR
MATANUSKA CORRIDOR
Palmer
Pt. MacKenzie
ANCHORAGE
Valdez
UNITED STATES DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
DEVIL CANYON PROJECT
ALTERNATIVE TRANSMISSION CORRIDORS
Scale in miles
0
50
75
100
125
A.P.A.-March 1975



FAIRBANKS
Ester
16
17
19
Healy
15
Dean Creek
13
14
Cantwell
12
Wells Creek
10
11
Paxson
18
Denali
7
Devil Canyon
Watana
8
9
Vee
5
6
2
3
4
Talkeetna
20
21
Glennallen
Slide Mountain
1
22
Palmer
Pt. MacKenzie
ANCHORAGE
Valdez
UNITED STATES DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
DEVIL CANYON PROJECT
TRANSMISSION
CORRIDOR SEGMENTS
Scale in miles
0
50
75
100
125
A.P.A.-March 1975

Key to Alternative Corridors and Segments

Corridor	Segments of Corridor	Approximate Total Mileage
	Susitna Corridors	
Susitna #1	1, 3, 7, 8, 9	166
Susitna #2	1, 2, 7, 8, 9	170
Susitna #3	1, 4, 5, 8, 9	159
Susitna #4	1, 4, 6, 8, 9	164
	Matanuska Corridors	
Matanuska #1	8, 9, 20, 22	258
Matanuska #2	8, 9, 18, 21, 22	385
	Nenana Corridors	
Nenana #1	9, 8, 7, 10, 13, 16	228
Nenana #2	9, 8, 7, 10, 12, 14, 17	250
Nenana #3	9, 8, 7, 10, 12, 14, 15, 16	261
Nenana #4	8, 9, 11, 14, 15, 16	223
Nenana #5	8, 9, 11, 14, 17	212
	Delta Corridor	
Delta #1	8, 9, 18, 19	280

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The probable impacts are identified and described under five broad categories in the environmental assessment.

(1) Soils
(2) Vegetation
(3) Wildlife
(4) Existing Developments
(5) Scenic Quality and Recreation.

Alternative corridors were compared utilizing a judgment ranking under each of the five impact categories.

The cost aspect of the corridor analysis is premised on rough reconnaissance costs for a double circuit steel tower line located in the corridor. The estimate included access facilities using the following criteria:

(1) For corridors within approximately five miles of existing surface transportation, pioneer access suitable for four-wheel drive vehicles would be provided where terrain and soils are favorable. Where soils are not suitable for pioneer road type of access, no road is provided and overland access for construction and operation and maintenance would be limited to winter periods with adequate snow cover. Otherwise, access would be by helicopter.

(2) For corridors pioneering into new areas, or more than five miles from existing surface transportation, the estimates include a new road to minimum standards suitable for access to the line and to provide appropriate environmental protections--adequate erosion control, permafrost protection, etc. Such new roads would be single lane, gravel surface, with periodic passing areas.

Relative cost and difficulty for operation and maintenance activities are shown by judgment ranking for this analysis. This reflects ease of access, terrain, climate, and other factors that bear on the operation and maintenance activities.

Reliability is also shown by judgment ranking reflecting relative hazards to major outages and relative difficulty of making repairs.

The Corridors

The alternatives represent only general corridors, and do not attempt to define an actual right-of-way. Thus, the alternatives do not distinguish among many minor variations, and as a result, are fairly flexible.

Only brief descriptions of the corridors are included here since details of resources and identified impacts are available in the APA environmental assessment. As a summary reference, the "Inventory" and "Impact" matrixes from the assessment are appended to this report.

Susitna Corridors

There are basically four feasible corridors which connect Devil Canyon to Anchorage via the Susitna drainage. All four of these incorporate the segment that runs from the endpoints of Point MacKenzie to Talkeetna, so this segment can, therefore, be treated as separate and not included in a comparison of the alternative corridors.

Of the four corridors that run from Talkeetna to Devil Canyon-Watana, the first follows the Susitna Valley north, paralleling the Alaska Railroad to Gold Creek, where it leads east to tie into Devil Canyon-Watana (Susitna - 1).

The next, and farthest west, parallels the Anchorage-Fairbanks Highway through Denali State Park, along Troublesome Creek, eventually leading east to tie into Gold Creek and Devil Canyon-Watana (Susitna - 2). The third goes up the Talkeetna River and gaining the ridge to the east of Disappointment Creek, leads north to the ridge leading to Devil Canyon (Susitna - 3).

The fourth and most easterly corridor follows the Talkeetna River to Prairie Creek, which it follows to Stephan Lake, halfway between Devil Canyon and Watana (Susitna - 3).

Nenana Corridors

There are five feasible corridors connecting the Upper Susitna with Fairbanks by way of the Nenana River. The first is a corridor paralleling the highway and railroad from Gold Creek to Cantwell, to Healy, and to Fairbanks (Nenana - 1).

The second duplicates the first corridor to Cantwell, but then leads east paralleling the Denali Highway, as far as Wells Creek and north over the pass to Louis Creek, continuing over the Dean Creek Pass to the Wood River. It then follows the Wood and Tanana Rivers to Fairbanks (Nenana - 2).

The third corridor, (Nenana - 3), duplicates the second to Dean Creek, where it then continues up Yanert Fork and over Moody Pass, ending up at Healy and joining the first corridor.

Corridor four (Nenana - 4) leaves Watana and heads north, emerging onto the Denali Highway near the Brushkana River. It then leads west, goes up Wells Creek, and joins corridor three to Healy and Fairbanks.

Corridor five starts the same way as corridor four, except instead of going over Moody Pass to Healy, it leads east over Dean Creek into the Wood River, and then leads north to Fairbanks, (Nenana - 5).

Delta Corridor

For this study, only one corridor along the Delta River was considered. This corridor leaves Watana damsite and leads east down Butte Creek to the Denali damsite and continues east along the Denali Highway. It then proceeds north near Paxson over the Isabel Pass and parallels the Richardson Highway into Fairbanks. Alternatives could be very limited in the vicinity of Isabel Pass, but additional alternatives could be considered in the Tanana Valley and Copper River Valley.

Matanuska Corridors

Two corridors were considered utilizing the Matanuska Valley as access to Anchorage. The first corridor connects Watana to Vee damsite, leads southeast to the Little Nelchina River, which it follows to the Glenn Highway and corridor one, which it follows to Point MacKenzie (Matanuska-1).

The second follows the Delta route to Paxson, then leads south to Glennallen. It then goes west, over Tahneta Pass, and into the Matanuska Valley, tying into Point MacKenzie (Matanuska-2).

Available Data

A variety of data sources were used in the study, including U. S. Geological Survey maps at scale 1:250,000 and 1:63,360, ERTS photo mosaics, and uncontrolled aerial and ground photo mosaics of critical areas.

The data compiled by the Resource Planning Team of the Land Use Planning Commission in their statewide inventory studies was used extensively. This data is available in a set of 1:250,000 overlay maps and supporting reports. It includes information on geology, vegetation, wildlife habitat, soils, water resources, recreation, land status, archaeological and historic sites, and other resource aspects.

More detailed soil survey data from the Soil Conservation Service is available for some corridor segments. U.S. Geological Survey permafrost maps were utilized.

Available climatological data from the National Weather Service were utilized for Fairbanks, Anchorage, Palmer, Talkeetna, Summit, McKinley Park, Clear, and other locations in the Railbelt.

In September, 1974, personnel from APA and Bonneville Power Administration made an aerial and surface reconnaissance of the alternative corridors to examine critical areas and obtain first-hand information on the terrain and other factors.

Over 2,600-35mm slides were taken, processed, indexed, and catalogued to record and preserve details of the observations. Interviews with management and maintenance personnel of the two major utilities operating transmission lines in the marketing areas of Anchorage and Fairbanks were made. The objective was to determine the criteria, problems, experience, and suggestions they could offer in planning, locating, and designing an upper Susitna transmission system.

Panoramic photo mosaics were prepared using photographic color prints made from the slides to help evaluate the impact of a transmission line constructed through critical, scenic, and other potential problem areas. Reports covering impressions and data gathered from the reconnaissance and rough cost evaluations were prepared to further assess the merits of the various alternative corridors.

Uncontrolled aerial photo mosaics of the alternative corridors were prepared to assist in the resolution of questions in critical problem areas.

Several environmental impact statements were used to provide information not readily available elsewhere.

Aerial photographs of the various corridor routes are available from Bureau of Land Management, U.S. Geological Survey, and Alaska State Highway Department.

Numerous magazines, newspapers, publications, and other reports were also incorporated into the study data.

Location Considerations

Corridor location objectives are to obtain an optimum combination of reliability and cost with the fewest environmental problems. In many cases, these objectives are mutually compatible. However, this is often not the case with respect to line visibility and scenic impacts. Throughout the corridor evaluation, the question arises of whether it is more desirable to place lines relatively close to existing surface transportation facilities or to pioneer new corridors where the line would be seen by few people.

The following items are major factors considered in the evaluation of alternative corridors:

Climate and Elevation

Winds, icing, snow depth, and low temperatures are very important parameters in transmission designs, operation, and reliability. Experience with existing lines of the area utilities indicates few unusual climatic problems for the areas away from the mountains, except for winter low temperatures that inhibit operation and maintenance activities.

The climate factors become more severe in the mountains. High winds, longer winters, more snow, and colder average temperatures are charactistic. APA believes that elevations above about 4000 feet in the Alaska Range and Talkeetna Mountains are completely unsuitable for locating major transmission facilities. Significant advantages in reliability and cost are expected if the lines can be kept well below 3000 feet in elevation.

Extreme winds in excess of 100 MPH are expected for exposed areas and passes in the mountains. The potential for icing is probably not as serious as in coastal areas of Alaska, so long as the lower elevation passes are used. The corridors under consideration do not involve unusually heavy snow depths.

Topography

Topography plays a threefold role in transmission location--(1) it affects cost of construction, inspection, and maintenance; (2) it affects visual impact; and (3) it affects reliability.

Transmission costs rise dramatically in areas of broken or steep terrain--towers require special foundations, individual design for variation in leg lengths to accommodate sloping sites. Broken relief also increases cost by increasing the number of towers required per mile due to decreased spacing. These same topographic characteristics increase access difficulties which, in turn, increase access road costs, time spent in transit, and difficulty in transporting construction and maintenance supplies and materials. Inspection of lines in rough terrain changes a routine operation into an ordeal or increases costs by making utilization of aircraft a necessity.

It is increasingly difficult to visually shield a line and its clearing scar as topographic relief increases. This is especially true under certain orientations, particularly when the line runs parallel to a steep side hill in view of a road, railroad, or other view point.

Conditions of instability pose physical threats to the reliability of the line. Broken terrain, steep slopes, or conditions in which the angle of the terrain exceeds the angle of repose of the soil, increase the chances of land, rock, or mud slides. Snow slides are an additional hazard on steep slopes.

Soils and Foundation

Transmission lines are less affected by soils and foundation limitations than are roads, railroads, and pipelines. Good examples of this exist in the GVEA and CEA transmission systems which traverse sensitive muskeg and permafrost areas with few problems. This requires designs of tower foundations that are compatible with the soil situation and careful design and control of access for construction and operation and maintenance.

Vegetation

Heavily forested areas in the valleys would require essentially continuous clearing of the transmission right-of-way. The higher elevations and muskeg areas would involve essentially no clearing. Impacts are diverse: in the forested areas, opportunities to shield the lines from view are good, but the continuous scar is generally unavoidable. At higher elevations, there would be very little impact on vegetation, but line visability is high.

Wildlife

There will be some habitat changes due to clearing and access facilities. Probably the major consideration for wildlife is the extent to which the transmission lines change the access to land by people. This is subject to some control by managing access, but new corridors and new access roads tend to encourage public use and thus increase pressures on fish and wildlife.

Visual Aspects

More than any other factor in transmission location, the visual aspect is controversial and subject to a wide range of opinion. Existing criteria provide for utilizing natural vegetation and topographic relief as a shield, minimizing crossings over roads, and otherwise utilizing route selection and orientation techniques to minimize visability. Other options include use of non-reflective conductors and towers. At best, such measures are only partly effective.

Socio-Economic Aspects

Land status, ownership, use, and value are important factors in the location of transmission corridor alignments.

Consideration of existing uses, costs of right-of-way and easements tend to influence the selection of alignments which will affect other uses least. Hunting lodges, tourist accommodations, and facilities with high scenic uses or values, such as parks, scenic viewpoints, recreation areas, etc., also should be avoided or skirted by transmission corridors or the corridor should be well screened.

Recent trends in land management tend to favor the corridor concept for combining transportation, utility, and communication facilities. The rationale is to confine man's influence to a relatively small zone

.

Distance

The economics of transmission line construction and maintenance dictate that line distances should be kept as short as possible while recognizing other criteria. This will result in lower construction costs and shorter construction periods. Lower operation and maintenance costs will result because it will take less time to find a fault on a shorter line. A shorter line will be subjected to fewer hazards because it is physically smaller. Power and energy losses will be lower on a shorter line.

Other impacts of a shorter line include less clearing--fewer trees must be cut, thus less land will be subjected to man's influence and less wildlife habitat will be altered.

Longer lines require higher voltages with a resultant requirement of higher capacity and larger conductors, towers, and hardware. This combination increases costs as well as right-of-way width.

Relative Transmission Construction Cost for Alternative Corridors - Upper Susitna to Anchorage

	Susitna Corridors				Matanuska Corridors	
	S - 1	S - 2	S - 3	S - 4	M - 1	M - 2
Length, miles	166	170	159	164	258	385
Max. elevation, feet	2,100	2,100	3,800	2,200	3,000	4,000
Clearing, miles						
Med. heavy	166	146	132	142	166	228
Light	---	10	10	13	17	157
None	---	14	17	9	75	---
Access Roads, miles						
New roads	0	0	12	32	84	64
4-Wheel drive access	122	126	122	104	138	290
None	44	44	25	28	36	31
Tower Construction, miles						
Heavy steel	44	44	68	62	30	94
Normal	122	126	91	102	228	291
Comparative Cost, $1,000						
Clearing	3,000	3,000	3,000	3,000	600	1,100
Access	8,000	8,200	9,500	10,900	19,900	27,200
Transmission Lines	82,000	84.000	81,300	82,200	132,700	196,200
Total	93,000	95,200	93,800	96,100	153,200	224,500

(continued) Relative Transmission Construction Cost for Alternative Corridors - Upper Susitna to Fairbanks

	Nenana Corridors					Delta Corridor
	N - 1	N - 2	N - 3	N - 4	N - 5	D
Length, miles	228	250	261	223	212	280
Max. elevation, feet	2,400	4,300	4,000	4,000	4,300	4,000
Clearing, miles						
Med. heavy	125	139	127	99	111	114
Light	0	0	0	0	0	21
None	103	111	134	124	101	145
Access Roads, miles						
New roads	0	136	50	96	182	168
4-Wheel drive access	97	22	119	97	0	82
None	131	102	92	30	30	30
Tower Construction, miles						
Heavy steel	155	194	188	121	127	198
Normal	73	56	73	102	85	82
Comparative Cost, $1,000						
Clearing	400	400	400	200	300	400
Access	7,800	21,800	17,400	20,500	24,800	27,300
Transmission lines	77,200	84,900	88,500	75,000	71,400	94,800
Total	85,400	107,100	106,300	95,700	96,500	122,500

Relative Cost

Rough reconnaissance cost estimates were made for transmission lines in the alternative corridors to illustrate relative costs. The estimates are summarized on Table 4.

The estimates reflect access, clearing, and line construction costs. For the Susitna and Matanuska Corridors, they are premised on a 345 kv double circuit line; the Nenana and Delta Corridors are based on a 230 kv double circuit line.

Corridor Evaluations

This section summarizes results of the evaluations and identification of preferred corridors. In the assigned ranking, lower numbers reflect a preference or fewer impacts.

Project Power to Anchorage-Cook Inlet Area

Six corridors were considered. A summary of the analysis is presented on Table 5.

The Matanuska Corridors were found to offer no significant advantage for major power supplies to the Anchorage-Cook Inlet area. Disadvantages include added length, significant distance at higher elevations which could complicate construction and operations, and additional impacts associated with more access and longer lines.

The four Susitna Corridors assume a common alignment from Talkeetna to Pt. MacKenzie. This should be depicted as a fairly broad corridor at this time, since the terrain is quite favorable for transmission and there would be a great deal of flexibility in locating the final route to minimize impacts and interference with existing developments. This will require very careful route studies.

North of Talkeetna, there are some critical factors of terrain and access. The feasible routes between Devil Canyon-Watana and the Talkeetna area are:

S-1, generally along the Alaska Railroad.
S-2, which generally follows the Anchorage-Fairbanks Highway
S-3 and S-4, which approach Talkeetna through the Talkeetna River Valley.

S3, the shortest route, also involves the most difficult terrain and highest elevations. This would be the least advantageous from the viewpoint of building and operating a transmission line.

Corridor Analysis - Project Power to Anchorage/Cook Inlet Area

Analysis Factor:	Susitna Corridors S - 1	Susitna Corridors S - 2	Susitna Corridors S - 3	Susitna Corridors S - 4	Matanuska Corridors M - 1	Matanuska Corridors M - 2
Length, miles	166	170	159	164	258	385
Max. elevation, feet	2,100	2,100	3,800	2,200	3,000	4,000
Ranking	1	1	2	1	3	4
Environmental Impacts						
Soils	1	2	1	1	2	2
Vegetation	2	3	1	3	4	5
Wildlife	1	2	3	3	4	3
Existing developments	3	3	2	1	3	3
Scenic quality/recreation:						
Developed areas	3	3	2	1	3	3
Remote areas	1	2	3	4	4	3
Ranking	1	3	1	3	4	4
Costs						
Construction	1	1	2	1	3	4
Operation and maintenance	1	1	2	1	3	3
Ranking	1	1	2	1	3	4
Reliability						
Exposure to hazards	1	1	2	1	2	3
Ease of repair	1	2	2	2	3	3
Ranking	1	2	3	2	4	4
Summary Ranking	1 (preferred corridor)	2	3	2	4	4

Reconnaissance of the four Susitna Corridors indicates that vegetation and topography would facilitate screening of lines to minimize visual impacts.

S-4 would involve pioneering a new road up the Talkeetna River to the Stephan Lake area; similarly, S-3 would involve considerable new road construction in the Talkeetna Valley. S-2 would traverse the existing Denali State Park, which would require a new access between Gold Creek and the Anchorage-Fairbanks Highway. The aspects of the State Park for S-2 and the new corridors required for S-3 and S-4 were major factors in the evaluations.

There does not appear to be a great deal of difference in terms of impacts on soil, vegetation, and wildlife, except that involved in new access road construction.

Cost aspects are quite similar for S-1, S-2, and S-3; S-1 appears most desirable from the reliability viewpoint because of proximity to existing transportation and lower elevations.

The preferred corridor is S-1.

Project Power to Fairbanks-Tanana Valley Area

Six corridors were considered, and a summary of the analysis is presented on Table 6.

The Delta Corridor involves several disadvantages which relate primarily to longer distances and a considerable distance at fairly high elevations. The potential advantages are avoiding entirely the Broad Pass-Nenana Canyon area and the potential for extending electric service to the Paxson area and portions of the Upper Tanana Valley.

Much of the Delta Route is in areas where lines would be quite visible because of limited vegetation and limited opportunity to shield lines with topography.

The Nenana alternatives fall into two general classes: (1) corridors paralleling the existing transportation corridor containing the Anchorage-Fairbanks Highway and the Alaska Railroad, and (2) alternatives to the east of this corridor through the Alaska Range to the Fairbanks area.

N-1 follows the Alaska Railroad to the Broad Pass area and Cantwell, proceeds through the Nenana Canyon to Healy, and generally parallels the existing GVEA transmission line from Healy to Fairbanks.

Corridor Analysis - Project Power to Fairbanks/Tanana Area

Analysis Factor:	Nenana Corridors					Delta Corridor
	N - 1	N - 2	N - 3	N - 4	N - 5	D
Length, miles	228	250	261	223	212	280
Max. elevation, feet	2,400	4,300	4,000	4,000	4,300	4,000
Ranking	1	3	3	2	3	3
Environmental Impacts						
Soils	1	3	2	2	3	3
Vegetation	2	2	3	2	1	3
Wildlife	1	3	2	3	3	3
Existing developments	3	2	2	2	1	2
Scenic quality/recreation:						
Developed areas	3	2	2	1	1	3
Remote areas	1	3	2	2	3	2
Ranking	1	3	3	2	1	3
Costs						
Construction	1	4	2	3	5	6
Operation and maintenance	1	4	2	3	5	3
Ranking	1	4	2	3	5	4
Reliability						
Exposure to hazards	1	4	3	2	4	4
Ease of repair	1	4	2	3	4	3
Ranking	1	3	2	2	3	3
Summary Ranking	1 (preferred corridor)	4	2	2	3	4

N-1 is an obvious first choice from the viewpoint of transmission line construction and operation because of the proximity to existing transportation throughout its length and use of the most favorable pass through the Alaska Range.

Because of proximity to existing transportation, impacts on soil, vegetation, and wildlife would likely be less severe than the other alternatives which pioneer routes in remote areas.

N-1 also has obvious disadvatages in that the area from Broad Pass through the Nenana Canyon offers very limited opportunities to shield transmission lines from view, and from Cantwell to Healy, the route parallels the eastern boundary of Mt. McKinley National Park. Portions of the line would be visible from the Park Headquarters. The environmental assessment includes a number of photos illustrating terrain and vegetation in this area.

The other Nenana alternatives provide a basis for exploring feasibility of avoiding the areas of Broad Pass and the Nenana Canyon.

N-1, N-2, and N-3 follow the same alignment from Devil Canyon to Cantwell. N-2 and N-3 follow east along the Denali Highway, and then head north through the Alaska Range about 30 miles east of the Nenana Canyon.

N-2 crosses two passes and returns to the Nenana River at Healy just below the Nenana Canyon. From Healy to Fairbanks, N-2 follows the existing GVEA line, as does N-1.

N-3 continues north through a third pass and approaches Fairbanks through the Wood River Drainage.

N-4 and N-5 avoid both the Broad Pass area and the Nenana Canyon. They head north from the vicinity of Watana Dam to Wells Creek and then north to the Fairbanks area using the same route as N-2 and N-3, respectively.

The primary advantages to this group of alternatives are avoiding highly scenic areas along the Alaska Railroad and Anchorage-Fairbanks Highway. N-2 and N-5 additionally are removed from the Railroad and the Highway between the Alaska Range and Fairbanks.

Other than visual impacts in presently utilized areas, N-2, N-3, N-4, and N-5 seem to offer no significant advantages. Because they involve pioneering new routes in remote areas, including substantial requirements for new access roads, the four alternatives would have greater impacts on soil and wildlife than would N-1.

APA believes it would be feasible from the engineerng viewpoint to construct and operate transmission lines in any of these corridors. However, because of remoteness, more rugged terrain, and the high elevation passes, alternatives N-2, N-3, N-4, and N-5 would involve significantly higher initial cost as well as operational costs and significantly lower reliability than alternative N-1.

On the grounds of environment, engineering, costs, and reliability, N-1 is the preferred corridor.

Project Power to Valdez and Other Points on the Richardson Highway

Analysis has not been completed of alternative corridors for delivering power to the Glennallen area and other points along the Richardson Highway.

The basic alternatives appear to be:

(1) Constructing a line from the Palmer area to Glennallen.

(2) Constructing a line from the Devil Canyon-Watana area to Glennallen.

(3) Completing a loop from Palmer to Glennallen and then north along the Richardson Highway to the Fairbanks area.

Existing studies by APA and area utilities evaluate possible electric service to points along the Richardson Highway from Glennallen to Valdez with and without power to electrify the pumping stations along the Alyeska pipeline. The studies indicate 138 kv system would suffice if pipeline pumping loads are not included, and that a 230 kv system would be needed with pipeline pumping. Neither of these alternatives would provide significant additional capacity to transfer power between the Anchorage and Fairbanks areas.

APA's present thinking is that a 138 kv or 230 kv line to Glennallen, either from Palmer or the Devil Canyon-Watana area should be evaluated for possible inclusion in early stages of project construction, and that completing a loop along the Richardson Highway may be desirable as a later stage of the project.

Part V TRANSMISSION SYSTEM DESIGNS AND ESTIMATES

This part summarizes designs and estimates for transmission systems for the four alternative development plans referenced in Table 1. The transmission studies assume lines located in the preferred corridors from the project to the Anchorage and Fairbanks areas. Transmission to the Glennallen area is treated as a separate alternative.

Electrical Design

Transmission Capacity

Based on firm power capability of the alternative systems, the relative size of power markets in the Anchorage-Cook Inlet and Fairbanks-Tanana Valley areas, and an assumed margin for flexibility, design capacities for the transmission systems were assumed as follows:

	Project Installed Capacity MW	Assumed Transmission Capacity, MW		
		Anchorage	Fairbanks	Anchorage + Fairbanks
System #1: Devil Canyon+Denali	580	500	250	750
System #2: Devil Canyon+Watana	1,070	1,000	300	1,300
System #3: Devil Canyon+ Watana+Denali	1,370	1,200	300	1,500
System #4: Devil Canyon+Watana +Vee+Denali	1,434	1,200	300	1,500
System #5: Watana+Devil Canyon	1,568	1,200	300	1,500

As discussed subsequently, these design capacities are not necessarily ultimate capacities of the transmission system. For example, with minor cost additions and nominal increases in losses at peak loading, the transmission system capacity for the proposed plan (System #5) could be upgraded by at least 50% without basic change in voltage, tower design, or conductors.

Voltage Selection and Line Characteristics

Based on nominal carrying capacities, both 230 kv and 345 kv systems entered consideration. Because reliability has high priority, the systems used multi-circuit configurations, except System #1. Conductor sizes, spacings, stranding, and bundling were assumed for each voltage. The following table summarizes these assumptions. It also indicates a measure of capability to be subsequently discussed. Design studies will determine final parameters, including series compensation.

69-737 0 - 81 - 11

Voltage	230 kv	345 kv
Conductor:		
Type	ACSR	ACSR
Name	Pheasant	Rail
Size	1272 MCM	954 MCM
Stranding	54/19	45/7
Number per phase	Simplex	Duplex
Flat Spacing:		
Conductor	---	16"
Phase	20'	28'
Towers:		
Material	Steel or Aluminum	Steel or Aluminum
No. per mile	6	5
Right-of-Way Width 1/	125'	140'
Single Circuit Capacity without Compensation	29,300 MW-mi.	82,200 MW-mi.

The two voltage options indicate minimum and maximum considerations. Alaska's first 230 kv line is now being constructed in the Anchorage area will be operated initially at 138 kv. Based on a conservative or "safe" stability criteria of 25° power angle between high voltage buses, the 138 kv transmission system is capable of less than 12,000 MW-mi. That is, the power transmitted times miles transmitted must be less than 12,000. The minimum acceptable capability north or south from the Susitna Project is over 50,000 MW-mi. and eventually could be as high as 188,000 MW-mi. Clearly, even a compensated 138 kv system of several lines would be inadequate and uneconomical.

Under the same stability criteria, a single circuit, uncompensated 230 kv transmission line has a capability of about 29,300 MW-mi. A 345 kv duplex system carries 82,000 MW-mi. A 500 kv line is capable of 186,000 MW-mi., which is too large to apply to the Susitna Project. The voltage alternatives therefore are bracketed by the standard 230 kv and 345 kv systems.

Conductors chosen for use in this study have not been subjected to detailed economic evaluation. The 1272 MCM applied to the 230 kv option is often used for that voltage but seldom is it exceeded. The 345 kv 954 MCM duplex conductor has been used extensively. Thermal constraints necessitate larger conductors with larger kv systems. The carrying capacity of the 345 kv transmission voltage can be accommodated by a simplex conductor, and there are many such in the U. S. However, the conductor size approaches an unwieldy diameter. Duplex bundling widely used in 345 kv systems reduces the diameter, retains thermal capacity, and increases stability limit. Higher voltages also produce more corona phenomena. This is

1/ Would be 50% greater for two single circuit lines on adjacent rights-of-way.

relieved somewhat by larger conductors. The 954 MCM duplex conductor approximates an average among all these factors for use in feasibility studies.

DC options were considered only briefly. Operating characteristics made DC systems inappropriate for a first major Railbelt intertie. The line lengths between the Project and the Anchorage and Fairbanks areas are 136 and 212 miles, respectively. It is generally considered that DC economics would not be attractive at these relatively short transmission distances.

Table 7 summarizes a comparison of 230 kv and 345 kv systems for the alternative hydro development systems. On the basis of this comparison, a 230 kv transmission plan was selected for System #1 with two circuits to Anchorage and a single circuit to Fairbanks. For Systems #2, #3, #4 and #5, two 345 kv circuits would be needed between Devil Canyon and Anchorage, and two 230 kv circuits between Devil Canyon and Fairbanks.

The assumed transmission system layout is indicated on Figure 10. The main lines go from the Devil Canyon switchyard to substations at Point MacKenzie and Ester-Gold Hill. Systems #2, #3, and #5 have a switchyard at Watana and two 230 kv circuits from Watana to the Devil Canyon switchyard. System #4 has a similar switchyard at Vee and two 230 kv circuits from Vee to Watana.

All transmission plans are relatively simple, radial systems that have distances, voltages, and loads well within experience of existing systems in the South 48. Hand studies were used to determine required compensation and system losses and to check for voltage drop and stability.

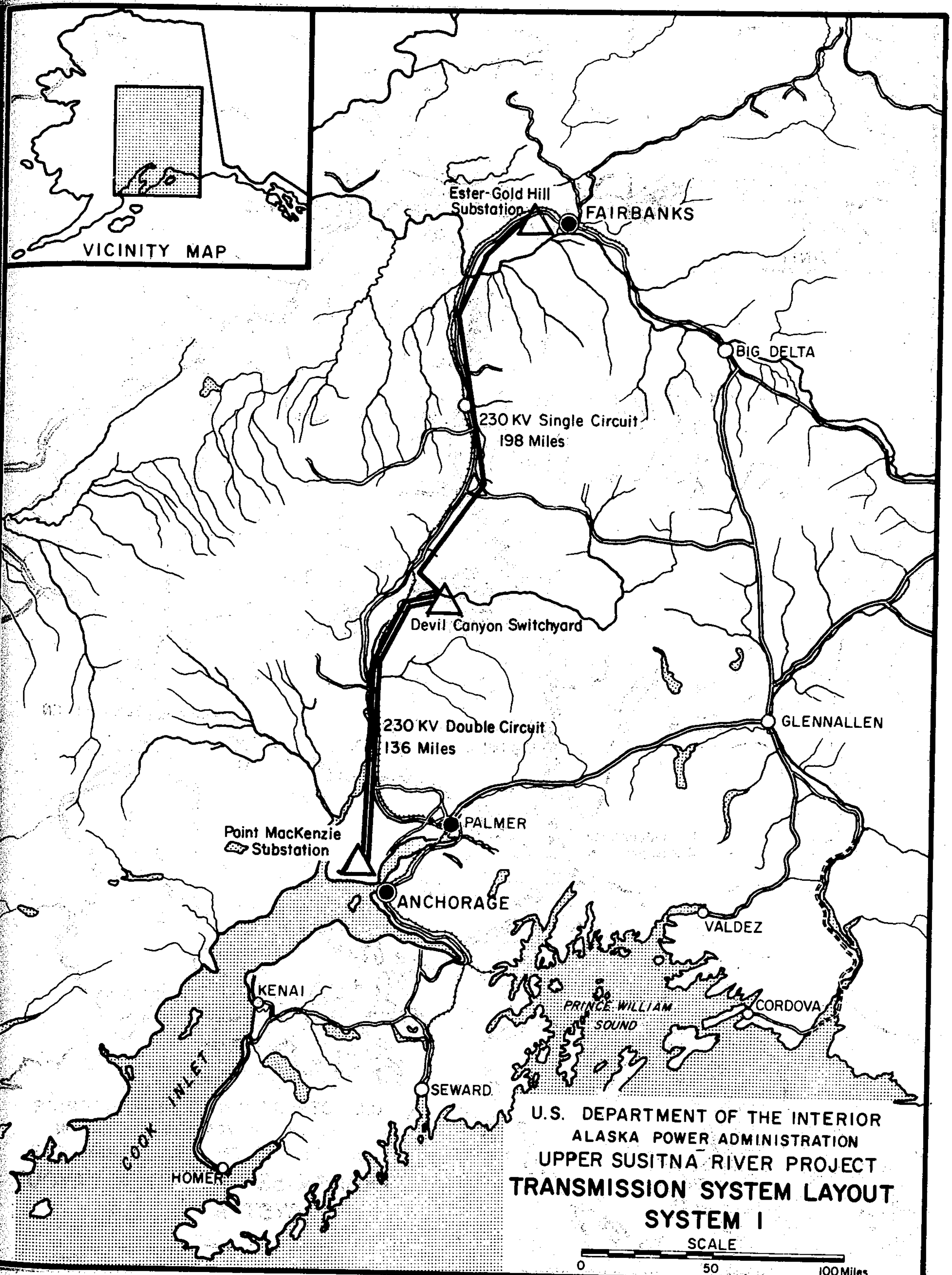
Table 8 summarizes line characteristics and system losses for the transmission systems. The 230 kv line from Devil Canyon to Fairbanks in System #1 appears to be close to stability limits. All of the double circuit lines could provide considerable additional capacity by adding series compensation.

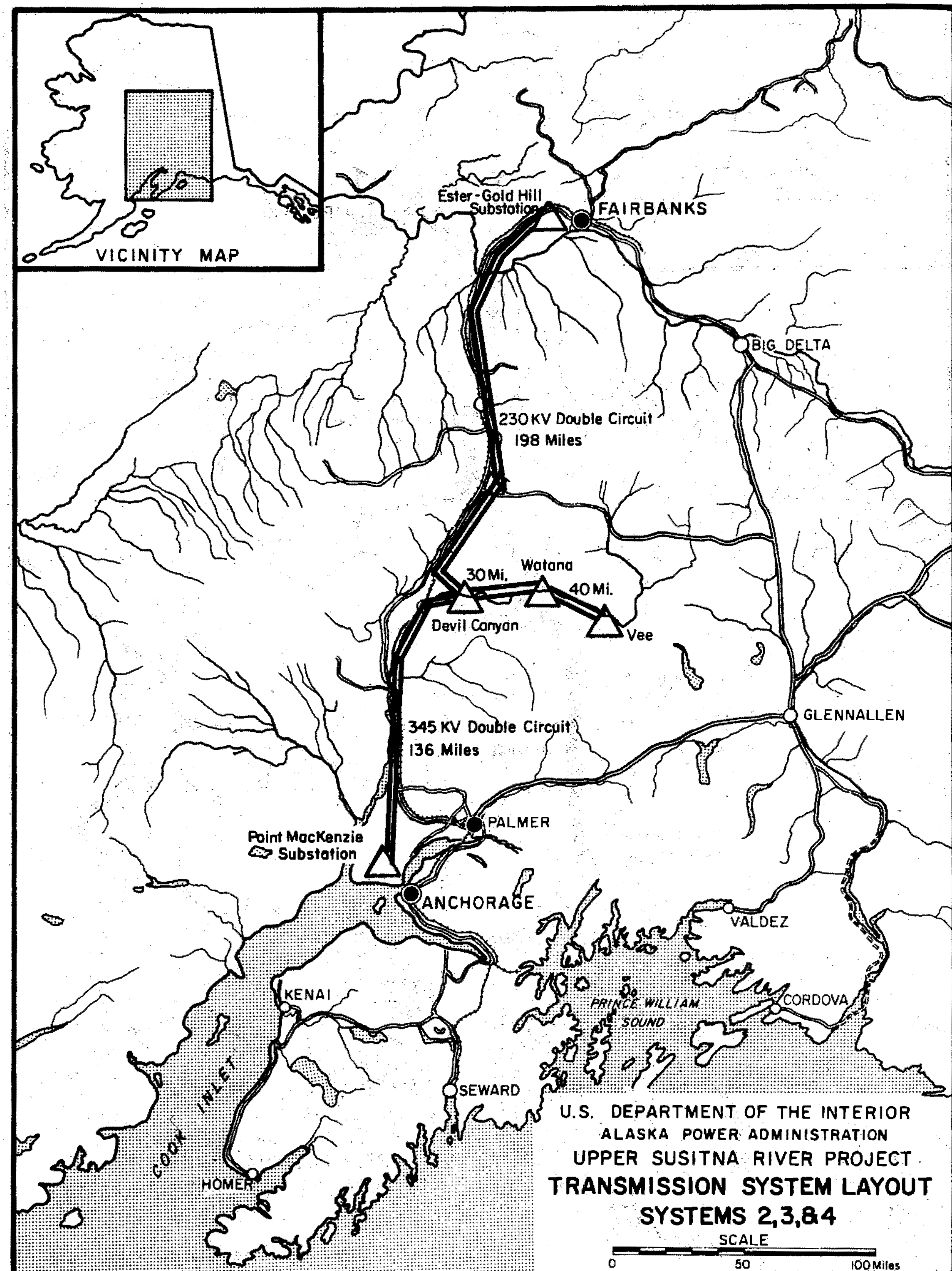
Substations and Switchyards

The transmission studies included switchyard and substation design, layouts, and cost estimates. Switchyard and substation designs assumed the nominal "breaker and one-half" scheme. Each line and transformer is protected by one and one-half circuit breakers. This is a compromise between the cost of a "two-breaker" plan and the reduction in reliability inherent in a "one-breaker" scheme. Figure 11 indicates substation layouts at the load center and switchyard layouts at powerplants.

Comparison of 230 and 345 KV Systems

Alternative System and Installed Capacity	# 1 (580MW)	# 2 (1070MW)	# 3 (1370MW)	# 4 (1434MW)	# 5 (1568MW)
Anchorage Line (136 mi.)					
Capability Requirement (MW-mi.)	70,000	140,000	164,000	164,000	164,000
230 kv Compensated Transmission Line (Pheasant Conductor):					
Compensation (%)	20	40	50	50	50
Maximum Capability (MW-mi.) (per circuit)	36,600	48,800	58,600	58,600	58,600
Number of Circuits Required	2	3	3	3	3
Power Loss (%)	4.8	6.5	7.7	7.7	7.7
345 kv Duplex Uncompensated Transmission Line (Rail Conductor):					
Maximum Capability (MW-mi.) (per circuit)	82,200	82,200	82,200	82,200	82,200
Number of Circuits Required	1	2	2	2	2
Power Loss (%)	2.9	2.9	3.5	3.5	3.5
Fairbanks Line (198 mi.)					
Capability Requirement (MW-mi.)	50,000	60,000	60,000	60,000	60,000
230 kv Compensated Transmission Line)Pheasant Conductor):					
Compensation (%)	5	12	12	12	12
Maximum Capability (MW-mi.) (per circuit)	55,000	33,300	33,300	33,300	33,300
Number of Circuits Required	1	2	2	2	2
Power Loss (%)	7	4.6	4.6	4.6	4.6
345 kv Duplex Uncompensated Transmission Line (Rail Conductor):					
Maximum Capability (MW-mi.) (per circuit)	82,200	82,200	82,200	82,200	82,200
Number of Circuits Required	1	1	1	1	1
Power Loss (%)	2.3	2.7	2.7	2.7	2.7


VICINITY MAP
Ester-Gold Hill Substation
FAIRBANKS
BIG DELTA
230 KV Single Circuit 198 Miles
Devil Canyon Switchyard
230 KV Double Circuit 136 Miles
GLENNALLEN
PALMER
Point MacKenzie Substation
ANCHORAGE
VALDEZ
KENAI
PRINCE WILLIAM SOUND
CORDOVA
COOK INLET
SEWARD
HOMER
U.S. DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
UPPER SUSITNA RIVER PROJECT
TRANSMISSION SYSTEM LAYOUT
SYSTEM I
SCALE
0
50
100 Miles


VICINITY MAP
Ester-Gold Hill
Substation
FAIRBANKS
BIG DELTA
230 KV Double Circuit
198 Miles
30 Mi.
Watana
40 Mi.
Devil Canyon
Vee
GLENNALLEN
345 KV Double Circuit
136 Miles
PALMER
Point MacKenzie
Substation
ANCHORAGE
VALDEZ
KENAI
PRINCE WILLIAM
SOUND
CORDOVA
SEWARD
COOK INLET
HOMER
U.S. DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
UPPER SUSITNA RIVER PROJECT
TRANSMISSION SYSTEM LAYOUT
SYSTEMS 2,3,&4
SCALE
0
50
100 Miles

Transmission Line Characteristics

	Transmission Data For Alternative Systems				
	System # 1	System # 2	System # 3	System # 4	System # 5
Devil Canyon to Pt. MacKenzie (136 miles):					
Number of circuits	2	2	2	2	2
Nominal line loading, MW	500	1,000	1,200	1,200	1,200
Voltage, kv	230	345	345	345	345
Conductor (ACSR)	1,272	954	954	954	954
Losses:					
Peak MW	24	28	40	40	40
Peak %	5	3	3	3	3
Energy MWH/yr.1/	19,100	22,700	32,700	32,700	32,700
Devil Canyon to Ester-Gold Hill (198 miles):					
Number of circuits	1	2	2	2	2
Nominal line loading, MW	250	300	300	300	300
Voltage, kv	230	230	230	230	230
Conductor (ACSR)	1,272	1,272	1,272	1,272	1,272
Losses:					
Peak MW	17	12	12	12	12
Peak %	7	4	4	4	4
Energy MWH/yr.1/	13,900	10,000	10,000	10,000	10,000

1/ At 40% Line Loading Factor.

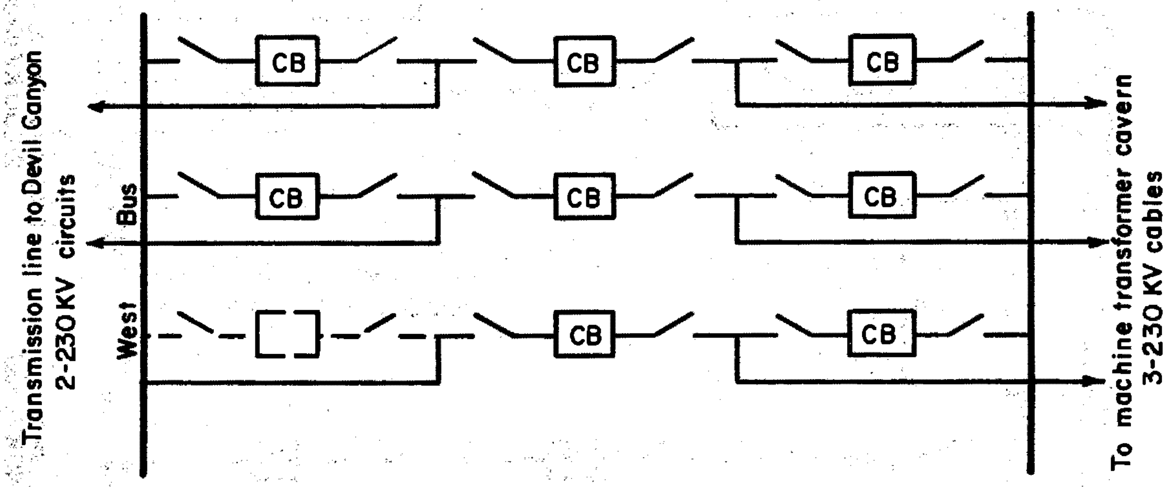
(continued)

Transmission Data For Alternative Systems

	System # 1	System # 2	System # 3	System # 4	System # 5
Watana to Devil Canyon (30 miles):					
Number of circuits		2	2	2	2
Nominal line loading, MW		470	670	721	750
Voltage, kv		230	230	230	230
Conductor (ACSR)		1,272	1,272	1,272	1.272
Losses:					
Peak MW		Less than 2% of peak			
Watana to Vee (40 miles):					
Number of circuits				2	
Nominal line loading, MW				300	
Voltage, kv				230	
Conductor (ACSR)				1,272	
Losses:					
Peak MW		Less than 2% of peak			

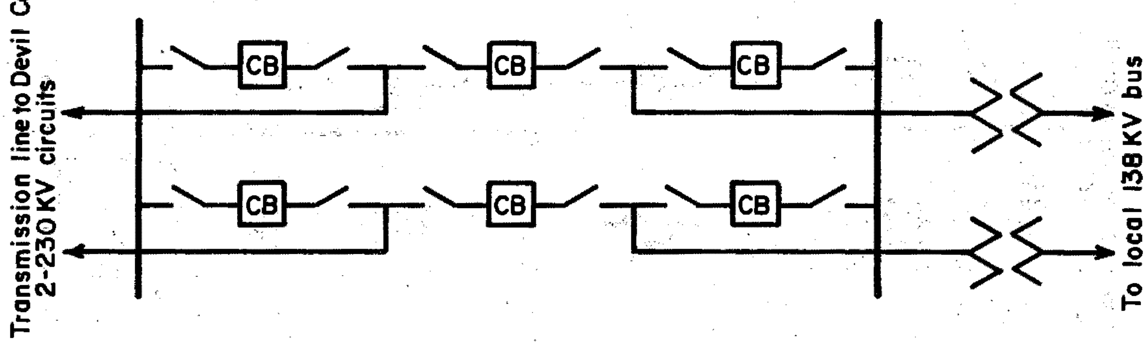
SUBSTATION LAYOUT

I. WATANA 230KV SWITCHYARD



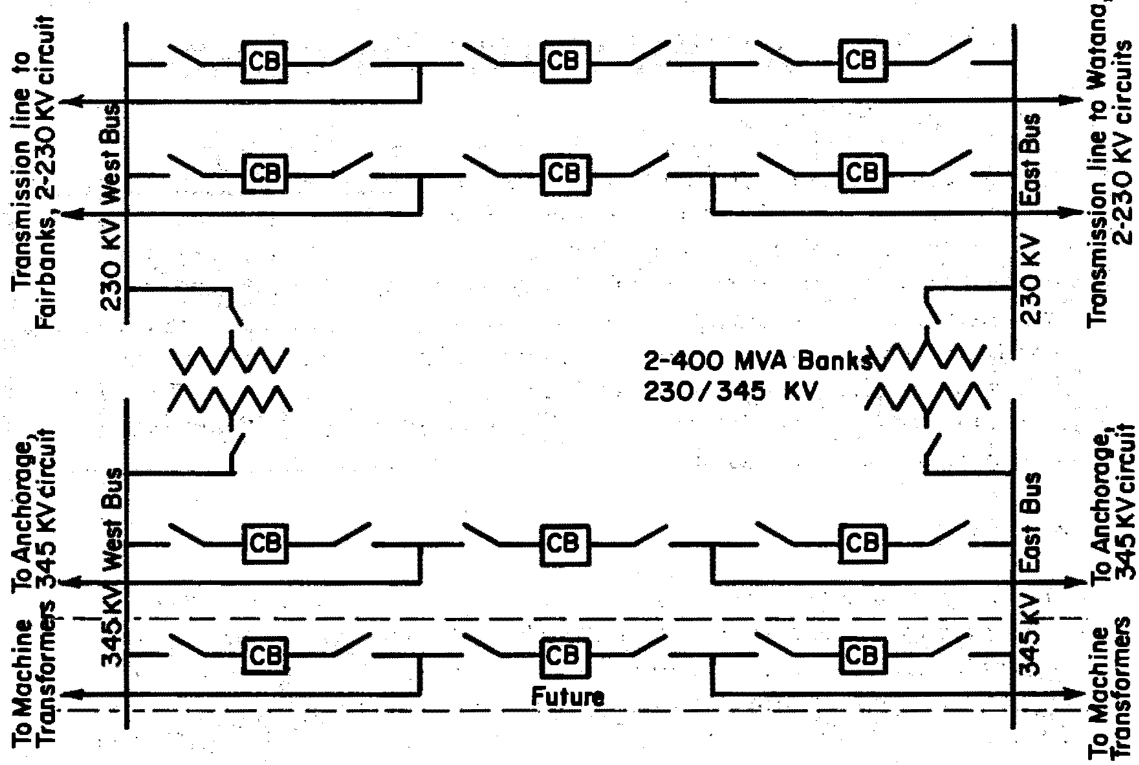
DEVICE	SIZE	No. OF UNITS
Circuit Breakers	230 KV	8
Sta. Svc., Reac., Capacitor	Mach. KV	5% of above

2. FAIRBANKS 230KV SUBSTATION



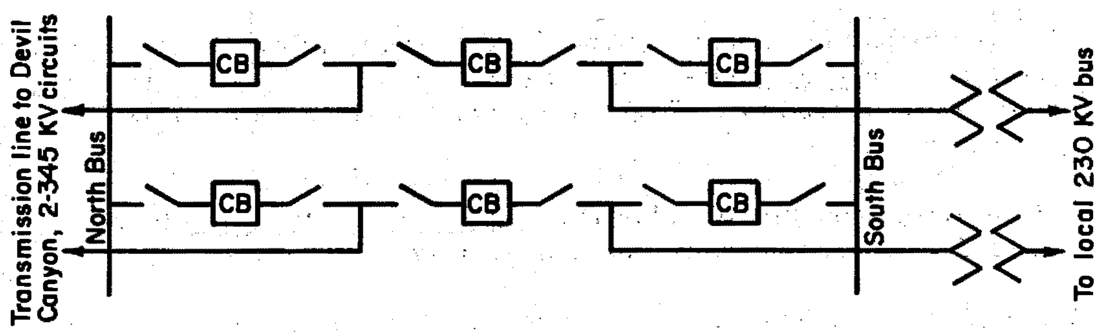
Power Transformers	230/138 KV-200MVA-3Ø	2-3Ø Units
Circuit Breakers	230 KV	6
Sta. Svc., Reac., Capacitors	Tertiary KV	5% of above

3. DEVIL CANYON SWITCHYARD



DEVICE	SIZE	No. OF UNITS
Power Transformers	2-400 MVA Bks. 230/345 KV	7-1Ø Units (133.3 MVA ea.)
Circuit Breakers	230 KV-345 KV	6-230 KV, 3-345 KV
Sta. Svc., Reac., Capacitors	Tertiary KV	5% of above

4. ANCHORAGE 345 KV SUBSTATION



Power Transformers	750 MVA Bks.-345/230 KV	7-1Ø Units (250 MVA ea)
Circuit Breakers	345 KV	6
Sta. Svc., Reac., Capacitors	Tertiary KV	5% of above

Note: Single-phase (1Ø) transformers are connected 3 per 3Ø bank with 1Ø spare per switchyard or substation.

In addition to the breakers, each end of the transmission line has transformers, bus work, and, where pertinent, reactors and capacitors. Transformers were provided between transmission voltages.

Power Flow Studies

As stated previously, hand studies were used to determine transmission system design parameters and losses. Several computer runs were made at the Bonneville Power Administration to check basic system performance under load and with assumed outages. The computer studies confirm that the system design assumptions are adequate for feasibility study purpose, that is, to provide an adequate basis for determining physical and financial feasibility of the system. The more detailed studies for actual design would include the full range of systems analysis appropriate for a major new power system.

Reliability

The preliminary transmission evaluations assumed multiple circuit configuration; substations, and switchyards use the "breaker and one-half" scheme. The various systems assume two circuits on a single tower except for a single circuit 230 kv line to Fairbanks in System #1. Tower designs are free-standing, steel with NESC "heavy" loading for the low-level portions of the corridors, and an additional safety factor for rugged terrain and mountain passes.

There have been no specific studies of system reliability. Based on experience elsewhere, the double circuit lines would have very high reliability. They would be vulnerable to outages due either to tower failure (landslides, etc.) or to a failure caused by interference with both circuits (such as an aircraft accident).

The next higher level of reliability would be to utilize two single-circuit lines. If these were in close proximity to each other, they could utilize the same access facilities. Right-of-way and clearing requirements would increase.

Some further reduction in vulnerability to serious outages would be obtained by parallel or looped lines in separate rights-of-way.

During review of the preliminary studies by the Bonneville Power Administration and area utilities, strong preference was indicated for placing each circuit on a separate set of towers. The reviewers felt the added reliability of such a plan would justify the additional costs.

Right-of-Way

Estimated width and area of rights-of-way are as follows:

Line	ROW Width	Acres Per Mile
230 kv, single or double circuit	125	15.2
2-230 kv, adjacent ROW	190	22.8
345 kv, single or double circuit	140	17.0
2-345 kv, adjacent ROW	210	25.5

Over most of the route, the normal ROW width would be adequate for both the lines and the access facilities.

Detailed analysis of land ownership would be needed as a part of final route selection. It is anticipated that some private lands will be crossed and that easements would be obtained (rather than purchased in fee). Where the lines are on public land, it is assumed that ROW can be obtained without cost to the project. The estimates include an allowance of $700 per acre for easements on portions of the lines which are assumed to involve private lands. On the basis of judgment evaluation of broad land ownership patterns for each corridor segment, approximately 75 miles along the Devil Canyon to Fairbanks and 89 miles along the Devil Canyon to Point MacKenzie route may require easements.

Clearing

Heavily forested areas in the Susitna and Tanana Valleys would require essentially continuous clearing. However, tree size varies from small to medium and clearing operations are not particularly difficult.

Based on USGS maps with vegetation overprint and Forest Service maps showing timber types, approximately 231 miles of line under System #1 and 261 miles for System #2, #3, #4, and #5 would require essentially continuous clearing. A unit cost of $500 per acre for clearing was assumed, based on recent highway construction bids. Acreage for clearing were premised on 4.6 acres per mile for the 230 kv lines and 5.1 for the 345 kv lines.

The remaining portions of the lines would involve only nominal clearing of occasional small trees and some brush removal.

Access Roads

Since the preferred corridor is in close proximity to existing surface transportation, requirements for new access roads are minimal. Where soils and topography are favorable, a primitive access road suitable for four-wheel drive vehicles is assumed. Such access roads would consist of little more than a trail along the right-of-way with occasional cross drainage structures and small amounts of gravel fill. Access to existing roads would be provided periodically. No major stream crossings would be involved. These rudimentary roads would be used in both the construction and operation and maintenance phases.

Between Gold Creek and the project powerplants, it is assumed that the access roads built for dam construction would be adequate for transmission access.

For the remainder of the line, an estimated 219 miles is suitable for four-wheel drive access roads. The estimates include $50,000 per mile for roads.

From Gold Creek to Cantwell and Healy, terrain, vegetation, and soils do not favor use of the primitive access roads. It is assumed that no new roads would be provided for this line segment. For this portion of the line, access would be limited to helicopter and winter over-snow vehicles for construction and operation and maintenance. Significant portions of the existing GVEA and CEA transmission systems have been built and operated in this manner.

Structural Design

Wind and Ice Loading

There is not a great deal of hard data on wind and icing extremes for the selected corridors. However, there is a sufficient experience base to establish that wind and ice conditions should not be unusually severe.

Existing transmission lines in the Matanuska-Susitna Valleys and from Healy to Fairbanks have not experienced any unusual icing problems. Hoarfrost is a fairly common experience in winter, but not a problem for HV lines. Climate and topography generally do not favor formation of heavy glaze or rime ice--during most of the year it is either too hot, too cold or too dry for heavy icing to occur.

This is markedly different from conditions in some mountainous areas along the Gulf of Alaska where temperature and moisture conditions favorable to heavy icing are quite common.

Key stations for wind data are at Anchorage, Talkeetna, Summit, Nenana, and Fairbanks. All of these stations have fairly lengthy records of wind observations; none have recorded unusually severe winds. The available recorded data is on the basis of fastest mile, so actual peak gusts would be higher.

Station	Period of Record	Maximum Wind Recorded MPH	Source (all from National Weather Service)
Anchorage	1914-1974	61	1974 Annual Station Summary
Talkeetna	1940-1974	38	1974 Annual Station Summary
Summit	1941-1974	48	1974 " " "
Nenana	1949-1967	less than 40	NWS Uniform Summary, Part C
Fairbanks	1929-1974	40	1974 Annual Station Summary

It is known that more severe winds occur through the Nenana Canyon. During initial operations of the Healy-Fairbanks 138 kv line, 3 towers in the immediate vicinity of Healy were lost due to high winds. The problem area is right at the mouth of Nenana Canyon. The Alaska State Highway Department operated an anemometer at the Moody Bridge site in Nenana Canyon for a short period during construction of the Anchorage-Fairbanks Highway. Maximum recorded wind was 62 MPH, and a more severe wind storm was observed during a period when the recorder was not operating. 1/

The basic transmission cost data for this study are premised on the Bonneville Power Administration designs for National Electric Safety Code Heaving Loading assumptions--4 pound wind concurrent with ½" radial ice or an alternative 8 pound wind loading. The NESC loading assumption is consistent with normal utility practice for this area and is considered adequate for the portions of the line from Talkeetna to Anchorage and from Healy to Fairbanks.

It is expected that more severe wind load criteria would be appropriate for portions of the line through the Broad Pass area and the Nenana Canyon. A more detailed study of climate conditions for these corridor segments, including collecting additional wind data, would be needed along with the detailed design studies. This study makes allowance for more severe wind conditions in these areas by increasing tower steel 10 percent.

1/ Communication from Alaska Department of Highways, June 1975.

Very severe icing is not considered likely based on the topography and climate data, comparatively low elevations through the Alaska Range, and absence of reports of severe icing. The available data also indicates possibilities are remote for simultaneous occurrence of maximum wind and maximum icing. A summary of data for the station at Summit follows. Heaviest winds occur from November to March when air temperatures are well below freezing.

Snow

Available snow depth data from Soil Conservation Service Snow Survey publications were reviewed primarily to determine if there were any areas along the corridor where snow depths are large enough to affect tower designs.

Standard tower designs assumed for this study are generally adequate to handle snow depths up to 10 feet. For areas of larger snow accumulation, added tower height would be needed to obtain necessary clearance. This is often handled by adding "snow legs" to standard tower designs.

Based on the snow data, maximum snow accumulation well under 10 feet is expected over the entire route, except for occasional areas subject to drifting. The snow depthwill not likely affect transmission designs and costs significantly.

Tower Design

The cost estimates are premised on free-standing, steel-lattice towers. This assumption reflects fully-proven technology for which there is a good experience base in costing and construction methods.

The final designs would consider several alternative designs and may result in selecting guyed towers for portions of the line and use of special tower designs in areas where the lines are most visible. Figure 12 indicates representative sizes and shapes for several 230 kv towers; 345 kv towers are somewhat larger because phase to phase and phase to ground clearances must be 8 to 10 feet greater than for 230 kv.

Foundations

Available soils and foundation data include: detailed soil surveys from the Soil Conservation Service for part of the lower Susitna Valley and the immediate Fairbanks area; general geologic and permafrost maps from the USGS; 1:250,000 scale reconnaissance level interpretation of soil types prepared by the Resources Planning Team of the Land Use Planning Commission; and data from route studies for existing transmission lines and highways. The environmental assessment includes a regional permafrost map and strip maps showing general soil types for the corridors.

Temperature, Precipitation, and Wind for Summit

	Average Temperature, °F			Mean Precip. Inches	Wind Speed, MPH	
	Mean Month	Maximum Month	Minimum Month		Mean	Fastest Mile
Jan.	0.8	7.3	- 5.7	0.9	15.1	44
Feb.	6.3	13.0	- 0.5	1.17	11.9	46
Mar.	10.4	18.7	2.0	1.01	11.0	48
Apr.	23.4	32.7	14.0	0.64	7.6	33
May	37.4	45.6	29.1	0.72	7.7	28
June	48.8	57.9	39.7	2.18	8.3	29
July	52.1	60.3	43.9	2.98	7.8	30
Aug.	48.7	56.1	41.2	3.25	7.4	26
Sept.	39.8	47.1	32.5	2.75	7.5	37
Oct.	23.7	30.1	17.2	1.62	8.0	35
Nov.	9.5	15.5	3.5	1.23	11.3	39
Dec.	3.0	9.3	- 3.3	1.17	12.7	44

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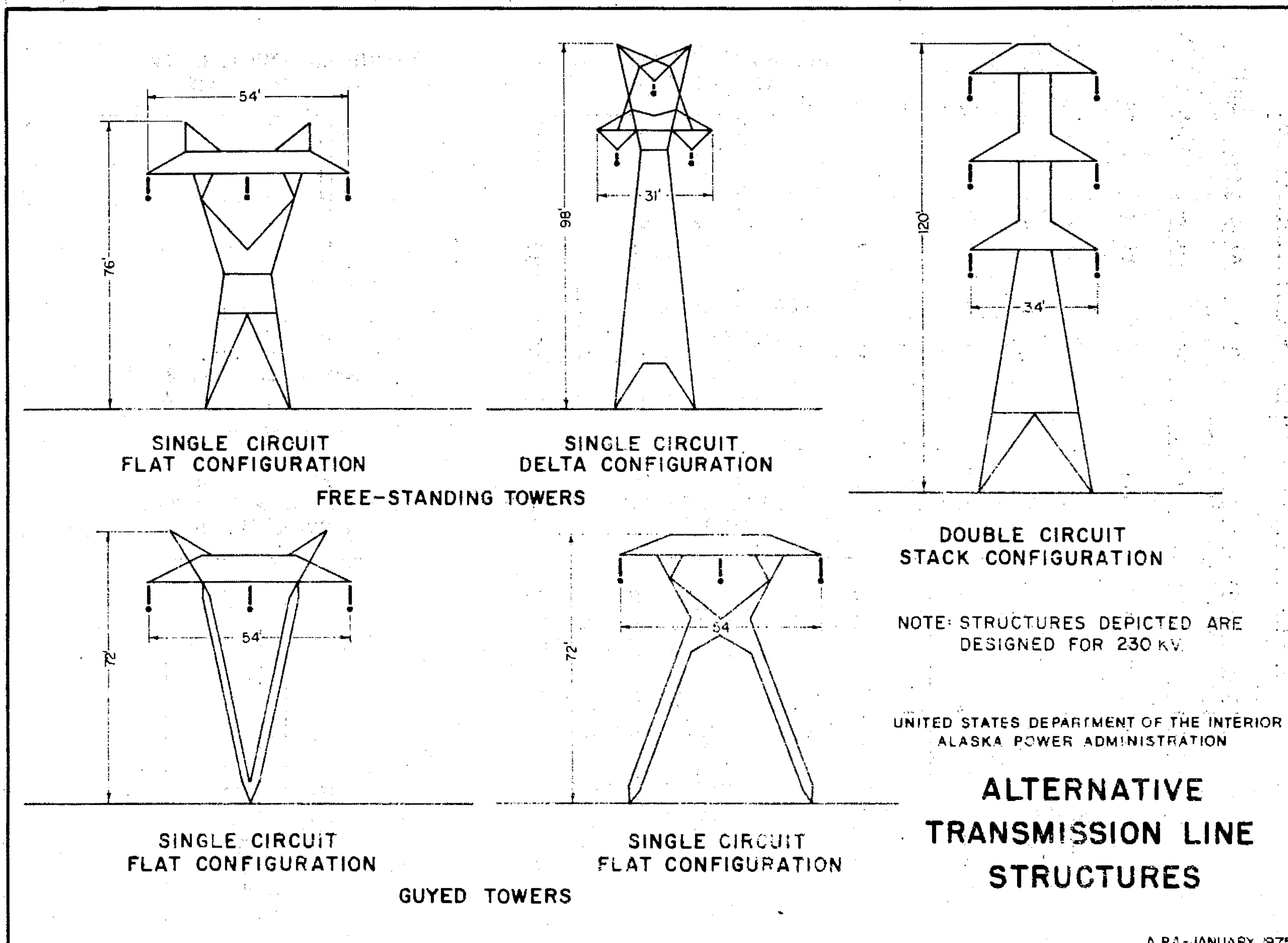
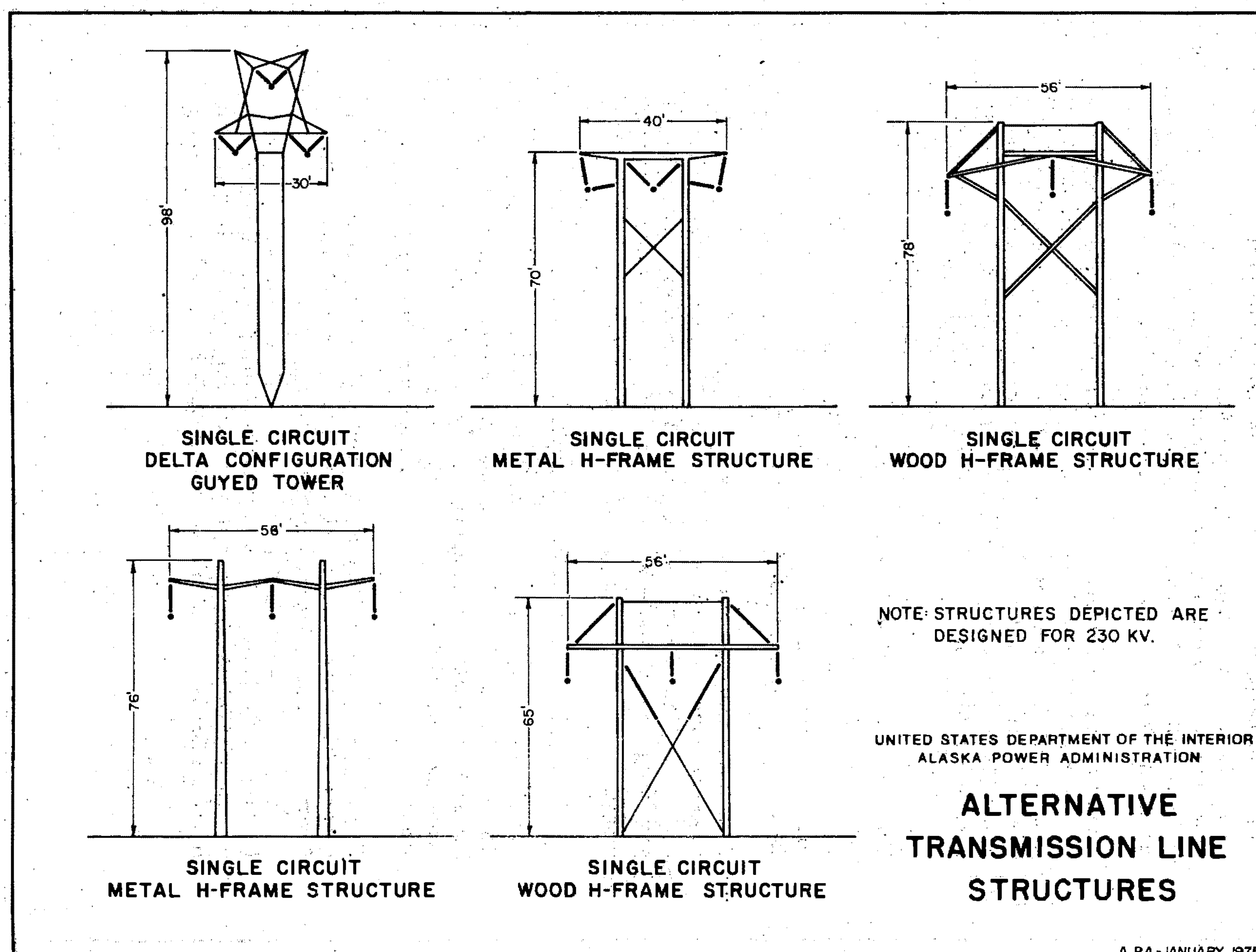

54'
76'
98'
31'
120'
34'
SINGLE CIRCUIT
FLAT CONFIGURATION
SINGLE CIRCUIT
DELTA CONFIGURATION
FREE-STANDING TOWERS
DOUBLE CIRCUIT
STACK CONFIGURATION
72'
54'
72'
54'
SINGLE CIRCUIT
FLAT CONFIGURATION
SINGLE CIRCUIT
FLAT CONFIGURATION
GUYED TOWERS
NOTE: STRUCTURES DEPICTED ARE DESIGNED FOR 230 KV.
UNITED STATES DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
ALTERNATIVE TRANSMISSION LINE STRUCTURES
A.P.A.-JANUARY 1975


98'
30'
SINGLE CIRCUIT
DELTA CONFIGURATION
GUYED TOWER
40'
70'
SINGLE CIRCUIT
METAL H-FRAME STRUCTURE
56'
78'
SINGLE CIRCUIT
WOOD H-FRAME STRUCTURE
58'
76'
SINGLE CIRCUIT
METAL H-FRAME STRUCTURE
56'
65'
SINGLE CIRCUIT
WOOD H-FRAME STRUCTURE
NOTE: STRUCTURES DEPICTED ARE DESIGNED FOR 230 KV.
UNITED STATES DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
ALTERNATIVE TRANSMISSION LINE STRUCTURES
A. P.A.-JANUARY 1975

Areas of muskeg, frost susceptible soils, and permafrost will require careful foundation design. It is estimated that up to about 30 percent of the line would require foundations designed specifically to accommodate these conditions. Experience suggests that such special designs would not involve major increased costs for the line.

A number of different design approaches have been used. Portions of existing CVEA lines through muskeg areas that have considerable frost action have used guyed towers set on steel pile foundations. The GVEA Healy-Fairbanks line crosses some very sensitive permafrost areas. It also uses guyed towers, but the foundation is a single pedestal. A further option would be use of thermal pilings to keep foundations in a frozen state.

Transmission lines for Canada's Nelson River Project use free standing towers with footings set on a grillage foundation to cross permafrost and muskeg. This technique involves setting a grillage of steel or timber below the active frost zone for the foundation. The estimates for this report are premised on use of the grillage foundations.

This is a conservative assumption since much of the route will undoubtably be suitable for normal tower foundations -- concrete footings under each tower leg. Foundation considerations will of course be a major consideration in the detailed route and design studies, following authorization.

Transmission Cost Estimates

This section summarizes the transmission system cost estimates. The basic estimates are premised on cost experiences of the Bonneville Power Administration with adjustments to reflect Alaska construction costs and January 1975 price levels. As noted previously, costs for rights-of-way, clearing, and access were estimated separately.

The first set of estimates were prepared to allow comparison of the several alternative hydro development plans and were used in the Corps of Engineers scoping analysis.

Further studies were made on alternative transmission plans for the proposed initial development plan (Watana and Devil Canyon) resulting in the transmission plan and estimate included in the project proposal.

Alaska Cost Factors

The basic cost data from BPA reflects Pacific Northwest conditions. Alaska construction would involve substantially higher labor costs and additional transportation costs to deliver materials fabricated in the South "48" to Alaskan construction sites.

APA derives "Alaska factors" of 1.9 for labor and 1.1 for added transportation. The BPA data were separated into components of labor and materials and the appropriate factors were applied to estimate Alaska costs.

The 1.9 labor cost factor is premised on a comparison of wage and fringe benefits data under recent IBEW contracts for the Anchorage and Portland areas with appropriate allowances for overtime and subsistance pay for remote work in Alaska.

The 1.1 transportation cost factor is premised on current barge and rail tariffs between Seattle and various points along the Alaska Railroad, with an allowance for loading and unloading.

Transmission Line Costs

Typical mile costs for constructing transmission lines were furnished by the Bonneville Power Administration. These costs were itemized by major components and portions of costs for labor and material. APA adjusted these costs with the Alaska factors for labor and transportation derived above. The estimates are summarized on Table 10.

The BPA typical mile costs were premised on January 1974 price levels and APA made adjustments to January 1975 prices. Based on advice from BPA personnel, tower steel costs were increased from $450 to $800 per ton. Other basic cost items were updated using USBR indexes.

The estimates include allowances for: handling and storage of materials; contingencies and unlisted items; and overhead items. The allowance for handling and storage is 15% of tower steel costs plus 10% of other material costs. There is a 25% allowance for contingencies and unlisted items such as communications equipment and series compensation. The 20% overhead item includes surveys, designs, inspection, and contract administration.

Typical Mile Transmission Line Costs

	230 kv Single Circuit		230 kv Double Circuit		345 kv Double Circuit	
	Labor	Materials	Labor	Materials	Labor	Materials
	January 1974 Costs, $1,000					
Tower Steel	13.18	13.95	22.95	24.30	42.71	45.23
Conductors	10.49	13.73	16.26	27.47	18.31	37.48
Hardware & Accessories		.82		1.64		4.00
Insulators		1.14		2.28		4.21
Miscellaneous	4.41	3.58	4.41	5.05	4.41	9.24
Subtotal (Pacific NW)	28.08	33.22	43.62	60.74	65.43	100.16
	January 1975 Costs, $1,000 1/					
Tower Steel	16.74	24.83	29.15	43.25	54.24	80.51
Conductors	13.32	17.44	20.65	34.89	23.25	47.60
Hardware & Accessories		1.04		2.08		5.08
Insulators		1.45		2.90		5.35
Miscellaneous	5.60	4.55	5.60	6.41	5.60	11.73
Subtotal (Pacific NW)	35.66	49.31	55.40	89.53	83.09	150.27
Alaska Factor	1.9	1.1	1.9	1.1	1.9	1.1
Alaska Cost	67.75	54.24	105.26	98.48	157.87	165.30
Subtotal	121.99		203.74		323.17	
Handling & Storage 2/	9.52		16.99		29.81	
Subtotal	131.51		220.73		352.98	
Contingencies & Unlisted Items (25%)	32.88		55.18		88.25	
Subtotal	164.39		275.91		441.23	
Admin. overhead, survey, design & inspection (20%)	32.88		55.18		88.25	
Total Alaska Construction Cost	197.27		331.09		529.48	
Rounded	200		330		530	

1/ Cost increase reflect following assumption:

Tower Steel: $\frac{\text{Jan 1975 } \$800/\text{ton}}{\text{Jan 1974 } \$450/\text{ton}} = 1.78$

Other items based on USBR transmission cost index:

$\frac{\text{Jan 1975 } 1.87}{\text{Jan 1974 } 1.47} = 1.27$

2/ 15% of tower steel cost plus 10% of other materials costs.

Typical Mile Transmission Line Costs - cont.

	345 kv Single Circuit		
	Labor		Materials
	January 1974 Costs, $1,000		
Tower Steel	26.35		27.90
Conductors	11.81		18.74
Hardware & Accessories			2.00
Insulators			2.10
Miscellaneous	4.41		5.95
Subtotal (Pacific NW)	42.57		56.69
	January 1975 Costs, $1,000 1/		
Tower Steel	33.46		49.60
Conductors	15.00		23.80
Hardware & Accessories			2.54
Insulators			2.70
Miscellaneous	5.60		7.60
Subtotal (Pacific NW)	54.06		86.24
Alaska Factor	1.9		1.1
Alaska Cost	102.71		94.86
Subtotal		197.57	
Handling & Storage 2/		17.67	
Subtotal		215.24	
Contingencies & Unlisted Items(25%)		53.81	
Subtotal		269.05	
Admin. overhead, survey, design & inspection(20%)		53.81	
Total Alaska Construction Cost		322.86	
Rounded		320.00	

1/ Cost increase reflect following assumption:

Tower Steel: $\frac{\text{Jan 1975}}{\text{Jan 1974}} \frac{\$800/\text{ton}}{\$450/\text{ton}} = 1.78$

Other items based on USBR transmission cost index:

$$\frac{\text{Jan 1975}}{\text{Jan 1974}} \frac{1.87}{1.47} = 1.27$$

2/ 15% of tower steel cost plus 10% of other materials costs.

As noted previously, tower steel was increased 10% above that for the typical mile costs for portions of the line in higher elevations through the Alaska Range.

Switchyard and Substation Costs

Table 11 shows sample computations of switchyard and substation costs.

These were estimated using basic cost data for major equipment items from Bonneville Power Administration's "Substation Design Estimating Catalog" with price levels of January 1975. The major cost items are the transformers and circuit breakers. As in the transmission estimates, costs for the major equipment items were adjusted for Alaska labor and transportation costs. Additional allowances were made for: handling and storage (15% of material cost); contingencies and unlisted items (25%); and overhead (20%).

Costs for individual switchyards and substations were determined by increasing the major equipment item as derived above by an additional 10% allowance for station service items.

Transmission Maintenance Facilities

The estimates include provision for transmission maintenance headquarters at roughly the mid-points of the Devil Canyon-Fairbanks and Devil Canyon-Anchorage lines. Each headquarters would consist of a lineman's residence, vehicle storage building, warehouse, and fenced storage yard.

Estimates for Alternative Hydro Development Plans

Table 12 summarizes cost estimates for transmission systems assumed for the Corps of Engineers scoping analysis of alternative hydro development plans. The plans include substations at Fairbanks and Point MacKenzie with switchyards at each powerplant. Transmission lines assumed for the scoping analysis are as follows:

System #1 assumes a single circuit 230 kv line from Devil Canyon to Fairbanks and a double circuit 230 kv line from Devil Canyon to Point MacKenzie.

The transmission plans in the scoping analysis for systems #2, #3, and #5 assume a double circuit line from Devil Canyon to Fairbanks, a 345 kv double circuit line from Devil Canyon to Fairbanks, and a 230 kv double circuit line from Watana to Devil Canyon. System #4 adds a 230 kv double circuit line from Vee to Watana.

Switchyard and Substation Costs

Part I - Sample Calculation, Derivation of Circuit Breaker and Transformer Costs

	Equipment Cost ($1,000 - January 1975 Costs)			
	Power Transformer 345/230 kv		Circuit Breaker 345 kv	
	Labor	Material	Labor	Material
Equipment Cost	11	320	15	265
Structures & Accessories	+ 5	+ 138	+ 8	+ 138
Subtotal	16	458	23	403
Alaska Factor	x1.9	x 1.1	x1.9	x 1.1
Alaska Cost	30	504	44	443
Subtotal	534		487	
Handling & Storage (15% of material)	76		66	
Contingencies and unlisted items (25%)	+ 134		+ 122	
Administrative overhead and design (20%)	+ 107		+ 97	
Total, Alaska Construction Cost	851		772	
Rounded	850		770	

Part II - Sample Calculation, Devil Canyon Switchyard

	Construction Cost January 1975 Costs
Six - 230 kv Circuit breakers 6 x $565,000 =	$ 3,390,000
Six - 345 kv Circuit breakers 6 x $770,000 =	4,620,000
Seven - 345/230 kv Single phase transformers 7 x $850,000 =	5,950,000
Subtotal	13,960,000
10% station service, capacitors, reactors	1,400,000
Total Construction Cost	$15,360,000

Switchyard and Substation Costs (cont.)

Part III - Summary, System 5 Switchyard and Substation Costs

	Watana Switchyard	Devil Canyon Switchyard	Ester-Gold Hill Substation	Point MacKenzie Substation	Intermediate Del. Point Substation	Switching Station (Compensation)
Circuit Breakers	8@230 kv	6@230 kv 6@345 kv	6@230 kv 2@138 kv	6@230 kv 2@138 kv	5-345 kv 1-138 kv	6-230 kv
Transformers	---	7@ 345/230 kv 1/	2@ 230/138 kv 2/	7@ 345/138 kv 1/	4@ 345/138 kv 1/	
Construction Cost ($1,000-January 1975)	4,970	15,360	9,150	12,420	7,890	3,720

1/ Single-phase transformers
2/ Three-phase transformers

Summary of Transmission System Cost Estimates

	System # 1	System #2-3-5	System #4
Length of line, miles	334	364	404
Portion requiring easements, miles	164	164	164
Portion requiring clearing, miles:			
Medium-Heavy	231	261	301
None	103	103	103
Access roads, miles:			
4-Wheel Drive	219	219	219
None	115	145	185
Tower Construction, miles:			
NESC Heavy	195	195	195
Added Steel (Mountains)	139	169	209

Estimates for Scoping Analyses

	Construction Costs ($1,000)		
	System # 1	System #2 & 3	System # 4
Clearing	1,010	1,210	1,210
Easements	2,240	2,410	2,410
Access Roads	14,240	14,240	14,240
Transmission Lines	87,190	151,960	165,700
Substations & Switchyards	19,320	41,900	46,870
TOTAL	124,000	211,720	230,430

Estimate for Proposed Plan (System #5)

	Construction Costs ($1,000)
Clearing	2,430
Easements	3,620
Access Roads	14,370
Transmission Lines	182,100
Substations & Switchyards	53,520
TOTAL	256,040
Rounded	256,000

Transmission Estimates for Proposed Plan

On the basis of reviews of the preliminary designs by area utilities, the Bonneville Power Administration, and others, further consideration was given to alternative circuit configuration, alternative service plans for the Anchorage-Cook Inlet area, and sectionalizing the Devil Canyon to Fairbanks line. This resulted in the following changes in the transmission plan adopted for the proposed project: (see Figure 13)

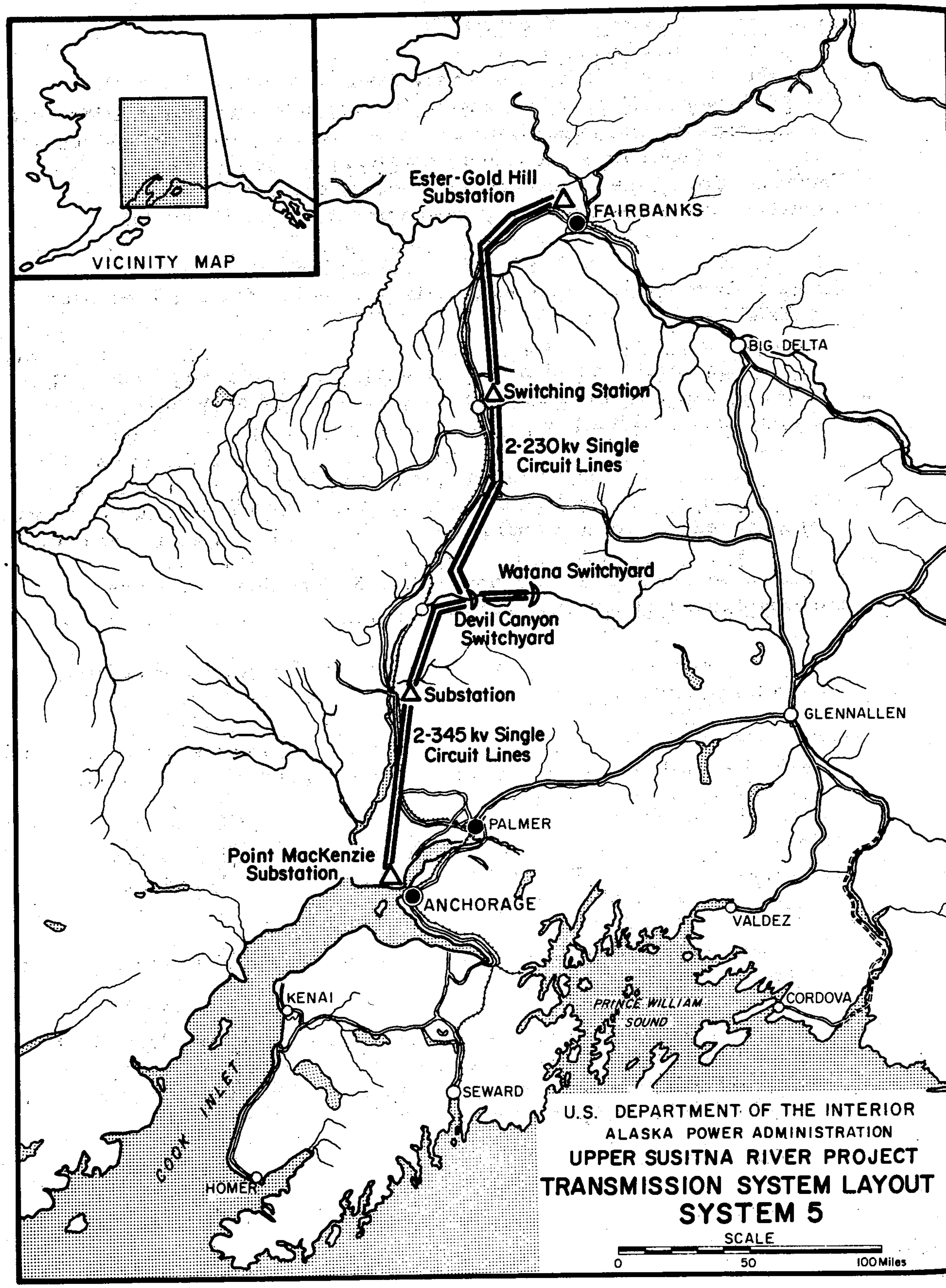
1. Addition of a switching station at the approximate mid-point of the Devil Canyon-Fairbanks line (this is assumed at Healy and estimated added costs are $3.7 million).

2. An additional substation in the vicinity of Talkeetna which appears warranted by the pattern of load development in the MEA system (estimated added costs of $7.9 million).

3. Including costs for parallel single circuit lines on adjacent rights-of-way in lieu of the double circuit lines in the preliminary estimates (added costs of $32.7 million).

With these changes, total construction costs of $256 million are included in the proposed initial development plan:

Item	Construction Cost $1,000
Transmission Lines:	
Clearing	2,430
Rights-of-Way	3,620
Access Roads	14,370
Lines	182,100
Subtotal, Transmission Line	$ 202,520
Switchyard and Substations:	
Fairbanks Substation	9,150
Talkeetna Substation	7,890
Point MacKenzie	12,420
Healy Switchyard	3,730
Watana Switchyard	4,970
Devil Canyon Switchyard	15,360
Subtotal, Switchyards and Substations	$ 53,520
Total Transmission Costs	$ 256,040
Rounded	$ 256,000


VICINITY MAP
Ester-Gold Hill Substation
FAIRBANKS
BIG DELTA
Switching Station
2-230kv Single Circuit Lines
Watana Switchyard
Devil Canyon Switchyard
Substation
GLENNALLEN
2-345 kv Single Circuit Lines
PALMER
Point MacKenzie Substation
ANCHORAGE
VALDEZ
KENAI
PRINCE WILLIAM SOUND
CORDOVA
COOK INLET
SEWARD
HOMER
U.S. DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
UPPER SUSITNA RIVER PROJECT
TRANSMISSION SYSTEM LAYOUT
SYSTEM 5
SCALE
0
50
100 Miles

Construction Schedule

It is estimated that actual construction of the backbone transmission system could be accomplished readily over a three-year period. It is assumed that construction would be keyed to completing the system at the same time that first generating units come on line.

Other Transmission Alternatives

Service Plans for Anchorage-Cook Inlet Area

It must be anticipated that there will be continuing problems and controversy as to bulk transmission facilities in the approaches to Anchorage. Knik and Turnagain Arms are formidable barriers; the Chugach Range and existing land use designation and ownership patterns combine to restrict alternatives for locating lines. Existing underwater cables across Knik Arm have had serious problems; overhead lines will continue to draw opposition; environmental groups would like to see all new lines underwater or underground; this technology has some severe problems in reliability and costs and is particularly vulnerable to extended outage.

The transmission alternatives for this area include the following:

- Additional underwater cables and locating cables at different crossing points to reduce hazards of failure.

- Cables constructed on a Knik or Turnagain causeway. This would eliminate much of the hazard to extended outages since cables would be easily accessible for repairs.

- Overhead lines around the two arms. One option is rebuilding along the Eklutna transmission right-of-way to provide additional capacity.

- Overhead lines across shallower portions of Knik and Turnagain Arms (place tower structures on piers).

Detailed cost estimates for these alternatives were not developed for this study. The same problems will exist with or without the Susitna Project since the available power supply alternatives also require lines crossing or routed around Knik Arm.

The basic cost estimates for the proposed plan assume two single circuit lines terminating at Point MacKenzie. An alternative estimate was prepared assuming one line terminating at Point MacKenzie and a second at the existing APA substation at Palmer. Total costs for the two alternatives were similar.

It is recognized that the detailed studies following project authorization will need to include careful study in cooperation with the area utilities to determine appropriate facilities in a final plan and that such studies may demonstrate need to include additional capacity to deliver project power to Anchorage. While the plan advanced in this report is not intended as a fixed plan, it is considered an adequate basis for determining merits of the proposed project.

Service to Other Railbelt Power Loads

The total Railbelt power system will include bulk transmission facilities such as those presented in this report and extensive transmission and distribution systems at lower voltage. The bulk power facilities do not replace the need for the distribution systems.

For example, the concept of electrifying the Alaska Railroad has been advanced from time to time. This would require power at distribution voltage along the railroad right-of-way. The high voltage lines for the Susitna Project may encourage consideration of Railroad electrification, but a separate line at lower voltage would be needed to serve the railroad.

Similarly, the proposal of GVEA to extend its 25 kv distribution line to Mount McKinley Park Headquarters and Cantwell is compatible with the Susitna plan. Again, the high voltage line does not replace the need for the distribution facilities--Susitna power would reach Cantwell through the GVEA distribution system.

As a part of the Susitna studies, very rough costs estimates were prepared for transmission lines to deliver Susitna power to Glennallen and other points along the Richardson Highway. These alternatives are discussed in the Power Market Report.

SECTION I

ENVIRONMENTAL ASSESSMENT

FOR

TRANSMISSION SYSTEMS

UNITED STATES DEPARTMENT OF THE INTERIOR
Alaska Power Administration
Environmental Assessment for
Transmission Systems for
Devil Canyon and other
Potential Units of
The Upper Susitna
River Project

December 1975

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LIST OF EXHIBITS

INTRODUCTION

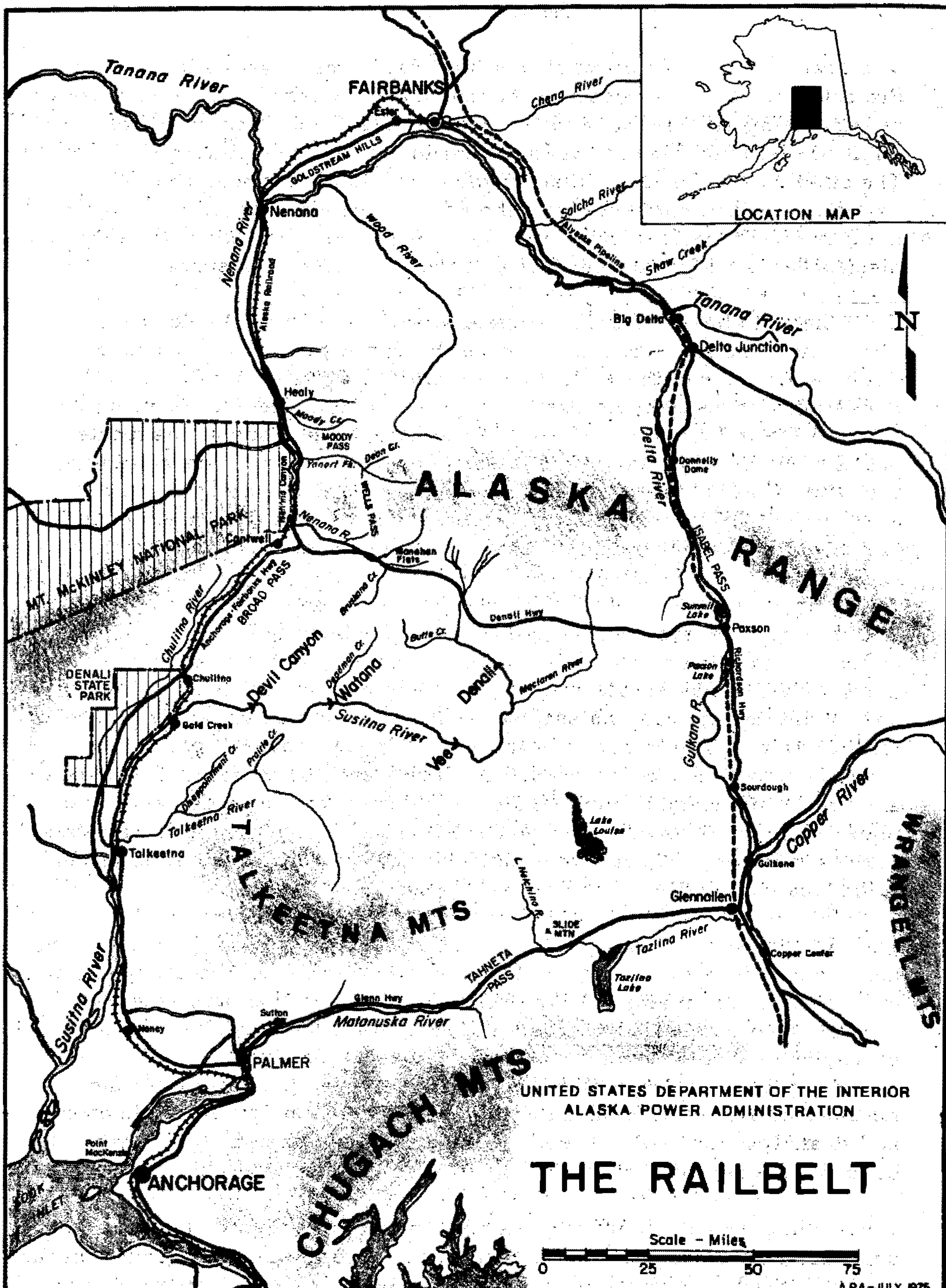
The Transmission System Environmental Assessment for the Upper Susitna Project is one of three reports produced by the Alaska Power Administration as supporting studies for investigations by the U. S. Army Corps of Engineers of hydroelectric development in the Upper Susitna River Basin. The other two APA reports that complement this Assessment are the Transmission System Report and the Power Markets Report. Although there is considerable overlap in these three documents, each of the three discusses basically different facets in the transmission systems.

The Corps studies considered several alternative hydro development plans involving four main damsites on the Upper Susitna River above Gold Creek. Four of these sites were identified in previous Bureau of Reclamation investigations (Devil Canyon, Watana, Vee and Denali, as indicated in Figure 1.) The fifth site (High Devil Canyon) is located between Devil Canyon and Watana and is an alternative for developing the head in that reach of the river. Based on engineering, cost, and environmental factors, the Corps proposes an initial development plan including the Watana and Devil Canyon dam and power plants at each site.

The transmission system studies for the Upper Susitna River Project are of preauthorization or feasibility grade. They consist of evaluation of alternative corridor locations from the viewpoints of engineering, costs, and environment; reconnaissance studies of transmission systems needed for alternative project development plans for use in overall project formulation studies; consideration of alternative transmission technologies; and feasibility grade designs and cost estimates for the preferred transmission plan. These studies deal with general corridor location; the more detailed studies following project authorization would include final, on-the-ground route location.

The purpose of a preliminary transmission corridor survey is to eliminate those which do not appear to be feasible, whether for technical, economic, or environmental reasons. The preliminary survey then analyzes those remaining corridors and presents the data on the various alternative corridors in such a way so that comparisons can be made. At this point, it is not within the scope of the preliminary survey to show preference for some corridors over others, only to reject obviously unfeasible ones and to analyze the feasible ones. Further analysis then provides the basis for the selection of the preferred system plan.

The width of the corridors is variable. In stretches confined by mountainous terrain, the corridor may be almost as narrow as the final route; in flat country, the corridor can be several miles wide. Within a given corridor there can be several feasible routes to be selected from in the final route survey.



Tanana River
FAIRBANKS
Chena River
Salcha River
Alyeska Pipeline
Shaw Creek
Tanana River
Big Delta
Delta Junction
LOCATION MAP
N
GOLDSTREAM HILLS
Nenana
Nenana River
Wood River
Alaska Railroad
Healy
MOODY PASS
WELLS PASS
ALASKA
Delta River
Donnelly Dome
ISABEL PASS
RANGE
MT. McKINLEY NATIONAL PARK
Cantwell
Nenana R.
BROAD PASS
Denali Hwy
Summit Lake
Paxson
Chulitna River
Devil Canyon
Watana
Denali
Maclaren River
DENALI STATE PARK
Chulitna
Gold Creek
Susitna River
Vee
Paxson Lake
Richardson Hwy
Gulkana R.
Sourdough
Copper River
Talkeetna River
Talkeetna
Lake Louise
TALKEETNA MTS
Gulkana
Glennallen
WRANGELL MTS
SLIDE MTN
Tazlina River
Copper Center
TAHNETA PASS
Tazlina Lake
Susitna River
Glenn Hwy
Sutton
Matanuska River
PALMER
CHUGACH MTS
Point MacKenzie
ANCHORAGE
KNIK ARM
COOK INLET
UNITED STATES DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
THE RAILBELT
Scale - Miles
0 25 50 75
A.P.A.-JULY 1975

Basically, the selection of corridors devolves on the need to transmit power from a generation site -- the Devil Canyon-Watana damsites -- to two load centers, Anchorage and Fairbanks (See Figure 1). The load centers are almost equally to the north and south of the Upper Susitna complex, and are connected to each other by two basic corridors -- the Anchorage-Fairbanks Highway/Alaska Railroad and the Glenn/Richardson Highway. The alternatives are all variations upon these two basic corridors, which are dictated by the topography and climate of the Railbelt area.

Although the most economical transmission corridor is theoretically a straight line joining generation site and load center, physical and social factors force deviations from this shortest-distance ideal. Thus, it can often happen that physical and social factors are in opposition to economic factors, and a balance has to be found. This striving for a balance results in alternatives, from which, eventually a most desirable corridor has to be chosen.

The method of analysis for the alternatives uses the shortest segments between intersections of alternative corridors as the units of evaluations; these may vary in length from 15 to over 100 miles. These segments were evaluated on a set of physical and social criteria, but are not to be compared to each other. These evaluations are shown in the matrixes on pages 19-22 and pages 34-37.

Using these segments as basic units in combination, several alternative corridors can be devised and can then be compared. To save repetition, segments common to alternative corridors being compared can be omitted from the comparison. The corridor presented in the Description of the Proposed Action is that route which produces the minimum adverse impacts consistent with economic feasibility.

The proposed action includes the construction and operation of a transmission system to deliver power generated by dams and powerplants on the Upper Susitna to the two primary load centers of Anchorage and Fairbanks, and perhaps other load centers that may prove feasible. The design and location of this line will provide for the most economical construction and reliable operation consistent with minimal damage to the environment. If approved, construction would begin by about 1980.

Besides delivery of power from the Upper Susitna Project, another quite important function of the transmission line is the interconnection of the systems presently serving the Anchorage and Fairbanks areas. Interconnection will have several results. It will provide increased reliability for the entire system in that severe shortage or outages in one utility can then be alleviated by a transfer of power from other utilities. Each utility will need less reserve capacity and surplus from one part of the system can offset deficits in another. Communities presently not served by the larger utilities, or near the fringes of service may benefit from interconnection by tying into the system, thus allowing them to avoid local generation, which is usually a more expensive alternative. Interconnection of the Anchorage and Fairbanks utilities would be a step toward an intertie with Canada and the Lower 48, with benefits on a larger scale than local interconnection. This would lead to the most efficient generation and distribution of energy, resulting in great savings of fossil fuels.

The proposed corridor runs from the Devil Canyon powerhouse west to Gold Creek, then southwest along the Susitna River and the Alaska Railroad to Talkeetna. From Talkeetna the corridor follows the east bank of the Susitna River to the Nancy Lake area and then due south to Point MacKenzie. The second half of the corridor runs from Gold Creek north to Chulitna and then parallels the Anchorage-Fairbanks Highway and the Alaska Railroad through Broad Pass, the Nenana Canyon, and to Healy. From Healy the corridor will follow the existing GVEA 138 kv transmission line to the existing substation at Gold Hill to Ester, although the existing right-of-way may not necessarily be used. The section of corridor from Devil Canyon to Point MacKenzie is about 140 miles; from Devil Canyon to Ester is about 200 miles.

The proposed facilities are a double circuit 345 kv transmission line to Anchorage, a double circuit 230 kv transmission line to Fairbanks, a switchyard at each powersite, and the necessary substations to deliver power to the utility systems. Access road suitable for four-wheel drive vehicles will follow the right-of-way where feasible. In areas of highly erodable soils, scenic sensitivity, or vulnerability to impacts stemming from improved access, these access roads will be omitted. This assessment was premised upon stacked double circuits, both circuits using the same set of transmission structures. However, reviews by Bonneville Power Administration and other agencies voiced concern for the reliability of this system, and an alternative arrangement of circuits studied.

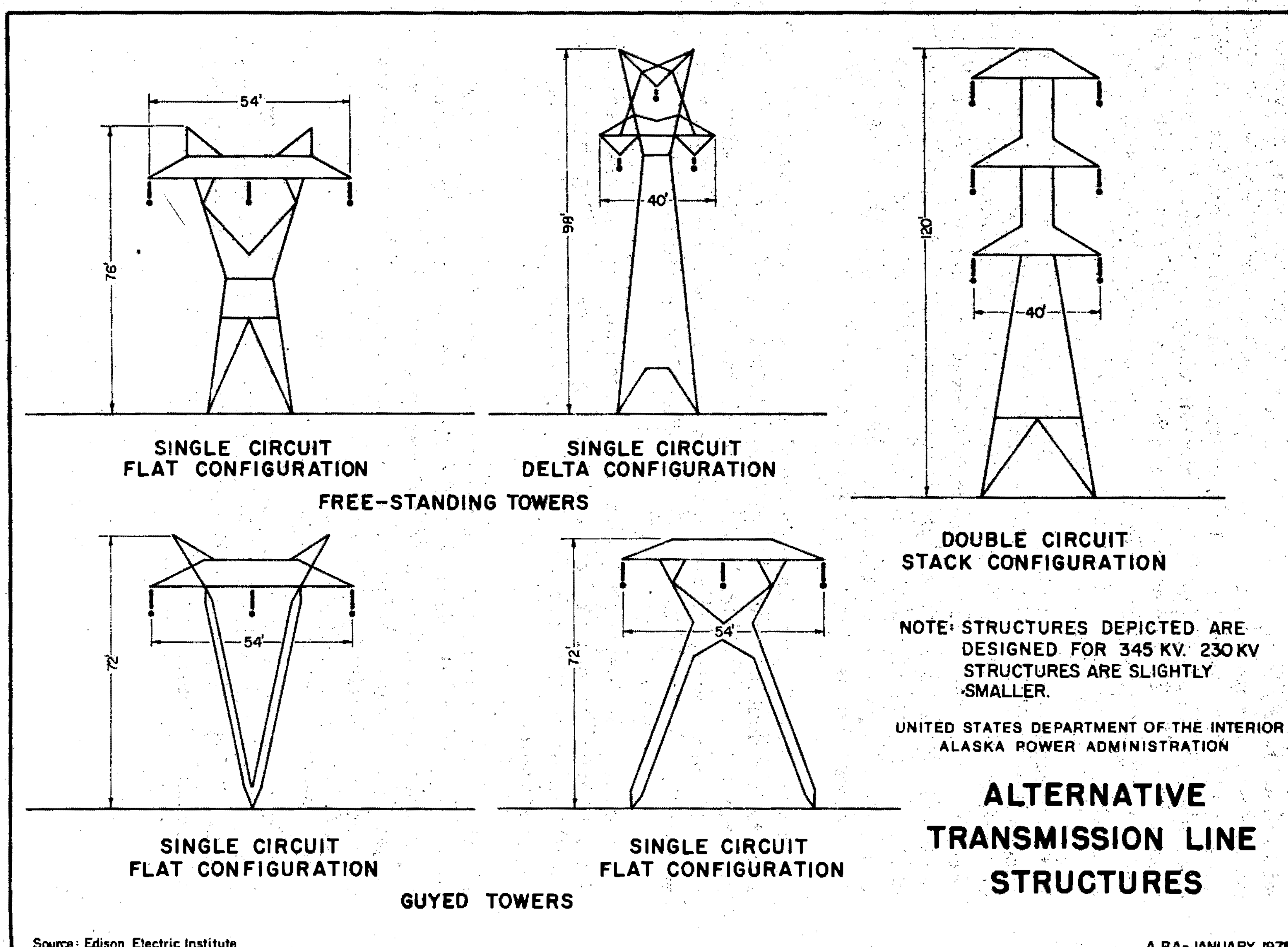
In this arrangement, two single circuit systems parallel each other, not necessarily along the same right-of-way. This parallel single circuit system will reduce the probability of a total break in transmissions, but will cost somewhat more and require more right-of-way and clearing than the stacked double circuit system. The right-of-way for double and single circuits of similar voltage is identical; in the case of 345 kv it is 140 feet, for 230 kv it is 125 feet. A parallel single circuit could require up to twice the right-of-way area and clearing of a single or double circuit.

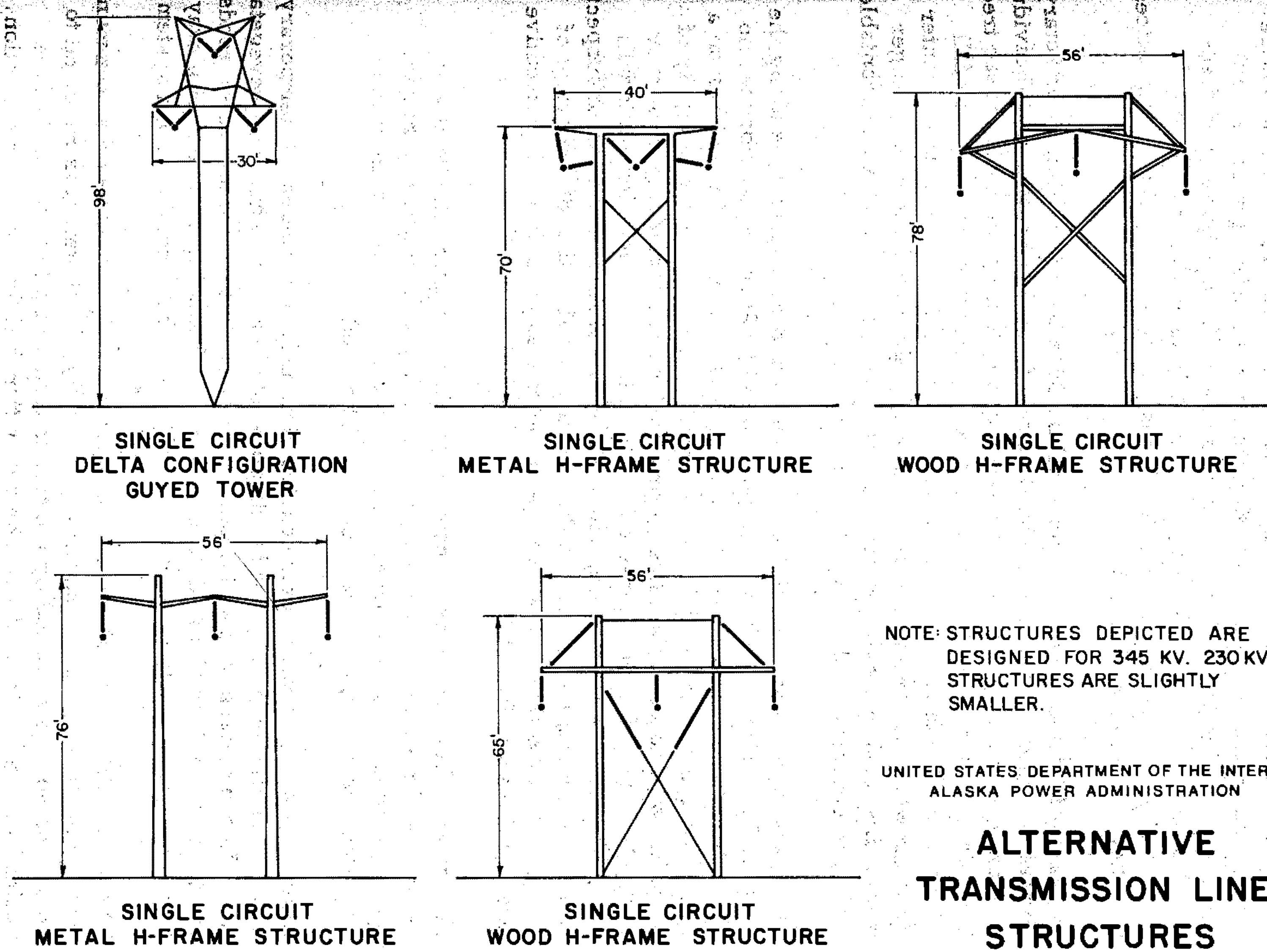
The proposed action will include the alternatives of parallel single circuits and stacked double circuit. Neither system will be exclusive; it is very possible to use both systems along different stretches of the transmission line. In the following discussions of impacts, the acreage of right-of-way and clearing will be premised upon stacked double circuit.

The sequence of final routing and construction follows a general sequence of final survey to locate towers and clearing widths, clearing and access construction, erection of towers, stringing, tensioning, and right-of-way restoration.

The final survey will involve photogrammetric determination of clearing widths to minimize the amount of clearing; not only is this more economical, but it also avoids the method of total clearing within set distances from the center line. Final tower locations are also determined at this time; tower spacings are usually on the order of four or five per mile, but will be spaced closer as conditions warrant.

Towers will be either steel or aluminum and of the free-standing type, although depending upon final design and local conditions, guyed towers may be used in some areas. The conductors are of aluminum conductor reinforced with steel.


54'
76'
98'
40'
120'
40'
SINGLE CIRCUIT
FLAT CONFIGURATION
SINGLE CIRCUIT
DELTA CONFIGURATION
FREE-STANDING TOWERS
DOUBLE CIRCUIT
STACK CONFIGURATION
72'
54'
72'
54'
SINGLE CIRCUIT
FLAT CONFIGURATION
SINGLE CIRCUIT
FLAT CONFIGURATION
GUYED TOWERS
NOTE: STRUCTURES DEPICTED ARE DESIGNED FOR 345 KV. 230 KV STRUCTURES ARE SLIGHTLY SMALLER.
UNITED STATES DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
ALTERNATIVE TRANSMISSION LINE STRUCTURES
Source: Edison Electric Institute
A.P.A.-JANUARY 1975



NOTE: STRUCTURES DEPICTED ARE DESIGNED FOR 345 KV. 230 KV STRUCTURES ARE SLIGHTLY SMALLER.

UNITED STATES DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION

ALTERNATIVE TRANSMISSION LINE STRUCTURES

Source: Edison Electric Institute

A.P.A.-JANUARY 1975

Tower designs will be determined in the final design; varying conditions may call for several designs being used. Free standing towers are more easily constructed on sections with good access roads; guyed towers are more suitable for helicopter construction. Various guyed and free-standing tower designs, for single and double circuits, and several alternate structures for use in lieu of these towers in special circumstances are shown on Figures 2 and 3.

In heavily forested areas, clearing will be done by brush blades, or rotary cutters on bulldozers and by hand removal of the cleared area and individual danger trees outside of the main cleared strip. Danger trees are those trees that may grown to such a size within five or ten years that they may fall within a set distance from a conductor or tower. Distance from the center line, growth rate, and maximum obtainable height will determine danger trees. Disposal of cleared materials may vary from selling of merchantable timber to chipping or burning of slash.

There are known and potential archeological and historical sites along the proposed corridors. To minimize possible vandalism or disturbance, no sites other than those on the National Register shall be located either on a map or on the narrative of this assessment. To preserve the integrity of these known and potential sites, a preconstruction archeological survey of the corridors will be carried out and the final transmission route will be adjusted to minimize disruption. Inadvertent discovery of an unsuspected site at a later stage will entail either the minor relocation of a segment of the transmission line or the salvage of the site as prescribed by Executive Order #11593 and P.L. 93-291.

In sections where permanent access roads are required, the road will be built and maintained to a standard suitable for four-wheel vehicles. Not all sections will have access roads; in critical areas, winter construction, or helicopter construction will be used.

Right-of-way restoration after construction includes removal of temporary structures and temporary roads, disposal of slash and refuse and revegetation. In some cases, it may be necessary not only to maintain access roads, but to upgrade them if it is determined by the State Department of Highways that such a road would be a suitable addition to the secondary road system.

At each terminus, and at any future taps on the line to serve other communities, a substation will be required. Basically, a substation is required to adjust the voltage supplied by the transmission line to match that of the recipient system. In addition, the substation fulfills a switching function.

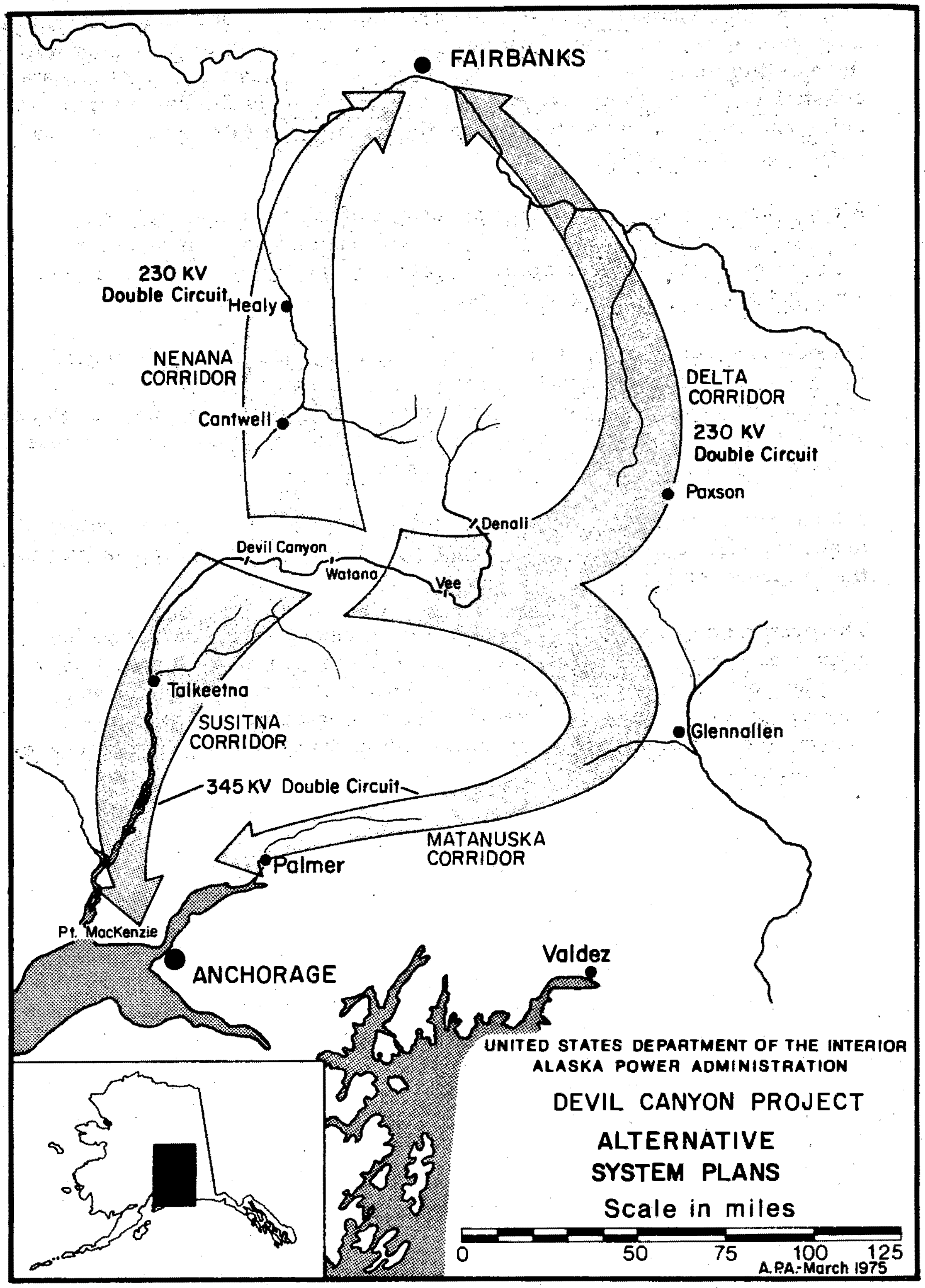
At the north terminous of Ester, the existing Gold Hill substation could be used with appropriate modification. At the south terminus at Point MacKenzie, the existing underwater cable terminal could be enlarged to accommodate a substation. If an alternative end point near Palmer is finally selected over Point MacKenzie, a substation presently serving the APA 115 kv Eklutna system could be used.

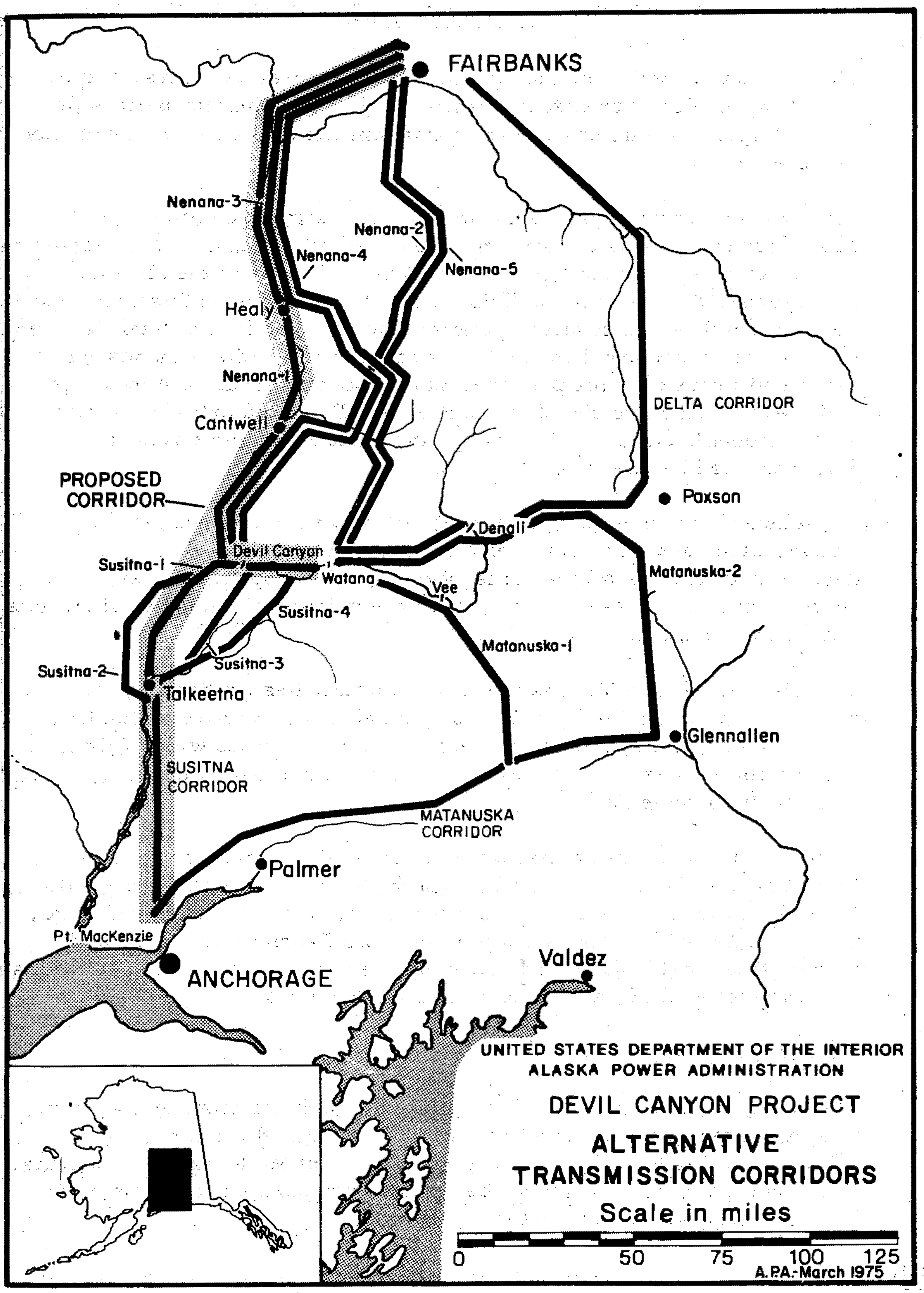
Along some sections, periodic suppression of tall vegetation will be necessary. This will be accomplished with manual application of herbicides or hand clearing, or both. Vegetation maintenance will need to be repeated every five years or longer.

Periodic inspection of the line will be done from the air, complemented by less frequent inspection from the ground. Inspection will reveal potential failure of tower components such as vibration dampers, insulators, and guy lines; condition of tower footings; condition of conductor; presence of danger trees; and condition of access roads.

Alternative methods of construction and maintenance which were referred to above, will be discussed in greater detail in the section Alternatives to the Proposed Action.

The preferred system plan was chosen by Alaska Power Administration after preliminary study of all feasible corridors joining the Upper Susitna complex to Anchorage and Fairbanks. The most feasible corridor was selected on the basis of cost, reliability, and potential environmental impact; the remaining corridors represent alternatives of varying degrees of feasibility.


FAIRBANKS
230 KV
Double Circuit
Healy
NENANA
CORRIDOR
Cantwell
DELTA
CORRIDOR
230 KV
Double Circuit
Paxson
Denali
Devil Canyon
Watana
Vee
Talkeetna
SUSITNA
CORRIDOR
345 KV Double Circuit
Glennallen
MATANUSKA
CORRIDOR
Palmer
Pt. MacKenzie
ANCHORAGE
Valdez
UNITED STATES DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
DEVIL CANYON PROJECT
ALTERNATIVE
SYSTEM PLANS
Scale in miles
0
50
75
100
125
A.P.A.-March 1975


FAIRBANKS
Nenana-3
Nenana-2
Nenana-4
Nenana-5
Healy
Nenana-1
Cantwell
DELTA CORRIDOR
PROPOSED CORRIDOR
Paxson
Denali
Devil Canyon
Susitna-1
Watana
Vee
Matanuska-2
Susitna-4
Matanuska-1
Susitna-3
Susitna-2
Talkeetna
Glennallen
SUSITNA CORRIDOR
MATANUSKA CORRIDOR
Palmer
Pt. MacKenzie
ANCHORAGE
Valdez
UNITED STATES DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
DEVIL CANYON PROJECT
ALTERNATIVE TRANSMISSION CORRIDORS
Scale in miles
0 50 75 100 125
A.P.A.-March 1975

The alternative system plans represent only general corridors, and do not attempt to define an actual right-of-way. Thus the alternatives do not distinguish among many minor variations, and as a result, are fairly flexible.

Four alternative dam systems for the Upper Susitna are outlined in the Transmission Systems Report, and two alternative transmission systems to connect them with Anchorage and Fairbanks. Details of the alternative dam systems will be found on Table 1 of the Transmission Systems Report. For three of these alternative systems--one of which is the Devil Canyon-Watana System proposed by the Corps of Engineers--the transmission system will consist of the proposed 345 kv double circuit to Anchorage and the 230 kv double circuit to Fairbanks. For the fourth dam system, a 230 kv double circuit to Anchorage and a 230 kv single circuit to Fairbanks will be used.

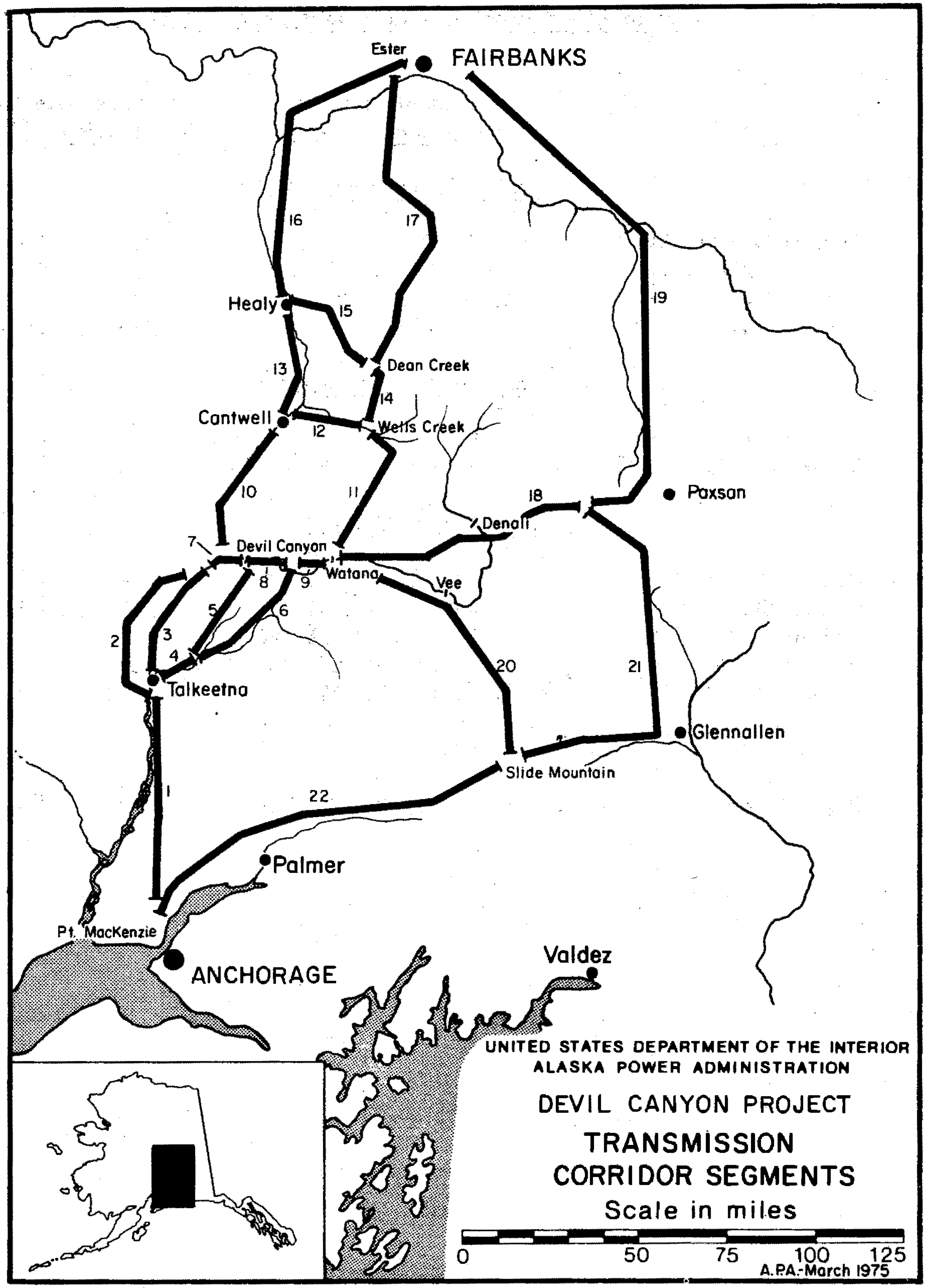
These two alternative designs in conjunction with the alternative transmission corridors, constitute the alternative system plans. The degree of environmental impact is more dependent upon the alternative corridor and, to a lesser degree, upon the voltage; the number of circuits affects environmental impacts least.

The width of the corridors is variable. In stretches confined by mountainous terrain, the corridor may be almost as narrow as the final route; in flat country, the corridor can be several miles wide. Within a given corridor, there can be several feasible routes to be selected from the final route survey.

There are four groups of alternatives: first, those that lead from Devil Canyon-Watana to Anchorage via the Susitna watershed; second, those that lead to Fairbanks via the Nenana and Tanana drainage; third, those that lead to Fairbanks via the Delta and Tanana drainages; and fourth, those that lead to Anchorage via the Copper and Matanuska drainages (see Figures 4 and 5, and Strip Maps in **Exhibit** I-2).

Susitna Corridors

There are basically four feasible corridors which connect Devil Canyon to Anchorage via the Susitna drainage. All four of these incorporate the segment that runs from the endpoints of Point MacKenzie to Talkeetna, so this segment can, therefore, be treated as separate and not included in a comparison of the alternative corridors.


FAIRBANKS
Ester
16
17
Healy
15
Dean Creek
13
14
Cantwell
12
Wells Creek
10
11
19
18
Paxson
Denali
7
Devil Canyon
8
9
Watana
Vee
2
3
5
6
4
Talkeetna
20
21
Glennallen
Slide Mountain
1
22
Palmer
Pt. MacKenzie
ANCHORAGE
Valdez
UNITED STATES DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
DEVIL CANYON PROJECT
TRANSMISSION
CORRIDOR SEGMENTS
Scale in miles
0
50
75
100
125
A.P.A.-March 1975

Key to Alternative Corridors and Segments

Corridor	Segments of Corridor	Approximate Total Mileage
	Susitna Corridors	
Susitna #1	1, 3, 7	136
Susitna #2	1, 2, 7	140
Susitna #3	1, 4, 5	129
Susitna #4	1, 4, 6, 8	147
	Matanuska Corridors	
Matanuska #1	8, 9, 20, 22	258
Matanuska #2	8, 9, 18, 21, 22	385
	Nenana Corridors	
Nenana #1	7, 10, 13, 16	198
Nenana #2	7, 10, 12, 14, 17	220
Nenana #3	7, 10, 12, 14, 15, 16	231
Nenana #4	8, 9, 11, 14, 15, 16	223
Nenana #5	8, 9, 11, 14, 17	212
	Delta Corridor	
Delta #1	8, 9, 18, 19	280

Of the four corridors that run from Talkeetna to Devil Canyon-Watana, the first is the southern half of the proposed corridor, which follows the Susitna valley north, paralleling the Alaska Railroad to Gold Creek, where it also leads east to tie into Devil Canyon-Watana (Susitna-1, in Figure 5).

The next, and farthest west parallels the Anchorage-Fairbanks Highway through Denali State Park, along Troublesome Creek, eventually leading east to tie into Gold Creek and Devil Canyon-Watana (Susitna-2). The third goes up the Talkeetna River and gaining the ridge to the east of Disappointment Creek, leads north to the ridge leading to Devil Canyon (Susitna-3).

The fourth and most easterly corridor follows the Talkeetna River to Prairie Creek, which it follows to Stephan Lake, halfway between Devil Canyon and Watana (Susitna-4).

Nenana Corridors

There are five feasible corridors connecting the Upper Susitna with Fairbanks by way of the Nenana River. The first is a corridor paralleling the highway and railroad from Gold Creek to Cantwell, to Healy, and to Fairbanks. This is the northern half of the preferred corridor (Nenana-1, in Figure 5).

The second duplicates the first corridor to Cantwell, but then leads east paralleling the Denali Highway, north up as far as Wells Creek and over the pass to Louis Creek, continuing over the Dean Creek Pass to the Wood River. It then follows the Wood and Tanana Rivers to Fairbanks (Nenana-2).

The third corridor, (Nenana-3), duplicates the second to Dean Creek, where it then continues up Yanert Fork and over Moody Pass, ending up at Healy and joining the first corridor.

Corridor four (Nenana-4) leaves Watana and heads north, emerging onto the Denali Highway near the Brushkana River. It then leads west, goes up Wells Creek, and joins corridor three to Healy and Fairbanks.

Corridor five starts the same way as corridor four, except that instead of going over Moody Pass to Healy, it leads east over Dean Creek into the Wood River, and then leads north to Fairbanks, (Nenana-5).

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Delta Corridor

There is only one basically feasible corridor along the Delta River. This corridor leaves Watana damsite and leads east down Butte Creek to the Denali damsite and continues east along the Denali Highway. It then proceeds north near Paxson over Isabel Pass and parallels the Richardson Highway into Fairbanks.

Matanuska Corridors

There are two corridors utilizing the Matanuska Valley as access to Anchorage. The first follows the Delta route to Paxson, then leads south to Glennallen. It then goes west, over Tahneta Pass, and into the Matanuska Valley, tying into Point MacKenzie.

The second corridor connects Watana to Vee damsite, leads southeast to the Little Nelchina River, which it follows to the Glenn Highway and corridor one, which it follows to Point MacKenzie.

Corridor Segments

In order to more easily assess environmental impacts of a transmission line on these corridors, they are reduced to smaller units, or corridor segments. A segment is thus that part of a corridor, either between two intersections with other corridors, or between an intersection and one of the endpoints near Anchorage or Fairbanks. The length of a segment is not standard, nor is the length set by any physical criteria. These segments are the minimum number of units that can be combined to form the previously described alternative corridors (see Figure 6).

Assessment of the existing environment and of impacts of a transmission corridor will be done on the segment level. As a convenience, these assessments will be summarized in matrix form, differentiated as to environmental inventory and assessment of impacts. The Susitna and Nenana corridors will each have separate matrixes; the Matanuska and Delta corridors will be combined because of the fewer number of alternatives.

Segments are labelled in two ways; the first is a nodal label, in which the nodes identify the segment (e.g. Wells Creek-Dean Creek), the second is an assigned number which corresponds to a key map. Both labels are used on the matrix. Matrixes will be found on pp. 18-20 and pp. 32-34.

Matrixes for Inventory of Corridor Segments:

The following matrixes are for inventory of the environment by nine categories. The definitions of the categories and general information are given in the Exhibit I-1. The process from which the 22 corridor segments are derived is explained on pages 15 - 20.

Due to the problems attendant to reducing such large amounts of information to such a constrained format, it would appear that some of the categories are not treated on the same level of detail as others. Specifically, climate, which is of greater concern from the design than the environmental stand point, and thus is relatively lightly treated in this Environmental Assessment. Only data that was found by searching the literature was entered. Thus, for example, caribou may be found in a segment although no mention of it is made in the matrix. One advantage to the matrix system of presentation is that it is easily updated; thus, discrepancies brought to our attention can easily be changed.

The constraints of this format also oblige the use of abreviations; MMCPM zone stands for the Mount McKinley Cooperative Planning and Management zone, GVEA refers to the Golden Valley Electric Association, MEA refers to the Matanuska Electric Association, and the ARR is the Alaska Railroad.

The land status entries are based upon the land status situation of March 1974. State selections refer to not only patented, but also all pending and tentatively approved State selections. Native village deficiencies and regional deficiencies (NVD and NRD) will perhaps be the most unstable areas at present, so it is quite likely that the entries regarding these lands may not be presently valid.

SUSITNA CORRIDORS

INVENTORY

	TOPOGRAPHY/GEOLOGY	SOILS	VEGETATION	WILDLIFE	CLIMATE	EXISTING DEVELOPMENTS	LAND OWNERSHIP/STATUS	EXISTING RIGHTS-OF-WAY	SCENIC QUALITY/RECREATION
Point MacKenzie - Talkeetna	64 miles. Highest point 500' at Talkeetna to sea level at Pt. McKenzie. Wide river valley; east bank more rolling than extremely flat west bank. Valley widens and flattens to south. Poorly drained, many bogs and lakes.	Glacial debris-ground moraine altered by outwash, flood plains, silt, sand, gravel, swamps and lakes. Free from permafrost. Poorly drained fibrous peat soils, other poorly drained soils and well drained strongly acid soils. Low to medium erosion potential.	Bottomland spruce-poplar, lowland spruce-hardwood, muskeg/bog.	Moose everywhere, black bear, fur bearers. Trumpeter Swan habitat in ponds along Susitna Valley.	Transitional - milder and wetter in southern end of segment.	Various small towns along transportation corridor. Several recreation areas and campgrounds along highway.	Primarily State potential selections; indeterminate (as of 3 - 74)Native villages of Montana Creek, Caswell, and Knik.	Anchorage-Fairbanks Highway, Alaska Railroad, MEA lines.	Recreation areas: Big Lake, Rocky Lake (Sucker Lake), Nancy Lake, Willow Creek. Medium to low scenic quality in south. Medium to high around Talkeetna.
Talkeetna - Gold Creek via Troublesome Creek (2)	42 miles. Rolling high plateau to north, becoming flatter, lower, forested hills to south. Merges into Susitna Valley. High point around 2000'.	In northern part, well drained thin soils, strongly acid; deep permafrost table. Southern part poorly drained fibrous peat, other poorly drained soils and well drained strongly acid soils. Slopes on north > 12%. Low to medium erosion potential.	Bottomland spruce-poplar, upland spruce-hardwood, low brush, muskeg/bog. Alpine tundra (?).	Caribou might be present, black bear, moose.	Transitional/mountain.	None.	State selected land. Denali State Park.	Parallels Anchorage-Fairbanks Highway in midsection.	Runs through Denali State Park. High scenic quality.
Talkeetna - Gold Creek via Alaska Railroad (3)	38 miles. High point 900'. Wee Canyon - moderately narrow valley floor widening to the south.	Well drained, gravelly, strongly acid soils. Southern third, poorly drained, fibrous peat and well drained, strongly acid soil. Slopes on north > 12%. Low to medium erosion potential.	Bottomland spruce-poplar, upland spruce-hardwood.	Moose, black bear, fur bearers.	Transitional.	Towns of Gold Creek, Curry, Lane, Chase, and Sherman. Most are small communities, not all served by Alaska Railroad.	State selected land, borders on Denali State Park.	Parallels A.R.R.	Parallels east boundary of Denali State Park.
Talkeetna River (4)	8 miles. 900' elevation. Wide, rolling valley bottom. Many lakes.	Poorly drained fibrous peat, vulnerable to heaving and well drained, strongly acid soils. Slopes < 12%. Low to medium erosion potential.	Bottomland spruce-poplar.	Moose, black bear, fur bearers.	Transitional.	None.	State selected land.	None.	Medium scenic value, relatively accessible by boat.
Disappointment Creek (5)	37 miles. 3800' elevation. Rolling hills increase in elevation to high plateau with several incised creeks.	Well drained, strongly acid soils thin in northern parts in conjunction with very steep and rocky ground. Gravelly soil. Slopes > 12%. Low erosion potential.	Bottomland spruce-poplar, upland spruce-hardwood, low brush, muskeg/bog and alpine tundra.	Moose in lower elevations and stream bottoms, black and grizzly bear, possible caribou range.	Mountain/transitional.	None.	1/3 State selected land, 2/3 Native regional deficiency.	None.	High scenic quality area - relatively inaccessible.
Prairie Creek - Stephan Lake (6)	42 miles. 2200' elevation. Wide valley narrows gradually as it rises to wide, flat, poorly drained pass.	Well drained, strongly acid, gravelly soils. Slopes > 12%. Low to medium erosion potential.	Bottomland spruce-poplar, upland spruce-hardwood, low brush, muskeg/bog in pass area.	Moose, black and grizzly bears.	Mountain/transitional.	None.	1/3 State selected land, 2/3 Native regional deficiency.	None.	Some recreational use of lakes in Prairie Creek Pass area. High scenic quality - accessible by float plane.
Devil Canyon - Gold Creek (7)	14 miles. 1500' elevation above damsite. Narrow canyon incised in plateau widens as plateau changes to rolling hills to west.	Well drained, strongly acid, gravelly soils. Slopes > 12%. Low to medium erosion potential.	Upland spruce-hardwood.	Moose, black bear.	Transitional.	None.	1/2 State selections, 1/2 Native regional deficiency.	None.	High scenic quality - impressive river valley. Limited accessibility.
Devil Canyon - Stephan Lake (8)	13 miles. 2200' elevation. High plateau with deeply incised creeks and rivers.	Well drained, strongly acid, gravelly soils. Slopes > 12%. Low to medium erosion potential.	Upland spruce-hardwood in river and stream valleys, low brush and bog/muskeg on plateaus.	Moose, black and grizzly bear, fur bearers.	Mountain/transitional.	None.	Native regional deficiency, powersite withdrawal for Denali Canyon Reservoir.	None.	High scenic quality - limited accessibility.
Stephan Lake - Watana (9)	17 miles. 2200' elevation. Flat plateau bounded by hills to north and south, incised river and creeks	Well drained, thin, strongly acid soils with deep permafrost table and poorly drained soils with shallow to deep permafrost table. Gravelly soils. Slopes < 12%. Medium erosion potential.	Upland spruce-hardwood in river and creeks, brush and bog and muskeg on plateau.	Moose, black and grizzly bear, fur bearers, caribou.	Mountain.	None.	Native regional deficiency, powersite withdrawal for Denali Canyon Reservoir.	None.	Recreational use of Fog Lakes area. High scenic quality - accessible by float plane.

NENANA CORRIDORS

INVENTORY

	TOPOGRAPHY/GEOLOGY	SOILS	VEGETATION	WILDLIFE	CLIMATE	EXISTING DEVELOPMENTS	LAND OWNERSHIP/STATUS	EXISTING RIGHTS-OF-WAY	SCENIC QUALITY/RECREATION
Gold Creek - Cantwell (10)	48 miles. 2400' elevation. Wide valley with moderately incised rivers in south, becoming very wide depression in Broad Pass, traveling NE, with rolling valley bottom.	Well drained, thin, strongly acid soils, deep permafrost table and poorly drained with surface peat and shallow permafrost table. Both soils gravelly with medium erosion potential. Slopes < 12%.	Bottomland spruce and poplar, upland spruce-hardwood, low brush - bog/muskeg.	Moose present, especially in lower valleys, black bear on forested areas.	Mountain/transition. Summit weather: annual temperature 25.9 F., annual precipitation 21.85".	Several small communities along transportation lines. FAA strips at Summit and Cantwell. Southern part borders Denali State Park.	State selected land, Native village withdrawal, area within MMCPM Zone.	Anchorage-Fairbanks Highway, Alaska Railroad.	High scenic quality along most of this route, southern part borders Denali State Park. Major views to west and north of transportation corridor of Alaska Range.
Watana - Wells Creek via Brushkana Creek (11)	46 miles. 3300' at Deadman Pass. Series of moderately wide valleys joined by gentle passes, culminating on wide valley of Brushkana Creek and Nenana River.	On slopes > 12%: Well drained thin strongly acid soils with deep permafrost table, gravelly. On slopes < 12%: Poorly drained loamy soils with surface peat and shallow permafrost table. Medium erosion potential.	Upland spruce-hardwood, lowland spruce-hardwood, low brush - muskeg bog. Alpine tundra.	Caribou concentrations, moose in lower valleys and plateaus, Dall sheep in high areas, black bear on forested areas.	Mountain.	None.	D-1 withdrawal, northern part within MMCPM Zone.	None.	Medium scenic quality but inaccessible.
Wells Creek - Cantwell (12)	22 miles. 2500' elevation. Valley at Wells Creek widens to west, with flat bottom bound by mountains to north and south.	Well drained, thin, strongly acid soils with deep permafrost table in conjunction with poorly drained soils with surface peat and shallow permafrost table. Medium erosion potential. Gravelly soils. Slopes < 12%.	Lowland spruce-hardwood.	Caribou concentrations, moose present, Dall sheep in high areas, black bear in forested area.	Mountain.	Denali Highway, some settlement along highway.	Native village withdrawal, State selected land, within MMCPM Zone.	Denali Highway.	High scenic quality, good views to all sides.
Cantwell - Healy (13)	39 miles. 2200' at Cantwell. Wide valley narrows to north to series of tight canyons separated by wide valley of Yanert Fork. North of canyon to Healy is wide rolling plain with stream terraces adjacent to Nenana. Denali fault crosses at Windy.	Well drained nonacid brown gravel soils in conjunction with poorly drained loamy soil with surface peat and shallow permafrost table. High erosion potential. Thin rocky soils and rock on lower canyon.	Upland spruce-hardwood, lowland spruce-hardwood, alpine tundra, some low brush - bog/muskeg.	Caribou concentrations south of canyons, moose present in more open parts of canyons, Dall sheep in high areas, black bear present.	Mountain. High winds reported by GVEA to have knocked down 138 KV towers. McKinley weather: annual temperature 27.7 F., annual precipitation 14.50".	Several small communities, McKinley Park on west bank of Nenana River. Flight strips of Yanert and McKinley Village and Healy (FAA at McKinley).	State selected land and McKinley National Park, within MMCPM Zone.	Anchorage-Fairbanks Highway, Alaska Railroad.	High scenic quality, impressive canyons interspersed with open areas of more distant views. Good possibility of viewing wildlife. High tourist traffic along this major transportation corridor.
Wells Creek - Dean Creek (14)	26 miles. 4,000' at Wells Pass. Wide valley narrowing to the north to pass with Louis Creek, a high saddle. Abrupt drop into Louis Creek, down to Yanert Fork and extremely wide aggrading channel.	Thin soils and rock, very steep slopes. Level areas poorly drained.	Lowland spruce-hardwood, upland spruce-hardwood, low brush-muskeg/bog, and alpine tundra. High brush in Yanert Valley.	Caribou concentrations, moose in lower elevations, Dall sheep in high areas, black bear in forested area, grizzly bear in higher areas.	Mountain.	None.	D-1 and State selected land, Wells Creek within MMCPM Zone.	None.	High scenic quality but inaccessible.
Dean Creek - Healy (15)	24 miles. 2700' at Moody Pass. North up wide valley and over wide flat pass into sinuous v-canyon, dropping into wider valley of Healy Creek.	Thin rocky soils and rock, steep slopes on upper parts. Steep gravelly poorly drained soils with variable permafrost table in conjunction with steep gravelly well drained gray soils, shallow bedrock. Moderate erosion potential.	Lowland spruce-hardwood, upland spruce-hardwood, low brush - muskeg/bog (in pass area), alpine tundra (ridges along lower Moody Creek).	Caribou concentrations, moose in lower elevations, Dall sheep in high areas, black bear in forested areas, grizzly bear in higher areas.	Mountain.	None in mountains; Usibelli Coal Mines at Healy.	State selected land.	None.	Medium scenic quality but inaccessible.
Healy to Ester (16)	97 miles. 1400' at Healy. 350' at Nenana, 1500' in Goldstream Hills. Wide, terraced valley of Nenana flows north to merge with Tanana flood plain. Over Tanana River trending N.E. are low rolling hills. Active fault at Healy. Ice-rich clay and silt at Moody.	Healy-Nenana: Well-drained brown gravel soils and poorly drained loams with surface peat, shallow permafrost table. Nenana-Ester: well-drained brown loams with lenses of fines and poorly drained loams with surface peat, shallow permafrost table. Medium to high erosion potential.	Bottomland spruce-poplar, upland spruce-hardwood, lowland spruce-hardwood, low brush - muskeg/bog, level areas tend to bogs, north slopes are lowland spruce-hardwood, sunny slopes are upland spruce-hardwood.	Caribou concentrations on west bank of Nenana between Healy and south of Clear AFB, moose along whole route, black bear in forested areas. Trumpeter Swan habitat along ponds of Tanana Valley.	Interior. Healy weather: annual temperature 26.4°F., annual precipitation 11.34"	Small communities along transportation lines. Several flight strips. FAA station at Nenana. Town of Nenana, Clear Military Reservation.	Primarily State-selected land with some existing Federal withdrawals and Native village withdrawals.	Anchorage-Fairbanks Highway, Alaska Railroad, GVEA 138 kv. line.	High scenic quality near Healy and the Goldstream Hills. Low to medium scenic quality along lower Nenana River. Dry Creek Archeological Site (National Register).
Dean Creek to Ester (Wood River) (17)	110 miles. 4300' at Dean-Wood Pass Dean Creek, sharp mountain valley heads in high pass into Wood River, a u-shaped glacier valley with aggrading stream, which eventually debouches onto Tanana flood plain, flat and poorly drained.	Upper Wood River: Thin rocky soils. Lower Wood River: Poorly drained loamy soils with surface peat and shallow permafrost table. Gentle slopes. Some well drained brown nonacid soils. Low to medium erosion potential.	Alpine tundra, high brush, low brush bog and muskeg, moist tundra, lowland spruce-hardwood, lower Wood River is area of interspersed bogs and levees and mounds with corresponding vegetative patterns.	Caribou concentrations in upper Wood River, moose present in lower elevations and stream bottoms, Dall sheep on high areas of upper Wood River, black and grizzly bear present. Trumpeter Swan habitat along ponds of Tanana Valley.	Mountain and interior.	Blair Lake Military Reservation.	Primarily State selected land. Native village deficiency and existing Federal withdrawals.	None.	Scenic quality ranges from high to medium but inaccessible.

NENANA INVENTORY

DELTA AND MATANUSKA CORRIDORS

INVENTORY

	TOPOGRAPHY/GEOLOGY	SOILS	VEGETATION	WILDLIFE	CLIMATE	EXISTING DEVELOPMENTS	LAND OWNERSHIP/STATUS	EXISTING RIGHTS-OF-WAY	SCENIC QUALITY/RECREATION
Watana to Paxson via Butte Creek (18)	98 miles. 4000' near Rock Creek. Varies from wide, flat, open terrain to rolling, post-glacial terrain. Valley floors are usually wide and flat, poorly drained. Many lakes, kettles, and morainal ridges east to Maclaren River. This upland area contains altiplanation terraces and is underlain with discontinuous permafrost.	Low areas: poorly drained soils with surface peat and shallow permafrost table. Textures range from gravelly to fine. Slopes: Well-drained, thin, strongly acid soils; deep permafrost table. Medium to high erosion potential.	Lowland spruce-hardwood; upland spruce-hardwood, low brush bog and muskeg moist tundra.	Nelchina caribou herd (presently about 4000-5000), moose present in moderately high numbers, black and grizzly bears, wolves present.	Mountain.	None. Low to no potential for commercial foresting and agriculture due to soils.	State selections, Native regional deficiency withdrawals, and D-1 withdrawals. Denali Damsite withdrawal. Area around Denali Damsite is within MMcPMZ.	Denali Highway.	Tangle Lakes Archeological District (National Register). Denali Campground. Tangle River Boat Launch. High scenic quality - easily accessible with good views to north of Mt. Hayes section of Alaska Range, Clearwater and Amphitheater Mountains.
Paxson to Fairbanks (19)	152 miles. 2700' at Paxson, 3000' at Isabel Pass. Rolling hills at Paxson lead to high flat pass and north to U-shape Mountain Valley near Rainbow Ridge-Black Rapids area. Rolling hills near Donnelly Dome decrease to flat land by Eielson AFB.	Low areas: Poorly drained soils with surface peat and shallow permafrost table. Slopes: Well drained soils; some containing lenses of fines. Shallow to deep permafrost table, if any. Medium erosion potential. Rocky soil and bedrock in Delta Canyon area. Thixotropic silts just north of Summit Lake. Permafrost continuous from Shaw Creek to Tanana River.	Full range of vegetative types from bottomland spruce-poplar to alpine tundra.	Trumpeter Swan habitat along ponds of Tanana Valley. Big Delta bison herd fall range (200 animals), Dall sheep common on Alaska Range, black and grizzly bears, good duck habitat in sloughs and oxbows of Chena and Salcha Rivers and morainal ponds of Donnelly Dome. Peregrine falcon habitat, particularly near Salcha R.	Interior.	Considerable settlement along highway near Fairbanks. Military bases, towns of Big Delta and Delta Junction, potential agriculture at Big Delte-Clearwater Lake.	State selections, utility corridors and military reservations.	Richardson Highway, Alyeska Pipeline.	Proposed Historical Sites: Rapids Hunting Lodge, Mile 220; Big Delta Roadhouse, Mile 252. Clearwater, Donnelly, Fielding Lake, Wayside Parks. Delta Campground, proposed Delta Wild River. Excellent views of Alaska Range from Big Delta south. Easily accessible.
Watana to Slide Mtn. via Vee (20)	90 miles. 3000' elevation at plateau at head of Little Nelchina River. Generally flat and rolling terrain; a high plateau extending from Susitna River to Lake Louise area. Numeros lakes and bogs.	Low areas: Poorly drained soils with peaty surface; shallow permafrost table. Medium erosion potential. Uplands: Well drained thin soils with dark acid surface; deep permafrost table. Gravelly texture. Medium erosion potential. Permafrost is continuous on this poorly drained, ice-rich area of fine sediments.	Upland spruce-hardwood; low brush bog and muskeg; moist tundra.	Nelchina caribou herd, moose in moderately high numbers, black and grizzly bears, wolves present.	Mountain/interior.	None. Low to no potential for commercial forestry or agriculture due to soils.	Native regional deficiency and state selections. Watana and Vee powersite withdrawals.	None.	To east is Lake Louise recreational land complex. High scenic quality - land of lakes and ponds. Accessible by dirt road from Glenn Highway to Lake Louise or by float plane.
Paxson to Slide Mtn. via Glennallen (21)	119 miles. 2700' at Paxson. Rolling hills and flat plateaus, cut by incised streams. Poorly drained, having many lakes and bogs.	Major portion of route: Poorly drained, fine grain soils with surface peat; shallow permafrost table. Medium erosion potential. Upland areas: Well drained, thin, strongly acid soils with deep permafrost table. Permafrost is continuous in this area.	Lowland spruce-hardwood, low brush bog and muskeg.	Nelchina caribou and very high moose concentrations on Gulkana drainage, black and grizzly bears, wolves present, good duck habitat along Gulkana from Summit and Paxson Lakes, Thaw Lakes. Gulkana is most important fishery in Copper River system. Paxson and Summit Lakes are important fish lakes.	Interior.	Towns of Glennallen, Gulkana, settlement along highway. Recreational development north of Glenn Highway. This area has low potential for commercial forestry and agriculture due to soils.	State selections and Utility Corridor. Native village withdrawals of Gulkana, Gakona, Tazlina and Copper Center.	Richardson Highway, Alyeska Pipeline, Glenn Highway.	Sourdough Lodge (National Register) Proposed historical sites of McCreary's Roadhouse, Mile 104; Gakona Roadhouse, Mile 132; Paxson Lake Wayside Park; Sourdough Campground, Dry Creek Wayside, Little Nelchina, Tolsona and Lake Louise Waysides. Proposed Paxson Lake Recreation Area and Gulkana Wild River. High to medium scenic quality.
Slide Mts. to Point MacKenzie (22)	138 miles. 3000' at Tahneta Pass. Wide pass approached from east becomes narrow valley to west of pass. Incised river and low ridges occupy valley bounded by major mountain ranges on north and south. Valley debouches onto Matanuska-Knik flood plain, to Pt. McKenzie, route crosses many lakes on flat flood plains and poorly drained uplands.	Matanuska Valley: Well drained loamy or gravelly gray soils and strongly acid soils. Medium to high erosion potential. Knik Arm: Poorly drained fibrous peat, vulnerable to frost heaving, and well drained acid soils. Low to medium erosion potential.	Lowland spruce-hardwood, low brush bog and muskeg; upland spruce-hardwood; Bottomland spruce-poplar agricultural land.	Moose present, black and grizzly bear, Dall sheep on surrounding mountains.	Transition/mountain.	Considerable development in Matanuska Valley. Coal deposits near Sutton. Farming in lower valley, recreation use along Knik Arm.	State selections primarily. Some Native regional deficiency and D-1 lands. Native village withdrawals of Chickaloon, Eklutna and Knik.	Glenn Highway, Alaska Railroad, various minor roads.	Knik Archeological Site - Independence Mines near Palmer (National Register). Big Lake/Rocky Lake Waysides. Chugach State Park to south. Matanuska Valley is high scenic quality area. Several scenic overlooks along highway. Highly vivid landscape.

The proposed corridor is a combination of the corridors Susitna-1 and Nenana-1, and is Multimodal Corridor #29 of the BLM study of Multimodal Transportation and Utility Corridors In Alaska. The common feature of both is their paralleling of the existing Alaska Railroad corridor. The Nenana-1 corridor is the shortest and most economical corridor connecting Devil Canyon to Ester, and is 198 miles long. The 136-mile long Susitna-1 corridor is only seven miles longer than the shortest corridor connecting Devil Canyon to Point MacKenzie, Susitna-3, but since it adheres more closely to the existing corridors, is the most economical and, at the same time, least environmentally detrimental corridor.

Susitna-1

From Point MacKenzie the Susitna-1 corridor travels north along the east flank of the Susitna Valley, an extremely wide and poorly drained plain. Heavy forests of bottomland spruce and poplar, interspersed with muskeg and black spruce, are typical. The soils tend to be deep, very poorly drained peats in conjunction with well-drained gravels and loams. The well-drained soils occupy more than half of the lower Susitna Valley; to the east along the terrace flanking the flood plain, the ratio of well to poorly drained soils is higher. Although permafrost is almost absent in this lower part of the Susitna Valley, the poorly drained areas are subject to freezing and heaving in winter.

A proposed Chugach Electric Association 230 kv transmission line would intersect the Susitna-1 corridor just north of Point MacKenzie. This line will be initially operated at 115 kv, and will eventually connect the gas turbine generation site at Beluga with the CEA system by following the north sore of Knick Arm and connecting south to Anchorage.

A sizeable concentration of moose inhabit the lower Susitna River Valley, and the valley also supports a moderate density of water fowl. Both brown and black bear are present.

As the Susitna-1 corridor approaches the Nancy Lake area, it meets and crosses the Alaska Railroad and the Anchorage-Fairbanks Highway, both of which run northwest to southeast. Continuing north and to the east of the highway/railroad corridor, the Susitna-1 corridor crosses several major tributaries of the Susitna River which originate in the Talkeetna Mountains. These are Willow Creek, Sheep Creek, and more importantly, the Kashwitna River. In this area the terrain has become more rolling, and the relative proportion of well drained soils supporting thick poplar-spruce forest is considerably greater than to the south.

The town of Talkeetna is the first sizeable community to be approached by the corridor. Talkeetna is a small town, originally a stop on the Alaska Railroad. Recreation plays a strong role in the town's economy since several charter flying services provide access to the Alaska Range and the Talkeetna Mountains.

Talkeetna is at the confluence of the Susitna, Chulitna, and Talkeetna Rivers; the corridor crosses only the Talkeetna River at this point. The rolling terrain encountered to the south is more pronounced here, and the valley of the Susitna River narrows considerably above Talkeetna. The highway turns west about 15 miles south of Talkeetna; the railroad continues north over the Talkeetna River and follows the river north to Gold Creek. The west bank of the river is the eastern boundary of Denali State Park.

At Gold Creek the Susitna River flows down from the east; the railroad continues north to Chulitna and an eventual re-convergence with the highway. The Susitna-1 corridor follows the river along the increasingly restricted valley to the Devil Canyon powersite. Along the valley floor and walls are forests of spruce and hardwoods based on relatively well drained soils. The uplands above the valley support sparser forests, and increasing amounts of permafrost soils are encountered. The Susitna-1 corridor traverses moose concentrations for its entire length; waterfowl density drops from moderate to low north of the Talkeetna River.

The Nenana-1 corridor retraces part of the Susitna-1 corridor to Gold Creek, but leads north to Chulitna, paralleling the railroad, and eventually the highway, also. Past Chulitna the corridor lies within the watershed of the Chulitna River until Broad Pass is crossed. The Chulitna Valley is relatively wide, with a rolling floor, and incised rivers and streams. The valley leads up to the northeast, and the low rolling hills on the floor and flanks reflect this orientation.

The soils here are poorly drained clays along the river bottoms, and well drained but thin soils. Permafrost, when present, is relatively deep. The forests here are sparse and become more so as the head of the pass is approached; generally upland spruce-hardwood, they are interspersed with bogs and muskegs in poorly drained areas. Some moose concentrations are traversed; Dall sheep inhabit the surrounding upland areas.

To the north of Broad Pass the Nenana-1 corridor lies within the Nenana watershed, dropping from a maximum elevation of 2,400 feet at Summit.

Broad Pass, drained by a tributary of the Nenana, also maintains the general character of the pass until Cantwell, at which point the Nenana-1 corridor converges to the Nenana River. A crossing is necessary, as the west bank of the Nenana north of Cantwell is the boundary of the Mount McKinley National Park. Following the east bank of the Nenana the corridor pierces the Alaska Range, emerging at Healy.

The valley of the Nenana becomes constricted in its passage through the Alaska Range; in two stretches it is particularly restricted. The entrance of the Nenana River immediately north of Cantwell is a tight valley hemmed in by loose, shaley talus cones for 10 or 15 miles. Downstream, a wide valley at the confluence of Yanert Fork separates this upper canyon from a canyon further downriver by the McKinley Park Headquarters. This lower canyon is even more restricted than the upper canyon; the highway is forced down next to the river, and bluffs and unstable slopes flank both sides.

A proposed 25 kv distribution line is planned to connect the McKinley Park Headquarters with the Golden Valley Electric Association. This line would be a combination of wood-pole overhead line and buried cable, and would connect to Healy.

The vegetation in the canyons varies from upland spruce-hardwood to alpine tundra; soils vary from poorly drained river bottoms to unstable talus. Some localized moose concentrations are crossed, particularly in the Yanert Fork confluence; in the restricted canyons Dall sheep habitat is encountered.

Heading northward out of the Alaska Range, the Nenana-1 corridor debouches onto the plains around Healy. The Nenana River is strongly incised from Healy northward for about 20 miles, and terraces are prominent along both banks. The soils vary from poorly drained soils on the terrace flats and river bottom to well drained soils on the slopes. These conditions are reflected in the vegetation, which tends to be black spruce and muskeg on the bottomlands and flats, and spruce-hardwoods on the slopes.

Coal is exposed on slopes on the east banks of the Nenana River. The Usibelli Mining Company at Healy provides fuel for the Golden Valley Electric Association steamplant, which is the southern terminus of a 138-kv transmission line to Ester. The Nenana-1 corridor parallels the Alaska Railroad and Anchorage-Fairbanks Highway.

Scenic quality north of Healy is moderate to low; the terrain is flat, blanketed with a fairly uniform mosaic of spruce-hardwoods and muskeg.

As the Tanana River is approached, the land becomes flatter and the forest density heavier; the Nenana divides into many branches and sloughs near its mouth.

The entire stretch of corridor from Healy to Nenana traverses good moose habitat; over the west bank of the Nenana River lies a considerable caribou winter range. Despite the large numbers of muskeg and ponds, particularly toward Nenana, this stretch is a low-density waterfowl habitat.

The corridor crosses the Tanana River, a major tributary of the Yukon River, and ascends the hills immediately to the north. These hills vary between 1,400 and 1,800 feet in elevation, and are oriented in a long ridge flanking the north bank of the Tanana River. The fine grain soil is easily eroded and is underlain by permafrost at varying depths. The soil is well drained on slopes and poorly drained on creek bottoms, and supports a moderately dense forest of upland and lowland spruce-hardwood

Small concentrations of moose habitat are crossed by the corridor. No other major wildlife habitats exist in this stretch.

Historically, gold mining was extensive here, usually in the form of dredging. The creek bottoms are often patterned with deposited tailings from previous workages. The end point of Ester reflects previous dredging activity; considerable spoils occupy most stream bottoms. Ester is an outlying community of Fairbanks, and the location of the Gold Hill substation, the assumed terminus of the Nenana-1 corridor.

Alternative Susitna-2

This alternative is part of the BLM Multimodal Corridor #29. Alternative corridor Susitna-2 is 140 miles long, 4 miles longer than Susitna-1. It differs from Susitna-1 in that from Talkeetna it crosses the Susitna River, heads north into Denali State Park, then northwest over Troublesome Creek and on to Gold Creek where it rejoins Susitna-1. This alternate segment is 42 miles long. In its southern part the environmental setting is similar to the Gold Creek-Talkeetna segment of Susitna-2; however, it crosses some low, rolling mountains, reaching a crest of 2,000 feet elevation before dropping back to the Susitna Valley. Alpine and moist tundra ecosystems will be crossed in addition to those ecosystems crossed on Susitna-1; however, these are limited in extent.

Alternative Susitna-3

Alternative corridor Susitna-3 is 129 miles long, 7 miles shorter than Susitna-1. It is basically a more direct corridor from Talkeetna to Devil Canyon, bypassing the Alaska Railroad between Talkeetna and Gold Creek. The length of the alternate segment is 45 miles; the length of the corresponding segment in Susitna-1 is 52 miles. Heading up the Talkeetna River it crosses and heads north up and over a plateau of almost 4,000 feet elevation. In the process, it crosses about 25 miles of moist tundra in addition to 20 miles of upland spruce-hardwood.

Alternative Susitna-4

Alternative corridor Susitna-4 is 147 miles long, 11 miles longer than Susitna-1. As with the other alternative Susitna corridors, it deviates from Talkeetna, heading up the Talkeetna River and Prairie Creek to Stephen Lake, then heading west to Devil Canyon damsite. This segment is 63 miles versus a distance of 52 for the comparable segment of Susitna-1. This corridor will require at least one crossing of the Talkeetna River; it traverses the upland spruce-hardwood ecosystem for most of its length, and a few miles of moist tundra. The major soil for this segment is a well drained gravel. Permafrost can be expected in the higher elevations. The crest of this segment is at Stephen Lake, an elevation of 2,200 feet.

Alternative Nenana-2

Alternative corridor Nenana-2 is 220 miles long, 22 miles longer than Nenana-1. This alternative departs Nenana-1 at Cantwell, heads east to Wells Creek, north to Dean Creek and the Wood River, and follows the Wood River north to Ester. This segment is 158 miles. From Cantwell the corridor parallels the Denali Highway, then crosses the Nenana River in the vicinity of the confluence of Wells Creek. Wells Creek valley progressively narrows and steepens as its head is approached, culminating in a 3,900 foot pass into Louis Creek which drains into Yanert Fort. From Yanert Fork the corridor leads up and over the Dean Creek-Wood River pass at 4,000 feet and follows the Wood River Valley out to the Tanana River Valley. A wide variety of ecosystems is traversed, from alpine tundra to bog and muskeg. Permafrost can be assumed to be prevalent; soils vary from poorly drained peats to rock. For 25 to 30 miles the corridor runs adjacent to or through the Blair Lake Air Force Range. Habitat of moose, caribou and Dall sheep are traversed. From the Project to Cantwell, this alternative is part of the BLM Multimodal Corridor #29.

Alternative Nenana-3

Alternative corridor Nenena-3 is 231 miles long, 33 miles longer than Nenana-1. It is identical to Nenana-1 up to Cantwell; from Cantwell it loops east and north through the Alaska Range, rejoining Nenana-1 at Healy. This segment is 72 miles. The comparable segment of Nenana-1 is 39 miles.

From Cantwell the corridor heads east along the Nenana River and Denali Highway, thence north, up the Wells Creek valley, over the pass (3,900 feet) to Louis Creek and Yanert Fork. From Yanert Fork the corridor goes over another pass (2,900 feet) to Moody Creek and follows this creek to Healy and Nenana-1.

The terrain varies from rolling hills and valleys to high passes and sharp ridges. Soils vary from poorly drained bottomland to exposed bedrock; permafrost is prevalent. Ecosystems crossed are moist tundra, alpine tundra, upland spruce-hardwood, and muskeg and bog. Habitats of moose, caribou, and Dall sheep are traversed. Except for 22 miles paralleling the Denali Highway, no other rights-of-way are paralleled. From Gold Creek to Cantwell, this corridor is part of BLM Multimodal Corridor #29.

Alternative Nenana-4

Alternative corridor Nenana-4 is 223 miles long, 25 miles longer than Nenana-1. From Devil Canyon it leads east and north, eventually tying into Nenana-1 at Healy. The length of this segment is 126 miles; the length of the comparable segment of Nenana-1 is 101 miles. The corridor leaves Devil Canyon, heading east to Watana Damsite, and then north up Deadman Creek and Brushkana Creek to Wells Creek. From Wells Creek it heads up over the pass (3,900 feet) to Louis Creek and Yanert Fork, over another pass (2,900 feet) to Moody Creek, which it follows to Healy. The terrain varies from rolling hills and valleys to high passes and sharp ridges. Soils vary from poorly drained bottomland to exposed bedrock; permafrost can be assumed to be prevalent. Ecosystems traversed are moist tundra, alpine tundra, muskeg and bog, and upland spruce-hardwood. Habitats of moose, caribou, and Dall sheep are crossed. There is no paralleling of existing corridors.

Alternative Nenana-5

Alternative corridor Nenana-5 is 212 miles long, 14 miles longer than Nenana-1. It is totally separate from Nenana-1, being a parallel corridor to the east of the preferred corridor. No existing rights-of-way or corridors are utilized or paralleled.

From Devil Canyon, the corridor leads east to Watana, thence north up Deadman Creek and down Brushkana Creek to Wells Creek. Climbing over the Wells Creek pass (3,900 feet), it drops into Yanert Fork and continues on up Dean Creek. The corridor crosses the Dean Creek-Wood River pass (4,000 feet) and travels north along the Wood River to Ester.

The corridor crosses terrain varying from the flat Tanana River valley to high mountain passes such as Wells Pass. Soils vary from poorly drained material on the Tanana flood plain to bare rock and talus in the Alaska Range. Permafrost is prevalent. Ecosystems crossed are alpine tundra, moist tundra, upland spruce-hardwood, lowland spruce-hardwood, and bog and muskeg. Significant amounts of Dall sheep, moose, and caribou winter range are encountered.

Alternative Matanuska-1

Alternative corridor Matanuska-1 differs radically from Susitna-1 in that it loops to the east and south, and approaches Point MacKenzie from the east. Its total length is 258 miles, 122 miles longer than Susitna-1. A considerable portion, 125 miles, parallels the Glenn Highway corridor and other secondary road and existing or planned transmission corridors.

From Devil Canyon the corridor heads east to Watana and Vee damsites, then travels southeast over a sparsely forested, poorly drained plateau to the head of the Little Nelchina River. Predominantly rolling hills, the terrain is fairly open and gentle. The corridor passes just to the west of Slide Mountain, where it turns west to parallel the Glenn Highway. Once over the Tahneta Pass and into the Matanuska drainage, the corridor leads west through a sharply defined valley floored with rolling hills and drained by a strongly incised river. Continuing west, the corridor encounters the flat land at the mouth of the Matanuska Valley and the diminutive farming area of the lower valley. Continuing southwest along the northern shore of Cook Inlet it traverses considerable forests and muskegs on the flat lands north of Point MacKenzie.

The soils encountered vary from the poorly drained, fine grain materials near the Little Nelchina to ground moraine and gravel in the Upper Matanuska Valley, well drained gray loam in the Lower Matanuska Valley, and poorly drained peat in the flatland nort of Point MacKenzie. Permafrost is continuous from Vee damsite to Tahneta Pass, discontinuous in the upper Matanuska Valley, and sporadic in the lower valley to Point MacKenzie.

The corridor encounters the upland spruce-hardwood ecosystems along the Susitna River to Vee damsite, and moist tundra to the Little Nelchina, and upland spruce-hardwood to the lower valley. From the lower valley to Point MacKenzie, bottomland spruce-poplar, farmland, and bog-muskeg are encountered.

The section from Devil Canyon to the head of the Little Nelchina River runs between major caribou calving and wintering ranges. The Nelchina herd numbered over 61,000 in the late 1960's, presently it has between 4,000 and 5,000 animals. Some wintering range is crossed along the Little Nelchina to the Glenn Highway and Tahneta Pass. Some Dall sheep habitat exists in the Tahneta Pass; moose concentrations are encountered in the Point MacKenzie area. From the Project to Glenn Highway, this alternative is part of BLM Multimodal Corridor #29; along the Glenn Highway to Palmer, it is part of Corridor #31.

Alternative Matanuska-2

Alternative corridor Matanuska-2 is 385 miles, 120 miles longer than Matanuska-1 and 249 miles longer than Susitna-1. From Watana damsite it loops much further to the east than Matanuska-1, rejoining it at Slide Mountain; this segment of Matanuska-2 is 217 miles, versus 97 miles, for the comparable segment of Matanuska-1.

From Watana damsite the corridor crosses the Susitna River, heading northeast toward Butte Creek and the Denali Highway. Recrossing the Susitna in the vicinity of Denali damsite, the corridor continues east, crossing the Maclaren River and still paralleling the Denali Highway until it approaches Paxson. Turning south and crossing the Gulkana River at least twice and paralleling the Richardson Highway and the Alyeska Pipeline, it heads toward Glennallen. From Glennallen the corridor heads west up the valley of the Tazlina River, paralleling the Glenn Highway to Slide Mountain and the junction with Matanuska-1.

The majority of the terrain is flat land; from Watana to Denali damsites the corridor encounters hilly terrain dissected by long valleys and low passes. The highest point on this corridor is in the Tangle Lakes-Rock Creek area between the Maclaren River and Paxson. This is a plateau of about 4,000 feet elevation, poorly drained and covered with post-glacial features such as eskers and terminal moraines, and many small lakes; permafrost is prevalent. The predominant ecosystem to this point is moist tundra.

From Paxson to Slide Mountain the corridor lies within the Copper River lowlands, a basin underlain by nearly continuous permafrost. Generally poorly drained, this basin is dominated by upland and lowland spruce-hardwood, and muskeg ecosystems.

Except for the area around Glennallen, this entire corridor runs through the winter range of the Nelchina caribou herd. Along the Copper, Gulkana and Tazlina Rivers around Glennallen moose concentrations exist, and smaller concentrations are encountered around Watana and Denali damsites and the Tangle Lakes. Almost all of this corridor traverses medium density waterfowl habitat.

The Tangle Lakes Archeological District, and the Sourdough Inn on the Richardson Highway, are listed in the National Register of Historical and Archeological Sites, published in the Federal Register of February 4, 1975. With the exception of the stretch from Watana to Denali damsites, all of Matanuska-2 parallels existing corridors. Parallel to the Richardson Highway, it is part of BLM Multimodal Corridor #33,; parallel to Glenn Highway, it is part of corridor #31.

The Delta Corridor Alternative

The Delta corridor is 280 miles long, 82 miles longer than Nenana-1. This corridor utilizes the corridor through the Delta River canyon on the Alaska Range, approaching Fairbanks from the southeast.

From Devil Canyon and Watana damsites, this corridor heads east over the hills north of the Susitna River, following Butte Creek to Denali Damsite. Paralleling the Denali Highway, the corridor re-crosses the Susitna and further east, the Maclaren River. Over the plateau between the Maclaren River and Paxson, the corridor reaches a crest of 4,000 feet. At Paxson, the corridor turns north, following the Richardson Highway-Alyeska Pipeline corridor over Isabel Pass, a wide, gentle divide at 3,000 feet of elevation.

North of the pass, the combined corridors pass through the Alaska Range, following the Delta River. There are some constrictions in the southern part of the Delta River canyon; however, the majority of the canyon is not overly severe. North of the canyon, the terrain consists of rolling hills until the Tanana Valley is reached. The towns of Big Delta and Delta Junction, both small settlements, are near the confluence of the Delta and the Tanana Rivers. The terrain in the Tanana Valley is a flat flood plain to the southwest of the river, and rolling hills punctuated by several major tributaries on the northeast. The hills on the northeast flatten out as the corridor approaches Fairbanks.

The predominant soils in the stretch from Watana to Isabel Pass are poorly drained peaty soils with shallow permafrost tables. Shallow, rocky soils dominate the Delta River canyon stretch, followed by mixed poorly and well drained soils with lenses of fine grain material, generally loess.

Moist tundra is the predominant ecosystem from Watana to Isabel Pass; the Delta River canyon and the hills northeast of the Delta and Tanana Rivers are mostly within the upland spruce-hardwood ecosystem. Along the Tanana flood plain, bottomland spruce-poplar forests are found; localized muskeg-bog conditions are found in the mouths of Salcha and Shaw Creeks, and some lowland spruce-hardwood occur just south of Fairbanks.

From Watana to Paxson, the winter range of the Nelchina caribou herd is crossed, and from north of the Delta River canyon to just south of Big Delta, bison range is crossed. The bison herd numbers about 200 animals and is the result of transplanting efforts. The corridor traverses sporadic areas of moose concentration, the largest occuring along the Tanana River. The corridor also intersects Dall sheep range in the Delta River canyon. Waterfowl habitat along this corridor is generally of low density, although local higher quality habitats exist near Donnelly, Shaw Creek, and Salcha River.

The area between Donnelly and Isabel Pass is one of good to high scenic quality, providing good views of the Alaska Range, particularly of the Mt. Hayes-Skarland group to the west. Several glaciers come within one to three miles of the corridor; many are visible from the highway. The Black Rapids Glacier is particularly well known for its surging activity.

This same mountainous area is highly mineralized, particularly with copper and gold. Some gold occurs also near Fairbanks. The only other significant mineral resources near the corridor are the areas southwest of the Tanana River which have a low potential for oil and gas.

Although attempts have been made, agriculture is not significant anywhere along this corridor. This is due to a combination of problems with soil, growing season length, and water supply. The forests from Big Delta to Fairbanks are moderately dense and may support a sizeable forestry. This corridor from Paxson to Big Delta is part of BLM Multimodal Corridor #33.

Matrixes for Assessment of Impacts on Corridor Segments:

The following matrixes are for assessment of impacts of a transmission line by five categories. The definitions of the categories and general information are given in Exhibit I. The process from which the 22 corridor segments are derived is explained on pages 10-15.

The constraints of this format also oblige the use of abbreviations: MMCPM zone stands for the Mount McKinley Cooperative Planning and Management zone; GVEA refers to the Golden Valley Electric Association; MEA refers to the Matanuska Electric Association; and the ARR is the Alaska Railroad.

The land status entries are based upon the land status situation of March 1974. State selections refer to not only patented, but also all pending and tentatively approved State selections. Native village deficiencies and regional deficiencies (NVD and NRD) will perhaps be the most unstable areas at present, so it is quite likely that the entries regarding these lands may not be presently valid.

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SUSITNA CORRIDORS

IMPACTS

	SOILS	VEGETATION	WILDLIFE	EXISTING DEVELOPMENTS	SCENIC QUALITY/RECREATION
Point MacKenzie - Talkeetna	Lowland soil vulnerable to frost heaving but with low erosion potential. Upland soils are more susceptible to erosion. Thermal disruption is unlikely. No major river crossings are anticipated on this route.	Considerable clearing is needed. Upland vegetation will warrant maintenance; poorly drained areas will probably need little maintenance. Slash must be disposed of to inhibit infestation of remaining trees with spruce beetle or ips beetle. Vegetation has high resistance to fire control.	Destruction of habitat for small animals. Enhancement of habitat for larger mammals due to increased successional growth. Harrassment unlikely due to good cover throughout area. From Nancy Lake to Pt. McKenzie, access will be improved if access road left in; increased hunting pressure may result.	Some possible conflicts with private lands from Nancy Lake to Talkeetna. No impact on foreseeable agriculture - most soils are unsuitable for agriculture.	Little impact on scenic quality from Nancy to Pt. McKenzie since line can be concealed. Possible conflict with recreation areas in Wasilla-Big Lake area and Nancy Lake area, depending upon final location. No conflict with Knik archeological site. Talkeetna to Nancy: line can be almost totally concealed or laid parallel and adjacent to existing line clearings.
Talkeetna - Gold Creek via Troublesome Creek (2)	Some design problems inherent to soils around Talkeetna: Frost heaving, possible permafrost, poor drainage, slow revegetation. Upland soils are well drained, but erosion potential is higher. Possible river crossing needed for Troublesome Creek, three needed for Susitna and Talkeetna Rivers. Access road crossing on Troublesome Creek may cause siltation.	Lower elevation forest will need considerable clearing; regrowth rate fast enough to warrant maintenance. Upland areas will require less clearing and maintenance. Except for area above timberline, vegetation has a high rate of spread of fire and a high resistance to control.	Route opens up an inaccessible area within Denali State Park; closed to hunting.	None	High impact on scenic quality - invades Denali State Park. Line can be concealed somewhat, but will undoubtedly interfere with potential trail users.
Talkeetna - Gold Creek via Alaska Railroad (3)	Talkeetna River only major river crossing; siltation here is not a problem as river carries glacial silt already.	Tree clearing needed along entire segment; maintenance will be needed. Vegetation has high rate of spread and high resistance to control. Brush will be introduced by regrowth.	No extensive inaccessible areas opened up line parallels A.R.R.; access road would allow vehicles to reach this area independently from the A.R.R., so hunting pressure may increase. If the A.R.R. right-of-way is adjourned or shared, impacts will be very low.	If line adjoins Alaska Railroad, railroad could be electrified and corridor consolidated. Increased access to an area presently having only a few flag stops on Alaska Railroad.	Medium impact on scenic quality. Most traffic through this stretch is by A.R.R., and line can be well hidden from passengers using rail lines unless corridor is consolidated.
Talkeetna River (4)	Poorly drained soils susceptible to frost heaving and poor foundations; well drained soils on slopes less apt to cause problems. Low to medium erosion potential. Little likelihood of serious permafrost degradation.	Expensive clearing of heavy forest needed with maintenance. Brush will be introduced by regrowth. Vegetation has high rate of fire spread and high resistance to control.	Pioneer route will open up new areas to access. Hunting pressure will increase. Brush introduction in this area will enhance habitats for moose, bear.	None	Low impact on scenic quality. Line is not visible. Wilderness quality somewhat impacted, but ease of concealment keeps impact low.
Disappointment Creek (5)	Possible degradation of local permafrost. Few foreseeable impacts from erosion, siltation, or permafrost degradation.	Clearing and maintenance need in lower elevations. Most of route is highland spruce-hardwood and alpine tundra. Preservation of ground vegetation essential - disruption can result in longlived scars due to slow regrowth rate. Upper elevations have high rate of fire spread, low resistance to control.	Pioneer route will open up considerable new areas to access. Most of this area is open forest toalpine tundra - damage to habitat could be severe (from fires, erosion, ORV's).	None	Line will cross open alpine tundra for quite a distance, having high impact on wilderness quality.
Prairie Creek - Stephan Lake (6)	Few foreseeable impacts from erosion, siltation or permafrost degradation.	Heavy forest clearing needed on Talkeetna River valley with introduction of brush requiring maintenance. Less clearing required and more care for vegetative mat needed in Prairie Creek valley to Stephen Lake. High to medium rate of fire spread, high to medium resistance to control.	Pioneer route will open up considerable new areas to access. Impact will be less on upper areas due to less disruption of vegetation by clearing. Area is presently accessible by float plane and received considerable hunting pressure already.	Private land and/or cabin leases on lake shores in the pass areas. Most of these can be avoided. Otherwise, no impacts on existing developments.	Where line emerges from Talkeetna River valley to Stephen Lake, scenic quality receives medium impact; lakes received some recreational use. Impact on wilderness is medium due to the existing recreational use and easy accessibility by float plane.
Devil Canyon - Gold Creek (7)	Few foreseeable impacts from erosion, siltation or permafrost degradation.	Clearing of medium forest with periodic maintenance. High rate of fire spread, medium resistance to control.	Moose and bear habitat enhanced by regrowth on clearings. Access road may result in increased hunting pressure.	Old jeep road exists, connecting Devil Canyon Damsite to Alaska Railroad. Mining claims, no longer operating, on Portage Creek. These roads could be part of the access road system.	Low impact on scenic quality - this area is not presently easily accessible, and Devil Canyon Damsite road will not be used much by non-project personnel; line can be concealed from this road or can be used as the line access road also.
Devil Canyon - Stephan Lake (8)	Few foreseeable impacts from erosion, siltation or permafrost degradation.	Clearing of medium forest in river valley; less clearing needed on plateau. Fire rate of spread in valley high, resistance to control medium. On plateau, rate of fire spread low, resistance to control high.	Little impact on habitat of large mammals such as moose and bear, minimal clearing on plateau areas and creek canyons can be spanned. Access road would be under control from damsite so unauthorized use for hunting would be low.	None	Low impact on scenic quality - area is of medium scenic quality. Some recreational use in Stephen Lake area. Line can be partially concealed but not totally.
Stephan Lake - Watana (9)	Few erosion impacts but possible permafrost degradation and frost heaving in poorly drained soils.	Heavier vegetation in creek bottoms can be spanned over by line. Vegetation on plateau does not require extensive cleaning. Rate of fire spread low, resistance to control high.	Little impact on habitat of moose and bear, minimal clearing on plateau areas and spanning of creek canyons. Access would be under control of damsites so unauthorized use for hunting would be low.	None	Medium impact on scenic quality - area is of medium scenic quality. Some recreational use of Stephen Lake area. Line can be partially concealed but not totally.

SUSITNA IMPACTS

NENANA CORRIDORS

IMPACTS

	SOILS	VEGETATION	WILDLIFE	EXISTING DEVELOPMENTS	SCENIC QUALITY/RECREATION
Gold Creek - Cantwell (10)	Erosion impact is low. Shallow permafrost in poorly drained areas susceptible to degradation; since the access road can avoid these areas, this impact will be low.	Successively less clearing as segment goes north. In Broad Pass, no trees need clearing and the only vegetation lost would be from access road. Slow regrowth implies that maintenance will not be needed and also that revegetation may be necessary along some areas. Medium to high rate of fire spread; high resistance to control.	Some enhancement of bear and moose habitat in southern part of segment; no change in northern part. This route opens up no major new areas to hunting; overall impact is low.	Few private holdings - small chance of conflict. Low impact - very few existing developments.	Entire segment within Mt. McKinley Cooperative Planning and Management Zone. Southern part borders Denali State Park. Visible line will have high impact, particularly if to west of highway and railroad. Line can be concealed somewhat, however, in most of segment. Broad Pass has least cover for line.
Watana - Wells Creek via Brushkana Creek (11)	Poorly drained loam: impact on permafrost in this case is high, and frost heaving is possible. Upland soils: impact is low on permafrost, medium on erosion.	Clearing varies from dense spruce-hardwoods to alpine tundra. Most vegetation loss will be from access road. Slow regrowth implies that maintenance will not be needed and that in places revegetation may be necessary. Medium to high rate of fire spread; high resistance to control; low resistance in alpine tundra.	Some enhancement of bear and moose habitat in heavier forested areas, but no significant change. Access road opens up a previously inaccessible area to intrusion and hunting; since caribou and moose are present, this could have a significant impact on hunting preserve. Firing on tundra areas could severely impact caribou habitat.	None	Low impact on scenic quality; this area is of medium scenic quality and not readily accessible. However, there is a high impact on wilderness, especially if an access road is built.
Wells Creek - Cantwell (12)	Erosion impact is low level. Shallow permafrost in poorly drained areas susceptible to degradation; since the access road can avoid these areas, this impact will be low.	Clearing varies from spruce-hardwoods to high brush. Most vegetative loss from access roads. Slow regrowth implies that maintenance will not be needed. Medium to high rate of fire spread; high resistance to control.	Some enhancement of bear and moose habitat in heavier forested areas, but little significant change. No new areas opened up. Overall impact is low.	Apart from settlements along Denali Highway, no developments - no impacts.	Medium impact on scenic quality; area is of high scenic quality, but line can be concealed. Entire segment within MMPCPM Zone.
Cantwell - Healy (13)	High erosion potential throughout stretch. Exposed bedrock in canyons will provide solid tower foundations but will inhibit access road construction if needed on canyon slopes. Poorly drained areas have high permafrost degradation susceptibility. Low siltation impact.	Heavy clearing in valley bottom by Yanert Fork; lighter clearing throughout rest of route. High rate of fire spread, high resistance to control on valley floor; low resistance in alpine tundra.	Some habitat destruction and enhancement due to clearing; overall impact of clearing is low. No new areas opened up to hunting. Construction activities combined with transportation use of corridor may temporarily repulse some mammals such as wolf and bear.	The addition of a third right-of-way through the canyons may cause congestion unless rights-of-way are consolidated. Possible connection to GVEA line at Healy. Potential tap to provide connection of Cantwell into system.	Severe impact on scenic quality; not only is the canyon an area of high scenic quality, concealment of the line is hard and the west bank of the Nenana is park land.
Wells Creek - Dean Creek (14)	High erosion potential and exposed bedrock on slopes. Some areas of poorly drained soil susceptible to permafrost degradation in wider valley floors. River too deep for fording and is silt-laden normally, so siltation will have low impact.	Heavy clearing on valley bottoms to no clearing in alpine tundra. Slow regrowth in higher elevations. High rate of fire spread; high resistance to control at lower elevations; low resistance to control in alpine tundra.	Construction activities may inhibit caribou and sheep activities. Overall habitat modification low, especially if winter roads and/or helicopter construction is used. Fire can seriously impact sleep and caribou habitat. Large new area opened by access road will increase hunting pressure.	None	High impact to wilderness quality, but limited to the immediate valley occupied by line; nature of terrain will adequately conceal line unless it is run on ridges (unlikely in this segment).
Dean Creek - Healy (15)	High erosion potential on slopes; high susceptibility to permafrost degradation on poorly drained valley floors. Towards Healy, well drained soils are subject to medium erosion potential and low susceptibility to permafrost degradation. Crossing needed on Healy Creek; low siltation impact.	Heavy clearing in Yanert Fork; little to no clearing elsewhere. Slow regrowth in higher elevations and poorly drained areas. High to low rate of fire spread; high to low resistance to control.	Construction activities may inhibit caribou and sheep activities. Overall habitat modification low, especially if winter roads/helicopter construction is used. Fire can seriously impact sheep and caribou habitat. Large new area opened by access road will increase hunting pressure.	Possible line connection at Healy Power Plant - Usibelli Mine roads may be used for access.	High impact to wilderness quality except for lower Moody Creek (Usibelli Mine works). Nature of terrain will conceal line except for ridge along lower Moody Creek where line will be silhouetted.
Healy to Ester (16)	Nenana flood plain has medium erosion potential. Poorly drained areas subject to potential permafrost degradation and frost heaving. Goldstream hills are highly erosive and susceptible to permafrost degradation and slope instability. Crossing of Tanana River needed: low siltation impact.	Heavy clearing for most of route except near Healy. Introduction of brush into right-of-way. High rate of fire spread; high resistance to control.	Clearing will enhance considerable amount o moose habitat. Caribou confined to west bank of Nenana and thus will not be affected if line runs on east bank. No new significant areas opened up, particularly if GVEA right-of-way is paralleled or adjoined.	Private holdings (claims, homesteads, etc.) along route - towns of Healy, Lignite, Nenana: These towns may be affected by construction activities since they are transportation centers along the segment. If GVEA line is adjoined, there will be a conflict with the FAA airport at Nenana for clearance.	No impact on Dry Creek archeological site since line will travel on east bank of Nenana River. Medium impact near Healy and in the Goldstream Hills; low impact along lower Nenana River. Impact will be less if GVEA right-of-way is adjoined. Low impact on wilderness.
Dean Creek to Ester (Wood River) (17)	Upper Wood River: low erosion and permafrost impacts. Lower Wood River: medium to high potential impacts on permafrost. High susceptibility to heaving. Low to medium erosion potential. Crossing of Tanana River needed.	Heavy clearing on Tanana lowlands. Light to no clearing in Upper Wood River in alpine and moist tundra, and the Tanana flood plain muskegs. Varying rates of fire spread and controllability.	Construction activities and fire in Upper Wood River will negatively affect caribou and sheep. Clearing in Lower Wood River will enhance moose habitat. Very large area opened up by access road will be subjected to greater hunting pressure.	None	Low impact on scenic quality due to extreme inaccessibility. Wilderness quality will receive high impact in upper Wood River, medium to low along lower Wood River because of varying concealment and presence of civilization.

NENANA IMPACTS

DELTA AND MATANUSKA CORRIDORS

IMPACTS

	SOILS	VEGETATION	WILDLIFE	EXISTING DEVELOPMENTS	SCENIC QUALITY/RECREATION
Watana to Paxson via Butte Creek (18)	Vulnerable to permafrost degradation. Low-lying areas are susceptible to heaving and settlement. Erosion potential is medium to high. Access road will need to be adequately culverted over areas of poor drainage.	Minimal clearing throughout segment; no need for maintenance. Possible disruption of surface mat and subsequent erosion on slopes or permafrost degradation on poorly drained areas. Fires have low to medium resistance to control.	Construction activities may interfere with caribou movements. Low impact on moose activities. Little change in habitat from construction, unless severe scarring or excessive fires affect vegetation. Access road will open up the Butte Creek area and hunting pressures may increase.	No existing developments except for scarce settlements along Denali Highway. No impact.	Low impact on Butte Creek area, medium impact on view as seen from Denali Highway; line can be concealed somewhat from highway. Preliminary route surveys in Tangle Lakes Archeological District will locate archeological sites; adjustment of route would alleviate conflict. Right-of-way will avoid recreation areas and east end of Denali Highway to lessen impact on recreation and scenic quality.
Paxson to Fairbanks (19)	In Delta Canyon bedrock is easily reached for tower foundations. Thixotropic silts north of Summit Lake combined with seismic risk will affect reliability of line. Phelan Creek, Tanana River, Gulkana River, Shaw and Salcha Creeks need crossings.	Light clearing from Paxson to Donnelly Dome area. Heavy clearing as route goes north. Brush introduction in clearings in Spruce-Hardwood forests. Slash must be disposed of to prevent beetle infestations. Vegetation has medium to high rate of fire spread and high to medium resistance to control. Impacts overall would be less if Alyeska right-of-way were to be adjoined.	Possible interference with caribou and bison movements. Low impact on moose in southern part, but will enhance habitat on more heavily forested areas. Low impact on Dall Sheep in Delta Canyon since line will stay low. Minimal destruction of duck habitat if right-of-way crosses Salcha sloughs and ponds by Donnelly Dome. Siltation in Gulkana, Salcha and Shaw creeks will affect anadromous fish.	Settlements along Richardson Highway may be impacted by line right-of-way acquisition. Towns of Delta Junction and Big Delta will receive some impacts, mostly beneficial, from transit of material and labor. Possible congestion of right-of-way through Delta Canyon unless rights-of-way are consolidated. Overall impacts would be less if Alyeska right-of-way were to be adjoined.	High impacts on scenic quality from Paxson to Donnelly Dome, medium to Delta Junction, and low to Eielson A.F.B. Impact is a function of existing scenic quality and ability to conceal the transmission line. If transmission line is routed parallel to Richardson Highway, recreation areas and historic sites will be negatively affected. If line adjoins the Alyeska right-of-way, impacts will be less.
Watana to Slide Mtn. via Vee (20)	Low areas vulnerable to heaving. Considerable impact to permafrost possible from access road; winter construction preferable. Access road will need to be adequately culverted over areas of poor drainage.	Light clearing over most of route; some clearing through Spruce-Hardwoods necessary around lower Little Nelchina River. Risk of beetle infestation ᶠ slash. Vegetation on Upper Susitna plateau has low to medium rate of fire spread and medium to high resistance to control. Vegetation on lower Little Nelchina has high rate of spread and high resistance to control.	Possible interference with Nelchina caribou herd movements. Low impact on moose except on lower Little Nelchina, where clearings will enhance caribou habitat. This route opens a very large area to hunting.	None	Wilderness quality suffers since this would be a pioneer corridor.
Paxson to Slide Mtn. via Glennallen (21)	Vulnerable to heaving. Considerable impact to permafrost possible from access road; winter construction preferable. Access road will need to be adequately culverted in areas of poor drainage. Overall impacts would be reduced if Alyeska right-of-way were to be adjoined where possible.	Medium to heavy clearing throughout segment. Brush introduction will occur in clearings. Risk of beetle infestation of slash. Vegetation has high rate of fire spread and high resistance to control. Overall impacts would be reduced if Alyeska right-of-way were to be adjoined were possible.	Possible interference with Nelchina caribou herd movements. Although moose are numerous, major impact should be the enhancement of habitat along clearings. Fire will be destructive to caribou habitat, may enhance moose habitat. Overall impacts would be less if the Alyeska right-of-way were to be adjoined.	Town of Glennallen will receive some impacts, mostly beneficial, from transit of material and labor. No other major impacts. Overall impacts would be less if Alyeska right-of-way were to be adjoined.	Low impact on scenic quality - line can be easily concealed for entire segment. Possible conflicts with recreational and historic sites depending on final location. Impacts would be less if Alyeska right-of-way were to be adjoined.
Slide Mts. to Point MacKenzie (22)	Erosion impact from construction and access road can be high. Permafrost degradation is unlikely. Impact of construction and road on Knik Arm soils will be low. Frost heaving is very probable in poorly drained areas.	Except for Tahneta Pass and Gunsight Mountain area, segment required medium to heavy clearing for entire length. Brush introduction will occur in clearings. Clearings will need periodic maintenance. Risk of beetle infestation of slash. Vegetation has medium to high rate of fire spread and high resistance to control.	Low impact on Dall Sheep. Clearing will enhance moose habitat. Low impacts on wildlife in general.	Considerable farming community on Palmer - conflicts may arise in land use. Roads by abandoned coal mine areas can be used as access. Lower Matanuska Valley has a high ratio of privately owned land which will result in acquisition for right-of-way.	Severe impact on scenic quality of Upper Matanuska Valley and Tahneta Pass. Partial concealment is possible. Impact lessens as valley widens, and agricultural use becomes more apparent and concealment increases. Low impact on Knik Arm area; line can avoid all recreation areas and be concealed from roads.

DELTA/MATANUSKA IMPACTS

Impacts of Preferred Corridor Susitna-1

Soils: In the lower Susitna Valley the corridor will encounter substantial areas of poorly drained soils that although not vulnerable to erosion will, however, pose the problem of frost-jacking of tower footings and anchors. Unless measures are taken to counteract this potential problem, additional maintenance and its corresponding impacts will be necessary. The better drained upland soils are less vulnerable to heaving, but, as with many flood plain soils, is rather susceptible to erosion, particularly stream erosion. Since the relative proportions of these two soil types vary from poorly drained soils in the southern portion to well drained upland soils in the northern, the impacts associated with them will have a similar distribution.

Access road construction, although requiring heavy clearing, will be relatively easy in the upland soils. Water erosion will occur somewhat, particularly during the construction phase, influencing water quality in the clearwater streams crossed. Road construction in the areas of poorly drained peats will involve problems of hardening the surface sufficiently to bear construction traffic. Rutting and gouging of tracks will occur if conventional vehicles attempt to cross an unhardened surface. Corduroy, piles, deep fills, and drainage are methods of hardening muskeg surfaces, all of which are expensive and will involve local impacts. Avoidance of the problem by careful routing, winter construction, and/or use of low-pressure tread vehicles will involve less impacts.

Permafrost is generally not present. Where isolated masses do exist, they are buried fairly deeply. Potential thermal disruption of permafrost along this corridor is unlikely.

The corridor parallels the Susitna, involving no crossing, but intersects several tributaries from the Talkeetna Mountains. Fording of machinery and yarding of logs across these streams will result in increased sedimentation. In the smaller clearwater streams this may result in reduction of spawning habitat and potential gill damage in fish downstream of the crossing.

Vegetation: If the line to Point MacKenzie is 345 kv, the amount of clearing for the right-of-way will be up to 2,308 acres; if the line is to be 230 kv, the amount of clearing will be up to 2,060 acres. The actual clearing will probably not be as high as these acreages since vegetation along some stretches may not require clearing, except around tower bases. The terrain being relatively flat, the access road can utilize the right-of-way without additional clearing.

The immediate effect of this clearing will be the destruction of the vegetation; the much more significant impact will be upon erosion and wildlife habitats. In hilly terrain mechanical clearing methods such as bulldozing will cause considerable disruption of the soil and subsequent erosion and stream sedimentation. The use of brush blades or rotary cutters will reduce this effect. On steep slopes hand clearing will mitigate the otherwise heavy erosion potential likely with mechanical clearing.

To reduce available fuel for forest fires, and to reduce potential infestation of healthy trees by spruce beetles (Dendroctomus rufipennis) and ips beetles, slash must be disposed of. This can be either by sale of marketable timber or by burning. Although burning will reduce air quality temporarily, it is more economical and less damaging than the alternatives. (See Mitigating Measures)

Regrowth rates along this corridor are fast enough, particularly in the southern portion, to warrant periodic suppression of tall growing trees which pose a hazard to the transmission line. The preferred method along this corridor is manual application of a suitable herbicide. The amount of clearing to be maintained, the modest regrowth rates, and high cost of labor make this alternative preferrable in this corridor over aerial application of herbicides on the one hand, or hand cutting of residual trees on the other. If proper application techniques are adhered to (see Mitigating Measures), there will be no other impacts other than the maintenance of a sub-climax vegetation. Accidental overspraying or wind drift, or improper dilution resulting in unnecessary destruction of vegetation, and spraying of water bodies resulting in habitat destruction for aquatic life are not likely to occur with manual application. Sections needing vegetation suppression occurs in the bottomland spruce-poplar, lowland spruce-hardwood, and upland spruce-hardwood forests, particularly in the bottomland spruce-poplar and muskeg-bog areas, which comprise a significant proportion of the ecosystems crossed by this corridor, will need little clearing and no vegetation suppression. Lowland spruce-hardwood areas will not need to be maintained as often as bottomland spruce-poplar.

Wildlife: Alteration of vegetation patterns will affect wildlife. This corridor traverses many areas of moose concentration, and moose should benefit from the introduction of brush resulting from the regrowth on the clearing. Since the clearing must be maintained, this brush area will last for the life of the line. Most brush areas are in transition, changing from the brush phase to some other phase nearer the climactic phase; the brush in a transmission clearing can be counted as a more permanent source of browse.

Animals dependent upon climactic forest, such as squirrels, will suffer loss and displacement. However, their faster reproductive rates will allow their populations to adjust rapidly.

Most animals will benefit from the edge environment, offering both forage and cover for the adjacent forest and brush. Initially, animal movements may occur along the right-of-way, but as the brush grows into a dense cover this will be limited. In any event, this impact should be low in this corridor.

Construction itself will affect wildlife. Larger mammals may temporarily leave the area to return after the construction activity. Smaller animals will suffer loss of individuals, but should recuperate rapidly once construction is completed. The density of forest in this corridor will allow animals to move only a short distance to avoid contact with construction activities.

Vegetation suppression, by whatever method, will periodically remove cover from along the right-of-way. However, due to the surrounding cover of the uncleared forests, this impact will be insignificant.

Recreation: The Susitna-1 corridor will approach within 10 miles of several recreational and wayside areas in the lower Susitna valley. The largest of these is the Nancy Lakes Recreation Area. In addition, the corridor will run adjacent to the Denali State Park for 22 miles. However, the Susitna River will separate the corridor from the Park; the main access to lands within the Park is the Anchorage-Fairbanks Highway, and this is an average of 10 miles away to the west over a 2,000 to 2,500 feet high ridge.

Depending upon the policies of the land managing agencies involved, this corridor will provide access to areas previously difficult of access. The largest such area is that south of Nancy Lake to Point MacKenzie. Dense forest and muskeg limit travel. Another such stretch is that from Talkeetna north. Although the service road parallels the Railroad, it will offer a significantly easier access by car or truck to this corridor. Many cabins along these stretches will be provided with better access; however, the creation of easier access may interfere with isolation desired by many of the owners. If no bridge is provided over the Talkeetna River, the service road will be less attractive to casual travellers.

Cultural Resources: The National Register of Historic and Archeological Sites lists only one site in the area, Knik Village. The corridor will run at least 10 miles to the west of this site. It is likely that archeological sites will be found along the corridor, either during the location survey or during construction. If so, minor route relocations, or careful tower locations, will protect these sites. Inadvertent alteration of a site will reduce or destroy its historical value.

Scenic Resources: This corridor does not traverse any areas of good or high quality scenic values. The northern portion is, however, more scenic than the southern portion. In the northern portion the fairly continuous moderately dense forest will provide ample screening from transportation routes. Further south, the forests are more intermingled with open muskeg. Glimpses of the transmission line can then be seen from the highway or railroad through these muskegs. South of Nancy Lake the corridor and the transportation corridors diverge, and although cover becomes more sporadic, the line will no longer be visible from the transportation routes. The transmission line will not be visible from the Nancy Lake Recreation Area.

As the Alaska Railroad and the transmission corridor approach Gold Creek, the valley becomes more confined, and screening becomes more difficult. However, it appears that the line can be concealed through most of this portion.

Land Use and Resources: From Point MacKenzie to Nancy Lake the corridor follows no existing corridor for 32 miles. North of Nancy Lake to Gold Creek the corridor parallels the Alaska Railroad, and to Talkeetna the Anchorage-Fairbanks Highway and Matanuska Electric Association distribution lines. No impact is expected on these utilities.

Although agriculture in this area is generally limited to a few farms and subsistence gardens, there is potential in the better drained soils to support farming. The corridor will encounter some agriculture near Nancy Lake, and again about 25 miles north near the settlement of Montana. Impact on agriculture will be very low.

Good stands of black cottonwood and balsam poplar exist near the Talkeetna River, but there is no extensive forestry to be impacted by the corridor. Future forestry may utilize the access road both for logging and as a fire road, but this impact is low and depends also upon the land ownership.

Impact on mineral resources is low; the corridor does not traverse significant areas of potential metallic minerals, and does not approach any existing coal or oil developments although the potential for coal, oil and gas exists along nearly the entire length of the corridor. Due to the high cost of a low-load tap on a 345 kv line, the likelihood of the development of these resources due to the proximity of a transmission line is low.

Social: Few towns are encountered by the corridor. Whenever possible, the final location will circumvent communities. The construction phase can last somewhere from three to five years. During that time, work on the transmission line will affect these communities. The numbers of workers needed on a transmission line relative to a pipeline is low. Workers will be housed in camps, or will be based in Anchorage or Fairbanks, both of which are large enough to absorb the workforce. Labor will probably be recruited from these cities or brought in by the contractors. Little or no labor force will be drawn from the smaller communities since it is not expected that their residents might have the skills and qualifications for transmission line work.

Some economic impact can be expected, as flying services, motels, restaurants, and entertainments receive business, not only from the transmission line workers, but from related personnel, also. Talkeetna is the only community, except Anchorage, receiving these impacts from corridor Susitna-1. It can be expected that Anchorage could accept this impact with little strain, but the impact may be high for Talkeetna. The impacts may be adverse in that services might be temporarily monopolized by the construction activity, and good in that it would bring considerable money to business in the town.

Impacts of Preferred Corridor Nenana-1

Soils: The incidence of permafrost increases from Devil Canyon north to Fairbanks; however, it is generally discontinuous, with a fairly deep table. Impacts resulting from thermal degradation will be low, except for soils in the Moody area which are ice-rich.

As in Susitna-1, soils vary from poorly drained soils on lowlands, and better drained soils on slopes. Erosion potential for the majority of the corridor is low to medium since the greater portion of the corridor is on relatively level land. Two significant exceptions are the sections in the Nenana Canyon and the "Goldstream Hills."

The Nenana Canyon area would pose severe erosional problems for an access road due to the steep slopes encountered. Discontinuous permafrost is found, which presents a high potential for degradation.

Due to the physical and political restraints, the corridor will have to traverse many slopes. Soils are often shallow on these slopes; indeed, many of them are talus. The upper canyon is constricted between Panorama Mountain and the Nenana River, and an extensive, unstable talus slope lies at the foot of Panorama Mountain. In the lower canyon, thin, unstable soil blankets the steep slope to the east of the highway. Where the corridor traverses slopes such as these, erosion will be a serious problem, especially on thin soils or unstable soils. This impact will be especially objectionable since erosion scars may be visible from the Anchorage-Fairbanks Highway and Mt. McKinley National Park. Because of the potentially severe impact of our access road in this area, none will be built and helicopter construction will be used.

The Nenana Canyon area is also in the vicinity of several large faults. The Denali Fault crosses the corridor just north of Cantwell, and another active fault is encountered near Healy, north of the lower canyon. This factor will affect location of the transmission line on unstable slopes.

The soil in the Goldstream Hills contains lenses of fine grain material which, combined with the slopes encountered by the corridor, poses a potential erosion problem. Fortunately, rainfall is scant in this area. The low lying areas in the Goldstream Hills have a shallow permafrost table; so avoiding the potentially erodable fine grain soils by locating the transmission line low will present a problem with frozen soils and muskegs.

The corridor will cross Portage Creek, the West and Middle Forks of the Chulitna River, the Jack River, the Nenana River, Yanert Fork, Healy and Lignite Creeks, and the Tanana River. With the exception of the Nenana and Tanana Rivers and Yanert Fork, these are clearwater streams. Fordings and crossings which disturb the bottom will affect water quality, as will run-off into these streams from a disturbed clearing.

Vegetation: Up to 1,440 acres will need clearing along this corridor. Actual acreage of clearing will probably be much less since this figure assumes clearing to the full width of the right-of-way. In many areas, only the areas around the tower bases will require clearing, particularly in the lowland spruce-hardwood and muskeg-bog ecosystems. The heaviest clearings will be necessary in the bottomland spruce-poplar and upland spruce-hardwood ecosystems along the lower Nenana River and the Tanana floodplain. Along the greater part of the corridor, the access road can be incorporated into the clearing due to level terrain. From Devil Canyon to Healy, there will be no access road.

The most immediate effect of clearing will be the destruction of the cleared vegetation. The timber cleared from the bottomland spruce-poplar will be sold, if merchantable. Non-merchantable timber will be burned if an access road is present. With no access road, machinery cannot be brought in for stacking, burning, or chipping, and downed timber will be left along the clearing. Beetle infestation will be of concern mainly in the bottomland spruce-poplar ecosystem.

Some disruption of the soil from clearing is to be expected; increased erosion because of this, and enhanced by the lack of cover, will result. If vegetation is cleared up to river banks on stream crossings, this may result in additional sedimentation. Clearing will entail habitat modification, to be discussed under "Wildlife."

Regrowth rates along this corridor are slow enough to not require a program of vegation suppression other than occasional cutting during routine inspection and maintenance patrols.

Wildlife: There will be loss of individual smaller animals, and displacement of others; however, this is a temporary setback. High reproductive rates of smaller mammals and re-invasion will alleviate this impact.

A permanent habitat modification will result from the clearing and maintenance; a corridor of brush will be maintained through otherwise forested land. Animals dependent upon climax forest, such as squirrels, will suffer some habitat loss. Animals dependent upon brush and forbs for browse will gain.

Apart from local concentrations, the only major moose concentration along this corridor occurs from Healy to the Tanana River along the Nenana River.

After the construction phase, moose will benefit from the "edge" environment, offering increased browse immediately adjacent to forest, which provides cover.

Depending upon the final location, the access road may result in additional hunting pressure upon moose in this area. This will also depend upon the chance of more hunters in the area than presently since if the number of hunters remains the same, there is no reason to suspect that increased access will result in better hunting success.

In passing through the lower Nenana Canyon, the Nenana-1 corridor traverses Dall sheep habitat. However, since the sheep tend to inhabit areas higher than any feasible line location, and since no access road will be used in this area, impact on Dall sheep will be low to none.

Recreation: The Nenana-1 corridor will parallel eight miles of the northeast border of Denali State Park, but will be separated from the boundary by Indian River, the Alaska Railroad, and at least one mile of buffer. Further north, it parallels the east border of Mt. McKinley National Park for 30 miles, being separated by the Nenana River, the Anchorage-Fairbanks Highway, and the Alaska Railroad. At no point will the corridor cross lands proposed as additions to the Mt. McKinley National Park.

The access road will open up no extensive previously inaccessible areas since it will parallel existing transportation a few miles distant; no recognized wilderness areas are infringed. Use of the access road by the public will be determined by the relevant land-managing agency. If the final route location crosses the Clear MEWS, restrictions may be placed upon public use of this portion of the access road.

Cultural Resources: The National Register of Historic and Archeological Sites lists only one site approached by the Nenana-1 corridor, the Dry Creek archeological site. This lies to the west of Healy, the Nenana River, and the existing transportation corridors. Since the corridor runs along the east bank of the Nenana, there will be no impact on this site.

If the final route survey discloses an unsuspected archeological or historical site with potential for inclusion in the National Register, minor route relocations, or careful tower location, will protect these sites. Inadvertant alteration of a site will reduce or destroy its historical value.

Scenic Resources: The corridor passes through an area recognized as being of good to high scenic quality from Devil Canyon to Healy. The possibility of screening throughout this area varies from moderate in the southern portion around Chulitna, to minimal in the Broad Pass and the upper and lower canyons of the Nenana River. Scenic quality will be impacted, the impact being a function of existing scenic quality and the opportunity for screening. Impact in the Nenana Canyon will be high; impact on Broad Pass will be moderate to high; impact elsewhere will be moderate. Two favorable factors mitigate the impact somewhat: 1) The corridor is not visually intact as the Alaska Railroad and the Anchorage-Fairbanks Highway have already reduced scenic quality somewhat. 2) The major views south of the canyons are to the west, toward the Mt. McKinley massif, whereas the corridor lies to the east of the transportation routes, the most likely viewpoints. (See Mitigating Measures.)

Land Use and Resources: The Nenana-1 corridor follows existing corridors for its entire length. For 10 miles it follows the Alaska Railroad from Gold Creek. From north of Chulitna to Ester it follows a combined Railroad/Highway corridor. From Healy north it also parallels the Golden Valley Electric Association 138 kv transmission line. It is possible the corridor could adjoin this right-of-way or the GVEA line could be rebuilt to a higher capacity and the existing right-of-way utilized.

Although the potential for agriculture exists along this corridor in the Tanana Valley portion, it exists in the form of home gardens and grazing if at all. Impact on existing and potential agriculture is low to none.

Some forestry exists in the bottomland spruce-poplar forests along the lower Nenana River and the Tanana River. Possible sales of merchantable timber from the clearing in this area will bring short-lived business to the town of Nenana, but this impact will be low. Use of the access road as a logging road and firebreak may occur, but this use will not significantly affect logging in this area.

Although the corridor approaches and crosses several mineralized areas and fossil fuel deposits, it will not make power directly available for development except through distribution systems of the existing electric utilities. The access road may be used as a prospecting road, but will not serve for heavier use. The value of the minerals and fuel is such that if a profitable area were to be developed, it would be feasible to relocate small sections of the transmission line. On the whole, impact on existing and potential mineral and fuel extraction is low.

Slightly more than half of the length of this corridor passes through the Mt. McKinley Cooperative Planning and Management Zone of Ecological Concern. This is a study area of a joint State-Federal Planning and Management Committee responsible for land use planning in the area peripheral to the Mt. McKinley National Park.

Social: These towns will be affected by the corridor: Cantwell, Healy, Nenana, and Fairbanks. Cantwell is a small community with no electric utility, and few services apart from a railroad station and a few restaurant/motel/gas stations. Incoming material may arrive at the Alaska Railroad; possible congestion of the station may occur. This is an insignificant impact, however, and quite temporary. It is possible that Cantwell will tap directly from the 230 kv transmission line.

Electrical service will either be via future distribution lines of one of the existing utilities or by tapping from a new substation. The proposed 25 kv distribution line to McKinley Park may eventually extend south to serve Cantwell and Summit. If the transmission line is constructed first, pressure is expected to be greater for a substation to serve Cantwell and Summit. The presence of a nearby transmission line will undoubtedly result in increased pressure from the community for electrical service; although which of the two methods will be determined by the cost and feasibility of both. Healy is similar to Cantwell, except that it is served by the GVEA system's Healy steamplant.

Nenana is a fairly important transportation node, situated at the crossing of the Tanana River, a navigable waterway, by the railroad and highway corridors. Situated in a bottomland spruce-poplar area, if the timber from a line clearing is to be sold, then the logs will pass through Nenana, offering some business and jobs. It is unlikely that much labor for the actual line construction will be drawn from Nenana. The town is already served by the GVEA system. The existing Healy 138 kv line passes very close to the town. For a short stretch it uses shorter towers and spans to minimize hazards to aircraft using the FAA strip south of town. The corridor will be far enough from the airstrip to reduce this hazard to a minimum, and any spans deemed hazardous by the FAA will be marked.

Impacts of Alternative Susitna-2

Alternative corridor Susitna-2 duplicates Susitna-1 from Point MacKenzie to Talkeetna. Impacts are identical for this segment, and are discussed under impacts of preferred corridor Susitna-1. Impacts discussed here are for the segment from Talkeetna to Gold Creek via Troublesome Creek.

Soils: In the southern portion of this alternative there is a high proportion of poorly drained soils which can be expected to present problems for tower footings and access roads. The severity of the problem will depend upon the vulnerability of the soil to frost heaving and the ability of the final line survey to avoid areas of poor soils.

In the upland areas around Troublesome Creek, gravelly soils will present erosional problems, particularly since steeper slopes are encountered. Frost heaving should be less of a concern, and maintenance of footings will be less.

There will be little or no problem with thermal disruption of permafrost as there is only discontinuous, deeply buried permafrost along this alternative. However, final line survey can locate and avoid any high risk areas. Thermal disruption, particularly in the upland areas, could lead to gulleying and other forms of erosion.

Crossings of the Talkeetna and Susitna Rivers, paralleling of Whiskers Creek, and a possible crossing of Troublesome Creek are necessary. Fording of the Talkeetna and Susitna Rivers is unlikely. In any event, the rivers are both already sediment laden rivers and will be little affected by additional sediment. Sediment will negatively impact fish habitat in the Whiskers and Troublesome Creeks, both of which are clearwater streams.

Vegetation: The amount of clearing for the Susitna-2 alternative is up to 2,375 acres, 67 acres more than that for Susitna-1, if the line is to be 345 kv. A 230 kv line would require up to 2,121 acres, 61 more than a similar line along Susitna-1. The actual acres of clearing will probably be less than these figures since some stretches may only require clearing for the access road and the tower bases. In the southern portion the terrain is flat enough so that the clearing will include the access road; in the steeper terrain the access road may have to deviate from the right-of-way to maintain grade, and this will require additional clearing.

The immediate effect of this clearing will be the destruction of the vegetation. The much more significant impact will be upon erosion and wildlife habitats. In hilly terrain, mechanical clearing methods such as bulldozing will cause considerable disruption of the soil, and subsequent erosion and stream sedimentation. The use of brush blades or rotary cutters will reduce this effect. On steep slopes hand clearing will mitigate the otherwise heavy erosion potential likely with mechanical clearing.

To reduce available fuel for forest fires, and to reduce potential infestation of healthy trees by spruce beetles (Dendroctonus rufipennis) and ips beetles, slash must be disposed of. This can be either by sale of merchantable timber or by burning. Although burning will reduce air quality temporarily, it is more economical and less damaging than the alternatives. (See Mitigating Measures.)

Regrowth rates along this corridor are fast enough, particularly in the southern portion, to warrant periodic suppression of tall growing trees which pose a hazard to the transmission line. The preferred method along this corridor is manual application of a suitable herbicide. The amount of clearing to be maintained, the modest regrowth rates, and high cost of labor make this alternative preferable in this corridor over aerial application of herbicides on the one hand, or hand cutting of individual trees on the other. If proper application techniques are adhered to (see Mitigating Measures), there will be no other impacts other than the maintenance of a sub-climax vegetation. Accidental overspraying or wind drift, or improper dilution, resulting in unnecessary destruction of vegetation and spraying of water bodies resulting in habitat destruction for aquatic life are not likely to occur with manual application. Sections needing vegetation suppression occurs in the bottomland spruce-poplar, lowland spruce-hardwood, and upland spruce-hardwood forests, particularly in the bottomland spruce-poplar and muskeg-bog areas, which comprise a significant proportion of the ecosystems crossed by this corridor, will need little clearing and no vegetation suppression. Lowland spruce-hardwood areas will not need to be maintained as often as bottomland spruce-poplar.

Wildlife: Alteration of vegetation patterns will affect wildlife. This corridor traverses many areas of moose concentration, and moose should benefit from the introduction of brush resulting from the regrowth on the clearing. Since the clearing must be maintained, this brush area will last for the life of the line. Most brush areas are in transition, changing from the brush phase to some other phase approaching the climactic phase. The brush in a transmission clearing can be counted as a more permanent source of browse.

Animals dependent upon climactic forest, such as squirrels, will suffer loss and displacement. However, their faster reproductive rates will allow their populations to adapt rapidly.

Most animals will benefit from the edge environment, offering both forage and cover from the adjacent forest and brush. Initially, animal movements may occur along the right-of-way, but as the brush grows into a dense cover, this will be limited. In any event, this impact should be low in this corridor.

Construction itself will affect wildlife. Larger mammals may temporarily leave the area to return after the construction activity. Smaller animals will suffer loss of individuals, but should recuperate rapidly once construction is completed. The density of forest in this corridor will allow animals to move only a short distance to avoid contact with construction activities.

Vegetation suppression, by whatever method, will periodically remove cover from along the right-of-way. However, due to the surrounding cover of the uncleared forests, this impact will be insignificant.

Recreation: This corridor penetrates 26 miles of the Denali State Park, coming within 4 miles of the Anchorage-Fairbanks Highway near the Park's southern border. This puts the corridor within easy walking distance of the highway for a significant part of its length within the Park. This will affect present and potential trails intersecting the corridor.

Accessibility to the Park would be increased by the creation of an access route parallel to the highway; however, the highway and the Susitna River are not separated more than nine or less than four and a half miles, so the corridor, which separates the two, will not service an inaccessible area. Hunting is presently prohibited in Denali State Park so an access road will have no value as hunters' access. Impact on recreation will be negative since the entire area of the Park to the east of the highway will be limited for hiking and day trails.

Cultural Resources: The National Register lists no historical or archeological sites along this corridor. If the final route survey locates an archeological site, minor relocation or careful tower location will avoid disruption of the site. Inadvertant disruption of an archeological site will reduce or destroy its archeological value.

Scenic Resources: The transmission line can be effectively hidden from the highway for its entire length; however, its impact is still high because of conflicts with the existing and potential trails in the State Park. A significant value of these trails is aesthetic, and visibility of a transmission line from an intercepted or adjacent trail will seriously detract from the original purpose of these trails.

Land Use and Resources: The major land use of this segment is scenic and recreational. Impacts are as described above under "Recreation" and "Scenic Resources."

There will be no significant impact on forestry or agriculture because of the exclusive nature of the State Park land use. There will be no impacts on other resources in this segment.

Impacts of Alternative Susitna-3

Soils: The soils encountered along this alternative are basically well suited to the construction of an access road. The low erosion potential, absence of significant permafrost, and the gravelly texture indicate that effects of erosion and consequent sedimentation will be low.

Depending upon the final route survey, several small clearwater creeks will be crossed. Some sedimentation will occur from fording of construction equipment. This sedimentation will be of a temporary nature, and of low significance since this upland area is not an important fishery. The Talkeetna River will need at least one crossing, but probably will not be forded. Since the Talkeetna River carries a glacial silt load, any additional sedimentation will not be significant.

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The upland soils are quite shallow; excavation of footings may require blasting. Access road location may have to deviate from the transmission line in order to keep an acceptable grade without extensive excavation.

Vegetation: The Susitna - 3 alternative for 345 kv could require up to 1,900 acres, 407 acres less than that for Susitna - 1. For 230 kv, this alternative would require up to 1,696 acres, 364 acres less than a similar line along corridor Susitna - 1. The majority of this clearing will occur in the Talkeetna River valley. Little or no clearing will be required in the upland areas toward Devil Canyon.

The immediate effect of this clearing will be the destruction of the vegetation. The much more significant impact will be upon erosion and wildlife habitats. In hilly terrain mechanical clearing methods, such as bulldozing, will cause considerable disruption of the soil and subsequent erosion and stream sedimentation. The use of brush blades or rotary cutters will reduce this effect. On steep slopes, hand clearing will mitigate the otherwise heavy erosion potential likely with mechanical clearing.

To reduce available fuel for forest fires and to reduce potential infestation of healthy trees by spruce beetles (Dendroctomus rufipennis) and ips beetles, slash must be disposed of. This can be either by sale of merchantable timber or by burning. Although burning will affect air quality temporarily, it is more economical and less damaging than the alternatives. (See Mitigating Measures.)

Regrowth rates along this corridor are fast enough, particularly in the southern portion, to warrant periodic suppression of tall growing trees which pose a hazard to the transmission line. The preferred method along this corridor is manual application of a suitable herbicide. The amount of clearing to be maintained, the modest regrowth rates, and high cost of labor make this alternative preferrable in this corridor over aerial application of herbicides on the one hand or hand cutting of individual trees on the other. If proper application techniques are adhered to (see Mitigating Measures), there will be no other impacts other than the maintenance of a sub-climax vegetation.

Wildlife: Alteration of vegetation patterns will affect wildlife. This corridor traverses many areas of moose concentration in the Talkeetna River valley, and moose should benefit from the introduction of brush resulting from the regrowth on the clearing. Since the clearing must be maintained, this brush area will last for the life of the line. Most brush areas are in transition, changing from the brush phase to some other phase nearer the climactic phase. The brush in a transmission clearing can be counted as a more permanent source of browse.

Animals dependent upon climactic forest, such as squirrels, will suffer loss and displacement. However, their faster reproductive rates will allow their populations to recuperate rapidly.

Most animals will benefit from the edge environment, offering both forage and cover from the adjacent forest and brush. Initially, animal movements may occur along the right-of-way, but as the brush grows into a dense cover, this will be limited. This impact should be low in this corridor.

There may be a possible impact on the caribou winter range reported to exist in in the upland areas along this alternative. Summer construction will reduce contacts of caribou and the construction activity. Fires started by construction may destroy potential winter browse. The degree of this impact depends upon the area burned and the season of the burning.

Larger mammals may temporarily leave the area to return after the construction activity. Smaller animals will suffer loss of individuals, but should recuperate rapidly once construction is completed. The density of forest in this corridor will allow animals to move only a short distance to avoid contact with construction activities.

Vegetation suppression, by whatever method, will periodically remove cover from along the right-of-way. However, due to the surrounding cover of the uncleared forests, this impact will be insignificant. Herbicides will not directly affect animals in the dilutions used for manual spraying; herbicides used on right-of-way maintenance are non-cumulative and are readily excreted. The overall adverse impact of herbicide spraying will be low, as it will be necessary only every five to ten years, whereas the availability of forage provided is as permanent as the transmission line.

Recreation: This corridor approaches no recognized recreation area. Since the entire length of this segment from Talkeetna to Devil Canyon parallels no existing transportation line, a sizeable amount of land is opened up to access by four-wheel drive vehicles, dependent upon the policies of the landowners or managing agency. For recreation requiring vehicular access, this increased access will have a beneficial impact. For recreation dependent upon primitive values, increased access will have a detrimental aspect.

Cultural Resources: There is no known impact on cultural resources in this segment.

Scenic Resources: In terms of viewer contacts, this corridor will have a low impact on scenic quality due to its relative inaccessibility. However, this corridor will have a higher impact upon the intactness of this area than the comparable segments of Susitna-1 and Susitna-2. The high primitive values and medium to high scenic value of this corridor, coupled with relatively high visibility of a transmission line in the upland area, will result in a high impact on scenic quality, disregarding the factor of viewer contacts.

Land Use and Resources: No impact on agriculture is anticipated along this corridor from Talkeetna to Devil Canyon. An access road will not enhance forestry in the Talkeetna River valley since it would be unsuitable for a logging road unless it were overbuilt, and since the access road would run very close to the transmission line itself. Impacts on mineral resources will also be low; not enough potential exists along the corridor to be influenced by the increased access.

Social: No communities are encountered along this corridor; so there is no impact.

Impacts of Alternative Susitna-4

Soils: For soils in the portion of this corridor that follows the Talkeetna River and Prairie Creek, impacts from erosion, siltation, and permafrost degradation are low. Crossings of the Talkeetna River and Iron Creek will be necessary. Both of these streams are sediment laden; so additional sedimentation will have little effect.

The soils on the upland portion of this corridor are more susceptible to erosion, although the slopes are shallower. An improperly constructed access road will cause erosion. Very few creeks are crossed. Sedimentation would be a very minor problem. Some permafrost associated with poorly drained, peaty soils may present problems, not only of permafrost degradation, but of frost-heaving. However, final line survey should reduce this potential impact. Unavoidable stretches of poorly drained soils may be rutted and scarred by vehicle tracks unless the access road is hardened with a gravel bed.

Vegetation: For a 345 kv line this corridor could require up to 2,257 acres of clearing, 50 acres less than Susitna-1. For a 230 kv design it would require up to 2,105 acres, 45 acres less than a similar line on

Susitna-1. Actual acreages of clearing will probably be less than these figures since the entire right-of-way will in most cases not be cleared, and along some stretches only the access road and tower bases need to be cleared.

The immediate effect of this clearing will be the destruction of the vegetation. The much more significant impact will be upon erosion and wildlife habitats. In hilly terrain, mechanical clearing methods such as bulldozing will cause considerable disruption of the soil and subsequent erosion and stream sedimentation. The use of brush blades or rotary cutters will reduce this effect. On steep slopes, hand clearing will mitigate the otherwise heavy erosion potential likely with mechanical clearing.

To reduce available fuel for forest fires and to reduce potential infestation of healthy trees by spruce beetles (Dendroctonus rufipennis) and ips beetles, slash must be disposed of. This can be either by sale of merchantable timber or by burning. Although burning will affect air quality temporarily, it is more economical and less damaging than the alternatives. (See Mitigating Measures.)

Regrowth rates along the Talkeetna River valley are high enough so that periodic suppression of tall growing trees within the clearing is required. The method to be used will be manually applied herbicide, applied to target trees during regular maintenance patrols. If properly applied, there will be no contamination of water bodies or destruction of non-target vegetation. The most important impact of this program will be the maintenance of sub-climax brush within forested areas.

Wildlife: Alteration of vegetation patterns will affect wildlife. This corridor traverses an area of moose concentration in the Talkeetna Valley, and moose should benefit from the introduction of brush resulting from the regrowth on the clearing. Since the clearing must be maintained, this brush area will last for the life of the line. Most brush areas are in transition, changing from the brush phase to some other phase nearer the climactic phase. The brush in a transmission clearing can be counted as a more permanent source of browse.

Animals dependent upon climactic forest, such as squirrels, will suffer loss and displacement. However, their faster reproductive rates will allow their populations to adapt rapidly.

Most animals will benefit from the edge environment, offering both forage and cover from the adjacent forest and brush. Initially, animal movements may occur along the right-of-way, but as the brush grows into a dense cover, this will be limited. In any event, this impact should be low in this corridor.

Construction itself will affect wildlife. Larger mammals may temporarily leave the area to return after the construction activity. Smaller animals will suffer loss of individuals, but should recuperate rapidly once construction is completed. The density of forest in this corridor will allow animals to move only a short distance to avoid contact with construction activities.

Vegetation suppression, by whatever method, will periodically remove cover from along the right-of-way. However, due to the surrounding cover of the uncleared forests, this impact will be insignificant. Herbicides applied as outlined under "Vegetation," will produce few effects upon animals. Since the herbicides are applied only to target vegetation, the probability of ingestion is reduced to a minimum. Herbicides are not toxic to animals in the concentrations normally used, and are not cumulative in effect.

Recreation: Although this corridor does not approach any State or Federal recreation areas or parks, it will affect the recreational use of the upland area near Stephen Lake. Readily accessible by float plane, this area is popular with sportsmen and vacationers. The lakes have many cabins along their shores. The access road would provide another means of access for this area, which would tend to increase the recreational use, and at the same time, the transmission line would be visible for most of its length over the upland area. If one of the perceived values of this area is its relative inaccessibility, then increased access and a visible transmission line would have a highly detrimental impact. Increased accessibility to other areas traversed by the corridor would be beneficial to recreational use dependent upon easy access.

Cultural Resources: If the final survey discloses an unsuspected archeological site along the right-of-way, the location of the line or towers will be altered to avoid damage to such sites. Inadvertent damage to an archeological site will reduce its historical value. At the same time, discovery of an archeological site during survey or construction will be a beneficial aspect.

Scenic Resources: In terms of viewer contacts, impact of a transmission line along the Talkeetna River valley will be low. Along the upland area it will be high. This area is a heavily used recreation area, sparsely forested, and of moderate to high scenic quality. Thus, the construction of a transmission line and the inherent visibility of such a line would result in a high impact.

Land Use and Resources: There will be significant impacts, both beneficial and detrimental, on the predominant land use, recreation. These impacts are discussed under the "Recreation" section above. There will be no impact on agriculture, forestry, and mineral resources.

Social: There will be no social impacts from this corridor.

Impacts of Alternative Nenana-2

Soils: Impacts on soils along this corridor will be identical to those outlined in Nenana-1 up to Cantwell. The generally flat, gravelly soil from Cantwell to Wells Creek is vulnerable to water erosion. Construction activities may cause gulleying in this area. The peaty permafrost soils also found in this area will present problems in constructing the access road. Possible rutting and scarring may lead to degradation of the underlying permafrost and further erosion.

From Wells Creek to the upper Wood River, impacts will vary with the type of soil encountered, which can be localized poorly drained frozen soil, thin soils and gravel, and bare bedrock and talus. Local pockets of poorly drained soils can be avoided to an extent. Unavoidable encounters will result in disturbance of the soil and possible consequent disruption of the permafrost. Thin soils and gravel are very susceptible to erosion, particularly since they will be found in conjunction with steep slopes. Access road construction will have a detrimental affect in both these soils. No impact on bare bedrock and talus is anticipated; however, footings for towers will require blasting and construction of an access road will be extremely difficult.

Increasing amounts of poorly drained, frozen, peaty soils encountered from along the lower Wood River to the Tanana River will cause increasing problems with access road construction, footing stabilization, and rutting and scarring of the soils. Unless the access road is bedded on gravel, there is a strong potential for permafrost degradation and consequent gulleying and maintenance problems. Immediately adjacent to the Tanana River, stratified soils present a potential water erosion problem, yet are easier to construct on than the surrounding poorly drained peats. These stratified materials are often levees of extinct or existing channels. They are linear, but sinuous, and may provide not only the best foundation for a road, but also the highest point above flood waters.

The impact of sedimentation on glacial rivers will be low. Sedimentation impact on clearwater streams will be medium for Wells Creek, Louis Creek, and Dean Creek. Sedimentation impacts upon the numerous clearwater tributaries of the Wood River will be low since they will be crossed close to their confluences with the silt laden Wood River.

Vegetation: This corridor could require up to 1,500 acres of clearing, 60 acres more than that for Nenana-1. Actual acreage cleared will probably be less than this figure since the entire right-of-way need not be cleared, and the terrain requiring the heavier clearing is generally flat enough to allow the access road to run within the clearing.

The immediate effect of this clearing will be the destruction of the vegetation. The much more significant impact will be upon erosion and wildlife habitats. In hilly terrain mechanical clearing methods such as bulldozing will cause considerable disruption of the soil and subsequent erosion and stream sedimentation. The use of brush blades and rotary cutters will reduce this effect. On steep slopes, hand clearing will mitigate the otherwise heavy erosion potential likely with mechanical clearing.

To reduce available fuel for forest fires and to reduce potential infestation of healthy trees in the bottomland spruce-poplar ecosystem by spruce beetles (Dendroctonus rufipennis) and ips beetles, slash must be disposed of. This can be done by sale of merchantable timber, by chipping, or by burning. Although burning will affect air quality temporarily, it is more economical and less damaging than the alternatives. With no access road, machinery cannot be brought in for stacking, burning, or chipping, and downed timber will be left along the clearing. (See Mitigating Measures.)

Except for the bottomland spruce-poplar forest along the Tanana River, regrowth rates are low enough so that little vegetation suppression other than routine trimming of danger trees is necessary. More extensive cutting programs may be necessary in the area around the Tanana River.

In the moist tundra and alpine tundra ecosystems, disturbed areas will be very slow to recuperate. Revegetation with appropriate species will be necessary to minimize surface erosion and permafrost degradation. Proper construction and access road design will limit vegetation loss to the area occupied by the roadbed and tower bases. No clearing is necessary in these areas.

Fires caused by construction and maintenance will have little impact, providing they are discovered quickly and stopped without excess disturbance of the soil. The present patterns of forests are caused by previous naturally caused fires which are an integral factor of these ecosystems. Impact from a small number of additional fires of limited area will be low.

Wildlife: The greatest anticipated impact upon wildlife will be the alteration of vegetative patterns, and this impact will be a function of the degree of clearing. Animals dependent upon climax forest will suffer loss of individuals and loss of habitat. Generally, these are the small mammals such as squirrel and marten. Moose will benefit from the creation of an area of maintained browse. Since the clearing will not be allowed total regrowth, the browse created can be considered as permanent as the line. The conjunction of forest and open brush creates a favorable "edge" environment for most animals, offering forage on the clearing and cover in the forest.

Construction activity will temporarily frighten away wildlife; however, this is an extremely local and temporary impact. Maintenance patrols will not be frequent enough to keep animals from returning to the corridor.

Impact upon the caribou wintering ranges on either sides of the Alaska Range will be low if construction is done in summer, which may be preferrable in any case because of better working conditions. Dall sheep habitat will be impacted in that they will be frightened away from construction activity more so than caribou and moose. Again, this impact is of a temporary nature. Unchecked fire in either of these habitats will adversely impact both caribou and sheep. With caribou particularly, destruction of their key winter browse, lichen, may have long lasting effects due to slow regrowth rates.

Recreation: This corridor does not traverse any Federal or State parks or recreation areas. It does, however, briefly approach within five miles the southeast corner of McKinley National Park.

Except for 22 miles along the Denali Highway, the corridor will provide access to an area previously accessible only by air or foot. In some cases, access is presently possible with all-terrain vehicles. Increased access will impact game animal populations somewhat; the actual impact will depend upon the desirability of the area for hunting, and access and hunting regulations imposed by the land managing agencies.

Cultural Resources: This alternative approaches no National Historic or Archeological Sites. If the final survey discloses an unsuspected archeological site along the right-of-way, the location of the line or towers will be altered to avoid damage to such sites. Inadvertent damage to an archeological site will reduce its historical value. At the same time, discovery of an archeological site during survey or construction will be a beneficial aspect.

Scenic Resources: This alternative traverses areas of low to high scenic quality. In terms of viewer contacts, this corridor will have little impact since it will not be visible from transportation routes for most of its length. Disregarding viewers, high visual impact to scenic and wilderness quality in the mountainous portion of the corridor can be expected.

Land Use and Resources: There will be no impacts on forestry and agriculture throughout this alternative. There will be no impacts on mineral or fossil fuel resources.

Apart from obtaining easements, no impact is expected on existing land use.

Impacts of Alternative Nenana-3

Soils: The majority of the soils on the portion of this alternative which differs from the proposed Nenana-1 corridor are rocky, thin soils and bedrock, and as such are well suited generally for tower foundations. Access road construction will be hampered by steep slopes, bedrock, and talus encountered by this corridor. Erosion will generally be low, although on thin soils or unstable slopes, erosion will be severe unless corrective measures are employed. Permafrost can be assumed to be continuous, but will not usually be of concern to tower location unless the soil is ice-rich. This condition is assumed to be restricted to valley floors.

Soil impacts for the remainder of the alternative are described under soil impacts of the proposed corridor.

Vegetation: The Nenana-3 corridor could require up to 1,318 acres of clearing, 121 acres less than Nenana-1. Almost no clearing is needed on the portion which differs from the Nenana-1 corridor since mostly alpine and moist tundra ecosystems are encountered in this portion. Impacts resulting from clearing will be similar to those discussed under Nenana-1. Along the differing segment destruction of vegetation will be limited to those areas directly occupied by the roadbed and the tower bases. This will be a permanent impact, although some revegetation of tower bases can be expected.

Destruction of the vegetative mat in tundra areas will result in long lasting scars unless corrective and preventive measures are taken. This scarring could lead to subsequent degradation of ice-rich permafrost and erosion.

Fires resulting from construction and operation, unless suppressed quickly, will result in extensive destruction of vegetation. These ecosystems are adapted to natural wildfires, and unless the occurrence of man-caused fires is very high, they should recuperate as quickly as they would under normal circumstances.

Wildlife: Impacts on wildlife for those segments of this alternative corridor to Nenana-1 are discussed under impacts to wildlife of the proposed corridor.

Along the differing segment, there will be little impact from habitat modification due to clearing. Increased incidence of fire resulting from operation or construction will adversely affect habitat for Dall sheep and caribou. Moose habitat will be enhanced, up to a point, by fire.

Construction activity may cause avoidance of the corridor by animals; however, this is a temporary impact. Operation and maintenance will not affect the animals' occupation of the corridor.

Increased access afforded by the access road may increase hunting pressure on Dall sheep, caribou, and to a lesser degree on moose. The degree of this impact is dependent upon the desirability of this corridor for hunting, and access and hunting regulations imposed by the land managing agencies.

Recreation: This corridor does not traverse any Federal or State parks or recreation areas. It does, however, briefly approach within 5 miles the southeast corner of McKinley National Park.

Except for 22 miles along the Denali Highway, the corridor will provide access to an area previously accessible only by air or foot. In some cases, access is presently possible with all-terrain vehicles. Increased access will impact game animal populations somewhat. The actual impact will depend upon desirability of the area for hunting, and access and hunting regulations imposed by the land managing agencies.

Cultural Resources: This alternative approaches no National Historic or Archeological Sites. If the final survey discloses an unsuspected archeological site along the right-of-way, the location of the line or towers will be altered to avoid damage to such sites. Inadvertent damage to an archeological site will reduce its historical value. At the same time, discovery of an archeological site during survey or construction will be a beneficial aspect.

Scenic Resources: This alternative traverses areas of moderate to high scenic quality. In terms of viewer contacts, this corridor will have little impact since it will not be visible from transportation routes for most of its length. Disregarding viewers, high visual impact to scenic and wilderness quality in the mountainous portion of the corridor can be expected.

Land Use and Resources: There will be no impacts on forestry and agriculture throughout this alternative. There will be no impacts on mineral or fossil fuel resources.

Impacts of Alternative Nenana-4

Soils: From Healy to Ester, this corridor duplicates Nenana-1, and impacts to soils are identical to those discussed under impacts of Nenana-1.

The soils from Watana Damsite to Wells Creek will be very vulnerable to permafrost degradation and frost heaving. The vegetative mat must be preserved, and construction activity must be planned to minimize disruption of the soil. Erosion caused by permafrost degradation and access road construction will have adverse impacts on water quality in the clearwater streams encountered.

Fording of streams in this segment, given the sensitive soil conditions, could result in extensive bank erosion. To minimize this and to ensure the integrity of the transmission line, the corridor will avoid river crossings when possible.

From Wells Creek to Healy via Nenana-4, the soils are rocky, thin soils and bedrock, and as such are well suited generally for tower foundations. Access road construction will be hampered by steep slopes, bedrock, and talus encountered by this corridor. Erosion will generally be low, although on thin soils or unstable slopes, erosion will be severe unless corrective measures are employed. Permafrost can be assumed to be continuous, but will not usually be of concern to tower location unless the soil is ice-rich. This condition is assumed to be restricted to valley floors.

Vegetation: The Nenana-4 alternative could require up to 1,182 acres of clearing, 257 acres less than Nenana-1. Actual acres cleared will probably be less than this since the entire right-of-way need not be cleared.

Impacts on vegetation from Healy to Ester are identical to those discussed for that segment under impacts of Nenana-1. Almost no clearing is needed on the portion which differs from the Nenana-1 corridor since mostly alpine and moist tundra ecosystems are encountered in this portion. Impacts resulting from clearing will be similar to those discussed under Nenana-1.

Along the differing segment, destruction of vegetation will be limited to those areas directly occupied by the roadbed and the tower bases. This will be a permanent impact, although some revegetation of tower bases can be expected.

Destruction of the vegetative mat in tundra areas will result in long lasting scars unless corrective and preventive measures are taken. This scarring could lead to subsequent degradation of ice-rich permafrost and erosion.

Fires resulting from construction and operation, unless suppressed quickly, will result in extensive destruction of vegetation. These ecosystems are adapted to natural wildfires, and unless the occurrenc of man-caused fires is very high, they should recuperate as quickly as they would under normal circumstances.

Wildlife: Impacts on wildlife for those segments of this alternative corridor to Nenana-1 are discussed under impacts to wildlife of the proposed corridor.

Along the differing segment there will be little impact from habitat modification due to clearing. Increased incidence of fire resulting from operation or construction will adversely affect habitat for Dall sheep and caribou. Moose habitat will be enhanced, up to a point, by fire.

Construction activity may cause avoidance of the corridor by animals; however, this is a temporary impact. Operation and maintenance will not affect the animals' occupation of the corridor.

Increased access afforded by the service road may increase hunting pressure on Dall sheep, caribou, and to a lesser degree on moose. The degree of this impact is dependent upon the desirability of this corridor for hunting, and access and hunting regulations imposed by the land managing agencies.

Recreation: This corridor does not traverse any Federal or State parks or recreation areas. The corridor will provide access to an area previously accessible only by air or foot. In some cases, access is presently possible with all-terrain vehicles. Increased access will impact game animal populations somewhat. The actual impact will depend upon the desirability of the area for hunting, and access and hunting regulations imposed by the land managing agencies.

Cultural Resources: This alternative approaches no National Historic or Archeological Sites. If the final survey discloses an unsuspected archeological site along the right-of-way, the location of the line or towers will be altered to avoid damage to such sites. Inadvertent damage to an archeological site will reduce its historical value. At the same time, discovery of an archeological site during survey or construction will be a beneficial aspect.

Scenic Resources: This alternative traverses areas of low to high scenic quality. In terms of viewer contacts, this corridor will have little impact since it will not be visible from transportation routes for most of its length. Disregarding viewers, high visual impact to scenic and wilderness quality in the mountainous portion of the corridor can be expected.

Land Use and Resources: There will be no impacts on forestry and agriculture throughout this alternative. There will be no impacts on mineral or fossil fuel resources.

Impacts of Alternative Nenana-5

Soils: The soils from Watana Damsite to Wells Creek will be very vulnerable to permafrost degradation and frost heaving. The vegetative mat must be preserved, and construction activity must be planned to minimize disruption of the soil. Erosion caused by permafrost degradation and access road construction will have adverse impacts on water quality in the clearwater streams encountered.

Fording of streams in this segment, given the sensitive soil conditions, could result in extensive bank erosion. To minimize this and to ensure the integrity of the transmission line, the corridor will avoid river crossings when possible.

From Wells Creek to upper Wood River the soils are rocky, thin soils and bedrock, and as such are well suited generally for tower foundations. Access road construction will be hampered by steep slopes, bedrock, and talus encountered by this corridor. Erosion will generally be low, although on thin soils or unstable slopes erosion will be severe unless corrective measures are employed. Permafrost can be assumed to be continuous, but will not usually be of concern to tower location unless the soil is ice-rich. This condition is assumed to be restricted to valley floors.

The Wood River valley and Tanana River valley present problems with locating well drained soils. Large areas of poorly drained peats with continuous shallow permafrost will result in potential severe impacts such as permafrost degradation, rutting and scarring of the surface, bank erosion where clearwater streams are forded, and erosion caused by access road construction. The necessary clearing will also greatly add to erosion and siltation. Preventive and corrective measures will need to be used to minimize these impacts.

Vegetation: This corridor will require up to 1,369 acres of clearing, 74 acres less than Nenana-1. Actual acres cleared will probably be less than this figure since the entire right-of-way need not be cleared. The majority of the clearing will be along the Tanana River valley and lower Wood River in the bottomland spruce-poplar and upland spruce-hardwood ecosystems. Along the greater part of the corridor the access road can be incorporated into the clearing due to level terrain.

The most immediate effect of clearing will be the destruction of the cleared vegetation. Downed timber and slash must be disposed of by open burning or chipping when possible to prevent infestation of standing stocks of bottomland spruce-poplar with spruce beetle (Dendroctonus rufipennis) and the accumulation of fuel for wildfire. Non-merchantable timber will be burned if an access road is present. With no access road, machinery cannot be brought in for stacking, burning, or chipping, and downed timber will be left along the clearing. Beetle infestation will be of concern mainly in the bottomland spruce-poplar ecosystem.

Destruction of the vegetative mat in tundra areas will result in long lasting scars unless corrective and preventive measures are taken. This scarring could lead to subsequent degradation of ice-rich permafrost and erosion.

Fires resulting from construction and operation, unless suppressed quickly, will result in extensive destruction of vegetation. These ecosystems are adapted to natural wildfires, and unless the occurrence of man-caused fires is very high, they should recuperate as quickly as they would under normal circumstances.

Some disruption of the soil from clearing is to be expected. Increased erosion because of this, and enhanced by the lack of cover, will result. If vegetation is cleared up to river banks on stream crossings, this may result in additional sedimentation.

Wildlife: There will be loss of individual smaller animals and displacement of others; however, this is a temporary setback. High reproductive rates of small mammals and re-invasion will amend this impact.

A permanent habitat modification will result from the clearing and maintenance. A corridor of brush will be maintained through otherwise forested land. Animals dependent upon climax forest, such as squirrels, will suffer some habitat loss. Animals dependent upon brush and forbs for browse will gain.

The large concentration of moose along the lower Wood River and the Tanana River will benefit from the regrowth of brush into cleared areas. Dall sheep and caribou in the mountainous areas will suffer some loss of forage to the roadbed and tower bases. Excessive fire will adversely affect the forage for these last two game animals since they are dependent upon climax vegetation which has a slow regrowth rate. Moose will benefit from fires, up to a point. Excessive fires may trigger erosion which would degrade, rather than enhance, browse for moose.

Construction activity may cause avoidance of the corridor by animals; however, this is a temporary impact. Operation and maintenance will not affect the animals' occupation of the corridor.

Increased access afforded by the service road may increase hunting pressure on Dall sheep, caribou, and moose. The degree of this impact is dependent upon the desirability of this corridor for hunting, and access and hunting regulations imposed by the land managing agencies.

Recreation: This corridor does not traverse any Federal or State parks or recreation areas. The corridor will provide access to an area previously accessible only by air or foot. In some cases, access is presently possible with all-terrain vehicles. Increased access will impact game animal populations somewhat. The actual impact will depend upon the desirability of the area for hunting, and access and hunting regulations imposed by the land managing agencies.

Cultural Resources: This alternative approaches no National Historic or Archeological sites. If the final survey discloses an unsuspected archeological site along the right-of-way, the location of the line or towers will be altered to avoid damage to such sites. Inadvertent damage to an archeological site will reduce its historical value. At the same time, discovery of an archeological site during survey or construction will be a beneficial aspect.

Scenic Resources: This alternative traverses areas of low to high scenic quality. In terms of viewer contacts, this corridor will have little impact since it will not be visible from transportation routes for most of its length. Disregarding viewers, high visual impact to scenic and wilderness quality in the mountainous portion of the corridor can be expected.

Land Use and Resources: There will be no impacts on forestry and agriculture throughout this alternative. There will be no impacts on mineral or fossil fuel resources.

Impacts of Alternative Matanuska-1

Soils: From Devil Canyon to Vee Damsite, some problems related to poorly drained woils will be encountered. Generally, erosion potential along this segment will be low to moderate. Permafrost degradation potential is low. The relatively level nature of the terrain will facilitate construction of an access road without undue erosional problems. Several clearwater streams will need crossing. Sedimentation may occur from these crossings, but since they will be crossed close to their confluences with the silt-laden Susitna, this impact will be low.

From Vee Damsite to Slide Mountain the potential for permafrost degradation is very high. The poorly drained fine-grain soils encountered are very vulnerable to frost heaving, which will entail much maintenance of the line and road. The potential for scarring and rutting of the surface is high, and the subsequent erosion may cause significant sedimentation in the many clearwater streams in this area.

From Slide Mountain to Palmer, the corridor encounters less sensitive soils. Once over Tahneta Pass permafrost becomes increasingly discontinuous, and well drained soils predominate. Erosion potential is low to moderate and construction of an access road should present no undue erosional impacts.

Steep slopes in the upper Matanuska Valley may present some erosional problems, but the slopes are generally stable. Thin soils are also common, and potential for denudation of slopes below an access road cut exists, but should be easily preventable.

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In the lower Matanuska Valley soils susceptible to water erosion are encountered, and location of towers and road will have to be planned not only to prevent bank cutting, but also to avoid a threat to the integrity of the line. Since this area is also the State's only major agricultural area, extensive care should be taken to avoid adversely affecting good quality, arable soils.

From Palmer to Point MacKenzie large areas of poorly drained soils will again necessitate great care in location of the transmission line. Although permafrost is absent, scarring of the soft peat soils is still a possibility, and the subsequent sedimentation of clearwater streams will have an adverse impact on aquatic life. The heavier clearing necessary in this area will also contribute somewhat to sedimentation; to what degree is dependent upon the care exercised in minimizing disruption of the soil.

Vegetation: If a 345 kv transmission system is constructed, this alternative could require up to 2,817 acres of clearing, 510 acres more than Susitna-1. If a 230 kv system is used, up to 2,514 acres of clearing will be necessary, 454 acres more than a similar system along Susitna-1. The majority of this clearing will be in the lower Matanuska Valley and along the north shore of Cook Inlet to Point MacKenzie. Very little clearing will be required along the portion from Vee Damsite to the Little Nelchina River. Actual acres of clearing will probably be less than the above figures since the entire width of the right-of-way need not be cleared. The terrain is generally level; so the access road can be incorporated into the line clearing without additional clearing.

The immediate effect of this clearing will be the destruction of the vegetation. The much more significant impact will be upon erosion and wildlife habitats. In hilly terrain, mechanical clearing methods such as bulldozing will cause considerable disruption of the soil and subsequent erosion and stream sedimentation. The use of brush blades or rotary cutters will reduce this effect. On steep slopes hand clearing will mitigate the otherwise heavy erosion potential likely with mechanical clearing.

To reduce available fuel for forest fires, and to reduce potential infestation of healthy bottomland spruce-poplar by spruce beetles (Dendroctonus rufipennis) and ips beetles, slash must be disposed of. This can be either by sale of merchantable timber, chipping, or by burning. Although burning will reduce air quality temporarily, it is more economical and less damaging than the alternatives; so, non-merchantable timber will be burned if an access road is present. With no access road, machinery cannot be brought in for stacking, burning, or chipping, and downed timber will be left along the clearing. Beetle infestation will be of concern mainly on the bottomland spruce-poplar ecosystem.

Regrowth rates along this corridor are fast enough, particularly in the southern portion, to warrant periodic suppression of tall growing trees which pose a hazard to the transmission line. The preferred method along this corridor is manual application of a suitable herbicide. The amount of clearing to be maintained, the modest regrowth rates, and high cost of labor make this alternative preferrable in this corridor over aerial application of herbicides on the one hand, or hand cutting of individual trees on the other. If proper application techniques are adhered to (see Mitigating Measures), there will be no other impacts other than the maintenance of a sub-climax vegetation. Accidental overspraying or wind drift, or improper dilution, resulting in unnecessary destruction of vegetation and spraying of water bodies resulting in habitat destruction for aquatic life will not occur.

Sections needing vegetation suppression occur in the bottomland spruce-poplar, lowland spruce-hardwood, and upland spruce-hardwood forests, particularly in the bottomland spruce-poplar. Muskeg-bog areas, which comprise a significant proportion of the ecosystems crossed by this corridor will need little clearing and no vegetation suppression. Lowland spruce-hardwood areas will not need to be maintained as often as bottomland spruce-poplar.

In the moist tundra ecosystems encountered between Vee Damsite and the Little Nelchina River, destruction of vegetation will be limited to those areas directly occupied by the roadbed and the tower bases. This will be a permanent impact, although some revegetation of tower bases can be expected.

Destruction of the vegetative mat in the tundra areas will result in long lasting scars unless corrective and preventive measures are taken. This scarring could lead to subsequent degradation of ice-rich permafrost and erosion.

Fires resulting from construction and operation, unless suppressed quickly, will result in extensive destruction of vegetation. These ecosystems are adapted to natural wildfires, and unless the occurrence of man-caused fires is very high, they should recuperate as quickly as they would under normal circumstances.

Wildlife: Alteration of vegetation patterns will affect wildlife. This corridor traverses many areas of moose concentration, and moose should benefit from the introduction of brush resulting from the regrowth on the clearing. Since the clearing must be maintained, this brush area will last for the life of the line. Most brush areas are in transition, changing from the brush phase to some other phase nearer the climactic phase. The brush in a transmission clearing can be counted as a more permanent source of browse.

Animals dependent upon climactic forest such as squirrels will suffer loss and displacement. However, their faster reproductive rates will allow their populations to adapt rapidly.

Most animals will benefit from the edge environment, offering both forage and cover from the adjacent forest and brush. Initially, animal movements may occur along the right-of-way, but as the brush grows into a dense cover, this will be limited. In any event, this impact should be low in this corridor.

Construction itself will affect wildlife. Larger mammals may temporarily leave the area to return after the construction activity. Smaller animals will suffer loss of individuals, but should recuperate rapidly once construction is completed. The density of forest in this corridor will allow animals to move only a short distance to avoid contact with construction activities.

Vegetation suppression, by whatever method, will periodically remove cover from along the right-of-way. However, due to the surrounding cover of the uncleared forests, this impact will be insignificant.

Areas requiring clearing coincide with moose populations. The resulting brush will be to their benefit. Caribou on the upland between the Susitna and Little Nelchina Rivers will suffer some direct loss of forage from the vegetation covered by the roadbed and tower bases. Of more importance to caribou habitat is the potential overburning of key winter browse, and the subsequent reduction of winter range. Since the Nelchina caribou herd has undergone drastic reductions in population (from an estimated 61,000 in the late 1960's to an estimated 4,000 to 5,000 presently) any adverse impact on caribou habitat can be considered serious. The access road will seriously affect hunting success unless hunting is further restricted in this area. There will be only slight impact on Dall sheep range in Tahneta Pass.

Recreation: This corridor approaches no State or Federal park or recreation area. However, areas with a high recreational use are encroached upon. The Lake Louise area is a complex of interconnected lakes set upon a gentle, rolling uplands, and receives high use for vacationing, fishing, and camping. Lake Louise itself lies approximately 10 miles east of this alternative corridor. Increased access and visibility of transmission structures will have impacts upon the recreational use. Since the area is served by only one road to the Glenn Highway, an access road would increase access to the area. This may be perceived as an adverse impact by people already owning or leasing sites along the lakes who value the relative solitude, and may be perceived as beneficial by fishermen, hunters, and others wanting access to cabin sites on these lakes.

From Devil Canyon to Slide Mountain this corridor will traverse areas previously accessible only by foot or air. The impact of an access road has been discussed above. For access to the north of Lake Louise, increased access will allow greater use of this upland area. For hunters particularly, the increased access may be perceived as desirable. Access will be controlled by the land managing agency having jurisdiction over these areas.

Cultural Resources: This corridor will approach the sites of the Independence Mines and Knik Village, both National Historical Sites. The corridor will avoid the Independence Mines by at least 8 miles; so no impact on this site is anticipated. The Knik site will be approached up to 3 to 5 miles; however, impact on this site will be low to none.

If the final survey discloses an unsuspected archeological site along the right-of-way, the location of the line or tower will be altered to avoid damage to such sites. Inadvertent damage to an archeological site will reduce its historical value. At the same time, discovery of an archeological site during survey or construction will be a beneficial aspect.

Scenic Resources: There will be a medium to high impact on scenic quality of the Tahneta Pass-upper Matanuska Valley area. High existing scenic quality, large numbers of viewers along the Glenn Highway, and some difficulty in concealment of a transmission line contribute to this impact. Development of the lower Matanuska Valley, which has already affected the intactness of that area, will lessen visual impact. The opportunities for concealment are greater also in the lower valley. Low numbers of viewer contacts and ease of concealment will greatly mitigate visual impact from Palmer to Point MacKenzie. Visual impact here is low to medium.

Visual impact from Vee Damsite to Slide Mountain is low. This is a factor of low viewer contacts, low to medium existing scenic quality, and toward Slide Mountain some measure of concealment.

Land Use and Resources: A low impact is expected on agriculture on the Matanuska. The final route can avoid presently developed land and high quality undeveloped land. Even if land in production were to be crossed, only the land directly occupied by the tower bases would be rendered unfarmable. Much of the agricultural land is devoted to dairying and hay. There would be a very low impact on these uses. Truck farming would be impacted more than dairying or hay since the patterns of row crops would be affected by tower locations.

No significant impacts are expected on potential forestry along this alternative, nor are any significant impacts expected on minerals extraction.

Social: Some socio-economic impacts can be expected for Palmer, Wasilla, and the several small communities along the north shore of Cook Inlet. Skilled labor will most likely not be drawn from these communities, although it is possible that unskilled labor from these communities might be employed on the construction phase. Local services such as food and lodging should experience an increase in business, but this will be a temporary impact, and due to the relatively small amount of workers needed and the shifting aspect of the construction, an insignificant impact, also.

Easements will need to be purchased over privately owned lands. This will give a lump sum payment, which will be a positive impact upon the land owner. Future rise in land prices and assessed taxes due to encroaching residential development will adversely impact land owners who have easements on their land. They will pay tax on land they cannot develop, at rates far beyond the rates for undeveloped land. In cases where this may occur, some arrangement such as an increased lump sum payment or annual payments equal to the difference in tax rates should be made.

Impacts of Alternative Matanuska-2

Soils: Impacts on soils from Slide Mountain to Point MacKenzie are identical to those described under impacts on soils of alternative corridor Matanuska-1.

Throughout the entire segment from Watana Damsite to Slide Mountain by way of Glennallen, the potential for permafrost degradation is very high. The poorly drained fine-grain soils encountered are very vulnerable to frost heaving, which will entail much maintenance of the line and road. The potential for scarring and rutting of the surface is high, and the subsequent erosion may cause significant sedimentation in the many clearwater streams in this area.

Particularly sensitive is the Gulkana and its tributaries. The corridor parallels this system for approximately 50 miles, and multiple crossings will have cumulative effect on sedimentation.

Vegetation: The Matanuska-2 alternative could require up to 3,869 acres of clearing if a 345 kv system is constructed. This is 1,561 acres more than the proposed Susitna-1 corridor. If a 230 kv system is used, up to 3,454 acres will need clearing, 1,394 acres more than Susitna-1. Actual acreage of clearing will probably be less than these figures since not all of the right-of-way need be cleared, and the terrain is level enough so that the access road can be incorporated into the line clearing.

The immediate effect of this clearing will be the destruction of the vegetation. The much more significant impact will be upon erosion and wildlife habitats. In hilly terrain, mechanical clearing methods such as bulldozing will cause considerable disruption of the soil and subsequent erosion and stream sedimentation. The use of brush blades or rotary cutters will reduce this effect. On steep slopes, hand clearing will mitigate the otherwise heavy erosion potential likely with mechanical clearing.

To reduce available fuel for forest fires, and to reduce potential infestation of healthy bottomland spruce-poplar by spruce beetles (Dendroctonus rufipennis) and ips beetles, slash must be disposed of. This can be either by sale of merchantable timber, by chipping, or by burning. Although burning will reduce air quality temporarily, it is more economical and less damaging than the alternatives, so non-merchantable timber will be burned if an access road is present. With no access road, machinery cannot be brought in for stacking, burning, or chipping, and downed timber will be left along the clearing. Beetle infestation will be of concern mainly on the bottomland spruce-poplar ecosystem. (See Mitigating Measures.)

In the moist tundra ecosystem crossed from Watana Damsite to within 10 or 20 miles of Paxson, destruction of vegetation will be limited to those areas directly occupied by the roadbed and the tower bases. This will be a permanent impact, although some revegetation of tower bases can be expected.

Destruction of the vegetative mat in tundra areas will result in long lasting scars unless corrective and preventive measures are taken. This scarring could lead to subsequent degradation of ice-rich permafrost and erosion.

Fires resulting from construction and operation, unless suppressed quickly, will result in extensive destruction of vegetation. These ecosystems are adapted to natural wildfires, and unless the occurrence of man-caused fires is very high, they should recuperate as quickly as they would under normal circumstances.

Wildlife: Alteration of vegetation patterns will affect wildlife. This corridor traverses many areas of moose concentration, and moose should benefit from the introduction of brush resulting from the regrowth on the clearing. Since the clearing must be maintained, this brush area will last for the life of the line. Most brush areas are in transition, changing from the brush phase to some other phase nearer the climactic phase. The brush in a transmission clearing can be counted as a more permanent source of browse.

Areas requiring clearing coincide with moose populations. The resulting brush will be to their benefit. Caribou on the uplands between the Susitna and Little Nelchina Rivers will suffer some direct loss of forage from the vegetation covered by the roadbed and tower bases. Of more importance to caribou habitat is the potential overburning of key winter browse, and the subsequent reduction in winter range. Due to the drastic reduction in the population of the Nelchina herd, (from an estimated 61,000 in the late 1960's to an estimated 4,000 to 5,000 in 1974) any adverse impact on caribou is a serious impact. Increased access will be a serious adverse impact unless hunting is further restricted in this area.

Animals dependent upon climactic forest such as squirrels will suffer loss and displacement However, their fast reproduction rates will allow their populations to adapt rapidly.

Most animals will benefit from the edge environment, offering both forage and cover from the adjacent forest and brush. Initially, animal movements may occur along the right-of-way, but as the brush grows into a dense cover, this will be limited. In any event, this impact should be low in this corridor.

Construction itself will affect wildlife. Larger mammals may temporarily leave the area to return after the construction activity. Smaller animals will suffer loss of individuals, but should recuperate rapidly once construction is completed.

Recreation: This corridor approaches no State or Federal park or recreation area. However, areas with a high recreational use are encroached upon. The Lake Louise area is a complex of interconnected lakes set upon a gentle, rolling uplands, and receives high use for vacationing, fishing, and camping. Lake Louise lies approximately 35 miles to the west. Since the corridor will parallel an existing highway, it is unlikely that it will contribute greatly to increased access to this lake complex.

Except for the portion from Watana Damsite to Denali Damsite, the corridor will parallel existing highway. Threfore, it is not expected that the corridor will provide access to significantly large areas.

Cultural Resources: Apart from Independence Mines and the Knik site discussed under alternative Matanuska-1, the only National Archeological site is the Tangle Lakes Archeological District west of Paxson. Careful examination of the final route will minimize any chance of disruption of archeological sites within this district. A National Historical Site, Sourdough Lodge, will not be approached enough to be affected. If the final survey discloses an unsuspected archeological site along the right-of-way, the location of the line or towers will be altered to avoid damage to such sites. Inadvertent damage to an archeological site will reduce its historical value. At the same time, discovery of an archeological site during survey or construction will be a beneficial aspect.

Scenic Resources: Impact to scenic quality from Denali Damsite to Paxson will be high. Large numbers of viewer contacts, little opportunity for concealment, and areas of high existing scenic quality are factors in this high impact. From Watana to Denali Damsites, visual impact is low. From Paxson to Slide Mountain visual impact will range from low to moderate.

For the rest of this alternative, visual impacts are as described for alternative Matanuska-1.

Land Use and Resources: Little or no impact is expected on agriculture, forestry, or mineral extraction.

This corridor will parallel the right-of-way of the Alyeska Pipeline and the Richardson Highway. It will, by doing so, reinforce the existence of a utility corridor and subsequently, the location of future rights-of-way. Some savings of total width of this corridor could be achieved by sharing of rights-of-way. (See Alternatives to the Proposed Action.)

Social: Socio-economic impacts will be identical to those discussed for alternative Matanuska-1, with the exception of two additional communities, Glennallen and Paxson. Since the corridor will run so close to both, it is very likely that they will receive impacts upon their services such as lodging and food. This is a temporary impact, and not very significant. Some local labor may be employed during construction, but this will probably be unlikely.

Easements will need to be purchased where private land must unavoidably be crossed. This will result in the land owner receiving a lump sum payment, and will provide some influx of capital to these areas.

Impacts of the Delta Alternative

Soil: This alternative crosses significantly large areas of soils having moderate to high erosion potential. There are two sensitive soil areas: 1) The poorly drained, ice-rich permafrost found throughout the entire length of the route. This soil is vulnerable to permafrost degradation, frost heaving, and rutting and scarring of the top soil. 2) The second sensitive soil type is the fine-grain soils, generally well drained upland soils, found between Shaw Creek and Fairbanks. This soil is vulnerable to gulleying, unstable slopes, and wind erosion.

Erosion from either of these two soil types may cause sedimentation in the many clearwater streams that are tributaries to the Tanana River. Generally, these clearwater tributaries are limited to those draining the northeast portion of the Tanana River valley in this area. Tributaries of the Tanana from the Alaska Range are sediment laden and will not be significantly impacted from erosion.

Local problem areas will be encountered. North of Summit Lake, in Isabel Pass, is an area of thixotropic soils which become plastic under seismic shock. Unless this soil can be feasibly circumvented, transmission towers in this area will be under higher than normal seismic risk. Through the Isabel Pass, rocky soils interspersed with bedrock and talus will present problems in placing of tower foundations and access road. Excessive cutting and filling for an access road through this area, in conjunction with thin soils or unstable slopes, can cause severe erosion.

A large, extremely marshy area around the Shaw Creek confluence will be encountered. Tower foundations will need special attention and the access road will need special design. Frost heaving will be severe in this marshy soil.

Vegetation: The Delta alternative could require up to 1,737 acres of clearing, 288 acres more than Nenana-1. The actual acreage cleared will probably be less than these figures since the entire width of the right-of-way need not be cleared. In areas where clearing is required, the terrain is level enough to permit the access road to be incorporated into the line clearing.

The majority of the clearing will be done in the upland spruce-hardwood and bottomland spruce-poplar along the lower Delta River and the Tanana River.

To reduce available fuel for forest fires, and to reduce potential infestation of healthy bottomland spruce-poplar by spruce beetles (Dendroctonus rufipennis) and ips beetles, slash must be disposed of. This can be either by sale of merchantable timber, by chipping, or by burning. Although burning will reduce air quality temporarily, it is more economical and less damaging than the alternatives, so non-merchantable timber will be burned if an access road is present. With no access road, machinery cannot be brought in for stacking, burning, or chipping, and downed timber will be left along the clearing. Beetle infestation will be of concern mainly in the bottomland spruce-poplar ecosystem. (See Mitigating Measures.)

The immediate effect of this clearing will be the destruction of the vegetation. The much more significant impact will be upon erosion and wildlife habitats. In hilly terrain, mechanical clearing methods such as bulldozing will cause considerable disruption of the soil and subsequent erosion and stream sedimentation. The use of brush blades or rotary cutters will reduce this effect. On steep slopes, hand clearing will mitigate the otherwise heavy erosion potential likely with mechanical clearing.

In the alpine and moist tundra ecosystems found from Watana Damsite through Isabel Pass and the Alaska Range, destruction of vegetation will be limited to those areas directly occupied by the roadbed and the tower bases. This will be a permanent impact, although some revegetation of tower bases can be expected.

Destruction of the vegetative mat in tundra areas will result in long lasting scars unless corrective and preventive measures are taken. This scarring could lead to subsequent degradation of ice-rich permafrost and erosion.

Fires resulting from construction and operation, unless suppressed quickly, will result in extensive destruction of vegetation. These ecosystems are adapted to natural wildfires, and unless the occurrence of man-caused fires is very high, they should recuperate as quickly as they would under normal circumstances.

Wildlife: The areas requiring the most clearing coincide with many areas of moose concentration, and moose should benefit from the introduction of brush resulting from the regrowth on the clearing. Since the clearing must be maintained, this brush area will last for the life of the line. Most brush areas are in transition, changing from the brush phase to some other phase nearer the climactic phase. The brush in a transmission clearing can be counted as a more permanent source of browse.

The large numbers of caribou in the Nelchina herd south of the Alaska Range will suffer some direct loss of forage from the vegetation covered by the roadbed and tower bases. Of more importance to caribou habitat is the potential overburning of key winter browse, and the subsequent reduction in winter range. Due to the drastic reduction in the population of the Nelchina herd, (from an estimated 61,000 in the 1960's to 4,000 to 5,000 in 1974) any adverse impact is a serious impact. Increased access will seriously affect the herd unless hunting is further restricted. There will be only slight impact on Dall sheep range in Isabel Pass and the canyon of the Delta River.

Animals dependent upon climactic forest such as squirrels will suffer loss and displacement. However, their faster reproductive rates will allow their population to adapt rapidly.

Most animals will benefit from the edge environment, offering both forage and cover from the adjacent forest and brush. Initially, animal movements may occur along the right-of-way, but as the brush grows into a dense cover this will be limited. In any event, this impact should be low on this corridor.

Construction itself will affect wildlife. Larger mammals may temporarily leave the area to return after the construction activity. Smaller animals will suffer loss of individuals, but should recuperate rapidly once construction is completed. The density of forest in this corridor will allow animals to move only a short distance to avoid contact with construction activities.

Vegetation suppression, by whatever method, will periodically remove cover from along the right-of-way. However, due to the surrounding cover of the uncleared forests, this impact will be insignificant.

Recreation: This corridor does not infringe upon any Federal or State park or recreation area. Since the Delta alternative parallels existing highways and the Alyeska Pipeline, it will not provide new access to any significantly large area. Use of the access road is dependent upon regulations imposed by the landowners or land managing agency.

Cultural Resources: For the segment from Watana Damsite to Paxson the impacts are as described under impacts of alternative Matanuska-2. From Paxson to Fairbanks there are no National Archeological or Historical Sites. If the final survey discloses an unsuspected archeological site along the right-of-way, the location of the line or towers will be altered to avoid damage to such sites. Inadvertent damage to an archeological site will reduce its historical value. At the same time, discovery of an archeological site during survey or construction will be a beneficial aspect.

Scenic Resources: This corridor will have visual impacts ranging from high along the Denali Highway and through the Isabel Pass-Alaska Range area, moderate from Donnelly Dome to the Salcha River, and to low from the Salcha River to Fairbanks. Since nearly the entire corridor is exposed to viewers from the Denali and Richardson Highways, the variables are the existing scenic quality and the opportunities for concealment. Along this alternative, generally the higher the existing scenic quality, the less the opportunity for concealment.

Land Use and Resources: No impacts are expected on minerals extraction. The area around Big Delta and Delta Junction is a potentially major agricultural area, particularly in grain crops such as barley. Crossing of good quality arable land will result in the removal from production of the land occupied by the tower bases. Row crops will be more affected than field crops in that patterns of tilling and harvesting will be more disrupted by tower locations.

Along the lower Delta River and the Tanana River there is potential for forestry, particularly in the bottomland spruce-poplar ecosystems. The Delta alternative will have little effect on forestry, apart from minimal use as logging roads or firebreaks. Merchantable timber from clearing operations can be disposed of by sale. The proximity of a highway and river will facilitate salvage of logs.

Paralleling of the Alyeska Pipeline and the Richardson Highway will reinforce the utility corridor along the Delta and Tanana Rivers, and will affect location of future rights-of-way. the total width of this utility corridor can be reduced by sharing of rights-of-way. (See Alternatives to the Proposed Action.)

Social: The towns of Paxson, Delta Junction and Big Delta will benefit from use of services such as food and lodging by construction workers. It is unlikely that much of the labor needed for construction will be drawn from the smaller communities.

Logging of timber and clearing contracts will affect towns along the Tanana River by providing jobs and capital from sales of timber. This will be a short-lived impact, however.

Some easements across private land may need to be purchased. The majority of the alternative can be routed along the utility corridor along the Alyeska Pipeline. Purchases of easement will provide a lump sum influx of capital to the affected land owners. This influx is temporary, unless arrangements are made for yearly payments.

Comparison of Impacts of Corridors

From the preceding descriptions of potential impacts of the various alternative corridors, comparisons can be drawn to rank these alternatives as to their degree of cumulative impact. Several assumptions will be used in these comparisons, and from these comparisons the proposed corridors were selected.

The first assumption to be made is that other factors being equal, cumulative impacts are proportional to corridor length. In other words, a 100 mile corridor will have twice the cumulative impact a 50 mile corridor crossing similar terrain and ecosystems would have. If varying conditions exist, this assumption is not necessarily valid; a 100 mile corridor crossing stable soils may incur less impact than a 50 mile corridor over ice-rich permafrost.

The second assumption is that joint use and paralleling of existing rights-of-way is preferable to pioneering of a new corridor because of the secondary impacts associated with new corridors.

Against this assumption is the assumption that transmission systems always cause an adverse visual impact of varying degree, and that transmission systems should be screened as much as possible from major surface transportation routes. Thus a transmission line ideally should share or parallel transportation rights-of-way and yet not be seen from them; this is a condition rarely achieved.

The fourth assumption is that a transmission corridor should be located to anticipate future needs, and so reduce potential proliferation of future transmission corridors. Practically, this will favor corridors that approach present and potential communities that may require interconnection.

The fifth assumption is that the corridor should fulfill its requirements as economically as possible while keeping environmental impacts to a minimum. This is an extension of the first, second, and fourth assumptions.

Using these assumptions as broad categories in conjunction with environmental criteria, the twelve corridors can be summarized and ranked in the following table:

Corridor Analysis - Project Power to Anchorage/Cook Inlet Area

	Susitna Corridors				Matanuska Corridors	
Analysis Factor:	S - 1	S - 2	S - 3	S - 4	M - 1	M - 2
Length, miles	136	140	129	147	258	385
Max. elevation, feet	2,100	2,100	3,800	2,200	3,000	4,000
% of joint or parallel use	75	75	39	35	52	90
Cost x $1,000	92,650	94,986	93,712	96,072	153,187	224,427
Ability to accommodate future needs	1	1	3	3	4	2
Ranking	1	1	2	1	3	4
Environmental Impacts						
Soils	1	2	1	1	2	2
Vegetation	2	3	1	3	4	5
Wildlife	1	2	3	3	4	3
Existing developments	3	3	2	1	3	3
Scenic quality/recreation:						
Developed areas	3	3	2	1	3	3
Remote areas	1	2	3	4	4	3
Ranking	1	3	1	3	4	4

Corridor Analysis - Project Power to Fairbanks/Tanana Area

Analysis Factor:	Nenana Corridors N - 1	N - 2	N - 3	N - 4	N - 5	Delta Corridor D
Length, miles	198	220	231	223	212	280
Max. elevation, feet	2,400	4,300	4,000	4,000	4,300	4,000
% of joint or parallel use	100%	38%	78%	43%	0%	86%
Cost x $1,000	85,382	107,090	106,272	95,648	96,572	122,475
Ability to accommodate future needs	1	4	3	4	5	2
Ranking	1	3	3	3	4	3
Environmental Impacts						
Soils	1	3	2	2	3	3
Vegetation	2	2	3	2	1	3
Existing developments	3	2	2	2	1	2
Scenic quality/recreation:						
Developed areas	3	2	2	1	1	3
Remote areas	1	3	2	2	3	2
Ranking	1	3	3	2	1	3

Combining the information on this table with the more detailed descriptions of potential environmental impacts of the corridors in pages 34 to 74, a brief discussion of each corridor and its relative suitability follows:

Susitna-1

Of the possible corridors from the Upper Susitna Project to the Anchorage area, the Susitna-1 corridor is the second shortest, and one of the closest adherents to existing corridors. Because of the fairly heavy to moderate forest density, the clearing can be screened from the parallel Alaska Railroad and Anchorage-Fairbanks Highway. Of the six corridors leading to the Anchorage area, this is the cheapest to construct.

Some of the advantages of this corridor are its directness and its proximity to small communities which may eventually require a direct tap. It avoids the Denali State Park and consequential scenic impacts as seen from the highway, and avoids unnecessary crossings of the Susitna River.

The disadvantages of this corridor are: the additional access provided to the area between Talkeetna and Gold Creek, which is presently served by flag stops on the Railroad; the new access provided to the area between Nancy Lake and Point MacKenzie; and the possible interference with recreation in the Nancy Lake Recreation Area.

Susitna-2

This corridor is slightly longer than Susitna-1, more expensive, and will interfere with recreation in the Denali State Park. Concealability of the line from transportation routes is equal to Susitna-1, as is its ability to incorporate future electrical needs of communities enroute. Interference with the Nancy Lake Recreation Area and the new access provided to Point MacKenzie is similar to Susitna-1.

The major disadvantage of this corridor will be the interference with the Denali State Park; it would practically render the Park area to the east of the Highway uesless for hiking trails, since trails of any length over five miles would cross the right-of-way. For this reason, it is not preferred over Susitna-1.

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Susitna-3

This is the shortest of the corridors, and the second to the cheapest corridor to Anchorage. It avoids visibility from transportation routes by striking to the northeast through relatively inaccessible country. Thus, it is less able to accommodate new taps along the stretch from Talkeetna to Gold Creek. The proximity to Nancy Lake Recreation Area and the access to Point MacKenzie are similar to Susitna-1.

This corridor has two serious disadvantages: First, it will pioneer a considerable area of land, reducing wilderness values and permitting problems with increased access. Secondly, it will be more vulnerable to weather and reliability will be reduced. For these two reasons, it is not favored over Susitna-1.

Susitna-4

This corridor is considerably longer and more expensive than Susitna-1; only 33% of its length follows existing corridors, since it avoids public transportation routes by leading northeast to Devil Canyon from Talkeetna. It is not as able to handle new loads from Talkeetna to Gold Creek as Susitna-1; the proximity to the Nancy Lake Recreation Area and the increased access to Point MacKenzie are similar to Susitna-1.

The large area of new access provided, with its attendant problems, combined with recreational use of the Stephan Lake area reduce the value of this corridor. Because of this and its higher cost, it is not preferred over Susitna-1.

Matanuska-1

This corridor is almost twice as long as Susitna-1, and about 60% more expensive. Half of its length parallels existing corridors; where it does follow these corridors, its concealability varies from low to high. It is poorly suited to accommodate future electrical needs.

There are several major environmental objections to this corridor. First, it would open up a very large area of previously inaccessible (except by air) area. This area is unique in many ways: first, it is a considerable part of the Nelchina caribou range, and since this herd has suffered major declines recently, any impact on their range will be adverse. Secondly, this area has a high recreational use, such as fly-in hunting, fishing, and cabins; increased access may reduce wilderness values for this sort of recreation. Thirdly, this is a large area of continuous ice-rich permafrost. These objections, combined with its length and cost, rule out this alternative.

Matanuska-2

This corridor is almost three times longer than Susitna-1 and almost 150% more in cost. However, most of its length parallels existing corridors; visibility from transportation routes would be medium to high for much of its length. It would be well-suited to the interconnection of the CVEA system.

Since it follows existing corridors for most of its length, the new-access problem is rather low for this alternative. The major environmental objection to this corridor will be the large area of ice-rich permafrost to be crossed, and visibility in scenic areas, as in Tahneta Pass and the Upper Matanuska Valley. However, its length and cost are inordinately high, so this corridor is not recommended at this time.

Nenana-1

The Nenana-1 corridor is the shortest and cheapest corridor connecting the Upper Susitna Project to Fairbanks. It would parallel or use existing rights-of-way for its entire length, and its ability to accommodate future electrical needs are very good.

The main objection to this corridor would be the lack of concealment from south of Broad Pass to Healy; varying degrees of visual impact along this stretch could be expected. Although not entering the Mount McKinley National Park, it would be visible along the Anchorage-Fairbanks Highway in the vicinity of the Park. No other major environmental problems are anticipated. To further reduce impact, no access road is planned from Healy south to the Project area. This modification would apply not only to this corridor, but also to the Cantwell-Gold Creek sections of Nenana-2 and Nenana-3.

Nenana-2

Although not much longer or more expensive than Nenana-1, this corridor would provide access to a very large area; only 38% of its length follows existing corridors. Those sections paralleling the Anchorage-Fairbanks Highway/Alaska Railroad corridor would be rather visible.

The increased access is a major environmental objection; the major recreational use of this access road would be for hunting, and wilderness quality of this area would be irreversibly damaged. Another major objection is the necessity of crossing several high passes in the Alaska Range; reliability would be less, not only because of harsher conditions, but also to uncertainty of access for repairs. This corridor is less suitable than Nenana-1.

Nenana-3

This corridor is more expensive and longer than Nenana-1. It parallels existing rights-of-way for more than 75% of its length, circumventing the Nenana canyon area by way of two other passes in the Alaska Range. From the Project to Cantwell, it would be rather visible. It is much better suited to connect existing and potential communities to the interconnected system than Nenana-2, but will not be able to be tapped by McKinley Park.

A significant area of mountainous terrain will be opened up by this corridor, unless helicopter construction is used. One high pass will need to be crossed; the harsh conditions will reduce reliability of operation and access. This corridor is not preferred over Nenana-1.

Nenana-4

Slightly longer and more expensive than Nenana-1, this corridor would not be seen from transportation routes from the Project area north to Healy. Less than half of this corridor parallels existing rights-of-way, and it would be poorly suited to accommodate future electrical needs of existing or potential communities.

Not only would this corridor have the same objections as that of Nenana-3, it also would provide access to the area immediately north of Watana damsite to the Denali Highway, dividing what is now a fairly large wilderness area. This area can be expected to provide unsuitable soils, much of it ice-rich permafrost. Nenana-4 is not preferred over Nenana-1.

Nenana-5

This corridor is unique in that its whole length pioneers a new corridor; no existing rights-of-way are paralleled. Yet, its length and cost are not much greater than Nenana-1. It would be very poorly suited to accommodate future electrical needs of existing and potential communities.

This corridor combines the objections of Nenana-2 and Nenana-4, and its only advantage would be its concealment from transportation routes. Thus, this corridor is not recommended.

Delta

The Delta corridor is twice as long and 50% more expensive than Nenana-1. Most of it parallels existing rights-of-way, and for many stretches, would be highly visible from the Denali and Richardson Highways. It has a fair suitability for accommodating future electrical needs of existing or potential communities. In addition, it can serve to power pipeline pumping stations and connect the CVEA and GVEA systems.

The major environmental objections to this line are: there is a large area of poor soils to be crossed along the Denali Highway and through Isabel Pass; the line would also be highly visible in these two areas. This corridor infringes on the Nelchina caribou range. Since the Nelchina herd has suffered such dramatic losses in the past ten years, any impact on their range should be considered adverse. The only Endangered Species in Alaska, the Peregrine falcon, would be affected in its habitat along the Salcha Bluffs. A large archeological district would have to be crossed west of Paxson. These objections, combined with length and cost, rule against this alternative.

The selection of the Nenana-1 and Susitna-1 as the proposed corridors does not disavow the impacts associated with them; it only selects these two as the most economically desirable and the least environmentally objectionable alternatives. Lessening, or mitigation, of the impacts of these two corridors is discussed in the following section.

Most mitigating measures are basically standard practices stringently enforced. If basic applicable regulations issued by the Federal, State, and local governments regarding environment quality are adhered to, most impacts affecting air and water quality will be minimized. Application of practices and guidelines such as those issued in Environmental Criteria for Electric Transmission Systems, a joint Department of the Interior, Department of Agriculture publication, will reduce visual and environmental impacts.

Consultation with agencies proficient in certain areas of concern, such as the Soil Conservation Service and the State Department of Fish and Game, will provide further guidance on mitigation of impacts.

More specific mitigating measures are discussed below. It must be remembered that many of these are standard practices intended not only to minimize damage to the environment, but also to protect the integrity of the transmission line.

Experience gained from construction and maintenance of other transmission systems in Alaska has shown that most environmental impacts from transmission lines can be avoided. Golden Valley Electric Association and Chugach Electric Association have constructed and operated several lines without access roads, on poor soils, and under harsh climatic conditions.

Except for visual impact, most environmental impacts caused by a transmission system are far less than many transportation and communication systems; particularly if it is an overhead system. The majority of the impacts are due to the access roads; if the access road can be omitted, a large portion of the potential impacts will be eliminated.

The following mitigative procedures will assume the existence of an access road and its potential impacts; it must be remembered that access roads will not be used where they are shown to be incompatible with the environment.

Soils

Since it is expected that most damage to soils will occur during the construction phase, the construction schedule can be arranged so that considerable amounts of the work, particularly those requiring the use of an access road, such as delivery of materials, can be done in winter and spring, when the ground is least vulnerable to physical disturbances.

However, winter road use will be dependent upon snow depth and surface conditions; winter use can affect surface vegetation through destruction of surface plants, or over-compaction of snow.

Temporary roads will be avoided as much as possible; access roads will be built to a standard applicable to the expected use. If so designated by the State Department of Highways, some sections of access roads will be built to secondary road standards.

Not all sections of the line will require an access road; particularly sensitive areas may be protected by the use of helicopter construction and maintenance, or the use of winter access roads and helicopter maintenance. It should be recognized, however, that dependence on aerial methods leaves the construction and/or maintenance program more vulnerable to weather conditions. One major section will be constructed without access roads from Devil Canyon to Healy.

For ground work, roads must be adequately constructed to avoid erosion, slope instability, degradation of the permafrost, and alteration of drainage. Gravel or other insulating material should underlay permanent access roads on permafrost area; culverts and bridges where necessary should be placed to avoid disruption of drainage and possible icing conditions. Slopes on cuts and fills should be of proper gradient and revegetated as soon as possible to prevent erosion and slumping. Revegetation will be done with species recommended in A Vegetative Guide for Alaska published by the Soil Conservation Service.

For ground work off of the access road, or where no access road will be provided, machinery compatible to the surface should be used. For shallow permafrost areas, soft muskeg and bogs, and highly erosive soils, machinery with low-pressure treads or tires shall be used to avoid scarring the vegetative mat and incurring subsequent erosion.

On sensitive soils, such as ice-rich soils with a shallow permafrost table, disturbed soil will be protected with an organic insulating mulch, such as straw, or when available, chipped slash from the clearing. Revegetation with appropriate cover plants will immediately follow construction. To reduce the likelihood of disturbance of marshy soils, mats of slash, logs, or other materials will be used.

On erodable slopes, no bulldozing will be done on slopes greater than 35%. All cuts and fills shall be angled back sufficiently to minimize slumping and immediately seeded with appropriate plants. Sodding or fabric mats may need to be used in some cases to minimize erosion until revegetation can control slope erosion. Culverts and water breaks will be placed to reduce water flow over the bare roadbed. No machine clearing will be permitted within 100 feet of any streambed.

To protect the integrity of structures in extremely marshy soils or soils with a shallow ice-rich, permafrost table, and to minimize use of the access road for maintenance of tower footings on these soils, heat transfer devices may be used if necessary to keep tower footings and guys frozen into place. This is especially important in those stretches not having an access road. Keeping poorly drained soils and the shallow active zone around tower bases permanently frozen, eliminates frost-heaving of anchors and settling of foundations due to changes in the permafrost. There are several types of these devices in use; their use is widespread along the Alyeska Pipeline where elevated sections of pipe are vulnerable to settling.

A good discussion of several types of these devices is found in the article "Settling a Problem of Settling", in the Northern Engineer, Vol. 7, no. 1.

The basic principle of these devices is that of "pumping" heat from the soil to the air. Year-round operation would require an actual pump to keep coolant flowing, but several types use no pump, relying instead upon the difference between soil and ambient air temperatures in winter and one-way flow of coolant to retard heat transfer to the soil in summer. These heat-transfer devices may provide the best available solution to the problem of suitable footings and anchors for structures in muskeg.

Fire control will be quick and efficient to limit fires to small areas. Fire control methods and machinery should not ultimately cause more damage than the fires themselves; soil disruption by fire control must not aggravate soil disturbance already caused by a fire. Aerial control and ground vehicles with low-pressure treads will be used where needed.

Crews will be instructed on fire safety. Extinguishing tools will be on hand; machinery will be suitably maintained to minimize sparking. Work will go on a special basis during high-risk periods. The permanent access road can double as a fire break and a fire-control road for continuing wildfire management.

On unbridged stream crossings, gravel fords will be constructed where the bottom is not already gravel. No trees shall be felled or yarded across streams. No waste material will be dumped into streams or abandoned on their flood plains. Towers will be located well away from streams, not only to reduce the potential for erosion, but also for their own safety.

Vegetation

Only the necessary vegetation will be cleared to minimize impact and cost. Photogrammetric identification of clearing zones will be used; this technique, already in use by Bonneville Power Administration, uses a combination of factors, including spacing of towers, line sag, topography, profiles, and growth rates to determine exactly which trees need to be eliminated in a forested area. Designation of the minimum safe clearing will be in keeping with the National Electric Safety Code.

Clearing will be with brush blades on bulldozers on frozen ground, as well as with rotary cutting or hand clearing to reduce unnecessary disruption of vegetation. No bulldozing will be permitted on slopes greater than 35%. Clearing on steep slopes will be by hand; stumps and roots will be allowed to remain to help keep slopes stable.

Slash will be immediately chipped to provide erosion control where necessary or burned to avoid potential insect epidemics and to reduce fire hazard. Non-merchantable timber will be burned if an access road is present. With no access road, machinery cannot be brought in for stacking, burning, or chipping, and downed timber will be left along the clearing. Beetle infestation will be of concern mainly on the bottomland spruce-poplar ecosystem. Disturbed areas will be graded back to merge with the contours of the land, and fertilized or revegetated if necessary to provide a ground cover. In many cases, chipping of brush, a very suitable method of reducing soil erosion in the clearing, will also provide some increase of insulation in areas of shallow permafrost. Fire hazard will be low, since the chips will usually be in wet soils in these conditions.

Revegetation of cleared areas can be with plant species that will enhance habitat for animals, yet can successfully dominate taller-growing species. Typical of these species are grasses and legumes. Revegetation will be carried out in accordance with A Vegetative Guide for Alaska presently used by the State Department of Highways.

Those sections of clearing needing periodic maintenance to keep down tall-growing trees will be cleared in such a way as to minimize further soil disruption. If mechanical methods are used, selective cutting is preferable over brush hogs or brush blades on tractors, which not only can be destructive to the soil, but inefficient, also, in that little selective cutting is possible. If herbicidal control is to be used, proper application methods and proper herbicide methods will be used. Aerial application will not be used; manual application is not only very selective, but accidental misapplication is less likely to occur. Herbicides will not be applied next to streams or lakes; a buffer strip will be left untreated adjacent to water bodies. Application will be of a coverage and dilution appropriate to the vegetation being treated.

Fire control will be as discussed in the preceding section on soils.

Wildlife

A policy of minimal clearing of vegetation should have the least impact upon wildlife in terms of destruction of habitat. Avoidance of unique habitat, or habitat of rare and endangered species will minimize impact on these important, but usually localized, areas. Seasonal scheduling of construction will minimize contacts with migrating mammals, although this may conflict with winter construction in areas used by wintering caribou or moose.

Any access roads will be designed to minimize river crossings, which should reduce sedimentation caused by fording machinery. Where possible, drainage will be preserved through proper placing of culverts and bridges. Borrow pits will be located to avoid sedimentation of clearwater streams and lakes and subsequent impacts on aquatic ecosystems. Spills of fuel, oil, and other chemicals will be avoided, particularly if streams or lakes may be affected. Herbicides, if used, will be applied properly.

Wildfire control will be as discussed in the section on soils.

Harassment of wildlife by ground vehicles, planes, or helicopters, either deliberate or inadvertant, will be minimized by strict enforcement of vehicle use and aircraft use by either the contractors or the supervisors during construction and maintenance. Hunting and trapping activities of work crews will be controlled. The Alyeska Pipeline camps restrict firearms possession to control hunting and harassment, as well as accidental shootings. The Alyeska Pipeline camp and construction areas have also been closed to hunting and fishing by the Alaska State Department of Fish and Game. Similar controls will be employed for transmission line work.

Increased exposure of wildlife to hunting or trapping because of the increased access of a service road can be controlled to a degree, if deemed necessary by game management agencies. Access roadheads can be barricaded or concealed, breaks can be designed on the access road to limit use by standard four-wheel drive vehicles, and the road can be posted.

However, it is not expected that such access-control measures will entirely succeed. In most areas, Alaska Power Administration favors multiple-use of the right-of-way; final regulation of access will be at the discretion of the land owner or land-managing agency.

Existing Developments-Social

To avoid preemption of private lands, the final route will be flexible enough to circumvent small blocks of private land. Larger privately owned sections will entail a purchase of easement. All of the alternative corridors can avoid communities en route. Sections of the line deemed hazardous by the FAA will be adequately marked as outlined in Part 77, FAA regulations "Objects Affecting Navigable Air Space".

Effects of audible noise and electromagnetic interference are minimized by the distance between the majority of the corridor and residences, especially residences with radio and/or television reception. Avoidance of communities for the most part will eliminate the nuisances of noise and interference. Paralleling communication lines vulnerable to reduced interference can be re-routed to minimize the distance along which transmission and communication lines closely parallel. The magnitude of induce voltage is inversely proportional to the square of the separating distance, so doubling the distance between the transmission line and communication lines would reduce induced interference to a quarter.

Camps will be provided for transmission line workers; these and all material dumps and construction areas will be located away from small communities; such precautions will not be needed for the larger towns of Anchorage and Fairbanks. The camps will be temporary, and will be removed as the construction phase in their vicinity is completed; the land occupied by the camps will either revert to their former use or used for other purposes.

Depending upon the ability of the community to absorb an influx of people, the camps will provide for entertainment, food, and lodging. This will minimize the strain on such services in the communities, at the same time, allowing local merchants to profit from these services.

Scenic Quality-Recreation

The obtrusiveness of a transmission line can be lessened by proper design and location. In forested areas, placing the clearing far enough from a parallel highway or railroad is sufficient to conceal the transmission line. In areas having shorter trees, using the topography to conceal a line behind ridges, in swales, and along breaks in slopes will help to lessen its visibility. In completely open areas, the only alternatives are using a combination of topography and distance to conceal a line, or to keep it close to the road if it cannot be concealed. By keeping an obvious line next to a road, one can walk under the line to get an unobstructed view of scenery on the other side; merely keeping an unconcealable line a short distance from a parallel road does not lessen its obtrusiveness, and it precludes getting a clear view of scenery beyond.

Other techniques of concealing or mitigating the presence of a line are to avoid clear-cuts for clearings, but instead, to feather back the break between original forest and clearing; use of photogrammetric selective clearing will ease the abrupt appearance of clearings. Where road crossings are necessary, it is best to cross at less than right angles and to leave a buffer strip of original vegetation to mask the right-of-way. This might involve using taller than usual towers on either side of the highway to provide the additional clearance. Placing lines on ridges silhouettes them, and will be avoided; ridge crossings are best put in notches or low spots.

Whenever possible, existing rights-of-way should be shared or paralleled to avoid the problems associated with pioneering a corridor in inaccessible areas. Trails in these "inaccessible" areas should,however, be avoided; preserving wilderness quality entails sharing or paralleling all rights-of-way except trails, and from these, lines should be shielded as much as possible.

Cultural Resources

There are known and potential archaeological and historical sites along the proposed corridors. To minimize possible vandalism or disturbance, no sites other than those on the National Register shall be located either on a map or on the narrative of this assessment. To preserve the integrity of these known and potential sites, a pre-construction archaeological survey of the corridors will be carried out, and the final transmission route will be adjusted to minimize disruption. Inadvertent discovery of an unsuspected site at a later stage will entail either the minor relocation of a segment of the transmission line, or the salvage of the site as prescribed by Executive Order 11593 and P. L. 93-291.

For sites already disturbed, such as those uncovered during excavation, accurate records of the site will be prepared; the site will be studied to determine its significance and the extent of disturbance. All photographs, drawings, and descriptions will be filed with the Library of Congress as part of the Historic American Buildings Survey or the Historic American Engineering Record. If the site is of such significance to warrant more detailed study, construction work shall be temporarily halted on the vicinity of the site; if necessary, a minor relocation can be arranged to prevent further disruption of very important sites.

All generation of power will create adverse impacts, all transmission of power will create adverse impacts; all generation sites, except for local generation, need a transmission system. The degree of adverse impact of a transmission line will vary with its length, the character of the terrain, and the care exercised in design, construction, operation, and maintenance.

Adherence to regulations and guidelines issued by the National Environmental Policy Act of 1969, the Water Quality Act, and relevant State and local agencies and application of mitigating measures as outlined in the preceding section will reduce unavoidable detrimental impacts to a considerable degree. Experience in construction and maintenance of the more recent transmission lines of Alaskan utilities has shown that most adverse impacts can be avoided or mitigated. The Healy-Fairbanks and the Beluga-Point MacKenzie transmission lines have been successful in crossing a wide variety of ecosystems with little damage. These lines have used winter and helicopter construction in addition to conventional vehicle access roads. The use of the experience gained in these projects will reduce the degree of adverse impacts considerably. However, some unavoidable impacts are inevitable. These impacts are of two kinds: Those resulting from the construction activities, and those inherent in the existence of a transmission line.

Unavoidable impacts due to construction activities are usually temporary; these include effects such as disruption of the surface vegetation and subsequent erosion on slopes; disruption of animal habitat due to human presence; and loss of vegetation due to clearing. The degree of these impacts will depend upon the mitigation measures taken, timing of the construction phase, and ecological factors; these impacts will lessen or cease after constructtion, as regrowth of vegetation and reinvasion of fauna occurs.

Unavoidable impacts of a more permanent nature associated with maintenance and operation of the transmission line include modification of habitat due to a maintained clearing; increased access and subsequent impacts of increased access; influence on existing and future land use; influences on existing and future utility corridors; and very importantly, impacts on scenic quality.

The maintenance of a clearing through forested areas will have impacts on wildlife for the life of the transmission lines. Animals dependent upon successional vegetation for browse, such as moose and snowshoe hare, will benefit by the introduction of brush into an otherwise forested area. Animals dependent upon climax forest for habitat, such as red squirrel, will suffer a reduction of habitat. In general, both of these impacts will be insignificant due to the small ratio of affected land to the area of unaffected forest traversed by a transmission route.

Increased access due to the existence of a transmission line will depend upon the type of access used to the line, the degree of present accessibility, the area of inaccessible land opened up, and the attraction for activities other than line maintenance.

Some sections of the line will have no access road; some will be serviced by temporary construction roads or winter roads; some sections will be serviced by an access road suitable for four-wheel drive vehicles. Thus, access will be effectively denied to vehicles unable to negotiate a road of this standard, and in many areas, to all vehicles except all-terrain vehicles or aircraft.

If the area is already suitably served by an existing road of higher standards, it would be expected that a transmission line access road will not appreciably affect the existing access. Also, it would be expected that large areas opened up by a new access road would receive more impacts than smaller areas; however, it can also be reasoned that larger areas can absorb the greater impacts of increased access more easily than smaller areas. If other factors are considered equal, impacts of increased access will depend upon the area's attractiveness for hunting, packing, camping, and sightseeing.

Alaska Power Administration presently favors multiple-use of transmission rights-of-way. Since most of the rights-of-way will be easements on State and private lands, and lands managed by other agencies, determination of access will be left to the land owners or managers.

There will be an unavoidable impact on present and future land use; the degree of this impact is a function of the existing use and the potential uses of not only the land occupied by the transmission line, but also the adjacent lands. Presently, there is little agriculture or forestry along the alternative corridors; residential areas are largely limited to the Anchorage-Palmer and Fairbanks areas.

However, future patterns of land use will change; agricultural patterns adjacent to a transmission line will be affected somewhat, depending on the crop and the method of agriculture. Since the transmission line will probably predate agricultural land use along the corridor, this impact will be slight, and probably beneficial, since a right-of-way would provide cleared land at little or no expense to the farmer. Irrigation and tilling methods will have to adapt themselves to the spacing of the towers; land occupied by the tower bases will be unusable, but this land is a small fraction of the right-of-way.

Forestry is presently limited by physical, economic, and ownership factors. Present forestry areas can easily be circumvented; potential areas may benefit from the existing access road of the transmission line not only for logging, but also for fire control. The existence of a transmission corridor in general will have a minimal impact on forestry.

Present residential areas will be unaffected by any of the alternative corridors; potential residential areas adjacent to an existing transmission line will accommodate themselves to its presence. The voltage of the transmission line precludes direct service to small communities; these will have to be served by lower voltage distribution lines, emanating from existing or future major substations. The potential for service to small communities is a significant impact in that these communities may strongly desire to tap the transmission line; if they are serviced by the transmission line, they will essentially become part of the interconnected system. Since the cost of power will most likely decrease in these communities after interconnection, some local growth can be expanded, depending on what degree the availability and cost of power was a limiting factor to growth.

The existence of a transmission corridor may tend to attract future corridors; to a considerable extent, this is a beneficial impact in that it is more economical for rights-of-way to be shared or to be adjacent; there is a lessened likelihood of large areas of wilderness to be cut into a multitude of smaller areas by redundant rights-of-way; and the possibility exists for "symbiotic" use of a right-of-way by two different types of utilities. Examples are the use of access roads for transportation and the electrification of railroads and pipelines. In corridors limited by physical and/or land-use constraints, such as the Nenana Canyon through the Alaska Range, proliferation of rights-of-way will lead to congestion; in cases such as this, it is most desirable to set a future pattern by attempting to utilize existing corridors to minimize potential congestion.

One of the most significant unavoidable adverse impacts will be upon scenic quality. A transmission line will always cause a detrimental impact; the degree of this impact is determined by the visibility and obtrusiveness of the transmission line as seen by the majority of the viewers. Since most of the viewers of the alternative corridors will be on the existing transportation routes, it is inferred that increased visibility and obtrusiveness from

However, it is impossible to hide any line from all viewers from all directions. Any transmission line is easily visible from the air; placing a line away from a road to hide it from motorists will not conceal it from hunters, hikers, and campers, to whom the line may be especially obtrusive. This dilemma becomes more severe in open country, particularly in scenic surrounds.

In summary, adverse environmental impacts will be:

- clearing of vegetation from as much as 3747 acres.

- subsequent periodic control of the regrowth on the clearing created.

- permanent removal of vegetation from tower bases, access roads, and any future substations to be added to the system.

- impacts to soil from construction and maintenance operations.

- impacts to fisheries in clearwater streams affected by construction and maintenance.

- impacts to wildlife, both beneficial and adverse, stemming from the above effects of construction and maintenance.

- visual impacts to scenic andrecreational resources from Talkeetna north to Healy.

- effects on air quality due to burning of slash resulting from clearing operations.

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RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

The transmission line can be assumed to have a very long life; as long as loads are expected to increase, as they are, and as long as the Upper Susitna project is a viable source of power, the transmission route can be considered operative. Individual components will be replaced, and it is foreseeable that the line itself may be upgraded to higher voltages and capacity, but it will still be essentially the same transmission system.

The bulk of the impacts on the environment of the line will be encountered during the relatively short construction phase. Of the long-term effects, some would terminate immediately or shortly after the retirement of the line. Some of these effects would be those springing from access road maintenance, vegetation control, noise and electromagnetic interference, (see Exhibit I "Hazards") and visual impact. Other impacts will be "imprinted" into the environment. Wildlife patterns may have been affected by continual hunting or habitat modification; these patterns will linger for a considerable time after a possible removal of the line. Vegetation patterns, altered by continual maintenance or introduction of grasses or other nonnative plants, may continue for a very long time. Unchecked regrowth of the clearing will eventually result in successional vegetation closer to the stage of the surrounding forests; this regrowth will entail habitat modifications opposite to those caused by the original clearing, but of course over a much longer time period.

The above assumes that the transmission right-of-way will retain its original function for the life of the project. However, this right-of-way may influence land use patterns that, like vegetation patterns, will linger after the term of the actual transmission line. The right-of-way may assume the function of a transportation route; this transportation route may eventually have more impact than the original transmission line and even outlive the line. Other rights-of-way may be routed adjacent to the transmission line, thus setting a regional pattern of corridors that again may outlive the lifetimes of the original utilities. A transmission line which presently pioneers a right-of-way into undeveloped areas may imprint a pattern, which although it might shift and fluctuate somewhat, will determine future land use and transportation and transmission networks for that area far beyond its own lifetime. This effect is similar for other rights-of-way which pioneer large undeveloped areas. A good example of this is the Alaska Railroad, which is now paralleled by distribution and transmission lines and a highway, and which resulted in the creation of several small communities along its length.

Another effect on the long-term productivity of the area by the transmission corridor would spring from the interconnection of the electric power grids of the two largest population centers in the State. Interconnection would enable use of the cheapest generation and the maintenance of smaller reserve capacity, while at the same time resulting in greater reliability for both systems. Interconnection would assume an importance nearly as great as the function of delivery of Upper Susitna power.

New population centers arising in the Railbelt area would be aided by proximity to this interconnected system. The growth of energy-intensive heavy industry along the corridor due to the availability of power is presently unlikely; this is due to the high transportation and labor costs of the area, which would outweigh the advantage of the availability of relatively cheap power. The construction of an interconnected power system for the Railbelt is a response to the increased demand for electric power. In itself, the availability of power is not enough to induce growth of an area; other factors, some of which are intra- and inter-regional transportation, the availability of labor, the existence of a market for manufactured goods, produce, and/or raw materials, must exist also to spur regional growth. These other factors are probably more responsible for growth than the availability of power.

There are no important potential hydro powersites close to the alternative corridors except the Wood Canyon site. The viability of this project may be enhanced by the existence of the transmission route which follows the Richardson Highway route. However, other factors such as large size of the potential project and environmental impacts of the Wood Canyon project reduce the probability of this project being spurred on by the existence of an alternative corridor.

The proposed Healy-McKinley Park 25 kv distribution line may be affected by the Nenana-1 corridor. The distribution line will add another right-of-way to a narrow canyon already occupied by two transportation lines. The construction of a transmission line could remove the necessity of part of this distribution line; a tap at McKinley Park could serve this area with power from the Upper Susitna Project. However, it has yet to be determined if the cost of a low-load tap at McKinley Park will prove more economical than an extension of a distribution line from Healy.

The proposed 230 kv CEA transmission line from Point MacKenzie around Knik Arm may provide another means of connection of the Susitna-1 corridor to the Anchorage area in conjunction with the existing submarine cables at Point MacKenzie.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The materials directly used in the construction of the transmission line and access roads will be irretrievably committed for the life of the transmission line. These materials include the aluminum and steel in the towers, aluminum and steel in the cables and guys, insulators, steel culverts, gravel and concrete. Of these, aluminum and steel have scrap value and can be recycled. Maintenance vehicles will be irretrievably committed, since their resale value after full use can be expected to be low. The fuel expended on construction and maintenance is irretrievably committed, as are other chemicals, such as paint, if steel towers are to be coated, and herbicides, if chemical control of vegetation is used.

The land occupied by the right-of-way is irreversibly committed for the life of the project, although it can revert to its original use or some other use after retirement of the line. This land can, for the most part be used for other activities, such as recreation, access, or agriculture. This is, however, at the discretion of the landowner or land-managing agency. Land use patterns may be permanently affected by the pattern originated by the transmission corridor, with effects outliving the original transmission line.

Irreversible ecological changes may result, depending upon the amount of clearing or large-scale change imposed upon an area by a right-of-way. Most of these changes, such as the maintenance of successional vegetation in an otherwise climatic forest, will eventually revert to their original condition, after retirement of the transmission line, although this may take a considerable period of time.

Mineral extraction may be affected by the location of the transmission line; such effects probably will last for the lifetime of the line, unless the line is later re-routed around ore bodies. This would not be practical for low unit-value minerals, such as sand and gravel.

Inadvertant disruption of undetected archeological sites would result in irreversible damage to such sites, reducing the amount of information obtainable and their historical or archeological value. Discovery of unharmed sites during construction will be a beneficial effect, however. All sites discovered during construction will be salvaged as prescribed by Executive Order 11593 and Public Law 93-291, an amendment to the Reservoir Salvage Act of 1960.

The labor spent in construction, operation, and maintenance of the transmission line is irreversibly committed, as are the secondary effects of the increased employment afforded.

MATERIALS AND LAND COMMITTED

Proposed System Plan	Length miles	Conductors 1/ Ton	Structures 2/ Ton	ROW 3/ acres	Maximum Clearing 4/ acres
Susitna-1: 345-kv - DC	136	4,624	13,668	2,308	2,308
Susitna-1: 345-kv - PSC		4,624	16,684	4,616	4,616
Susitna-2: 345-kv - DC	140	4,760	14,070	2,376	2,376
Susitna-2: 345-kv - PSC		4,760	17,360	4,752	4,752
Susitna-3: 345-kv - DC	129	4,556	13,467	2,274	1,900
Susitna-3: 345-kv - PSC		4,556	15,996	4,548	3,800
Susitna-4: 345-kv - DC	147	5,066	14,975	2,529	2,257
Susitna-4: 345-kv - PSC		5,066	18,226	5,058	4,514
Matanuska-1: 345-kv - DC	258	9,010	26,633	4,497	2,817
Matanuska-1: 345-kv - PSC		9,010	31,992	8,994	5,634
Matanuska-2: 345-kv - DC	385	13,056	38,592	6,516	3,869
Matanuska-2: 345-kv - PSC		13,056	47,740	13,032	7,738
Nenana-1: 230-kv - DC	198	5,108	10,692	3,000	1,439
Nenana-1: 230-kv - PSC		5,108	13,144	6,000	2,878
Nenana-2: 230-kv - DC	220	5,676	11,880	3,333	1,500
Nenana-2: 230-kv - PSC		5,676	14,508	6,666	3,000
Nenana-3: 230-kv - DC	231	5,960	12,474	3,450	1,318
Nenana-3: 230-kv - PSC		5,960	15,190	6,900	2,636
Nenana-4: 230-kv - DC	223	5,753	12,042	3,378	1,182
Nenana-4: 230-kv - PSC		5,753	13,826	6,756	2,364
Nenana-5: 230-kv - DC	212	5,470	11,448	3,212	1,364
Nenana-5: 230-kv - PSC		5,470	13,144	6,424	2,728
Delta: 230-kv - DC	280	7,224	15,120	4,242	1,727
Delta: 230-kv - PSC		7,224	17,360	8,484	3,454

1/ Assumes Rail and Pheasant conductors; can be 10% greater in rough terrain.

2/ Assumes steel free-standing tower; can be 10% greater in rough terrain.

3/ Assumes R.O.W. width of 140' for 345 kv, and 125' for 230 kv.

4/ Assumes total clearing for full width of right-of-way.

DC=Double Circuit; SC=Single Circuit; PSC=Parallel Single Circuit

MATERIALS AND LAND COMMITTED

Alternate System Plan	Length miles	Conductors 1/ Ton	Structures 2/ Ton	ROW 3/ acres	Maximum Clearing 4/ acres
Susitna-1: 230-kv - DC	136	3,509	7,344	2,060	2,060
Susitna-1: 230-kv - PSC		3,509	8,432	4,120	4,120
Susitna-2: 230-kv - DC	140	3,612	7,560	2,121	2,121
Susitna-2: 230-kv - PSC		3,612	8,680	4,242	4,242
Susitna-3: 230-kv - DC	129	3,457	7,236	2,030	1,697
Susitna-3: 230-kv - PSC		3,457	7,998	4,060	3,394
Susitna-4: 230-kv - DC	147	3,844	8,046	2,257	2,015
Susitna-4: 230-kv - PSC		3,844	9,114	4,514	4,030
Matanuska-1: 230-kv - DC	258	6,837	14,310	4,015	2,515
Matanuska-1: 230-kv - PSC		6,837	15,996	8,030	5,030
Matanuska-2: 230-kv - DC	385	9,907	20,736	5,818	3,454
Matanuska-2: 230-kv - PSC		9,907	23,870	11,636	6,908
Nenana-1: 230-kv - SC	198	2,254	6,138	3,000	1,439
Nenana-2: 230-kv - SC	220	2,838	6,820	3,333	1,500
Nenana-3: 230-kv - SC	231	2,980	7,161	3,450	1,318
Nenana-4: 230-kv - SC	223	2,876	6,913	3,378	1,182
Nenana-5: 230-kv - SC	212	2,735	6,572	3,212	1,364
Delta: 230-kv - SC	280	3,612	8,680	4,242	1,727

1/ Assumes Rail and Pheasant conductors; can be 10% greater in rough terrain.
2/ Assumes steel free-standing tower; can be 10% greater in rough terrain.
3/ Assumes R.O.W. width of 140' for 345 kv, and 125' for 230 kv.
4/ Assumes total clearing for full width of right-of-way.

DC=Double Circuit; SC=Single Circuit; PSC=Parallel Single Circuit

OTHER ALTERNATIVES TO THE PROPOSED ACTION

Alternative corridors have already been discussed and compared on the previous sections and on the matrixes in the appendix. In this section, alternatives to basic assumptions of the proposed transmission line will be discussed along with the alternative of non-construction.

Sharing of Rights-of-Way

The assumption is made in the proposed and the alternative corridors that an entirely new right-of-way will need to be obtained for the entire corridor. Sharing right-of-way with another utility (not necessarily electrical) may obviate many potential impacts in that access may already exist, reducing construction activity somewhat, and that pioneering of new corridors, with attendant problems, is no longer necessary.

The proposed transmission corridor could adjoin or share the rights-of-way of five types of systems: other electrical transmission, communication, pipelines, railroads, and highways. Although the benefit in each case is a savings in total land use, the adverse impacts upon these five systems vary. Electrical transmission systems that are jointly using one right-of-way will suffer a reduction in reliability, in that a catastrophe affecting one line, such as seismic activity, is very likely to affect the other. Safety during maintenance will decrease somewhat.

Joint use of an existing communiciation right-of-way will entail possible damage to the existing system during construction of the transmission line. Steady state noise may be induced into the communication line; the communication line will also be more vulnerable to fault and lightning damage. In the case of buried communication cables, erosion will occur unless corrective measures are used.

Pipelines are subjected to corrosion risk also. The hazards of construction damage, shock and fires or explosion will exist.

Railroads will be subjected to shock and fire hazards. Communications may suffer interference, and in the case of electric signals, induced current may cause false control signals.

Along highways, transmission lines can contribute to radio and audible noise, and in the case of accidents, can cause a fire and shock hazard.

In the case of joint use of railroad and highway rights-of-way, the risk of accidents on these systems affecting the integrity of the transmission system must also be considered.

The above risks are considered with no compensation or mitigation. For instance, corrosion of cables can be controlled, as can induced currents. Proper construction techniques will greatly minimize risk of damage. Effects such as audible noise and resulting risks of fire and explosion from accidents cannot be resolved with joint right-of-way use. However, the use of a buffer strip between right-of-way will not entail a savings in land; in the case of adjoining or partial overlap of rights-of-ways requiring clearing through forest, the use of a buffer of standing trees will realize no savings in clearing.

Not all rights-of-ways are visually compatible; for instance, sharing of right-of-way with a major highway or trail systems will cause an unacceptable scenic impact. For highways, this incompatibility must be weighed against the additional scenic visual impact of viewing the parallel, but separate rights-of-way. However, utilities not directly involving human transportation or those in commercial or industrial surroundings are suited for right-of-way sharing particularly if the utility is an existing transmission line.

On the proposed corridor to Fairbanks, the Golden Valley Electric Association owns a 138 kv transmission line from Healy to Ester. It is possible to combine this line with the proposed 230 kv double-circuit line from Devil Canyon by upgrading the proposed line to 345 kv double-circuit and adding enough width to make a 140 foot wide right-of-way. This would be a more efficient use of the land, along with the elimination of redundancy of parallel transmission lines.

Another existing right-of-way which could be shared is that of the Alyeska Pipeline. This is a right-of-way with an existing road for nearly its entire length; use of this utility would, however, entail a longer transmission line. The pumping stations along the pipeline are planned to operate with a portion of the transported oil; however, if the stations were to be electrically operated, they could draw power from an adjacent distribution line which taps the transmission line. Extra width will need to be obtained for the right-of-way if the transmission line were to follow the pipeline. The feasibility of having individual taps to serve the pumping stations is low, due to the inordinate expense involved.

One utility right-of-way closely follows the proposed transmission corridor for nearly its entire length. This is the Alaska Railroad, owned by the Federal Government and operated by the Department of Transportation.

Presently, the railroad is operated by diesel motors; if electric motors were to be used, power could be tapped from an adjacent powerline. However, due to a relatively narrow right-of-way which a transmission line could not simultaneously occupy, the right-of-way would need to be doubled on width, creating, in effect, two immediately adjacent right-of-ways. Thus, there would not be the savings of right-of-way as the previous two cases. The Alaska Railroad carries mainly freight; in 1973, the railroad operated over 1800 freight cars and 54 passenger cars. There will be some objection on the part of the passenger component to the extreme closeness of a major transmission line for 250 miles; however, this is much less of an impact than if the line were to closely parallel the Anchorage-Fairbanks highway for the same distance.

T.Y. Lin (in the Northern Engineer, Vol. 5, No. 4) proposes the construction of Integrated Pipeline Transportation, a coalescence of separate but parallel transportation corridors into one integrated structure to minimize environmental impacts, economize on construction, and increase efficiency of service and maintenance. It is possible to integrate transmission lines into such a transportation system, and would result in the best use of the land and the least impacts. However, the presence of several existing transportation routes preclude construction of such integrated transportation systems; they are most feasible in opening up new corridors of significant length, and this situation is not foreseeable in the Railbelt. Also, a transmission line integrated into such a system would require technology similar to that required by an underground cable, the next alternative to be discussed.

Underground Transmission Systems

This discussion will limit itself to the present technology of transmission systems; potential capabilities will be discussed at the end of this section. Much of this material is abstracted from the Bonneville Power Administration's draft Fiscal Year 1976 Proposed Program Environmental Impact Statement.

Underground transmissions have been found to be practical in two types of situations; one in which the costs of an underground system are less than an overhead one, such as in areas of very high right-of-way costs or where a large savings in line length is possible, such as with submarine cables. The other situation is that in which an underground system has high suitability, such as entry to substations in congested areas or eliminating the hazards of critical crossings, such as other transmission systems, and to eliminate hazards to aircraft near airports.

Neither of these two general situations exists for any appreciable length along the proposed corridor or any of the alternatives. Although underground lines will almost eliminate some impacts, such as visual impacts, they will produce other impacts not normally associated with overhead systems.

In some cases, the use of underground transmission can be justified to reduce visual impacts where these impacts are judged to be greater than the adverse impacts of undergrounding. Such a situation is typical in those highly scenic areas where the transmission structures would either be silhouetted, highly visible, or highly obtrusive, yet where the access road and trenching scar of an underground cable would not be overly visible. This sort of situation will rule out canyons and other high-relief areas, but will favor relatively flat land.

The greatest visual difference between underground and overhead transmission is obviously the lack of the transmission structures. However, an underground system in all cases will require not only an access and construction road, but also a trench which will be visible for quite some time after construction. Overhead systems, however, can be built without the need for an access or construction road, and the only excavation needed will be for the tower foundations spaced out at a rate of four or five to a mile.

If the location, design, and construction of an overhead system are properly specified, the access road and clearing will be as visible, and usually more visible, than the structures themselves. Where clearing is not needed, the most visible component will then be the access road, and as indicated, even this need not be constructed for an overhead system. In contrast, an underground system will always need a clearing in any area and will always need a construction road. Thus, an underground system in rolling or steep terrain may well be more visible than an overhead system in these situations. For this reason, coupled with the seismic risk to be discussed below, it is not recommended that the section of corridor through the Alaska Range be underground.

A major factor in the use of underground systems is the cost. Transmission systems are usually designed to meet given requirements for the least cost; in almost all situations, overhead lines will meet system requirements at a lower cost than underground cables. The A. D. Little Report to the Electric Research Council (October 1971) states that underground transmission costs can be as high as ten times greater than overhead systems, and in the case of compressed gas cable systems, up to 20 times.

Underground systems generally involve higher materials cost for the cable and for associated materials such as insulating backfill or protective sheeting. Installation is more complicated, involving excavation and backfilling and labor use is higher than for overhead systems. Splicing of a 345 kv cable can take eight or more full workdays and must be performed in specially constructed air-conditioned rooms, ("Underground Power Transmission", P.H. Rose, Science, Vol. 170, Oct. 1970).

Theoretically, overhead systems have more outages than underground systems since they are exposed to weather, vandalism, and accidents; however, unless damage is exceptionally severe, including failure of one or more towers, or access is restricted by weather, these outages are of short duration. Faults in underground cables may result in long-term outages up to several weeks; this results from the difficulty in location of the fault, the time involved in excavation and backfilling, and the time needed to replace the faulted section by splicing in a new section. Frozen ground, which persists for five or six months, will retard repair efforts more than usual.

In seismically active areas, such as can be found in the railbelt, the reliability of underground cables must be questioned. Slicing of the cable can result from settling or slumping of the soil; oil-filled or compress-gas filled cables may rupture during soil movement. Other agents can cause faulting, such as rodents, corrosion, and subsequent excavation. Location and correction of faults in a cable following quakes may involve considerable time and effort as opposed to the location of faults in an overhead system. Overhead transmission lines have more inherent resiliency than underground cables, and faults are more accessible and easier to locate.

Environmental impacts of an underground cable can be quite significant in that a continuous trench is required and an access road is mandatory for the construction vehicles and the laying of the cable. The backfilled trench may cause erosional problems, particularly if the trench cuts up or down slopes. A cleared right-of-way must be provided for maintenance vehicles needed to unearth a faulted line; however, this clearing need not be as wide as for an overhead system. Repairs will involve re-excavation, with attendant impacts due to potential erosion. An underground cable in use will continuously give off heat; this can be very serious in ice-rich permafrost areas, which occur in all of the alternative corridors. Insulating backfill will retard but not eliminate this heat flow; heat-transfer devices will be necessary to prevent excessive slumping and settling of ice-rich areas traversed by an underground cable.

Generated heat will also affect the growth of vegetation, but this does not appear to be a significant impact.

Due to the expense and difficulty of installation, underground cables are rather inflexible with regards to changing power needs. The addition of another circuit or the addition of taps for local communities is very difficult in comparison to overhead systems, where the addition of an additional circuit will not require another right-of-way, and the addition of a tap will not involve the excavation of the cable, splicing, and terminal facilities for the oil or pressurized gas insulation.

On hilly terrain, unreinforced low-pressure, oil-filled cable is subject to possible rupture due to the increased oil pressure at the low points of cables. Reinforcing and pressure compensation devices are necessary in this type of cable over hilly ground.

High-pressure oil-filled pipe cable requires a continuous high pressure maintained by pumps. This type of underground system is also subject to pressure differentials due to elevation changes.

Cables filled with nitrogen or SF6 gas contain conductors wrapped with oil-impregnated paper; on hilly terrain, this oil will seep to the lower ends, and so this cable is only suited for level terrain.

Cables insulated with solid insulation, such as cross-linked polyethylene are subject to manufacturing flaws, such as small voids, which can later develop into electrical faults; the probability of faults is proportional to the voltage. Usage is usually limited to 138 kv or lower.

A major disadvantage of underground systems is the carrying capacity dictated by capacitive reactance. Capacitive reactance is inherent in the cable construction, and results in a charging current which decreases the usable power that can be transmitted. The power loss in an underground cable is 25 to 30 times greater than for an overhead system. If a cable exceeds a certain length, its transmission capacity becomes zero. For a cable of 115 kv, this length is about 45 miles; for a 230 kv cable the length is about 35 miles. In other words, for a 230 kv cable 35 miles long, the loss is equal to the input power.

To overcome capacitive reactance losses, and thus lengthen the critical length of an underground cable, shunt reactors must be installed at periodic intervals along the cable. These shunt reactors are preferrably located above ground for access and heat dissipation, and are basically equivalent to a series of miniature substations with the attendant similar environmental impacts, high reduction in reliability, and additional costs.

Research to improve the underground transmission technology is carried on by the Department of the Interior through the Office of the Assistant Secretary for Energy and Minerals, and by private industry through the Electric Power Research Institute; private industry is making by far the greater contribution, spending $14 million during fiscal year 1974 in efforts to advance underground transmission technology.

One result of recent efforts is the Compressed Gas Insulated Bus (CGIB). Although still 10 to 20 times more expensive than overhead transmission and of untested reliability, this sytem can handle 500 kv with a critical length of up to 200 miles, a tenfold improvement over previous critical lengths for this voltage. The potential advantages of such a system include reduced visual impact, no audible noise as electromagnetic interference, small volume, simplicity of maintenance, and power handling capability approaching that for overhead systems. Bonneville Power Administration plans to operate a length of prototype 500 kv CGIB near Ellensburg, Washington starting the summer of 1974 to accumulate experience with this system. Eventually, underground cables may be expected to equal overhead systems in performance and overall reliability; however, since most of the cost of an underground system is attributable to labor, the cost differential between the two systems is not expected to decrease significantly.

APA will not recommend underground construction for this project. The present technology for underground transmission is not sufficiently advanced to assure reliability of service for a regional intertie. APA intends to follow continuing developments in undergrounding technology, but there is no indication that the disadvantages of undergrounding will be solved in the near future.

Direct Current Transmission

Direct current transmission has been used in several countries for bulk transmission of power over long distances. Due to the higher costs of conversion, this type of transmission is usually used for distances of 500 to 1,000 miles between converter stations. If no itermediate taps are planned between the generation site and Anchorage and Fairbanks, then the 136 mile and 198 mile lengths of the proposed corridors are considerably shorter than the economical distances. Intermediate taps to serve presently unconnected town and future population centers along these corridors would require converter stations and even shorter transmission lengths.

Environmental impacts of d-c transmission systems are generally the same as for a-c systems, except that d-c systems require only two conductors instead of three, and thus would require a slightly narrower right-of-way. For underground transmission, the use of direct current will obviate losses from capacitive reactance, and in this way, enhance the viability of undergrounding while imposing the additional costs of converters at each end of the cable. The use of d-c in underground systems will not lower the installed cost per cable, nor will it enhance reliability. The need for only two cables will lower the total cost versus a-c transmission, and if one cable is faulted, the other can function at half-capacity with proper grounding.

The limitations of d-c transmission presently are great enough so that it cannot be recommended for the Upper Susitna River Project. However, technological advances may eventually provide a cheaper alternative to the present converters, and thus provide the flexibility possessed by the a-c system.

Alternative System Plans

Alternative Voltages:

The proposed system plan specifies a 345 kv double circuit line from the generation site to Anchorage and a 230 kv double circuit line from the generation site to Fairbanks. The "Transmission Report" discusses an alternative system plan with a 230 kv double circuit line to Anchorage and a 230 kv single circuit line to Fairbanks. For design details, refer to the "Transmission Report".

The right-of-way width for 230 kv is 125 feet; for 345 kv it is 140 feet. Double and single circuit lines of the same voltage require identical widths. The structures needed for 345 kv are slightly larger than those for 230 kv, and in some cases, may be more visible, but this is unlikely.

The environmental impacts of this alternative voltage will be essentially identical to the proposed one. There will be some major differences, however, in the amount of right-of-way and clearing for all the alternative corridors from the generation site to Anchorage, and in the amounts of materials committed for all the alternative corridors.

Double Circuits: Stacked or Parallel Single Circuits: Both of the above alternative voltages will call for double circuits to Anchorage, and one will require a double circuit to Fairbanks. In the Description of the Proposed Action section, the use of stacked double circuits was premised. In this arrangement of circuits, both circuits occupy the same right-of-way and are supported by the same towers, such as shown in Figure 2. However, another arrangement of circuits will be proposed for those segments of the corridor requiring added reliability. Since the proposed project will be a regional intertie, there is concern for reliability by the utilities serving the Anchorage and Fairbanks areas and consulted agencies such as Bonneville Power Administration and the Bureau of Reclamation. Because of this concern, most of the proposed corridor will require a more reliable arrangement of circuits than the stacked double circuit.

This alternative arrangement of circuits for either voltage plan will call for two parallel single circuits instead of a stacked double circuit. This will not affect the system plan, as in either method, a double circuit will be provided where needed. However, a parallel single circuit will require up to twice the acreage and clearing of a stacked double circuit, which requires no more acreage or clearing than a single circuit. The major advantage of such a method will be the extra reliability provided by a redundant transmission line; outages from dropped towers or dropped conductors shorting another circuit are eliminated. The visibility of a parallel single circuit line will be different than a stacked double circuit; the towers are shorter than double circuit towers, but the number of structures per mile is twice as much. In addition, the clearing is twice as wide.

The extra reliability of a redundant transmission line may not be necessary for the entire length of a corridor, but only in those areas of high risk from winds, slides, or seismic activity. In the table on pages 108-109, the materials and land committed for each alternative corridor and both alternative system plans are presented. For each double circuit system, the equivalent material and land for the parallel single circuit system is presented also. It must be remembered that in this table, it assumed for the parallel single circuit system that the entire corridor will use this system, the actual materials and lands committed will probably be less.

Common or Divided Right-of-way for Parallel Single Circuits: When two parallel single circuits are used, they can be located either on a common right-of-way of a width up to twice the width required for a single circuit, or they can be located along two totally separate rights-of-way.

The advantages of a common right-of-way are economy of construction and maintenance in that only one access road need be built and maintained; and a better use of the land in that unusuable strips of land between rights-of-way will be minimized. Problems related to increased access will be less with a common access road than with duplicate access roads.

The reliability of parallel single circuits will be increased if separate rights-of-way are used on the theory that natural disasters affecting one circuit will probably affect the other one immediately adjacent to it. Separation of the two circuits will increase the chance of survival of at least one of the circuits. In this case, the distance of separation is understood to be on the order of up to several miles; both circuits would remain the same corridor. An additional advantage of separate rights-of-way will be flexibility for local service for communities enroute, and for local service, assuming it is decided that a community in the vicinity of the corridor of a 345 kv double circuit line will be connected to the transmission system. If two parallel single circuits are used, one right-of-way can be routed to provide a closer approach to the community, reducing the length of distribution line. The use of parallel single circuits for connection to the Anchorage area will be discussed under Alternative Endpoints.

A common right-of-way may in some instances require only half the clearing required of separate rights-of-way; in most cases, however, the amounts of clearing will be nearly equal. Both will require the same amounts of material and labor in construction. If two parallel single circuits are used, both common and separate rights-of-way may be used. In stretches of high risk of catastrophic failure, such as slide and seismic areas, separate rights-of-way are preferrable. In areas of low risk of natural disaster, economy of construction and maintenance would indicate a common right-of-way.

The cost of parallel single circuit construction on a common right-of-way is included in the "Transmission Report." Later design studies will go into greater detail on the problem of reliability.

Additional Transmission Lines Along Other Corridors: Another alternative is the construction of transmission lines along the Matanuska-1 or Matanuska-2 and the Delta corridors in conjunction with the proposed system. These corridors would not necessarily be constructed at the same time nor same voltages or capacities as the proposed system. The main advantage of such a system would be the increased reliability of redundant lines, and the interconnection of communities along the Glenn and Richardson Highways, the Copper Valley Electric Association and the interconnected system produced by the proposed system plan.

The environmental impacts of these additional corridors would essentially be the same as those outlined for Matanuska-1 and Matanuska-2 and the Delta corridors. However, the amounts of right-of-way, clearing, and materials committed will depend upon the voltage and capacities of these additional corridors. For details, refer to the "Transmission Report."

Alternative Methods of Construction and Maintenance

Access Roads versus Helicopter Construction: It is proposed to build permanent access roads for the length of both the proposed Susitna-1 and Nenana-1 corridors with the exception of unsuitable areas. These areas will be constructed by helicopter access. Where an access road is used, it will be broken at major stream crossings, stretches of poor soil or broken terrain, or where it would result in excessive visual degradation. The major sections of the access road will tie into existing transportation corridors. These breaks in the access road will also serve to limit access.

The advantages of an access road over helicopter access are: less expense per mile over most terrain; ease in transportation of machinery and materials, tower erection, stringing of conductors, and removal of merchantable timber; more reliability of access for maintenance and inspection; and multiple-use of corridor.

Disadvantages of an access road are: increased maintenance problems; unauthorized use of access road; potential increase in erosion and sedimentation; increased visibility, and more clearing required with subsequent impacts.

Since neither alternative method is suitable for the entire length of the proposed corridor, the proposed method of access is that which was judged to be most suitable to the location.

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Winter Access versus Year-Round Access: Transportation of materials and machinery and construction during winter would eliminate many impacts related to access road construction and tower erection. With total winter construction, the access road would not be necessary.

Winter road use will depend upon the topography, snow depths, soil moisture content, vegetation cover, and loaded vehicle weights. Two major abuses of winter roads are their use over insufficient snow cover, especially with vehicles of high surface loading, which can destroy the vegetative cover; and the over-compaction of snow caused by high surface loadings in deeper snow, which results in loss of insulation for surface vegetation and a more tenacious spring snowpack on the track area.

Disadvantages of winter access and construction are: the construction season would be rather limited; conditions will be harsh on men and machinery; snow and frozen ground may interfere with excavation and placement of tower footings; the lack of an access road will affect the reliability of maintenance access, and will eliminate any multiple-use of the clearing.

Considering the site of this project, it is necessary to use as much of the year as possible in order to complete construction within a reasonable time. Also, given some of the weather conditions and the length of the corridors, reliability of access is imperative, especially since there is no proposed back-up transmission line in case of a fault. Thus, whenever possible, year-round construction will be used. As outlined above, access roads will be used whenever indicated.

Alternative Methods of Clearing: Presently, some of the clearing methods used by the utilities are as simple as bulldozing over any and all trees within a set distance from the centerline of the right-of-way, insuring enough width for an access road, ease of construction, and clearance between falling trees and the conductors. This method is fairly direct, involving little discretion between what is cleared, and actually what is minimally necessary for construction and maintenance. However, this method also results in excessive disturbance of the soil and unnecessary destruction of vegetation.

Considerably cheaper and less environmentally damaging, the technique of only clearing that vegetation necessary for construction and maintenance is recommended. Instead of toppling trees with a bulldozer, selective cutting is used, allowing stumps to remain.

There are three methods of disposal of cleared vegetation: sales of merchantable timber, burning, or chipping. All three alternative methods will be used where applicable.

With no access road, machinery cannot be brought in for stacking, burning, or chipping, and downed timber will be left along the clearing.

Sale of timber will require an access road; some of the timber can be used in road construction in timber bridges and corduroy in muskeg. Also in this category is the offering of timber to any who wish to remove it for firewood; this will only be significant near settled areas, and any timber not disposed of in this way after a few months will be disposed of in other ways.

If no access road is to be used, then open burning is the only available method of disposal. A temporary decline in air quality is inevitable, and open burning, in any case, will be subject to local ordinances of the affected boroughs.

Forced-draft burning will considerably reduce particulates, but will require an access road for the large tub burners. In any case where burning is allowable, where an access road will be built, and where chipping is not necessary, forced-draft burning will be used.

In areas where large-scale burning is prohibited, or where chipping is more suitable, then slash and unsalable timber will be chipped. Although most expensive and time consuming of the three methods, chipping in many instances is preferable. Where permafrost degradation is likely, where the surface mat of vegetation has been seriously disturbed or destroyed, or on potentially erosive soils, the use of chips as a protective humus is indicated. Chips will provide a measure of insulation over ice-rich frozen soils, some protection for bare soils, and although decomposition rates are slow, an organic mulch to aid revegetation.

Since the chips will lie on the ground, and usually be somewhat wet, they will present less of a fire hazard than unchipped slash.

A fourth method of disposal is to stack slash and allow it to naturally decompose. Although this will provide a temporary habitat for small mammals, it will also provide good habitat for destructive insects, provide fuel for fires, and reduce the value of the clearing as a firebreak. Thus, this option is not recommended in the ecosystems of moderate and dense forests, specifically the bottomland spruce-poplar and dense upland spruce-hardwood ecosystems.

Alternative Methods of Clearing Maintenance: In areas of fast regrowth, some periodic suppression of tall plants is necessary. There are three major alternative methods: aerial application of herbicide, manual application of herbicide, and physical cutting of trees and brush.

Aerial spraying involves the coverage of large areas with herbicides sprayed from an airplane, or more frequently, a helicopter. Due to the non-selective nature of application and the risk of accidental overspraying, spraying of water bodies, and improper concentrations, this method will not be used.

Manual application of herbicides involves the spraying of target trees, dispersal of pellets at the base of target trees, or selective spraying of thicket of brush. It is relatively safe from the risks associated with aerial spraying, and also much more selective. It can be carried out during routine ground inspections or during scheduled programs of brush suppression.

Physical cutting involves the identification and destruction of danger trees and the periodic suppression of brush. Chain saws, brush axes, and motorized rotary axes can be used for this. The labor expended is greater than for manual application of herbicide, but is safe for use adjacent to water bodies. If large areas of brush are cut, the slash must be burned or chipped. Small amounts of slash widely dispersed will not pose an insect or fire hazard.

The proposed method of control is the manual application of herbicides with cutting in sensitive areas; aerial spraying is not proposed.

Alternative Endpoints:

For this feasibility study, it was necessary to assume endpoints to allow determination costs, clearing, etc. This in no way will finally define the endpoints of the actual transmission, just as the location of a corridor does not attempt to locate the actual placement of a transmission line within that corridor. The actual endpoints will be determined in the final design studies.

The choice of endpoints of the Nenana and Delta alternative corridors is relatively limited to those already postulated--Ester and Fairbanks. Unless new substations were to be built, these are the only two feasible choices.

The Anchorage area will need additional transmission capacity, whether the proposed transmission system is built or not. However, there are serious problems in supplying power to Anchorage. Presently, power is brought into Anchorage through the submarine cables at Point MacKenzie from the northeast via the APA 115 kv line, and from the south, which will not be of concern in this discussion. The two supplies to Anchorage via Point MacKenzie and the APA line overcome the barrier of Knik Arm in two ways: a direct crossing, and an end-run around the north of the Arm. Although most direct, the submarine cables are not as reliable as an overhead system; this was brought out in the failure of the cables caused by a dragging ship's anchor in the winter of 1974-75.

Point MacKenzie is far closer to the main load center at Anchorage than Palmer; the transmission corridor will cross relatively less developed land to approach Anchorage via Point MacKenzie than via Palmer. Power would be marketed directly to Chugach Electric Association, and wheeled over their system to Anchorage Municipal Light and Power, Homer Electric Association, Matanuska Electric Association, and the Seward Electric System.

Another possible method for connection to Anchorage, utilizing the Point MacKenzie endpoint would be the overhead crossing of Knik Arm. Placing the towers on piers across a relatively shallow section of Knik Arm would allow a more direct connection to Anchorage, avoiding both the submarine cables and the more circuitous route around the Arm. However, visibility would be high for this line, possible interference with marine and air traffic may result, and there is a possible risk of damage by pack ice to the towers.

CEA presently operates a 138 kv line from the Beluga gas turbine generation site to Point MacKenzie, designed for upgrading to 230 kv, and has proposed an extension around Knik Arm which will eventually tie into Anchorage by way of Reed Substation. An endpoint for Susitna-1 at Point MacKenzie could use this proposed line as an alternate connection to Anchorage along with the submarine cables. This would, however, be dependent upon authorization for the construction of the extension.

Delivery to the existing APA system at Palmer would avoid the limitations and risk of the submarine crossing of Knik Arm, but would involve more crossing of privately owned land. Power would be marketed directly to

Anchorage Municipal Light and Power and Chugach Electric Association. Power would be wheeled over the CEA system to HEA, SES, and MEA.

The environmental assessment for the Susitna corridor with an endpoint at Palmer would be substantially the same as that for the proposed system. Mileage, clearing, and other impacts would remain virtually the same. If the corridor were to be routed along the uplands north of the Anchorage-Fairbanks Highway, somewhat better soils would be encountered, and more privately owned land and farms would be crossed.

For the Matanuska alternative corridors, there would be more substantive differences: the corridor would be about 45 miles shorter, and would involve up to 764 acres less of right-of-way and clearing. Also, less materials would be used, and less labor expended by utilizing the Palmer endpoint.

The use of separate rights-of-way for parallel single circuits would enable the utilization of two separate endpoints chosen to maximize ease of access to Anchorage while retaining a high degree of reliability. As an example, one circuit could terminate at the Point MacKenzie cable terminal, the other could deliver power via the APA system near Palmer. Other possible combinations could be devised with endpoints of Palmer, a potential causeway across Knik Arm, and the projected Beluga extension around Knik Arm.

Another variation on endpoints would be the upgrading of the existing 115 kv APA line from Palmer to Eklutna to Anchorage. Either a single circuit or both circuits from the Upper Susitna project could be built upon this right-of-way if additional capacity was added to handle the output of the Eklutna powerplant.

The final decision on endpoints will be made in later design studies, and will be dependent upon the evolution of the existing transmission systems in the time until the final design studies.

Alternative Local Service

Along the proposed corridors are several communities not presently served by the larger utilities. These communities depend upon local diesel generation for electrical power, and not all members of these communities can afford the high cost of local generation. These communities will eventually be served with Upper Susitna power, either by a direct tap from the proposed transmission line or indirectly by extensions of existing distribution systems.

Size of the load, length and cost of the necessary distribution system extension, and distance from other presently unserved communities will determine which of these two methods will serve a community.

A community, or cluster of communities, relatively distant from existing distribution systems, yet close to the transmission system, and having an expected load of five to ten megawatts, will be likely to tap directly from the transmission line. However, a distribution system will still be necessary to deliver power from the substation to the community.

Communities with expected low loads may not justify the expense of a substation for a direct tap; these communities will have to wait for an extension of existing distribution.

<u>No Action (Non-construction)</u>

In discussing the alternative of non-construction of the proposed transmission line, the viability of the Upper Susitna hydroelectric project must be considered, since the primary purpose of the transmission line will be to deliver the generated power to the major centers in the Railbelt. In essence, non-construction of the transmission line implies non-construction of the Upper Susitna powersites.

No action will mean that the potential power of the Upper Susitna will not be made available to the Railbelt area. Since use of power is projected to increase, alternate sources of power will have to be used. If present plants are upgraded, this will result in the increased use of fossil fuels such as coal and gas. It is not likely that costs of fossil fuels will remain the same, and they will almost certainly not decrease. Development of large-scale hydro projects will probably be beyond the capability of the present utilities, so fossil fuels will be used for a relatively low-priority use whereas a renewable resource, water power, will go untapped.

If additional power sites are required to satisfy energy needs, as they probably will be, then they will require their own transmission systems to deliver their power. Thus, non-development of the Upper Susitna and its transmission system will not halt further construction of transmission systems by other agencies or utilities, and if new powersites tend to be small-scale due to inability of utilities to develop large hydro sites, then more transmission lines may result than if the Upper Susitna were to be developed.

Another effect of non-construction will be to preserve the insular and disconnected character of the utility systems presently serving the Railbelt. A transmission line to be built with the main purpose of interconnection would not be likely in the near future, and the duplication and waste of the present situation will be prolonged.

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Bureau of Reclamation
U.S. Forest Service, Alaska Region
National Park Service
Fish and Wildlife Service
National Weather Service

State of Alaska:
- Department of Environmental Conservation
- Department of Community and Regional Affairs
- Department of Natural Resources - Division of Parks
- Department of Fish and Game
- Department of Highways

Fairbanks North Star Borough
Anchorage Municipal Light and Power Department
Chugach Electric Association
Golden Valley Electric Association
Homer Electric Association
Matanuska Electric Association
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PHYSICAL AND SOCIAL CHARACTERISTICS

OF THE ENVIRONMENT

Exhibit I-1

The following appendix will discuss general characteristics of the physical and social categories used in the assessment of the proposed corridors and their alternatives. Both a definition or description of the category and a description of potential impacts in these categories from a transmission line corridor will be discussed. Note the phase "potential impacts"; not all impacts described will necessarily occur.

This section is intended only for background information; specific and more detailed treatment of the proposed corridors and their alternatives is covered under "Environmental Assessment of Corridors" and "Assessment of Impacts".

Topography and Geology

This is one of the more important categories, for topography influences most of the succeeding ones. Topography is itself a surface expression of underlying geology and tectonics (for convenience, tectonics will be considered under geology while hydrology will be covered along with topography).

The Railbelt area is characterized by three lowland areas separated by three major mountain areas. To the north is the Tanana-Kuskokwim Lowland, which is delineated by the Alaska Range to the south. The Susitna Lowland is to the southwest, bounded to the north by the Alaska Range, and to the east by the Talkeetna and Chugach Mountains. The Copper River Lowland in the east is bounded on the north by the Alaska Range, and the west by the Talkeetna Mountains. Each basin is underlain by quaternary rocks surfaced with glacial debris, alluvium, and eolian deposits. The mountains are primarily metamorphic and sedimentary rocks of the Mesozoic, with several areas of intrusive granitic rocks in the Talkeetna Mountains and the Alaska Range, and Mesozoic volcanic rocks in the Talkeetna Mountains. Figure 1 delineates the major features.

The Railbelt is an active seismic area; the 1964 earthquake was perhaps one of the most destructive earthquakes on record. The seismic history is short relative to the time over which strains accumulate to produce an earthquake, so historic seismicity is a poor guide to potential seismic risks. There are several significantly active faults in the Railbelt area. The most spectacular fault in terms of length and prominence is the Denali Fault, a long arc bisecting the entire Railbelt through the Alaska Range. Maximum expectable earthquakes in the area can be of at least a magnitude of 8.5 on the Richter Scale. Figure 2 depicts seismic history of the railbelt from 1899 to 1964.

LEGEND

SEDIMENTARY AND METAMORPHIC ROCKS

QUATERNARY
Surficial deposits, alluvium, glacial debris, eolian sand and silt

TERTIARY
Sandstone, conglomerate, shale, mudstone; nonmarine and marine

MESOZOIC
Sandstone and shale; marine and nonmarine; includes some metamorphic rocks

PALEOZOIC AND PRECAMBRIAN
Sandstone, shale, limestone; mostly marine; includes some early Mesozoic rocks

PALEOZOIC AND PRECAMBRIAN
Metamorphic rocks: schist, gneiss, etc.; mainly Paleozoic

IGNEOUS ROCKS

Quaternary and Tertiary volcanic rocks

Mesozoic intrusive rocks; mainly granitic

Mesozoic volcanic rocks

Paleozoic volcanic rocks

Paleozoic intrusive rocks; granitic and ultramafic

Fault
(Dashed where inferred)

Source: U.S.G.S.
APA-1975

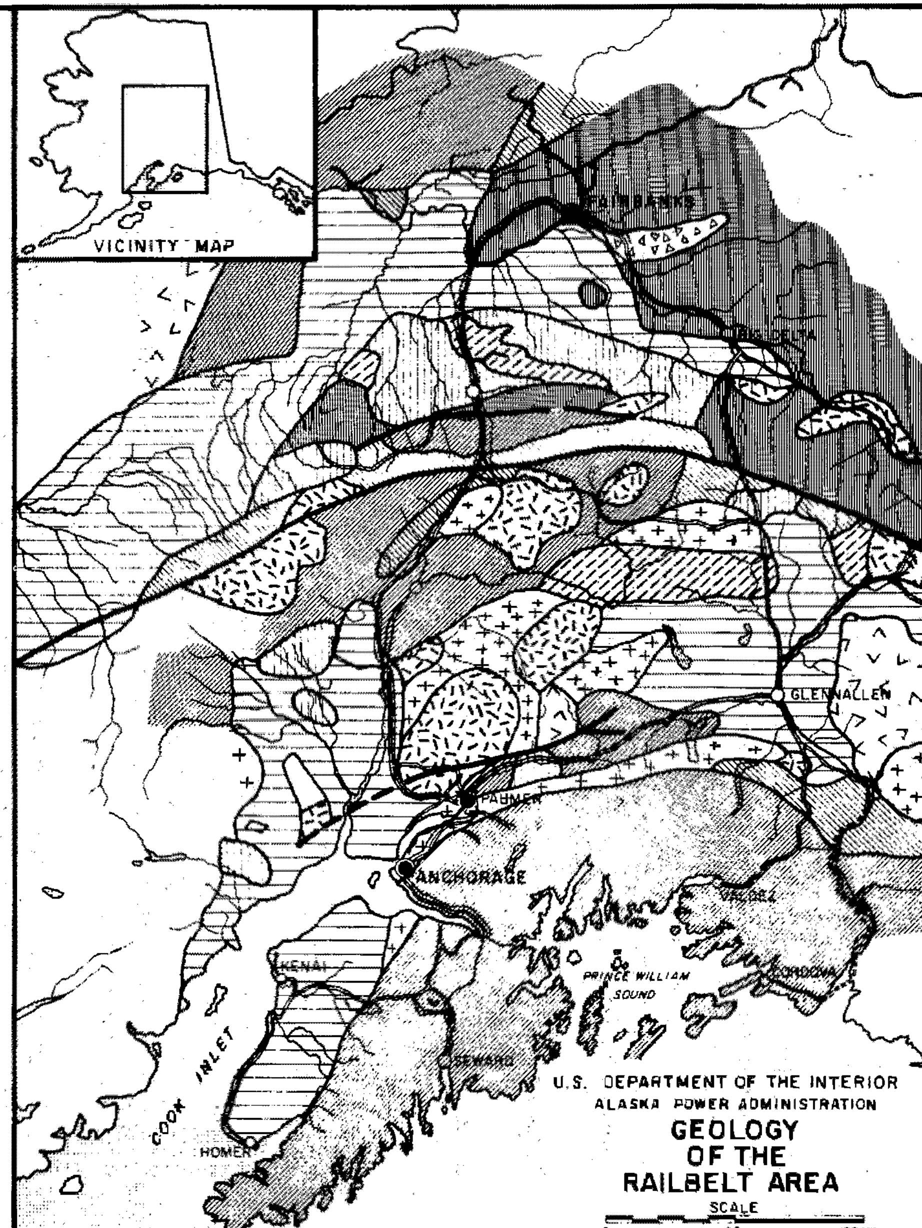
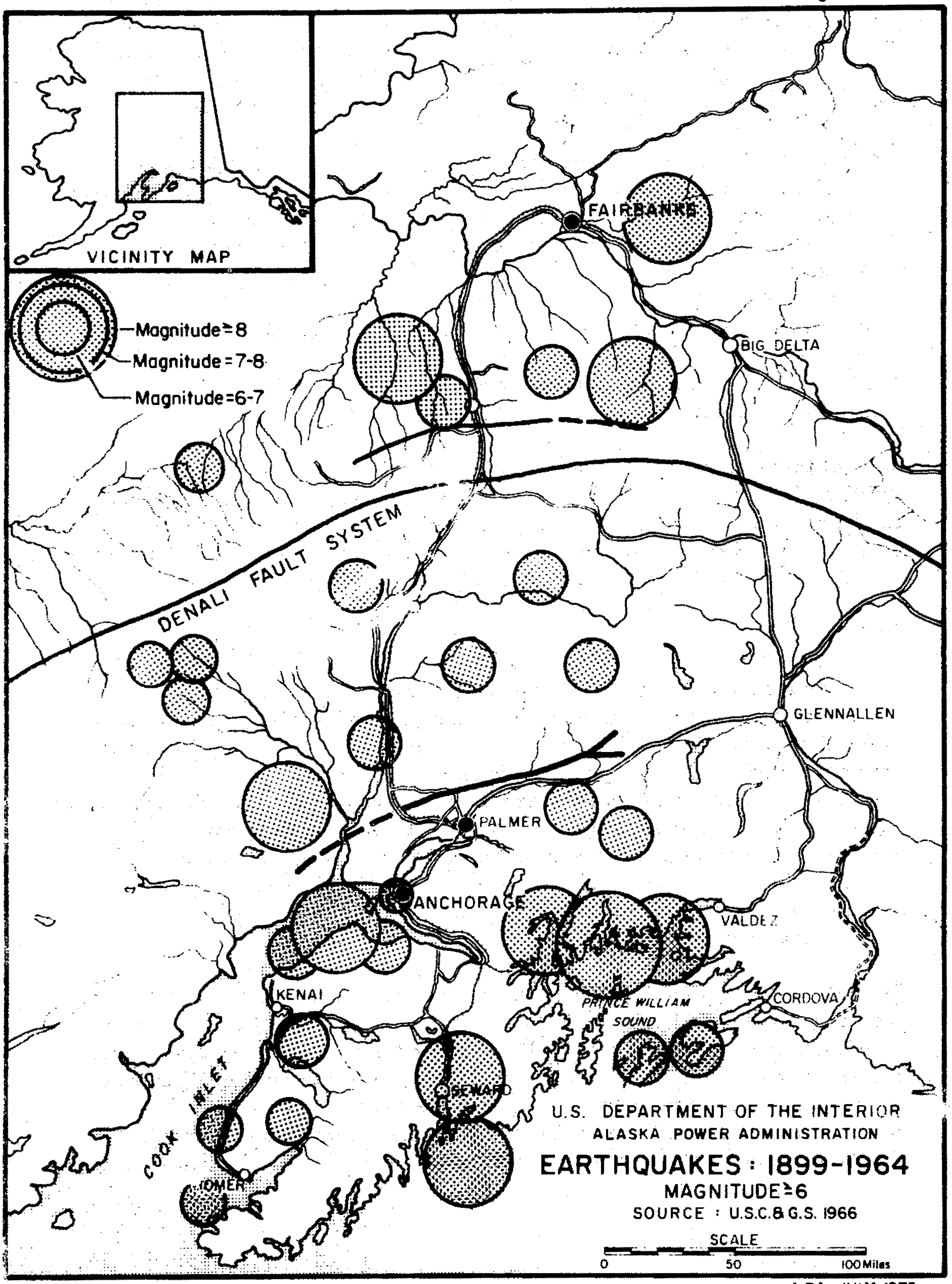


Figure 1

Figure 2



A.P.A.-JULY 1975

The Alaska Range, within the area under consideration, is pierced by two tributaries of the Tanana River, the Nenana and Delta Rivers. The rivers to the north of the range for the most part flow from glacial sources, through the rolling northern foot hills, and then directly north to feed into the Tanana River.

The Susitna River starts from glacial origins quite close to those of the Nenana River. The upper Susitna drains a large plateau and foothill area, debouching onto a wide flood plain from the junction with the Chulitna and Talkeetna Rivers, then flowing south to its mouth in Cook Inlet.

The Gulkana and Nelchina Rivers are both tributaries of the Copper River. The Gulkana has its glacial origins on the Alaska Range, the Nelchina from glacial and clearwater origins in the Talkeetna and Chugach Mountains.

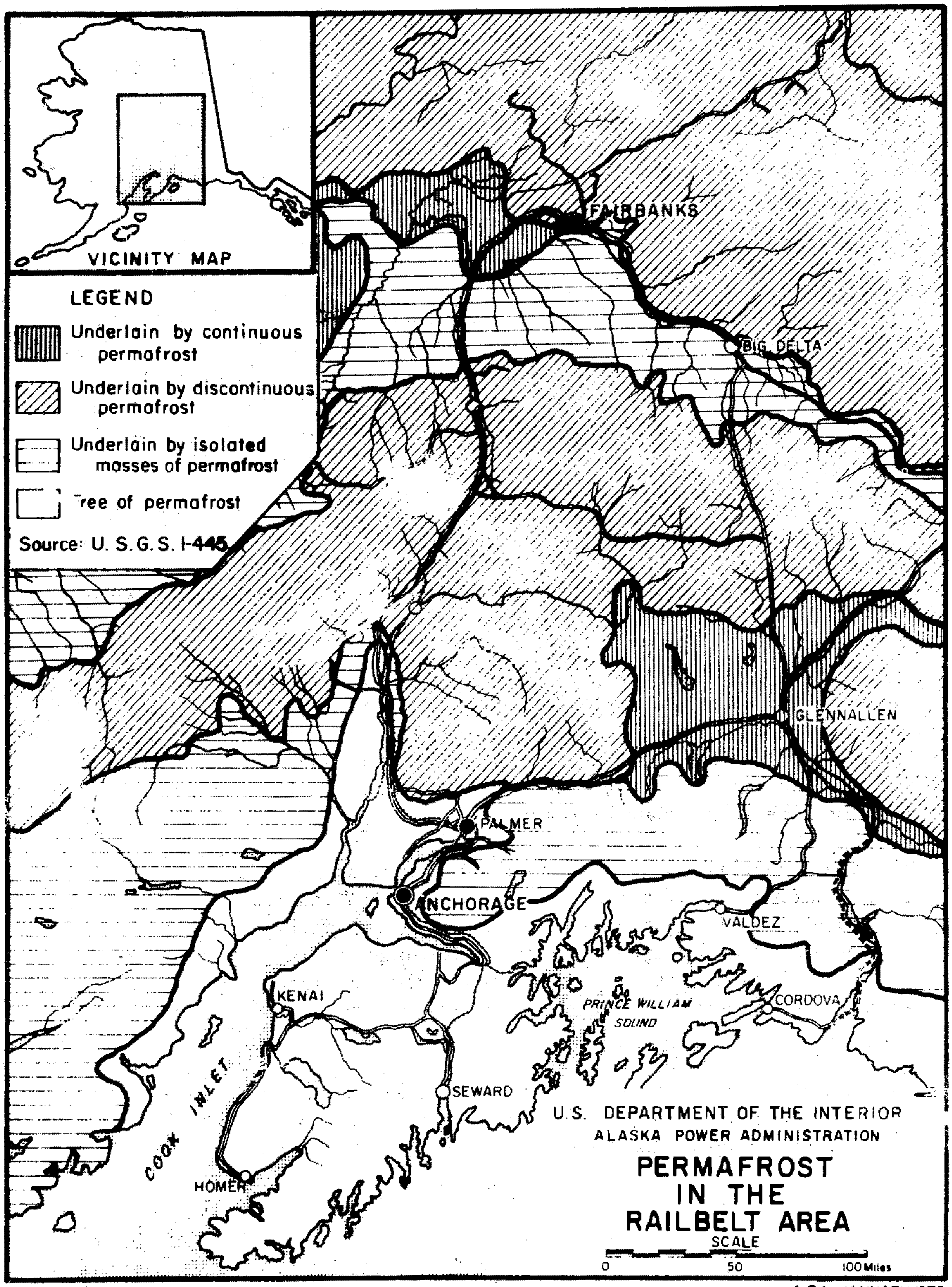
Most of these river systems experience high flows starting in late April and continuing through late summer, diminishing to minimums in March or early April. Breakup usually precedes the snow melt and occurs in late April or early May. Glacial-fed streams are subject to violent flow and rapid channel changes.

Soils

Soils are a function of geology, vegetation, and climate. Climate, particularly, plays an important role in soil formation and distribution, being the cause of one of the more well-known attributes of northern soils--permafrost. In general, soils in both the taiga and tundra region are shallow and profiles are poorly developed. Slow decomposition rates limit the nutrient supply; insolation is low and the yearly average soil temperature is low, often below freezing. In general, subarctic brown forest soils dominate north of the Alaska Range, podzols dominate south of the Range, and bog and half-bog soils are found everywhere.

Permafrost is the result of an annual soil temperature near or below freezing. Technically, permafrost is that part of the soil and bedrock which has had a temperature of 0^{o} or lower for at least two years. Thus, frozen rock and dry soils can be considered to be permafrost; however, ice-rich soils are generally the types of permafrost of most concern to man-made projects. Permafrost is generally continuous north of the Alaska Range and sporadic south of it; its depth and thickness vary considerably.

Figure 3



A.P.A.-JANUARY 1975

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The soil above the permafrost table which thaws in summer is known as the active layer. Since ice-rich permafrost is relatively impermeable, a shallow active layer will tend to be quite moist; runoff is slight due to low evaporation rates and low soil permeability, so even in the relatively dry interior there is considerable soil moisture. The active layer, if of finegrain material, is very susceptible to frost action, such as heaves and formation of ice lenses. Shallow moist active layers may be lubricated due to excessive moisture at the permafrost table, resulting in mass wasting on even gentle slopes, called solifluction.

The vegetative cover has a strong influence on permafrost; the relatively high reflectance of solar radiation (albedo) limits insolation, and the insulation provided limits heat transfer from above. Other factors in permafrost distribution are slope and aspect, and underlying parent material. Due to the warmer mean annual temperature, the equilibrium between vegetation and permafrost can be more delicate in taiga than in tundra areas. For general permafrost distribution, see Figure 3.

Most soils are of glacial origin; either directly from morainal material; or from glaciolacustrine or glaciofluvial materials; or from loess, or wind deposited material of glacial origin. Some of these origins are evident in the continuing deposition of the major rivers springing from the Alaska Range.

Low temperatures and high soil moisture combine to cause slow decomposition of organic material and subsequently cause the ubiquitious bogs and muskeg, typified by peat layers over finegrain material, supporting little else than black spruce and sedges. Bogs and muskegs are especially prevalent in the flood plains of rivers and level areas underlain by permafrost.

The major impacts of a transmission line will be as a result of construction activities and of any access roads. Construction activities, with their potential for breaking the surface mat of vegetation and disruption of surface drainage, can possibly result in wind and water erosion. The existence and maintenance of an access road may cause erosion, though to a lesser degree than construction activities.

Groundwater regime and surface drainage may be altered by an access road, particularly on finegrain soils. This could result in creation of bogs on flat land or gullying on side slopes.

Destruction of permafrost and the resultant settling and erosion may result from increased insolation where the vegetation mat has been destroyed, either from direct destruction from vehicles, or from over-compaction of winter roads. Destruction of permafrost may also occur from erosion and severe wildfires. Fire control procedures may result in greater damage to the vegetation cover than that caused by the fire itself.

Other potential results from destruction of permafrost are lowering of the water table with an increase in thickness of the active layer, and slope instability which manifests itself as slumping and solifluction.

In some local areas, thixotropic soils exist, which become plastic under stress such as would be caused by earthquake. The integrity of a transmission line can be threatened in these situations either by failure of tower foundations or by slide or slumps.

Wet, finegrain soils are particularly vulnerable to frost-heaving, which could cause damage to tower footings and the roadway; since heaving is a seasonal phenomenon, this might result in constant maintenance of these areas.

Vegetation

There are seven general vegetation types present within the study area. They are classified as to the predominant vegetation type and topographic location; this classification is derived from that of the ecosystem classification of the Joint Federal-State Land Use Planning Commission. These are depicted in Figure 4; forest density in Figure 5.

Bottom land spruce-poplar is confined to broad flood plains and river terraces, and warmer south slopes of major rivers. Characteristic vegetation is white spruce, balsam poplar, birch and aspen.

Upland spruce-hardwood is similar to bottomland spruce-poplar in the presence of the same characteristic trees, but is limited to the higher portions of watersheds. Actual species composition varies due to slope and exposure.

Lowland spruce-hardwood is generally found on poorer soils or sites, such as on peat, glacial deposits, outwash plains and alluvial fans, or on north-facing slopes. Characteristic trees are white spruce, black spruce, tamarack, aspen and birch.

Legend

- Coastal Hemlock-Spruce
- Bottomland Spruce-Poplar
- Upland Spruce-Hardwood
- Lowland Spruce-Hardwood
- High Brush
- Low Brush, Muskeg-Bog
- Moist Tundra
- Alpine Tundra
- Wet Tundra

Source: Joint Federal-State Land Use Planning Commission

APA - July 1975

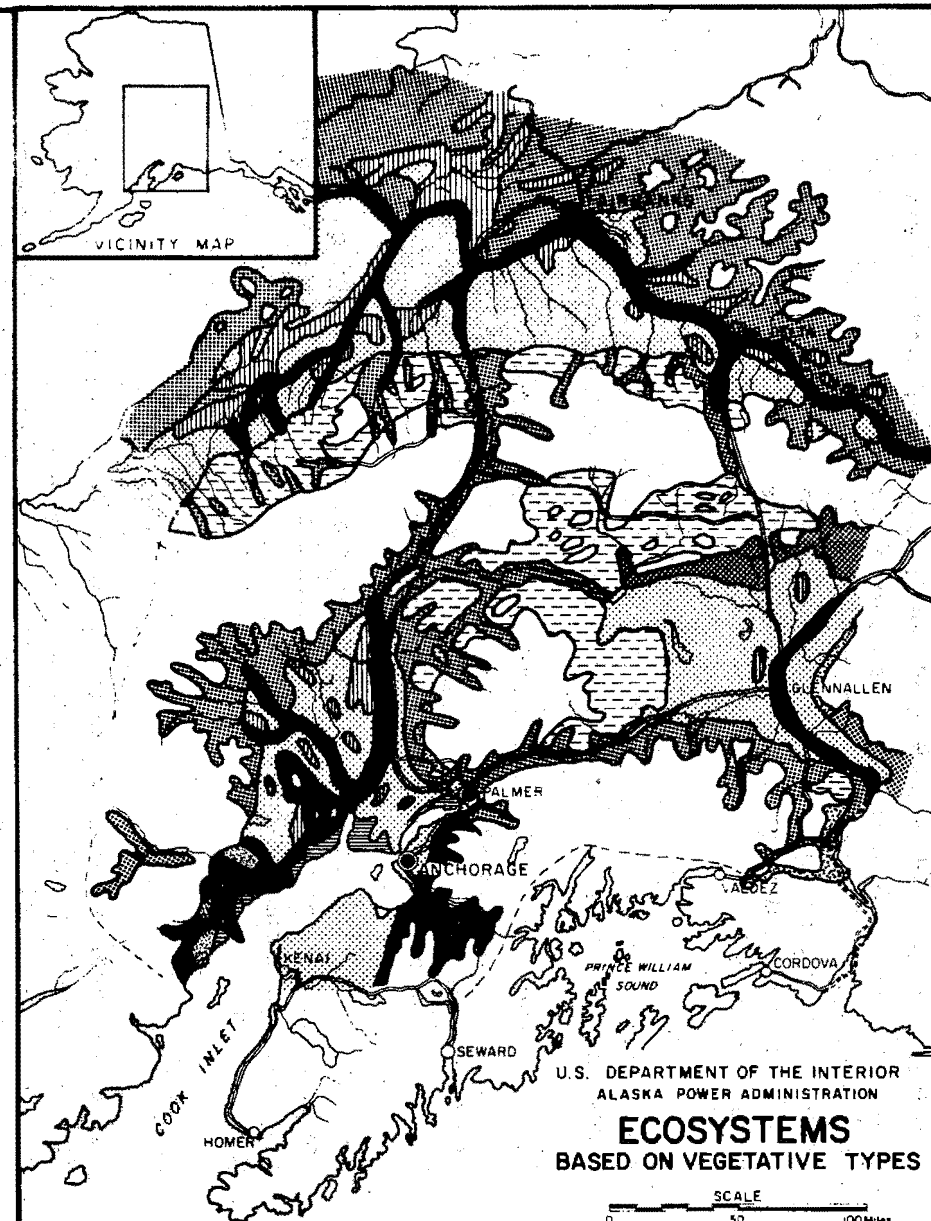
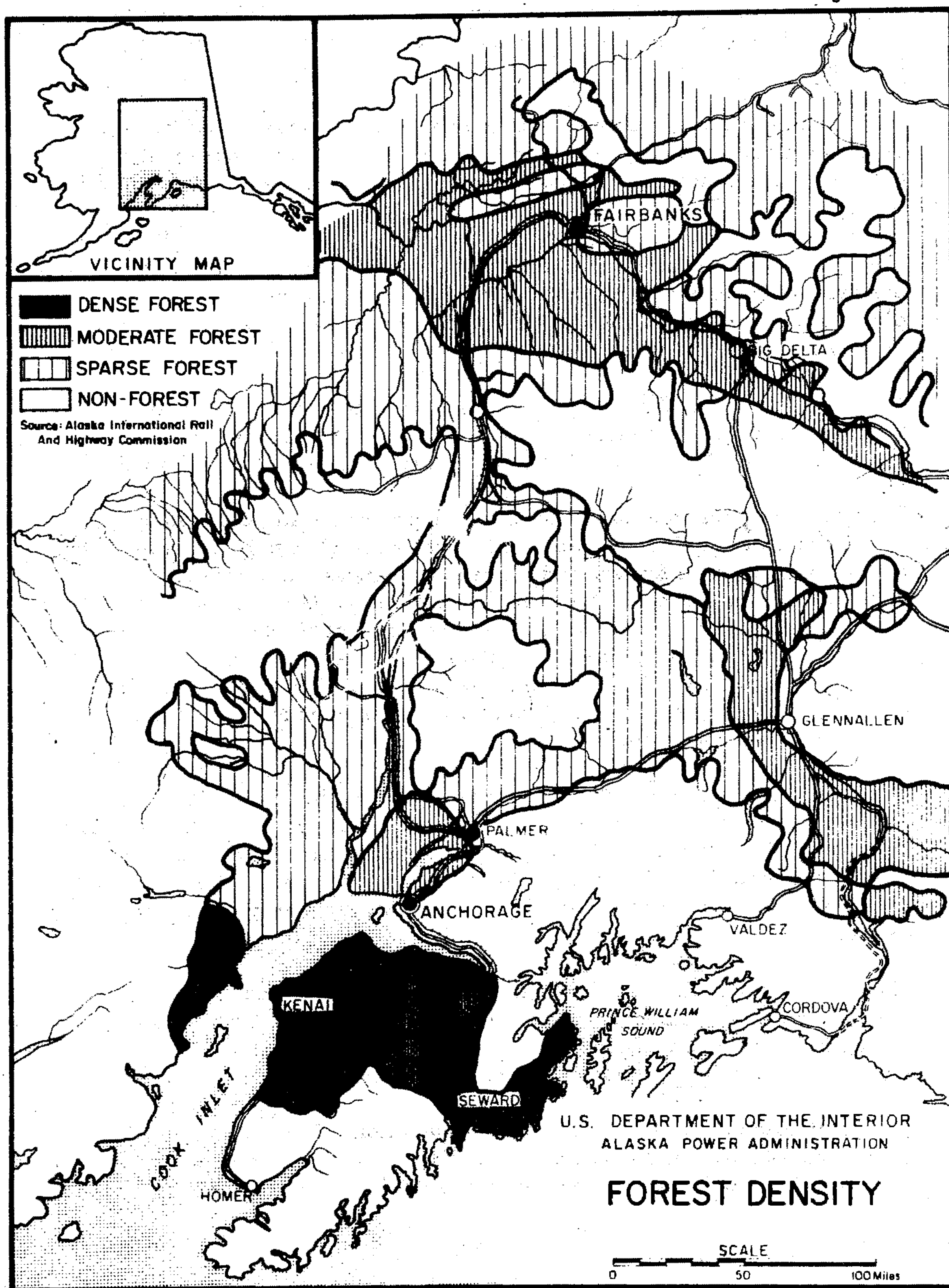


Figure 4

Figure 5



A.P.A. - JULY 1975

High bush includes two sub-types. One exists just above timberline in mountainous areas, the other exists on active flood plains of major rivers. Characteristic plants are aspen, balsam poplar, alders and berries.

Low bush, bog, and muskeg is formed usually on outwash and old river terraces, in filling ponds and sloughs, and throughout lowlands. Characteristic plants are tamarack, black spruce, alders, willows, and berries.

Moist tundra exists on the rolling foothills of the Alaska Range and the higher portions of the upper Susitna River. Characteristic plants are dwarf willows and birches, Labrador tea, green alder, and berries.

Alpine tundra typically is found in mountain areas, generally above the forest and brush systems. Characteristic plants are resin birch, Labrador tea, mountain heath, rhododendron and dwarf blueberry.

Vegetation is a function of climate, soil, topography and other factors, among which is wildfire. Natural wildfires have always been an important part of taiga (boreal forest) and tundra ecosystems, and vegetation mosaics are often an expression of past wildfires. Many taiga species show adaptations to fire; for example, the cones of black spruce open with heat and thus are among the earliest colonizers of burnt-over areas. Fire can prevent vegetation systems from reaching a climactic stage by periodic destruction of forest, to the benefit of successional vegetation, such as brush.

Primal productivity in taiga ecosystems is highest in successional brush and lowest in black spruce, muskegs and bogs. Therefore, agents such as wildfire and active flood plains can increase and maintain primal productivity. Secondary effects of these agents can be increased forage for mammals and deepening of the active layer in permafrost areas.

Most of the direct impacts of a transmission line and access road upon vegetation are small because of the insignificant ratio of land occupied by the line, road, borrow pits, etc. to the surrounding unaffected land. Some secondary impacts are of greater consequence.

The most obvious impact is the loss of vegetation. This is limited to the access road, and temporarily, the right-of-way. Primary productivity may be decreased; in forested areas it will probably be increased. Limited regrowth and maintenance along the right-of-way will result in a subclimax plant community in forested areas; regrowth in brush and tundra areas will eventually reach climax as far as natural conditions allow. In any case, direct changes in primary productivity along the right-of-way upon the total productivity of the area are negligible.

There is a potential for introduction of non-native or "weed" species into cleared areas. However, few plants not already adapted to the harsh climate, especially of the tundras, will be able to compete with the native species.

Where clearing has resulted in slash and debris, this slash must be disposed of. Although stacked or dispersed slash may provide habitat for small animals, there is a high potential that slash may result in increased fire hazard and increases in insect populations and possibly affecting sorrounding forests. Slash can be burned in the open, burned in forced-draft burners, or chipped. Open burning results in considerable smoke and ash, yet is simple and direct. Forced-draft burning is more expensive than open burning. Both burning methods are subject to open burning ordinances of boroughs. Chipping eliminates smoke and ash entirely, but is very expensive and requires more machinery to travel along the right-of-way. Disposal of the chips is a problem, because ideally they should be dispersed to prevent killing the plants on the ground. Since decomposition rates are slow, chips may not revert to humus for quite some time. Disposal of chips in lakes and ponds will result in eutrophication and contamination.

Slow growth rates will keep vegetation management along the right-of-way to a minimal maintenance. Periodic control will still be necessary in forest areas however. Mechanical control, the physical destruction of trees, can be time consuming, expensive, and detrimental to the right-of-way cover. The use of brush hogs and other large mechanized clearing machines is not only inefficient, but also entails damage to the soil and small plants. Cutting will again raise the problem of slash disposal.

The use of herbicides to control vegetation in the right-of-way is considerably cheaper than physical destruction. Herbicides can either be of a broad-spectrum type or species-specific; application can be from the air or on the right-of-way.

Overspray and drifting are problems with aerial application; application on the ground is much more selective and accurate. Degeneration of herbicides depends on the chemical used, soil temperature, moisture, texture, and the rate of biodegradation. Most herbicides used in right-of-way control are of low toxicity to animals, and appear to be non-cumulative, unlike many pesticides. Contamination of lakes and streams is possible; potential destruction of aquatic plants may result, destroying fish habitat. However, this possibility is offset by the decomposition and dilution of herbicides. There is little or no evidence of long-term accumulation of herbicides on the soil; leaching, sunlight, microbial action, and degradation by vegetation itself inhibits accumulation.

Physical disruption of the vegetative mat, either from clearing or machine tracks, or from road construction, will reduce the insulation of frozen soil from summer warmth. The exposure of darker soil will increase warmth from insolation; these factors can combine to alter the permafrost-vegetation relationship. Settling from permafrost destruction will cause erosion and thermokarst; lowering of the permafrost table will alter the ground water regime. These effects in turn will affect the vegetation cover. Areas with thin permafrost, such as in the taiga, are in a more delicate balance with vegetation than more heavily frozen areas, particularly if the active layer is shallow also. Experience in farming in the Tanana Valley has shown that lowering of the permafrost table due to disruption of the original vegetation can also cause lowering of the water table and subsequent changes in vegetation due to a deeper active layer and dryer topsoil.

Although taiga ecosystems are adapted to wildfire, exceptionally deep-burning fires in peat can change the permafrost regime of an area, with subsequent change in vegetation. Excessive repetition of fires in an area can achieve the same result, and also can have a result of maintaining a low subclimax vegetation. Secondary impacts to wildlife are varied, from destruction of habitat and cover to enhanced habitat due to increased primary productivity. Construction and maintenance activities provide additional potential for fire; to what degree fires will increase is impossible to predict. Potential man-caused fires depend upon the distribution and flammability of plant communities along the right-of-way, the seasonal schedule of construction, and annual climatic variation. During construction, potential of man-caused fire will be great, but detection should be early, and areas burned small. During operation and maintenance of the transmission line, potential of man-caused fire will be low, but detection slower, and consequently, areas burned will be larger. Operation of fire-fighting machinery off the access roads may cause considerable damage.

Various plant communities differ in rate of fire spread and resistance to fire control:

Type	Rate of Spread	Resistance to Control
Upland Spruce-Hardwood	High	Medium
Lowland Spruce-Hardwood	High	High
Bottomland Spruce-Poplar	Medium	High
High Brush	Low	High
Moist Tundra	Medium	Medium
Alpine Tundra	High	Low

Man-caused fire potential exists mainly during the period of May through September. Uncontrolled use of access roads will increase the potential for man-caused fires.

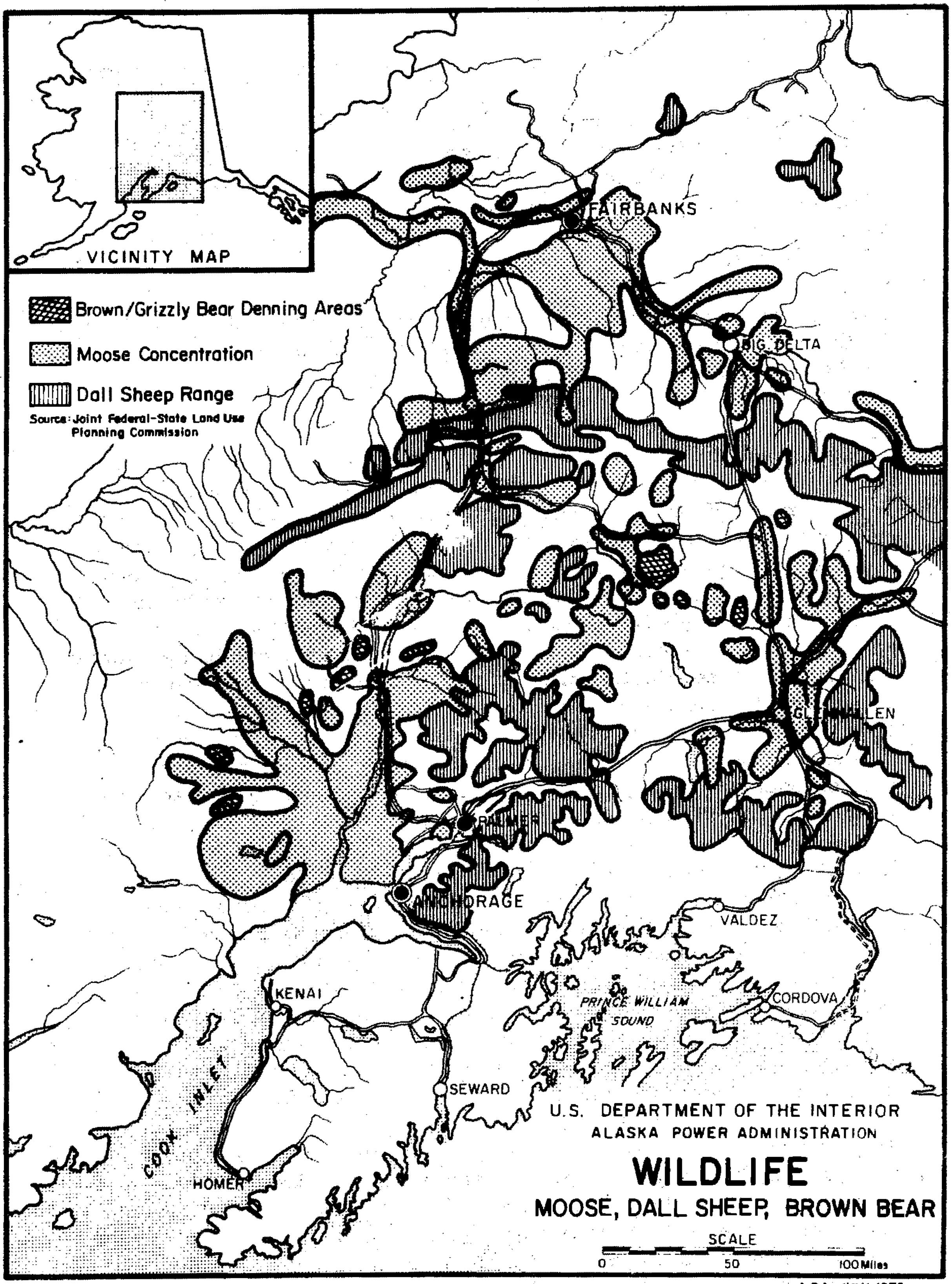
Wildlife

Some generalities can be drawn for as the fauna of the taiga and tundra ecosystems. The most important factor governing wildlife populations and distribution is the relatively low primal productivity of the taiga, and the even lower productivity of the tundra. Herbivore-based food chains are more developed and diverse on the taiga then the tundra. In both areas, a relatively small number of herbivore species exist, with less on the tundra. Some herbivores experience cyclical population fluctuations; these fluctuations are coupled to fluctuations in predator populations. There is high mobility of the larger mammals and birds. Migrating mammals are an expression of the low bearing capacity of the land for large herbivores. Migrating birds reflect extremes in the seasonal availability of food. Sapravory (consuming of dead plant and animal material) plays an important role in the food chain.

The low number of species in the tundra ecosystem food chain makes this an extremely sensitive area. A disturbance affecting one species will have an inordinate subsequent effect on other species in the food chain. An expression of this tenuous balance is in the fluctuations in populations. Examples of these fluctuations are the periodic explosions of limming and snowshoe hare populations, which are related to the somewhat milder and slightly lagging fluctuations of predators, such as lynx or wolf. Distribution of moose, bear, Dahl sheep, caribou, bison and waterfowl are shown in Figures 6, 7, and 8.

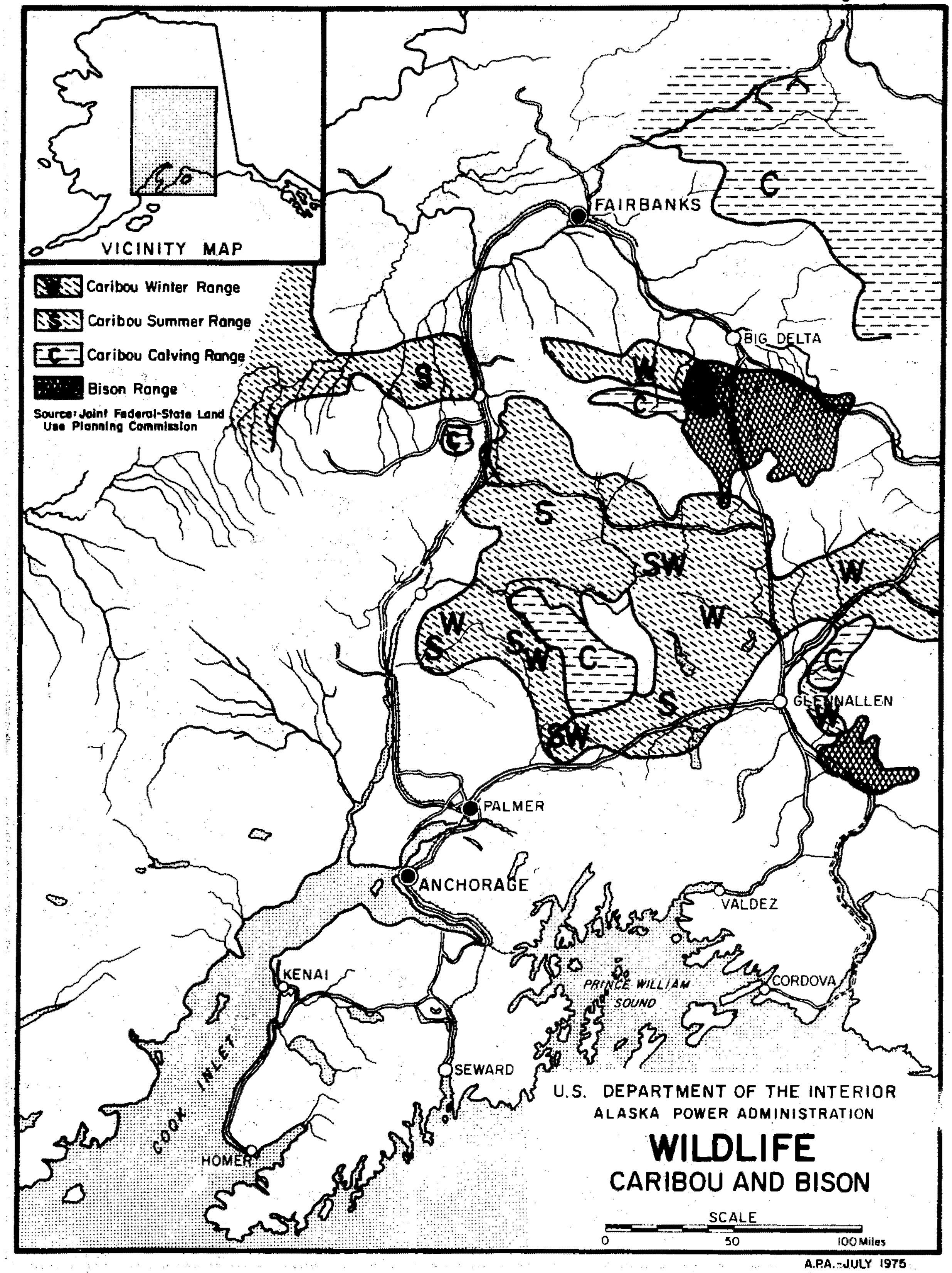
Aquatic ecosystems have similar features of the above terrestrial ecosystems. Low species diversity, low growth rates, and long life spans are characteristics of the lake fish. Anadromous fish such as salmon are extremely important in the railbelt area; the lower Susitna, Copper, and Tanana Rivers are the basis for a considerable commercial, subsistence, and sport fishery.

Figure 6



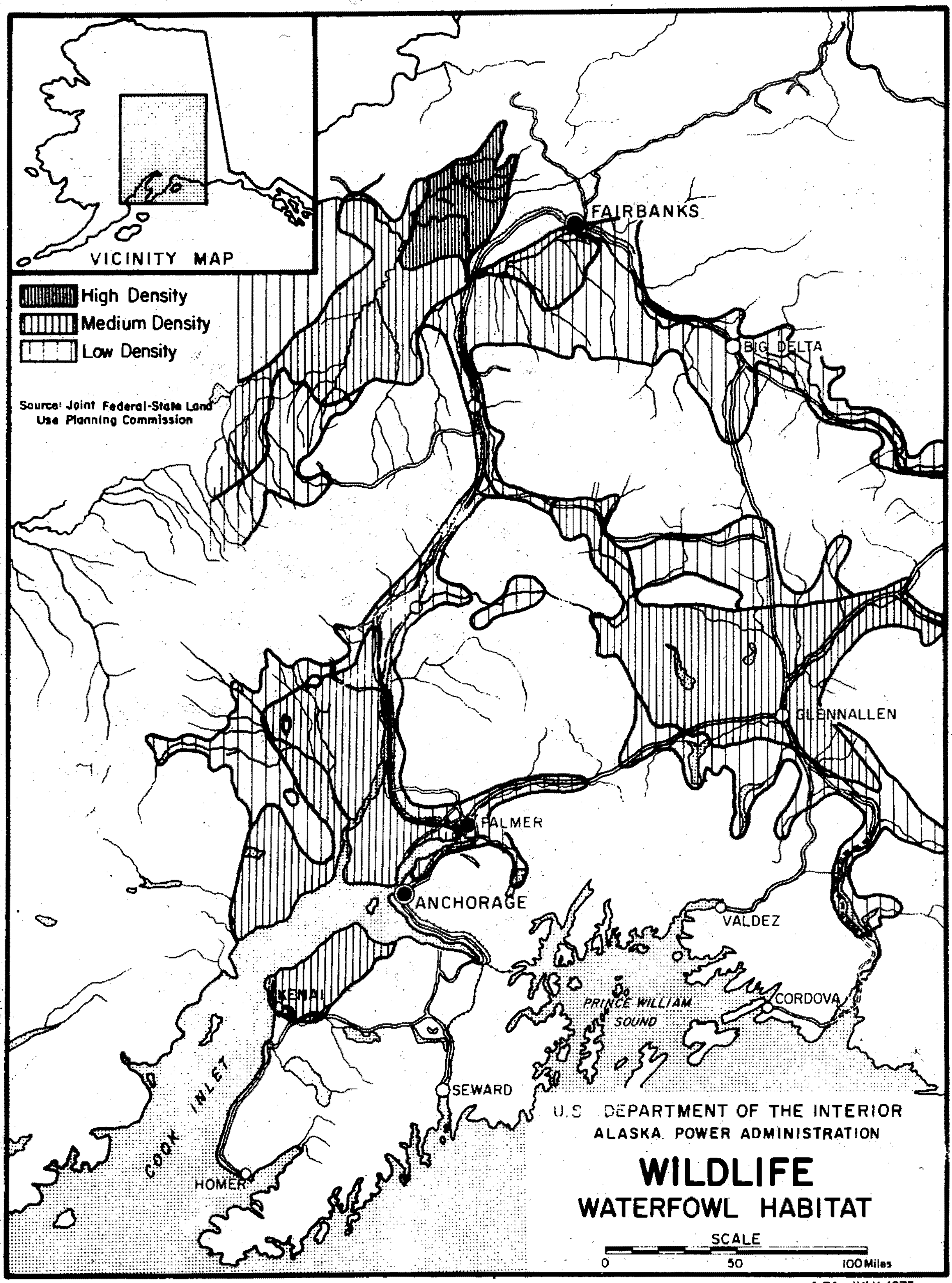
A.P.A.- JULY 1975

Figure 7



VICINITY MAP
Caribou Winter Range
Caribou Summer Range
Caribou Calving Range
Bison Range
Source: Joint Federal-State Land Use Planning Commission
FAIRBANKS
BIG DELTA
GLENNALLEN
PALMER
ANCHORAGE
VALDEZ
KENAI
CORDOVA
PRINCE WILLIAM SOUND
COOK INLET
SEWARD
HOMER
S
W
C
SW
U.S. DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
WILDLIFE
CARIBOU AND BISON
SCALE
0
50
100 Miles
A.P.A.-JULY 1975

Figure 8



A.P.A.-JULY 1975

A transmission line per se will not have many impacts upon wildlife; most of the impacts will be as a result of construction and maintenance. Direct destruction will affect the less mobile animals such as the small mammals, whose territories may be small enough to be encompassed by the construction area. The significance of this impact is small in relation to the animal population in the surrounding areas unless the area effected is a key area for a particular species. The construction area will be reinvaded to a degree by animals from the surrounding area after the line is built and regrowth proceeds. Hunting and trapping by construction workers can be considered direct destruction; mortality from project-related fires can also be considered direct destruction.

A more serious impact than direct destruction is the preemption of habitat. Animals forced out of their habitat by construction may not find another niche; this assumes that the land is at its carrying capacity for that species which is affected. Some animals, such as carnivores, will flee at almost all human intrusion; if they are forced into a lower-grade area, or are dislocated for a long period, they will be weakened and increased mortality can be expected.

Deliberate or inadvertent harassment of wildlife, particularly large mammals, will be a serious impact. Flights to construction sites, maintenance flights, and operation of vehicles on open areas, all have the potential for animal harassment. Harassment during calving for sheep and caribou can cause increased stillbirth.

Although a transmission and access road will not impose a barrier to migration of caribou, construction work during certain seasons may inhibit herds from approaching work areas. The creation of a cleared corridor through heavy forest may result in increased animal movement along the right-of-way.

Migrating birds may suffer some mortality from collisions with towers of lines, but these losses should be negligible. Collisions of birds will be most likely near areas of bird congregations, such as resting or feeding areas, particularly during times of poor visibility and during takeoff or landing. The cables are not spaced close enough nor are they invisible enough to be efficient snares. The size of conductor for the 230 kv line is 1.4 inches across and the spacing is 18 to 40 feet between cables. The probability of a bird flying in an appropriate area at the right elevation and at the proper angle to the line simultaneously is rather small.

Electrocution of birds is also unlikely; the distance between lines over 115 kv and between lines and ground is great enough to make shorting out by a bird almost impossible. Birds can safely perch on cables or towers. There is little experience of proven bird fatalities from collision or electrocution with the present APA transmission lines in Juneau and Anchorage.

The most significant impacts result from habitat modification resulting from impacts on soils and vegetation. Clearing in forest areas and maintenance of a subclimax plant community of brush and low plants will enhance habitat by increasing the primary productivity of the cleared area. Browse for moose will be increased; the conjunction of good cover in the original forest with a swath of browse creates a diverse "edge" habitat for many animals dependent on subclimax growth. Animals dependent on climax or near-climax vegetation will suffer loss of habitat; examples are the red squirrel and northern flying squirrel, both of which depend upon White Spruce.

Destruction of climatic lichen on tundra areas will destroy winter browse for caribou. The decline of the caribou herds in Alaska is attributed not only to hunting, but also to destruction of tundra lichen by man-caused fires. Lichen is the key browse for caribou, for it is their prime food during the winter. It is estimated that approximately 50 years are required for a burned area to recover a usable cover of lichen for caribou.

Destruction of climactic vegetation by fire often enhances moose habitat. Tiaga ecosystems are adapted to wildfire, and present mosaics of vegetation communities are often a reflection of former fires. An increase of fires resulting from man-made causes will, up to a point, have not much more impact than the incidence of lightning-caused fires. A significant increase over natural-caused fires will result in increased mortality from fires, excessive destruction of cover and habitat for wildlife dependent upon climactic or near-climactic vegetation, increased silting of rivers and lakes, potential disruption of seasonal habits and migrations, and potential disruption of the permafrost-vegetation relationship.

Impact upon aquatic life from a transmission line should be small. The aquatic food chain in the taiga and tundra is extremely simple, and as a result, disruption of habitat for one species quite often indirectly affects many other species. Potential impacts are the increased sedimentation of rivers and lakes; alteration of flows; eutrophication and pollution of lakes and streams; disruption of habitat due to gravel borrow, fill, and excavation; and withdrawal of water, especially during winter.

Sedimentation can result from erosion along the construction sites, burned-over areas, borrow pits, and river crossings. The impact of sedimentation depends upon the severity of sedimentation, the existing water quality, and the amount of aquatic life in the stream or lake.

In rivers already carrying glacial sediment, the effect of man-caused sedimentation will be slight. Clear water streams and lakes supporting large aquatic populations will be most affected. Suspended sediment can cause gill damage in fish and sediment settling out of suspension can fill interstices in gravel beds, reducing suitability for spawning.

Alteration of drainage by an access road may influence river flow, but a transmission line project should not affect surface drainage to any appreciable degree.

Spills of oil or fuel, herbicides, and other chemicals into water bodies will impact aquatic habitat. Fast-flowing streams will be the least affected by spills, due to the rapid dispersal and dilution of the contaminant; lakes and slow streams will be most affected. The actual impact is dependent upon the type of spill, the amount, and the volume of water affected. Addition of excessive nutrients or organic matter to lakes, such as disposal of slash, may cause eutrophication, either from excessive algal growth or from decomposition or organic material. Excessive oxygen depletion in lake waters will lead to fish kills.

Alteration of stream and lake beds will destroy habitat. Some of the alterations, such as gravel extraction, will add an inordinate amount of sediment to a clear water stream.

A secondary impact of great significance to wildlife from a transmission line will be the increased access to areas now unserviced by roads. If an access road is maintained for line maintenance, it is very likely that it will be used by the public. Bonneville Power Administration has experienced unauthorized public use of those access roads which are supposedly closed to all non-maintenance use. To many mammals, the presence of man has an impact, particularly the presence of hunters. Increased access to presently inaccessible areas will certainly add to hunting pressures on game in those areas. The degree of the impact depends upon regulation by game management agencies, the quality of the area for hunting, and the season.

Climate

This category adheres to the definition of climate, that is, the average weather conditions over a long period; however, there are very few climatic data for the study area, particularly in regards to wind speeds. Thus, each segment is assigned to one or more of three general climatic zones. These are the Transitional, Interior, and Mountain zones.

The Transitional Zone is a modified continental climate, having some of the characteristics of the Maritime Zone along the coast of the Gulf of Alaska, yet being partially subject to the greater temperature extremes and drier climate of the Interior Zone.

The yearly average temperature for this zone is about 29°F in the northerly part to 38° in the southerly part. Temperature extremes range from about -40° to 85°F. Precipitation ranges from 12 to 24 inches per year; snowfall ranges from less than 50 to more than 200 inches per year. Winds are generally calm, although high winds over 50 mph can be expected.

The Interior Zone is a true continental climate. It is relatively dry, being dominated by high pressure air masses. As a result, extreme seasonal temperature variations and relatively mild winds can be expected.

The yearly average temperature for this zone is about 24° to 29°F; annual temperature extremes range from -60° to nearly 100°F. Precipitation has an annual range of about 8 to 16 inches a year. Snowfall amounts from less then 50 to almost 100 inches a year. Winds are generally very light, with high winds recorded at less than 50 mph.

Since this area is dominated by stable high pressure air, temperature inversions are common, and ventilation is low. Thus the potential exists for smog, fog, and ice-fog around sources of particulates and/or moisture. Ice-fogs repeatedly cover Fairbanks and seriously reduce visibility; the temperature usually must be below -35°F for this to occur.

The Mountain Zone is basically a modification of a more prevalent zone, in this case, either the Transitional or the Interior Zones. The causes of the modification are elevation and relief. Increased elevation tends to lower the yearly average temperature without decreasing seasonal temperature variations present at lower elevations. High relief combined with elevation results in increased precipitation due to adiabatic cooling of uplifted air masses, and an increase in the force of local winds. Since mountainous terrain is anything but uniform, wind patterns can vary tremendously. However, it is safe to assume high extremes of wind throughout the entire zone.

Land Ownership and Status

Land ownership is considerably less influenced by physical factors and more by social factors. At present, land ownership is an unstable situation, for although the majority of the land traversed by the route segments is presently Federal land, that ratio is destined to change, with more land being in State and Native ownership. With the exception of the Matanuska Valley and the more heavily settled areas, there is presently relatively little privately owned land.

Land Status is an even more changing situation than land ownership. The present land status situation is largely a result of the Statehood Act of 1959, ANCSA in 1971, and the Alaska Conservation Act of 1974. All Federal lands in Alaska are presently in a withdrawal status; not only will a considerable portion of Federal land be transferred to State and Native ownership, but all the remaining Federal lands are slated either for inclusion into either the existing National systems such as National Parks and the National Forests, or for withdrawals for classification and public interest.

At present, apart from private holdings, only patented State land and existing Federal withdrawals can be considered constant. Most of the corridor segments lie in lands that are pending or tentatively approved State selections, Native village withdrawals, and Native regional deficiency withdrawals, all of which are in flux at the present.

Therefore, assessment of the land status of a segment reflects only the situation at the time of this publication.

Direct impacts on existing developments will generally be low, mainly because there are so few existing developments along the segments. Due to the changing nature of land use and ownership, impacts may change considerably in the space of a few years.

With the present pattern of land ownership, there will be few conflicts with land ownership, as most of the land along the routes are presently in Federal and State ownership. Distribution of lands to Natives and other private owners by the Federal and State governments in the future will increase the likelihood of purchase of easement of private lands and possible subsequent displacement of private owners.

Little impact is expected upon existing land use; the right-of-way width required for a transmission line is a small fraction of the land the line traverses. There will be almost no conflict with agricultural lands; at present, agriculture is basically limited to the lower Matanuska Valley, and smaller areas in the Tanana and Copper River Valleys. The potential for agriculture exists over a considerable area of the railbelt (see Figure 9), but the impact of a transmission line on these potential areas is less than on the existing areas. Forestry at present is very limited in the Railbelt, more from ownership causes then natural causes. Forestry can be expected to increase, but impacts from a transmission line will be minimal.

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Known and potential areas of coal, oil, natural gas, and minerals exist in the Railbelt area. The fossil fuels are predominant in the three basins of the Tanana River, Cook Inlet, and the Copper River lowland. Minerals are more usually found in the more mountainous areas. A transmission line itself will have little effect on development of these resources. The availability of power from the Upper Susitna project might spur development, but this is dependent upon the local utilities and their distribution systems. Location of these mineral resources is shown in Figure 10, 11, and 12.

Little direct impact on towns from a transmission line can be expected; this results from the ability to circumvent the few towns encountered. The endpoint substations are outside of Anchorage and Fairbanks, so these towns will not be penetrated by a right-of-way.

Social Impacts

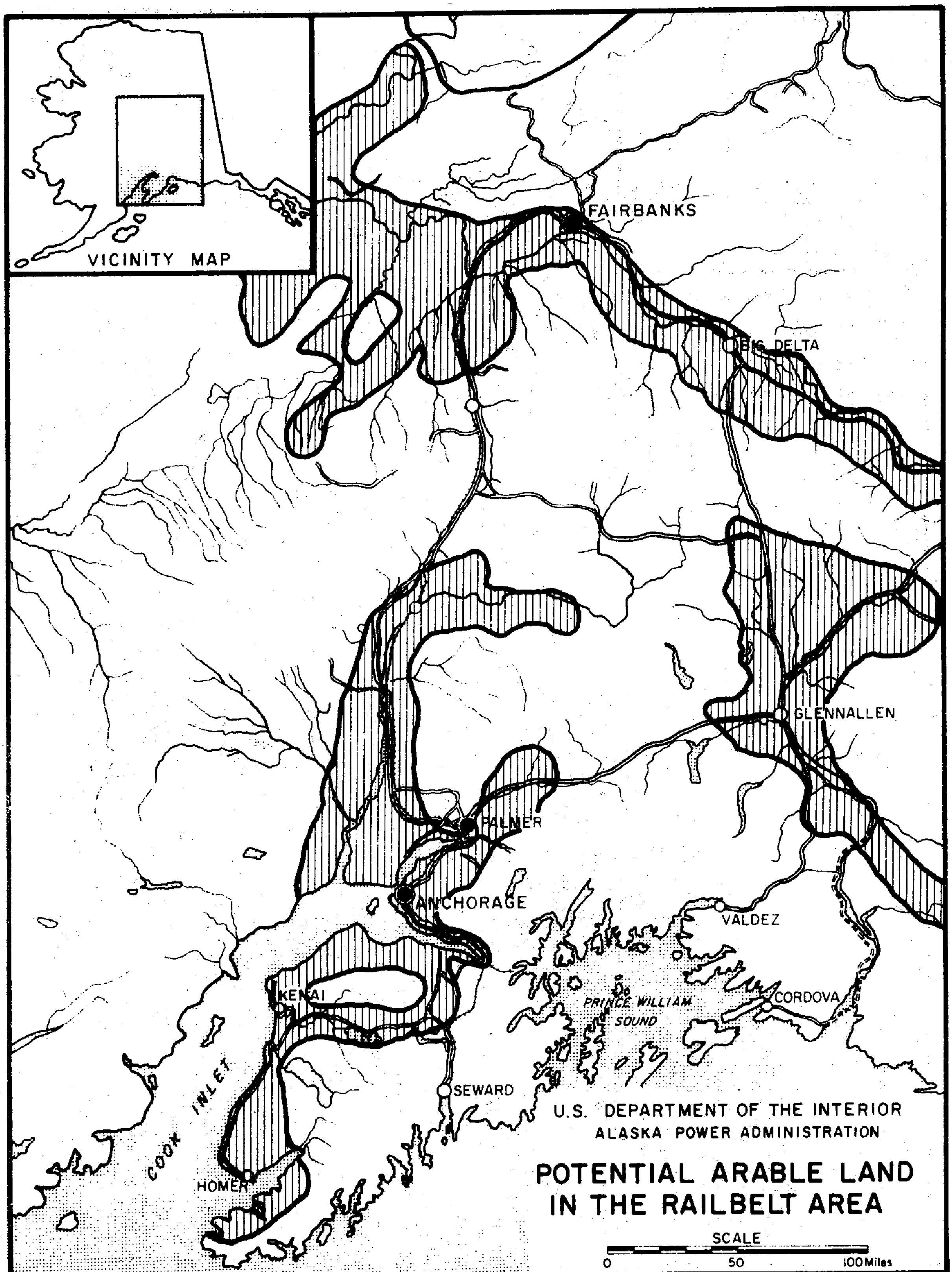
The prediction of social impacts and their mitigation is difficult; quite a few variables are involved, such as the labor supply, the desires of the affected communities, and the occurrence of other large projects in the area of the proposed corridor.

However, it is certain that because of its size, there will be social impacts due to the construction activity, interconnection, and the availability of power.

Construction activity will affect communities in direct proportion to the involvement and in indirect proportion to their size. Perhaps the best way to minimize the effects of construction activity upon small communities is with the use of construction camps spaced along the corridor, avoiding the communities of Talkeetna and the lower Susitna, Cantwell, Healy, and Nenana. These camps will be temporary, to be constructed and maintained in such a manner as to minimize damage to their surroundings. Upon completion of the project, the camps shall be removed and restored as closely as possible to their original condition or can be re-used for other purposes. The spacing of the camps is dependent upon the nature of the terrain and the method of construction; spacing will vary from forty to one hundred miles. Not all camps will necessarily operate simultaneously.

The estimated time needed for construction is three years; assuming that the camps are not operating simultaneously, but progress from one section to another; then it follows that the construction period for a given area along the proposed corridor will be considerably shorted than three years. Thus, impacts from construction activities can be expected to last less than three years.

Figure 9



SOURCE: ALASKA INTERNATIONAL RAIL AND HIGHWAY COMMISSION

A.P.A.-JANUARY 1975

Figure 10

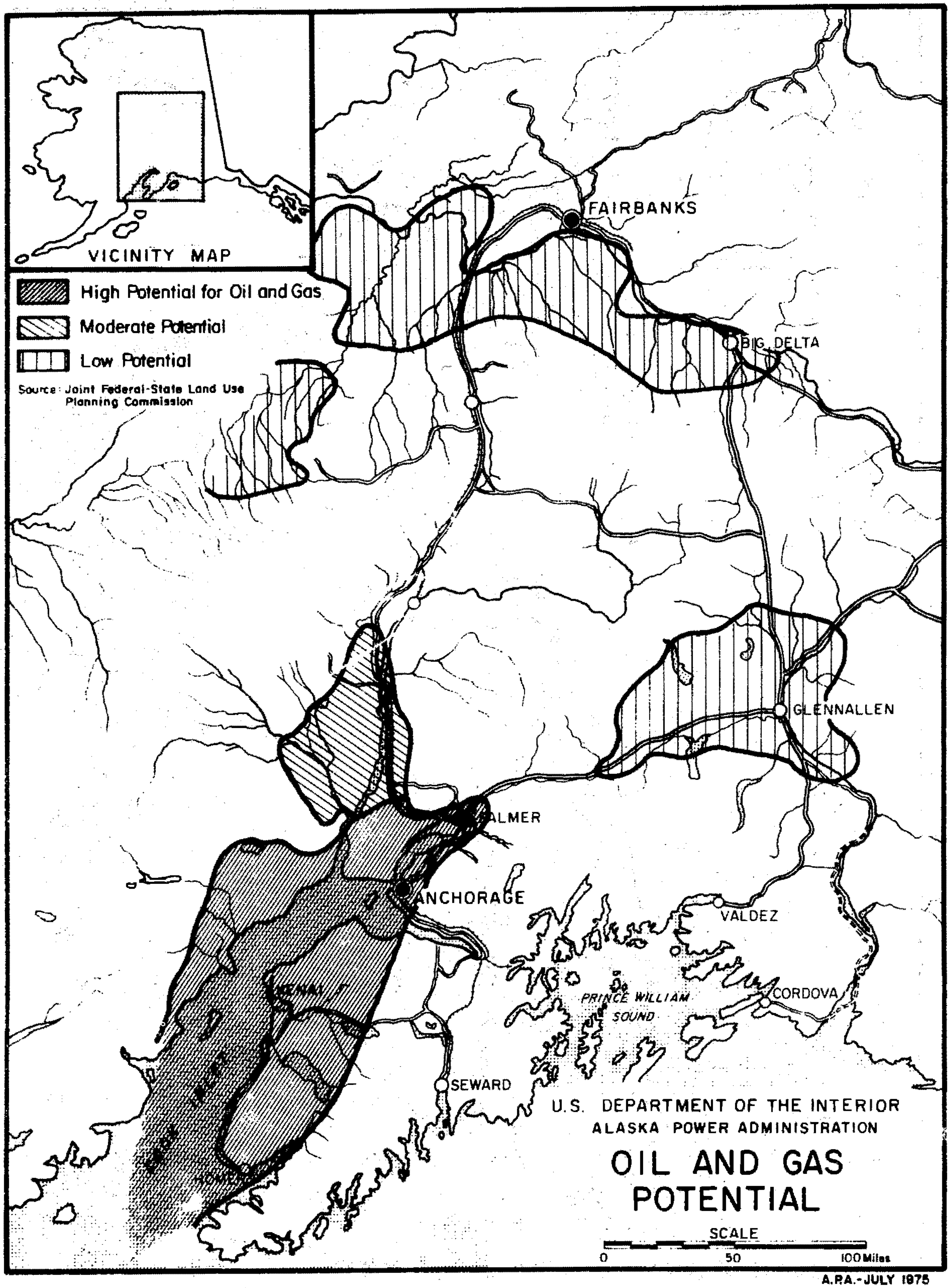
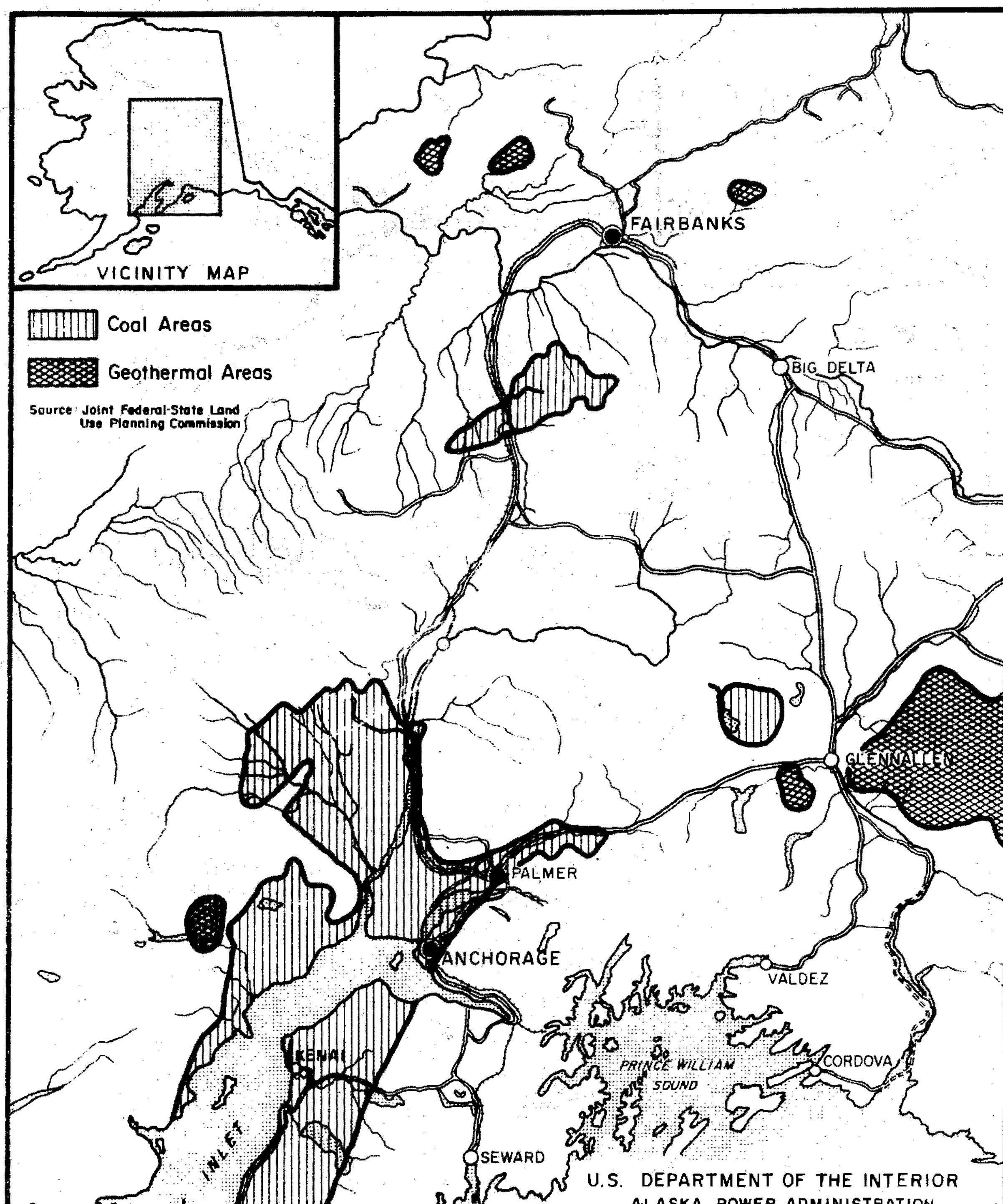
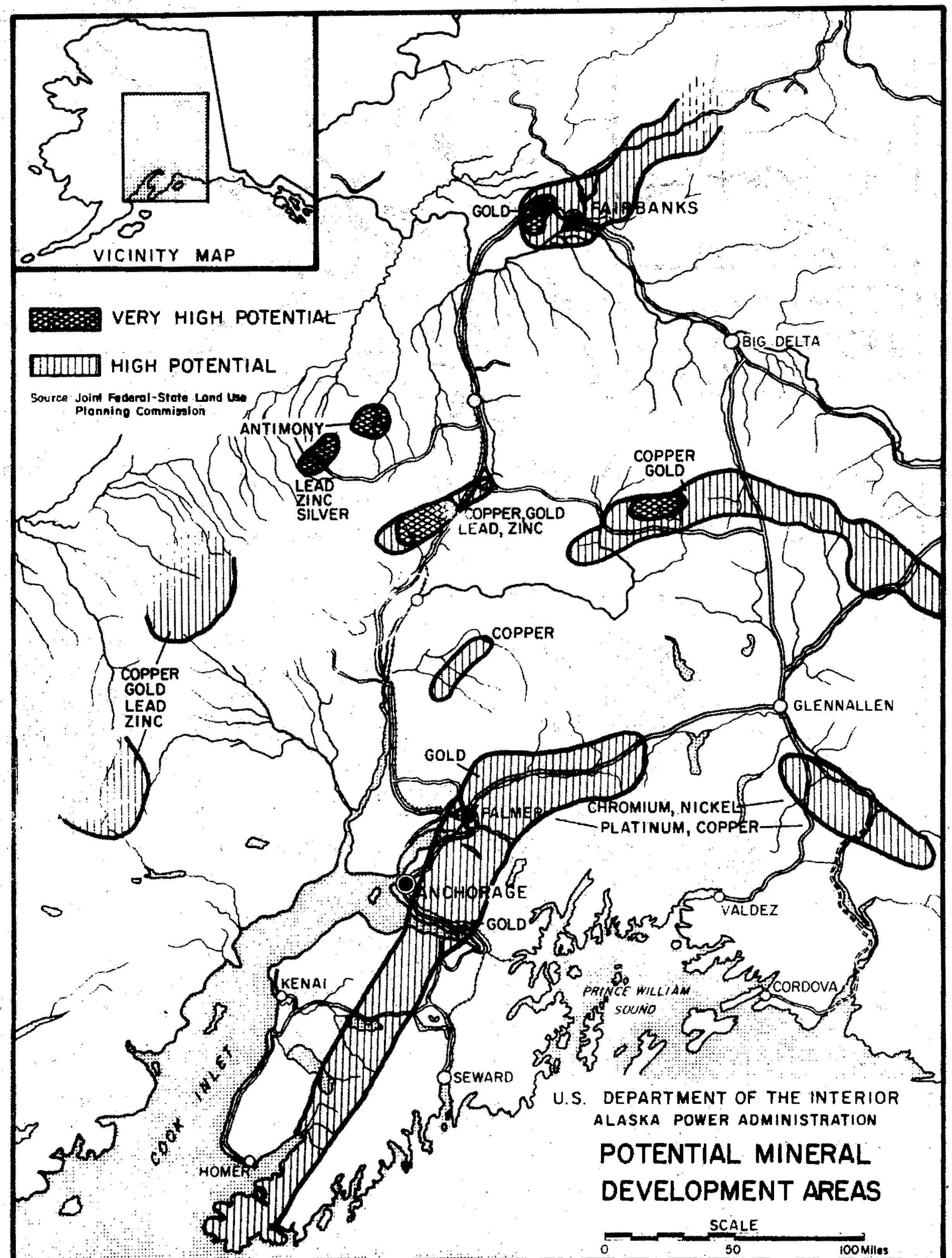

VICINITY MAP
High Potential for Oil and Gas
Moderate Potential
Low Potential
Source: Joint Federal-State Land Use Planning Commission
FAIRBANKS
BIG DELTA
GLENNALLEN
PALMER
ANCHORAGE
VALDEZ
KENAI
PRINCE WILLIAM SOUND
CORDOVA
SEWARD
U.S. DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
OIL AND GAS POTENTIAL
SCALE
0
50
100 Miles
A.P.A.-JULY 1975

Figure 11



A.P.A.-JULY 1975

Figure 12


VICINITY MAP
VERY HIGH POTENTIAL
HIGH POTENTIAL
Source Joint Federal-State Land Use Planning Commission
GOLD
FAIRBANKS
BIG DELTA
ANTIMONY
LEAD
ZINC
SILVER
COPPER
GOLD
COPPER, GOLD
LEAD, ZINC
COPPER
COPPER
GOLD
LEAD
ZINC
GLENNALLEN
GOLD
PALMER
CHROMIUM, NICKEL
PLATINUM, COPPER
ANCHORAGE
GOLD
VALDEZ
KENAI
PRINCE WILLIAM SOUND
CORDOVA
SEWARD
COOK INLET
HOMER
U.S. DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
POTENTIAL MINERAL DEVELOPMENT AREAS
SCALE
0
50
100 Miles
A.P.A.-JULY 1975

The work force is dependent upon the contractor, the time schedule, and the availability of workers. A figure can be obtained as follows: assume that work is progressing simultaneously along the entire corridor; that camps are an average of sixty miles apart, and that it requires five men per tower for transmission line construction. Within a 60 mile stretch of line there are 300 towers, and if it takes ten working days on the average to place a 345 kv tower, including foundations, then five crews could complete the towers in range from camp in 60 days. The time needed to string and tension the stretch with three conductors will be another 20 days; associated work prior to and following this construction will occupy the rest of the season of about 15-20 weeks.

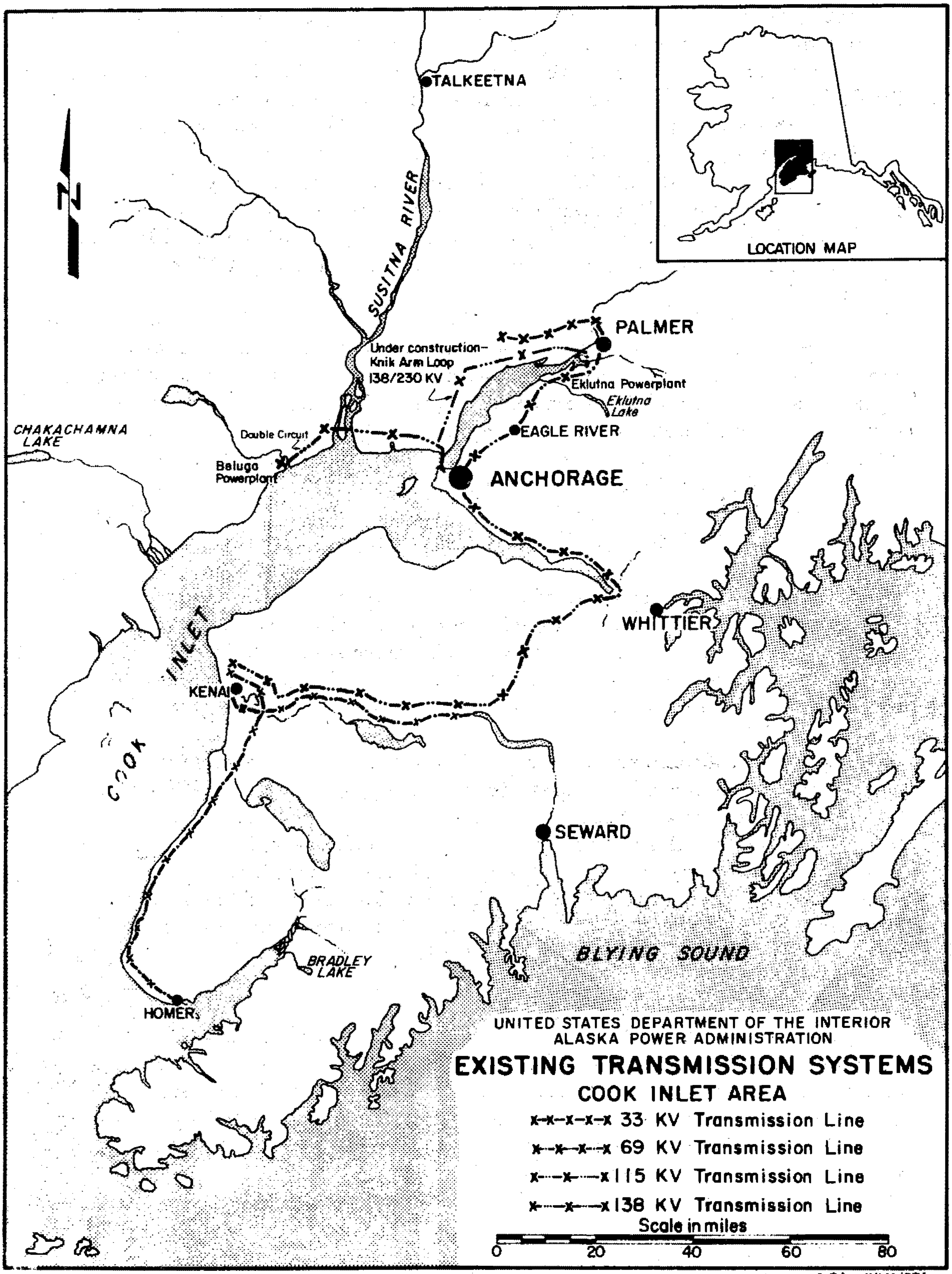
If this rate of work is progressing at the other camps, and if six camps are planned in all, then a total of 150 line workers are required. Other workers are needed such as drivers, pilots, laborers, cement workers, surveyors, camp support, and administration. This could bring the total up to 250 people; however, actual numbers may be as high as twice or three times the estimate. Associated with the employment generated directly by this project is the effect on services in the railbelt area, such as suppliers, machinery sales, shippers, etc.

The impact on a small community, such as Cantwell, will be that of a camp separated from the town, with about 100-125 workers for the space of one or two working seasons; apart from incidental contacts, such as entertainment, and service to visitors to the project, this impact will be rather low, and of short duration.

Operation and maintenance impacts will also be low. A relatively small work force can handle operations at the powersites, substations, and intervening transmission line. Most operations will occur at the powersites and the terminal substations at Ester and Point MacKenzie; a much smaller force can patrol the transmission periodically, making necessary repairs and maintaining effective clearance. If the smaller communities are served, they will require their own substation and crew, which can handle both substation operation and line maintenance for their area.

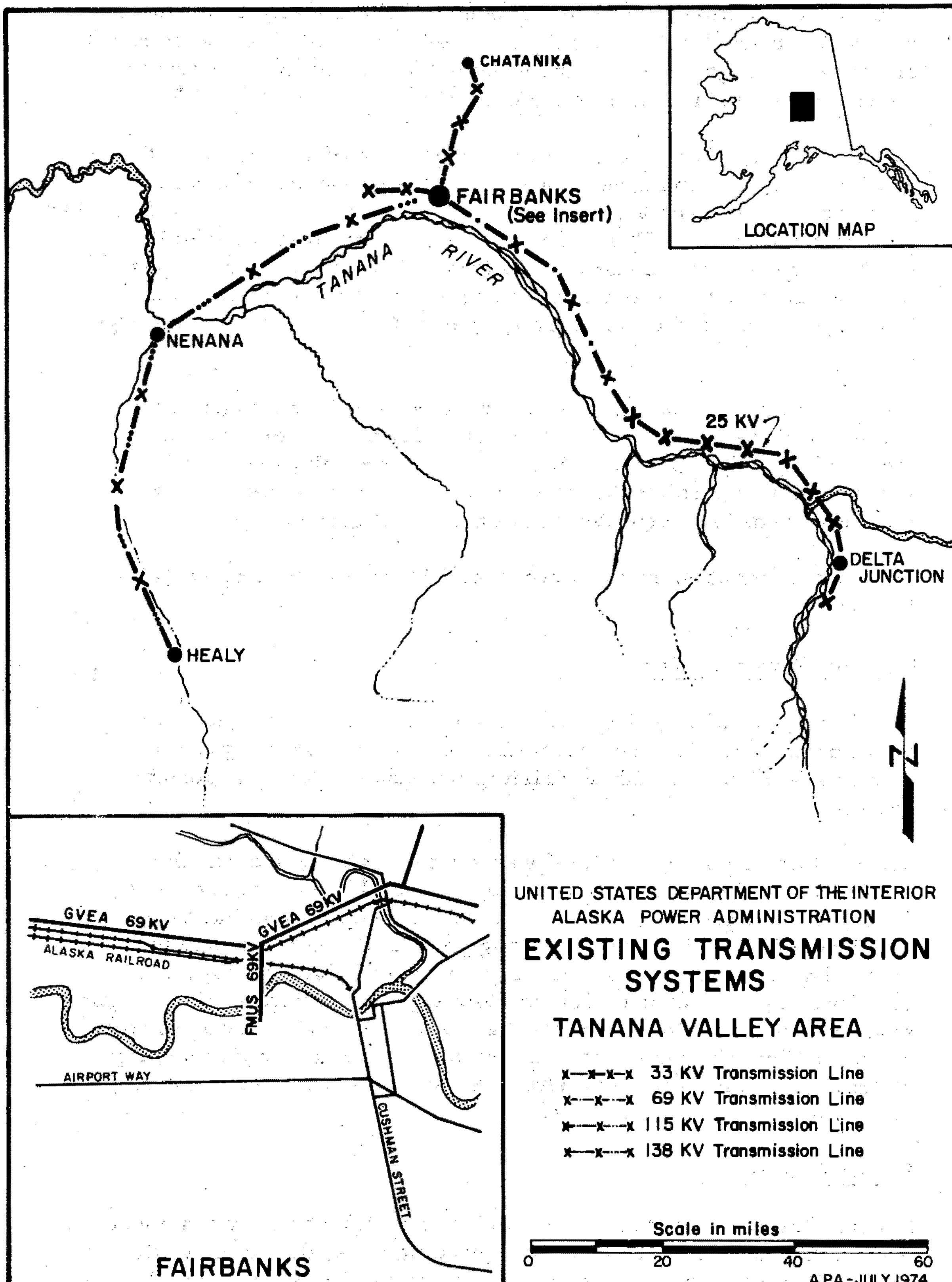
The interconnection and availability of Upper Susitna power will have some effects. For the smaller communities along the proposed corridor, connection with the interconnected system would provide electric power cheaper than the present local generation. Many families presently without electric power because of the cost of generators and fuel would find it more economically available. The availability of power, not

Figure 13



A.P.A. - JULY 1974

Figure 14



UNITED STATES DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION

EXISTING TRANSMISSION SYSTEMS

TANANA VALLEY AREA

x—x—x—x 33 KV Transmission Line
x---x---x 69 KV Transmission Line
x—x---x 115 KV Transmission Line
x—x---x 138 KV Transmission Line

Scale in miles
0 20 40 60

A.P.A.-JULY 1974

necessarily cheap power, will probably be a cause of some growth in these communities. However, it is extremely unlikely that industry would be attracted to outlying communities as a result of the availability of power; the high costs of transportation, labor and material would outweigh the benefit of accessible power.

The probability of development of a new State capital along the proposed corridor would be enhanced somewhat by the existence or promise of available power and a connection to the present utilities in the Anchorage and Fairbanks areas. The location of the new State capital would, however, be influenced more by transportation. In any case, if the new capital were to be connected to Upper Susitna power, it would have a projected load of less than ten percent of the present Anchorage load.

Unlike the smaller communities presently not serviced by one of the railbelt utilities, the availability of Upper Susitna power would not significantly affect growth in Anchorage or Fairbanks. Growth in these areas is a problem that already exists, and increased power for these towns is a response to, not a cause of growth.

For more information on socio-economic factors, see the Power Market Report.

Existing Rights-of-Way

Existing rights-of-way is concerned with surface transmission and transportation routes. The possibility exists for shared rights-of-way or shared access with an existing transmission or transportation system.

Some of these existing rights-of-way are the highway system, the Alaska Railroad, transmission corridors, the Alyeska Pipeline, and for a proposed natural gas pipeline system. Federal land has been withdrawn for a utility corridor along parts of the Alyeska pipeline route. The possibility exists not only for shared right-of-way, but also for a "symbiotic" use of an existing right-of-way in which a transmission line could provide power for the present occupant. Two examples are electrification of the Alaska Railroad, and using electric pumping stations along the Alyeska Pipeline. Existing transmission systems are shown on Figures 13 and 14.

Scenic Quality

Scenic quality does not lend itself well to quantification; this is a much more ambiguous category than the preceding ones, due to the difficulty in definition of such terms as "scenic quality". There are several components of scenic quality, which when defined, will define this category. "Existing scenic quality" is a statement of the present visual aspect of an area, whether it is an area of perceived high scenic value, or an area of low scenic value. Perceived scenic values (beautiful, ugly, monotonous, vibrant, etc.) are extremely variable, not only by location, but also by season, weather, and most importantly, by the individual viewer.

Some of the more important components of scenic quality are scale, unity, intactness, variety and vividness. Scale is relationship of a viewed area to the viewer. Scales range from detail, or close-up views, (such as views of small elements of the landscape as plants, rock formations, etc.) to middle views, such as one could have in a forest, in which individual elements still hold most of the attention; to distant or scenic views, in which individual elements are subordinate to the entire view (perception of a forest rather than perception of individual trees).

Unity is the degree of harmony among elements in a landscape; put another way, it is the degree of the lack of discordant elements. A wheat farm of five acres is considered by most people to be less discordant in an otherwise forested landscape than a five acre tank farm. Unity is a learned concept, and as such, is variable not only among the individuals and groups, but also is variable over time as tastes change.

Variety is the degree of diversity in a landscape; its converse is uniformity, the degree of homogeneity. Variety may be a function of scale; a landscape perceived as uniform, such as tundra, may have detail views of amazing variety, particularly in its plant life. There appears to be no obvious relationship between variety and unity or between variety and intactness.

Vividness is the strength of the impression of landscape. It is a function of the degree of pronouncement of the major qualities in a landscape. Vividness is interrelated with the components of unity, intactness, and variety. It does not imply strong variety or strong uniformity, but rather the degree to which variety or uniformity is perceived and remembered. As two examples, the highly diverse view of Mt. McKinley as seen from Wonder Lake and the highly uniform landscape around Lake Louise are both very vivid to the author, whereas the landscape of lower Talkeetna River is much less vivid.

Since scenic quality is a complex subject, some assumptions must be made in order to use it as category in a matrix. The first assumption is that we will only be considering large-scale views; detail and middle-views should not be affected by a transmission line. Second,

Figure 15

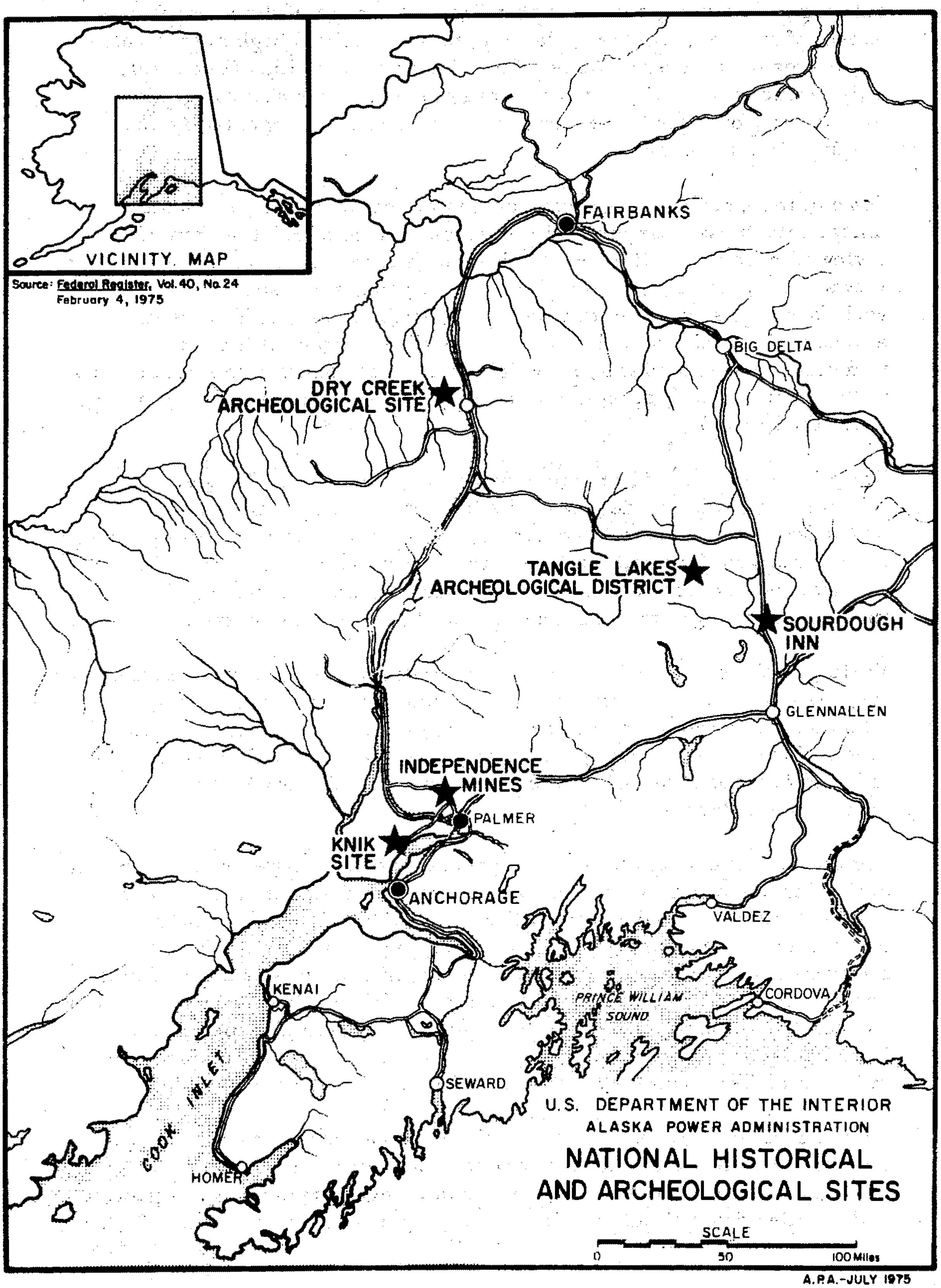
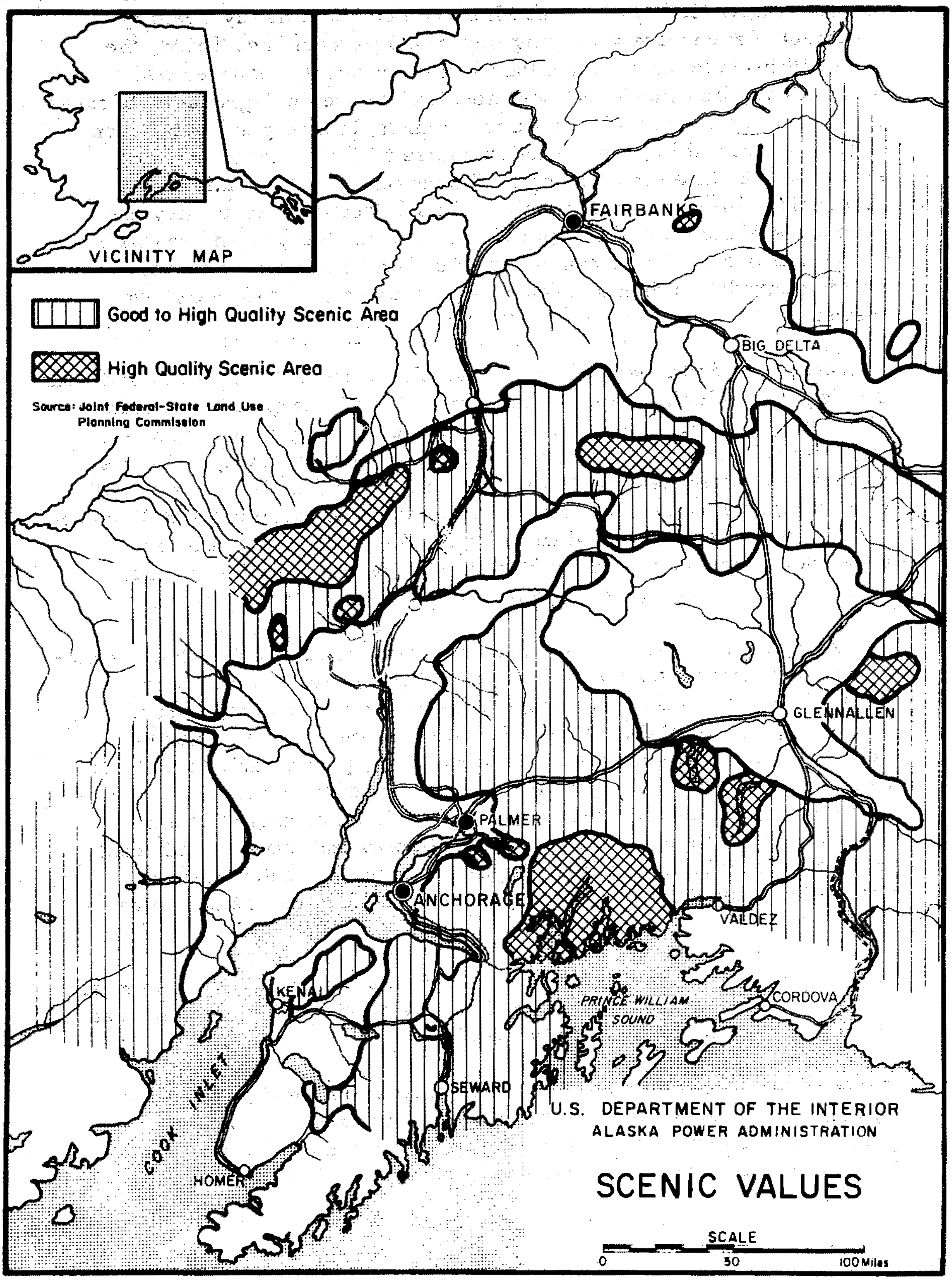

VICINITY MAP
Source: Federal Register, Vol. 40, No. 24
February 4, 1975
FAIRBANKS
BIG DELTA
DRY CREEK
ARCHEOLOGICAL SITE
TANGLE LAKES
ARCHEOLOGICAL DISTRICT
SOURDOUGH
INN
GLENNALLEN
INDEPENDENCE
MINES
PALMER
KNIK
SITE
ANCHORAGE
VALDEZ
KENAI
PRINCE WILLIAM
SOUND
CORDOVA
SEWARD
COOK INLET
HOMER
U.S. DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
NATIONAL HISTORICAL
AND ARCHEOLOGICAL SITES
SCALE
0
50
100 Miles
A.P.A.-JULY 1975

Figure 16


VICINITY MAP
Good to High Quality Scenic Area
High Quality Scenic Area
Source: Joint Federal-State Land Use Planning Commission
FAIRBANKS
BIG DELTA
GLENNALLEN
PALMER
ANCHORAGE
VALDEZ
KENAI
CORDOVA
PRINCE WILLIAM SOUND
COOK INLET
SEWARD
HOMER
U.S. DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
SCENIC VALUES
SCALE
0
50
100 Miles

no attempt will be made to quantify scenic qualities; the study of perception is not yet advanced to the point where one can confidently quantify a subject of such widely varying individual perceptions. Third, the area within National and State Parks or other scenic reserves will automatically be considered more sensitive to scenic degradation because of their recognized scenic qualities. Fourth, landscapes visable from major surface public transportation routes will be considered more sensitive than those that are not. The reasoning behind this is that all scenic values are not intrinsic to the landscape, rather, they are responses of the individuals perceiving that landscape. An area with a high number of viewer contacts would then be more sensitive to scenic degradation than an area with no viewers, or with very few viewers.

Obtrusiveness is the lack of unity of an element with the rest of a landscape, the degree to which an element is perceived as incongruous. A transmission line in a valley bottom seen from two miles away is less obtrusive and visible than a line silhouetted on a ridge one mile away. Factors affecting obtrusiveness are tower design and height; design and width of clearing; reflectiveness of tower and cable; topography; and distance from viewer. Where natural cover and topography enable a line to be hidden, impact on scenic quality is low; on open tundra, impact will be medium to high, depending on distance and topography.

There are several recreation and scenic reserves affected by the alternative routes; most important are Mount McKinley National Park and Denali State Park. Both are rather sensitive areas, as they attract and are the result of a considerable tourist trade. Parks in Alaska have the image of open, unspoiled wilderness, particularly to tourists from outside the State. Visibility of a transmission line in or around these parks will have a greater impact than in other areas. There are a variety of State-owned recreational areas and waysides adjacent to the highways in the Railbelt; impact on these recreational sites will be low; due to their relatively small size, they can be circumvented easily.

The National Register of February 4, 1975 lists six registered historical and archaeological sites that might possibly be affected by the alternative routes. These are shown on Figure 15.

There are known and potential archeological and historical sites not on the National Register along the proposed corridors. To minimize possible vandalism or disturbance no sites other than those on the National Register shall be located either on a map or on the narrative of this assessment. To preserve the integrity of known and potential sites, a pre-construction archeological survey of the corridors will be carried out, and the final transmission route will be adjusted to minimize disruption. Inadvertent discovery of an unsuspected site at a later stage will entail either the minor relocation of a segment of the transmission line, or the salvage of the sites as prescribed by Executive Order 11593 and P.L. 93-291.

The alternative routes cross no proposed or existing scenic, wild or recreational rivers, nor do they cross any proposed or existing wilderness areas or wildlife refuges. However, in segments where the transmission line will pioneer a corridor through a previously intact area, the quality of wilderness will suffer, especially if the transmission line is easily visible. However, in most segments the transmission line will parallel existing corridors or will traverse no significantly large areas of intact wilderness. A pioneer corridor crossing a significantly large wilderness area will have a high impact on access and future location of other rights-of-way. These in turn will degrade wilderness quality further, but to the benefit of increased access for recreational uses involving motorized access.

Figure 16 shows an approximation of existing scenic quality.

Hazards and Inconvenience

One of the more obvious potential hazards is that of electrical shock. Three distinct hazards can be defined. One is the brief voltage briefly appearing on the ground near a dropped conductor. The second is the direct contact with a conductor. The third hazard is that of induced current in metallic objects near an operating transmission line.

When a conductor is dropped, either as a result of tower or conductor failure, it is switched off in a fraction of a second. During this short time, a voltage is caused in the immediate vicinity of the contact; the hazard would vary with the distance to the contact point, the voltage produced, and other factors. Dropped conductors are a rare event in most transmission systems; they are the result of vandalism (rifle fire), storms, and occasionally, defects of components.

Direct contact can be a lethal hazard; usually it involves inadvertently shorting one of the conductors with machinery or other equipment working under a transmission line. Construction booms, pipes, and poles must be maneuvered with care near an operating transmission line. Since ground clearance increases with operating voltage, this hazard is less with the higher voltages.

It is possible to induce a voltage in metallic conductors paralleling a transmission line; such as rail lines and fences. This could present a potential hazard dependent upon the conductivity and length of the object, and its distance from the transmission line. Proper grounding of potential inducting objects will eliminate this hazard.

Overhead transmission systems near airfields and areas of heavy low-flying air traffic present a potential hazard to aircraft. Proper placement and routing will reduce this hazard; the use of taut-span short towers can reduce the height of an overhead system, and marking conductors that span valleys and notches will increase visibility to aircraft.

An operating overhead transmission system will generate audible noise immediately adjacent, particularly if the voltage is 345 kv or higher.

For a 345 kv line, audible noise at the edge of the right-of-way will be less than 45 decibels, roughly equivalent to the noise level of light traffic at 100 feet. Actual audible noise levels are related to voltage, configuration, and height of conductors, atmospheric conditions, and individual sensitivity.

Radio and television reception immediately adjacent to an overhead transmission system may suffer from electromagnetic interference (EMI). Such interference is localized, and is more intense during rain. Other factors influencing levels of EMI are the voltage and configuration of the conductors, height of conductor above ground, age and surface finish of conductor, and atmospheric conditions.

A good reference for EMI and audible noise is the EHV Transmission Line Reference Book.

Evidence of effects on life from exposure to electrical fields present in the vicinity of transmission lines is inconclusive. Several tests cited in the Battelle Report "Measuring the Social Attitudes and Aesthetic and Economic Considerations Which Influence Transmission Line Routing" indicate no ill effects noted on linemen working in very strong electrical fields, and mice exposed to electrical fields; however, other sources in the USSR and Germany cited by this report indicated possible harmful effects on animals and humans.

Ozone production by Corona losses from transmission lines is low. The Battelle Report cited above indicates that ozone concentration adjacent to a 765 kv line was on the order of only 2 to 3 parts per billion by volume; this concentration should be considerably less for 230 kv lines.

STRIP MAPS COVERING THE
ALTERNATIVE CORRIDORS

Exhibit I-2

Strip Maps covering the Alternative Corridors.

The following strip maps are in three groups: those showing the general features, those depicting land status, and those delineating soil types. The alternative corridors are covered by seven maps for each group; there is some overlap from map to map, but not all alternative corridors are entirely depicted on any one map.

On each map is a gray stripe showing the approximate position of an alternative corridor on that map; these positions are very approximate, and the exact location and width are indeterminate.

The land status mapped is based upon the land status situation of March 1974. State selections include patented, pending, and tentatively approved State-selected lands. Due to the present unstable condition of land status, it must be recognized that there may be changes since the date of the map.

The soils maps are based upon the 1:250,000 soils overlay map published by the Joint Federal-State Land Use Planning Commission.

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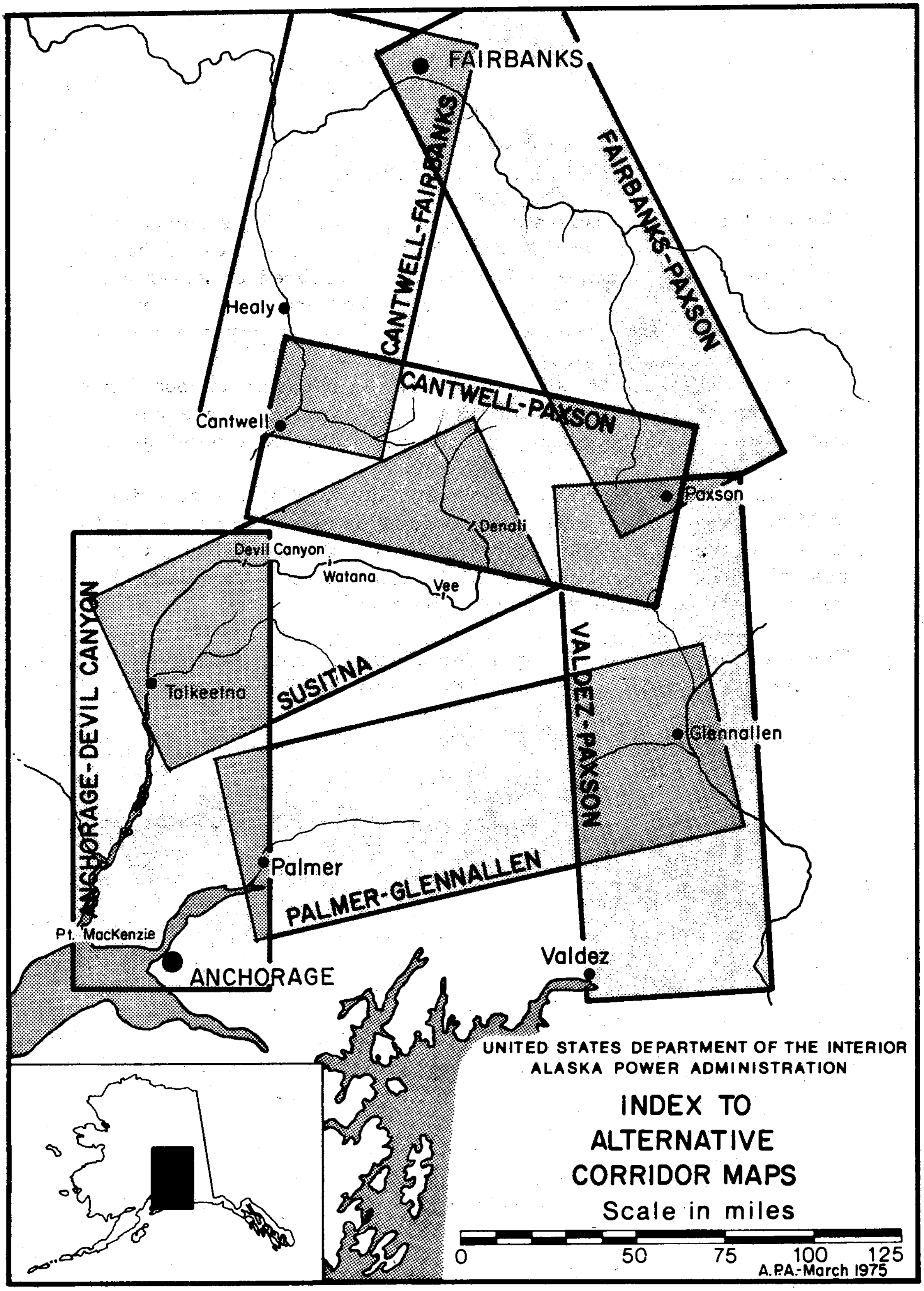
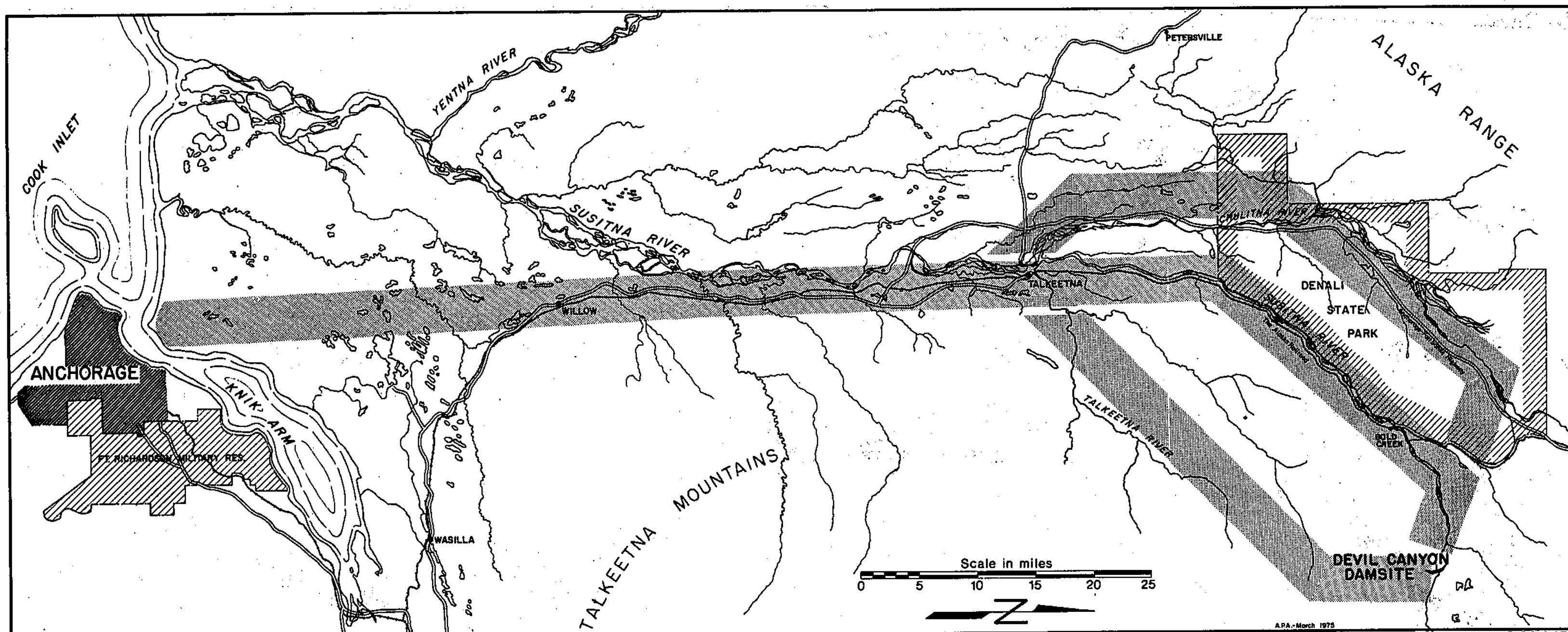
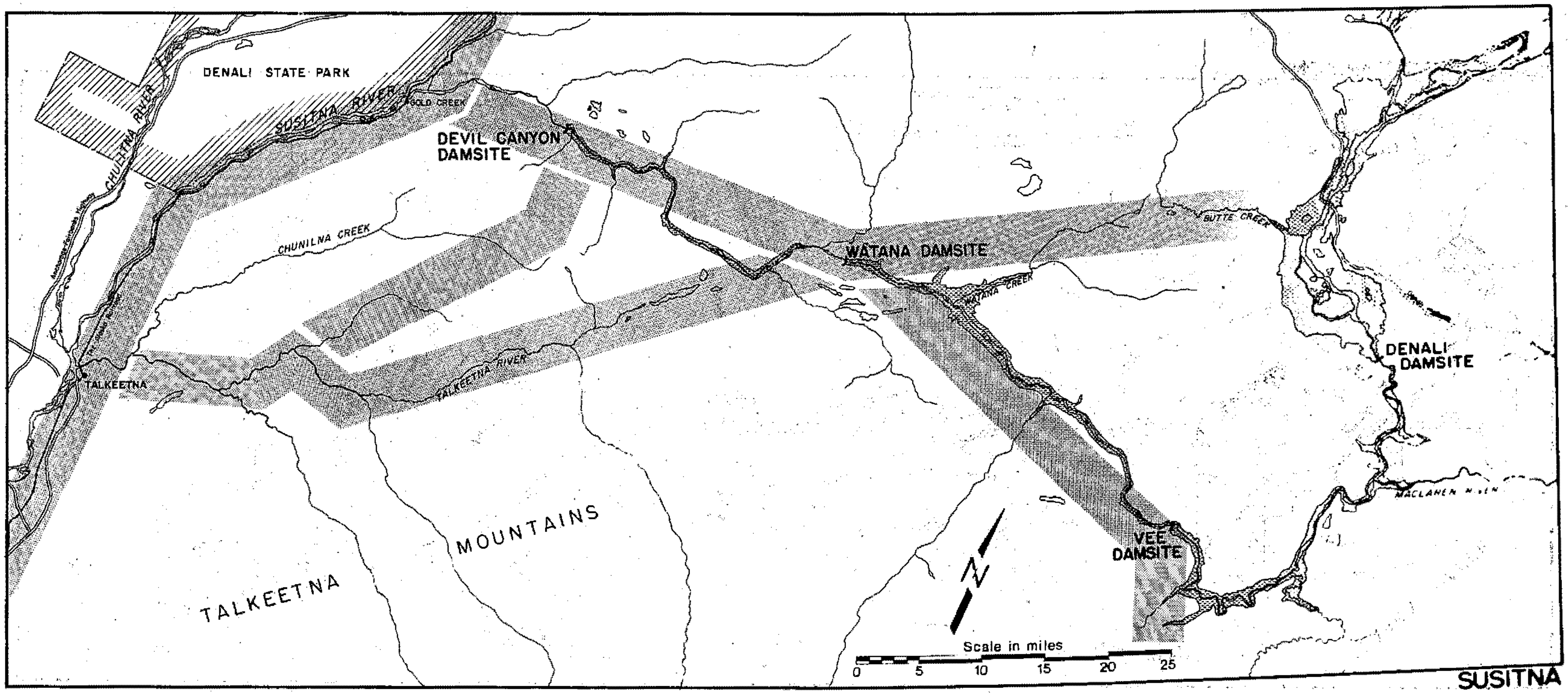
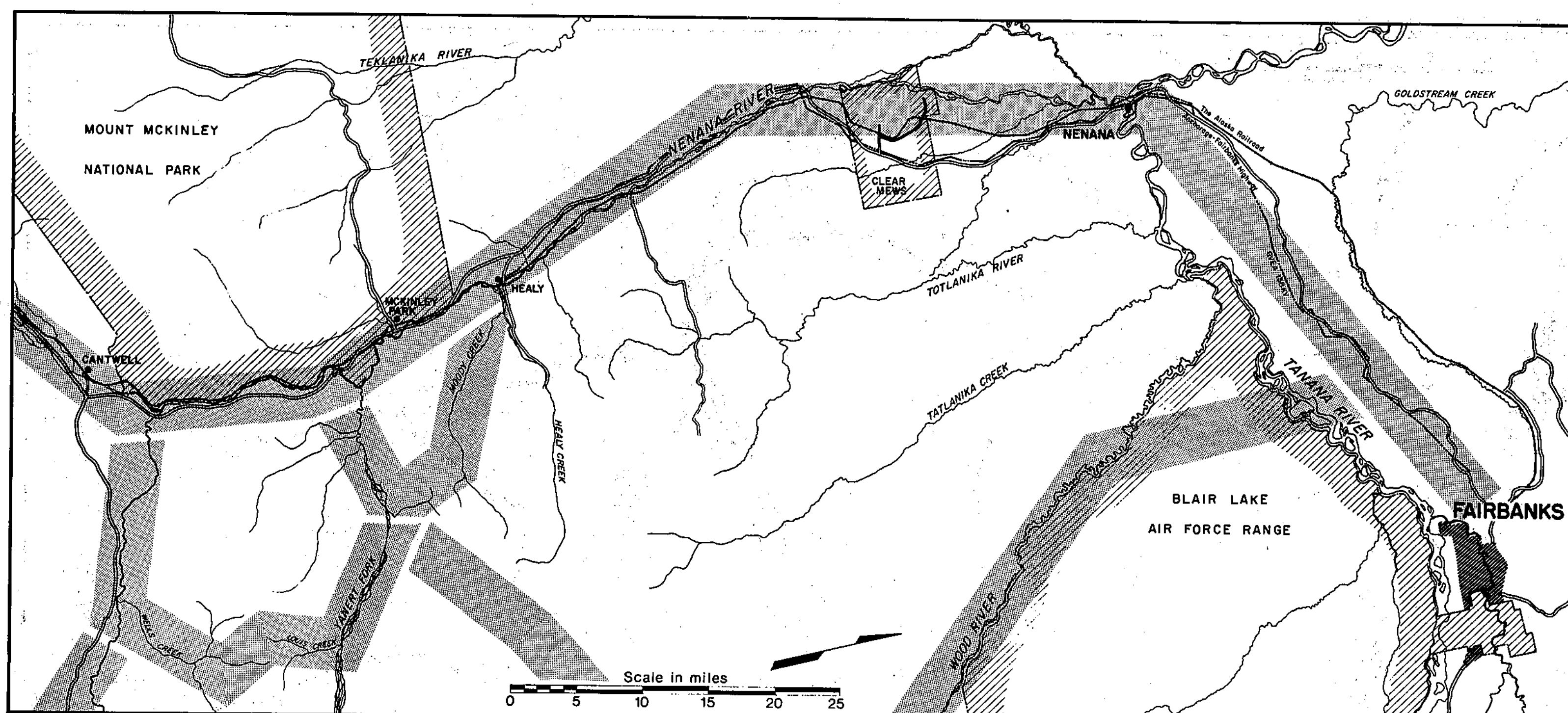

FAIRBANKS
CANTWELL-FAIRBANKS
FAIRBANKS-PAXSON
Healy
Cantwell
CANTWELL-PAXSON
Paxson
Denali
Devil Canyon
Watana
Vee
ANCHORAGE-DEVIL CANYON
Talkeetna
SUSITNA
VALDEZ-PAXSON
Glennallen
Palmer
PALMER-GLENNALLEN
Pt. MacKenzie
ANCHORAGE
Valdez
UNITED STATES DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
INDEX TO
ALTERNATIVE
CORRIDOR MAPS
Scale in miles
0
50
75
100
125
A.P.A.-March 1975

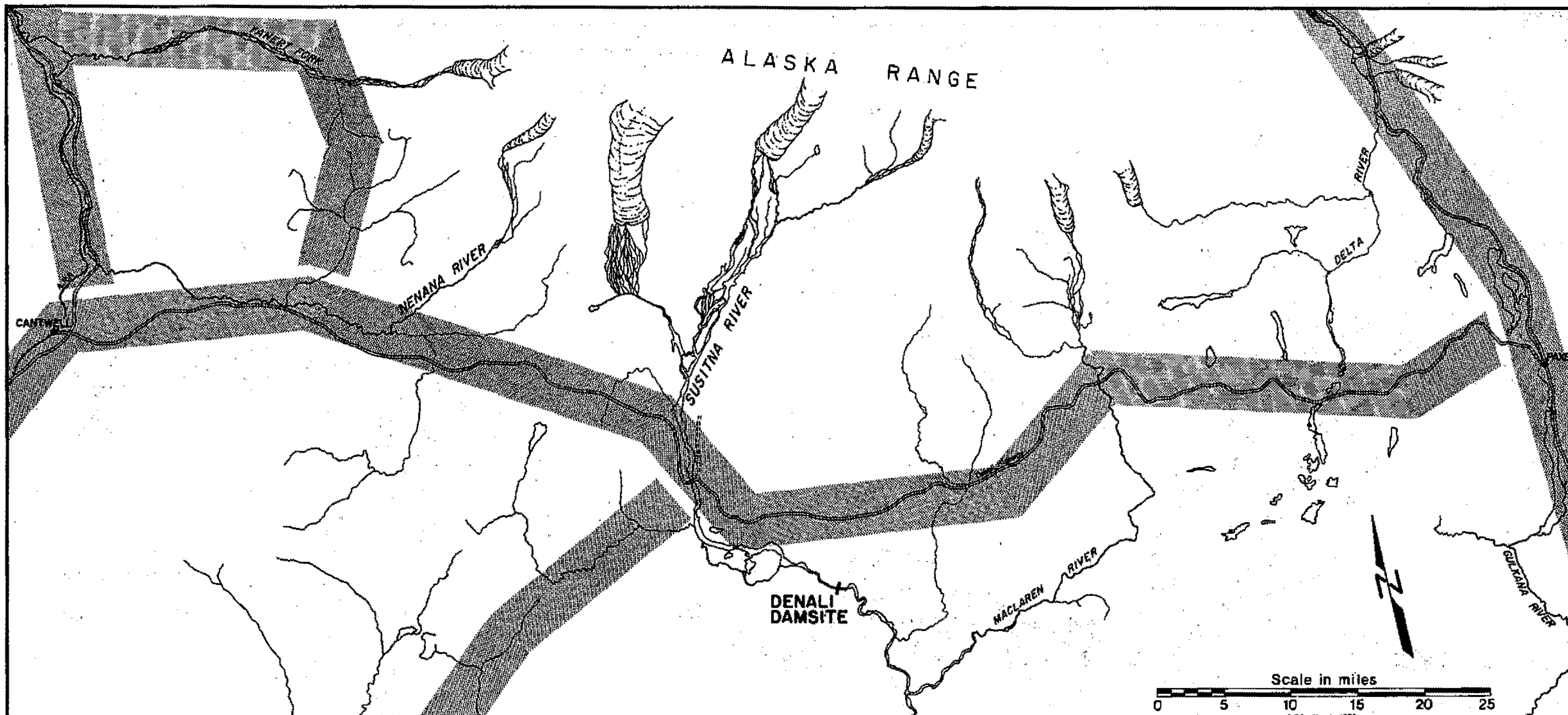


ANCHORAGE-DEVIL CANYON

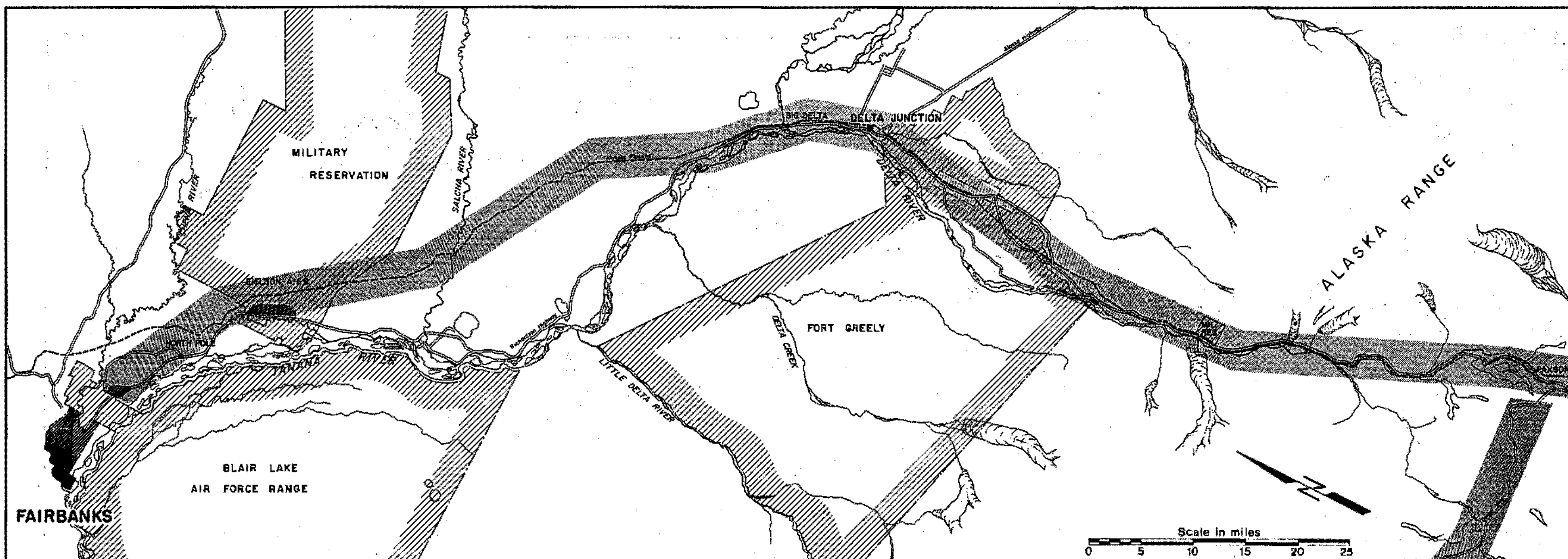

DENALI STATE PARK
SUSITNA RIVER
CHULITNA RIVER
GOLD CREEK
DEVIL CANYON DAMSITE
CHUNILNA CREEK
WATANA DAMSITE
BUTTE CREEK
WATANA CREEK
TALKEETNA
TALKEETNA RIVER
DENALI DAMSITE
VEE DAMSITE
MACLAREN RIVER
MOUNTAINS
TALKEETNA
Scale in miles
0 5 10 15 20 25
N
SUSITNA



CANTWELL-FAIRBANKS

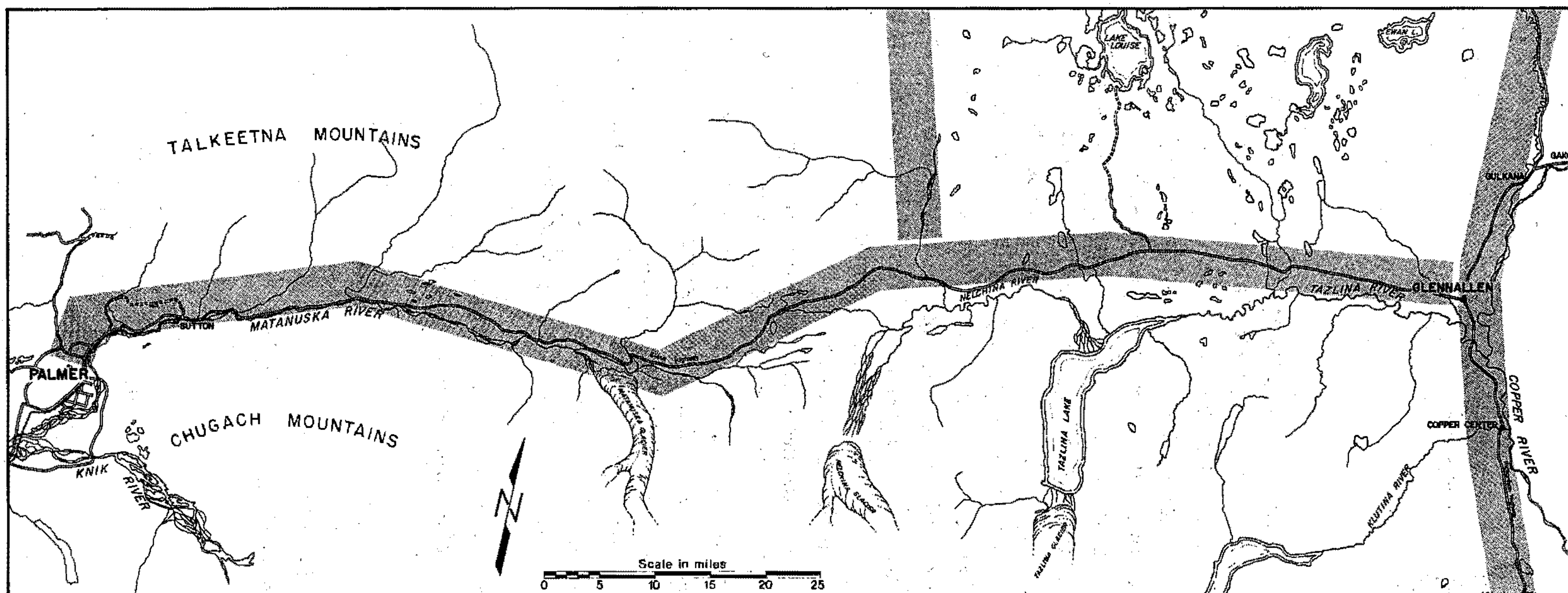


CANTWELL-PAXSON



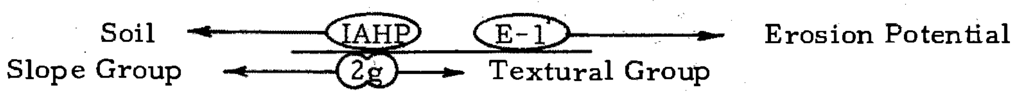
FAIRBANKS-PAXSON

VALDEZ-PAXSON



PALMER–GLENNALLEN

SOILS LEGEND



Soils

EAT - Poorly drained soils, normally in waterlaid materials.
EFT - Well drained soils, in stratified materials on flood plains and low terraces.
EOL - Well drained gray soils; shallow bedrock.
EOP - Well drained loamy or gravelly gray soils; deep permafrost table.
HMT - Poorly drained partially decomposed peat; seldom freezes in winter.
HMV - Poorly drained partially decomposed peat; contains lenses of volcanic ash.
HY(B)G - Poorly drained fibrous peat; freezes in winter.
HYP - Poorly drained fibrous peat; shallow permafrost table.
IAHP - Poorly drained soils with peaty surface layer; shallow permafrost table.
IAP - Poorly drained soils; shallow to deep permafrost table.
IAW - Moderately well to poorly drained soils; may contain deeply buried ice masses.
ICF - Well drained brown soils; contains lenses of fine-grain material.
ICP - Well drained thin grown soils; deep permafrost table.
ICT - Well drained grown soils; non-acid.
IND - Well drained dark soils formed in fine volcanic ash.
IUE - Well drained soils with dark, acid surface layer.
IUL - Well drained soils with dark, acid surface layer; shallow bedrock.
IUP - Well drained thin soils with dark acid surface; deep permafrost table.
RM - Very steep, rocky, or ice-covered land.
SOP - Well drained, thin, strongly acid soils; deep permafrost table.
SOT - Well drained strongly acid soils.
SOU - Well drained, strongly acid soils; very dark subsoil.

The mapping units, while referring to only one or two dominant soils in the association, include other soils and less extensive soils.

Slope Groups

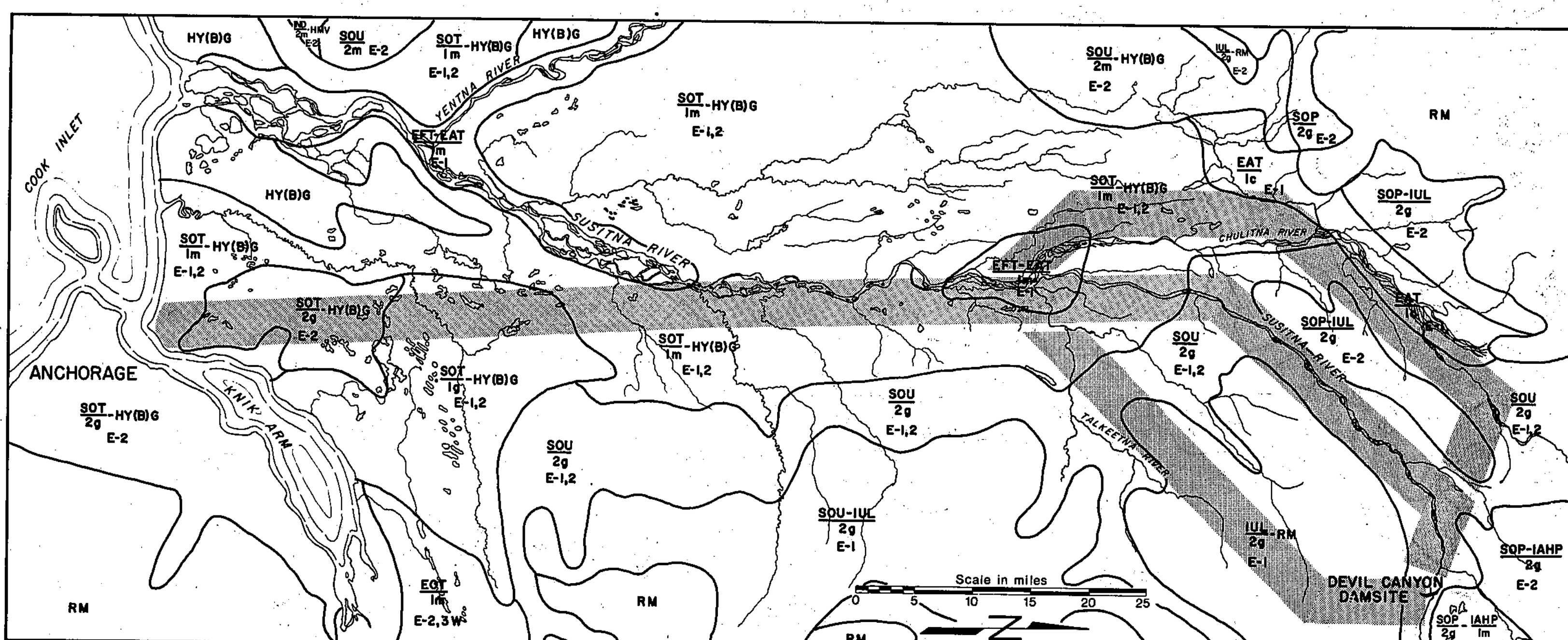
1 - Slopes dominately less than 12%.
2 - Slopes dominately steeper than 12%.

Textural Groups

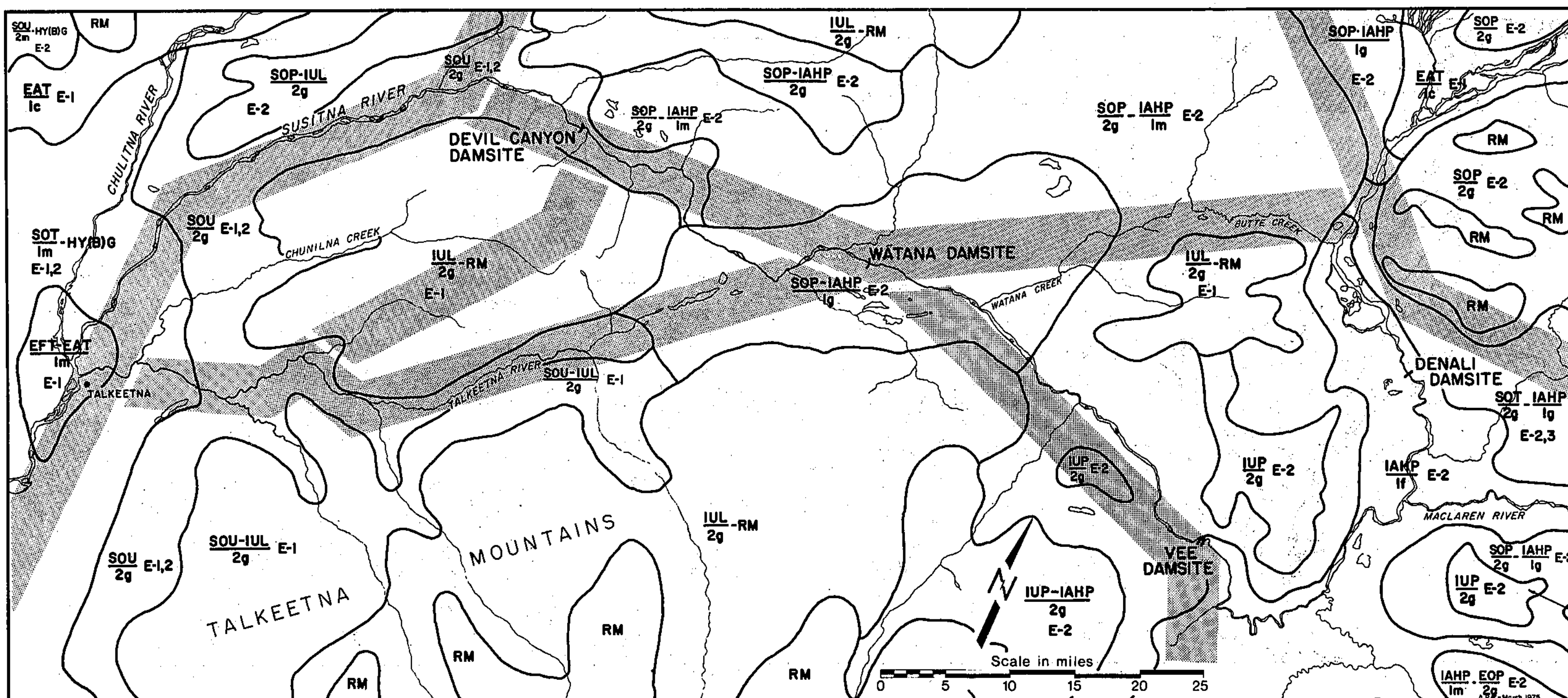
c - sandy
f - clayey
g - very gravelly
m - loamy (medium)

Erosion Potential

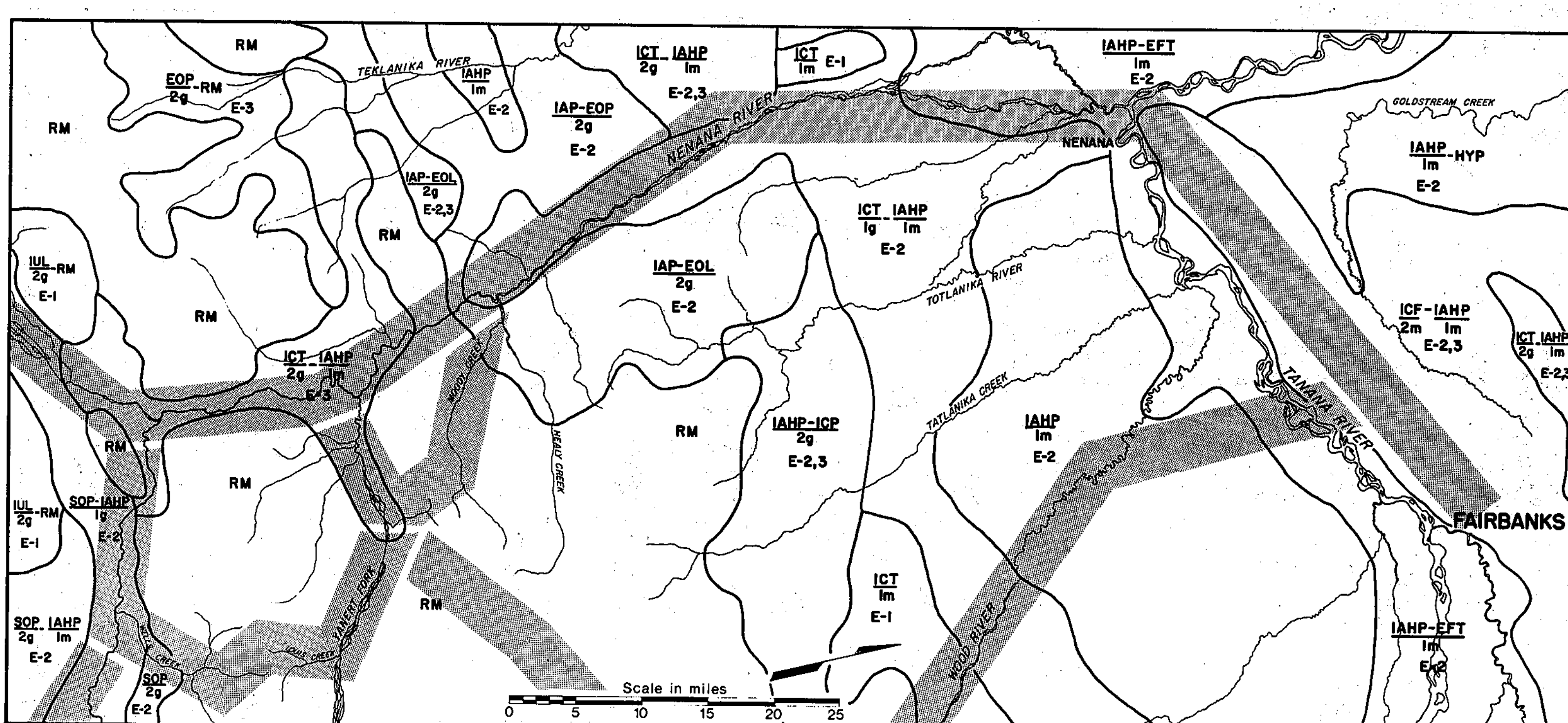
E-1 - low
E-2 - medium
E-3 - high



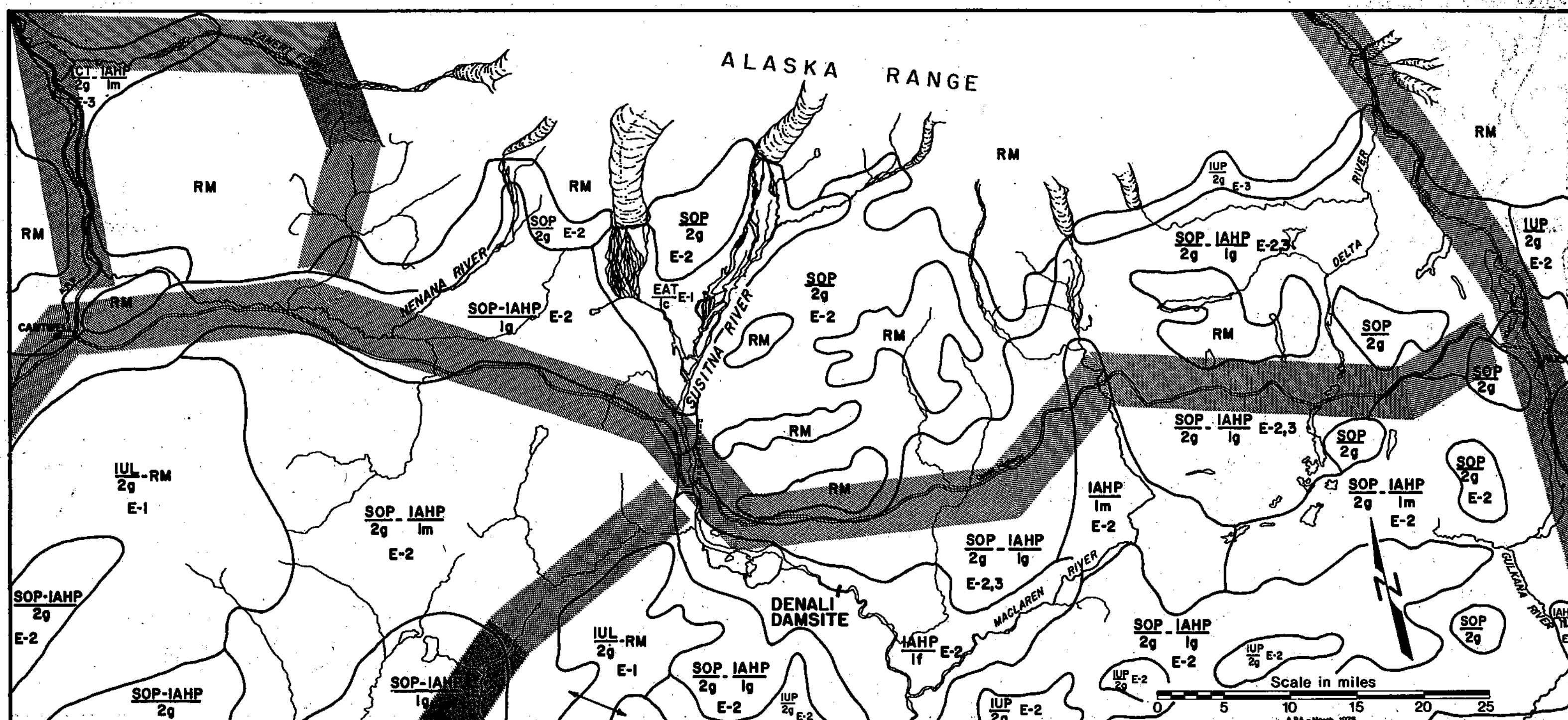
SOILS: ANCHORAGE-DEVIL CANYON



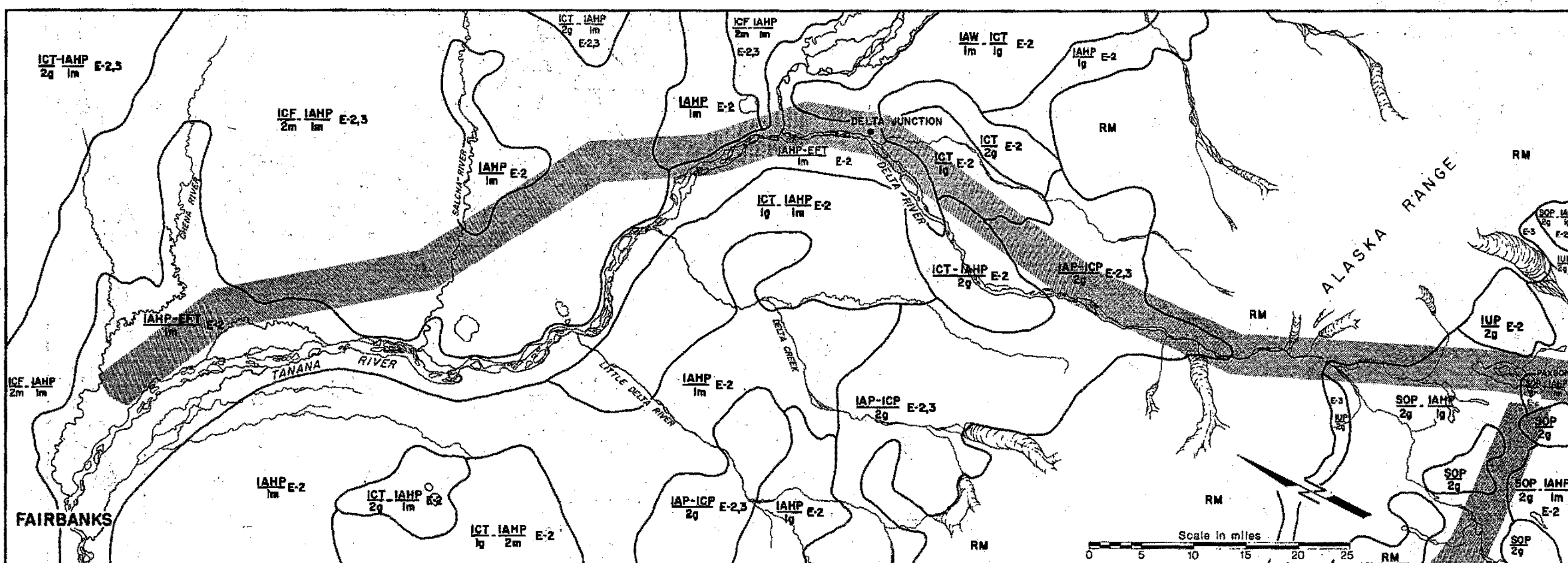
SOILS : SUSITNA



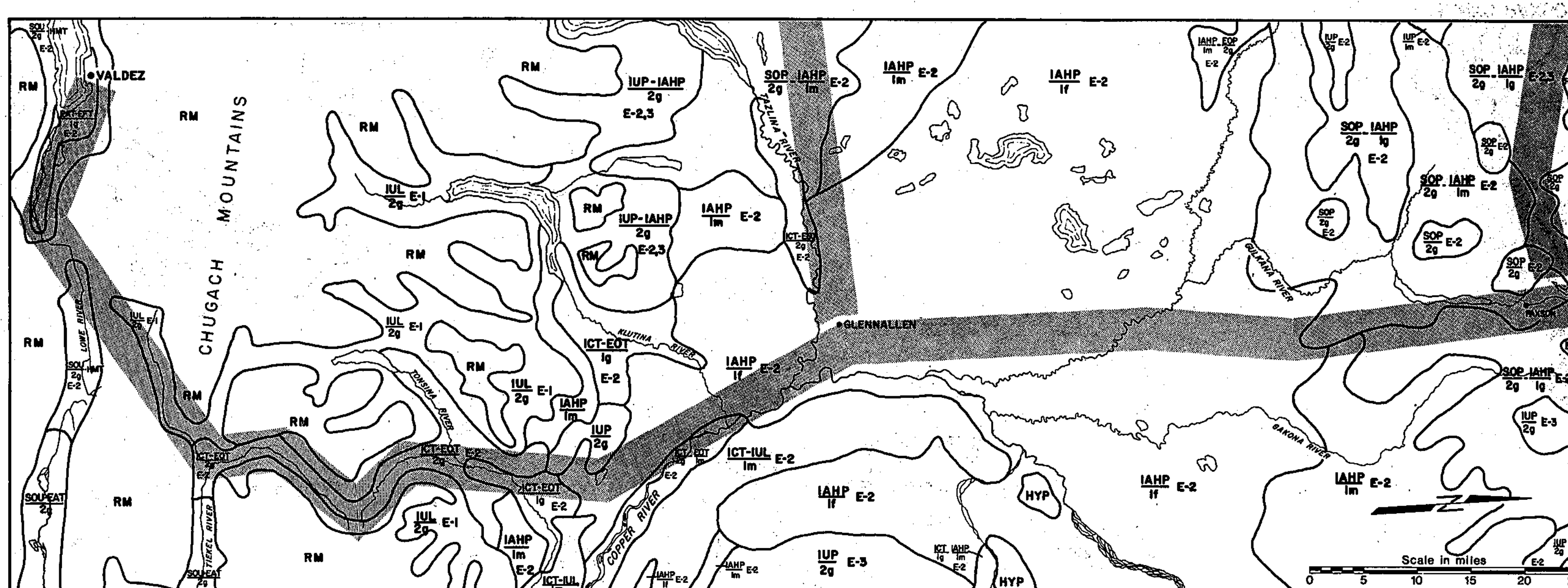
SOILS: CANTWELL-FAIRBANKS



SOILS - CANTWELL-PAXSON



SOILS, FAIRBANKS-PAXSON



SOILS: VALDEZ-PAXSON

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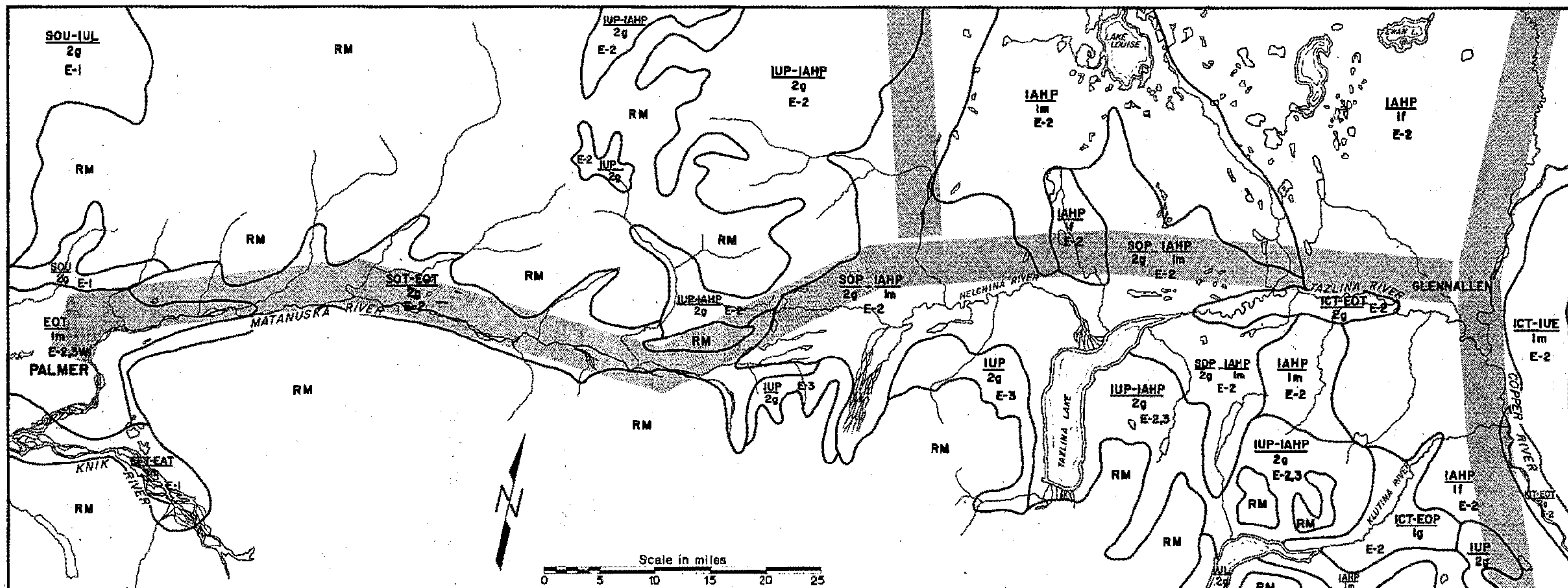
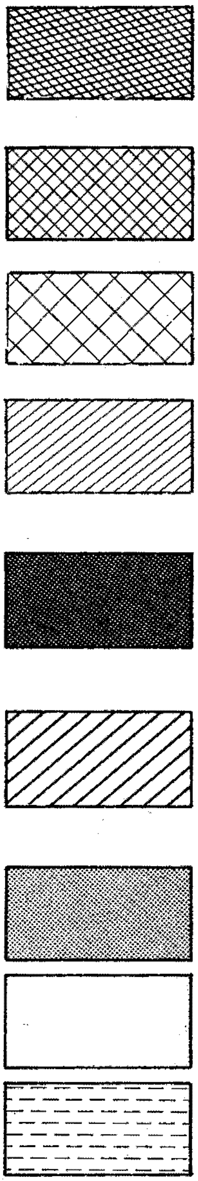


SOILS : PALMER—GLENNALLEN

LAND STATUS LEGEND



Major withdrawals prior to Alaska Native Claims Settlement Act, (December 18, 1971)

Withdrawals for possible inclusion on the four National systems (D-2)

Withdrawals for classification and public interest (D-1)

State selections - patented, tentatively approved, and pending (SS)

Withdrawals for Native villages eligible for land selections

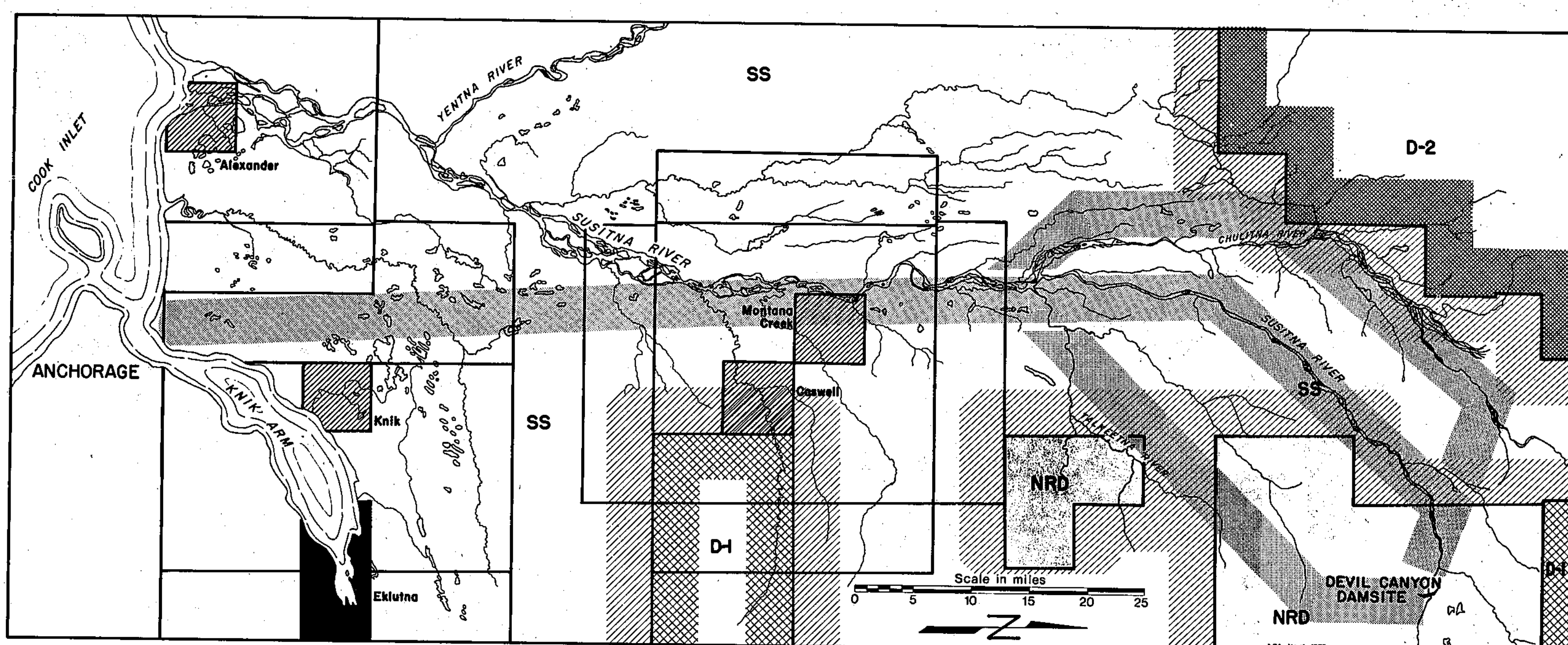
Withdrawals for Native villages, eligibility for land selection not finally determined

Village deficiency withdrawals (NVD)

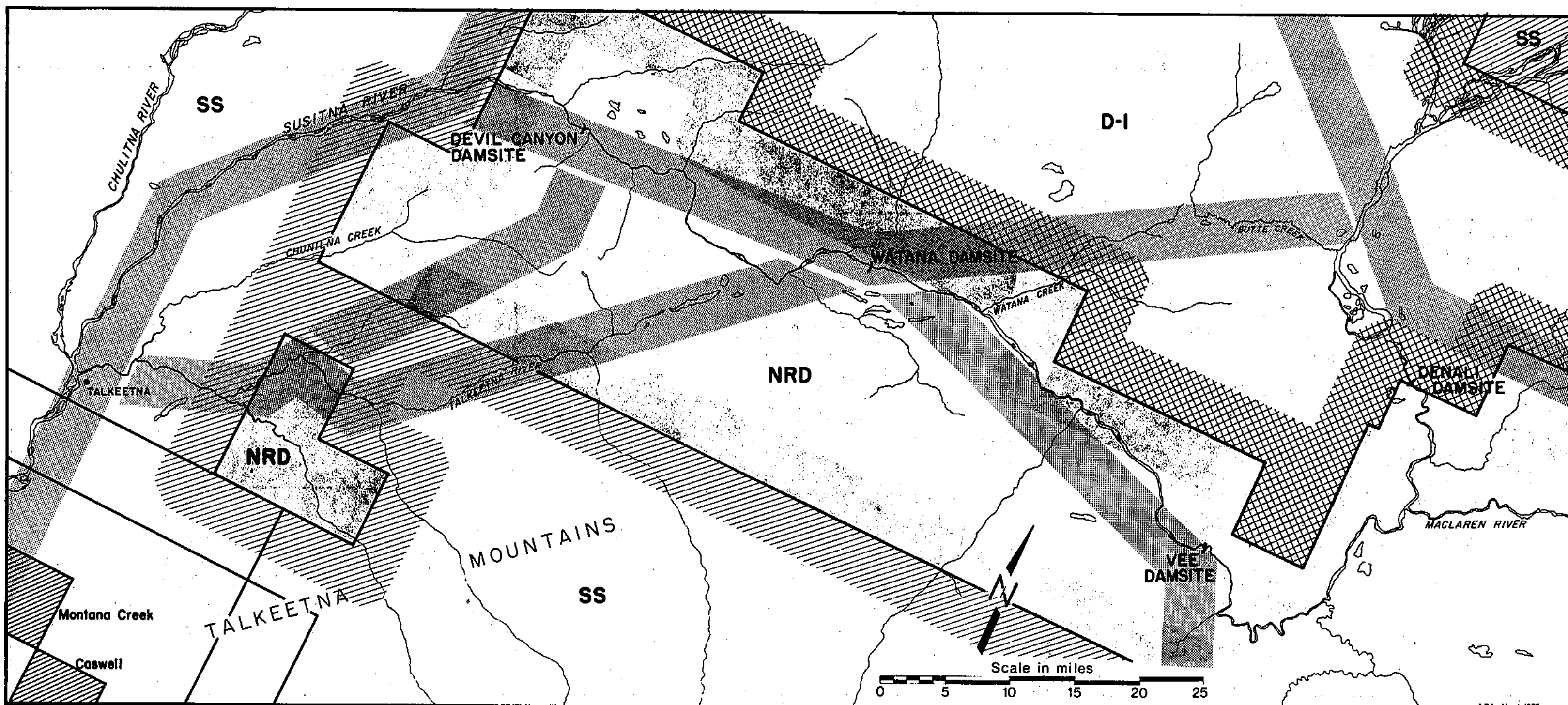
Regional deficiency withdrawals (NRD)

Utility corridor (UC)

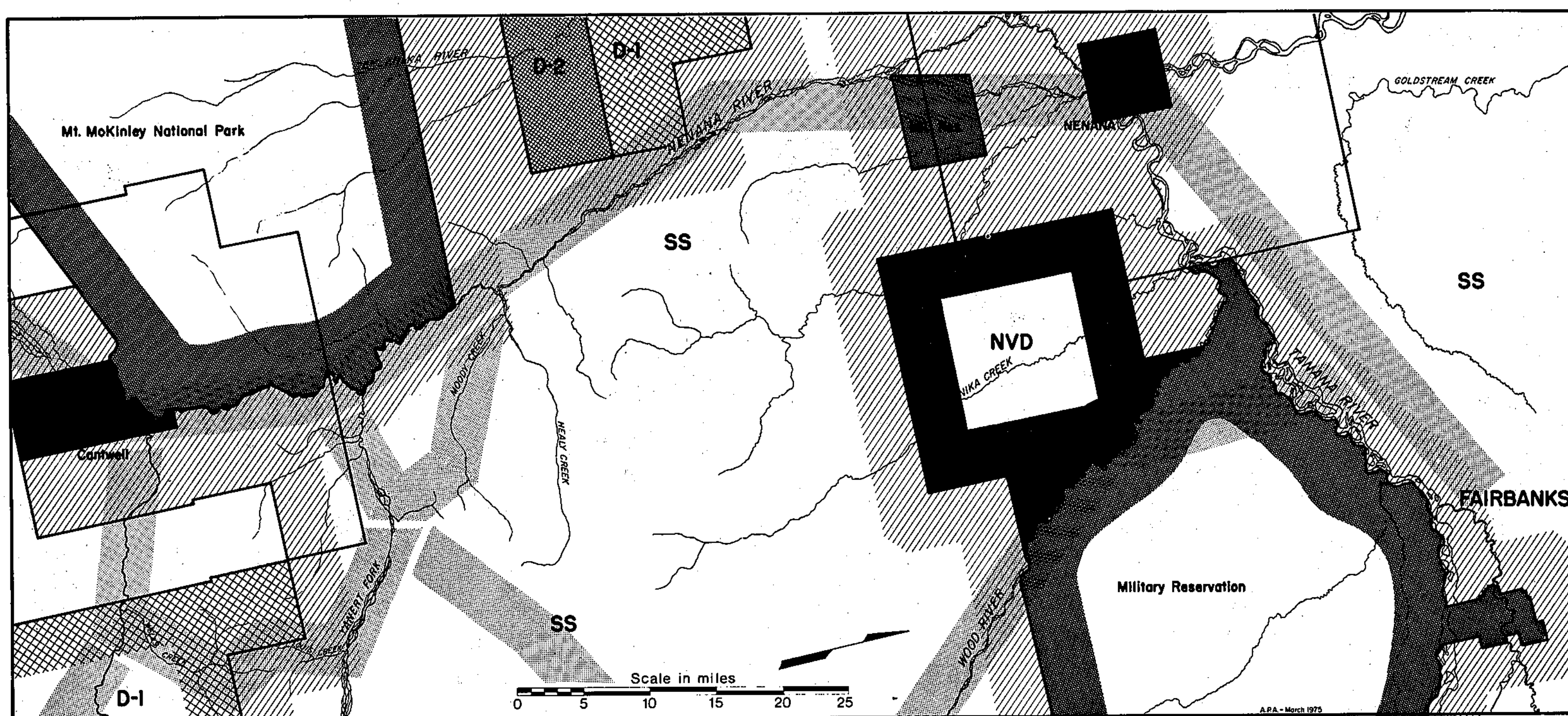
These maps represent the land status situation as determined by the Bureau of Land Management, December 18, 1973



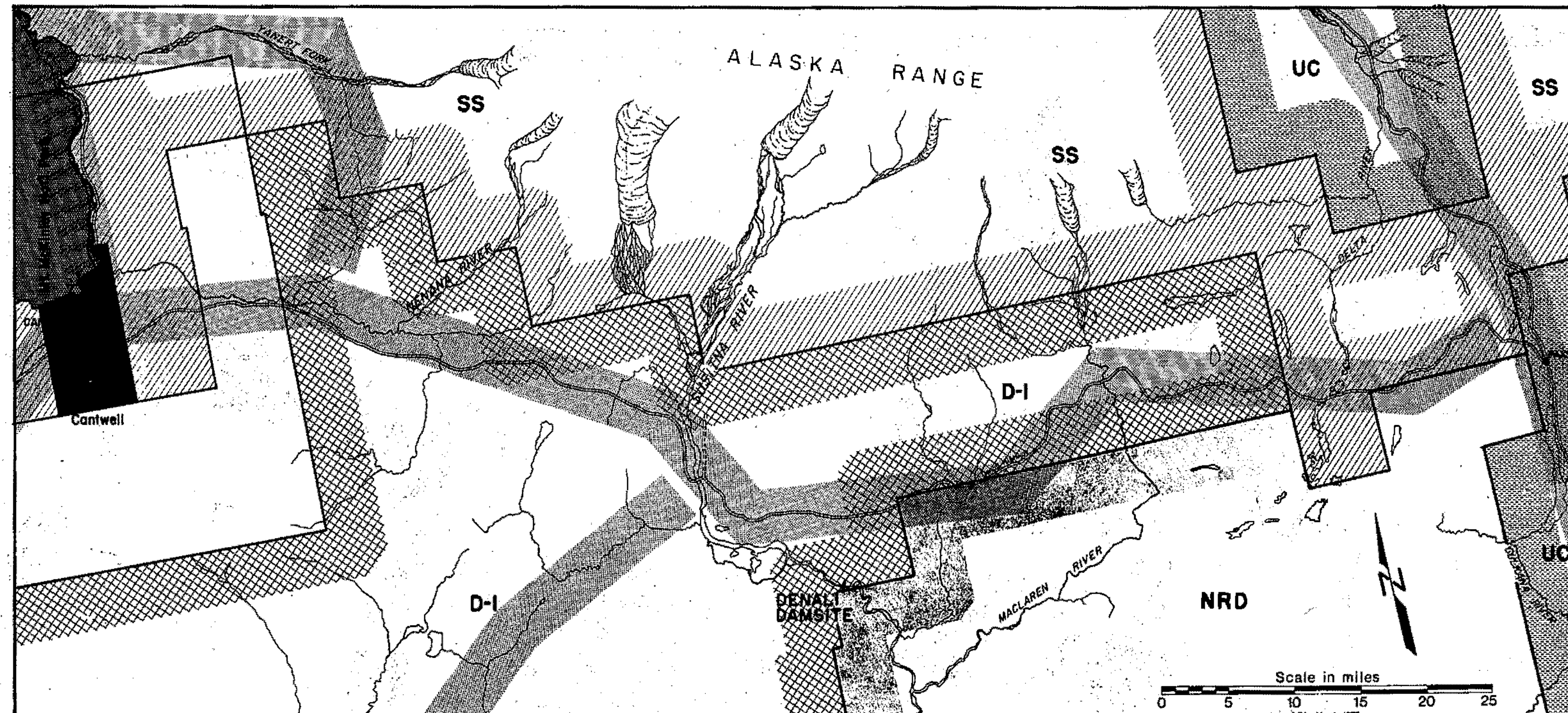
LAND STATUS: ANCHORAGE-DEVIL CANYON



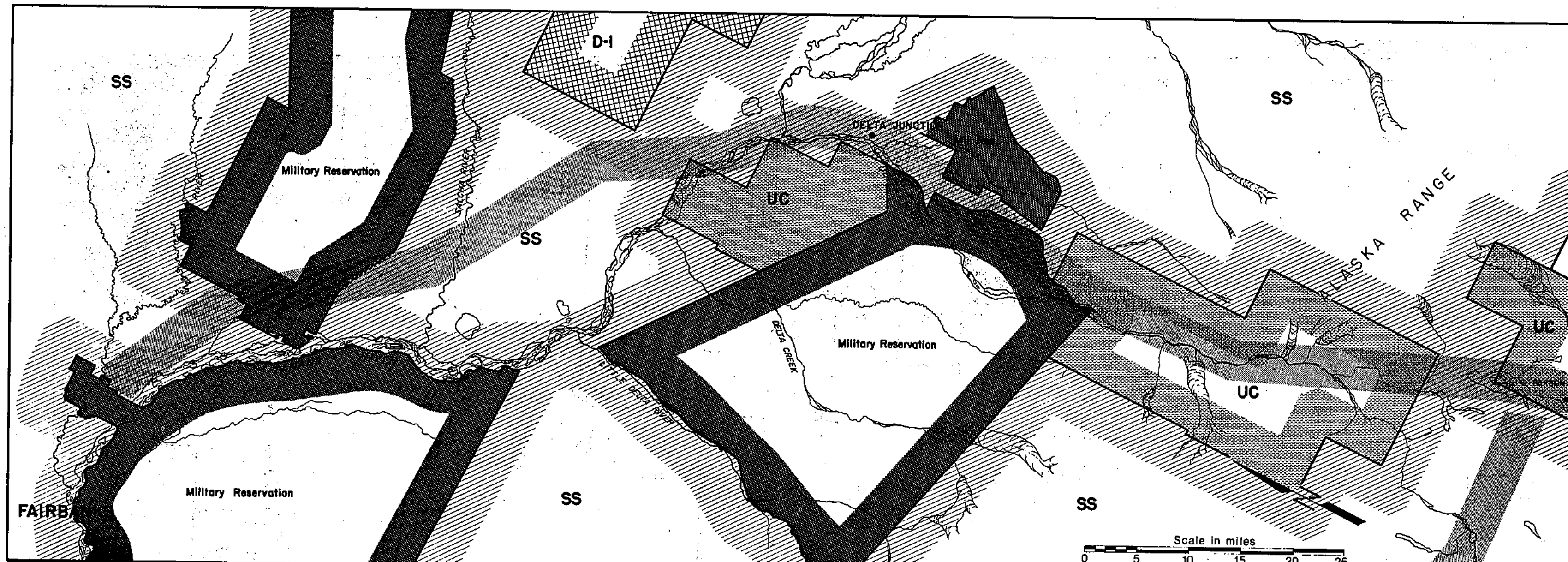
LAND STATUS: SUSITNA



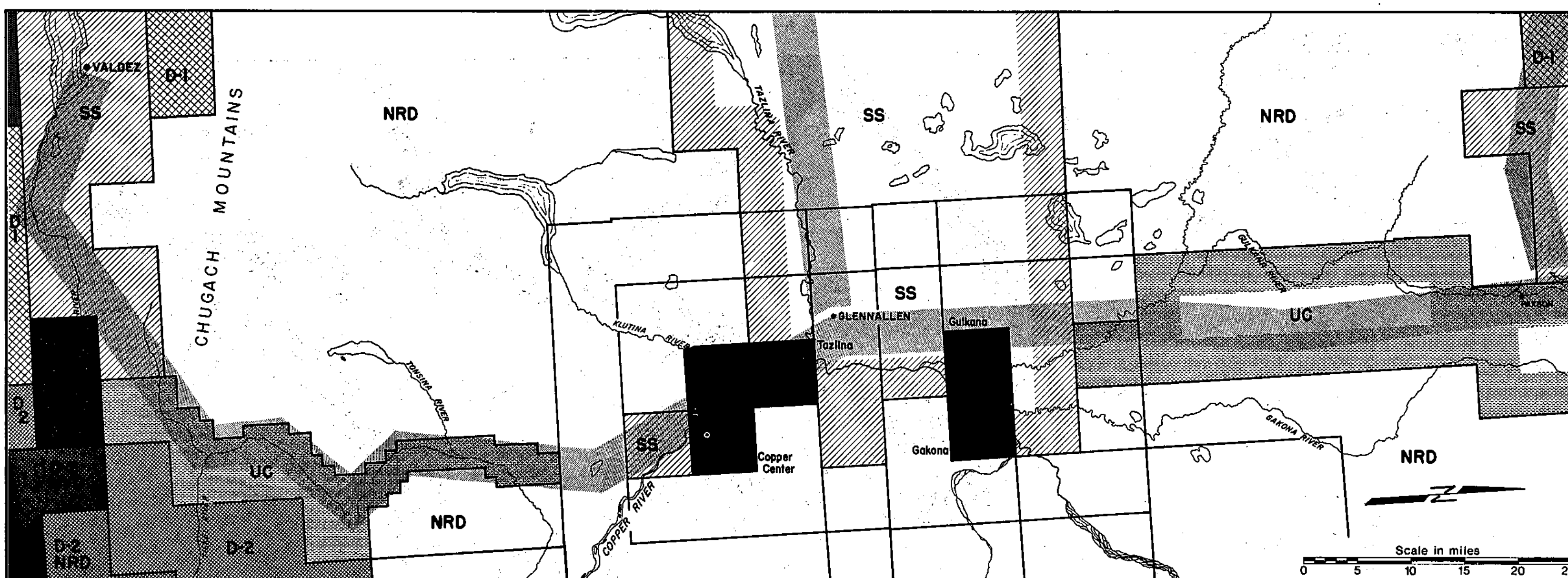
LAND STATUS:CANTWELL-FAIRBANKS



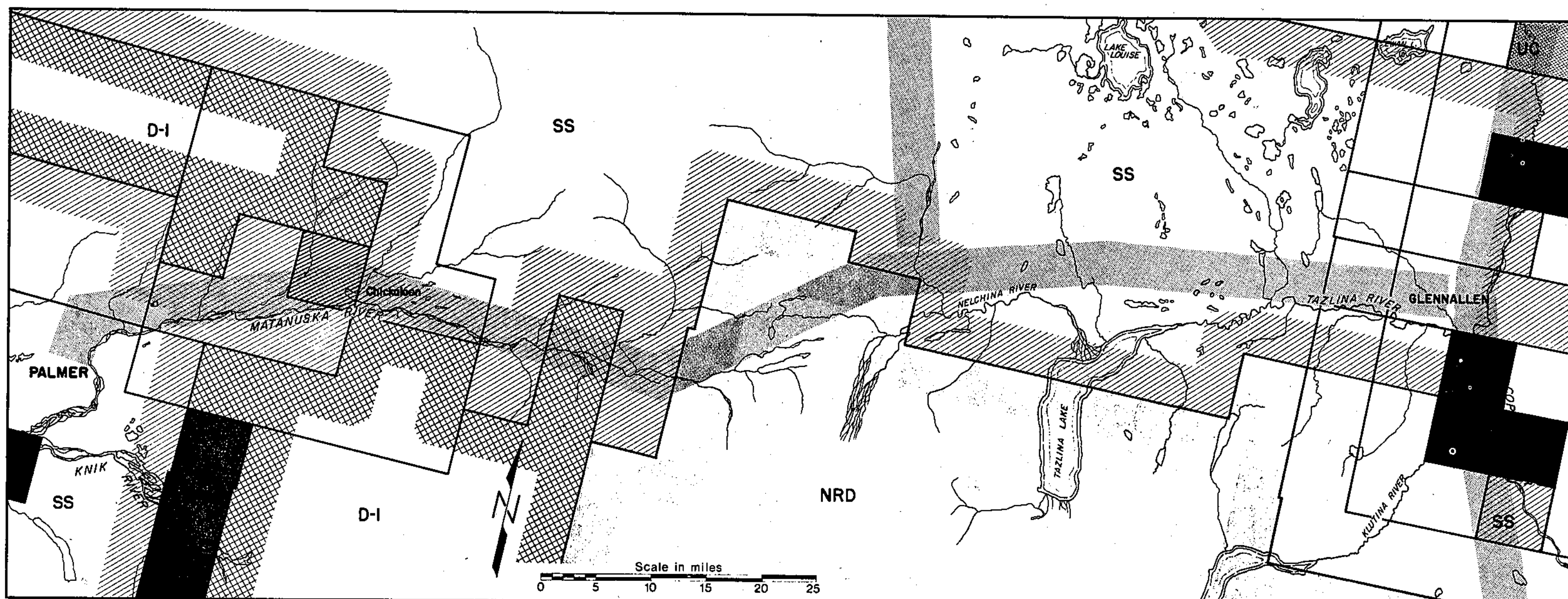
LAND STATUS: CANTWELL-PAXSON



LAND STATUS: FAIRBANKS-PAXSON



LAND STATUS : VALDEZ-PAXSON



LAND STATUS: PALMER—GLENNALLEN

EXHIBIT I-3

Photographs

The following photographs depict typical views and critical points along the proposed corridors and their alternatives:

Photos 1 - 4 are illustrations of Corridor Susitna-1

Photos 5 - 25 are illustrations of Corridor Nenana-1

Photos 26 - 28 are illustrations of Corridor Susitna-2

Photos 29 - 30 are illustrations of Corridor Susitna-3, 4

Photos 31 - 40 are illustrations of Nenana-2, 3, 4, 5

Photos 41 - 56 are illustrations of Matanuska-1, 2

Photos 57 - 69 are illustrations of Delta Corridor

All photographs in this appendix were taken by APA personnel. The majority were taken in September of 1974.

Lower Susitna River Valley. This area is characterized by extensive muskegs, intermingled with bottomland spruce-poplar forests. Permafrost is absent or discontinuous in this area, although the soils are generally poorly drained.

Susitna River Valley. Lakes are prevalent and associated with muskegs, which succeed them in formation. Muskegs are succeeded in turn by forests dependent upon well-drained soils. The three stages of succession are shown here.

Susitna River Valley near Talkeetna. As the terrain becomes more rolling, the relative amount of muskeg becomes less.

Town of Talkeetna. This town is at the confluence of the Talkeetna, Susitna, and Chulitna Rivers. The Alaska Railroad can be seen crossing the Talkeetna River near the right edge of the picture.

Summit Lake at Broad Pass. Broad Pass is an aptly named feature; a structurally-controlled depression in an otherwise mountainous area. It is the divide for tributaries of the Chulitna and Nenana Rivers.

Alaska Range from Anchorage-Fairbanks Highway near Broad Pass, late spring. Vegetation biome is lowland spruce-hardwood. Soils here are basically glacial deposits.

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Alaska Range from Anchorage-Fairbanks Highway near Broad Pass. Soil here is poorly drained; trees visible are black spruce.

Entering Alaska Range on Anchorage-Fairbanks Highway, north of Cantwell. Concealment of line will be difficult in areas such as this.

Looking south along Nenana River to Upper Nenana Canyon. The Anchorage-Fairbanks Highway parallels the left bank. Mount McKinley National Park and the Alaska Railroad are on the right bank of the river.

Nenana River and Sugar Mountain, seen from Anchorage-Fairbanks Highway near Yanert. Yanert Fork enters Nenana River near right-hand edge of photo. Visible also is communication line for Alaska Railroad.

Very restricted canyon along Nenana River north of McKinley Park. Alaska Railroad is off left-hand edge of photo. Land left of river is within Mount McKinley National Park.

Another view of canyon on Nenana River.

Nenana River valley in vicinity of Moody bridge on Anchorage-Fairbanks Highway.

Alaska Railroad north of McKinley Park.

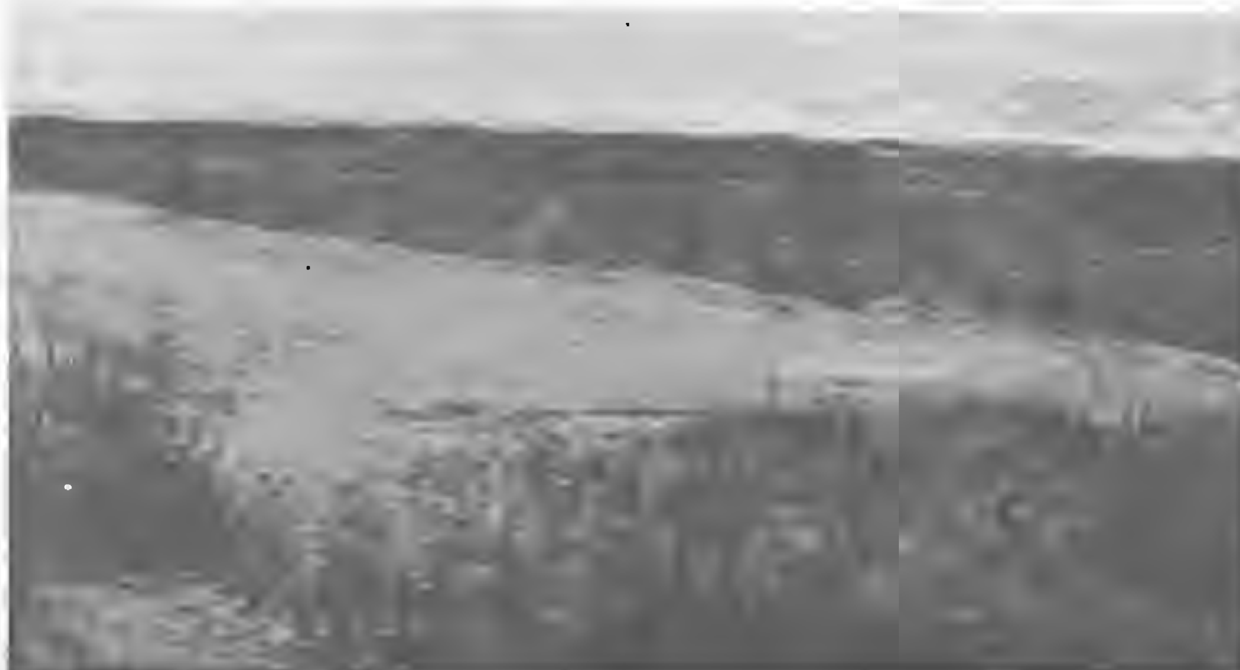
Usibelli Coal Mines near Healy. Note the seams of coal in the scarp. This coal is the fuel for the Healy steamplant.

Nenana River flood plain near Healy. Note the terraces characteristic of the Nenana Valley in this area.

138 KV Healy transmission line. Looking south from Anchorage-Fairbanks Highway towards Healy.

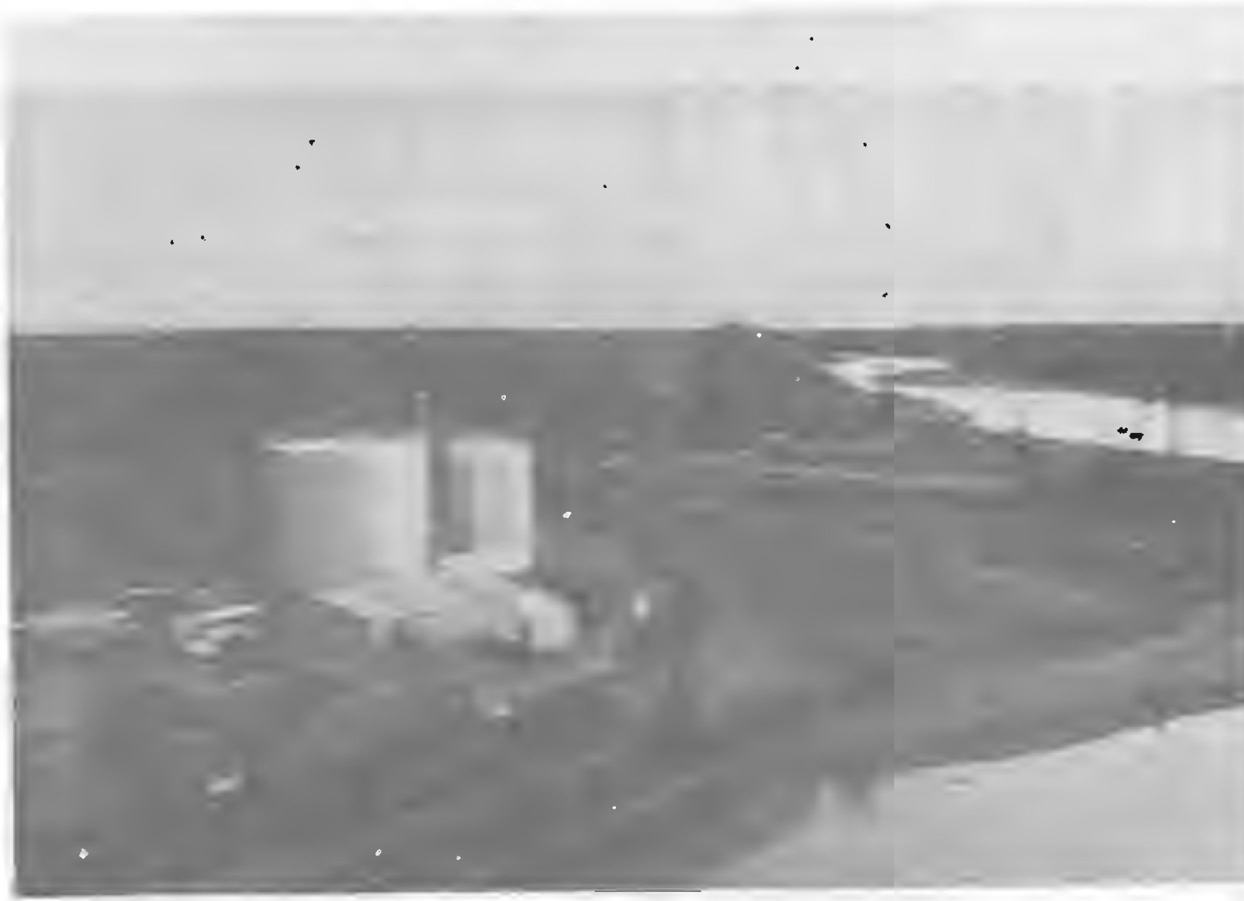
Guyed tangent tower in foreground; guyed dead-end towers in background; Healy 138 KV transmission line.

Guyed 138 KV tower on the Healy transmission line.



Nenana River valley, looking south to Alaska Range. Terraces are fairly evident along right background.

Town of Nenana, at confluence of Tanana River and Nenana River, which flows in from lower right. Double-span bridge is for the Anchorage-Fairbanks Highway; single-span bridge is for Alaska Railroad.



Alaska Railroad siding along Tanana River at Nenana. Large free-standing tower is part of river crossing of Healy 138 KV transmission line.

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Town of Nenana; frontage on Tanana River. Nenana handles considerable river traffic on the Tanana River.

"Goldstream Hills". On the slopes, the predominant vegetation is birch-white spruce, on poorly drained areas and some north-facing slopes; black spruce predominate.

View to the west from the "Goldstream Hills". These hills flank the north bank of the Tanana River; the Anchorage-Fairbanks Highway enters them immediately across the river from Nenana, and follows their crest to Ester and Fairbanks.

Clearing for Matanuska Electric Association (MEA) distribution line. Vegetation is predominantly poplar and spruce. Clearing was done by uprooting trees with a bulldozer.

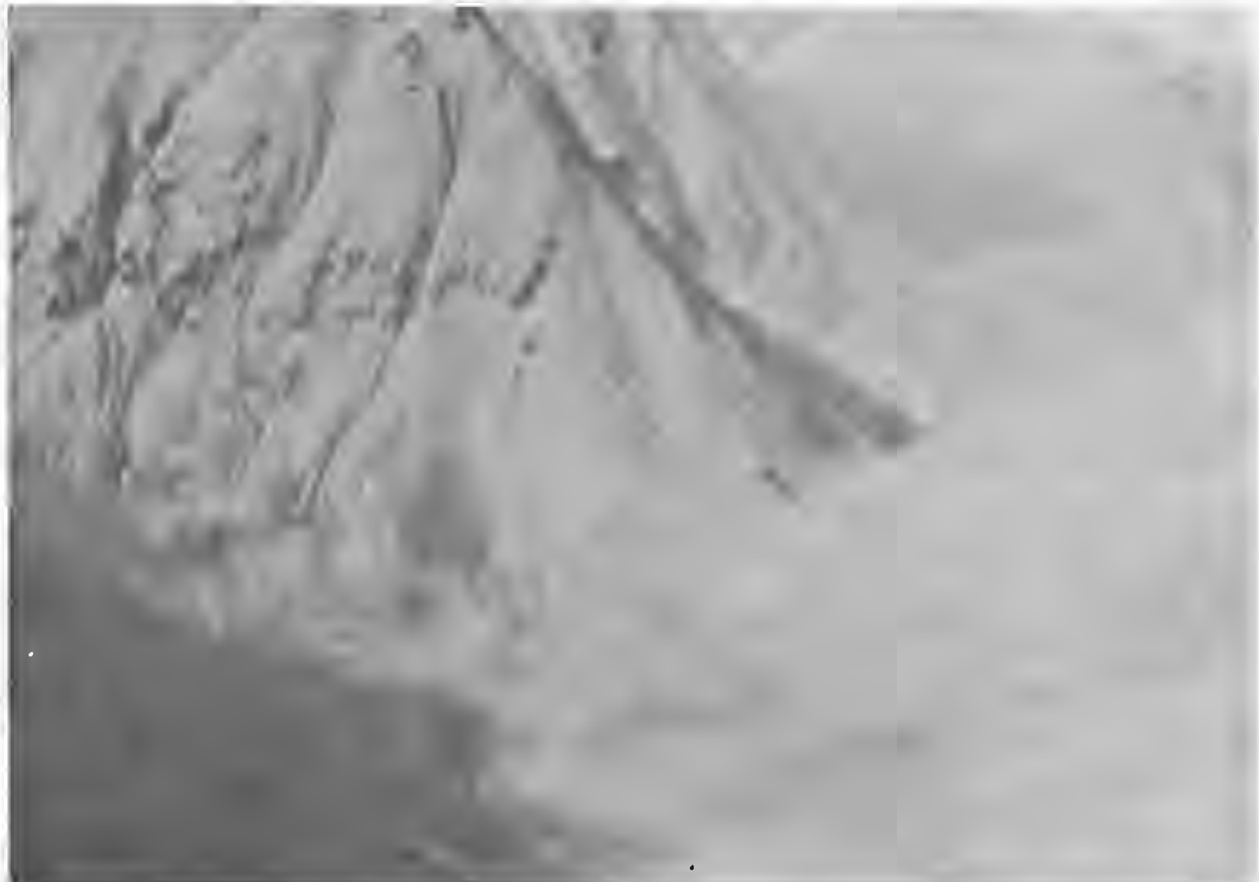
Near Honolulu on the Anchorage-Fairbanks Highway. Biomes shown on low brush muskeg in foreground and upland spruce-hardwood in background. Black spruce in foreground are associated with poorly drained soils and/or shallow permafrost tables.

Little Coal Creek in Denali State Park. Vegetative biome is classified as upland spruce-hardwood. Streams in this area are incised into a relatively gentle plain.

Talkeetna River near town of Talkeetna. This photo shows the density and conformity of the forest of the lower Susitna Valley in the Talkeetna area.

Detail of bottomland forest near Talkeetna. Predominant trees are poplar and white spruce with considerable brush understory. This forest type can easily conceal a transmission clearing.

Upper Wells Creek, approaching pass to Louis Creek. Biome is alpine tundra.



Wells Creek Pass as seen from Louis Creek side.

Moody Pass from Yanert Fork to Moody Creek, which is visible in the upper left. This pass is relatively low (2900') and wide, but soils are poorly drained and subject to permafrost.

Lower Moody Creek. This is a well-dissected area, covered with upland spruce-hardwood. Routing of transmission may prove difficult in this stretch.

Lower MoodyCreek at confluence with Healy Creek
(top of photo). Unstable slopes are evident.

Looking north from western end of Denali Highway. Typical low brush and muskeg biomes. Trees are black spruce.

Aerial view looking west along Denali Highway and Nenana River to Cantwell. Note that forests are limited to the terrace slopes and levees of the river channel.

Surface view of area typical of that shown in photo above; in this case, the Nenana River is in the vicinity of the Wells Creek confluence. The lowland spruce-hardwood is limited to the terrace slope and river bottom.

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Looking west up the Nenana River and Denali Highway. The sources of both the Nenana and Susitna Rivers are in the Alaska Range visible in the upper left. In the upper left also is the divide between these two rivers, a wide, poorly-drained area called Monahan Flat.

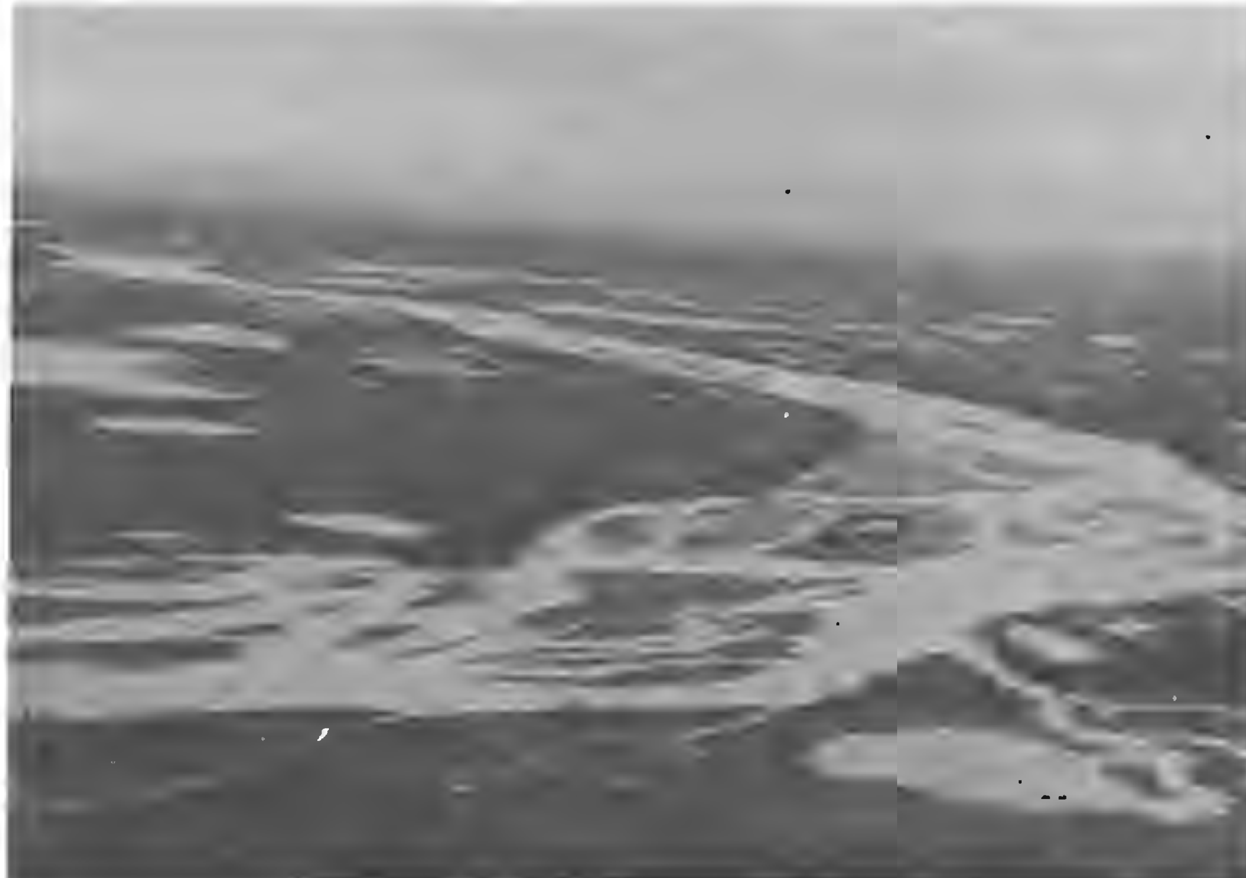
Susitna River between Watana and Vee damsites. Heavier vegetation, in this case upland spruce-hardwood forest, is limited to the valley slopes, the vegetative biome on the upper plateaus is generally moist tundra, muskeg, and alpine tundra.

Susitna River at Vee damsite. This demonstrates the typically incised character of the Upper Susitna from Devil Canyon to the Tyone River. Note that heavier vegetation is limited to slopes and creek valleys.

Moist tundra near Butte Lake; looking north to Monahan Flats and Alaska Range. ATV tracks are visible in the foreground; these tracks start from the Denali Highway, which crosses the flats in the background.

ATV tracks leading from Denali Highway. This photo shows typical moist tundra vegetation with low-growing brush, peaty soil, and poor drainage.

Susitna River above Denali damsite, looking west. The few spruce to be found are limited to the river bottom.



Impoundment area of Denali damsite. The Susitna here is a meandery, aggrading river, the surrounding land is very poorly drained and underlain by fairly continuous permafrost.

Maclaren River, looking north to the Clearwater Mountains. The foreground knob is part of a morainal ridge. These morainal features are reltaively well-drained, whereas the flat low-lying lands are poorly drained with shallow permafrost tables.

Looking north along the Denali Highway to the Amphitheater Mountains. Morainal ridges run across the middle of the photo. The biome along most of the eastern half of the Denali Highway is moist tundra.

Uplands near Sourdough on the Richardson Highway. This is typical of the plateau bordering the Copper River lowland on the north and east. Poorly drained, it supports many lakes, the largest of them in the Lake Louise complex.

The Lake Louise plateau. Biomes are predominantly lowland spruce-hardwood and muskeg. These uplands are underlain by continuous permafrost.

The Copper River lowlands, a large basin underlain by permafrost.

Tazlina River as seen from the Glenn Highway.

Tahneta Pass area between the Tazlina and Matanuska River drainages. Lakes and muskegs are indicative of poor drainage. The mountains are part of the Chugach Range.

Talkeetna Mountains; Glenn Highway runs across the lower portions of the photo. The Matanuska valley is bordered on the north by the Talkeetna Range, on the south by the Chugach.

Howell Glacier and the Chugach Range. The Matanuska River flows in an incised channel across the middle of the photo.

Caribou Creek and the Talkeetna Mountains; Glenn Highway on lower portion of photo. This tributary of the Matanuska River typifies the incised character of many rivers eroding through glacial debris and loess, such as the Matanuska, Copper, Gulkana, and upper Nenana Rivers.

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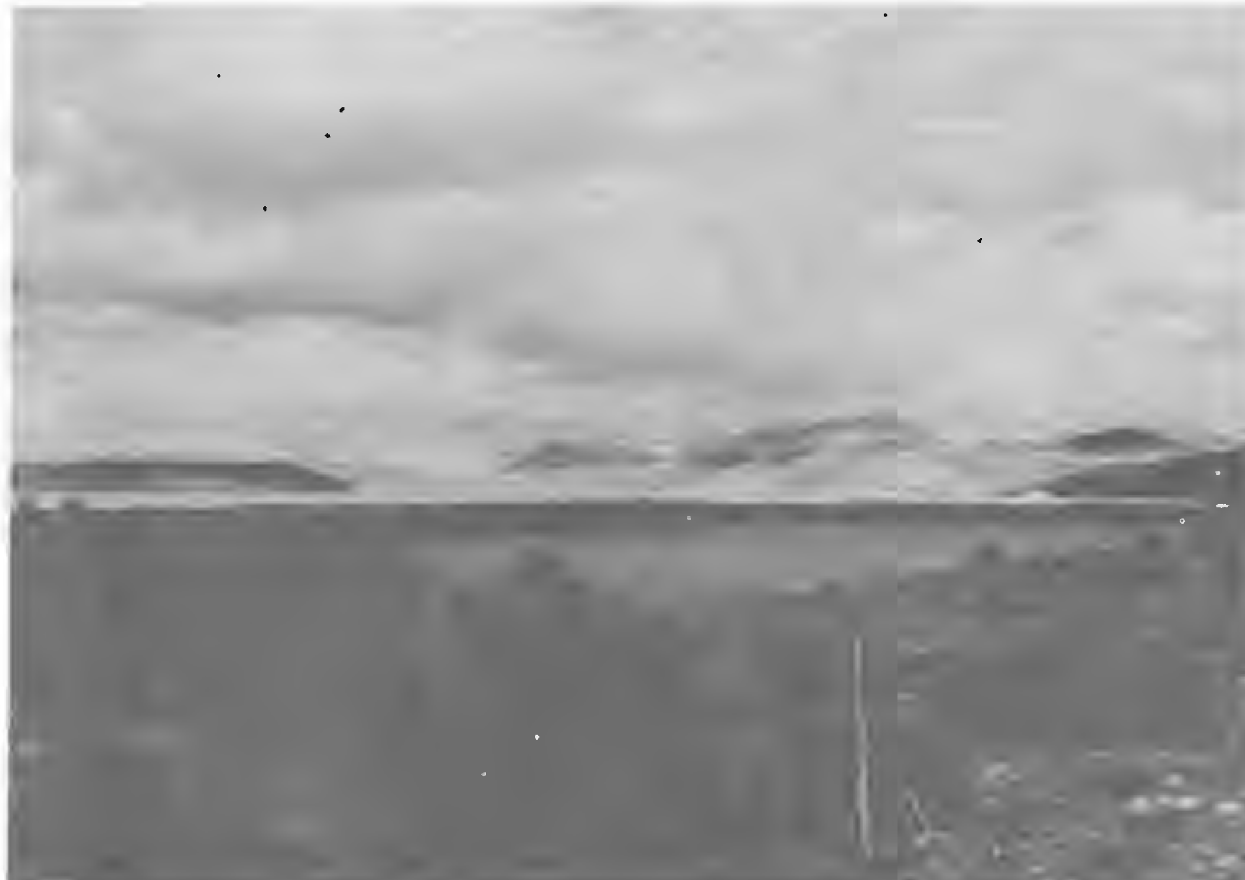
Matanuska River and Chugach Range. The Matanuska River has a braiding channel due to the high silt load from the Howell and Matanuska Glacier, and the glacial tributaries entering from the Chugach Range.

Looking north by Paxson Lake on the Richardson Highway to the Alaska Range. Paxson Lake is an important part of the fisheries of the Gulkana River.



Summit Lake and the Alaska Range. Summit Lake is drained by the Gulkana River and is just south of Isabel Pass.

Isabel Pass, looking north to Rainbow Ridge. The Richardson Highway, the Delta River, and the Alyeska Pipeline cross the photo at the base of Rainbow Ridge.

Rainbow Ridge, as seen from the south. The Richardson Highway crosses under the ridge from right to left. The slope of the ridge is a series of adjoining talus cones some of which are unstable.

Delta River by Black Rapids Glacier. The glacier is partially visible in the upper center of the photo. The Delta River carries considerable glacial silt, resulting in aggradation and braiding of the channel.

Alaska Range seen from the north from the Richardson Highway. This is not true perspective as seen from the highway, since the photo was taken with a telephoto lens.

The Alaska Range seen from the Richardson Highway near Donnelly Dome, looking south. The dust is from the channel of the Delta River, which is extremely undersized for its channel.

Another view of the Delta River as seen from near Donnelly Dome.
Again, the blowing dust from the channel is evident.

Alaska Range from Big Delta, taken with telephoto, In the foreground is the Delta River channel, which near here joins the Tanana River.

Farm near Delta Junction. Some attempt at farming is made in the Clearwater Lake area, but agriculture is relatively unimportant except for the lower Matanuska Valley area.

Silhouetted notch on a clearing for a GVEA distribution line.

Looking up the Tanana River across the confluence of Shaw Creek. The braiding of channels characteristic of the Delta and Tanana Rivers is evident.

The Tanana River flood plain. This area is extremely flat and poorly drained. Three types of biome are represented in this picture: muskeg, lowland spruce-hardwood, and bottomland spruce-poplar. The dark forests are mainly black spruce. The sinuous lighter forest is white spruce, aspen and birch. This forest type prefers well-drained soils, and so is found on old levees of existing and extinct channels.

1. Brush blades, brush hogs: Devices mounted on tractors or bulldozers which cut and clear brush with less soil disturbance than the methods of uprooting with the standard blade or shovel.

2. Chipping: Method of disposal of cleared brush and slash by mechanical cutting into suitably small chips, which are then either dispersed or hauled away.

3. Climax: A stable condition achieved by a community of plants and animals resulting in successful adjustment to its environment. The stability involved is of a long-term nature; short-term fluctuations are to be expected. In this way, a climax stage of development can be considered dynamically stable rather than static. See Succession.

4. Conductor: The part of the transmission system which actually transmits power. In overhead systems, this is an uninsulated cable, generally of aluminum and steel, connected to the towers by way of insulators. In underground systems, the conductor is generally aluminum cable insulated with oil-impregnated paper, oil, or plastic. This cable is often wrapped in a protective sheath. In overhead systems, there can be multiple conductors per phase. Single conductors are called simplex; double conductors are called duplex. Larger numbers of cables per phase can be used, the resulting combination called conductor bundles.

5. Corridor: A generalized route. A strip of land of variable width joining two end points. In this assessment, corridors are not defined in width and final location. A more specific linear location is the Route.

6. Danger Tree: Any tree which threatens the safety of a transmission system. Several factors determine danger trees: voltage of line, height of line above ground, height of tree, growth rate of tree, and distance of tree to center line. These trees must be periodically identified and removed.

7. Ecosysem: The complex of a community and its environment functioning as an ecological unit in nature.

8. Electromagnetic Interference (EMI): Interference with radio and television produced by corona losses from transmission lines. EMI is a function of many factors, among them the voltage of the line, the configuration, site, height and age of the conductors, and atmospheric conditions.

9. Fault: In the transmission sense, a condition of either open or short circuiting can be caused by defects, lightning, grounding or connecting of phases, dropping of overhead cable, or break in insulation in underground cable. In the geologic sense, a fracture in the crust, along which displacement has occurred.

10. Free-standing Towers: A transmission tower design needing no support from guyed cables. This design generally has four legs, and is usually of steel lattice construction. See Guyed Tower.

11. Generation Site: Any power site, without regard to method of generation. Generation sites are one end to transmission lines. In this assessment, the generation sites are the potential power sites on the Upper Susitna River.

12. Guyed Tower: A transmission tower supported by two or more guyed cables and pivoting on one or two points. Generally lighter than free-standing towers, they are more suited to helicopter construction. See Free-standing Towers.

13. Habitat: The particular area in which a plant or animal lives. In general, any area possessing those conditions necessary to support a population of a particular plant or animal.

14. Herbicide: A variety of pesticide which affects plants. Herbicides can be general or specific in action, and of various potencies and duration.

15. Interconnection: The connection of two or more independent power systems with tie lines. Besides an increase in total reliability, the opportunity exists for one system to sell surplus power to another, which can result in greater efficiency of generation.

16. Load Center: A point at which the load of a given area is concentrated. For example, the Anchorage load center, as referred to in this assessment, covers the load included in the CEA, AML&P, HEA, SES, and MEA systems. The load center is assumed to be the receiving end of a transmission line. See Generation Site.

17. Permafrost: Permafrost is a condition resulting whenever soil or rock has been subjected to an annual average temperature of less than 0°C for more than two years. Ice-rich permafrost is permanently frozen soil with a high moisture content. Permafrost table is the level beneath the soil surface which remains frozen through summer.

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18. Right-of-way (ROW): A right-of-way is a strip of land dedicated for use of some utility, such as transportation or transmission. The land within a ROW is sometimes an easement, not involvingthe purchase of the land, or can be owned by the utility. The right-of-way width for a transmission line is generally less than 200 feet wide. Clearing width and right-of-way width should not be confused; clearing width, if clearing is needed at all, is almost always less than the right-of-way width.

19. Route: A definite location of a ROW, as opposed to a corridor.

20. Seismic: Pertaining to, subject to, of the nature of, or caused by an earthquake.

21. Substation: A facility at a junction of transmission lines or at the point of distribution to a load center. A substation functions to switch power and raise or lower voltage. See Tap.

22. Succession: A process by which a community of plants and animals achieves a stable adjustment to its environment; a successional stage is a transition culminating in a stable climax stage, providing the process is allowed to continue. However, due to natural and human causes, a community will often never reach a climax stage, the successional stages being maintained by fire, logging, grazing, agriculture or other reasons.

23. System Plan: A plan of transmission from generation site to load center which is a combination of two factors: the corridor location and the voltage and capacity of the transmission line.

24. Tap: A drawing of power from a transmission line, particularly at a point between the generation site and the main load center. Each tap will involve a substation.

25. Utility Corridors: A concept of concentrating generally parallel rights-of-way, even to the point of sharing of rights-of-way. The rights-of-way can be for various utilities, such as pipelines, railroads, transmission lines, and highways.

26. Sedimentation: The introduction into a stream or lake of sediment not normally associated with that water body. Although sometimes caused by natural agents, such as slides or erosion triggered by fires, it is more often a result of man's activities, such as logging and farming.

.SUMMARY.

Hyroelectric Power Development, Upper Susitna River Basin
(Southcentral Railbelt Area, Alaska)

( ) Revised Draft Environmental Statement (X) Final Environmental Statement

Responsible Office: Alaska District, Corps of Engineers
Colonel George R. Robertson, District Engineer
P. O. Box 7002, Anchorage, Alaska 99510
Telephone (907) 276-4915

1. Name of Action: ( ) Administrative (X) Legislative

2. Description of Action: The recommended plan is to construct dams on the upper Susitna River at Watana and Devil Canyon, powerplants, electric transmission facilities to the Railbelt load centers, access roads, and permanent operation and recreational facilities. The project has been authorized for detailed preconstruction studies. When funded, environmental, social, economic, and engineering aspects of the project will be studied at greater depth over a period of several years prior to recommending to Congress whether or not the project should be advanced to final design and construction. A major supplement to the Environmental Impact Statement will be prepared at the conclusion of preconstruction stage studies. The supplement will be coordinated for public review and comment and furnished to the Congress along with the Alaska District's final recommendations.

3. a. Environmental Impacts: The two-dam system would inundate some 50,500 acres extending 84 miles upstream from Devil Canyon Dam. Nine miles of a total 11-mile reach of white water would be inundated in Devil Canyon. Transmission lines would total 364 miles in length; corridors would average 186-210 feet in width, and require about 8,200 acres of right-of-way, of which about 6,100 acres would require vegetative clearing. The project would utilize a renewable resource to produce projected power needs of the Railbelt area equivalent to the annual consumption of 15 million barrels of oil. Heat and noise and air pollution problems associated with most alternative energy production sources would be prevented. Stream flows for some distance below Devil Canyon would carry significantly reduced sediment loads during the summer months. Recreational opportunity would be increased by access roads and creation of project-related recreational facilities.

b. Adverse Environmental Effects: The following adverse impacts would result from project implementation: impairment of visual quality resulting from access roads, dams, and transmission lines; loss of vegetation and habitat due to inundation and road construction; creation of public access resulting in increased pressure on wildlife and need for intensified game management and fire prevention practices;

increased turbidity of Susitna River downstream from Devil Canyon Dam during winter months; prevention of future mineral extraction from inundated land and limitations of options for uses of lands affected by the transmission corridors; direct impact on moose through some reduction of existing habitat; possible inhibition of movement of caribou which cross the reservoir between calving and summer ranges; temporary degradation of air, water, and vegetation as a result of slash and debris disposal; inundation of one historical site and any archeological sites which might be discovered within the reservoir pools; social impacts related to seasonality of construction work and demands upon services of small communities located in the vicinity of construction activity.

4. Alternatives: Construct no additional electrical generating facilities, construct other Susitna hydroelectric alternatives, construct other Southcentral Railbelt hydroelectric facilities, develop other alternative energy generating facilities using resources such as coal, oil, and natural gas, nuclear power, geothermal, solar, or other alternative power generating resources.

5. Comments Received:

a. District Review of Draft Statement:

United States Department of the Interior
- Alaska Power Administration
- Geological Survey--Reston, Virginia
- Fish and Wildlife Service
- Bureau of Outdoor Recreation--Seattle, Washington
- National Park Service--Anchorage, Alaska
- National Park Service--Seattle, Washington
- Bureau of Indian Affairs--Juneau, Alaska
- Bureau of Land Management--Anchorage, Alaska

United States Department of Commerce
United States Environmental Protection Agency
Department of the Army
- U.S. Army Cold Regions Research and Engineering Laboratory--Hanover, New Hampshire

Department of Transportation
- Coast Guard--Seattle, Washington
- Federal Aviation Administration--Anchorage, Alaska
- Federal Highway Administration--Portland, Oregon

Department of Housing and Urban Development--Seattle, Washington
Department of Agriculture--Soil Conservation Service
Federal Power Commission

State of Alaska--Office of the Governor

Greater Anchorage Chamber of Commerce

Office of the Mayor--Anchorage, Alaska

Sierra Club
Alaska Conservation Society--College, Alaska
Alaska Conservation Society--Anchorage, Alaska
Knik Kanoers and Kayakers, Inc.--Anchorage, Alaska
Cook Inlet Region, Inc.--Anchorage, Alaska
Orah Dee Clark Jr. High, Seventh Grade, Sixth Period Class

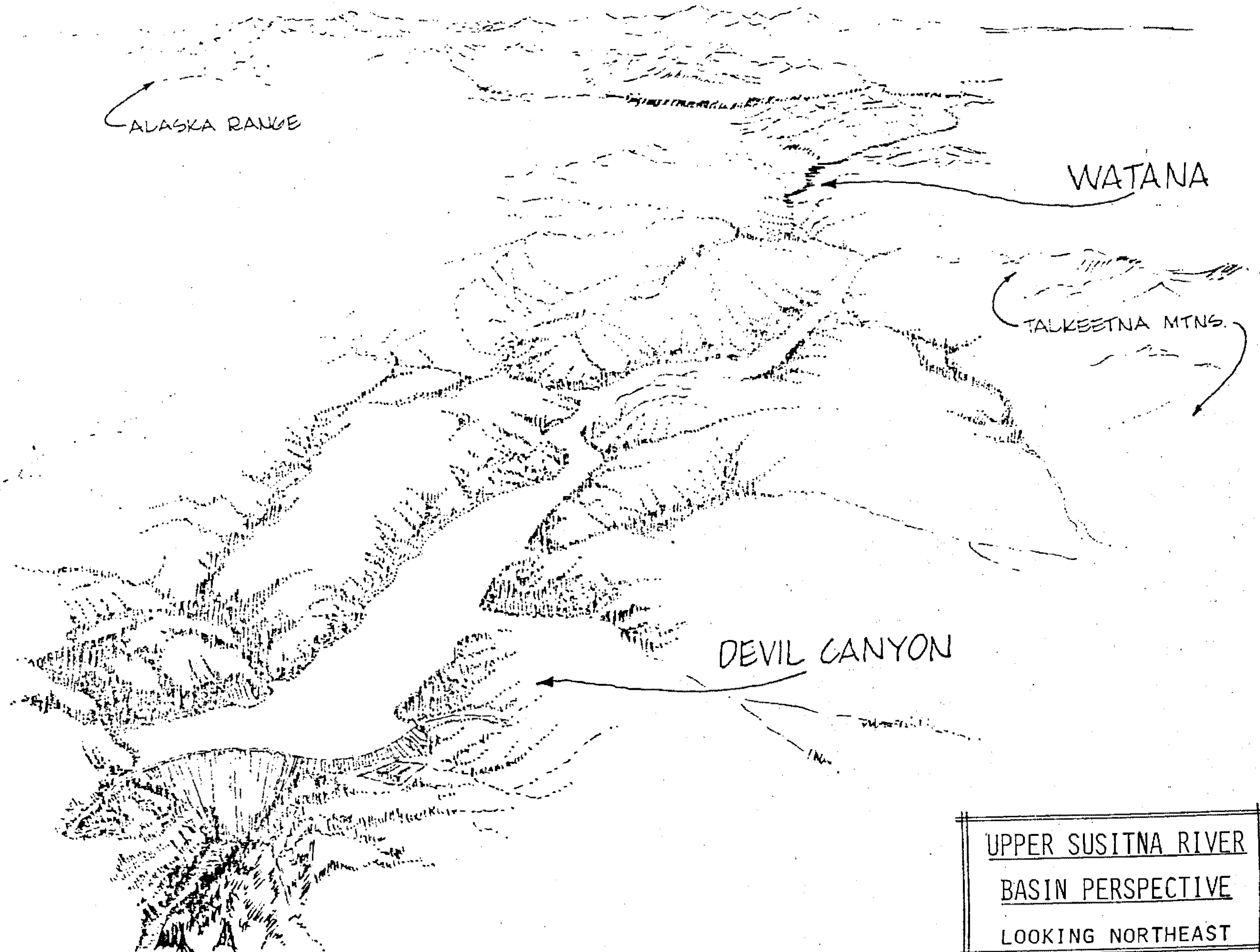
Private Citizens

b. Departmental Review of Revised Draft Statement:

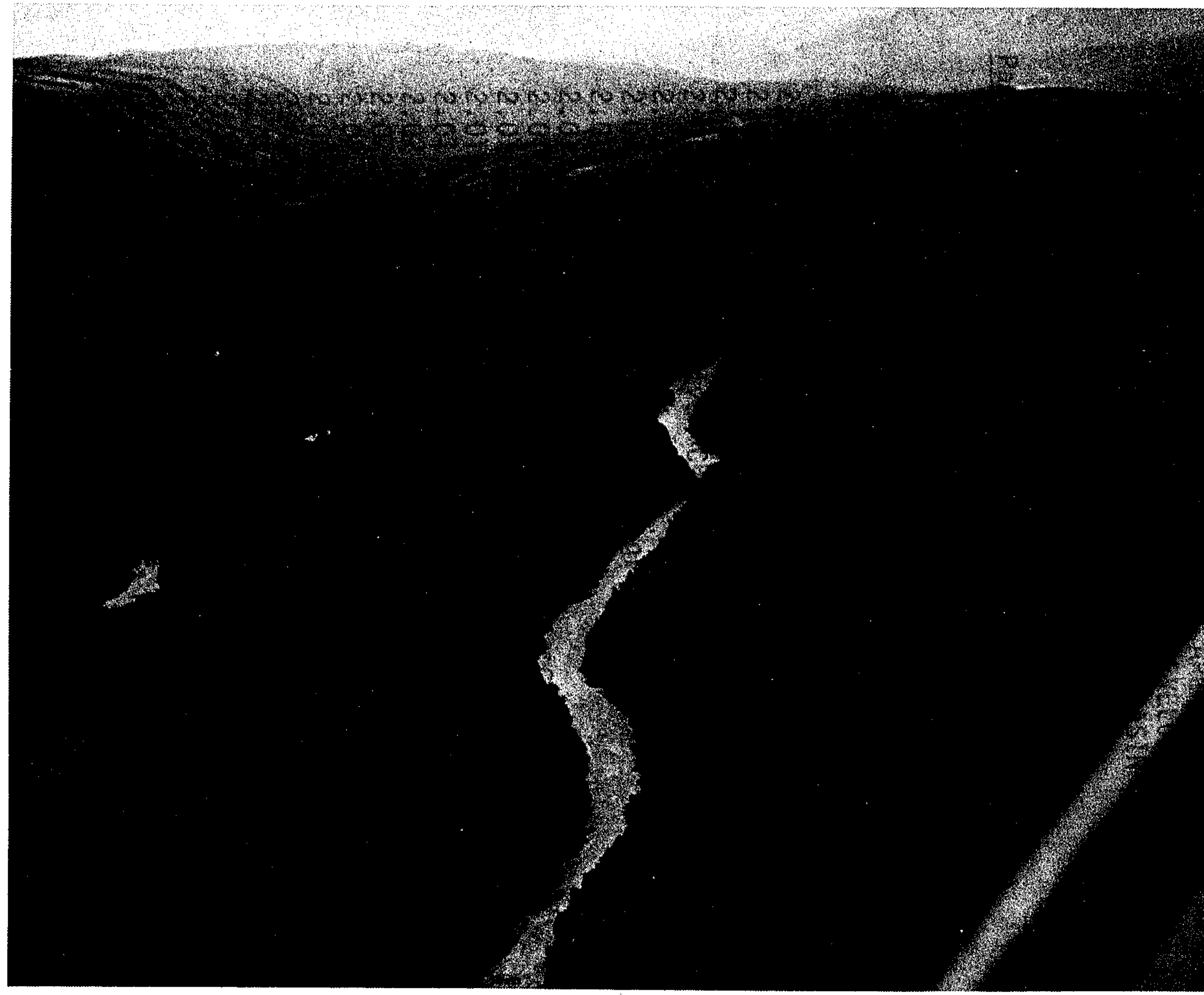
United States Department of the Interior
United States Department of Agriculture
United States Department of Commerce
United States Environmental Protection Agency
Federal Energy Administration
United States Department of Transportation
Federal Power Commission
United States Department of Housing and Urban Development
United States Department of Health, Education, and Welfare

Office of the Governor of Alaska--State Clearinghouse

6. Draft Statement to CEQ 3 October 1975.
   Revised Draft Statement to CEQ 9 July 1976.
   Final Statement to EPA 26 June 1979.



UPPER SUSITNA RIVER
BASIN PERSPECTIVE
LOOKING NORTHEAST



Looking downstream on Susitna River at Devil Canyon damsite. Dam would be located near bottom of photo. Vegetation is mostly white spruce.

DRAFT ENVIRONMENTAL IMPACT STATEMENT
SOUTHCENTRAL RAILBELT AREA, ALASKA
HYDROELECTRIC POWER DEVELOPMENT
UPPER SUSITNA RIVER BASIN

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1.0 PROJECT DESCRIPTION

1.01 Purpose and Authority. The utilization of renewable resources to produce electrical energy for domestic and industrial uses has become a primary concern in today's energy crisis. The consumption of nonrenewable sources of energy such as petroleum and natural gas has now reached a critical point where conservation of domestic sources must be considered. With the forecast increase in development for Alaska and corresponding increase in demand for electric power, the Committee on Public Works of the U. S. Senate adopted a resolution on 18 January 1972, requesting a study for the provision of power to the Southcentral Railbelt area of Alaska. The resolution is quoted as follows:

> That the Board of Engineers for Rivers and Harbors created under the provisions of Section 3 of the River and Harbor Act approved June 13, 1902, be, and is hereby, requested to review the reports of the Chief of Engineers on: Cook Inlet and Tributaries, Alaska, published as House Document Numbered 34, Eighty-fifth Congress; Copper River and Gulf Coast, Alaska, published as House Document Numbered 182, Eighty-third Congress; Tanana River Basin, Alaska, published as House Document Number 137, Eighty-fourth Congress; Yukon and Kuskokwim River Basins, Alaska, published as House Document Numbered 218, Eighty-eighth Congress; and, other pertinent reports, with a view to determining whether any modifications of the recommendations contained therein are advisable at the present time, with particular reference to the Susitna River hydroelectric power development system, including the Devil Canyon Project and any competitive alternatives thereto, for the provision of power to the Southcentral Railbelt area of Alaska.

1.02 Scope of the Study. The Southcentral Railbelt area is that portion of the Yukon and southcentral subregions which extends from Cook Inlet and the Gulf of Alaska on the south to the southern slopes of the Brooks Range on the north, a distance of about 500 miles. This area, containing about 75 percent of Alaska's population, is served by the Alaska Railroad and is commonly referred to as the "Railbelt" (see Figure 1). Major power resources, both hydroelectric and fossil fuels, and the greatest power demands are in this region.

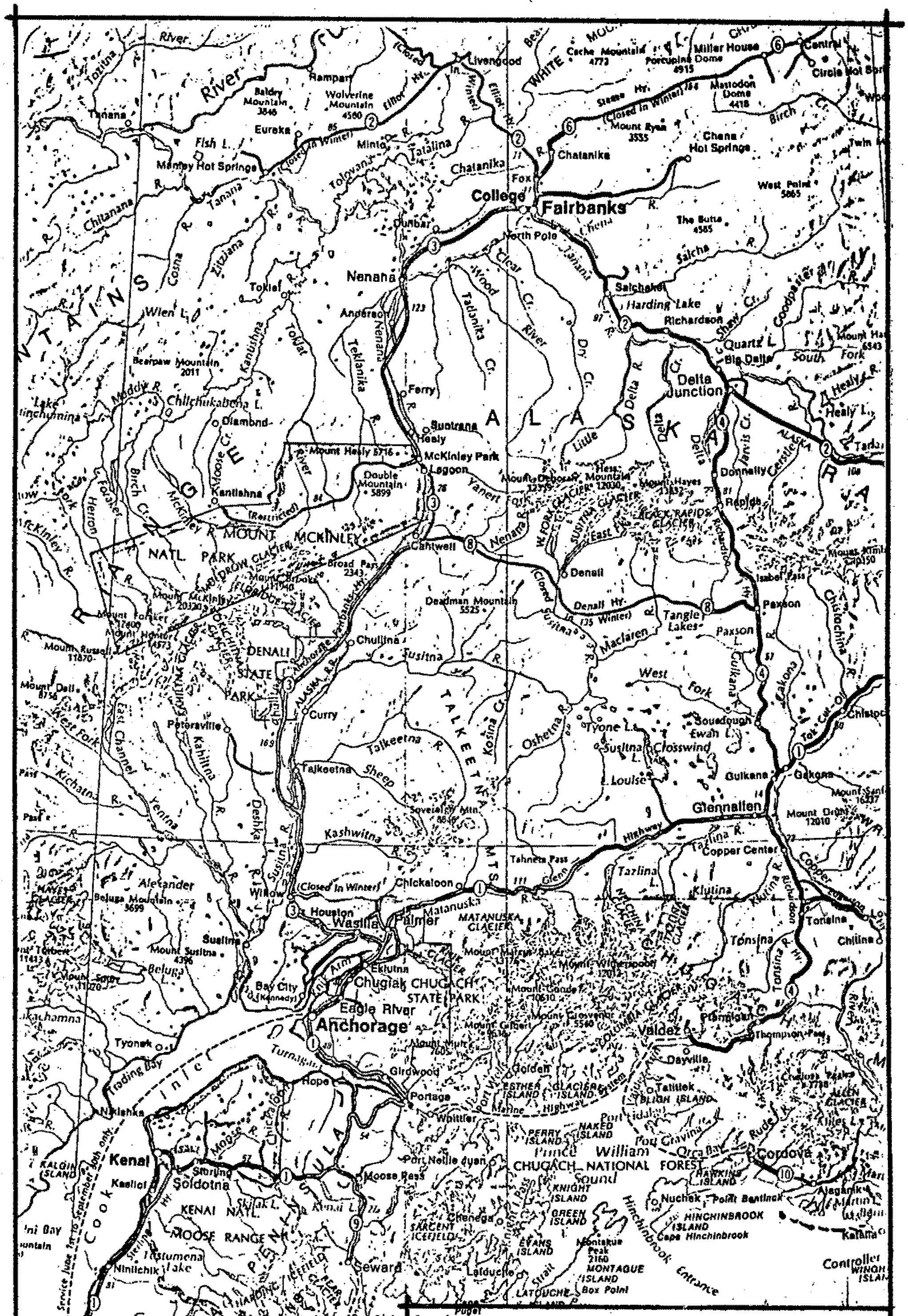
THE RAILBELT
MILES
0
50
100
Fairbanks
College
Nenana
Anderson
Ferry
Healy
McKinley Park
Cantwell
MOUNT MCKINLEY NATL. PARK
DENALI STATE PARK
Chulitna
Curry
Talkeetna
Willow
Houston
Wasilla
Palmer
Chickaloon
Eklutna
Chugiak
CHUGACH STATE PARK
Eagle River
Anchorage
Girdwood
Portage
Whittier
Hope
Moose Pass
Seward
Kenai
Soldotna
Kasilof
Ninilchik
Homer
Seldovia
Port Graham
KENAI NATL. MOOSE RANGE
Cook Inlet
Turnagain Arm
Knik Arm
Tyonek
Valdez
Cordova
Glennallen
Gulkana
Gakona
Copper Center
Paxson
Delta Junction
Big Delta
Richardson
Salchaket
North Pole
Livengood
Rampart
Eureka
Manley Hot Springs
Tanana
Chatanika
Chena Hot Springs
Central
Circle Hot Springs
Denali
Tangle Lakes
Prince William Sound
CHUGACH NATIONAL FOREST
HINCHINBROOK ISLAND
MONTAGUE ISLAND
Blying Sound
Kachemak Bay
Two Arm Bay

FIGURE 1
2

The proposed action discussed in this draft environmental impact statement is a two-dam system located in the Upper Susitna River Basin, which will provide hydroelectric power to the Southcentral Railbelt region in Alaska.

1.03 Description of Action. The recommended plan consists of construction of dams and powerplants on the upper Susitna River at Watana and Devil Canyon, and electric transmission facilities to the Railbelt load centers, access roads, permanent operating facilities, and other project-related features.

A subsidiary purpose in the construction of the electric transmission line will be the interconnection of the two largest electric power distribution grids in the State of Alaska, which will result in increased reliability of service and lower cost of power generation.

The proposed plan for the Watana site (Figure 2) would include the construction of an earthfill dam with a structural height of 810 feet at river mile 165 on the Susitna River. The reservoir at normal full pool would have an elevation of 2,200 feet and a crest elevation of 2,210 feet, have a surface area of approximately 43,000 acres, and would extend about 54 river miles upstream from the damsite to about 4 miles above the confluence of the Oshetna River with the Susitna.

The generating facilities at Watana would include three Francis reaction turbines with a capacity of 236 MW (megawatts) per unit and a maximum unit hydraulic capacity of 7,770 cfs (cubic feet per second). The firm annual production of electrical power at Watana would be 3.1 billion kilowatt-hours.

Development of the Devil Canyon site includes the construction of a concrete, thin-arch dam with a maximum structural height of 635 feet and with a crest elevation of 1,455 feet. The dam would be located at river mile 134 on the Susitna River. Devil Canyon reservoir would have a water surface area of about 7,550 acres at the normal full pool elevation of 1,450 feet. The reservoir would extend about 28 river miles upstream to a point near the Watana damsite, and would be confined within the narrow Susitna River canyon.

The generating facilities at Devil Canyon would include four Francis reaction turbines with a capacity of 171 MW per unit and a maximum unit hydraulic capacity of 6,250 cfs. The firm annual energy provided at Devil Canyon would be 3.0 billion kilowatt-hours.

A total of 6.1 billion kilowatt-hours of firm annual energy would be produced by the combined Devil Canyon-Watana system. Secondary annual average energy production from this two-dam system includes an

Looking upstream toward Watana damsite. Tsuena Creek in left center of photo. Damsite just beyond the visible section of river.

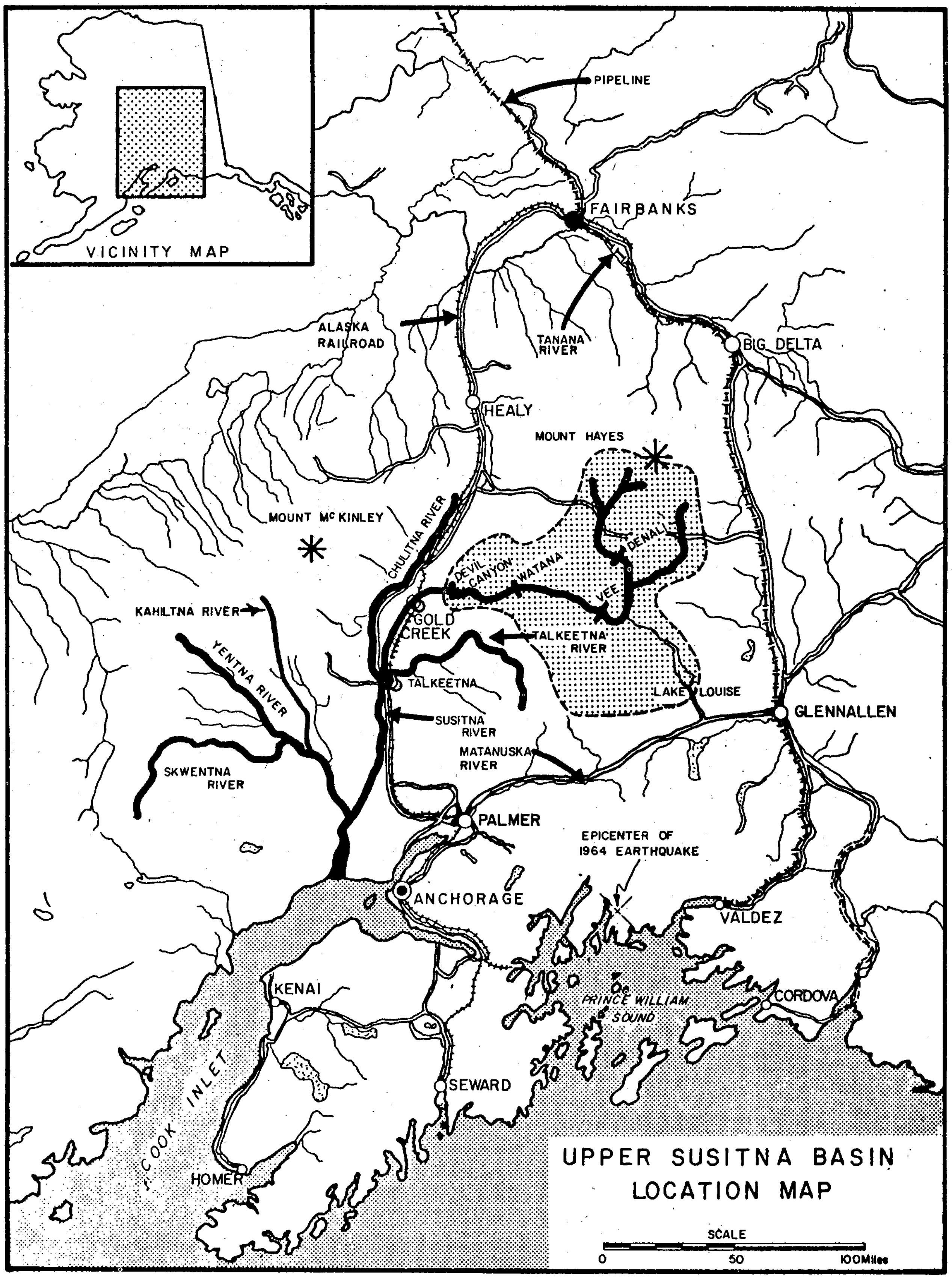

FIGURE 2

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additional 0.8 billion kilowatt-hours per year. The 6.9 billion kilowatts of firm and secondary annual energy would be the energy equivalent of about 15 million barrels of oil per year, or about 112 billion cubic feet of natural gas per year, or about 1.5 billion barrels of oil over a 100-year project-life period.

Most of the generated electrical power would be utilized in the Fairbanks-Tanana Valley and the Anchorage-Kenai Peninsula areas. The proposed transmission system would consist of two 198-mile, 230 kv single circuit lines from Devil Canyon to Fairbanks (called the Nenana corridor), and two 136-mile, 345 kv single circuit lines from Devil Canyon to the Anchorage area (called the Susitna corridor). Both lines would generally parallel the Alaska Railroad. Power would be carried from Watana to Devil Canyon via two single circuit 230 kv transmission lines, a distance of 30 miles. Total length of the transmission lines would be 364 miles. The general locations of the transmission lines are shown on Figure 3. Transmission line corridors would require a right-of-way of approximately 186-210 feet in width totaling slightly more than 8,200 acres of which about 6,100 acres would require clearing. Towers would be either steel or aluminum and of free-standing or guyed type, depending upon final design and local conditions.

Access to the Devil Canyon and Watana sites would be determined by siting studies that would include consideration of the environmental impacts for roads and transmission lines. Preliminary studies indicate an access road approximately 64 miles in length would connect the Watana site with the Parks Highway via Devil Canyon. A factor considered in location and design of access roads would be their subsequent use for public recreational purposes.

Project-oriented recreational facilities would include visitor centers at the dams, boat launching ramps, campgrounds, picnic areas, and trail systems. Some of these facilities would be developed in cooperation with Federal, State or private owners of land adjacent to the project. Housing would also be provided for operations personnel.

The total first costs of the proposed hydroelectric project based on October 1976 prices are estimated at $1.86 billion, including the transmission system. Overall, Devil Canyon costs are estimated at $527,000,000, and Watana at $1,327,000,000. Watana Dam would be constructed first and Watana's costs would include the total cost of the transmission system.

The benefit-to-cost ratio compared to the coal alternative at 6-1/8 percent interest rate and 100-year project life is 1.3 using Federal financing.

Detailed power and economics, hydrology, project description and costs, foundation and materials, transmission line, and recreational information are available at the Alaska District, Corps of Engineers, office in Anchorage, Alaska.

Various studies, reports, and articles provided background data and information for this Environmental Impact Statement. (See Selected Bibliography.)

Environmental studies by the Corps and other State and Federal agencies will continue, in order to provide a detailed and exhaustive evaluation of project impacts. The water Resources Development Act of 1974, Public Law 93-251, sets forth a two-stage post-authorization preconstruction planning process prior to Congressional authorization for construction. When a project is authorized and funded for preconstruction planning, the process requires the Corps of Engineers to report their findings for Congressional approval before advancing to final project design and construction. During this interim period, additional studies will be undertaken to further assess environmental impacts of the project. The EIS will be supplemented during this phase to reflect the changed conditions which normally prevail several years later when planning and design studies are undertaken, and to more fully address impacts on those resources for which detailed information is presently limited. Since supplements to the EIS will again be fully coordinated with all reviewing entities, Congress will be fully apprised of the latest thinking and the fullest possible consideration of environmental impacts in determining whether or not to authorize construction of the project.

The environmental studies will include investigation and evaluation of possible ecological and socio-economic impacts of the project. As specific areas of concern are identified during preconstruction studies, they will be investigated more intensively. Problems to be addressed during the detailed design study phase include identification of significant adverse impacts to the environmental, cultural and recreational resources of the area and specific actions which should be taken to prevent, ameliorate, or mitigate these impacts. Inventory and evaluation of fish and wildlife resources affected by the project will continue. Intensive hydrological studies will be made to determine the effects of altered stream flow on the fish and wildlife habitat downstream of the project. Mineral resource potential will be assessed for the impoundment areas. Also reconnaissances and surveys will be made for historical and archeological resources which may lie within the proposed project sites and transmission corridors.

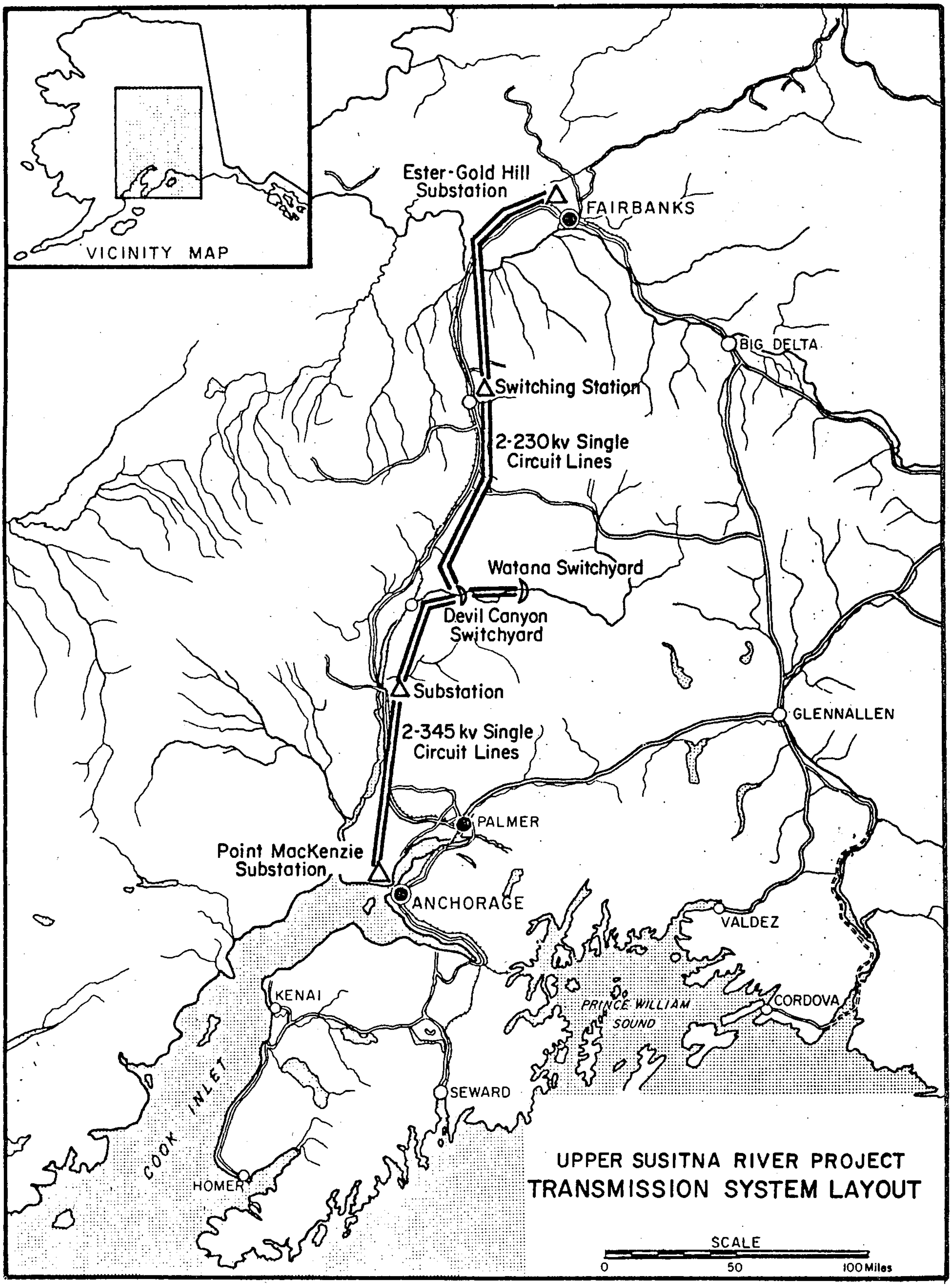

FIGURE 3

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2.0 ENVIRONMENTAL SETTING WITHOUT THE PROJECT

2.01 Physical Characteristics

2.01.1 Description of the Area. The Susitna River, with an overall drainage area of about 19,400 square miles, is the largest stream discharging into Cook Inlet. The Susitna River basin is bordered on the south by the waters of Cook Inlet and the Talkeetna Mountains, on the east by the Copper River plateau and the Talkeetna Mountains, and on the west and north by the towering mountains of the Alaska Range. The upper Susitna River upstream from the proposed Devil Canyon damsite drains an area of approximately 5,810 square miles (see Figure 2).

Three glaciers flow down the southern flanks of the Alaska Range near 13,832-foot Mount Hayes to form the three forks of the upper Susitna River. These forks join to flow southward for about 50 miles through a network of channels over a wide gravel flood plain composed of the coarse debris discharged by the retreating glaciers. The cold, swift, silt-laden river then curves toward the west where it winds through a single deep channel, some 130 miles through uninhabited country, until it reaches the Alaska Railroad at the small settlement of Gold Creek.

After the Susitna escapes the confinement of Devil Canyon, the river's gradient flattens. The river then turns south past Gold Creek, where it flows for about 120 miles through a broad silt and gravel-filled valley into Cook Inlet near Anchorage, almost 300 miles from its source.

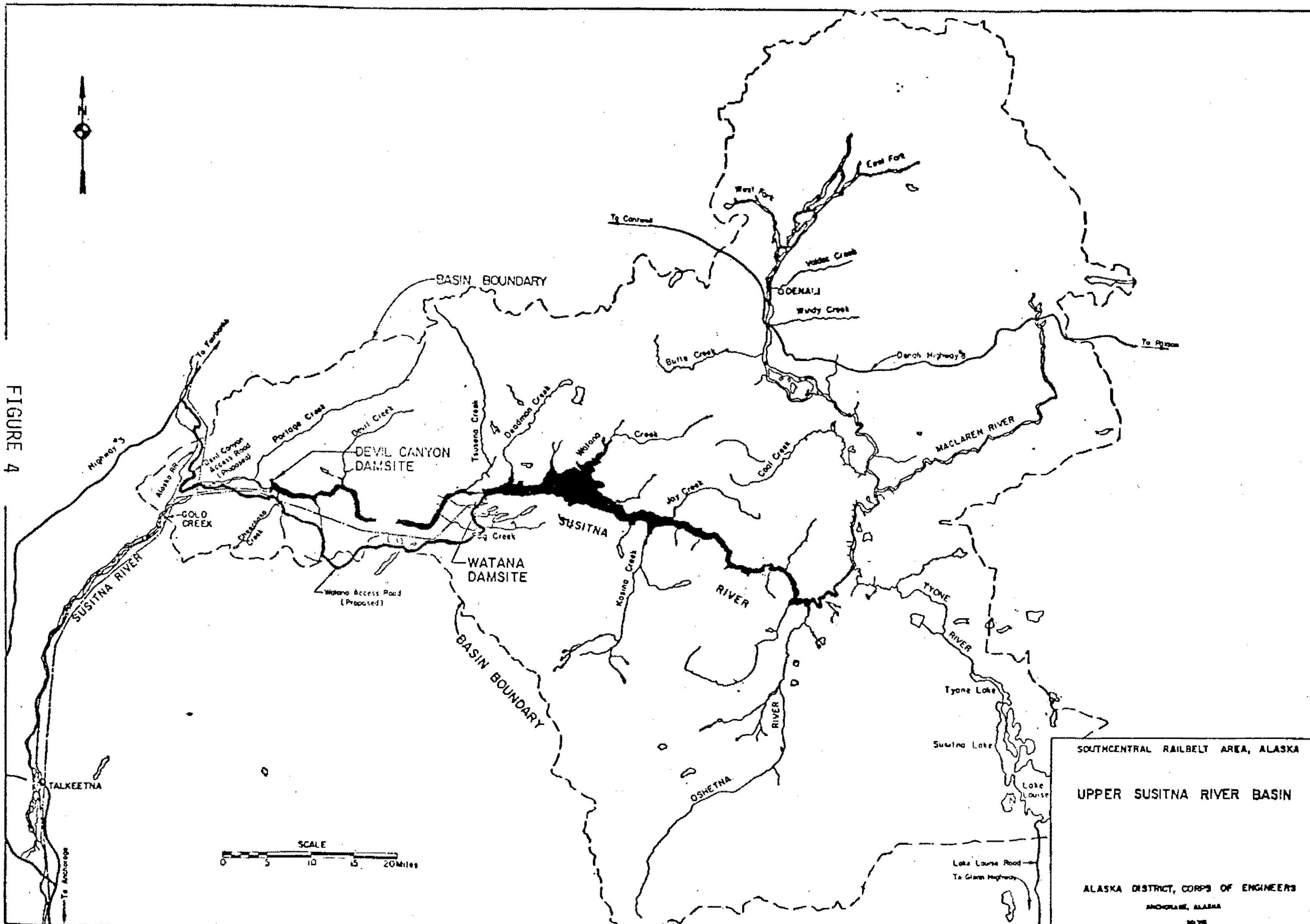
Principal tributaries of the lower Susitna basin also originate in the glaciers of the surrounding mountain ranges. These streams are generally turbulent in the upper reaches and slower flowing in the lower regions. Most of the larger tributaries carry heavy loads of glacial silt during the warmer summer months.

The Yentna River, one of the Susitna's largest tributaries, begins in the high glaciers of the Alaska Range, flows in a general south-easterly direction for approximately 95 miles and enters the Susitna 24 miles upstream from its mouth.

The Talkeetna River originates in the Talkeetna Mountains on the southeastern part of the basin, flows in a westerly direction, and discharges into the Susitna River 80 miles upstream from Cook Inlet and just north of the community of Talkeetna.

The Chulitna River heads on the southern slopes of Mount McKinley, the highest point in North America, with an elevation of 20,320 feet. The river flows in a southerly direction, joining the Susitna River near Talkeetna.

Susitna Glacier on Susitna River drainage. Glacier melt in summer months contributes to high sediment in the river.



SOUTHCENTRAL RAILBELT AREA, ALASKA
UPPER SUSITNA RIVER BASIN
ALASKA DISTRICT, CORPS OF ENGINEERS
ANCHORAGE, ALASKA
1975
N
SCALE
0 5 10 15 20 Miles
BASIN BOUNDARY
BASIN BOUNDARY
DEVIL CANYON DAMSITE
WATANA DAMSITE
SUSITNA RIVER
SUSITNA
RIVER
MACLAREN RIVER
TYONE RIVER
OSHETNA
RIVER
TALKEETNA
GOLD CREEK
DENALI
Highway #3
To Fairbanks
To Anchorage
Alaska RR
Devil Canyon Access Road (Proposed)
Watana Access Road (Proposed)
Portage Creek
Devil Creek
Tsusena Creek
Deadman Creek
Watana Creek
Fog Creek
Kosina Creek
Jay Creek
Coal Creek
Butte Creek
Windy Creek
Valdez Creek
West Fork
East Fork
To Cantwell
Denali Highway #8
To Paxson
Tyone Lake
Susitna Lake
Lake Louise
Lake Louise Road
To Glenn Highway

FIGURE 4

The principal tributaries of the upper Susitna basin are the silt-laden Maclaren, the less turbid Oshetna, and the clear-flowing Tyone (Figure 4). Numerous other smaller tributaries generally run clear. Streamflow in the Susitna River basin is characterized by a high rate of discharge from May through September and by low flows from October through April.

Much of the Upper Susitna River Basin is underlain by discontinuous permafrost. Permafrost is defined as a thickness of soil, or other surficial deposit, or of bedrock beneath the ground surface in which a temperature below 32°F has existed continuously for two years or more. Such permanently frozen ground is found throughout much of Alaska.

The area above and below the Maclaren River junction with the Susitna is generally underlain by thin to moderately thick permafrost. Maximum depth to the base of permafrost in this area is about 600 feet. Around the larger water bodies, such as lakes, permafrost is generally absent. In some areas of the lower section of the upper Susitna basin, permafrost is not present. Additional data is required before permafrost areas can be specifically identified upstream from Devil Canyon.

Because of the length of the proposed transmission system, and the diversity of terrain and ecosystems bisected by a corridor extending from Anchorage to Fairbanks, the system is divided into six major segments which lend themselves to discussion in terms of generally similar ecological characteristics. The route extending south from Watana Dam to Point MacKenzie is referred to as the Susitna Corridor. The route north from Gold Creek to Ester is called the Nenana Corridor (both corridors share the line from Watana to Gold Creek). The corridor for most of its length generally parallels the Alaska Railroad.

The Susitna Corridor is subdivided into three major segments: (a) Point MacKenzie north to Talkeetna, a distance of 84 miles; (b) Talkeetna to Gold Creek, 38 miles; and (c) Gold Creek to Watana, 44 miles. The Nenana Corridor is also divided into three segments (continuing north): (a) Gold Creek to Cantwell, 62 miles; (b) Cantwell to Healy, 39 miles; and (c) Healy to Ester, 97 miles. These locations are shown on Figure 3. Relevant physical and ecological features of individual transmission line segments are described in the following paragraphs.

2.01.2 River Characteristics. The upper Susitna River is a scenic, free-flowing river with very few signs of man's presence. The extreme upper and lower reaches of the Susitna occupy broad, glacially scoured valleys. However, the middle section of the river, between the Denali Highway and Gold Creek, occupies a stream-cut valley with extremely violent rapids in Devil Canyon.

Confluence of the Tvone and Susitna Rivers several miles above the upper reaches of the proposed Watana reservoir.

The Susitna River is one of three major whitewater rivers in Alaska. Portions of all three are Class VI (on a scale of I to VI) boating rivers at the upper limit of navigability. Few kayakers have completed the challenging 11-mile run through Devil Canyon. One who has successfully kayaked it, Dr. Walt Blackadar, has described it as the "Mount Everest" of kayaking (Anchorage Daily Times, March 28, 1973).

The Susitna was one of the Alaskan rivers recommended for detailed study as possible additions to the National Wild and Scenic Rivers System in 1973, but was not one of the 20 rivers recommended for inclusion in the system by the Secretary of the Interior in 1974. The Susitna River has not yet been studied as recommended.

About 86 percent of the total annual flow of the upper Susitna occurs from May through September, with the mean daily average flow from late May through late August in the range of 20,000 to 32,000 cubic feet per second. In the November through April period, the mean average daily flow of the river is in the range of 1,000 to 2,500 cubic feet per second. On 7 June 1964, the recording station at Gold Creek measured a flow slightly in excess of 90,000 cubic feet per second, which was the highest flow recorded for the upper Susitna River since recording started in 1950.

High summer discharges are caused by snowmelt, rainfall, and glacial melt. The main streams carry a heavy load of glacial silt during the high runoff periods. During the winter when low temperatures retard water flows, streams run relatively silt-free.

2.01.3 Cook Inlet. All of the major water courses which flow into Cook Inlet either originate from glaciers or flow through erosive soils; either type of stream carries a high suspended-solids load. The natural high flow period in steams tributary to Cook Inlet occurs during the summer months of May to September, the main period when sediment is transported to the Inlet.

Freshwater runoff into the upper Inlet is an important source of nutrients and sediments. Large quantities of nitrate, silicate, and surface-suspended sediment with particulate organic carbon enter the Inlet with fresh water. Concentrations are especially high in the initial runoff each spring and summer. These additions decrease in concentration down the Inlet upon subsequent mixing with saline oceanic water and with tidal action. The large input of fresh water dilutes and tends to reduce salinity and phosphate concentration around river mouths and in the upper reaches of Cook Inlet.

2.01.4 Geology/Topography

2.01.4.1 General. The Railbelt area is characterized by three lowland areas separated by three major mountain areas. To the north is the

Tanana-Kuskokwim Lowland, which is delineated by the Alaska Range to the south. The Susitna Lowland is to the southwest, bounded to the north by the Alaska Range, and to the east by the Talkeetna and Chugach Mountains. The Copper River Lowland in the east is bounded on the north by the Alaska Range, and the west by the Talkeetna Mountains. Each basin is underlain by quaternary rocks surfaced with glacial debris, alluvium, and eolian deposits. The mountains are primarily metamorphic and sedimentary rocks of the Mesozoic, with several areas of intrusive granitic rocks in the Talkeetna Mountains and the Alaska Range, and Mesozoic volcanic rocks in the Talkeetna Mountains. Figure 5 delineates the major features.

2.01.4.2 <u>Susitna Basin</u>. The Alaska Range to the west and north and the Talkeetna Mountains to the east make up the high perimeter of the Lower Susitna River Basin. The Alaska Range is made up of Paleozoic and Mesozoic sediments, some of which have been metamorphosed in varying degrees and intruded by granitic masses. The Talkeetna Mountain Range, with peaks up to 8,850 feet, is made up of a granitic batholith rimmed on the Susitna basin side by graywackes, argellites, and phyllites. Much of the interior portion of the basin is fluvial-glacial overburden deposits. Glaciers, in turn, carved the broad U-shaped valleys. Glacial overburden covers the bedrock, which is composed mainly of shale and sandstone with interbedded coals, Paleozoic and Mesozoic sediments, and lava flows.

The Upper Susitna River Basin is predominantly mountainous, bordered on the west and south by the Talkeetna Mountains, on the north by the summits of the Alaska Range, and on the south and east by the flat Copper River plateau. Valleys are floored with a thick fill of glacial moraines and gravels.

2.01.4.3 <u>Transmission Line Corridor</u>. Beginning at sea level at Point MacKenzie, the transmission line corridor rises to an elevation of 500 feet at Talkeetna. The corridor traverses a wide river valley with rolling terrain east of the Susitna River and extremely flat land to the west. The valley flattens and widens to the south, is poorly drained, and has many bogs and lakes.

From Talkeetna to Gold Creek, the corridor follows a moderately narrow valley floor narrowing toward the northern end. Maximum elevation is 900 feet.

The corridor from Gold Creek to Watana rises to an elevation of about 2300 feet on the plateau south of Devil Canyon before descending to the Watana damsite.

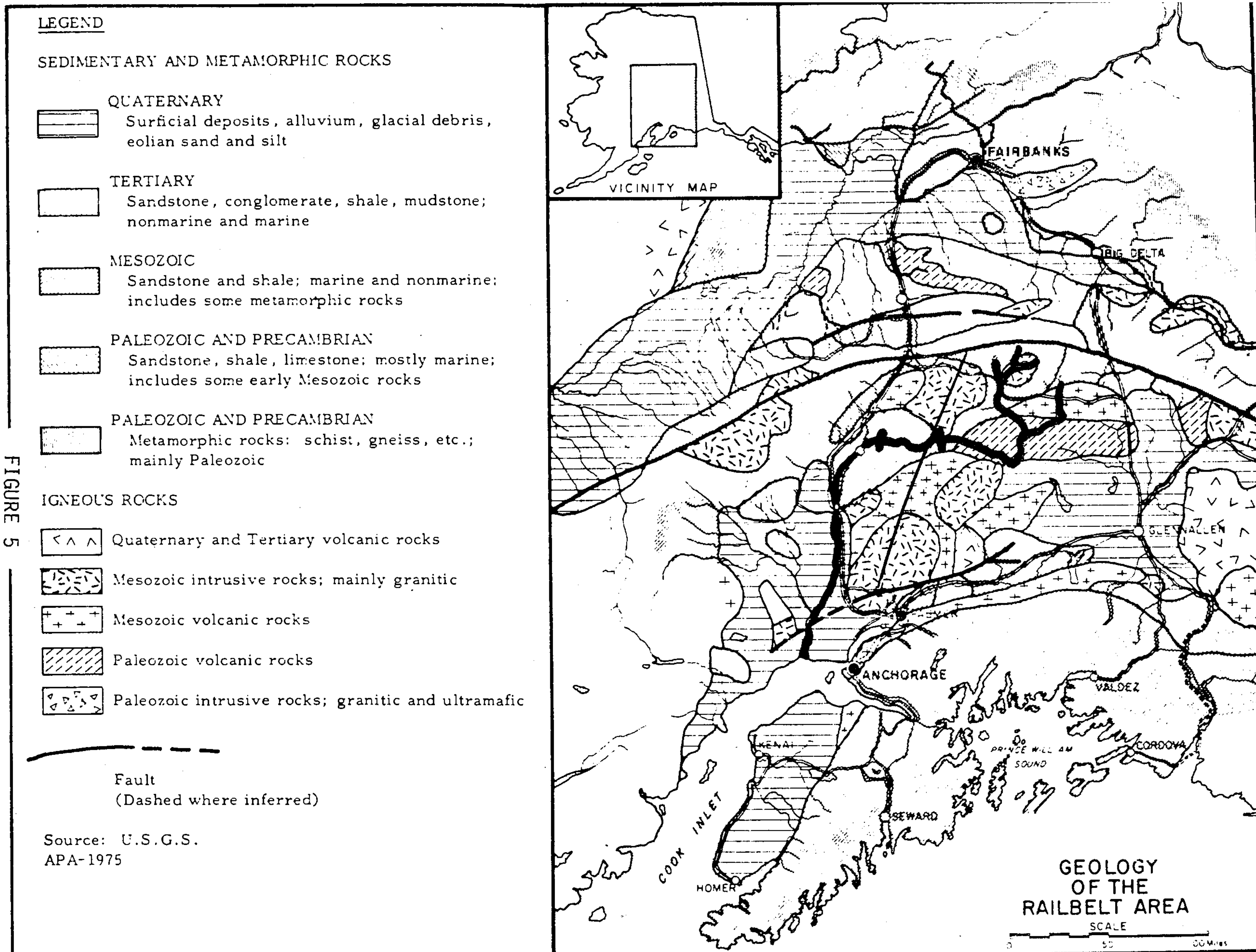

LEGEND
SEDIMENTARY AND METAMORPHIC ROCKS
QUATERNARY
Surficial deposits, alluvium, glacial debris, eolian sand and silt
TERTIARY
Sandstone, conglomerate, shale, mudstone; nonmarine and marine
MESOZOIC
Sandstone and shale; marine and nonmarine; includes some metamorphic rocks
PALEOZOIC AND PRECAMBRIAN
Sandstone, shale, limestone; mostly marine; includes some early Mesozoic rocks
PALEOZOIC AND PRECAMBRIAN
Metamorphic rocks: schist, gneiss, etc.; mainly Paleozoic
IGNEOUS ROCKS
Quaternary and Tertiary volcanic rocks
Mesozoic intrusive rocks; mainly granitic
Mesozoic volcanic rocks
Paleozoic volcanic rocks
Paleozoic intrusive rocks; granitic and ultramafic
Fault
(Dashed where inferred)
Source: U.S.G.S.
APA-1975
VICINITY MAP
FAIRBANKS
BIG DELTA
GLENNALLEN
ANCHORAGE
VALDEZ
CORDOVA
PRINCE WILLIAM SOUND
KENAI
SEWARD
HOMER
COOK INLET
GEOLOGY OF THE RAILBELT AREA
SCALE

FIGURE 5

Between Gold Creek and Cantwell, the corridor rises to a 2400-foot elevation. It traverses a wide valley with moderately incised rivers in the south, becoming a very wide depression in Broad Pass with rolling valley bottom continuing to the northeast.

From Cantwell, elevation 2200 feet, the Nenana River valley narrows to the north into a series of tight canyons separated by the wide valley of Yanert Fork. The corridor emerges from the canyon into a wide rolling plain south of Healy, with stream terraces adjacent to the Nenana River. The corridor is bisected by the Denali Fault at Windy Creek. Elevation at Healy is 1400 feet, dropping to 350 feet at Nenana, and rising again to 1500 feet in the Goldstream Hills southwest of Ester.

2.01.4.4 <u>Seismic Areas</u>. The southcentral area of Alaska is one of the world's most active seismic zones. In this century, 9 Alaskan earthquakes have equalled or exceeded a magnitude of 8.0 on the Richter Scale, and more than 60 quakes have exceeded a magnitude of 7.0. Several major and minor fault systems either border or cross the Susitna River basin. The March 1964 Alaska earthquake, with a magnitude of 8.4, which struck southcentral Alaska, was one of the strongest earthquakes ever recorded. A total of 115 lives were lost, 98 by quake-associated tsunami (seismic sea waves). The Richter scale is a logarithmic scale where a 7.0 earthquake would be ten times stronger than a 6.0 quake and an 8.0 quake would have one hundred times the intensity of a 6.0 earthquake.

Much of southcentral Alaska falls within seismic zone 4 (on a scale of 0 to 4) where structural damage caused by earthquakes is generally the greatest. This area of Alaska and the adjoining Aleutian chain are just part of the vast, almost continuous seismically and volcanically active belt that circumscribes the entire Pacific Ocean Basin.

2.01.4.5 <u>Minerals</u>. Most of the Susitna basin above Devil Canyon is considered to be highly favorable for deposits of copper or molybdenum and for contact or vein deposits of gold and silver. One known deposit of copper of near-commercial size and grade is near Denali. Also, the Valdez Creek gold placer district, from which there has been some production, is within the proposed project watershed.

Though a number of mineral occurrences are known and the area is considered favorable for discovery of additional deposits, much of the drainage basin has never been geologically mapped. Thus, geologically, the basin constitutes one of the least known areas in the State except for a few areas in the vicinity of Denali where some geologic mapping has been done.

Geologic information for the project area is not detailed enough to assess mineral resource potential within the proposed reservoir impoundment areas.

The Alaska State Department of Natural Resources states that there are "active" and "non-active" mining claims in the upper Susitna River drainage area between Devil Canyon and the Oshetna River. Many of these claims are in upper Watana Creek above the maximum reservoir pool elevation, and in the surrounding drainage areas where copper activity is moderately extensive.

2.01.5 Climate. The Susitna basin has a diversified climate. The latitude of the region gives it long winters and short summers, with great variation in the length of daylight between winter and summer. The lower Susitna basin owes its relatively moderate climate to the warm waters of the Pacific on the south, the barrier effect of the Alaska Range on the west and north, and the Talkeetna Range on the east. The summers are characterized by moderate temperatures, cloudy days, and gentle rains. The winters are cold and the snowfall is fairly heavy. At Talkeetna, at an elevation of 345 feet, which is representative of the lower basin, the normal summer temperature ranges between 44^{o} and 68^{o}F, with winter temperatures ranging between 0^{o} and 40^{o}F. The extreme temperature range is between -48^{o} and 91^{o}F. The average annual precipitation is about 29 inches, including about 102 inches of snowfall.

The upper Susitna basin, separated from the lower basin by mountains, has a somewhat colder climate and an average overall annual precipitation rate of approximately 30 inches.

The climate of the transmission line corridor from Devil Canyon to Point MacKenzie is transitional, with mild, wet conditions prevailing toward the southern end of the segment. The northern corridor has extremely variable climate related to differences in elevation. From Gold Creek to Cantwell, the annual temperature averages 25.9^{o}F and annual precipitation 21.85 inches. From Cantwell to Healy, the annual temperature is 27.7^{o}F and annual precipitation 14.5 inches. High winds are reported in this segment. North from Cantwell, the climate is typical of the interior, with an average temperature of 26.4^{o}F and annual precipitation 11.34 inches.

2.02 Biological Characteristics.

2.02.1 Fish.

2.02.1.1 Anadromous Fish. Fish inhabiting the Susitna basin are divided into two major groups: resident and anadromous. The anadromous fish spends a portion of its life cycle in salt water, returning to the freshwater streams to spawn. In this group are included five species of Pacific salmon: sockeye (red); coho (silver); chinook (king); pink (humpback); and chum (dog) salmon. Juvenile salmon of several of these spend several years in fresh water before migrating to sea. All five species of salmon die soon after spawning. Dolly Varden, a char, is widely distributed in the streams of Cook Inlet and is present in the Lower Susitna River Basin with both anadromous and resident populations.

Smelt runs are known to occur in the Susitna River as far upstream as the Deshka River about 40 miles from Cook Inlet.

Salmon are found to spawn in varying numbers in some of the sloughs and tributaries of the Susitna River below Devil Canyon. Salmon surveys and inventories of the lower Susitna River and its tributaries have been made over a number of years, resulting in considerable distribution data; however, population studies and additional resource studies are needed. The surveys indicate that salmon are unable to ascend the turbulent Devil Canyon, and, thus, are prevented from migrating into the Upper Susitna River Basin.

The 14 million pounds of commercial salmon caught in Cook Inlet during 1973 comprised about 10 percent of the 136.5 million pounds of salmon harvested in Alaska during the year. Chum, red, and pink salmon totaled about 94 percent of the salmon catch for Cook Inlet during 1973. (1973 Catch and Production--Commercial Fisheries Statistics--Leaflet #26, State of Alaska Department of Fish and Game).

The 1973 commercial catch figures do not approach the maximum sustained yields for Cook Inlet, but do present the latest available commercial catch information, and except for chinook salmon are representative of the last several years of commercial salmon fishing. Sport and subsistence fishing for salmon in Cook Inlet and in the Susitna basin are also important considerations.

According to the Alaska Department of Fish and Game, a significant percentage of the Cook Inlet salmon run migrates into the Susitna River Basin. Although all salmon stocks are important, data from earlier 1950 and 1960 fish and wildlife reports added to the latest 1974-75 studies indicate that only a small percentage of the Susitna Basin salmon migrate into the 50-mile section of the Susitna River between the proposed Devil Canyon damsite and the confluence of the Chulitna River to spawn in the river's clearwater sloughs and tributaries. Further studies should determine more specific information on salmon numbers and habitat impacts. A 1974 assessment study, by the Alaska Department of Fish and Game, of anadromous fish populations in the Susitna River watershed estimated 24,000 chum, 5,200 pink, 1,000 red, and between 4,000 and 9,000 coho salmon migrated up the Susitna River above the river's confluence with the Chulitna River during the 7-week study period from 23 July through 11 September when most of the salmon were migrating up the river. The report indicated that chinook salmon were also present.

According to the 1974 assessment by the Alaska Department of Fish and Game, a minimum of 1,036 pink, 2,753 chum, 307 coho, and 104 sockeye, and an undetermined number of chinook salmon spawned during the August and September spawning period in the streams and sloughs of the Susitna River between the Chulitna River tributary and Portage Creek as determined from peak slough and stream index escapement counts. The assessment also indicated that a portion of the pink salmon spawn in the study area may have been destroyed by a late August-early September flood.

Chinook (King Salmon). The king salmon spends from one to three years in fresh water before migrating to sea. It is not unusual for this species to attain a weight of over 40 pounds. The maximum age is 8 years. In 1973, over 5,000 kings were caught in Cook Inlet; the total commercial catch comprised about 1.5 percent of the total weight of salmon caught in this area. The 1973 catch figures for king salmon were very low when compared to the average yearly catch for this species.

Sockeye Salmon (Red). The sockeye salmon averages between 6 and 8 pounds, with a range of from 2 to 12 pounds. This species spends from 1 to 3 years in a river system in which there are connecting lakes. The maximum age attained by this salmon is 7 years, but most return to spawn at 4 or 5 years of age. The landlocked variety of this species is called a kokanee and usually attains a length of from 12 to 15 inches. In 1973, almost 700,000 sockeyes were caught in Cook Inlet, with a total weight of over 5 million pounds, or 37.0 percent of the total weight of the Cook Inlet commercial salmon catch. About 14.5 percent of the sockeye salmon catch in Alaska occurred in Cook Inlet.

Coho Salmon (Silver). The coho or silver salmon spends from 1 to 2 years in fresh water and returns from the ocean to spawn at 3 or 4 years of age. Mature coho average about 10 pounds; some reach weights of over 30 pounds. The 106,000 cohos caught in Cook Inlet during 1973 weighed just over 648,000 pounds and comprised about 4.5 percent of the total commercial salmon catch for the area.

Pink Salmon (Humpback). The pink salmon migrates to sea immediately after hatching and returns to spawn at 2 years of age. The average weight of a mature pink is 3 to 4 pounds, with some pinks weighing up to 10 pounds. The 624,000 pink salmon caught in Cook Inlet during 1973 weighed over 2,260,000 pounds and comprised about 16.2 percent of the total weight of the commercial salmon catch in the area. Historically, odd-year catches of pink salmon are poor. Even-numbered year catches average about 2 million pinks.

Chum (Dog Salmon). Chum salmon attain weights of up to 30 pounds, with an average mature weight of 8 to 9 pounds. This species migrates to sea immediately after hatching and matures between 3 and 6 years of age. The 742,000 chums caught in Cook Inlet during 1973 weighed almost 5,800,000 pounds and made up over 41.0 percent of the total commercial salmon catch for the area, the largest percentage of any of the 5 species of Pacific salmon. About 12.5 percent of the 1973 Alaskan chum salmon catch occurred in Cook Inlet.

Salmon eggs hatch in late winter or early spring following the summer and fall spawning periods. The eggs incubate in gravelly streambeds and cannot tolerate high levels of siltation or low flows that dewater the streambeds during the incubation or alevin (pre-emergent) stages. Low flows, especially critical during the winter months, can dewater many of the spring-fed freshwater sloughs that are available to spawning salmon (see Table 1, page 45.)

2.02.1.2 Resident Fish. Grayling, rainbow trout, lake trout, Dolly Varden, whitefish, sucker, sculpin, and burbot (ling) comprise the principal resident fish population of the Susitna River basin. Although distribution studies have been made in the past, the magnitude of resident fish populations in the Susitna drainage is largely unknown.

During the warmer months of the year, when the Susitna River is silt laden, sport fishing is limited to clearwater tributaries and to areas in the main Susitna River near the mouths of these tributaries.

Resident fish, especially grayling, apparently inhabit the mouths of some of the clearwater streams on the Susitna River between Devil Canyon and the Oshetna River; however, most of the tributaries are too steep to support significant fish populations. Some of the upper sections of these clearwater tributaries, such as Deadman Creek, support grayling populations. Lake trout are also prominent in many of the terrace and upland lakes of the area.

2.02.2 Birds.

2.02.2.1 Waterfowl. The east-west stretch of the Susitna River between the Tyone River and Gold Creek is a major flyway for waterfowl. The majority of the waterfowl nesting areas in the Upper Susitna River Basin are on the nearby lakes of the Copper River Lowland region, on the Tyone River and surrounding drainage areas, and on the ponds and lakes of the wide flood plain in the Denali area.

The Upper Susitna River Basin has a moderate amount of use by waterfowl when compared with the Lower Susitna River Basin. The lower basin has a substantially greater amount of waterfowl habitat, and a greater number and variety of waterfowl seasonally use the thousands of lakes and ponds in this area to nest and to raise their young. Large numbers of migrant birds also use the Susitna River basin for feeding and resting during spring and fall flights to and from Alaska's interior and north slope. Distribution and density of waterfowl habitat within the Railbelt area is shown on Figure 6.

2.02.2.2 Raptors. Raptors, including golden eagles, bald eagles, and various species of hawks, owls, and falcons, occur throughout the entire Susitna River basin but in smaller numbers in the river canyon between Portage Creek and the Oshetna River. A June 1974 survey of cliff-nesting raptors conducted by the U.S. Fish and Wildlife Service, determined that the population densities of these birds between Devil Canyon and the Oshetna River are low and that no endangered species of peregrine falcons, American or arctic, appear to nest along the upper Susitna River. Peregrines have occasionally been sighted within the area of the upper Susitna basin and along migration routes through the Broad Pass area of the upper Chulitna River.

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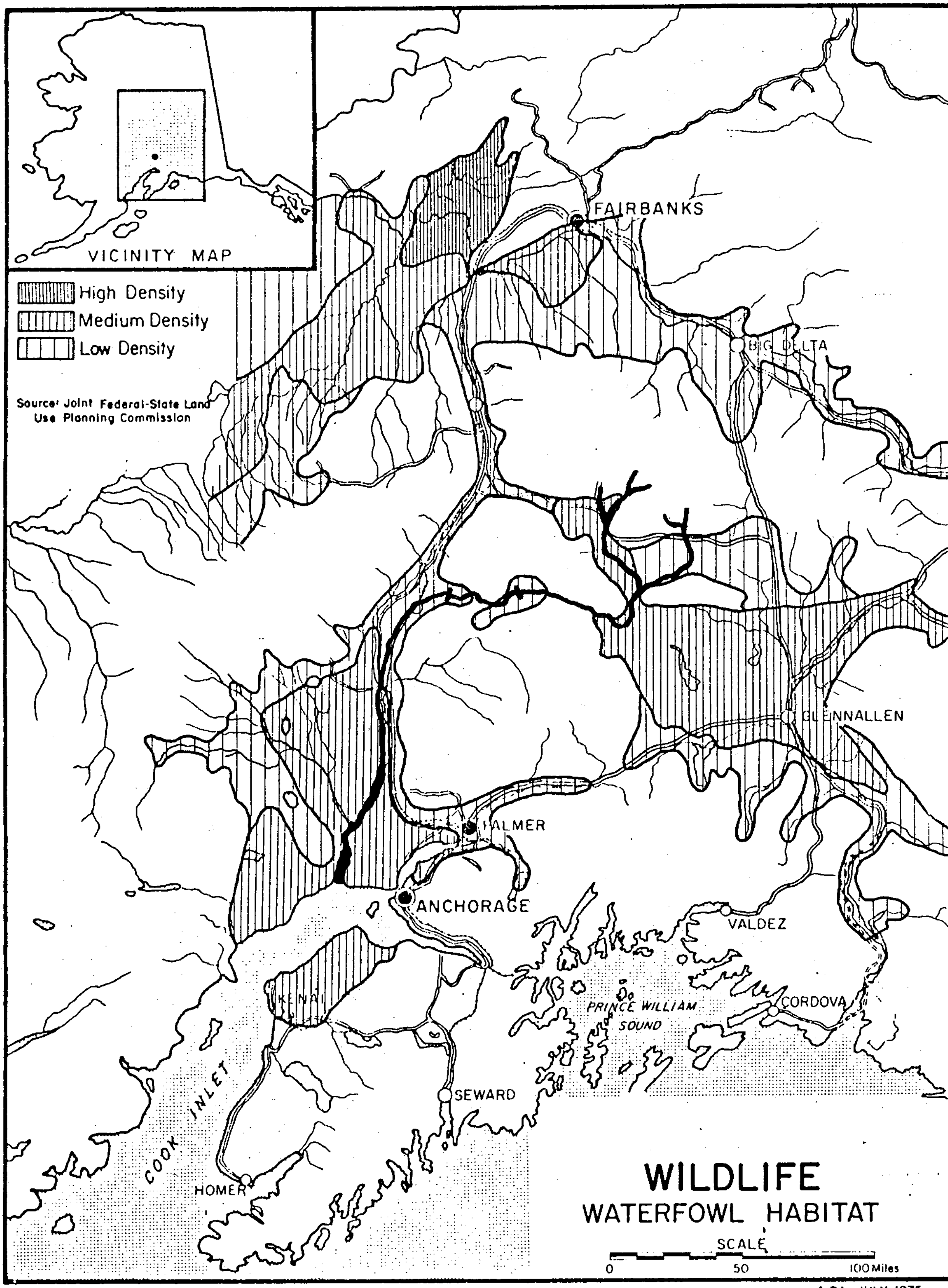

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FIGURE 6

On the basis of the 1974 U.S. Fish and Wildlife Service findings, other raptor populations in the canyon area of the upper Susitna River were determined to be minor, although minimal data were acquired on the tree-nesting raptors. Several nesting pairs of bald eagles and gyrfalcons were observed in or near the canyons of this area, and golden eagles frequently occupied upland cliffs in the vicinity of Coal Creek.

Substantial populations of ravens were found in reaches of the Susitna River above Gold Creek. The nests of this large bird are often used by raptors, including peregrines and gyrfalcons. However, there was no evidence that the nests observed were being used by raptors.

2.02.2.3 Other Birds. Unknown numbers of game birds, such as spruce grouse and willow ptarmigan, inhabit the Upper Susitna River Basin. Some incidental game bird hunting takes place along the Denali Highway, but such hunting pressures are practically nonexistent in most of the area.

Various other species of birds including songbirds, shorebirds, and other small birds are found throughout the Upper Susitna River Basin in varying numbers.

2.02.3 Mammals.

2.02.3.1 Caribou. One of the most significant wildlife resources of the Upper Susitna River Basin is the wide-ranging Nelchina caribou herd. This herd, a major recreational and subsistence resource in the south-central region, declined from a population high of about 71,000 in 1962 to a low of between 6,500 and 8,100 animals in 1972. This spectacular decline has been attributed to various factors, including migration to other areas, bad weather, predation, and overhunting. Motorized all-terrain vehicle access to the backcountry has improved hunting success even in the face of a rapidly declining caribou population.

Segments of the Nelchina herd periodically range throughout much of the Upper Susitna River Basin (see Figure 7). The major calving area for the herd is on the northeast slopes of the Talkeetna Mountains on the upper reaches of the Kosina Creek, Oshetna River, and Little Nelchina River drainages. Calving generally takes place between mid-May and mid-June. Except for intermittent seasonal migration routes across the Susitna River in areas upstream from Tsusena Creek, caribou are not resident to the main Susitna River canyon between Devil Canyon and the Oshetna River.

Caribou depend upon climax range, especially for winter forage; any alteration of the vegetation, especially of sedges and lichens, has a detrimental impact upon their distribution and numbers. A trait of the Nelchina herd is an almost constant change of winter ranges, a phenomenon that has undoubtedly characterized Alaska's caribou populations for centuries.

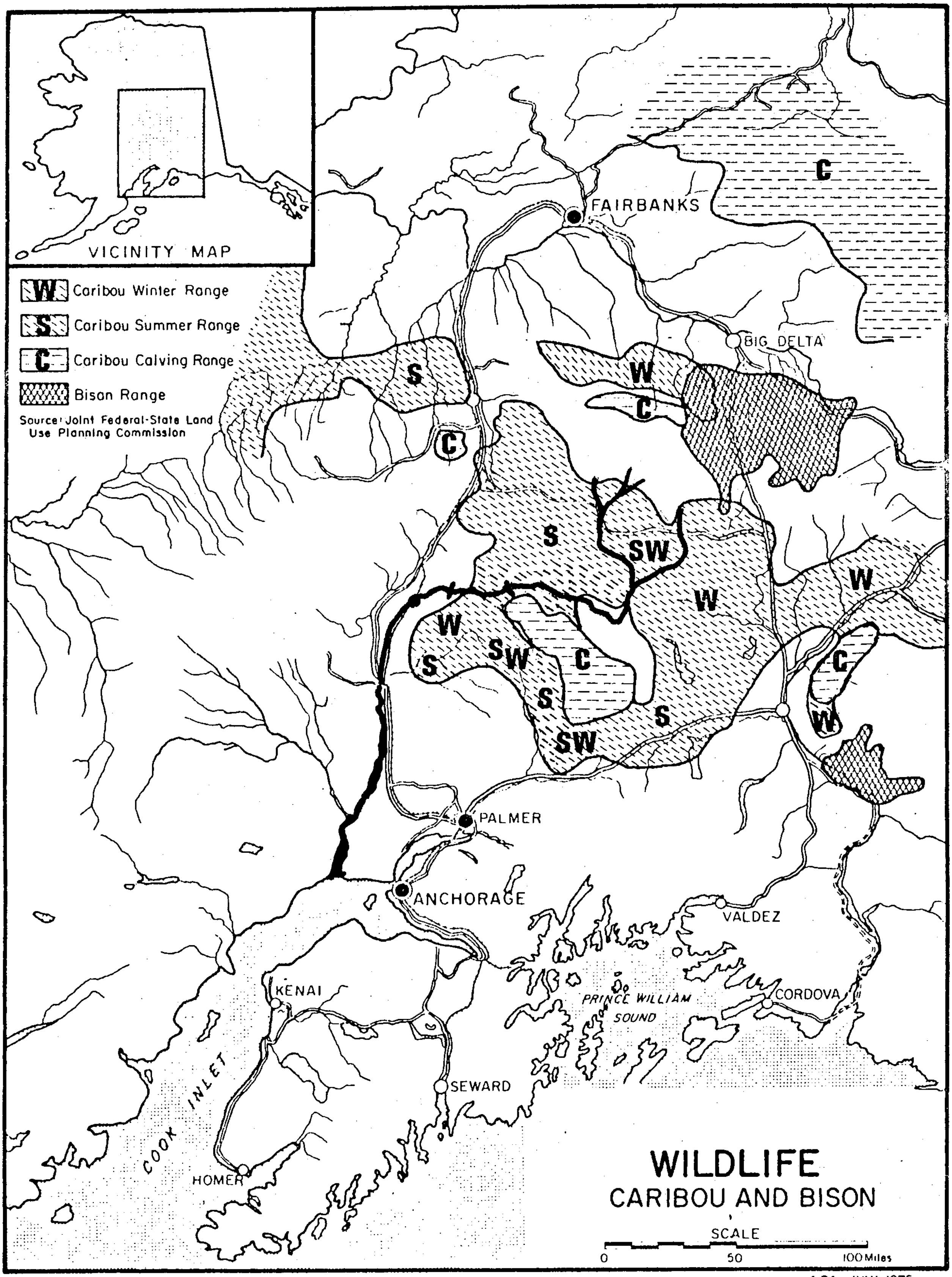

VICINITY MAP
W Caribou Winter Range
S Caribou Summer Range
C Caribou Calving Range
Bison Range
Source: Joint Federal-State Land Use Planning Commission
FAIRBANKS
BIG DELTA
PALMER
ANCHORAGE
VALDEZ
KENAI
SEWARD
HOMER
CORDOVA
PRINCE WILLIAM SOUND
COOK INLET
WILDLIFE
CARIBOU AND BISON
SCALE
0
50
100 Miles
A.P.A.-JULY 1975

FIGURE 7

The Alaska Department of Fish and Game considers the Nelchina herd to be one of the State's most important caribou populations. Several thousand hunters from Anchorage and Fairbanks participate in the annual hunting of this species. Additional thousands of non-hunting recreationists view the migrations of caribou as they cross the State's major highways. In addition, the herd provides sustenance to predators and scavengers such as wolves, grizzly bears, black bears, wolverines, lynx, and various species of birds.

Caribou are essentially limited in distribution within the transmission line system to the 136-mile segment extending north from Cantwell. In the mountainous area between Cantwell and Healy, they concentrate south of canyons. They are found in concentrations on the west bank of the Nenana River north of Healy and south of Clear Air Force Base.

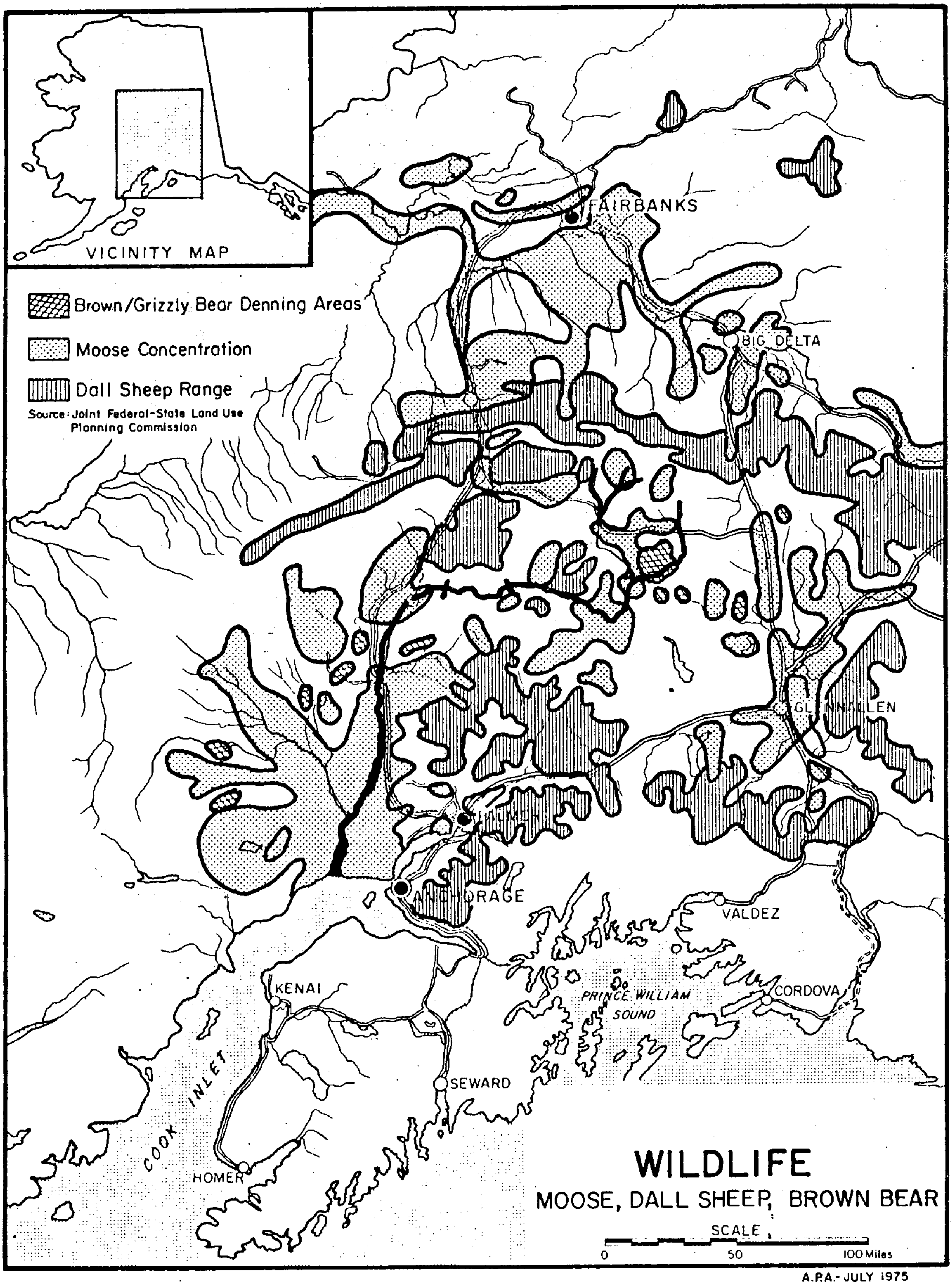
2.02.3.2 Moose. Moose range throughout much of the Upper Susitna River Basin (Figure 8). Wide fluctuations of populations have occurred over the years. A 1973 Alaska Department of Fish and Game fall aerial count resulted in sighting of approximately 1,800 moose in the upper Susitna River drainage. Numbers of moose in the southcentral region of Alaska have been reduced in recent years due mainly to weather conditions, hunting pressures, wolf predation, unbalanced age-sex ratios, and elimination of habitat.

Much of the Upper Susitna River Basin is at or above timberline, resulting in large amounts of "edge" at timberline which produce considerable quantities of willow, an important winter forage for moose. Successional vegetation changes following fire also contribute heavily to areas favoring moose habitat.

Limited numbers of moose inhabit the Susitna River bottom between Devil Canyon and the Oshetna River, because of a restricted amount of suitable habitat. However, the available habitat provides critical winter range for moose that do utilize this area.

Moose inhabit the entire length of the transmission line corridor but are more abundant in the lower valleys. In mountainous terrain, they are more commonly found in more open parts of canyons.

2.02.3.3 Grizzly/Brown Bears. Grizzlies, also referred to as brown bears in Alaska, are common throughout the Susitna River drainage and are fairly numerous in the upper Susitna despite the absence of salmon. Alpine and subalpine zones are the habitats most frequently used by grizzlies, although the more timbered areas are seasonally important. Denning begins in October, and all bears are in dens by mid-November (see Figure 8). Bears usually reappear during May, depending on weather conditions. Important spring foods include grasses, sedges, horsetails, other herbaceous plants, and carrion when available. On occasion,



VICINITY MAP
Brown/Grizzly Bear Denning Areas
Moose Concentration
Dall Sheep Range
Source: Joint Federal-State Land Use Planning Commission
FAIRBANKS
BIG DELTA
GLENNALLEN
ANCHORAGE
VALDEZ
KENAI
CORDOVA
PRINCE WILLIAM SOUND
SEWARD
COOK INLET
HOMER
WILDLIFE
MOOSE, DALL SHEEP, BROWN BEAR
SCALE
0
50
100 Miles
A.P.A.- JULY 1975

FIGURE 8

moose or caribou calves are taken. Berries--lowbush and highbush cranberries, blueberries, and bearberries--provide major summer food supplements. A prime consideration for grizzly bears is to minimize direct conflict with humans as the grizzly is adversely affected by contact with man.

Hunting for grizzly bears in this area often occurs incidentally to other hunting during the short fall open season.

Within the transmission line corridor, most grizzly bears are limited in distribution to the higher areas, primarily between Cantwell and Healy although they are found throughout this part of Alaska.

2.02.3.4 Black Bears. The Upper Susitna River Basin supports fair black bear densities. The larger populations are in semi-open forested areas with readily accessible alpine-subalpine berry crops. River bottoms, lake shores, and marshy lowlands are favorite spring black bear areas. Black bears generally eat many of the same types of food as are eaten by grizzlies. Denning habits are also somewhat similar to the grizzly bear's.

Natural fires generally benefit black bears, especially when dense mature spruce stands are burned. Most other land uses do not seriously affect bear numbers in this area, and black bears are not as adversely affected by contact with man as are grizzlies.

Black bears are found in forested areas throughout the length of the transmission line corridor.

2.02.3.5 Dall Sheep. These sheep are present in many areas of the Alaska Range, Talkeetna Mountains, and in the higher elevations of the Susitna River basin (Figure 8). The greatest concentrations of Dall sheep in the Susitna basin occur in the southern portions of the Talkeetnas; herds become scattered on the northern portion of the range, where parts of the mountains are uninhabited by sheep. Dall sheep are also found in the Watana Hills. Because of the relatively gentle nature of much of the Talkeetna Mountains and Watana Hills, predation in this area has more effect on sheep numbers than in more rugged habitats. Sheep have always furnished some of the diet of wolves and other carnivores in this area.

Within the transmission line corridor, Dall sheep are essentially limited to the mountainous area between Cantwell and Healy.

Hunting pressure for rams is fairly heavy due to relatively good access from highways, by air, and by ATVs (all-terrain vehicles). Nevertheless, as is true elsewhere in the State, ram-only hunting seems to have little effect on overall numbers. Sheep populations are almost entirely controlled by natural factors such as habitat, weather conditions, predation, and disease. Conflicts between man's activities and critical sheep habitat, such as lambing or wintering areas, can adversely impact Dall sheep populations.

2.02.3.6 Mountain Goats. Goats occur in low numbers in various areas of the Talkeetna Mountains and in the Watana Hills area, and do not provide a significant amount of hunting in the upper Susitna basin. The goats generally inhabit rougher terrain than do Dall sheep, and are thus less susceptible to man's activities.

2.02.3.7 Wolves. Wolves occur throughout most of the Upper Susitna River Basin. Populations are subject to rapid fluctuations, and estimates should be viewed with extreme caution. Wolf numbers have been estimated from a low of 13 in 1943, after predator control efforts, to a high of 400 to 450 in 1965. Currently an estimated 300 wolves populate the area encompassing the upper Susitna, the Talkeetna Mountains, and the upper Copper River drainage area. The wolf has been removed from predator classification and is now classified as a game animal in Alaska.

Alaska Department of Fish and Game management studies concluded that, from 1957 to 1967, wolf predation neither adversely affected other game populations, nor reduced hunting success for sportsmen. However, absolute conclusions were uncertain since moose and caribou populations may have reached their highs during this period. The study proved that wolves and men can often coexist while competing for game animals, but that at times man must accept reduction of available game by wolves.

2.02.3.8 Wolverines. This area of Alaska has consistently produced more wolverines than any other area of comparable size in the State. Wolverines are seen regularly throughout the area, and it is not unusual for a hunter returning to a kill site to find a wolverine feeding on his moose or caribou. Wolverines have withstood human encroachment and trapping without any noticeable reduction in numbers or range.

2.02.3.9 Other Mammals. Fur animal species of the upper Susitna in addition to wolf and wolverine include beaver, muskrat, otter, mink, Canada lynx, fox, marten, and weasel. Found in varying populations throughout much of the Upper Susitna River Basin and transmission corridor, each of these species has its own unique habitat requirements. However, except for a limited number of beaver, the river canyon area between Devil Canyon and the mouth of the Oshetna River is not considered good quality fur animal habitat for most of these species.

Other mammals found in this area include coyotes, snowshoe hares, ground squirrels, tree squirrels, pikas, marmots, and several species of voles, shrews, and mice. As with other animals, the populations of the various species vary as adverse or beneficial factors are encountered.

Susitna River between Watana and Vee damsites. Heavier vegetation, in this case upland spruce-hardwood forest, is limited to the valley slopes, the vegetative biome on the upper plateaus is generally moist tundra, muskeg, and alpine tundra.

2.02.4 Threatened Wildlife of the United States. The only species in the U.S. Fish and Wildlife Services publication, Threatened Wildlife of the United States, that might be resident in or migrate through the Upper Susitna River Basin are the two subspecies of the peregrine falcon: Falco peregrines anatum (American) and Falco peregrines tundrius (arctic). Although no peregrines appear to be nesting along the upper Susitna River at present, there have been occasional sightings within the area and along known migration routes for this species as they move through the Broad Pass area on the upper Chulitna River. These migrating peregrines are occasionally reported to include members of the two endangered subspecies.

Several species of wildlife that are considered threatened or depleted in the Lower 48 States have substantial populations within Alaska. Such species include the American bald eagle, the wolf, and the grizzly bear.

2.02.5 Vegetation. The major ecosystems of Alaska are divided into marine and land groupings, with the land group divided into fresh-water, tundra, and coniferous systems. The freshwater system includes glaciers and ice fields, lakes, and riverine ecosystems; the tundra system is subdivided into moist, wet, and alpine tundras; and the coniferous system is divided into six plant-related classifications.

The Upper Susitna River Basin includes the following four broad land ecosystem classifications: moist tundra; alpine tundra; upland spruce-hardwood forest; and lowland spruce-hardwood forest. The largest percentage of the basin is classified as moist or alpine tundra with most of the area in and adjacent to the main river channel below the Maclaren River classified as either upland or lowland spruce-hardwood forest.

At Gold Creek, the bottomland forest of white spruce and black cottonwoood is very much in evidence on well drained banks. Ascending the river, balsam poplar replaces the cottonwoods around Fog and Tsusena Creeks. Thin hardwoods and white spruce become less and less in evidence but still occur in small stands on well drained river bars and tributary fans upstream to Butte Creek. Above this tributary, only scattered stands of black spruce occur, growing up to the glaciers. The lower hillsides have a low brush cover with moist tundra in the lower areas. The periodically flooded river flats are in willow, sedges-high brush, and wet tundra. Since much of the drainage basin is uplands, alpine tundra is one of the most prominent vegetation types.

Alpine tundra is composed of low mat plants, both herbaceous and shrubby. Moist tundra usually forms a complete ground cover and is very productive during the growing season. Plant types vary from almost continuous cottongrass with a sparse growth of sedges and dwarf shrubs to stands where dwarf shrubs dominate. Tundra ecosystems are especially fragile and are very susceptible to long-term damage or destruction from overuse. Regeneration is extremely slow, with some lichens requiring more than 60 years to recover.

Most of the timber ecosystems in the upper Susitna basin are located adjacent to the river and tributaries on the canyon slopes and on the surrounding benchlands. The major timber species include birch, balsam poplar, black cottonwood, white spruce, and black spruce. Overall, the timber quality in this area is not good, with a wide variety of sizes, mostly smaller and noncommercial. Much of the birch and spruce is more suitable for pulp than for sawtimber; however, a fair yield of sawlogs could be obtained from stands of black cottonwood and balsam poplar.

The transmission line corridor transects five generally distinct vegetation types. Three of these--upland spruce-hardwood, lowland spruce-hardwood, and alpine tundra--are common within the upper Susitna basin, as discussed above. Two are related to distinctly different land forms. Bottomland spruce-poplar is confined to broad flood plains and river terraces, and warmer slopes of major rivers. Characteristic vegetation is white spruce, balsam poplar, birch, and aspen. Low bush, bog, and muskeg are another distinct type usually formed on outwash, and old river terraces, in filling ponds and sloughs, and throughout lowlands. Characteristic plants are tamarack, black spruce, alders, willows, and berries.

Progressing northward from Point MacKenzie, the corridor is principally characterized by bottomland spruce-poplar, lowland spruce-hardwood, and muskeg bog to Talkeetna. From this point to Gold Creek, bottomland spruce-poplar is interspersed with upland spruce-hardwood. The segment leading from Gold Creek to Cantwell is typically bottomland spruce-poplar interspersed with upland spruce-hardwood, and low brush-bog/muskeg. Through the Alaska Range between Cantwell and Healy, the vegetation is a mixture of upland spruce-hardwood, lowland spruce-hardwood, alpine tundra, and some low brush-muskeg/bog. From Healy to Ester, the vegetation is characterized by bottomland spruce-poplar, upland spruce-hardwood, lowland spruce-hardwood, and low brush-muskeg/bog.

2.03 Cultural Characteristics.

2.03.1 Population. The Southcentral Railbelt area of Alaska contains the State's two largest population centers, Anchorage and Fairbanks, and almost three-fourths of the State's total population. The Anchorage area alone has over half the residents in the State. Recently revised estimates for 1975 indicate over 386,000 people will be in Alaska by the end of the year, compared to slightly over 302,000 counted in the 1970 census, an increase of about 28 percent in that period. Other estimates by the Alaska Department of Labor indicate an expected State population of almost 450,000 for the year 1980, an additional 16 percent increase over 1975, and a population increase of nearly 50 percent in 10 years. The largest growth in the State has been in the Southcentral Railbelt area, and this trend is expected to continue. With the possible relocation of Alaska's capital from Juneau to the Railbelt area, an additional population impact will be exerted on this area of the State.

Looking upstream at Susitna River near Gold Creek about 15 miles below Devil Canyon. Note Alaska Failroad bridge.

At the present time, only a few small settlements are located along the Parks Highway between Anchorage and Fairbanks and the Alaska Railroad in the Susitna River valley. Except for the small settlement at Denali, there are few, if any, permanent full-time residents in the Upper Susitna River Basin above Devil Canyon.

2.03.2 Economics. Both Anchorage and Fairbanks are regional economic centers for the Southcentral Railbelt area. Government, trade, and services comprise the major portion of the area's total employment. Construction and transportation are also important. Making relatively less significant contributions are the financing, mining, and manufacturing industries, while agriculture, forestry, and fisheries contribute less than one percent of the employment dollar to the economy of the Railbelt area. In 1972 the wages and salaries for the southcentral region of Alaska amounted to more than $704,000,000.

In the government groups, employment is divided more or less equally between Federal, State, and local sectors. The area's major Federal employer is the Department of Defense, with most of its employees concentrated in four military installations. State and local government employment includes employees from agencies of the State of Alaska and the cities and boroughs within the area.

After government, the two groups having the largest employment are trade and services. Their importance as sources of employment for the Railbelt area residents is a further manifestation of the region's two relatively concentrated population centers and of the high degree of economic diversity, as well as levels of demand for goods and services, which are substantially higher than in most other parts of Alaska. The importance of construction is largely due to the high level of expansion experienced by the Anchorage and Fairbanks areas since 1968. This growth can partly be attributed to the trans-Alaska pipeline project, which is encouraging much new construction in both public and private sectors.

High levels of employment in the region's transportation industry reflect the positions of Anchorage and Fairbanks as major transportation centers, not only for the Southcentral Railbelt area but for the rest of the State as well. The Port of Anchorage handles most of the waterborne freight moving into southcentral and northern Alaska. International airports at Anchorage and Fairbanks serve as hubs for commercial air traffic throughout Alaska and are important stopovers for 37 major international air carriers. Anchorage also serves as the transfer point for goods brought into the area by air and water, which are then distributed by air transport, truck or by Alaska Railroad to more remote areas.

Although exerting relatively little direct impact on total employment, mining, finance, insurance, and real estate play important roles in terms of the secondary employment they generate in the region. Most people employed in mining engage in activities relating to petroleum extraction from fields in Cook Inlet and the Kenai Peninsula. A substantial portion of the royalties and taxes collected by the State as a result of oil production in the area is returned to the area in the form of jobs in State government and through revenue sharing with various local governments. The total value of oil and gas production in the southcentral region for 1972 was almost $240 million. Similarly, the Anchorage financial sector, in spite of its small employment, exerts considerable economic leverage as the banking center for Alaska.

Most agricultural activities in the Southcentral Railbelt area take place in the Matanuska, Susitna, and Tanana Valleys. The potential for agriculture in these areas of Alaska is considered favorable, although development of the industry has not been extensive.

Commercial fisheries activity is the oldest cash-based industry of major importance within the region. The industry has changed substantially during the past 20 years and continues to be modified as a result of both biologic and economic stimuli. The salmon industry has always been a major component of the industry in terms of volume and value. Since 1955, the king crab, shrimp, and Tanner crab fisheries have undergone major development, and halibut landings have increased substantially in recent years. The total wholesale value of commercial fish and shellfish for the southcentral region of Alaska in 1972 was just over $100 million including a catch of almost 110 million pounds of salmon with a wholesale value of nearly $38 million.

The southcentral region of Alaska includes the Kodiak-Shelikof area, the Cook Inlet area, and the Copper River-Gulf of Alaska area. The Southcentral Railbelt area is that portion of the southcentral and Yukon subregions that is served by the Alaska Railroad.

The region's timber output is less than 10 percent of the total timber harvested commercially in Alaska. The timber industry is shifting from supplying the local market to production aimed at the export market. Stumpage value of timber cut from State and National forest lands in the southcentral region during 1972 was about $130,000.

The tourist industry plays an increasingly important role in the economy of the region. Precise data on tourism are not available, but the numbers of Alaskan visitors have increased from about 130,000 in 1971 to approximately 216,000 in 1973. A forecast by the Division of Tourism in 1973 estimated 288,000 people would visit Alaska in 1975 and about 554,000 in 1980.

Looking north along the Denali Highway to the Amphitheater Mountains. Morainal ridges run across the middle of the photo. The biome along most of the eastern half of the Denali Highway is moist tundra.

With population trend projections showing a substantial increase in the number of future residents in the State and espcially in the South-central Railbelt area, there will be a related increase in the demand for jobs, goods, energy, and services. Alaska has a wealth of reserves in renewable and nonrenewable resources that will have to be addressed in the very near future.

The world consumption of nonrenewable resources for energy production such as oil and gas has reached or will soon reach a critical point in time where alternative means to produce energy must be developed. The need for the development and utilization of those renewable resources must be weighed against the adverse effects that these developments would have on an ever-decreasing regime of natural environment.

2.03.3 Transportation.

2.03.3.1 Rail. The Alaska Railroad runs from Seward on the Gulf of Alaska, past Anchorage, up the Susitna Valley, past Mount McKinley National Park, and down to Fairbanks on the Tanana River, a distance of 483 miles. The Federally constructed and operated Alaska Railroad was built between 1914 and 1923.

2.03.3.2 Roads. Paved roads in the Railbelt area include: the 127 mile Seward-Anchorage highway which includes 38 miles of the 174 mile Sterling Highway between Seward and Homer; the newly-constructed 358-mile Parks Highway between Anchorage and Fairbanks; a 205-mile section of the Alaska Highway that connects Tok Junction with Fairbanks; the 328-mile Glenn Highway connecting Anchorage with Tok Junction; and the 266-mile Richardson Highway from Valdez, on Prince William Sound, to its junction with the Alaska Highway at Delta Junction, 97 miles southeast of Fairbanks.

The only road access through the upper Susitna basin is the 135-mile gravel Denali Highway between Paxson on the Richardson Highway and Cantwell on the Parks Highway, and the 20-mile gravel road from the Glenn Highway to Lake Louise. The Denali Highway is not open for use during the winter months.

2.03.3.3 Air. In addition to major airlines within Alaska, there are numerous small commercial operators plus the highest per capita ratio of private aircraft in the nation. Many small remote landing strips are scattered throughout the Susitna basin, and float planes utilize many lakes and streams to ferry freight and passengers to the remote back-country areas. In many areas of the State, the only access is provided by the airplane.

2.03.3.4 Other Forms of Transportation. ATV's and other types of off-road vehicles provide transportation into areas in the upper Susitna basin where there are no developed roads. Several developed trails are shown on maps of the upper basin. Trails are utilized by ATVs, trail bikes, hikers, horseback riders, and winter travelers.

Shallow-draft river boats, small boats, canoes, rubber rafts, and kayaks utilize sections of the upper Susitna River, a few tributary streams, Lake Louise, and some of the other lakes for recreation purposes. Except for these few areas, boating use is practically nonexistent within much of the upper basin.

2.03.4 Recreation.

2.03.4.1 Access. The greatest constraint on recreation activities for most of the 5,800-square-mile Upper Susitna River Basin is the shortage of road access. Except for a 20-mile gravel road from the Glenn Highway to the southern shores of Lake Louise on the upper drainage of the Tyone River, the main access to the area is by way of the gravel Denali Highway through the upper part of the basin.

Float planes are used to fly in hunters, fishermen, and other recreationists to various areas within the basin, but, except for a few larger isolated lakes, this form of access is relatively minor. All-terrain vehicles and snowmobiles also provide off-road access to areas within the upper Susitna basin. Boats are used to some extent to provide access on the Tyone River drainage and to areas of the Susitna River between the Denali Highway and Devil Canyon.

Much of the Upper Susitna River Basin has very little recreational activity at the present time. Great distances, rough or wet terrain, and lack of roads limit use of most of this area to a few hardy souls who enter these wild lands for recreational purposes, or to the wildlife residents and migrant birds and animals that pass through the region.

2.03.4.2 Hunting. A major recreational use of the upper Susitna area is big-game hunting and associated recreational activities. The greatest hunting pressures are exerted from a few fly-in camps, and from areas along the Denali Highway. Most wolves and bears harvested are taken while hunting caribou or moose. The increased use of ATVs to provide access and to haul big game is a significant factor in improved hunting success, even in the face of declining game populations. The mechanized ATV can penetrate deeply into previously inaccessible country, leaving few areas that provide havens for the reduced numbers of caribou and moose. It appears that the use of ATVs for hunting, already prohibited in some areas, may have to be further controlled.

The hunting of Dall sheep, mountain goats, and waterfowl is minimal in the upper basin even in areas of road access such as the Denali Highway.

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2.03.4.3 Fishing. Access is again the major factor in determining areas that are utilized in fishing for grayling, rainbow trout, whitefish, and lake trout. The Susitna and Maclaren Rivers are silt laden throughout their entire courses during the warmer months of the year. Therefore, sport fishing is limited to lakes, clearwater tributaries, and to areas in the main Susitna near the mouths of these tributaries.

Sport fishing pressure in the upper Susitna basin is light. Many lakes and some areas of the river afford landing sites for float-equipped aircraft. A few areas along the main Susitna and some tributaries, such as the Tyone River and Lake Louise, have some pressure from boat fishermen. An increasing number of hunters use ATVs to get into and out of the back country, exerting incidental fishing pressure in some areas.

As previously stated, salmon do not migrate into the upper Susitna River above Devil Canyon so are not a factor in the sport fishery of this area.

2.03.4.4 Boating. A minor amount of recreational boating occurs in the waters of the upper Susitna basin. Some lakes such as Lake Louise have a heavier amount of boating activity, and some rivers such as the Tyone and the Susitna have a lighter amount of boating activity. Some kayakers utilize portions of the main Susitna River, but very few have braved the difficult waters of the Susitna through the area known as Devil Canyon.

2.03.4.5 Camping. Most camping use in this area is incidental to other recreational activities such as hunting, fishing, boating, and highway travel. Some developed campground facilities are located at Lake Louise and at three campgrounds along the Denali Highway outside the upper Susitna basin. Tourism during the summer months involving the use of campers, trailers, and similar recreational vehicles is increasing at a dramatic rate in Alaska. Many of these vehicles camp along the roads where adequate facilities do not exist and where these activities are creating ever-increasing adverse impacts upon the land.

2.03.4.6 Other Outdoor Recreational Activities. Most other recreational activities in the upper Susitna River basin exert varying environmental impacts on the area. Many activities such as hiking, backpacking, and photography take place incidentally to other recreational pursuits such as hunting, fishing, boating, camping, and driving for pleasure. Trail bikes, snowmobiles, four-wheel-drive vehicles, and other mechanical equipment can cause extreme adverse environmental damage to the fragile ecosystems of the basin when used in a careless, uncontrolled manner.

At the present time, recreation is one of the major uses of the upper Susitna River drainage area, but the overall utilization of this area by humans remains comparatively light.

2.03.5 Historic Resources. The current National Register of Historic Places has been consulted, and no National Register properties will be affected by the project. A historical-archaeological study recently completed for the Corps of Engineers by the Alaska Division of Parks (Heritage Resources Along the Upper Susitna River, August 1975) indicates 11 historic sites within the study portion of the upper Susitna basin. These are all essentially related to the discovery of gold. Most of the early mining activity occurred on Valdez Creek, where the town of Denali was established. Nine of the sites are located in that general area. Two sites, both designated as cabins, are located on Kosina Creek, one near its mouth, and one about six miles upstream. The apparent dearth of historical locations between Devil Canyon and the Maclaren River is explained by the following excerpt from the Alaska Division of Parks' report (in discussing the first mapping of the area in 1912): "Except for a few prospects on the Oshetna River, the USGS never received any reports of gold being found on the Susitna between Devil Canyon and the Maclaren in significant quantities. Though the Tanaina and Ahtna Indians did a great deal of hunting and fishing on the river in this area, the white man found little gold, an almost unnavigable river, and no reason to settle anywhere near the 'Devil's Canyon'."

In 1920 the Alaska Railroad was completed, giving general access to Mount McKinley National Park. Highways followed in the 1940's and 1950's, and the primary use of the area became recreational. The road approach to Mount McKinley Park was by way of the gravel Denali Highway until the recent completion of the Parks Highway between Anchorage and Fairbanks.

2.03.6 Archaeological Resources. Only one archaeological site has been examined within the study area portion of the upper Susitna basin, and it has never been excavated. This is the Ratekin Site, located near the Denali Highway several miles east of the Susitna River. Three other late prehistoric archaeological sites have been reported, one on upper Valdez Creek, and two on the Tyone River. Very little information is presently available on the aboriginal uses of the Upper Susitna River Basin. Based upon the knowledge of the prehistory of contiguous areas, the Alaska Division of Parks' report concludes that the Upper Susitna River Basin was likely inhabited as early as 10,000 years ago, during Late Pleistocene/Early Holocene times, with use continuing in intensity during Late Prehistoric/Early Historic times.

One archaeological site within the general vicinity of the proposed transmission line corridor is listed in the National Register of 4 February 1975. This is the Dry Creek site.

Extensive archaeological remains have been found in the Tangle Lakes area outside the Upper Susitna River Basin near the Maclaren River drainage, and the area has been entered on the National Register of Historic Places. The remains are apparently associated with a large proglacial lake that existed during and after the last period of glaciation, dating back some 10,000 to 12,000 years. It is reasonable to expect further remains to be found around the lakebed margins when more detailed investigations are made.

2.04 Energy Needs. Power requirements for the Railbelt are increasing rapidly, and substantial amounts of new generating capacity and additional transmission system development will be needed in the near future. The Railbelt now derives most of its power from oil and natural gas. Past planning has contemplated that natural gas and, eventually, fuels from the Alyeska Pipeline would continue as long-range energy sources for Railbelt power systems. However, recent changes in the national and international energy situation indicate that other alternatives such as the abundant coal and hydro resources of the Railbelt should be reconsidered.

The energy demand curve used in the hydropower study is based on 1975 projections provided by the Alaska Power Administration. The curve represents the combined demand of the areas that could be served directly from an interconnected Railbelt system, and is premised upon assumed growth rates after 1980 that are substantially below existing trends. These growth rates assume substantial savings through increased efficiency in use of energy and through conservation programs.

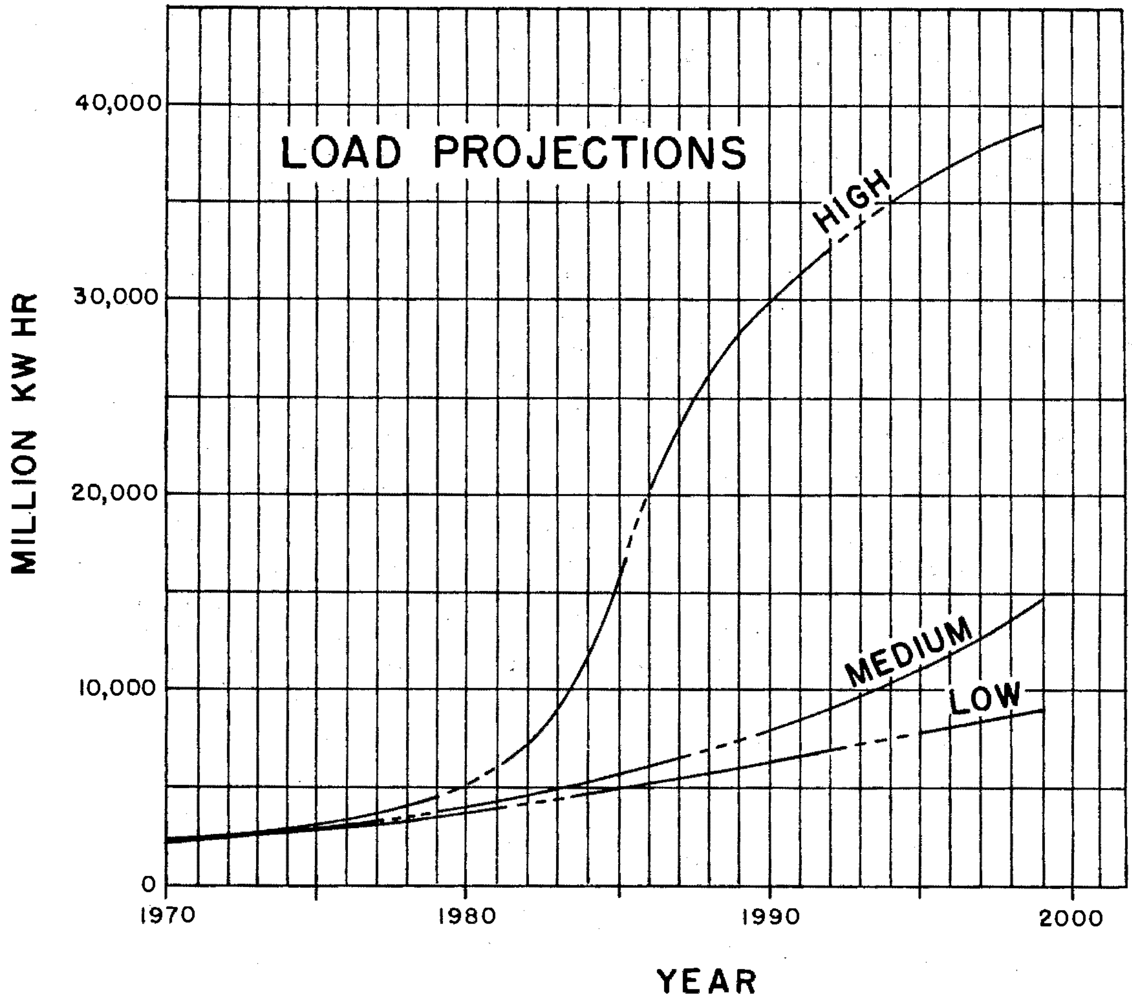
The load projection used in the hydropower study is depicted in Figure 9 along with the other estimates provided in APA's 1975 analysis. The "higher" range anticipates significant new energy and mineral developments from among those that appear most promising, along with an annual growth rate in residential, commercial, and light industrial uses that remains throughout the study period somewhat above recent electrical energy consumption growth rates in the U.S. The "lower" range presumes minimal industrial development, a load growth rate for the remainder of this decade well below current actual rates of increase, and energy growth over the next twenty years that barely matches the latest population growth rate projections for that period. This lower estimate generally assumes a significant slackening of the pace of development almost immediately and continuing throughout the period of study. The "mid-range" appears to be a reasonably conservative estimate, with annual rates of increase in power requirements less than 7 percent after 1980 as compared to an historical annual growth rate of 14 percent during the period 1960 to 1971. This adopted "mid-range" projection assumes steady but moderate growth after the present boom period coupled with more efficient energy use.

Because of lead time needed for coal and hydroelectric development, immediate needs for the next decade will have to be handled by additional oil and gas-fired units. However, the opportunity exists for hydro and coal to become the main energy sources for Railbelt power by about 1985, if priority is attached to these resources.

Studies by the advisory committees for the current Alaska Power Survey provide estimates of costs for alternative power supplies from coal, natural gas, and oil-fired plants. Indications are that power from Susitna hydroelectric development would be comparable in cost to present gas-fired generation in the Cook Inlet area and would be less expensive than alternatives available to other Southcentral Railbelt power markets.

There are many questions concerning future availability and costs of natural gas and oil for power production. Oil prices have increased dramatically in the past few years, and there are many pressures to raise natural gas prices. There are also arguments that natural gas reserves are needed for petrochemical industries and for other non-power uses. Many people in Government and industry question the use of natural gas and oil for long-range power system fuels.

On 31 December 1974 the Congress enacted Public Law 93-577. This act established a national program for research and development in non-nuclear energy sources. One of the sections of the law stipulated that heavy emphasis should be given to those technologies which utilize renewable or essentially inexhaustible energy sources.



PROJECTED
ENERGY DEMAND
SOUTHCENTRAL RAILBELT

FIGURE 9

3.0 RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS.

3.01 Present Land Status. Lands in the general project area of the proposed Upper Susitna River Basin hydroelectric development at Devil Canyon and Watana are under Federal jurisdiction and administered by the U.S. Bureau of Land Management. These lands have been classified as power sites by Power Site Classification Number 443, dated 13 February 1958. The project areas are designated in the Power Site Classification by approximate damsite locations and contour designations as follows:

Devil Canyon: This area begins approximately 1.4 miles upstream from the mouth of Portage Creek and includes all lands upstream from this point below the 1500-foot contour.

Watana: This area begins approximately 1.5 miles upstream from Tsusena Creek and includes all lands upstream from Tsusena Creek and from this point below the 1,910-foot contour.

Transmission Corridor: Most of the route segments lie in lands that are pending or tentatively approved State selections, native village withdrawals, and native regional deficiency withdrawals, all of which are in a state of flux at the present. There is very little privately owned land within the proposed corridor. Most of the affected lands between Point MacKenzie and Talkeetna are potential State selections. Native village withdrawals relevant to the settlements of Montana Creek, Caswell, and Knik are indeterminate. From Talkeetna to Gold Creek, the corridor transects State selected land and borders on Denali State Park. Between Gold Creek and Devil Canyon, the lands are 50/50 State selections and native regional deficiency. From Gold Creek to Cantwell, the lands are comprised of native withdrawals and State selections. From Cantwell to Healy, the route is State selected land bordering on Mount McKinley National Park. Route lands between Gold Creek and Healy also fall within the Mount McKinley Cooperative Planning and Management Zone. From Healy to Ester, the route primarily transects State selected land with some existing Federal withdrawals and native village withdrawals. Land status described above is subject to change as determinations are made for ultimate disposal.

3.02 Alaska Native Claims Settlement Act. The Power Site Classification withdrawals are in an area designated under the Alaska Native Claims Settlement Act (Public Law 92-203) for village deficiency withdrawals: lands which can be selected by village corporations which cannot meet their selection entitlement from withdrawals in the areas immediately surrounding those villages as provided in Section 11(a)(3) of PL 92-203. Lands within the power site withdrawal may not be selected as Native Village deficiency lands. Accordingly, the effect of PL 92-203 concerns only the lands lying above the contours designated in the Power Site withdrawal. A proposed exchange of lands is presently being considered by the Cook Inlet Native Regional Corporation, the State of Alaska, and the Bureau of Land Management. This proposed exchange would result in the State's becoming owner of the lands above the contours designated in the power site withdrawal in lieu of the Native Village corporations. The proposed exchange, however, necessitates an amendment to PL 92-203, and possibly to Alaska statutes, to permit such an exchange to proceed.

3.03 Utility Corridors. The U.S. Bureau of Land Management has prepared a report suggesting a Primary Corridor System for the State of Alaska. The report was prepared in accordance with the provisions of Section 17 (b)(3) of the Alaska Native Claims Settlement Act (Public Law 92-203).

The Primary Corridor System is defined as a network of corridors intended for the systematic transport of high-value, energy-related resources from their point of origin to processing or transshipment points in other regions of the State. The network is intended to identify transportation routes for resources of national or statewide significance and is analogous to the transportation network that already exists in conterminous states consisting of navigation, highway, railroad, and pipeline systems.

The Susitna project is one of the hydroelectric power developments sufficiently advanced in the planning phase to warrant corridor consideration for high-voltage power transmission lines. The transmission lines from the proposed Susitna project have been identified as a portion of Corridor No. 29 in the suggested Primary Corridor System.

4.0 ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

4.01 Hydrology and Water Quality. About 86 percent of the total annual flow of the upper Susitna River occurs from May through September. Average daily flows from the latter part of May through the latter part of August fluctuate in the range of 20,000 to 32,000 cubic feet per second (cfs). November through April the average daily flows range between 1,000 and 2,500 cfs. The river also carries a heavy load of glacial sediment during the high runoff periods. During the winter when low temperatures reduce water flows the streams run relatively silt-free.

Some of the impacts that could be caused by the project downstream from Devil Canyon Dam are discussed below.

Significant reductions of the late spring and early summer flows of the river and substantial increases of the winter flows would occur. The flow of the river during the period 1950 through 1974 averaged about 9,280 cfs. The projected average regulated downstream flows for a Devil Canyon-Watana system computed on a monthly basis would range between about 7,560 cfs in October to almost 15,100 cfs in August. In extreme years, the monthly averages would range from about 6,300 cfs to nearly 28,300 cfs. The average monthly regulated flows compared to the average unregulated flows based on the period from 1950 through 1974 are as follows:

TABLE I - FLOWS

Month	Regulated cfs	Unregulated cfs
January	9,905	1,354
February	9,429	1,137
March	9,026	1,031
April	8,278	1,254
May	8,158	12,627
June	8,329	26,763
July	9,604	23,047
August	15,091	21,189
September	10,800	13,015
October	7,560	5,347
November	8,369	2,331
December	8,968	1,656

The heavier sediment material now carried by the river during high runoff periods between Devil Canyon and the junction of the Chulitna and Talkeetna Rivers with the Susitna River would be substantially reduced, and a year-round, somewhat milky-textured "glacial flour" (suspended glacial sediment) would be introduced into the controlled water releases below the dam. Preliminary studies by the Corps of Engineers indicate that the suspended sediment in releases at Devil Canyon Dam would be at low levels (15-35 ppm). According to fishery investigations during the winter of 1974-75 by the Division of Commercial Fisheries of the Alaska Department of Fish and Game on the Susitna River between Portage Creek and the Chulitna River, suspended solid samples of river water at Gold Creek, Chase and the Parks Highway bridge, indicated a range of from 4 to 228 ppm, and that these suspended solids are within anadromus fish tolerances. Although the average sediment load in summer months is less than 1000 ppm, loads sometimes reach a maximum of 5000 ppm in the unregulated river. Reduction of existing summer sedimentation peaks should have a beneficial effect on anadromous and resident fish populations for some distance downstream from Devil Canyon Dam.

On occasions when spilling water over Devil Canyon Dam would be necessary during late summer periods of extreme high flows, nitrogen supersaturation could be introduced into the river below the dam. Fish exposed to high levels of this condition can suffer gas-bubble disease (like bends to a deep-sea diver) which can be fatal.

The combined high level regulating outlets and powerhouse capacities (30,000 cfs and 24,000 cfs respectively) at the Watana Dam are adequate to accommodate floods with recurrence intervals of up to approximately 50 years. At the Devil Canyon Dam the hydraulic capacity of the initial four generating units is approximately 25,000 cfs at normal maximum pool elevatioon of 1,450 feet. The low level outlet works at Devil Canyon are not designed to generate at pool elevation 1,450 feet, therefore, total outflow without spill is limited to a maximum of 25,000 cfs. Of the 25 years of streamflow record, spills were estimated to occur in 11 of the operation years, with the average spill lasting 14 days with an average flow of an additional 8,500 cfs. However, any nitrogen supersaturation and dissolved oxygen thus introduced should be reduced substantially in the turbulent river section just downstream from Devil Canyon dam. The proposed spillway at Watana Dam is not conducive to high levels of nitrogen or oxygen supersaturation, and spills would occur very seldom, only on the occasions of extreme flooding conditions in late summer. Few fish, under existing conditions, are believed to occupy the two and one-half mile section of Susitna River between the proposed Devil Canyon damsite and the mouth of Portage Creek. This situation could change with a decrease in regulated flows during the summer months.

Temperature of the water released from Devil Canyon Dam would be adjusted to approach the natural river water temperatures. This would be made possible by the proposed incorporation of selective withdrawl outlets into the dam structure.

Variations in water releases at Devil Canyon Dam would cause less than a one-foot daily fluctuation of downstream water levels in the river during the May through October period since the reservoir would not be used for peaking purposes. The regulated daily fluctuations during the winter months could range up to one foot under normal operating conditions. According to U.S. Geological Survey studies, the natural normal daily fluctuations in the Susitna River below Devil Canyon range up to about one foot.

Stratification conditions within the reservoirs could cause some temperature and dissolved oxygen problems in the river for some distance downstream from the Devil Canyon Dam and within the reservoirs themselves. These conditions could have an adverse impact on the downstream fishery. However, this problem can be minimized by multiple-level water release structures which are proposed for incorporation into both dams. This would provide the capability of selective withdrawal of water from various levels within the reservoir to moderate release temperatures and dissolved oxygen content. Spillway designs will also be considered to reduce supersaturation of downstream water flows with atmospheric gases.

There would be a period of channel stabilization in the 50-mile section of the Susitna River below Devil Canyon Dam in which the river would tend to adjust to the stabilized flow with low sediment levels but general channel degradation caused by a river's attempt to replace the missing sediment load with material picked up from the riverbed is not expected to be a significant concern along the coarse gravel bed reaches of the Susitna River between Talkeetna and Devil Canyon. However, this phenomenon would be the subject of future detailed studies to determine the distance at which sediment loads would become reestablished.

Upstream from the dams the major environmental impacts would be caused by the reservoir impoundments. Under the proposed two-dam system, the reservoir behind the Devil Canyon Dam would fluctuate up to 5 feet during the year, while Watana reservoir would fluctuate between 80 and 125 feet during the year under normal operating conditions. The maximum daily fluctuation at Devil Canyon reservoir under normal operating conditions would be less than two feet.

Devil Canyon reservoir would cover about 7,550 acres in a narrow steep-walled canyon (1/4 to 3/4-mile-wide) with few areas of big game habitat and a minimal amount of resident fish habitat near the mouths of several of the tributaries that enter the Susitna River in the 28-mile section above the proposed damsite. The reservoir would also flood approximately 9 miles of the 11-mile, whitewater section of Devil Canyon.

Watana reservoir, with a structural height of 810 feet and a pool elevation of 2,200 feet, would flood about 43,000 acres in a 54-mile section of the Susitna River that would reach upstream about 4 miles above the Oshetna River confluence. Except in a few areas near the mouths of tributaries such as Deadman Creek, Watana Creek, Jay Creek, and Kosina Creek, the Watana reservoir would be contained within a fairly narrow canyon 1/3-mile to 1 mile in width for much of its length.

The spillway design at Watana diverts the excess river flows into the Tsusena Creek drainage approximately 2.5 miles above the creek's confluence with the Susitna River. On the occasions (approximately once every 50 years) when it would be necessary to divert excess river flows over the spillway during extreme flooding conditions in late summer, the adverse environmental impact on fish and vegetation resources in lower Tsusena Creek could be significant.

Watana reservoir would flood reaches of the Susitna River upstream from Tsusena Creek that are sometimes used as caribou crossings. It would also flood some moose winter range in the river bottom. The reservoir would also cover existing resident fish habitat at the mouths of some of the tributaries in this section of the river and possibly would create other fish habitat at higher elevations on these tributaries.

Potential water quality impacts caused by construction of transmission facilities are the increased siltation of rivers and lakes; alteration of stream flows; eutrophication (increased nutrient levels) and pollution of lakes and streams; and disruption of aquatic habitat due to gravel borrow, fill, and excavation. Eliminating or minimizing these potential adverse impacts would be emphasized during the design, construction, and maintenance of the proposed project.

4.02 Fish. One of the environmental impacts caused by the proposed Devil Canyon-Watana project would be the substantial reduction of natural river flows during the latter part of June and the early part of July when salmon start migrating up the Susitna River. The projected average monthly regulated flows during periods in August and September, when the majority of the salmon are spawning, approach the average natural flows of the river during this period.

In a 1974 study by the Alaska Department of Fish and Game on surveys conducted to locate potential salmon rearing and spawning sloughs on the 50-mile section of the Susitna River between Portage Creek and the Chulitna River, 21 sloughs were found during the 23 July through 11 September study period. Salmon fry were observed in at least 15 of these 21 backwater areas. Adult salmon were present in 9 of the 21 sloughs. In 5 of the sloughs the adult salmon were found in low numbers (from 1 to 24 with an average between 6 and 7). In 4 other sloughs large numbers were present (from 107 to 681 with an average of just over 350).

During December 1974 and January and February 1975, the Alaska Department of Fish and Game investigated 16 of the 21 sloughs previously surveyed during the summer of 1974. Of the 16 sloughs, 5 indicated presence of coho salmon fry. The numbers of fry captured in the 5 sloughs at various times ranged from 1 to 21 with an average of 5. Many of the 16 sloughs surveyed were appreciably dewatered from the summer/fall state.

The report also stated that a number of coho fry were captured in the Susitna River near Gold Creek indicating that some coho salmon fry do overwinter in the main river.

The winter investigations indicated that the Susitna River between Devil Canyon and Talkeetna was transporting suspended solid loads ranging from 4 ppm to 228 ppm.

It may be reasonable to assume that one of the most critical factors in salmon spawning is the dewatering of areas in which the salmon have spawned. If winter flows are insufficient to cover the spawning beds it would be of little consequence if high summer flows allowed salmon to spawn in some of the sloughs that are dewatered during the egg incubation or alevin stages. According to a Hydrologic Reconnaissance of the Susitna River Below Devil's Canyon, October 1974 by the National Marine Fisheries Service when comparing regulated flows to natural flows (see Table 1 on page 45), "It is reasonable to conclude that during the months of October through March spring flows may be enhanced in the river valley bottom, during the months of May through mid-September these springflows may be depressed."

It is reasonable to assume on the basis of existing data that there will be some changes in the relationship between the regulated river and access to existing salmon rearing and spawning sloughs and tributaries downstream from Devil Canyon Dam. It appears feasible to develop a program to improve fish access to and from some of the sloughs and tributaries in the Susitna River as a consequence of the project's stabilizing effect on summer flows. Such a program would be a project consideration.

Flooding, which occurs frequently under natural conditions and presently destroys salmon eggs in this stretch of the river would be almost completely eliminated by regulation of the upper Susitna River flows.

Reduction in flows and turbidity below Devil Canyon Dam might cause some disorientation of salmon migrating into the section of the Susitna River between Portage Creek and the Chulitna River during an initial period after construction of the dams and until future salmon stocks readjusted to the change in regulated river conditions.

During the period of construction, river flows will be diverted through tunnels in the canyon walls and past the construction areas at the damsites with minimal changes in existing water quality.

During the periods in which the newly-constructed reservoirs would be filling with water, downstream flow maintenance would be coordinated with the fish and wildlife agencies to prevent unnecessary damage to downstream fishery resources. It is proposed to initiate construction of Watana Dam in about 1981, and Devil Canyon approximately five years later.

According to a study discussed in the Journal of Fisheries Research Board of Canada--Volume 32, No. 1, January 1975, Ecological Consequences of the Proposed Moran Dam on the Fraser River, some of the beneficial downstream impacts of the dam could include the following:

The higher regulated winter flows might increase the survival of salmon eggs in the sloughs and backwater areas of the river downstream from the dam. The increased flows could insure better coverage and better percolation through the gravel and presumably increase egg and alevin survival. Salmon alevin are young fish with attached egg-sacs that remain in the gravel beds until they emerge as fry.

An additional consequence of reduced turbidity below the dam might be a gradual reduction in the percentage of fine materials in the salmon spawning areas near the mouths of sloughs and tributaries as they enter the Susitna River. This could also lead to improved percolation through the gravel in the streambed and possibly improve survival of eggs.

Reduced siltation during the summer months should prove beneficial for both anadromous and resident fish species for some distance downstream from the proposed Devil Canyon Dam. It is also reasonable to expect that some additional salmon spawning and rearing habitat would develop within some sections of the Susitna River between Devil Canyon and Talkeetna.

According to the Moran Dam study, reduced turbidity during the summer months or during the periods of seaward migration could lead to an increase in visibility within the river and therefore an increase in predation of salmon fry. A slight increase in turbidity during the winter months might also increase the survival of young salmon due to a decrease in visibility during that period. Another impact on juvenile salmon could be the extention of the seaward migration period due to less turbid water in the 50-mile portion of the Susitna River below Devil Canyon.

Other hydrologic factors previously discussed would also affect the fishery resource downstream from the dams. These and other changes could also influence the food and life cycles for fish in this section of the river. Biological and physical changes likely to occur are the subjects of ongoing studies by State and Federal agencies under the direction of the U.S. Fish and Wildlife Service. Results of these studies will be used in determining needs for more detailed final design phase studies, feasible project modification, and mitigative or ameliorative measures.

Upstream from the dams, the major impact on the resident fish populations would be caused by the reservoir impoundments. Under the proposed plan, Devil Canyon reservoir would fluctuate very little. Even though the steep-walled canyon of this reservoir might prove less than desirable for a program to develop a resident fish population, some species of fish might be able to adapt to this reservoir and provide future sport fishing benefits.

Watana Dam would have a widely fluctuating reservoir which would generally prove detrimental to the development of resident fish populations. Suspended glacial sediment could be a factor in both of the reservoirs after the heavier glacial sediments have settled out; however, some natural lakes in Alaska such as Tustumena and Skilak, with heavy inflows of glacial debris sustain fish populations under similar conditions, so to develop populations of fish under related conditions may be feasible.

Most resident fish populations, especially grayling, utilize some of the clearwater tributaries of the Susitna River or areas near the mouths of these streams as they enter the glacially turbid main river channel during periods of high runoff. Many of these tributaries would be flooded in their lower reaches by the proposed reservoir impoundments. The resident fish populations would be affected by the increased water levels in the proposed reservoirs; but in some areas, access to tributaries for resident fish may be improved by increased water elevations.

It appears highly unlikely that anadromous fish such as salmon could be successfully introduced into the Upper Susitna River Basin. With the succession of very high dams and the related problems and costs of passing migrating fish over and through these dams, such a program appears infeasible (Report, Ecological Consequences of the Proposed Moran Dam on the Fraser River). This report states in reference to high dams: "The choice is clearly between upstream salmon stocks or dams." However, the introduction of a resident salmon species, such as sockeye (kokanee) or others to some waters of the upper Susitna basin might prove feasible with further studies.

Other problems related to the introduction of anadromous fish into the Upper Susitna River Basin would include the following: Fish would experience high mortality rates if they attempted to move downstream through turbines or outlet works in the proposed series of high-head dams. According to Corps of Engineers studies, a 35 percent mortality rate could be expected on fish such as young salmon at each high dam. Perhaps even more significant than turbine loss is the experience background that juvenile salmonids will generally not migrate out of large storage type reservoirs. Reverse currents, temperature stratification, etc., apparently disorients the migrants and causes them to lose their migrational motivation. As a result many never even reach the dam and they spend their lives as residuals in the reservoir. (Example: Brownlee Reservoir, Snake River, Idaho and Oregon)

Impact upon aquatic life from the transmission line should be small because of the care that would be taken to prevent degradation of streams within the corridor. However, the aquatic food chain in the taiga (boreal forest) and tundra is extremely simple, and as a result, disruption of habitat for one species quite often indirectly affects many other species. Potential impacts are: increased siltation of rivers and lakes; alteration of flows; eutrophication and pollution of lakes and streams; and disruption of habitat due to gravel borrow, fill, and excavation. All construction and maintenance activities would be controlled to prevent or minimize adverse environmental impacts.

4.03 Wildlife. Reservoir impoundments, transmission line corridors, and access roads would have varying degrees of environmental impact on wildlife.

The Devil Canyon reservoir would be located within the confines of a narrow, steep-walled canyon with few areas of big-game habitat and on no major migration routes for big-game animals. In some cases, animals such as moose and caribou may find it easier to cross the narrow reservoir than they would the present fast-moving river at the bottom of a deep, steep-sided canyon.

The proposed Watana Dam would be generally contained within a fairly deep and narrow river canyon. Watana reservoir would lie across one of the intermittent seasonal caribou migration routes between the main calving area of the Nelchina caribou herd, located south of the river in the northeast foothills of the Talkeetna Mountains, and some caribou summer range on the north side of the Susitna River. Calving generally takes place during a month-long period starting in the middle of May and most of the caribou move out of the calving area in June and July.

Ice-shelving conditions caused by winter drawdown on Watana reservoir or spring ice breakup conditions on the reservoir could cause problems for caribou, moose, or other animals if they attempt to cross this reservoir when these adverse conditions exist. Warmer weather and a rapidly filling reservoir should eliminate any adverse ice conditions at Watana during the month of May. As caribou are strong swimmers, they should have fewer problems crossing the narrow 2/3 to 1 mile wide section of the reservoir in the historic crossing areas in the vicinity of Kosina and Jay Creeks during July after calving than they would crossing the swollen glacial river during periods of high runoff. Some caribou could also migrate around the upper reaches of the proposed Watana reservoir area as indicated in existing spring migration patterns. Caribou migration patterns for the Nelchina herd are continually changing, as stated in Alaska Department of Fish and Game study reports. Their studies also indicated the use of the Watana reservoir site by Nelchina caribou for grazing and crossing was minimal during the period November 1974 through April 1975. Under adverse ice conditions, the reservoirs could result in increased problems for some segments of the herd. Also, there could be some permanent changes in historical herd movement patterns.

Within the transmission line corridor system, impacts to caribou would be limited to the 136-mile segment extending north from Cantwell. There is no significant caribou use of areas to the south. Although the transmission line and related access roads would not impose a physical barrier to migration of caribou, construction and maintenance work during certain seasons may inhibit herd movement. Since caribou are primarily confined to the west bank of the Nenana River, they will not be significantly affected in this area if the line runs along the east bank. Although physical destruction of caribou habitat will not be a significant impact of power line construction, there are indirect consequences which could be significant. Increase of fires resulting from manmade causes could destroy tundra lichen which is their prime source of winter food. It is estimated that approximately 50 years are required for a burned area to recover a usable cover of lichen for caribou. Noise generated by the transmission lines could also modify normal behavior, as could public accessibility provided by transmission line roads.

A moose survey conducted in early June 1974 by the Alaska Department of Fish and Game indicated that, although spring counting conditions were less than ideal, a total of 356 moose were seen along the upper Susitna River and in the lower drainage areas of the major tributaries. A 1973 fall count in the same general area sighted a total of 1796 moose.

Of the 356 moose counted in the June 1974 survey, 13 were seen in or near the area of the proposed Watana reservoir below Vee Canyon. None were sighted within the proposed Devil Canyon reservoir impoundment. Although limited moose habitat appears to exist within the pool areas of the proposed Devil Canyon and Watana reservoirs, it is considered critical to those moose now utilizing the area. Special studies will be required to determine impacts upon moose habitat and populations.

During the June 1974 Fish and Game survey period, one grizzly was sighted on the upper Oshetna and one on the Maclaren River. Five black bears were sighted on the Susitna River. A total of 56 caribou were sighted in the survey area.

Moose are found throughout the length of the transmission line corridor. The greatest adverse impact to these animals would be the increased hunting access provided by roads and the openness of the corridor itself. Habitat, on the other hand, would overall be improved. Subclimax growth within the transmission line corridor would increase moose browse.

The proposed reservoirs at Devil Canyon and Watana are located along a major flyway for waterfowl. Very few waterfowl appear to nest on the sections of the river that would be flooded by these reservoir proposals. On the other hand, the reservoirs would provide suitable resting areas for waterfowl migrating through the basin.

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Migrating birds would possibly suffer some mortality from collisions with towers or lines, but such losses should be negligible. The line would generally parallel normal north-south migration routes. The cables would be large enough to have a high degree of visibility and would be widely enough spaced to be ineffective snares. Electrocution of birds is also unlikely since the distance between lines and between lines and ground would be great enough to make shorting out by birds almost impossible.

A transmission line per se will not have many impacts upon wildlife; most of the impacts will be as a result of construction and maintenance. Direct destruction will affect the less mobile animals such as the small mammals, whose territories may be small enough to be encompassed by the construction area. The significance of this impact to these animals is small in relation to their population in surrounding areas.

The loss of habitat for bears, wolves, wolverines, Dall sheep, and other animals also appears to be minimal. However, losses to any significant element of the food web will affect consumers. Thus, losses to moose or caribou would impact upon predator species. Other birds, including raptors, songbirds, shorebirds, and game birds, do not appear to be significantly affected by the reduction of habitat in the area of the proposed dams and reservoirs and on the transmission line corridor, although some habitat will be lost for all species of wildlife that utilize the affected areas.

Road access to the two damsites and to the transmission line would have a significant impact on fish and wildlife resources in areas opened to vehicle encroachment. Specific areas such as Stephan Lake, Fog Lakes, lower Deadman Creek, and the northern slopes of the Talkeetna Mountains could be significantly impacted by hunters, fishermen, and other recreationists by an access road to the Watana Dam. The same would be true along various segments of the transmission line. State game management policies could control some of the adverse impacts on fish and wildlife in these areas. However, this increase in public accessibility would significantly increase the necessity for intensified law enforcement and fire prevention measures.

4.04 Recreation. Much of the Upper Susitna River Basin has little or, in many areas, no recreational activity at the present time. A combination of poor road access, rough terrain, and great distances presently limit the use of the 5,800-square-mile basin, especially the lands directly impacted by the proposed project, to a few hunters, fishermen, and other hardy souls who utilize these wild lands for recreational purposes.

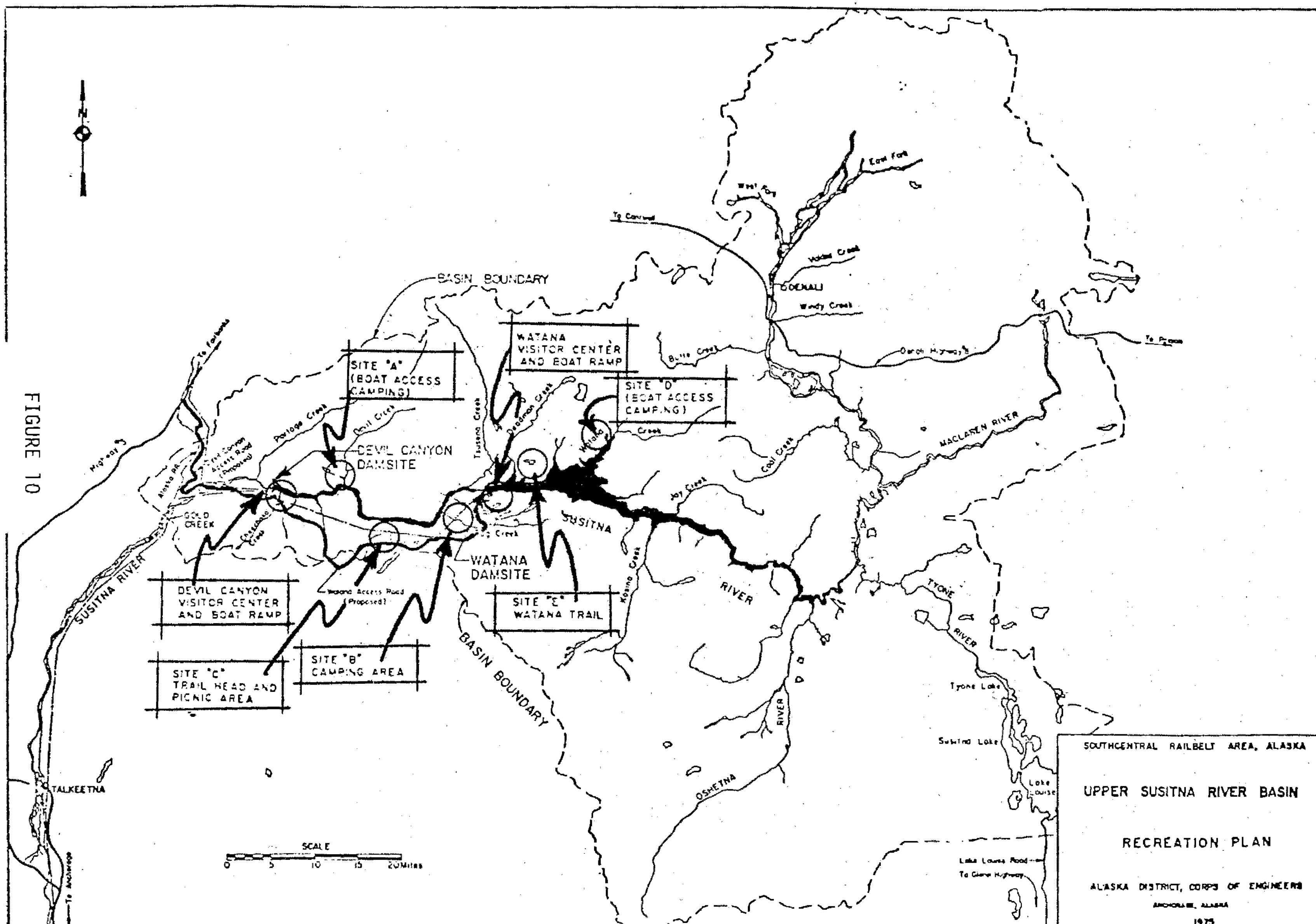
The construction of the proposed hydroelectric project would have an impact on a number of present and projected recreational activities both in the immediate dam and reservoir areas and downstream from the dams.

At the present time, the Susitna River upstream from Portage Creek to the Denali Highway bridge is a free-flowing river with few signs of man's activities and minimal public use. The project would significantly change both the present riverine setting and human use of the area. Improved road access into the upper Susitna basin would substantially increase pressures on all the resources impacted by outdoor recreation activities within these areas. Along with a potential increase in hunting pressure, the construction of project-oriented recreational facilities would further increase public use in the immediate vicinity of the proposed dams and reservoirs. These recreational developments would eventually include visitor centers at the dams, boat launching ramps on the reservoirs, campgrounds, picnic areas, trail systems, and other related developments, as shown in Figure 10. It is estimated that with the recommended development plan, the initial annual visitation to the project area would be about 77,000 people.

The possible relocation of the state capital to the Lower Susitna River Basin could have a substantial impact on the extent of development of recreational facilities within the Devil Canyon-Watana project area. At the present time, few people reside within a 100-mile radius of the project area, and day-use of the project by local residents would be minimal under existing growth conditions.

Any project-related recreational development program would involve cooperation between the appropriate Federal, State, and local interests and would require State or local sponsorship, sharing of costs for construction, and maintenance of the developed recreational facilities by the appropriate State or local sponsor. The State of Alaska (Division of Parks) has indicated an interest in sponsoring a program of recreational development in the area of the proposed project.

4.05 Historical Resources. Although a preliminary investigation by the Alaska Division of Parks (Heritage Resources along the Upper Susitna River, August 1975) indicates the location of 11 historic sites within the upper Susitna basin hydropower study area, only one of these would be directly affected by the currently proposed two-dam development. This site is located near the mouth of Kosina Creek and would be inundated by the Watana reservoir. The significance of this site, a cabin, is not disclosed in the State report. However, on the basis of the limited early modern history associated with the upper Susitna basin, particularly the downstream portion above Devil Canyon, it is most likely that the site is related to early exploratory mining in the area. The Knik historical site, although located in the vicinity of the transmission line would not be affected by the transmission corridor.



SOUTHCENTRAL RAILBELT AREA, ALASKA
UPPER SUSITNA RIVER BASIN
RECREATION PLAN
ALASKA DISTRICT, CORPS OF ENGINEERS
ANCHORAGE, ALASKA
1975
BASIN BOUNDARY
SITE "A" (BOAT ACCESS CAMPING)
WATANA VISITOR CENTER AND BOAT RAMP
SITE "D" (BOAT ACCESS CAMPING)
DEVIL CANYON DAMSITE
WATANA DAMSITE
DEVIL CANYON VISITOR CENTER AND BOAT RAMP
SITE "C" TRAIL HEAD AND PICNIC AREA
SITE "B" CAMPING AREA
SITE "E" WATANA TRAIL
BASIN BOUNDARY
SUSITNA RIVER
SUSITNA
RIVER
MACLAREN RIVER
TYONE RIVER
OSHETNA
RIVER
DENALI
TALKEETNA
GOLD CREEK
Portage Creek
Devil Creek
Tsusena Creek
Deadman Creek
Jay Creek
Coal Creek
Kosina Creek
Butte Creek
Windy Creek
Valdez Creek
West Fork
East Fork
To Cantwell
To Paxson
Denali Highway
Tyone Lake
Susitna Lake
Lake Louise
Lake Louise Road
To Glenn Highway
Highway 3
To Fairbanks
To Anchorage
Watana Access Road (Proposed)
SCALE
0 5 10 15 20 Miles
N

FIGURE 10

Looking upstream at Susitna River near Denali. Tundra ecosystems with scattered areas of black spruce.

4.06 Archaeological Resources. Of the four presently known archaeological sites in the upper Susitna basin, all lie upstream from the influence of the Watana Dam and reservoir, according to the Alaska Division of Parks report of August 1975. On the basis of probable highest game diversity in early times, the report selects areas most likely to have been inhabited by people, and thus identifies sites for potential archaeological exploration. These sites are most generally designated as being near the confluence of streams where habitat diversity was likely highest. The report concludes that "--the entire river system should be regarded as an area of extremely high archaeological potential." The report further states: "While it is difficult to measure the amount of adverse impact each of the four dam complexes will have on heritage resources, it is possible to ascertain that the Devil Canyon Dam will have the least effect. The Watana Dam will have the second lowest adverse impact, followed by Denali Dam. The construction of the Vee Dam site will have the most adverse impact on significant heritage resources." (The Vee and Denali Dams are not in the proposed plan of development.)

More intensive reconnaissance of the affected areas will be necessary following project authorization to determine the actual existence and locations of sites.

The Dry Creek archaeological site is located in the vicinity of the proposed transmission line corridor. The site will not be affected by development within the proposed route.

4.07 Vegetation. All of the vegetation within the pools of the proposed reservoirs and in the proposed road locations would be eliminated if the dams were constructed. Trees would also be cleared in areas within transmission line corridors. Most of the trees and shrubs would be cleared during construction operations, and some of the commercial timber would probably be marketed. Most of the residue slash material and debris would be burned or buried.

Much of the existing tree and shrub cover in the Upper Susitna River Basin is located in the river and creek bottoms and on the steep canyon slopes above the streams and would be lost during dam construction. The operations to clear the vegetation within the reservoir impoundments and other areas would require a network of temporary roads and work areas for personnel, equipment, and vehicles within and around the areas to be cleared. Controls over the clearing and related operations would include provisions to reduce or prevent many of the adverse environmental impacts of these activities including the possibility of uncontrolled fires.

The major ecosystems of the upper Susitna basin include the upland and lowland spruce-hardwood forest systems and the moist and alpine tundra systems. All these ecosystems are susceptible to long-term damage or destruction; the predominant tundra systems are especially vulnerable. Particular care would have to be taken to protect the land and the vegetation from unnecessary damage, and remedial actions would also need to be taken to make feasible repairs to whatever damage should occur. Except for the river itself the area within the proposed reservoir pool is dominated by the upland spruce-hardwood forest ecosystem.

Most of the direct impacts of the transmission line and required access roads upon vegetation would be relatively small with respect to the magnitude of surrounding unaffected land. Up to 6,100 of the approximately 8,200 acres of right-of-way would have to be cleared.

The effect on scenic quality would be a major impact of the cleared right-of-way. Regrowth beyond a limited height would be prevented by maintenance, thus cuts through forested areas would be permanently visible. This effect would not be as significant in more open areas at higher elevations, such as Broad Pass, where no tree clearing is required. On the other hand, in such areas the transmission line itself would be more visible. This effect is more fully discussed under the heading of Esthetics.

The disposal of slash and debris, whether by burning, burying, chipping, or stacking has potentially adverse effects upon remaining vegetation and other resources. Although stacked or dispersed slash may provide habitat for small animals, there is a high potential that slash may result in increased fire hazard and increases in insect populations which could damage surrounding forests. Chipping is very expensive and requires more machinery to travel along the right-of-way. Disposal of chips is a problem because they should be dispersed to prevent killing the plants on the ground. Since decomposition rates are slow, chips may not revert to humus for quite some time. Vegetation along most of the transmission line corridor is conducive to a high rate of fire spread and is considered to be of medium to high resistance to fire control. However, with proper precautionary measures, burning would probably be the most desirable method of slash and debris disposal from an environmental viewpoint.

Significant impacts to wildlife would result from habitat modification resulting from impacts upon vegetation. Transmission corridor clearing in forest areas and maintenance of a subclimax plant community of brush and low plants would improve habitat for some species by increasing primary productivity in the cleared areas. Browse for moose will be increased; the conjunction of good cover in the original forest with a swath of browse creates a diverse "edge" habitat for many animals dependent on subclimax growth. Animals dependent on climax or near-climax vegetation will suffer loss of habitat; examples are the red squirrel and northern flying squirrel, both of which depend upon white spruce.

4.08 Mining. The U.S. Department of Interior, Bureau of Mines office in Juneau, Alaska, has stated that the Susitna River basin in the proposed reservoir impoundment areas is generally favorable for various types of mineral deposits, but the area has never been mapped geologically.

4.09 Agriculture. No project benefits are anticipated for irrigation at this time, and except for providing reasonably priced electrical power to farms and agricultural activities, no other major impacts on agriculture are expected.

Presently most agricultural activity in the State, from crop farming to dairy farming, occurs in the Cook Inlet subregion. Of the 2.5 million acres of land that have soil characteristics conducive to the production of cultivated crops in the Cook Inlet-Susitna Lowlands, about 70 percent occurs in the valleys of the Matanuska and the Susitna Rivers and their tributaries. Most of this land is as yet undeveloped.

4.10 Roads. Permanent roads would be built to provide access from the Parks Highway to the Devil Canyon and Watana damsites and some segments of the transmission line. Permanent roads would also provide access to proposed recreation facilities within the project area. Temporary roads for project construction and reservoir clearing operations would also be constructed. No roads would be built within the transmission line corridor in the 39-mile reach between Cantwell and Healy, and the 10-mile reach between Gold Creek and Chulitna. No permanent roads would be constructed upstream from the vicinity of Watana dam.

The impact of road access to areas within the proposed hydroelectric developments would be significant; also, the roads themselves would have a definite impact upon the land. Resource values impacted by proposed roads include fish, wildlife, vegetation, recreation, scenery, water, and soils. Air and noise pollution related to road construction and dust generated by vehicle travel on unpaved roads could also be significant adverse environmental impacts.

In sections where permanent transmission line access roads are required, the road would be built and maintained to a standard suitable for four-wheel-drive vehicles. Not all sections will have access roads; in critical areas, winter construction or helicopter construction will be used.

It is also expected that helipads and possibly an aircraft landing strip would be provided within the project area for air evacuation of injured workers and for the convenience of reduced travel time; any temporary aircraft landing facilities would be rehabilitated after project construction.

Proposed right-of-way restoration after construction includes removal of temporary structures and temporary roads, disposal of slash and refuse, and where necessary, revegetation.

Design, location, construction, rehabilitation, and maintenance of a project road system will be given prime consideration with the utilization of good landscape management practices.

4.11 Construction Activities. Proposed project-related construction activities include the building of the dams and their related facilities; the clearing of reservoir areas; the construction of roads, electrical distribution systems, and recreation facilities; and the building of facilities for workers. The construction of the Susitna project is estimated to take 10 years to complete, with an estimated 6 years of construction for the Watana dam and 5 years for Devil Canyon with a one-year overlap.

The impact of these construction activities on the existing environment would be significant. The activities themselves would cause varying degrees of physical pollution to the air, land, and water within the project area and to some areas outside the development area. Fish, wildlife, vegetation, visual resources, soils, and other resource values would be adversely impacted by construction activities within the project area. General construction activities would intrude on existing fish and wildlife habitat, cause soil erosion problems with related reduction of water quality, clear areas of vegetation, cause noise and dust problems, intrude on natural visual resource values, introduce air pollutants into the atmosphere by burning slash and debris, and cause other related environmental impacts. For instance, breaking the surface mat of vegetation and disruption of surface drainage can result in wind and water erosion, and melting of permafrost, resulting in subsidence and disruption of groundwater tables, which in turn results in erosion.

Most of the damage to soils along the transmission line would occur during the construction phase. The construction schedule would be arranged so that work requiring use of an access road, such as delivery of materials, could be done in winter and spring, when the ground is least vulnerable to physical disturbances. This would eliminate the need for extensive filling and consequent use of borrow pits or quarries.

To obtain materials from borrow sources and quarry sites for the construction of the dams, roads and other facilities would be necessary. Borrow areas would be located within the proposed reservoir pool areas where feasible. Any borrow or quarry sites necessary outside of the pool area would be rehabilitated. Areas will also be needed to dispose of some materials and debris. All construction activities would be controlled to minimize or to prevent adverse environmental impacts.

4.12 Workers' Facilities. No communities within commuting distance to the proposed project area could absorb the number of workers required for the construction of the dams and related facilities. Some type of temporary construction camps with the necessary facilities would need to be provided during the construction periods, and permanent facilities would need to be built for maintenance and operational personnel after completion of the construction phase.

The construction and operations of the workers' camps would comply with State and Federal pollution control laws and standards, and all activities would be controlled to minimize adverse environmental impacts presented by the camps. Lands used for operating the temporary camp areas would be rehabilitated when the project work was completed.

4.13 Esthetics. The proposed project would be located in areas that presently have practically no permanent signs of man's presence. The land between Portage Creek and the Denali Highway is a natural and scenic area which would probably qualify for wilderness classification under most definitions of the term.

The construction of the proposed hydroelectric project would have a significant impact on the existing natural scenic resource values within the project area. Any dam construction on the upper Susitna would change a segment of what is now a natural, free-flowing river into a manmade impoundment. Within a 12-month period, Devil Canyon reservoir could fluctuate up to 5 feet while Watana reservoir would fluctuate up to 125 feet under normal operating conditions. The proposed Watana impoundment is located in a narrow, steep, isolated canyon where the seasonal fluctuation would not have a substantial scenic impact. The violent, whitewater section of the Susitna River through Devil Canyon would be substantially inundated by a dam at Devil Canyon. Roads and transmission lines would also impact the natural scenic resource values of the area.

Since it is expected that a considerable number of tourists and State residents would visit the damsites, every effort would be given to minimizing the adverse visual impacts of construction activities. A great deal can be accomplished to maximize scenic resource values that will remain after construction. Good landscape management practices would add substantially to the recreational experience of the project visitor with facilities that are well planned and well maintained.

The proposed transmission line corridor would cross no existing or presently proposed scenic, wild, or recreational rivers, nor would it cross any existing or presently proposed wilderness areas or wildlife refuges. In most segments, the transmission line would parallel existing corridors or traverse no significantly large areas of intact wilderness. However, in some segments where the transmission line would pioneer a corridor through a previously intact area, the quality of wilderness would suffer, especially where the transmission line is easily visible. Location and design of the transmission facilities will include maximum considerations to minimize the adverse esthetic impacts within the transmission corridor.

The transmission line would have minimum impact on scenic quality from Point MacKenzie to Talkeetna since it could be concealed or in some areas be laid parallel and adjacent to existing line clearings. The line would have a moderate impact on scenic quality between Talkeetna and Gold Creek. The line could be hidden well from rail lines unless the corridors were consolidated. From Gold Creek to Devil Canyon, the line could either be largely concealed from the road or could be used as the road access route itself. Between Gold Creek and Cantwell, a visible line would have substantial impact, particularly if located west of the highway and railroad. The line through this area could be somewhat concealed, with the exception of Broad Pass which has the least vegetative cover. From Cantwell to Healy, the line would have a severe impact on scenic quality; not only is the canyon an area of high scenic quality, concealment of the line is difficult and the west bank of the Nenana is Park land. The impact would be moderate near Healy and in the Goldstream Hills and low along the lower Nenana River. Impact would be less if Golden Valley Electric Association right-of-way were joined. It would be more difficult to reduce the visual impact of the transmission line corridor from the air traveler, but the design of the transmission facilities would consider this important factor.

The installation of significant lengths of high voltage underground electrical transmission cable is limited by present technology. From the standpoint of esthetics, underground transmission cables would definitely be preferred to an overhead transmission system. Should technology of underground electrical power transmission become sufficiently advanced prior to transmission line construction, it may be feasible to utilize underground cable in short reaches of the transmission system where the visual obtrusiveness of an overhead system is particularly objectionable.

In seismically active areas the reliability of underground cables must be questioned where slicing of the cable can result from settling or slumping of the soil; oil-filled or compress-gas filled cable may rupture during soil movement; and it is more difficult to locate and correct damaged underground cable. Overhead transmission lines also have more inherent resiliency than underground cables.

4.14 Earthquakes. Several major and minor fault systems either border or cross the Upper Susitna River Basin, and the southcentral area of Alaska is in one of the world's most active seismic zones. One of the strongest earthquakes in recorded history struck southcentral Alaska in March of 1964; the magnitude of the quake was 8.4 on the Richter Scale. The quake was centered just north of the Prince William Sound area, approximately 120 miles from the proposed damsites (see Figure 2).

Devil Canyon and Watana Dams will be designed to withstand a Maximum Credible Earthquake of 8.5 magnitude with an epicenter of 40 miles at a focal depth of 20 miles, which is the approximate distance of both damsites to the Denali Fault system, and is the most likely source of a seismic event of this magnitude. The Susitna Fault, truncated by the Denali Fault, bisects the region in a northeast to southwest direction approximately 2.5 miles west of the Watana damsite. Due to the relatively short length of the Susitna fault, a maximum credible earthquake of 6.0 is considered reasonable. An earthquake of this magnitude along this fault will be considered in the design of Watana and Devil Canyon dams.

4.15 Sedimentation. Reservoir sediment inflow would vary at each reservoir. Under the proposed system, Devil Canyon reservoir would lose approximately 6.5 percent of its total storage area to sedimentation during a 100-year period. Watana reservoir would have a 100-year sediment inflow that would equal about 4.2 percent of the reservoir's storage capacity.

Both proposed reservoirs have a dead storage area that is not utilized for power production; therefore, much of the initial 100-year sedimentation for the reservoirs would be contained within this "dead storage space," which would not have any significant effect on reservoir operations. Much of the heavier sediment deposited in Watana reservoir would collect at the head of the 54-mile-long reservoir. Even though the project-life is computed on a 100-year period for economic reasons, with adequate maintenance, the useful life of the proposed project due to sedimentation is estimated to be in excess of 500 years. If at some future time a feasible program of sediment removal were developed, the useful life period could be extended.

4.16 Climatic Conditions. The severe climatic conditions in the Upper Susitna River Basin could have a substantial environmental impact on the design, construction, and operation of the proposed hydroelectric development. Permafrost conditions, extreme cold winter temperatures, a long period of cold weather, and ice conditions on the reservoir and river are some of the significant climatic conditions that would have to be considered.

The Upper Susitna River Basin is underlain by discontinuous permafrost, so some project areas will have to contend with permafrost and other areas will not.

Extremely cold winter temperatures and long periods of cold weather will place substantial restrictions on many project construction activities and increase the time needed to complete the construction of the project to a total of 10 years.

Icing conditions on the reservoirs and the river may cause a wide range of adverse impacts both on project construction activities and on project operations. An ice-free stretch of warmer, open water below

Devil Canyon Dam could cause ice-fog conditions in that area during periods of extremely cold weather. Regulations of winter flows are not expected to have any significant effects on river ice conditions necessary for the continued use of the stream for winter travel downstream from Talkeetna.

The effects of possible high winds and icing conditions on the transmission lines will be evaluated and design features will be incorporated into the construction of these facilities to reduce or eliminate the adverse impacts posed by these conditions.

4.17 Air Pollution. Most of the existing electrical power in the Southcentral Railbelt area is produced by gas, coal, and oil-fired generating units which cause varying degrees of air pollution.

Cook Inlet gas is a clean fuel that causes few serious air pollution problems at the present time. The existing gas turbines have very low efficiencies and emit visible water vapor during the colder winter months. Also, nitrogen emissions could be of significant concern for any proposed larger gas-fired plants.

Hydroelectric energy could replace the burning of fossil fuels for electric power generation in much of the Fairbanks area and could help to alleviate the severe winter ice fog and smoke problems in that area.

Hydroelectric projects provide a very clean source of power with practically no direct air pollution-related problems. This type of electrical power generation could reduce a substantial number of future air pollution problems associated with the burning of gas, oil, and coal. It would be necessary to burn some of the residue slash material and debris during project construction and clearing operations, and fires would be controlled as necessary.

4.18 Social.

4.18.1 Population. Substantial increases in population are expected within the Southcentral Railbelt area through the year 2000 and, with the possible relocation of Alaska's State capital from Juneau to the Railbelt, an additional population impact can be expected in this area.

The population of the area will increase with or without the development of hydroelectric projects proposed for the Susitna River; construction of the project is not expected to have any significant long range effect on overall population growth, but is rather designed to fulfill presently projected needs of a growing population as one alternative means of producing power which will have to be provided in one way or another. Thus the total amount of power generated by the proposed Susitna hydroelectric project would generally be an alternative source, which would have as one of its major considerations a renewable energy source, rather than being an additional power source. Projected power requirements based on mid-range estimates show that the proposed Susitna hydroelectric development program could supply a substantial portion of the Railbelt's projected electric power needs starting in about 1985. The proposed upper Susitna River hydro projects will not create large blocks of excess electric power for heavy energy-consuming industries. If larger amounts of electric energy are needed for a program of heavy industrial development, additional energy-producing sources will have to be constructed. In summary, the project is designed to serve projected population needs--not to stimulate population growth as a consequence of industries which would be attracted by large blocks of excess electrical energy.

A 10-year Devil Canyon-Watana hydroelectric development program would have an economic impact on the Southcentral Railbelt area that would be felt to a greater degree during the construction phase of project development.

It is expected that this proposed project would have some stabilizing influence on the overall economy of the Railbelt area during the period of construction starting in about 1980, since construction would be initiated several years after the Alaskan oil pipeline has been built and about the time the proposed gas pipeline is scheduled for completion. The number of men required to construct this project is estimated to be about 1,100 men during the peak summer construction period.

Various community, borough, state, and private facilities and agencies would be impacted to varying degrees by the workers involved in the construction of the proposed project. Workers' camps would be constructed in the vicinity of some of the various construction activities, but additional impacts would be created by the families of the construction workers living in various nearby communities who would require additional facilities and services. It is also expected that due to adverse climatic conditions, much of the construction on the project facilities would be restricted to the warmer months of the year--probably April through October. The seasonal nature of the construction work would have an adverse impact on the local economy during the winter months.

After the construction of the project, a small number of people would be required to operate and maintain the project and project-related facilities--these people would not create a significant social or economic impact on the railbelt area.

5.0 ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

Approximately 50,550 acres of land would be flooded by the reservoirs (7,550 acres at Devil Canyon, 43,000 acres at Watana) at normal pool elevation. This encompasses an almost continuous 84-mile reach of the upper Susitna River. Approximately 2 miles of natural river would remain unflooded between the two reservoirs. All woodlands and other vegetation within the reservoir pools would be permanently lost. Transmission line clearing would be required essentially the full length of the 136-mile-long Susitna corridor for a total of about 3,700 acres. Only about half of the 198-mile-long Nenana corridor would require clearing, or approximately 2,400 acres.

Water released from the reservoirs would be slightly turbid throughout the year, whereas under existing conditions the stream normally runs clear from late fall until early spring breakup. Studies to date indicate that the sediment in suspension would not be high in the releases at Devil Canyon dam, ranging probably from 15-35 ppm. On the other hand, heavy sediment loads now carried by the stream during the warmer months of spring through early fall would be significantly reduced.

Downstream water quality problems related to temperature, dissolved oxygen, and nitrogen supersaturation could occur. These would be held to minimal, and possibly insignificant levels by spillway design and the incorporation of multiple-level water withdrawal structures.

Approximately 9 miles of the existing 11-mile whitewater reach through Devil Canyon would be lost through inundation.

The lower 2.5 miles of Tsusena Creek, which would be utilized as a spillway for excess river flows (this would occur only on the occasions of a period of excessive late summer flooding), will suffer adverse impacts to fish and on-shore vegetation during such periods.

Some moose habitat within the canyon floor and adjacent slopes would be inundated by the reservoirs. Most of the present use is upstream from Tsusena Creek, thus the greatest impact to moose would result from the Watana reservoir. The amount of good habitat is limited, but its loss would be permanent.

The Watana reservoir would lie between the spring calving grounds and portions of the summer range of the wide-ranging Nelchina caribou herd. Mortality to caribou and other animals attempting to cross the reservoirs could result from ice-shelving conditions which might occur into the month of May, on Watana reservoir, and other difficulties which might be encountered in swimming both reservoirs. The reservoirs could conceivably alter historical herd movement and distribution, although the animals do not exhibit any readily definable patterns, other than in the broadest of terms, at the present time.

During the average winter, Watana Reservoir would have a drawdown of about 95 to 120 feet below full pool level. This fluctuation would create large mudflats adjacent to the reservoir in times of maximum drawdown.

Although other major wildlife species, such as bears, wolves, wolverines, and Dall sheep are not expected to be directly affected by the project to a significant extent, there will inevitably be some secondary impacts resulting from disruption of existing predator-prey relationships. Overall, terrestrial wildlife habitat will be reduced. Small animals resident to inundated areas will be lost. Within the transmission line corridors, those species dependent upon climax or near-climax vegetation will be the most adversely affected. Examples are the red squirrel and northern flying squirrel.

Resident fish populations above Devil Canyon Dam (there are no anadromous fish under existing conditions above this point) would be adversely affected to some extent by the change from a riverine to lake environment within the reservoir pools, particularly by the substantial winter drawdown conditons at Watana. The resident sport fishery is not significant within the main river channel. Primary impacts would occur near the mouths of a few clearwater tributaries which provide some known grayling habitat. The intricate changes expected to occur downstream from Devil Canyon will result in both beneficial and adverse impacts to resident and anadromous fishes. Adverse impacts could result from possible reduction in nutrients and primary productivity, cutting, and erosion of existing steambed configuration, increased turbidity during the winter months, and changes in the hydraulic and biological regime of salmon rearing and spawning sloughs. (As pointed out in Section 4, many of the anticipated changes downstream from Devil Canyon Dam could prove beneficial to both the anadromous and resident fishery. Determinations as to the offsetting effects of these changes are the subject of ongoing studies.)

Roads required for project construction, operation, and maintenance would impair visual quality and permit general public access into a largely pristine area. This would have the potential to increase pressure on existing game populations through hunting, trapping, and general disturbance and harassment. This in turn would require intensified game management and law enforcement practices and preventative measures for the control of wildfire. Another harmful effect would be the impact of some of the roads themselves where delicate ecosystems are traversed. Some of the inevitable consequences of road construction are destruction of vegetation and wildlife habitat, reduced insulation of frozen soils, and settling from permafrost degradation, resulting in both erosion and alteration of the groundwater regime.

Degradation of visual quality in general would be a major adverse effect of project construction. This would be attributable primarily to roads, dam construction, right-of-way clearing for the transmission line, and the obtrusiveness of the transmission line itself. Although care would be taken to minimize these impacts to the greatest possible extent, the overall natural setting and scenic quality of the damsites and transmission line corridor would be permanently impaired.

Although only one historical cabin site and no archaeological sites are presently known to exist within the proposed reservoir pools or transmission line corridor, ground reconnaissance of the affected areas which would take place prior to any construction activity could result in the discovery of such sites. Where determined necessary, sites would be salvaged at project cost.

Disposal of slash and other woody debris resulting from reservoir and transmission line right-of-way clearing would have varying degrees and duration of impact. Material in the reservoir pools would most likely be disposed of by burning. This could increase the possibility of wildfire in woodlands adjacent to the clearing area, and would affect ambient air quality, and introduce ash and other material into the Susitna River during reservoir filling. These impacts, while temporarily harmful, would be of short duration. Other methods of disposal, such as stacking, burying, and chipping, have related adverse impacts, many of which are more severe or of longer duration than burning.

Mineral resource potential within areas which would be inundated by the reservoirs is not fully known. Inundation would obviate the practicability of future mining or extraction of such resources.

Future options concerning any other use of lands within the reservoir pools would effectively be foreclosed. Impacts on land use related to the transmission lines are more difficult to assess. There will be unavoidable impacts on present and future land use with foreclosure of some alternative future uses. These could be both adverse and beneficial. In potential farming areas, irrigation and tilling methods would have to be adapted to the spacing of towers, and land occupied by the tower bases would be unusable. Also, the transmission corridor could attract future corridors. This would further increase visual impacts associated with the additional corridors and structures.

Both temporary and permanent facilities would have to be provided for project workers. Impacts from temporary facilities, while adverse, would be temporary. Permanent facilities would be located and designed to minimize adverse impacts. Small communities near construction activities would be impacted by an influx of temporary construction workers and their families, with resultant increased demand upon community services. The temporary nature of this influx of people would be difficult to cope with, and could well have community effects lasting well beyond the departure of this transient population. Another problem related to work generated by the project would be its seasonality. In many instances, construction activity would be limited to the warmer season; thus many of these workers would be seasonally employed.

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Susitna River at Vee damsite. This demonstrates the typically incised character of the Upper Susitna from Devil Canyon to the Tyone River. Note that heavier vegetation is limited to slopes and creek valleys.

6.0 ALTERNATIVES TO THE PROPOSED ACTION

6.01 General. Alaska has a wide variety of energy alternatives to produce electricity. Each of the major energy resources--oil, coal, natural gas, and hydroelectric potential could easily meet projected power requirements well beyond the year 2000. The nuclear energy alternative is also available, and geothermal resources could be significant in some parts of the State. Present energy generation systems depend heavily on fuel oils and natural gas with smaller amounts of electrical energy coming from hydro powerplants and coal.

It is assumed that hydroelectric power from the Upper Susitna River Basin could be operational by 1986 with the completion of the first dam and powerplant; thus economic and financial feasibility should be assessed in terms of realistic alternatives that could be made available in about the same time frame. Such alternatives include power from Cook Inlet oil and natural gas, coal resources in the Beluga and Nenana fields, oil from the Alyeska pipeline, natural gas from the North Slope, other hydro resources, nuclear power, and geothermal power.

Public Law 93-577 passed by the Congress on 31 December 1974 has emphasized the conservation of nonrenewable resources and the utilization of renewable resources where possible. The construction of the proposed hydroelectric dams on the upper Susitna River is a feasible project that utilizes a renewable resource to generate electrical power while helping to conserve the use of nonrenewable resources such as oil and natural gas. Present Alaskan power systems have a significant environmental impact on urban environments, but a relatively small environmental impact outside the urban areas. Substantial increases in Southcentral Railbelt power requirements will involve the development of future electric power systems, larger facilities, and some alternatives that have very important environmental implications.

Future power systems will also require approaches that include full consideration of environmental values and alternatives and must anticipate that Alaska and the nation will attach increasing importance to environmental protection, energy conservation, and conservation of nonrenewable resources. Additional requirements must be anticipated for long-range advance planning and site selection, public participation, and full consideration of the environment in planning, design, construction, and operation of power facilities.

The significant environmental impacts of the various proposed alternatives would vary depending on the location, design, construction, and operation of the facilities for each of the alternatives.

Solutions considered in this investigation to meet electrical needs in the Southcentral Railbelt area were grouped in three major categories: alternative sources of power; alternative hydropower sources in the Railbelt area; and alternative hydropower plans in the Upper Susitna River Basin. The extent of study given to each potential solution was established by first screening each alternative for suitability, applicability, and economic merit in meeting needs. Each alternative was tested for physical, political, financial, institutional, economic, environmental, and social feasibility. Continuous coordination was maintained with area State and Federal agencies which have related interests. Alternative measures considered for power purposes are discussed in the following paragraphs.

6.02 Alternative Sources of Power.

6.02.1 No Action. One of the alternatives to the development of facilities to generate additional electric power would be not to build any additional facilities. This approach would save the costs of planning, designing, constructing, and operating additional facilities. It would also avoid the adverse environmental impacts which would be generated by the construction of dams or of other electrical generating facilities; however, additional power sources are thought to be necessary and would not be provided by this alternative. If a hydroelectric system is not developed, alternative power sources would be required to satisfy projected future growth needs of the Railbelt area. Because of lead time involved in planning, financing, and construction of any currently viable alternative, oil and natural gas must continue to provide the bulk of the area's power supplies until the 1980's. On an equivalent time-frame basis, coal is the most likely future electrical energy source for the Railbelt area, if hydropower is not developed. The impacts of the coal alternative are discussed in the following paragraph.

6.02.2 Coal. Coal is the most abundant fossil fuel in the nation. Southcentral Alaska has two known extensive deposits (Figure 11). The Beluga River area northwest of Cook Inlet contains coal reserves of at least 2.3 billion tons or, energy-wise, an equivalent of almost 6 billion barrels of oil. Development of Beluga coals would enhance possibilities for coal-fired power generation at reasonable cost. Coal resources in the Nenana Fields in the Southcentral Railbelt south of Fairbanks near Healy, Alaska, are even more extensive than the Beluga River reserves, totaling at least 7 billion tons, or equivalent of about 18 billion barrels of oil.

In many cases, the major obstacle to increased coal usage is the problem of removing the high sulfur content in order to meet air pollution standards when the coal is burned. Other problems include strip and subsurface mining, with associated environmental impacts, and transportation of the coal. The Beluga coals have low amounts of sulfur but also have high ash and water content. Considerable refining would be needed to enable its use in power generation.

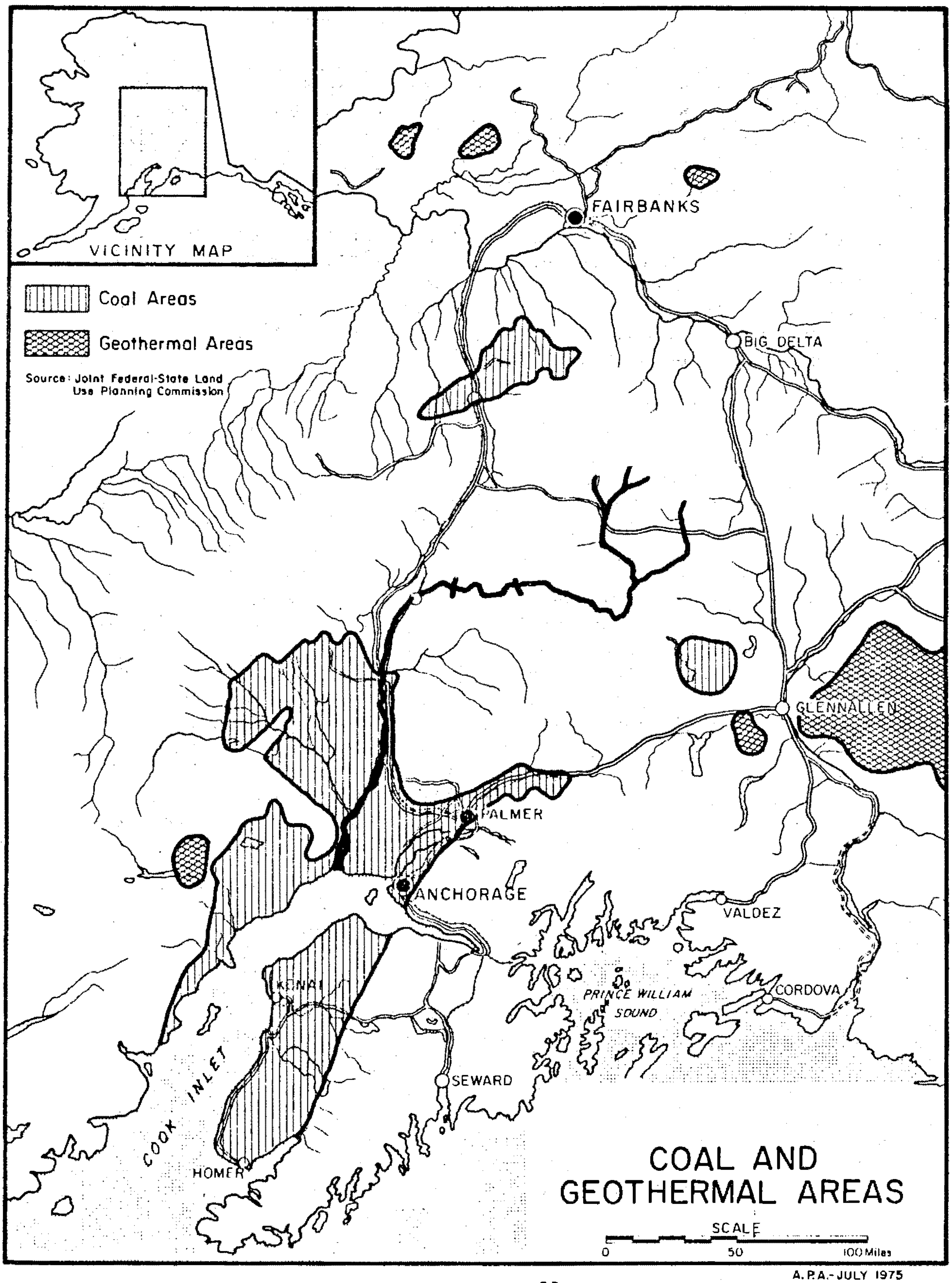

VICINITY MAP
Coal Areas
Geothermal Areas
Source: Joint Federal-State Land Use Planning Commission
FAIRBANKS
BIG DELTA
GLENNALLEN
PALMER
ANCHORAGE
VALDEZ
CORDOVA
PRINCE WILLIAM SOUND
KENAI
SEWARD
COOK INLET
HOMER
COAL AND GEOTHERMAL AREAS
SCALE
0
50
100 Miles
A.P.A.-JULY 1975

FIGURE 11

The coal alternative could be available on about the same time frame as other major new power sources such as hydropower and possibly nuclear power. It appears that baseload thermal plants could be utilized in the Railbelt area by 1990. Coal and hydro potential for the South-central Railbelt may be the least expensive alternatives for the new power supplies in the 1980's and beyond, but coal would be more expensive than hydro. Coal-fired plants should also be given consideration in remote areas which could be supplied by water transportation.

In the absence of major hydro development or the discovery of additional gas reserves, it is assumed that the Railbelt power system would shift from oil and gas-fired power units to coal as the principal energy source starting about 1985. It is further assumed that the coal plants would either be conventional steam or steam and gas turbine units located near the Beluga and Nenana coal fields.

In view of the quantities of coal involved and present-day mining practice, it is presumed that strip mining would be employed to obtain the coal. Without specific knowledge of the mining site, it is not possible to project how much acreage would be affected; however, it is assumed to be in the hundreds, possibly thousands, of acres. Much additional land would be required for stockpiling of overburden and mine wastes until such time as a portion of the pit became worked out and could be used for disposal. The immediate impacts would be the destruction of the overlying vegetation and thus loss of habitat for the resident animals and birds. Additional land would be altered for roads or other routes for working the mine(s) and transporting the coal to generation facilities. Air quality could be expected to suffer from large inputs of dust. Water in contact with coal and mine wastes generally become acidic and toxic to vegetation and animal life. It is difficult to prevent such water from entering either the underground water table or the natural drainage streams in the area and thus impacting water quality to some distance from the actual mine. Any scenic values in the mine area would be lost at least until the mine was exhausted and restoration completed.

Environmental qualities would also be affected at the power generating facilities. Considerable land would be occupied by the structures and more by the operating coal stockpiles and access routes. The associated vegetation, habitat, and scenic values would be lost. Even with emissions controlled to legal levels, there would be an input of particulate matter and chemical compounds into the atmosphere. Large amounts of water would be needed for cooling ponds requiring either land for installation of the ponds and the removal of the water from natural sources or the use of a natural water body (lake or river) for the cooling element. In the latter case, the effects of "thermal pollution" on the receiving water would be substantial, especially as regards stimulation of vegetal growth and adverse impacts on fish, if present. Disposal sites for the waste combustion products would be needed and could require alteration of large quantities of land and its natural values.

Social impacts would be mixed in effect. The operation of the minepowerplant would provide long-term employment for many more people than for hydroelectric facility of the same size. Because of this, the visible economic effects related to disposable income and the multiplier effect of additional cash circulating in the economic community would be much more evident than with a hydropower system. However a coal-thermal facility would forego the recreational and possible flood control benefits provided by a hydropower project.

The adverse effects of coal mining will occur eventually regardless of the presence of hydropower development as this resource will be utilized for other purposes.

Using coal as a power source involves extensive adverse impacts to the environment, both in the magnitude of the effects and in the size of the areas affected. Development of hydropower sources would allow for other, more beneficial uses of our coal resources. Therefore, coal is determined to be a less desirable source of electrical energy production than hydroelectric development. Coal was the economic standard by which each of the hydro alternatives was tested.

6.02.3 Oil and Natural Gas. In the period following the 1967 Department of Interior report, Alaska Natural Resources and the Rampart Project, most studies by Federal agencies and area utility companies focused on the Cook Inlet supplies of natural gas and, more recently, on pipeline fuels for Railbelt power. Location of potential oil and gas reserves in the Southcentral area are shown in Figure 12.

Cook Inlet gas is a clean fuel, and few serious air pollution problems exist for gas-fired units. Gas turbine exhaust is noisy, but modern noise suppression equipment can reduce this impact. Energy conservation aspects of gas-fired units may become significant because existing gas turbines have low efficiencies and emit visible water vapor during the colder winter months. Also, nitrogen emissions could be of significant concern for any proposed larger gas-fired plants.

Existing plans for the Cook Inlet area involve additional large, advanced-cycle gas turbine units at Beluga and additional turbines and waste-heat-recovery units in Anchorage. The Fairbanks area utility companies plan additional gas turbine units using pipeline fuels.

Plans for the near future include a number of measures to increase efficiency, including the advanced cycle and waste-heat-recovery units mentioned previously. However, because of lead time involved in planning, financing, and constructing alternatives, oil and natural gas must provide the bulk of the area's power supplies, at least until the mid-1980's.

Cook Inlet natural gas has provided low cost power benefits for the surrounding area in the recent past and, with substantial reserves under contract, should handle area power requirements for several more years.

expensive, if only because of pressures to export the fuels to areas where higher prices can be obtained. The present use of oil and natural gas as a source of electrical energy is viable for Alaska; however, a higher and better future use of these resources can and, in all probability will, be made.

In view of the national efforts to develop energy sources that limit the use of oil and gas for power generation, this alternative was rejected.

6.02.4 Nuclear Power. The use of nuclear power as a commercial electrical energy source for the nation is expected to increase considerably by the year 1985. Adverse environmental impacts are associated with surface and subsurface mining of uranium, changes in land use, disposal of waste heat, risk of accidents, and safe storage of highly radioactive wastes. In spite of these factors, more than 50 percent of the electrical power of the nation is expected to be generated by nuclear power by the year 2000. By the end of this century, breeder plants, which produce additional fuel while they produce power, will gradually take over a larger share of the production of electricity. Possibly at some time in the next century, nuclear fission plants and proposed nuclear breeder plants will be replaced by nuclear fusion reactors and by central generating stations running on solar power.

Nuclear power should be considered a likely long-range source of baseload power for the Railbelt area and is generally considered a distant option because of size of power markets, cost and environmental factors, and the availability of more favorable coal and hydro alternatives. The foreseeable future for nuclear power generation in Alaska should become materially more favorable only if there is either a breakthrough in costs and technology or significant new development in small-sized plants.

Because of the size of power markets, costs, and environmental factors, nuclear power development in Alaska is not considered to be an attractive alternative to cheaper, readily available power sources during this century.

6.02.5 Geothermal. Geothermal resources may eventually provide significant power generation in Alaska; the Southcentral Railbelt area has substantial geothermal potential (see Figure 11). This source of energy is not considered a reasonable short term alternative to other more proven types of power generation, as increased utilization of geothermal resources depends upon additional technological development and economics. Geothermal power generation is also considered to be a future supplement to other power sources rather than an alternative method of producing electricity.

Some of the possible problems associated with the generation of electric power from geothermal resources include siting of facilities, brine disposal, and corrosion. This renewable resource could also provide usable side products such as heat, water, and chemicals.

This is not considered a realistic alternative to other energy sources within the foreseeable future.

6.02.6 Solar. The radiant heat of the sun is another renewable source of energy that has considerable potential for generating power in this country and the world. Practical use of solar energy to produce electric power on a large scale is primarily a question of developing the technology to generate and to store large amounts of electricity produced by the sun's radiation. A major disadvantage wherever such development is pursued is the large land area required for reflector installation to provide usable amounts of power and thus the large environmental disturbances inherent in such a change in land use.

A second concern especially in Alaska is that during the winter, when demand for electrical power is greatest, the sun is either absent from or at best a brief visitor to local skies. Solar power generation is not considered a feasible planning alternative for Alaskan power systems in the near future.

6.02.7 Wind and Tidal. Research and development proposals for wind generators should improve future capabilities of wind-powered electrical generating systems. With increased diesel fuel costs, wind-generated electrical power is a possible alternative power source for remote areas with small loads. The extreme costs and environmental effects involved in most tidal flow hydroelectric proposals are major factors opposing this alternative method of generating electrical power. Neither alternative is considered feasible for provision of large amounts of energy at this time.

6.02.8 Wood. In parts of southeastern Alaska, wood is used to fire steam-generating power plants. Alaska does have vast forest reserves that could be used; however, these same trees have far higher and better alternative uses in wood, paper, and other industries. In addition the esthetic, ecological, and environmental impacts of the large harvests necessary to allow production of large amounts of energy appear to be massive. Wood as an energy source is not considered a major alternative.

6.02.9 Intertie. Alaska could purchase surplus power from sources in Canada or the "Lower 48;" however, the cost of transmission facilities and the uncertainty of available dependable power would be major factors opposing such a scheme. Therefore, an intertie does not appear to be feasible at this time.

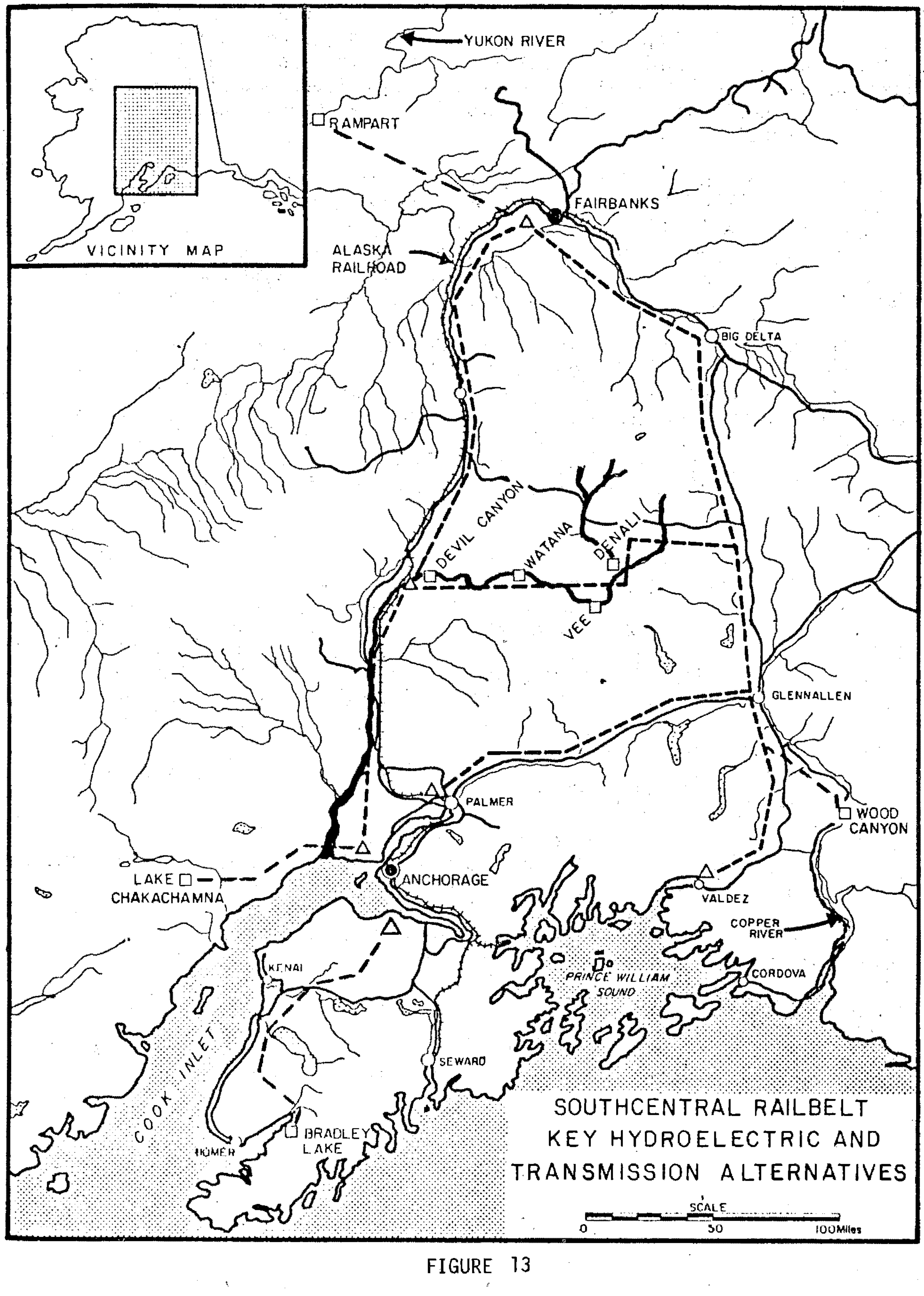
6.02.10 Solid Waste. The burning of solid waste products to produce electrical power has potential in some areas of the country, but there does not appear to be an adequate supply of solid waste products in the railbelt area to produce substantial amounts of energy. Associated air quality and odor problems would also appear to be severe. This alternative is not considered feasible to meet the energy needs in the railbelt area, but could supplement the total power needs for the area.

6.02.11 Hydropower. The reconnaissance report on potential development in the State of Alaska made in 1948 by the U.S. Bureau of Reclamation, included hundreds of potential power development sites located throughout the five study regions of the State: Southeast, Southcentral, Yukon-Kuskokwim, Seward Peninsula, and Arctic. In 1969 and again in 1974 the 1948 report was updated, and in May 1974 the latest revision was published as the 1974 Alaska Power Survey. The two largest market areas for power are located in the Southcentral Railbelt, particularly the Anchorage-Cook Inlet area, and the Fairbanks-Tanana Valley area. The large amount of the available renewable water resource which could produce electric power has excellent potential to answer the energy needs of the Southcentral Railbelt area.

6.03 Alternative Hydrologic Basins in the Southcentral Railbelt Area

6.03.1 Rampart Canyon. Considerable study has been made of the possibility of developing hydroelectric power in the Upper Yukon Basin with a damsite located in Rampart Canyon on the Yukon River approximately 140 miles northwest of Fairbanks, Alaska. The project has one of the greatest hydroelectric potentials in North America. The proposal would create a reservoir with a water surface area of approximately 10,600 square miles, with a maximum length of 280 miles and a maximum width of about 80 miles. The project would provide firm annual energy of 34.2 billion kilowatt-hours (the energy equivalent of over 74 million barrels of oil per year). However, the impacts on fish and wildlife resources in the Yukon Flats would be significant. Implementation of such a project would also be extremely controversial.

Rampart is engineeringly feasible and the proposed project would provide enough excess energy to encourage further industrial development in Alaska, but it would introduce a number of secondary impacts not associated with the recommended alternative. Excess energy could also be transmitted to the "Lower 48" through an intertie system. However, this would be a major action not directly applicable to energy needs of the Railbelt Area. Justification would have to be based on a nationwide plan which included Rampart as a recommended alternative to the development of other energy sources. Within the time-frame criteria established for fulfillment of projected growth needs in the Railbelt Area, this is not considered a viable alternative.



VICINITY MAP
YUKON RIVER
RAMPART
FAIRBANKS
ALASKA RAILROAD
BIG DELTA
DEVIL CANYON
WATANA
DENALI
VEE
GLENNALLEN
PALMER
WOOD CANYON
LAKE CHAKACHAMNA
ANCHORAGE
VALDEZ
COPPER RIVER
KENAI
PRINCE WILLIAM SOUND
CORDOVA
COOK INLET
SEWARD
HOMER
BRADLEY LAKE
SOUTHCENTRAL RAILBELT KEY HYDROELECTRIC AND TRANSMISSION ALTERNATIVES
SCALE
0
50
100Miles

FIGURE 13

The tremendous financial investments, the substantial environmental impacts, the limited opportunities for marketing the enormous amounts of power, and the availability of more favorable, less costly alternatives preclude recommending construction of the Rampart project at this time. Rampart Dam could be developed if future national needs recommend the project's construction.

6.03.2 Wood Canyon. Another possible location for significant hydroelectric power development is Wood Canyon on the Copper River. The damsite would be located about 85 miles above the mouth of the Copper River in the Chugach Mountains of southcentral Alaska. A "high dam" would develop firm annual energy of 21.9 billion kilowatt-hours. A "low dam" would provide 10.3 billion kilowatt-hours of firm annual energy.

The construction of a dam at Wood Canyon would force relocation of two communities and would create serious environmental problems affecting both fish and wildlife values, especially to the large salmon runs on the Copper River. Unless the problem posed to migrating salmon could be solved satisfactorily, the project would have an extremely adverse effect on the major commercial fishing industry in a wide area of the Gulf of Alaska. This alternative is not considered feasible at this time.

6.03.3 Chakachamna Lake. The possibility of developing hydroelectric power from Chakachamna Lake was investigated. The lake is located on the Chakachatna River which empties into the west side of Cook Inlet approximately 65 miles west of Anchorage. The facility would generate 1.6 billion kilowatt-hours of firm annual energy. The project would require the erection of transmission facilities over difficult terrain to tie into a Southcentral Railbelt transmission system and the construction of a high-cost 11-mile tunnel for power generation. The adverse environmental impact would be substantially less than for many proposed Alaskan hydroelectric projects. However, the low energy output and the high costs render this alternative infeasible at this time.

6.03.4 Bradley Lake. The site for this authorized hydroelectric project is at Bradley Lake on the Kenai Peninsula at the head of Kachemak Bay near Homer, Alaska. The proposal would generate 0.4 billion killowatt-hours of firm annual energy and could serve as a southern peaking installation for a Southcentral Railbelt power system. Adverse environmental impacts of this proposed project would be relatively minor compared to the other hydroelectric development alternatives which were considered. If an economically feasible plan can be developed for Bradley Lake, the project could be integrated with future development of the Susitna River basin. By itself, this project would fulfill only a small portion of the projected electrical needs of the Railbelt area.

Upstream view of Devil Canyon damsite.

6.03.5 Susitna River. Surveys for potential hydropower development in the Susitna River basin were reported by the Corps of Engineers in 1950 and by the U.S. Bureau of Reclamation in 1948, 1952, 1961, and 1974. The 1952 USBR report indicated 12 potential hydropower sites in the basin; of these, the five damsites studied in the upper Susitna basin showed the highest potential. These studies showed the environmental impact from projects in the Upper Susitna River Basin would not be as severe as those from other basins, and the firm energy potential could contribute substantially to satisfying the needs of the Southcentral Railbelt area.

6.04 Alternative Hydroelectric Plans in the Upper Susitna River Basin:

6.04.1 General: Eight plans for hydroelectric development of the Susitna River basin including the proposed actions were studied as follows:

6.04.2 Devil Canyon. The possibility of a single dam development of the Upper Susitna basin located at the Devil Canypn damsite was investigated. The proposed thin-arch dam with a structural height of about 635 feet would have a water surface area of about 7,550 acres at the normal maximum pool elevation of 1,450 feet, m.s.l. The project would produce 0.9 billion kilowatt-hours of firm annual energy from an installed capacity of 220 megawatts. Because of the very limited storage capacity, the project has a low firm energy capability and is not considered economically viable.

6.04.3 Watana. This single dam development of the upper Susitna basin located at the Watana site would be an earthfill dam with structural height of about 810 feet. The reservoir would have a normal maximum pool elevation of 2,200 feet, would have a surface area of approximately 43,000 acres, and would extend about 54 river miles upstream to a point between the Oshetna and Tyone Rivers. The annual firm electrical production of Watana would be 3.1 billion kilowatt-hours from an installed capacity of 792 megawatts. Although feasible, the project develops less than half of the basin potential and is not viable in itself since more productive feasible plans are available.

6.04.4 Devil Canyon High Dam. In September 1974, Henry J. Kaiser Company prepared a report proposing an alternative hydroelectric development project on the upper Susitna River. The report states that preliminary investigations indicated that an 810-foot-high, concrete-faced rockfill dam located about five miles upstream from the proposed Devil Canyon site would provide 3.7 billion kilowatts of average annual energy, or 2.6 billion kilowatt-hours of firm annual energy (figures converted to standard Corps of Engineers evaluation parameters). This dam would inundate about 58 miles of the Susitna River with a reservoir of approximately 24,000 surface acres at a full pool elevation of 1,750 feet.

This project would be located in much of the same area of the Susitna River canyon occupied by the proposed Devil Canyon-Watana project and would have similar environmental impacts with some exceptions. Whereas the Devil Canyon reservoir in the two-dam proposal would remain nearly full all year, the Kaiser reservoir would fluctuate substantially.

Kaiser's proposed Devil Canyon High Dam, located about 25 miles downstream from the Watana site, would have proportionately fewer miles of permanent roads and transmission lines than the Devil Canyon-Watana project, therefore less environmental impact on resources affected by these facilities.

The recreation opportunities would be fewer for the one-dam proposal. The substantial fluctuation of the reservoir would reduce some recreation potential and reduce resident fish populations while increasing the adverse visual impact associated with reservoir drawdown. The plan was found to lack economic feasibility.

6.04.5 Devil Canyon-Denali. This alternative two-dam system would include the thin arch concrete dam at Devil Canyon and a 260-foot-high earthfill dam in the vicinity of Denali. The Denali Dam would provide storage only and would have no powerhouse. This system would generate 2.5 billion kilowatt-hours of firm annual energy from an installed capacity of 575 megawatts at Devil Canyon Dam. The surface acres flooded would total about 62,000 acres (Devil Canyon, 7,550; Denali 54,000). The plan would entail significant environmental impacts on waterfowl nesting areas, moose range, and archaeological/historical values in the Denali reservoir area. Economic feasibility is lacking.

6.04.6 Three-dam System. A three-dam Devil Canyon-Watana-Denali hydroelectric development on the upper Susitna River could be built as an extension of the two-dam Devil Canyon-Watana project if the Denali storage site proved feasible. Such a dam system would provide a total of 6.8 billion kilowatt-hours of firm annual energy.

If a three-dam Devil Canyon-Watana-Denali project were constructed, it would include Devil Canyon and Watana dams previously described, and a 260-foot storage dam at Denali. This three-dam system would inundate approximately 104,550 acres and would take 13 to 17 years to construct. With a three-dam system, the 100-year storage capacity in Watana reservoir would be reduced by less than 3 percent due to sedimentation.

Environmentally, this plan would result in the adverse impacts associated with the Devil Canyon-Denali two-dam system, plus the added impact of inundating some additional moose range and bisecting a seasonal caribou migration route. Though the latter impact should not seriously impede summer caribou migration, it could result in some caribou mortality if animals attempted to cross the reservoir during adverse ice conditions, including the possibility of ice-shelving during periods of reservoir drawdown.

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TABLE II

DATA ON THE PROPOSED PROJECT AND SELECTED SUSITNA ALTERNATIVES

	Type of Construction	Structural Height	Normal Full Pool Elevation	Surface Acres	Total Storage Acre-Feet	Miles of River Inundated	Billion Kilowatt-Hours of Firm Annual Energy
Selected Plan:							
Devil Canyon	Concrete, thin-arch	635'	1,450'	7,550	1,050,000	28	
Watana	Earthfill	810'	2,200'	43,000	9,624,000	54	
Totals				50,550			6.1
Alternatives:							
Kaiser's High Devil Canyon	Earthfill	810'	1,750'	24,000	4,700,000	58	(2.6)
Olson	Concrete, gravity	200'±	1,020'	1,000	83,000	8	
Vee	Earthfill	455'	2,300'	9,400	920,000	32	
Denali	Earthfill	260'	2,535'	54,000	3,850,000	34	
Totals				88,400			5.6
Devil Canyon	Concrete, thin-arch	635'	1,450'	7,550	1,050,000	28	
Watana	Earthfill	810'	2,200'	43,000	9,624,000	54	
Denali	Earthfill	260'	2,535'	54,000	3,850,000	34	
Totals				104,550			6.8
Devil Canyon	Concrete, thin-arch	635'	1,450'	7,550	1,050,000	28	
Watana	Earthfill	515'	1,905'	14,000	2,420,000	40	
Vee	Earthfill	455'	2,300'	9,400	920,000	32	
Denali	Earthfill	260'	2,535'	54,000	3,850,000	34	
Totals				84,950			6.2

This alternative has significantly greater total adverse environmental impacts than the recommended plan (Devil Canyon and Watana development) and is economically feasible.

6.04.7 Four-dam System. In May 1974, the Alaska Power Administration updated a March 1961 report of the Bureau of Reclamation which proposed development of the hydroelectric resources of the Upper Susitna River Basin. The report proposed an initial plan to build the Devil Canyon Dam and powerplant and an upstream storage dam and reservoir at Denali. Subsequent development of a four-dam system would include dams at both the Watana and Vee sites. The four-dam system would generate a total of 6.2 billion kilowatts of firm annual electrical energy. The Watana Dam under this plan would be about 300 feet lower than in the selected Devil Canyon-Watana proposal, and the Vee Dam would be about 55 feet lower than in the original Bureau of Reclamation 4-dam proposal.

Initial development of the four-dam system, Devil Canyon-Watana-Vee-Denali, would include only the construction of the hydroelectric dam at Devil Canyon and the storage dam at Denali. This combination of two dams would produce 2.5 billion kilowatt-hours of firm annual energy. This initial two-dam stystem would also be compatible with the three-dam Devil Canyon-Watana-Denali, alternative proposal.

The four reservoirs considered in this development would inundate approximately 85,000 acres of land and river in the upper Susitna basin, compared with about 50,550 acres flooded in the selected two-dam proposal. The two reservoirs proposed in the lower section of the upper Susitna River would have substantially fewer known adverse environmental impacts than the two upper area reservoirs at the Vee and Denali. Generally the further upstream a reservoir is located in the four-dam system, the greater the overall adverse environmental impact would be on fish, wildlife, and esthetic resources.

In a four-dam plan, Watana reservoir would cover a surface area of about 14,000 acres behind a 515-foot-high dam with a pool elevation of 1,905 feet. The reservoir would extend over 40 miles upstream from the damsite and would be contained in the narrow canyon for most of its length.

Under either Watana alternative, the reservoir would flood areas used by migrating caribou and would flood some moose winter range in the river bottom. It would also cover existing resident fish habitat at the mouths of some of the tributaries in this section of the river and possible would create additional stream habitat at higher elevations.

The 455-foot-high Vee Dam would be built only under the four-dam plan in conjunction with the lower height Watana Dam. Vee reservoir would inundate about 32 miles of glacial river and would have a pool elevation of 2,300 feet with a surface area of approximately 9,400 acres. The reservoir would flood a substantial amount of moose habitat on the main Susitna and on the lower reaches of the Oshetna and Tyone Rivers. Caribou migration routes along the south bank of the Susitna River would also be affected as would some waterfowl habitat of minor significance. Present resident fish habitat, especially grayling, would be flooded at the mouths of many of the clearwater tributaries in the area covered by the Vee reservoir.

Any road to the Vee damsite would open up larger areas of wild lands that are prime wildlife habitat and escapement areas (inaccessible to man) for caribou, bear, and moose, and would have a significant impact on these and other fish and wildlife resources within these areas.

Denali Dam, with a structural height of 260 feet, would form a 54,000-acre storage reservoir with a pool elevation of 2,535 feet. Large areas of wildlife habitat, especially for moose, caribou, and waterfowl, would be inundated in an area between 2 and 6 miles wide and approximately 34 miles long. Many clearwater streams entering the Susitna River in this area have varying populations of arctic grayling; how the fluctuating reservoir would affect this fishery is generally unknown at this time. Substantial areas of lands would be exposed during the seasonal drawdowns of this storage reservoir; from an esthetic standpoint, this would be a substantial adverse environmental impact, especially when viewed from the well-traveled Denali Highway during the earlier summer months when the reservoir would be low.

The relocation of 19 miles of the Denali Highway necessary with the construction of a dam at the Denali site would provide additional access to this area with increasing pressures on the fish and wildlife resources in Coal Creek, Clearwater Creek, lower Maclaren River, Butte Creek, and the eastern slopes of the Watana Hills. There would be substantially less developed recreational potential at the Vee and Denali sites than at Devil Canyon because of travel distances involved and reservoir drawdown, especially at the Denali damsite.

It is expected that construction of the Vee project would take 5 to 6 years, while the Denali dam and reservoir would take between 3 and 5 years to construct. The construction period of the four-dam system would be between 18 and 23 years, if the dams were constructed in sequence. The magnitude of environmental impacts resulting from a four-dam system in the Upper Susitna River Basin clearly makes this a less desirable alternative than the one-, two-, or three-dam plans.

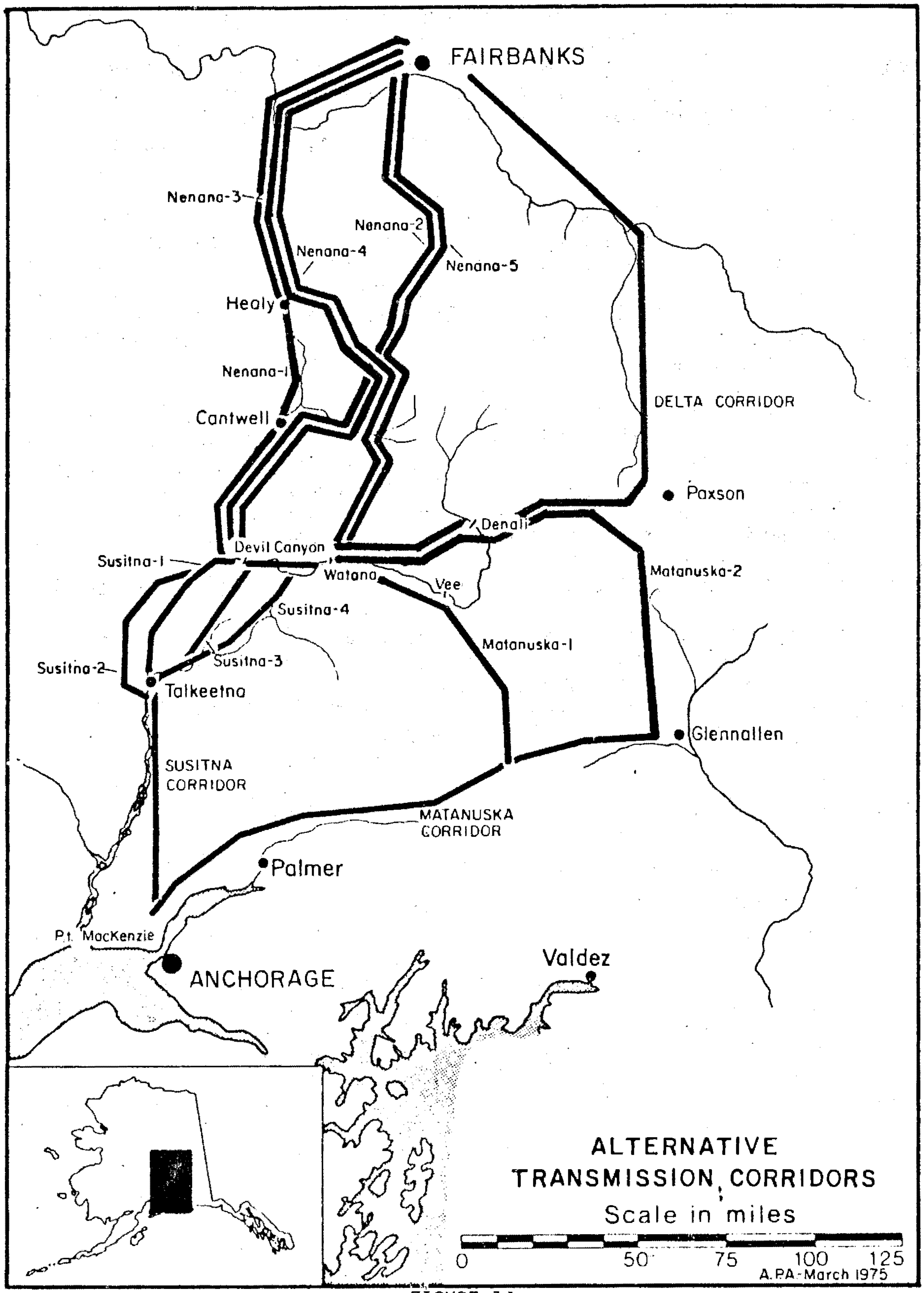
FAIRBANKS
Nenana-3
Nenana-2
Nenana-4
Nenana-5
Healy
Nenana-1
Cantwell
DELTA CORRIDOR
Paxson
Denali
Devil Canyon
Susitna-1
Watana
Vee
Matanuska-2
Susitna-4
Matanuska-1
Susitna-3
Susitna-2
Talkeetna
Glennallen
SUSITNA
CORRIDOR
MATANUSKA
CORRIDOR
Palmer
Pt. MacKenzie
ANCHORAGE
Valdez
ALTERNATIVE
TRANSMISSION CORRIDORS
Scale in miles
0
50
75
100
125
A.PA-March 1975

FIGURE 14

6.04.8 Kaiser Four-Dam System. An additional study of a four-dam system was made by the Corps of Engineers utilizing the Kaiser Devil Canyon High Dam as the main component in an upper Susitna basin system. This alternative included both the Vee and Denali Dams and a low reregulating dam (Olson) just below the confluence of Portage Creek. This four-dam system could provide an estimated 5.6 billion kilowatt-hours of firm annual energy.

The environmental impacts of this four-dam system are a combination of the impacts of the Kaiser Devil Canyon High Dam, the Vee and Denali damsites, and a low reregulating dam downstream from Devil Canyon just below Portage Creek. The system would inundate about 88,250 acres. One of the major additional impacts would include anadromous and resident fishery impacts caused by the reregulating dam just below Portage Creek. The plan is not economically feasible.

6.05 Alternative Power Transmission Corridors. Any development of hydroelectric power in the upper Susitna basin would require development of electric transmission facilities to the Railbelt load centers. In determining the preferred system, the Alaska Power Administration studied all feasible corridors joining the upper Susitna complex to Anchorage and Fairbanks. The most feasible corridor was selected on the basis of cost, reliability, and potential environmental impact; the remaining corridors represent alternatives of varying degrees of feasibility.

Four groups of alternatives were considered: first, those that lead from Devil Canyon-Watana to Anchorage via the Susitna watershed; second, those that lead to Fairbanks via the Nenana and Tanana drainage; third, those that lead to Fairbanks via the Delta and Tanana drainages; and fourth, those that lead to Anchorage via the Copper and Matanuska drainages. Within each of the four basic corridor systems, a number of alternative corridor routes were considered. Figure 14 displays these various routes. Susitna 1 and Nenana 1 are the selected routes.

6.05.1 Alternatives to Susitna 1. As shown in Figure 14, a common corridor is shared by all Susitna alternative alignments from Point MacKenzie to Talkeetna. From Talkeetna to the reservoir sites, four alternative corridor segments were considered. Impacts attributable to Susitna 1, the selected corridor, are discussed in Sections 4.0 and 5.0 of the EIS. The other three corridors are discussed as follows:

Susitna 2 This corridor is 140 miles long, 4 miles longer than Susitna 1. It differs from Susitna 1 in that from Talkeetna it crosses the Susitna River, leads north into Denali State Park, then northwest over Troublesome Creek and on to Gold Creek where it rejoins Susitna 1.

This alternative segment is 42 miles long. Alpine and moist tundra are crossed in addition to those ecosystems crossed by Susitna 1; however these are limited in extent. In comparison to Susitna 1, this alternative also requires clearing 100 more acres. It traverses 26 miles of Denali State Park, and conflicts with trail systems in the Park.

Susitna 3. This corridor is 129 miles long, 7 miles shorter than Susitna 1. It is basically a more direct corridor from Talkeetna to Devil Canyon, bypassing the Alaska railroad between Talkeetna and Gold Creek. The length of the alternative segment is 45 miles. It crosses over a plateau of almost 4,000 feet elevation as compared to maximum elevations of about 2,000 feet for Susitna 1 and 2. It also crosses about 25 miles of moist tundra and 20 miles of upland spruce-hardwood. In comparison to Susitna there would be 1,610 acres less clearing of vegetation required, there would be possible impacts on caribou winter range, sizeable amounts of land would be opened up to vehicular access, primitive values would be adversely affected, and the transmission line would be highly visible.

Susitna 4. This corridor is 147 miles long, 11 miles longer than Susitna 1. It leads from Talkeetna, up the Talkeetna River and Prairie Creek to Stephen Lake, then west to Devil Canyon damsite. This segment is 63 miles, versus 52 miles for the comparable Susitna 1 segment. This segment traverses upland spruce-hardwoods for most of its length, and crosses a few miles of moist tundra. Permafrost is present at the higher elevations, which rise to about 2,200 feet. Compared to Susitna 1, this alternative would result in permafrost and soil erosion problems, 75 acres less vegetative clearing, penetration of a moose concentration area, impact upon recreational use near Stephen Lake by creating vehicular access, and be highly visible in the upland area which is relatively intensively used by recreationists.

6.05.2 Alternatives to Nenana 1. There are five alternative corridors connecting the project area with Fairbanks by way of the Nenana River. Nenana 1 parallels the highway and railroad and comprises the northern half of the selected corridor system. Nenana 1 is described in Section 2.0 and impacts are discussed in Sections 4.0 and 5.0 of the EIS. The other four Nenana corridor alternatives are discussed and compared to Nenana 1 as follows:

Nenana 2. This corridor is 220 miles long, 22 miles longer than Nenana 1. It departs Nenana 1 at Cantwell, leads east to Wells Creek, north to Dean Creek and the Wood River, and follows the Wood River north to Ester. This segment is 158 miles. The corridor rises to 4,000 feet on the Dean Creek-Wood River pass. A wide variety of ecosystems is traversed, from alpine tundra to bog and muskeg. Permafrost can be assumed to be prevalent. For 25 to 30 miles the corridor runs adjacent to or through the Blair Lake Air Force Range. Habitats of moose, caribou, and Dall sheep are traversed. The following conditions or impacts are of greater magnitude along this corridor than along Nenana 1: Peaty, permafrost soils are more prevalent and would cause greater problems related to access road construction and erosion prevention or control; about 90 more acres of clearing would be required; and disturbed areas in moist and alpine tundra would be very slow to recuperate. Dall sheep and caribou, in addition to moose, would be disturbed by construction activity, and most of the corridor would provide vehicular access to areas now accessible only by foot. Viewer contact would be relatively low because of the isolation from existing transportation routes.

Nenana 3. This corridor is 231 miles long, 33 miles longer than Nenana 1. It is identical to Nenana 1 from Devil Canyon to Cantwell where it then loops east and north through the Alaska Range, rejoining Nenana 1 at Healy. This segment is 72 miles long while the comparable segment of Nenana 1 is 39 miles. Terrain along the alternative segment varies from rolling hills and valleys to high passes and sharp ridges, the highest of which is about 3,900 feet. The alternative segment traverses moist and alpine tundra, upland spruce-hardwood, muskeg, and bog; however, rocky thin soils and bedrock predominate. Erosion would generally be low. Valley floors have continuous permafrost. As compared to Nenana 1, nearly 200 acres less clearing would be required, and increased access would cause a potential increase in hunting pressure on Dall sheep, caribou and moose. Construction of the transmission line within the alternative segment between Cantwell and Healy would be technically difficult and expensive, and it would be difficult to maintain. However, since it would not be visible from existing transportation routes, it would have low viewer impact.

Nenana 4. This corridor is 223 miles long, 25 miles longer than Nenana 1. From Devil Canyon it leads east and north, tying in at Healy to Nenana 1. The length of this separate segment is 126 miles; the comparable segment of Nenana 1 is 101 miles. From Devil Canyon, the corridor leads east to Watana Damsite and then north up Deadman and Brushkana Creek to Wells Creek where it continues over a 3,900-foot pass to Louis Creek and Yanert Fork, then over another pass (2,900 feet) to Moody Creek which it follows to Healy. Ecosystems traversed are moist and alpine tundra, muskeg and bog, and upland spruce-hardwood. Moose, caribou, and Dall sheep inhabit this corridor. Between Watana and Wells Creek, soils are very vulnerable to permafrost degradation and frost heaving. Erosion would be a serious problem related to powerline and road construction and would result in degradation of water quality in the clearwater streams encountered. From Wells Creek to Healy, soils are rocky and thin. Erosion would be relatively low in this reach. Permafrost is continuous in the valley floors. As compared to Nenana 1, this corridor would require about 380 acres less clearing. Little modification of habitat would be required on this differing segment. Vehicular access would be provided which would potentially increase human pressures on Dall sheep and caribou, and to a lesser degree on moose. Most of this segment would have low viewer contact because of its isolation from existing transportation systems.

Nenana 5. This corridor is 212 miles long, 14 miles longer than Nenana 1. It is totally separate from Nenana 1, being a parallel corridor lying to the east of the proposed corridor. It is identical to Nenana 4 from Devil Canyon to Yanert Fork where it becomes separate as it leads up Dean Creek and crosses over a 4,000-foot pass into the Wood River drainage. It then leads north along the Wood River to Ester. Permafrost is prevalent. Alpine and moist tundra, upland spruce-lowland spruce-hardwood, and bog and muskeg ecosystems are traversed by the segment which differs from Nenana 4. Significant numbers of Dall sheep and moose are encountered as well as important winter range for caribou. Construction problems along the Wood River and Tanana River valleys would result from the lack of well drained soils and the presence of continuous shallow permafrost. Soil erosion and permafrost degradation would pose serious siltation threats to clear-water streams. This corridor would require clearing of about 100 acres less than Nenana 1; Dall sheep and caribou habitat would be adversely affected. Increased access to relatively inaccessible areas would be provided. Viewer contacts would be relatively few as a result of the remoteness of the corridor.

6.05.3 Alternatives to Susitna and Nenana Corridors. In addition to the Susitna and Nenana alternative corridors previously described, consideration was given to an alternative routing system for transmitting electricity to the two major load centers, Anchorage and Fairbanks (see Figure 14). Two other corridors were considered as access to Anchorage via the Matanuska Valley. These are referred to as Matanuska Corridors 1 and 2. Essentially only one other corridor is deemed feasible from the hydropower sites at Devil Canyon and Watana to Fairbanks. This is called the Delta Corridor.

Matanuska 1. This corridor differs radically from Susitna 1 in that it loops to the east and south, and approaches Point MacKenzie from the east. Its total length is 250 miles, 122 miles longer than Susitna 1. A considerable portion, 125 miles, parallels the Glenn Highway or other secondary roads or planned transmission corridors. From Devil Canyon the corridor leads east to Watana Damsite thence southeasterly over a sparsely forested, poorly drained plateau to the head of the Little Nelchina River. Here, the terrain is fairly open and gentle with predominantly rolling hills. The corridor, on passing just to the west of Slide Mountain, turns west to parallel the Glenn Highway. It crosses over Tahneta Pass into the Matanuska drainage, which it follows to the flat land at the mouth of the Matanuska Valley. It continues southwest along the northern shore of Cook Inlet, traversing considerable amounts of forest and muskeg as it approaches Point MacKenzie. Permafrost in this corridor is continuous from the upper end of Watana reservoir to Tahneta Pass, discontinuous in the Upper Matanuska Valley, and sporadic in the lower valley. Ecosystems traversed include spruce-hardwoods and moist tundra between the Watana Damsite and the Little Nelchina River, and upland spruce-hardwood in the lower valley. Between Devil Canyon and the Little Nelchina River, the corridor generally runs between caribou calving and wintering ranges. Also, some wintering range is traversed along the Little Nelchina River and Glenn Highway to Tahneta Pass. Some Dall sheep habitat exists in Tahneta Pass and Moose concentrations are encountered in the Point MacKenzie area. Between Watana reservoir and Slide Mountain, the potential for permafrost degradation is very high. Frost heaving in the poorly drained fine-grained soils would require heavy maintenance of both line and access road. Erosion would contribute sediment to clearwater streams in the area. Erosion potential is relatively low along the remainder of the corridor. This route would require approximately 750 acres more clearing than Susitna--mostly in the lower Matanuska Valley. Moose would generally benefit from clearing, whereas caribou range would suffer loss. Lake Louise and some other high recreational use areas would be impacted upon. Increased access would be provided to areas north of the Glenn Highway. The scenic quality along the highway would generally be lowered, since concealment of the line would be a problem along most of its route.

Matanuska 2. Alternative corridor Matanuska 2 is 385 miles long, 120 miles longer than Matanuska 1 and 249 miles longer than Susitna 1. From Watana Damsite it loops much further to the east than Matanuska 1, rejoining it at Slide Mountain. This segment of Matanuska 1 is 217 miles long, versus 97 miles for the comparable segment of Matanuska 2. From Watana Damsite the corridor crosses the Susitna River and leads northeast toward Butte Creek and the Denali Highway, which it parallels to Paxson. Here it turns south, paralleling the Richardson Highway and the Aleyska Pipeline to Glennallen. From Glenallen it parallels the Glenn Highway up the valley of the Tazlina River to Slide Mountain and the junction with Matanuska 1. Most of the corridor traverses flat terrain. Highest point on the corridor is a plateau of about 4,000 feet elevation in the Tangle Lakes - Rock Creek area between the Maclaren River and Paxson. This area is poorly drained and covered with post-glacial features such as eskers and terminal moraines, and many small lakes. Permafrost is prevalent. The predominant ecosystem is moist tundra. From Paxson to Slide Mountain the corridor lies within the Copper River lowlands, a basin underlain by nearly continuous permafrost.

Generally poorly drained, this basin is dominated by upland and lowland spruce-hardwood and muskeg ecosystems. Except for the area around Glenallen, the entire corridor runs through the winter range of the Nelchina caribou herd. Moose concentrations are found along the Copper, Gulkana, and Tazlina Rivers. Most of the corridor traverses medium density waterfowl habitat. Within the segment from Watana Damsite to Slide Mountain the potential for permafrost degradation is very high. Frost heaving would entail high maintenance of this line and road. Subsequent erosion could cause significant impact on clearwater streams in the area. Clearing would be required for about 2,200 acres more than the Susitna 1 corridor. Moose would generally benefit from clearing while some caribou range would suffer damage and loss. Existing recreational uses in the Lake Louise area would not be significantly impacted by this corridor. The archaeological richness of the Tangle Lakes area makes it likely that presently unknown sites would be discovered, and possibly disturbed, as a result of the project. Impact on scenic quality along the Denali Highway to Paxson would be high as a result of large numbers of viewer-contacts and little opportunity for line concealment.

Delta Corridor. This corridor is 280 miles long, 82 miles longer than Nenana 1. From Devil Canyon, it follows essentially the same path as Matanuska 2 to Paxson. Here it turns north, following the Richardson Highway - Alyeska Pipeline corridor over Isabel Pass, a wide, gentle divide at 3,000 feet of elevation. It continues along the pipeline corridor through the Alaska Range, following the Delta River. North of Delta River canyon the terrain consists of rolling hills until the Tanana Valley is reached. The terrain here is flat to Fairbanks. Shallow rocky soils dominate the Delta River Canyon stretch, followed north by mixed poorly and well drained soils. This segment traverses upland spruce-hardwood northeast of the Delta and Tanana Rivers. Along the Tanana floodplain, bottomland spruce-poplar forest predominate. Some lowland spruce-hardwood occurs immediately south of Fairbanks. Bison range would be traversed between the Delta River Canyon and Big Delta. Sporadic moose concentrations occur along the Tanana River. Dall sheep range occurs in the Delta River Canyon. Ice-rich permafrost is found throughout the corridor, and the soil is vulnerable to permafrost degradation, frost heaving, rutting and scarring. Generally well drained upland soils between Shaw Creek and Fairbanks are subject to gulleying, unstable slopes, and wind erosion. Clearwater streams are subject to sediment pollution from construction and maintenance activity. Thixotrophic soils in Isabel Pass would expose transmission towers to higher than normal seismic risk. Clearing required in this corridor would be about 430 acres more than in Nenana 1. The Nelchina caribou herd south of the Alaska range would be adversely impacted by this alternative. Additional access to hunters would be provided. The areas of highest scenic value along the Denali and Richardson highways coincide with the least opportunity for transmission line concealment.

Denali Highway bridge across upper Susitna River. This area would have been inundated by a dam at the Denali site.

7.0 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The project as presently conceived could have a useful life span in excess of 500 years based on the "dead storage space" (space below the lowest water intakes for the powerhouses) within the reservoirs for sediment accumulation. Individual components would be replaced as necessary, but the overall system would remain essentially the same. Should the system last this long, or for any number of reasons be made inoperative at an earlier date (an example would be development of more desirable alternative sources of electrical power), many of the resources described above in Sections 4 and 5 would have been, for all practical purposes, committed to permanent foreclosure of options for alternative future uses.

In this sense, the long-term productivity of the directly affected environment will have been sacrificed for a shorter-term alternative use, since impacts attributable to the reservoirs will be of much longer duration than the useful life of the project for hydroelectric power production. By the same token, the project would contribute to a savings in nonrenewable energy sources with an energy equivalent of about 15 million barrels of oil, or approximately 112 billion cubic feet of gas per year. Although this savings is a principal factor in the consideration of a hydroelectric alternative, over the long haul, hydroelectric energy must be viewed as an interim measure for conserving the nation's nonrenewable energy sources until some more practical, permanent method of producing electricity is achieved which will not overburden the nation's or world's finite resources.

Some features of the project will have less lengthy impact on the environment than the dams and reservoirs. Many of the impacts will be encountered during--and for a relatively brief time following--the construction phase. Of the longer-term impacts, some would terminate or lessen immediately or shortly after retirement of a given project component. For instance, if the transmission line were to be removed, many of its impacts would soon disappear. Maintenance activity, noise and electromagnetic interference, and visual impacts associated with the lines and towers would be immediately eliminated. Roads could be removed, top soils replaced, and eventually natural revegetation processes would largely obscure the previous existence of the transmission system. Other impacts would, to varying degrees, be "imprinted" into the environment. Wildlife patterns may have been affected by continual hunting or habitat modification. Vegetative patterns, altered by continual maintenance or introduction of nonnative plants, may continue for a long time. Land use patterns influenced by the project would linger after it ceased to function.

No extremely short-term benefits from the project are the basis for justifying the long-term, if not permanent, commitment of the productivity of the affected areas. The trade-off is essentially a long-term benefit which can be achieved only at the expense of an even more extended commitment of the affected resources.

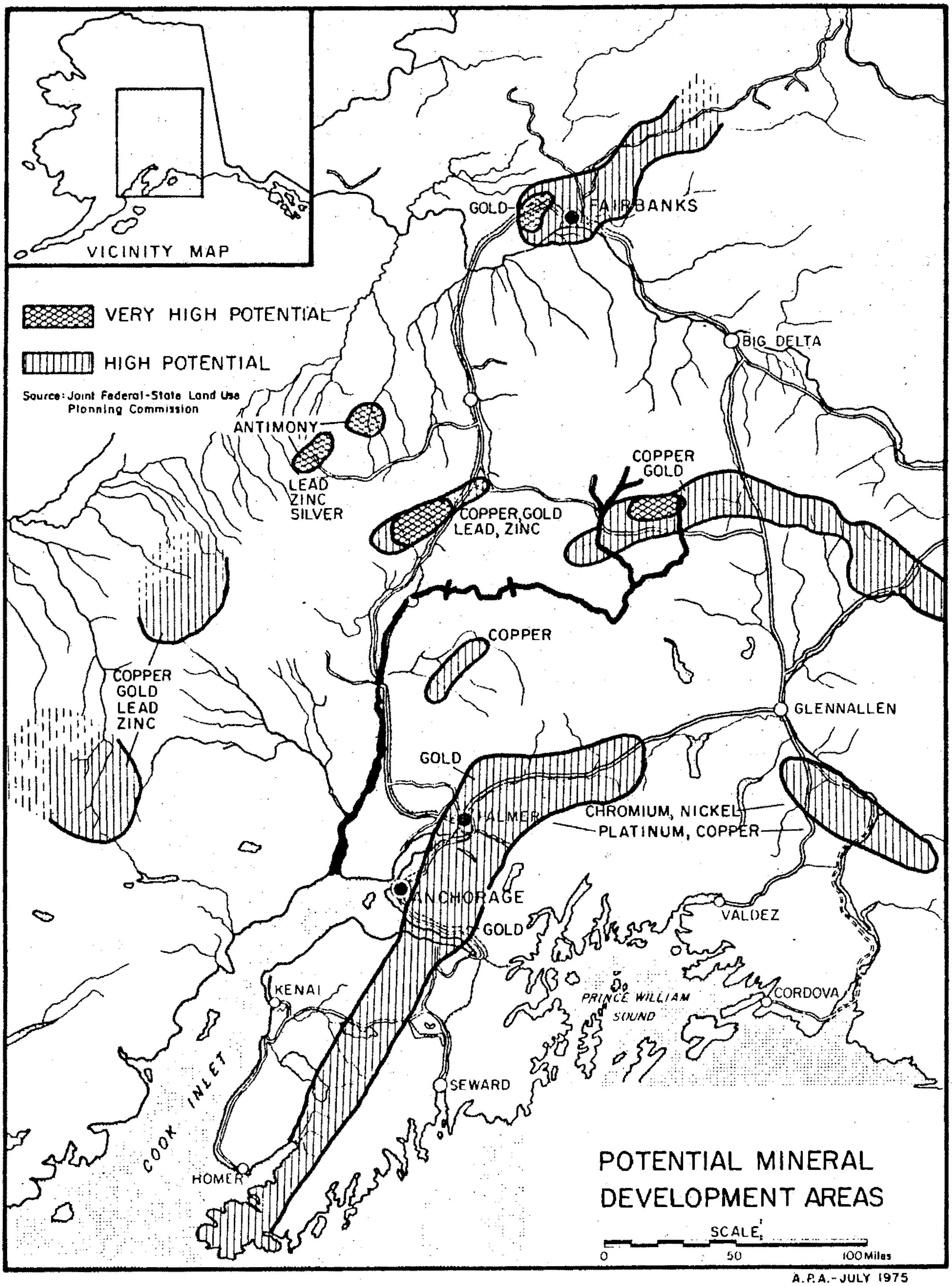
VICINITY MAP
VERY HIGH POTENTIAL
HIGH POTENTIAL
Source: Joint Federal-State Land Use Planning Commission
GOLD
FAIRBANKS
BIG DELTA
ANTIMONY
LEAD
ZINC
SILVER
COPPER
GOLD
COPPER, GOLD
LEAD, ZINC
COPPER
COPPER
GOLD
LEAD
ZINC
GLENNALLEN
GOLD
PALMER
CHROMIUM, NICKEL
PLATINUM, COPPER
ANCHORAGE
GOLD
VALDEZ
KENAI
PRINCE WILLIAM SOUND
CORDOVA
SEWARD
COOK INLET
HOMER
POTENTIAL MINERAL DEVELOPMENT AREAS
SCALE
0
50
100 Miles
A.P.A.-JULY 1975

FIGURE 15

8.0 IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES IN THE PROPOSED ACTION.

8.01 Changes in Land Use. The development of hydroelectric dams on the upper Susitna River would present an irreversible change of land use from an existing wilderness type land-use situation, along a free-flowing river with limited access, to a land-use situation where public access would be provided to a series of manmade lakes created by the construction of hydroelectric dams within the river corridor and to recreation sites within the project area.

Proposed transmission lines and permanent roads would also be located in areas of existing wild lands or where transportation corridors presently exist.

8.02 Destruction of Archaeological or Historic Sites. At the present time, no archaeological sites are known to exist within the areas of the proposed impoundments, damsites, power line routes, or road locations. Should such sites be located during on-the-ground reconnaissance during the detailed study phase, measures will be taken to avoid disturbance where possible. Should they fall within the reservoir pools, salvage will be undertaken. In the latter event, however, the sites would be permanently lost to alternative future uses.

One old cabin site, probably related to early mining exploration, is located at the mouth of Kosina Creek within the Watana reservoir impoundment area. This site is designated as a historical site by the Alaska Division of Parks.

8.03 Change in River Use. If the proposed project is developed, the 84-mile portion of the river above the dams would be converted from a free-flowing river to a series of manmade lakes totaling about 50,000 surface acres. Such development would preclude any consideration for Wild and Scenic River classification.

The "whitewater" section of the river through Devil Canyon would be substantially inundated, as would sections of the river bottom now used for wildlife habitat.

Downstream the initial 50-mile section of the river would be changed from an uncontrolled natural river, with very high summer flows and heavy glacial sedimentation and low winter flows with practically no sedimentation, to a river with regulated flows and a small amount of suspended glacial sediment. The 80-mile section of the river between Talkeetna and Cook Inlet would be affected to a lesser degree because of major tributaries.

8.04 Construction Activities.

8.04.1 Fuel Requirements. Significant amounts of fuel oils and gasoline for use in transportation and construction activities related to project construction would be irretrievably committed.

8.04.2 Manpower. Manpower resources during the construction and operation phases of the project would be irretrievably committed. The majority of these man-hours would be committed over a 10-year period, depending on the final development program.

8.04.3 Material. All the material used in project-related construction would constitute an irretrievable commitment of resources, as this material would not be available for other uses. Some amounts of material might be salvaged if the facilities were removed at some later date.

8.04.4 Land. Any land committed to project development such as reservoir impoundment areas, damsites, roads, etc., would be unavailable for other than project-related uses until such time as the facilities were no longer needed.

9.0 COORDINATION WITH OTHER AGENCIES

9.01 General. A public participation program was maintained throughout the investigation. Coordination with various agencies and groups was made to provide and to obtain pertinent information, and the following methods were used: public meetings, workshop meetings, and informal meetings.

9.02 Public Participation Program. A workshop meeting was held in Anchorage on 30 April 1974 to discuss the study with interested environmental groups. Representatives of the consultant firm of Jones and Jones, which was contracted by the District to conduct an inventory and evaluation of environmental, esthetic and recreational resources of the study area, presented and discussed results of their studies. A similar workshop meeting was held with Federal and State agency representatives on 29 October 1974, and another was held with Native Corporations on 12 March 1975.

Initial public meetings were held on 6 May 1974 in Fairbanks and 8 May 1974 in Anchorage to notify the public that the study had been initiated, and to furnish available information and receive comments. Several environmental groups stated that they would reserve judgement of the project until the Draft Environmental Impact Statement was available for review. Concerns expressed by these groups (the Alaska Center for the Environment and the Sierra Club) included impacts upon the future quality of life in Alaska which would be caused by hydroelectric development. They also questioned the Alaska Power Administration's projection of power needs, the examination of alternatives, and the shipping of Alaska's fossil fuels elsewhere. They stressed the need for coordination with the Alaska Land Use Planning Commission, and suggested public hearings on the Final Environmental Impact Statement.

Interim public meetings were held in Anchorage on 27 May 1975 and Fairbanks on 29 May 1975. Environmental groups represented included the Alaska Conservation Society, the Sierra Club, and the Alaska Center for the Environment. Comments of these groups included the opinion that the project would spur more growth, but that nuclear energy was believed not to be an acceptable energy source at this time. They further recommended the alternative of burning solid wastes to produce power. They were troubled by the location of transmission lines, and stated that we may have a greater need for hydroelectric power in 50-75 years. They questioned hydroelectric power as being a renewable resource. Other concerns included land status of the affected areas, siltation, costs of power, and the need for considering alternative sources of power.

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Late stage public meetings were held in Anchorage on 7 October 1975 and Fairbanks on 8 October 1975 to present and discuss the selected plan. A number of environmental groups were represented at one or both of these meetings. They included: the Isaac Walton League, the Mountaineering Club of Alaska, the Alaska Conservation Society, Knik Kanoers and Kayakers, and Fairbanks Environmental Center. Comments included the need for Corps funding for fish and wildlife studies and data processing of environmental information. Expressed concerns included the inundation of a scenic, white-water river, location of the project area too close to a proposed Talkeetna State Park, too much human use in the area, impacts on moose habitat and downstream salmon runs, differences reflected in the 1960 and 1975 cost estimates, the low interest rate used in computing project benefits, who would operate the dams and sell the power, reservoir siltation, turbidity, fluctuations in stream flows, impacts on permafrost, the possibility of earthquakes, the formation of frazil ice, the geology of the area, benefits claimed for flood control, the location of transmission corridors and construction of transmission lines, land status, impacts upon population growth, recreational development, the production of secondary energy, and others. Most of these groups voiced either strong opposition to the project or reserved judgement pending further studies and specific project recommendations.

Many organizations, groups, and individuals expressed support of the selected plan. An informal poll of people attending the late stage public meetings indicated support for the project by about 5 persons for each person who opposed it.

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ECONOMIC DATA EXTRACTED FROM
U.S. ARMY CORPS OF ENGINEERS INTERIM FEASIBILITY REPORT
COMPLETE DOCUMENT IS AVAILABLE AT U.S. ARMY
ENGINEER DISTRICT, ANCHORAGE, ALASKA

Estimated First Cost (Includes Non-Federal Recreation)	$1,520,000,000
Estimated Value of Public Domain (Land transferred without Cost)	$ 11,800,000
Average Annual Cost	$ 104,020,000
Average Annual Benefits	$ 137,876,000
Power (Includes Transmission Line Intertie)	$ 128,153,000
Recreation	$ 300,000
Flood Control	$ 50,000
Area Redevelopment	$ 9,373,000
Net Annual Benefits	$ 33,856,000
Benefit to Cost Ratio	1.3 to 1

PROPOSED TRANSMISSION LINE CORRIDOR

(Photos courtesy of Alaska Power Administration)

Lower Susitna River Valley. This area is characterized by extensive muskegs, intermingled with bottomland spruce-poplar forests. Permafrost is absent or discontinuous in this area, although the soils are generally poorly drained.

Susitna River Valley. Lakes are prevalent and associated with muskegs, which succeed them in formation. Muskegs are succeeded in turn by forests dependent upon well-drained soils. The three stages of succession are shown here.

Town of Talkeetna. This town is at the confluence of the Talkeetna, Susitna, and Chulitna Rivers. The Alaska Railroad can be seen crossing the Talkeetna River near the right edge of the picture.

Near Honolulu on the Anchorage-Fairbanks Highway. Biomes shown on low brush muskeg in foreground and upland spruce-hardwood in background. Black spruce in foreground are associated with poorly drained soils and/or shallow permafrost tables.

Alaska Range from Anchorage-Fairbanks Highway near Broad Pass, late spring. Vegetation biome is lowland spruce-hardwood. Soils here are basically glacial deposits.

Looking south along Nenana River to Upper Nenana Canyon. The Anchorage-Fairbanks Highway parallels the left bank. Mount McKinley National Park and the Alaska Railroad are on the right bank of the river.

Very restricted canyon along Nenana River north of McKinley Park. Alaska Railroad is off left-hand edge of photo. Land left of river is within Mount McKinley National Park.

The Tanana River flood plain. This area is extremely flat and poorly drained. Three types of biome are represented in this picture: muskeg, lowland spruce-hardwood, and bottomland spruce-poplar. The dark forests are mainly black spruce. The sinuous lighter forest is white spruce, aspen and birch. This forest type prefers well-drained soils, and so is found on old levees of existing and extinct channels.

DISTRICT REVIEW

LETTERS RECEIVED BY THE DISTRICT ENGINEER

ON THE

DRAFT ENVIRONMENTAL STATEMENT

AND RESPONSES THERETO

FEDERAL COMMENTS AND RESPONSES

	Comments
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UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
204 East 5th Avenue, Room 217, Anchorage, Alaska 99501

December 2, 1975

Charles A. Debelius
Colonel, Corps of Engineers
District Engineer
Alaska District, Corps of Engineers
P. O. Box 7002
Anchorage, Alaska 99510

Dear Colonel Debelius:

We have reviewed the draft environmental impact statement, "Hydroelectric Power Development, Upper Susitna River Basin, Southcentral Railbelt Area, Alaska." We offer the following comments for your consideration: This represents all comments of the Soil Conservation Service.

GENERAL COMMENTS

The statement represents considerable effort in the assembly of available data and in effective presentation of pertinent facts throughout the report. The statement appears to appraise impacts adequately for a feasability stage study. We have previously reviewed and commented on the environmental assessment of the transmission line proposal that is an integral part of this proposal. 1

SPECIFIC COMMENTS

The statement contains no information on soils involved with the proposal, except for some brief statements in the captions at the end of the volume. The caption of the second photo, implying that well drained soils succeed muskegs, is erroneous. The absence of soils information at the dam site or in the transmission corridors is a serious deficiency of the statement. 2

In the discussion of aesthetics, mention is given to landscape management practices being considered. It is suggested that following construction, consideration be given to mitigating unpleasant aesthetic results by planned use (landscaping) of adaptive plant species. The "Vegetative Guide for Alaska", attached, may be of value to you. 3

This discussion of "adverse environmental effects which cannot be avoided" notes the need for temporary and permanent facilities for project workers. We suggest that a soil survey, and the interpretations therein should be useful in locating facilities on suitable soils. 4

69-737 O - 81 - 37

We appreciate the opportunity to comment.

Sincerely,

Weymeth E. Long
State Conservationist

enclosure

cc: Council on Environmental Quality (5 copies)
Office of Coordinator of Environmental Quality Activities
R. M. Davis, Administrator, SCS, Washington, D. C.
K. L Williams, Director, WTSC, SCS, Portland, Oregon
District Conservationist, SCS, Fairbanks, Alaska

RESPONSE TO COMMENTS BY
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

1 Comment noted.

2 Comment noted. Detailed soils information at the damsite and in the transmission corridors is not presently available. Such studies would be the subject of future investigations required for facilities siting, construction techniques, etc. The SCS letter was received too late to change the referenced photo caption, since that portion of the EIS had already gone through final printing. However, the statement that "muskegs are succeeded in turn by forests dependent upon well-drained soils" is acknowledged as an error. Obviously, muskeg areas do not rapidly, if ever, evolve into well-drained soils. They may, however, eventually support water-tolerant tree species.

3 Concur. Unavoidable construction scars related to project features, such as roads and borrow areas, will be rehabilitated, including dressing with topsoil and appropriate landscaping and vegetative planting. The Soil Conservation Service will be consulted with regard to these efforts.

4 Concur. Temporary and permanent facilities will be designed and located with a view to aesthetics, erodibility of soils, and other relevant factors.

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Science and Technolog
Washington, D.C. 20230

November 25, 1975

Colonel A. Debelius
District Engineer - Alaska District
Corps of Engineers
U. S. Department of the Army
P. O. 7002
Anchorage, Alaska 99510

Dear Colonel Debelius:

This is in reference to your draft environmental impact statement entitled "Hydroelectric Power Development, Upper Susitna River Basin, Southcentral Railbelt Area, Alaska". In order to expedite transmittal of the enclosed comments from the National Oceanic and Atmospheric Administration, we are sending them to you as they were received in this office.

Thank you for giving us an opportunity to provide these comments, which we hope will be of assistance to you. We would appreciate receiving eight (8) copies of the final statement.

Sincerely,

Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs

Enclosures: Memo from NOAA - National Marine Fisheries Service
Memo from NOAA - National Ocean Survey
Memo from NOAA - National Weather Service

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE
Silver Spring, Md. 20910

Reply to Attn. of: W2x2/AE

Dr. William Aron
Director, Office of Ecology and Environmental Conservation (EE)

ORIGINAL SIGNED BY

Dr. George P. Cressman R. E. HALLGREN
Director, National Weather Service (W)

DEIS 7509.61 - Upper Susitna River Basin, Alaska

The plan proposes the construction of dams and power plants on the upper SUSITNA River. The operation of these facilities will impact upon the public river and flood forecast warning service provided by the National Weather Service in this basin. These services emanate from NWS offices at Anchorage and Fairbanks as described in the enclosures. This should be made a part of the EIS.

Encl.

Weather Service Statement on Flood Warning Program

The National Oceanic and Atmospheric Administration (NOAA) National Weather Service provides flood forecasting service for major river basins. This system involves predictions of anticipated stages at a particular gage or gages in the basin. These forecasts are based on observed precipitation and stages at upstream points and anticipated weather conditions. The flood forecast is transmitted to City officials, newspapers, and radio and television stations in the basin. These media disseminate the information to residents of the flood plain in the form of a flood warning. This timely forewarning permits protective measures to be undertaken by industrial plants public utilities, municipal officials, and individuals with property in the lowlands. Services available are of the following types:

1. Flash Flood: The responsible Weather Service Forecast Office supplies weather forecasts twice daily for the State. In addition to the routine forecasts, special forecasts of severe storms and general flash flood watches for small streams are issued as required. WSR-57 Weather Radar installations have capability for immediate detection and evaluation of rainfall intensity, location, and storm movement. Information is promptly relayed by teletype circuits and telephone to news media and community officials and law enforcement agencies. The Weather Service Office issues Flash Flood Warnings as required for small streams in its area of responsibility.

2. Major Floods: River stage forecasts are based on radar coverage, reports from river and rainfall reporting stations and telemetry in or near the basin. The River Forecast Centers are staffed with professional hydrologists responsible for the preparation of river forecasts based on water equivalent of snow cover, rainfall-runoff relations, streamflow routing, and a working knowledge of anticipated weather conditions. The lead time between distribution of the forecasts and the flood crest may be short; however, lead time normally ranges from 12 hours for rainfall and up to several weeks for snowmelt Specific crest forecasts are issued as required. River District Offices are responsible for the interpretation and distribution of flood forecasts and the operation of the hydrologic reporting substation network in its area of responsibility.

3. Hydroclimatic Data: Most of the data from the network is published. These records provide the basis for forecasts as well as for the planning and design of protective works and their operation during floods. River and flood forecasting is fundamental in the design and essential in the operation of a levee or reservoir system.

RESPONSE TO COMMENTS BY
U.S. DEPARTMENT OF COMMERCE
NATIONAL WEATHER SERVICE

5 Comments of Dr. George P. Cressman, Director of the National Weather Service, are acknowledged. As suggested, the Weather Service Statement on Flood Warning Program, as appended to Dr. Cressman's letter, is reproduced in the EIS.

C52/JLR

OCT 31 1975

TO: Dr. William Aron
Director
Office of Ecology and Environmental Conservation

FROM: Dr. Gordon Lill (signed) GORDON LILL
Deputy Director
National Ocean Survey

SUBJECT: DEIS #7509.61 - Upper Susitna River Basin South Central Railbelt Area, Alaska

The subject statement has been reviewed within the areas of NOS responsibility and expertise, and in terms of the impact of the proposed action on NOS activities and projects.

The following comment is offered for your consideration.

6 Geodetic control survey monuments may be located in the proposed transmission line routes. If there is any planned activity which will disturb or destroy these monuments, NOS requires not less than 90 days notification in advance of such activity in order to plan for their relocation. NOS recommends that funding for this project includes the cost of any relocation required for these monuments.

RESPONSE TO COMMENTS BY
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEAN SURVEY

6 We concur. Every effort will be made to avoid disturbing geodetic control survey monuments in locating the proposed transmission lines. In the event that disturbance is unavoidable, the National Ocean Survey will be given at least 90 days advance notice, and costs of relocation will be borne at project expense.

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
P. O. BOX 1668 - JUNEAU, ALASKA 99801

November 19, 1975

Colonel Charles A. Debelius
District Engineer
Alaska District, Corps of Engineers
P. O. Box 7002
Anchorage, Alaska 99510

Dear Colonel Debelius:

The National Marine Fisheries Service has reviewed the draft environmental impact statement for "Hydroelectric Power Development, Upper Susitna River Basin, Southcentral Railbelt Area, Alaska."

In order to provide as timely a response to your request for comments as possible, we are submitting the enclosed comments to you directly, in parallel with their transmittal to the Department of Commerce for incorporation in the Departmental response. These comments represent the views of the National Marine Fisheries Service. The formal, consolidated views of the Department should reach you shortly.

Sincerely,

for Harry L. Rietze
Director, Alaska Region

Enclosure

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P. O. Box 1668, Juneau, Alaska 99802

Date : November 19, 1975 Reply to Attn. of: FAK/RJM/

To : Director, Office of Ecology & Environmental Conservation, EE

Thru: Associate Director for Resource Management, F3

From : Harry L. Rietze
Director, Alaska Region

Subject: Comments on Draft Environmental Impact Statement--Hydroelectric Power Development-Upper Susitna River Basin, Southcentral Railbelt Area, Alaska. Corps of Engineers DEIS #7509.61

The draft environmental impact statement for Hydroelectric Power Development, Upper Susitna River Basin, Southcentral Railbelt Area, Alaska, that accompanied your memorandum of September 30, 1975, has been received by the National Marine Fisheries Service for review and comment.

The statement has been reviewed and the following comments are offered for your consideration:

General Comments

It is estimated that approximately 3,300,000 salmon, which include all five Pacific species, are produced in the Susitna River for the Alaska commercial catch. Based on 1975 prices, the annual value to fishermen would be nearly $9,000,000. 1/ It should be noted that the Southcentral Railbelt Area plays a significant role in the recreational activities of the resident and tourist fishing industry. Presently, there is no data available on salmon recreational fishery values accruable to the Susitna River. However, we would expect this value to increase proportionately to projected increases in population and tourism in the project area. 7

As outlined by the Alaska Department of Fish and Game at recent public meetings regarding the DEIS, much of the information needed to make a systems analysis of the living resources of the river environment has never been collected. We believe it would be imprudent to make any objective comments regarding the fishery aspects within the various sections of the DEIS, because of the lack of any substantial data on which to base our conclusions and because inventories and evaluations are still being conducted by resource agencies. 8

1/ U.S. Fish and Wildlife Service. 1975. Southcentral Railbelt Area Upper Susitna River Basin Hydroelectric Project Two Dam Plan. U.S. Department of the Interior. October 1975. 28 pp.

Specific Comments

4.0 Environmental Impacts of the Proposed Action
4.02 Fish

9 Page 49, paragraph 7. We believe the collection of one field season's data is not sufficiently definitive to make any assumptions regarding the relationships between salmon spawning and rearing sloughs and any regulated flows within the proposed project.

10 Page 49, paragraph 8. The statement regarding the elimination of salmon egg destruction should be qualified by noting that it is based on an inconclusive single-year observation. 2/

Page 50, paragraph 1. The statement regarding salmon disorientation by initial project startup should be expanded to include the effects of project construction. Water quality degradation, diversion, etc., would all serve to confuse salmon returning to their natural spawning areas.

11 Page 50, last paragraph. This paragraph should be written to qualify the status of future fisheries studies noted. The Corps of Engineers has no assurance that any proposed fish and wildlife studies will be funded or carried out in time to be of value in making any feasible project modifications.

6.0 Alternatives to the Proposed Action
6.02 Alternative Sources of Power
6.02.3 Oil and Natural Gas

Page 72. Because the proposed El Paso Alaska natural gas line could be constructed to bring fuel from the known Prudhoe Bay field to the
12 Anchorage-Fairbanks area, it should be given consideration as a possible alternative source of power.

We would appreciate receiving two copies of the final environmental impact statement.

2/ Barrett, Bruce M. 1974. An Assessment of the Anadromous Fish Populations in the Upper Susitna River Watershed Between Devil Canyon and the Chulitna River. Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage. November 1974. 56 pp.

RESPONSE TO COMMENTS BY
U.S. DEPARTMENT OF COMMERCE
NATIONAL MARINE FISHERIES SERVICE

7 Comment noted.

8 The need for additional environmental data to make an objective analysis of the proposed projects is a recognized concern of the Corps. During the post-authorization phase, environmental studies will be made to obtain the needed data to develop both design and mitigation measures to minimize or delete the chances of environmental impact. The preliminary data presently available is a basis for identifying areas of concern that need detailed analysis. As post-authorization studies proceed, supplements to the statement will be prepared and coordinated.

9 Noted.

10 Water quality degradation during construction would be limited to possible increase in turbidity. However, this condition would only be minor since the runoff in those areas that would produce turbid conditions will be diverted into settling basins prior to returning to the river. During construction natural river flows will be diverted around the construction area above any known spawning areas and would have no impact on downstream fish populations. At the time of initial storage, the fish and wildlife agencies will be requested to furnish necessary flow releases to prevent any downstream impacts.

11 Future studies identified in referenced paragraph are those that would be considered if congressional authorization is received for the proposed project. These studies would be accomplished during the post-authorization and design phases of the projects. No assurances can be given at this time that these studies would be funded since funding will be dependent upon congressional appropriations.

12 The proposed new natural gas pipeline from the Prudhoe Bay field, although not specifically identified in the alternative discussion of Oil and Gas, was taken into consideration when this alternative was investigated.

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
ARCADE PLAZA BUILDING, 1321 SECOND AVENUE
SEATTLE, WASHINGTON 98101

REGION X

Office of Community
Planning & Development

IN REPLY REF

10D

Charles A. Debelius
Colonel, Corps of Engineers
Alaska District Corps of Engineers
PO Box 7002
Anchorage, AK 99510

Dear Colonel Debelius:

Subject: Draft Environmental Impact Statement
Hydroelectric Power Development, Upper Susitna River Basin

We have reviewed the draft statement submitted with your September 22, 1975 letter requesting comments within 45 days.

The proposed action is to construct dams on the upper Susitna River at Watana and Devil Canyons, power plans, transmission facilities, access roads, and operating and recreational facilities.

13 At this point we do not see any significant impact in our areas of concern. As plans develop, we would like to be kept up on possible changes in population projections and related housing and community facilities needs. Your plans appear to be consistent with the Alaska Water Study Committee's assumptions that there would be initial and continued hydropower development in the Susitna River Basin. Since both our agencies as well as the State, is represented on this Committee, there should be no problem in adequately coordinatin water related project plans.

Thanks for the opportunity to review your statement.

Sincerely,

Robert C. Scalia
Assistant Regional Administrator

RESPONSE TO COMMENTS BY
U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

13 Comment noted.

United States Department of the Interior
ALASKA POWER ADMINISTRATION
P. O. BOX 50
JUNEAU, ALASKA 99802

December 1, 1975

IN REPLY REFER TO:
700

Colonel Charles Debelius
District Engineer
Corps of Engineers
Box 7002
Anchorage, AK 99510

Dear Colonel Debelius:

The Interior Department, Office of Environmental Project Review, requeste that we furnish you comments on your draft EIS, "Hydroelectric Development, Upper Susitna River Basin, Southcentral Railbelt Area, Alaska."

General Comments

14 We believe the draft statement does not provide adequate information on the proposed project transmission system, and impacts, alternatives considered, and measures to mitigate potential adverse impacts of the transmission system. Such material could be included by extract or by appropriate reference to the Alaska Power Administration's Environmental Assessment of the project transmission system.

15 The statement includes a list of references cited, but for the most part, the text of the statement does not indicate sources of data. We believe a more complete citation of data sources is needed.

16 We believe the draft substantially overstates potential adverse impacts of the identified upstream dam and reservoir sites at Vee and Denali (see, for example, the 1965 report of the Fish and Wildlife Service, "A Detailed Report on the Fish and Wildlife Resources Affected by the Vee Project, Alaska"). We believe it is very likely that a full development of the Upper Susitna River hydroelectric potential, including one or both of the upstream reservoirs, would result in significantly less adverse environmental impacts than would development of available alternatives outside the Susitna basin.

If the Corps' proposed development plan is authorized (Devil Canyon and Watana), we believe it is probable that the Denali Dam would receive further consideration as a potential additional development. The data generated in your current studies indicates additional reservoir capacity would be beneficial; we feel this is particularly significant in view of very heavy winter energy demands in the Railbelt. We believe this matter should be discussed in the final statement. 17

Specific Comments

These are referenced to section numbers in the draft EIS.

1.03. Description of Action. Suggest including a concise description of actions involved in constructing and operating the transmission system (clearing, access, towers, lines, substations, maintenance). 18

2.02.2.2. Raptors. The Fish and Wildlife Service made aerial surveys to determine relationships of the proposed transmission facilities to raptors. The data should be referenced in the EIS. The attached letter of July 14, 1975, from Dr. Clayton R. White discusses findings. 19

2.03.6. Archeological Resources. Based on informal consultation with the Alaska Division of Parks on the transmission corridor studies, we understand that there are known and potential archeological and historical sites along the proposed transmission corridors. To avoid possible disturbance, these sites cannot be identified in the project reports. We believe the project report and EIS should recognize needs for pre-construction archeological surveys under applicable regulations.

4.03. Wildlife. We believe that experience with the existing Healy to Fairbanks transmission line, and CEA and APA lines in the lower Susitna Valley and Anchorage-Palmer areas is pertinent with respect to potential impacts on caribou and waterfowl. We are not aware of any experienced or alleged problems with caribou on the Healy-Fairbanks line. Similarly, the existing lines in the Cook Inlet area have apparently not caused significant problems for migrating birds.

6.02.11. Hydropower. The referenced 1948 report of the Bureau of Reclamation was but one of the early evaluations of Alaska hydro potential. Subsequent studies, including the Statewide Inventory published in the 1969 and 1974 Alaska Power Survey reports, and the June 1967 Interior Department report, "Alaska Natural Resources and the Rampart Project," provide a great deal of further definition of these resources.

69-737 O - 81 - 38

20 We believe these more recent studies should be referenced as the basis for selecting the Upper Susitna project as the most desirable near-future major hydro project for the Railbelt. The existing data are adequate to demonstrate that the very large alternatives such as Rampart and Wood Canyon would involve greater environmental problems. An alternative plan to replace Susitna with equivalent power supplies from other potential hydro projects would require developing several projects in different basins with attendant impacts.

21 6.04.5. Devil Canyon-Denali, and 6.04.6., Three-Dam System. We do not concur in the statements that economic feasibility is lacking for these plans, since we believe this finding is premised on unreasonably conservative evaluations of costs involved in the Denali Dam. As indicated in the "General Comments," we believe the Denali Dam may ultimately prove to be a desirable future addition to the proposed Watana-Denali Canyon Plan, considering need for winter energy, environmental aspects, and available alternatives.

Sincerely yours,

Robert J. Cross
Acting Administrator

Enclosure

cc: Office of Environmental Project Review

DEDICATED TO LOVE OF GOD
YOUTH SERVICE TO MANKIND

1875 • Brigham Young University Centennial • 1975

July 14, 1975

Mr. Melvin Monson
U. S. Fish and Wildlife Service
813 "D" Street
Anchorage, Alaska 99501

Dear Melvin:

I am sending this brief letter for your use in discussion with the Alaska Power Administration concerning the proposed Susitna Dam Site and associated Power transmission lines. A full report will be sent to you which will include the entire summer's findings. This, however, will require some time to complete and I am desirous of you and the power administration receiving the following information as early as possible.

We use both helicopter and fixed wing (helio) to search for falcons. The transmission lines that form the basic figure 8 configuration of the Alaska-Fairbanks, Fairbanks-Big Delta, Big Delta-Anchorage, Denali Highway were investigated. These routes basically parallel existing highways.

Within this area there is considerable habitat for cliff nesting raptors. However, as I indicated in my 1974 interim report to Fish and Wildlife Service, I found no nesting Peregrine Falcons within the confines of any of the 4 proposed dam sites. Historically there may have been Peregrines there, but in the year of the survey none was found. The transmission routes also traverse areas that look excellent for Peregrine Falcons, however, the only area of concern at the moment, as regards Peregrines, would be that portion of the proposed transmission line route which basically parallels the highway and Tanana River from Fairbanks to Big Delta. There are several historical Peregrine sites along the Tanana River and Sulcha River.

One should be mindful, however that aside from the Peregrine, the Gyrfalcon is also found in limited numbers within that portion of Alaska and because of its overall restricted range in the Arctic, one should be cautious of this species. Several nesting pairs are found from Summit Lake region to the Denali Highway region, thence, north along the Anchorage-Fairbanks Highway in the area of the Healy-Cantwell region. To produce least impact in terms of raptors, the transmission lines should probably be placed along the south side of the Denali Highway and the west side of the new Fairbanks-Anchorage Highway.

The only conceivable area, then, of impact with the Peregrine Falcon would be that part of the transmission route from Fairbanks to Big Delta, thence, south along the Big Delta region to about Summit Lake. In this region no recent Peregrine Falcon nestings (since 1972) have been made. The Peregrine is indeed in trouble in this region. Further impact can be avoided by perhaps running the transmission lines across the flats south of the Fairbanks-Big Delta Highway keeping, perhaps, 2 to 3 lines away from the Tanana River.

Hopefully, these data will suffice until the entire report can be submitted to you.

Sincerely,

Clayton M. White, Ph.D.
Associate Professor of Zoology

mp

RESPONSE TO COMMENTS BY
U.S. DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION

14 The portion on alternative transmission systems has been expanded. The cooperation of APA in evaluating potential hydroelectric facilities on the Upper Susitna River has been extremely helpful. The environmental assessment of transmission facilities has been used as a supporting document in compiling the EIS and has been incorporated into the Appendix of the technical feasibility report.

15 The Selected Bibliography has been expanded to list sources not previously cited as well as additional sources utilized in revising the document.

16 The environmental impacts stated for the upstream damsites are in relation to those in the lower portion of the basin. But when compared to impacts of hydroelectric alternatives outside the basin, i.e., Rampart and Wood Canyon, they are significantly less overall.

17 The alternative three-dam scheme does show a net benefit, but under an incremental analysis the third dam add-on is not economically viable at this time.

18 Comment noted.

19 Comment noted. Referred letter is included in the EIS as an attachment to APA's letter.

20 Comments noted.

21 Comment noted. See response number 17.

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

ALASKAN REGION
632 SIXTH AVENUE
ANCHORAGE, ALASKA 99501

TELEPHONE 272-5561

OCT 30 1975

Colonel Charles A. Debelius
District Engineer
Department of the Army
Alaska District Corp of Engineers
P. O. Box 7002
Anchorage, AK 99510

Dear Colonel Debelius:

We have completed our review of the draft EIS on the Hydroelectric Power Development for the Upper Susitna River Basin Southcentral Railbelt Area.

The following comments are offered for your consideration as you prepare your final EIS.

We recommend using the word "airplane" in place of the term "bush plane"
as it is used in paragraph 2.03.3.3 Air. The term may be misleading or
22 confusing since many of the locations that are only accessible by air
are served by large jet aircraft.

Section 2.0 Environmental Setting without the Project, covers the existing
Air Transportation in paragraph 2.03.3.3 Air. Section 4.0 Environmental
Impact of the Proposed Action, makes no mention of any aviation impact
23 related to the project. As a minimum, the potential impact of the heli-
copter construction mentioned in paragraph 4.10 Roads should be covered.
Also, we have noted that on other construction projects, even when there
is road access, there has been a tendency to provide helipads or landing
strips for air evacuation of injured workers or the convenience of
24 reduced travel time. If these aspects have been reviewed, it appears
that Section 4.0 would be enhanced by including some comment on the poten-
tial for impact or the lack of it from air operations.

Thank you for the opportunity to review and comment on your draft EIS.

Sincerely,

LYLE K. BROWN
Director

RESPONSE TO COMMENTS BY
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
ALASKAN REGION

22 The suggested change has been made in the appropriate section in the Statement.

23 Section 4.10 has been revised to indicate that any helipads constructed would be of a temporary nature and would be rehabilitated when no longer needed.

21 Section 4.10 has been revised to discuss the need for facilities to provide for air evacuation of injured personnel.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
ALASKA AREA OFFICE
813 D STREET
ANCHORAGE, ALASKA 99501

NOV 14 1975

Colonel Charles A. Debelius
District Engineer, Corps of Engineers
Alaska District
P. O. Box 7002
Anchorage, AK 99510

Upper Susitna Hydroelectric
Power Development ER 75/942
NPAEN-PR-EN

Dear Colonel Debelius:

The Alaska Area of the U. S. Fish and Wildlife Service has the following comments to offer on this environmental statement.

GENERAL

25 We regret that there was no general discussion included on possible mitigating measures to be employed in the project. We understand that detailed studies undertaken by the Corps later in the authorization process will provide the bases on which mitigating measures will be developed; however, a general outline of possible ameliorating measures at this point would be informative. Loss of habitat, for example, might be mitigated by acquisition or protection of similar acreage elsewhere. Anticipated heavy use by recreationists might be alleviated by placing access roads so as to discourage such use or by ORV regulations enforced by the land-managing agency. An outline presentation such as this would clearly demonstrate the forethought given this subject by the Corps without requiring detail which is unavailable yet.

26 We are pleased to note that consideration will be given to improving fish access to and from some of the sloughs and tributaries downstream from Devil Canyon . We are also pleased that the results of ongoing studies under the direction of the Fish and Wildlife Service will be used during the final design phase studies for feasible project modification and mitigating measures.

SPECIFIC

27 Summary, 3B and page 53, para. 3 - the present document tends to minimize impacts to moose habitat. Especially on page 53, the effects of the loss of moose habitat should be described in detail and the terms "preferred" and "critical" defined. The number of acres to be inundated and secondary adverse effects, if any, should be discussed. A small loss of habitat may not appear to be significant when assessed alone, but when added with all the statewide losses of similar size, the loss may be signficant.

Page 23, para. 3 - Other Birds. The statement "Some incidental hunting takes place along the Denali Highway" is misleading, though this is presumably a reference to game bird hunting. Hunting pressure generally is heavy along the Denali Highway and this statement needs to tie more closely with bird hunting only. 28

Page 37, first para. - Other Forms of Transportation. The statement concerning shallow-draft river boats, small boats, canoes, rubber rafts and kayaks needs expanding, since Lakes Louise, Susitna, Tyone and the Tyone River complex in the Upper Susitna drainage receive heavy boating and floatplane use by hunters and fishermen from the Glennallen and Anchorage area. 29

Page 48, para. 3 - The statement "...and a minimal amount of resident fish habitat at the mouths of a few of the tributaries that enter the Susitna River in the 28-mile section of the proposed damsite" should be expanded to identify how many tributaries enter the Susitna River in the affected reach of river and to discuss more fully the "minimal fish habitat". 30

Page 48, para. 5 - This paragraph should be expanded to include the anticipated number of "rare occasions" when excess water would be diverted over the spillway, the climatic or engineering factors precipitating these occasions, and the degree of significant adverse impacts on fish and vegetation. 31

Page 48, para. 6 - This paragraph should specify the acres of moose habitat inundated and its importance to moose. Likewise, the fish habitat inundated should be described in greater detail. How much fish habitat will be inundated and what species will be affected? What types of fish habitat will be created at higher elevations and what species are expected to use the "new" habitat? 32

Page 51, last para. - We suggest substitution of the word "fragile" for the word "simple" in the statement, "However, the aquatic food chain in the taiga (boreal forest) and tundra is extremely simple, and as a result, disruption of habitat for one species quite often indirectly affects many other species." 33

Page 53, para. 3 - "Although moose habitat does exist within the pool areas of the proposed Devil Canyon and Watana reservoirs, the overall loss of preferred or critical winter forage areas would affect but a small percentage of the Upper Susitna moose population." (emphasis added). We do not believe there is sufficient information available at this time on the Upper Susitna moose population to categorically imply only a small percentage of moose will be affected. Anticipated studies by the Fish and Wildlife Service in cooperation with the Alaska Department of Fish and Game should provide the needed information for a determination within the next four years. 34

Page 64, para. 1- the background data supporting the assertion that large blocks of excess power will not be created by the project should be presented. Obviously, the impact on the State of Alaska would be profound and long-lasting if a large surplus of power became available and industrial development were stimulated by this. Since this would be viewed by many as an adverse impact, or at the least a secondary impact of magnitude, it should be explored here. 35

Thank you for the opportunity to review this draft statement. As an agency with specific responsibilities related to the project, the Fish and Wildlife Service looks forward to reviewing the other documents as the project goes through its authorization procedure and offers to assist at any time.

Gordon W Watson

RESPONSE TO COMMENTS BY
U.S. DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

25 An outline presentation of possible ameliorating or mitigating measures can not be made until a determination as to what types and to what extent such measures will be required. As stated at the end of Section 1.0: "Examples of problems expected to be addressed during the detailed design study phase include identification of significant adverse impacts to important fish and wildlife species, and specific actions which should be taken to prevent, ameliorate, or mitigate these impacts." The provisions of the 1958 Fish and Wildlife Coordination will be fully complied with in the consideration of project damages to fish and wildlife resources, and the implementation of appropriate ameliorative or mitigative measures.

26 Comment noted.

27 True, past fish and wildlife reports generally discounted moose habitat in Devil Canyon and showed comparatively low moose populations in the Watana reservoir area. A definition of "preferred" and "critical" in relation to moose habitat has not been defined in the EIS at this time. Future wildlife studies should determine and define critical moose habitat and number within the proposed impoundment areas.

28 The words "game bird" have been added to the statement to clarify this discussion of hunting pressure.

29 In Section 2.03.3 (Transportation), the EIS indicates boating and floatplane use in areas of the Upper Susitna River Basin.

30 The fish habitat at the mouths of clearwater tributaries which would be inundated by the proposed impoundments is more fully discussed in Section 2.0 under the heading Resident Fish. According to a survey conducted jointly by the Fish and Wildlife Service and the Alaska Department of Fish and Game in May and September 1974, only Fog Creek and Tsusena Creek provide good resident fish habitat within the reservoir impoundment areas. Some of the other tributaries provide poor habitat, while others indicated no presence of fish.

31 The EIS has been expanded to indicate that excess water would be diverted over the spillway once in approximately 50 years. The factors precipitating these occasions would consist of a full reservior concurrently with inflow in excess of the combined turbine and regulatory outlet works capacity. Impacts on the 2.5-mile reach of Tsusena Creek would consist of channel and streambank erosion,

flushing of fish and other stream organisms, and damage to streamside vegetation.

12 A discussion of the importance of inundated moose habitat has been added to Section 4.0 of the EIS. Acres of significant moose habitat can only be determined from studies which are proposed to be conducted during the pre-construction stage of planning. These studies will determine the extent and types of ameliorating measures required to offset any unavoidable damage to moose habitat and populations. As stated in Section 2.0 of the EIS, grayling, rainbow trout, lake trout, Dolly Varden, whitefish, sucker, sculpin, and burbot comprise the principal resident fish population of the Susitna drainage. As also stated, grayling is the principal sport species inhabiting the mouths of clearwater tributaries. It is expected that this would be the predominant species inhabiting any new habitat created at higher elevations by the reservoirs, since habitat conditions would probably be similar at the higher elevations. As with the case of moose, such eventualities can only be ascertained by detailed future studies.

13 We disagree. Admittedly, the taiga and tundra are "fragile" ecosystems. However, an ecosystem could be fragile and still have a complex aquatic food chain. Such a food chain would probably be less severely damaged by a given action than would a "simple" food chain in which loss of one link might directly affect the entire system.

14 Comment noted, but past studies indicate low numbers of moose are found within the proposed reservoir areas.

15 See response number 255.

United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VIRGINIA 22092

OFFICE OF THE DIRECTOR

ER-75/942

NOV 17 1975

Colonel Charles A. Debelius
Alaska District, Corps of Engineers
P.O. Box 7002
Anchorage, Alaska 99510

Dear Colonel Debelius:

We have reviewed your draft environmental statement on the Upper Susitna hydroelectric development and offer the following suggestions.

It has been noted that impacts will be analyzed after project authorization and prior to project design (p. 8, par. 1). Information conspicuously absent in the present statement, but which should be incorporated in a revised or final environmental statement, includes the geology of the proposed dam sites, including permafrost conditions, and related impacts. Much pertinent information can be found in a recent Geological Survey report, "Preliminary geologic and seismic evaluation of the proposed Devil Canyon and Watana Reservoir areas Susitna River, Alaska," by John C. Lahr and Rueben Kachadoorian. That report notes that the Devil Canyon damsite is underlain by argillite and graywacke of Cretaceous age, and describes joint sets and shear zones in the damsite area (p. 5-6). The Watana damsite is described as being underlain by granitic rock which has intruded the Cretaceous argillite and graywacke.

In discussing potential geologic and seismic hazards to the project, the Survey report states that "one must assume that the proposed Devil Canyon and Watana Reservoirs could be subjected to earthquake generated landslides" (p. 14, par. 1). It has also been observed that unconsolidated sediments high above the river on the canyon walls would be inundated when the reservoirs are filled and "during a major seismic event these sediments may slide and generate waves in the reservoir" (p. 14, par. 2). Another hazard discussed in the preliminary report is that of the runup against the dams of waves that might conceivably be generated by blocks falling into the reservoirs or by subaerial or subaqueous landslides; additionally, the possibility

36 of damage by seiches that might develop in the reservoirs during earthquakes has been briefly discussed (p. 14-15). Possible hazards of earthquakes induced by reservoir filling have also been discussed (p. 15-16). It is concluded that all of the foregoing possible hazards should be carefully assessed in the siting and design of the proposed dams (p. 17). Recommendations are presented for geologic and geophysical studies (p. 18-19; p. 21-24).

37 Daily fluctuations of up to two feet in the river below the proposed Devil's Canyon dam are compared to the natural fluctuations of about one foot (p. 46, par. 5). However, the natural daily fluctuations occur during the spring and summer runoff of snow-melt at high flows while those after construction of the project would occur at lower flows, be more abrupt, and occur in winter. Thus, some different effects might be expected and these should be discussed in the final statement.

38 The spillway design at the upper dam would divert flows that cannot be taken through outlet structure into Tsusena Creek, 2.5 miles above the confluence with the Susitna River. It is indicated that on the rare occasions when this diversion would take place, the impacts on Tsusena Creek could be significant (p. 48). The frequency at which damaging diversions might occur should be given as well as estimates of extent of the resulting effects.

39 The occurrence of ground-water resources in the project area is not addressed in the environmental statement, although bits of information on geology (p. 14-15) and the suggested ground-water impacts of the coal alternative (p. 71) indicate that appreciable ground-water resources exist in the area. It is not possible to evaluate the impacts of the proposed project on ground water without more information. Although we realize that this document represents only a feasibility stage, we believe that impacts on ground water should be evaluated for each major component of the recommended development plan, especially for the proposed dams, powerplants, transmission facilities, roads and recreational facilities. These evaluations might be presented in detail after the project is authorized, but current knowledge should be sufficient for evaluation in general terms.

40 There is some apparent conflict in the interpretation of the Alaska Native Claims Settlement Act which is not resolved (p. 43-44). A further statement seems necessary to say that this difference between the intent of the law and the understanding of the Bureau of Land Management is yet to be settled.

We thank you for the opportunity to comment on the draft environmental statement.

Sincerely yours,

Henry W. Coulter

Acting Director

RESPONSE TO COMMENTS BY
U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

36 The geology of the foundations for Devil Canyon is a phyillite complex with joint sets crossing the river at a slight diagonal. Due to the steep cliffs there is no overburden. Foundation rocks at Watana are granitic types with joints crossing the river at a slight diagonal. Overburden varies greatly and is expected to be 1 to 10 feet deep in the vicinity of the axis. Depth of bedrock in the river channel could be as much as 70 feet according to seismic studies. The bedrock formation of the canyon walls changes from igneous complexis to metamorphized sediment complexes. The exact boundaries will not be known until later design studies are authorized. Detailed seismicity studies will be required in determining the exact siting and final design of the dams. The Corps concurs with the Geological Survey that the geology of the project area must be studied in depth to identify hazards which the dams and reservoirs could be subjected to.

37 The hydro projects will be operated in a manner similar to the normal load demand of the railbelt area which presently has an annual load factor of 50 percent. Monthly load factors throughout the year have ranged between 70 to 76 percent, and weekly load factors are frequently above 80 percent. Therefore, under the normal energy demand makeup, the Watana turbines would have adequate capacity to meet all peaking requirements, and the Devil Canyon project would serve the baseload, thus regulating the Watana discharges and maintaining a relatively stable downstream discharge. However, if the Devil Canyon projects were operated within a 70 to 80 percent plant factor range on a monthly basis, the respective river fluctuations would be minimal (on the order of less than a foot on a monthly basis). Under extreme conditions when a railbelt system failure of existing thermal units may require heavy hydro usage, abrupt fluctuations could occur. Spring, summer, and fall stage increases would have relatively the same effect as natural stage fluctuations brought on by flooding. Generally, however, system failures at this time of the year could be met by other thermal units held in reserve. Therefore, a winter system failure would probably provide the most adverse river effect.

In regard to premature ice breakup brought on by river fluctuations, studies conducted by the Missouri River Division, Corps of Engineers, have found that stage increases of up to 7 feet at moderate rate can be tolerated without premature breakup. A 7-foot fluctuation is far in excess of the maximum stage increases anticipated for the proposed hydro projects.

38 This paragraph has been expanded on page 48 of the EIS. The spill frequency is approximately once every 50 years.

39 Groundwater within the confines of the proposed reservoirs and dam structures is limited to the shallow aquifer which discharges to the Susitna River and to local benches perched on bedrock. The aquifer is roughly 80 feet deep and is underlain by bedrock. Because the stream channel and subsequent bedrock are "river cut," the lateral extent of groundwater is intermittent and confined to benches shaped by glacial scour. The flood plain of the Susitna River upstream from the proposed Devil Canyon damsite but below the upper reaches of the Watana reservoir is confined to a steep-walled, narrow canyon.

Groundwater within the study area has no existing or planned human use. From an engineering standpoint, few problems are anticipated from groundwater interference during or after construction. Conversely, although inundated within reservoir areas, downstream groundwater impact is expected to be minimal. Adequate freshet recharge coupled with the influent nature of the winter flow regime should maintain existing downstream water tables.

Access roads will traverse the basin on relatively high ground outside of the canyon confines. While some groundwater may be encountered, the general route of the roads has been chosen to minimize design problems such as groundwater. The topography of the area would not indicate that the roads would have any significant groundwater impact. The same general observations hold for the transmission system; however, considerably more terrain would be crossed and a greater potential for groundwater impact may exist. Much of the transmission system will follow existing transportation and utility corridors and an analagous observation of groundwater interference along these routes would indicate few potential problems.

40 The discussion of the Alaska Native Claims Settlement Act has been expanded and updated in the EIS to reflect the latest status of the lands in the project area and to indicate that some of the matters concerning the ultimate disposition of these lands have not yet been resolved. See Section 3.02 in EIS.

IN REPLY REFER TO

UNITED STATES
DEPARTMENT OF THE INTERIOR

BUREAU OF INDIAN AFFAIRS
Juneau Area Office
P. O. Box 3-8000
Juneau, Alaska 99802

November 3, 1975

Memorandum

To: District Engineer, Department of the Army
Anchorage

From: Area Director

Subject: Review of draft environmental impact statement for Hydroelectric Development, Upper Susitna River Basin, Southcentral Railbelt Area, Alaska (ER 75/942)

General Comments:

The document is presented in a good format so the document is readable and easy to follow through. There appear to be provisions made to avoid any future land conflicts under the Alaska Native Claims Settlement Act. 41

Specific Comments:

We have no further comments.

Area Director

69-737 0 - 81 - 39

RESPONSE TO COMMENTS BY
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF INDIAN AFFAIRS

41 Comments noted.

IN REPLY REFER TO:
1792.5 (911)

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
State Office
555 Cordova Street
Anchorage, Alaska 99501

Colonel Charles A. Debelius
District Engineer
Corps of Engineers
Alaska District
P.O. Box 7002
Anchorage, Alaska 99510

Dear Colonel Debelius:

We have reviewed the draft environmental impact statement titled "Hydroelectric Power Development, Upper Susitna River Basin, Southcentral Railbelt Area, Alaska" ER 75-942. Our concerns basically center around the lack of assessment of the effects of the proposed project on the downstream portion of the Susitna River. We are also concerned that 42
since the project is only in the feasibility stage, future design efforts and ongoing studies may uncover additional environmental data. Thus, another impact statement or an update would be desirable at the time the project became more specific.

General Comments

The proposed Devils Canyon-Watana Dam project is being placed on one of the major river drainages in southcentral Alaska, but the DEIS does not provide a comprehensive overview of the impacts of this proposed hydro- 43
electric complex on the stream ecosystem and associated resource values.

Consideration of the environmental impacts of the project and affects on recreation, navigation and fisheries, for example, need to be expanded to include the lower Susitna River from Devils Canyon to its mouth on Cook Inlet. In this regard, the DEIS is deficient, and adverse impacts 44
in the lower river may outweigh potential beneficial aspects of the proposal in opening up access to the Upper Susitna Basin.

Specific Comments

Summary Page

2. Description of Action - The draft states that all impacts were not exhaustively evaluated since the project is only in the "feasibility study" stage. However, it appears that the proposal has gone

45 far beyond the feasibility stage and should require a detailed EIS Which evaluates all possible impacts. If another impact statement will be prepared after design and further studies, this should be so stated or explained.

3. a. Environmental Impacts - Increased turbidity of the Susitna River downstream from the project area during the winter months is listed as a major adverse environmental impact. Yet, no analysis is made

46 in any of the remaining sections of the EIS of the potential impacts of this water quality change upon overwintering resident and anadromous fish in the main stem Susitna River below the site.

47 The recreational opportunities would more than likely be altered rather than increased. Use patterns would shift from de facto wilderness oriented activities to more intensive activities adjacent to the new roads and reservoirs.

48 The project would also promote the development of adjacent private (Native) lands.

Page 1, paragraph 1.02

49 It is suggested that it is premature to consider the subject project without first completing the Stage 2 comprehensive report on the feasibility of developing other hydroelectric sites in the area.

Page 6, paragraph 1.03

50 The discussion of access road design/location should be strengthened, if possible. Mention is only made that such construction will include consideration of environmental factors. It would appear appropriate for such considerations to be discussed in detail.

51 It is understood that the operation and maintenance of project-related, recreational developments will be assumed by the land managing agency having responsibility for the major portion of adjacent public lands; and, as such, it would seem best to resolve that matter at an early date and incorporate that organization's goals/plans into the design of any recreational developments.

Page 15, paragraph 2.01.4.3

52 It is impossible to consider the environmental impacts of the transmission corridor as described. A considerable expansion of this section is warranted.

Pages 18-21, paragraph 2.02.1

The draft would benefit in this section by the inclusion of a
fisheries habitat map detailing the distribution and the spawning
and rearing habitat, by species, of both anadromous and resident fish
in the immediate area of the dam proposals (Chulitna River conflu- 53
ence to the upper end of the Watana impoundment).

Page 23, paragraph 2.02.3.1

Rather than state that ATV access to the back country has improved
hunting access in spite of a rapidly declining caribou population,
it might be justified to state that increased access, whether via
ATV's or roads, coupled with an increasing human population, may be 54
a contributing cause of the rapidly declining caribou population.

Page 36, paragraph 2.03.3.4

River boats and airboats are a common form of transportation to
recreational cabins, homesites, and the hunting and fishing oppor-
tunities of the lower Susitna River. Due to the braided and often
shallow character of the Susitna River in the area between the
mouths of the Kashwitna and Deshka Rivers, the 3,252 and 19,160 cfs
reductions in flow created by the proposed project during May through 55
July (as shown in Table 1, page 45) could have a considerable impact
on the navigation of the lower river, particularly for boaters
using propeller-driven outboard craft.

The impact of flow reductions on current transportation to recreational
opportunities in the lower river should be examined and weighed against
the suggested advantages of increased access to the Upper Susitna Basin
(Page 54, paragraph 4.04).

In winter, the lower Susitna River is also a highway for travel by
snowmachine for homesteaders and recreational tract owners. It
should be determined if regulated discharges ranging from 6,038 to 56
7,428 or 481% to 657% increases over natural flows in January
through April will result in hazardous travel due to thinner ice
formations or their complete absence in the lower segment of the
river.

Page 37, paragraph 2.03.4.1

It is incorrect to state that floatplane access is relatively
minor and restricted to a few large lakes. Such use is actually
quite common and in all probability, most lakes large enough to 57
accommodate a Super Cub are utilized.

58 It is also incorrect to say that the Upper Susitna River Basin has very little recreational activity. As noted previously, float-planes and ATV's are utilized quite heavily by hunters, fishermen and other recreationists. Preliminary studies indicate significant populations of hunters, fishermen and miners utilizing the Susitna River Basin. Reference: University of Alaska 1975 ORV Study (report being prepared).

Page 37, paragraph 2.03.4.2

59 Reference to the hunting of sheep and goats being minimal, even along the Denali Highway, implies a general lack of interest in that direction; however, the real reason for minimal hunting pressure along the highway is probably the result of minimal sheep populations.

Page 43, paragraph 3.01

60 Although the general project area is presently under the jurisdiction of BLM and the area to be inundated is classified as a power site, the entire area is withdrawn under ANCSA for possible selection by Native corporations. Selections have already been filed for lands in the immediate area of the proposed sites. We suggest you contact the Land Office, 555 Cordova Street, for the specific locations.

Pages 45-52, paragraphs 4.01 and 4.02

61 The present relationship of food supply, water temperatures, turbidities, velocity of flow and dissolved oxygen levels currently found in the lower Susitna River provide a balance which permits the existence of overwintering fish populations migrant to the stream from clearwater sloughs and tributaries which have diminished water flows or are frozen to the bottom. Alteration of any one of these conditions produces changes in the others which degrade the lower Susitna River's capability to support wintering and will result in a decline of resident and anadromous fish populations.

62 Any attempt through engineering design and discharge management to maintain the lower Susitna River is subject to failure because of the harsh climate and the complex interaction of the above factors.

Assuming, for example, that discharges from the Devils Canyon Dam are increased 657% above the natural flow level during the winter period and all other of the above factors remain at the natural level, the following will happen:

1. Temperatures remain at natural level of 32° F. Fish, being
cold blooded organisms, have their basic activity level "set"
by temperature--in this case their lowest. Stream velocities
have been increased and fish cannot maintain their station in
the river currents. By their inability to maintain or produce
a higher activity level, they are subject to stress and mortality.

2. Food supply is presently limited, and for this exercise, is
presumed to remain the same. Utilization of available food supply
by fish is decreased because more of their basic energy expen-
diture must go into swimming rather than into the activity cost 63
to capture prey organisms. Fish lose condition, are stressed and
subject to mortality.

3. Dissolved oxygen is presently above 5 mg/l. At this level, oxygen
is in sufficient supply to maintain the low metabolic rate of the
fish. Much lower levels would be required to cause fish stress
and mortality. Discharge-stream velocity would have no impact.

4. The waters are presently clear in the winter situation. With
increased flow, there would be no impact on fish life, adverse
or beneficial.

In the above case, alteration of stream velocities affects swimming
performance of fish and utilization of their food supply introducing
stress and mortality. If all the possible permutations and combinations
of change and interaction of the above factors are worked through,
it can be realized that construction of the Devils Canyon project 64
will affect the lower Susitna River's suitability as critical winter
habitat for resident and anadromous fish with little hope for
mitigation. This should be clearly and positively outlined by the
Corps of Engineers as an adverse impact of the project. The effect
on fish production and stream ecology should be expanded to include
the entire lower Susitna River.

<u>Page 50, paragraph 4.02</u>

What is the basis for the readjustment of fish? Presumably some sort
of evolutionary adaptation is to be accomplished in a short period
of time to complex habitat changes and alteration of natural biological 65
cues. More likely, the adjustment will be a substantial decline in
fish population numbers. This should be positively stated.

<u>Page 50, paragraphs 4-6</u>

Presently, it is doubtful that spawning by salmon occurs in the main
stem Susitna River. This paragraph is irrelevant to the true fisheries

66 value of the river, namely winter habitat for fish from sloughs and tributaries. Additional spawning habitat will not be of any value, provided the critical winter habitat for fish survival is not available.

Pages 55-56, paragraph 4.04

67 The lower Susitna Basin encompasses one of the largest blocks of land currently patented to the State of Alaska. The area will see increased public use in recreation due to the fact that many areas of the state will shortly be turned over to the private ownership of Native regional corporations and villages which will restrict access to lands previously used by recreationists from the densely populated Anchorage area. Also, as suggested, a new capital may be constructed close to the lower Susitna River. The impacts of reduced discharges in the Susitna River during the summer months should be examined to determine the effect on current modes of transportation and navigation for recreational purposes in an area which has a growing demand.

68 The draft estimates an annual visitation to the project area of 77,000 people. The methodology for arriving at this figure should be shown, since there are no previous similar situations or case analyses in Alaska.

Page 59, paragraph 4.10

69 It would be of value for the reader to know the actual locations of proposed roads and the conditions under which it would be considered necessary to accomplish revegetation of temporary roads and other disturbed areas.

Page 61, paragraph 4.13

70 Care should be exercised in locating the transmission line between Point MacKenzie and Cantwell so as to avoid a degradation of the scenic views of Mt. McKinley.

71 An expansion of the brief discussion of planned landscape management techniques would be appropriate.

72 The last sentence in the first paragraph should read positively, "That would (delete probably) qualify for wilderness classification" (delete rest).

We suggest qualification as to what extent roads and transmission lines will impact aesthetics. 73

The third paragraph reads as a justification statement. 74

Page 68, paragraph 6.0

It is suggested that alternatives to the proposal might surface in
the feasibility study (Stage 2) for the development of other hydro- 75
electric sites in the Southcentral Railbelt area which is scheduled to be completed in 1978.

Pages 69 and 78, paragraphs 6.02, 6.03

Development of the Beluga Coal Fields will probably occur regardless of the presence or absence of the Upper Susitna Hydroelectric Project. Considering the adjacency of the Beluga Coal Fields and the potential Chakachamna Hydroelectric Project, some consideration should be given to potential power production based on a blend of these two systems. Other factors in favor of concentration of power
production in the area are the potential for industrial development, 76
deepwater port capabilities and the presence of some power transmission lines at present.

Oil and gas field development has already occurred throughout the Beluga area and a major timber operation exists, so the projects would not be affecting a de facto wilderness like the Upper Susitna Basin.

Page 71, paragraph 6.02.2

Reference is made to the lack of recreational and flood control benefits in a coal-thermal facility. There are no known flooding
problems along the river which require control; hence the flood 77
control "benefits" of the two-dam proposal are of little value.

Page 89, paragraph 6.05

A transmission corridor is indicated in figure 15 as possibly passing through the Copper River Basin served by the Copper Valley Electric Association which has plans to increase their service by a
new hydroelectric project at Solomon Gulch near Valdez with a 78
transmission line to the Copper River Basin. The coordination of these two transmission or power systems should be explained in the final.

Sincerely yours,

Curtis V. McVee
State Director

RESPONSE TO COMMENTS BY
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

42 The purpose of future design efforts and ongoing studies is to obtain additional environmental data. The EIS will be amended or updated periodically during the course of these studies to reflect all significant impacts identified.

43 As acknowledged in the first paragraph of BLM's letter, the project is currently in the feasibility stage. A comprehensive and detailed overview of the impacts of the project cannot be ascertained until the detailed, pre-construction stage of planning is authorized and funded by the Congress. The FEIS will be revised and updated to include all additional information received during the EIS review process.

44 The need for further studies to determine detailed impacts of the project is acknowledged in the EIS. The Corps does not view opening up access to the Upper Susitna Basin as being beneficial. The EIS fully addresses the general impacts expected to result from such access--both adverse and beneficial. Any "benefits" from such access are not weighed as a trade-off to adverse impacts which may or may not occur downstream.

45 All Corps project studies are in a feasibility stage prior to being authorized and funded by the Congress for advancement to detailed studies, which are made prior to--and results of which are a determining factor in--a determination by the Congress that the project should be authorized and funded for construction. Thus, this proposal is currently in a feasibility stage, and will remain so until such time that Congress may approve authorization for pre-construction studies and appropriation of funding therefore. On the basis of detailed studies made during the next stage, the EIS will be appropriately amended or updated.

46 Increased turbidity which is expected to occur downstream from the project during the winter months is not listed as a major adverse environmental impact in the EIS. It is discussed as an unavoidable adverse impact, the significance of which presently is not wholly known. There is some evidence to support a view, however, that the impact may be relatively minor. Estimates of 15 to 35 ppm of suspended sediment are based on concentrations below glacial-fed natural lakes in Alaska. One of these is Skilak Lake. The Kenai River, which flows from this lake, is generally recognized as one of the more important salmon streams in Alaska.

47 Comment noted.

48 Comment noted.

49 The most feasible alternative hydroelectric sites in the Southcentral Railbelt and Yukon regions were considered during the Stage 1 Interim Report. Stage 2 studies would consist primarily of a more in-depth evaluation of the alternatives already considered.

50 Considerations of environmental factors related to road construction will be considered in great detail when and if studies for such roads are authorized and funded. At the present feasibility stage of planning, the exact location of access roads is not known.

51 Concur. As soon as it is determined--as a result of consumation of the provisions of the Native Claims Settlement Act--what agency or organization will have the management responsibility for the major portion of adjacent lands, efforts will be made to incorporate recreational development into that organization's plans and goals. These lands are presently in a state of flux, having been designated as Native Village Deficiency Lands.

52 Impacts of the transmission lines, insofar as can be presently predicted with a reasonable degree of accuracy, are discussed under appropriate resource categories throughout the EIS. A comprehensive environmental assessment of the impacts of all the alternative transmission line corridors has been made by the Alaska Power Administration. This document is included in the appendix to the Corps' interim feasibility report, and is available for public review in the District office.

53 We agree. Such a map would have been included had it been made available by any of the responsible fishery resource agencies. This type of information will not be available until fishery studies currently underway are completed.

54 The statement describes suspected and known impacts of ATV access to basin moose and caribou herds. It also acknowledges that road access will increase the potential for additional hunting pressure. As stated by the Alaska Department of Fish and Game, in commenting on the EIS, that agency has the statutory authority and capability to control hunting pressure.

55 This could conceivably happen, particularly during the early years following project completion while the river is still divided amongst a series of braided channels. However, the river is expected, through regulated flow and elimination of high flood stages, to eventually assume a basically single, meandering channel. When this occurs, with water having been concentrated in a single channel, the summer navigability of the stream might well improve. Concurrently

with this, downstream recreational opportunity may well improve during the summer months. Heavy sediment loads and high flood stages which now characterize the river during the height of the outdoor recreational season will be significantly diminished, thus making the area more attractive to general outdoor recreationists.

56 As stated in the EIS, winter ice conditions are not expected to be significantly changed downstream from Talkeetna. Above Talkeetna the river may become more hazardous for winter travel. Such use above Talkeetna, at the present time, is minor.

57 The extent of floatplane use is described in more detail in a previous paragraph entitled Air. The terms "minor" and "common" are relative in context. In comparison to known areas of common or high floatplane use in Alaska, such use in the Upper Susitna Basin is considered to be relatively minor.

58 Again, "very little" is a relative term. The use of ATV's and floatplanes by hunters, fishermen, and other recreationists in the remote setting of the Upper Susitna Basin is miniscule compared to areas near human population centers where easy access is provided by roads.

59 The first half of this comment is not clear as to what is meant by "implies." It is agreed, however, that minimal sheep and goat hunting along the Denali Highway may well indeed be the result of minimal populations.

60 This section has been updated to reflect the current status of lands affected by the project. The status of filing on these lands is not cogent at this time, since exchanges presently proposed are subject to an amendment to PL 92-203 and possibly to Alaska statutes.

61 This is a purely conjectural statement. No such assertion has been made by any of the responsible fish management agencies, since such a determination can only be made based on detailed studies, which are currently underway. It would be just as valid to state that the opposite condition could occur; i.e., alteration could improve overwintering capability of the main stream.

62 Comment noted.

63 Comment noted.

64 There appears to be a conflict between the first sentence of this paragraph which states: ". . .alteration of stream velocities affect swimming performance of fish and utilization of their food supply introducing stress and mortality."--and subparagraph 4 of the previous paragraph which states: "With increased flow, there

would be no impact on fish life, adverse or beneficial." The content of the remainder of this paragraph is noted.

65 The statement has not been modified. Comment noted.

66 Comment noted.

67 The subject of reduced discharges during the summer months as related to recreational transportation (navigation) is discussed in response to an earlier BLM comment. We agree that if lands in the project area are turned over to the Natives, recreational usage in the Upper Susitna Basin will likely be restricted, and that if a new State capital is constructed close to the Susitna River, recreational demand will increase. The project, by providing public use on lands which would otherwise be restricted to such use by Native ownership, will contribute significantly to the recreational needs of people living in the new capital.

68 The visitation figures were developed by a private consultant in coordination with the Bureau of Outdoor Recreation and the Alaska Division of Parks, and are included in the Recreation Section of Appendix I of the feasibility report.

69 Comment noted.

70 Comment noted.

71 Comment noted.

72 The sentence referring to "probable" wilderness classification is accurate.

73 It is stated in the EIS: "Degradation of visual quality in general would be a major adverse effect of project construction. This would be attributable primarily to roads, dam construction, right-of-way clearing for the transmission line, and the obtrusiveness of the transmission line itself." No meaningful qualification as to what extent roads and transmission lines will impact upon esthetics can be made, since such impacts are wholly subjective in nature, and are dependent upon each individual's sense of what constitutes esthetic impairment.

74 Comment noted.

75 See response number 49.

76 Coal and other hydroelectric alternatives, including Lake Chakachamna, are sufficiently addressed in the EIS to explain why they were not selected as the recommended plan. Development of the Beluga Coal Fields may indeed be developed regardless of the presence or absence of the Upper Susitna hydroelectric project.

77 On the contrary, there are existing flooding problems along the Susitna River which require control. One involves the town of Talkeetna which is being threatened by riverbank caving, and the other involves nearly annual damage to the Alaska Railroad tracks. "Benefits" from flood control are indeed small, thus very little of project benefits are attributed to it (0.03 of 1 percent of average annual benefits).

78 The EIS makes it perfectly clear that the depicted transmission corridors are all alternatives which were considered and all but one of which were rejected. There are no transmission line planned for construction in relation to this project which would pass through the Copper River Basin.

United States Department of the Interior

NATIONAL PARK SERVICE
Alaska Task Force
524 West 6th Street, Room 201
Anchorage, Alaska 99501

November 11, 1975

Colonel Charles A. Debelius
District Engineer
Alaska District
Corp of Engineers
P.O. Box 7002
Anchorage, AK 99510

Dear Colonel Debelius:

We have been asked to submit our comments on the draft environmental statement, "Hydroelectric Power Development, Upper Susitna River Basin, Southcentral Railbelt Area, Alaska" directly to your office. Our comments are as follows:

A section should be included to show projected future power requirements of the railbelt area. This section should provide a comparison 79
of existing requirements and projected needs.

The impacts concerning recreational opportunities need expansion. In a land of so many natural lakes it seems that a reservoir of the proposed design (long and narrow) would be of little recreational attraction. The attraction would be the fish that were planted and 80
the facilities provided (which could be done for natural lakes, thus not requiring the project).

The document states that very little recreational use is now made of the upper Susitna basin. Future needs (1986) should be shown. This area will receive increased pressure by 1986 and will be significant when the Susitna flats are further developed. The summer draw down of the Watane project will impair the recreation use of the project and leave a barren area which will not be available for any use or 81
provide wildlife habitat. Does this activity balance the loss of white water and river boating due to the impoundments? Aside from access to a previously primitive area, how do the recreational improvements compliment or blend with those of the region e.g., Mt. McKinley National Park and Denali State Park? How was the figure of 77,000 potential visitors arrived at?

The power line should not be built to Fairbanks. Such an approach would eliminate the severe impacts of such a line through the Broad

Pass area and the Nanana Canyon. Why is it necessary to transmit power north to the Fairbanks area? The esthetic damage caused by
82 transmission line construction should be more carefully examined. Consideration of underground lines in certain stretches should be carefully considered. Economic costs should not be the only consideration for those sections where ethetics are most important.

6.02 Alternatives

All alternatives need expansion. On page one of the draft EIS, the resolution states in part an investigation of "any competitive alternative." Can this really be done if on the one hand oil and gas alternatives are dismissed in view of a "national effort," and
83 coal is discounted on the basis of extensive adverse environmental impacts even though statements such as on page 71 indicate that extensive studies of the impact of coal mining have not been conducted. An alternative consisting of the development of several sources combined to produce the power requirements of the State should be considered.

6.02.2 Coal

It should be stated that the Healy Coal fields have been developed and that the strip mining damage in this area has been taking place for a number of years.

84

Roads from the Healy coal fields have been built and the transportation problem is minimal when the generating plant is adjacent to the coal source. Higher local employment will be realized by development of coal energy sources.

6.02.3 Oil and Natural Gas

These fuel sources need to be considered in more detail. What will be
85 available in the Fairbanks area by 1986 and what are the cost benefits in relation to the $1.343 billion 1975 required for the two dam project.

6.04.2 Devil Canyon

This alternative should be more carefully examined. Even with a low firm energy capability it appears that this project would produce power during the season when it is most needed. The impacts from
86 this single dam project are minor as compared to the two dam project. Less transmission line construction would be required with this alternative combined with other projects. This project appears to have the highest recreation potential.

87 We recommend that the question of environmental impact versus cost benefit of development for a number of energy sources be explored.

Not enough discussion of the intertie and the secondary social-
economic impacts of the intertie, i.e. encouragement of strip 88
development all along the power line. Do we really need/want an
intertie in Alaska? How much energy is lost through transmission
lines?

Water for domestic/agricultural use will soon be in short supply. 89
How does this use of water fit in with long range water needs.

Under section 4.0 the impact of the material sites to construct
the dams has not been evaluated. Gravel, limestone for cement, and
earth for land fill if taken from sites not be to flooded will have
a major impact on the areas esthetics and important sightseeing use.
If local limestone is used to make the cement necessary for the 90
Devil's Canyon Dam, this will create scars on the landscape and
considerable air and noise pollution in an area critical to the
visitor to this Mt. McKinley region. Limestone sources near Cantwell
if utilized and processed there would create visual and air pollution
impacts to the Mt. McKinley National Park visitor, as well as the
residents of Cantwell. This impact must be evaluated and mitigated
in this EIS.

Sincerely,

Albert G. Henson
Project Leader

AGHenson: jkm

69-737 O - 81 - 40

RESPONSE TO COMMENTS BY
U.S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
ALASKA TASK FORCE

79 An entire section (2.04) is devoted to a discussion of energy needs. Figure 9 is a graph which illustrates a five-year record of energy consumption (1970-1974) plus projected load growth through the year 1999.

80 Recreation is not the purpose of the reservoirs. However, they will inevitably attract some visitation for recreational purposes. Recreational usage, as estimated in the EIS, is claimed as a project benefit, but its contribution to project justification is infinitesimal--being less than 0.2 of 1 percent of total project benefits.

81 The reservoirs, either directly or indirectly, afford more recreational opportunity in the Upper Susitna Basin than would otherwise exist, both as a result of the flatwater recreational opportunity afforded by the reservoirs, and access provided by the road system which will be necessary to construct and operate the project. Most of the reservoir recreational visitation will be associated with the Devil Canyon site. Watana will be much less attractive as a result of its drawdown. The loss of white water, itself, cannot be measured in terms of trade-offs to recreational uses afforded by the hydropower project. Recreational uses of the white water, on the other hand, can be directly related to post-project recreation. Present and future boating uses of Devil Canyon would not begin to compare to other forms of recreation uses in the Upper Susitna Basin (primarily hunting and fishing), with or without the project. The visitation estimate was provided by a private consultant who closely coordinated his procedures and methodology with the Bureau of Outdoor Recreation and the Alaska Division of Parks, and is included in the Recreation Assessment section, Appendix I, of the feasibility report.

82 The purpose of the hydropower project would be to provide projected energy load requirements to the Southcentral Railbelt area and particularly to the two large demand centers of Fairbanks and Anchorage. The esthetic impact of the transmission line will be carefully examined, and every effort made to minimize its visual impacts in determining the exact alinement of this facility. Consideration of underground cables has been made, and a discussion of this alternative has been added to the EIS.

83 Achievement of national energy goals was not the only criterion upon which the selection of the hydropower alternative was based. Neither were environmental impacts the sole basis for the rejection of the coal alternatives. Economic factors played a large role in these determinations.

84 The development of coal as a means of producing electrical power was the economic standard against which each of the hydroelectric plans was tested. That is, the power benefits used in computing the benefit-to-cost ratio represented the cost of producing the same amount of power by constructing and operating a generating system using coal as the fuel. For purposes of simplification and more direct comparability to each hydro system alternative evaluated, a single large coal-find complex located in the Healy area was utilized. The Healy Creek coal district has available reserves approximately equal to the energy production requirements of the 100-year period of analysis. Since this coal field has already been developed for this very purpose, it is a logical choice for comparison. Socioeconomic impact would develop each time a generating facility was constructed in the area, but the overall permanent jobs arising from operation would have a minimal effect on the overall economy of the area.

85 Oil or natural gas, from whatever source, is expected to be an expensive source of energy in the future. A major consideration in the hydropower proposal is the conservation of nonrenewable resources. The benefit/cost ratio of the proposed hydropower project would be comparable to near future oil and natural gas alternatives.

86 As stated, the project--by itself--has a low firm energy capability and, therefore, is not economically viable when compared with the economic standard of coal. That is, in order for the project to pay for itself, the wholesale mill rate would be greater than that of an alternative coal system. A fluctuating pool has less recreation potential than a steady reservoir as proposed in the selected plan for the Devil Canyon facility. This alternative is discussed in Section 6.04.02 of the EIS.

87 During the process of plan formulation, the objective of Environmental Quality was considered along with the objective of National Economic Development in the development and evaluation of alternative plans, as prescribed by the Water Resource Council's Principles and Standards. Thus, environmental impacts were weighed against the monetary benefits for each of the alternatives explored.

88 The discussion of the transmission systems has been expanded in the EIS. Since essentially all of the corridor system traverses either public lands or lands which may be assigned to the Natives, there should be no significant potential for uncontrolled "strip" development. An intertie is essential if the proposed hydroelectric project is constructed. It also has other advantages related to reliability of energy supply to the State's two largest load centers. Average energy loss through the transmission lines will be 0.7 percent of the total energy transmitted, but the 6.1 billion kilowatt-hours of firm annual energy is the net energy available at the delivery points near Anchorage and Fairbanks.

89 Should the proposed plan be implemented, the summer flows of the Susitna River will be regulated, and water in excess of summer power needs

will be stored for release during the fall and winter months. There would not appear to be any future water supply shortages for domestic/agricultural use in the Lower Susitna River Basin, and the proposed dams only temporarily store the water for hydroelectric power generation.

90 Restoration of material borrow areas outside the reservoir pools will be conducted to blend the sites into the surrounding area as much as possible to minimize the esthetic impact. In compiling the construction costs for all alternatives, the utilization of cement manufactured outside of Alaska was used. If local areas are developed as limestone sources, appropriate measures will be taken to minimize the adverse impacts of such action.

United States Department of the Interior

NATIONAL PARK SERVICE

Pacific Northwest Region
Fourth and Pike Building
Seattle, Washington 98101

L7619
(PNR)CAE

October 22, 1975

Colonel Charles A. Debelius
District Engineer
Alaska District, Corps of Engineers
P.O. Box 7002
Anchorage, Alaska 99510

Dear Colonel Debelius:

We have reviewed the draft environmental impact statement for Hydroelectric Development, Upper Susitna River Basin, Southcentral Railbelt Area, Alaska, and have the following comments.

We are quite concerned about the possibility of an above-ground,
high-voltage power line paralleling the eastern boundary of Mount
McKinley National Park. The statement does not give specific
information on routing, tower design, or vegetational and scenic
impacts, so it is difficult to determine the extent of impacts on the 91
Park and its visitors. We request that contact with our office in
Anchorage be maintained regarding the progress of this project and
that we be informed of decisions regarding the Cantwell to Healy
transmission corridor.

We feel that the alternatives for power transmission corridors on
page 89 are inadequate. Firstly, underground systems are not
considered--especially in the Cantwell to Healy section. Certainly
the cost for underground lines would be more, but the statement
should weigh economic considerations against the other impacts 92
involved. Impact on scenic values near Mount McKinley National Park
and in the Nenana Canyon will be substantial, and thus we feel that
undergrounding must be seriously considered.

The second reason we consider the alternatives for power transmission
corridors inadequate is that there is no analysis of impacts.
Figure 15 graphically presents the alternatives. The text then states
that the proposal was selected on the basis of cost, reliability, and 93
potential environmental impact, but none of the needed information is
presented. An environmental statement should present enough information for the reader to understand why the proposal was selected over
the alternatives.

94 The National Register Criteria (36 CFR 800) should be applied to the cabin which was identified by the Alaska Division of Parks and would be inundated by the Watana reservoir. These procedures were printed in the Federal Register of February 4, 1975, and should be consulted.

Sincerely yours,

Edward J. Kurtz
Acting Regional Director

RESPONSE TO COMMENTS OF
THE NATIONAL PARK SERVICE
PACIFIC NORTHWEST REGION

91 A map has been added to the EIS which more clearly indicates the location of the transmission line corridor. The exact alignment within this corridor, and tower design, have not yet been determined, but esthetic impacts will be a primary consideration in powerline location and tower design. In any event the transmission line will be located on the east side of the George A. Parks highway and the Alaska Railroad through the Broad Pass--Mount McKinley National Park area, and every effort will be made to either entirely conceal the line or minimize its visual obtrusiveness. The National Park Service will be kept fully informed of decisions regarding the Cantwell to Healy segment of the transmission line corridor.

92 The EIS has been expanded to include a discussion of underground cables as an alternate made of transmitting electricity. Economic considerations will not be the basis for selecting overhead trans mission lines in lieu of underground cables. Other factors which will be considered include environmental impacts, technical problems, maintenance, and reliability.

93 The EIS has been expanded to include a discussion of the relative impacts of the alternate transmission line corridors.

94 As stated in the EIS, the current National Register of Historical Places was consulted, and revealed no National Register properties which would be affected by the project. National Register criteria (36 CFR 800) will be applied not only to the cabin identified in the preliminary reconnaissance study made by the Alaska Division of Parks under contract to the Corps, but to the entire area affected by the project. This includes thorough archaeological and historical surveys along all access road routes, transmission line corridor, and the dam and reservoir sites.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF OUTDOOR RECREATION
NORTHWEST REGION
~~1000 SECOND AVENUE~~ 915 SECOND AVENUE, RM. 990
~~SEATTLE, WASHINGTON 98104~~ SEATTLE, WASHINGTON 93174

IN REPLY REFER TO:
E3027

Colonel Charles A. Debelius
District Engineer
Alaska District, Corps of Engineers
P.O. Box 7002
Anchorage, Alaska 99510

NOV 1 1975

Dear Colonel Debelius:

The Draft Environmental Statement, "Hydroelectric Power Development, Upper Susitna River Basin, Southcentral Railbelt Area, Alaska," has been received in this office for review and comment. The following comments are provided for your consideration.

We recognize that environmental studies are not complete; nonetheless, we would like to mention two subjects which we feel should be covered in more detail.

95 The whole subject of roads to the hydroelectric developments, to the recreation facilities, and to and along the transmission corridor has not been adequately addressed. Locations and impacts of roads whether permanent or only for the construction period need to be discussed in greater detail.

96 The intrusion of man as construction worker and later as recreationist may have significant impacts on the ecology of this area. The effect of man and his machines and the impacts associated should be discussed in greater detail also.

97 It should be noted that this is the view of our office and does not necessarily represent the official view of the Secretary of the Interior.

We appreciate the opportunity to comment and hope our comments will assist in the preparation of the final statement.

Sincerely yours,

Maurice H. Lundy
Regional Director
by Richard L. Winters

RESPONSE TO COMMENTS BY
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF OUTDOOR RECREATION

95 Specific location of roads, both permanent and temporary, has not been determined at this stage of planning for the proposed projects. Detailed planning and design for this transportation network will be accomplished in the post-authorization stage. A proposed road corridor has been identified for the approximate 64-mile road to the Watana damsite (Figure 4). Location, design, construction, rehabilitation, and maintenance of the project road system will be given prime consideration with the utilization of good landscape management practices. When the specific road system has been developed, this system and its related impacts will be discussed in future supplements to the statement.

96 The opening up of the Susitna Basin to man and his machines is considered one of the major adverse impacts of the proposed projects. This action will increase the need for institutional regulations in an area that presently has few to control activities that would be magnified because of easy access. This, in turn, will have both social and economic impacts in that man may not be able to do things in the future that he was used to doing in the past, and would cost more because of the need to enforce the regulation to protect the environment.

97 Noted.

U. S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
Room 412 Mohawk Building
222 S.W. Morrison Street
Portland, Oregon 97204

November 24, 1975

IN REPLY REFER TO
10ED.3

Colonel Charles A. Debelius
District Engineer
Alaska District, Corps of Engineers
P. O. Box 7002
Anchorage, Alaska 99510

Re: Draft Environmental Impact Statement
Hydroelectric Power Development
Upper Susitna River Basin
Southcentral Railbelt Area, Alaska

Dear Colonel Debelius:

We have the following comments on the above DEIS which you may wish to consider:

98 1. The report depicts that the general choice of the routes to place the transmission lines is within the existing highway corridor from Summit to Healy. At present, there is nothing to mar the pristine beauty of the valley except for the railroad on one side and the highway on the other. The Nenana River meanders through a pass in the Alaska range. The beauty is stunning viewed from both the railroad and the highway. To add a transmission line through this corridor would certainly destroy the unusual natural beauty. The Broad Pass area south of Cantwell is without trees and transmission lines would be difficult to hide.

99 2. We have noted there is no mention of the recent archeological find near Carlo Creek. You may wish to include this in your discussions on page 93.

100 3. A discussion of impacts to the existing highway system that may occur as a result of this project is needed. This should include the potential need for reconstruction or added maintenance costs resulting from transporting necessary construction materials. Also, any hazards to traffic that may occur during construction should be discussed.

We appreciate the opportunity to comment on this draft EIS.

Sincerely yours,

Richard C. Cowdery, Director
Office of Environment and Design

RESPONSE TO COMMENTS BY
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

98 Comment noted.

99 The recent archeological find near Carlo Creek was excavated in a road cut on the Parks Highway near Mt. McKinley National Park. The remains of both fossils and artifacts were found in this buried site. Thorough archeological reconnaissance will be made of the entire transmission line corridor prior to establishing the exact alinement of the transmission line. It is expected that most sites can be avioded by judicious alinement. If and where this should be impossible, appropriate salvage or other mitigative measures will be taken.

100 The total impact of this project on the existing highway system has not yet been evaluated. the impact would include additional vehicle travel due to the project construction phase. Only a moderate increase in vehicle traffic over normal highway travel due to the use of project facilities is expected after project construction. Studies required to evaluate the potential need for reconstruction or added maintenance costs will be made during the detailed planning phase. No such needs have been identified during the feasibility stage of planning. Impacts on the highway system, overall, should be minor.

Form DOT F 1320.1 (1-67)

UNITED STATES GOVERNMENT

DEPARTMENT OF TRANSPORTATION

OFFICE OF THE SECRETARY

Memorandum

DATE: November 11, 1975

SUBJECT: Hydroelectric Power Development, Upper Susitna River Basin, Southcentral Railbelt Area, Alaska

In reply refer to:

FROM : Secretarial Representative, Region 10

TO : District Engineer
Corps of Engineers
Anchorage, Alaska

Attached is the only comment received from DOT agencies on the subject EIS.

for DON SAMUELSON
Regional Representative of the
Department of Transportation, Region 10

Attachment

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS:
COMMANDER (dpl)
17TH COAST GUARD DISTRICT
FPO SEATTLE 98771

1 October 1975

From: Commander, Seventeenth Coast Guard District
To: Secretarial Representative, Region 10, Seattle, WA.
Attn: CAPT R. T. BROWER

Subj: Review of EIS for Hydroelectric Power Development, Upper Susitna River Basin, Southcentral Railbelt Area, Alaska; comment concerning

1. Subject EIS has been reviewed and the only significant Coast Guard impact would be the increase in recreational boating activity on the newly created lakes behind the dams. No other areas of Coast Guard interest were revealed. 101

A. D. GRANTHAM
By direction

RESPONSE TO COMMENTS BY
U.S. DEPARTMENT OF TRANSPORTATION
COAST GUARD

101 Comment noted.

DEPARTMENT OF THE ARMY
U.S. ARMY COLD REGIONS RESEARCH AND ENGINEERING LABORATORY
HANOVER, NEW HAMPSHIRE 03755

CRREL-RE 12 November 1975

SUBJECT: Review Draft Susitna Impact Statement

District Engineer
U.S. Army Engineer District, ALASKA
P.O. Box 7002
Anchorage, AK 99510

1. USACRREL staffs both in Fairbanks and Hanover have reviewed the Draft Environmental Impact Statement, "Hydroelectric Power Development, Upper Susitna River Basin, Southcentral Railbelt Area, Alaska." We find the report a comprehensive assessment of the proposed project and one which deals realistically with the adverse environmental effects.

2. Our comments are more specifically directed at questions requiring further investigation and which should be kept in mind as the project develops. These are briefly stated:

a. The influences and constraints of permafrost at the dam sites for design purposes and in the reservoirs, particularly as related to erosion along shorelines. The need for proper assessment of permafrost conditions and how the impoundment will modify ground temperatures is apparent.

b. The influence of a fluctuating river level below Devil Canyon on winter ice formation. Ice production is likely to increase as a result of the fluctuating water levels (breaking up of the ice cover due to peak power releases). This may cause down river ice problems due to natural or man-made obstructions.

c. The production of frazil ice in the white water section of Devil Canyon and earlier ice formation in the reservoir. These may result in restricted flow conditions and greater ice formation in the impoundment.

d. The change in reservoir and down river water qualities particularly under winter, ice-covered conditions. The question of modified sediment load and its significance to both fish productivity and flood plain ecology requires additional investigation.

102 e. Modification in flood plain and reservoir shoreline vegetation as a source of high quality forage for moose and waterfowl and methods to reduce adverse visual impacts. The question of large, seasonal fluctuation in the Watana impoundment and how to stabilize the shoreline for wildlife and recreational use and erosion control requires further investigation.

f. Site investigations related to transmission line corridors. These are required to resolve questions of large mammal impacts and optimal restoration techniques for erosion control and visual impacts.

103 3. We also note an apparent discrepancy in the calculation of the annual production of 3.0 billion KWH for the Devil Canyon (180MW/4400 cfs/Francis unit is given on p. 3; on p. 45, Table I, average regulated flow is approximately 4200cfs/month; 9200cfs/4400cfs/180MV ≈ 376MW per month or 4.5 billion KWH per year). Is this a real difference or due to assumptions made in arriving at the 3.0 billion figure?

4. I look forward to receiving copies of the final statement and in providing the District with continued input from our staff.

ROBERT L. CROSBY
Colonel, CE
Commander and Director

RESPONSE TO COMMENTS BY
DEPARTMENT OF THE ARMY
CRREL

102 The Corps generally concurs with the needs for further investigations as itemized under paragraph 2 of the CRREL letter. All necessary additional engineering and biological studies will be conducted during the pre-construction stage of planning.

103 The 4,400 cfs relates to the maximum discharge per each 180 mw (name plate) unit, and in no way enters into the energy potential of the river. The actual dependable capacity of each unit is roughly 171 mw based on the firm annual energy and a 50 percent plant factor. It must be realized that only under peak load requirements or heavy reservoir inflow would all 4 turbines be operated simultaneously. For example, if all 4 turbines were operated at full overload capacity for an entire year (4 X 180 mw X 1.15 = 828 mw), the energy produced would be 7.25 billion kilowatt hours of energy. By applying the Devil Canyon maximum head to the basic power equation, the resulting average monthly streamflow required to produce the hypothetical 7.25 BKwh energy would be in excess of twice the average monthly streamflow of 9,200 cfs.

Subsequent estimates of dependable capacity based on average annual evergy have resulted in a re-sizing of the Devil Canyon units to 194 mw, each with a maximum hydraulic capacity of roughly 6,200 cfs.

69-737 O - 81 - 41

U.S. ENVIRONMENTAL PROTECTION AGENCY

REGION X

1200 SIXTH AVENUE

SEATTLE, WASHINGTON 98101

REPLY TO ATTN OF: 10FA - M/S 623 November 13, 1975

Colonel Charles A. Debelius
Department of the Army
Alaska District, Corps of Engineers
P. O. Box 7002
Anchorage, Alaska 99510

Dear Colonel Debelius:

We have completed review of your draft environmental impact statement, "Hydroelectric Power Development, Susitna River Basin" and submit the following comments.

The increased river turbidity during the winter months caused
by releases from the reservoir is of particular concern. The
statement, on page 46, says "preliminary studies by the Corps of
Engineers indicate that the suspended sediment would be at low levels
(15-35 ppm)." These levels of suspended sediment are sufficiently
high to warn of potential violations of water quality standards.
104 These Joint Federal-State Water Quality Standards (18AAL·70.020)
limit suspended solids by prohibiting deposits which adversely affect
fish and other aquatic life reproduction and habitat. The standards
limit turbidity to less than 5 Jackson Turbidity Units (JTU) above
background.

We recognize the high natural suspended solids load carried by the Susitna River. During the winter, however, the Susitna contains relatively clear water. The absolute value of the solids level is not as important as the change in timing of the higher solids level from summer to winter. The magnitude of this change and potential standards violations should be discussed in the final impact statement.

Another concern would be possible altered temperatures due to releases from the reservoir. According to the statement, by using multiple level discharge outlets, the temperature of the released water could be made to approximate natural conditions. We are interested in the operational details of this procedure. How will natural temperatures be established once the project is in operation? 105

The discussion of supply and demand of electric power on pages 40 and 64 implies no large excess of power not needed by the projected population increase. That is, no large amounts of power would be available to promote large scale industrial projects with their secondary environmental effects. A more quantitative discussion is
needed to show the approximate equivalence of future demand and supply 106
of energy.

Under "Sedimentation" on page 62 mention is made of deposits of heavier sediments in the upper reaches of the Watana reservoir. Would the higher drawdown at Watana combined with gradual bottom slope and
sediment accumulation form large mud areas devoid of vegetation? 107
Would these areas tend to increase as the age of the project increased? These questions and possible remedies need to be addressed.

Additional environmental studies are promised when congressional authorization for the project is obtained. Because of the present insufficiency of information in some areas, the statement is not adequate for review purposes at this time. Consequently, we are classifying our comments on this project as ER-2 (Environmental Reservations-Insufficient Information). The ER rating is based on the potential
violation of Water Quality Standards. This issue must be addressed 108
in the final statmeent. The Insufficient Information rating is based on the anticipated future studies. This classification of the Environmental Protection Agency's comments will be published in the Federal Register in accordance with our responsibility to inform the public of our views on proposed Federal actions.

Our rating of the project relates solely to its water quality aspects and does not indicate either our opposition or support. The Environmental Protection Agency's responsibility is to make certain that adverse impacts within our area of expertise are clearly documented.

Thank you for the opportunity to comment on this draft environmental impact statement. If you have any questions concerning our comments or categorization procedures, please let us know.

Sincerely yours,

Walter D Jaspers

Walter D. Jaspers
Director
Office of Federal Affairs

RESPONSE TO COMMENTS BY
U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION X

104 Due to the sediment retention characteristics of the reservoirs, suspended sediments downstream from the Devil Canyon Dam would be significantly reduced overall. This reduction would be most apparent during the summer months when glacial melt results in extremely high sediment loads. This presently occurs during the salmon spawning period, when siltation and turbidity are likely the most critical to aquatic life reproduction and habitat. The EPA estimated increase in turbidity during the winter months may be high. These estimates of 15 to 35 ppm in the releases at Devil Canyon Dam are based on measured suspended sediment concentrations below glacial-fed natural lakes in Alaska, including rivers flowing from Skilak, Tustumena, Eklutna, and Long Lakes. The proposed projects will have multiple-level discharge outlets which will permit selective withdrawal of outflows from a range of reservoir elevations. As stated in Section 4.01 of the EIS, sediment samples taken by the Alaska Department of Fish and Game during the winter of 1974-75 in the Susitna River between Gold Creek and Talkeetna indicated a range of 4 to 228 ppm.

105 One of the major reasons, along with control of oxygen content, for incorporation of multiple-level discharge outlets into the dam structures is to provide for temperature regulation of water released from the reservoirs. Since there will be thermal stratification in these deep pools throughout the year, water can be released from various heights, or combination of heights above the "dead" storage space, to provide a mix of waters approaching natural streamflow temperatures.

106 See response number 255.

107 The answer to both questions is "yes." These are phenomena characteristic of any reservoir receiving heavy sediment loads and having significant periodic drawdown. Mudflats would become most extensive in areas immediately above the low-water pool. As the water level falls from the high pool elevation, much of the sediment accumulated within the inundated streambed would be flushed down into the reservoir. Lands immediately above the low pool elevation would become inundated too early in the spring for plant growth to establish. However, the higher elevations within the drawdown area would probably develop a growth of annual grasses and forbs prior to being inundated late in the summer or early fall.

108 Comments noted.

FEDERAL POWER COMMISSION
REGIONAL OFFICE
555 BATTERY STREET, ROOM 415
SAN FRANCISCO, CALIF. 94111

December 4, 1975

Colonel Charles A. Debelius
District Engineer
Alaska District, Corps of Engineers
P. O. Box 7002
Anchorage, Alaska 99510

Dear Colonel Debelius:

We have reviewed your Draft Environmental Impact Statement on the Hydroelectric Development Upper Susitna River Basin, Southcentral Railbelt Area, Alaska, dated September 1975.

These comments of the San Francisco Regional Office of the Federal Power Commission's Bureau of Power are made in accordance with the National Environmental Policy Act of 1969, and the August 1, 1973, Guidelines of the Council on Environmental Quality.

Our comments are primarily directed toward the need for power that would be produced by the Upper Susitna Development, the alternative power sources, and the fuel situations relative to non-hydroelectric power alternatives.

The recommended plan is to construct dams and power plants at the Watana and Devil Canyon sites and electric transmission facilities to the Railbelt load centers. The proposed plan for the Watana site would include the construction of an 810-foot high earthfill dam and power plant which would contain three Francis turbines with a nameplate capacity of 250 MW each. The firm annual generation would be 3.1 billion kWh. Development of the Devil Canyon site would include a 635-foot high thin-arch dam and power plant with four Francis turbines, each rated at 180 MW. The firm annual generation would be 3.0 billion kWh with regulated streamflow from Watana storage. The electrical power generated would be transmitted to the Fairbanks - Tanana Valley and the Anchorage - Kenai peninsula areas. The recommended development is shown to be economically feasible.

(1) The Need for Power

We agree with and endorse the subject report's assertion in Section 2.04 that substantial amounts of new generating capacity will be needed to meet future power requirements of the Southcentral Railbelt area. Recent studies of the Southcentral and Yukon region (which includes the Southcentral Railbelt as its main component), as defined in the 1974 Alaska Power Survey Report of the Executive Advisory Committee, indicate that rapid rates of increase in power requirements will continue at least for the balance of the 1970's, reflecting economic activity associated with North Slope oil development and expansion of commercial and public services. Estimates beyond 1980 reflect a range of assumptions as to the extent of future resources use and industrial and population growth. All indications are that accelerated growth will continue through the year 2000, with economic activity generated by North Slope oil and natural gas development being a major factor - but only one of several important factors. It is generally considered that the Southcentral-Yukon regional population will continue to grow at a faster rate than the national and state averages, that future additional energy systems and other potential mineral developments will have a major effect, and that there will be notable expansion in transportation systems. Significant economic advances for all of Alaska and especially for the Alaska Native people should be anticipated as a result of the Alaska Native Claims Settlement Act. Other influencing factors could be cited, but the general outlook is for further rapid expansion of energy and power requirements in the Southcentral-Yukon area.

A range of estimates for future power requirements of the Southcentral and Yukon regions is presented in the 1974 Report of the Alaska Power Survey Technical Advisory Committee on Economic Analysis and Load Projections. The range of estimates attempts to balance a myriad of controlling factors including costs, conservation technologies, available energy sources, types of Alaskan development, et cetera. The higher growth range anticipates significant new energy and mineral developments from among those that appear more promising. The lower growth range generally assumes an unqualified slackening of the pace of development following completion of the Alyeska pipeline and, in our opinion, is not considered realistic. The mid-range growth rate appears to be a reasonable estimate which we adopt as most representative based on recent manifestations and our assessment of future conditions. It should be noted that there are several responsible advisory committee members who feel that recent acceleration of mineral raw material shortages of all kinds indicates a possibility that even the high range estimates could be exceeded. Table 1, which is a condensed extract of information contained in the aforementioned advisory committee report, summarizes load estimates for the Southcentral and Yukon Regions. Indicated load increments by decade are as follows:

Increments of Southcentral-Yukon Power Requirements

	1972-1980		1980-1990		1990-2000		1972-2000	
	Peak Demand MW	Annual Energy GWh	Peak Demand MW	Annual Energy GWh	Peak Demand MW	Annual Energy GWh	Peak Demand MW	Annual Energy GWh
Higher Estimate	888	4 623	4 460	28 110	2 800	13 070	8 148	45 803
Mid-Range	638	3 093	930	4 570	1 950	10 240	3 518	17 903

According to the subject report, a total of 6100 GWh of firm annual energy would be produced by the combined Devil Canyon-Watana system which would have a nameplate capacity of 1470 MW. Although the report does not indicate proposed commercial operation dates, based on information in our files the project would be staged and the initial Devil Canyon installation (3000 GWh and 720 MW) could become operable in 1985 and the ultimate installation in 1990. Under this timetable it is apparent that there is a need for power in the Southcentral-Yukon Region by 1985 and 1990 in the order of magnitude of at least as much as the proposed subject development. Therefore, operation of the proposed project would help meet the power needs of the Southcentral Railbelt area by 1985 and beyond.

(2) Alternative Power Sources and Fuel Situation

Our recent estimate of power values for the Devil Canyon-Watana project indicates that the most economical alternative to the project's output would be power from a combined cycle generating plant using natural gas as an operating fuel. We acknowledge the subject report's premise that there are many questions concerning future availability and costs of natural gas and oil for power production. It is the policy of this Commission to discourage use of natural gas as an operating fuel for power generation in the contiguous United States. Due to changes in requirements, other Federal and/or State agencies may impose restrictions on the future usage of natural gas and oil for electric power production throughout Alaska. Recognizing the undertainty of the future availability of natural gas and oil after 1985 for new generating capacity, the possibility of its restrictive use if available, and its sensitivity to worldwide pressures, coal may be the most likely alternative fuel for thermal-electric plants to be constructed in the mid-1980's and beyond. Essentially, we agree with the discussion of alternative sources of power in paragraphs 6.02.1 - 6.02.10 of the subject report.

(3) <u>Other Alternatives to the Proposed Action</u>

The Corps' DEIS discusses several potential alternative hydroelectric developments within the Southcentral Railbelt Area. All of these alternatives either have a greater adverse environmental impact than the proposed plan, or are not considered feasible at the present time.

Very truly yours,

109 George R. Bell (Deputy)

M. FRANK THOMAS
(Acting) Regional Engineer

Attachment
(Table 1)

TABLE 1

Total Power Requirements

Southcentral and Yukon Regions [1/]

Region	Actual Requirements 1972 Peak Demand MW	Actual Requirements 1972 Annual Energy GWh	Estimated Future Requirements 1980 Peak Demand MW	1980 Annual Energy GWh	1990 Peak Demand MW	1990 Annual Energy GWh	2000 Peak Demand MW	2000 Annual Energy GWh
			Higher Rate of Growth					
Southcentral	317	1 465	990	5 020	5 020	30 760	7 190	40 810
Yukon (Interior)	115	542	330	1 610	760	3 980	1 390	7 000
Total	432	2 007	1 320	6 630	5 780	34 740	8 580	47 810
			Likely Mid-Range Growth Rate					
Southcentral			790	3 790	1 530	7 400	3 040	15 300
Yukon (Interior)			280	1 310	470	2 270	910	4 610
Total			1 070	5 100	2 000	9 670	3 950	19 910

1/ As defined in the 1974 Alaska Power Survey

RESPONSE TO COMMENTS BY FEDERAL POWER COMMISSION REGIONAL OFFICE

169 Statements and comments from the Federal Power Commission are noted, including the general agreement on power needs and alternatives.

STATE COMMENTS AND RESPONSES

STATE OF ALASKA

JAY S. HAMMOND, GOVERNOR

OFFICE OF THE GOVERNOR

STATE POLICY DEVELOPMENT AND PLANNING

POUCH AD — JUNEAU 99811
PHONE 465-3512

November 10, 1975

Colonel Charles A. Debelius
Corps of Engineers
District Engineers
Department of the Army
Alaska District
P.O. Box 7002
Anchorage, Alaska 99510

Subject: Southcentral Railbelt Hydroelectric Project
State I.D. No. 75091103

Dear Colonel Debelius:

The Alaska State Clearinghouse has completed review on the subject project.

The following agencies were invited to review and comment:

State of Alaska

- Department of Community & Regional Affairs
- Office of Planning & Research (H&SS)
- Department of Environmental Conservation
- Department of Fish & Game
  - Anchorage
  - Fairbanks
- Department of Highways
- Department of Law
- Department of Natural Resources
  - Division of Lands
  - Division of Parks
- Department of Public Works
- Department of Commerce & Economic Development
- Alaska Energy Office
  - Division of Policy Development

Five of the above agencies responded and their comments are attached.

110 The State does not object to this project at this time, however, our final position cannot be determined until a more comprehensive review of this project has been completed by the State.

It is obvious from the responses received in this office that a great
deal of additional studies will have to be done before the real impact
can be determined. The Governor has created a multi-agency State Task
Force to conduct a thorough assessment of the Susitna River hydroelectric
power development proposals. This group will make recommendations to 111
the Governor on a number of critical aspects of the proposal, including
an analysis of demand projections, alternate energy sources, growth
impacts, and environmental effects. The Corps should consider this Task
Force as its basic contact with the State on this project.

The Clearinghouse finds this project to be consistent with State long-range planning goals and objectives. Therefore, this letter will satisfy the review requirements of the Office of Management and Budget Circular A-95.

Sincerely,

Raymond W. Estess
State-Federal Coordinator

Attachment

cc: Commissioner Langhorne Motley

RESPONSE TO COMMENTS OF
STATE OF ALASKA
STATE COVER LETTER

110 Subsequent to receipt of the Alaska State Clearing House letter of 10 November 1975, the Corps met with the Governor's multi-agency State Task Force on 12 December 1975. This group was established to conduct a thorough assessment of the Susitna River hydroelectric power development proposal, and to make recommendations to the Governor on a number of critical aspects of the project. The purpose of this initial meeting, which was considered very fruitful by Task Force members, was to provide a more comprehensive review of the project. Subsequent coordination will be conducted with the Task Force to provide them with additional information on which to base their recommendations.

111 Detailed studies will be conducted in the future to evaluate, in depth, the impact of the project before recommending funding of construction should the additional studies indicate the project is still viable.

MEMORANDUM

State of Alaska

TO: Raymond W. Estess
State-Federal Coordinator
Division of Policy Development
and Planning
Office of the Governor

DATE: November 3, 1975

FILE NO:

TELEPHONE NO:

FROM: Ernst W. Mueller
Commissioner
Department of Environmental Conservation

SUBJECT: Draft EIS--Hydroelectric Power Development, Upper Susitna River

The Department of Environmental Conservation is aware that the proposed activity is a legislative action. However, if the Congress does authorize the construction of this project as the Corps of Engineers is requesting, the Corps must initiate detailed studies culminating in the formulation of a comprehensive environmental impact statement on the proposed hydroelectric power project. Rather than simply commenting on the draft EIS, it is essential that this Department and other interested State and Federal agencies participate in all stages of the planning, research, and construction review phases of this activity. 112

To implement this proposal, the Department of Environmental Conservation proposes that a joint Federal-State task force be formed and meet on a regular basis to review, comment, and advise the Corps on the environmental implications of each phase of the proposed hydroelectric power project in the Upper Susitna Basin. Members of this task force should include representatives from the Governor's Energy Office, the Department of Environmental Conservation, the Department of Fish and Game, the Department of Natural Resources, the United States Fish and Wildlife Service, the National Marine Fisheries Service, the Bureau of Land Management, and the Alaska Power Administration. 113

By utilizing such an interdisciplinary planning team, the environmental, social, economic, and engineering aspects of this project can be fully analyzed and researched, and appropriate mitigating measures taken. 114

The following are our comments on the draft EIS:

The figure of 35% salmon fry mortality in turbines (p. 51, EIS) should be footnoted and referenced as there are a large number of variables that may affect this figure. In addition to fish mortality in turbines, there are several other project-associated conditions listed which, if considered collectively, might represent potential for significant impact to resident and anadromous fish. They are as follows:

a. The unspecified effects of cooler summer and winter water temperatures on anadromous and resident fish (p. 67 of the Feasibility Study).

b. The effects on migrating fish caused by the reduction of natural river flows during late June and early July (p. 69).

c. Effects of the spilling of water over Devil's Canyon Dam (pp. 66-67).

115 d. The possibility that reduction in flow, turbidity, and temperature below Devil's Canyon Dam might cause disorientation of migrating salmon during an "initial period" during and after construction (p. 70).

e. The feasibility of passing migrating fish over and through the high dams (p. 72).

116 On page 75 of the Feasibility Study, there is the possibility, however small, that transmission lines might impede migrating big game through its inherent characteristics, such as constant noise (line hum) and "smell" (ozone). Any in-depth studies of impacts resulting from this project's transmission line routings, including alternate routes, should be referenced. In addition to direct impacts such as on scenic-visual quality and archeological sites, such studies should deal with indirect impacts such as new residences, for example, the new capital site and industries that otherwise could not locate in the region without the available power.

117 The figure cited for frequency of spilling excess water at the Devil's Canyon Dam on page 46 (once every 10 years, three-day duration) can also be contested. The magnitude of the nitrogen super-saturated water problem on the Columbia River suggests that resident and anadromous fishes could be adversely affected on a much more frequent basis. The reduced flow velocity downstream from the dam will more than likely allow passage of fish upstream into previously inaccessible areas adjacent to the dam, subjecting them to the problems cited above. Precautions taken to mitigate these problems are not stated and one has to assume that few, if any, measures will be taken in dam construction to accommodate these concerns.

118 In reference to page 58, EIS, the climax or near climax vegetation, in this case predominately white spruce, is also preferred nesting for a number of important avian species.

119 One major potential adverse impact not mentioned (p. 67, EIS) is failure of the dam structure. With regard to this, more detail is needed on the high potential in the region for severe seismic activity. What, in addition to seismic shocks, are the chances for landslides generating surges of displaced water, fault displacement, and other responses to seismic activity exceeding structural limits? The effect of inundated areas of seismic activity is only now being understood, and must be fully addressed in the EIS.

Attention should also be given to any landslide potential resulting from inundation and subsequent saturation and/or erosion of slopes. This is particularly true where permafrost exists. Little is known and less is understood about the behavior of permafrost around and under an inundated area, but one certainty is that it will thaw under water and where exposed at shoreline. This could lead to mass wasting on even moderate slopes, creating an unstable condition that could then migrate uphill. A detailed treatise on the behavior of permafrost is strongly recommended for this project. The threat of massive erosion resulting from liquification of permafrost constitutes a priority impact consideration. 120

What volume of sediment annually do the ppm load figures represent, i.e., what is the basis for projecting a "500 year" project life? (p. 91.) 121

One failing of the environmental impact statement is a more detailed analysis of Alternative Hydrologic Basins in the Southcentral Railbelt Area (6.03) and Alternative Power Transmission Corridors (6.05). While the case for the Upper Susitna River site is convincingly and completely presented and acknowledging that the DEIS is written specifically for this site, the alternative areas are not developed in sufficient detail. Phrases like "tremendous financial investments" and "substantial environmental impacts" (p. 78) are used to justify rejection of specific alternatives. These comments are highly subjective and should not be substituted for factual data. 122

It is also a point of conjecture that alternative exotic energy sources, particularly geothermal, should be categorically dismissed as being economically and technologically impractical in this region. This is not necessarily so and may represent a serious underestimation of their long-term potential. For example, hydrogeneration from non-constant energy sources is showing much promise. Also, tidal power was understated as there is potential for using Cook Inlet's large tide range in an environmentally acceptable manner. 123

The use of different scales for the map series Figures 4-8 makes easy comparison of competing land use values difficult. This is especially true where the major landmarks (e.g., Susitna River and tributaries) are not included on the map. For example, compare Figures 4 and 7. The Upper Susitna River, Watana, Devil's Canyon Damsites, and proposed transmission corridors should be highlighted on the habitat map so that the impacted area can be easily seen. It would also be helpful to incorporate more detailed information on wildlife distribution and seasonal movements in the final environmental statement than that provided by the map series of the Joint Federal-State Land Use Planning Commission. One major source in this regard could be the Alaska Department of Fish and Game's Alaska Wildlife and Habitat Atlas. This information base could be further expanded through informal discussions with wildlife biologists of the State and the U. S. Fish and Wildlife Service. 124

One point that has not been adequately addressed in the DEIS is the following question: Will the proposed hydroelectric power development act as a catalyst for unwanted growth in Southcentral Alaska? The literature is replete with cases which clearly indicate that highways and sewer and water systems can induce unwanted growth. Does the same rationale hold true for the proposed hydroelectric facility in the Upper Susitna Basin? These questions have been only weakly addressed on pages 63 and 64 of the DEIS. 125

69-737 0 - 81 - 42

RESPONSE TO COMMENTS BY
STATE OF ALASKA
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

112 Concur.

113 Concur. We suggest that local government entities also participate.

114 Comment noted.

115 The 35 percent mortality rate on fish, such as young salmon, is a figure based on Corps of Engineers experience at other high dams.

a. This will be a factor. Alteration of temperature regime will certainly influence salmon egg development, and possibly outmigration time. As stated in Section 4.01 of the EIS, the use of multi-level discharge outlets at the dams would allow for some adjustment in temperature to approach the natural river temperatures.

b. The EIS acknowledges in Section 4.02 the possible impact on migratory salmon.

c. Supersaturation of gases requires more than spill. Temperature, distance, and volume are also factors. This impact is discussed in the EIS and will be the subject of detailed design studies.

d. Same as b.

e. Based on extensive studies on the Columbia River and in British Columbia, cost, engineering, and biological considerations cumulatively make fish passage over high dams infeasible.

116 Concur. These considerations will be studied and evaluated in detail prior to any recommendation for project construction.

117 A change in design of outlet and generating facilities at the dam has revised the spill frequency at Devil Canyon as shown in the EIS. Salmon are not likely to attempt to migrate to the dam, even if passage is possible (which appears unlikely)since the last tributary in which they are able to spawn is Portage Creek--several miles below the dam. Contrary to the stated assumption, features will be incorporated into the dam outlet works to minimize nitrogen supersaturation.

118 Comment noted.

119 Dam design will incorporate features to withstand earthquakes of

An extreme magnitude of 8.5 with an epicenter of 40 miles which is greater than the maximum credible earthquake that could be expected to affect these damsites. No dams designed by the Corps of Engineers have ever failed, and the Corps has a record of being very conservative in designing safety features into dams.

120 For a discussion of landslide potential resulting from thawing of permafrost, see response Number 173.

121 Additional sediment information can be found in Appendix I of the feasibility report. Project costs and benefits are based on a standard 100-year period for this type of project. Actual useful life of the project would be substantially more than 100 years, and, based on sedimentation studies alone, the project would have a useful life in excess of 500 years.

122 The alternative hydrologic basins and power transmission corridors were studied in sufficient depth to determine their economic, social, environmental, and engineering feasibility. All alternatives rejected for further consideration failed to meet standards of acceptability under one or more of these criteria. A more thorough analysis of each of these alternatives is displayed in the Feasibility Report and its technical appendices. Phrases such as "tremendous financial investments" and "substantial environmental impacts" are supported by the results of previous studies on many of the alternative damsites. Reports of these studies are available in the District office. These terms are not the basis for rejection of specific alternatives. The Congressional mandate specifically directed the Corps to evaluate the Devil Canyon Project.

123 "Exotic energy sources" were not categorically dismissed. The long-term potential of geothermal energy is clearly acknowledged in the first sentence of the discussion of this alternative, which states: "Geothermal resources may <u>eventually</u> provide significant power generation in Alaska;....." (emphasis added). However, as clearly stated in the EIS, this alternative depends on technological development and economic feasibility. Futhermore, it is considered to be a future supplemental means of generating power. It is not considered to be a reasonable alternative to proven types of power generation within the time-frame of projected future electrical needs. Tidal power is not rejected on the basis of technical feasibility. We do not agree that it could be developed in Cook Inlet in either an economically or environmentally acceptable manner within the foreseeable future.

124 The Susitna River and the damsites have been emphasized in figures showing the various resources within the Railbelt area. Information in the <u>Alaska Wildlife and Habitat Atlas</u> is similar to data in the

Southcentral Regional Profile printed September 1974 in cooperation with the Joint Federal-State Land Use Planning Commission for Alaska. The Corps of Engineers also had the close cooperation of the State and Federal fish and wildlife agencies in developing the EIS.

125 As stated in Section 4.18 of the EIS: "The population of the area will increase with or without the development of hydroelectric projects proposed for the Susitna River; construction of this project is not expected to have any significant long-range effect on overall population growth, but is rather designed to fulfill presently projected needs of a growing population as one alternative means of producing power which will have to be provided in one way or another." For further response to this comment, see response No. 255.

STATE
of ALASKA

MEMORANDUM

DEPARTMENT OF COMMERCE AND ECONOMIC DEVELOPMENT

OPR: Mike Ford
465-2022

TO: Raymond W. Estess
State-Federal Coordinator
Division of Policy Development
and Planning
Office of the Governor

DATE: October 16, 1975

FROM: Langhorne A. Motley
Commissioner
Department of Commerce and
Economic Development

SUBJECT: Southcentral Railbelt Hydro-
electric Project
State I.D. No. 75091103

The hydroelectric project proposed by the Alaska District Corps of Engineers is a key element in meeting Alaska's future power needs. 126

At present, the project needs to receive an intensive and detailed study of several potential adverse impacts on the environment. These include further examination of the dam's effect on the 127
anadramous fish, the increased turbidity of the Susitna River during winter months, and the inhibition and higher mortality of the caribou population.

However we believe the project should, at this point, receive the full support of the State for the following reasons:

a) It utilizes a renewable resource;
b) environmental impact is comparatively less than alternative power sources;
c) federal approval would result in the Corps receiving 128
needed funding to obtain the answers to the necessary questions of adverse environmental impact, through further detailed analysis and study.

In summary, project is definitely necessary if Anchorage and Fairbanks are to receive low-cost, dependable power, and the subsequent lack of heat, noise, and air pollution problems add to its feasibility. The draft environmental impact statement raises several pertinent questions, but the answers will only be achieved through State and Federal support of the project.

RESPONSE TO COMMENTS BY
STATE OF ALASKA
DEPARTMENT OF COMMERCE AND ECONOMIC DEVELOPMENT

126 Comment noted.

127 Concur. Such studies are proposed for the pre-construction stage of detailed planning.

128 Comments noted.

MEMORANDUM State of Alaska

TO: Pete Cizmich
Regional Supervisor
Habitat Protection
Department of Fish & Game
Anchorage

DATE: October 2, 1975

FILE NO:

TELEPHONE NO:

FROM: Larry J. Heckart
Mgt/Research Coordinator
Division of Sport Fish
Department of Fish & Game
Anchorage

SUBJECT: Susitna (Devil's Canyon, E.I.S. Comments

Following are the consolidated comments on the Corps of Engineers draft E.I.S. pertaining to the Susitna River Hydroelectric development:

Page 18, last paragraph - It is significant that some salmon species rear juveniles for several years in fresh water prior to seaward migration. This paragraph implies they originate in salt water. The fresh water rearing segment may be the most critical. 129

Page 19, paragraph 1 - Should mention what surveys and the year(s) they were conducted to determine that fish do not migrate beyond Devil Canyon. 130

paragraph 2 - This is not indicative of Northern District Cook Inlet (Susitna River Basin) as a whole. 131

paragraph 3 - ADF&G currently has escapement goals for Kenai and Kasilof rivers. We cannot conclude that adequate escapement occurs into the Susitna River because escapement goals have been reached in the Kenai and Kasilof rivers. 132

paragraph 4 - This paragraph should be rewritten as it is misleading as written, i.e.,: according to the ADF&G, a significant percentage of the Cook Inlet salmon run migrates up the Susitna River. Spawning is found to occur as far upstream as Portage Cr k, approximately three miles downstream from the Devil Canyon dam site. Spawning and rearing salmonids occur in many clearwater sloughs and tributaries from Portage Creek downstream to the confluence of the Susitna Chulitna rivers. 133

Last two sentences in paragraph are okay.

paragraph 5 - Should identify study (first sentence) as 1974 assessment study by ADF&G.
Omit last sentence.
Also, king salmon are excluded. Barrett's 1974 report indicates king salmon present. 134

135 Page 20, paragraphs 1-5 - Trying to relate Cook Inlet catch to Susitna River stocks may be misleading. The Department does not have a method of differentiating salmon stocks in upper Cook Inlet that are landed in the commercial fishery. We do know that the majority of salmon landed in the Northern District commercial fishery are produced in the Susitna basin. However, we do not know what proportion of the commercial catch landed between the latitudes of Anchor Point and the Forelands are produced in the Susitna basin.

In certain years, primarily even years, a substantial per cent could be from the Susitna River. Therefore, to use the Northern District catch as an indicator of the Susitna production would be invalid.

The case pack for Cook Inlet as an indicator of Susitna production is also worthless in that it reflects the total cases of salmon packed in all districts of Cook Inlet and in some years includes fish packed from Bristol Bay and other areas.

In essence there is no present method of affixing a value to the Susitna River salmon production. We do have a "gut feeling" based on experience, that a substantial proportion of Cook Inlet salmon production is from the Susitna watershed.

136 Page 21, paragraph 1 - Why not a life history section for resident species, as given for anadromous species?

137 Page 23, paragraph 3 - Omit "limited". The numbers of game birds is unknown.

138 Page 24, Figure 7 - The white (unmarked) area in the center of the caribou range map is both summer and winter range. This area should be so indicated.

139 Page 27, paragraph 3 - Not true! Bears occur in both directions along the transmission corridor.

140 Page 37 & 38 - Recreation in the areas affected downstream of Devil's Canyon would appear to warrant mention.

Page 46, paragraph 1 - What is the source of information indicating unregulated summer silt loads? Again, while summer siltation is decreased and the effects may be beneficial, the increased winter silt load may cause deleterious effects.

At what point is the (15-35 ppm) sediment load calculated and at what seasonal period?

If multiple level discharge outlets are utilized to approximate normal stream temperatures it may be implied that in the winter water will be drawn from the bottom of the reservoir. It is logical to assume release from these levels would carry a greater silt load than those closer to the surface.

If this is so, discussions referring to a winter milky textured "glacial flow" may be extremely optomistic.

If the 15-35 ppm winter sediment load is calculated at the release 141
sits it can be expected to increase rapidly as the downriver flows replace the sediment load lost upstream in the reservoir.

Estimates of 15-35 ppm winter sediment load appear extremely low and likely would not apply for any distance below Devel Canyon. Winter turbidity may well exceed the indicated estimate.

Page 49, paragraph 1 - If regulated flows are not great enough adults may be unable to enter sloughs and tributaries to spawn. Concern is ex- 142
pressed for extremely low water years and planned regulated flows under these conditions.

paragraph 2 - What flow reductions will occur during construction and 143
the subsequent fill period and for what duration?

paragraphs 3 & 4 - More current data is now available re numbers of 144
sloughs and tributaries utilized by salmon and other mainstem migrational characteristics.

The clear water condition of the Susitna River during winter months could be a contributing factor to salmon fry utilizing the mainstem. 145
If a year-round somewhat milky-textured "glacial floor" condition is introduced because of controlled water releases below the dam, fry may not be able to rear in the mainstem Susitna River.

paragraph 7 - It is likely that a program to improve fish access to the sloughs as a result of decreased summer flows will not only be 146
feasible but "necessary" and required.

Page 50, paragraph 1 - Previously (page 46) it was stated downstream water temperatures would approximate normal winter regimes. This paragraph implies decreased temperatures.

Green stated in his paper, entitled Ecological Consequences of the Proposed Moran Dam on the Fraser River that reduction in downstream discharge and resultant water velocities during the spring seaward outmigration could adversely affect survival of young salmon by extending the period required to make the migration.

He also suggested reductions in turbidity would likely limit daily migration to the darker hours, further extending the total migrational period.

Columbia River data indicates mortality of salmon increases with the time required to complete the downstream migration.

(see further comments following re increased mortalities dependent on silt loads).

147 Reductions in summer flow temperatures can be expected to reduce the speed of upstream migrating salmon. The degree to which this may affect maturation and eventual spawning must be determined.

Increased winter temperatures downstream of Devil Canyon can be expected to increase the rate of development and may load to premature fry emergence and downstream seaward migrations. These effects must be determined.

148 paragraph 2 - Should indicate what flows will be during this period. What about other water quality parameters?

paragraph 4 - This agency currently has available little evidence of significant mainstem Susitna River spawning downstream of Devil Canyon. Therefore, unless flows are high enough to flood the slough and tributary areas where spawning is known to occur, benefits are likely to be of little value.

149 paragraph 5 - While Green made this statement as re improved egg survival, he also suggested further increases in mortalities due to predation were possible due to decrease in turbidity.

It was also suggested that altered temperature, discharge, and turbidity regimes could significantly reduce the survival of outmigrant juvenile salmon.

There is no solid evidence available that adult salmon can adequately adjust to altered flow, temperature, and turbidity regimes.

150 paragraph 6 - final sentence - There is no evidence of mainstem spawning so it is doubtful there is anything to enhance. The reduction in summer flows may cause a reduction in both tributary spawning areas and tributary and/or mainstem rearing.

151 Page 51, paragraph 7 - This also applies to downstream areas. Insects are found to provide an important part of rearing fry diets.

152 Page 52, paragraph 3 - This sentence sounds theoretical. Cite evidence supporting this statement.

153 Page 53, paragraph 4 - Paragraph meaningless. Sample size too small to be significant.

paragraph 5 - Improvement of habitat quality through construction of transmission lines is theoretical. 154

Page 56, paragraph 1 - Hunting pressures will not increase, only the potential for hunting pressure increases. ADF&G has the statuatory capabilities to control the actual pressures. 155

Page 65, paragraph 2 - Will the summer silt loads during the 10-12 year construction period actually be decreased, or perhaps increased as a direct result of excavation, road building, etc.? 156

Page 66, paragraph 3 - Again, only the potential for hunting pressure is increased. 157

General Comments:

Findings indicate the lower reaches of the Talkeetna River are very important to adult and fry salmon. Changes in the Susitna River could potentially have a great effect on this area, too.

Another area not mentioned in the report is the possibility of the Susitna River just north of Talkeetna being a major milling area for salmon spawning downstream as is indicated by two seasons of tagging studies. The changes in the Susitna River could affect fish returning to the Talkeetna, Chulitna, and lower clearwater tributaries of the Susitna River. 158

Mention is not made of the loss of game habitat downstream of Devil Canyon due to flow regulation, thus eliminating the periodic flooding necessary for maintenance of riparian bar areas. Moose habitat can be expected to be adversely affected due to resultant successional changes in the downstream areas from Devil Canyon to Talkeetna. 159

This statement refers only to regulation versus non-regulation. The 12-year period of construction and resultant effects on the fish, wildlife, and recreational resources are not addressed. 160

RESPONSE TO COMMENTS BY
STATE OF ALASKA
DEPARTMENT OF FISH AND GAME

129 A sentence has been added establishing the fact that juvenile salmon may spend several years in freshwater before migrating to saltwater.

130 The paragraph is considered factual as presently stated. No data have been provided from any authoritative source, including the Alaska Department of Fish and Game, that salmon have ever been recorded upstream from Devil Canyon.

131 The statistics presented in this paragraph of the EIS are taken, as indicated by reference, from Leaflet #26 prepared by the State of Alaska Department of Fish and Game.

132 Comment noted.

133 A statement has been added that a significant percentage of the Cook Inlet salmon run migrates into the Susitna River Basin.

134 The paragraph has been revised as suggested with exception of omitting the last sentence. The statement made in the 1975 Alaska Department of Fish and Game assessment that a portion of the pink salmon run may have been destroyed by a late August-early September flood has not been omitted.

135 There is no attempt anywhere in the referenced five paragraphs to relate Cook Inlet catch to Susitna River stocks. Neither is there any reference to case packs for Cook Inlet as an indicator of Susitna production. We agree that there is no present method of affixing a value to the Susitna River salmon production and have not attempted to do so. We have added a statement that the Alaska Department of Fish and Game accords a significant percentage of the Cook Inlet salmon run to the Susitna River Basin.

136 The inclusion of a life history section for anadromous fish was an optional decision made by the writers of the EIS. There is no requirement by NEPA or CEQ guidelines that such a section be included in an EIS. Salmon were included because of the great significance (recreational as well as economical) accorded this species. Also, project impacts are more subtly associated with the life requirements of salmon than with any of the other major fish species.

137 Concur. The statement has been revised to indicate that the numbers of game birds are unknown.

138 Caribou range map is as shown from maps in the Southcentral Regional Profile and the Alaska Wildlife and Habitat Atlas.

139 The statement has been clarified to indicate that grizzly bear are also found throughout this part of Alaska.

140 Possible improvement of summer fishing conditions might occur with reduced sediment loads downstream of Devil Canyon dam. Other recreation downstream of Devil Canyon does not appear to be significantly affected at this time.

141 Detailed information on hydrology, including sedimentation, can be found in Appendix I of the feasibility report. Multi-level water release structures do not draw water from the bottom of the reservoir storage pool (the so-called dead storage pool), but generally from the upper one-half to one-third of reservoir storage.

Comment on the replacement of sediment load in water releases at Devil Canyon is discussed in Section 4.01 Hydrology and Water Quality of the EIS. We concur that sediment loads below the dam would probably increase as sediment is picked up from the riverbed, but the 15 to 35 ppm refers to the releases at Devil Canyon dam.

142 Comment noted.

143 There will be no reduction of downstream flows druing construction. Close coordination with the U.S. Fish and Wildlife Service and the Alaska Department of Fish and Game will be undertaken to pre-determine minimum flows downstream from the dams during filling.

144 The EIS will be updated or supplemented as significant new information is acquired and provided to the Corps of Engineers.

145 This determination will be an objective of fishery investigations as the study progresses.

146 Fish access to the sloughs as a result of decreased summer flows will be improved if it is found to be necessary and required.

147 Comments noted.

148 As previously stated, minimum flows required to maintain the fishery will be determined in cooperation with U.S. Fish and Wildlife Service and Alaska Department of Fish and Game. Impacts on other water quality parameters which might result from withholding a portion of the water during high flows for reservoir filling is not known at this time.

149 Comments noted. The EIS has included additional temperature and turbidity information from the Moran Dam study.

150 If provisions are made to prevent hydraulic blockages to salmon spawning tributaries and sloughs (as the EIS says there will be, if necessary), it is not likely that tributary spawning areas will be reduced. The EIS does not state that mainstem spawning will be enhanced. We agree that little, if any, mainstem spawning occurs under present natural conditions. However, it is not unrealistic to assume that some spawning habitat could develop in the mainstem within the reach subjected to significantly reduced summer sediment loads and flooding.

151 Concur.

152 The second sentence in the referenced paragraph does make a theoretical statement. The evidence supporting the statement is contained in the sentence itself where an example is cited of natural lakes in Alaska which have heavy glacial inflow, yet sustain fish populations.

153 The Alaska Department of Fish and Game is the source of these figures (as indicated by reference in the paragraph). They are included here only as a matter of officially recorded data--observations made during one moose survey. The paragraph contains no allusion as to the significance of the figures--they speak for themselves.

154 Disagree. Transmission line rights-of-way are known to improve habitat for wildlife species which benefit from subclimax vegetation.

155 Concur. The sentence has been modified to indicate that there will be a potential increase in hunting pressure.

156 The paragraph which is the subject of this comment refers to sediment and turbidity changes which would occur upon completion of the project. Any increases in turbidity during construction would be of extremely short duration, while small diversion dams were being placed to direct river flow through bypass tunnels. Dam construction, itself, would be done "in the dry," thus construction of the dams would have no significant impact on water quality.

157 Concur. The sentence has been modified to indicate a potential increase in pressure on existing game populations.

158 Comments noted.

159 Disagree. Until studies are made of this situation, no positive conclusion can be made concerning the downstream impacts of flow regulation upon moose habitat. However, there is a good possibility

that moose browse will be increased as a result of regulation. Bar areas within the braided stream channel are too frequently and extensively flooded under natural conditions to support any significant amount of browse vegetation. When the flow becomes regulated, the stream channel is expected to become more unified and will probably assume a meandering pattern. Large, barren bar areas, no longer subjected to intensive erosion from frequent flooding, will probably establish permanent plant growth. As this growth evolves through the shrubby successional stages, moose browse will be increased. Eventually, much of these lands will establish trees, mostly cottonwood, and thus evolve beyond the browse stage. Moose habitat will, at that time, decrease but will probably continue to exist in greater quantity than is presently available within the braided channel system.

160 There will be no significant effects on fish during the 10-year construction period. As previously stated, there may be some very temporary degradation of water quality through increased siltation during the short period when the stream will be blocked with temporary diversion dams required to divert river flow through the bypass tunnels. This impact should be minor. With regard to terrestrial wildlife, construction activity will result in some outright destruction of habitat and the evacuation, and probable decimation, of species inhabiting the immediate and surrounding construction areas. This impact, overall, will be much less significant, however, than the subsequent impact related to habitat inundation as the reservoirs are filled.

STATE
of ALASKA

MEMORANDUM

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF LANDS

TO: RAYMOND W. ESTESS
State-Federal Coordinator
Office of the Governor
Division of Policy Development and Planning
Pouch AD
Juneau, Alaska 99801

DATE: October 27, 1975

FROM: GARY JOHNSON, Acting Chief
Planning & Classification Section
Alaska Division of Lands
323 E. 4th Avenue
Anchorage, Alaska 99501

SUBJECT: State I.D. No. 75091103
Southcentral Railbelt Hydro-electric Project

The above-noted project has been reviewed by the Division of Lands' staff, with the following comment considered appropriate:

161 "General Comment: This project appears to have favorable energy development benefits while having a relatively low environmental impact." (Planning & Classification - G. Johnson)

Thank you for the opportunity to review this project.

RESPONSE TO COMMENTS BY
STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF LANDS

161 Comment noted.

69-737 O - 81 - 43

MEMORANDUM State of Alaska

RECEIVED OCT 24 1975
Div. of Policy Development & Planning

TO:	Raymond W. Estess State-Federal Coordinator Division of Policy Development and Planning Office of the Governor	DATE:	October 21, 1975
		FILE NO:	
		TELEPHONE NO:	
FROM:	James E. Moody Chief Planning Engineer Division of Aviation Department of Public Works	SUBJECT:	State I.D. No. 75091103 Susitna River Hydroelectric Proposal

Following are off-the-cuff comments on the subject project as requested in your September 24 memo, and as related to the September 22 transmittals from the Corps of Engineers.

Attached is a copy of the October 9 memo with Mr. Baxter's comments following his review of the material.

162 The data, as Baxter noted, was too broad in scope and brief to allow us to evaluate how the project could effect our present and future operations. Specifically, there is no inventory of the airports or recognized landing areas, either public or privately owned, in the immediate vicinity of the project. The scale of the maps and the quality of the printing supplied with the data are such that it is not possible to identify the boundaries of the project so that we can compare them against our inventory of landing areas, although we doubt that very many fields would be involved.

163 The biggest question from the standpoint of transportation deals mainly with surface transportation rather than aviation. That is, how would the dams, lakes, and related facilities improve, and restrict, accessibility to the Susitna Basin? The creation of an 80 mile long system of lakes would certainly restrict the selection or alignment of road routes traversing the area. On the other hand, the lakes themselves might offer a certain degree of flexibility relative to surface transportation. Perhaps the most important point is the fact that there would likely be a spur highway constructed connecting the railroad and George A. Parks Highway to the dam system, thereby providing convenient public vehicular access to what is now a relatively remote region.

164 It is also likely that some type of airport or landing strip will be constructed in the immediate proximity of each of the dams, to provide quick access during construction if for no other reason. It would be interesting to know where these strips might be, how large they would be, and so on. (Potential for future use after dam construction is complete?)

The dams and their related hydroelectric plants will in themselves create employment opportunities. Since the projects will result in improved surface access plus a major supply of electrical energy, and since the area is relatively close to mineralized zones, mineral and other resources may be developed thus contributing to more employment, increased settlement or population, and an increased need for both air and surface transportation. The increased accessibility will likely attract considerable recreational activity, whether or not any mineral or other industrial resources are developed. 165

Has anyone considered the alternative of private development of this hydroelectric resource? Which would benefit the State more - federal development of the resource, or private development? 166

The tone of the draft EIS and the draft Interim Feasibility Report seem to indicate a relatively detailed review of the impact on the lands actually encompassed by the proposed project. However, a project of this scope which will create an 80 mile system of lakes with road access (such that perhaps 75 percent of the State's population will be within roughly 4 hours driving time) will have a significant impact on the adjacent lands. The subsequent impact on air and other transportation can only be identified after probable uses of this adjacent land have been cataloged. For example, if the National Park Service, or the Division of Parks of the State's Department of Natural Resources, desires to preserve the surrounding area for recreational purposes, one type of aviation activity will predominate. That is, recreational flying or simple transportation for recreational purposes might be the prime transportation mode. Seaplane traffic might comprise the highest percentage of aeronautical activity and might result in heavy impacts at corresponding seaplane bases in Anchorage and elsewhere. On the other hand, should there be extensive settlement of the area, and particularly if this is associated with mineral or industrial development, a higher percentage of aeronautical activity might involve commercial (scheduled airline) operations - possibly with medium to heavy aircraft. 167

A better map showing the lake system, probable surface access routes, and surrounding area; plus more information on the wildlife, mineral, and agricultural resources of the area from respective State offices would help us better gauge the impact of the project. It is apparent that the project itself will have less long range impact on air transportation than the secondary developments which will spring from the proposed hydroelectric complex. 168

Attachment

STATE
of ALASKA

MEMORANDUM

TO: James E. Moody
Chief Planning Engineer

DATE: October 9, 1975

FROM: Kinney R. Baxter
Assistant Planning Engineer

SUBJECT: Alaska State Clearinghouse
State I.D. No. 75091103
Upper Susitna River Basin
Southcentral Railbelt Area

169

After reviewing the Draft Environmental Impact Statements for the Hydroelectric Power Development, I have found that the way in which it is written does not create much detail to analyze constructively or destructively. The approach is of a general nature and prohibits many comments being made towards the EIS. In the past EIS's that have been reviewed, the author will commit himself to particular controversial topics, thus creating a flock of comments from the various agencies.

The only comments that I have to make are concerning the introduction of two large lakes that will greatly influence the activities of float planes and boats. This will open the adjacent land to hunting and fishing camps as well as other recreational functions. Will the adjacent land be open to public sale or will it be established into a Wildlife Reserve, or whatever? I am sure that with the introduction of visitor centers that other people will follow and a community will more likely be established.

RESPONSE TO COMMENTS BY
STATE OF ALASKA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF AVIATION

162 Comment noted. Air transportation is discussed in the EIS to the depth necessary for the feasibility stage of planning. During detailed planning, all Alaska State agencies would be closely coordinated with to insure consideration of resources or developments within their areas of purview. The Corps, upon request, will be happy to provide the Division of Aviation with detailed maps of the project study area.

163 Construction of the dams will not restrict surface accessibility to the Susitna Basin, since no road access is presently available through the canyon area. Construction of an access road leading from the George A. Parks highway will provide public vehicular access to what is now a relatively remote region. We agree, road route selection will be restricted by the reservoirs. Also, the reservoirs, themselves, may provide some benefit as landing sites for amphibious airplanes.

164 No landing strips related to project construction will be developed in the area without prior consultation with the Federal Aviation Administration and the Alaska Division of Aviation.

165 Comment noted.

166 Yes. The Devil Canyon High Dam alternative discussed in the EIS is a proposed development by Henry J. Kaiser Company. Private financing of electrical energy projects is one of the standard tests in computing benefits of Federal projects. In the instance of this study, coal, which was determined to have a lower benefit-to-cost ratio than hydropower, could easily be a privately developed power source. Either Federal or private development would be of benefit to the State. If identical resources were developed to the same degree, presumably the benefits would be approximately equal.

167 Comment noted.

168 The quality of maps has been improved in the revised EIS. However, they are still small in size and scale. As previously noted, the Corps will provide larger, more detailed maps upon request.

169 All public lands acquired for project purposes will be open to the public. The status of wildlife on these lands would be determined by the Alaska Department of Fish and Game. Other comments made by Mr. Baxter are noted.

GROUP COMMENTS AND RESPONSES

Alaska Conservation Society

Incorporated in 1960

Box 80192 College, Alaska 99701

ALASKA CONSERVATION SOCIETY COMMENTS ON THE ALASKA DISTRICT, CORPS OF ENGINEER'S ENVIRONMENTAL IMPACT STATEMENT, HYDROELECTRIC POWER DEVELOPMENT, UPPER SUSITNA RIVER BASIN, SOUTHCENTRAL RAILBELT AREA, ALASKA dated: September 1975

GENERAL COMMENTS

Considering the magnitude of the proposed two dam project for the upper Susitna River, the draft environmental impact statement (deis) is wholly inadequate in a great many respects, even as a feasibility study. A thorough analysis of its inadequacies would require considerably more 170
energies than we, as an organization dependent upon volunteer workers, can muster in the short time period available for study since the release of the document on September 22, 1975. Instead, we have chosen to identify types of deficiencies and present examples of these types in the remarks that follow.

TYPE ONE: CONFUSING PRESENTATION

Is this or is this not a draft EIS, that is the question? According to the title page, the document published in September 1975 is a draft EIS and according to a cover letter sent with the document that is dated September 22, 1975 signed by Col. Charles A. Debelius, District Engineer, the document received by us is THE draft EIS. "A final Environmental Impact Statement, incorporating all comments received, will be prepared and will be filed with the Council on Environmental Quality" (letter dated Sept. 22, 1975 from Col. Debelius). However, at the public hearing held by the Corps of Engineers on 8 October 1975 in Fairbanks, Alaska, Col. Debelius and his staff stated that the document entitled draft EIS was in fact a <u>preliminary</u> draft EIS and that a draft EIS would be developed later followed by a final draft EIS. To add to the confusion, the summary page, under item 2 "Description of Action" states that "since the current study is in the feasibility stage, impacts are not exhausitvely evaluated. If the project is authorized and funded for detailed studies environmental, social,economic, and engineering aspects of the project will be studied at length prior to a recommendation to Congress for advancement to final project design and construction." Later, on page 1

of the document, under paragraph 1.02, "Scope of the Study" a two stage study is indicated wherein Stage 1 "is an interim report, to be completed by 1 December 1975, on the feasibility of hydroelectric development on the upper Susitna River" and Stage 2 "is a comprehensive report, anticipated to be completed in 1978, to determine the feasibility of developming other hydroelectric sites in the Southcentral Railbelt area." From this statement is one to conclude that the document we received is a draft (or preliminary draft) EIS for Stage 1 of a feasiblity study? Will this then be followed by a final EIS on Stage 1? And this followed by a draft EIS on Stage 2; followed by a final EIS on Stage 2; followed
171 by a draft EIS on the Devil Canyon/Watana authorized project; followed by a final EIS on the authorized project????

What makes these questions relevant is the vast difference in importance between being asked to comment on a draft EIS on Stage 1 of a feasibility study versus a draft EIS on a project that is authorized. Although the latter has not yet been accomplished, the Corps is recommending authorization and Senator Mike Gravel has already introduced a bill to the U.S. Senate "authorizing construction of Devil Canyon and Watana dams in order to hurry the project along so that it can be included in this sessions "omnibus water resources development package". (Gravel, 1 August 1975 News Release.) If authorization is given by Congress, what happens to the normal and proper sequence of environmental evaluation required by NEPA? Will the two stage feasibility study of hydroelectic sites in the railbelt area be continued even though construction of one project (Devil Canyon/Watana) has been authorized?

TYPE TWO: BIASED EVALUATION OF ALTERNATIVES

The resolution adopted by the Committee on Public Works of the U.S. Senate on 18 January 1972 specifically requests that the Board of Engineers for Rivers and Harbors include in its evaluation of materials relating to developing power resources in the Southcentral Railbelt area of Alaska a review of the potential of "the Susitna River hydroelectric power development system, including the Devil Canyon Project and ANY COMPETITIVE ALTERNATIVES THERETO...(p.1: caps are ours). Ten alternative power sources are mentioned in the DEIS but all are dismissed as noncompetitive in the course of ten pages! Two of these sources, natural gas and coal, are really viable alternatives in Alaska at this time, yet the treatment in this EIS is, to say the least, biased and wholly inadequate. For example, in paragraph 2, page 71 the document states: "In view of the quantities of coal involved and present-day mining practice, it is presumed that strip mining would be employed to obtain the coal. Without specific knowledge of the mining site, it is not possible to project how much acreage would be affected; however, it is assumed to be in the hundreds, possibly thousands, of acres..." If this isn't biased, I don't know a biased statement when I see one. If it isn't deliberately biased, then it reflects a non-objective and incompetant review of existing knowledge regarding coal as an energy source in Alaska.

In the first place t' e distribution of coal suitable for use in generating electricity for the southcentral railbelt area IS KNOWN; the sites are few in number and there are reasonable estimates of the coal reserves available in them. (See paragraph 6.022 USGS Report). Thus, the acreage that would have to be disturbed to extract the coal to supply a given amount of generating capacity can be calculated but apparently wasn't. Second, if we assummed that the acreage that would be affected was "in the hundreds, possibly thousands," how does that compare with the 50,500 acres (=78.91 square miles) which will be inundated by the two dams to say nothing of the roads, construction camps etc.!!! Furthermore, a strip mined area can be recontoured and revegetated so they come back into being productive habitat for at least some (and in the Nenana coal field, perhaps most) of the species that inhabited the area before stripping occurred. In addition, the total acreage disturbed is not affected all at once, whereas, inundation by a resevoir with the consequent siltation, buries the total acreage in a few years, and, for all practical purposes, completely eliminates its biological productivity or at least significantly reduces it forever.

Later in this same paragraph the statement is made that "Water in contact with coal and mine wastes generally become acidic and toxic to vegetation and animal life." What does that general statement have to do with the specific alternative of using coal to generate electricity in Alaska? Coal in the Nenana coal field (near Healy, Alaska) is very low in sulfur and thus there is very little potential of a serious acid waste problem. Furthermore, burning this coal produces very low emissions of sulfur dioxide and that which is produced can be captured by appropriate stack design. Thus, the impression given the uninformed reader that <u>all</u> coal produces bad environmental conditions is very misleading especially in the case of the Alaskan situation. The final sentence in this same paragraph appears absolutely ludicrous when compared with another sentence from this same document: "The construction of the proposed hydroelectic project would have a significant impact on the existing natural scenic resource values within the project area." (Draft EIS, page 61, paragraph 2). Which is worse? The final paragraph of the coal alternative concludes: "In view of the extensive adverse environmental impacts associated with the coal alternative, both in magnitude of effects and areas affected, this is determined to a less (sic) desirable source of energy production than hydroelectric development." (p.72) How could the Corps arrive at this conclusion when NO EVIDENCE is presented that using Alaskan coal as an energy resource would produce more "extensive adverse environmental impacts" than hydroelectric power from two dams on the Susitna River? 172

TYPE THREE: LACK OF QUANTIFICATION OF MATERIAL DESCRIBING EXISTING ENVIRONMENT

Throughout the draft EIS, meaningless adjectival descriptors are used rather than numbers. Examples:

173 a. Page 12, para. 2: "Most of the upper Susitna River Basin is underlain by discontinouous permafrost." How mueh is most? What is the relationship of discontinous permafrost to the success or failure of the hydro project? What are the environmental consequences of building dams in such terrain?

174 b. Page 14, para. 1:" Few kayakers have attempted the dangerous eleven mile run through Devil Canyon." How many is a few? Were white-water canoer groups contacted and asked about their views?

175 c. Page 25, para. 2.02.3.: "Grizzlies are common throughout the Susitna River drainage and are fairly numerous in the upper Susitna despite the absence of salmon (see Fig.8)" "Common" and "fairly" numerous in relation to what other areas? How many per square mile?

176 Many additional examples could be cited but they are almost too numerous to count! If the data are available, present them and if they are not available, say so.

TYPE FOUR: IMPORTANT ISSUES NOT ADDRESSED ANYWHERE OR VERY LIGHTLY TOUCHED UPON

177 a. On page 17, paragraph 2.01.4.5 the point is made that "much of the drainage basin has never been geologically mapped," and the "the basin constitutes one of the least known areas in the State"... yet NO WHERE in Section 4.0, Environmental Impacts, does the EIS consider the consequences of inundating 50,500 acres of geologically unmapped terrain. The potential loss of mineral resources is dismissed in one sentence: "Inundation would obviate the practicability of future mining or, extraction of such resources." (page 67).

178 b. The EIS makes the following statements:

page 10:"The Susitna River...is the largest stream discharging into Cook Inlet."

page 14:"Freshwater runoff into the Upper Inlet is an important source of nutrients and sediments"

page 45:"Significant reductions of the late spring and early summer flows of the river and substantial increases of winter flows would occur" if the dams are built.

In spite of these facts, no where does the EIS consider the impact on Cook Inlet of modifying the river flow!

TYPE FIVE: INADEQUATE REFERENCING OF SOURCES UTILIZED

Although 31 pages of the draft EIS are devoted to a description of the "environmental setting without the project", very few references are made to the sources of the material presented and the few citations that are given, are incomplete so that someone wishing to check with the original source would have a difficult time locating it. 179

TYPE SIX: UNREADABLE OR INADEQUATE FIGURES

Figure 3 (page 7) is so sketchy as to be useless for assessing relationships between the transmission corridor and even basic terrain features. Figure 4 (page 11) is unreadable. 180

SUMMARY

Following a review of the draft EIS for hydroelectric development in the Upper Susitna River Basin, the Alaska Conservation Society found the document to be a totally inadequate evaluation of the environmental impacts likely to occur if the Devil Canyon and Watana dams were to be constructed on the river. Deficiencies in the document are so numerous that an item by item enumeration of them would probably require a document equal to or greater in length than the draft EIS itself. In order to keep our comments to a reasonable level, we classificed the deficiencies into six types: 1. Confusing Presentation; 2. Biased Evaluation of Alternatives; 3. Lack of Quantification of Material Describing Existing Envrionment; 4. Important Issues Not Addressed; 5. Inadequate Referencing; and 6. Unreadable Figures. Several examples of the deficiencies noted for each category are presented and referenced to their location within the draft EIS. 181

CONCLUSION

In view of the inadequacy of the draft EIS, the Alaska Conservation Society feels that the existing document needs to be completely revised and upgraded BEFORE any further recommendations are made to Congress by the U.S. Army Corps of Engineers. In particular, the Corps should meet its responsibility as mandated by the Committee on Public Works of the U.S. Senate to evaluate "any competitive alternatives" to the Devil Canyon and Watana Dam project in an unbiased manner and present this evaluation to the public. 182

RESPONSE TO COMMENTS
OF ALASKA CONSEVATION SOCIETY
COLLEGE, ALASKA

170 Comment noted.

171 This comment indicates a lack of understanding of the procedural requirements established by the Council on Environmental Quality for federal agency compliance with the National Environmental Policy Act. Guidelines to Federal agencies for preparing detailed Environmental Statements on proposals for legislation appear in the Code of Federal Regulations in Title 40, Chapter V, at Part 1500. In addition, pursuant to Section 2(f) of Executive Order 11514, the Corps has developed agency procedures in consultation with CEQ which even more specifically provide guidance for the preparation of Corps Environmental Impact Statements. Both CEQ guidlines and Corps regulations have been adhered to in the preparation of the Draft Environmental Impact Statement. Following coordination of the DEIS with other agencies, groups and individuals--and incorporation of all comments received, responses thereto, and addition to the EIS of any new or additional information received--the Corps will prepare an updated revised Draft Environmental Impact Statement. The RDEIS will then be subjected to intensive in-house review at higher levels of authority, and the District will make any necessary revisions. After such revisions are made, the RDEIS will be submitted to CEQ and, at the same time, will be sent out to the Board of Engineers for Rivers and Harbors, the final review agency of the Corps, and to Federal and State agencies for review and comment. Groups and individuals commenting on the draft statement will be furnished informational copies. The District will prepare appropriate responses, make necessary revisions to the main text due to comments received and forward a Final Environmental Statement to the Office of the Chief of Engineers which in turn will forward the document to the Office, Secretary of the Army. If the Chief of Engineers determines that new information received is of such significance as to warrant reconsideration of previous recommendations of the Board of Engineers for Rivers and Harbors, he will send the document back to the Board for such reconsideration. When the Office, Secretary of the Army, transmits the Final Feasibility Report and accompanying FEIS to Congress, it will also transmit the Final Environmental Impact Statement to CEQ. At the same time, the Division and District office will be notified of the transmittal for timely distribution of the FEIS to agencies, groups, and individuals that have received and furnished comments at various levels on the statement. The document commented on by the reviewer is a Draft Environmental Impact Statement, as indicated on the cover and in the text. The DEIS addresses Stage I of a two-stage study. Stage I involves a study, as mandated by Congress (by resolution of the Committee

on Public Works of the United States Senate on 18 January 1972), to determine the feasibility of hydroelectric development on the Upper Susitna River. Stage II will involve an additional study (not yet undertaken) which will determine the feasibility of other hydroelectric sites in the Southcentral Railbelt area. Thus, the second stage study will be conducted to fully respond to Congress' directive. There is a vast difference in importance in being asked to comment on a Draft Environmental Impact Statement of a feasibility study versus a Draft Environmental Impact Statement on a project that is authorized. If this project is authorized, extensive, detailed environmental studies will be undertaken to identify unavoidable adverse impacts which will result from project construction. Procedures will be studied whereby the project can be modified to minimize adverse impacts or to otherwise mitigate unavoidable damages. At this time the EIS will essentially be rewritten and the review process initiated again. As a result of this detailed evaluation of project impacts, Congress will again have an opportunity to consider the merits of the project and make a determination as to whether or not it should be authorized for funding and construction. The latter requires a distinct and separate action by the Congress.

172 In reference to the alternatives to the proposed Susitna River hydroelectric development, the Interim Feasibility Report discusses in greater detail the reasons that coal was determined to be a less desirable source of electrical energy production than hydroelectric development. The alternatives to hydroelectric development are also discussed in section 6.0 of the EIS. The information was gathered from a wide variety of sources and presented in a condensed form.

173 Many unquantified--unquantifiable--resource values are described narratively throughout the EIS. The statement makes it clear that permafrost is primarily restricted to areas of the Upper Susitna Basin upstream from the reservoir sites, though the Watana site is known to have some permafrost. The exact extent of this condition will not be known until proposed detailed geologic studies have been completed. Permafrost will have no relationship to the success or failure of the hydro project. It will, however, be a factor (one of many geological considerations) that will have to be taken into account in the design and function of the project. Permafrost is not present in the Devil Canyon damsite but may be present within a portion of the reservoir site. The Watana reservoir site contains areas of intermittent permafrost, particularly on north-facing slopes. In these areas the overburden mantle assumes a steeper angle of repose than would normally exist. It is expected that as the reservoir fills and permafrost degrades, some slumping of natural slopes will occur. These slumps or slides will be minimal in their effect on the capacity of the reservoir, since very light overburden is found in the lower elevations of the canyon where such slumping would occur. Above these rocky walls the valley flattens abruptly into the high terraces of glacial deposits where the slopes are generally stable. Permafrost

will not be a factor in the success of the dam since the foundation will be established well below the level of permafrost conditions.

174 There have been only two or three people, to our knowledge, who have claimed to have run the 11 miles of "whitewater" at Devil Canyon; there have been others who have kayaked portions of this section of the river and portaged out of the deep canyon around dangerous sections of the river. A copy of a report by Dr. W.L. Blackadar of Salmon, Idaho is included. See response No. 257.

175 The words "common" and "fairly" numerous are descriptions used from various State and Federal agency wildlife statements and reports - it is presumed that these terms were used in relation to the animals in the State of Alaska.

176 The terms and numbers used in the EIS were from available data from Fish and Wildlife Agencies. It is also stated that additional fish and Wildlife data will be obtained during the preconstruction planning process.

177 By selectively quoting portions of two sentences the reviewer conveys the impression that absolutely nothing is known about mineral resources in the drainage basin. In their entirety, the two sentences which are partially quoted read thus: "Though a number of mineral occurrences are known and the area is considered favorable for discovery of additional deposits, much of the drainage basin has never been geologically mapped. Thus geologically, the basin constitutes one of the least known areas in the State except for a few areas in the vicinity of Denali where some geologic mapping has been done." Additionally, the previous paragraphs states: "Most of the Susitna Basin above Devil Canyon is considered highly favorably for deposits of copper or molybdenum and for contact or vein deposits of gold and silver." The paragraph goes on to identify two known mineral deposit sites - one for copper and one for gold. The potential loss of know, suspected, and unknown mineral resources is thus candidly acknowledged in the sentence as quoted wholly from Section 4.0. Geologic mapping of the impoundment areas, required to determine faults and foundation conditions, would be extensive prior to any recommendation that the project be funded for construction.

178 Although Cook Inlet is not specified by name in discussing the downstream effects of modified river flow, the following statement is made in Section 5.0: "Adverse impacts could result from possible reduction in nutrients and primary productivity, cutting, and erosion of existing streambed configuration, increased turbidity during the winter months and changes in the hydraulic and biological regime of salmon rearing and spawning sloughs." These impacts will diminish with downstream distance, but some of them may well be felt to some extent in Cook Inlet itself. A determination of any significant

impact on Cook Inlet can only be determined subsequent to lengthy and costly detailed hydrological, biological, and water quality studies of the entire downstream system. Such studies are planned if the project is authorized and funded for preconstruction planning. The magnitude and cost of these and other studies which will be required prior to final recommendations for construction authorizations are clearly beyond the scope and funding constraints of the current feasibility study.

179 Many specific material sources are referenced within the body of the draft EIS and general information sources are listed in the bibliographic references section of the EIS.

180 A new schematic drawing of the proposed transmission corridor has been furnished by APA. The exact on-the-ground location of the proposed transmission line will be determined in future studies that will incorporate environmental, economic and engineering considerations.

181 The word "if" is significant in the context of the first sentence of this comment. The Corps has clearly stated in the draft EIS that if the project is authorized and funded for preconstruction planning, detailed environmental studies will be undertaken prior to any recommendations for construction authorization and funding. At the present time it is not known <u>if</u> the project will even be funded for further studies, much less construction. In response to the remainder of the "Summary" comment, every deficiency that can be specifically identified has been given an individual response and clarified in the RDEIS.

182 The Corps of Engineers is very aware of its responsibility as mandated by the Committee on Public Works of the U.S. Senate. The public has been kept fully informed throughout the progress of this study. A number of public meetings have been held, workshops with interested environmental groups have been conducted, and the draft EIS has been sent to everyone indicating an interest in it, along with a letter specifically requesting their views and comments. See response No. 171, for a discussion on procedures of updating the EIS prior to formal submittal to Congress.

ALASKA CONSERVATION SOCIETY

UPPER COOK INLET
CHAPTER
BOX 3395
ANCHORAGE, ALASKA
99501

Oct. 17, 1975

Charles Debelius
Col., Corps of Engineers
District Engineer
Box 7002
Anchorage, Alaska 99510

Col. Debelius:

The following are the comments of the Upper Cook Inlet Chapter of the Alaska Conservation Society on the Draft Environmental Impact Statement on "Hydroelectric Power Development - Upper Susitna River Basin Southcentral Railbelt Area, Alaska", Alaska District, Corps of Engineers, Sept. 1975.

183 UCIC,ACS protests the short time frame in which this statement has been brought out. The agencies much less the public asked to comment on the statement has scarcely enough lead time to identify what needed to be done, much less to do it. Some of the following questions asked at the hearings were partially answered at the public meeting held by the Corps in Anchorage Oct. 7(which was only 16 days before written comments were due) but we wish to assure they are contained in the final EIS.

184 UCIC,ACS believes this DEIS to be generally inadequate and unacceptable. We agree with the statement on pg. 8 "...The EIS does not include a detailed and exhaustive evaluation of project impacts..." We object strenuously to the fact that the proposed project has to be authorized to be built before adequate environmental studies can be made.

The following are some general observations and questions on the DEIS:

Fish, Game, Habitat

The most obvious factor is the loss of 50,000 plus acres that will be inundated by the resevoir waters and lost as habitat. Talks with F & G personnel reveal that they need more time to do adequate game counts (moose, caribou, etc.), range work to determine what kind of habitat will be lost, identify specific caribou migration routes through the area, and they need time to identify exactly which streams the mixed stocks of salmon spawn in. As we understand it, they had at the most a year to start doing this work with only 2 full time regular staff people and the

DEDICATED TO THE WISE USE, PROTECTION AND PRESERVATION OF
ALASKA'S RENEWABLE AND NON-RENEWABLE NATURAL RESOURCES.

parttime help of 2 aides. Also, money was not available to do the studies needed. This money, as we understand it, would be provided under enabling legislation should it be passed, but again, we protest that this proposed project should not be authorized <u>until</u> adequate studies are done.

F & G as well as other concerned agencies, need time to initiate studies 185
to define impact, regulatory changes and to define mitigation to compensate for loss of habitat. They also need more specific data from the Corps in order to evaluate downstream effects on fish and other aquatic inhabitants of the streams and tritutaries affected by this proposed dam system.

Game counts sited in the DEIS are completely ir dequate - i.e. pg. 53 "During the June 1974 survey, one grizzly was sighted...five black bears were sited on the Susitna River. A total of 56 caribou were sighted in the survey area" What was the survey area? Is one years data the only available? How many times during the year were counts made? Information as basic as this does not seem to be available in the DEIS.

Specific studies need to be done to determine how increased river 186
water temperature will effect such things as downstream icing conditions, salmon egg emergence, and effects on other inhabitants of this system. The effects will not be limited to just the immediate area of the dams.

What will the specific changes be in going from an unregulated river to a regulated one? What effect will this have on the moose range? What will the Corps do to mitigate these effects? The Corps seemingly will have to mitigate for the loss of moose range - will they give lands to the State somewhere else or provide money to increase management on other lands? This question does not seem to be addressed at all in the DEIS.

<u>Siltation</u>

The problem of siltation raises many questions in our minds that are not addressed in the statement. How will decreased siltation in the summer effect primary productivity? If the nutrients are decreased during the warmer months when life re-emerges in this northern latitude, what will be the result up the food chain? Especially in Cook Imlet into which the Susitna drains? How will this effect the zooplankton? And on up the food chain? Eventually, could this possibly effect the salmon runs? Also, as decreased siltation is predicted after completion of the proposed dams, what about the increased siltation bound to result from the construction phase (est. to be 10 - 15 years)? Other questions - How much silt will be picked up after the water is released from the dam? There may be a low sediment load spilled from the dam, but what are the' figures say, 1 mile below the dam?

<u>Sedimentation</u>

The factors that influence the rate of erosion, transportation of materials to a reservoir and the trapping of sediment within a reservoir are complex and highly variable. The geology of an area, nature of the soils, slopes, rainfall, runoff, hydraulic characteristics, cover and other conditions vary greatly.

However, given the glacial silt and other sediment content of the water of the Susitna River, the stated loss of storage capacity for a 100 year period (6,5% for Devil Canyon dam, 3.6% for the Watana dam) appear low. The reduction of suspended sediment to 15-35 ppm (pg. 46) means that much of the unregulated river sediment load (less than 1000 ppm in summer months) would be retained in the proposed dams.

Records from 20 existing reservoirs in the U.S. having drainage areas greater than 1000 square miles and storage capacities ranging from 0.05 to 2.06% and averaging 0.72% (Gottshalk, 1964). A couple of examples:

69-737 0 - 81 - 44

Elephant Butte reservoir in New Mexico, lost 16% of its original storage
capacity (2.6 million acre-feet) in 32 years of operation. Guernsey reservoir
in Wyoming lost 39% of its storage capacity of 73,000 acre-feet in just
187 26 years.

The data sources and methods used to compute those sedimentation
rates are not included in the DEIS and are thus not available for
evaluation by reviewers of the statement. Also, there is no mention of
the construction of a sediment pool to mitigate the estimated loss of
storage volumne over the years.

<u>Frazil Ice</u>

Has the problem of frazil ice been considered? This phenomen of
northern climates is a great hazzard to power plants. It is essentially ice
fog that solidifies into a special crystal formation on the intake system
as the cold (glacial in this instance) water hits the warmer area nearer the
188 turbines. It solidifies instantly and when this happens, the fast
revolving turbines have a decreased water flow and could burn out. There is
supposedly technology to overcome this, but the problem is <u>not</u> addressed
in the DEIS and we feel it is a very important environmental consideration.
(See Williams, J.P. "Frazil Ice - A Review of its Properties with a
Selected Bibliography", <u>Engineering</u> , Nov. 1959, pg. 55-60). We are not
convinced this problem can be dismissed by saying the water temperature
in the reservoir will be "to high for this to occur".

<u>Water Flows</u>

What will be the effect of essentially eliminating peak and low flows?
189 Providing flow figures for the Chulitna and other down stream areas we do
not feel "are beyond the effect of the project". Also, what will be the effect
of warmer water flow in winter and cooler in summer?

<u>Permafrost</u>

There seems to be incomplete identification of permafrost areas. How
will melting ice on reservoirs effect the permafrost? How much will erosion
190 contribute to the sediment load and will wave action cause increased erosion
on permafrost areas? What will be the effect of innundating large areas of
discontinuous permafrost? Exactly how much permafrost will be under the
impounded area?

<u>Earthquakes</u>

Pg. 62 states: "Devil Canyon and Watana Dams will be designed to with-
191 stand a Maximum Credible Earthquake of 8.5 magnitude with an epicanter of
40 miles at a focal depth of 20 miles which is the approximate distance of
both damsites to the Denali Fault system and is the most likely source of a
seismic event of this magnitude. The Susitna Fault, truncated by the Denali
Fault, bisects the region in a NE to SW direction approximately 2.5 miles
west of the Watana damsite". As the Susitna Fault is part of the Denali
fault system, is it not possible that a quake could occur closer than
40 miles? We feel this certainly needs more study and further clarification.

<u>Geology</u>

What is the geology of the foundation of the dams? How far to
192 bedrock? What is the formation of the canyon sides that will be innundated
with water?

<u>Flood Control</u>

Pg. 71 mentions under Alternative Sources of Power - "A coal-thermal
193 facility would forego the recreational and flood control benefits provided
by a hydropower project". <u>Where</u> is the data documenting flooding and the
need for flood control on the Susitna? Is flooding a problem on the Susitna?

<u>Recreation</u>

As moose and caribou habitat will be destroyed (thus decreasing
hunting) and there will be no fish in the reservoirs, what will the great
recreational benefit of these proposed dams be to the public? Boating?
Water sports? What? As the area below the proposed dams will probably be

closed due to safety reasons, kayakers will probably be excluded from using the river. Also, will the access roads be open to the public of will they be closed due to safety reasons? 194

Access Roads

Exactly where will these be built - it is very hard to tell by the maps in the DEIS. Also mileage estimates vary. Will they be open to the public? How wide will the right of way be? How will the dirt and gravel be obtained to build these roads? . 195

Transmission lines and corridors

The statement is very unclear as to exactly where these will be. How will right of way be obtained? It proposes to cross federal, state, private, and native lands. With increased pressure on land resource and use of land for nonproductive purposes, has burying the transmission lines been considered? Technology is available to do this and could cause much less disruption of the land. Fewer trees would have to be destroyed and the buried limes area could be revegetated. Such a corridor could have varied edges instead of a straight swath cut thru the wilderness. We realize this alternative is very expensive but we feel it should be considered as an alternative to overhead transmission lines in the DEIS.

We also note the effect of earthquakes on overhead transmission lines has not been addressed. We have some questions as to possible health hazzards around transmission lines due to high wattage radiation. 765,000' volts seems to be the critical point at which adverse impacts begin. Some of the problems encountered include:

1. ozone formation 196
2. interferance with radio and T.V. signals
3. noise pollution - humming and crackling sound (up to 70 decibels has been recorded - 90 decibels is the legal noise limit)
4. possibility of electric shock
5. possibly health hazzards - increased b/p, chromosome damage, nervous system damage)

We do not know if any of this would happen with this proposed project, but we feel in the interests of public health, that this should be looked into and addressed in the DEIS.

What studies have been done on strength of the wind in the areas for transmission lines? We understand the project around Juneau has had incredible problems with wind blow-down of lines - not that there are as strong winds in the interior, but then who knows? No data is presented on this. What will be the energy as delivered to Anchorage and Fairbanks? What will be lost in transmission? On pg. 3 it states: "A subsidiary purpose in the construction of the electrical transmission line will be the interconnection of the largest electrical power distribution grids in the State of Alaska..." What are these 2 power grids? Could they be interconnected without the proposed dam? Why is it necessary to interconnect them?

Dam operation

Who will be charged with operating the dam if it is built? The Corps? Utilities commission? The State? Also a very important question is what is going to be done with the "secondary power" produced? The proposed project has a built in surplus of power - or in other words, it is building way ahead of the current needs of the railbelt. What is the purpose of 197
this secondary power production? Is the purpose to attract industry? If so, we feel that this is a sell out from the original stated purpose. "Extra power" with no where to go will necessate carrying charges and as usual, the taxpayer will pay. Plus the fact that this overproduction will be wasted and thus the rational to attract big industry to use it.

198 Cost benefit ratio

This ratio is computed as 1.4 so supposedly there is more benefit than cost? But, looking at the interest rate which was computed at 6 3/8%, we do not feel this is an accurate reflection of the realistic market. We need to know the cost of this proposed project in terms of how much energy will be used to build the dam, how many barrels of oil will be irretrevibly committed, and how much energy will it "cost" to maintain the dam? Let's look at the cost - as one of the benefits, the dam is supposed to be "lower cost of power generation" (pg. 3) how are we to evaluate the following figures of estimated cost of the dam and transmission lines:

1. When first proposed in April 1960 -$478,874,000 (Devil Canyon Project Report of Commission of Reclamation, March 1961)
2. Jan 1974 - $682,000,000 (Devil Canyon Status Report, May 1974, Dept. of Interior, Alaska Power Adm.)
3. Jan. 1975 - $1.343 billion (Corps, DEIS)

To our way of thinking, this project is economically unfesible. How can the Corps justify this outrageous expenditure - which almost amounts to their total operating budget for the entire Corps last year? We do not feel all the alternative sources of power have been evaluated with an "open mind". Could currently available power sources developed to their fullest supply the needs of the railbelt? How much energy will really be needed in the railbelt? What will be the net energy benefit analysis? Will other energy resources be developed concurrently and be available by the time the dams are on line?

199 Inconclusion, we have very serious questions about the lack of factual content of the DEIS, the potential attraction of big industry due to overproduction of power, and socio-economic impact that would be inevitable. We see no proven need for this project and certainly cannot see that it is economically fesible.

Susitna River Fact Finding Committee UCK/HCS

Jim Larsen
Virginia del Vay
Chris Beardsley

RESPONSE TO COMMENTS BY
ALASKA CONSERVATION SOCIETY
UPPER COOK INLET CHAPTER

183 Formal public meetings to discuss the selected plan for hydropower development on the Upper Susitna River Basin were held in Anchorage on 7 October 1975 and in Fairbanks on 8 October. The public was given 15 days to include written comments they wished to be inserted into the public record for those meetings along with any statements they made at the meetings.

The District Engineer stated that all written comments on the Draft Environmental Impact Statement for the proposed project, which was distributed by the Corps of Engineers on 22 September 1975, should be made to the Corps by 17 November 1975 so that these comments could be included in the Environmental Impact Statement due to be completed in early December 1975. Actually, environmental comments dated through 3 December are included in the Comment and Response Section of the EIS.

184 As stated in Section 1.03 of the Draft Environmental Impact Statement for the proposed Devil Canyon-Watana hydroelectric project on the upper Susitna River, the study is in the feasibility stage, and the EIS does not include a detailed and exhaustive evaluation of project impacts, many of which cannot be fully ascertained prior to congressional authorization and funding of detailed economic, environmental, and engineering studies (including additional fish and game studies). The two-stage authorization process requires congressional approval before advancing from the detailed studies stage to final project design and construction stage when the actual project funding would be authorized and project construction would begin. Many projects have preliminary authorization from Congress, but for one reason or another they are not all funded or constructed.

185 As indicated in Section 4.03 (Wildlife) of the EIS, the numbers of big game and the amount of habitat are minimal within the proposed Devil Canyon impoundment area, and preliminary data indicate that low populations of such animals presently utilize the proposed reservoir area. If the project is authorized, it is expected that construction on the first dam would start in 1980 or 1981. Authorized fish and wildlife studies would be funded to continue during the interim study period and the information would be used to prevent, ameliorate, or mitigate the adverse impacts to important fish and wildlife species.

186 All project data, including river regulatory information, are available to the fish and wildlife agencies at the District Engineers' office in Anchorage, and these agencies are aware of this coordination

of information. Although up-to-date information on fish and wildlife is somewhat limited, past data--including information from the 1950's and 1960's--indicate that these are low game populations in the proposed Devil Canyon-Watana project areas. One survey study made during the winter of 1974-75 does not constitute a reasonable scientific study, as such, but it further indicates that the numbers of various animals in this area are relatively low.

187 Sedimentation studies to determine the significant environmental impacts--both adverse and beneficial--that would be generated by the proposed project, will be continued. Preliminary studies, including A Hydrologic Reconnaissance of the Susitna River Below Devil's Canyon, October 1974, prepared for National Marine Fisheries Service at Juneau, Alaska, and various detailed U.S. Corps of Engineers and Bureau of Reclamation hydrological studies and other studies on sedimentation are available for review at the Alaska District, Corps of Engineers' office in Anchorage, Alaska. During the construction phase, the river's flows would be diverted through tunnels around the dam construction areas and should not significantly affect sediment below the dams. Other activities, such as building roads and bridges and clearing vegetation in the proposed reservoir areas and transmission line corridors, could cause some siltation or sediment problems. These activities would be done in such a manner as to minimize possible adverse impacts (see Section 4.11). Preliminary sedimentation studies and post-Bureau of Reclamation studies indicate the rates of sediment deposition in the reservoirs as stated in the EIS. These computations are available for review at the Corps' office in Anchorage. The sediment load one mile below the Devil Canyon dam should be substantially the same as the releases at the dam due to the rocky nature of the riverbed in this section of the Susitna River and with no significant tributaries in this section of the river that could contribute higher sediment loads. There would be a period of channel stabilization in the 50-mile section below the proposed Devil Canyon dam in which the river would tend to adjust to the stabilized regulated flows with low sediment levels. Some channel degradation in some sections of the river would occur as the river would attempt to replace the missing sediment load with material picked up from the riverbed, but this is not expected to be of significant concern along the coarse gravel bed reaches of the river between Devil Canyon and Talkeetna. Projected studies should further clarify and define degradation of the riverbed in this section of the Susitna.

188 Yes, the problem of frazil ice has been considered. Also see response number 298.

189 The detailed effects of altering the present flow regimen of the river can only be determined by studies which have not yet been made, but which are proposed during the pre-construction stage of planning when detailed studies are normally made. Effects of flow changes will be studied as far downstream as they can be measured, including Cook Inlet. Winter and summer water temperatures will not be significantly affected by the project. Multiple outlet structures will permit withdrawal from the reservoirs (in which water will be thermally stratified) at any level required to maintain near-natural stream temperatures.

190 See response number 173.

191 See response number 240.

192 See response number 36.

193 The quoted sentence is a statement of fact. The Corps has a wealth of data, available for public perusal in the District office, documenting flood damages to the Alaska Railroad and the town of Talkeetna. Benefits attributable to reducing damages to the Alaska Railroad are computed in the project cost-benefit ratio. Benefits to Talkeetna are not. Benefits resulting from increased recreational opportunity are also included in the cost-benefit analysis. Benefits attributable to flood control and recreation comprise about 0.2 of 1 percent of the total project benefits, thus neither is a factor in project justification.

194 The recreational benefits ascribable to the project are summarized in the EIS. The detailed recreational analysis is contained in Section F to Appendix I of the Interim Feasibility Report. This document is available for public inspection in the District office. Access roads and all other facilities will be open to public use unless some areas or operational procedures of the project are determined to be dangerous to public safety.

195 Exact locations of the roads are not presently known, nor have mileages and right-of-way widths been exactly determined. It is anticipated that the majority of access roads will be open to the public. This is a basic premise in the estimate of public recreational usage on project waters and lands. Dirt and gravel will be obtained in the vicinity of road construction. Necessary borrow areas, where possible, will be screened from view from the access road. These areas will be rehabilitated as necessary.

196 Transmission line right-of-way will be obtained through standard real estate procedures. Very little of the line will cross private property, and, wherever possible, private lands will be avoided altogether. In the event some private lands are traversed, property will be acquired where possible by negotiation. If this cannot be accomplished, the government will exercise its power of eminent domain. Yes, burying the transmission line has been considered, and a discussion of this alternative has been added to the EIS. It is the conclusion of the Alaska Power Administration that underground cable is much more susceptible to damage from seismic activity than are overhead transmission lines, and that the installation of significant lengths of high voltage underground electrical transmission cable is limited by present technology (see Section 4.13 of the EIS). A number of studies have been made concerning health hazards associated with radiation from high-power transmission lines. It is generally concluded that lines transmitting less than 500 kv pose no threat to human health. One of these studies was made by Battelle Pacific Northwest Laboratories and is entitled <u>Measuring the Social Attitudes and Esthetic and Economic Considerations Which Influence Transmission Line Routing</u>. The report is dated July 1974 and is identified by index number NW-1837UC-11. There are very few climatic data for the area traversed by the transmission line corridor, particularly in regard to wind speeds. The Interior Zone (north of the Alaska Range) is dominated by high pressure air masses resulting in relatively mild winds. The Transitional Zone (south of the Alaska Range) has generally calm winds, although high winds over 50 m.p.h. can be expected. The Mountain Zone (Alaska Range) can be expected to have the highest winds. High winds are reported to have knocked down 138 kv towers in the area lying between Cantwell and Healy. As stated in the EIS, the <u>net</u> firm annual energy delivered to Anchorage and Fairbanks would be 6.1 billion kilowatt-hours. This is <u>net</u> of losses in power transmission, which amounts to 0.7 percent of the energy generated at the power sites. The two referenced power grids are comprised of existing networks of transmission facilities which separately serve the greater Anchorage and Fairbanks areas. Yes, they could be interconnected without the proposed dam; however, it is not necessary to connect them. The advantage to interconnection is largely related to the greater reliability of electric energy supply to the two separate communities. They would automatically be interconnected if the proposed hydropower system is developed.

197 The marketing agent and operator of the system would be the Alaska Power Administration. For a detailed discussion of secondary energy and attraction of industry, see response number 255.

198 Ideally, the interest rate shown reflects the opportunity cost of the funds committed to the project. It should not necessarily reflect current financial market conditions, but rather the approximate return to savings and investment over the 100-year project

life. Current high interest rates are very possibly a short-term aberration. By law, the interest rate is annually set equal to the average interest rate on long-term government securities, limited by a maximum increase of 0.25 percent per year. A sensitivity analysis using a range of interest rates is described in Section C of Appendix 1 to the Interim Feasibility Report which is available for public review in the District office. The costs mentioned are costs of different systems with different capabilities; they are not altered cost estimates of the same project. Currently available power sources (coal and natural gas) could supply the needs of the railbelt but at higher cost than the proposed plan. The energy needs of the Railbelt area are discussed in the revised main report. If constructed, the selected plan is to meet increased energy loads during the period from about 1986 to 1997. During this time, if the load projections are not exceeded, the existence of the hydro project would take the place of any net addition to thermal plant capacity that would otherwise be added in the Railbelt area.

199 Comment noted.

Greater Anchorage

CHAMBER of COMMERCE

October 22, 1975

Crossroads of the Air World

Colonel Charles A. Debelius
District Engineer
Corps of Engineers
P.O. Box 7002
Anchorage, Alaska 99510

Dear Colonel Debelius:

On behalf of the Board of Directors and membership of the Anchorage Chamber of Commerce, I wish to express our total support for the development of hydroelectric power in the Upper Susitna River area.

The Chamber would like to offer its services in helping to promote the construction of the Devil's Canyon and Watana dams as soon as possible. Please call on us for any further help we may provide.

Sincerely yours,

200 Loren H. Lounsbury
Loren H. Lounsbury
President

BWW

GREATER ANCHORAGE CHAMBER OF COMMERCE — 612 F STREET, ANCHORAGE, ALASKA 99501 — (907) 272-2401

RESPONSE TO COMMENTS BY
GREATER ANCHORAGE CHAMBER OF COMMERCE

200 Comment noted.

COOK INLET
CIRI
REGION, INC.

October 9, 1975

Alaska District, Corps of Engineers
Attn: Colonel Charles H. Debelius,
District Engineer
P.O. Box 7002
Anchorage, Alaska 99510

Dear Sir:

This is to notify you of a possible error in the impact statement "Hydroelectric Power Development Upper Susitna River Basin Southcentral Railbelt Area, Alaska." On page 39 the second paragraph under Archeological Recources states that, "two archeological sites within the general vicinity of the proposed transmission line corridor are listed in the National Register of 4 February 1975. These are the Knik and Dry Creek Sites." According to Doug Reger, State Archeologist, the Knik site is not an archeological site, but an historic townsite. It is not listed in the National Register as an archeological site (p. 5250). However, Dry Creek is listed as an archeological site.

Employed as a research assistant with the Cook Inlet Historic Sites Project, I have encountered this apparent inconsistency. The Project is involved in compiling an inventory of Native historic and cemetery sites in the Cook Inlet Region.

If you have any comments on this matter, please direct them to:

201

Mary Weirsum
Cook Inlet Historic Sites Project
1211 West 27th Avenue
Anchorage, Alaska 99503

Thank you.

Sincerely,

Mary Wiersum

Mary Weirsum, Research Assistant
Cook INlet Historic Sites Project

RESPONSE TO COMMENTS BY
COOK INLET REGION, INC.

201 The correction has been made in the EIS.

Knik Kanoers & Kayakers, Inc.
3014 Columbia
Anchorage, Alaska 99504
17 November, 1975

Col. Charles A. Debelius, District Engineer
Alaska District, Corps of Engineers
Department of the Army
P.O. Box 7002
Anchorage, Alaska 99510

Dear Col. Debelius:

The Knik Kanoers & Kayakers wish to go on record as opposing the construction of any dams on the Susitna River. Such development would destroy a major wilderness whitewater river, termed "the biggest in North America" by its first paddler, Dr. Walter Blackadar.

In the 'fifties and 'sixties the Corps dammed a number of the nation's finest whitewater rivers in the name of "progress." Yet each new dam served only to spur on further profligate use of energy. In other words, these beautiful rivers were sacrificed to no useful purpose. Nowadays such economic boondoggles would never win approval, yet the Corps is attempting to start the same destructive, wasteful process here with one of the country's most spectacular, wildest, loveliest rivers. The Susitna must be left to run free for future generations.

Sincerely yours,

202

Ed Swanson
President

RESPONSE TO COMMENTS BY
KNIK KANOERS & KAYAKERS, INC.

202 Comments noted.

October 8, 1975

From:

Orah Dee Clark Jr. High
150 South Bragaw
Anchorage, AK

To whom it may concern,

The seventh grade sixth period class took a poll, and has decided, at the rate of seventeen to three, against the series of dams, beginning with the Devils Canyon Dam. We decided against it for various reasons; (1) that it would harm the ecology, (2) That it would harm the natural habitat of moose and other wildlife, and (3) that it would damage the scenery, which we feel has been damaged enough.

We were appointed to this commitee by our teacher Mrs. Stark of Orah Dee Clark Jr. High. She gave us the pro's and con's of the issue, and took the poll.

203

Respectfully yours,
Kris Ashley
Theresa Rusnak

RESPONSE TO COMMENTS BY
SEVENTH GRADE
ORAH DEE CLARK JR. HIGH SCHOOL

203 Comments noted.

69-737 O - 81 - 45

Sierra Club
3304 Iowa, #5
Anchorage, Alaska 99503
15 November, 1975

Col. Charles A. Debelius, District Engineer
Alaska District, Corps of Engineers
Department of the Army
P.O. Box 7002
Anchorage, Alaska 99510

Re: NPAEN-PR-EN

Dear Col. Debelius:

The following are the comments of the Sierra Club on the Corps of Engineers' draft environmental statement on Susitna River hydropower development.

204 The draft statement is inadequate. Its basic fault is that it is one long propaganda piece, with a notable lack of hard data presented. Such date must be supplied in the final document so that readers can make a rational choice as to whether the proposed Susitna dams are economically and ecologically justifiable.

205 There has been a serious failure to discuss alternatives to the project. The Federal Power Commission did the scoping analysis to select the least-cost alternative for comparative evaluation with the hydro project. In doing so, the FPC eliminated from consideration several alternatives which could, if allocated the $1.5 billion projected hydro cost or even lesser amounts, compare favorably to the dams. These alternatives include solar, wind, geothermal, and tidal power generation systems and investment in conservation measures.

206 The DEIS recognizes that oil, natural gas, and coal will be Alaska's major power sources for at least the next decade. During this time it makes much more sense to invest in technologies which the scoping analysis ruled out and have them on line by the end of the decade.

207 A major advantage of non-hydro alternatives is their flexibility. Coal plants, for example, can come on and off line in response to demand. Once a hydro project is built it will generate large amounts of electricity regardless of need. The effect of this will be to attract industries that need large blocks of electricity

On page six, it is stated that "The benefit-to-cost ratio compared to the coal alternative at 6 1/8% interest rate and 100-year project life is 1.4 using Federal financing." Surely the writers of the DEIS understand that a benefit-cost ratio is meant to indicate whether a project's costs outweigh its expected benefits. It is an internal relationship and the coal alternative should not have entered into the calculation at all, 208 though it is proper, once the B/C ratio is computed, to compare it to the B/C ratio for other projects. Furthermore, the DEIS gives no information on how this figure was arrived at. What are the project's expected benefits? On page 71 recreation and flood control are mentioned as benefits, but within the body of the DEIS flood control is otherwise never referred to.

The Corps accepted the FPC scoping study and proceeded to evaluate coal as the least-cost alternative. Coal was evaluated at a 8.77% discount rate while the hydro project was evaluated at the 6 1/8% interest rate prescribed by the Principles and Standards Act (which, while a vast improvement over the 209 ridiculous interest rates the Corps used to assume, is still extremely low in terms of today's money market). The draft interim feasibility report gives a B/C ratio of 1.4 for hydro and 1.3 for coal. But the difference in interest rates seems to account for the reason the B/C for hydro is more than that for coal. Even with that favorable interest rate, the ratios are almost the same! Furthermore, the B/C analysis gives no weight to flexibility and responsiveness of the power generating systems. The coal alternative is a flexible system which the private sector would finance, and coal is a resource which can be developed ton by ton as it is needed. The hydro project would be an inflexible commitment of resources underwritten by the federal government; its "front-end" costs are extremely high and represent bills which fall due before any energy is produced at all.

Another flaw in the B/C study is the estimate for recreation benefits. Recreation benefits are estimated at $300,000 annually. In fact, there are virtually no recreational benefits for the project and there are very high recreation losses. According to the draft interim feasibility report (p. F-3), "Few places in the world offer the variety of outdoor recreation resources available in Alaska. Both residents and visitors alike have 210 unexcelled opportunities for recreation activities among a profusion of beautiful lakes, rivers, and mountains, largely untouched by modern civilization." Given these fortunate circumstances, why would anyone want to visit a narrow, murky, artificial lake? The Watana reservoir, with its annual drawdown of from 80 to 125 feet (which would be at its worst in early June, then rise steadily throughout the summer), would be virtually unusable for recreation purposes. A boat-ramp which can allow for a 125-foot variation in water level in a steep, narrow canyon would be difficult indeed to design.

The Susitna flows "some 130 miles through uninhabited country" (p. 10). This is another, roundabout way of stating that it flows 130 miles through wilderness. Were the writers of the DEIS

211 afraid that the word "wilderness" might make the river in its undammed state sound too valuable?

212 The statements at the top of page 14 are misleading. It should be noted that none of these rivers is Class VI in its entirety. Turnback Canyon on the Alsek can be portaged; the rest of the river has been run by inexperienced kayakers. Devil Canyon on the Susitna can also be portaged; here again, the river above the canyon can be and has been run by kayakers of limited experience. Less is known of the Bremner, but the heavy whitewater is confined to its two canyons. The point is that even a very difficult river can be utilized by inexpert kayakers and rafters if the rapids can be portaged. As for Devil Canyon itself, instead of making value judgements and using loaded words like "dangerous," the final EIS should emphasize that it is attractive to kayakers precisely BECAUSE it is difficult. Walt Blackadar, the first person to run it and a heavy-water paddler of extensive experience, termed it "the biggest whitewater in North America."

213 Mention is made here that the Susitna was recommended as a BOR study river "but was not one of the 20 rivers recommended for inclusion in the (Wild & Scenic Rivers) system by the Secretary of the Interior in 1974." True, as far as it goes, but it doesn't go far enough; Interior's d-2 bill is only one of several. The Susitna is indeed proposed as a wild river in the conservationists' d-2 bill, as the authors of the DEIS were surely well aware.

214 Page 23. "Several" nesting pairs of bald eagles and gyrfalcons were observed in the canyon area. How many is "several"? Were there so many that they could not be counted?

215 On the same page, it is noted that "Motorized all-terrain vehicle access to the backcountry has improved hunting success even in the face of a rapidly declining caribou population" (Nelchina herd). A critical factor has been winter maintenance of the Nabesna road, which permits snowmobilers to haul their machines in as far as they wish in comfort, then take off. Caribou--especially pregnant cows--are not able to withstand the resultant noise and harassment. Roads vastly increase the activity of off-road vehicles, and the Susitna dams will require roads (built at state expense?), presumably maintained in winter (also at state expense?). The final EIS should investigate the probable consequences to an already threatened caribou herd.

216 Page 24. The maps through the entire document are poor. Only someone who recognizes the shape of the Susitna would be able to locate it on the maps, since it is not labeled. Yet presumably the relationship of the river to the habitat being mapped is critical--far more so, for instance, than the location of Cordova (which appears on each map). Without knowing which line represents the river, and the location of each dam, the graphics are quite literally meaningless.

Hunting pressure for rams in the Cantwell-Healy area is "fairly

heavy due to relatively good access from highways, by air, and by ATV's" (p. 27). The statement is true, and the Susitna hydro project would provide equally easy access for an area that 217
is now wilderness--a road, which can also be used to haul ATV's on, and two or more enormous lakes to land a floatplane or ski-plane on. The effect on moose, caribou, and bear should be noted in the final EIS.

The Susitna area "has consistently produced more wolverines than any other area of comparable size in the State....Wolverines have withstood human encroachment and trapping without any noticeable reduction in numbers or range" (p. 28). Yet it has already been admitted that the area is presently wilderness, so any "encroachment" so far has been hunting lodges and trappers' 218
cabins--not 70,000 visitors a year. Would the DEIS have us believe that wolverines won't mind the dams, roads, people, noise, etc.? Absurd. The wolverine is an extremely secretive, wary wilderness species which cannot coexist with highways and industrial development.

Page 37: "Float planes are used to fly in hunters...but this form of access is relatively minor....A major recreational use... is big-game hunting....The greatest pressures are exerted from a few fly-in camps." If fly-in access is "minor," then how can it produce the "greatest" pressure in a "major" recreational use? The statements are inconsistent, a frequent problem in the DEIS 219
"It appears that the use of ATV's for hunting, already prohibited in some areas, may have to be further controlled." This statement misleadingly implies that such use can be controlled, when in fact it is very difficult (and expensive) to do. What will be the costs of the extra wildlife protection officers needed to enforce such a closure in an area where easy access has newly been created? Who will pay these costs?

Page 38. Again, the superlative, huge whitewater of Devil Canyon is implied to be very unattractive, equivalent to implying that Mt. St. Elias is "no good" for climbing because it 220
is very difficult and successful attempts have been few.

We find it exceedingly odd that the DEIS was rushed to publication just before the Corps was due to receive the Jones and Jones study on recreational use and potential of the Susitna. Although as a consequence we have not had the benefit of reading the study 221
itself, we understand that it recommends that the whitewater of Devil Canyon not be inundated, because of its great value as a scenic and recreational resource.

Page 40, energy needs. Again, these are mere unsubstantiated statements. "Because of lead time needed for coal and hydro-electric development, immediate needs for the next decade will have to be handled by additional oil and gas-fired units." True, 222
even too generous, as regards hydropower (the Corps fact sheet of Oct. 23, 1975 estimates construction time at 14 years), but Beluga coal has already been leased and is ready to be mined, and Healy coal is already in production and has been for years.

223 Page 41. "Heavy emphasis should be given to those technologies which utilize renewable or essentially inexhaustible energy sources." It is preposterous to imply, here as elsewhere in the DEIS, that the Susitna dams represent the use of renewable resources. A wilderness river is not a renewable resource. Once developed, it is destroyed forever. And great wilderness whitewater rivers are not only nonrenewable, they are exceedingly rare, thanks largely to the Corps of Engineers.

224 Page 42. More garbage graphics. What on earth do the figures on the left represent? 50,000 WHAT? On what information is the graph based? Here again, we are to accept it on faith. And it's an old, old trick to set forth one absurdly high figure to make one's preferred alternative look more reasonable by comparison. Whatever those left-hand numbers symbolize, the high range indicates we'll use 19 times as many of them in the year 2000 as we did in 1970. Even hamsters don't multiply that fast.

225 Page 45. There are some interesting implications on sedimentation here, although the DEIS wrongfully fails to make them explicit. The average natural flow in the five high-flow months of May-September is 19,328 cfs. If we assume an average sediment load of about 1000 ppm (the DEIS says it is "less than 1000," leading the cynic to believe that it must be very close indeed to 1000 ppm), then 19.3 cubic feet of silt would be flowing into the Watana reservoir every second during those five months for a total of 255,130,560 cubic feet (9,449,280 cubic yards), just in the May-September period, every year. We will charitably assume that no silt enters the reservoir from October-April. Meanwhile, of course, a small amount of silt is leaving the system: 15-35 ppm year-round in an average flow of 9300 cfs. Again generously assuming that a high 32 ppm leaves the system, that's .3 cubic feet of sediment lost per second or 9,460,800 cubic feet each year (350,400 cubic yards). In short, 9,449,280 cubic yards of silt, sand and gravel entering the system every year, 350,400 cubic yards going out, and a net yearly gain of 9,098,880 million cubic yards. That's a formidable amount of silt. Can the Corps guarantee that reservoir siltation problems will not occur here as they have at other dams?

226 Page 46. If whitewater can "reduce substantially" the supersaturated nitrogen and dissolved oxygen introduced into the water in passing over the spillway, then why not leave more whitewater available for this useful purpose, instead of submerging nine of the 11 miles of Devil Canyon?

227 Page 48. "Future detailed studies" will be necessary to make sure general channel degradation won't occur below the dam as the river attempts to regain its normal sediment load. These studies are to be part of "pre-construction planning," which the Corps would have us believe does not necessarily commit us to building the dams, despite the name.

We are told that the Watana would flood existing fish habitat but might create "other fish habitat at higher elevations on

these tributaries." Perhaps. But it's certainly not going to
replace spawning habitat, which requires clean, well-oxygenated
gravel; not while the Watana reservoir is fluctuating 125 feet 228
every summer!

Page 49. The Susitna carries winter silt loads of 4-228 ppm;
earlier the DEIS had termed the winter water "clear." Yet the
discharge below the dams would be "milky" at 15-35 ppm.
Both statements can't be true. The problem may be that the DEIS 229
tends to use figures distorted by extreme circumstances when the
mode would be more useful. Trivial here, perhaps, but not so
elsewhere--as regards energy demands, for instance.

Page 51, the question of fish habitat in lakes with heavy silt
inflow. The DEIS admits that it could be a problem, but mentions
the many natural lakes where there is fish habitat despite heavy
inflows of silt. But these lakes have equally heavy silt flows 230
back out, as anyone knows who has paddled the Tazlina. The lakes
don't simply silt up as the Watana reservoir will eventually.

Also on this page is the first hint ("the proposed series of
high-head dams") that the Corps does indeed intend to build all
four dams once it gets its foot in the door, despite the
pious assurance on page 89 that "the magnitude of environmental
impacts resulting from a four-dam system in the Upper Susitna
River Basin clearly makes this a less desirable alternative 231
than the one-, two-, or three-dam plans." The final EIS should
make explicit the Corps' intention to build all four dams.

Page 52. The problem of ice shelving in the Watana reservoir
and the attendant difficulties for caribou and moose attempting
to cross it is a serious one and there is no justification for
glossing over it, as the DEIS does. Studies indicate that cari- 232
bou use of the Watana site for grazing and crossing "was minimal
during the period November 1974 through April 1975." One five-
month study, on a migratory species like caribou, is of very
limited utility, yet the reader of the DEIS might well recieve
the impression that it proved that caribou do not and will not
use the area. No such conclusion is possible on the basis of
a single winter's study.

Page 53. Counting conditions in June 1974 were "less than ideal."
ADF&G saw only 356 moose, whereas they'd seen 1796 the previous
fall. Unless the winter was inordinately severe, we can assume
that counting conditions were not merely "less than ideal": they
were totally inadequate.. Yet the DEIS mentions the figures as 233
though they were meaningful. ADF&G has rightfully resented the
unreasonable haste with which it has had to carry out its Susitna
dam studies, and on a meager budget. Cooperation from the Corps
has been very poor.

Page 54, transmission line impacts. The DEIS states there will
be "not many per se; most...will be as a result of construction
and maintenance." In fact the growth the Susitna dams will
foster, and the easy access it will provide, will cause major

234 impacts. And as any hunter can attest, wildfowl tend to avoid transmission line corridors.

235 Page 56. "Initial annual visitation to the project area would be about 77,000 people"! Is this figure part of the source of that inflated 1.4 B/C ratio? How was it derived? If 77,000 people really did use the area (as opposed to merely driving by out of curiosity to glance at the dam, which would hardly provide a significant recreational benefit), the impact would be tremendously heavy. Can Talkeetna (pop. 200) handle such a visitor load?

236 Page 57. "Much of the existing tree and shrub cover in the Upper Susitna River Basin is located in the river and creek bottoms and on the steep canyon slopes above the streams and would be lost during dam construction." This is important moose habitat.

237 Page 61. Land along the Susitna "is a natural and scenic area that would probably qualify for wilderness classification under most definitions of the term." (Emphasis added.) Under what definition could it possibly fail to qualify? The proposed Corps project would definitely destroy a wilderness river and area of high quality. That fact should be admitted forthrightly in the final EIS.

238 "The proposed transmission line corridor would cross no existing or presently proposed scenic, wild, or recreational rivers, nor would it cross any existing or presently proposed wilderness areas or wildlife refuges." True, but what of the dams themselves, and the proposed Susitna National Wild River of conservationists' d-2 legislation now pending before Congress?

239 "Between Gold Creek and Cantwell, a visible (power) line would have substantial impact, particularly if located west of the highway and railroad." It could not be concealed through Broad Pass. This area provides some of the most strikingly scenic views of Mt. McKinley and the impact of such a transmission line would be devastating. It is appalling that the Corps would even consider placing the line on the west side of the highway and railroad.

240 Page 62. How fortunate that the "most likely" source of an 8.5 earthquake would be a safe 40 miles distant. Yet it is also admitted that "the Susitna Fault, truncated by the Denali Fault, bisects the region in a northeast to southwest direction approximately 2.5 miles west of the Watana damsite." What studies of the fault system and "most likely" quakes have been done by independent seismic experts? Why does the DEIS contain no maps or graphic displays showing the location of these faults? Was it feared that it would look a little too graphic only 2.5 miles from an 810-foot-high earthfill dam?

Page 63. There could be ice-fog conditions in the area below Devil Canyon Dam "during periods of extreme cold weather." The implication is that ice fog is a rare occurrence indeed, happening only under "extreme" conditions. Alaskans know better. Why did the DEIS not frankly state that ice fog would be present? It's hardly a critical point. Of course, the defensive attitude carries through elsewhere in the DEIS to more important matters. 241

Page 64. "The proposed projects will not create large blocks of excess electric power for heavy energy-consuming industries." An amazing statement! Without some good demand figures, how are we to believe this? What of the Healy and Beluga coal and the Cook Inlet and Prudhoe gas? Are these other entrepreneurs expected to give up their markets and go elsewhere? More plausibly, there will be a vast surplus and industry will be encouraged to come up to Alaska to use it. And in fact the Corps' own Joe Auberg (Western Planning Division, Washington office) says that the final EIS will recognize that construction of the hydro project would mean commitment to a growth policy for the southcentral region. 242

Can the town of Talkeetna handle the impact of 500 to 1000 construction workers? The construction period should be mentioned here. The reader should not have to look up a separate Corps fact sheet to find that the project will take 14 years. 243

Page 65. Problems with temperature, dissolved oxygen, and supersaturated nitrogen "would be held to minimal, and possibly insignificant levels by spillway design..." If the problem is really that easy to solve, why does it still exist on other major dams (e.g. Columbia)? The final EIS should not imply that the Corps has the answer to all the questions on supersaturated nitrogen, etc. It doesn't. 244

Page 68. "Future power systems" (but not this one?) "will also require approaches that include full consideration of environmental values and alternatives and must anticipate that Alaska and the nation will attach increasing importance to environmental protection, energy conservation, and conservation of nonrenewable resources." Again the DEIS fails to recognize that huge wilderness whitewater rivers are nonrenewable resources, and scarce, too. Nor is a dam, rapidly filling up with silt, truly a "renewable" resource. 245

Pages 70, 73. It is interesting to note the close proximity of major coal and petroleum resources to the cities of Anchorage and Fairbanks. Since the concept of the "railbelt" as having high energy needs is fallacious (the two widely-separated cities of Anchorage and Fairbanks are heavy energy consumers, and so to a much smaller extent are the towns of the Kenai Peninsula, but the handful of homesteaders, lodge-owners and railroad workers living along the "railbelt" account for a minute share of the total energy demand), why not simply utilize these nearby resources, which are already being developed, and without the need for federal funding? Or is the Corps telling Alaskans that we

246 must endure the environmental costs of strip-mining for coal, and the stress of pipeline booms, but are not to be permitted to gain any benefit from the development of our state's resources? Must all our coal, oil and gas be shipped to the Lower 48 for others to use?

247 Page 75. The forecast of energy needs is absurd. Having used 1.4 million barrels of oil and 16 billion cubic feet of natural gas in 1972, we are expected to use (under "mid-range" estimates!) 26 million barrels of oil (19 times as much) and 134 billion cubic feet of gas (eight times as much) in the year 2000 "if recent trends continue." Without further documentation of these amazing figures, the reader must inevitably think them equivalent to saying, "If recent trends continue, the teenager will be 10'6" by the time he's 33 years old."

248 Page 77. The "extreme costs and environmental effects involved in most tidal flow hydroelectric proposals are major factors opposing" tidal power. True enough; very few places in the world are suitable for the development of tidal power. Cook Inlet happens to be one of the best, however.

249 It is notable that the DEIS finds us "too small" for nuclear power or solid waste burning, but "too big" to be allowed to use our own oil and gas.

250 Page 67. The transmission line "right-of-way would provide cleared land at little or no expense to the farmer." A dangerously irresponsible statement that should be deleted from the final EIS. Radiation from high-voltage power lines is hazardous to living tissues.

251 Page 75. The difficulty of safe disposal of radioactive wastes is noted. Many people question the wisdom of a system that must rely on many future generations to deal responsibly with the byproducts of energy used by this generation. But the same argument can be raised in connection with this hydropower project. Even if it becomes obsolete, even if it silts up and can no longer produce power, a huge dam must be maintained and repaired forever, else downstream residents will be at risk of horrendous floods or mud-slides. A dam is a sword of Damocles hanging over the heads of our great-granchildren.

Page 94. We concur with the Alaska Energy Office criticism that the final EIS should include a net energy benefit analysis for the whole system, including the energy used during construction and losses during long-distance transmission.

Page 6, cost. Total first cost (January 1975) prices of $1.343 billion. There was no justification for using January 1975 prices in the DEIS. The Corps' October 23 fact sheet already shows a price jump to $1.5 billion (a $157,000,000 rise--more than enough to build Senator Gravel's federal office building!), but even this figure is ludicrous. The contractors will not be paid in 1975 dollars. The same fact sheet mentions a 14-year construction period. If the project were already in progress today, it could not be finished until late 1989. The whole DEIS is filled with speculative projections on dubious grounds; why was there no projection of costs in October 1989 dollars? If inflation continues at its current 13% rate--note that we are playing the Corps' own game here--the final cost will be $8.33 billion, a staggering sum. 252

But let us assume that inflation will be nonexistent for the next 14 years and that there will be no cost overruns. A modest proposal: instead of building the Susitna dams, that $1.5 billion could be invested. Even at a mere 6%, it would produce $90 million a year. It could be split up among some 400,000 people expected to live in the railbelt area at $225 per capita. Surely most Alaskans would prefer to have the cash--$900 yearly for a family of four would go far toward paying the gas bill!--and the generous U.S. taxpayer would be sure to approve, since the $1.5 billion principal would remain untouched. A beautiful wilderness whitewater river would not have to be destroyed, and Alaskans would not have to suffer through still another wracking construction boom. 253

The hydro project not only makes little sense for Alaska, it makes little sense in terms of a wise national energy policy. The opportunity cost of investing $1.5 billion to produce power for approximately 400,000 people is extremely high. This large an investment in projects other than hydropower could provide more energy for more people at lower environmental cost. 254

The DEIS suggests that Alaska would be dependent on oil and gas during the dams' 14-year construction time. When the dams come on line, the hydropower would theoretically replace oil and natural gas generating facilities, thus freeing up the oil and gas to be shipped to the Lower 48. (This scenario is unlikely to occur, as earlier noted, because the hydropower would probably attract large block industrial users and stimulate demand, rather than meeting existing and projected demand.) But even if oil and natural gas were no longer needed for electrical generation, the yearly savings would be insignificant compared to national oil consumption. The DEIS states that estimated 1972 fuel use for Alaska's power systems included 1.4 million barrels of oil. For purposes of comparison, in 1972 the nation as a whole used 5.99 billion barrels of oil. (Source: Ford Foundation Energy Policy Project, <u>Preliminary Report</u>.) Thus Alaska represented less than one four-thousandth of the total demand. 255

A major goal of the project is to conserve fossil fuels (p. 91).

> "By the same token, the project would contribute to a savings in nonrenewable energy resources with an energy equivalent of about 11.3 million barrels of oil, or approximately 80 billion cubic feet of gas per year. Although this savings is a principal factor in the consideration of a hydroelectric alternative, over the long haul hydroelectric energy must be viewed

256 as an interim measure for conserving the nation's nonrenewable energy sources until some more practical, permanent method of producing electricity is achieved which will not overburden the nation's or world's finite resources."

But $1.5 billion invested now in new energy sources and conservation measures would yield much greater benefits than the dams. The Corps is pushing for "pre-construction planning" funding as though an energy emergency situation, rather than a surplus, exists or will exist within the next couple of decades. There is no emergency, however. Alaska is well supplied with
257 energy resources in the process of being developed. The just-released study by the state Division of Geological and Geophysical Survey shows that with the Prudhoe Bay gas owned by the state we will have an embarrassment of energy riches. Since there is time, the $1.5 billion or $3 billion or $8 billion of the federal taxpayers' money which the dams will cost should instead be invested in research for alternative, better means of energy production, research which would be a godsend to the whole nation.

Sincerely yours,

Jack Hession

Jack Hession
Alaska Representative

RESPONSE TO COMMENTS BY
SIERRA CLUB

204 Comment noted.

205 The Federal Power Commission, in carrying out its functions under the Federal Power Act, is concerned with all elements in determining power values. The Corps cooperates with the Federal Power Commission in evaluating power benefits on the basis of unit power values developed by the Commission. Project power benefits include financing factors related to the alternative source of power, public or private, that would most likely be utilized to serve the same market area in the absence of the project. The alternative is usually a new, privately financed, modern, and efficient thermal powerplant. However, all alternatives are carefully examined. In the case of this study, both natural gas and coal were chosen as the most reasonable potential alternatives. Gas was eliminated on the basis of projected availability at the time hydropower would go on line in 1986, and by the direction of Congress to conserve nonrenewable resources and to utilize renewable resources for power generation where possible. There is no longer any reason to anticipate this fuel will continue to provide an abundant, cheap energy source for the long term as has been exercised in the past. In calculating the benefit/cost ratio of coal and hydropower alternatives, the latter was determined to have the greater benefits.

206 Comment noted.

207 It is true that some non-hydro alternatives, such as coal, are more flexible than hydropower in response to fluctuation in demand. However, the hydropower project presently proposed will not meet energy demand projected to exist within a relatively few years following project completion. Thus, existing or future coal or gas plants may well be used to provide the flexibility to cope with fluctuation in demand above the level of baseload requirements fulfilled by the hydropower project. For a thorough discussion of the effect of the project upon industrial development, see response number 255.

208 The coal alternative does enter into the hydro project cost-benefit calculation, because this alternative is the economic standard against which each of the hydropower plans is tested. That is, the power benefits of a given hydro system represent the cost of producing the same amount of power by constructing and generating a conventional, state-of-the-art generation system using coal as fuel. Thus, the coal alternative, by definition, has a benefit-cost ratio equal to one. The interest during construction was added to project costs, and those expenditures accruing after 1986 were discounted to the 1986 power-on-line date at 6-1/8 percent to give the total investment cost. The present worth of the benefits was calculated also by discounting at 6-1/8 percent to 1986. The investment cost and present worth of the benefits were then amortized at 6-1/8 percent over the 100-year project life to give annual costs and benefits which were then compared to give the benefit-cost ratio.

209 The coal alternative was not evaluated at an 8.77 percent discount rate. The 8.77 percent figure is used to calculate annual fixed charges and, as such, is used for different purposes than the discount rate employed in the hydro analysis. Incorporated in this 8.77 percent is the composite of municipal and REA borrowing costs in the Anchorage and Fairbanks areas. It is this cost of borrowing that is properly compared with the 6-1/8-percent discount rate annually established by the Treasury Department. The composite financing used by FPC in analyzing the public, non-Federally financed coal alternative was 6.25 percent interest rate for the Anchorage-Kenai market area, and 5.95 percent interest rate for the Fairbanks market area.

210 Most of the recreation benefits attributed to reservoir development are associated with the Devil Canyon site. Also see response number 81.

211 Comment noted.

212 The paragraph has been reworked to indicate that portions of the listed rivers are Class VI boating rivers, and that Devil Canyon is difficult instead of dangerous. For more information on white water of Susitna, see response number 257.

213 The Corps of Engineers is aware that "The Susitna is indeed proposed as a wild river in the conservationists' D-2 bill--". Furthermore, all land and water within the immediate area of project influence, including the upper Susitna River, are tentatively scheduled for selection as Native deficiency lands, which are classified as D-1. Section 3.0 of the EIS is devoted entirely to a discussion of the relationship of the proposed action to land use plans.

214 The paragraph from which the word "several" is excerpted refers to the 1974 findings of the U.S. Fish and Wildlife Service during a survey of raptor populations in the canyon area of the upper Susitna River. During this survey, three nesting pairs of bald eagles and two gyrofalcon nests were observed near the Devil Canyon area.

215 The Susitna River dams will require access roads which will be built at Federal expense. They will require year-round maintenance. The State may choose to incorporate these roads into the State highway system. If it does, then maintenance will become a State responsibility and cost. On the other hand, if the State does not choose to incorporate the roads into its highway system, maintenance will continue as a Federal responsibility and cost. Hunting pressure will not increase as a result of road access into the damsites since ADF&G has the statutory capabilities to control the actual pressures. Thus, only the potential for hunting pressure will increase.

216 The Susitna River has been drawn with a darkened line to more clearly show its location on the schematic maps.

217 The EIS clearly states (in Section 5.0) that increased pressures on existing game populations through hunting, trapping, and general disturbance and harassment will require intensified game management and law enforcement practices. As previously stated, ADF&G has the statutory capabilities to control these pressures--albeit, at greater cost and effort on the part of State government.

218 The quoted statement is included in the EIS to emphasize the importance of Susitna River Basin to wolverines. Encroachment to date has included more than "hunting lodges and trappers' cabins;" it has also included hunting and significant impact on wolverines in the Upper Susitna River Basin. We have expressed concern, however, (in Section 5.0) that any losses to moose and caribou occasioned by the project will "...impact upon predator species." This, of course, includes the wolverine.

219 Of course, the use of ATV's can be controlled. The Alaska Department of Fish and Game, in commenting on the draft EIS, has stated that it has the statutory capabilities to control the actual pressures of increased hunting potential. In the discussion of adverse environmental effects which cannot be avoided (Section 5.0), with reference to required road construction, it is stated: "This would have the potential to increase pressure on existing game populations through hunting, trapping, and general disturbance and harrassment. This in turn would require intensified game management and law enforcement practices and preventative measures for the control of wildfire." Increased costs related to intensified management and law enforcement would be borne by the State.

220 There is nothing in the referenced paragraph which implies that the "Superlative, huge whitewater of Devil Canyon" is unattractive, much less 'very unattractive'." However, to be constant with an earlier change in adjectives suggested by the reviewers, we have substituted the word "difficult" for "violent."

221 The Jones and Jones report was provided to the Alaska District in March 1975, and has been available in the District office for public review since that time. All relevant, significant information contained in the report was utilized in preparation of the draft EIS. With respect to the report's recommendation concerning the inundation of Devil Canyon, the following is quoted from page 8 of the report: "In particular, it is suggested that relocation of the Devil Canyon Dam to a point above Devil Creek be investigated, perhaps at a higher pool level, coupled with relocation of the Vee damsite somewhat downstream and deletion of the Watana damsite entirely. Possible benefits include preservation of the esthetic resources of Devil Canyon and enhanced reservoir fish habitat and recreational opportunities." In fact, not only was this alternative considered and evaluated, it was but one of a number of dams and combinations of reservoirs which were evaluated in selecting the proposed plan. The authority and responsibility for this final decision rests with the District Engineer--not with a consultant.

222 Comment noted.

223 The EIS candidly discusses the inundation of some 82 miles of the Susitna River, including 9 miles of the existing 11-mile whitewater section in Devil Canyon. The whole section from which the sentence is quoted deals with energy needs. The Susitna River does, in fact, constitute an inexhaustible energy source.

224 The ordinate scale of the load projections on the projected energy demand graph was inadvertently not labeled in the draft EIS. The numbers in this scale represent kilowatt-hours (in millions) and have been so labeled in the revised draft EIS. The origin and meaning of the curves on the graph are fully discussed in the EIS. The mid-range load projection curve selected for the Corps' analysis is considered conservative, with annual rates of increase in power, requirements less than 7 percent after 1980 as compared to an historical annual growth rate of 14 percent during the period 1960 to 1971.

225 On the basis of data from reservoir projects on many types of rivers, the Corps has developed a reliable methodology for calculating sedimentation rates. On the basis of this methodology, which includes consideration of geologic characteristics of the basin, river gradient, precipitation patterns, runoff characteristics, and topography, the Corps has estimated that the project will exceed by a large margin the 100-year life upon which economic justification is based (it is presently believed that the useful life of the project due to sedimentation may exceed 500 years).

226 Nitrogen supersaturation is a phenomenon which would only occur when water is released through the overflow structure. This would occur at an estimated frequency of once every 2 years with a duration of 14 days. The overflow structure will be designed to minimize introduction of nitrogen. The expected impact of this condition is not significant enough to warrant relocation of the dam.

227 Quoted fully, the sentence containing the phrase "future detailed studies" states: "However, this phenomenon would be the subject of future detailed studies to determine the distance at which sediment loads would become reestablished." There is nothing in the EIS indicating that such studies "...will be necessary to make sure general channel degradation won't occur below the dam..." It is true that the referenced future detailed studies are recommended as part of preconstruction planning. Detailed planning of all Corps projects is done following specific Congressional authorization and funding of such studies. Following the completion of detailed preconstruction planning, Congress again determines whether or not the project should be funded for construction.

228 The EIS states only that possibly other fish habitat would be created at higher elevations on the tributaries to the Watana reservoir. The actual effects can only be predicted on the basis of detailed field studies. There is a good possibility that reservoir fluctuation would not significantly affect spawning habitat. Drawdown will occur during the winter months, when river inflow is low. The reservoir will be filled during the spring and summer months of higher runoff. Should spawning occur during the period when the reservoir is full and relatively stable, there may be little adverse impact on any new spawning habitat created at the higher elevation.

229 In describing river characteristics under existing conditions in Section 2.0 of the EIS, it is stated: "During the winter when low temperatures retard water flows, streams run relatively silt-free." We see no conflict between this statement and the one on page 49 of the draft EIS which states that winter investigations by the Alaska Department of Fish and Game indicated that suspended solids ranged from 4 ppm to 228 ppm. Following project construction it is predicted that suspended sediment in releases at Devil Canyon Dam would be relatively low (15 to 35 ppm) year-round as a consequence of heavier sediments being retained in the reservoirs. However, even at this low figure, it is predicted that the water may not be as clear in the winter months as it now is due to the nature of the very fine "glacial scour" which will be introduced into the reservoirs during the summer months and remain in suspension during the winter. Sediment samples taken by ADF&G under existing conditions reflect a transport of heavy sediments which originate from the riverbed itself. Relatively high concentrations of large, granular material may not significantly affect water clarity, whereas much smaller amounts of a finely suspended sediment will cause a turbid or "milky" appearance. The last two sentences of the reviewer's comment are noted.

230 All lakes silt up. The rapidity of filling is related to the amount and characteristics of sediment inflow, outflow, and the size, depth, and length of the lake. This is equally true of natural bodies of water and manmade lakes.

231 The "proposed series of high-head dams" refers to the Devil Canyon and Watana dams. These are the only dams proposed for development in the Upper Susitna River Basin. The proposed high-head Watana Dam inundates the Vee damsite thus making it unavailable for hydroelectric development. There are no other damsites suitable for development of a high-head dam.

232 The following statement is made in the referenced paragraph of the EIS: "...under adverse ice conditions, the reservoirs could result in increased problems for some segments of the herd. Also, there could be some permanent changes in historical herd movement patterns." The five-month study by ADF&G was referenced because it is the only study that has been made of caribou crossing at the Watana reservoir site. A previous paragraph states that caribou do use the area.

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233 There is no implication in the referenced paragraph that the moose count figures are "meaningful." They are included simply as a matter of recorded fact. If any conclusion can be drawn from these statistics, it would appear to be that the upper Susitna River and the low drainage areas of the major tributaries provide important moose wintering habitat. The statement "cooperation from the Corps has been very poor" is a misstatement of facts. The Corps has cooperated and worked very closely with ADF&G.

234 Impacts resulting from the transmission lines, including secondary effects resulting from road access, are thoroughly discussed in other paragraphs in this section of the report. We note with interest that some reviewers regard transmission lines as a threat to wildfowl because of the possibility of collision while others believe that wildfowl tend to avoid transmission line corridors.

235 The visitation estimate was provided by a private consultant who closely coordinated his work with the Bureau of Outdoor Recreation and the Alaska Division of Parks. Benefits attributable to recreation constitute approximately 0.2 of 1 percent of the annual project benefits. The Corps has not predicted that the estimated 77,000 people who will visit the project annually will also visit Talkeetna, which would be separated from the Devil Canyon site by over 110 miles of roads. There is no planned direct project road access between Gold Creek and Talkeetna.

236 As required by the 1958 Wildlife Coordination Act, the Corps has requested from the U.S. Fish and Wildlife Service an evaluation of project impacts upon fish and wildlife resources, including moose. Upon the conclusions of their study, a determination will be made through the cooperative efforts of wildlife agencies to determine mitigation measures necessary for the unavoidable destruction of moose habitat.

237 The Corps' description is accurate as written. There are many criteria established for wilderness classification of an area. The description was put in the EIS to inform the reader of the wilderness quality of the area. The fact that a portion of this area will be extensively modified, including complete inundation of some 84 miles of river, is clearly stated and extensively described in the EIS.

238 As stated in response to a previous question, the lands affected by the project are presently classified as native village deficiency lands, and the Corps is aware of conservationists' D-2 legislation now pending before Congress.

239 The Corps is not considering placing the transmission line on the west side of the highway and railroad between Gold Creek and Cantwell. The quoted sentence is factual as written. The schematic figure indicating the location of the transmission line corridor has been clarified.

240 The Susitna Fault, although close to the project, does not have the probability of creating as violent an earthquake at the reservoir sites as does the more distant Denali Fault. For this reason, an 8.5 Richter Maximum Credible Earthquake (MCE) at the Denali Fault (40 miles distant) was selected for design purposes rather than the 6.0 Richter MCE event which could result from the Susitna Fault (2.5 miles distant). The fault system of the entire area would be thoroughly studied prior to final project design and construction.

241 Again the statement concerning the possibility of the occurrence of ice-fog conditions below Devil Canyon Dam during periods of extreme cold weather is factual as written. As noted in the comment, this is hardly a critical point given the remote location of the damsite.

242 The EIS already recognizes growth as an inevitable occurrence in the Southcentral Region, unless an anti-growth policy is established to prevent it. The projected energy demand upon which justification for the project is based is clearly explained in the EIS and illustrated in Figure 9. A medium growth rate, as projected by the Alaska Power Administration, contains no provision for energy needs which would be required of large industrial development. The question of industrial development is more fully addressed in response number 255.

243 The temporary impact of construction workers upon small communities is discussed in the EIS (Section 5.0). The fact that the impact is temporary is one of the primary reasons that it may be particularly adverse. The total period of construction is expected to take 10 years. Approximately 4 years will be required for preconstruction planning. Construction workers will not be present during this period. As stated previously, Talkeetna is over 110 miles by road from Devil Canyon Dam and nearly 150 miles by road from the Watana damsite.

244 Nitrogen supersaturation in the Columbia River is caused by the depth of the plunge pools immediately downstream of the various dam projects. The Corps of Engineers, through extensive research conducted jointly with State and Federal environmental agencies, has developed a "flip lip" that is being incorporated into the Columbia River spillway section of hydropower projects to prevent flows from plunging into deep pools. Although nitrogen supersaturation is still present in the Columbia River, the concerned agencies are optimistic that with the installation of "flip lips" into the spillway of critical projects, the level of nitrogen supersaturation in the Columbia River system will be reduced to noncritical levels. Other factors influencing nitrogen supersaturation include water depth in the river, stream turbulence, distance, etc.

245 The sentence quoted from the EIS states that, along with energy conservation and conservation of nonrenewable resources, environmental protection will be attached increasing importance by the nation. The EIS clearly indicates the trade-offs between these different values which would be required by hydroelectric development. The nation, as represented by the actions of Congress, will in effect determine whether or not the costs of the trade-off are justified by the benefits. The EIS does not state or imply that dams constitute a renewable resource. Only water is indicated as having this characteristic.

246 Alternatives related to gas, oil, and coal are sufficiently discussed in the EIS to explain the justification of their rejection as alternatives to hydropower.

247 Comment noted.

248 The sentence from which the phase is quoted refers to all tidal flow hydroelectric proposals. Tidal power is seldom if ever proposed in areas where it is not "suitable." Cook Inlet may be one of the best areas for such development; nevertheless, the "extreme costs and environmental effects" are the basis for not recommending it for tidal flow hydroelectric development.

249 The basis for the rejection of nuclear power, solid waste burning, and oil and gas alternatives are explained in the EIS. Some of the alternatives were rejected on the basis of providing either excess or insufficient energy to meet a reasonable amount of the needs of moderately projected growth.

250 The statement is factual and has not been deleted from the EIS. Scientific studies of the radiation effects of high voltage power lines indicate that there are no harmful human effects from lines transmitting less than 500 kv. The maximum power transmitted on the proposed system would be 345 kv. Farming practices, furthermore, generally do not expose humans to sustained, close-range contact with transmission lines. For reference to an authoritative study concerning the health hazards of transmission line radiation, see response number 196.

251 Comments noted.

252 Prices at the actual time of construction will undoubtedly be higher than January 1975 prices. Similarly, the price of energy will also be higher, and since the project produces energy long after the great majority of project costs are paid, incorporation of a general price level escalator would have the effect of amplifying benefits to a greater degree than costs. Assuming inflation would, therefore, cause the project to appear more economically favorable. Inflation is not assumed because assumptions about future price levels are deemed too speculative. Future values, cost, and benefits will be equally affected by inflation. Long-range projections are not made based simply on historical rates of growth. They are often included in a discussion for purposes of comparison.

253 Comment noted.

254 The study reveals that the hydro project will produce the required energy at a low economic and environmental cost.

255 Stimulation of significant heavy industrial development is not expected to result from the Susitna Project for the following reasons:

1. The projected energy load growth upon which the marketability assumptions are based, does not incorporate significant heavy industrial development. Rather, the projection assumes a gradual expansion of industry based only on already planned expansions to existing facilities and on readily identifiable new industry closely tied to proven resource capabilities and economic realities; this development is expected with or without the project.

2. The hydro project is designed to provide additional power incrementally through phased construction. From 1986 to about 1995, the Susitna power will meet both increased load and displace otherwise produced by more costly stream-fired plants. The less efficient and obsolete steam-fired plants will be inactivated or retired.

3. There will be some secondary energy associated with the proposed plan. Such energy is not designed into the plan, but is a result of defining the "firm" energy as that which can be produced in the worst water year (drought). Thus, in most years, there is additional water available to produce "secondary" energy which, because it cannot be quaranteed to the user, is usually sold at a discount on a when-available basis.

The secondary capability of the proposed plan is seasonal, occuring during the summer months of June through September, and amounts to about 12 percent of the firm energy output. Of the 25 years of stream flows utilized for the operational studies, secondary energy would be available during the summer months of 16 of the years. It is estimated that secondary energy would be marketed at about 10 mills per KWH or approximately 50 percent of the estimated cost of firm energy. Neither firm nor secondary energy generated from the Susitna Basin projects will be what is commonly termed "cheap" power even though it is attractive when compared to the thermal generated alternatives available for satisfying future Railbelt energy needs. Marketability analysis has determined that the required pay-back usage rate for firm energy from the Susitna Project, is 21.2 mills per KWH. In comparison, present rates for firm energy marketed by Bonneville Power Administration in the Pacific Northwest during the winter months is 4.1 mills and less in the summer. In general, energy by the hydro project will be somewhat less expensive than energy provided from alternative sources. It is for this and environmental reasons, that the hydro project is the selected plan. The resulting energy cost savings will accrue to all Railbelt area electricty users. This lower cost energy will provide a slight locational advantage to the Railbelt area in comparison to conditions without the plan. Significant stimulation of heavy industry is not expected to result, however, because as noted above, the project is designed such that available capacity as closely as possible approximates the projected demand. Further, the cheaper secondary energy will be available on too irregular a basis to serve as an important determinant in industrial locational decision-making.

256 Coment noted.

CITIZEN COMMENTS AND RESPONSES

SALMON MEDICAL CENTER
BOX 1110
SALMON, IDAHO 83467
W. L. BLACKADAR, M.D. 756-3833
BOYD K. SIMMONS M.D. 756-3833

October 16, 1975

Alaska District Corps of Engineers

Anchorage, Alaska

Re: Draft environmental impact statement on the Upper Susitna Basin - Hydroelectric power development

Dear Sir:

I have reviewed carefully your 95 page statement and am alarmed that you dismiss the adverse changes in Devil's Canyon in a two line insert on page 93. The loss of Devil's Canyon for white water kayaking deserves much more impact than you have given it. This section of canyon has only been paddled a few times but it is paddleable and it is destined to become extremely well used and extremely popular.

Ten years ago, almost no one had run the Grand Canyon in kayaks. Now, thousands are traversing this famous gorge. As these thousands look for new horizons, Devil's Canyon looms as the only challenge which is technically feasible to do without undue risk. I paddled Devil's Canyon in 1972, plan to return with a large group this next summer and I know of another group that will go independently. To lose the Devil's Canyon section of white water would be a tragic loss to America and it's future generations because there is no other place like it in North America, or for that matter the world as far as I know.

You dismiss the anadromous fish capacity of the Susitna by stating that fish do not now traverse Devil's Canyon. This to my knowledge is true and yet it would be a very simple project to pass fish successfully through Devil's Canyon since the bottleneck, I believe, is only in two drops. These could easily be altered with short tunnels to permit this passage or some sort ofladder operation so actually the loss to fisheries of Devil's Canyon is thoroughly as great as that loss would be at Rampart over a five hundred year period.

While you have listed many proposals for the Susitna all of them include a dam in Devils Canyon. Certainly some alternative thought should be given towards having only the upstream dams built allowing future generations to make the decision in, Devils Canyon.

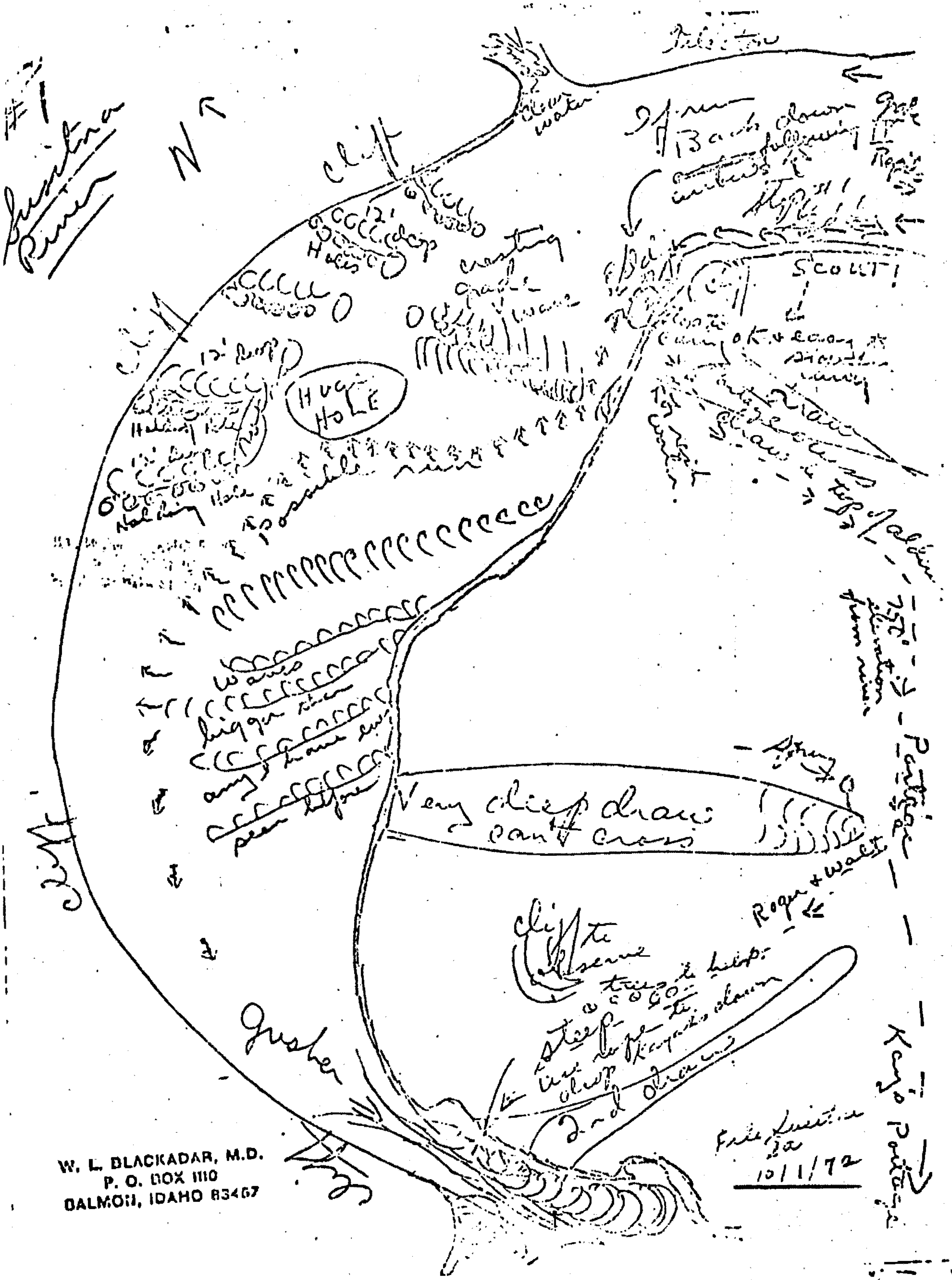
Please enter this statement in the hearing record and have it show that there is strong opposition to the Devil's Canyon dam and that this loss will be irretrievable.

Sincerely submitted,

Walt Blackadar

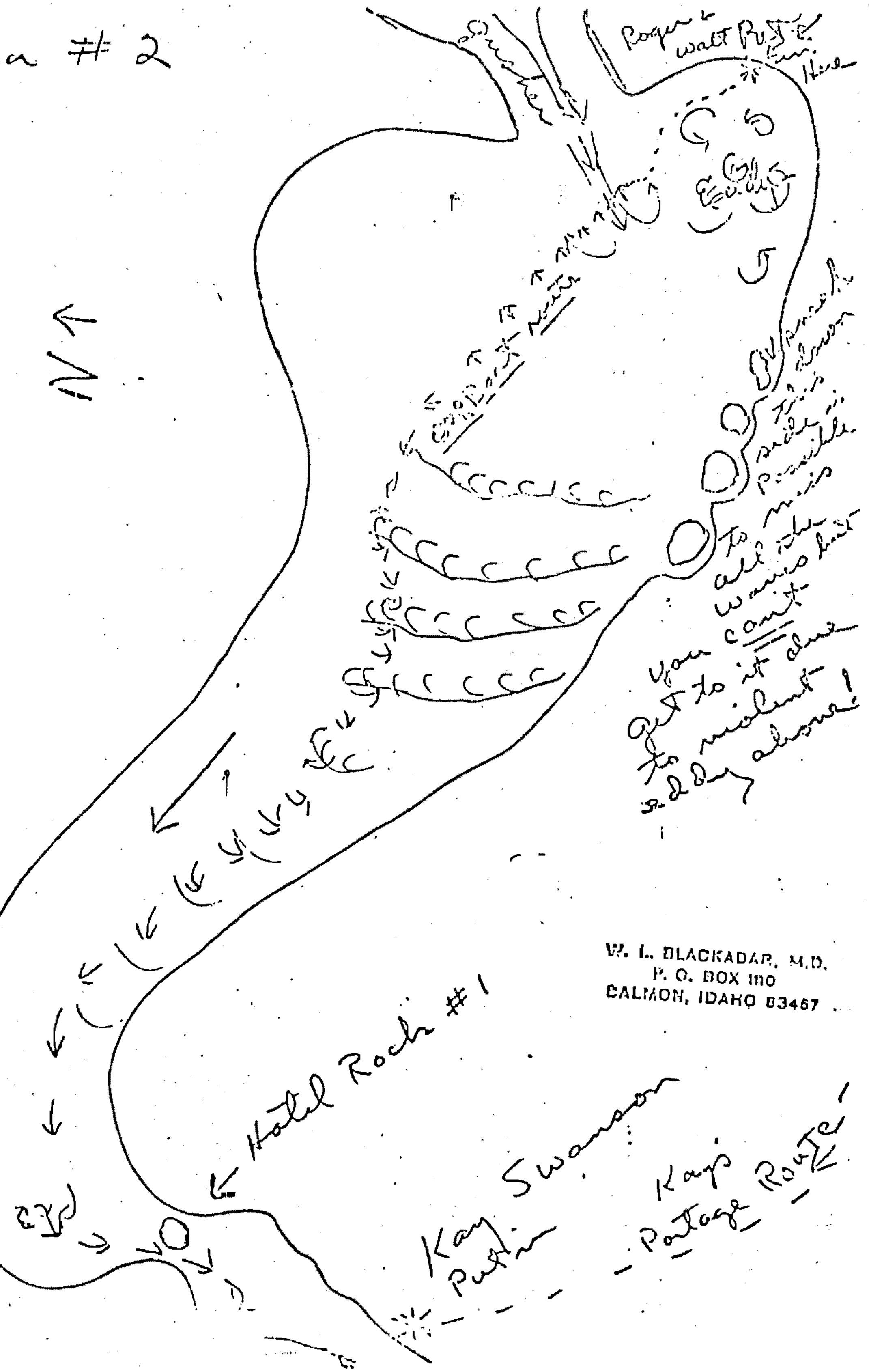
W. L. Blackadar, M.D.

WLB:kc



W. L. BLACKADAR, M.D.
P. O. BOX 1110
SALMON, IDAHO 83467

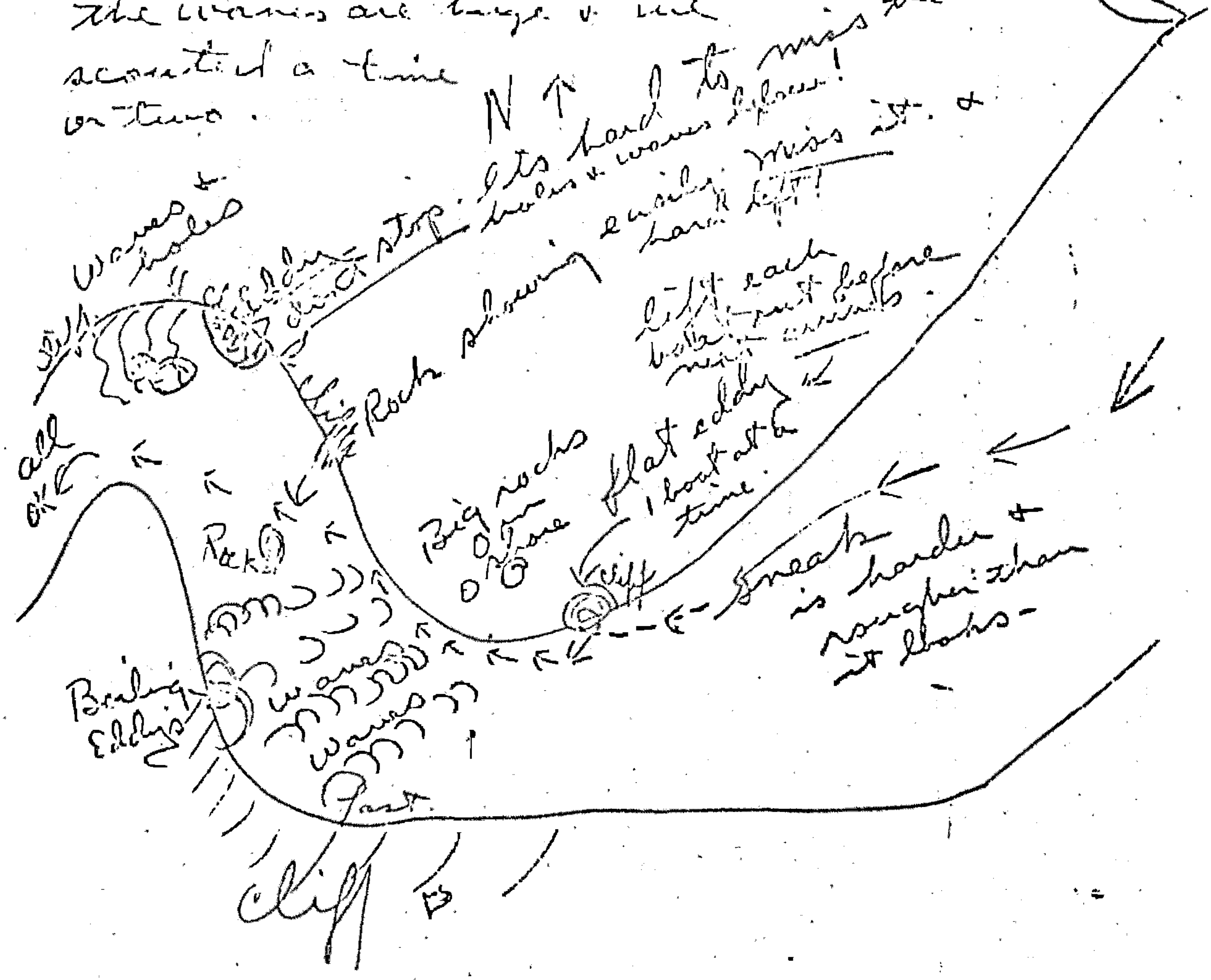
Susitna #2



W. L. BLACKADAR, M.D.
P. O. BOX 1110
SALMON, IDAHO 83467

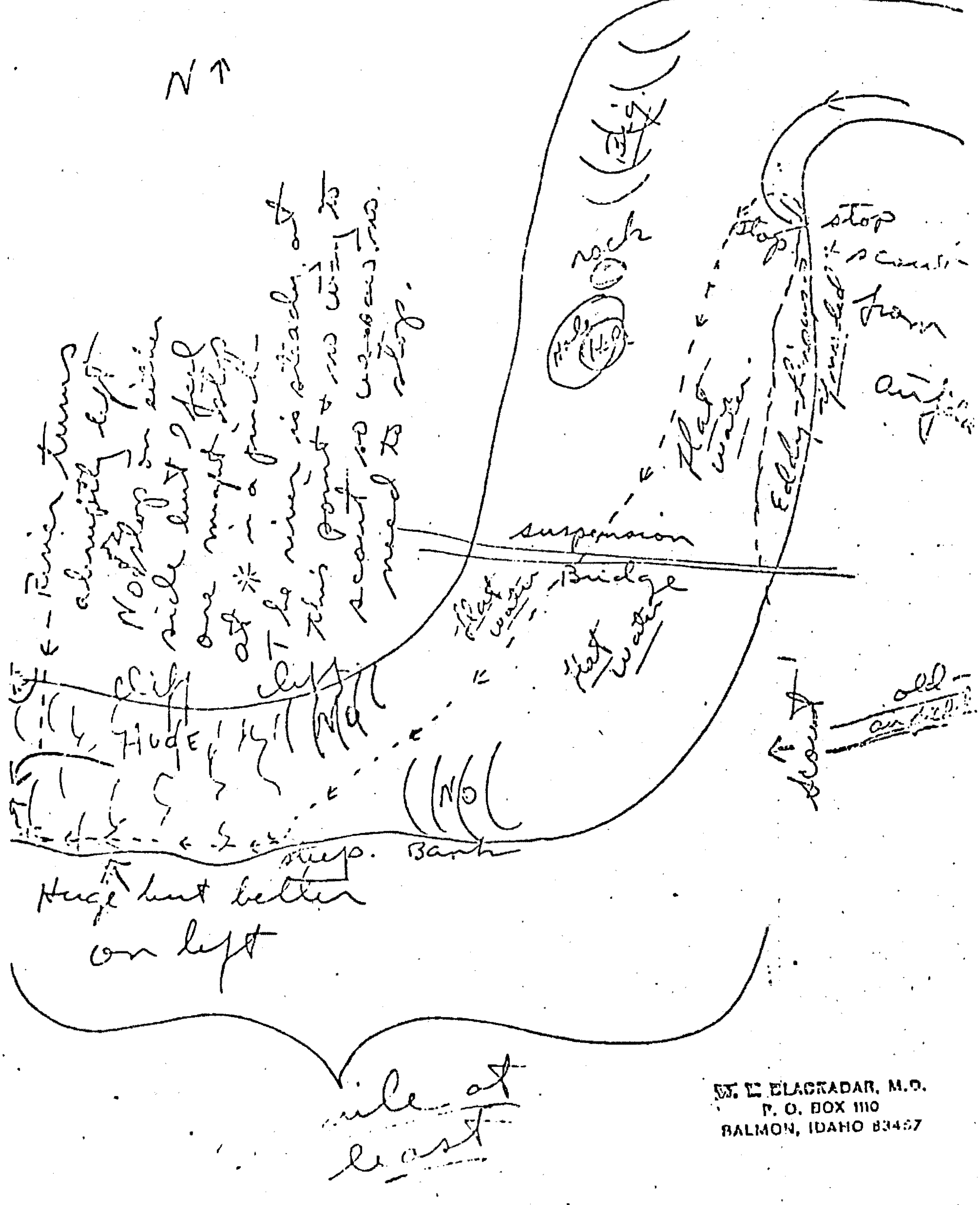
Susitna #3

nothing else needs scouting from the house rocks in #2 even though the waves are large & one scouted a time or two.

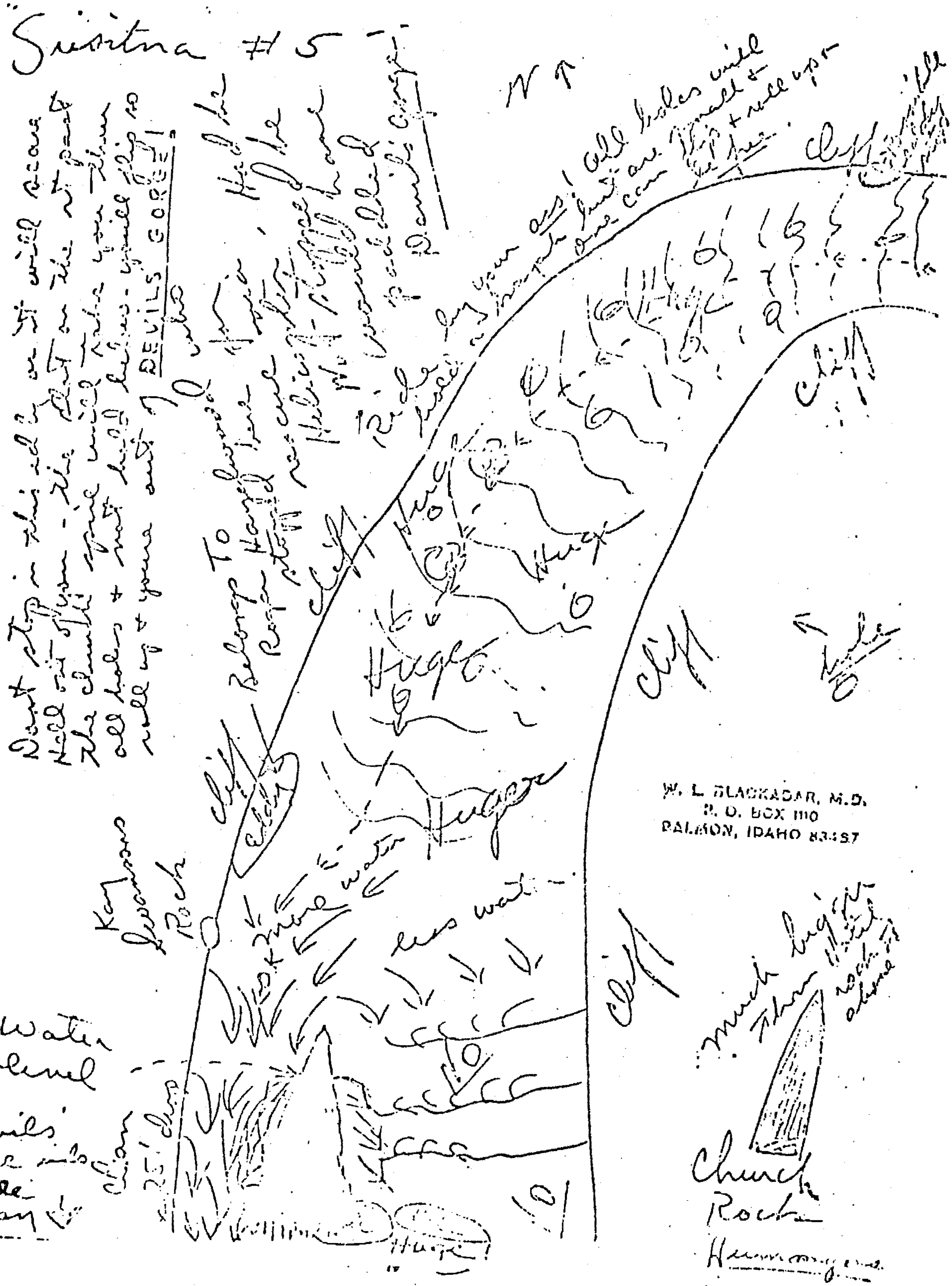


W. L. BLACKADAR, M.D.
P. O. BOX 1110
SALMON, IDAHO 83467

Susitna # 4



W. L. BLACKADAR, M.D.
P. O. BOX 1110
SALMON, IDAHO 83467



W. L. BLACKADAR, M.D.
P. O. BOX 1110
SALMON, IDAHO 83467

Susitna # 6

This is a class VI river A.W.A.
No one should paddle it unless he or she has run Crystal + Lava in the middle - It's huge water of unbelievable strength + power. Waves well over 20' high + much more unstable like [illegible] #5 above! Watch carefully for the spine at the bottom of 5 + go on the rt. bank and trust to luck. It's clean but quite a ride! 25' or more down

#1 might be paddleable but none of us were interested! The only route feasible would be to work backwards down the left chute + ferry for your life to the rt. hoping to use the bottom of the holes to cross - thereafter running down the rt bank to the gusher which will squirt you way out! Should you miss the ferry you'll be in for the ride of your life - and you won't live unless you roll up!

Best wishes,

Walt Blackadar, M.D.

W. L. BLACKADAR, M.D.
P. O. BOX 160
SALMON, IDAHO 83467

RESPONSE TO COMMENTS BY
W. L. BLACKADAR, M.D.

257 Comments contained in Dr. Blackadar's letter of 16 October 1975 are noted. Drawings and notations made by Dr. Blackadar on 1 October 1972 (not an inclosure with Dr. Blackadar's letter of 16 October 1975) are also inclosed, since they contain additional information related to the navigability of the whitewater section of Devil Canyon. Comparing the possible loss to theoretical salmon introduction into the upper Susitna basin to the huge area covered by the Yukon River drainage above Rampart appears to be somewhat exaggerated.

October 7, 1975

My name is Eric Boemer and I live ~~at~~ on Dearmoun Road. As of now, my occupation is a school bus driver. I am interested in what is taking place here in this wild and beautiful state of Alaska

Originally I am from California and am familar with this word we know as "progress." Also I am familar with the Army Corp of Engineers and their occupation. The issue here tonight is as I feel, is a dam or several dams on the Susitna River in the best interests of all Alaskans. Searching my soul, it says that the dam is not needed.

258 Anchorage and Fairbanks are growing in leaps and bounds. The sprawling metropolis thrives on our natural resources. It is evident to see what could happen if these dams are erected, and power is distributed from Anchorage to Fairbanks. Do Alaskans really want this so called progress?? I think not.

The rivers on the earth are throbbing arteries which support life on this planet. What happens when man made dams are constructed on these rivers? First of all, the fertile nutrients normally carried downstream are backed up in a artificial lake. Whatever happens upstream on the river is going to have a significant effect on the downstream portions. How will this effect the waters in the ocean or bay when they are deprived of these nutrients. In Egypt, the Aswan dam had a drastic effect on the fisheries in the ocean; will this happen to the Cook Inlet??

In 1973, the Susitna river was recommended for detailed study under the National and Wild Rivers Act. So far, it has not been seeing much attention this river could possibly be of national significance; for the entire United States. The white water stretch in Devils Canyon is a wild and raging torrent of water, symbolizing the qualities that make Alaska what it is. If the dam is constructed, the river will be tamed ~~to a slow moving remnant of~~ beyond repair.

259 What are our alternatives to damming the Susitna river, or for that matter any river? First, in this age of computer technology, it seems that anything that man can put his unlimited mind to, he can do. Using this as a basic philosophy, other sources of energy can and should be utilized. The corps of engineers feel that solar, wind, ~~an~~ geothermal, and nuclear fusion are not feasible in the next 15 years. I disagree!!! These comparatively non-polluting forms of energy, are within our grasp.

It is time to set new directions!!

Other considerations which need mentioning deal with the possibility of Earthquakes in this region. Will the proposed dam really hold up to a earthquake of the magnitude of the last 1964 quake?? What would happen if it did not?? The communities that had developed because of this power supply would be wiped out.

What of the wildlife of the region? What will happen 260
to the migrating caribou, the of the Nelchina herd. The Alaska Fish and Game considers them to be a one of the most important carib
population in the State. Is it worth pushing these animals farther 261
and farther back into the wilds, in the name of development and progress. How will this effect the Natives who are subsisting off of these wander. creatures?? More research is needed to determine the effects that dam build. will have on the wildlife in the area and also the socio-economic aspects effecting the people of Alaska.

Thank you for your time and patience in hearing my story.

Eric Boemer

69-737 O - 81 - 47

RESPONSE TO COMMENTS BY
ERIC BOEMER

258 The growing populations of the Anchorage and Fairbanks areas will generate an increased demand for energy. Hydroelectric power is considered to be the most desirable method of supplying projected energy needs at this time.

259 The alternatives are listed and discussed in Section 6.0 of the EIS.

260 See response number 240.

261 The possible impacts of the impoundments on the Nelchina herd have been discussed in the EIS. Additional studies concerning the wildlife within the region will be conducted during the preconstruction planning phase of the project.

October 19, 1975

426 Skarland Hall

U. of A., College, Ak.

99701

Southcentral Railbelt Task Team

Alaska District, Corps of Engineers

Box 7002,

Anchorage, Ak., 99510

Dear Sirs,

We've been discouraged by past proposals made by the Corps, particularly the Rampart Dam proposal. We're more encouraged by the Susitna Dam project, which demonstrates more thorough research and more attention to environmental impacts than the preceding studies. However, we do find some weaknesses in the study, and we find we can't accept the proposal for a number of reasons.

This testimony considers only the Devil Canyon/Watana dams proposal. These two dams will have some significant impacts, which we found were inadequately considered, or not considered at all, in your study.

Most important are the possible impacts on the Nelchina caribou herd. This is the most important herd in Alaska in terms of annual sport-hunter harvest: it deserves much consideration. Colonel Debelius mentioned during his presentation at the Fairbanks hearing on the Draft EIS that the herd consistently crosses the river in July, and that the major impact of the dams on the herd would be an occasional mortality due to ice shelving in the reservoirs.

We've done some further research, and feel that a far greater impact on the herd is likely. In middle May, the herd calves along the south banks of the Susitna River, beside the proposed Watana reservoir. The herd normally crosses to the summer grounds north of the river in late May and early June. Migration times fluctuate more widely than your report indicates. (Most of this information comes from an Alaska Department of Fish and Game report entitled, "Nelchina Caribou Report", by Gregory N. Bos, published in April 1973 by the Department)

It is likely that the herd would frequently cross the reservoir before the ice is out. Caribou are excellent swimmers and low mortality would be expected even when large numbers of very young calves cross an ice-free, turbulent river. However, hoofed animals can't cope with falls through ice: they are not able to climb out again. At Lake Louise, biologists have observed caribou breaking through thin ice, and all the animals subsequently drowned.

We wonder about the stability of the ice on Watana Reservoir with expected water level fluctuations of 125 feet. Ice developing on fluctuating water surfaces could be expected to be particularly unstable. We would expect unstable ice on the reservoirs to have serious effects on calf numbers.

The proposed access road is likely to draw a number of hunters, snowmachiners and assorted members of the public to the area, further increasing mortality. The area presently acts as a recharge area for wildlife: a number of different game populations enjoy stability of numbers and security in the dam area, due mostly to difficult access. If the dams are built, we strongly recommend keeping the access road closed to the public, and we recommend not planning campsites and recreation areas around the reservoirs.

We looked at the Alaska Power Commission report on which your energy demand curve is based. We question its accuracy, since it predicts future energy need partly on increased energy use stemming from the oil pipeline impact: an impact we don't expect to continue. Energy needs may well be much less than the energy needs you have projected.

The Corps' Public Brochure stated," A particularly important consideration of certain hydropower projects is the potential to provide far more power than demanded at the time operation begins. Plentiful power at relatively low costs can stimulate growth and development."(pg. 11).

We don't want to see increased industrialization in the state--we feel that this is a very real danger from this hydroelectric project. Primarily for this reason, we would rather see, for the immediate future, utilization of natural gas from the proposed natural gas pipeline, replaced in the more distant future by geothermal power.

We don't want energy production above that necessary for the immediate future, since excess energy could stimulate, not only industrialization, but wasteful energy use--a bad habit for the public to develop. We feel that it is poor planning to decide to build a dam before knowing where the gas pipeline will go.

We question Colonel Debelius' statement, made at the Fairbanks hearing, that the life expectancy of the dam would be 500 years. This seems improbable, since we know of no dam with a projected lifetime of over 100 years. Hoover dam was also predicted to have a low siltation rate, and it began silting up before construction was completed. What would the benefit/cost analysis look like if the projected lifetime was 100 years or less, rather than 500 years? We feel this would be a more realistic estimate.

The Susitna is one of the most important rivers in the state in terms of its beauty and in terms of the abundance of wildlife in its drainage area. We place a very high value on an undammed Susitna River, not only for the above reasons, but for its value as a wilderness. If energy is really necessary, we approve of hydropower projects on smaller scales. We feel that the Susitna River is the wrong river to dam.

262

Sincerely,

Mary Evans

Mary Evans
wildlife management major, U. of A.

Dan Huttunen

Dan Huttunen
wildlife management major, U. of A.

Bob Fox

Bob Fox
TVCC instructor

RESPONSE TO COMMENTS BY
MARY EVANS, DAN HUTTUNEN, AND BOB FOX

262 Comments are noted.

In reference to comments on the Nelchina caribou herd: The information on caribou (Sections 2.01.3.1 and 4.03 of the EIS) was taken from several sources including the Alaska Regional Profiles--Southcentral Region, July 1974 and the State of Alaska, Department of Fish and Game's Alaska's Wildlife and Habitat, January 1973. As stated in the EIS: "Warmer weather and a rapidly filling reservoir should eliminate any adverse ice conditions during the month of May." The major calving area for the Nelchina herd is on the upper reaches of Kasina Creek, Oshetna River, and Little Nelchina River drainages with calving generally taking place between mid-May and mid-June. Migration to the surrounding summer ranges usually begins in the latter part of June with the major movement taking place in July.

As stated in Section 4.15 of the EIS: Even though the project-life is computed on a 100-year period for economic reasons, with adequate maintenance, the useful life of the proposed projects due to sedimentation is estimated to be excess of 500 years. The benefit-cost ratio is based on a project-life of 100 years and is a fixed standard for all Federal hydropower project evaluation.

SEA AIRMOTIVE, INC.

Mr. Chairman, Ladies & Gentlemen:

My name is Ward I. Gay. We operate Sea Airmotive, Inc. at Lake Hood, an air taxi operation. I have lived in Anchorage for the past 40 years and have seen a lot of changes here.

We have needed the Devil Canyon Dam on the Upper Susitna River for 20 years and,in fact, I flew personnel on survey trips of this dam site more than 25 years ago, before any gas or oil was discovered in Alaska. I also remember when the Eklutna hydroelectric plan was first proposed (before World War II). The original estimate was slightly over six million dollars. When we finally got around to doing it, the cost was in excess of 32 million dollars. The big delay was because we did not need that much power. Then gas was discovered at Kasilof. The people in Anchorage wanted gas, so we voted a 20 year franchise to a company and built a pipeline from Kasilof to Anchorage that we are still paying for, even though we have natural gas right across the inlet from us that there is no use for. Chugach Electric has built a power plant at Beluga, that should have been in Anchorage, but the gas was cheaper at Beluga even with building 2 power lines to transmit it to Anchorage. It seems they can bring the power in but not the gas. Maybe because of the franchise. Anyway, the people have to pay for it no matter how it is done so instead of making more mistakes, lets build the Devil Canyon Dam on the Susitna and furnish power to the whole railbelt. This will be utilizing a natural resource that is not expendable. Then the natural resources that are expendable, such as natural gas, oil and coal can be sold to other states and countries that are not as fortunate as we are in having an abundance of water.

It has been said that this dam would destroy wild game habitat and calving grounds fot caribou. I took my first hunting party to the Fog Lakes in the fall of 1947 and have hunted there every year since. I have seen thousands of caribou go down the bank and swim the 100 yards of river and go up the other side, seldom stopping in the small spruce timber because they know they are vulnerable to wolves and bear in the timber, and there is very little for them to eat there. I have never seen a cow have her calf down in the canyon. They like the hills above timber where they can see and run. This also applies to moose. With the dam built, the caribou would only have to swim across a 1/4 mile lake. That is nothing for them or moose either, or a grizzly bear for that matter. There has never been any fish in the Susitna drainage above the dam site. Even the salmon cannot buck the white water in the canyon. The lake could be stocked with fish and made a wonderful, accessable recreation area that the people of the railbelt are already in need of. The game animals are nearly gone in this area now, mainly because we have protected the wolves for the last 7 years. This can be changed in a few years. I think the proper people have now learned that man cannot allow the other predators to increase, unlimited, and still have the wonderful game paradise that he desires to view.

Sincerely,

263 Ward I. Gay

Ward I. Gay

RESPONSE TO COMMENTS BY
WARD I. GAY
SEA AIRMOTIVE, INC.

263 Comments noted.

5001 Roger Drive
Anchorage, Alaska 99507
October 20, 1975

Alaska District, Corps of Engineers
Box 7002
Anchorage, Alaska 99510

Dear Sir:

I present the following letter and attachments to you for entry in the official list of comments on the DEIS, Hydroelectric Power Development, Upper Susitna River Basin, Southcentral Railbelt Area, Alaska. The subject DEIS is inadequate in its assessment of the project's total environmental effects and further, I am opposed to the project regardless of the adequacy of the DEIS. The proposed project is not in the best interest of all the people of this state and country. The basis for my conclusion can best be summarized by referring you to excerpts from the publication by the U.S. Fish and Wildlife Service circular 39, which are contained in attachment II. It will be necessary for you to draw the correlation between "wetlands" and the virgin land remaining in Alaska.

Itemized comments relative to the subject DEIS are contained in Attachment I. 264

Perhaps a solution to the problems of today is to concentrate our efforts on improving what we have and to forego further development and exploitation of rapidly diminishing resources. 265

Sincerely,

Stephen Kuth

Attachment I

These comments are based on the information presented in the Draft EIS for the Devils Canyon/Watana hydro power project. They are not all inclusive but rather touch only the high points.

266 Ref. Page 6, para 1.03, description of Action
The cost/benefit ratio is questionable when one considers the low interest rate used

267 Ref. Page 45, para 4.01
By reducing flooding of the lower Susitna River valley, moose browse will be effectively reduced because new channels and islands will form less frequently thus reducing the areas favorable for new growth willow etc.

Ref. Page 63, para 4.18, Social Impact
This paragraph speaks of the project as being "designed to fullfill presently projected needs...." and "not to stimulate ... growth". The paragraph also states that the "hydro projects will not create large blocks of excess electrical power for heavy energy consuming industries." My question is, how does the Corps intend to keep industry from using the power? This project will increase the

power generation capacity of the railbelt area 3.44 times. It is not proposed to be a replacement for the fossil fuel plants we have now. 268

By providing low cost energy before the so called "needs" arise, the government is in fact stimulating growth. The concept of providing power to accomodate projected growth is based on the governments predetermination that growth and development will occur at rates projected from the past. Governments have traditionally encouraged, fostered and stimulated growth and development 269

examples: North Slope Oil & gas
Gulf of Alaska oil
Pet 4 oil
Eklutna Power

in order to expand tax bases etc; therefore, past figures reflect trends as induced by the governments.

Ref. Page 69, para 6.02.1, No action alternative
As presented, the no action alternative does not discuss the effects of no action. It

only discusses other alternatives. All the alternatives presented were apparently based on the predetermination that additional power sources are required,
270 according to projected future growth curves. A no action alternative relative to no additional power supplies, hydro or otherwise, is not discussed.

Ref. Page 75, Para 6.02.4, Nuclear Power

Nuclear power is spoken to as being the prime source of electrical power (50+%) by the year 2000, a mere 25 years from today. If this is true, why is the government so persistant in developing
271 a hydro project with an expected useful life in excess of 500 years; a project that will destroy the integrity of over 50,000 acres of unspoiled land forever? This does not include the thousands of acres that will be used as spinoff development due to the induced growth factor

Ref. Page 95, para 9.02 Formal Public Meetings

"There has been no significant opposition to the proposed project as of September 1975."

I have talked to many people that are opposed to the project and have corresponded with the corps and state on the subject. Obviously, those of us that oppose the project are considered to be insignificant by the corps. What does the opposition have to do to be considered significant? 272

Ref. Page 78 & 80, Para's 6.03.3 & 6.03.4

The Chakachamna and Bradley Lake projects combined would almost double present electrical power production. The environmental affects of these projects would be small except that the induced growth factor, the major affect, would still be present and of major consequence. 273

General comments

The alternative of no power development in Alaska suggests that it would be necessary to introduce special legislation to curtail growth. The fact is, special

legislation by the federal and state governments is required to promote and develope power supplies. West Coast states, as late as it may be, have learned by their mistakes and are
274 indeed introducing legislation that discourages growth. Why can Alaska not be far sighted enough to curtail growth and development before the state is in ruins? Dollars are cheap. The federal government turns out dollars by the thousands but, unspoiled land, once committed, is gone for many, many lifetimes

The project, by its physical self, is only a small part of the total effect. The devastating effects will come from the increase in power production of 3.44 times Available power will alway be used and it takes people and industry to use it. Great numbers of people are what spoils virgin country with trash, clearing, noise, hunting, fishing and overuse of the land in general. It is not unreasonable to assume that an increase in power production of 3.44 times will induce a corresponding increase of 3.44 times the population because of supporting industry; services, police protection, fire protection, grocery store expansions, more government controls and expanding bureaucracies, more gas stations and on and on. 275

Development projects such as this are prime inducers of growth. They are like the match that kindles the forest fire. The match in itself is rather insignificant. 276

69-737 O - 81 - 48

Attachment II

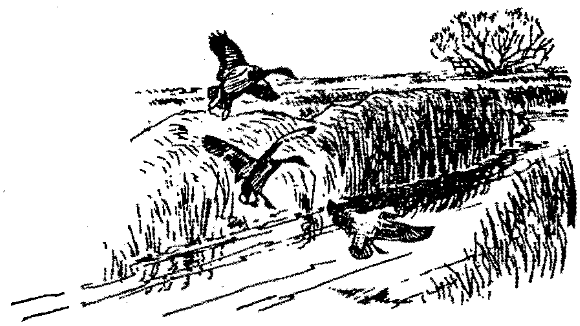
WETLANDS of the UNITED STATES

THEIR EXTENT AND THEIR VALUE TO WATERFOWL AND OTHER WILDLIFE

By Samuel P. Shaw and C. Gordon Fredine
Office of River Basin Studies

CIRCULAR 39
FISH AND WILDLIFE SERVICE
UNITED STATES DEPARTMENT OF THE INTERIOR

THE PROBLEM OF SAVING WETLANDS



The great natural wealth that originally made possible the growth and development of the United States included a generous endowment of shallow-water and waterlogged lands. The original inhabitants of the New World had utilized the animals living among these wet places for food and clothing, but they permitted the land to remain essentially unchanged.

The advent of European settlers brought great changes in the land, and aquatic habitats were particularly vulnerable to the settlers' activities. Kenney and McAtee wrote in 1938:

> Among the assets of mankind, wildlife receives its true appraisal only in advanced stages of civilization, when, owing to the heedless destruction of earlier times it has been seriously if not irreparably reduced. Under pioneer conditions the rules for the treatment of wildlife are immediate exploitation of the useful and drastic destruction of the useless, and these rules tend to remain in effect long after the original motives are gone. In the earlier stages of settlement no one thinks of allotting any land for the use of wildlife; the effort is to wrest every possible acre from nature and make it yield an income. There is no vision to see, there is no time to learn, that land units with their natural occupants, as exemplified by a beaver meadow, a muskrat marsh, a duck lake, a deer forest, or an antelope mesa, are productive entities that under certain circumstances may be worth far more than anything man can put in their place and that once destroyed may never be re-established. *[7]* [1]

THE NATURE OF WETLANDS

The term "wetlands," as used in this report and in the wildlife field generally, refers to lowlands covered with shallow and sometimes temporary or intermittent waters. They are referred to by such names as marshes, swamps, bogs, wet meadows, potholes, sloughs, and river-overflow lands. Shallow lakes and ponds, usually with emergent vegetation as a conspicuous feature, are included in the definition, but the permanent waters of streams, reservoirs, and deep lakes are not included. Neither are water areas that are so temporary as to have little or no effect on the development of moist-soil vegetation. Usually these very temporary areas are of no appreciable value to the species of wildlife considered in this report.

Most wetlands can be drained or filled to create suitable land for agricultural, industrial, or residential expansion. Others lie in potential impoundment sites where permanent deep-water environments can be developed. If either type of project is carried out, however, the food and cover plants required by waterfowl and other wetland wildlife no longer grow in abundance. These aquatic plants need waterlogged or shallow-water soils in order to thrive.

Apparently, a great many people still think that until one of these two courses is followed, any wetland area is just so much wasteland—an unfortunate occurrence in the land-economist's classification of productive land uses. So long as this belief prevails, wetlands will continue to be drained, filled, diked, impounded, or otherwise altered, and thus will lose their identity as wetlands and their value as wildlife habitat.

COOPERATIVE PLANNING

State and Federal agencies engaged in conflicting programs of wetland destruction and wetland preservation must work together to develop unified wetland-use programs that are both acceptable to the landowner and beneficial to the Nation.

It is one-sided planning, for example, if a flood-control agency neglects wildlife values as it plans for the elimination of river-overflow areas, when these areas are used by millions of ducks during the winter season.

In land-use planning, an agency dealing with drainage projects would be subject to criticism if its plans to remove water from extensive marshlands or scattered potholes were developed without regard for the fact that, individually or collectively, they provide essential habitat for thousands

[1] Italic numbers in brackets refer to items in the List of References on page 47.

SUMMARY OF CHAPTERS

The problem of saving wetlands is to prevent marshes, swamps, open shallow waters, and seasonally flooded lands from being drained, flooded, or filled, hence losing their value as wildlife habitat. These types of aquatic environments, collectively identified in this report as *wetlands*, furnish essential habitat for all waterfowl, most species of fur animals, and many species of farm game, forest game, and warm-water fish. Coordinated advance planning by all resource interests is the keynote to solving the problem. As an aid in such planning, the Fish and Wildlife Service, with the cooperation of State game agencies, conducted a wetlands inventory with emphasis on present usefulness of the lands as waterfowl habitat.

A century of wetland exploitation has taught many lessons in the use and misuse of wetlands. The Swamp Land Acts of 1849, 1850, and 1860 paved the way for transferring nearly 65 million acres of wetlands in 15 States from Federal to State administration for the purpose of expediting their drainage. Nearly all these lands are now in private ownership, and their use by wildlife is usually only a minor consideration. Although evidences of wetland losses as revealed by previous inventories are not completely reliable because they represent different types of coverage, it appears that at least 45 million of the original 127 million acres of natural wetlands have been drained or otherwise destroyed. Agricultural drainage (102 million acres now in organized enterprises) and flood control are the forces primarily responsible, but other activities such as canal construction, drainage for mosquito control, industrial expansion, and highway building have greatly reduced the wildlife values of some wetlands, particularly along the coasts.

Wetland soils have physical and chemical properties that are derived from the environment in which the soils originate. Climate, landform, and native vegetation largely govern the nature of this environment, hence also the nature of the soils and their potential uses. Most wetlands are underlain by organic soils known as peat and muck, or by recently deposited, water-carried alluvial soils. In general, alluvial soils have higher agricultural potentials than peat and muck. Many peat and muck soils have proved unproductive for agriculture after drainage; others are inherently fertile. In many areas, there appears to be a direct relation between potentially good agricultural wetlands and presently good waterfowl wetlands, suggesting that competition between agricultural and wildlife interests will become more intense in the years ahead.

The wetlands inventory reveals the location, classification, and evaluation of 74,439,300 acres of wetlands as waterfowl habitat. At least 90 percent of all wetlands of importance to waterfowl are included. From the standpoint of waterfowl value, the total acreage covered by the inventory is distributed as follows (in millions of acres): 8.9, high; 13.6, moderate; 24.0, low; and 27.9, negligible. Values are based on relative waterfowl use in the State where the wetlands are located. By wetland categories, the eight inland fresh types comprise 63,491,000 acres, the three inland saline types comprise 1,618,000 acres, the three coastal fresh types comprise 4,041,000 acres, and the six coastal saline types comprise 5,290,000 acres.

The 20 wetland types are ecological classifications designed to help recognize the relative importance to waterfowl of the many different kinds

RESPONSE TO COMMENTS BY STEPHEN KURTH

264 Comment noted. Practically no "wetlands" for waterfowl are located within the proposed Devil Canyon and Watana reservoir areas.

265 Comment noted.

266 The 6-1/8 percent interest rate is provided by Water Resource Council, and is based on the current cost to the Federal Government of borrowing money.

267 Reduction of flooding and erosion could result in subclimax growth of vegetation in the braided channel system and would provide browse for moose.

268 Project power will be marketable by existing power marketing agencies, at rates to be established by normal rate-setting procedures and after public hearings have been held. Use of power by industries can be regulated by means of power rates. Also see response number 255.

269 Growth projections in Alaska are not based primarily on past growth statistics, but rather on demographic, economic, and other factors which will control future growth.

270 The no action alternative is covered in Section 6.02.1 of the EIS.

271 Statement regarding nuclear power providing 50 percent of the electrical power by the year 2000 refers to the nation as a whole. Nuclear power does not represent the most feasible alternative power source for Alaska, as stated in Section 6.02.4 of the EIS.

272 Comments noted.

273 Comments noted.

274 Comments noted.

275 Comments noted.

276 Comments noted.

10-21-75

Gentlemen,

I am writting this letter out of the frustration of knowing that it will have a small (if any) effect on the proposed and eventual building of the Dam at ~~Deth~~ Devils Canyon.

By the Army Corps own admission construction of access roads, transmission

277 lines and Dams, will effect Caribou migration and the small moose habitat left in the area not to mention the asthetic quality of the

278 present wilderness area. I am of the opinion that for these reasons alone the project should be Damned instead of the area.

I/We, who live in these mountains are of course more personally involved

279 with its eco-system and balance than would be someone in Anchorage and therefore for the above reasons, are opposed to this project.

It would be appreciated if a comment from your Office were sent to me, but no news, is good news!

The only way I receive news of decisions directly affecting my environment is through the media and this fact greatly annoys me. After all, who will be directly affected when this project becomes a reality? In none of the correspondence on this subject is there any mention of contact, and or consideration of people who live in the bush. Oh well, no one ever stands in the way of progress. Move over moose, here comes the future! 280

Dan Mawhinney
Box 22
Talkeetna, Alaska
99676

RESPONSE TO COMMENTS BY
DAN MAWHINNEY

277 The proposed Susitna project would change the areas where project facilities such as dams, reservoirs, roads, transmission lines, and recreation areas would be built, but we would design and construct these facilities using the highest standards to lessen the adverse impacts and to maximize the beneficial impacts.

278 Alaska is and will continue to be a great state where people can live, work, play and enjoy the wonderful natural resources that are found here, but those of us who moved here from other places or were born here will have to consider that others will come here in the future for much the same reasons that motivated the present residents to live here. To some this might not necessarily mean progress, but it is the "real world."

With good planning we hope to help provide a good place to live and work and still retain much of Alaska's great wealth in the natural environment. True, some people will be more directly affected by our proposals for hydroelectric power than others, but we believe that what we do propose will adversely affect fewer people than any other viable alternative which would provide equivalent electrical energy. Also, we believe that the proposed project is economically and engineeringly feasible and less environmentally damaging than any other alternative which could meet electrical energy needs of the future.

279 In the Alaska Native Claims Settlement Act more than 80 million acres of Alaska's 356 million acres are proposed to be retained in the 4 Federal systems including parks, wildlife refuges, wild and scenic rivers and natural forests. The State has also proposed millions of acres for park and recreation lands. It is also reasonable to assume that much of the over 40 millions of acres of native lands, 106 millions of acres of State lands and the balance of lands left in other private and Federal control will be left in its natural state or developed to encourage recreation but it is obvious that some development will also take place.

280 As noted in Section 9.0 of the Environmental Impact Statement, we have had three sets of Public Meetings in both Anchorage and Fairbanks where all the public has been invited to attend and to express their feelings and concerns on this proposed project. People from the Talkeetna area and from the areas that would be directly affected by project facilities attended the meetings; the people listened to the proceedings and some made comment, both for and against the proposed project.

THOMAS E. MEACHAM
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October 9, 1975

Colonel Charles Debelius
District Engineer
Alaska District
U.S. Army Corps of Engineers
Box 7002
Anchorage, AK 99510

Re: Written Testimony Concerning Draft Environmental Impact Statement

Dear Colonel Debelius:

I am enclosing with this letter a copy of my comments concerning your Draft Environmental Impact Statement on hydroelectric power development on the Upper Susitna River Basin, Alaska. I delivered this testimony orally at your public hearing on October 7, 1975, and would request that my written testimony be included in your hearing record.

I would also request that this letter of transmittal be included in your hearing record, since additional facts concerning the production of your Draft Environmental Impact Statement became evident during the course of the hearing Tuesday night. From the testimony given by the Alaska Department of Fish and Game, it is apparent that your Draft Environmental Statement was issued prior to completion of studies by the Alaska Department of Fish and Game, which had been on contract with the U.S. Fish and Wildlife Service to conduct wildlife studies in the affected area, and for the specific purpose of your environmental analysis of the proposed project. By accelerating the completion and issuance of the Draft Impact Statement, your office has totally excluded a body of knowledge which, if available to the general public, would have permitted a much more thorough analysis of the effects of your proposed project. In addition, I would assume that availability of the results of this study would have aided your own planners in evaluating the proposed project.

Not only is this deliberate omission very detrimental from the standpoint of an adequate environmental statement, but

I learned at the hearing that the Corps of Engineers had also excluded an additional contracted study which was intended to explore in depth some aspects of the project, for purposes of your Environmental Impact Statement. I believe that the firm of Jones & Jones, Consultants, was engaged to study certain aspects of the project. I have seen their report, entitled Upper Susitna River: Inventory and Evaluation of the Environmental, Aesthetic and Recreational Resources. This firm was also contracted to analyze specific aspects of the proposal, but the last-minute acceleration of the deadline date for the Impact Statement precluded any analysis of the voluminous results of their study in your Draft Environmental Statement.

I believe that the deliberate exclusion of these two relevant source materials, and the lack of public knowledge of their conclusions, has dealt a very strong blow against your Draft Environmental Statement. I would expect that, at the least, full consideration of these documents will be given in your Final Environmental Impact Statement, and that these documents will be available for evaluation by the interested public.

Thank you very much for your even-handed treatment of the hearing itself, and for the efficient manner in which it was organized and conducted.

Yours sincerely,

281 Thomas E. Meacham

Thomas E. Meacham

TEM/bja
Enclosure

RESPONSE TO COMMENTS BY
THOMAS E. MEACHAM
LETTER DATED 9 OCTOBER 1975

281 A concerted, continuing effort has been made throughout the study process to acquire all data possible from all concerned sources with special emphasis on fishery and wildlife data so vital for a valid assessment of project effects on major ecosystems and the total environment. We have worked through the U.S. Fish and Wildlife Service (FWS), as the lead agency, to coordinate our study with Alaska Department of Fish and Game (ADF&G). We had, prior to the Public Meeting, a preliminary report of FWS (containing the ADF&G contribution). This report, prepared in accordance with the Fish and Wildlife Coordination Act, was formally published on 10 October 1975. In addition, we had informal contacts on a nearly daily basis with FWS personnel to be as sure as possible that no new or important information relative to their area of responsibility was being omitted from consideration. The fact that the Jones and Jones inventory and evaluation (prepared under contract to the Corps of Engineers) is not contained in toto in either the DEIS or feasibility report does not mean that it has been excluded, omitted, or ignored in our evaluations. Quite the contrary, it has been of much value to us, and has been in our hands for over six months prior to completion of the DEIS.

COMMENTS REGARDING DRAFT ENVIRONMENTAL IMPACT STATEMENT: HYDROELECTRIC POWER DEVELOPMENT ON THE UPPER SUSITNA RIVER BASIN, ALASKA

October 7, 1975

Gentlemen:

My name is Tom Meacham. I am a resident of Anchorage, Alaska and am conservation chairman of the Mountaineering Club of Alaska. I am testifying as an individual.

I believe that your Draft Environmental Impact Statement regarding hydroelectric power development on the Upper Susitna River is subject to criticism both in concept and in detail. I will deal with the criticisms I have regarding the concept first.

Your Draft Impact Statement was issued on September 22, 1975. This hearing comes exactly two weeks after that date, offering no realistic opportunity for public input based on the assertions of fact and assumptions made in your Impact Statement.
282 Instead, this hurried consideration of the Impact Statement seems designed to nullify or eliminate any meaningful criticism from persons or organizations which may have some doubts about your project. This certainly is not the "atmosphere of public understanding, trust, mutual cooperative, and in a manner responsive to the public interest", as your regulations require.

The Draft Impact Statement itself is much too narrow, given the scope of the problem. The Draft Statement purports to analyze the feasibility of hydroelectric power in the Upper Susitna Basin, in relation to other alternative power sources which may be available. We are told that more extensive studies will be made of the various factors required under the National Environmental Policy Act, if the project is approved. However, I have found nothing in the Draft Statement which could be termed a feasibility report, in relation to other alternative power sources and the projected needs of the rail belt area in future years. Because the question of feasibility and of future need will receive only the present environmental analysis, that analysis must be as complete as any required under NEPA for any specific aspect of actual hydroelectric plant construction. The

writers of this Impact Statement have, with no statutory authority and very little actual authority, determined that hydroelectric power is the "most feasible" means to meet the area's presumed future needs, and have, without further analysis, proceeded to 283
present the details of the proposed dam construction. Questions which they have left unanswered are the following:

1. What is the source of any assumptions regarding population growth and growth in electrical demand in the rail belt area? Are there variations 284
among sources in these projections; and if so, which projections did the Corps examine and adopt?

2. Has any comprehensive economic, social or environmental analysis been done of other alternatives to the hydroelectric project, including purchase of power from Canada, coal gasification, coal burning, 285
use of natural gas, geothermal resources, or any other available or projected source in Alaska? If studies have been examined regarding these factors, what is the source of these studies?

3. Will hydroelectric development in the rail belt area discourage use and development of alternative sources? Will other sources develop despite con- 286
struction of hydroelectric projects?

These questions, and others which I am sure other persons will raise, go to the very premise upon which your Environmental Impact Statement was based: the "feasibility" of hydroelectric power development in the rail belt region. Until these issues are addressed, there is no point in discussing specific construction proposals for various dams. However, the tone of your Impact Statement indicates quite clearly that "feasibility" to your agency is merely a question of receiving the requisite amount of dollars from Congress, and that once that grant is assured, the Corps of Engineers will very quickly demonstrate that hydroelectric power in the rail belt region is physically feasible. The real question of the propriety of hydroelectric power, in the context of this region's needs and in contrast with other available sources, will never be answered.

Because the majority of your Draft Impact Statement deals with the reality of a two-dam construction proposal, I have some

287
questions to raise concerning that proposal. I feel that there are several very serious inconsistencies or unwarranted assumptions made in that Impact Statement, and I feel confident that satisfactory answers will be provided at the time the final impact statement is written. Among my questions are the following:

288 1. Is the capacity of the Devil Canyon-Watana project excessive? The projected electrical output is approximately six times the present need for the entire state, yet it is only one-fourth of your projection of the rail belt area's needs in 1985.

289 2. What entity will manage the proposed project? Will it be a TVA-type authority, which has demonstrated little responsiveness to the public interest? Will the authority operating the project be subject to jurisdiction of the Alaska Public Utilities Commission?

290 3. What will be the policy on sale of "secondary energy"? What is the purpose for providing a capacity to produce secondary energy? Will sale of secondary energy be subject to regulation by the Alaska Public Utilities Commission?

291 4. Will rate structures favor sale of large blocks of power, at low unit cost, to major industrial users? If so, will the availability of cheap power induce basic industries to locate in the rail belt region? Would this location for basic industries be desirable, from the social, economic and environmental standpoint of the existing rail belt community?

292 5. You have stated that the project area contains some discontinuous permafrost. Is any permafrost located beneath the impoundment areas of the two dams? If so, will the extreme yearly drawdown behind Watana Dam lead to continuous melting of permafrost and erosion of resevoir banks?

6. What will be the effects upon fish, wildlife and human activities downstream from the dam sites

during the twelve years of construction? Will the Susitna River be entirely impounded by Watana Dam while Devil Canyon Dam is being constructed? 293

7. What effect will the loss of low, clear flows of the Susitna River in wintertime have upon the fish which migrate from the tributaries to the main stem during wintertime to avoid freezing? 294

8. What effect will the increased wintertime volume, more than eight times the existing uncontrolled winter flow, have upon fish and wildlife in the Lower Susitna? What effect will this increased winter flow have upon erosion potential? 295

9. Will multi-level releases of water from behind the dams lead to increased siltation during releases, when water and silt from the bottom portions of the resevoir are released? 296

10. What will be the peak monthly flows anticipated on the river after construction? The Impact Statement lists only average monthly flows, not peak flows. 297

11. What measures will be taken to control the problem of "frazzle ice" under cold winter conditions? 298

12. What is the present consumption of the rail belt area, in terms of barrels of oil? 299

13. Has the total energy cost of twelve years of dam construction been debited against the eventual production of the project, in terms of barrels of oil? 300

14. How much oil would the total first costs of the project buy at today's prices? 301

15. What will be the actual amount of delivered power to Fairbanks, Anchorage, and other rail belt points? The Impact Statement lists only the projected power production at the dam site, and does not calculate 302

power losses.

16. What factors were used to calculate a benefit-cost ratio of 1.4? Why was an artificially low interest rate of six and one-eighth per cent
303 used? Does the nature of this project, on a glacial river with no presently known technique for dredging resevoirs filled by sediment, justify a 100-year life projection?

17. Upon what factors was the 100-year project life calculated? Does the Corps of Engineers have
304 any available data from other hydroelectric projects constructed on glacial rivers with stream flows comparable to the Susitna River?

18. What will be the effect of increased energy, velocity and abrasion of the released water below
305 Devil Canyon Dam upon the Lower Susitna River, and upon the turbidity of the river?

19. Is "flood control" a planned benefit of the
306 resevoirs, as mentioned on page 71 of your draft? What is the historical incidence of Susitna River floods?

20. Why has the proposed project been stressed for a "maximum credible earthquake" with an epicenter forty miles distant, since the Susitna fault is
307 only 2.5 miles from the site of the dams? Upon
21. what assumptions is the turbidity rate during winter flows of 15 to 35 parts per million calculated? This assumption seems excessively low, when measured against the river's increased abrasion potential, the multi-level releases, and the significantly increased winter volumes.

Your Draft Impact Statement has seriously neglected to place Devil Canyon in the context of present and future recreation potential in Alaska and in North America. You state that it is one of three major white water rivers in Alaska. However, you neglected to point out that, among white water experts, it is considered the premier stretch of white water in North America, if not in the world. Of the three Alaskan rivers mentioned, the Alsek and the Bremner are inaccessible by boaters at either their origin or their terminus. By contrast, Devil Canyon can be reached on the Denali Highway for departure, and its terminus lies on the Parks Highway. Recreational white water boating is one of the fastest-growing sports in the nation, and particularly in Alaska, yet we have no analysis of this increase in popularity in your Impact Statement. On the contrary, your only statements concerning outdoor recreationists, or to white water boaters in particular, are repeated references 308 to "a few hardy souls" with veiled implications that anyone who tries to Kyak any portion of Devil Canyon has a death wish. Your impact statement fails to analyze the tremendous growth of self-propelled sports, such as mountaineering, hiking, backpacking, and white water boating. Instead, it assumes without basis in fact that the Devil Canyon area has no present or future potential for these sports, and can only be made available for recreation users by creating some sort of artificial access, such as resevoirs and roads. The Draft Impact Statement does not discuss the proposed Talkeetna Mountains State Park and the effect such a resevoir might have on that proposal. Nor does it discuss the federal lands surrounding the resevoir proposal which may be selected by Cook Inlet Native Regional Corporation, or may be traded to the State of Alaska as an addition to the Talkeetna Mountains State Park proposal. With increased mechanized access being one of the prime features of the project, it will almost certainly have some type of impact upon a State Park proposal. What value was added to your benefit-cost ratio for the recreation opportunities which you foresee as a result of construction of the project, and upon what factors were these values based?

Simply stated, I feel that the value of Devil Canyon of the Susitna River, as the freest, wildest, most violent and most impressive free-flowing river on the continent, has been entirely overlooked. The river, to my knowledge, is still eligible for wild river status under federal law, and any decision by the Interior 309 Department not to recommend the river in 1973 was based on the fact that a hydroelectric project was proposed, and not on any inherent characteristic of the river itself. Based upon the content of your Draft Environmental Statement, I have found no compelling reason why Devil Canyon should not remain free and uncontrolled, a monument to nature and not to man, or particularly to the Corps of Engineers or our Congressional delegation.

Please include my statement in your record of oral testimony

69-737 O - 81 - 49

310 concerning this proposed project. I am also submitting a written statement which I would like included in your hearing record. I will expect to receive copies of any further public correspondence which you may issue as consideration of the feasibility of this proposed project continues. In addition, I would expect to receive your Final Environmental Impact Statement concerning hydroelectric project feasibility in Southcentral Alaska.

Thank you very much.

Thomas E. Meacham
1410 "H" Street
Anchorage, Alaska 99501

RESPONSE TO COMMENTS
OF
THOMAS E. MEACHAM
DATED 7 OCTOBER 1975

282 The timing of the issuance of the DEIS (22 September) and the scheduling of the Public Meeting(s) (7 and 8 October in Anchorage and Fairbanks) were responsive to CEQ guidelines. Guidelines for agency compliance with NEPA are promulgated by the President's Council on Environmental Quality. These guidelines stipulate a 45-day review period for the DEIS following the announcement of its availability in the Federal Register. Such announcement was made in the Federal Register printed on 3 October 1975. Thus, the period for public review and comment on the document does not expire until 17 November 1975. With regard to public hearings, CEQ guidelines stipulate that a DEIS be made available at least 15 days prior to the time of such hearings. This requirement was met in scheduling the Public Meeting in Anchorage on 7 October 1975. Opportunity for public input into the DEIS in this instance is 57 days--from 22 September to 17 November 1975. Actually, comments received by 3 December 1975 are included in the EIS.

Public Meetings (hearings) are designed to involve public participation in a continuous two-way communication process which involves keeping the public fully informed on the status and progress of studies and findings of plan formulation and evaluation activities. It is a means of actively soliciting from agencies, groups, and individuals their opinions and perceptions of objectives and needs. And, finally, it is one tool for determining public preferences regarding resource use and alternatives thereto. Two previous sets of meetings had been conducted prior to the October meetings. The first informed the public that the study was underway and solicited their views as to the direction it should take and as to what specific concerns, wishes, or inputs they had relative to the study subject matter, the study area, and any other allied fields they cared to address. The second set of meetings reported to them the study progress, especially a number of possible alternative means of accomplishing (and even the option of foregoing accomplishing) the basic study purpose of providing electrical energy to supply projected area needs. Once again the comments, desires, and inputs (both factual and intangible) of the public were solicited. The latest meetings continued the previous progress from general to specific by presenting the end results of the preceeding studies, expressed public opinions and wishes, and weighing of the many technical, environmental, and economic aspects of the alternatives.

283 Related to the above misunderstanding of the public review period of the DEIS, there appears to be some confusion as to the purpose and scope of this document. Simply stated, under NEPA (Public Law 91-190), a summary document (EIS) must be prepared outlining for public scrutiny (and review by Federal, State, and local agencies) the significant impacts (both adverse and favorable) which can be reasonably foreseen to result from a specific course of action proposed by a Federal agency. The content of the document is outlined to include five major areas of discussion. They are: the environmental impact of the proposed action; and adverse environmental effects which cannot be avoided should the proposal be implemented; alternatives to the proposed action; the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity; and any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented. A great body of interpretations, regulations, legal decisions, and policies have subsequently evolved to more specifically define the procedures, formats, detailed contents, and processing of the various and sundry versions of EIS's. The feasibility report is a separate and distinct document which examines in detail many of the questions you raise. This document, as well as the DEIS, contains data which were summarized at the Public Meeting. Because the report could not be finalized until the public views on its general content, especially on the conclusion and recommendations to be contained therein, it could not, of course, be published prior to the meetings set to obtain those views. It is now being given final revisions as a result of the meetings and of review by higher authority.

284 The growth rate projections for energy demand are by the Alaska Power Administration (APA). They reflect a 1975 revision of the figures from the 1974 Alaska Power Survey. The major competitive projections are those published by OBERS (Office of Business Economics--now renamed Bureau of Economic Analysis--and Economic Research Service). These projections are based almost solely on population trends and have to date consistently badly underestimated all varieties of growth in Alaska.

285 The alternatives mentioned have been considered as a part of the feasibility study. Data from all available sources have been utilized. Coal is found to be the major alternative to hydropower.

286 Hydrodevelopment may or may not supplant development of alternative power sources. The proposed project will supply the area power deficit only to about the mid-1990's when either additional hydropower or other alternative sources will have to be developed.

287 Comment noted.

288 The capacity of the two-dam project is not excessive. The electrical output is less than three times the present Railbelt need (not six times the present State need, as you state). As such, in conjunction with present systems (and any others developed to meet the demand growth prior to hydropower availability), the proposed system will satisfy the mid-range demand curve until the 1990's when additional power will be needed.

289 Alaska Power Administration (APA), a Department of Interior agency, will manage the project much in the way Bonneville Power Administration manages the Federal hydro system in the Pacific Northwest. They are not subject to APUC regulation, but work closely with them.

290 Yes. However, there is very little secondary energy associated with the proposed plan. Such energy is not designed into a plan, but is a result of defining the "firm" energy as that which can be produced in the worst water year (drought). Thus, in most years, there is additional water available to produce "secondary" energy which, because it cannot be guaranteed to the user, is usually sold at a discount on a when-available basis. The secondary capability of the proposed plan is only about 12 percent of the firm energy output. Again, APA is not subject to APUC regulation, per se, but cooperates closely with them.

291 The proposed project is not intended to be developmental, but to meet a projected, conservative growth projection. If the projection is correct, there should be little in the way of large blocks of power available to induce extraordinary industrialization. For further response to this comment, see response number 255.

292 Yes, some permafrost is located beneath the Watana reservoir and may be also within a portion of the Devil Canyon reservoir. We foresee both melting of this permafrost and some erosion as a result. However, the overburden subject to erosion is shallow over a majority of the steep, rocky canyons, and the net effects on either storage capacity or the shoreline should be minor.

293 The downstream effects during construction should be minimal inasmuch as the entire natural river flows will be passed by diversion tunnels until completion of the Watana Dam about 1986. At that time, a regulated flow consistent with the needs of downstream fishery management will be passed until completion of Devil Canyon about 1990. Again the river flows will be diverted through a tunnel around the Devil Canyon damsite during the construction period at that site. After that, full regulated flow, as

described at the Meeting, will be released. It is now standard procedure to minimize construction inputs of turbidity-pollutants to the river during construction to the extent that all construction waters will be cycled through settling basins, etc., if such need is found.

294 The low level (less than 35 ppm) of glacial "flour" which we expect to be passed downstream year-round (in lieu of highly turbid summer flows and very clear winter flows) is similar to the natural conditions at Kasilof River-Tustumena Lake where fish thrive very well. We foresee no noticeable adverse impact from this source. However, a final determination of these effects will not be made until detailed studies, some of which are currently underway, are completed.

295 The wintertime flow volume, even though substantially greater than that of minimum natural flows, is still quite moderate and should have little adverse impact on downstream fish and/or wildlife. The equalization of the summer and winter flows and the elimination of most of the sediment load will tend to change the dimensions at the river and will increase its erosive potential, but not necessarily actual erosion. The rocky nature of much of the canyon below the damsite will resist any regime change for centuries. Only in areas of alluvial deposits would the tendencies for concentrated flow in a narrower, deeper, possibly meandering channel manifest themselves. Furthermore, they would only be noticeable in that portion of the Susitna River upstream of the Chulitna River confluence. In the past, estimates of erosion downstream of damsites have been too great. In these estimates, the phenomenon of channel armoring (i.e., the small size material is swept away and not replaced, leaving a uniformly large stone bottom highly resistant to further erosion) was not considered. With the present state of the art, most of the above-mentioned morphological processes are calculable, and any potentially adverse effects can be minimized.

296 The purpose of the multilevel intake structures is to allow selection of the water released to preclude just such downstream quality problems. No releases will be made from the reservoir bottom, but only from the active power pool--say about the upper one-third to one-half the reservoir depth.

297 The peak monthly flow would occur during a major flood and would be much less than the natural peak flow since the reservoirs offer storage to allow a spreading of the total flood volume over a period of days rather than a few hours under unregulated conditions. During non-flood periods the combined Devil Canyon and Watana system would be operated so that Devil Canyon would reregulate the Watana reservoir discharge to provide

nearly constant hourly streamflow below Devil Canyon. Devil Canyon, in effect, will be serving a component of the baseload of the system and Watana would be utilized to serve peaking requirements. The composite effect of this operation would provide a nearly constant hourly hydrograph for the river reach below Devil Canyon.

298 Frazil ice is a short-term early winter phenomenon involving a specific set of meteorological conditions in association with shallow, clear rapidly flowing water, and the absence of ice cover. The very deep, milky, relatively placid waters of the reservoirs are totally opposite to the conditions favorable to frazil ice formation. Be that as it may, if such ice did form, the capability of selective withdrawal of deeper-lying, warmer waters provided by the multilevel intake system would offer a simple, immediate, built-in solution to the problem.

299 The estimated Railbelt energy demand for 1975 is 2.4 billion kilowatt-hours, the equivalent to consumption of 5.2 million barrels of oil.

300 In terms of construction costs, yes; in terms of energy consumed, no.

301 The answer depends on what value is assigned to today's oil. At a price of $13 per barrel for oil from OPEC nations, the project's first cost is equivalent to approximately 115 million barrels of crude oil. It should be noted that the energy provided by the project over its 100-year economic life will result in non-use of over 1.5 billion barrels of oil or its energy equivalent of over 11 trillion cubic feet of natural gas. It is also likely that future oil prices could increase substantially.

302 The quoted 6.1 billion kilowatt-hours reflect the net annual power delivered to the two distribution centers, Pt. Mackenzie for Anchorage and Ester-Gold Hill for Fairbanks, after deduction of transmission losses estimated at 0.7 percent of prime energy. The approximate split of delivered energy is 25 percent to Fairbanks and 75 percent to Anchorage.

303 The basic benefits are shown on page 106 of the EIS. The interest rate is that set by regulation of the Water Resource Council for use in economic evaluation of Federal projects, and reflects the government's cost in borrowing money. Sedimentation is calculated to reduce the system storage capacity by 4.2 percent in 100 years. Most of the lost storage is in the "dead storage" zone, not available for power production in any case. The system power output reflects the storage lost to sedimentation over the 100-year project life. Also see response number 121.

304 The 100-year life is a Corps of Engineers standard for this type of project, used in computation of project economics. This policy is accepted by the Water Resources Council and by Congress. The actual useful life of the structures should exceed the 100 years by a large margin. The Corps has data from projects located on many types of rivers. It is from this data that a standard methodology of calculating sedimentation rates has been developed. To attempt correlation of sedimentation of the upper Susitna River with other rivers only on the basis of flow or storage of water is meaningless. Many factors, including but not limited to geology of the basins, river gradients, precipitation patterns, runoff characteristics, and topography, influence sedimentation and must be considered to determine any valid correlation.

305 Increased kinetic energy in the form of high water velocities due to the large head of water behind the dam is dissipated at the dam. Most of the energy is absorbed by the power station turbines. Spillway and outlet works releases spend their energy in the discharge pool below the dam. Thus, the discharge velocity ratios in the canyon downstream of the dam are the same after project completion as under natural conditions.

306 Flood control is a project benefit. The present adverse effect of floods on humanity is limited to damages to the Alaska Railroad. Prevention of these damages is the sole claimed flood control benefit. As the downstream area develops, there will be a growth in population and property which could be adversely affected by unregulated flows; however, no estimate of this future benefit is claimed. Flood control benefits are about 0.03 of 1 percent of average annual project benefits.

307 The Susitna Fault, although close to the project, does not have the probability of creating as violet (high magnitude) an earthquake as the more distant Denali Fault. It is for this reason that an 8.5 Richter Maximum Credible Earthquake (MCE) at the Denali Fault (40 miles distant) was selected for design purposes over the 6.0 Richter MCE event at Susitna Fault (2.5 miles distant).

The turbidity level is predicted on the basis of all settleable solids being trapped by the two reservoirs with only the suspended solids (glacial flour), 15-35 ppm being released at Devil Canyon Dam. The present summer sediment load of the river is attributable to easily erodable soils in the upper basin and is not an indication that significant material is being picked up downstream of the canyons. In fact, the lower riverbed is relatively stable under all but extremely high flows because of the gravel-cobble nature of the bed materials.

The DEIS and feasibility study do not slight the recreational potential of the whitewater river. Factually, the area is isolated, has little access, no supply-subsistence facilities, and the Devil Canyon portion of the river is so violent as to discourage all but the most skillful kayakers. As best as we have been able to determine, less than a dozen attempts have been made to run portions of the rapids in the last 50 years. Its classification as a Class 6 river, a threat to the life of even the most skillful boatsman, and the awe of its violence exhibited in written accounts of some who have challenged the rapids guarantee that its recreational use would be limited to a very few people. The reservoirs could and would, however, provide recreational opportunity to broader sections of the public, while about three miles of the rapids would remain to challenge the whitewater enthusiasts. As to ignoring the area potential for "self-propelled sports," our view is that these are the most likely recreational uses for the lands surrounding the reservoirs. As such, we have estimated only a limited recreational development based on camping-hiking-boating, rather than a heavy day-use type of development.

The DEIS does not discuss the conceptual Talkeetna Mountains State Park inasmuch as the State Division of Parks has not indicated any plan that the project area should be a part thereof when or if the park becomes a reality. Rather, they have discouraged association of the project too closely with the existing Denali State Park, preferring that the area be considered a separate State Recreation Area if the State becomes the project recreational sponsor. The fact that the lands for many miles to the south of reservoir sites are presently set aside for native selection under the Alaska Native Claims Settlement Act would appear to argue heavily against the probability that the proposed park and project would be in any way closely associated, at least for the foreseeable future.

Comment noted.

Comment noted.

philip n. osborn • geologic consultant

21-92ND AVE. N.E. • BELLEVUE, WA 98004 • (206) 455-3588

17 October 1975

Col. Charles A. Debelius, District Engineer
Department of the Army
Alaska District, Corps of Engineers
P.O. Box 7002
Anchorage, Alaska 99510

SUBJECT: Draft Environmental Impact Statement: Hydroelectric Power Development, Upper Susitna River Basin, Southcentral Railbelt Area, Alaska

Gentlemen:

The following material is submitted for inclusion in the records of the public meeting of 7 October 1975, RE: Southcentral Railbelt Area, Hydroelectric Power Study, and as specific comment in reply to the Draft Environmental Impact Statement recently issued by the Corps in relation to this study. Within my capacity as a geologic consultant I have had previous imput to this study; specifically, in preparing a reconnaissance geologic study of the Upper Susitna River watershed for the report to the Corps by Jones and Jones; Upper Susitna River, Alaska: An Inventory and Evaluation of the Environmental, Aesthetic, and Recreational Resources. My comments are restricted to the geologic aspects of the proposed project and within this discipline to the inherent seismic dangers of the site and the geomorphological adjustments which may ensue construction of the project. I have thoroughly reviewed the Draft EIS and have personally communicated with Mr. Yould and Mr. Chandler.

Respectfully submitted,

Philip N. Osborn

Philip N. Osborn
Geologic Consultant

Enc.

The Draft Environmental Impact Statement for hydroelectric power development in the Upper Susitna River basin contains insufficient data within the geologic discipline. This data is essential to a complete and adaquate evaluation of the proposed project - - its merits, benefits, and costs. Specifically:

1) The geologic map on page 16 is incomplete; faults which transect the Susitna Basin are not shown. Major faults intersect the Susitna River downstream from Tsusena Creek (Susitna Fault), at Vee Canyon, upstream from the confluence of the Susitna and Maclaren Rivers, and near Denali. Several smaller faults are located in the Valdez Creek area and at other areas within the site. Undoubtably, other faults exist within the study region; they may be presently inferred or unmapped due to the immense area and the lack of detailed geologic surveillance.

2) The geologic map shows no indication of structural features, particularly in Devil Canyon. A larger scale map should be included showing faults, joints, shear zones, and lithology of the Upper Susitna Basin at the proposed dam sites. Specifically, at Devil Canyon, a master joint set striking N. 25° W. and dipping 80° east, a minor joint set striking east - west and dipping north, a shear zone with strike and dip similar to the master joint set, and the massive phyllite lithology striking east - west and dipping approximately 50 - 60° south are not shown (Kachadoorian, 1974; Osborn, 1974; Jones and Jones, 1975).

3) There is no mention of actual movement along the major faults within the study area and those outside but which could have significant effect on a dam and reservoir system; in particular, but not limited to, these faults and offsets should be mentioned: Denali Fault - - post-Pleistocene displacement of 120m measured and 200m from aerial photograph interpretation; Totchunda Fault - - post-Wisconsan displacement of 270m (Page, 1972); Susitna Fault - - 11 km of displacement inferred from morphological expression (Osborn, 1974)

4) The possibility of an increase in seismic activity as a result of reservoir impoundment and fluctuation is not mentioned. Noting the immediate proximity of the Watana reservoir to the Susitna Fault, this possibility should be considered. This phenomenon has been widely recognized and is well documented, e.g., increase in earthquake activity following the impoundmont of Lake Mead behind Hoover Dam (Richter, 1958).

5) There is no mention of the recurrence periodicity of great earthquakes (greater than 8.0) within Southcentral Alaska. A great earthquake may be expected approximately once every 30 years (Sykes, 1971) or 16.7 times during the reasonable lifespan of the dam structure.

6) Large portions of the Upper Copper River basin subsided during the March, 1964 earthquake (Plafker, 1965). The implications of further subsidence during future earthquakes and the possibility, however remote, of a change in drainage patterns whereby the Watana reservoir might invade the Upper Copper River basin should be analyzed. It should be noted there is only 162 feet of elevation gain from the Watana full pool level to Lake Louise. There is a high probability that the Copper River system has been the outlet for the Upper Susitna drainage at least once and possibly several times during the geologic history of the Upper Susitna River (Osborn, 1974).

7) It is absolutely imparative that the possibility of a seiche generated by seismic activity or landslide within either reservoir be considered. These standing waves can have devastating effects, as evidenced at Lituya Bay (Miller, 1960), and have been responsible for several overtoppings and dam failures in historic times.

In addition, the following geomorphological problems and questions should be addressed.

8) How will the accumulation of sediment at the bedload "dumping ground" at the upper end of the Watana reservoir effect the river morphology?

9) What changes will occur in delta building at the mouth of the Susitna River and what are the effects on sedimentation in Turnagain Arm as a result of lower sediment loads in the Susitna? (The principal source area of sediment in Turnagain Arm is the Susitna drainage.)

10) All existing sediment load study samples are instantaneous; there are no continuous samples. Due to the tremendous sediment load in the 30 day period following breakup (perhaps 60 - 80% of total) when discharges may exceed 90,000 cfs, the existing data is inadaquate to allow volumetric extrapolation for a 100 year period.

11) What effects will fluctuations of the Watana reservoir have on solifluction mass wasting and will there be a substantial increase in shoreline erosion?

12) What effects will the transmission corridor have on permafrost in the area of traverse? How will the transmission towers be anchored to prevent dislocation by heaving of the disturbed surface?

These and many other questions, problems, and inadaquacies suggest that the document should be returned to the Southcentral Railbelt Task Team for additional studies and voluminous additions to the Draft Environmental Impact Statement.

Philip N. Osborn

Philip N. Osborn,
Geologic Consultant

311

REFERENCES CITED

Jones and Jones, 1975, Upper Susitna River, Alaska: An Inventory and Evaluation of the Environmental, Aesthetic, and Recreational Resources. Prepared for Alaska District, Corps of Engineers.

Kachadoorian, R., 1974, Geology of the Devil Canyon Dam Site, Alaska, U. S. Geological Survey Open File Report 74-40.

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Osborn, Philip N., 1974, Geologic Reconnaissance of the Upper Susitna River Watershed. Prepared for Jones and Jones.

Page, Robert A., 1972, Crustal Deformation on the Denali Fault, Alaska, 1942 - 1970, Journal of Geophysical Research, v. 77, p. 1528.

Plafker, George, 1965, Tectonic Deformation Associated with the 1964 Alaska Earthquake, Science, v. 148, p. 1675.

Richter, Charles F., 1958, Elementary Seismology, San Francisco: W. H. Freeman and Co.

Sykes, Lynn R., 1971, Aftershock Zones of Great Earthquakes, Seismicity Gaps, and Earthquake Prediction for Alaska and the Aleutians, Journal of Geophysical Research, v. 76, p. 8021.

RESPONSE TO COMMENTS BY
PHILIP N. OSBORN

311 The EIS recognizes the most important and major geologic aspects of the project area. The Corps of Engineers will study all of the areas of geologic concern expressed in Mr. Osborn's letter and many more geologic conditions as the Southcentral Railbelt study continues. To this end, the Corps has already retained two consultants specialized in the field of tectonics and seismicity of the area. The United States Geological Survey has been asked to do the geological mapping of the river and reservoirs. This would include tectonics of the area, land slides into the reservoir, seiches in the reservoir, as well as the required geologic data as outlined in Corps of Engineers' regulations and manuals.

Christopher Pearson
Geophysical Inst
College Ak

Dear Sir.

I don't think that the state has any need for the more than 5 billion kw hrs that the two proposed dams on the upper Susitna river would produce. I think that the projections of energy demand do not take into account a probable downturn in the rate of energy growth in the Fairbanks area after the pipeline is finished. I think that options 1 & 2 (ie the Devils canyon & the D.C. High dams) are more reasonable & they have the added advantage of flooding less land & thus would have a smaller environmental impact. I do think though that if a dam is to be built in Alaska the Susitna river is the place for it.

312 Sincerely

Chris Pearson

69-737 0 - 81 - 50

312 Comments noted.

P.O. Box 171
Anchorage, AK 99510
October 11, 1975

Col. Charles A. Debelius
District Engineer
Alaska District, Corps of Engineers
P.O. Box 7002
Anchorage, AK 99510

Dear Col. Debelius:

I am writing in general reference to the Upper Susitna River Project. Although I am against the project for environmental and social impact reasons, I would like to focus my comments on a specific part of the study. The following comments, therefore, have to do with the transmission corridor, called alternative "Susitna-1" in the September 1975 draft of the Environmental Assessment of the Susitna Transmission System, which parallels the Alaska Railroad between Talkeetna and Gold Creek.

As a part-year resident of Lane Creek, located near mile 241.7 of the Alaska Railroad, I am deeply concerned about this part of the project. I am not alone; there are hundreds of people who o wn or lease land and who have recreation or residence cabins in the area affected by "Susitna-1" between Talkeetna and Gold Creek. Access roads will ruin this area, bringing in large numbers of people and all the attendant problems, which is precisely what most people who built in this area wanted to get away from. In addition to the roads, the transmission towers, lines, and cleared areas will be unsightly and an impairment of the wilderness environment.

In reading the above mentioned draft, I was surprised and distressed at the incomplete and misleading information which it contained. I am refering here to the matrices and supporting text for the Environmental Assessment and Environmental Impact sections. Although the draft seems to have been intended as a superficial study, the errors I will note are so glaring that they require comment and correction before the draft is used as a basis for any decisions.

The matrix for this segment of "Susitna-1" under Existing Developments indicate several railroad stops, of which Lane is one. Lane is not even a flag stop, and hasn't been for many years. The current flag stops are mile 232, 233.5, 236, 238.4, 239.5, 241.7, 244.6, and others north to Gold Creek. Each of these stops represent small communities of a scattered three to ten cabins which people use for recreation or residence, mostly the latter. The locations of the cabins range up to three miles, and occaisionally further, from the railroad tracks. The matrix for Impacts under Existing Developements indicates no impact in this area, although lower down on the page the Stephan Lake cabins are mentioned. The text is equally incomplete. Infact, the "Impacts of Preferred Corridor Susitna-1" (pg. 38) scarcely mentions the Talkeetna-Gold Creek segment at all.

The rather significant oversignt of ignoring this large block of people and the impact the "Susitna-1" corridor will have on them, indicates a very superficial and almost irresponsible analysis. I note that the matices can be easily updated. In light of the information contained herein, I hope that the draft, matrices and text, will be corrected before being submitted to decision makers.

A wilderness life for myself and a large number of people will be destroyed if the transmission lines are built in this corridor. I would therefore like to see the "Susitna-1" alternative between Talkeetna and Gold Creek abandoned. If this cannot be done, then at least study it carefully to minimize the impact. Therefore, I certainly hope you will consider helicopter construction in this area and choose a route which will avoid privately leased or owned land.

313 Sincerely,

R. John Strasenburgh

cc. Senators Gravel and Stevens
Representative Young
Bob Cross, Alaska Power Administration

RESPONSE TO COMMENTS BY
R. John Strasenburgh

313 The study is currently in the feasibility stage, thus detailed design and routing of the transmission line has not yet been accomplished. For this reason, the present routing of the line is designated as a relatively broad strip of land constituting a "corridor." As stated in the Environmental Assessment for Transmission Systems (APA): "To avoid presumption of private lands, the final route will be flexible enough to circumvent small blocks of private land." The assessment goes on at some length describing the actions which will be taken to lessen the obtrusiveness of the transmission line with care given to proper design and locations. The section of the assessment dealing with impacts on scenic quality and recreation ends with the following statement: "Whenever possible, existing rights-of-way should be shared or paralleled to avoid the problems associated with pioneering a corridor in inaccessible areas. Trails in these "inaccessible" areas should, however, be avoided; preserving wilderness quality entails sharing or paralleling all rights-of-way except trails, and from these, lines should be shielded as much as possible." Thus, preservation of the wilderness setting will be a major consideration in transmission line location and construction.

STILLWATER CLINIC
BOX 8
COLUMBUS, MONTANA

October 21, 1975

Alaska District Corp of Engineers
Anchorage, Alaska
99500

Re: Upper Susitna Basin Hydro-Electric Power Development.

Dear Sirs:

It comes to my attention that a power development including a dam or several dams in the upper Susitna and Devil's Canyon is still being proposed. It is my feeling that very little thought has been given to the environmental impact that such a project would have, and the permanent loss of some tremendous river floating and boating in the future years. This particular stretch of river is as magnificent, as far as rivers go, as McKinley is when one considers its relationship to other mountains. I feel that any measure to change or deface this river should be as carefully considered as would a proposal to change or deface Mount Mc Kinley.

I wish you would enter this statement in the hearing record as evidence that there is strong opposition to the Devil's Canyon Dam that will permanently destroy the marvels of this canyon.

314 | Sincerely yours

C.H. Swanson Jr., M.D.

C.H. Swanson Jr..M.D.

CHS/ch

RESPONSE TO COMMENTS BY
C. H. SWANSON, JR. M.D.

314 Comments noted.

JOHN R. SWANSON
P. O. Box 922
Berkeley, California 94701

October 12, 1975

District Engineer
U.S. Army Corps of Engineers
PO Box 7002
Anchorage, Alaska 99501

Dear Sir;

Please accept my Comments concerning the Draft Environmental Impact Statement pertaining to the proposed Devil Canyon and Watana Dams on the Susitna River, Alaska. I wish to advise you of my Opposition to such Dams as they will be destructive to Fish and Wildlife resources as well as destructive to Scenic and Wilderness resources within this general area of Alaska.

The Susitna River should remain free-flowing as it is a unique river in its natural state and added, or at least portions of it, to our National System of Wild and Scenic Rivers.

Free flowing natural rivers are now nearly extinct in the United States, all the more reason, then to keep the Susitna free from any Dams and related developments and, is the power generated from such Dams actually necessary as Alaska is now within a substantial oil and natural gas boom?

As I am familiar with portions of the Susitna River, I again urge that it be not destroyed by Dams.

315 Sincerely, John R. Swanson.

RESPONSE TO COMMENTS BY JOHN R. SWANSON

345 Comments noted.

410 Skarland Hall
University of Alaska
Fairbanks, Alaska 99701
Oct 7, 1975

Alaska District
Corps of Engineers
P.O. Box 7002
Anchorage, Alaska 99510

Dear Sir:

I attended your hearings held here in Fairbanks in October, with great interest and concern for the future development of the proposed dams on the Big Susitna River.

I was somewhat surprised when Colonel Debelius mentioned that there might still be a possibility of additional dam construction such as the Rampart. When the Corps tries to resurrect such skeletons of this magnitude of biological blunder, it makes one wonder about some of the reasoning behind present studies.

Although I would be the first to admit that the Devil's Canyon area would be ~~the~~ probably the best location for a dam site in the State, I feel that it is necessary to evaluate all of Alaska's resources, and wise land use planning, with the best and wisest use of resources instead of developing in a piece meal style.

I feel that the question should be raised as to the necessity of a dam for hydro-electric power at this time. There are presently many energy resources being wasted in Alaska. Flaring of natural gas has been carried out for over a decade in Cook Inlet. As a student on campus at the University of Alaska at College, I witness entire floors unnecessarily burning electricity 24 hours a day, and consumption is at a maximum.

The fact that the Corps of Engineers is planning this project at this time, prior to knowledge of the route the gas pipeline will take, indicates an attitude of "development for development's sake" to perhaps quote a well known Alaskan inversely.

If infact the North Slope gas pipeline does go through Alaska, it would appear to me to be extremely short sighted at this time to go ahead with construction plans, as well as encouraging more waste of Alaska's renewable and non renewable resources.

316

Yours sincerely,

Barbara Winkley

Barbara Winkley

cc: Governor Hammond

RESPONSE TO COMMENTS BY
BARBARA WINKLEY

316 Comments noted.

LETTERS RECEIVED BY THE CHIEF OF ENGINEERS

AS A RESULT OF COORDINATION

OF THE

REVISED DRAFT ENVIRONMENTAL STATEMENT

AND RESPONSES THERETO

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Science and Technology
Washington, D.C. 20230

October 4, 1976

Lieutenant General J. W. Morris
Office of the Chief of Engineers
Department of the Army
Washington, D. C. 20314

Dear General Morris:

This is in reference to your revised draft environmental impact statement entitled "Upper Susitna River Basin, Southcentral Railbelt Area, Alaska." The enclosed comments from the National Oceanic and Atmospheric Administration are forwarded for your consideration.

Thank you for giving us an opportunity to provide these comments, which we hope will be of assistance to you. We would appreciate receiving eight copies of the final statement.

Sincerely,

Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs

Enclosure: Memo from Mr. Harry L. Rietze
Director, Alaska Region

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P. O. Box 1668, Juneau, Alaska 99802

DATE: September 15, 1976 FAK21/JB

TO: EE, Office of Ecology and Environmental Conservation

Robert C. Schuel SEP 29 1976 SEP 29 1976

THRU: for F3, Associate Director for Resource Management

John P. [signature]

FROM: for Harry L. Rietze
Director, Alaska Region

SUBJECT: Review of Revised DEIS #7607.37, Hydroelectric Power Development, Upper Susitna River Basin, Southcentral Railbelt Area, Alaska Corps of Engineers

The revised draft environmental impact statement for Hydroelectric Power Development, Upper Susitna River Basin, Southcentral Railbelt Area, Alaska, that accompanied your memorandum of July 21, 1976, has been received by the National Marine Fisheries Service and we offer the following comments.

Comments

4.0 Environmental Impacts of the Proposed Action

This section made several references to changes in various parameters of water quality and fish habitat. However, the problem of streambed erosion and channel change and its effect on fish spawning and rearing habitat in the Susitna River system should be discussed in greater detail.

317 We believe that if the channel pattern changes from a braided stream pattern to a single, deep or incised watercourse during winter months, as indicated,[1] there could be a significant reduction of groundwater head with resultant dewatering of sloughs used as spawning and rearing areas. Of twenty-eight sloughs identified in 1974 and 1975, at least 22 were utilized by salmon for spawning and/or rearing areas.[2] Reduction of intra-gravel flows could seriously affect mortality of eggs and alevins.

5.0 Environmental Effects Which Cannot Be Avoided
Page 67, paragraph 3

Elevated water temperatures during the first few weeks of development of salmon eggs can create abnormalities and increased mortality.[3] Higher than normal temperature regimes can also affect the degree-day requirements of developing eggs and fry so that earlier emergence from the substrate can occur. This could take place at a time when food sources are not available or during a period of adverse environmental conditions. Both could affect survival of fry. We believe that the DEIS should address these effects. 318

1 Hydroelectric Power Development, Upper Susitna River Basin, Southcentral Railbelt Area, Alaska Corps of Engineers, Interim Feasibility Report, page 67, paragraph 5.

2 Preauthorization Assessment of Anadromous Fish Population of Upper Susitna River Watershed in the Vicinity of the Proposed Devil Canyon Hydroelectric Project. Alaska Department of Fish and Game, 1975.

3 The Low-Temperature Threshold for Pink Salmon Eggs in Relation to a Proposed Hydroelectric Installation. Bailey, Jack E., and Evans, Dale R., Fishery Bulletin: Vol. 69, No. 3, 1971.

RESPONSE TO COMMENTS BY
U. S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHORIC ADMINISTRATION
NATIONAL MARINE FISHERIES SERVICE

317 Further environmental studies are required to adequately address the problem of streambed erosion and channel change and resulting effects on fish spawning and rearing habitat. The preliminary data presented in the DEIS are a basis for identifying areas that need further analysis. Detailed biological and hydrological studies will be made to obtain data necessary to assess the impact of altered stream flow on the relationship between the main stream channel and existing sloughs and tributaries downstream from the project.

318 As stated in the DEIS, temperatures of the water released from Devil Canyon Dam would be adjusted to approach the natural river water temperatures. This would be made possible by the proposed incorporation of selective withdrawal outlets into the dam structures. The design necessary to provide optimum temperatures, as well as dissolved oxygen and nitrogen levels and other critical water quality control, will be determined by detailed modeling studies.

U.S. ENVIRONMENTAL PROTECTION AGENCY

REGION X

1200 SIXTH AVENUE

SEATTLE, WASHINGTON 98101

REPLY TO ATTN OF: 10FA - M/S 623

OCT 15 1976

Colonel George R. Robertson
District Engineer
Alaska District, Corps of Engineers
Department of the Army
P. O. Box 7002
Anchorage, Alaska 99510

Dear Colonel Robertson:

We have completed reviewing the Revised Draft Environmental Impact Statement issued by your office on "Hydroelectric Power Development, Upper Susitna River Basin." We believe that this version of the DEIS is, like its predecessor, premature in that the Corps has not yet collected enough current water quality data to adequately describe that portion of the existing environment and to allow a thorough review. We feel there should also be an attempt to model the reservoirs and their discharges in an effort to estimate their effects on downstream water quality and aquatic biota. 319

In particular, for our review the environmental statement should contain data which shows the current values for turbidity (as well as suspended and dissolved sediments), dissolved oxygen, dissolved nitrogen and temperature for points in the river upstream of the proposed reservoir sites, at these reservoir sites and downstream of the proposed project. We do not believe that water quality data which is largely twenty years old can always be used to represent current conditions in the river. 320

This additional data should be used to model the reservoirs and the effects of project discharges on downstream water quality so that a supportable assessment can be made, in the statement, of the project's effects on downstream turbidity, dissolved oxygen concentrations and water temperatures. We believe that such an effort is essential

321 in order to ensure that the proposed mitigating measure (multi-level reservoir outlets) is adequate to ensure compliance with Alaska's Water Quality Standards.

322 Because of this information gap we must continue to rate the proposed action and the environmental statement ER-2 (environmental reservations, inadequate information). This rating and the date of our comments will be published in the Federal Register in accordance with our responsibility to inform the public of our views on proposed Federal actions under Section 309 of the Clean Air Act, as amended.

We appreciate this opportunity to review your Revised Draft Environmental Impact Statement and would be glad to discuss our concerns with you at your convenience. For additional information contact Dan Creventsen in our Anchorage office (907) 265-4881 and/or Dan Steinborn in the Seattle Regional Office (206) 442-1595.

Sincerely,

Alexandra Smith

Alexandra B. Smith
Director
Office of Federal Affairs

69-737 O - 81 - 51

RESPONSE TO COMMENTS BY
U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION X

319 We agree that further water quality studies, both for baseline data and impact analysis, are required to thoroughly describe the existing environment and to assess project impacts. During the preconstruction phase, detailed biological and hydrological studies, including reservoir modeling, will be made to obtain this information.

320 Detailed water quality studies to determine present baseline levels of a variety of parameters, including those listed above, will be made. As preconstruction studies proceed, supplements to this statement will prepared and coordinated as appropriate.

321 During preconstruction stages, reservoir modeling will be accomplished to allow simulation of reservoir and downstream changes of a number of parameters which affect the ecological cycle. This will require an extensive baseline data acquisition program to properly calibrate the model. This analytical model will then be used to adequately determine environmental impact and to ensure that proper mitigating measures are incorporated in the design of the project.

322 Comments noted.

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

OFFICE OF THE SECRETARY

WASHINGTON, D.C. 20201

15 September 1976

Lieutenant General J. W. Morris
Chief of Engineers
Department of the Army
Washington, D. C. 20314

Dear General Morris:

This Department has reviewed the draft environmental impact statement concerning the Upper Susitna River Basin, Southcentral Railbelt Area, Alaska.

While the proposed project does not appear to significantly impact on the remote Alaskan area in which it
323 is located, the DEIS does not address plans for providing health services to construction workers, many of whom may well be Alaskan natives. This matter should be addressed in the final EIS.

Thank you for the opportunity to review the document.

Sincerely,

Charles Custard
Director
Office of Environmental Affairs

RESPONSE TO COMMENTS BY
DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

323 Because of the remoteness of the site, complete health services will be provided throughout the construction phase of the project. Thank you for the comment recognizing the need for plans for provisions of these services.

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

PEP ER-76/692

29 October 1976

Dear General Morris:

Your letter of July 9, 1976, transmitted your proposed report and revised draft environmental impact statement on Hydroelectric Power Development in the Upper Susitna River Basin, Alaska. Your letter requested the comments and recommendations of this Department on the report and comments on the draft environmental impact statement. We are pleased to respond with the views and comments as set forth in the body of this letter.

Chief of Engineers' Report

We have no objection to your recommendation for authorization of the phase I design memorandum stage of advanced engineering and design for the project. We agree that additional detailed studies will be required to determine the potential impacts of a project of this magnitude and complexity on the Alaskan environment and economy. The wilderness characteristics of this remote area with its fish, wildlife, and recreational resources will have to be fully investigated prior to consideration of authorization for project construction.

Many of the necessary studies will involve this Department by tradition, expertise, and legal responsibility. We would expect to work closely with you in determining the scope of project studies to be undertaken and in developing a schedule and budget to support this work.

Areas of specific concern include evaluation of impacts on fish, wildlife, and recreational resources, including impacts on whitewater boating; land management; mineral resources; and the Department's responsibilities with respect to transmitting and marketing power from Corps of Engineers' projects.

The report of the Fish and Wildlife Service makes several specific recommendations which we believe should be adopted as part of the phase I planning effort. Among other things, the Fish and Wildlife Service recommends that the preservation, propagation, and management of fish and wildlife resources be among the purposes for which the project will be authorized for construction. We believe that phase I work should include detailed studies of the fish and wildlife resources of the project area and potential project effects on these resources. We direct your attention to coordinated studies recommended in November 20 and December 15, 1975, letters from the Area Director, Fish and Wildlife Service, to the District Engineer and to a November 18, 1975, report entitled, "Biological Study Proposals Relating to Hydroelectric Development of the Upper Susitna River Basin" prepared by the Alaska Department of Fish and Game.

The Fish and Wildlife Service provided funding estimates in those letters for the detailed fish and wildlife studies covering a five-year study period. We understand that the phase I study period may cover only three years; consequently, the fish and wildlife studies would have to be condensed into the three-year period. This would not affect budget requirements. The recommended studies reflect concerns that the baseline hydrology and fishery data are inadequate to predict even primary project impacts.

Range and effects of turbidity and temperature changes are speculative, as is the extent of dewatering of sloughs. The proposed fish and wildlife studies would be aimed at a detailed understanding of these project impacts and the formulation of measures to mitigate or compensate for fish and wildlife losses. It is not apparent from your proposed report or from the Conference Report on S.3823, the Water Resources Development Act of 1976, whether the recommended fish and wildlife studies are to be included in the phase I funding. We strongly recommend that the proposed fish and wildlife studies be recommended in your final report for funding and implementation.

We recommend that the detailed location studies of facilities and power transmission lines include clarification of land status and consultations with land managing entities. We urge close coordination with the State Director, Bureau of Land Management, 555 Cordova Street, Anchorage, Alaska 99501. This office can assist you in such complex areas as right-of-way permits and compliance with the Alaska Native Claims Settlement Act.

Essentially all project costs would be allocated to power purposes to be repaid, with interest, from revenues from power and energy sales. The criteria for repayment are somewhat different than the criteria for economic evaluation with respect to period for analysis and interest rates. This is reflected in the marketability analysis furnished by the Alaska Power Administration (letter of December 10, 1975).

From the viewpoint of the Interior Department responsibilities for transmitting and marketing power under Section 5 of the 1944 Flood Control Act, the project as proposed in the District Engineer's report appears to be a feasible undertaking. However, this finding must be qualified to the extent that any substantial changes in the plan may adversely affect project feasibility.

In some study areas we cannot fully agree that the available data and studies are not adequate for the purpose of seeking an authorization to construct. We believe the finding ignores a large portion of the data in the studies relevant to Susitna Basin that have been compiled over a period of more than 20 years since the project was first given serious consideration. To the extent that these data are applicable and sound, they should be utilized.

We recognize that the project would involve a very large investment. However, the indicated costs do not appear out of line with other power alternatives available to the State and the Nation. The indicated costs appear quite favorable in comparison with current experience with large coal-fired or nuclear power plants and substantially lower than expected costs for more exotic future alternatives.

We obtained from the District Engineer, Alaska, an indication that the phase I studies would probably require approximately three years and would cover the full range of data and studies concerning environmental, socio-economic, and engineering studies. The District Engineer also advised that the phase I studies would not include constructing a road to the Watana damsite, but that a pioneer road to Watana would likely be included in the advanced engineering and design studies (Section 1(b) provisions). This point concerns us since Section 1(b) specifically excludes construction and land acquisition. It appears that this should be resolved in your final report even though the Conference Report on S.3823 did not adopt the Section 1(b) recommendation.

We believe the data from the marketability analysis should be included in your report to Congress since that analysis is directly relevant to impact of the proposed project on power system rates, revenue requirements, and costs to the consumer.

Your report notes that the power is to be marketed by the Alaska Power Administration of the Interior Department and the District Engineer's report makes the recommendation that the marketing agency also operate and maintain the project. These provisions are consistent with the March 14, 1962, Memorandum of Agreement, between our two departments concerning water development in Alaska, the Columbia River Basin, and the Missouri River Basin.

Technical Appendixes

There are two changes in the technical appendixes furnished by the Alaska Power Administration. Appendix I, Part 2, Page G-90, revise the last sentence to read: "They indicated that on the basis of normal utility requirements, an intertie to Glennallen could probably not be justified until after 1990, thus a line to Glennallen is not included in the plans and costs for the initial development proposal."

Appendix I, Part 2, Page H-39, last paragraph, delete sentence: "Thermal constraints necessitate larger conductors with larger kV systems." The conductor size needed to meet current carrying capacity is generally smaller than the conductor size needed to reduce interference (TVI, RI, audible noise) to acceptable levels. This interference is a result of corona which is a function of voltage level and conductor diameter.

Page H-44, Table 8. A total figure for losses for each plan should be given.

We have some questions on Appendix I, Part 1, principally concerning the Corps' modification of the Bureau of Reclamation's feasibility design for the Devil Canyon Dam. The questions are of a technical nature and are being discussed with the District Engineer. We will furnish supplementary comments after these discussions are completed.

Revised Draft Environmental Impact Statement

General Comments

324 We suggest the statement be revised to show that the proposed Federal action is authorization and implementation of the phase I design memorandum work. A brief description of the work contemplated under this action should be included.

The revised draft statement appears to include essentially all items that would actually be impacted by the hydroelectric project and the transmission lines. Thus it appears adequate for the purposes of phase I studies even though data is lacking to make detailed analyses of impacts.

We note that previous comments by several Interior Department bureaus are acknowledged in the Revised Draft Statement, and that the indication of Corps commitments made in response to the comments should somewhat mitigate potential adverse impacts.

Detailed Comments

325 Summary page, paragraph 3(a). The paragraph should refer to the capacity and number of powerplants involved.

326 Page 7, Section 1.03. Description of Action. Along with statements about ongoing studies and studies that will be conducted during the preconstruction planning stage, a statement should be included to the effect that minerals assessment surveys will also be conducted during preconstruction planning stage. This same statement should be included in the final Chief of Engineers' report before transmittal to Congress for funding of the necessary studies. Mineral resources should be given the same treatment as other resources present in the proposed project area.

327 Page 43, 3.01. Since title to Native corporations or the State of Alaska has not been issued to land at this date along the proposed transmission corridor, the status remains unsettled. The final statement should indicate coordination with the BLM State office in this matter.

328 Page 43, 3.02. The land status here remains unclear since the proposed exchanges have not been fully implemented or concurred by all parties. Development impacts on adjacent lands cannot be assessed until ownership is finally determined. The State and Native corporations could have different development philosophies.

Page 50, paragraph 2. There is an important apparent contradiction between the feasibility report and the draft statement concerning winter flows. Page 67, paragraph 5 of
the report states that the river will channelize into a 329
single deep watercourse between Devil Canyon dam and Talkeetna in winter; page 50, paragraph 2 of the draft states that higher winter flows may increase egg survival in the sloughs. We believe there is a good chance that if the river does form a single deep channel in winter, the sloughs may drain into it and markedly reduce egg survival. This possibility should be treated at length in the final statement.

The regulated flows will have the additional adverse effect of limiting natural streambank and bar erosion and deposition
downstream from the dam. These natural processes presently 330
create large areas of floodplain willow and alder and support sizeable numbers of moose. Regulated flows will reduce the extent of disturbed area and consequently the amount of floodplain habitat and the number of moose supported by it.

In view of these serious problems, the release regime for the dam will have to maintain the integrity of present aquatic
and floodplain habitat. Regulation of flow as proposed in 331
the draft statement may therefore not be possible.

Pages 67-70, Section 5.0. The section does not describe any
impacts from powerplants and switchyards. The statement should 332
discuss these impacts or lack of impacts as applicable.

<u>Summary</u>

The Department of the Interior concurs in the Army recommendation and recent Congressional action calling for authorization of the phase I design memorandum stage of advanced engineering
and design including necessary detailed environmental studies, 333
subject to the comments stated above. With above noted exceptions, we further believe the revised draft environmental impact statement is generally adequate for its purpose.

Sincerely yours,

Stanley D. Doremus

Deputy Assistant Secretary of the Interior

Lt. General J. W. Morris
Chief of Engineers
Department of the Army
Washington, D. C. 20314

RESPONSE TO COMMENTS BY UNITED STATES DEPARTMENT OF THE INTERIOR

324 Based on current guidelines established by Executive Order 11514, the Council on Environmental Quality and Corps of Engineers Regulations, we interpret the proposed Federal action to consist of the ultimate project proposal. This is necessary to insure that decision makers have sufficient information concerning a given proposal to determine its justification in light of environmental consequences. Studies made during phase I design memorandum work are necessary to determine the impacts of the recommended proposal, and the EIS will subsequently be supplemented as appropriate to reflect impacts in detail. Some impacts related to phase I studies are inevitable due to the remoteness and inaccessibility of the proposed project area. These will be related primarily to physical explorations in the vicinity of the dam sites and along an access route which would be developed if the project is authorized for construction. This will require use of heavy equipment which is proposed to be hauled to the work site by all-terrain vehicles during the winter to avoid damage to tundra and other vegetation and delicate soils. Thus physical disturbance will be limited to relatively small areas and will, in so far as practicable, be contained within proposed impoundment areas, or along the access trail developed by the Department of Interior when it made geological studies of the area in years past. Should the project not be authorized for construction, some rehabilitation measures may be necessary. Overall, the physical impacts related to phase I field investigations are expected to be relatively insignificant. A major objective of phase I studies is to identify avoidable adverse impacts associated with the project should it be implemented, and to incorporate mitigative measures where necessary.

325 The summary page has been held to a very brief, general description of the proposed action and the major impacts associated with it. A discussion of specific features would be so lengthy as to negate the usefulness of the summary. The capacity and number of power plants involved are described in section 1.03.

326 During phase I studies the mineral resource of the proposed impoundment areas will be assessed. The need for such a study has been acknowledged in the final EIS.

327 The referenced paragraph clearly states that the status of land occupied by alternative transmission corridors is presently unsettled and that existing jurisdictions are subject to change as determinations are made for ultimate disposal. The State BLM

office has been kept informed of potential real estate requirements throughout the initial study phase. These efforts will be intensified during the detailed study phase not only with BLM, but with all other concerned agencies, organizations and individuals.

328 Comments noted.

329 As stated on page 47, paragraph 2, and page 49, paragraph 4, of the DEIS, there is expected to be a period of channel stabilization of the Susitna River with some changes in the relationship between the regulated river and existing salmon rearing and spawning sloughs and tributaries. The extent of channel degradation and the effects of this phenomenon on important fisheries habitat will be the focus of extensive biological and hydrological studies throughout the preconstruction planning stage.

330 The expected short-term result of regulated flow downstream of the project is the enlargement of areas supporting pioneering species, such as willow and alder, as this vegetation overtakes the areas previously dominated by flood disturbances. But as the vegetation of these areas matures, climatic species may take over and result in reduced moose habitat. The significance of this phenomenon will be the subject of detailed baseline data accumulation and analysis during the detailed study phase.

331 Although detailed baseline hydrologic data are presently not available on which to base conclusions, preliminary findings indicate that the release regime of the project may cause an unavoidable change in the present aquatic and floodplain habitat of the Susitna River. It is possible that the river, through flood stage reduction and flow regulation, may become a single meandering channel, with increased flow and turbidity expected downstream from the project during the winter and decreased flows and turbidity during the summer. Therefore floodplain and aquatic habitat may be modified. The magnitude and extent of this change is speculative until further studies are conducted during the detailed study phase.

332 Upon completion of installations there should be no appreciable impacts resulting from the location and operation of the powerplants since they will be located underground and will not release gaseous or solid pollutants. Switchyards will occupy open space which must be altered for this purpose. However, this will be infinitesimal compared to lands inundated by reservoirs. Impacts of these facilities will be addressed in a supplement to the EIS upon completion of detailed studies required to determine their design and specific location.

333 Comments noted.

FEDERAL POWER COMMISSION
WASHINGTON, D.C. 20426

2 December 1976

Lieutenant General J. W. Morris
Chief of Engineers
Department of the Army
Washington, D.C. 20314

Reference: DAEN-CWP-A

Dear General Morris:

This is in reply to your letter of July 9, 1976, inviting comments by the Commission relative to your proposed report, and to the reports of the Board of Engineers for Rivers and Harbors and of the District and Division Engineers, on the Southcentral Railbelt Area, Alaska (Hydroelectric Power) Upper Susitna River Basin. A revised draft environmental impact statement accompanied the reports.

The cited reports cover studies of the feasibility of providing electric power for the Anchorage-Fairbanks Railbelt area through hydroelectric development in the Upper Susitna River Basin. After consideration of alternative plans, the plan selected would consist of developments at the Watana and Devil Canyon sites. Because of the magnitude and complexity of the projects, a phased approach to the final decision on construction was recommended. Initiation of the phase I design memorandum stage was authorized in Public Law 94-587, approved October 22, 1976.

As proposed, the development would consist of the 810-foot high Watana Dam with an installed capacity of 708,000 kilowatts and the 635-foot high Devil Canyon Dam with an installed capacity of 684,000 kilowatts. The total estimated cost of construction, based on January 1975 price levels, is $1,531,800,000.

The proposed hydroelectric development is designed to supply most of the increased power demands between 1985 and 2000 of the Anchorage and Fairbanks areas, as well as other small communities in the Railbelt region. The Alaska Power Administration has made several projections of the combined loads of these areas. The various projections are generally consistent with information supplied to the Federal Power Commission by the advisory committees involved in the Commission's forthcoming Alaska Power Survey. The mid-range projection, which was selected by your Department for use in its evaluations, assumes a utility load growth rate of 12.4 percent annually between 1974 and 1980, 7 percent between 1980 and 1990, and 6 percent between 1990 and 2000. Total peak demands would increase from 451 megawatts in 1974, to 870 megawatts in 1980, to 1,670 megawatts in 1990, and to 3,170 megawatts in 2000. The mid-range projection appears to be a reasonable estimate of power loads that can be anticipated to occur within the Railbelt area.

Power values developed by the Commission staff were based on the estimated costs, using January 1975 price levels, of coal-fired steam-electric plants constructed in the Fairbanks and the Anchorage-Kenai areas. A combination of REA and municipal financing was assumed. On the basis of Commission staff assumptions as to the utilization of the hydro system power between the two areas, composite power values of $89.93 per kilowatt-year for dependable capacity and 5.98 mills per kilowatt-hour for energy were derived.

Using these values, and applying appropriate discounts to reflect a time-lag before the power installation would be fully usable to meet the area loads, the total annual power benefits as computed by your Department are $128,153,000, including a nominal economic value for the interconnection between Fairbanks and Anchorage. Independent calculations by the Commission staff agree very closely with that amount. The staff also notes that, in addition to the economic benefits, the proposed interconnection between Anchorage and Fairbanks power systems should have a definite beneficial effect on the reliability of both systems. Including your Department's estimated benefits for recreation, flood control, and area redevelopment, the total annual benefits would be about $138,000,000, compared to your Department's estimates of annual costs of about $104,000,000. Consequently, the proposed development appears to be economically justified.

The staff suggests that further studies be made during the phase I design memorandum stage to determine the optimum development of the Upper Susitna Basin. Although the basic Watana-Devil Canyon development appears to be well justified, variations in power load growth could warrant con- 334
sideration of additional projects in the basin or deferral of construction of the Devil Canyon project. Further studies could also lead to different conclusions concerning such factors as height of dams, size and number of units, or provisions for future units.

Based on its consideration of the reports of your Department, the revised draft environmental impact statement, and the studies of its own staff, the Commission concludes that the proposed Watana and Devil Canyon hydroelectric developments appear to be economically effective means of meeting projected power loads of the Anchorage and Fairbanks Railbelt area. The Commission recommends that further studies be made to determine the optimum scale and scheduling of the developments needed to meet the load growth of the area. The Commission staff will be available to work with your Department in resolving some of these issues.

Sincerely yours,

Richard L. Dunham
Chairman

RESPONSE TO COMMENTS BY
FEDERAL POWER COMMISSION

The Corps of Engineers acknowledges and concurs in the views expressed by the Federal Power Commission. Detailed studies
334 will be made during the phase I design memorandum stage to determine the best combination of features for optiumum development of the Upper Susitna Basin.

STATE OF ALASKA
OFFICE OF THE GOVERNOR
JUNEAU

November 17, 1976

Lt. General J. W. Morris
Chief of Engineers
Department of the Army
Washington, D.C. 20314

Dear Lt. General Morris:

Reference is made to your letter of July 9, 1976, informing me that a copy of your proposed Southcentral Railbelt Area, Alaska, Upper Susitna River Basin, Interim Hydroelectric Power Feasibility Report had been submitted to the Director, Division of Water and Harbors, for review and comment prior to transmission of the report to Congress. Subsequent to this action, coordination has been maintained with the Alaska District Engineer who has provided additional information defining the range and type of studies endorsed in your report.

I concur in the recommendation by the Board of Engineers report that
further study effort is needed for a project of this magnitude. I agree
335 that additional detailed studies, including those addressed by my task
force, will be required to determine the significant impacts associated
with the magnitude and complexity of the project. Our task force
recommendations will be supplied to the District Engineer.

The information obtained from the District Engineer concerning studies proposed in the next stage coincides well with the environmental, socio-economic and technical studies identified by the State Task Force during review of the Draft Environmental Impact Statement. As these detailed studies are addressed, coordination should be maintained with the State's designee to assure that assessments are answering those points raised in the task force report and to insure that the information developed will be adequate on which to base future State recommendations.

Thank you for the opportunity to review the document and make these comments.

Sincerely,

Jay S. Hammond
Governor

69-737 O - 81 - 52

RESPONSE TO COMMENTS BY
STATE OF ALASKA
OFFICE OF THE GOVERNOR

335 The Corps of Engineers acknowledges and concurs in the comments expressed by the Governor of the State of Alaska. Detailed environmental, socioeconomic and technical studies will be made during the phase I design memorandum stage to determine the impacts of the project. These studies will incorporate recommendations by the State Task Force, and coordination will be maintained with the State's designee.

Thomas Taggart
Box 1195
Seward, Alaska 99664
19 December, 1976

Certified Mail

Chief of Engineers
United States Army Corps of Engineers
Washington, D. C. 20314

Re: DAEN-CWP-C: REVISED DRAFT ENVIRONMENTAL IMPACT STATEMENT, HYDROELECTRIC POWER DEVELOPMENT, UPPER SUSITNA RIVER BASIN, ALASKA.

Dear Sir:

If you can at all comprehend the pure hatred which I attempt to convey in this letter, you will have begun to grasp the magnitude of your crimes. I hold in utter contempt every breath of air which enters your atrophied lungs, every perverse offspring which will follow in your shadowed corridors. I hereby dedicate the last drop of blood within me to the negation of your will.

Befor going further here, and ever mindful of my own lack of eloquence, I rededicate the following excerpts of a poem to you and your fellow conspirators againest life.

<u>MASTERS OF WAR</u> by Bob Dylan

Come you masters of war, you that build the big guns
You that build the death planes, you that build all the bombs
You that hide behind walls, you that hide behind desks
I just want you to know that I can see through your masks

You that never done nothin' but build to destroy
You play with my world like it's your little toy...
You've thrown the worst fear that can ever be hurled
Fear to bring children into the world...

How much do I know to talk out of turn
You might say that I'm young, you might say I'm unlearned
But there's one thing I know, though I'm younger than you
That even Jesus would never forgive what you do

Let me ask you one question, is your money that good
Will it buy you forgiveness, do you think that it could
I think you will find when your death takes its toll
All the money you made will never buy back your soul

And I hope that you die and your death'll come soon
I will follow your casket in the pale afternoon
And I'll watch while your lowered down to your deathbed
And I'll stand o'er your grave 'til I'm sure that you're dead

Concerning the matter at hand, I was informed on December 6th, 1976 by Mr. Steve Wilson, rank unknown, Army Corps of Engineers, Alaska District that comments on the above-mentioned subject could still be submitted for inclusion in the Final Environmental Impact Statement. I herewith submit my comments, some of which are in the attached letter of March 9th, 1976 to the Chairman of the Board of Engineers for Rivers and Harbors. I ask for that letter pertaining to the Interim Feasibility Report to be included with this one in the FEIS, since it relates to basically the same issues and will save me the necessity of duplication of effort.

I do have additional comments however. To the north of the Upper Susitna River Basin lies Prudhoe Bay with perhaps 10 billion or more barrels of oil, and trillions of cubic feet of natural gas. To the west are the Beluga and Healy coalfieds (low-sulphur) which are estimated to contain the equivalent of 24 billion barrels of oil. To the south is Cook Inlet oil and gas, probable extensive O. C. S. reservoirs, and the potential of harnessing Cook Inlet's 30 foot tides. At all times in Alaska there are tremendous winds waiting to generate electricity, in summer months we have up to 24 hours per day of unrestricted solar energy, and geothermal potential such as exists in Sonoma County, California is abundant here.

Despite this wealth of resources, in your blundering incompetence and maze of bureaucratic regulations you can find no other way to provide power for Alaska's miniscule population than to construct dams on the Susitna River. Instead of allowing North Slope oil to go to Japan as is proposed (less oil company taxes to U. S. Treasury), why don't you energetically work to see that Alaska get just the small trickle of oil which she needs? It would hardly be missed by the gluttonous consumers of the "lower 48" in their headlong rush into oblivion. Conversely, it would save billions of tax dollars by preventing the Susitna Dam boondoogle.

Please refrain from quoting to me Public Law 93-577 pertaining to conservation of nonrenewable resources. I understand it perfectly, and I also understand how ludicrous the application of the letter of that law is to this situation. WE ARE SURROUNDED HERE IN ALASKA BY A VERITABLE WEALTH OF NATURAL RESOURCES OF UNLIMITED PROMISE. We in Alaska could not use these resources in 2000 years. ALLOW US THE INSIGNIFICANT FRACTION OF THOSE RESOURCES NEEDED TO SUSTAIN OURSELVES and still maintain the integrity of our natural environment. Most Alaskans are Alaskans precisely because of the lack of dams, freeways and other insidious, demeaning encroachments of your society.

The following sketchy comments pertain to the revised DEIS or revised IFR, as noted.

1) I believe that the FEIS should include metric conversions following all numerals where applicable. The fact that this wasn't done in the draft statement indicates that the Corps 336
itself is unresponsive to the changing values of our society.

2) It would be appropriate for the FEIS to be expediently brought to the public's attention via the public libraries of the following communities: All Southcentral Alaskan communities, Juneau (the state capitol), the public libraries of the capitol cities of each state and territory, and the District of Columbia. Furthermore, there should be no dollar value placed on such documents which would inhibit the public's ability to obtain such. Please note my
comments in the attached letter pertaining to the Corps dubious methods of disseminating 337
information on the draft proposals for this project.

3) Section 2.01.4.5, paragraph 1, page 17 states that "Most of the Susitna basin above Devil Canyon is considered to be highly favorable for deposits of copper or molybdenum.." Sec. 4.08, p. 60 of the same document (RDEIS) states that "..the area has never been mapped geologically." Despite these two statements, the Corps is apparently not soliciting comments from the U. S. Bureau of Mines, and this fact casts a pall on the integrity of the Corps.
Since the area has not been extensively checked for minerals, let us assume for the moment 338
that vast deposits of uranium, gold, plutonium, etc. exist there.

4) Throughout the RDEIS and the RIFR the Corps refers simply to moose habitat or good moose habitat. However in Appendix 2 of the IFR, the USF&WS refers to the same areas as preferred
or critical moose habitat. The Corps is again caught being less than candid about important 339
facts which are of concern to all Alaskans.

5) On the Summary page, sec. 3b, the Corps refers to "increased turbidity downstream from Devil Canyon" as an adverse environmental impact. The same phenomemon (increased turbidity) is cited on p. 63 of the RIFR as a reason for not opting for the alternative of a coal fired
source of energy. Does the Corps possibly consider the potential damage to the Susitna (a 340
major river) to be of less significance than damage to streams around Beluga or Healy where

TEMPORARY

mining activity already is in progress?

341 6) In the same paragraph as cited above, the Corps refers to the "possible" inhibition of caribou movements. Why not "probable" or "highly probable" considering that you propose to locate the Watana Reservoir directly on the path of the Nelchina herd? Another case of the Corps inclination to give us vicious half-truths perhaps?

342 7) Sec. 1.01, sentence 2 is a highly accurate appraisal of the situation, and as a solution, WHY NOT REDUCE CONSUMPTION?

343 8) Sec. 1.01, sen. 3 mentions "...at the request of local interests..." As a concerned citizen, I hereby demand that the Corps elaborate on that statement in the FEIS.

344 9) Sec. 1.01...This Resolution mandates that the Corps review "any competitive alternatives" to the Susitna Hydro Proposals, and it is apparent from the PDEIS and the RIFR that the Corps has failed to extensively review the alternatives.

345 10) Sec. 1.02, para. 1, sen. 3: It is implied that Alaska's major power resources exist in the Southcentral Railbelt Area. Does the Corps consider Prudhoe Bay and Petroleum Reserve #4 to be minor resources?

346 11) Sec. 1.03, par. 3, sen. 1: In light of the recent Idaho disaster, is it wise to construct an earthfill dam of this magnitude? If the Watana Dam bursts, what effect would it have on the Devil Canyon Dam? If they both go, what would be the effect on Willow (the new State capitol) and lesser villages of the Lower Susitna River?

347 12) Sec. 1.03, par 6: The figures here do not correspond with those given on page 92 of the RIFR. How can the Corps publish a blunder of this magnitude and expect to maintain its credibility?

348 13) Fig. 2,3,5-8,11,12: The maps are in error by projecting the Copper River Highway to connect at Chitina, rather than at Thompson Pass north of Valdez.

349 14) Sec. 1.03, par. 11; These figures should be updated in the FEIS to 1977 estimates.

350 15) Sec. 1.03, par 12: The benefit to cost ratio given here (1.4) is in conflict with the one given in the RIFR (1.3). Who are we to believe? How does Senator Gravel's bond proposal affect the 6 1/8% interest rate?

351 16) Sec. 1.03, par. 15, sen. 4: To what Congressional Committee does the Corps submit its findings?

352 17) Sec. 1.03, par. 15, sen. 5: Wouldn't these additional studies referred to here be a waste of tax money if Congress should decide to shoot down the proposal?

353 18) Sec. 1.03, par. 15, sen 7: This sentence is worded as though it is a foregone conclusion that Congress will authorize advvancement to final project design and construction. On what does the Corps base such a presumption?

354 19) Sec. 2.01.1, par. 2, sen. 3: The adjectives used here (cold, swift, silt-laden, uninhabited) may be accurate, but are obviously intended to project an image of a harsh, unrelenting river and land which possibly "deserves" to be tamed. Why not describe the river as "wild and scenic", the land as "uninhabited, but not uninhabitable". Why not indeed.

355 20) Fig. 4: This map is untitled.

356 21) Sec. 2.01.2, par. 2 &3: Although the Susitna was not recommended as a wild & scenic river by the Secretary of Interior, it has indeed been redommended as such by other legislation (S2918 & HR13564), and that fact deserves mention in the FEIS, as does the river's nickname: "THE MOUNT EVEREST OF KAYAKING".

22) Sec. 2.01.4.5, par. 4, sen. 1: This is a vague statement. Just how many mining claims are up there anyway? And in how large an area of acres/hectares? 357

23) Sec. 2.01.4.5, par. 4, sen. 2: If "many" of these claims are above the proposed reservoir, can we safely assume that likewise "many" are within the area of the proposed reservoir? 358

24) Sec. 2.02.1.1, par. 2, sen. 3: With a little help from humans salmon could probably be passed through Devil Canyon, thus the statement "unable to ascend" should be followed by the words "at present", in the FEIS. 359

25) Sec. 2.03.1, par. 1: Despite all the pipeline related figures cited here, the population of Alaska (1/5 the land area of the remaining 49 states combined) remains SMALLER THAN the population of any one of America's 83 largest cities! 360

26) Sec. 2.03.2, par 3, sen. 4: To say that Alaska's current growth rate can partly be attributed to the trans-Alaska pipeline is a very misleading statement, unless figures are given to substantiate it. I would guess that perhaps 90-95% of the current growth rate is directly attributable to TAPS, and Alaska will subsequently have a large decline in population when the pipeline is completed. 361

27) Sec. 2.03.2, par. 12: This is a truly incredible statement. Why not consider reducing consumption as one means of solving the energy problem? Our growth has become malignant, and must be treated as a malignancy. 362

28) Sec. 2.03.3.2, par. 1: The spur mentioned here is in actuality the Seward Highway, the main road of the Kenai Peninsula. The segment referred to is 38 miles long, not 27. 363

29) Sec. 2.03.4.2, par. 1, Sen 5: This sentence should be entirely deleted from the FEIS. It has no relevance, but rather is intended to show the majesty of machines over nature, which is an inacurate and immature position, and typical of the insensitive thinking of the Corps of Engineers which is probably made up of people who are totally estranged from their natural environment. 364

30) Sec. 4.01, par. 4: The anticipated suspended sediment levels (15-35ppm) at the proposed Devil Canyon Dam would not conform to EPA regulations. This fact alone has caused the EPA to classify this project as ER-2 (Environmental Reservations). This is a serious consideration, and should be greatly expanded upon in the FEIS. 365

31) Sec. 4.01, par. 14: It is stated that "some winter moose range in the river bottom" would be flooded. I refer here to Appendix 2 of the IFR, page 13 of the USF&WS report, the chart which indicates that 33,920 acres of preferred or critical moose habitat will be lost to the Watana Reservoir. Would the Corps care to comment? 366

32) Sec. 4.02, para 18 &19: Here it is concluded that fish would have a difficult (if not impossible) time of establishing themselves in either of the proposed reservoirs. So what recreational potential would be available without fishing? Powerboating? Swimming? 367

33) Sec. 4.03, par. 2: This paragraph tells us that Devil Canyon has few areas of big-game habitat. The USF&WS in the chart quoted in item #31 above tells us that Devil Canyon has 5,760 acres of preferred or critical habitat for moose. 368

34) Sec. 4.03, par. 10: Why was this paragraph deleted from the Revised Interim Feasibility Report (RIFR)? 369

35) Sec. 4.13, par. 4: "The proposed transmission line corridor would cross no existing or presently proposed scenic, wild, or recreational rivers, nor would it cross any existing or presently proposed wilderness areas..." The Susitna River itself is proposed as a wild & scenic river, and all of the land in the Upper Susitna River Basin "would probably qualify for wilderness classification under most definitions of the term" (Sec. 4.13, par.1). 370

371 36) Sec. 4.07, par. 2, sen 2: It is stated that temporary roads would need to be constructed in "other areas" to implement clear cutting for the reservoirs. How temporary is a temporary road and how is it to be "removed"?

372 37) Sec. 4.07, par 3: What is the commercial potential of the timber to be clear cut within the reservoir areas and transmission corridors?

373 38) Sec. 5.0, par. 2: On two occasions in this paragraph the Susitna River is referred to as a stream. That is tantamount to referring to the Himalayas as "hills", and by using such phraseology it is apparent that the Corps is attempting to implement in our minds the image of the Susitna being somewhat insignificant in the regional context. Furthermore, the last sentence in this paragraph should be deleted, since it does not refer to an "adverse effect".

374 39) Sec. 5.0, par. 4: "Approximately 9 miles of the existing 11-mile whitewater reach through Devil Canyon would be lost through inundation." Does the Corps intend to dismiss the significance of this adverse effect with one brief sentence? I refer the Corps here to the Jones & Jones Recreational Report which in no less than five seperate instances cites the importance of the recreational and aesthetic value of Devil Canyon in its primitive state. On pages 8 & 210 of that report, Jones & Jones recommend moving the lower dam entirely out of Devil Canyon. This in fact is a wild & scenic river, and will surely be designated as such by the U. S. Congress.

375 40) Sec. 5.0, par. 6: The "some" moose habitat referred to here is in actuality 39,680 acres of critical or preferred habitat as per the USF&WS. Although the USF&WS did enter the error on page 13 of their report in appendix 2 of the feasibility report, this does in no way indicate that all their figures are inaccurate. Conversely, rather than questioning the credibility of the USF&WS, the Corps should accept the professionialism of their work, which is documented with photographs.

376 41) Sec. 5.0, Par. 9, sen. 1: To say that the resident fish population could be adversely affected is an incredible understatement. Cross reference here to section 4.02, par. 19 which, in the Corps own words, states that conditions will "generally be detrimental" to resident fish. Another instance of the unbounded hypocrisy inherent in the Corps position as it attempts to "sell" this proposal to the American people.

377 42) Sec. 5.0, par. 15, sentence 5 should be deleted from the FEIS since it has no relevance to this section (adverse environmental impacts).

378 43) Sec. 6.01, Par. 6, Could the Corps define what is meant by "political feasibility"?

379 44) Sec. 6.02.1: Noting that this alternative action has not been dismissed as lacking feasibility, it should be greatly elaborated upon in the FEIS.

380 45) Sec. 6.02.2, par.2: The first sentence here has absolutely no relevance to Alaska's coal resource and should be deleted in the FEIS.

381 46) Sec. 6.02.2, par. 5, sen. 2 thru 4: The quality and quantity of the land Temporarily altered by strip mining for coal would not begin to approach the irreparable and permanent damage to be done to 39,680 acres of critical/preferred moose habitat by the hydro proposal. The final EIS should reflect that fact.

382 47) Sec. 6.02.2, par 7: This paragraph depicts the inane and hypocritical position of the Corps to the extreme. The Corps attempts to offset the economic superiority of the coal alternative (Many more jobs & greater kilowatt output) by saying that the coal alternative would not provide recreational or flood control benefits. Yet on page 96 of the RIFR, the Corps states that the significance of recreational & flood control together equal less than 2/10ths of one per cent of the total project cost. How badly the Corps wants to justify its presence!

48) Sec. 7.0: How many 500 year old dams are there in existence at this point in time? How many 100 year old dams? 383

49) Sec. 9.02, par. 5: "An informal poll of people attending the late stage public meetings indicated support for the project...." This is a highly unprofessional statement by the Corps and should be deleted in the FEIS. Does the Corps believe that the public is gullible enough to lend creedence to an informal poll conducted by the Corps itself? 384

50) Sec. 5.0: This section should list the huge mudflats to be created by the Watana reservoir drawdown as an adverse environmental effect. 385

The following statements pertain to the Interim Feasibility Report and the <u>revised</u> IFR.

Page 23: Why was the source <u>Alaska Regional Population and Employment</u> by G. W. Rogers deleted from the RIFR?

Page 35 thru 38: Concerning the methodlogy used by the Alaska Power Administration for projecting power requirements, is it wise to project that Alaska's growth rate in the next 15-20 years will be similiar to the national average of the 1960's and early 1970's? This can be a cold and inhospitable land at times, and people are not going to migrate here as readily as they would in the "lower 48". This questionable method of estimating Alaska's growth rate casts doubt on the justification for this hydroelectric project.

Page 40: In this table the higher range estimate given for the decade 1990-2000 is actually lower than the lower range! Another indication that the Corps threw this report together will little thought. Footnote 1/on this page indicates that the figures in the table were arrived at by a highly speculative way of reasoning, and indicates that the whole series of figures is little more than a fabrication.

Page 45, last paragraph: Who is the Corps of Engineers to assay that we here in Alaska do not have "generally accepted growth goals"? WHO ARE YOU PEOPLE WHO WOULD ATTEMPT TO CHANNEL OUR LIVES TO APPROXIMATE YOUR OWN MORBID, PERVERSE AND REGIMENTED EXISTENCES?

Page 59: National Economic Development Criteria: "Tangible benefits must exceed economic costs." I do not believe that this criteria will be met. Consider the following items..
A) By negating the coal alternative in favor of hydropower, a vast amount of jobs will be lost to Alaskans. The FEIS should spell out how many jobs will be lost because of this.
B) This is the construction of a <u>first-time-ever</u> dam system under Alaskan conditions. Cost overrides due to the harsh <u>environment</u> could make a shambles of the B/C ratio. Look at the current pricetag on the Trans Alaska Pipeline System for an indicator...$8,000,000,000. Up 1000% from the original estimates, largely due to inflation, but likewise largely due to the unpredictable elements.

It is possible that the Devil Canyon Dam would not meet the requirement specified under item 2 of the NED criteria on this page. Item 3 of the NED guidelines may not be met if the potential loss to the economy of the coal related jobs is figured in, as it should be.

Page 61, par. 2: The first half of sentence five is deleted from the RIFR. Without this explanatory phrase, the second half of the sentence tends to be misleading.

Page 62, par. 1: Half of this paragraph was deleted from the revised IFR. Those sentences contained the facts, without which the remainder of the paragraph appears to be conjecture. They should be reinstated.

Page 63, par. 2: Here we have <u>the</u> classic example of how the Corps of Engineers is attempting to negatively influence our thinking concerning the merits of the coal alternative. The IFR states: "Even with pollution control devices to restrict and/or remove harmful substances, there would be some degradation of air quality from combustion products."
In the revised IFR, the Corps deletes the term "combustion products" in favor of this: "water vapor, carbon particles, sulfur compounds, and unburned gases..." WHAT WE ARE MOST CONCERNED WITH HERE IS A SUBTLE ATTEMPT AT BRAINWASHING THE AMERICAN PEOPLE.

Page 64, Par. 3: It is stated here that the coal alternative would provide power equivalent to any other alternative. This statement is false. The coal alternative would in fact provide 110,000,000 Kilowatt Hours MORE firm energy than the hydropower proposal. I refer here to page 89 of the revised IFR, where it is also stated that the coal alternative would have a dependable capacity of 106,000 kilowatts MORE than the hydro project. It is also misleading on this page to say that the coal alternative meets the projected demand until the 1990's. It is in fact a virtually unlimited resource in comparison to Alaska's needs, and could keep us going for well over 1500 years.

Page 65: Comparing the figures from the IFR and the revised IFR, it is informative to note that the benefit to cost ratio and net annual benefits of the hydropower project have been revised downward by about 25% in the six months that elapsed between these reports. By the time the cost of coping with Alaska's adverse environment is added to the costs, the figures may well reflect a negative B/C ratio and no benefits whatever.

Page 78: No where here is mentioned the loss of habitat to transmission corridors. Furthermore, it is inane to say that these reservoirs will provide a contribution to waterfowl as a "resting area". I suppose you wish to imply that the present waterfowl are now suffering without a manmade "resting area"! THE LOSS OF 39,680 ACRES OF CRITICAL OR PREFERRED MOOSE HABITAT TO THESE RESERVOIRS IS PARAMOUNT.
Under recreation, the term "adverse effect" referring to the Devil Canyon whitewater should be revised to read "total destruction".

Page 89: Under NED benefits for the coal alternative, it should be considered that this would be a private enterprise endeavor which would contribute much to the perpetuation of our free enterprise system. The figures could be arrived at, if anyone cared to pursue that line of thinking. The figures given here under the Environmental Quality guidelines are inaccurate. They are in fact outright lies by the Corps of Engineers. As stated previously, the proposed dams would destroy forever nearly 40,000 acres of critical or preferred moose habitat. To compare the total destruction of 82 miles of a major river like the Susitna to the minor degradation of 110-120 miles of lesser rivers is a distortion which is indicative of criminal intent by its perpetrator, the U. S. Army Engineers.

In closing, I am compelled to say that it becomes extremely difficult to maintain respect for one's government when againest all reason and common sense that government attempts to burden its people with an unneeded and unwanted colossus such as this hydroelectric project.

And when, as in this case, that government attempts to influence opinion by putting forth misleading and distorted facts, it is time for those people to revaluate their priorites and redirect the course of their lives. A redress is in order, and shall be forthcoming.

Thomas Taggart
Seward, Alaska
[signature]
20 DEC. 1976

CC: District Engineer, Anchorage
Division Engineer, Portland, Oregon
President (Elect) Jimmy Carter, ~~Washington~~ PLAINS, GEORGIA
Governor Jay Hammond, Juneau
Senator Ted Stevens, Washington
Senator Mike Gravel, Washington
Representative Don Young, Washington
CHAIRMAN RUSSELL PETERSON, CEQ, WASHINGTON
SECRETARY DESIGNATE CECIL ANDRUS, USDI, WASHINGTON

RESPONSE TO COMMENTS BY
THOMAS TAGGART

The responses which follow are directed to the numbered comments beginning on page 2 of Mr. Taggart's letter of 19 December 1976. Comments previous to these reflect Mr. Taggart's personal views of the Corps of Engineers and do not specifically address the EIS; therefore, no response is deemed necessary or appropriate.

336 (1) At the present time metric figures are not well understood by most of the reviewers. The intent of this EIS is to present information concisely and in nontechnical terms so that it can be easily read and understood by the reviewing public.

337 (2) The FEIS will be brought to the public's attention in accordance with official directives and guidelines, including those of the Council on Environmental Quality. There has never been any monetary charge for an EIS prepared by the Alaska District, nor will there be in the future. Nevertheless, reproduction costs for these documents are high and are included as part of finite funding appropriated by the Congress for report preparation and dissemination. It does not appear reasonable to furnish copies to libraries in all other states when it is not known whether or not they are desired or whether they will even be utilized. EIS copies are furnished to everyone who has expressed a prior wish to receive them. Extra copies are printed to fill anticipated additional requests. No one has been denied access to an EIS who has expressed an interest to review one.

338 (3) In coordinating an EIS, the Corps provides the Department of Interior with sufficient copies for distribution to all of the internal agencies or bureaus within the department. The Bureau of Mines is one of these agencies. As a result of the department's internal distribution, a total of seven agencies responded with comments on the EIS (see pages 124-165, FEIS). As no comments were received from the Bureau of Mines, it is assumed they had no comments on the EIS. However, the U. S. Geological Survey did provide comments (see pages 137-140, FEIS). Mineral resources, as well as all other applicable physical, biological, economic, social, and technical aspects of the project will be thoroughly investigated, inventoried, and evaluated prior to any recommendation for construction of the project.

339 (4) The "facts" concerning moose habitat remain to be determined. Studies currently underway and which are proposed to be continued for several more years by the U. S. Fish & Wildlife Service will

determine the amounts, locations, and criticality of moose habitat. Such adjectives as "good" or "critical" have little meaning during the feasibility stage of a study prior to the completion of the intensive studies required to determine the precise value of a known resource.

340 (5) Increased turbidity, which is expected to occur downstream from the project during the winter months, is discussed in the RDEIS as an unavoidable adverse impact, the significance of which is not wholly known at this time. At present, there is a very high summer sediment load due to glacial outwash and a very low winter sediment load. With construction of the reservoirs, there is expected to be a low year-round sediment load consisting only of the very fine "glacial flour" which will remain in suspension. The post-project, downstream sediment load is estimated to approximate concentrations found below glacier-fed natural lakes in Alaska. Future hydrological and biological studies will further refine these estimates and evaluate the environmental impacts.

In the Interim Feasibility Report, the probability of increased turbidity due to the introduction of sediments into the streams and rivers in the vicinity of coal mining activities is discussed as an adverse environmental impact which must be addressed in the consideration of the coal alternatives. Environmental impacts were not the sole basis for the rejection of the coal alternative. Economic factors played a large role in this determination.

341 (6) As stated in section 4.03 of the RDEIS, Watana Reservoir would lie across one of the intermittent seasonal caribou migration routes between the main calving area and some summer range of the Nelchina caribou herd. It is not known what barrier the reservoir will present in place of the turbulent river. Also the migration patterns for this herd are continually changing. Therefore, we think the choice of the phrase "possible inhibition of movement of caribou" is appropriate--at least until detailed studies of caribou movements are completed during the preconstruction planning phase.

342 (7) This is a rhetorical question the answer to which is beyond the scope of this EIS. See response number 362 for further comment.

343 (8) The referenced phrase has been deleted from the FEIS. In studies mandated by congressional resolutions, it is assumed that the resolutions were initiated at the request of local constituents. Since the Senate Public Works Committee Resolution, which is quoted in its entirety in section 1.01, does not identify the basis for this resolution, further speculation will be omitted from this EIS.

344 (9) Consideration of alternatives to the Devil Canyon-Watana Hydroelectric project was included in both documents. The discussion in the RDEIS considered nine alternatives to hydroelectric power of which coal was determined to be most competitive. In addition, four other general hydropower sites were evaluated as were several configurations for the Upper Susitna River Basin.

345 (10) Section 1.02 of the RDEIS does not imply or specify that all of Alaska's major power resources are in the Southcentral Railbelt area. It does state that major power resources, both hydroelectric and fossil fuel, exist in this region. Prudhoe Bay and Petroleum Reserve #4 are major power resources occurring outside this area.

346 (11) The geology of the project area will be investigated in depth to identify and evaluate any hazards which the dams and reservoirs could be subjected to. These detailed geologic and seismic studies will be used to determine the exact siting and final design features of the dams. Final location and design plans will incorporate all precautions necessary to insure against catastrophe.

347 (12) The RDEIS and the Interim Feasibility Report, initially published in December 1975, utilized average annual energy as the controlling parameter for powerhouse design. As a result, 194 MW units were projected for the Devil Canyon plant. The feasibility report was revised on 1 June 1976 to utilize firm annual energy as the control. Thus, the power units were sized to 171 MW. The smaller units will not affect the overall firm annual energy of the two dam system. It will, however, slightly decrease the amount of secondary energy that can be produced. This change was not incorporated in the RDEIS. It has no bearing on environmental impacts and thus, though a regrettable omission, is of no practical significance. The turbine capacity figures for Devil Canyon and Watana have been updated in the FEIS.

348 (13) This map used in the referenced figures projects the Copper River Highway as it was originally proposed, that is, as connecting at Chitina. Subsequent revisions project the highway as connecting to the Richardson Highway north of Valdez.

349 (14) The estimated costs given on page 6 have been updated to October 1976 prices, which are the most recent figures available.

350 (15) The difference in the values for the benefit-to-cost ratio is again due to revisions shown in the Interim Feasibility Report

and not reflected in the RDEIS. The FEIS shows the updated B-C ratio of 1.3. The interest rate that might be applied to a State revenue bond issue is not known at present. It will be set during the bond bidding process and will depend, in part, on the State's credit standing at that time.

351 (16) The Secretary of the Army submits the report of the Chief of Engineers to the Public Works Committee(s) or whichever House(s) of Congress that originally adopted the resolution requesting the study.

352 (17) As stated in the referenced paragraph, the additional environmental studies will be used to inform Congress as fully as possible of all environmental impacts of this project. This additional information will be utilized in the decision making process of whether or not to advance to the final design and construction stages. Thus, the knowledge gained from these studies will be part of the basis for reaching the final decision.

353 (18) The referenced sentence has been reworded to make clear the point that Congress may or may not authorize construction of the project. Detailed environmental, social, economic, and engineering data required for informed decision-making will be provided for that purpose.

354 (19) The adjectives used here seem accurate and appropriate. The Upper Susitna River is wild and scenic, but wild and scenic rivers are not necessarily cold, swift, or silt-laden. The project area is not presently inhabited.

355 (20) The title of figure 4 does appear in the lower right-hand corner of the map. It is entitled "Upper Susitna River Basin."

356 (21) In checking on the current status of the Susitna River, it has been found that multiple recommendations have been made for the wild and scenic river designation. One of the latest such proposals is included in HR39 submitted by Representative Morris K. Udall (D. AZ) in 1977. The ultimate outcome of these proposals or their effect on the project is unknown at this time. The paragraph describing the kayaking opportunities in Devil Canyon has been expanded to include its nickname.

357 (22) On the basis of information provided by the Alaska Department of Natural Resources, the number and locations of mining claims in the Upper Susitna Basin are presently only generally known. Specific identification of all mining claims subject to impact from the project will be accomplished during the detailed preconstruction study phase and they will be addressed in a supplemental EIS.

358 (23) See above response.

359 (24) According to the October 1975 Fish & Wildlife Service report on the Upper Susitna River Basin, the most probable reason that salmon are unable to ascend Devil Canyon is "a hydraulic block resulting from high water velocities for several river miles within Devil Danyon." The only way that man could assist the salmon past this block is to provide alternate transportation means, such as capturing and trucking spawning adults around the canyon or constructing a fish passage facility similar to that found on the Frazer River in British Columbia. Since no such plans exist for the foreseeable future, we think that the statement "unable to ascend" is an accurate description of conditions for salmon in relation to Devil Canyon.

360 (25) Comment noted.

361 (26) The growth of Anchorage and Fairbanks since 1973 has been largely due to activity associated with TAPS. The Anchorage Business Index, tabulated below, indicates the general level of economic activity in Anchorage since 1970.

YEAR	INDEX	RATE OF INCREASE
1970	100	
1971	104.3	4.3%
1972	108.1	3.6
1973	114.9	6.3
1974	139.8	21.7
1975	169.9	21.5
1976	172.7	1.7

Source: Mr. Bob Richards, Alaska Pacific Bank

There was about a five-fold increase in the rate of economic growth during the pipeline years over the underlying growth rate of about 4 percent. Postpipeline uncertainties and out-migration of workers resulted in a less than normal expansion in 1976.

Alaska population and economic growth in the future depends primarily on development of the State's petroleum reserves, State fiscal policy, and the growth of other basic industries. Growth will not stop with the completion of the pipeline. Rather, completion of the pipeline allows the State to begin collecting large oil revenues that will be a key determinant in continued economic expansion, but at a lesser rate than experienced at the peak of the pipeline construction activity.

362 (27) Reduced comsumption is one of the various approaches to the country's energy problem as demonstrated by President Carter's energy proposal. However, it is not anticipated that reduced consumption will be the complete solution. Therefore, the development and utilization of renewable resources will become increasingly important in the future. Implementation of an energy consumption reduction program is beyond the authority of this agency. Also an indepth analysis of this matter is beyond the scope of this EIS and would be speculative in nature at this time.

363 (28) The referenced paragraph has been corrected to reflect the true length of the Seward Highway.

364 (29) Contrary to the expressed opinion that the referenced sentence is "not relevant and should be deleted from the FEIS," the present use of all-terrain vehicles and the potential for their increased use resulting from the project is an area of major concern to the Alaska Department of Fish and Game. They have requested that secondary impacts related to increased accessibility resulting from the project be the subject of intensive study and evaluation during the preconstruction study phase. Furthermore, the referenced sentence discusses all-terrain vehicles with the intention of pointing out their potential adverse impact on game herds.

365 (30) As discussed in response number 340, the estimates of suspended sediment are based on concentrations found in rivers below glacier-fed natural lakes in Alaska. Additional hydrological studies are required to adequately address the question of postproject suspended sediment levels. Studies to be made during phase I of the General Design Memorandum will assess this problem and possible effects on the biota of the river. The EIS will subsequently be supplemented as appropriate to discuss any impact in detail.

366 (31) See Response Number 339.

367 (32) Any project-related recreational development program would involve cooperation between the appropriate Federal, State, and local interests for sponsorship, cost sharing and maintenance of recreational facilities. Proposed recreational facilities for the project area include visitor centers, campgrounds, picnic areas, trail systems, and boat launches. Therefore, recreational potential would exist for day-use activities, camping, hiking, and boating besides hunting and fishing in the area.

368 (33) See Response Number 339.

369 (34) Paragraph 10 of section 4.03 of the REIS is not deleted in the Revised Interim Feasibility Report (1 June 1976). The same paragraph appears as the second paragraph of page 72 of the RIFR.

370 (35) See Response Number 356.

371 (36) The "roads" in question will be the minimum necessary to allow men (to cut the plants) and vehicles (to haul the cut material to a burning or other disposal site). They will, to the greatest extent possible, be within the impoundment area of the reservoirs. Where this is possible, they will be in existence only until covered by the reservoir and, thus, will require no removal. Where this is not possible, the roads will be temporary in the sense that they will not be maintained once clearing is accomplished. At a minimum, unflooded sections of the roads will be rendered unusable and allowed to revegetate naturally. Complete "removal" of such roads would require regrading, plowing and planting to promote revegetation. Many areas of the reservoir walls would not be cleared by use of roads; they are too precipitous and helicopter access, both for personnel and debris removal, would be the only practical approach.

372 (37) The commercial potential has not been quantified, but, from observation of the types and sizes of trees found in the reservoir area (as differentiated from those on more nearly level surrounding lands), the value is considered minimal. A more explicit inventory will be achieved during pre-construction investigations, both from the viewpoint of commercial value and from their value as wildlife habitat.

373 (38) According to the American Heritage Dictionary, 1976 New College Edition, the definition of a stream is "a body of running water, especially, such as a brook, rivulet, or river." Thus, the Susitna River may correctly be termed a stream in the broad sense of the word and the use of this word is not an attempt to play down the significance of a mighty river. Whether the reduction of the heavy sediment loads of the summer is an adverse effect or not is still open to question. Future detailed environmental studies will decide what effects this reduction will have on such processes as nutrient transport.

374 (39) The Corps recognizes the value of Devil Canyon in its present state. The recreational and/or esthetical value is discussed in more detail in the sections of the RDEIS titled "River Characteristics," "Recreation," and "Esthetics." The sentence referred to on page 67 simply lists the inundation of the river as an adverse environmental effect of the project which cannot be avoided with construction of the project.

375 (40) See Comment Number 339.

376 (41) The referenced sentence has been modified to indicate that some adverse effects would result to resident fish populations, particularly in Watana Reservoir.

377 (42) We concur. The paragraph has been modified to delete references to beneficial effects.

378 (43) Yes. "Political" feasibility is that which can reasonably be achieved within the social (political) framework of the time and place in question. It is usually narrower in scope than "economic" feasibility which depends (in our social system) on the net profit-loss parameter and is in turn narrower than "technical" feasibility which is that which can (or could) be accomplished with present technology without regard to either economic or political restraints. Thus, political feasibility usually represents a compromise among the many and varied views and goals of the public.

379 (44) The alternative of no action will be one of several alternaives that will be examined in more detail during the preconstruction studies. As these investigations proceed, supplements to this FEIS will be prepared and coordinated as appropriate.

380 (45) We concur. The sentence has been deleted.

381 (46) The economic life of the proposed hydropower project is 100 years. In actuality, the project may function effectively for as long as 500 years. Depending on the depth of coal veins which would be strip-mined as an alternative source of energy, the damage to surface areas could be in excess of that of the reservoir impoundment areas. There are also enormous costs and technical problems associated with restoration of mined areas and the prevention of erosion and pollution, especially in the fragile environment of Interior and Southcentral Alaska. At present, there has been no large-scale attempt at revegetation of highly disturbed soils under the severe climatic conditions found here, and the feasibility of such an undertaking is not completely known at this time. During detailed studies which will be conducted prior to a decision by Congress as to whether or not to authorize project construction, the comparison of these two alternatives will be more thoroughly assessed and evaluated as to what the trade-offs actually would be.

382 (47) Although the recreational and flood control elements of the project constitute a minor portion of the total project costs and benefits, these are benefits that would not be obtained with the coal alternative.

383 (48) We have no statistics on the number of existing 500 and/or 100 year-old dams. Since technology has changed vastly in 500

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(or even 100) years, the existence of such structures would have little bearing on the life of the proposed structures, except to stress that if such outmoded techniques and materials could survive such a time, modern methods and materials could be expected to do even better. There are, however quite a few historic buildings using portland cement concrete (usually as a mortar but sometimes as slabs or mass elements) that date well in excess of 100 years and even 500 years.

384 (49) The statement is factual as written. The poll has not been nor will it be used to justify any future action. It merely represents the expressed views of people attending the meeting.

385 (50) We agree that the creation of mudflats in Watana Reservoir during periods of low river flows should be discussed in this section. This omission has been corrected in section 5.0 of the FEIS.

Further comments beginning on page 6 of Mr. Taggart's letter of 19 December 1976 pertain only to the Interim Feasibility Report. Thus, no response is considered appropriate in the FEIS. Mr. Taggart's letter of 9 March 1976, which also refers to the Interim Feasibility Report, was inclosed with his comments on the RDEIS and has been included here. Also included is the letter of response from the Corps to his letter.

Thomas Taggart
Postal Box 1195
Seward, Alaska 99664
9 March, 1976

Chairman
Board of Engineers for Rivers and Harbors
Kingman Building
Fort Belvoir, Virginia 22060

CERTIFIED MAIL

RE: INTERIM FEASIBILITY REPORT ON THE UPPER SUSITNA RIVER BASIN, ALASKA

Dear Sir:

A copy of this study in four volumes and including the Jones & Jones Recreational Report was received by the Seward Public Library on Friday, 5 March, 1976, which gave the people of Seward approximately three (3) days to review it and submit comments by the deadline of 10 March. The report had been requested approximately one month ago, which would have allowed a fairly reasonable time for the public to review it had it been delivered expediently. I would like to take this opportunity to congratulate the Army Corps of Engineers on its excellent timing in getting this report into the hands of the people who will be directly affected by the proposed project. It is my estimation that the Corps questionable methods of disseminating information to the public could best be defined as Bordering On Criminality And Not Serving The National Interest. May I ask that such future pertinent information be given freely, openly and joyously to the public libraries of those communities where the proposal(s) will have great effect upon the populace. I furthermore ask that this letter in its entirety be incorporated into any future study or impact statement regarding this project.

I have had time to briefly review the five volumes, and I would at this time like to comment upon them. I am basically in opposition to the proposed project because of three reasons which I will here elaborate upon:

(1) The project will irreversibly alter a relatively pristine area of Alaska.
(2) There is at least one viable alternative to the project which seems to have more merit.
(3) The Corps of Engineers has been less than candid and perhaps overtly deceitful in presenting its case, which leads one to believe that the project itself may not be feasible or desirable from various standpoints.

Firstly I will touch upon what I perceive as the major environmental impacts. On the issue of moose habitat, I here quote from the main report, page 71: "...it is estimated that 2000 to 3000 acres, mostly in Watana Creek, could be favorable moose habitat..." This statement by the Corps is quite pallid in comparison with the following statement from the letter of the USF&WS published in Appendix 2, page 22: "...Reservoirs will inundate moose habitat consisting of... 21,120 acres of habitat which receives moderate use, and 18,560 acres of habitat which receives heavy use. The moderate and heavy use areas are considered preferred or critical winter habitat." Could the Corps have possible left these facts out of the main report by oversight? It does not seem likely from where I sit. Anyone living in Alaska at this time could not help but be aware that the moose population is on the wane, and by flooding 39,680 acres of critical and/or preferred moose habitat the Corps will in fact be contributing to what could be the permanent demise of the Alaskan moose as we now know it. Does the Corps care?

The proposed dams will have an adverse effect upon caribou, salmon, and the endangered Peregrine Falcon, to wit: The migration route of the greatly diminished (90%) Nelchina Caribou Herd will be frustrated by the proposed Watana Reservoir. On pages 206-207 of the supplemental Jones & Jones Recreational Report it is heavily emphasized that the Watana Reservoir could have "immediate and severe" impact on this herd. (2) The endangered peregrine falcon has at least three migration routes through the Susitna River Valley. Page 72 of the main report states that "Migrating birds would possibly suffer some mortality from collisions with towers or lines..." How many losses can this endangered species sustain? (3) Concerning the Susitna River salmon runs, I here again quote the USF&WS letter in Appendix 2: "The potential loss to the economy of Southcentral Alaska through construction of this project could be many times greater than the estimated figures depicted on pages 10 and 11." These figures are $8.94 and $3.52 millions. I again ask: "Does the Corps care?"

The proposed Devil Canyon ( ) will permanently eliminate 9 ( )les of the 11 miles of whitewater which exists there. It should be noted that this particular stretch of whitewater is that which inspired inclusion of the Susitna River in S2918 and HR13504 as a Wild River under the Alaska Native Claims Settlement Act. Needless to say, this is one of the most unique stretches of water which God has granted us on this earth. In no less than five (5) instances (pages 8, 139, 180-181, 192, 210) the Jones & Jones Recreational Report cites the importance of the recreational and aesthetic value of Devil Canyon in its primitive state. The river itself is described as "The Mount Everest of kayaking" on page 181. On pages 8 &210 the report suggests moving the lower dam entirely out of Devil Canyon to preserved the high quality of the areas "aesthetic and recreational value and its uniqueness in the regional context..." Is the Corps capable of listening to its own contracted advisors?

There does seem to be other valid reasons to abort this project. Although the Corps estimates the project cost to be approximately $1.5 billion, there are quite a few people in high places who disagree. Among them is U.S. Senator Ted Stevens of Alaska who concludes that the cost will be at least $2.5 to $3.0 billions. If those latter figures are more nearly accurate, then the project is not economically feasible.

The Lahr-Kachadoorian report (App. 1, exhibit D-2) says that "it is preferable to place the dams away from faulted and jointed areas." Nevertheless, the Watana Dam as proposed will be only 2½ miles east of the Susitna Fault. Has the Corps considered that there are in the neighborhood of twelve (12) communites downstream from Devil Canyon which could be imperiled by a precipitous sesmic related disaster? The new state capital is likewise projected to be built near the banks of the lower Susitna River.

It is concluded on page 49 of the main report that coal is "a technically feasible and economically viable alternative..." to the hydropower proposal. There are many facts and figures which support the feasibility of utilizing coal at this time for Alaska's needs. It is conservatively estimated that a minimum of 9.3 billion tons of coal exist in the combined Nenana-Beluga fields. Your report states that this coal is of low-sulphur content which is environmentally acceptable. The report estimates that 5.83-5.85 million tons would be consumed annually by Alaska. By dividing 9.3 billion tons by the estimated annual consumption we come up with enough coal to supply Alaska's needs for approximately 1600 years at the current rate of consumption. Even if 95% of this coal was shipped outside of the state, there would still be enough left to take care of Alaska's needs for 80 years. Furthermore, the two fields are relatively close to the major population centers which would need them, thus eliminating the need for gangling transmission lines extending all over the interior. These coal fields would create many more permanent jobs for Alaskans than would the proposed hydropower project which could only employ 45 workers. It seems that the strategic location of these coal fields and their magnitude indicate that coal is indeed the more sensible way of generating power for Alaska during the next few decades, or until technological advances allow us to utilize Solar, Geothermal, Wind and Tidal resources.

Concerning the environmental impact of coal, it is stated on page 62 of the main report that approximately 18,300 acres of land would be strip mined over "the 100 year life" of the Healy project. However, on page 89 the report contradicts itself by saying that the Healy project is estimated at 35 years, which, if true, would reduce the impacted acreage by 65%. It should be emphasized that these 6400 acres which would be stripped are far less than the 60,000 acres which will be inundated and/or clearcut for the proposed reservoirs and transmission corridors. Furthermore, the Healy area is not considered as critical habitat for any wildlife species as is the vast majority of acreage which will be inundated by the Watana Reservoir.

In summary, it is apparent that the Healy and Beluga coalfields should be utilized to the extent that they are needed to fulfill Alaska's energy requirements. It would also be wise to conduct the much needed research into harnessing the 30 foot tides of Cook Inlet for serving the needs of Anchorage and the new capital.

Sincerely,

Thomas Taggart

c.....District Engineer, Anchorage
Division Engineer, Portland, Ore.
Honorable Jay S. Hammond, Juneau
Honorable Mike Gravel, Washington, D.C.
Honorable Ted Stevens, Washington, D.C.
Honorable Donald E. Young, Washington, D.C.

NPAEN-PR-R 20 April 1976

Mr. Thomas Taggart
General Delivery
Seward, Alaska 99664

Dear Mr. Taggart:

I am writing in response to your 9 March 1976 letter to the Board of Engineers for Rivers and Harbors concerning the Upper Susitna River Basin report which was prepared by this office.

First, let me apologize for the lateness of the report reaching the Seward Library. This was not intentional nor was there any desire to deny the public full opportunity to review and comment on the matter. Rather, it was a result of our underestimation of the public desire to be informed which caused us to print and assemble fewer of the rather massive reports than proved to be necessary to meet the public demand. About 200 copies of the report have been distributed when normally, a demand of half that would put a report on our "best seller" list. In general, we have made a concerted effort throughout the past two years to foster widespread public participation in all phases of the study and not just in the review of the end result. This is both a Corps policy and plain common sense, inasmuch as our studies are designed to meet public needs and desires by the possible expenditure of public funds to accomplish actions which the public will have to live with for many years to come.

As to your specific comments on the report and related documents, I provide the following replies:

We are aware of the descrepancy between the acres of moose habitat which will be lost as estimated by the Corps and by the U. S. Fish and Wildlife Service (USF&WS). The acreages estimated by USF&WS reflect some obvious errors. On page 13 of their report you will find a tabulation showing that within the 7,550-acre Devil Canyon reservoir, USF&WS classifies

7,040 acres as being lightly used by moose and an additional 5,760 acres as being moderately used. Unfortunately, we thus find the moose habitat inundated by the reservoir is some 5,250 acres (69.5 percent) in excess of the total acreage covered by the reservoir. Further, examination of the topography and visual observation show that extremely steep canyon sides, where it would be difficult for a moose to stand or walk and where vegetation appears to be of a type not generally favorable as moose forage, make up about one-half to two-thirds of all terrain which would be inundated by the proposed pool. Again, this conflicts with the cited moose habitat acreages. The figures for the Watana reservoir, although not summing to more than the total reservoir acres, are similarly questionable when compared with the observable terrain (specifically very steep canyon walls) and vegetation over much of the reservoir.

Regarding the effects of the proposed dams on caribou, salmon and the peregrine falcon, I offer the general comment that we foresee the possibility of adverse effects on the first two life forms but little chance of ill effect on the falcon. The magnitude of the adverse impacts on caribou and salmon cannot at this time be measured. However, the information and data we were able to acquire indicates that the magnitude of adverse impacts to both caribou and salmon would most probably be moderate and, in the case of salmon, subject to correction through management and mitigation efforts. The Jones and Jones statement raises valid questions which will be addressed in future studies. We cannot prove that adverse effects mentioned in the report could not result from the profect, but find little evidence that, in fact, they would. The statement concerning migrating birds and their possible collisions with the towers and lines was based on the large masses of waterfowl which migrate through the Susitna-Nenana valleys. The falcon, one of the most keen-sighted of all creatures, should have no trouble avoiding a structure which occupies a 200-foot wide strip through a valley a mile or more in width. As to the USF&WS statement on the value of possible salmon losses, again there is presently no supportive data to indicate that salmon, in the numbers implied by the dollar values, inhabit the affected waters. Quite the contrary, based on the data produced to date by Alaska Department of Fish and Game and USF&WS, it would be difficult to assign a dollar value loss in the thousands of dollars, much less in the millions. The multmillion dollar figures, by the way, appear to be based on total destruction of all salmon thought to originate anywhere in the total Susitna River drainage, in no way consistent with any foreseeable impacts of the proposed project.

The third major area which you addressed concerns the destruction of the esthetic and recreational value of 9 miles of the Devil Canyon rapids.

This is a matter which cannot be adequately analyzed from a purely logical or numerical viewpoint in that it deals with the emotional reactions of people to such matters as beauty and awesomeness, the perceptions of which vary from person to person. We recognize the unusual violence of these rapids and can understand how canoers and kayakers who identify strongly with such creations of nature would regard them as unique or "the Mount Everest of Kayaking." We also realize that, of all the thousands of kayakers in the nation, only a handful have, or will ever develop, the skill to actually run these whitewaters. Thus, as a recreational asset, Devil Canyon rapids is of little value to the general public or even to the vast majority of kayakers. From the standpoint of esthetics, few people have the means to view the canyon since there is, without disturbing the land and damaging other esthetic values by construction of many miles of roads, no convenient way for the general public to come within miles of the area. This is not to say that we regard the destruction of this whitewater resource as meaningless or inconsequential. The question of the trade-off value between the rapids and electrical energy was one of the greatest concerns throughout the study. We wish it were possible to have both of them; however, our investigations have led us to conclude that we can have only one and to further conclude that the best interest of the majority of the public lies in producing the electrical energy at the expense of sacrificing the esthetic value of the stretch of river.

If the project costs of $2.5 to $3.0 billion which you attribute to Senator Stevens were in fact accurate, you would be correct in concluding that the project was not viable. The figure of $1.5 billion, and awesome amount in itself, is our best professional estimate of the present project cost. I stress "present" because continued inflation and thus lessened purchasing value per dollar would in time lead to a higher project cost just as deflation would tend to reduce the cost. Please recognize that whatever the general economic trend, the value of the project output, electrical energy, would follow the same trend with the probable result of little change in the benefit-to-cost ratio of the project whatever the dollar cost of construction. This, of course, is a very simplified economic projection which would be subject to many other variables which could affect project viability in either direction

We concur with the Lahr-Kachadoorian view that it is best not to build dams on or near faults. It is unfortunately true, however, that most of the better hydropower sites throughout the world are found in mountainous areas which are in all probability the result of the same geologic processes which also produce earthquakes and faulting. Thus, it is rarely possible to have the "best," in which case the engineer is left with the second choice which is to design his dams to withstand the unavoidable earthquake forces. Such is the case for this project. We have indeed considered the threat to downstream communities and, as have most of the numerous dam projects along the western coast of North America, are designing to preclude a disastrous dam failure. The comment on the location of the new State capitol is difficult to address inasmuch as no firm siting has been made. However, it does point up one thing which should be carefully considered in the choice and development of the capitol site, that is, locating the city outside of known or projected flood hazard zones. We concur that coal powered generation is technically and economically feasible and that much future use of this resource can and probably will be made. The numerical analysis you have performed is oversimplified but probably reflects an adequate general picture as relates to many centuries of supply (at present use rates) being available. Please recognize that the cost of mining this coal will vary greatly since it lies at depths up to 3000 feet below the surface. Also, please note that even with the most economical mining technique at relatively shallow depths (not to exceed 200 feet) that electrical energy would cost about one and one-half times as much to produce from a coal-fired plant as form the proposed hydroelectric dams. This is why we consider the hydro plant as economically superior in this case. Coal, to us, is a very sensible way of generating much of the future Alaskan demand. The proposed project, at this time and for the projected near future demands, is even more sensible.

The "project life" is 100 years for both coal and hydropower to make economic comparison of the two quite different systems valid. The actual physical life of the coal plant would be more nearly 35 years which means in effect that the coal plant would have to be rebuilt twice before the initial hydropower plant wore out. Because 100 years is the comparison period, the full 18,000 acres (at a minimum) would have to be mined. Furthermore, the Healy area, as stated, is heavily utilized by both moose and caribou, much of it for winter range which means that in all probability there would be more critical habitat contained in the 50,000 (not 60,000) acres of the reservoirs. I concur that future use of Healy and Beluga coals should be utilized as practible to meet a substantial portion of the Alaskan energy demands; but not to the exclusion of better alternatives where such exist. I also concur that research might eventually allow beneficial harnessing of the Cook Inlet tides but must honestly state that I do not foresee this occurring in what remains of this century.

It is clearly stated in the Draft Environmental Impact Statement, which was prepared for this project in September 1975, that since the current study is in the feasibility stage, impacts are not exhaustively evaluated.

It is made clear that if the project is authorized and funded for detailed studies, environmental, social, economic and engineering aspects of the project will be studied at length prior to a recommendation to Congress for advancement to final project design and construction. Indeed, the State of Alaska has conditioned its endorsement of the project with the stipulation that these types of studies be made. Fish and wildlife studies alone are estimated by the State to require 5 years for completion at an estimated cost in excess of $4 million. The Corps is in general agreement with these study proposals in the event the project is authorized.

For addtional information which was not included in the 4-volume Interim Feasibility Report, I am inclosing a copy of the Draft Environmental Impact Statement. We have added your name to our mailing list, and will furnish you a copy of the final Environmental Impact Statement when it becomes available.

Sincerely yours,

1 Incl
As stated.

S/ JOSEPH W. HURST
LT Colonel, Corps of Engineers
Acting, District Engineer

APPENDIX II

PERTINENT CORRESPONDENCE
AND
REPORTS OF OTHER AGENCIES

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United States Department of the Interior

ALASKA POWER ADMINISTRATION

P. O. BOX 50

JUNEAU, ALASKA 99802

IN REPLY REFER TO:

700

November 20, 1975

AIRMAIL

Colonel Charles Debelius
Corps of Engineers
Alaska District
Box 7002
Anchorage, AK 99510

Dear Colonel Debelius:

This covers several items discussed in telephone conversations of November 11 and 12, 1975, with Eric Yould and Gary Flightner of your office. Subjects discussed included:

1. Consideration of adding an additional skeleton bay at both Watana and Devil Canyon powerplants for future peaking capacity.

2. A request for APA views on any benefits that might be associated with interconnecting Railbelt area power loads.

3. Revisions in the designs and estimates for Devil Canyon and Watana which resulted from internal Corps review, specifically a requirement for capability to evacuate Watana Reservoir in a short period of time which would require a large increase in outlet capacity and costs.

We do not have the details on items 1 and 3, but it is apparant that these changes could have significant impact on power marketability. Therefore, we would like to offer comments on the changes as well as furnishing the requested views in interconnection benefits.

1. Additional Peaking Capacity

The plan included in your draft report is premised on a 50 percent annual plant factor with provisions of a skeleton bay in each powerplant for future additional peaking capacity. The 50 percent figure is as recommended by APA; we understand the additional skeleton bays are judgement additions by the Corps. The costs and benefits associated with the provisions for added peaking capacity are not identified in the Corps draft reports.

Our draft power market appendix (September 1975) includes some of the reasoning behind our recommendations for a 50 percent plant factor. This is premised on rather simplistic assumptions relative to the role of a major hydro plant in the Railbelt area. Our data and studies have not, at least thus far, given any indication that markets would exist for additional peaking capacity at this project until well beyond the year 2000.

We do not object to including the single skeleton bay for peaking additions at the two powerplants. However, we do not have any support for assigning benefits to this future added capacity.

It is our suggestion that the incremented costs for the skeleton bays including waterways be identified and excluded from your basic benefit-cost comparison. This would amount to: (1) demonstrating feasibility based on the 50 percent plant factor, and (2) demonstrating costs for providing the future option separately.

We do not concur in the concept of adding a second skeleton bay at each of the two plants, since we believe that any potential markets for such additional capacity are too remote to be considered in a feasibility determination.

2. Interconnection Benefits

A number of previous studies by APA and others provide good indication that a Railbelt intertie would be justified eventually without development of the Upper Susitna Project. Possible situations that would bring about the justification include:

1. Bulk power supply to the Interior from a future large thermal station (coal or nuclear).

2. Any new sizable power demands at points between Anchorage and Fairbanks. An example is the concept of electric drive for pipeline pumping stations, or a possible new community in Susitna drainage.

The existing studies indicate advantages associated with load diversity and shared reserves would be relatively minor. For example, as between the Anchorage and Fairbanks areas there is not a great diversity on a seasonal or hourly basis, and any advantages in reserve sharing would be limited by reserve requirements imposed because of transmission reliability.

A further limit on intertie advantages is disparity in size of market. Anchorage area loads are several times larger than Fairbanks area loads.

Areas of potential intertie benefits include added flexibility in day to day scheduling of generation, increased flexibility in selecting new power sources, and added flexibility in power sale and interchange arrangements.

We believe it would be consistent with your procedures for benefit evaluation to examine intertie benefits on the basis of alternative costs for achieving the intertie benefits. The APA evaluation of alternative power costs (power market study) and the FPC benefit determination assume separate coal fired plants for the Anchorage and Fairbanks areas. Location assumptions of Beluga and Healy for the plants are consistent with the evaluation, with aggregate plant capacity equivalent to the Susitna plan.

Following this "alternative", it would be logical to assume that the next major power addition for the Railbelt would be a large thermal plant in the Beluga area with an intertie between Beluga and Healy. For your benefit evaluations, you might assume a completion date of around 1995 and a construction cost of around $60 million as the alternative cost of achieving the intertie benefits. This is premised on rough estimates of costs of a 230 kv intertie between Beluga and Healy including necessary substation costs.

3. <u>Requirement for Rapid Evacuation of Watana Reservoir</u>

We understand that the requirement under consideration is essential evacuation of active capacity over a four month period assuming record high inflows for the period. We also understand that this is now a standard design criteria for Corps reservoirs subject to exception on an individual basis.

It occurs to us that such a requirement would be essentially infeasible for most large reservoir projects, but may very well be desirable for many structures in and near populous areas.

From the viewpoint of project operation, including structural safety, we do not see a requirement for the suggested rapid evacuation of Watana Reservoir. The long winter period and very large hydraulic capacity of the powerplant would appear thoroughly adequate as provision for reservoir drawdown.

4. Fuel Conservation Aspects

The existing evaluation procedures do not provide specific recognition of fuel conservation aspects of water power development except as purchase cost of fuel is included in the evaluation of alternative costs or benefits. From the viewpoint of the nation's energy economy, the development of the hydro project provides a new source of power which is recognized under NED objectives. It results in a net increase in national fuel supplies because less energy would be taken from thermal plants over the life of the hydro project. The actual fuel savings would include substantial amounts of oil and natural gas immediately on completion of the project and longer term savings of coal.

We believe it is quite well established that current and near future fuel prices are generally below the probable long-term value of these fuels to the nation, and to this extent the project benefits are understated.

In its benefit evaluation, FPC used coal prices of 60¢ and 50¢ per million Btu for the Fairbanks and Anchorage areas, respectively. In the APA alternative power cost evaluation, the assumption is made of a price range of $1.00 to $1.50 as 1985 coal cost in 1974 dollars (no inflation). If the higher values are appropriate, and assuming no further increase in real value of the fuels after 1985, project benefits will likely be on the order of 5 to 10 mills per kilowatthour higher than indicated by the FPC estimates.

We recognize that FPC procedures require use of current cost levels in their benefit determinations. However, I am sure that all involved recognize that the procedures were developed during a period when fuel prices and real cost of energy in the economy were on a long-term down trend relative to other prices.

Sincerely yours,

R. J. Cross

Robert J. Cross
Acting Administrator

United States Department of the Interior
ALASKA POWER ADMINISTRATION
P. O. BOX 50
JUNEAU, ALASKA 99802

IN REPLY REFER TO:
700

December 10, 1975

Colonel Charles A. Debelius
District Engineer
Corps of Engineers
Box 7002
Anchorage, AK 99510

Dear Colonel Debelius:

The enclosed reports cover the Alaska Power Administration's studies on power markets, operation and maintenance requirements, transmission systems, and transmission system environmental assessment for the proposed Upper Susitna hydroelectric development. We understand the APA reports are to be included as portions of Technical Appendix I for the Corps of Engineers report on the proposed project with the following designation:

Appendix I, Part G. Report on Power Markets (including estimates of project operation, maintenance, and replacement requirements).

Appendix I, Part H. Report on Project Transmission Systems.

Appendix I, Part I. Transmission System Environmental Assessment.

Authority

The APA studies were prepared in support of the Corps of Engineers evaluation of hydroelectric development of the Upper Susitna River Basin in Alaska under a January 1972 study resolution by the U. S. Senate Public Works Committee. Authorization for the APA work includes Section 5 of the Flood Control Act of 1944 concerning Interior Department responsibilities for transmission and marketing of power from Corps of

Engineers projects, and the Act of August 9, 1955, concerning Interior Department investigations of Alaska water and power development potential. The project plan was formulated in accordance with the Alaska provisions of the Army-Interior Agreement of March 14, 1962.

Plan of Development

The proposed plan of development includes the Watana dam and powerplant with installed capacity of 792,000 kilowatts, followed by the Devil Canyon dam and powerplant with installed capacity of 776,000 kilowatts, for a total capacity of 1,568,000 kilowatts. The Corps of Engineers studies indicate the plan would have annual firm energy potential of 6.149 billion kilowatt hours based on evaluation of critical period water supply. Average annual energy production would be 6.85 billion kilowatt hours. The plan includes transmission lines to the Anchorage-Cook Inlet area, and Fairbanks-Tanana Valley area, and necessary switchyard and substations. The transmission facilities are described below:

Transmission System Studies and Transmission Environmental Assessment

The main elements of these studies were evaluation of alternative corridors for locating project transmission facilities, considering environmental, engineering, reliability and cost aspects, and preparation of designs and cost estimates for transmission systems needed for alternative project development plans. The corridor studies concern general locations of facilities with actual route locations to be determined in the more detailed studies following project authorization. It was concluded that the most desirable corridor locations would follow existing surface transportation systems, rather than pioneering new corridors for the transmission facilities.

The transmission plan and cost estimate for the proposed hydro development plan includes the following features: 1) two single-circuit 230-kv lines from Watana to Devil Canyon (30 miles); 2) two single-circuit 230-kv lines from Devil Canyon to Fairbanks (198 miles), with an intermediate switching station at Healy; 3) two single-circuit 345-kv lines to points on the North Shore of Knik Arm (136 miles), with an intermediate substation in the vicinity of Talkeetna; 4) switchyards at the two powerplants; and 5) substations at Fairbanks and in the Point Mackenzie area. Estimated construction costs for the transmission system are $256 million based on January 1975 price levels. It is estimated that three years would be required for construction following completion of the detailed route studies, final designs, and acquisition of necessary rights-of-way.

The most serious conflicts in the final route selection will likely be encountered in the Nenana Canyon route through the Alaska Range. The Fish and Wildlife Service has recommended that a route west of the Parks Highway be selected through the Nenana Canyon to minimize possible conflicts with raptor habitat. Any route through the Canyon area would involve lines visible from portions of Mount McKinley National Park and the FWS proposal would place portions of the route within park boundaries. APA considers use of the corridor through the Nenana Canyon will result in substantially less environmental damage than would the pioneering of new corridors through the Alaska Range.

Additional conflicts are anticipated in final route selection along the approaches to Anchorage because of the Knik Arm, and topography, and land use and ownership patterns on possible routes around Knik Arm. Cost estimates presented in this report assume delivery of project power to points on the CEA transmission system north of Knik Arm. It is recognized that the detailed studies following authorization would need to consider several alternative plans to transmit power across or around Knik Arm to Anchorage.

Based on informal consultations with the State Archeologist, the corridors under consideration involve known and potential archeological sites. Archeological surveys would be needed as part of the final route studies. Inadvertent discovery of an unsuspected site at a later stage would entail either relocation of a line segment or salvage of the site under applicable laws and regulations.

The initial plan does not include transmission facilities to serve the Copper Valley area. Such facilities may be justifiable as a future stage of the system.

Operation, Maintenance, and Replacement

APA's evaluation of annual costs, operation, maintenance, and replacement are summarized on Exhibit 2 of the report on power markets. The estimates cover the full range of operations and marketing activities. Annual "OM&R" costs for the proposed plan are estimated at $2,400,000 based on 1975 price and wage levels.

69-737 O - 81 - 54

Power Market

The APA power market report includes our estimates of future area power requirements, the portion of the requirements that might be served from the Susitna Project, a review of available alternatives to hydro development, and evaluation of repayment requirements.

As indicated below, we estimate that an average rate for firm energy delivered at wholesale in the Fairbanks and Anchorage areas at 21.1 mills per kilowatt hour would be needed under present Federal repayment criteria:

	Devil Canyon	Watana	Total System
WS. Elevation	1,450	2,200	
Completion date	1990	1986	
Installed Capacity, MW	776	792	1,568
Annual Firm Energy, billion kwh	3.05	3.10	6.15
Annual Secondary Energy, billion kwh			0.7
Construction Costs, $1,000	432,000	1,088,000	1,520,000
Interest During Construction $1,000			248,000
Total Investment, $1,000			1,768,000
Total Annual Costs, $1000			115,612
Assumed rate for secondary energy, mills/kwh			10
Required average rate for firm energy, mills/kwh			21.1

These computations are premised on January 1975 price levels and future cost increase would be reflected in higher cost for project power.

Our review of alternative power sources indicates that the Susitna power would be substantially more expensive than present power from natural gas in the Cook Inlet area, but less expensive than alternative power supplies from new coal-fired plants. It is APA's view that alternative costs for power from coal-fired steamplants is an appropriate measure of relative merit of the Upper Susitna proposal.

Conclusions

This letter reflects the findings of the Alaska Power Administration and does not represent a position by the Interior Department on the Susitna Project.

APA considers the general corridor locations, the transmission plan and estimates, and the operation, maintenance and replacement evaluations appropriate for purposes of determining feasibility of the Upper Susitna Project. From the viewpoint of power markets, the proposed development plan including the Watana and Devil Canyon units appears feasible and relatively more attractive than the other alternative hydro development plans considered in the Corps studies.

We are not in agreement with the Corps' appraisal of the potential Denali unit, and we believe that future studies may demonstrate that Denali is a desirable future addition to the proposed plan.

It is APA's view that the proposed plan of development, including Watana and Devil Canyon units, is feasible from the viewpoint of power marketing and repayment requirements.

Sincerely yours,

Robert J. Cross
Acting Administrator

Enclosures

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION

THE ALASKA RAILROAD
P. O. Box 7-2111
Anchorage, Alaska 99510

June 10, 1975

Mr. Charles Welling
Economic Section, Corps of Engineers
Box 7002
Anchorage, AK 99510

Dear Mr. Welling:

You have requested information from us concerning possible benefits that could be derived by the Railroad as a result of the construction of a dam on the Susitna River.

One direct benefit would be a reduction in periodic damage to roadbed and track during break up. Large ice jams would be eliminated, which on previous occasions have caused flooding and washing out of grade with a subsequent interruption in train service to Fairbanks. Average damage of such a washout has run about $50,000.

A controlled flow of the Susitna would also reduce bank protection work. It is estimated that a yearly expenditure of $50,000 is currently required to provide the necessary rip rap and revetment work.

Sincerely,

T. C. Fuglestad
T. C. Fuglestad
Chief Engineer

IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF INDIAN AFFAIRS
Juneau Area Office
P. O. Box 3-8000
Juneau, Alaska 99802

November 3, 1975

Memorandum

To: District Engineer, Department of the Army
Anchorage

From: Area Director

Subject: Review of draft environmental impact statement for Hydroelectric Development, Upper Susitna River Basin, Southcentral Railbelt Area, Alaska (ER 75/942)

General Comments:

The document is presented in a good format so the document is readable and easy to follow through. There appear to be provisions made to avoid any future land conflicts under the Alaska Native Claims Settlement Act.

Specific Comments:

We have no further comments.

Area Director

IN REPLY REFER TO
2650.11 (931)

United States Department of the Interior

BUREAU OF LAND MANAGEMENT

State Office
555 Cordova Street
Anchorage, Alaska 99501

MAR 13 1975

Mr. Lee Thompson
U.S. Army Corps of Engineers
Real Estate Division
P. O. Box 7002
Anchorage, Alaska 99510

Dear Mr. Thompson:

Since your telephone inquiry of February 19, 1975, we have done some research on the relationship between power site reserves and Alaska Native Claims Settlement Act withdrawals and have come to the following conclusion. A 25-township withdrawal under section 11(a)(1) of the act (PL 92-203, 85 Stat. 688) predominates over all other withdrawals except National Park System and National Defense withdrawals. A deficiency withdrawal under section 11(a)(3) of the act does not.

The reason for this difference is found in the differing authorities under which the two types of withdrawals are made. The 25-township withdrawals are by direct act of Congress "the following public lands are withdrawn . . . 1/ The deficiency withdrawals, however, are public land orders signed by the Secretary of the Interior under a restricted authority from Congress, "The Secretary shall withdraw three times the deficiency from the nearest unreserved, vacant and unappropriated public lands."2/ (Emphasis added). The land within the power site reserve is segregated from a deficiency withdrawal under ANCSA because it is "reserved public land" and Congress did not give the Secretary the authority to make deficiency withdrawals from reserved lands.

What this all means is that Native villages and regions may select power site land if it lies within their section 11(a)(1), 25-township withdrawal, but they may not select power site land from within a section 11(a)(3) deficiency withdrawal.

Sincerely yours,

Sue A. Wolf
Acting Chief Adjudicator

1/ PL 92-203, § 11(a)(1)
2/ PL 92-203, § 11(a)(3)(A)

IN REPLY REFER TO:
1780 (110)

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Anchorage District Office
4700 East 72nd Avenue
Anchorage, Alaska 99507

JUL 15 1975

Mr. Henry Nakamura
Department of the Army
Alaska District
Corps of Engineers
P.O. Box 7002
Elmendorf AFB, Alaska 99510

Dear Mr. Nakamura:

Impacts of the proposed Devils Canyon, Watana Creek and Denali hydroelectric power project on BLM lands, resources and programs is difficult to access. The information necessary to do a thorough analysis of these projects, simply isn't available. The reports of the impacts on the various resources drafted by our staff, briefly summarizes the basic data that is available, recognizing that more detailed information is necessary.

Management of the recreation activities which would be generated by development of the proposed projects will also be an important consideration. If the lands adjoining the future reservoirs go into private ownership, the on-the-ground recreation management responsibilities may better be handled by an agency other than the BLM; the State may be a good choice. However, in order to insure public access, it is strongly recommended that the BLM, through whatever means possible, retain ownership of public access points to the lake. The actual management, operation and/or ultimate ownership could rest with another public agency after a more detailed cost effectiveness analysis were undertaken. Naturally, if the adjacent lands remain in Federal administration, we would be interested in developing and managing a recreation program. With the present land status situation, it is impossible to determine whether or not the adjoining lands will remain in public ownership.

A more thorough analysis will be made during the impact statement review process.

Sincerely,

Donovan Yingst

Donovan Yingst
Acting District Manager

UNITED STATES GOVERNMENT

Memorandum

DEPARTMENT OF TRANSPORTATION
OFFICE OF THE SECRETARY

DATE: November 11, 1975

In reply refer to:

SUBJECT: Hydroelectric Power Development, Upper Susitna River Basin, Southcentral Railbelt Area, Alaska

FROM : Secretarial Representative, Region 10

TO : District Engineer
Corps of Engineers
Anchorage, Alaska

Attached is the only comment received from DOT agencies on the subject EIS.

for DON SAMUELSON
Regional Representative of the
Department of Transportation, Region 10

Attachment

DEPARTMENT OF TRANSPORTATION

UNITED STATES COAST GUARD

MAILING ADDRESS:
COMMANDER (dpl)
17TH COAST GUARD DISTRICT
FPO SEATTLE 98771

1 October 1975

From: Commander, Seventeenth Coast Guard District
To: Secretarial Representative, Region 10, Seattle, WA.
Attn: CAPT R. T. BROWER

Subj: Review of EIS for Hydroelectric Power Development, Upper Susitna River Basin, Southcentral Railbelt Area, Alaska; comment concerning

1. Subject EIS has been reviewed and the only significant Coast Guard impact would be the increase in recreational boating activity on the newly created lakes behind the dams. No other areas of Coast Guard interest were revealed.

A. D. GRANTHAM
By direction

FEDERAL POWER COMMISSION
REGIONAL OFFICE
555 BATTERY STREET, ROOM 415
SAN FRANCISCO, CALIF. 94111

August 12, 1975

Colonel Charles A. Debelius, District Engineer
Alaska District, Corps of Engineers
P. O. Box 7002
Anchorage, AK 99510

Subject: Power Values for Devil Canyon - Watana Project (Your NPAEN-DB-HY)

Dear Colonel Debelius:

In response to your letter of 17 April 1975 requesting subject power values, we are furnishing the values shown following. The power values are based on a January 1, 1975 price level and public non-federal and federal financing, the latter at 5-7/8% interest rate. Public-nonfederally financed values were estimated using the same methodology employed in computed federal values except that fixed charges were calculated using composite REA-municipal financing derived on the basis of the weighted-average of REA and municipal electric utility net energy for loads in 1974. This composite financing was computed at 6.25% interest rate for the Anchorage-Kenai market area and 5.95% interest rate for the Fairbanks market area.

Hydroelectric power values in both the Fairbanks and Anchorage-Kenai markets delivered at the respective 138-kV receiving station bus were estimated for average annual capacity factors of 45% and 51.8%. These capacity factors correspond to the peaking capability and average annual energy output for Devil Canyon without upstream storage and Devil Canyon with Watana. Peaking capability is estimated to be 15 percent higher than the installed nameplate capacity. As shown in our letter of March 7, 1975 regarding power values for the Devil Canyon-Denali project, it was assumed that the output of the proposed subject project would be delivered to the two market areas, in 1985 and thereafter, in the ratio of 25% to the Fairbanks load area and 75% to the Anchorage-Kenai load area. This approximate division of load requirements is based on projected future power requirements, using a mid-range growth rate, as shown in Table 12, Total Power Requirements by Regions, 1972-2000, of the May 1974 Report of the Alaska Power Survey Technical Advisory Committee on Economic Analysis and Load Projections. This estimate was used in sizing alternative steam-electric capacity.

As previously mentioned in our letter of May 9, 1975, we reviewed all of the factors which affected the subject study. Data which you, the Alaska Power Administration, utilities, and electric equipment manufacturers furnished were thoroughly analyzed to determine material and construction costs in the Southcentral area of Alaska.

Fuel costs used are based upon the best information available pertaining to contract prices as of the pricing level date. Among the sources of information are: the 1974 Alaska Power Survey Reports of the Executive Advisory Committee and the Technical Advisory Committee on Resources and Electric Power Generation; Southcentral electric utility reports, data, and personal contacts; various State agencies; and several natural gas and coal producing companies.

The at-market power values are shown below. The total value is the sum of the value of project's dependable capacity and its usable energy.

VALUE OF POWER

Market Area	Type of Financing (Price level of 1/1/75): Public-nonfederal 1/ — Dependable Capacity $/kW-yr.	Public-nonfederal 1/ — Usable Energy mills/kWh	Federal — Dependable Capacity $/kW-yr.	Federal — Usable Energy mills/kWh
45% Annual Capacity Factor				
Fairbanks	96.95	7.89	87.54	7.89
Anchorage-Kenai				
Coal-fired Alternative	86.15	5.42	74.14	5.42
Combined Cycle Alternative	46.89	6.43	41.14	6.43
51.8% Annual Capacity Factor				
Fairbanks	98.32	7.84	88.88	7.84
Anchorage-Kenai				
Coal-fired Alternative	87.13	5.36	75.12	5.36
Combined Cycle Alternative	47.78	6.37	42.00	6.37

1/ Composite REA and Municipal

Fairbanks Power Values

The at-market power values for the Fairbanks area are based on estimated costs of power from an alternative steam-electric source described as follows: A coal-fired generating plant with 150 MW total capacity consisting of two 75 MW units; heat rate, 12,000 Btu/kWh; capital cost, $640 per kilowatt; service life, 35 years; and coal cost of 60¢ per million Btu.

For the Fairbanks area neither a combined cycle nor combustion turbine alternative plant was considered due to: 1) uncertain future availability of natural gas and/or oil in sufficient quantities to use as an operating fuel, and 2) the relatively abundant source of coal in the Healy area. The power values include a 10% hydro-steam adjustment made to at-market estimated capacity costs to credit the hydroelectric plant with its greater operating reliability and flexibility.

Anchorage-Kenai Power Values

The at-market power values for the Anchorage-Kenai area are based on studies of the estimated costs of power from two alternative sources as described following:

(1) Coal-fired generating plant with 450 MW total capacity consisting of three 150 MW units; heat rate, 9800 Btu/kWh; capital cost, $585 per kilowatt; service life, 35 years; and coal cost of 50¢ per million Btu.

(2) Combined cycle generating plant with 450 MW total capacity consisting of four 112.5 MW (100 MW nameplate) units (one combustion turbine and one steam turbine per unit); heat rate, 8500 Btu/kWh; capital cost, $235 per kilowatt; service life, 30 years; and natural gas (operating) cost of 70¢ per million Btu and distillate oil (standby) cost of $1.75 per million Btu.

The estimates include 5% and 10% hydro-steam adjustments made to at-market estimated costs for the combined cycle and coal-fired alternatives respectively. These adjustments credit the hydroelectric plant with its greater operating reliability and flexibility.

Although for the Anchorage-Kenai area the combined cycle alternative plant is the more economically feasible of the two considered, it is desirable to provide values for both alternatives. The Alaska Power Survey indicates that natural gas could supply sufficient energy to meet total State power requirements through the year 2000 and beyond. Some utilities, gas producing companies, and State agencies question the amount of natural gas reserves but acknowledge that reserve potential exists. It is the policy of this Commission to discourage use of natural gas as an operating fuel for power generation in the contiguous United States. Due to changes in requirements, other Federal and/or State agencies may impose restrictions on the future usage of natural gas or oil for electric power generating purposes in Alaska. Due to the uncertainty of the future availability of natural gas after 1985 for new generating capacity, the unforeseen possibility of its restrictive use if available, and its sensitivity to worldwide economic pressures, coal may be the most likely alternative fuel for thermal-electric plants to be constructed after 1985. The extensive coal deposits near Cook Inlet are attractive future alternative sources of energy for this region and could lead to options to convert from oil and natural gas to coal as the major power source during the 1980's. In summary, it is not readily apparent whether future generating plants will use natural gas or coal as a primary fuel. Assuming either fuel is sufficiently available, its use would then be dictated by not only economics but future environmental constraints. Therefore, we are providing power values for two alternate fuels - natural gas and coal.

Dependable Capacity

Dependable capacity of the project has been estimated using subject project critical period energy output as supplied in the attachments to your letter of 17 April 1975 and assuming power first becomes available in 1985. On a calendar year basis, December was determined to be the critical month - the month when maximum other capacity is required. Our load-resource studies show that the Devil Canyon project without upstream storage can be absorbed by the combined Anchorage-Kenai and Fairbanks loads in 1990. Devil Canyon with Watana, available in 1990, would be usable in meeting combined area loads in 1993. Our estimate of the dependable capacity of the Devil Canyon-Watana project is shown on the attached table.

Very truly yours,

M. Frank Thomas

M. Frank Thomas
Regional Engineer

Attachment

cc: North Pacific Div.
Corps of Engineers

DEVIL CANYON-WATANA PROJECT, ALASKA

Year	Capacity Dependable on Combined Anchorage-Kenai and Fairbanks Area Loads MW
1985	117
86	213
87	328
88	449
89	575
1990	765
91	932
92	1110
93 to end of service life	1233 1/

1/ Equals 115% (600 + 472) MW

FEDERAL POWER COMMISSION
REGIONAL OFFICE
555 BATTERY STREET, ROOM 415
SAN FRANCISCO, CALIF. 94111

August 20, 1975

Lt. Colonel Joseph W. Hurst
Acting District Engineer
Alaska District, Corps of Engineers
P. O. Box 7002
Anchorage, AK 99510

Subject: Power Values for Devil Canyon-Watana Project (Your NPAEN-DB-HY)

Dear Colonel Hurst:

In response to the request in your letter of August 11, 1975, power values for the Devil Canyon-Watana Project based on Federal Interest Rate of 6-1/8% are furnished below. The price level of January 1, 1975 and all other considerations described in our letter of August 12, 1975 remain unchanged.

At-Market Value of Hydroelectric Power

Market Area	Federal Financing - 6-1/8% (Price level of 1/1/75) Dependable Capacity $/kW-yr.	Usable Energy mills/kWh
45% Annual Capacity Factor		
Fairbanks	89.49	7.89
Anchorage-Kenai		
Coal-fired Alternative	75.78	5.42
Combined Cycle Alternative	41.93	6.43
51.8% Annual Capacity Factor		
Fairbanks	90.84	7.84
Anchorage-Kenai		
Coal-fired Alternative	76.77	5.36
Combined Cycle Alternative	42.79	6.37

Yours very truly,

M. Frank Thomas

M. Frank Thomas
Regional Engineer

FEDERAL POWER COMMISSION
REGIONAL OFFICE
555 BATTERY STREET, ROOM 415
SAN FRANCISCO, CALIF. 94111

December 4, 1975

Colonel Charles A. Debelius
District Engineer
Alaska District, Corps of Engineers
P. O. Box 7002
Anchorage, Alaska 99510

Dear Colonel Debelius:

We have reviewed your Draft Environmental Impact Statement on the Hydroelectric Development Upper Susitna River Basin, Southcentral Railbelt Area, Alaska, dated September 1975.

These comments of the San Francisco Regional Office of the Federal Power Commission's Bureau of Power are made in accordance with the National Environmental Policy Act of 1969, and the August 1, 1973, Guidelines of the Council on Environmental Quality.

Our comments are primarily directed toward the need for power that would be produced by the Upper Susitna Development, the alternative power sources, and the fuel situations relative to non-hydroelectric power alternatives.

The recommended plan is to construct dams and power plants at the Watana and Devil Canyon sites and electric transmission facilities to the Railbelt load centers. The proposed plan for the Watana site would include the construction of an 810-foot high earthfill dam and power plant which would contain three Francis turbines with a nameplate capacity of 250 MW each. The firm annual generation would be 3.1 billion kWh. Development of the Devil Canyon site would include a 635-foot high thin-arch dam and power plant with four Francis turbines, each rated at 180 MW. The firm annual generation would be 3.0 billion kWh with regulated streamflow from Watana storage. The electrical power generated would be transmitted to the Fairbanks - Tanana Valley and the Anchorage - Kenai peninsula areas. The recommended development is shown to be economically feasible.

(1) The Need for Power

We agree with and endorse the subject report's assertion in Section 2.04 that substantial amounts of new generating capacity will be needed to meet future power requirements of the Southcentral Railbelt area. Recent studies of the Southcentral and Yukon region (which includes the Southcentral Railbelt as its main component), as defined in the 1974 Alaska Power Survey Report of the Executive Advisory Committee, indicate that rapid rates of increase in power requirements will continue at least for the balance of the 1970's, reflecting economic activity associated with North Slope oil development and expansion of commercial and public services. Estimates beyond 1980 reflect a range of assumptions as to the extent of future resources use and industrial and population growth. All indications are that accelerated growth will continue through the year 2000, with economic activity generated by North Slope oil and natural gas development being a major factor - but only one of several important factors. It is generally considered that the Southcentral-Yukon regional population will continue to grow at a faster rate than the national and state averages, that future additional energy systems and other potential mineral developments will have a major effect, and that there will be notable expansion in transportation systems. Significant economic advances for all of Alaska and especially for the Alaska Native people should be anticipated as a result of the Alaska Native Claims Settlement Act. Other influencing factors could be cited, but the general outlook is for further rapid expansion of energy and power requirements in the Southcentral-Yukon area.

A range of estimates for future power requirements of the Southcentral and Yukon regions is presented in the 1974 Report of the Alaska Power Survey Technical Advisory Committee on Economic Analysis and Load Projections. The range of estimates attempts to balance a myriad of controlling factors including costs, conservation technologies, available energy sources, types of Alaskan development, et cetera. The higher growth range anticipates significant new energy and mineral developments from among those that appear more promising. The lower growth range generally assumes an unqualified slackening of the pace of development following completion of the Alyeska pipeline and, in our opinion, is not considered realistic. The mid-range growth rate appears to be a reasonable estimate which we adopt as most representative based on recent manifestations and our assessment of future conditions. It should be noted that there are several responsible advisory committee members who feel that recent acceleration of mineral raw material shortages of all kinds indicates a possibility that even the high range estimates could be exceeded. Table 1, which is a condensed extract of information contained in the aforementioned advisory committee report, summarizes load estimates for the Southcentral and Yukon Regions. Indicated load increments by decade are as follows:

69-737 O - 81 - 55

Increments of Sou[illegible]-Yukon Power Requirements

	1972-1980		1980-1990		1990-2000		1972-2000	
	Peak Demand MW	Annual Energy GWh	Peak Demand MW	Annual Energy GWh	Peak Demand MW	Annual Energy GWh	Peak Demand MW	Annual Energy GWh
Higher Estimate	888	4 623	4 460	28 110	2 800	13 070	8 148	45 803
Mid-Range	638	3 093	930	4 570	1 950	10 240	3 518	17 903

According to the subject report, a total of 6100 GWh of firm annual energy would be produced by the combined Devil Canyon-Watana system which would have a nameplate capacity of 1470 MW. Although the report does not indicate proposed commercial operation dates, based on information in our files the project would be staged and the initial Devil Canyon installation (3000 GWh and 720 MW) could become operable in 1985 and the ultimate installation in 1990. Under this timetable it is apparent that there is a need for power in the Southcentral-Yukon Region by 1985 and 1990 in the order of magnitude of at least as much as the proposed subject development. Therefore, operation of the proposed project would help meet the power needs of the Southcentral Railbelt area by 1985 and beyond.

(2) Alternative Power Sources and Fuel Situation

Our recent estimate of power values for the Devil Canyon-Watana project indicates that the most economical alternative to the project's output would be power from a combined cycle generating plant using natural gas as an operating fuel. We acknowledge the subject report's premise that there are many questions concerning future availability and costs of natural gas and oil for power production. It is the policy of this Commission to discourage use of natural gas as an operating fuel for power generation in the contiguous United States. Due to changes in requirements, other Federal and/or State agencies may impose restrictions on the future usage of natural gas and oil for electric power production throughout Alaska. Recognizing the undertainty of the future availability of natural gas and oil after 1985 for new generating capacity, the possibility of its restrictive use if available, and its sensitivity to worldwide pressures, coal may be the most likely alternative fuel for thermal-electric plants to be constructed in the mid-1980's and beyond. Essentially, we agree with the discussion of alternative sources of power in paragraphs 6.02.1 - 6.02.10 of the subject report.

(3) Other Alternatives to the Proposed Action

The Corps' DEIS discusses several potential alternative hydroelectric developments within the Southcentral Railbelt Area. All of these alternativ either have a greater adverse environmental impact than the proposed plan, or are not considered feasible at the present time.

Very truly yours,

George R Bell (Deputy)

M. FRANK THOMAS
(Acting) Regional Engineer

Attachment
(Table 1)

69-737 O - 81 - 56

TABLE 1

Total Power Requirements

Southcentral and Yukon Regions 1/

Region	Actual Requirements 1972 Peak Demand MW	Actual Requirements 1972 Annual Energy GWh	Estimated Future Requirements 1980 Peak Demand MW	1980 Annual Energy GWh	1990 Peak Demand MW	1990 Annual Energy GWh	2000 Peak Demand MW	2000 Annual Energy GWh
			Higher Rate of Growth					
998 Southcentral	317	1 465	990	5 020	5 020	30 760	7 190	40 810
Yukon (Interior)	115	542	330	1 610	760	3 980	1 390	7 000
Total	432	2 007	1 320	6 630	5 780	34 740	8 580	47 810
			Likely Mid-Range Growth Rate					
Southcentral			790	3 790	1 530	7 400	3 040	15 300
Yukon (Interior)			280	1 310	470	2 270	910	4 610
Total			1 070	5 100	2 000	9 670	3 950	19 910

1/ As defined in the 1974 Alaska Power Survey

DRAFT

TO: Mr. Vernon K. Hagen
Office of Chief of Engineers
Corps of Engineers
Forrestal Bldg., Rm. 5-F-039
Washington, D.C. 20314

FROM: John T. Riedel
Chief, Hydrometeorological Branch

SUBJ: Tentative Estimates of Probable Maximum Precipitation (PMP) and Snowmelt Criteria for Four Susitna River Drainages

Introduction

The Office of Chief of Engineers, Corps of Engineers requested PMP and snowmelt criteria for the subject drainages in a memorandum to the Hydrometeorological Branch, dated December 12, 1974. The Alaska District requested the study be completed by February 1, 1975; however, a more realistic date for completing a study in which we have confidence is June 1, 1975. Because of the need to soon begin hydrologic studies based on meteorological criteria, the Branch has concentrated on the problem and has determined the general level of criteria. A range of PMP values are given in this memorandum within which we believe values from a more comprehensive study will fall. The sequences of snowmelt winds, temperatures, and dew points should be checked with additional studies. In addition, if we knew in detail how snowmelt will be computed, we could give emphasis to the more important elements.

PMP estimates for four drainages

A range of estimates of PMP for 6, 24, and 72 hours for four drainages outlined on the map accompanying the December 12, 1974 memorandum are listed in table 1. These are numbered from 1 to 4 (smallest to largest).

The estimates are for the months of August and September - the season of greatest rainfall potential. For the snowmelt season, multiply the estimates by 70 percent.

The estimates take into account numerous considerations including several methods of modifying PMP estimates made previously for other Alaska drainages, and PMP estimates from the Western United States for areas with similar terrain.

Temperatures and Dew Points for Snowmelt.

A. During PMP Storm

1. Dew point for PMP centered on June 15 = 56°F (assume maximum 1-day PMP in middle of 3-day storm).

2. For PMP placement prior to June 15 subtract 0.8°F for each 3-day period prior to June 15 (e.g. the PMP dew point for June 12 will be 55.2°F). This -0.8°F per 3-days may be applied to obtain the maximum 1-day dew point during the PMP back to as early as May 15.

3. For first day of PMP storm, subtract 1°F from criteria of 2; for 3rd day of PMP storm subtract 2°F.

4. Add 2°F to each of the three daily dew points to get daily temperatures for the 3-day PMP period.

B. Temperatures and Dew Points Prior to 3-Day PMP Storm (High dew point case)

Adjustment to temperature and dew point on day of maximum PMP

Day prior to PMP	Temperature (°F)	Dew point (°F)
1st	-2	-2
2d	-1	-4
3rd	0	-4
4th	+1	-5

C. Temperatures, Dew Points Prior to 3-day PMP
(High temperature case)

Adjustment of temperature and dew point on
day of maximum PMP

Day prior to PMP	Temperature (°F)	Dew point (°F)
1st	+1	-12
2d	+2	- 9
3rd	+4	- 7
4th	+7	- 6

Elevation Adjustment

For the 3 days of PMP and for the high dew point case, apply a -3°F per 1000 ft to the temperatures and dew points. The basic criteria are considered applicable to 1000 mb or zero elevation.

For the high temperature criteria apply a -4°F per 1000 ft increase in elevation.

Half-day Values

If half-day values are desired for temperatures and dew points, the following rules should be followed:

1. For the high-temperature sequence, apply an 18°F spread for temperatures and a 6°F spread for dew point. For example, for a mean daily dew point of 50°F, the half-day values would be 47°F and 53°F.

2. For the high dew point case, apply a 12°F spread for temperature and a 4°F spread for dew point.

3. In no case, however, should a 12-hr dew point be used that exceeds the 1-day value for that date. For example, the value not to be exceeded for June 15 is 56°F, for June 3 (four 3-day periods before June 15) is 52.8°F.

Wind Criteria for Snowmelt

Since two sets of criteria (one emphasizing high temperature and the other high dew point sequences) are given for snowmelt prior to PMP, two sets of wind criteria are also necessary since the pre-PMP synoptic situation favoring high temperatures differs from the criteria favoring high dew points. The recommended winds, tables 2 and 3, are given by elevation bands. In the high dew-point case, table 2, (where synoptic conditions exist favoring maritime influences prior to PMP), the same wind for 4-days prior to PMP is appropriate.

All of the winds presented in tables 2 and 3 have been adjusted for applicability over a snow surface. Although a seasonal variation in the high dew point wind criteria is realistic for the present tentative criteria, they are considered applicable to May and June.

Snowmelt Winds During the PMP

Wind criteria for the 3-day PMP are the same for both the high temperature and high dew point sequences. They are shown in table 4.

Snow Pack Available for Melt

Some work was done in determining the mean and maximum October-April precipitation of record for the available precipitation stations. These stations and other data are tabulated in table 5. The drainages and available stations are shown in figure 1.

Table 5 also shows the years of record available for October-April precipitation, as well as a column labeled "synthetic October-April precipitation." This gives the sum of the greatest October, greatest November, etc., to the greatest April precipitation total from the available record. These synthetic October-April precipitation values and the means are plotted on figure 1.

Approximately 9 years of snow course data are available for 14 locations in and surrounding the Susitna drainage. From these records, the greatest water equivalents were plotted on a map. These varied from a low of 6 inches at Oshetka Lake (elevation 2950 ft) to an extreme of 94.5 inches at Gulkana Glacier, station C (elevation 6360 ft). A smooth plot of all maxima against elevation gave a method of determining depths at other elevations. Figure 2 shows resulting smooth water equivalents based on smoothed elevation contours and this relation.

Some additional guidance could be obtained from mean annual precipitation maps. One such map available to us is in NOAA Technical Memorandum NWS AR-10, "Mean Monthly and Annual Precipitation, Alaska." The mean annual of this report covering the Susitna drainage is shown in figure 3.

Also on this figure is shown the mean runoff for three portions of the Susitna River drainage based on the years of record shown. No adjustment has been made for evapotranspiration or any other losses. This indicates that the actual mean annual precipitation is probably greater than that given by NWS AR-10.

Conclusion. Time hasn't allowed checks, evaluation, and comparison of the several types of data summarized here. It appears the "synthetic October-April precipitation" generally is less than the maximum depths over the drainages based on snow course measurements. There depths, or figure 2, would be considered the least that could be available for melt in the spring.

Further Studies

The variation of precipitation with terrain features in Alaska is important but yet mostly unknown and unstudied. More effort should be placed on attempts to develop mean annual or mean seasonal precipitation maps, at least for the region of the Susitna River. Some 10 years of data at about a dozen or so snow courses could be used in this attempt, as well as stream runoff values.

Some work has been done toward estimating maximum depth-area-duration values in the August 1967 storm; an important input to the present estimates. Attempts should be made to carry out a complete Part I and Part II for this storm, although data are sparse and emphasizing the use of streamflow as a data source.

The objective of these two studies with regard to the Susitna drainages is to attempt a better evaluation of topographic effects, and to make a better evaluation of snow pack available for melt.

Study of additional storms could give some important conclusions and guidance on how moisture is brought up the Cook Inlet to the Talkeetna Mountains and how these mountains effect the moisture.

Snowmelt criteria in this quick study is limited to 7 days. Considerably more work needs to be done to extend this to a longer period. Then we would need to emphasize compatability of a large snow cover and high temperatures. More known periods of high snowmelt runoff need to be studied to determine the synoptic values of the meteorological parameters.

Table 1

General level of PMP estimates for 4 Susitna River drainages

Drainage Number	Area (sq mi)	72-hr PMP (in.)
1	1260	9-12
2	4140	7.5-10.5
3	5180	7-9
4	5810	7-9

For 24-hr PMP, multiply 72-hr value by 0.60.

For 6-hr PMP, multiply 72-hr value by 0.30.

PMP for intermediate durations may be obtained from a plotted smooth curve through the origin and the 3 values specified.

Table 2

Snowmelt Winds preceding PMP for Susitna Basins for high dew point sequence

Elevation (ft)	Daily Wind speed* (mph)
sfc	8
1000	9
2000	12
3000	18
4000	25
5000	34
6000	36
7000	37
8000	39
9000	40
10,000	42

*For each of the 4 days preceding the 3-day PMP.

Table 3

Snowmelt winds preceding PMP for Susitna Basins for high temperature sequence

Elevation (ft)	Daily wind speed (mph) Day prior to 3-day PMP			
	1st	2nd	3rd	4th
sfc	10	13	4	4
1000	10	13	4	4
2000	11	14	5	5
3000	12	16	5	5
4000	13	16	6	6
5000	13	17	6	6
6000	14	18	6	6
7000	15	20	6	6
8000	16	20	7	7
9000	16	20	7	7
10,000	17	21	7	7

Table 4

Winds during 3-day PMP

Elevation (ft)	Wind speed (mph)		
	Day of maximum PMP	Day of 2nd highest PMP	Day of 3rd highest PMP
sfc	12	9	8
1000	14	10	9
2000	19	14	12
3000	29	21	18
4000	42	31	27
5000	56	42	36
6000	58	44	38
7000	62	46	40
8000	64	48	41
9000	68	51	44
10,000	70	52	45

Table 5

Stations with Precipitation Records in and surrounding the Susitna Drainage

Station	Elevation (ft.)	Yrs of record for complete Oct.-Apr. precipitation	Maximum obs. Oct-Apr. prec. (in.)	Yr of Maximum	Mean Number of months for synthetic Oct.-Apr. season	Synthetic Oct.-Apr. precip. (in.)	Mean Oct.-Apr. Precip. (in.)
Susitna Meadows	750	4	17.18	70-71	4	23.18	13.77
Gulkana	1572	18	6.77	56-57	18	12.68	4.19
Paxson	2697	2	8.42	43-44	6	14.25	7.64
Trims Camp	2408	3	23.26	59-60	5	35.82	15.3
Summit	2401	19	14.09	51-52	20	26.59	7.93
Talkeetna	345	35	21.17	29-30	37	40.59	12.26
Sheep Mountain	2316	13	11.91	59-60	12	18.42	4.78

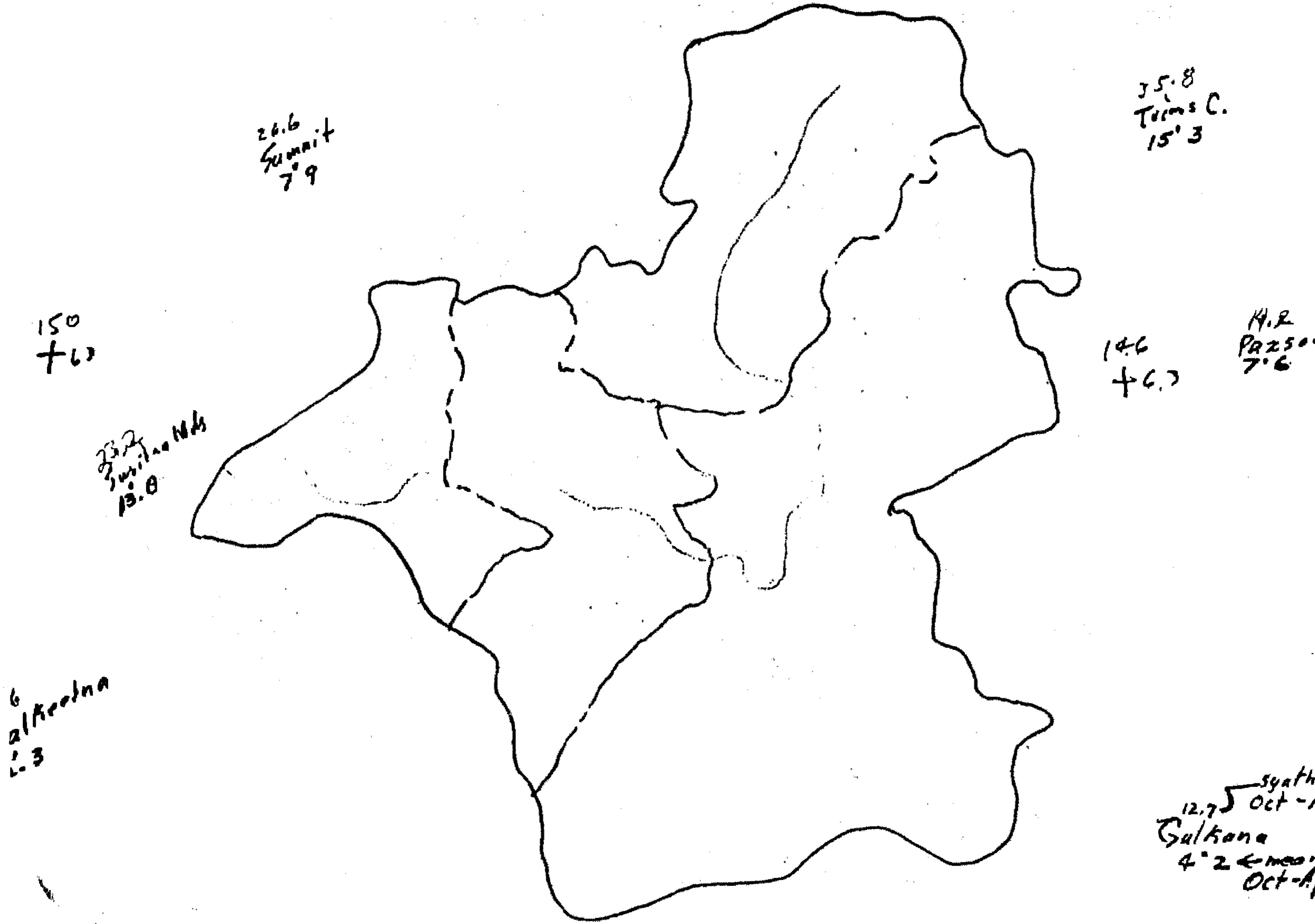

Figure 1.—Drainage outlines and October-April precipitation in inches. (Upper values = synthetic October-April precipitation; Lower = mean October-April precipitation.)

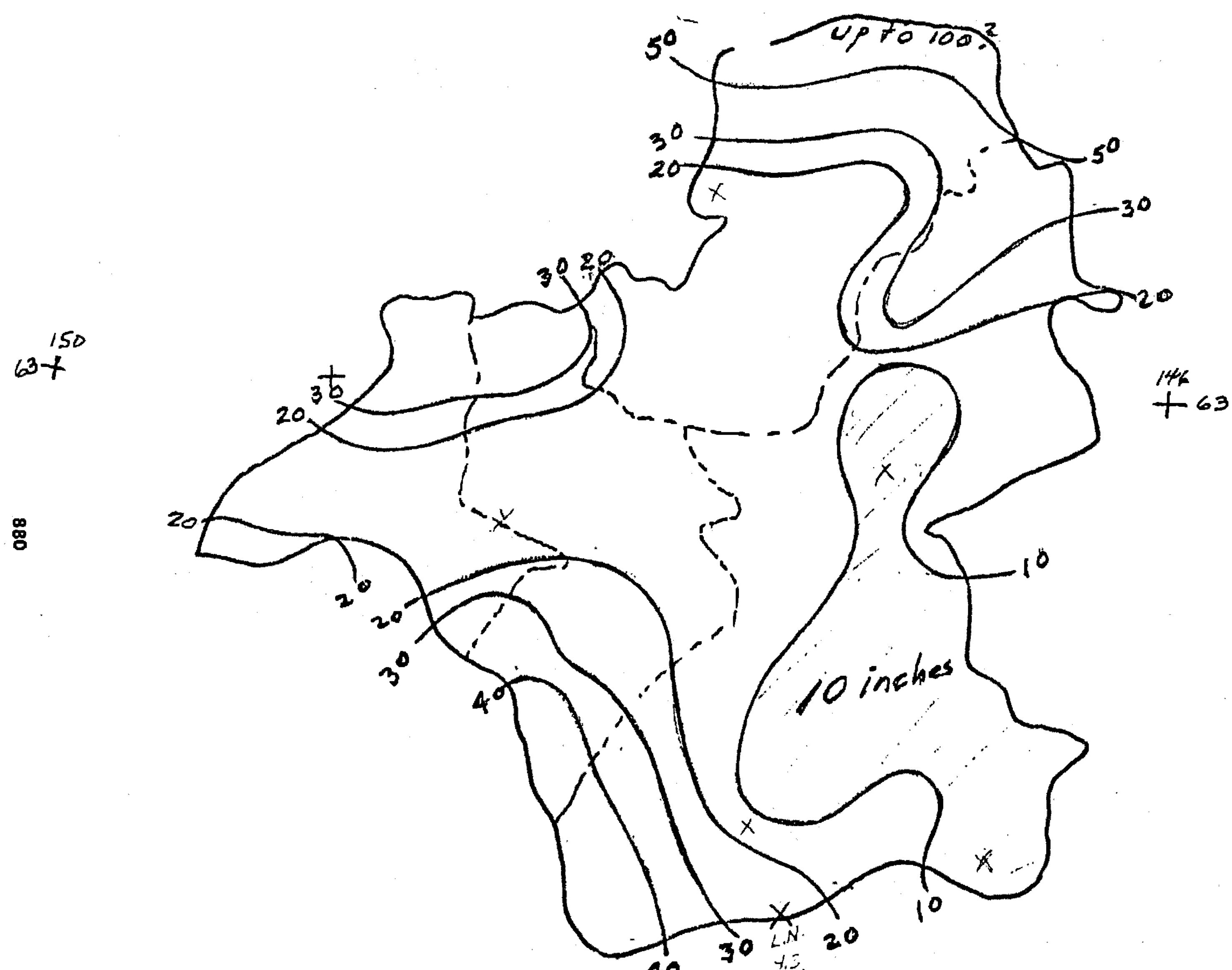

Figure 2.--Minimum water equivalents of snow pack in inches (based on gross smoothing of maximum snow course measurements.)

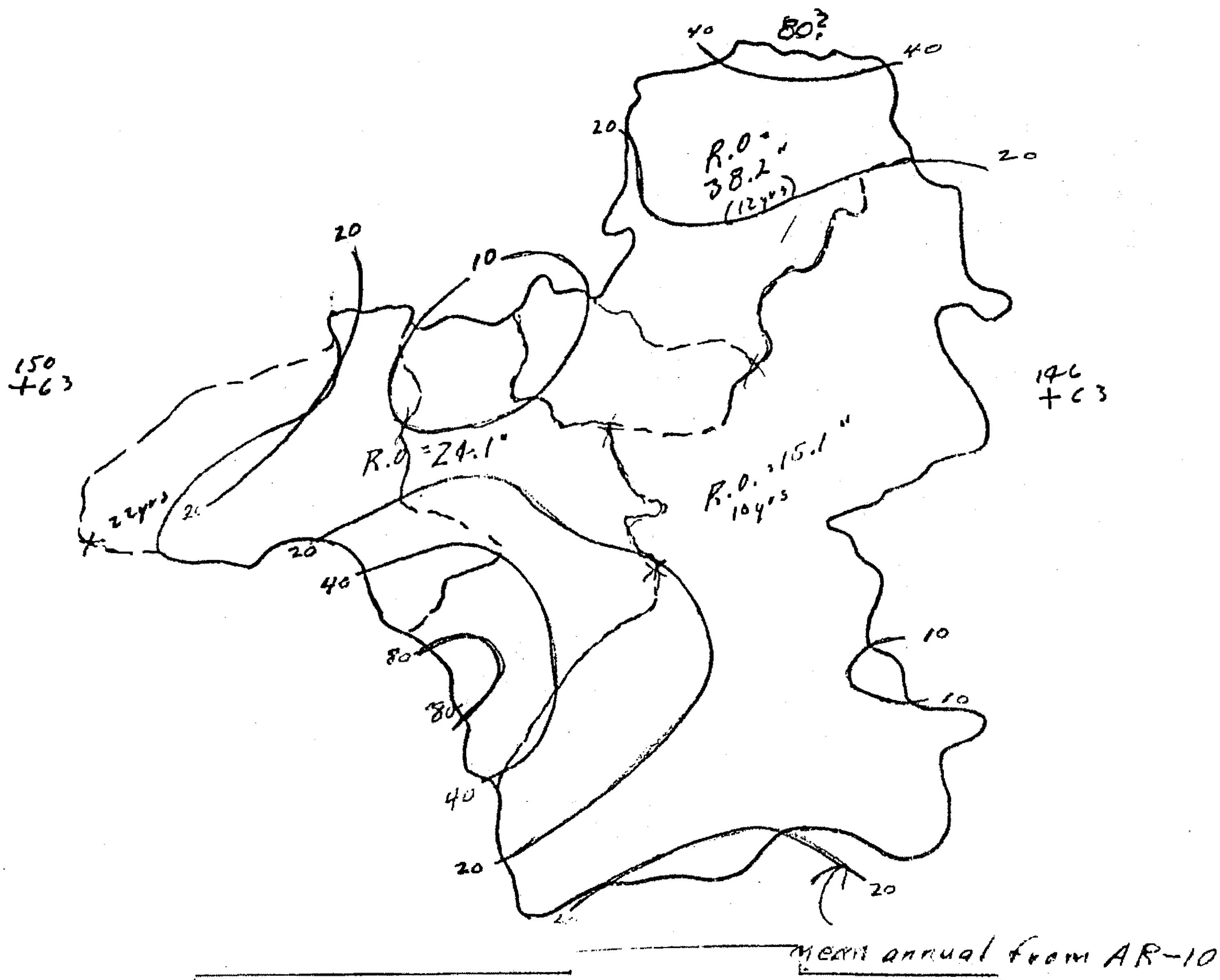

Figure 3.--Mean annual precipitation and stream runoff (in inches).

TEN MOST SEVERE STORMS IN UPPER SUSITNA
BASIN SINCE 1961

Year	Date of Storm	Date of Flows Over 35,000 cfs at Gage
1962	June 13-15	June 11 to June 24
1963	July 16-18	July 7 to 18
1964	*June 10	June 1 to 22
	*June 20-27	June 1 to 22
1965	*June 26-28	June 28 to June 29
	*July 12-15	July 13 to July 14
1967	July 18-22	July 20 to 22
	Aug 9-16	Aug 13 to 19
1971	June 29-30	June 23 to July 1
	July 12-17	July 15 to 16
	Aug 1-10	Aug 8 to 15

NOTES: (1) Weather Stations
The Gracious House
Summit FAA
McKinely Park
Trims Camp

(2) U.S.G.S. Gage
Susitna River at Gold Creek

(3) * = Used Summit FAA only

STATE OF ALASKA

JAY S. HAMMOND, GOVERNOR

OFFICE OF THE GOVERNOR

ALASKA ENERGY OFFICE — *338 DENALI STREET – ANCHORAGE 99501*
PHONE: 907-272-0527

6 October, 1975

Colonel Charles A. Debelius
U.S. Army Corps of Engineers

Gentlemen:

The Alaska State Energy Office, within the Office of the Governor, appreciates the importance of the possible development of the Upper Susitna River hydro-electric potential. We also appreciate the opportunity to express a point or two concerning this matter.

Before final approval of the two dams now being considered, the Devil's Canyon and the Watana, is made we feel quite strongly that a net-energy-benefit analysis should be prepared and circulated for study and comment. How much energy will be consumed in the construction, operation, and maintenance of these dams, including the entire system and other costs such as rerouting highways? How does that compare with the energy it will produce? Is that ratio worth attaining? These questions need to be addressed and answered.

Sincerely

William C. McConkey

William C. McConkey
Director
WMc/mgf

STATE OF ALASKA

JAY S. HAMMOND, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF PARKS

323 E. 4TH AVENUE
ANCHORAGE 99501

April 4, 1975

RE: 2425

Colonel Charles A. Debelius
Corps of Engineers, Alaska District
Department of the Army
P. O. Box 7002
Anchorage, AK 99510

Dear Colonel Debelius:

Reference is made to your letter of March 18, 1975 and our response dated March 19, 1975 concerning the cooperative aspects of the planning and development of a recreation program for the proposed Devil's Canyon Hydroelectric Project and related impoundments. This letter will serve as a declaration of intent on our part to provide the necessary local participation at said project, as required under the Federal Water Project Recreation Act, Public Law 89-72, to the extent set forth hereafter: The State of Alaska would:

1. Administer project land and water areas for recreational purposes.

2. With legislative approval, contribute in kind, pay, or repay with interest, 1/2 of the separable cost for recreation facilities and specific recreation lands, in accordance with the Federal Water Project Recreation Act of 1965.

3. Operate and maintain said recreation facilities.

At this very preliminary stage of planning, we recognize that the proposed projects have the potential for fulfilling a portion of the significant deficits of recreation facilities within the Southcentral and Interior regions of Alaska. Furthermore, we recognize the very general and tentative nature of the recreation program identified here with respect to congressional authorization for further study and funding, and the capability of future state budgets to support such endeavors.

It is our understanding that more definitive recreation area and site planning would follow project authorization by congress, and based on this, formal contract agreement could become possible between our respective agencies. Furthermore, it is our understanding that this letter of intent does not bind the State of Alaska to any future formal contract agreement with the Corps of Engineers.

Due to the very limited staff of the Division of Parks, we can provide only limited comment and input during this pre-authorization stage of planning. However, if authorized, the project will be of great interest to the state and at that time we would wish to discuss a formal recreation contract agreement.

Sincerely,

FOR William A. Sacheck
Director

cc: Guy R. Martin, Commissioner
Department of Natural Resources

NCJ:krm

STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES

JAY S. HAMMOND, GOVERNOR

DIVISION OF PARKS / 323 E. 4TH AVENUE – ANCHORAGE 99501

June 4, 1975

Re: 2425

Colonel Charles A. Debelius
Corps of Engineers, Alaska District
Department of the Army
P. O. Box 7002
Anchorage, Alaska 99510

Dear Colonel Debelius:

The Division of Parks has reviewed the April 1975 draft copy of the "Recreation Resource Appendix for Devil's Canyon Interim Feasbility Study", by Don Geil, and we offer the following comments. Generally, the report appears adequate; however, it should be pointed out that Section 5.01 (Basic Assumptions) is not an accurate statement of the intent of the Division of Parks.

Although the Division of Parks is interested in operating the recreational aspects of the Devil's Canyon Project, we do not consider the area as "an extension of Denali State Park". We see Devil's Canyon more as an independently operated State Recreation Area. Undoubtedly there will be a close relationship between Denali State Park and Devil's Canyon, but the purposes of a state park are different from those of a Recreation Area. It is our feeling that since Devil's Canyon will be subject to significant man-made disturbance that the classification of Recreation Area is the only definition which can be applied to this project.

The projected visitor use and recommended development plan for the project, although in a very conceptual stage, appear reasonable.

We appreciate the opportunity to review this draft document and look forward to continuing communication with the Corps of Engineers on this project.

Sincerely,

RUSSELL W. CAHILL
Director

By: Neil C. Johannsen
Park Planner

STATE OF ALASKA

JAY S. HAMMOND, GOVERNOR

OFFICE OF THE GOVERNOR

STATE POLICY DEVELOPMENT AND PLANNING

POUCH AD – JUNEAU 99811
PHONE 465-3512

June 9, 1975

H. W. Holliday
Chief, Engineering Division
Department of the Army
Alaska District
Corps of Engineers
P.O. Box 7002
Anchorage, Alaska 99510

Subject: Southcentral Railbelt Hydroelectric Power Study
State I.D. No. 75041804

Dear Mr. Holliday:

The Alaska State Clearinghouse has completed review on the subject project.

The following agencies were invited to review and comment:

State of Alaska

- Department of Community & Regional Affairs
- Department of Economic Development
- Department of Environmental Conservation
- Department of Fish & Game
- Department of Highways
- Department of Law
- Department of Natural Resources
- Division of Lands
- Division of Parks
- Department of Public Works
- Alaska Energy Office
- Office of Comprehensive Health Planning

Seven of the above agencies responded.

The Department of Community & Regional Affairs stated:

> In short, the brochure is designed to be a public opinion questionnaire and an announcement that a study is in progress. The information presented is insufficient to warrant comments on the quality of the study or on the effects the proposed Upper Susitna River hydroproject will have on this Department's operations. We do have some study content recommendations.
>
> The Corps has conducted an "inventory and evaluation of the environmental, esthetic and recreational resources of the Susitna River". However, this information is only available for review at the Anchorage office. A task team

has also been organized to "evaluate environmental, economic, engineering and social aspects of hydropower development of the Upper Susitna River as well as possible alternatives". This team is responsive to questions, but there is little published information for review and comment.

We welcome, indeed request, an opportunity to review and comment on a draft and final copy of the study. For this Department to determine the quality of the study and the possible effects of the proposed hydroprojects on our operations, at least the following concerns must be addressed in detail:

1. Effect on Community Growth and Development:

Development or nondevelopment of additional electric generation capacity is a policy issue which must be resolved at all levels of government. A decision not to expand generation capacity will tend to slow population growth and community development. Whereas the amount of power developed and construction schedule can be varied to meet existing and anticipated needs or to serve as a catalyst for increased population and industry growth.

Information on the impacts of the various power development and construction schedule alternatives should be available to decision-makers. Direct impacts such as population changes and increased traffic associated with project construction as well as secondary impacts such as housing shortages, demand for municipal services and changes in the natural environment due to community growth (or lack of growth).

2. Alternatives to the Devil Cany[illegible]ojects:

The U. S. Senate Public Works Committee resolution specifically requested the study on the Devil Canyon and associated projects. Thus, there is an inherent pro-hydroelectric bias which may overshadow other alternatives. This bias can be seen in the brochure. The only detailed information presented is related to the Devil Canyon projects. The quality of the final study will depend on how much consideration is given to alternatives. To adequately comment on the Devil Canyon projects, we need to see more information on the alternatives.

The Department of Economic Development stated:

Hydropower is one of several energy resources available to the Southcentral region. If developed, it can free fossil fuels for export or for their petrochemical values. The total energy equivalent of capital costs and materials for dam construction should be evaluated. Net energy production should be positive and preferebly high.

Southcentral Alaska has both the energy potential and the developed frame work for surface transportation to market. The threat of over production of energy seems highly unlikely, especially if hydropower and fossil fuel energy can be interfaced to provide for both industrial and residential needs. The region compares well with many industrial nations.

The final decision should depend on careful study of the total energy equivalent of the investment in capital and materials. The proposal area appears to be favorable with consideration for game crossing and phased construction. An optimum energy - environmental mix should be feasible.

A series of low dams may yield a better balance with lower drawdown requirements and more modest construction costs. The sequence could develop over time to grow with requirements and market -- with the plan with the best total balance.

Cost estimates should be supplied to give the public a better idea of the funding problem and a comparison of this between planning choices. (As against Btu equivalents of the power potential.)

The Department of Environmental Conservation stated:

We have no comments on the reiterated information in this study.

The Department of Law stated:

The corps should be commended for developing and using this means of incorporating public and outside opinions into its planning at an early date.

The Department of Public Works stated:

We are firmly on record in favor of this project and its impact on public works.

The Alaska Energy Office stated:

The Alaska Energy Office fully supports the Southcentral Railbelt Hydroelectric Power Study now being conducted by the Army Corps of Engineers. Focusing on the hydropower potential of the Upper Susitna River, this feasibility study also provides an excellent opportunity to investigate other energy resource alternatives in the area.

In 1985, the estimated demand for power in the railbelt area, which contains over 75% of the state's population will be around 7,000 million kilowatt hours per year. Existing power plants are not capable of meeting this demand; therefore, in order for these future needs to be met, it is imperative that consideration and advance planning take place now. The feasibility study by the Corps provides an excellent oppourtunity to evaluate not only hydropower but other energy resource options available in the region as well.

The Alaska Energy Office is firmly committed to the premise that the policy of continued Alaskan dependence on "non-renewable" fossil fuels must be reevaluated. This is because the present traditional energy resources (coal, oil, and natural gas) are not unlimited and we must learn to use them wisely and in the most efficient way possible if the United States is to ever achieve "energy independence".

Although the state's fossil fuels remain virtually untouched, we Alaskans must also realize that the demand for use of these fuels outside will become more and more intense as these energy resources in the Lower 48 become depleted.

Today hydropower is the most attractive "renewable" resource available in the state. A proven technology and economic practicability make it commercially competitive with the fossil fuels when generating large blocks of electricity.

Perhaps the greatest hindrance to hydropower development is the potential negative impact upon the land, fisheries, and wildlife of the area. Unfortunately, little detailed information on these possible consequences is available. Before construction of any hydroelectric sites on the Upper Susitna River can be endorsed by the Alaska Energy Office, a thorough environmental impact evaluation of the region must be completed.

At the present time geothermal, wind, solar, and tidal power are not practical energy alternatives for large scale power plants. Future technological advances and changing economics, however, may help these energy sources play an instrumental role in Alaska's long range energy picture. Nuclear power may also have a significant impact in the years ahead, but at this time little is known about the state's uranium reserves.

We do recommend that a detailed inventory of these alternative sources be taken for the region now. This valuable information would then be on hand when evaluation of the long range power needs of the area takes place.

Of course, attention must also be given to possible use of our "non-renewable" fossil fuels. Continued use of natural gas from Cook Inlet, tapping off a natural gas pipeline from the North Slope, construction of additional refineries to process Alaskan oil and building production facilities at the Susitna and Nenana Coal Fields are all possible short term options which must be considered. Further depletion of coal, oil, and gas reserves in the Lower 48, the possible deregulation of natural gas, and the volatile Middle East situation make the future use of these fuels for power generation questionable. There are many other more efficient and required uses for these resources. As always all environmental considerations must be analyzed before new projects can be condorsed by this office.

In conclusion, the Southcentral Railbelt Hydroelectric Power Study is an Important first step toward what, we hope, will become a coordinated and systematic state and federal effort aimed at meeting Alaska's future energy needs.

The Office of Comprehensive Health Planning stated:

This office has no comment.

In reviewing the comments received, and from conversations with those agencies not responding to this public brochure, there is not enough information in this document to form any sort of state position on this project at this time. However, we hope these comments will be of some assistance to you in the development of the draft environmental impact statement.

Sincerely,

Raymond W. Estess
State-Federal Coordinator

cc: Robert Weeden, DPDP
Robert LeResche, F&G

69-737 O - 81 - 57

STATE OF ALASKA

JAY S. HAMMOND, GOVERNOR

OFFICE OF THE GOVERNOR

STATE POLICY DEVELOPMENT AND PLANNING

POUCH AD — JUNEAU 99811
PHONE 465-3512

September 12, 1975

Colonel Charles A. Debelius
District Engineer
Corps of Engineers
Alaska District
P. O. Box 7002
Anchorage, Alaska 99510

Dear Colonel Debelius:

In response to you August 28, 1975 letter the State of Alaska definitely sees a need to reserve lands for public recreation and fish and wildlife purposes within the proposed Devil Canyon-Watana power project, if concerned agencies and Congress approve the project.

More extensive studies should be conducted by the State and Federal agencies on land use in the upper Susitna River area before any decision is made on the boundaries of the proposed power project. We would like to be involved in any future studies on land use in this area.

If we can be of further assistance, please advise.

Sincerely,

Raymond W. Estess

Raymond W. Estess
State-Federal Coordinator

UNIVERSITY OF ALASKA
COLLEGE, ALASKA 99701

29 May 1975

Southcentral Railbelt Task Team
Corps of Engineers, Alaska District
Box 7002
Anchorage, Alaska 99510

Dear Sirs:

The comments I make here are my own and don't necessarily represent the opinions of the Institute of Water Resources.

The Susitna River Hydro-electric project stirs mixed reactions with me. It is easy to recommend the project on it's merit of saving oil, but will that really happen or will it attract industrial development and leave the domestic market still reliant on oil fired generators? Before I would support this project I would have to be convinced that the power will be used by Alaskan home owners and not for stimulation of industrial development.

I feel there are better solutions to our energy problem which should be tried before building hydro projects. Energy conservation measures could be used to decrease demand. This should be tried through a combination of 1) public awareness campaigns, 2)raising fuel prices, and 3) giving tax incentives for insulating and other energy saving measures.

Development of alternate energy sources should also be given priority to dam construction on the Susitna River. Solar, wind, tidal and refuse burning are all viable energy sources which could easily be developed.

Another area that I am concerned about is water quality and for the last year I have studied the effect of reservoirs on water quality extensively. The following is the conclusion of my masters special topics paper, a copy of which is included.

> " In a reservoir the processes of stratification, eutrophication, evaporation, sedimentation, ice cover and leaching all cause changes in water quality to occur. Examination of the processes and their inter-relations is essential to a complete understanding of what changes will take place in impoundment water quality. The results may be an improvement in water quality although often times the water is degraded.
>
> In general, reservoirs are documented to cause increases in the concentrations of color, total dissolved solids, electrical conductivity, alkalinity, hardness, iron, manganese, chlorides, nitrogen, phosphorus, and carbon. The concentrations of suspended matter, dissolved oxygen and bacteria usually decrease as water passes through a reservoir.

The literature shows that removal of organic material prior to reservoir site inundation results in improved water quality characteristics. The various methods of aerating the hypolimnion, withdrawing only selected layers of water and applying chemicals have all met with some degree of success in alleviating reservoir problems."

I recommend, if the project is built, that it include the following operational and design features.

1) The reservoir sites should be cleared of all trees and brush. Areas of deep organic material should either be covered with inorganic material or removed.

2) The dam should be designed with multiple outlets at different elevations so as to allow for the controlled release of specific water layers.

3) Aeration devices should be installed for use in controlling stratification and low dissolved oxygen.

4) A sound water quality management plan should be developed to protect downstream fisheries and water uses.

In closing I emphasize my point that the project should be for replacement of oil and gas use and not for stimulation of industrial development with cheap power.

Sincerely,

Stan Justice
Environmental Engineer

MATANUSKA ELECTRIC ASSOCIATION, INC.

P. O. Box "G"

PALMER, ALASKA 99645

TELEPHONE
(907) 745-3231

June 10, 1975

District Engineer
Alaska District, Corps of Engineers
Box 7002
Anchorage, Alaska 99510

The Board of Directors and Management of Matanuska Electric Association, Inc. wish to go on record as being in full support of the full development of the Upper Susitna River hydroelectric potential to be brought on line on a schedule that will be paced to the needs of the railbelt area.

MEA's service area extends from Eagle River northerly to include the Knik River, Matanuska River, and much of the Susitna River valleys. It is our firm belief that the development of Susitna hydro is the most realistic solution to the areas' growing needs. MEA's projections indicate that its system requirements could easily exceed 100 megawatts by the time the first Devil Canyon units could come on the line.

We are much in favor of the development of this renewable resource which, in a moderate way, can help to conserve fossil fuels for other than boiler fuel to generate needed electricity.

The South Central Railbelt Area continues to grow at a rapid rate with its demand for electric energy steadily rising. The need cannot be met by such interesting sources of energy such as wind, solar, tidal, or geothermal on any kind of realistic schedule. Gas and oil should be conserved. Coal could be used as it is in abundance in this area; however, we see some serious environmental objections to large scale mining and coal burning electric generation plants.

We see no reason to consider development of nuclear energy when we have the Susitna potential at our doorstep with its minimal environmental impact. Of the several alternate plans it would be our opinion that the final decision should rest on the combination that will most efficiently harness the full potential of the river system for the production of hydroelectric energy.

We predict that the construction of the project and the availability of an abundance of electric energy will impact the railbelt area and hasten its occupation and development in many ways, such as farming, mining, commercial, industrial, and residential activities.

It's our fear that without the earliest possible availability of Susitna hydro energy in the railbelt area we will see utilities, of necessity, turning to less efficient, less desirable environmentally, and more costly alternates that will not be to the maximum benefit of the region and its people.

Willard H. Johnson, P.E.
General Manager

cn

621 West 15th Avenue
Anchorage, Alaska 99501

June 13, 1975

Col. Charles A Debelius,
Alaska District Engineer
U. S. Army, Corps of Engineers
P. O. Box 7002
Anchorage, Alaska 99510

Sir:

Your presentation, yesterday, of the Devils Canyon hydro-electric complex, to the Anchorage Chapter of the Alaska Society of Professional Engineers, was most interesting.

I have one complaint. You stated that the Benefit/Cost ratio was slightly better than unity, and that it had been developed with alternative thermal systems fired by fossil fuels. Further, as I asked you, the basis for comparing the cost of electricity generated from using natural gas did not include the obvious escalation in the cost of this fuel. In addition, I would venture to say that natural gas will become so costly as a fuel by the end of the century its use for such purposes will become prohibitively costly. In fact, at our present rate of consumption, I would expect the known gas fields in Alaska to be depleted within two or three decades.

Thus, comparison of costs based upon present prices of a fuel which will increase in price concommitantly with a rising demand for electricity, and, in all likelihood will not even be available at the halfway point in the "fifty year" life of the project, is patently absurd.

Although Alaska has vast deposits of coal, the costs for this fuel also must be expected to rise during the rest of the century. I had not asked if cost escalation had been taken into account.I assume that, as for gas, it hadn't been. Since the supply of coal is so large, there is no reason to question its availability well beyond the end of the century, and, accordingly, the cost should not increase as sharply as for gas. The plethora notwithstanding, the crucial necessity for environmental conservation will have to pay for restoration of mined lands, removal of sulfur and other atmospheric contaminants, disposal of ashes, and dispersal of waste heat - all subject to inflationary pressures - if the B/C ratio is to be logical.

Water is a renewable resource; fossil fuels are not.

Very truly yours,

John L. Cerutti

John L. Cerutti, P. E.

410 Skarland Hall
University of Alaska
Fairbanks, Alaska 99701
Oct 7, 1975

Alaska District
Corps of Engineers
P.O. Box 7002
Anchorage, Alaska 99510

Dear Sir:

I attended your hearings held here in Fairbanks in October, with great interest and concern for the future development of the proposed dams on the Big Susitna River.

I was somewhat surprised when Colonel Debelius mentioned that there might still be a possibility of additional dam construction such as the Rampart. When the Corps tries to resurrect such skeletons of this magnitude of biological blunder, it makes one wonder about some of the reasoning behind present studies.

Although I would be the first to admit that the Devil's Canyon area would be ~~the~~ probably the best location for a dam site in the State, I feel that it is necessary to evaluate all of Alaska's resources, and wise land use planning, with the best and wisest use of resources instead of developing in a piece meal style.

I feel that the question should be raised as to the necessity of a dam for hydro-electric power at this time. There are presently many energy resources being wasted in Alaska. Flaring of natural gas has been carried out for over a decade in Cook Inlet. As a student on campus at the University of Alaska at College, I witness entire floors unnecessarily burning electricity 24 hours a day, and consumption is at a maximum.

The fact that the Corps of Engineers is planning this project at this time, prior to knowledge of the route the gas pipeline will take, indicates an attitude of "development for development's sake" to perhaps quote a well known Alaskan inversely.

If infact the North Slope gas pipeline does go through Alaska, it would appear to me to be extremely short sighted at this time to go ahead with construction plans, as well as encouraging more waste of Alaska's renewable and non renewable resources.

Yours sincerely,

Barbara Winkley

Barbara Winkley

cc: Governor Hammond

MOUNTAINEERING CLUB OF ALASKA, INC.

BOX 2037 ANCHORAGE, ALASKA

October 7, 1975

Col. Charles A Debelius
Department of the Army
Alaska District Corps of Engineers
P. O. Box 7002
Anchorage, Alaska 99510

Dear Colonel Debelius:

The Mountaineering Club of Alaska is a recreational organization located in Anchorage, Alaska and has approximately two hundred fifty mamberships representing a slightly larger number of individuals.

Two primary interests of the club are mountaineering and wilderness backpacking and exploration.

We oppose the proposed construction of the Upper Susitna Hydroelectric Project because of its intrusion into an area of wilderness close to Anchorage. We are concerned not only with the inundation of a scenic white-water river but also with the establishment of a permanent access road and other recreational projects which would encourage motorized recreation in the area.

The Mountaineering Club supports creation of the Talkeetna Mountain State Park to the south of the area in question and is concerned that the dams project and related recreational development in the adjoining region would detract from the wilderness aspect of the northern portions of the Talkeetna Mountain State Park.

We are particularly concerned with the potential for heavy off road vehicle (ORV) use in the immediate area of the access road and perhaps spilling into even further reaches of this wilderness. In this regard we are reminded of the ORV problem along the Denali Highway during hunting season.

Thank you for this opportunity to express our concerns.

Yours truly,

Fritz Rieger
Fritz Rieger
President

FAIRBANKS NORTH STAR BOROUGH

Box 1267, Fairbanks, Alaska 99707

October 13, 1975

Col. Charles A. Debelius
Col. Corps of Engineers
District Engineer
Box 7002
Anchorage, Alaska 99510

Dear Col. Debelius:

As stated at the public hearing held on October 8th, the Fairbanks North Star Borough is supporting development of the hydro-electric potential of the Upper Susitna River as a means of meeting future needs for energy in Interior Alaska.

Only through utilization of a natural renewable resource can we best use our non-renewable resource.

Interior Alaska is well along is its development as a service area for petroleum and gas fields to the north. The need for electric power is critical now and will become more critical as industrial and commercial development takes place.

Long range planning is necessary, but time is slipping by and the energy needs will soon be upon us. It is important that funds be made available for the pre-construction planning for hydro-electric power. We will add whatever support we can.

Very truly yours,

John A. Carlson

JOHN A. CARLSON
Borough Mayor

JAC:lsa

cc: U. S. Senator Ted Stevens
U. S. Senator Mike Gravel
U. S. Representative Don Young

By: John A. Carlson
Introduced: 10/9/75
Adopted: 10/9/75

RESOLUTION NO. 75-40

A RESOLUTION URGING THAT THE CORPS OF ENGINEERS CONTINUE THE UPPER SUSITNA RIVER BASIN PRE-CONSTRUCTION PLANNING.

WHEREAS, the Corps of Engineers has been doing preliminary studies of the Susitna River Hydro-Electric power potential, and

WHEREAS, reports indicate this as a feasible source of energy to generate electricity, and

WHEREAS, use of hydro power would conserve natural non-renewable resources such as petroleum, natural gas and coal, and

WHEREAS, energy demands are increasing as Interior Alaska develops, and

WHEREAS, it is important that a source of dependable, reliable, economical power be provided for Interior Alaska:

NOW, THEREFORE, BE IT RESOLVED by the assembly of the Fairbanks North Star Borough that the Corps of Engineers continue the Upper Susitna River Basin (Southcentral railbelt area), Alaska pre-construction planning.

PASSED AND APPROVED THIS 9th DAY OF October 1975.

Presiding Officer

ATTEST:

10/15/75

Re: Susitna River Dams

Dear Col. Debelius,

It is my opinion that the dams should be built, after sufficient study to determine they will be safe. The concern for environment should be secondary.

As long as our population increases, a "growth" economy must exist. Growth needs energy, and renewable sources are much preferred to non-renewable ones.

The ducks and moose are just going to have to take "hind teat" until people stop proliferating, which is a ways down the pike.

Sincerely,
TRSlaton, P.E.

STILLWATER CLINIC
BOX 8
COLUMBUS, MONTANA

October 21, 1975

Alaska District Corp of Engineers
Anchorage, Alaska
99500

Re: Upper Susitna Basin Hydro-Electric Power Development.

Dear Sirs:

It comes to my attention that a power development including a dam or several dams in the upper Susitna and Devil's Canyon is still being proposed. It is my feeling that very little thought has been given to the environmental impact that such a project would have, and the permanent loss of some tremendous river floating and boating in the future years. This particular stretch of river is as magnificent, as far as rivers go, as McKinley is when one considers its relationship to other mountains. I feel that any measure to change or deface this river should be as carefully considered as would a proposal to change or deface Mount Mc Kinley.

I wish you would enter this statement in the hearing record as evidence that there is strong opposition to the Devil's Canyon Dam that will permanently destroy the marvels of this canyon.

Sincerely yours

C.H. Swanson Jr., M.D.

C.H. Swanson Jr..M.D.

CHS/ch

Greater Anchorage

CHAMBER of COMMERCE

Crossroads of the Air W

October 22, 1975

Colonel Charles A. Debelius
District Engineer
Corps of Engineers
P.O. Box 7002
Anchorage, Alaska 99510

Dear Colonel Debelius:

On behalf of the Board of Directors and membership of the Anchorage Chamber of Commerce, I wish to express our total support for the development of hydroelectric power in the Upper Susitna River area.

The Chamber would like to offer its services in helping to promote the construction of the Devil's Canyon and Watana dams as soon as possible. Please call on us for any further help we may provide.

Sincerely yours,

Loren H. Lounsbury

Loren H. Lounsbury
President

sww

Knik Kanoers & Kayakers, Inc.
3014 Columbia
Anchorage, Alaska 99504
17 November, 1975

Col. Charles A. Debelius, District Engineer
Alaska District, Corps of Engineers
Department of the Army
P.O. Box 7002
Anchorage, Alaska 99510

Dear Col. Debelius:

The Knik Kanoers & Kayakers wish to go on record as opposing the construction of any dams on the Susitna River. Such development would destroy a major wilderness whitewater river, termed "the biggest in North America" by its first paddler, Dr. Walter Blackadar.

In the 'fifties and 'sixties the Corps dammed a number of the nation's finest whitewater rivers in the name of "progress." Yet each new dam served only to spur on further profligate use of energy. In other words, these beautiful rivers were sacrificed to no useful purpose. Nowadays such economic boondoggles would never win approval, yet the Corps is attempting to start the same destructive, wasteful process here with one of the country's most spectacular, wildest, loveliest rivers. The Susitna must be left to run free for future generations.

Sincerely yours,

Ed Swanson
President

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Anchorage, Alaska

SOUTH CENTRAL RAILBELT AREA

UPPER SUSITNA RIVER BASIN

HYDROELECTRIC PROJECT

TWO DAM PLAN

October 1975

United States Department of the Interior

FISH AND WILDLIFE SERVICE
ALASKA AREA OFFICE
813 D STREET
ANCHORAGE, ALASKA 99501

OCT 10 1975

Colonel Charles A. Debelius
District Engineer
Alaska District
Corps of Engineers
PO Box 7002
Anchorage, Alaska 99510

Dear Colonel Debelius:

In response to your letter of March 10, 1975, this is our detailed report on portions of the Susitna River hydroelectric projects associated with the Southcentral Railbelt Area investigation. This report has been prepared in accordance with the Fish and Wildlife Coordination Act, 48 Stat. 401, as amended: 16 U.S.C. 661 et seq., and the National Environmental Policy Act of 1969 (P.L. 90-190; 83 Stat. 652-856). This report is limited to the selected two-dam plan, i.e., Devil Canyon and Watana Damsites on the Susitna River. The Denali damsite was deleted for several reasons, e.g., anticipated severe environmental problems, and the late planning schedule (1995). Further, there is not time within the allotted time frame to conduct a detailed evaluation and prepare a fish and wildlife plan for all three sites. Should the Denali proposal become a viable and imminent alternative the Service, in cooperation with the Alaska Department of Fish and Game, will prepare a detailed report on that project at a later date.

This report has been prepared in cooperation with the Alaska Department of Fish and Game as indicated by the appended letter of October 8, 1975, from Commissioner James W. Brooks, and by the National Marine Fisheries Service as indicated by their letter of October 8, 1975, from Regional Director Harry Rietze.

DESCRIPTION OF THE AREA

The Susitna River Basin lies in southcentral Alaska north of the farthest inland projection of Cook Inlet between latitudes 61° - 64° north and longitudes 146° - 153° west. Total drainage of the basin comprises about 19,300 square miles of relatively uninhabited lands. The basin is bordered on the south by the waters of Cook Inlet and the Talkeetna Mountains, on the east by the Talkeetna Mountains and the Copper River plateau, and on the west and north by the Alaska Range.

The main stem of the Susitna River from its source in the Alaska Range to its point of discharge into Cook Inlet is about 275 miles long. It flows southward from the Alaska Range for about 60 miles; thence, in a general westerly direction through the Talkeetna Mountains for about 100 miles, and then south for the remaining 115 miles to its mouth at the head of Cook Inlet.

Principal tributaries of the lower basin have as their origin glaciers high in the surrounding mountain ranges. These streams are for the most part turbulent in the upper reaches and slower flowing in the lower regions. Most of the tributaries carry a heavy load of glacial silt.

The Yentna River, one of the largest tributaries, begins in the mountains of the Alaska Range, flows in a general southeasterly direction for approximately 95 miles, and enters the Susitna River 24 miles upstream from tidewater. Alexander Creek, Deshka River, Montana, Goose, Sheep, Caswell, Little Willow, and Willow Creeks are major clear water tributaries on the Susitna River.

The Talkeetna River has its origin in the Talkeetna Mountains. It flows in a westerly direction and discharges into the Susitna River 80 miles upstream from tidewater.

The Chulitna River heads in the Alaska range and flows in a southerly direction, joining the Susitna River opposite the Talkeetna confluence.

Principal tributaries of the upper Susitna drainage are the Oshetna, Tyone, and Maclaren Rivers. The Oshetna and Maclaren Rivers are usually turbid, but have numerous feeder streams that drain many clear-water lakes.

Stream flow in the Susitna Basin is characterized by a high rate of discharge from May through September and by low flows from October through April. High discharges are caused by snow melt, rainfall, and glacial melt. Streams carry a heavy load of glacial silt during the summer. During the winter when low temperatures retard water flows, streams are relatively silt free.

The Alaska Range to the west and north, and the Talkeetna Range to the east make up the high perimeter of the lower Susitna River Basin. The Alaska Range is made up of sedimentary rocks, some of which have been metamorphosed and intruded by granitic masses. The Talkeetna Mountains are primarily granitic. The floor of the lower basin is largely covered with glacial stream deposits.

The upper basin, predominantly mountainous, is bordered on the west by the Talkeetna Mountains, on the north by the Alaska Range, and on the south and east by the flat Copper River plateau. Valleys are floored with a thick fill of glacial moraines and gravels.

Climate of the Susitna Basin is rather diversified. Latitude of the region gives it long winters and short summers with great variation in the length of the daylight between winter and summer.
The lower Susitna Basin owes its relatively moderate climate to the warm waters of the Pacific on the south and the barriers of surrounding mountains. Summers are characterized by moderate temperatures, cloudy days, and gentle rains; winters are cold and the snowfall is fairly heavy. Talkeetna, representative of the lower basin, has an annual mean temperature of 33.2°F., and an average annual precipitation of 28.85 inches.

The upper Susitna Basin, separated from the coast by high mountains, has a somewhat more severe climate than the lower basin. The nearest weather station at Mount McKinley Park has an annual mean temperature of 27.5°F., and annual precipitation of 14.44 inches.

Spruce, birch, aspen, cottonwood, willow, and alder are found throughout the lower basin up to about 2,000 feet. These are interspersed with low muskeg vegetation on the floor of the basin and grassy meadows on higher benches. Understory of timbered areas consists of moss, ferns, high and low bush cranberry, devil's club, wild rose, blueberry, currants, grass, and wildflowers. Above timberline, thickets of alder and willow occur interspersed with grassy meadows. Above this zone vegetation consists of moss, lichens, and wildflowers.

Spruce occurs throughout the upper basin up to the 2,500 to 3,000 foot timberline. Low, scrubby, black spruce grows on the poorly drained bottomland, while the larger white spruce is found on better drained sites. Dwarf birch is distributed throughout the upper basin, and willow occurs along water bodies. White birch and alder occur in limited amounts. The understory includes blueberry, low-bush cranberry, Labrador tea, crowberry, fireweed, mosses, and lichens. Muskeg is interspersed throughout the bottomland and tundra is present throughout better drained areas.

Within the project area of influence is Mount McKinley National Park, which lies some 50 miles to the northwest of Devil Canyon. The Park contains about 3,030 square miles and is the second largest park in the national park system, exceeded in size only by Yellowstone National Park. It was created by an act of Congress in 1917 and has as one of its objectives the protection of the great herds of mountain sheep and caribou in this portion of the Alaska Range. Mount McKinley, the highest mountain in North America, is the principal scenic feature of the park. This lofty peak rises 20,320 feet above sea level, and soars some 17,000 feet above the surrounding forested plateau; it is the only mountain in the world to rise so high from its own base.

Human population of the basin is chiefly concentrated along the railbelt with trappers and miners utilizing the entire basin. The proposed project is located approximately midway between Anchorage and Fairbanks, the two largest cities in the State. It is estimated that these two areas contain about 226,500 people or approximately 75 percent of the entire State's population.

Until 1971, the Alaska Railroad was the only overland means of transportation through the lower Susitna River Basin. The recently constructed Parks Highway now parallels the railroad. The Denali Highway passes through the headwater portion of the upper Susitna Basin. Although other secondary roads are being developed, access to remote areas is still possible only by air and boat travel.

Economic activities are chiefly centered in the lower 100 miles of the basin along the railbelt. The commercial fishery utilizing the Susitna salmon runs is located in Cook Inlet. Placer and lode gold, tungsten, and construction materials are produced in this lower area, but only in limited quantities. Coal and other minerals are present and are receiving more attention as demand increases. Much of the basin is under lease by oil interests. Portions of the lower basin are suited for agriculture and forest industries, which still await full development.

DESCRIPTION OF THE PROJECT

Devil Canyon: The dam, rising 635 feet above its foundation and 565 feet above the normal water surface of the river, will be of a concrete-arch design at river mile 134. It will have a crest length of 2,475 feet. The reservoir created by the dam will have a surface area of 7,550 acres and inundate the Susitna River bed 28 miles upstream to near the Watana damsite.

Watana: The Watana structure would be a rock fill dam rising 810 feet at river mile 165 and would have a crest length of 3,450 feet, at an elevation of 2,200 feet m.s.l. The structure would create a reservoir with a surface area of 43,000 acres and will inundate about 54 miles of the Susitna River. Preliminary reservoir data are shown in Table 1.

Table 1. Pertinent Dam and Reservoir Data[1/]

	Type of Const.	Crest Length	Struct. Height	Norm. Pool elevation m.s.l.	Surface acres	Storage (ac/ft.)	Miles of river inundated
Devil Canyon	concrete thin-arch	2,475	635	1,450	7,550	1,050,000	28
Watana	rockfill	3,450	810	2,200	43,000	9,400,000	54

1/ Both structures are designed to withstand an earthquake of 8.5 on the Richter scale with an epicenter factor of 40 miles.

Distribution of the power would require a transmission line from Watana to Gold Creek where it would be split. The Anchorage route would parallel the Susitna River to the Nancy Lakes area, thence due south to Point MacKenzie. The Fairbanks corridor would run north from Gold Creek to Chulitna at which point it would generally follow the Parks Highway and Alaska Railroad to the existing substation at Ester. The transmission corridor would be about 334 miles in length. Average width would be 125 feet and total required right-of-way would be about 5,100 acres. (Transmission corridor data is set forth in Table 2).

Table 2. Transmission Corridor System

	To Anchorage	To Fairbanks
Double Circuit	136 miles 345 kv	198 miles 230 kv
Route	Southern	Northern
	Powerhouse - Gold Creek - SW along Susitna R., ARR - Talkeetna - E. bank Susitna R. - Nancy Lake area - S. to Pt. MacKenzie.	Gold Creek N. to Chulitna along Parks Highway, ARR thru Broad Pass, Nenana Canyon - Healy, then along existing line - Gold Hill - Ester.
Length	Devil Canyon-MacKenzie 140 mi.	Devil Canyon-Ester 200 mi.
	Devil Canyon-MacKenzie	Devil Canyon-Ester
Cleared right-of-way	140 feet	140 feet
Towers	Steel or aluminum	

Combined electrical production of both dams would be 6.1 billion kilowatt hours of firm energy annually. The two-dam system would also be capable of providing an additional .7 billion kilowatt hours of secondary electrical energy.

FISH AND WILDLIFE RESOURCES

Fishery

Sport: During the warmer months of the year, the Susitna River is silt-laden throughout its entire course due to its glacial origin. Sport fishing is thereby limited to the clear-water tributaries, sloughs, and areas in the main Susitna River near the mouths of these tributaries. Principal freshwater sport fishing species are salmon, rainbow and lake trout, Dolly Varden, and grayling. Other species of lesser importance are burbot and whitefish. The longnose sucker, sculpin, three-spine and nine-spine sticklebacks are present in the river but are generally not considered as important sport fishes.

Sport fishing pressure in the Susitna Basin immediately above the Devil Canyon site is relatively light, with the primary limitation being that of access. Many lakes and rivers afford landing sites for float-equipped aircraft, and fishermen using this method of transportation are frequently rewarded with good catches. The Alaska Railroad and the Parks Highway are the primary means of access to the lower basin. During the summer season, trains sometimes make unscheduled stops at streams along the way to accommodate photographers and fishermen. Completion of the Denali Highway in 1957 opened a small portion of the upper Susitna Basin to fishermen. The Tyone River, originating at Lake Louise and flowing northwest to the Susitna River, has increased in popularity with boat fishermen during the last ten years and is believed to support the largest winter burbot fishery in the state.

That section of the Susitna River downstream from Devil Canyon to its confluence with the Talkeetna and Chulitna Rivers is fed by a few clear tributary streams which furnish habitat for salmon, rainbow trout, grayling, Dolly Varden, and burbot. It is not known how extensively the main stem Susitna below the Devil Canyon damsite is utilized for spawning by these fish, but such usage is probably light due to the silt-laden water and the relatively muddy, sandy nature of the channel. Sport fishing between the damsite and confluence of the Susitna, Talkeetna, and Chulitna Rivers is limited to the mouths of the few clear-water tributaries. Lake trout are present in certain parts of the tributary drainages which contain deep lakes above the Devil Canyon site. The Devil Canyon impoundment area is a rugged, narrow canyon with several rapids and a few clear-water tributaries, the largest being Fog Creek and Devil Creek. Grayling, whitefish, burbot, suckers, and cottids occur in these tributaries and in the main river.

An economic survey conducted by Sport Fish personnel of the Alaska Department of Fish and Game on nine Susitna tributaries from Willow to Talkeetna indicated 21,153 anglers expended $255,092 in the Matanuska-Susitna and Greater Anchorage Boroughs during a brief 35-day salmon fishery. These figures and values are now several years old. Angling intensity has risen sharply since that time and the demand for recreational salmon angling is at an unprecedented level. These figures might easily double if a similar study were conducted at this time.

Commercial: That section of the Susitna River downstream from the Devil Canyon damsite to its confluence with the Talkeetna and Chulitna Rivers is fed by a few clear tributary streams which furnish spawning and rearing grounds for five species of Pacific salmon: sockeye (red); coho (silver); chinook (king); pink (humpback); and chum (dog). Portage Creek, three miles below the Devil Canyon damsite, is the uppermost tributary on the Susitna River where significant numbers of spawning salmon have been noted. Investigations conducted by the Fish and Wildlife Service intermittently from 1952 to 1975 failed to reveal the presence of adult or young salmon above the proposed Devil Canyon damsite. No actual waterfalls or physical barriers have been observed in or above the Devil Canyon area which would preclude salmon from utilizing the drainage area above the damsite. The most logical reason for the absence of salmon from the area, however, is the probability of a hydraulic block resulting from high water velocities for several river miles within Devil Canyon.

Twenty-seven spring fed slough areas adjacent to the main stream Susitna River between the Devil Canyon damsite and the confluence of the Chulitna River have recently been identified as being important for fish rearing. Adult spawning salmon have been recorded in 9 of the 27 sloughs. Rearing salmon fry have been observed in 17 of the sloughs. Additional slough areas are probably present in the same reach or further downstream. Adult spawning salmon have also been observed in nine-clear-water creeks.

Studies concerning both sport and commercial fisheries are currently being conducted under contract between the Alaska Department of Fish and Game and the U. S. Fish and Wildlife Service. Unfortunately, study results are not available for this report because of time restraints imposed on both agencies.

The Commercial Fisheries Division of the Alaska Department of Fish and Game provided the following estimates in Table 3 of maximum sustained yields (MSY) based on historical catch trends for salmon produced in the gill net districts of Cook Inlet, i.e. the area north of the latitude of Anchor Point.

It should be noted the figures shown in Table 3 and those following reflect only minimal estimates of value to commercial fishermen and do not include the equally important additional values related to 1) license revenues, 2) taxation of salmon case pack, 3) contribution to supportive services dependent upon commerical fishing industry, 4) investments in fishing gear, vessels, fishing sites, etc.

Of significant importance in the following information is the total omission of recreational or sport fishing values associated with the Susitna River salmon resource, which is of critical importance in the most densely populated area of the state. The same values for license revenue, taxation on sporting equipment, investment in fishing equipment, etc., apply to the recreational fishing industry, and could be added to the figures presented.

Table 3. Estimated Maximum Annual Sustained Yield (MSY)

Species (salmon)	Estimated Maximum Sustained Yield 1/
Sockeye	1,700,000
Chinook	66,000
Pink	1,800,000
Chum	700,000
Coho	300,000
Total MSY	4,566,000

1/ It should be emphasized that the MSY figures are the best <u>estimates</u> available at this time.

Based on the above "estimates" it is anticipated that the totals presented in Table 4 are produced annually in the Susitna River basin.

Table 4. Salmon Produced for the Commercial Catch in Susitna River Basin

Species (salmon)	Estimated Number of Fish Produced Annually[1/]
Sockeye	850,000
Chinook	59,400
Pink	1,530,000
Chum	630,000
Coho	210,000
Total	3,279,400

1/ Again, it should be emphasized that the total is the best estimate available.

Using average prices paid to commercial fishermen in 1975, the values to fishermen for their catch on an annual basis are presented in Table 5. Average prices per pound paid in 1975 for sockeye, chinook, pink, chum, and coho salmon were .63, .62, .36, .43, and .47 respectively.

Table 5. Average Annual Value to Fishermen[1/]

Species (salmon)	Production	Average Weight	Average Price/lb.	Value to Fishermen
Sockeye	850,000	6.1	.63	$3,266,550
Chinook	59,400	25.0	.62	920,700
Pink	1,530,000	3.9	.36	2,148,120
Chum	630,000	7.4	.43	2,004,660
Coho	210,000	6.1	.47	602,070
Total Annual Value to Fishermen				$8,942,100

1/ Based on average price per pound to fishermen in 1975.

The above value does not include, of course, the value of salmon it takes to produce the estimated catch produced in the Susitna Basin. Therefore we will address this problem by using estimated return by spawner by species using the 1975 price per pound paid to fishermen as presented in Table 6.

Table 6. Value of Salmon Spawning Stock

Species	Return/Spawner	Spawners1/
Sockeye	3.0:1	283,333
Chinook	1:1	59,400
Pink	3.8:1	402,632
Chum	2.2:1	318,182
Coho	2.2:1	136,364

Value of Spawners

Species	Avg. Wt.	Avg. Price	Spawners	Value
Sockeye	6.1	.63	136,364	524,046
Chinook	25.0	.62	59,400	935,550
Pink	3.9	.36	283,333	143,200
Chum	7.4	.43	402,632	1,012,454
Coho	6.1	.47	318,182	912,227
Total Average Annual Value of Spawners				$3,527,477

1/ Spawners needed to produce annual catches shown in Table 4.

WILDLIFE

General

The dominant wildlife vegetative cover throughout the Devil Canyon and Watana impoundment area is spruce. Low bottom land along the Susitna River and the tributaries supports black spruce-aspen stands. White spruce occurs on the steep side hills in conjunction with paper birch, black spruce, and occasional stands of aspen and cottonwood. Dwarf birch is present in the rolling country on each side of the sites, while willow occurs infrequently throughout the entire area. The understory includes blueberry, lowbush cranberry, narrow-leaved Labrador tea, cranberry, fireweed, mosses and lichens.

Game populations are limited in number along the steep walls of Devil Canyon which comprise most of the area to be flooded at that site. A few moose, black and grizzly bears are present. Segments of the Nelchina caribou herd periodically range throughout the impoundment areas, particularly the Watana site.

Beaver, present in sloughs along the Susitna River, are probably the most abundant furbearers. Other species of fur animals present include land otter, mink, wolf, lynx, marten, wolverine, and muskrat.

Hunting and trapping in the impoundment areas are virtually nonexistent due to inaccessiblity and rough terrain. This situation may change as the use of snowmobiles and all terrain type vehicles increases. The steep terrain and turbulent flow make crossing the Susitna River difficult for hunters.

Dall sheep frequent the Watana Hills area but none were observed during the period November 1974 to April 1975 when surveys for moose were conducted.

Within the transmission corridor system the area of greatest concern is the area which basically parallels the highway and Tanana River from Fairbanks to Big Delta. There are several historical Peregrine falcon nesting sites along the Tanana and Salcha Rivers. The gyrfalcon is also found in limited numbers in this general area. Several nesting pairs of gyrfalcons have been recorded from the Summit Lake region along the Denali Highway to the Cantwell-Healy area of the Anchorage-Fairbanks Highway.

Two species of big-game, i.e., moose and caribou, need to be addressed in detail. The Alaska Department of Fish and Game, under contract with the Fish and Wildlife Service, conducted monthly game surveys along the Susitna River drainage from November of 1974 until April 1975.

Moose: Monthly moose distribution data indicate that movements occur on a major scale (Fig. 1). During the November survey a majority of moose observed were found at higher elevations near the timber line. By late January they had become concentrated in the lower portions of drainages, including the Susitna River, and relied heavily on browse adjacent to the river (Fig. 2). They remained along these drainages at lower elevations until late April when they began dispersing, some moving back to higher elevations with the receding snow line.

Areas of preferred or critical winter range were delineated at both the Devil Canyon and Watana reservoir sites (Table 7). Classification of each area and boundaries for each area were determined by the relative density of cumulative moose tracks observed from early winter of 1974 until April 23, 1975. The classification categories were: (1) Light use - occasional tracks with little cratering, i.e., areas where snow has been pawed aside to obtain forage, (2) Moderate use - tracks and cratering but not dense, and (3) Heavy use - tracks dense and cratering extensive (Figs. 3 and 4).

Table 7. Preferred or Critical Moose Winter Range

Category of Use	Acres Inundated
Devil Canyon - up to elevation 1,450 m.s.l.	
Light	7,040
Moderate	5,760
Heavy	0
Watana - up to elevation 2,045 m.s.l.	
Light	0
Moderate	15,360
Heavy	18,560

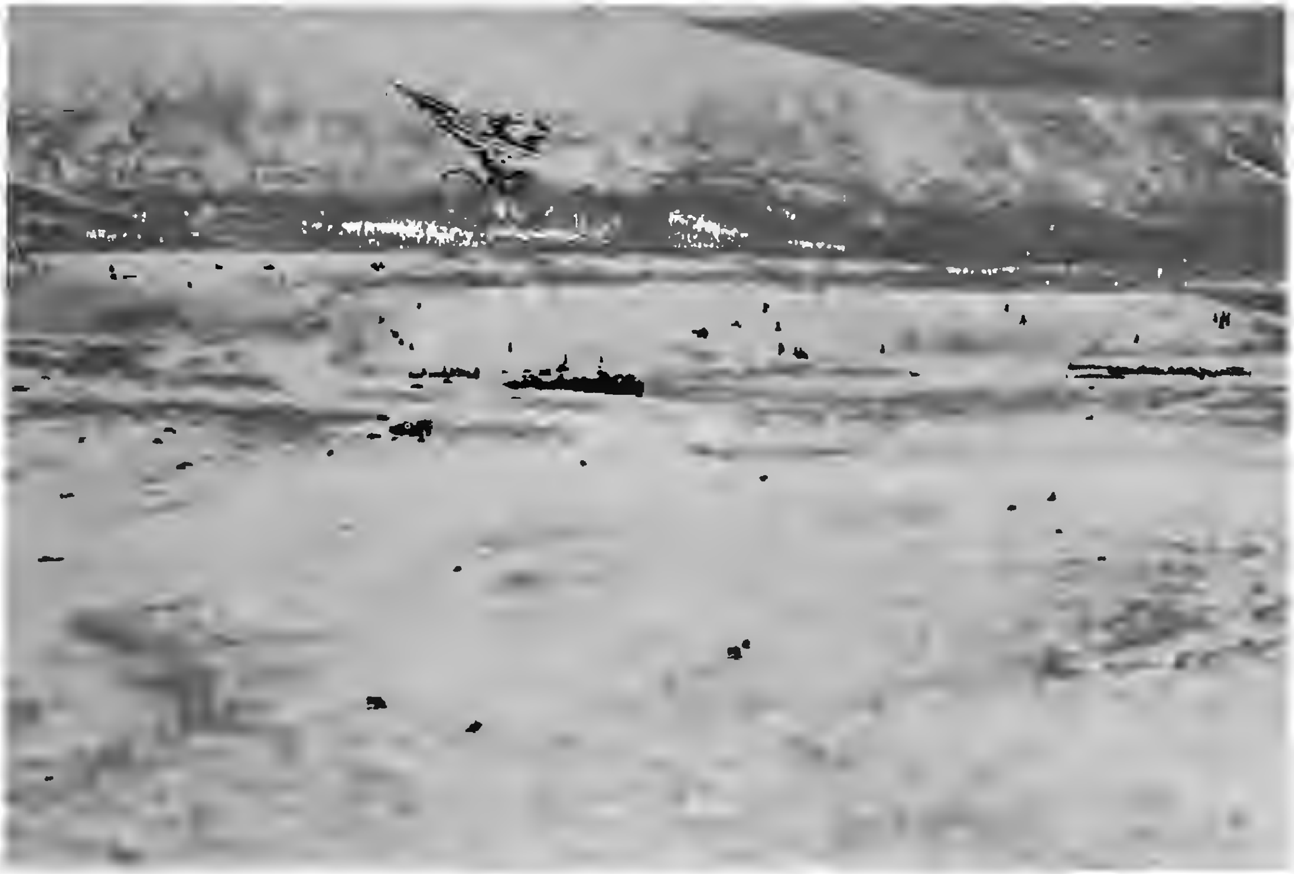

Photo by Ted Spraker, ADF&G
Winter 1974-75

Figure 1. Moose movement on a major scale resulted in the concentration of 43 moose along the Susitna River near Valdez Creek. Similar critical winter habitat exists in the Watana Reservoir site.

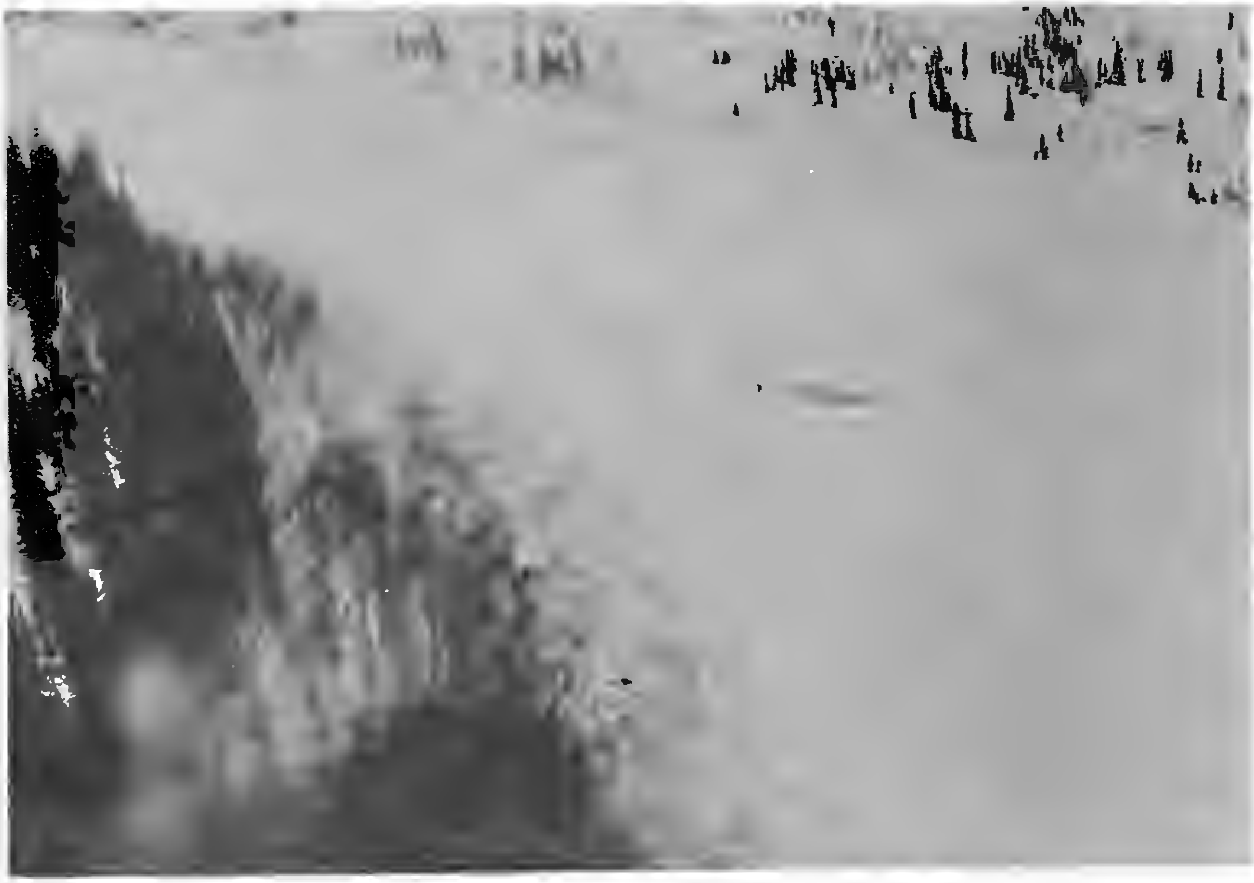

Photo by Ted Spraker, ADF&G
Winter 1974-75

Figure 2. Note heavy use of browse material along the left bank of the Susitna River.

Photo by Ted Spraker, ADF&G
Winter 1974-75

Figure 3. Close up view of moose "cratering", i.e., areas where snow has been pawed aside for forage.

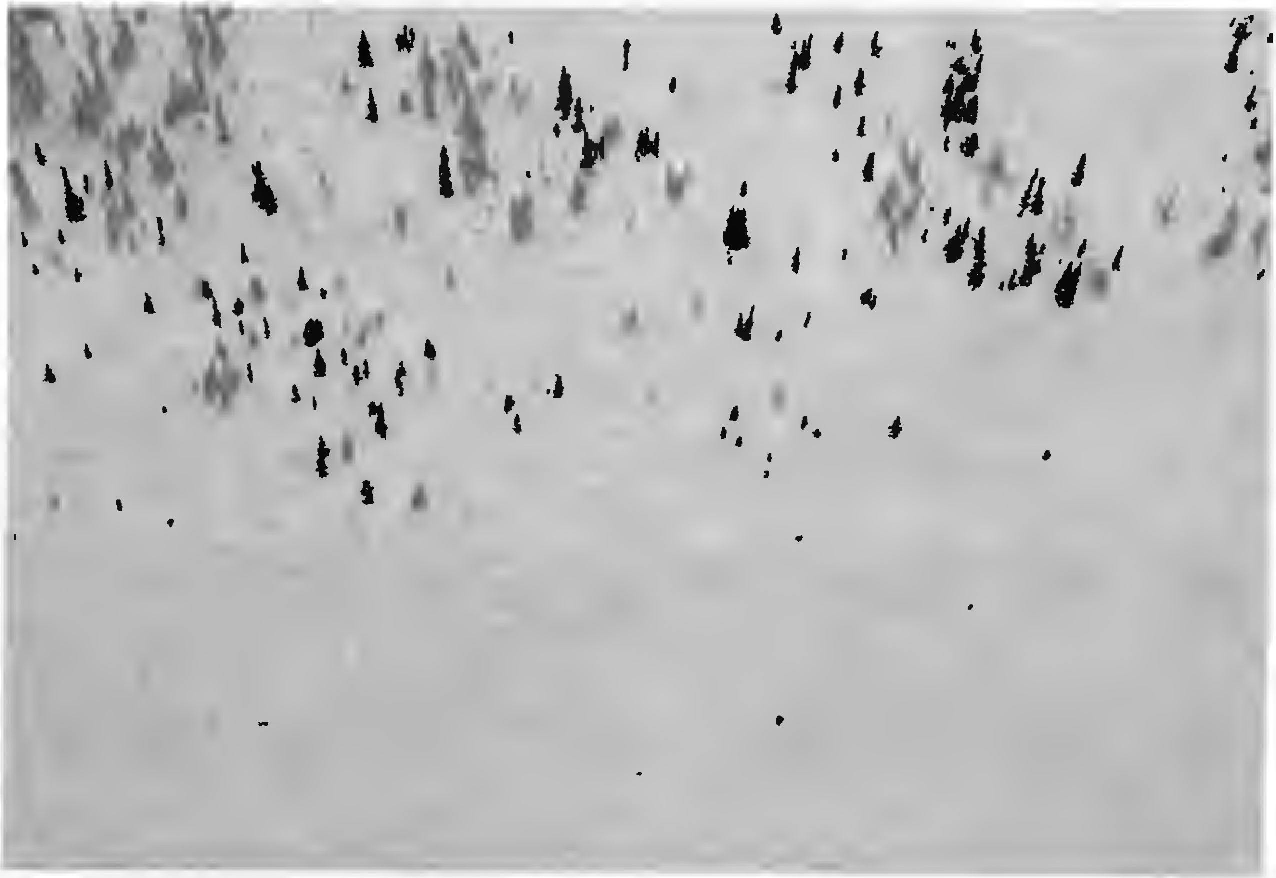

Photo by Ted Spraker, ADF&G
Winter 1974-75

Figure 4. View of typical area receiving heavy use by moose along the Susitna River. Note that tracks are dense and cratering is extensive.

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Wildlife: Devil Canyon and Watana Reservoirs will inundate moose habitat consisting of 7,040 acres which receive light use, 21,120 acres of habitat which receive moderate use, and 18,560 acres of habitat which receive heavy use. The moderate and heavy use areas are considered preferred or critical habitat.

Associated with loss of moose riparian browse sites through flooding, is loss of the passage ways between preferred areas if the water or ice level is fluctuated. This problem became apparent by midwinter observation of moose tracks along the Susitna River where animals traveled from one tributary to another (Fig. 5). Locations of moose concentration remained the same throughout the midwinter surveys, but trails indicated that individuals moved from one concentration to another frequently during the winter (Fig. 5). Figure 6 shows moose moving along the Susitna River near the confluence of the Oshetna River.

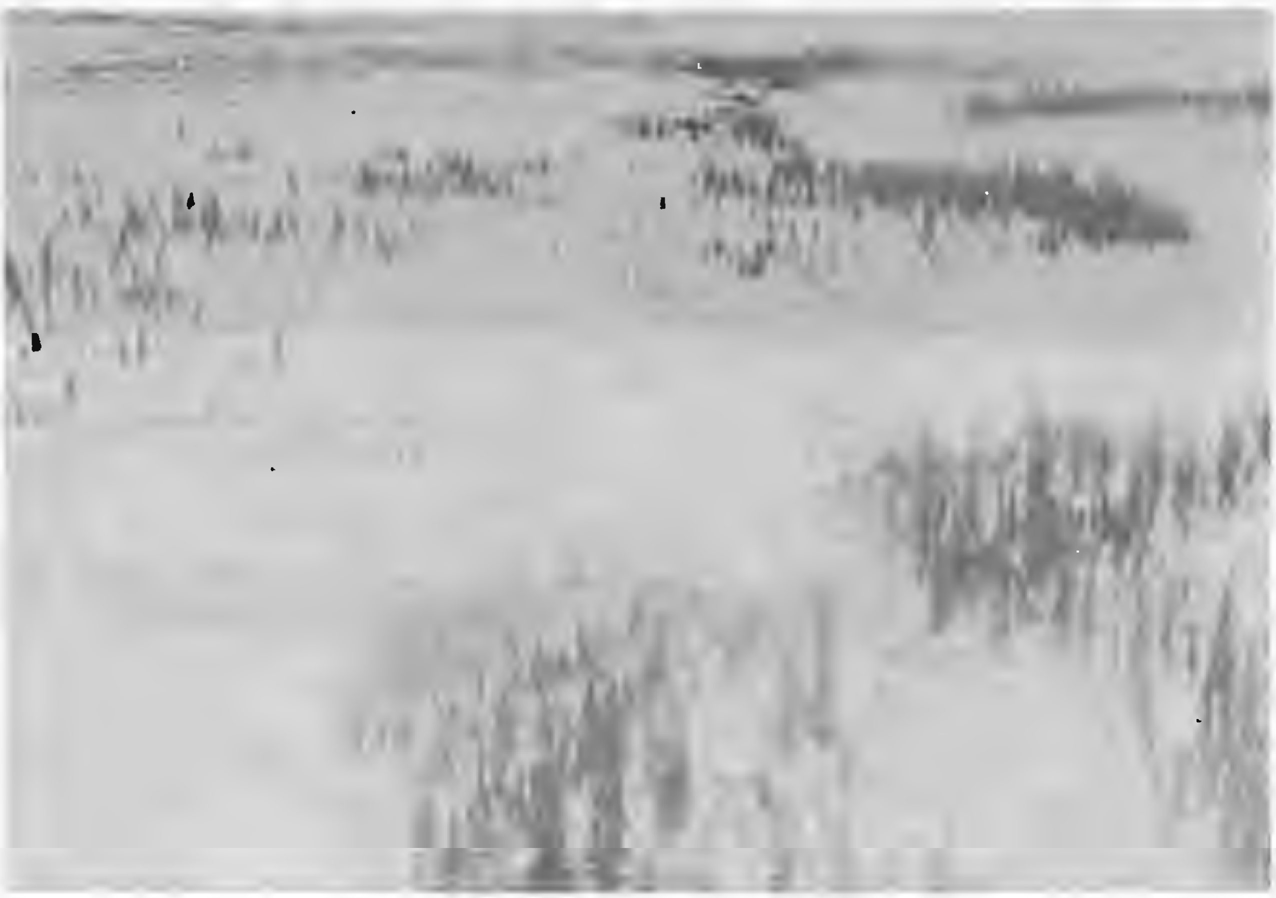


Photo by Ted Spraker, ADF&G
Winter 1974-75

Figure 5. Moose tracks across Susitna River indicate movement from one area to another. Note heavily browsed area on right bank.

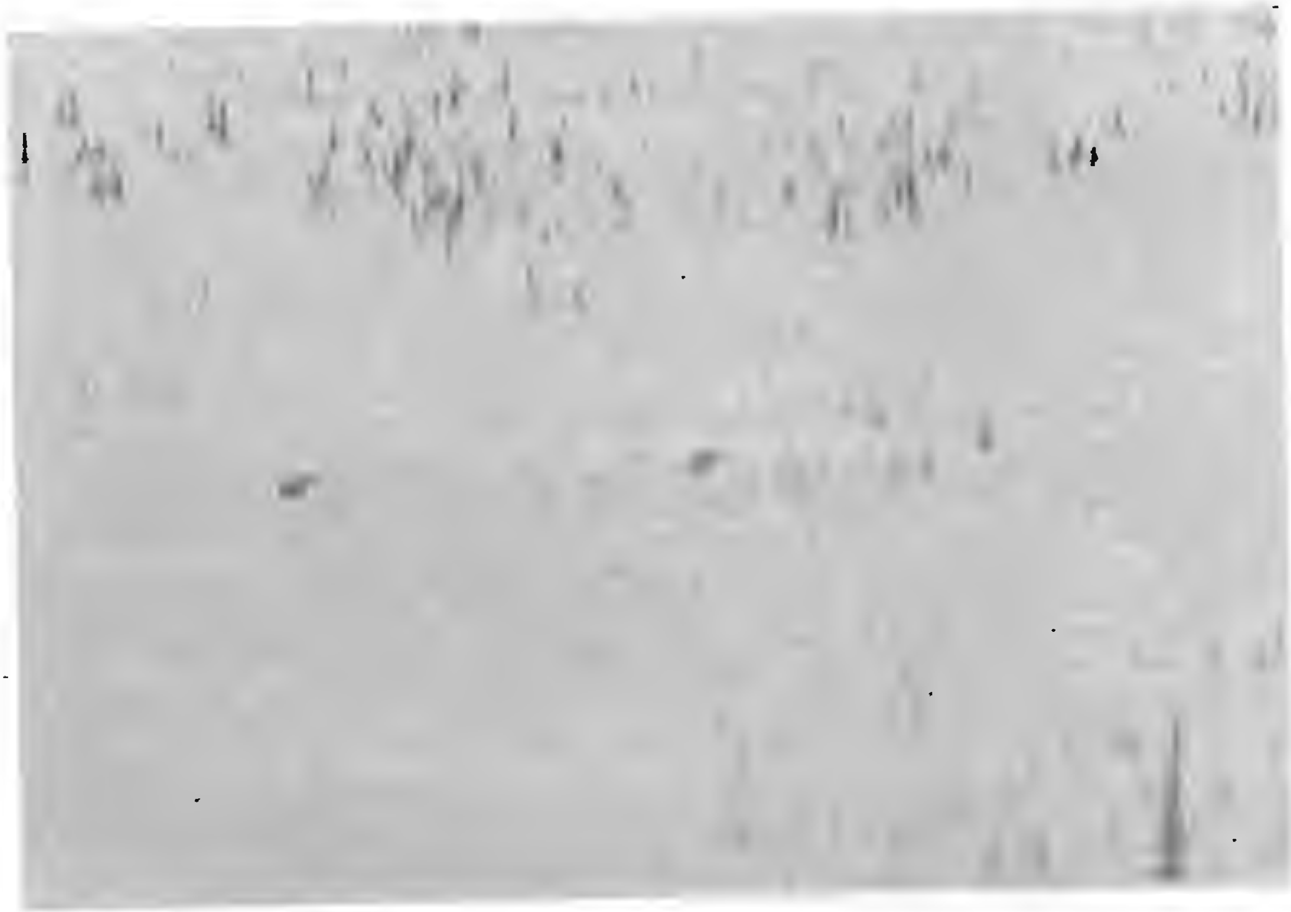


Photo by Ted Spraker, ADF&G
Winter 1974-75

Figure 6. Moose movement along the Susitna River near the confluence of the Oshetna River. This habitat area will be inundated by the Watana Reservoir.

The total acreages of moose winter range below elevations shown in Table 2 at the Devil Canyon and Watana sites by light, moderate, and heavy use categories are 7,040; 21,120; and 18,560 respectively.

<u>Caribou</u>: Use of the Watana Reservoir site by Nelchina caribou for grazing and crossing was minimal during the period November 1974 through April 1975. Deeply rutted caribou trails crossing the Susitna River north of Watana Mountain were observed. Caribou observed wintering north of the Susitna River during the November 1974 survey may have crossed the Susitna River to reach their traditional calving grounds near Kosina Creek. If observations had been made in May, June, July and August, it is likely an entirely different migrational pattern of major caribou crossings may have been indicated.

The use of the Susitna River in the vicinity of Devil Canyon and Watana damsites by Nelchina caribou for grazing and crossing was minimal during the period November 1974 through April 1975. Deeply rutted trails of historic crossing sites along the Susitna River were observed, however. Caribou seen wintering north of the Susitna River during the November 1974, survey may have crossed the Susitna River to reach their traditional calving grounds near Kosina Creek. Fluctuating water or ice levels associated with Watana Dam could disrupt movements across the Susitna River with unpredictable effects.

The Watana Hills Dall sheep herd was not observed close to areas that would be inundated by Watana reservoir. No direct effects on these sheep are expected, although indirect effects due to improved hunter access may well occur.

Increased hunting pressure on big game through creation of access corridors is a major effect foreseen by construction of these dams. Moose in the vicinity of the Devil Canyon and Watana Creek Dams are lightly hunted now because of poor access. Loss of the sanctuary area (the uninhabited, lightly-hunted core) of the Nelchina caribou's range may result in displacement of the herd from some of its essential habitat due to increased human activity on that habitat. Hunting regulations may be modified by the Alaska Department of Fish and Game. The road corridor plus limited river crossing area may prevent movements across the Susitna River. Improved access will result in increased harvest potential and the need for more intensive management.

Loss of winter range for moose, loss of the river corridor for moose movement during the winter, disruption of caribou movements by fluctuation of water/ice levels or transportation corridors, increased hunting pressure on all big game, and increased human activity on key caribou range are some of the problems that may result from construction of dams on the Susitna River. The Watana Dam and any other dams upstream will have substantial effects, while the Devil Canyon Dam will probably be mild in its impact on big game.

EFFECTS OF THE PROJECT ON FISH AND WILDLIFE RESOURCES

Fish: Devil Canyon and Watana Reservoir will inundate about 82 miles of the Susitna River and tributary streams which support existing populations of grayling, Dolly Varden, whitefish, burbot, suckers, and cottids. Grayling and Dolly Varden are found primarily in clear water areas where tributaries join the Susitna River. It is anticipated that both Devil Canyon and Watana Reservoirs will be turbid. Stream fishing potential and production on inundated portions of these tributaries will be eliminated. It is unknown at this time if significant fisheries can be developed in the reservoirs because of the anticipated turbidity and glacial characteristics of the water in the Upper Susitna Basin. Devil Canyon Reservoir affords the best opportunity for the development of a sport fishery as it will be less turbid and more stable than the Watana Reservoir.

A significant portion of the salmon found in Cook Inlet utilize the Susitna River and its tributaries below the Devil Canyon damsite for spawning and rearing. At the present time the Susitna is relatively clear in the winter and turbid in the summer. With the project in operation, the river is expected to be more turbid in the winter and less turbid in the summer. Other changes expected with the project which may have an adverse impact on fish resources including mortality are: (1) altering the natural seasonal flow (reduced summer flows and increased winter flows), (2) changes in natural seasonal water quality (the possibility of supersaturation of certain dissolved gases such as nitrogen as a result of spillage), (3) dewatering of the clearwater sloughs adjacent to the river), (4) thermal changes, and (5) increased winter turbidity with attendant adverse impacts on resident and anadromous fish movement into the mainstem of the Susitna River.

It is anticipated that with the project in operation fishing pressure on the Susitna River below Devil Canyon Dam may increase. Sufficient operational data are not available at this time to determine the magnitude of releases, and the resulting fluctuations in river flows. Conceivably, larger releases could create a hazard for fishermen and have an adverse impact on fish production. If later studies reveal such a possibility, the need for a downstream regulating facility should be considered.

The Susitna River salmon resource has been of economic value to a commercial fishery since the late 1800s. In more recent years, it has played an important additional role in providing extensive recreational fishing opportunity in Southcentral Alaska.

The degree to which these important industries can be affected is totally related to the possible degree of loss which may be incurred as a result of this project.

The possibility exists that some loss to the fishery resource could occur as a result of the project. Loss of Susitna River salmon stocks could contribute to losses of (1) taxes and license revenues, (2) economic hardship or loss of fish processing plants, (3) economic loss to fisherment, (4) loss of revenues by supportive services and businesses, (5) loss of capital investments as fisheries are restricted or closed, etc.

Most of these effects would be felt by both the sport and commercial industries. The potential loss to the economy of Southcentral Alaska through construction of this project could be many times greater than the estimated figures depicted on pages 10 and 11.

Wildlife: Devil Canyon and Watana Reservoirs will inundate moose habitat consisting of 7,040 acres which receive light use, 21,120 acres of habitat which receive moderate use, and 18,560 acres of habitat which receive heavy use. The moderate and heavy use areas are considered preferred or critical winter habitat.

Associated with loss of moose riparian browse sites through flooding, is loss of the passage ways between preferred areas if the water or ice level is fluctuated. This problem became apparent by midwinter observation of moose tracks along the Susitna River where animals traveled from one tributary to another. Locations of moose concentration remained the same throughout the midwinter surveys, but trails indicate that individuals moved from one concentration area to another frequently during the winter. Flow regulation below Devil Canyon Dam may create successional changes in the riparian browse areas with adverse effects to moose.

The use of the Susitna River in the vicinity of Devil Canyon and Watana damsites by Nelchina caribou for grazing and crossing was minimal during the period November 1974 through April 1975. Deeply rutted trails of historic crossing sites along the Susitna River were observed, however. Caribou seen wintering north of the Susitna River during the November 1974, survey may have crossed the Susitna River to reach their traditional calving grounds near Kosina Creek. As we pointed out earlier, if observations had been made in May, June, July and August, it is likely an entirely different migrational pattern may have been observed. Fluctuating water or ice levels associated with Watana Dam could disrupt movements across the Susitna River with unpredictable effects.

The Watana Hills Dall sheep herd was not observed close to areas that would be inundated by Watana Dam. No direct effects on these sheep are expected, although indirect effects due to improved hunter access may well occur.

Increased potential hunting pressure on big game through creation of access corridors is a major effect foreseen by construction of these dams. Moose in the vicinity of the Devil Canyon and Watana Creek Dams are lightly hunted now because of poor access. Loss of the sanctuary area (the uninhabited, lightly-hunted core) of the Nelchina caribou's range may result in stricter hunting regulations in order to properly manage the resource. The road corridor plus limited river crossing area may prevent movements across the Susitna River.

Loss of winter range for moose, loss of the river corridor for moose movement during the winter, disruption of caribou movements by fluctuation of water/ice levels or transportation corridors, increased hunting pressure on all big game, and increased human activity on key caribou range are some of the problems that may result from construction of dams on the Susitna River. The Watana Creek Dam and any other dams upstream will have substantial effects, while the Devil Canyon Dam will probably be mild in its impact on big game.

Birds: Bald eagles, golden eagles, owls, falcons, and various species of hawks are found throughout the entire Susitna River basin. The Fish and Wildlife Service conducted a survey in June of 1974 and found that the population densities of cliff-nesting raptors were low between the Devil Canyon site and the Oshetna River. Several nesting pairs of gyrfalcons and bald eagles were observed in or near the canyons of the upper Susitna River. No endangered species of peregrine falcons, arctic or American, are known to nest along the upper Susitna River, although peregrines have been sighted during migration periods in the Broad Pass and Chulitna River areas.

Unknown numbers of spruce grouse, willow ptarmigan, and rock ptarmigan are found within the project area. Songbirds, shorebirds, and other small birds are found throughout the entire Susitna River basin, but the project is not expected to have a serious impact on these resources.

Waterfowl of various species are found in small numbers along the Susitna River during the nesting season. The Susitna River drainages provide a migratory corridor. Impoundments created by Devil Canyon and Watana dams may provide concentration or resting areas for birds prior to their migration south.

PLAN OF DEVELOPMENT FOR FISH & WILDLIFE RESOURCES

Recommendations:

1. The project be designed, constructed and operated in such a manner as to provide water releases or a flow regime below Watana and Devil Canyon Dams of suitable temperature and water quality, to preserve existing downstream fish resources. Sufficient detailed hydraulic and biological information is not available at this time to determine the above requirements. Should the flow requirements and water quality needed to preserve the existing downstream fish resources not be obtainable or that the fish resources are lost as a result of the project construction or operation, artificial propagation facilities will be required at project cost. In the event that adequate natural reproduction fails to occur in the tributary streams to the reservoir areas, a stocking program will be required at project expense. Costs of appropriate studies, design, construction, operation and maintenance of the facilities should be authorized as a project cost. The design and location of the artificial propagation facilities should be developed cooperatively with the Fish and Wildlife Service, Alaska Department of Fish and Game, National Marine Fisheries Service and the Corps of Engineers. The facility would be operated by the Alaska Department of Fish and Game.

2. If fluctuations of discharge flows below Watana and Devil Canyon Dams create a public hazard or are detrimental to the maintenance of downstream fish resources, a regulating dam and reservoir will be required.

3. Provide safe and convenient access for fishermen to project facilities for recreational purposes.

4. The report of the District Engineer include the preservation, propagation and management of fish and wildlife resources among the purposes for which the project will be authorized.

5. Project lands be acquired in accordance with Joint Army-Interior Land Acquisition Policy for Water Resource Projects.

6. Leases of Federal land in the project areas reserve the right of free public access for hunting and fishing.

7. All project lands and waters at the Devil Canyon and Watana Reservoirs which are not designated for recreation, safety, and efficient operation be dedicated to use for fish and wildlife management in accordance with the provisions of a General Plan prepared pursuant to Section 3 of the Fish and Wildlife Coordination Act. These lands and waters should be made available to the Alaska Department of Fish and Game for management.

8. Detailed biological studies of fish and wildlife resources affected by the project be conducted jointly during pre- and post-authorization periods by the U. S. Fish and Wildlife Service, Alaska Department of Fish and Game, National Marine Fisheries Service, and the Corps of Engineers. These studies shall be allocated as a joint cost among project purposes.

9. The U. S. Fish and Wildlife Service and the Alaska Department of Fish and Game investigate portions of the Upper Susitna River Basin and other areas as replacement habitat for losses caused by the proposed project. The areas delineated should be covered by a General Plan prepared pursuant to Section 3 of the Fish and Wildlife Coordination Act. Operation, maintenance and replacement costs shall be authorized as a project cost.

10. A reservoir clearing plan and a reservoir recreational zoning plan be developed, as necessary, to insure that certain areas, or certain periods, are available for fishing, hunting, and other fish and wildlife purposes without conflicting uses. These plans shall be developed cooperatively by the U. S. Fish and Wildlife Service, Alaska Department of Fish and Game, Corps of Engineers, and Bureau of Outdoor Recreation.

11. To produce the least potential adverse impact on raptors, the transmission lines should be placed along the west side of the Parks Highway.

12. Section of road right-of-ways, borrow areas, and related construction operations be planned in cooperation with the U. S. Fish and Wildlife Service, Alaska Department of Fish and Game, Bureau of Outdoor Recreation, and the Corps of Engineers, so as to minimize damage to fish and wildlife and other recreational resources.

We request that the recommendations in this report be included in your report for authorization.

We appreciate the opportunity to comment on this project and should like to be notified of changes in project plans as they occur.

Sincerely,

Acting Area Director

STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

JAY S. HAMMOND, GOVERNOR

333 RASPBERRY ROAD
ANCHORAGE 99502

October 8, 1975

Gordon Watson, Area Director
Fish & Wildlife Service
U. S. Department of the Interior
813 D Street
Anchorage, Alaska 99501

Dear Mr. Watson:

The Southcentral Railbelt, Upper Susitna River Basin Hydroelectric Report prepared by your agency has been reviewed by this department.

The Alaska Department of Fish and Game concurs with the contents of the report, with minor exceptions.

We have compiled a list of suggested changes and/or corrections and submitted them directly to Mr. Ivan Harjehausen of your office through our Anchorage Susitna River project coordinator. Your attention to these comments is requested.

This department would once again like to emphasize the very great need for continuation of existing, and initiation of new studies, to further define the impacts to fish and wildlife.

If we may be of further assistance in finalization of your report, feel free to contact us.

Sincerely,

James Brooks, Commissioner
Department of Fish and Game

Larry J. Heckart

By: Larry J. Heckart
ADF&G Coordinator
Department of Fish and Game

LJH:mk

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
P. O. BOX 1668 - JUNEAU, ALASKA 99801

October 8, 1975

Mr. Gordon W. Watson
Director, Alaska Region
Fish and Wildlife Service
813 D Street
Anchorage, AK 99501

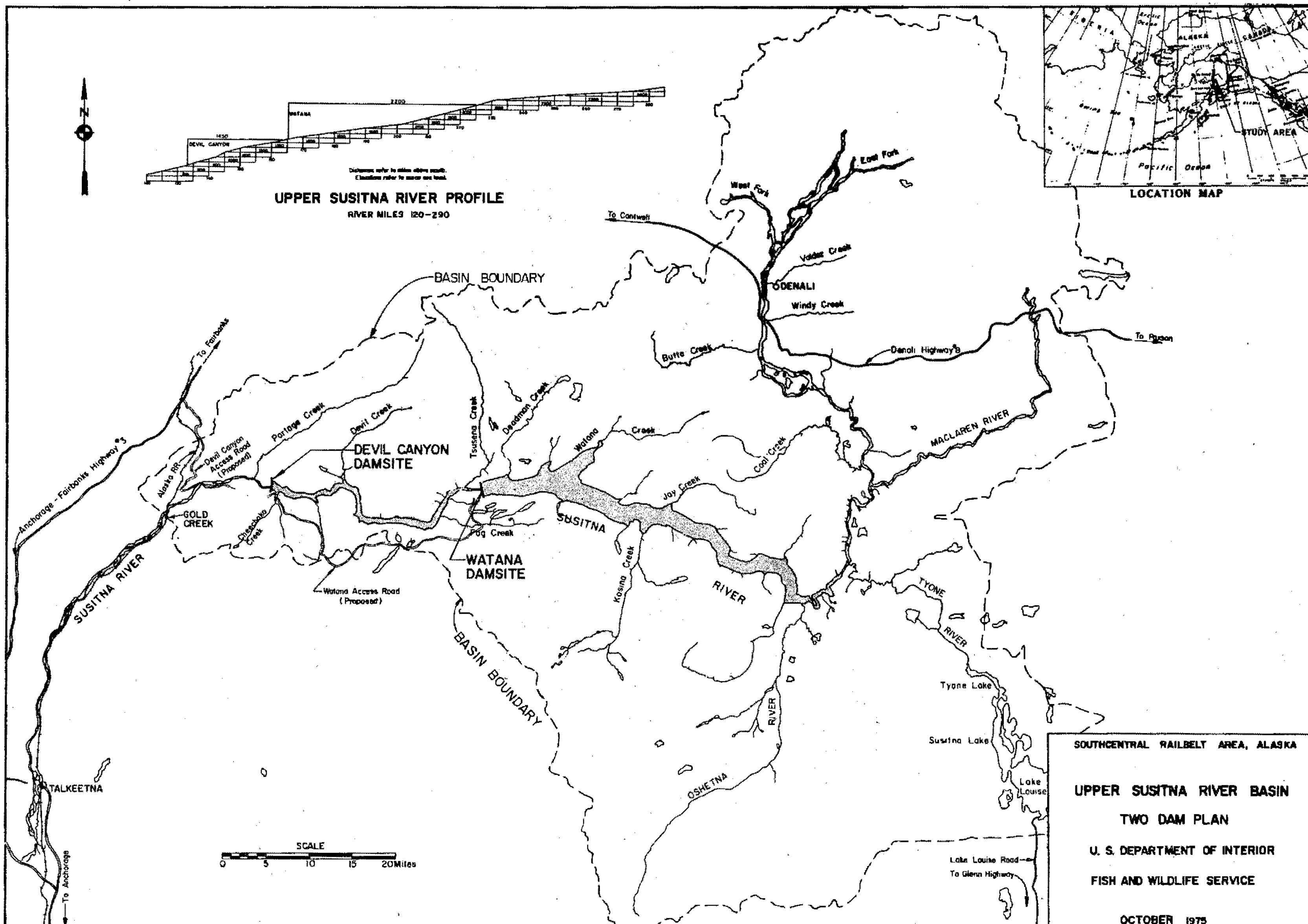
Dear Mr. Watson:

The National Marine Fisheries Service has received your draft final report "South Central Railbelt Area, Upper Susitna River Basin Hydroelectric Project, Two Dam Plan" for review and comment.

We concur with the recommendations as outlined in the "Plan of Development for Fish and Wildlife Resources." We note, however, that results of current studies concerning sport and commercial fisheries are not available for this report. We, therefore, expect to make later comments and offer further recommendations pending conclusion of these studies.

Sincerely,

for Harry L. Rietze
Director, Alaska Region



CORPS OF ENGINEERS BASE MAP

STATEMENT OF FINDINGS

HYDROELECTRIC POWER DEVELOPMENT
UPPER SUSITNA RIVER BASIN
SOUTHCENTRAL RAILBELT AREA, ALASKA

1. As District Engineer, Alaska District, U.S. Army Corps of Engineers, I have reviewed and evaluated, in light of the overall public interest, the documents concerning the proposed action, as well as the stated views of other interested agencies and the concerned public. My review and evaluation of alternatives have been in accordance with a resolution of the Committee on Public Works of the U.S. Senate adopted on 18 January 1972 directing that a study be made "...with particular reference to the Susitna River hydroelectric power development system, including the Devil Canyon Project and any competitive alternatives thereto, for the provision of power to the Southcentral Railbelt Area of Alaska."

2. The possible consequences of these alternatives have been studied for environmental, social well-being, and economic effects and for engineering feasibility. The alternatives were assessed and evaluated in light of national objectives related to regional and national economic development, and preservation and enhancement of environmental quality, in accordance with the Water Resources Council's Principles and Standards for water and related land resources planning.

3. In evaluation of the selected plan and other alternatives, the following points were considered pertinent:

a. Plan selection criteria. A basic premise utilized in the assessment and evaluation of alternative electrical generating facilities is that growth in electrical power demand will be as projected by the Alaska Power Administration. Their projected growth rates after 1980 are substantially below existing trends, and they also reflect an assumed substantial saving through increased efficiency in use of energy and implementation of electrical energy conservation programs; thus they are judged to be conservative. Another assumption is that required electrical power generation development from whatever source or sources will proceed to satisfy the projected needs. Also considered in the weighing of alternatives is that a plan must be technically feasible at the present time to be considered for initial development. After considering numerous alternative sources of power, those adjudged to be most competitive to hydropower were coal and gas or oil thermal generating facilities. My choice of the selected plan is based on the identification and evaluation of significant environmental, social, and economic effects associated with these and other alternatives, including that of no Corps action. These factors, plus engineering feasibility, were considered in arriving at the selected plan in preference to other alternatives. A final consideration in my choice of the selected plan is Public Law 93-577, passed by Congress on 31 December 1974, which establishes as national policy the conservation of non-renewable resources through the utilization of renewable resources, where possible.

b. Environmental considerations. All viable alternatives (those having existing technical feasibility, which provide long-term sources of power, and which would provide approximately equivalent amounts of electrical energy as the selected plan) would have some adverse impacts on the total human environment. Although adverse impacts related to coal would be of a different nature than those caused by hydropower, they would be significant, and in some respects, be less amenable to amelioration or mitigative efforts. However, the selection of a hydropower alternative does not preclude the possibility, or likelihood, that coal will be mined and utilized for exportation or as a supplemental source of power within the Railbelt area itself. Gas or oil would have less overall adverse environmental impact than coal and hydropower. However, long-range outlooks for availability and costs of oil and gas, and the possibility that higher and better future uses can and probably will be made of these resources, makes them economically and socially less desirable than coal or hydropower. This alternative was rejected largely on the basis of the national efforts to develop energy sources that limit the use of oil and gas for power generation. Significant impacts directly related to the selected plan include inundation of some 50,550 acres of land and 82 miles of natural stream (including 9 miles of a unique 11-mile reach of whitewater rapids) and associated wildlife and fishery habitat, creation of reservoirs perpendicular to caribou migration routes which lead between calving grounds and summer ranges, and changes in downstream flow regimen and water quality characteristics. The selected plan is determined to be environmentally acceptable in that it provides, from all the viable alternatives, the most favorable balance in the trade-offs between resources irretrievably lost and long-term benefits derived.

c. Social well-being considerations. A major consideration is the fulfillment of projected energy needs of a moderately growing population in the Southcentral Railbelt Area. Reliability and long-term benefits are considered to be essential to any plan of development. These conditions are more assured with coal and hydropower than they are with gas and oil. Without an intertie, a coal alternative would be less reliable than hydropower. Conservation of non-renewable resources is also viewed as a growing social concern. No other alternative considered would likely have less direct impact on existing manmade resources or developments than the selected plan. The remote, essentially uninhabitated project site and the lack of developed private property precludes the social disruption associated with displacement of people's homes, businesses, and institutions. Adverse social effects resulting from the plan include drastic modification of the existing natural visual quality of the area, physical disturbance of an essentially wilderness setting, changes in traditional recreational usage of the project area and surrounding lands, and influx of temporary construction workers on small communities near the construction sites.

d. <u>Economic considerations</u>. From an economic standpoint, the selected plan is estimated to provide the greatest net addition to national economic development of all alternatives studied. Additionally, the regional economy will be benefited during the construction period through the employment of a significant number of otherwise unemployed individuals.

e. <u>Engineering considerations</u>. All major alternatives considered are technically feasible, involving only existing technology, methods, and equipment to construct and operate. Of the hydroelectric alternatives, the selected plan utilizes the two damsites with the most favorable foundation conditions. Both dams are large, the Watana structure exceeding the height of the highest present earthfill structure in the Western Hemisphere. Major considerations in the design of the structures include the possible effects of high intensity earthquakes because the project site is in a zone of high seismic activity, outlet works to allow rapid and safe draining of the impoundments if, in spite of all design efforts, one or both of the structures is severely damaged to the point of imminent failure, and multiple level intake works providing for selective withdrawal of waters to allow control of downstream water quality in the interest of conserving or enhancing downstream fishery values.

f. <u>Other public interest considerations</u>. Close coordination has been maintained with other agencies, groups, and the general public throughout the study period. Results of a series of public meetings indicate general public support for the selected plan. However, vocal opposition in response to public review of the Draft Environmental Impact Statement has been expressed by some environmental groups and individuals. Notable among these are the Sierra Club, the Upper Cook Inlet and College Chapters of the Alaska Conservation Society, Knik Kanoers and Kayakers, Inc., and individual whitewater boating enthusiasts. Several Federal agencies, particularly the Bureau of Land Management, the U.S. Geological Survey, and the U.S. Fish and Wildlife Service have expressed views concerning the need for detailed environmental and geological studies prior to final determinations regarding project construction.

4. I find that the action proposed, as developed in accordance with the Principles and Standards established by the Water Resources Council and stated in the recommendations of the Interim Feasibility Report, is based on a thorough analysis and evaluation of various practicable alternatives which would achieve the stated objectives; that wherever adverse effects are found to be involved which cannot be avoided by following reasonable alternative courses of action to achieve the congressionally specified purpose, they can either be ameliorated, or are substantially outweighed by other considerations

of national policy; that the recommended action is consonant with national policy, statutes, and administrative directives; and that on balance the total public interest should best be served by implementation of the recommended plan.

CHARLES A. DEBELIUS
Colonel, Corps of Engineers
District Engineer

19 December 1975

I have reviewed the Statement of Findings and concur with the recommendations of the District Engineer.

24 Dec '75

Division Engineer Date

I concur in the preceding Statement of Findings.

7 Feb 1977

DRAKE WILSON DATE
Brigadier General, USA
Deputy Director of Civil Works