SUSITNA TRANSMISSION SYSTEM ENVIRONMENTAL ASSESSMENT

DRAFT

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

September 1975

Preface

The Alaska Power Administration is cooperating with the Corps of Engineers in their evaluation of Devil Canyon and other potential units of the Upper Susitna River Project under the January, 1972, study resolution by the U.S. Senate Public Works Committee. As requested by the Corps, and consistant with APA's planning and power market responsibilities, APA is providing the transmission system and power market analyses for the Corps studies.

Authorities for this work include Section 5 of the Flood Control Act of 1944 concerning 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.

This report is a preliminary environmental assessment for the project transmission facilities. It is being circulated in preliminary draft for informal comments; based on comments received, the draft will be modified and forwarded to the Corps for their use in preparation of the draft Environmental Impact Statement for the project.

This draft addresses only the proposed transmission facilities; it does not cover environmental impacts of the hydroelectric development and alternatives to hydroelectric development.

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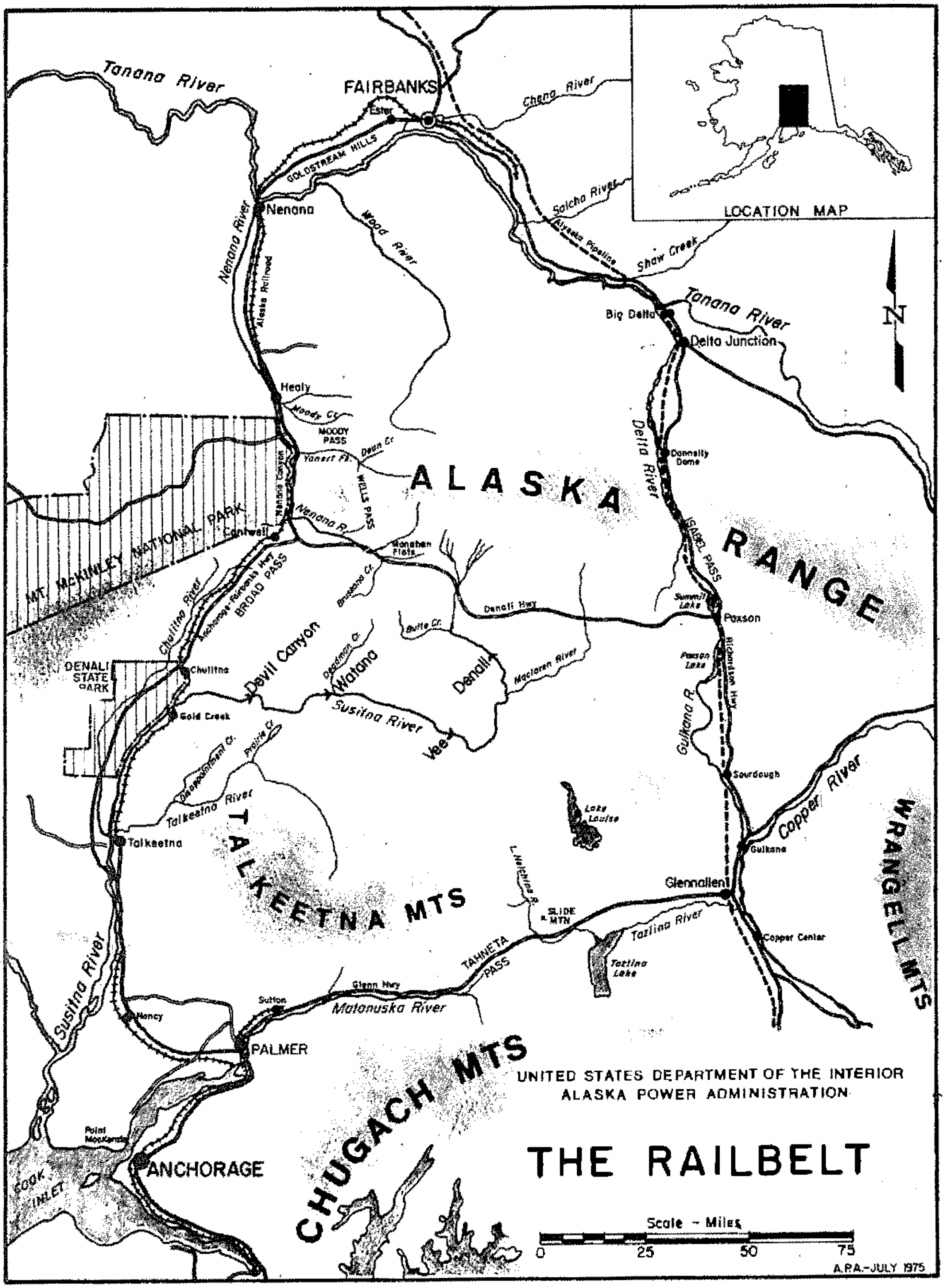
INTRODUCTION

Figure 1



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

INTRODUCTION

The transmission system studies for the Upper Susitna River Project are of pre-authorization 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, in 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.

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.

DESCRIPTION OF THE PROPOSED ACTION

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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 in 1986.

A subsidiary purpose in the construction of this line will be the interconnection of the two largest electric power distribution grids in the State of Alaska; this will result in increased reliability of service and lower cost of power generation.

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 voltage of the section from Devil Canyon to Anchorage is 345 kv and that of the section from Devil Canyon to Fairbanks is 230 kv. Both sections are double circuit and will require a cleared right-of-way of approximately 125 feet. 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.

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.

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 towers in special circumstances are shown on Figures 2 and 3.

In heavily forested areas, clearing will be done by brush blades on bulldozers and by hand removal of individual danger trees outside of the main cleared strip. Danger trees are those trees that may grow 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.

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.

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.

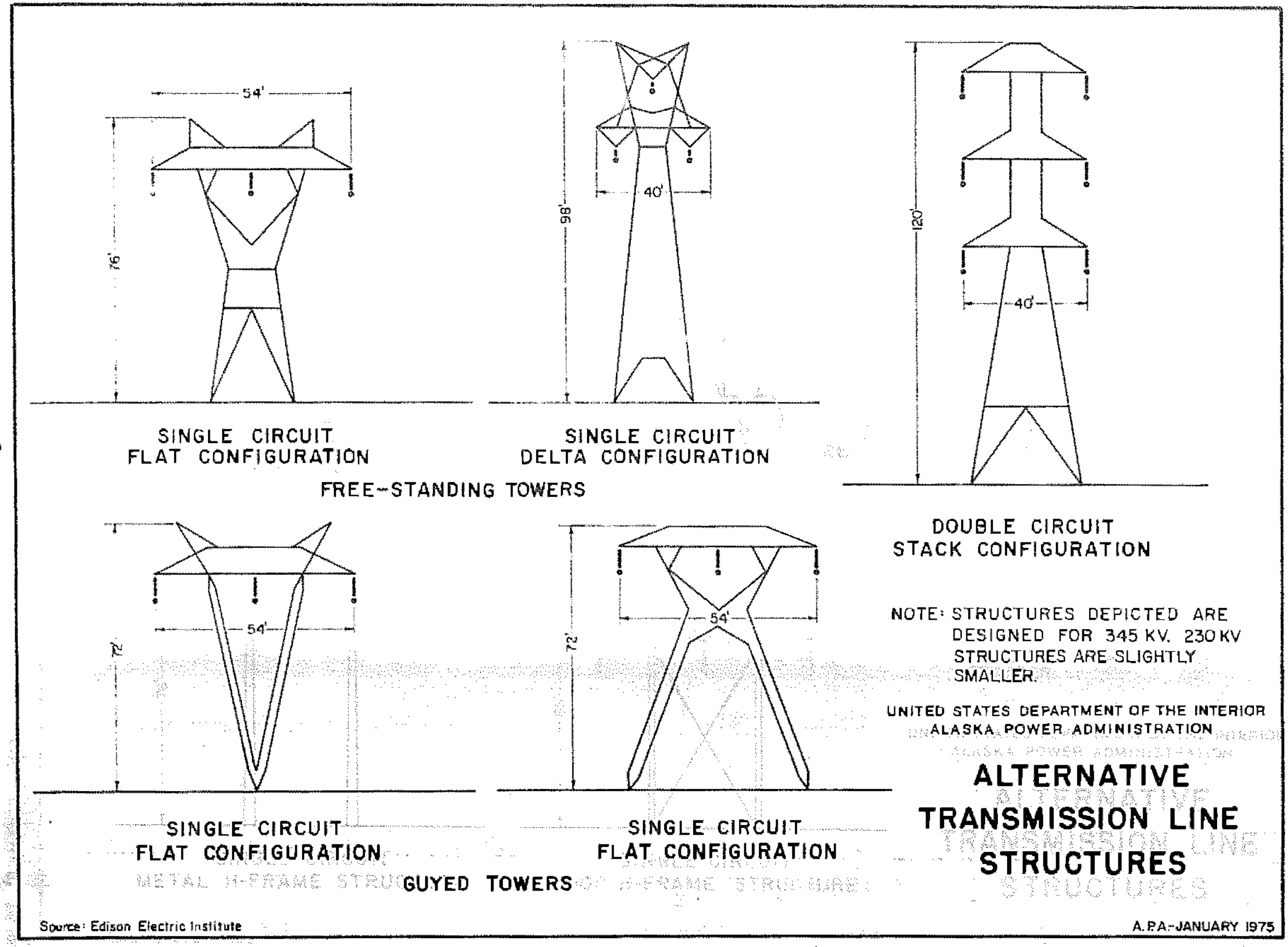
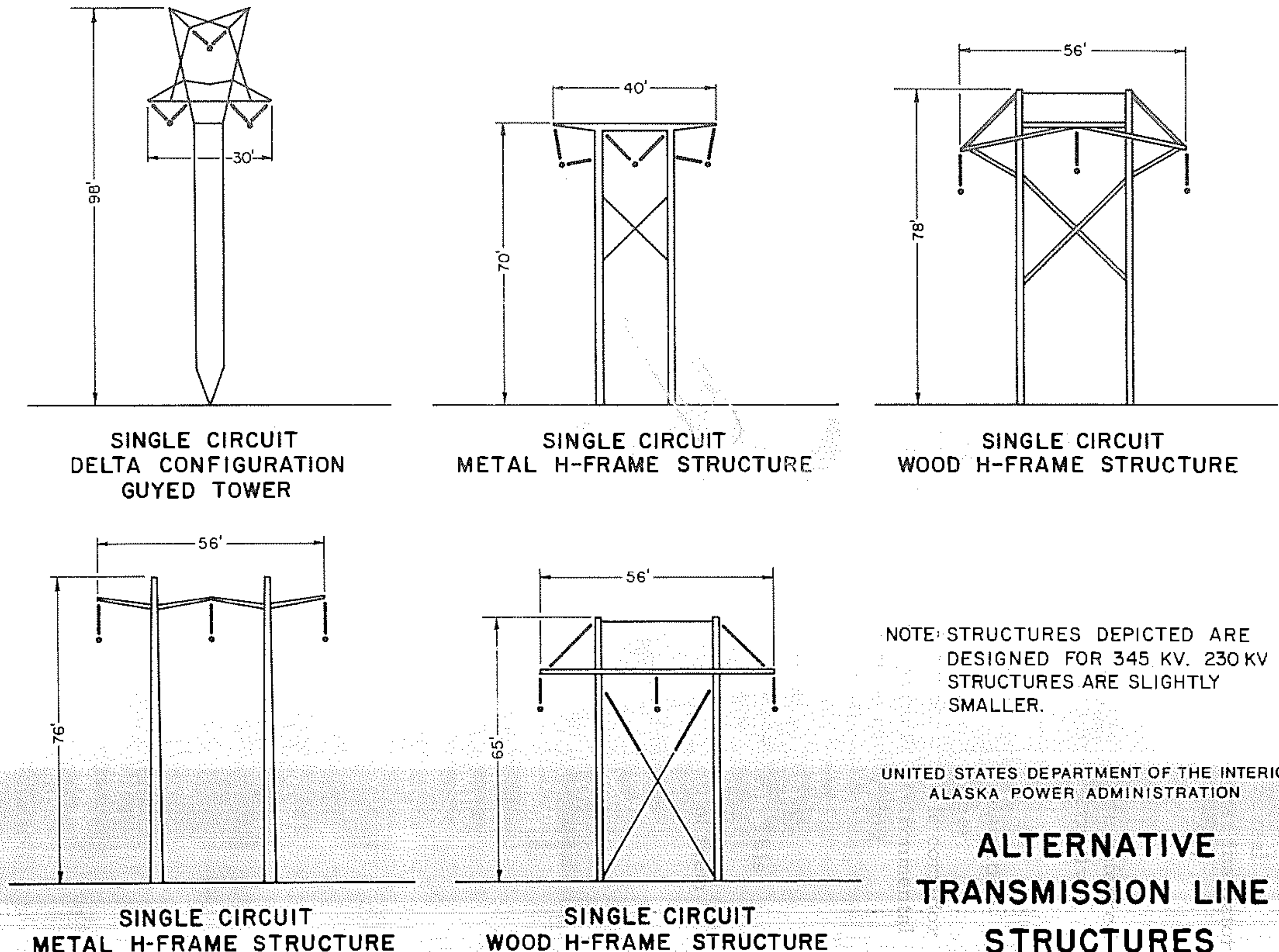

54'
76'
SINGLE CIRCUIT
FLAT CONFIGURATION
98'
40'
SINGLE CIRCUIT
DELTA CONFIGURATION
FREE-STANDING TOWERS
120'
40'
DOUBLE CIRCUIT
STACK CONFIGURATION
72'
54'
SINGLE CIRCUIT
FLAT CONFIGURATION
72'
54'
SINGLE CIRCUIT
FLAT CONFIGURATION
GUYED TOWERS
NOTE: STRUCTURES DEPICTED ARE DESIGNED FOR 345 KV. 230 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

Figure 2



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

Figure 3

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.

The following sections will discuss the proposed corridor and the alternative corridors equally; no differentiation will be made. This reflects the process by which the preferred corridor was chosen, in which no preference was given to any one corridor until all of them had been given equal consideration.

THE CORRIDORS

THE CORRIDORS

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.

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 Appendix II).

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 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).

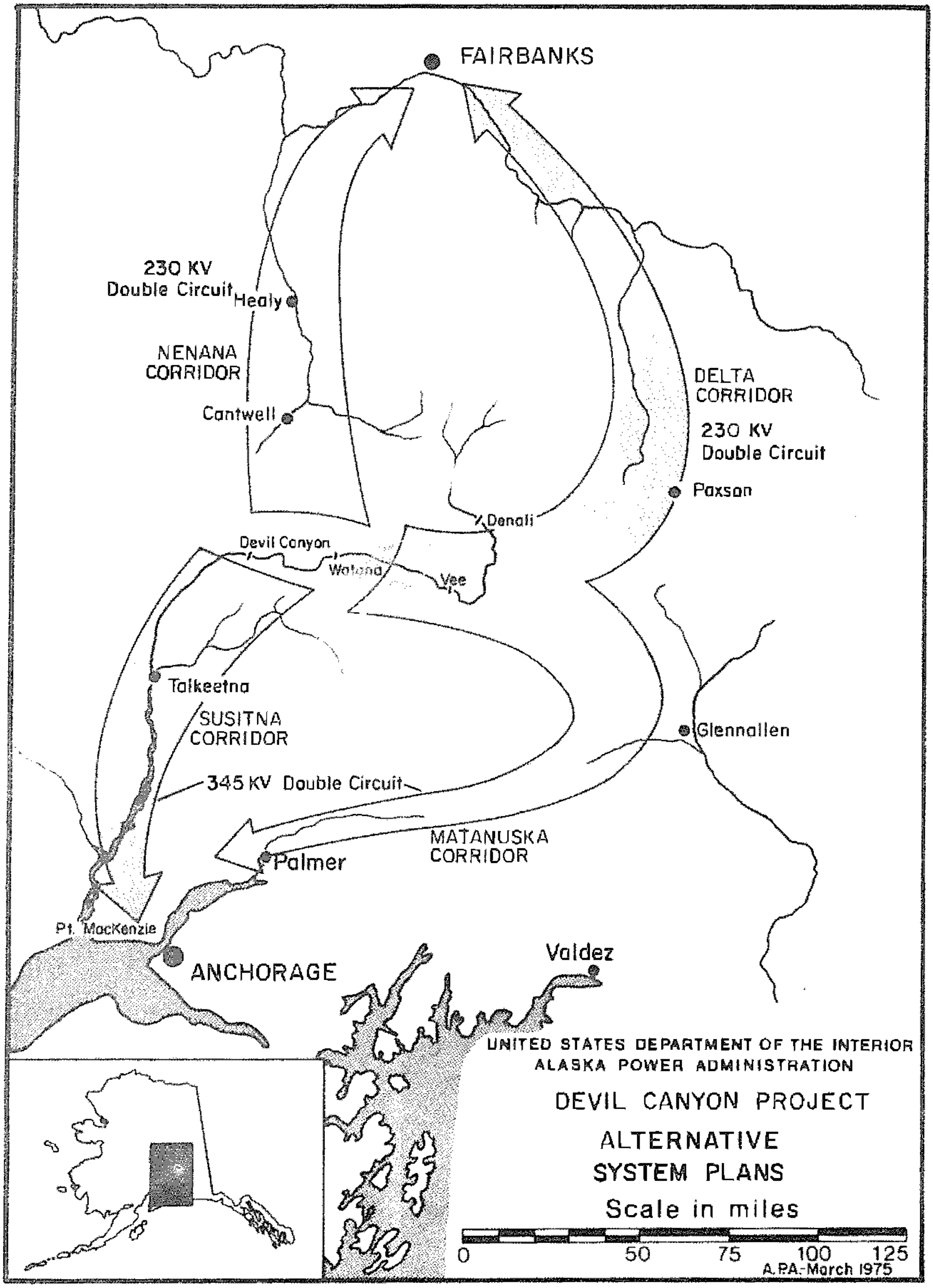
The next, and farthest west parallels the Anchorage-Fairbanks Highway through Denali State Park, along Troublesome Creek, eventually leading east to tie into Gold Creek and Devil Canyon-Watana (Susitna - 2). The third goes up the Talkeetna River and gaining the ridge to the east of Disappointment Creek,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

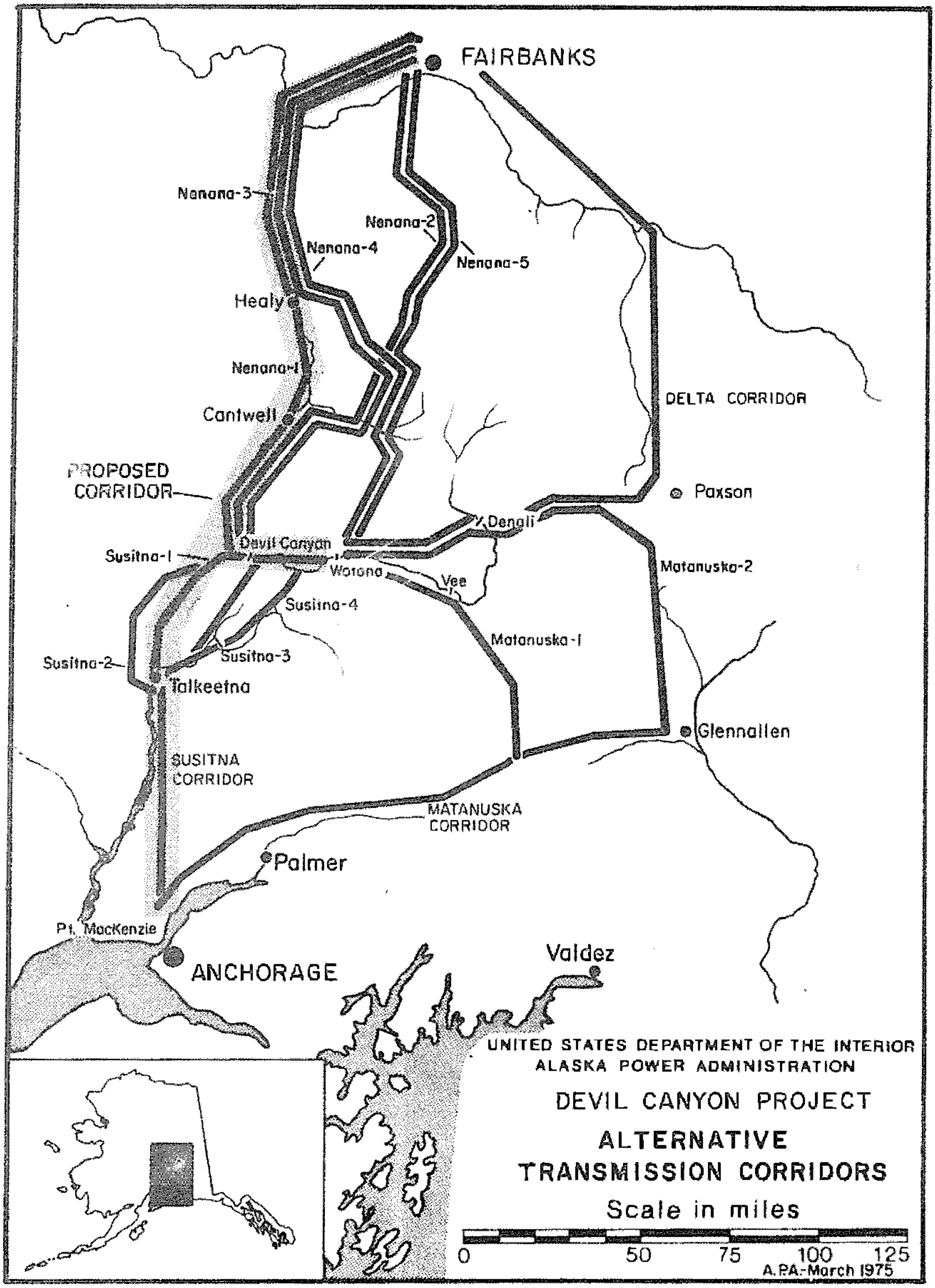
There are five feasible corridors connecting the Upper Susitna with Fairbanks by way of the Nenana River. The first is a corridor paralleling the highway and railroad from Gold Creek to Cantwell, to Healy, and to Fairbanks. This is the northern half of the preferred corridor (Nenana - 1, in Figure 5).

Figure 4



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

Figure 5


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 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).

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.

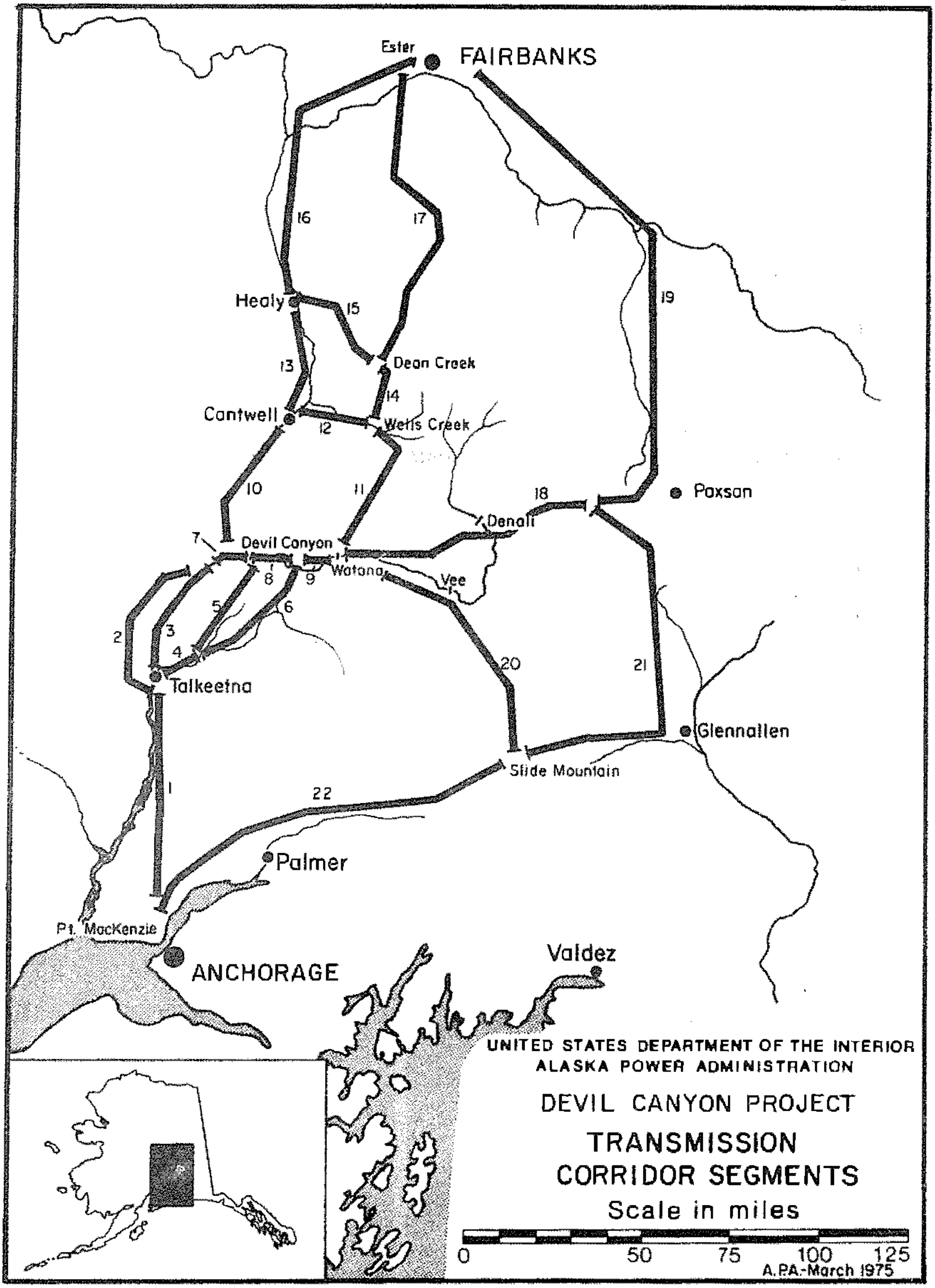
Matanuska Corridors

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.

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

Figure 6



FAIRBANKS
Ester
16
17
19
Healy
15
Dean Creek
13
14
Cantwell
12
Wells Creek
10
11
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.PA-March 1975

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 tabulated on 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. 33-35.

ENVIRONMENTAL ASSESSMENT OF CORRIDORS

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 Appendix I. The process from which the 22 corridor segments are derived is explained on pages 10 - 15.

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 a less-studied and less stable situation than soils, which are treated on a more detailed level. 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, descrepancies 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 McKinely 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.

	TOPOGRAPHY/GEOLOGY	SOILS	VEGETATION	WILDLIFE	CLIMATE	EXISTING DEVELOPMENTS	LAND OWNERSHIP/STATUS	EXISTING RIGHTS-OF-WAY	SCENIC QUALITY/RECREATION
Point MacKenzie - Talkeetna	84 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. Discontinuous permafrost. Poorly-drained fibrous peat soils, vulnerable to frost heaving 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.	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, vulnerable to heaving 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, penetrates Denali State Park.
Talkeetna - Gold Creek via Alaska Railroad (3)	38 miles. High point 900'. Vee 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 (railroad stops).	State selected land, borders on Denali State Park.	Parallels A.R.R.	Parallel east boundary Denali State Park.
Talkeetna River (4)	8 miles. 500' 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.

INVENTORY

	TOPOGRAPHY/GEOLOGY	SOILS	VEGETATION	WILDLIFE	CLIMATE	EXISTING DEVELOPMENTS	LAND OWNERSHIP/STATUS	EXISTING RIGHTS-OF-WAY	SCENIC QUALITY/RECREATION
Gold Creek - Cantwell (10)	62 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 trade.
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.	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. Shallow 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.	Mountain, most part 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.

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. Large areas are entire soils of lowlying type which is very vulnerable to frost heaving.	Lowland spruce-hardwood; upland spruce-hardwood, low brush bog and muskeg moist tundra.	Nelchina caribou herd (61,000 in 1967), 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 Mt. McKinley co-op. Management zone.	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 thaw; some containing lenses of fives. 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.	Big Delta bison herd fall range (200 animals), Dall sheep common on Alaska Range, black and grizzly bears, good duck habitat in sloughs and exbends of Chena and Salcha Rivers and morainal ponds of Donnelly Dome.	Interior.	Considerable settlement along highway near Fairbanks. Military bases, towns of Big Delta and Delta Junction, potential agriculture at Big Delta-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. Numerous 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 complex of recreational land. 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 here, 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 the IAHP type soils present.	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 small 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.

ENVIRONMENTAL ASSESSMENT OF CORRIDORS

The proposed corridor is a combination of the corridors Susitna-1 and Nenana-1. 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 two miles longer than the shortest corridor connecting Devil Canyon to Point MacKenzie 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 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.

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.

<u>Alternative Susitna-2</u>

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.

<u>Alternative Susitna-3</u>

Alternative corridor Susitna-3 is 134 miles long, 2 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 50 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 30 miles of moist tundra in additiona to 20 miles of upland spruce-hardwood.

Alternative Susitna-4

Alternative corridor Susitna-4 is 149 miles long, 13 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 65 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 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.

Alternative Nenana-3

Alternative corridor Nenana-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.

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 sheet 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 265 miles, 129 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.

Alternative Matanuska-2

Alternative corridor Matanuska-2 is 384 miles, 119 miles longer than Matanuska-1 and 248 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 216 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.

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 in 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 3000 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 occurs 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 s ıthwest 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.

ENVIRONMENTAL IMPACTS OF CORRIDORS

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 Appendix I. The process from which the 22 corridor segments are derived is explained on pages 10-15.

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 a less-studied and less stable situation than soils, which are treated on a more detailed level. 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.

IMPACTS

	SOILS	VEGETATION	WILDLIFE	EXISTING DEVELOPMENTS	SCENIC QUALITY/RECREATION
Point MacKenzie - Talkeetna	Dearth of suitable soil types on flood plain floor - most of area is poorly drained fibrous peat - vulnerable to frost heaving but with low erosion potential. Upland soils are well drained, but more susceptible to erosion. Permafrost is absent, discontinuous, or deeply buried, so thermal disruption is unlikely. No major river crossings are anticipated on this route.	Whole area is bottomland spruce-poplar, except for local muskeg, so considerable clearing is needed. Upland vegetation has a fast enough regrowth rate to warrant maintenance, poorly drained areas will probably need very 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 productivity of introduced brush and second growth. Harassment 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 but only adjacent to clearing.	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; however, this area lies within Denali State Park and is closed to hunting.	No existing developments - no impacts.	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)	Soils in northern part well drained, deep permafrost table; southern part poorly drained and susceptible to frost heaving. 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. Low impact otherwise.	Medium impact on scenic quality. Most traffic through this stretch is by A.R.R., and line can be hidden well from rail lines unless corridor is consolidated.
Talkeetna River (4)	Mixture of poorly drained soils susceptible to frost heaving and poor foundations, and 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.	No existing developments - no impacts.	Low impact on scenic quality. Line is not visible except from air. Wilderness quality somewhat impacted, but ease of concealment keeps impact low.
Disappointment Creek (5)	Low erosion potential but possible degradation or local permafrost. Soils well drained over most of route, shallow to bedrock. 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 to alpine tundra - damage to habitat could be severe (from fires, erosion).	No existing developments - no impacts.	Line will cross open alpine tundra for quite a distance, having high impact on wilderness quality. Impact on scenic quality is low due to inaccessibility.
Prairie Creek - Stephan Lake (6)	Most soils well drained gravels; some poorly drained areas near Stephen Lake. Few foreseeable impacts from erosion, siltation or permafrost degradation.	Heavy forest clearing needed on Talkeetna River valley with attendent maintenance and introduction of brush. 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. Access road will probably not be used by most hunters.	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)	Well drained gravel soils with low to medium erosion potential and deep permafrost table, if any. 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)	Well drained gravel soils with low to medium erosion potential and deep permafrost table, if any. 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. Plateau rate of 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.	No existing developments. Powersite withdrawal for Devil Canyon Reservoir. Possible use of edge of withdrawal for right-of-way.	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)	Well drained gravel soils and poorly drained soils with variable permafrost table. 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 is high brush, and low brush bay, neither of which 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.	No existing developments. Powersite withdrawal for Devil Canyon Reservoir. Possible use of edge of withdrawal for right-of-way.	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.

IMPACTS

	SOILS	VEGETATION	WILDLIFE	EXISTING DEVELOPMENTS	SCENIC QUALITY/RECREATION
Gold Creek - Cantwell (10)	Shallow slopes and gravelly soils will reduce erosion impact to low levels. 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)	Where the access road crosses shallow slopes, it has a high probability of crossing poorly drained loam with surface peat and shallow permafrost. Impact on permafrost in this case is high, and frost heaving is possible. Upland soils are well drained with deep permafrost, so 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.	No existing developments - no impacts.	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)	Shallow slopes and gravelly soils will reduce erosion impact to low levels. 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 entire 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 medium permafrost degradation susceptibility. Active fault near Healy; Denali Fault crosses near Windy. Crossing of Nenana River necessary.	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 GVED line at Healy.	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. Denali Fault crosses Wells Creek. Crossing of Nenana River necessary; 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.	No existing developments - no impacts.	Low impact to scenic quality due to the inaccessibility of this otherwise highly scenic area. 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. Active faults near Healy. Crossing needed on Healy Creek.	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.	Low impact to scenic quality due to the inaccessibility of this otherwise highly scenic area. High impact to wilderness quality except for lower Moody Creek (Vsibelli 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 fine-grain with and are highly erosive and susceptible to permafrost degradation and slope instability. Crossing of Tanana River needed.	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 of 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.	No existing developments - no impact.	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.

DELTA AND MATANUSKA CORRIDORS

IMPACTS

	SOILS	VEGETATION	WILDLIFE	EXISTING DEVELOPMENTS	SCENIC QUALITY/RECREATION
Watana to Paxson via Butte Creek (18)	Considerable areas of shallow permafrost table soils with consequent vulnerability to degradation. Low-lying areas are poorly drained and 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)	Soil varies from shallow continuous permafrost to frost free soils, with medium to high erosion potential. Soil in Delta Canyon very thin, so bedrock is easily reached for tower foundations. Thixotropic silts north of Summit Lake combined with seismic risk will have an effect on 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)	Continuous permafrost. Low areas poorly drained and vulnerable to heaving. Medium erosion potential. 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 of 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.	The probability of construction of Vee Dam is increased by routing a transmission line by the damsite.	Low impacts on scenic quality due to medium-high existing scenic quality of very inaccessible area. To the east towards Lake Louise, impact would be higher because of greater accessibility. Wilderness quality suffers since this would be a pioneer corridor.
Paxson to Slide Mtn. via Glennallen (21)	Continuous permafrost. Low areas poorly drained and vulnerable to heaving. Medium erosion potential. 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)	Matanuska Valley soils have medium to high erosion potential; impact from construction and access road can be high. Permafrost degradation is unlikely. Knik Arm soils have low erosion potential, so impact of construction and road will be low. Permafrost degradation is unlikely but 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.

ENVIRONMENTAL IMPACTS OF CORRIDORS

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 siltation. 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 siltation. The use of brush blades 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 is 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 comprises 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. A service road would allow access for hunters, boaters, and campers.

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.

Although agriculture in this area is virtually non-existant beyond occasional 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 inefficiency of local 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 will last about three 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 poses severe erosional problems 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. Foundations may have to be blasted into rock; construction of an access road would be prohibitive, and for this and other reasons an access road will not be used on this stretch. The upper canyon is constricted between Panarama 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.

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.

<u>Vegetation:</u> 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. Otherwise, downed timber and slash must be disposed of by open burning when possible to prevent infestation of standing stocks with spruce beetle (Dendroctonus rufipennis) and the accumulation of fuel for wildfire.

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 siltation. 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.

<u>Recreation:</u> 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.

<u>Cultural Resources:</u> 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.

<u>Scenic Resources:</u> 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.

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 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 silt laden rivers and will be little affected by additional silt. Silt 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 siltation. The use of brush blades 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 is not likely to occur with manual application. Sections needing vegetation suppression occur in the bottomland spruce-poplar, lowland spruce-hardwood, and upland spruce-hardwood forest, particularly in the bottomland spruce-poplar. Muskeg-bog and moist tundra areas, which comprise a significant proportion of the ecosystems crossed by this corridor, will need little or no 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 siltation will be low.

Depending upon the final route survey, several small clearwater creeks will be crossed. Some siltation will occur from fording of construction equipment. This siltation 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, additional siltation will not be significant.

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 siltation. The use of brush blades 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 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 siltation 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. Siltation 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 siltation. The use of brush blades 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 mainten ce 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 siltation on glacial rivers will be low. Siltation impact on clearwater streams will be medium for Wells Creek, Louis Creek, and Dean Creek. Siltation 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 siltation. The use of brush blades 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.)

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 road bed 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 when possible to prevent infestation of standing stocks with spruce beetle (Dendroctonus rufipennis) and the accumulation of fuel for wildfire.

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 siltation.

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. Siltation 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.

..om 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 siltation 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.

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 siltation of clearwater streams will have an adverse impact on aquatic life. The heavier clearing necessary in this area will also contribute somewhat to siltation; 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 siltation. The use of brush blades 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 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 importa e to caribou habitat is the potential overburning of key winter browse, and the subsequent reduction of winter range. Since the elchina 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 siltation 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 siltation.

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 siltation. The use of brush blades 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.)

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 siltation 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 silt 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 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.)

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 siltation. The use of brush blades will reduce this effect. On steep slopes, hand clear ng 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.

De ruction of the vegetative mat in tundra areas will result in long ting 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.

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.

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.

MITIGATION OF IMPACTS

MITIGATION OF IMPACTS

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.

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.

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 the vegetative guide for Alaska published by the Soil Conservation Service.

For ground work off of the access road, or where no access road will 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, bogs, 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 immedately 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. By keeping poorly drained soils and the shallow active zone around tower bases permanently frozen, eliminating 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 Pipeling 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 crossing, 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 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. 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 the "Vegetation 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 siltation caused by fording machinery. Where possible, drainage will be preserved through proper placing of culverts and bridges. Borrow pits will be located to avoid siltation 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. Hunting and trapping activities of work crews will be controlled. The Alyeska Pipeline camps restrict firearms possession to control hunting and harassment, not to mention 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.

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.

<u>Existing Developments</u>

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".
The project will provide services for its workers, thus avoiding the potential straining of a community's services. However, the local communities should benefit economically from fringe services, such as entertainment, and services to transmission line-related workers outside of the actual project.

<u>Scenic Quality-Recreation</u>

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 of it; 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 it.

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, a line will avoid an area of particular scenic quality; especially when an unconcealed line has to be seen against a very scenic background. Where such conflicts are inevitable, extra design and location attention is called for to reduce the obtrusiveness of the line. Forsaking an access road for helicopter maintenance, minimal right-of-way clearance, alternative tower designs and special finishes on line components help considerably. Replacing the standard guyed tower designs with alternative wood-pole and metal designs considered to be more aesthetic, using anodized or painted towers, and using dull finish conductors minimize the visibility of the line components. In all cases, all temporary structures will be removed upon completion of the construction phase. Smaller recreation areas and scenic areas will be avoided altogether; usually these recreation areas are State-maintained wayside parks of relatively small size. Archeological sites will be identified on preliminary surveys of the chosen corridor and the final route adjusted accordingly to avoid disruption of these sites.

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.

ADVERSE ENVIRONMENTAL IMPACTS

ADVERSE ENVIRONMENTAL IMPACTS

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 on the preceeding section will reduce unavoidable detrimental impacts to a considerable degree. 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 construction, 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, local growth can be expanded.

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 political 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 these routes can be equated to greater visual impact. Visual impact on viewers from the transportation routes will be minimized, from total screening in heavily-forested areas, to camouflaging by means of colored towers and intelligent tower location.

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 surroundings.

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 benefical and adverse, stemming from the above effects of construction and maintenance.
- visual impacts to scenic and recreational resources from Talkeetna north to Healy.
- effects on air quality due to burning of slash resulting from clearing operations.

RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

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 Appendix 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 outweight 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 along 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 probability of an alternative corridor.

IRREVERSIBE AND IRRETRIEVABLE
COMMITMENTS OF RESOURCES

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.

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

Corridor: System	Length miles	Conductors 1/ Ton	Structures 2/ Ton	ROW 3/ acres	Clearing 4/ acres
Susitna-1: 345-kv - DC	136	4,624	13,668	2,308	2,308
Susitna-1: 230-kv - DC	136	3,509	7,344	2,060	2,060
Susitna-2: 345-kv - DC	140	4,760	14,070	2,376	2,376
Susitna-2: 230-kv - DC	140	3,612	7,560	2,121	2,121
Susitna-3: 345-kv - DC	134	4,556	13,467	2,274	1,900
Susitna-3: 230-kv - DC	134	3,457	7,236	2,030	1,697
Susitna-4: 345-kv - DC	149	5,066	14,975	2,529	2,257
Susitna-4: 230-kv - DC	149	3,844	8,046	2,257	2,015
Nenana-1: 230-kv - SC	198	2,254	6,138	3,000	1,439
Nenana-1: 230-kv - DC	198	5,108	10,692	3,000	1,439
Nenana-2: 230-kv - SC	220	2,838	6,820	3,333	1,500
Nenana-2: 230-kv - DC	220	5,676	11,880	3,333	1,500
Nenana-3: 230-kv - SC	231	2,980	7,161	3,450	1,318
Nenana-3: 230-kv - DC	231	2,960	12,474	3,450	1,318
Nenana-4: 230-kv - SC	223	2,876	6,913	3,378	1,182
Nenana-4: 230-kv - DC	223	5,753	12,042	3,378	1,182
Nenana-5: 230-kv - SC	212	2,735	6,572	3,212	1,364
Nenana-5: 230-kv - DC	212	5,470	11,448	3,212	1,364
Matanuska-1: 345-kv - DC	265	9,010	26,633	4,497	2,817
Matanuska-1: 230-kv - DC	265	6,837	14,310	4,015	2,515
Matanuska-2: 345-kv - DC	384	13,056	38,592	6,516	3,869
Matanuska-2: 230-kv - DC	384	9,907	20,736	5,818	3,454
Delta: 230-kv - DC	280	7,224	15,120	4,242	1,727
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 towers 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.

OTHER ALTERNATIVES TO THE PROPOSED ACTION

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, errosion 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.

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 365 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.

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 addtional 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.

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

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 environmental impacts of this alternative system plan 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. These differences are reflected in the table on page 88.

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.

Another alternative is the construction of transmission lines along the Matanuska-1 or -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 iability 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 -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 one--from Gold Creek to Healy. This area will be constructed by helicopter access.

The advantages of an access road over helicopter access are: less expensive per mile over most terrain; ease in transportation of machinery and materials, tower erection, strength 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 siltation; and increased visibility, 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.

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.

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 elimiate 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.

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.

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 is not recommended.

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 hazard.

T e recommended method of control is the manual application of herbicides wi h cutting in sensitive areas; aerial spraying is not proposed.

Alternative Endpoints

For this feasibility study, it was necessary to postulate definite 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 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. However, for the Matanuska and Susitna alternative corridors, two alternative endpoints are obvious. Point MacKenzie is the terminus of a set of underwater cables to Anchorage; Palmer is the northern end of an existing APA transmission line.

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.

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.

APA will continue to propose the Point MacKenzie endpoint until more input favorable to the utilization of the Palmer endpoint is received.

No Action (Nonconstruction)

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.

ACKNOWLEDGEMENTS

ACKNOWLEDGEMENTS

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Comments and advice have been given by various State agencies, chiefly the Alaska Department of Fish and Game and the Alaska Department of Highways; also the University of Alaska helped with comments and advice.

APPENDIX I

Appendix I

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-Kuskikwim 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

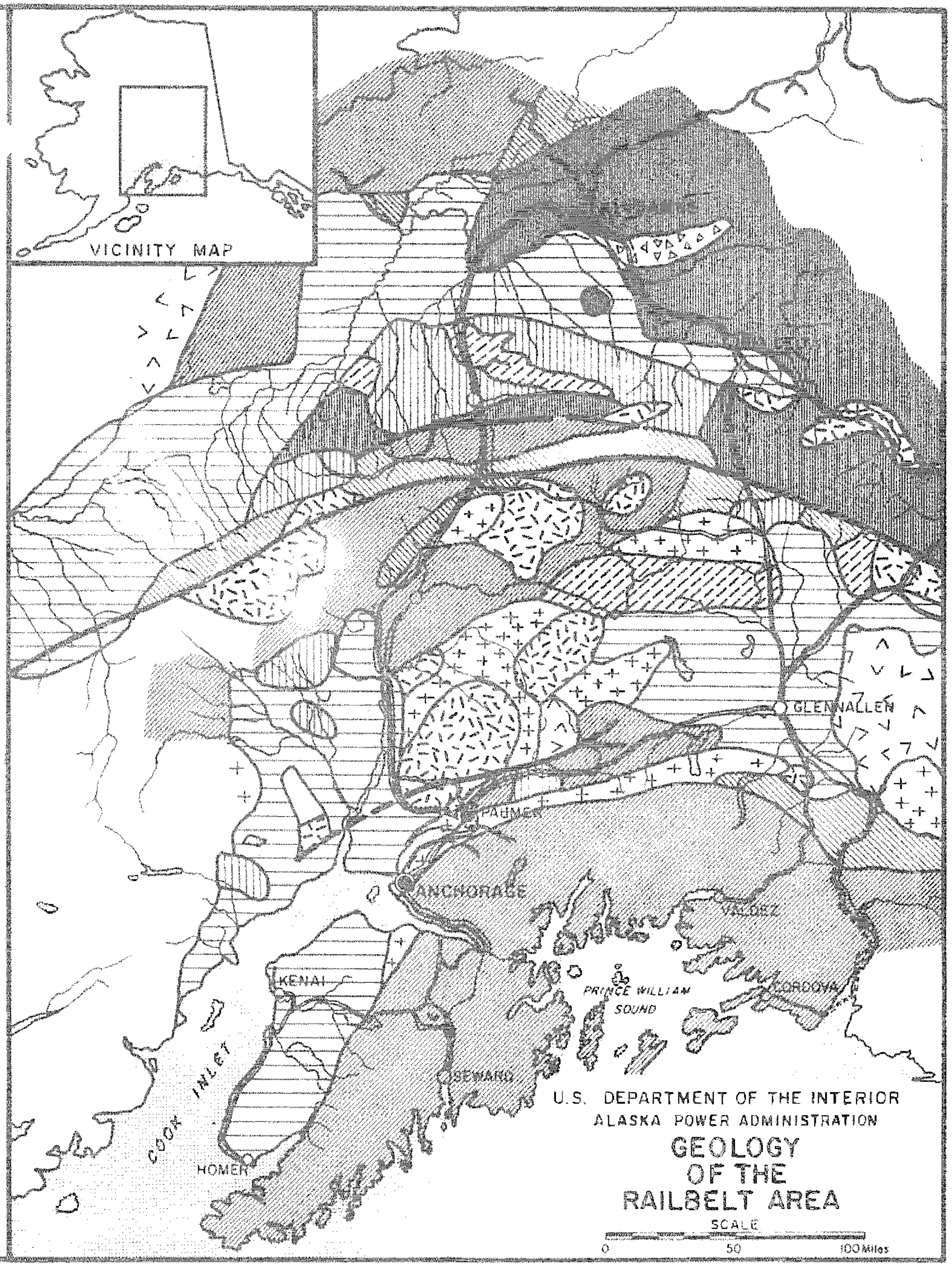
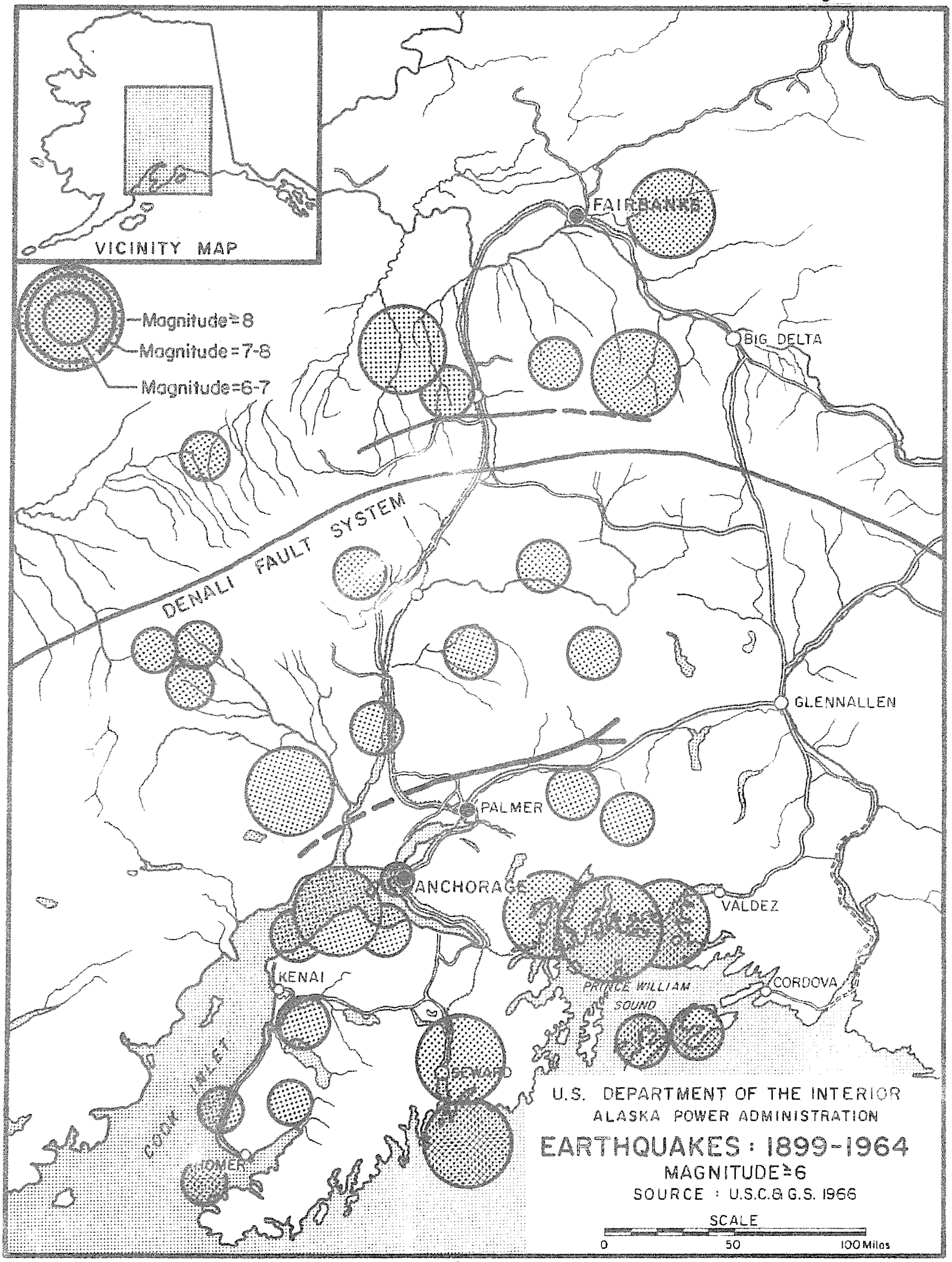


Figure 1

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.

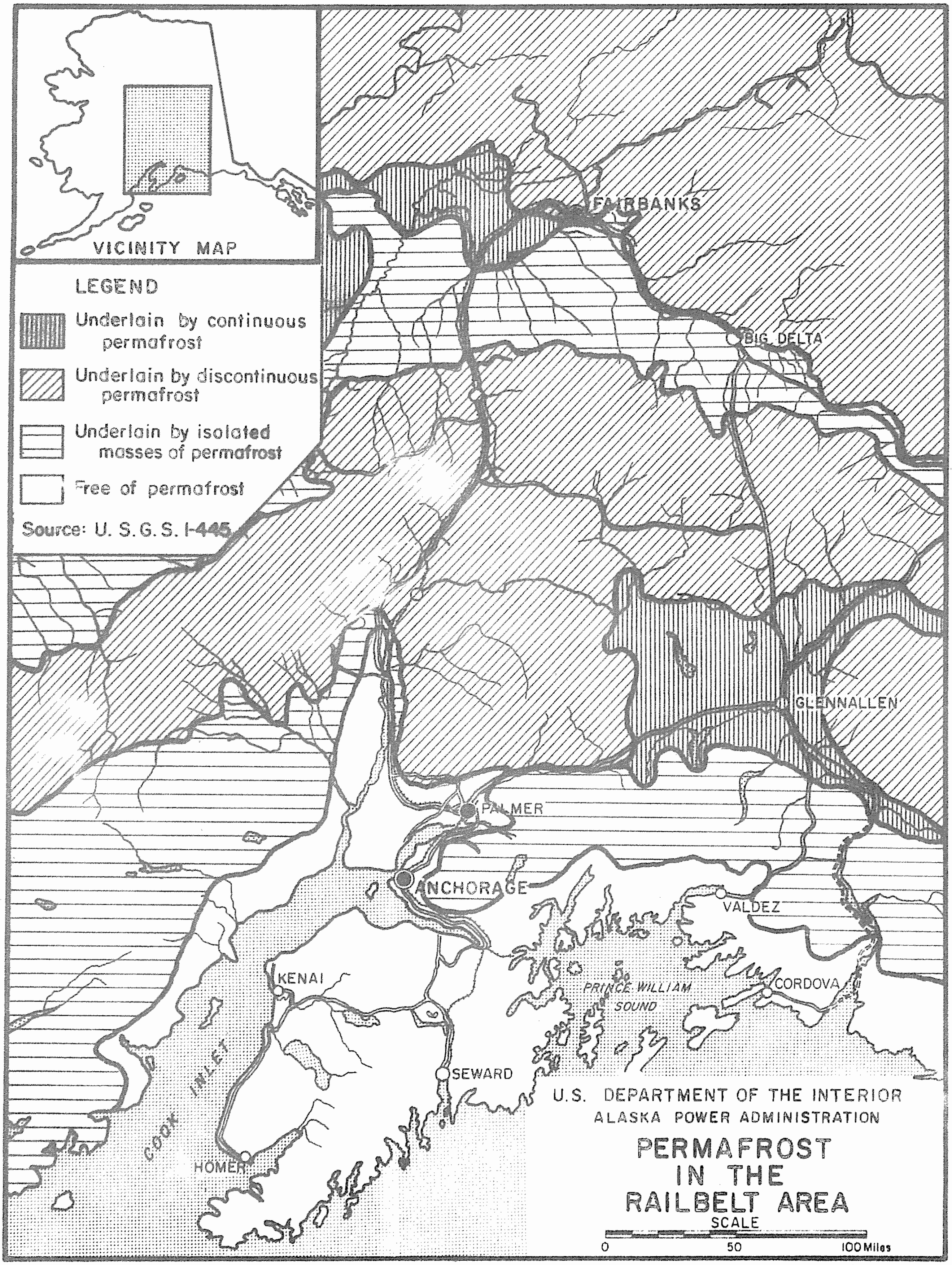
Most of these river systems experience high flows starting in late April and continuing through late summer, diminishing to minimums in March or early April. Breakup usually precedes the snow melt and occurs in late April or early May. Glacial-fed streams are subject to violent flow and rapid channel 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

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

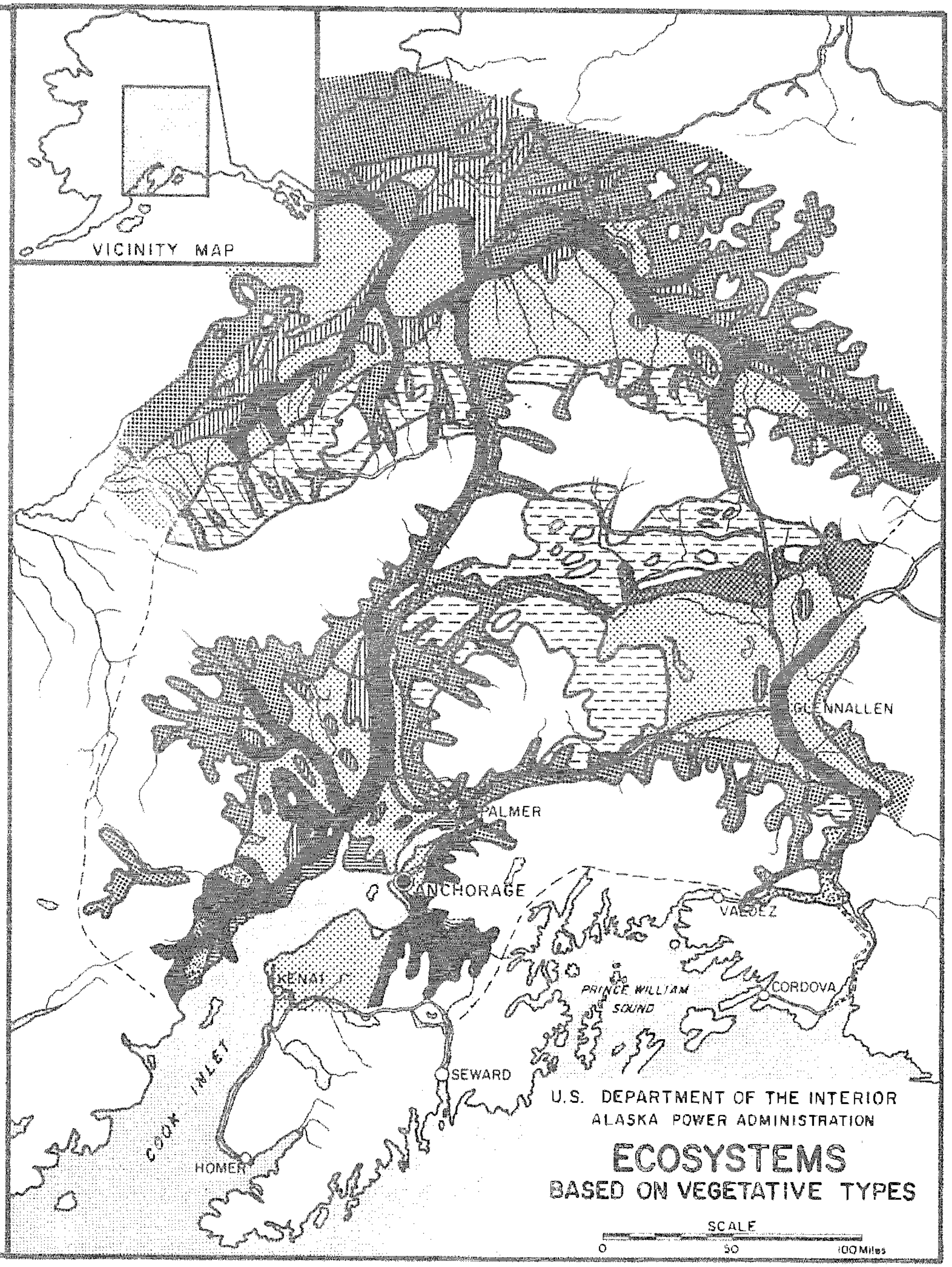
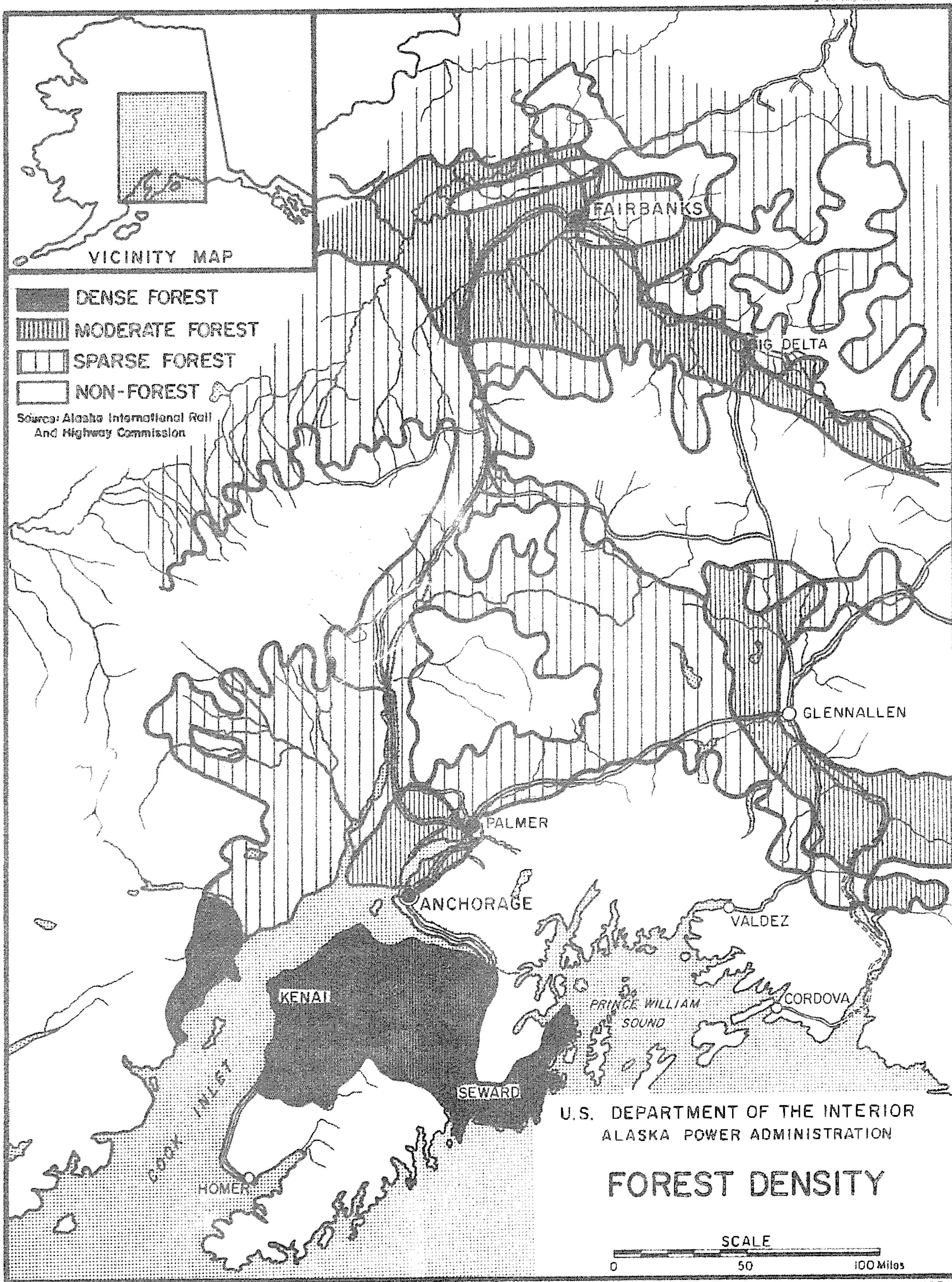


Figure 4

Figure 5



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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 surrounding 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. 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 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, and 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 Matanuska and Tanana Valleys 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 lemming 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

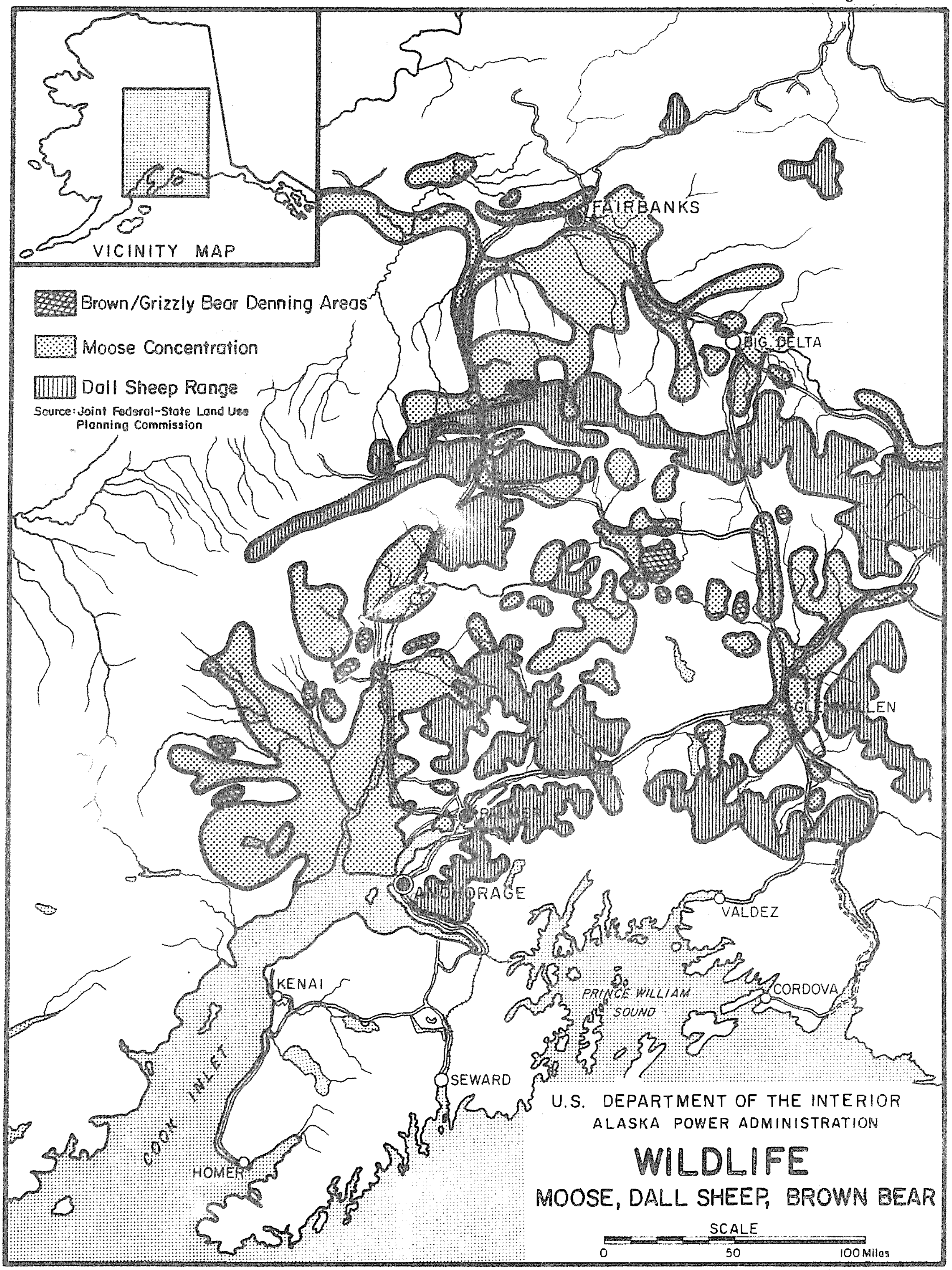

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Figure 7

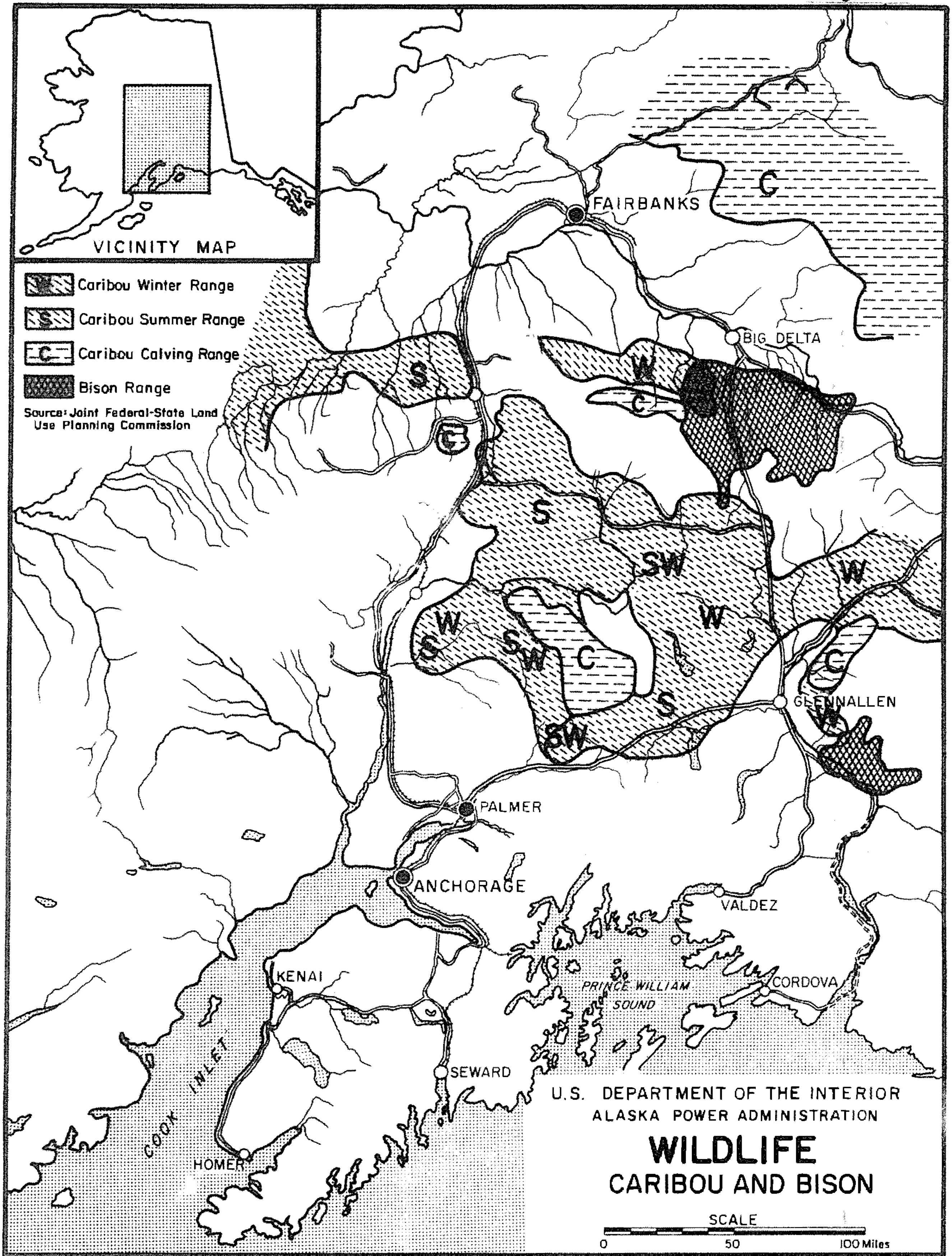
VICINITY MAP
Caribou Winter Range
Caribou Summer Range
Caribou Calving Range
Bison Range
Source: Joint Federal-State Land Use Planning Commission
FAIRBANKS
BIG DELTA
GLENNALLEN
PALMER
ANCHORAGE
VALDEZ
KENAI
CORDOVA
PRINCE WILLIAM SOUND
SEWARD
COOK INLET
HOMER
U.S. DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
WILDLIFE
CARIBOU AND BISON
SCALE
0
50
100 Miles
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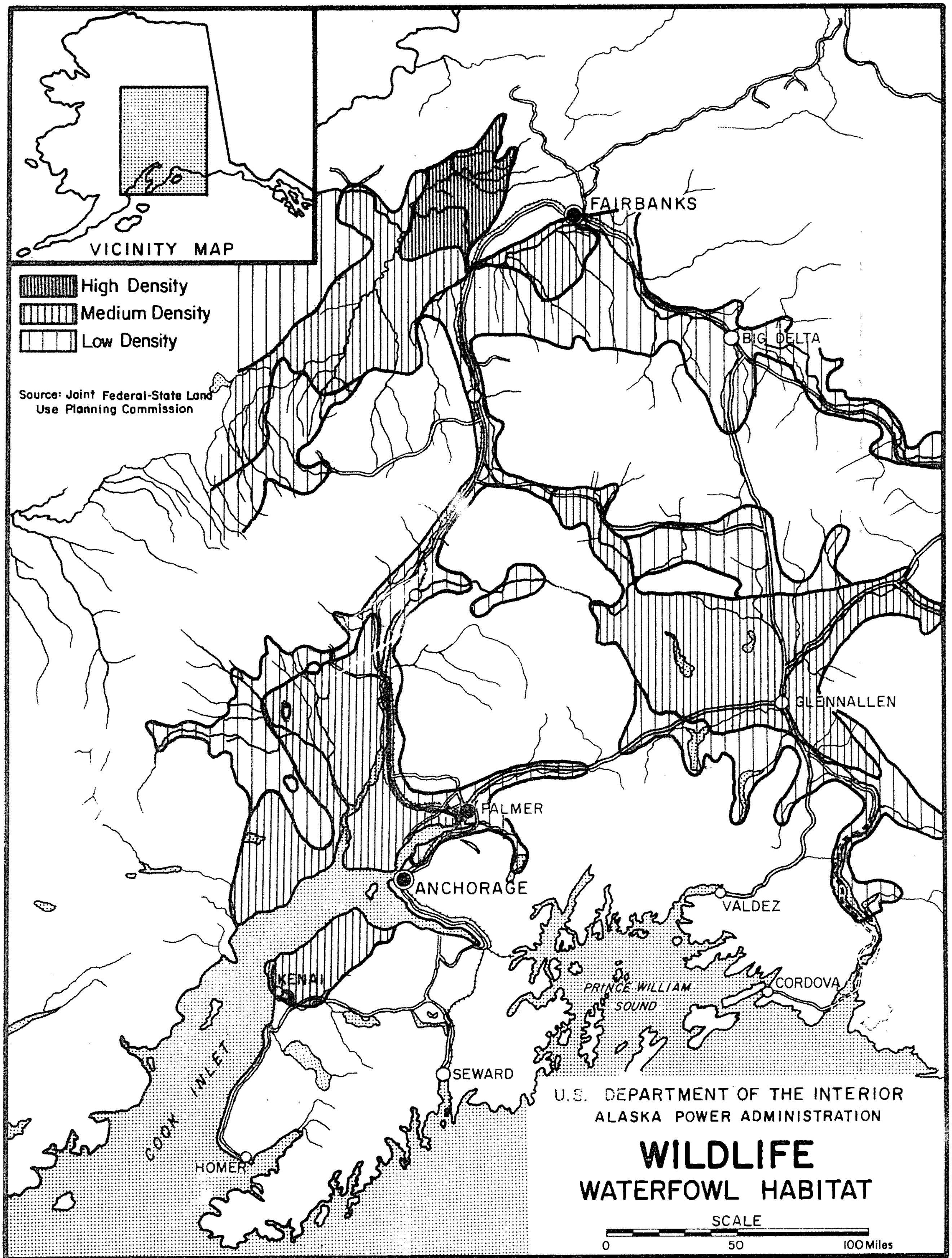
Figure 8



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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. The construction area will be reinvaded 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 inadvertant 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 or lines, but these losses should be negligible. The cables are not spaced close enough nor are they invisible enough to be efficient snares; also 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 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.

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 climactic 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. Taiga 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 siltation 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.

Siltation can result from erosion along the construction sites, burned-over areas, borrow pits, and river crossings. The impact of siltation depends upon the severity of siltation, the existing water quality, and the amount of aquatic life in the stream or lake. In rivers already carrying glacial silt, the effect of man-caused siltation will be slight. Clear water streams and lakes supporting large aquatic populations will be most affected. Siltation can cause gill damage in fish and may result in filling 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 silt 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 than 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 e 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 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 ands; 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.

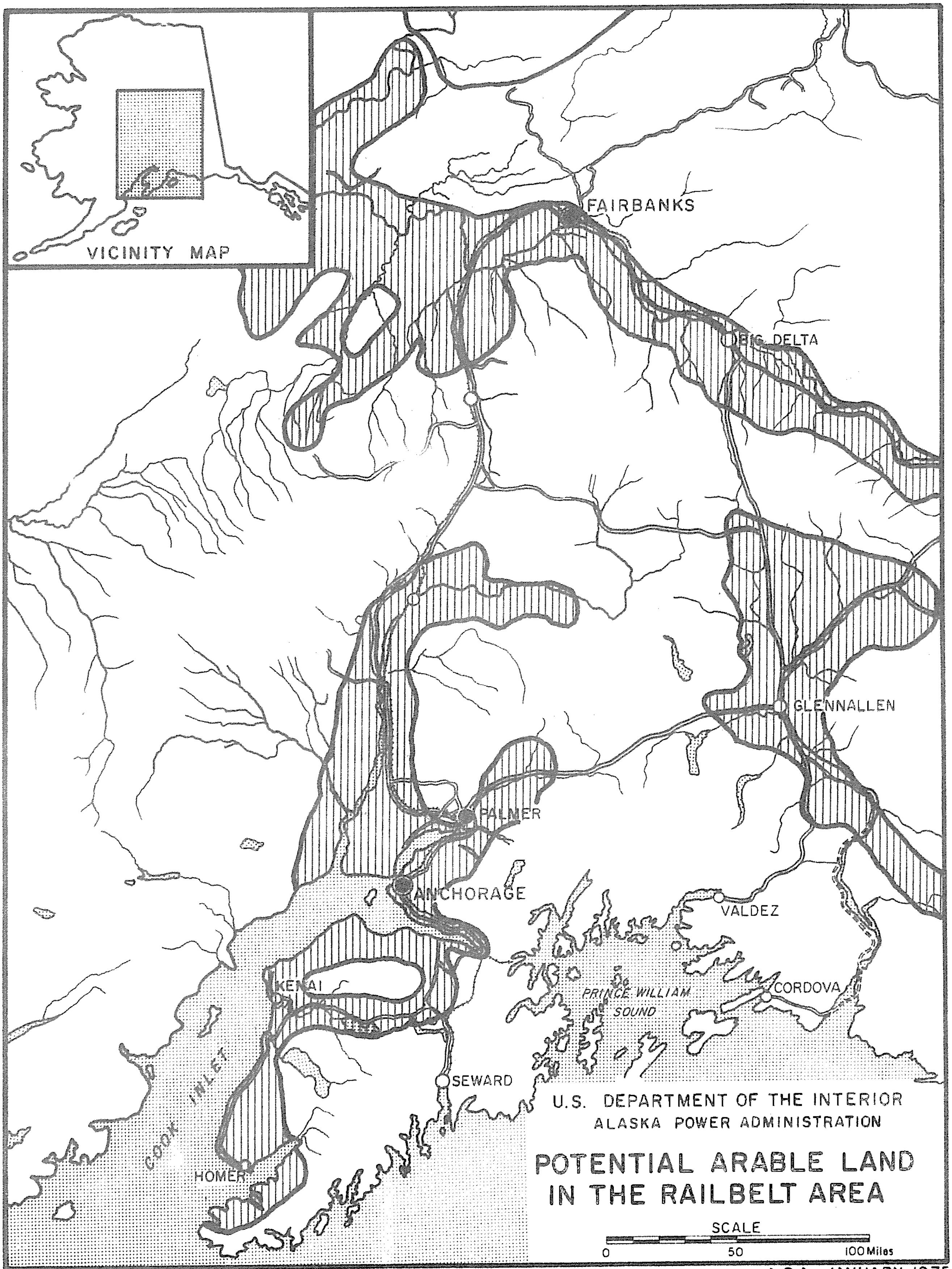
Known and potential areas of coal, oil, natural gas, and minerals exist in the Railbelt area. The fossil fuels are predominant in the three basins of the Tanana River, Cook Inlet, and the Copper River lowland. Minerals are more usually found in the more mountainous areas. A transmission line itself will 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 Figures 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.

Some employment can be drawn from communities on the Railbelt for the construction of the transmission line. Larger towns, such as Anchorage and Fairbanks, could be expected to contribute a higher proportion o killed workers than the smaller towns. Since line crews would e working well away from towns and residing in camps, they should not present a strain to services in communities. Activities associated with the transmission line may cause impacts on services in communities; these impacts will probably represent use of the communities goods and services, and if not an inordinately large use, will be beneficial to the economies of the communities. Thus, disruption of the economies and services of communities along the route by the construction phase should be low.

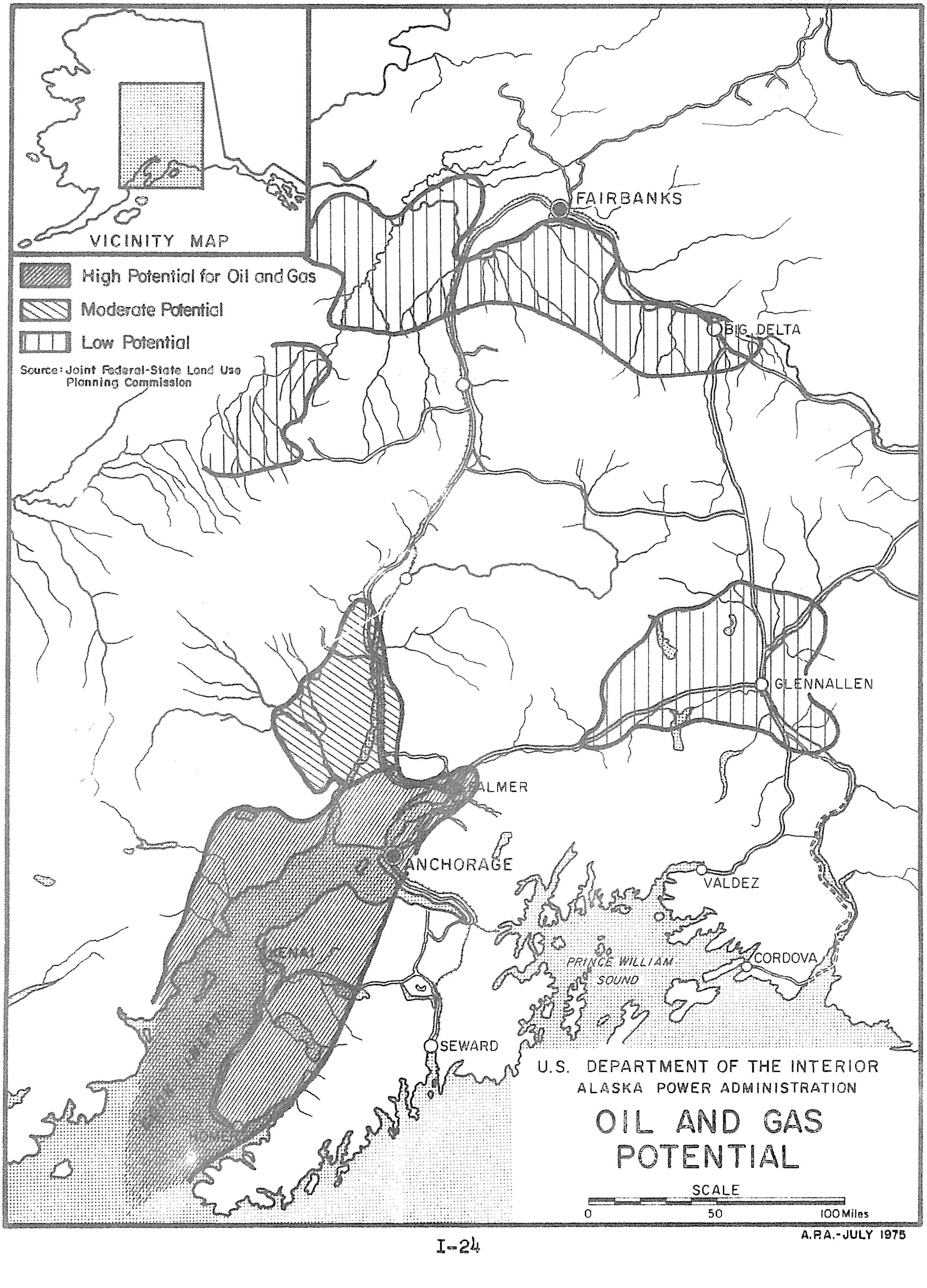
Operation and maintenance impacts on communities will also be low; a relatively small crew of workers can periodically inspect and maintain the transmission line, and actual operations will be concentrated in the powersites and the terminal substations. Since it is relatively inefficient for small communities to tap a transmission line of 230 kv or higher, the probability that the transmission line will serve adjacent communities is low.

Figure 9



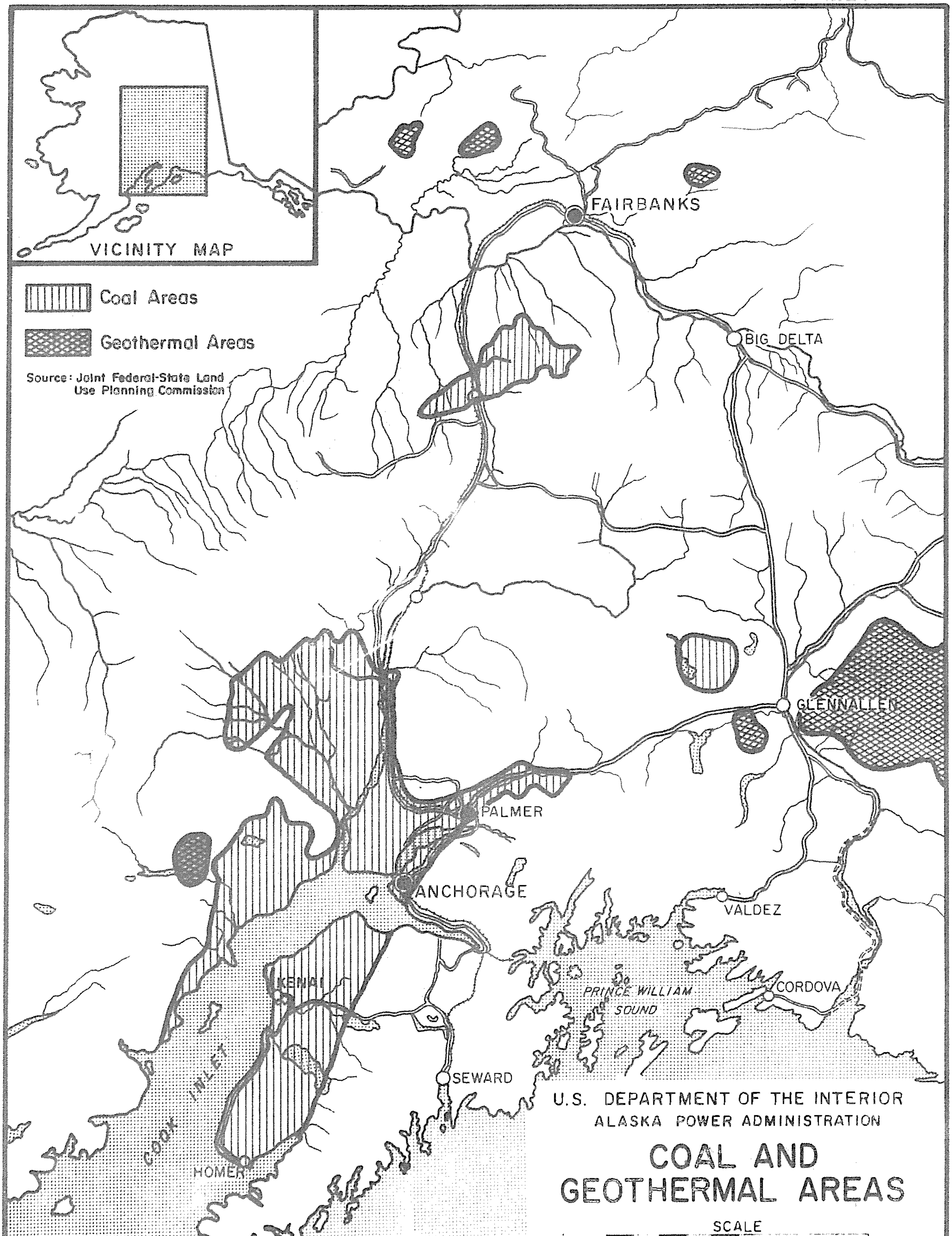
SOURCE: ALASKA INTERNATIONAL RAIL AND HIGHWAY COMMISSION   A. P. A.-JANUARY 1975

Figure 10



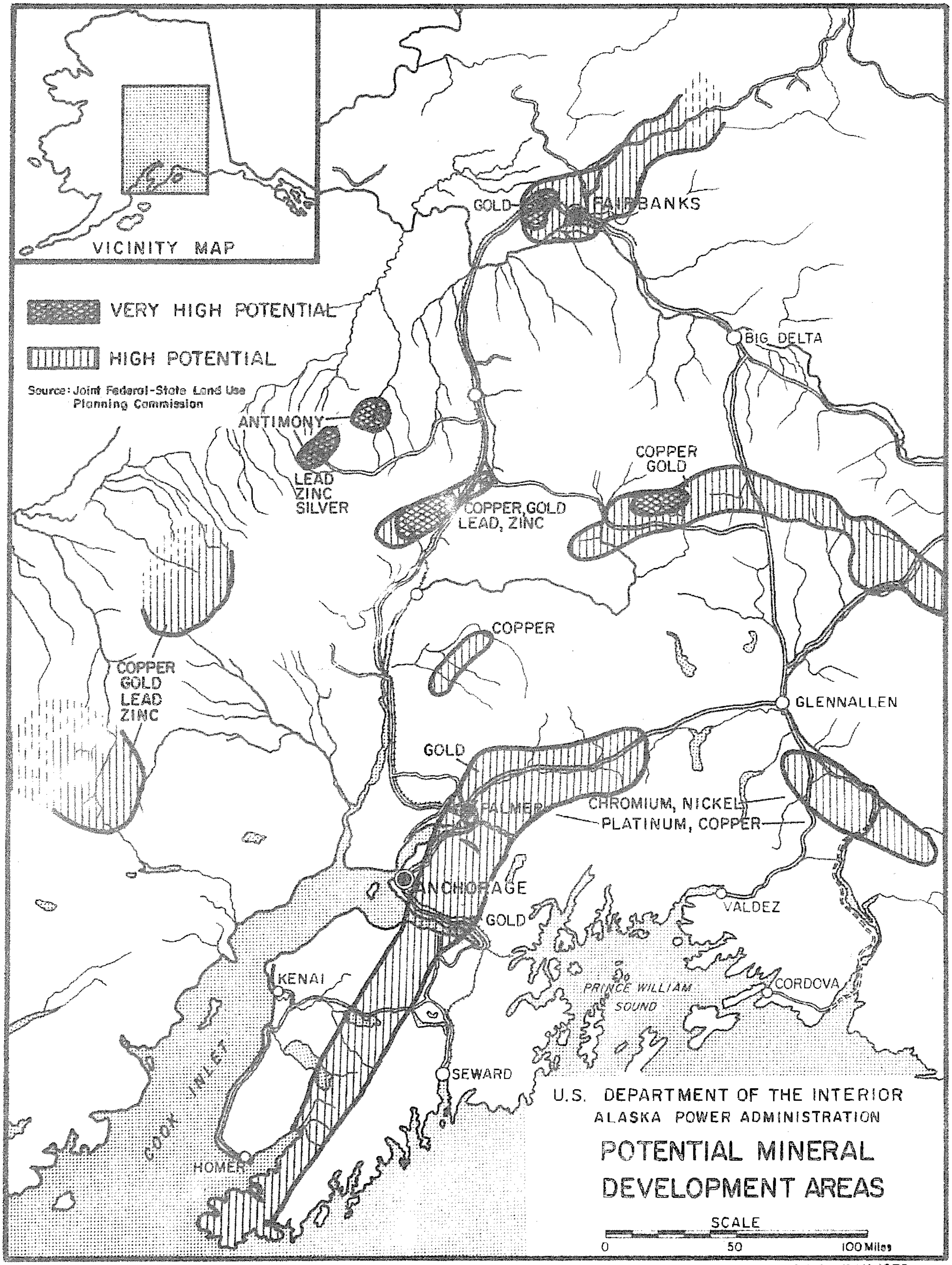
A.P.A.-JULY 1975

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
LEAD, ZINC
COPPER
GOLD
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

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.

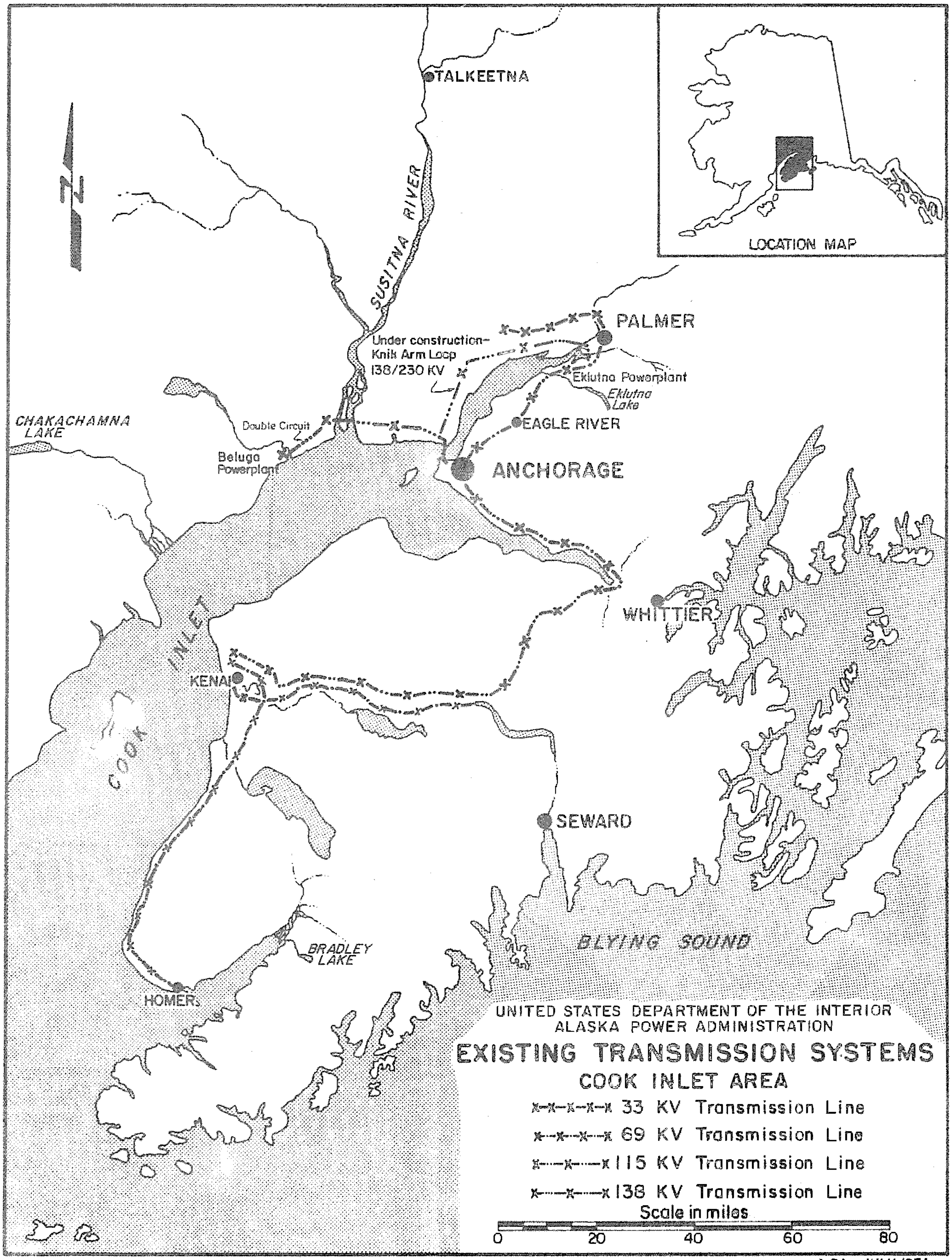
Scenic Quality

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).

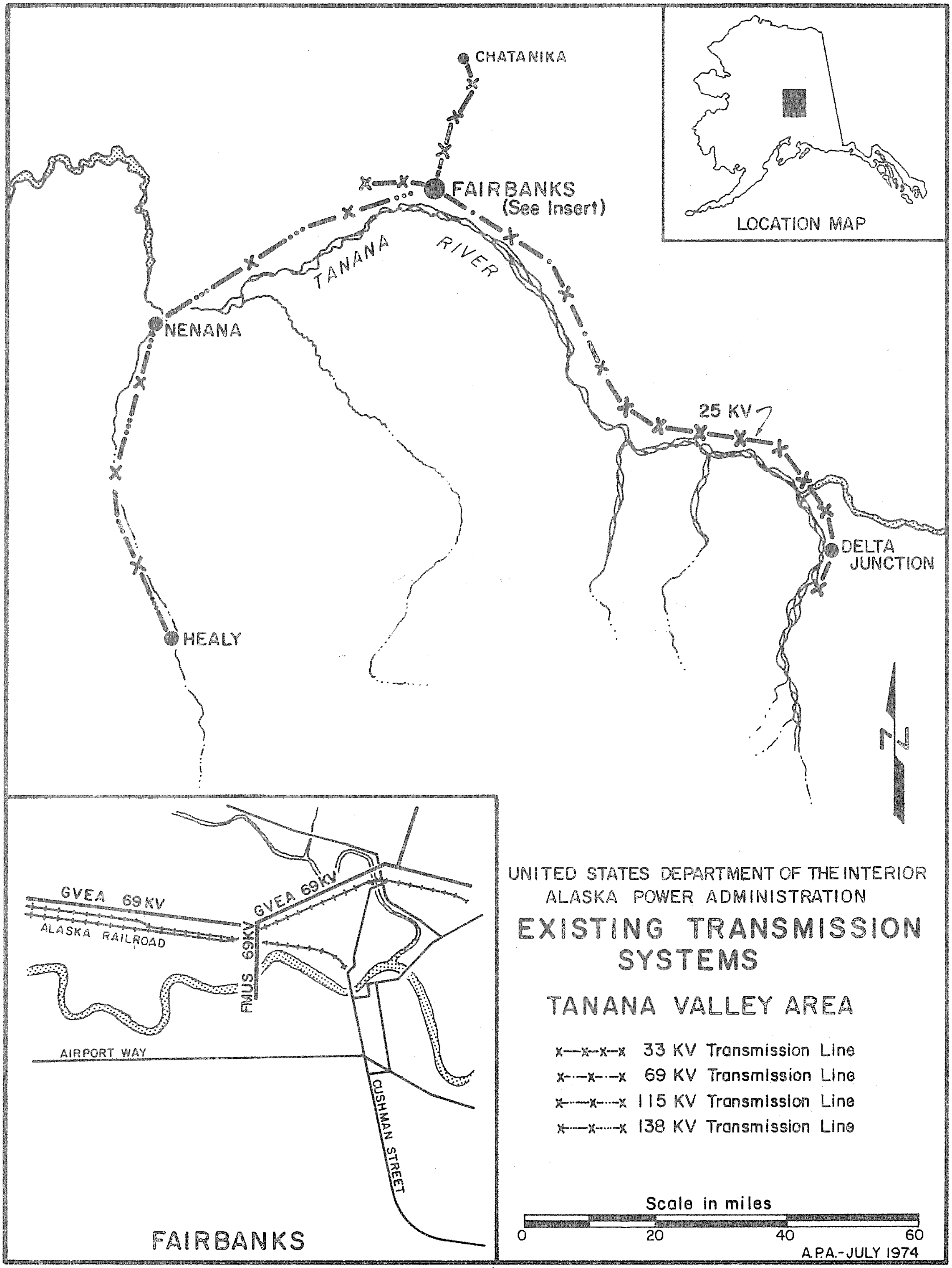
Unity is the degree of harmony among elements in a landscape; put another way, it is the degree of the lack of discordant elements. A wheat farm of five acres is considered by most people to be less discordant in an otherwise forested landscape than a five acre tank farm. Unity is a learned concept, and as such, is variable not only among the individuals and groups, but also is variable over time as tastes change.

Figure 13



A.P.A. - JULY 1974

Figure 14



CHATANIKA
FAIRBANKS
(See Insert)
TANANA
RIVER
NENANA
HEALY
25 KV
DELTA
JUNCTION
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
33 KV Transmission Line
69 KV Transmission Line
115 KV Transmission Line
138 KV Transmission Line
Scale in miles
0
20
40
60
A.P.A.-JULY 1974

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, 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. In most cases, impact on these will be low to none; the others can be circumvented to minimize disturbance.

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.

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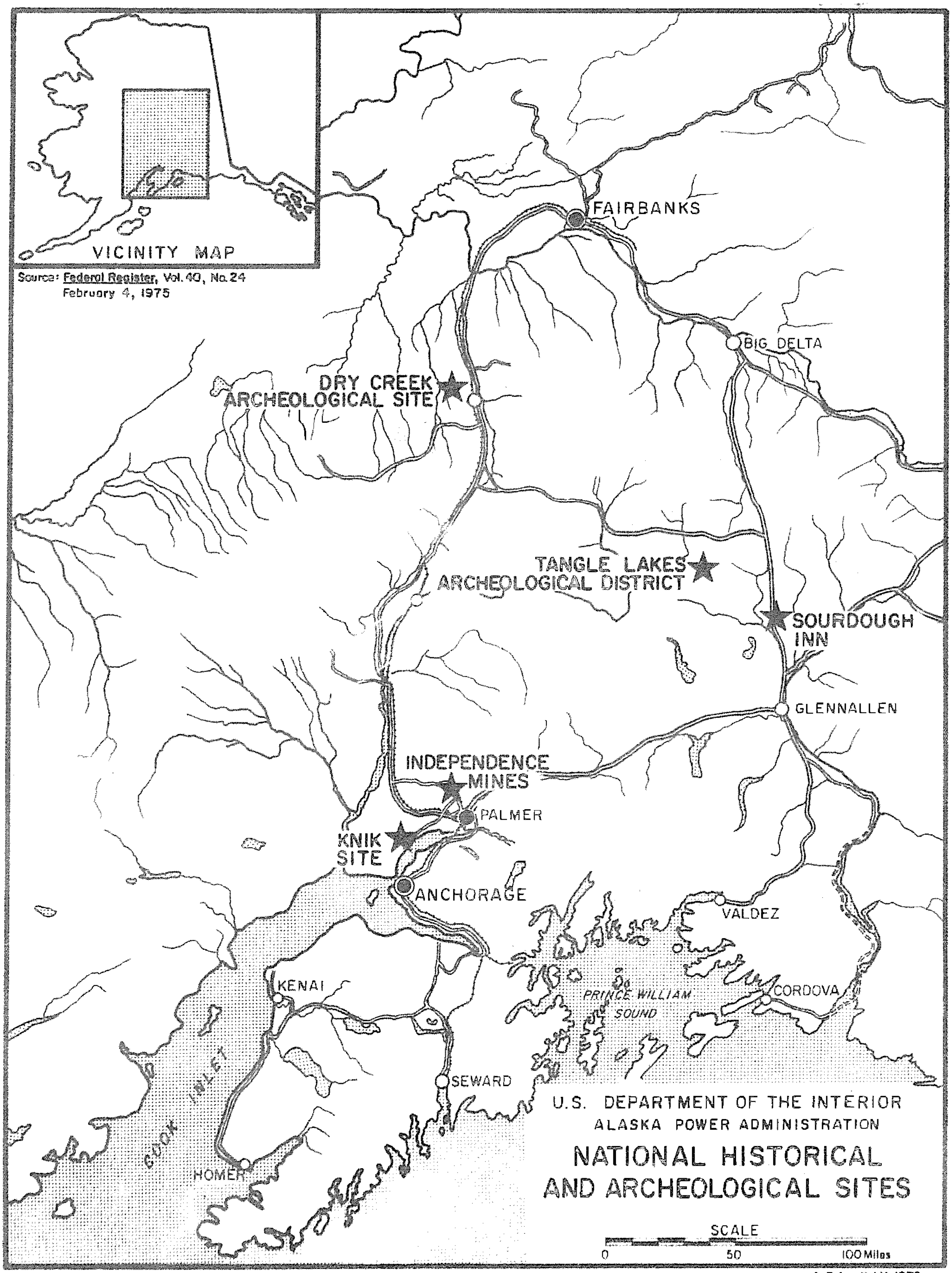
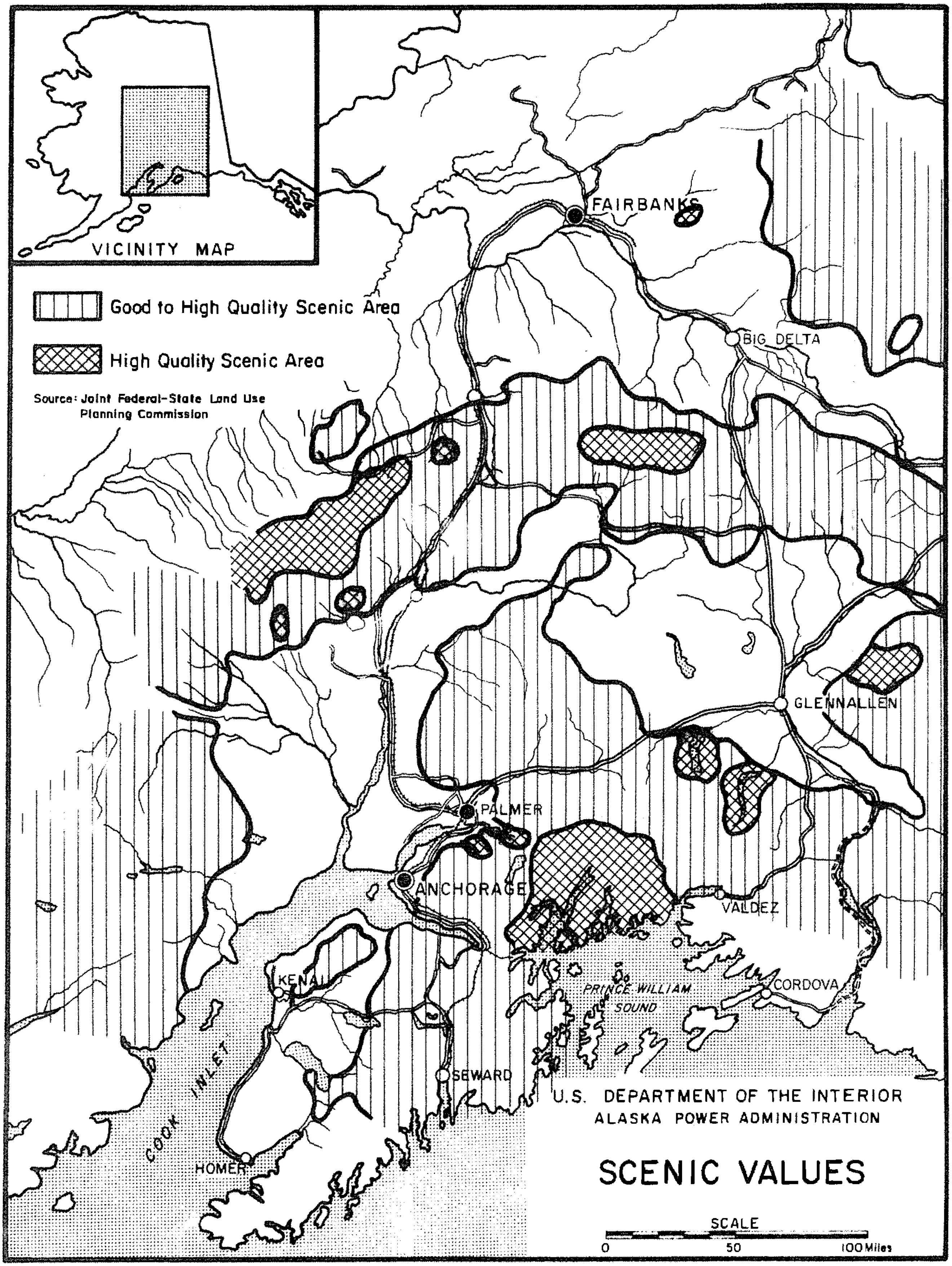


A.P.A.-JULY 1975


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
PRINCE WILLIAM SOUND
CORDOVA
SEWARD
COOK INLET
HOMER
U.S. DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
SCENIC VALUES
SCALE
0
50
100 Miles

APPENDIX II

Appendix II

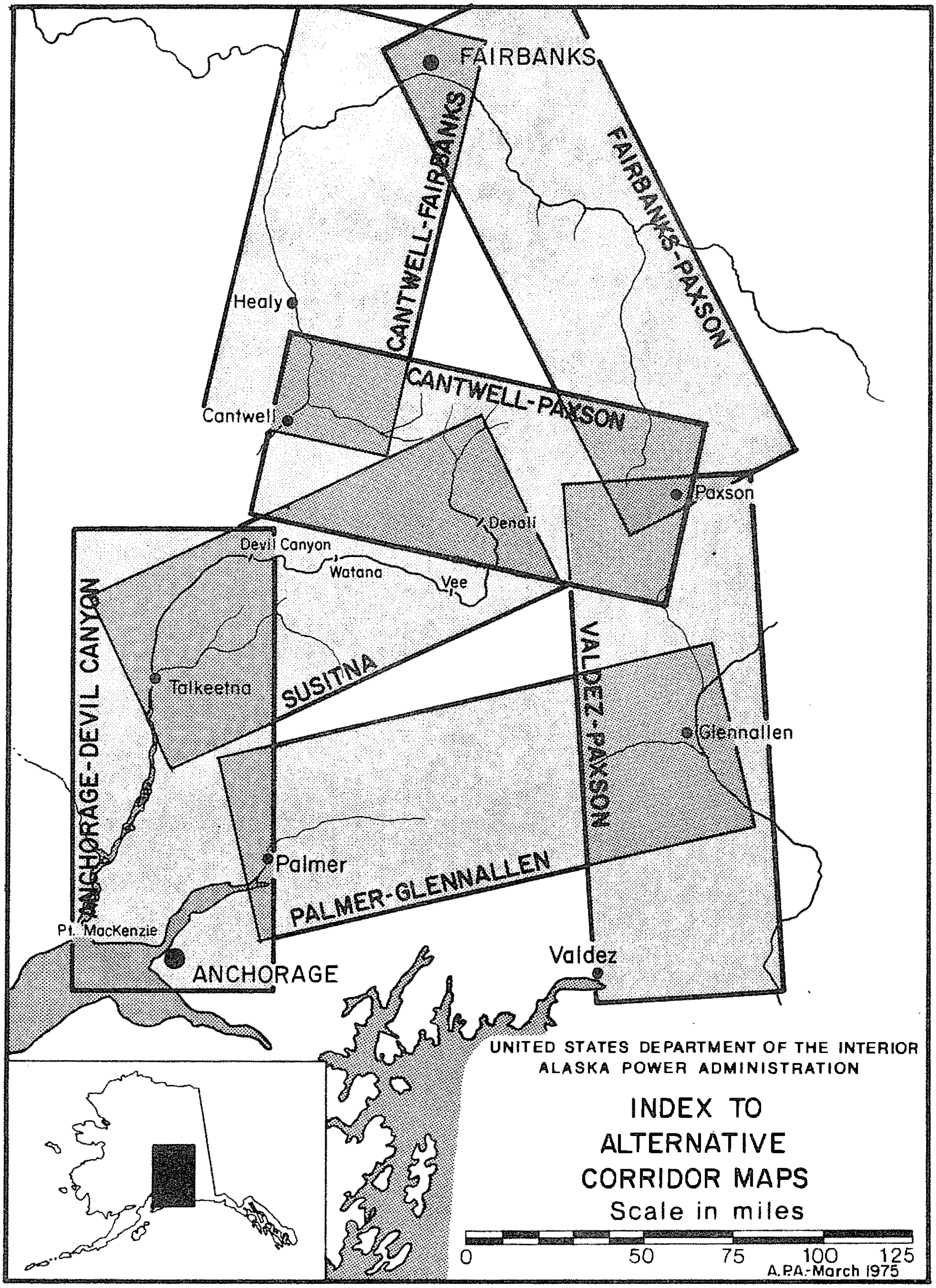
Strip Maps covering the Alternative Corridors.

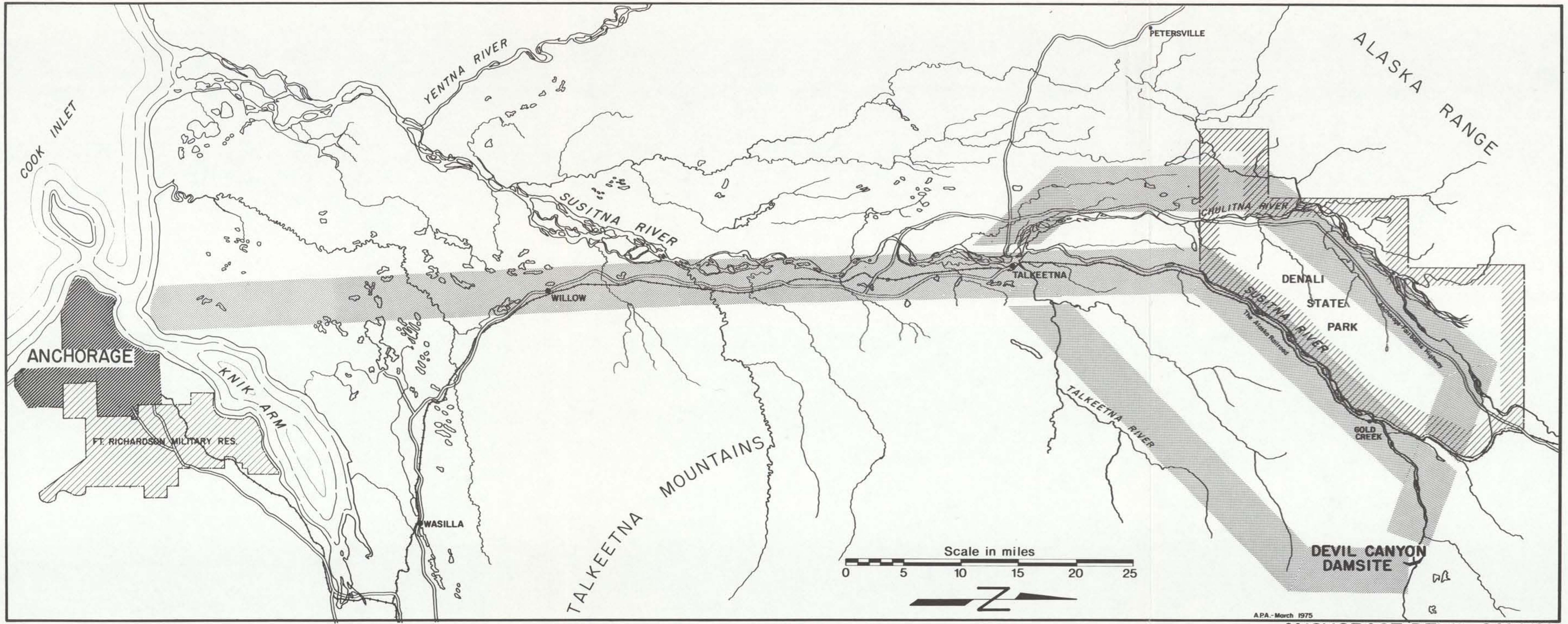
The following strip maps are in three groups: those showing the general features, those depicting land status, and those delineating soil types. The alternative corridors are covered by seven maps for each group; there is some overlap from map to map, but not all alternative corridors are entirely depicted 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.

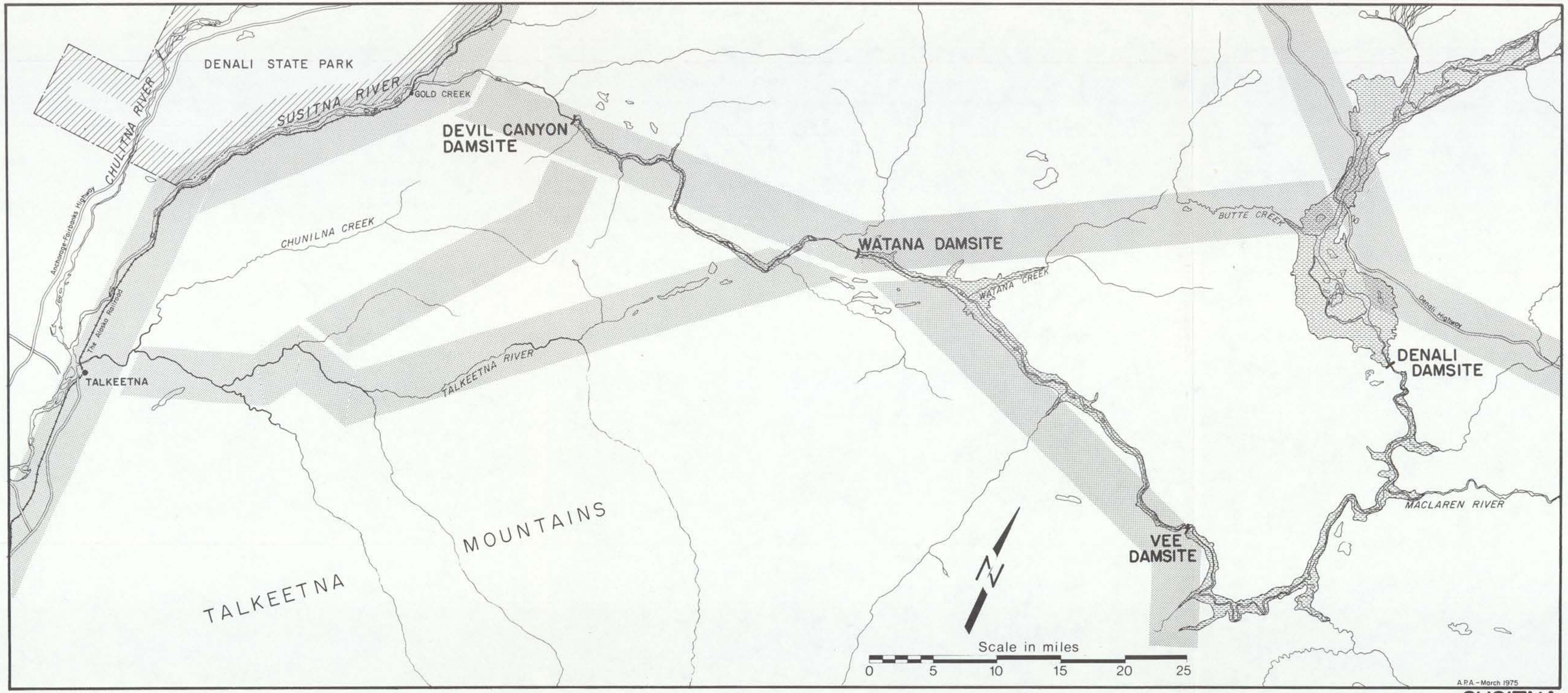
The land status mapped is based upon the land status situation of March 1974. State selections include patented, pending, and tentatively approved State-selected lands. Due to the present unstable condition of land status, it must be recognized that there may be changes since the date of the map.

The soils maps are based upon the 1:250,000 soils overlay map published by the Joint Federal-State Land Use Planning Commission.

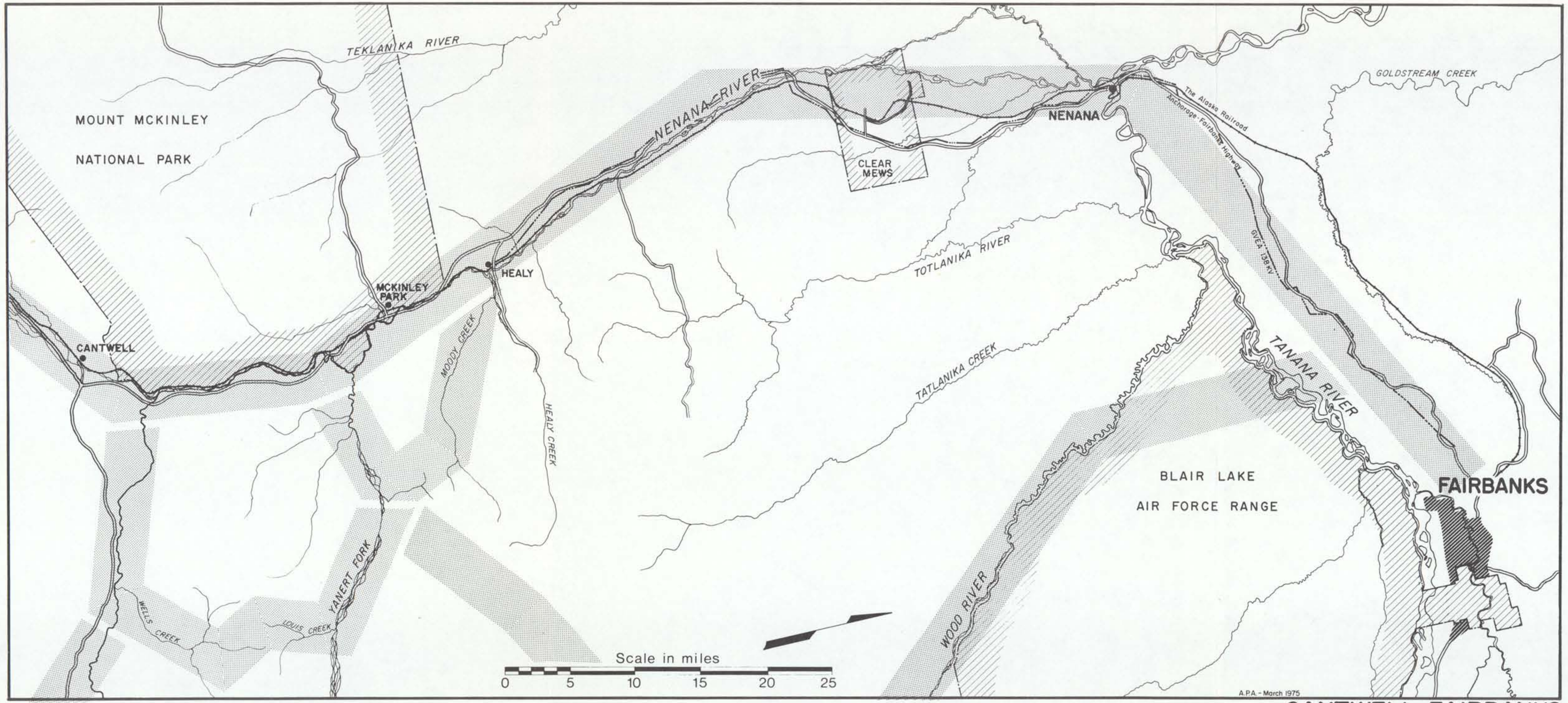

FAIRBANKS
CANTWELL-FAIRBANKS
FAIRBANKS-PAXSON
Healy
CANTWELL-PAXSON
Cantwell
Paxson
Denali
Devil Canyon
Watana
Vee
ANCHORAGE-DEVIL CANYON
VALDEZ-PAXSON
SUSITNA
Talkeetna
Glennallen
Palmer
PALMER-GLENNALLEN
Pt. MacKenzie
ANCHORAGE
Valdez
UNITED STATES DEPARTMENT OF THE INTERIOR
ALASKA POWER ADMINISTRATION
INDEX TO
ALTERNATIVE
CORRIDOR MAPS
Scale in miles
0
50
75
100
125
A.P.A.-March 1975



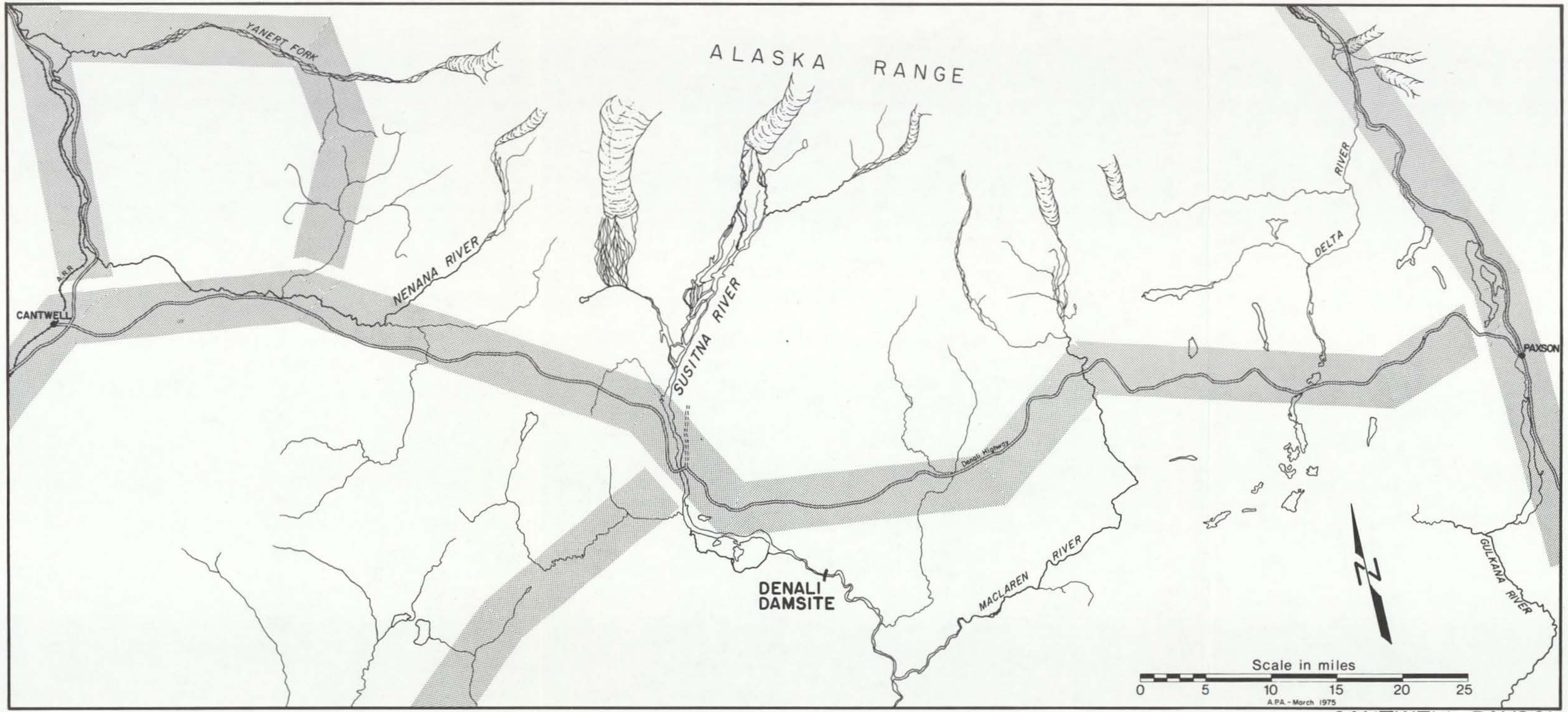
ANCHORAGE-DEVIL CANYON


DENALI STATE PARK
SUSITNA RIVER
GOLD CREEK
CHULITNA RIVER
Anchorage-Fairbanks Highway
The Alaska Railroad
DEVIL CANYON
DAMSITE
CHUNILNA CREEK
WATANA DAMSITE
WATANA CREEK
BUTTE CREEK
Denali Highway
DENALI
DAMSITE
TALKEETNA
TALKEETNA RIVER
MOUNTAINS
TALKEETNA
VEE
DAMSITE
MACLAREN RIVER
Scale in miles
0 5 10 15 20 25
A.P.A.-March 1975

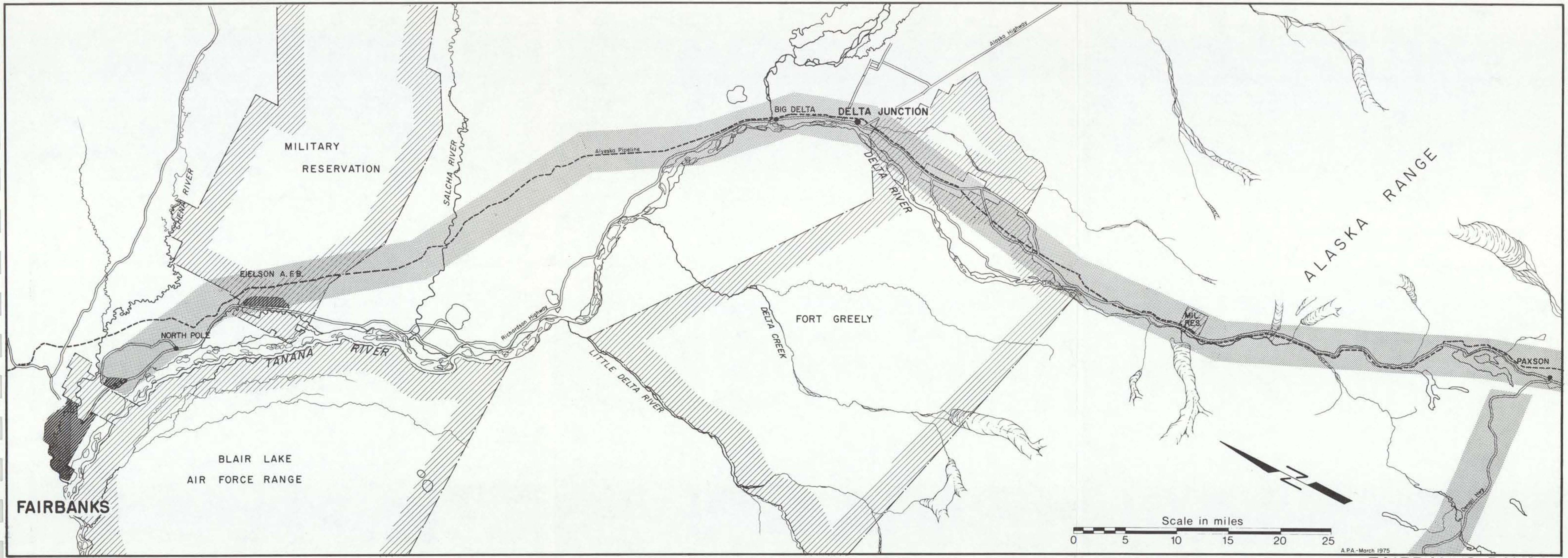
SUSITNA



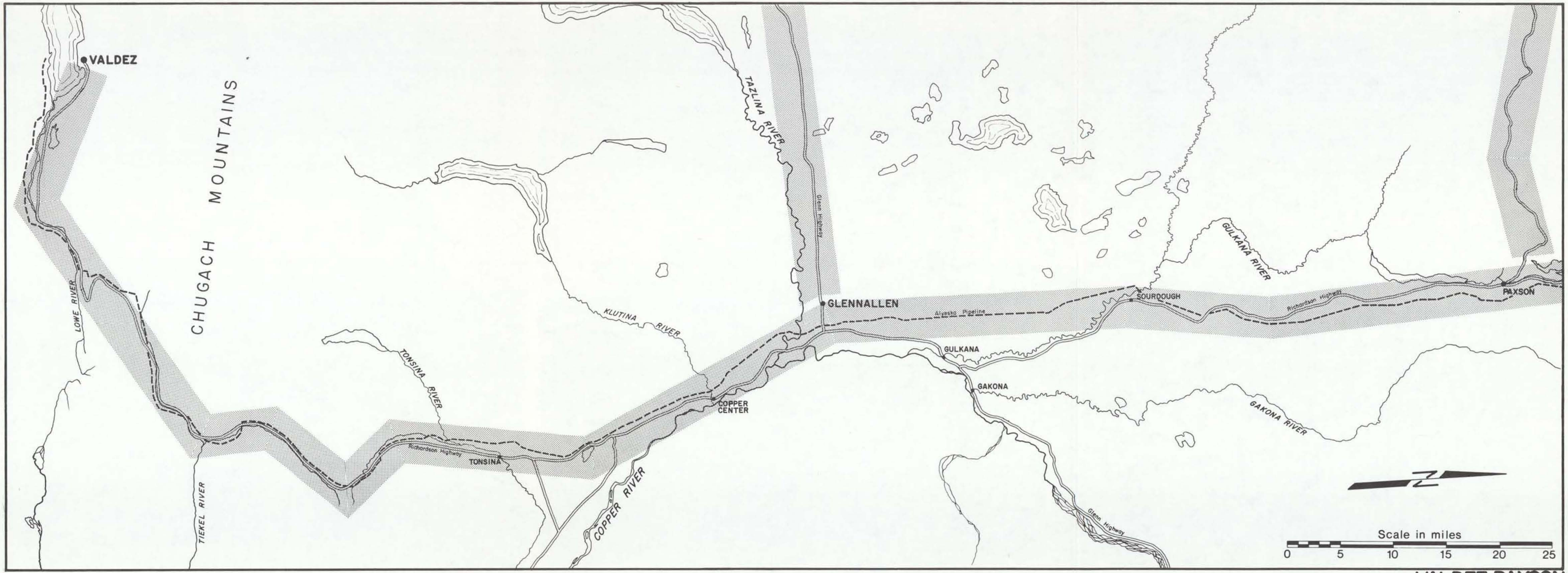
CANTWELL-FAIRBANKS



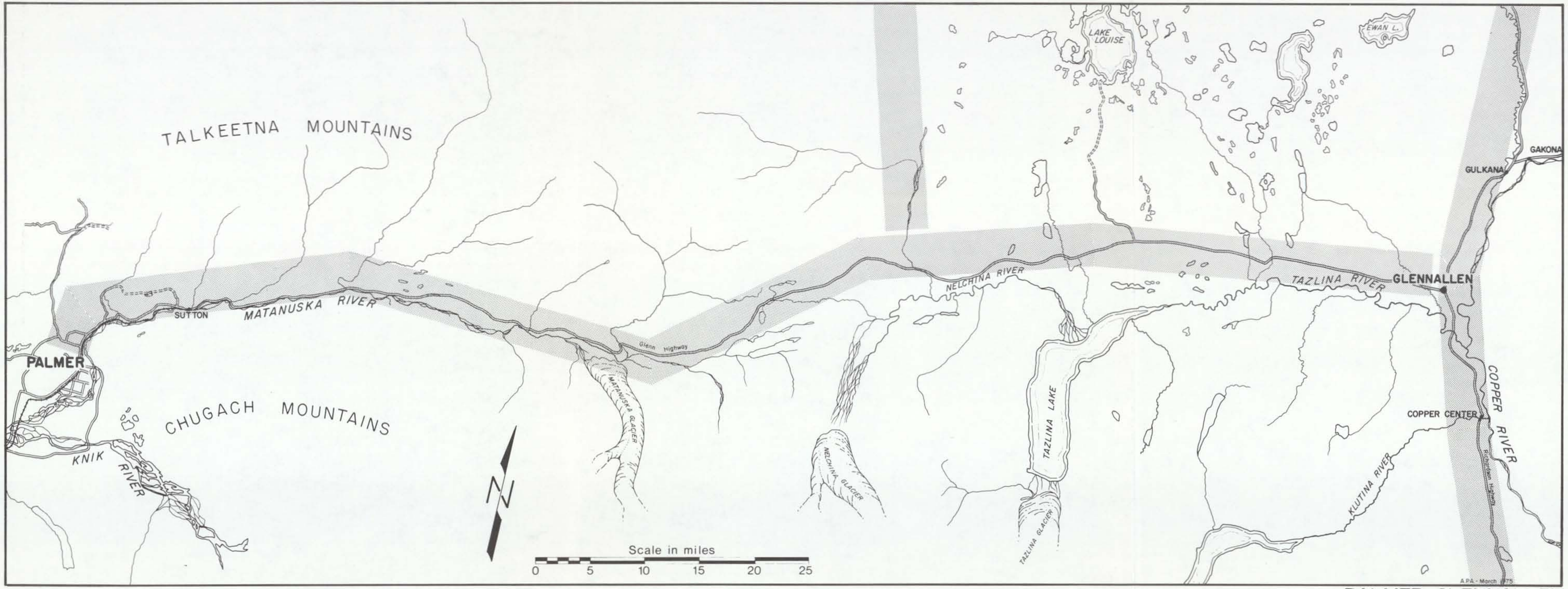
CANTWELL-PAXSON



FAIRBANKS-PAXSON



VALDEZ-PAXSON



PALMER–GLENNALLEN

SOILS LEGEND

Soil ← IAHP E-1 → Erosion Potential
Slope Group ← 2g → Textural Group

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

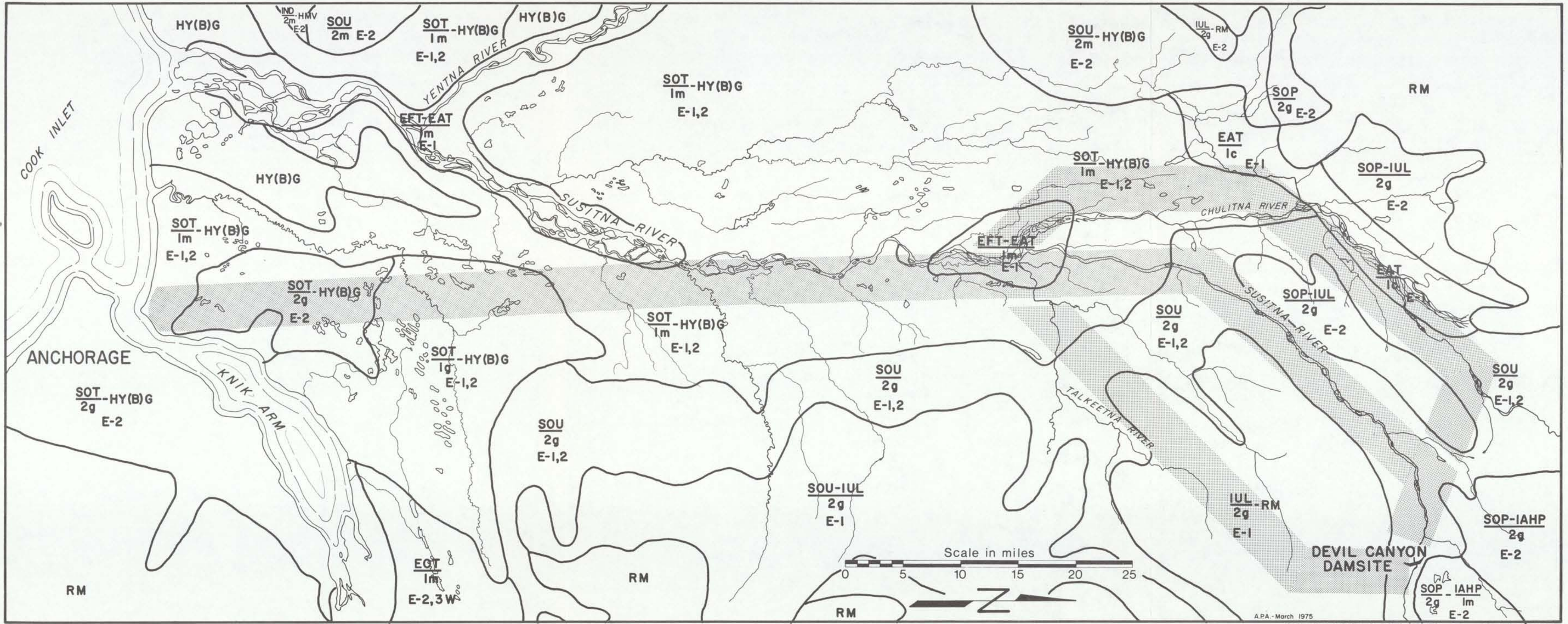
1 - Slopes dominately less than 12%.
2 - Slopes dominately steeper than 12%.

Textural Groups

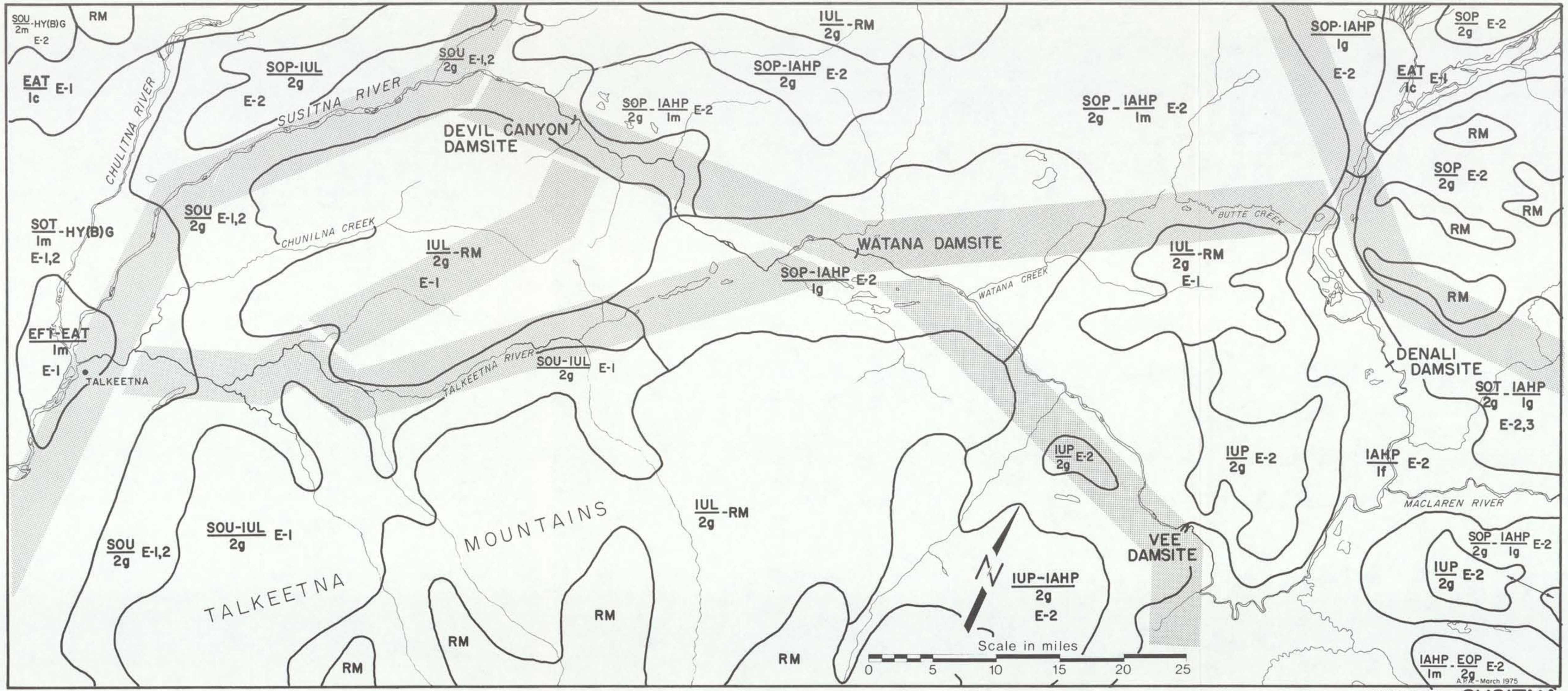
c - sandy
f - clayey
g - very gravelly
m - loamy (medium)

Erosion Potential

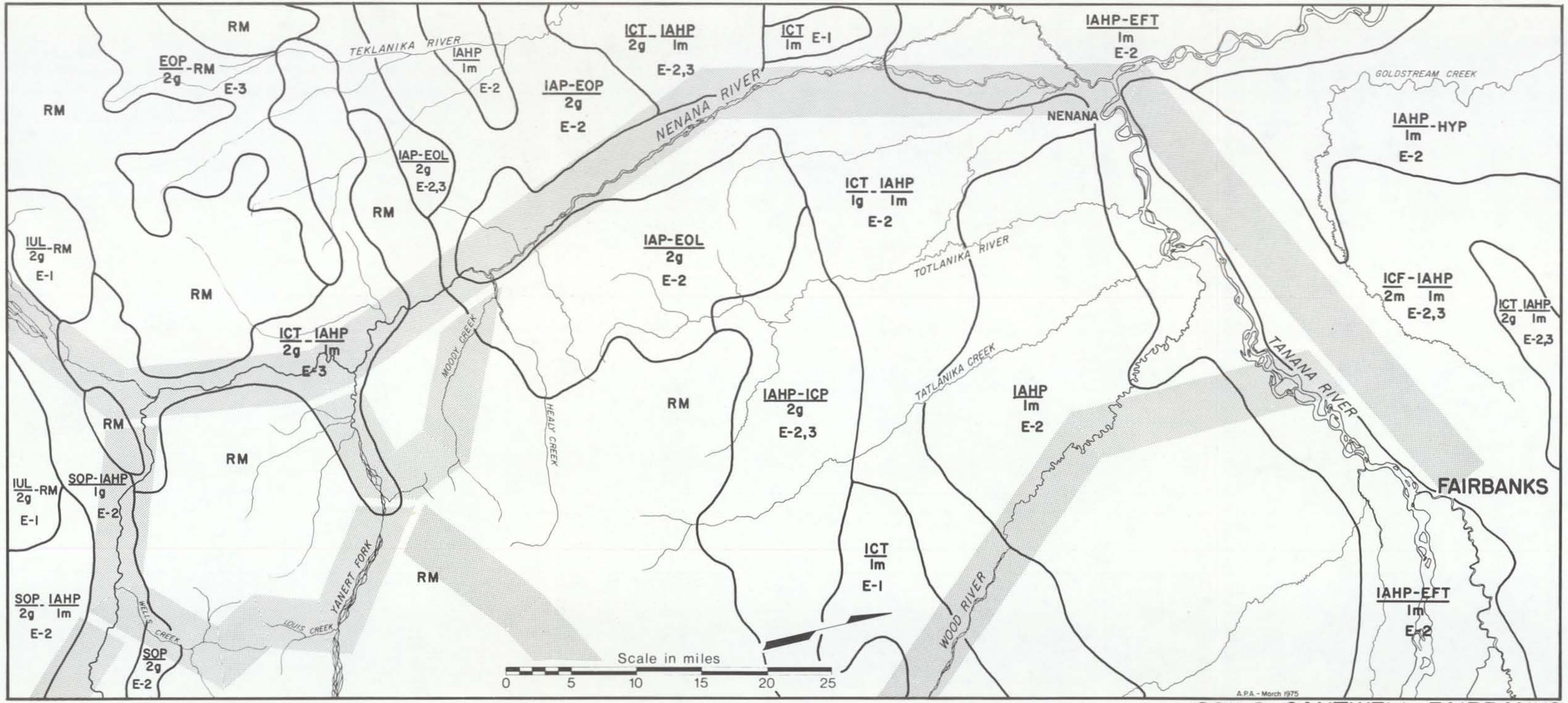
E-1 - low
E-2 - medium
E-3 - high



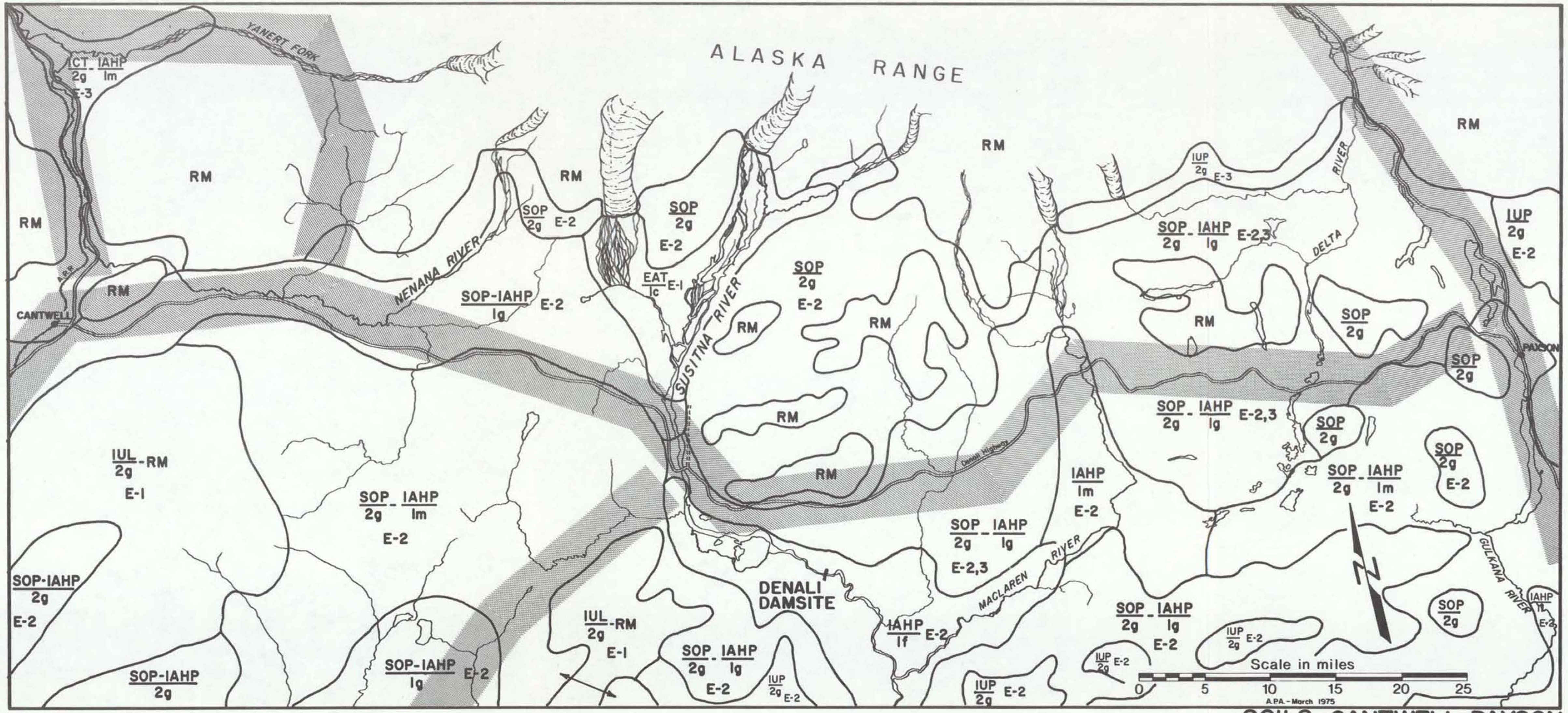
SOILS: ANCHORAGE-DEVIL CANYON



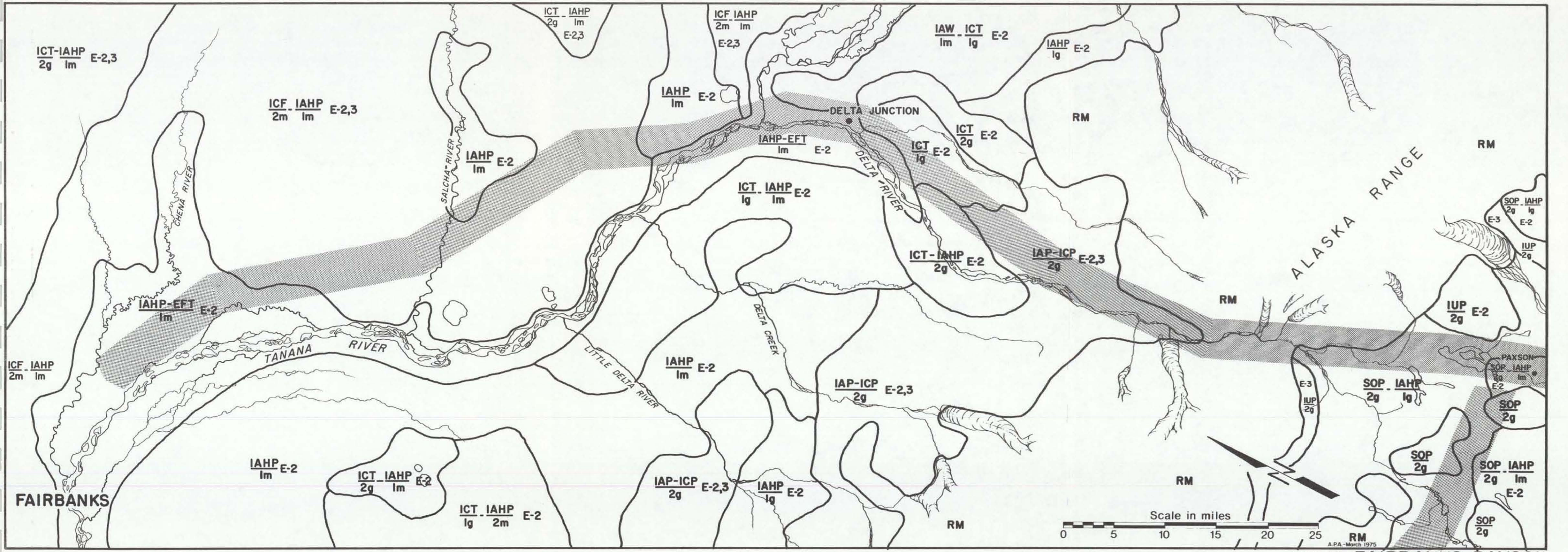
SOILS : SUSITNA



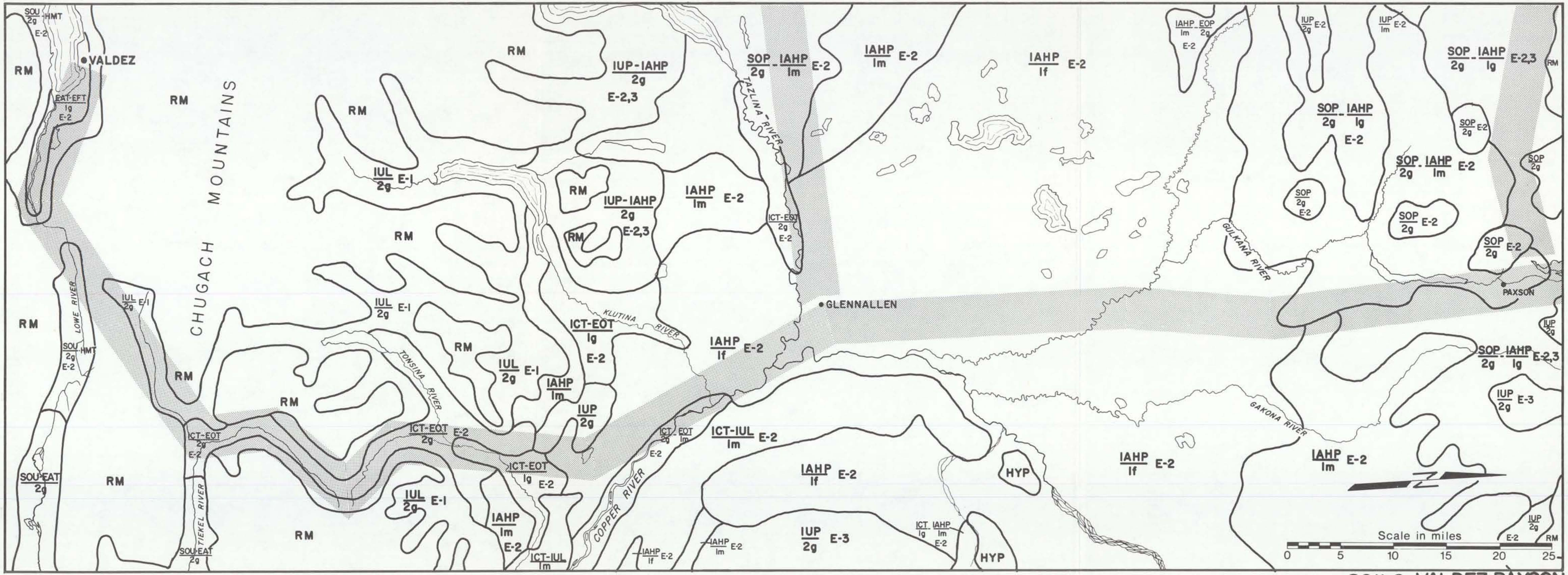
SOILS: CANTWELL-FAIRBANKS



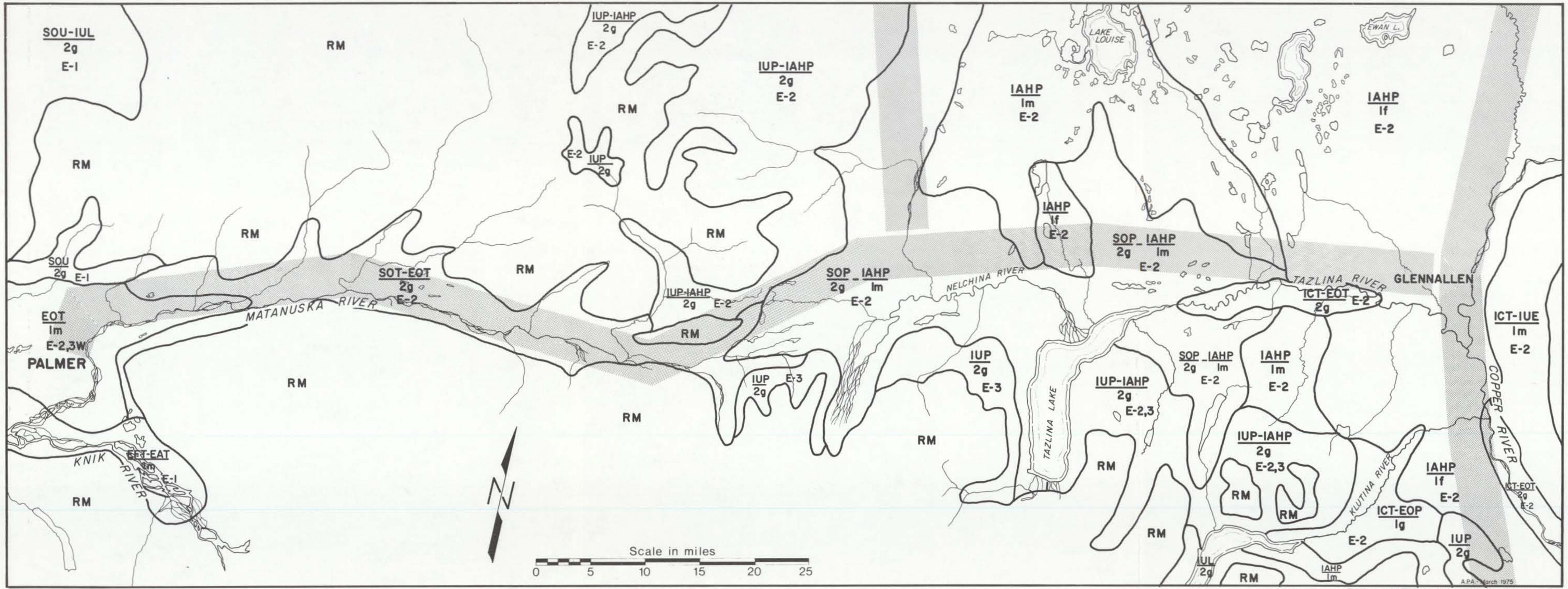
SOILS - CANTWELL-PAXSON



SOILS: FAIRBANKS-PAXSON



SOILS: VALDEZ-PAXSON



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

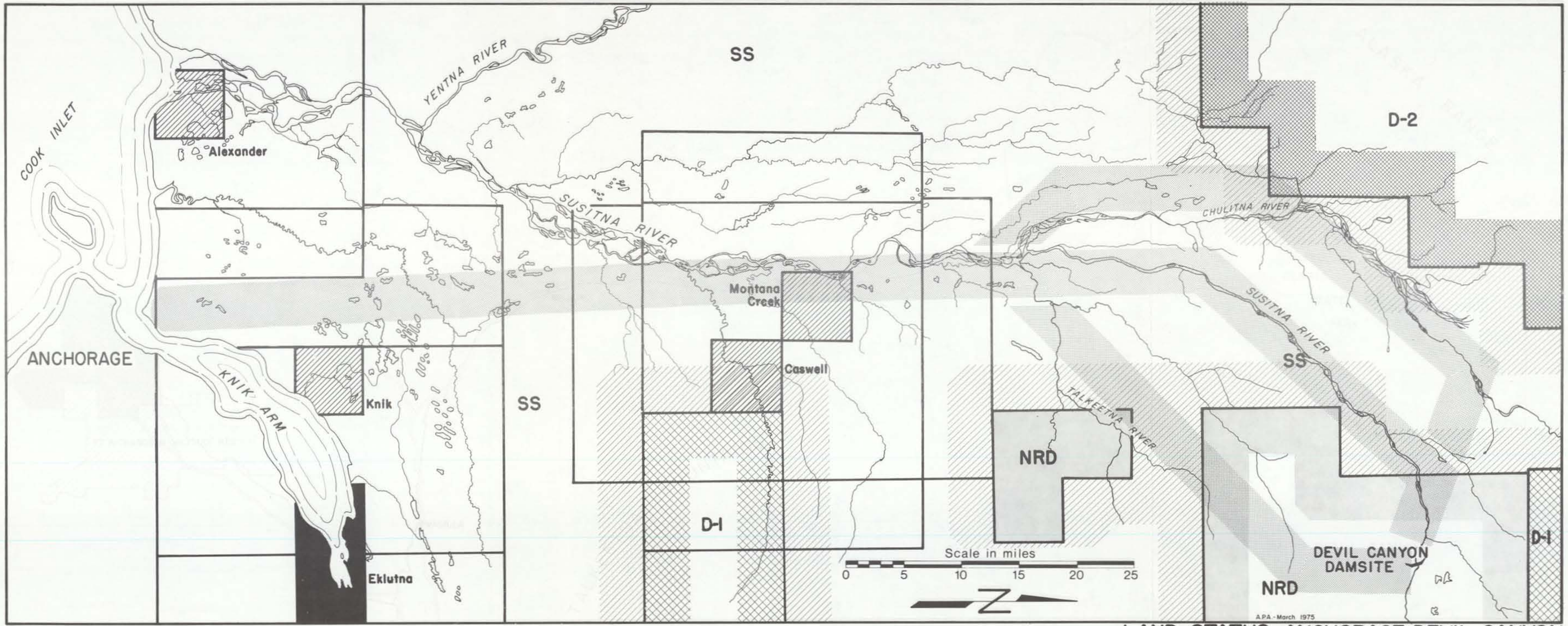
Withdrawals for Native villages, eligibility for land selection not finally determined

Village deficiency withdrawals (NVD)

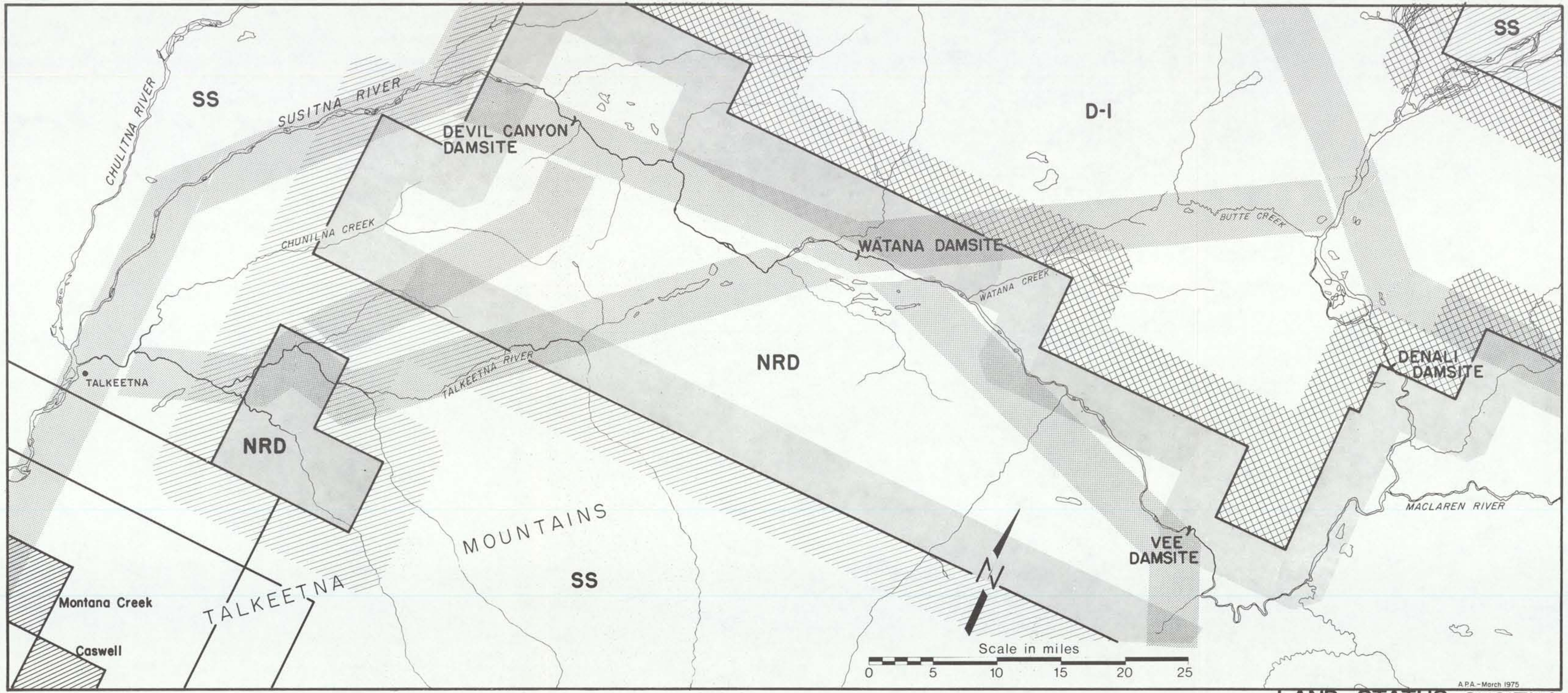
Regional deficiency withdrawals (NRD)

Utility corridor (UC)

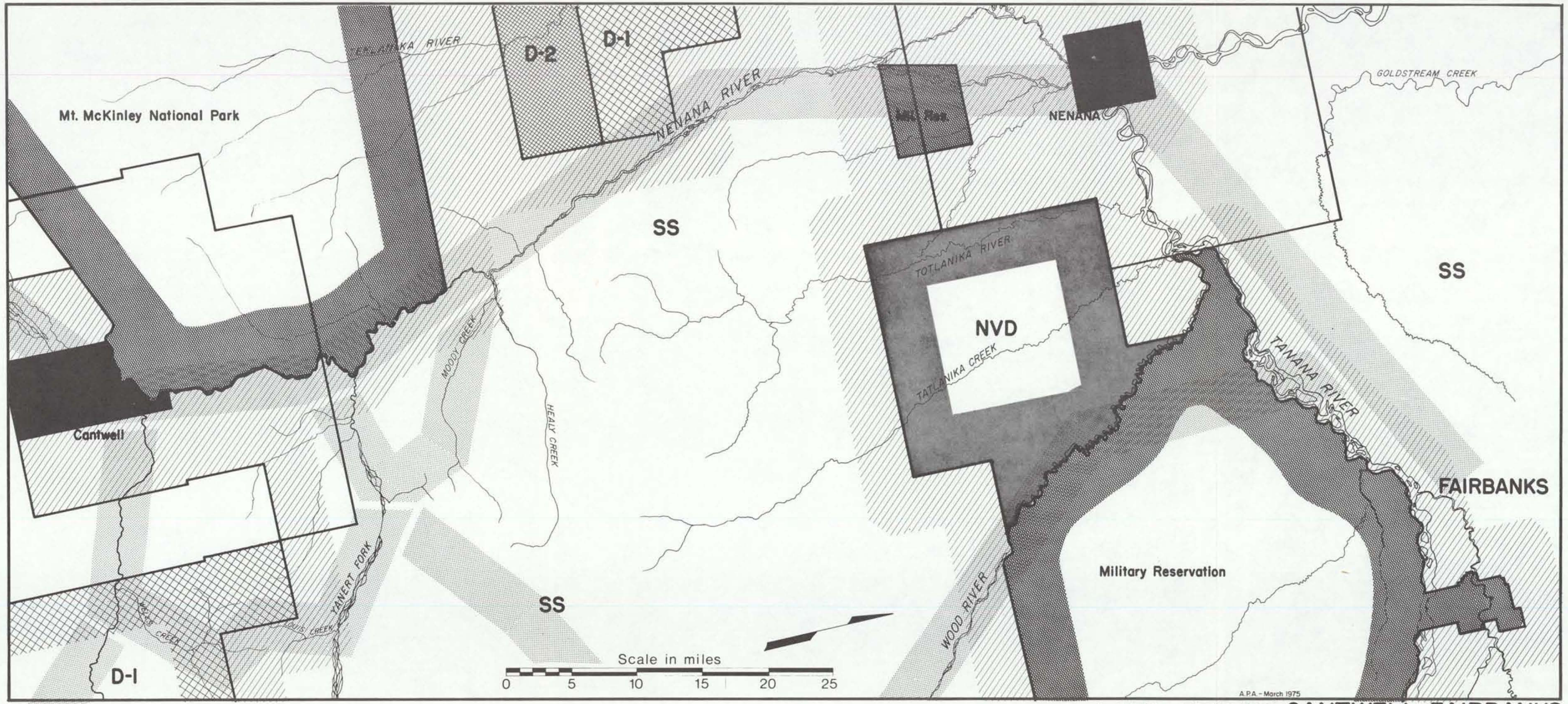
These maps represent the land status situation as determined by the Bureau of Land Management, December 18, 1973



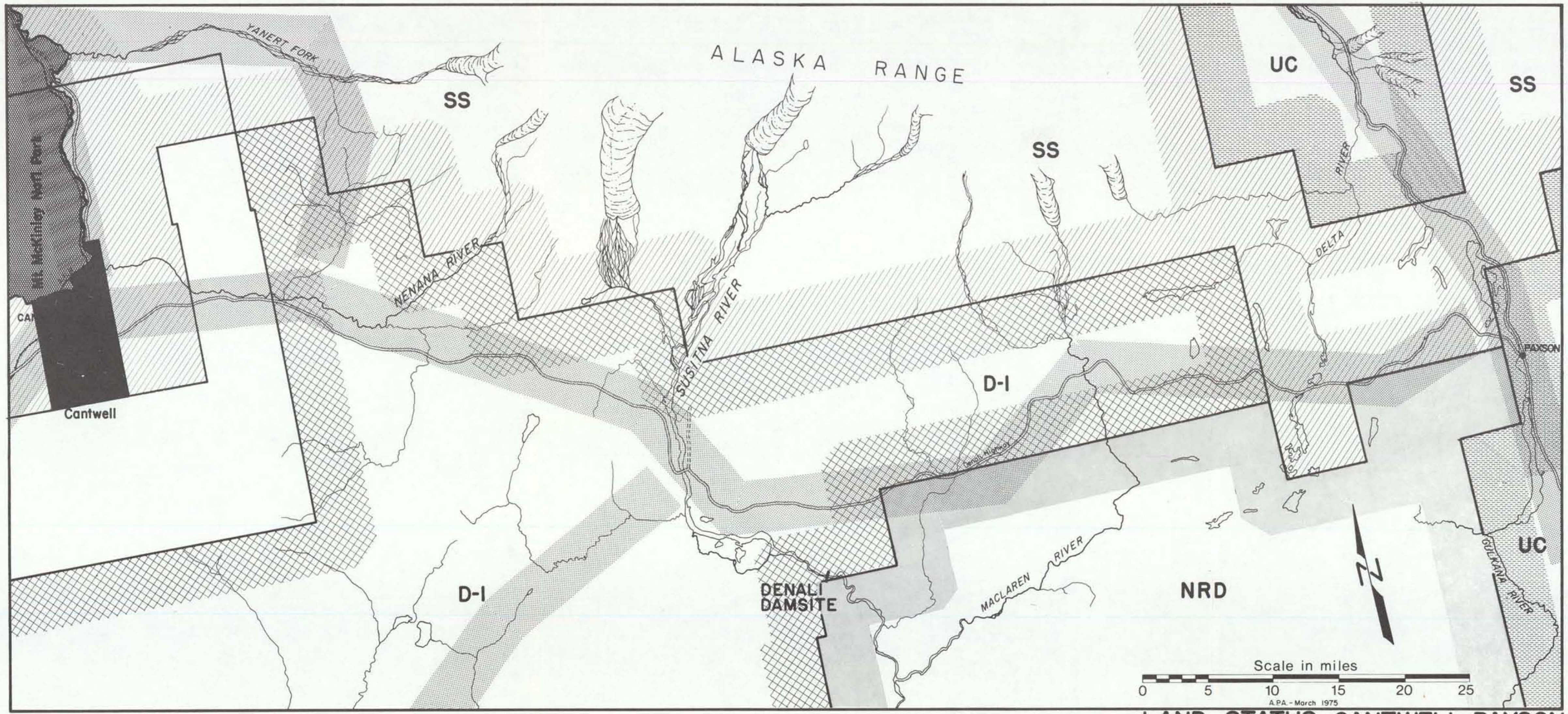
LAND STATUS: ANCHORAGE-DEVIL CANYON



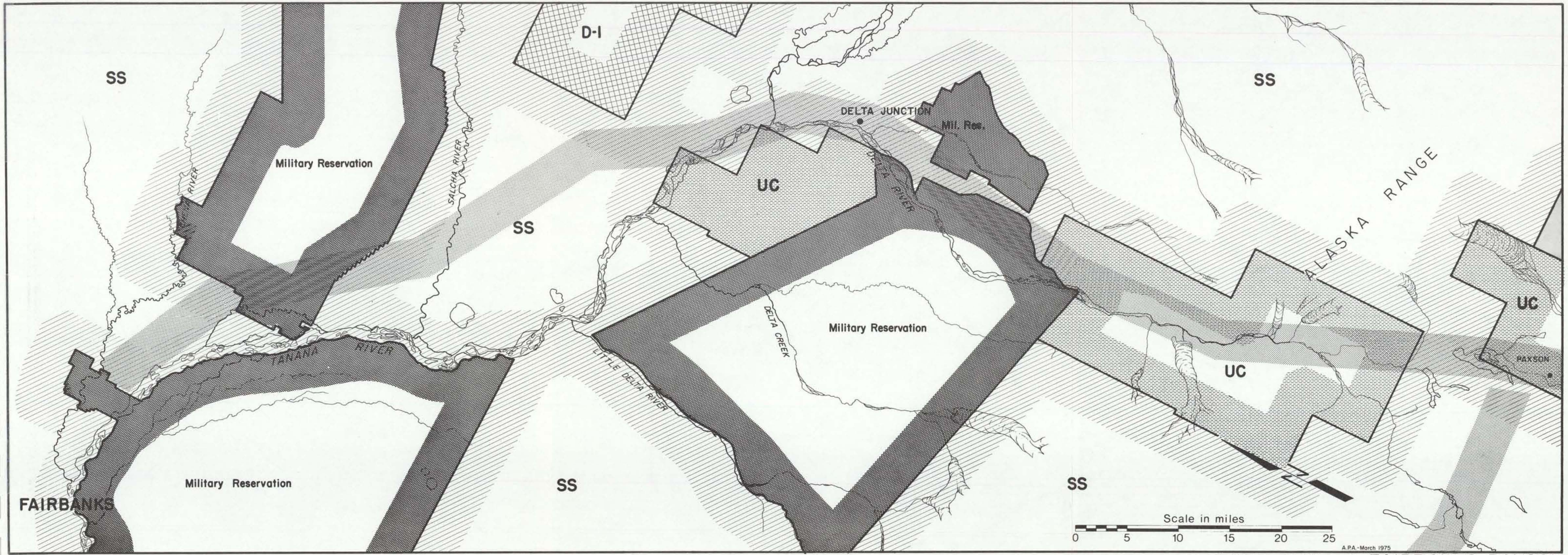
LAND STATUS: SUSITNA



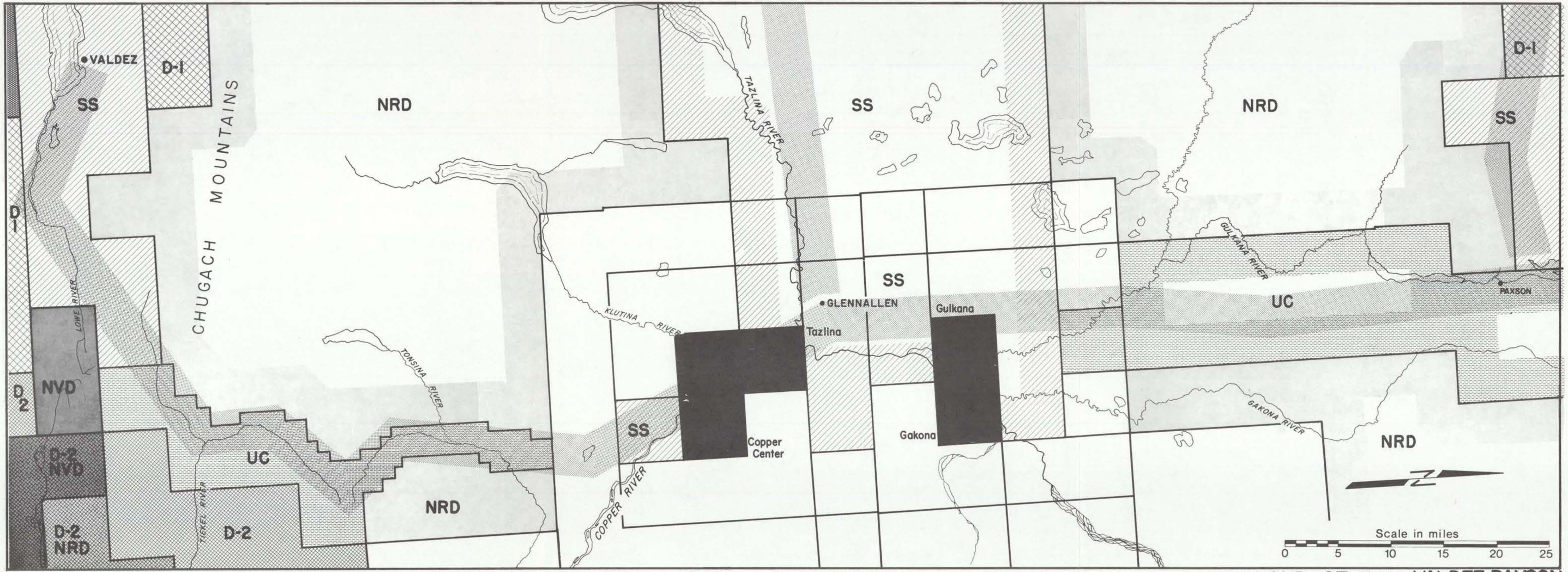
LAND STATUS: CANTWELL-FAIRBANKS



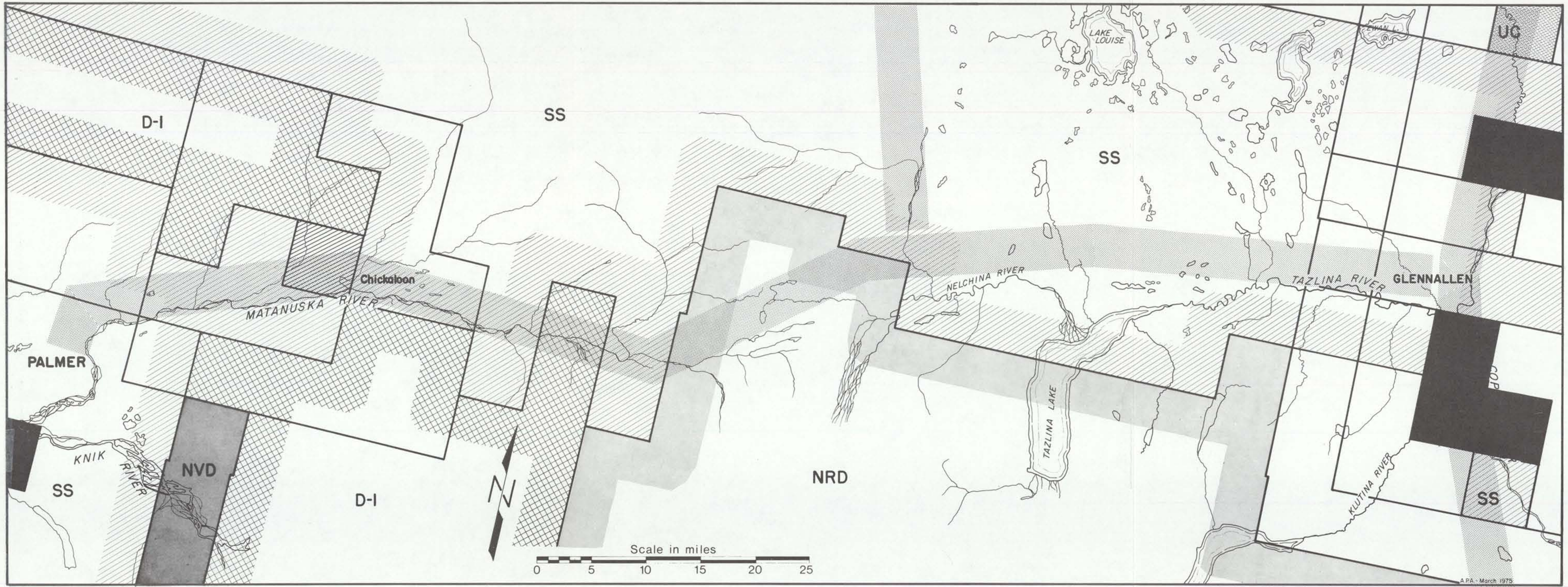
LAND STATUS: CANTWELL-PAXSON



LAND STATUS: FAIRBANKS-PAXSON



LAND STATUS : VALDEZ-PAXSON



LAND STATUS: PALMER-GLENNALLEN

APPENDIX III

APPENDIX III

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

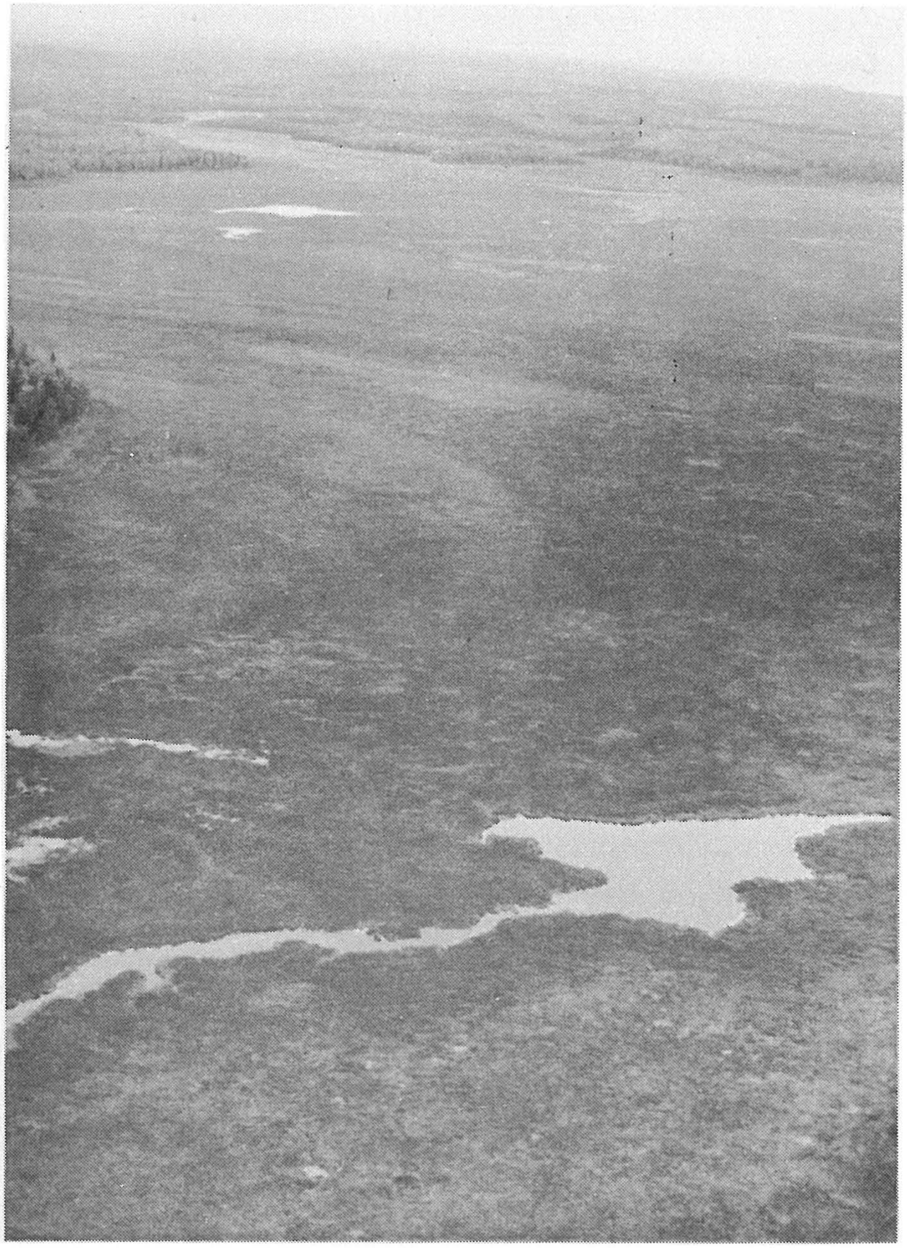
Photos 29 - 30 are illustrations of Corridor Susitna-3, 4

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.

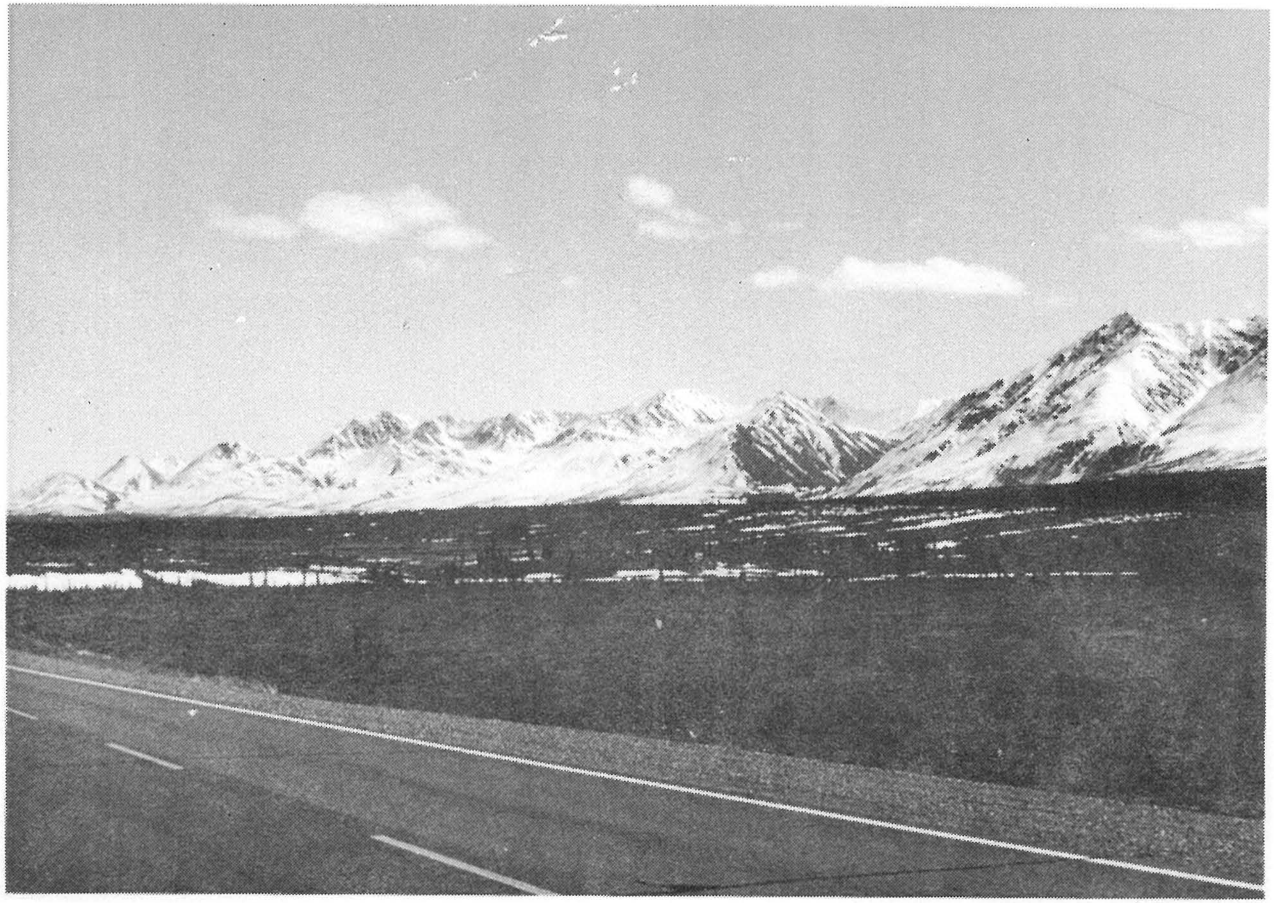
Susitna River Valley. Lakes are prevalent and associated with muskegs, which succeed them in formation. Muskegs are succeeded in turn by forests dependent upon well-drained soils. The three stages of succession are shown here.

Susitna River Valley near Talkeetna. As the terrain becomes more rolling, the relative amount of muskeg becomes less.

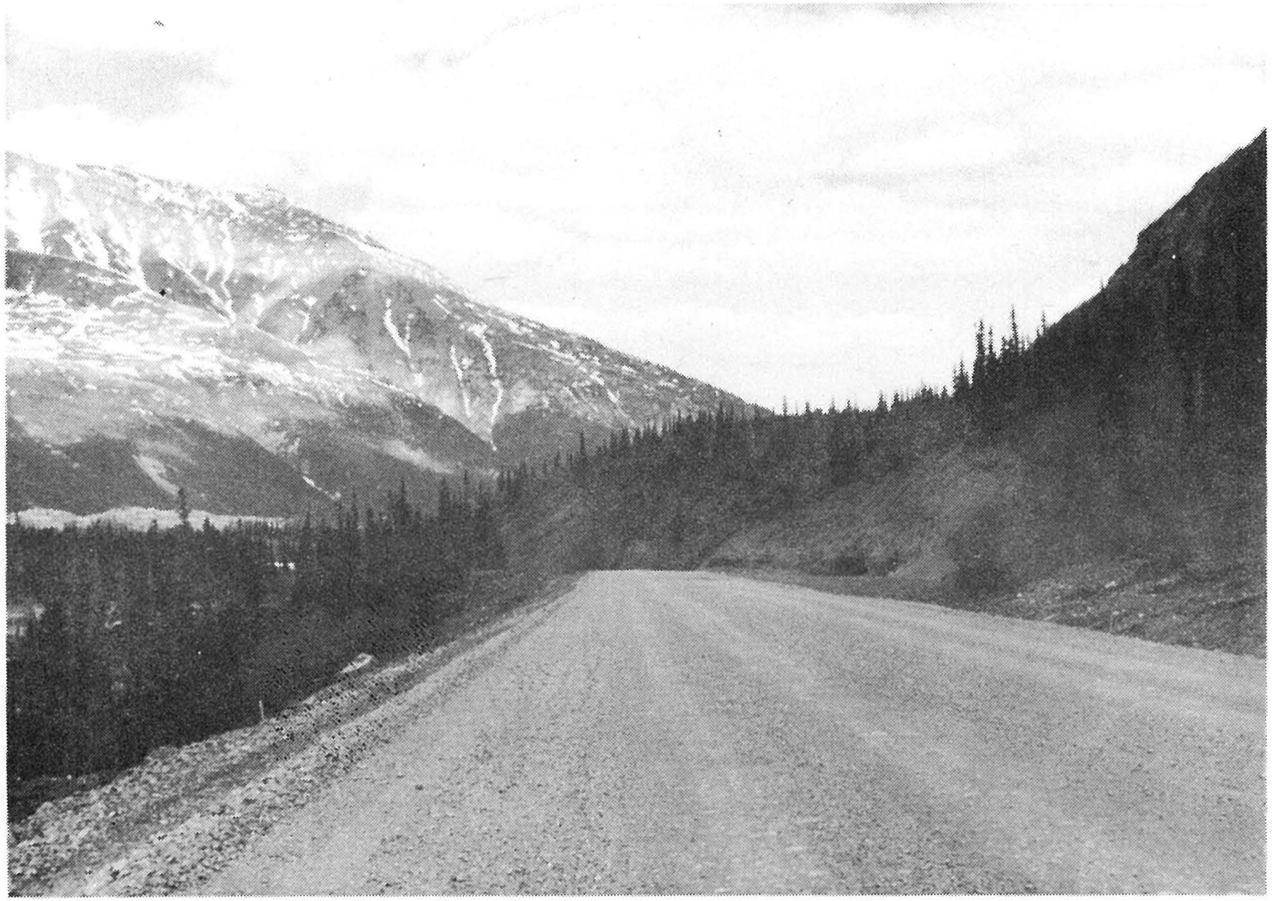
Town of Talkeetna. This town is at the confluence of the Talkeetna, Susitna, and Chulitna Rivers. The Alaska Railroad can be seen crossing the Talkeetna River near the right edge of the picture.

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.



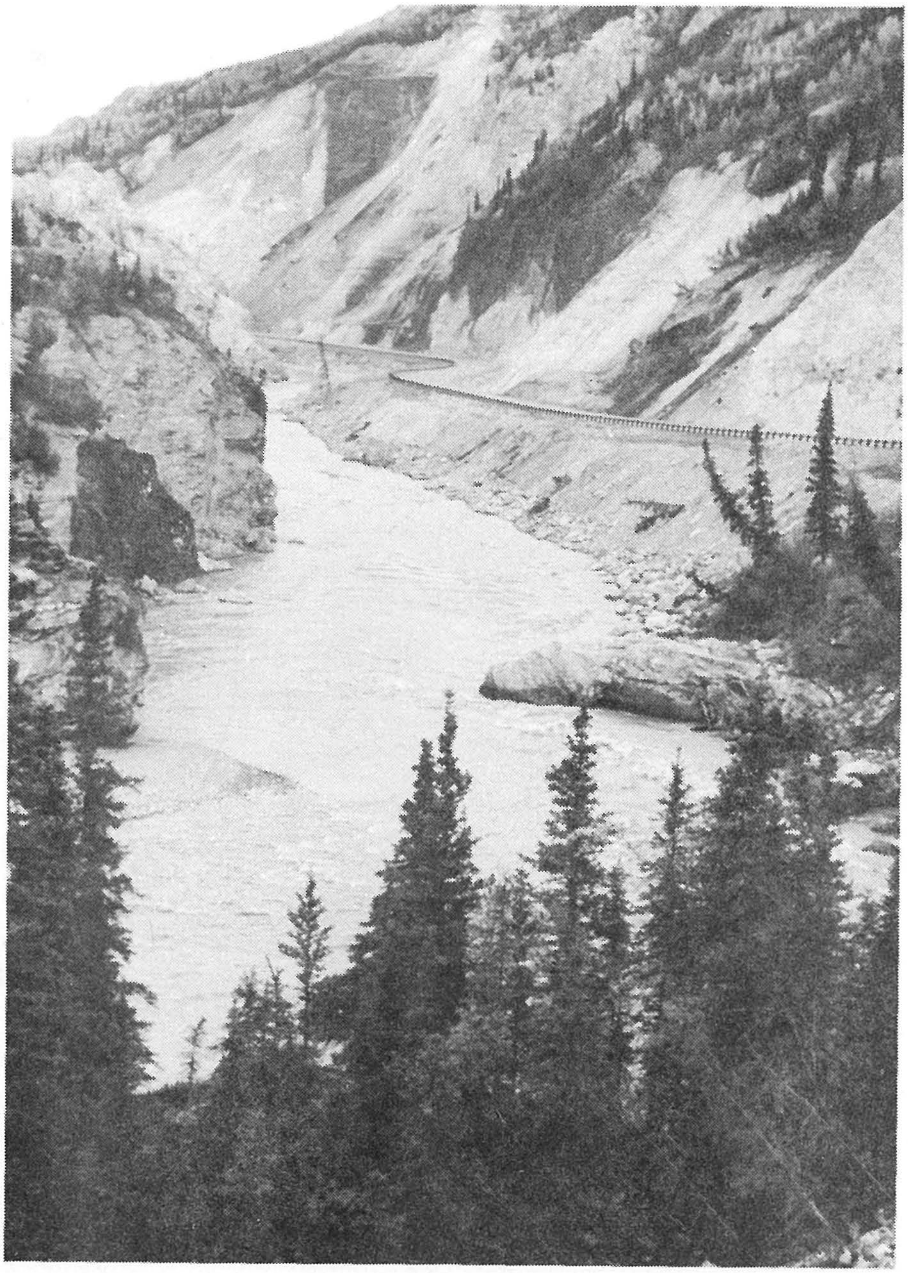
Alaska Range from Anchorage-Fairbanks Highway near Broad Pass. Soil here is poorly drained; trees visible are black spruce.



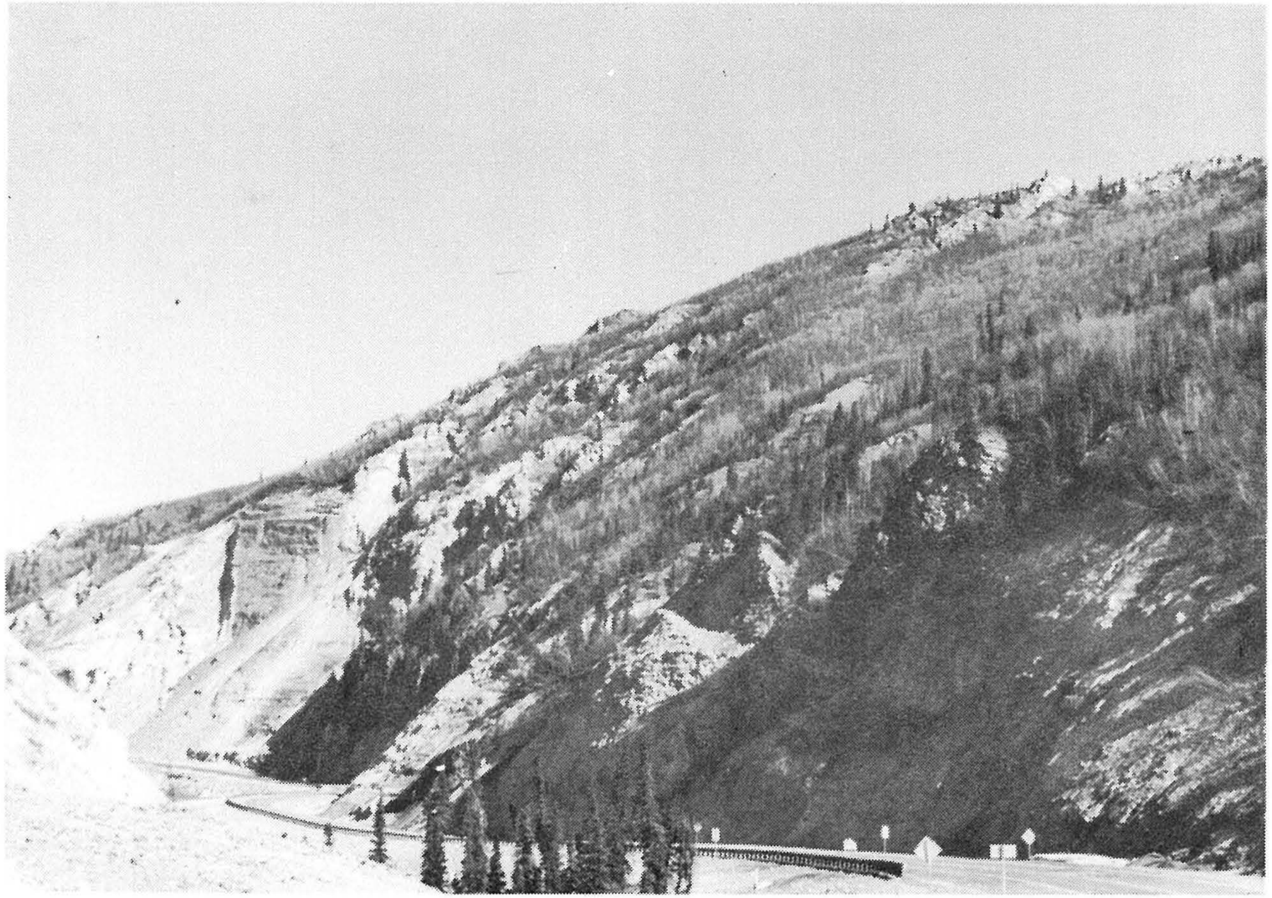
Entering Alaska Range on Anchorage-Fairbanks Highway, north of Cantwell.
Concealment of line will be difficult in areas such as this.

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.



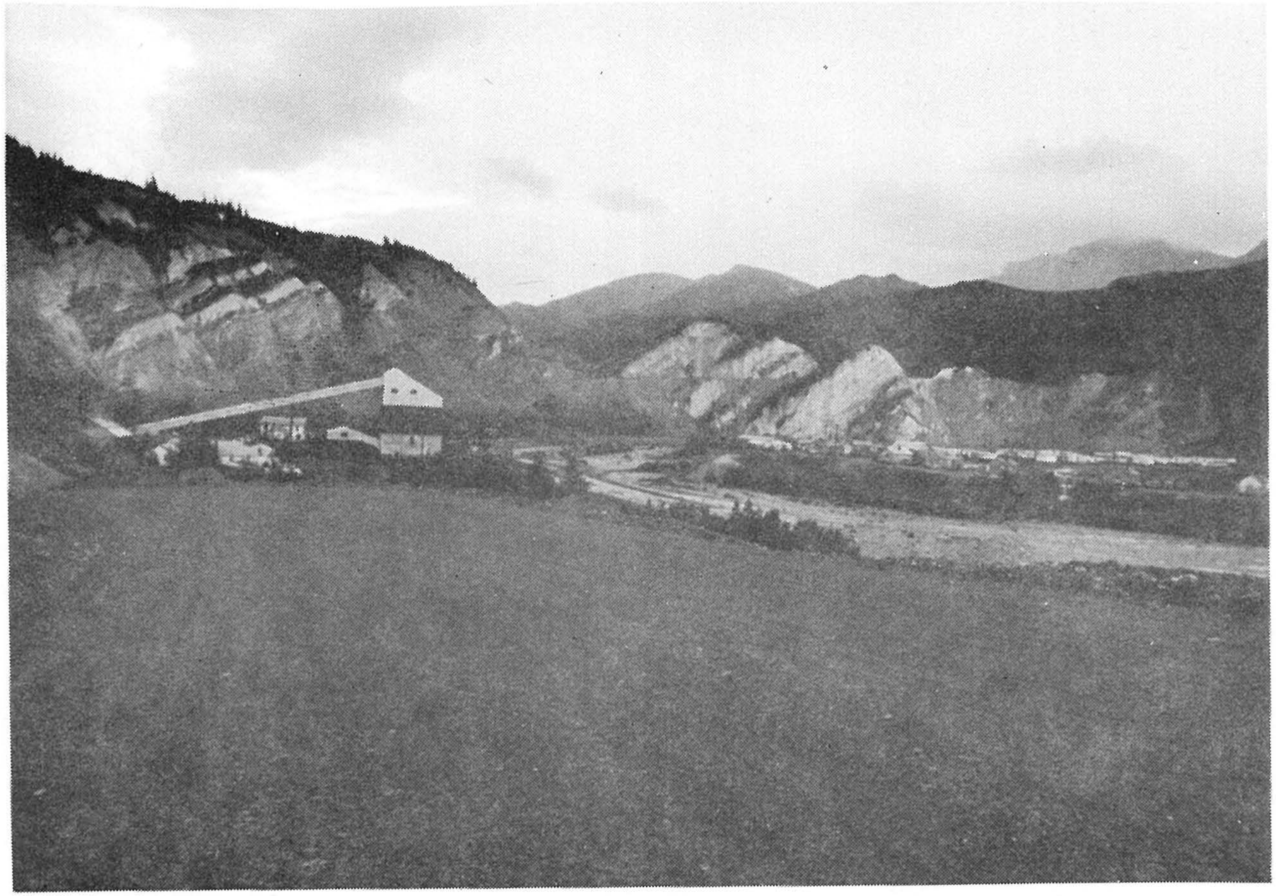
Very restricted canyon along Nenana River north of McKinley Park. Alaska Railroad is off left-hand edge of photo. Land left of river is within Mount McKinley National Park.



Another view of canyon on Nenana River.

Nenana River valley in vicinity of Moody bridge on Anchorage-Fairbanks Highway.

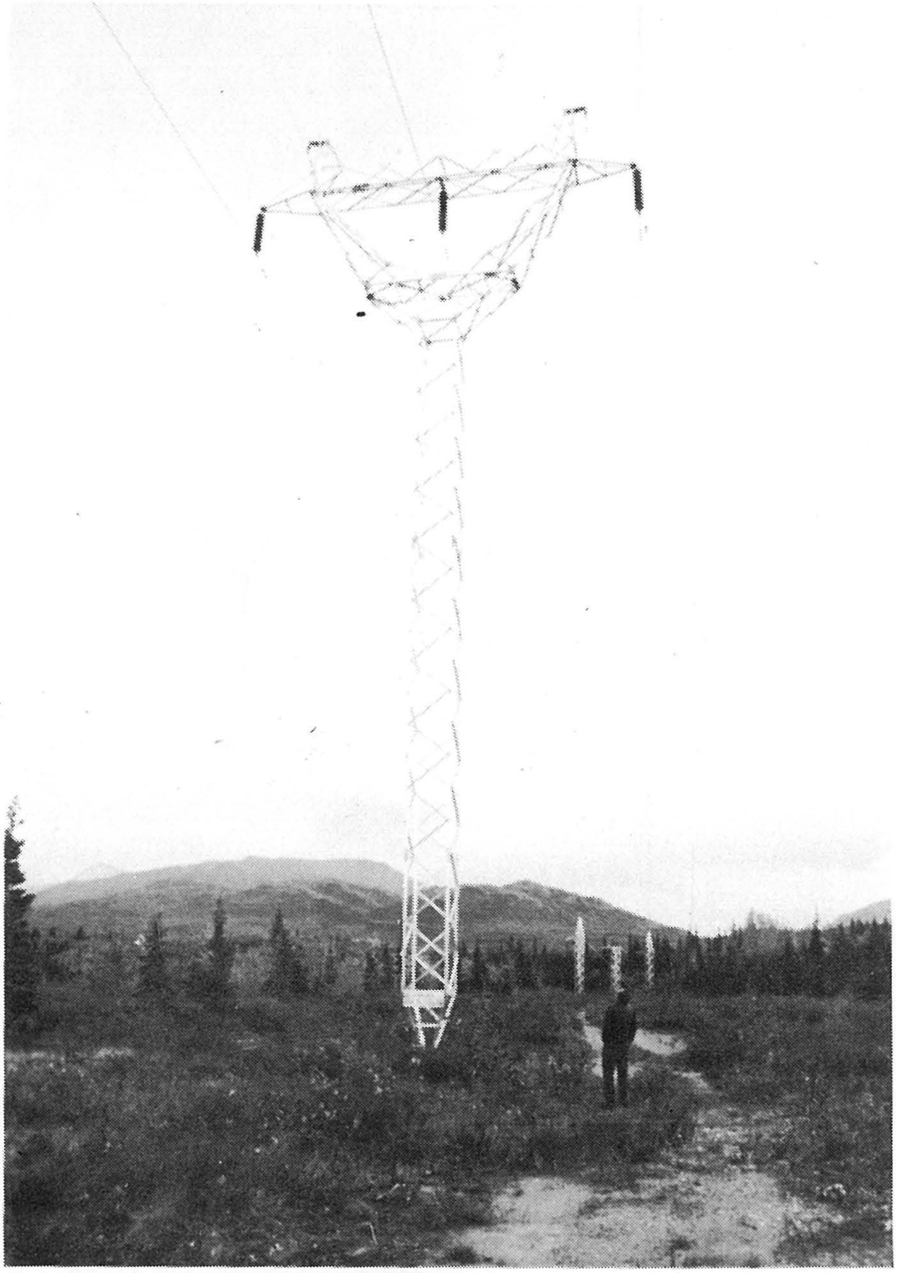
Alaska Railroad north of McKinley Park.



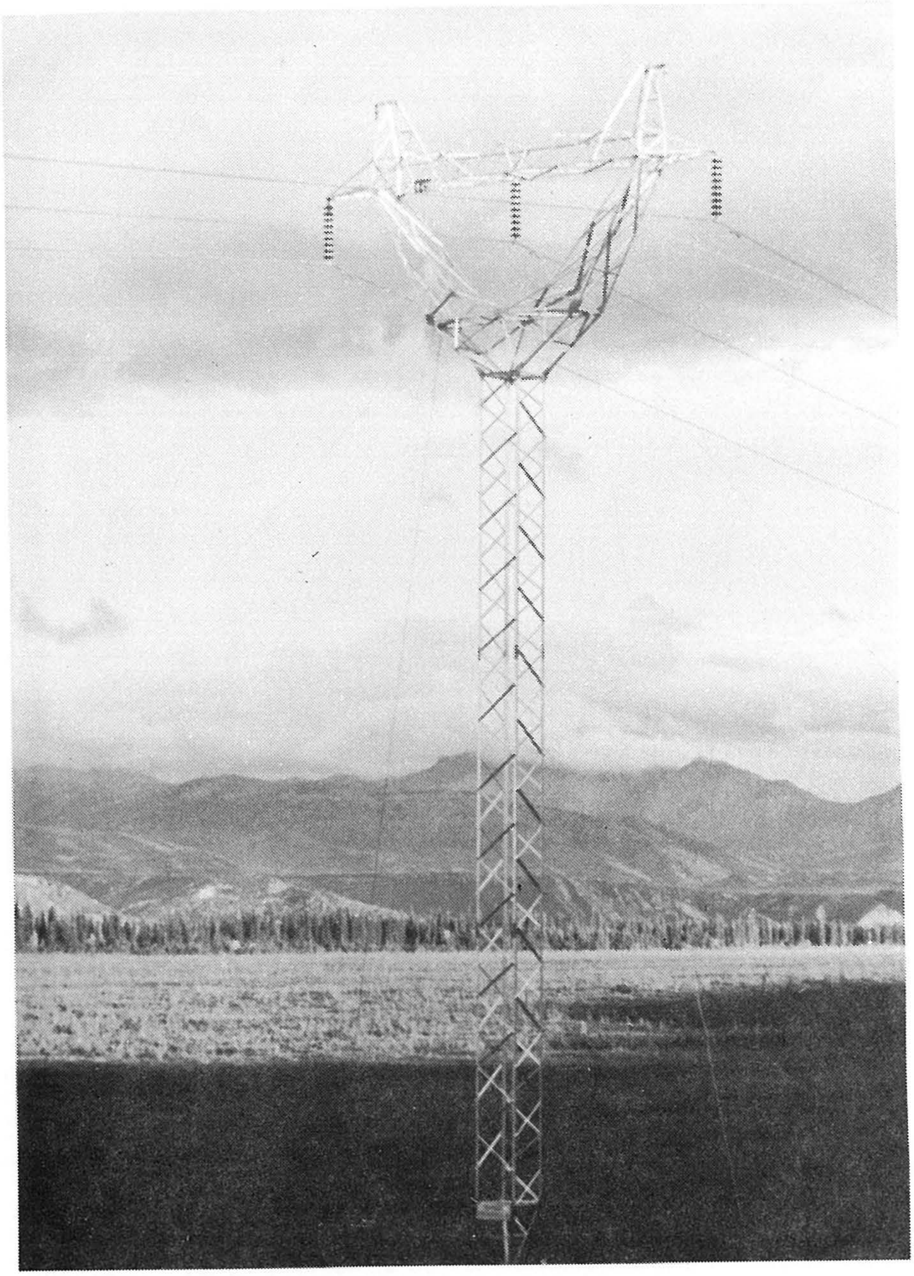
Usibelli Coal Mines near Healy. Note the seams of coal in the scarp. This coal is the fuel for the Healy steamplant.

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.

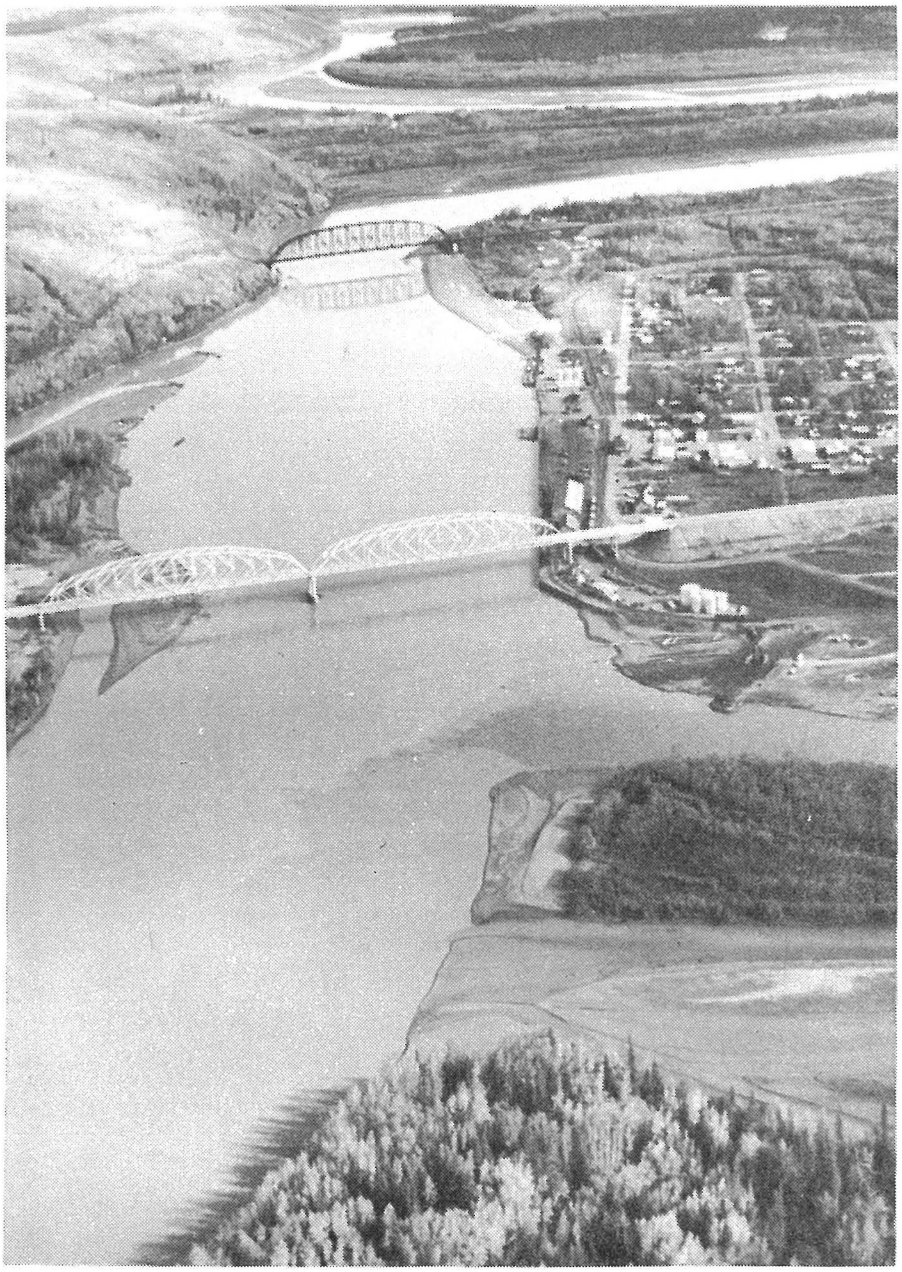


Guyed tangent tower in foreground; guyed dead-end towers in background; Healy 138 KV transmission line.



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.

Town of Nenana; frontage on Tanana River. Nenana handles considerable river traffic on the Tanana River.

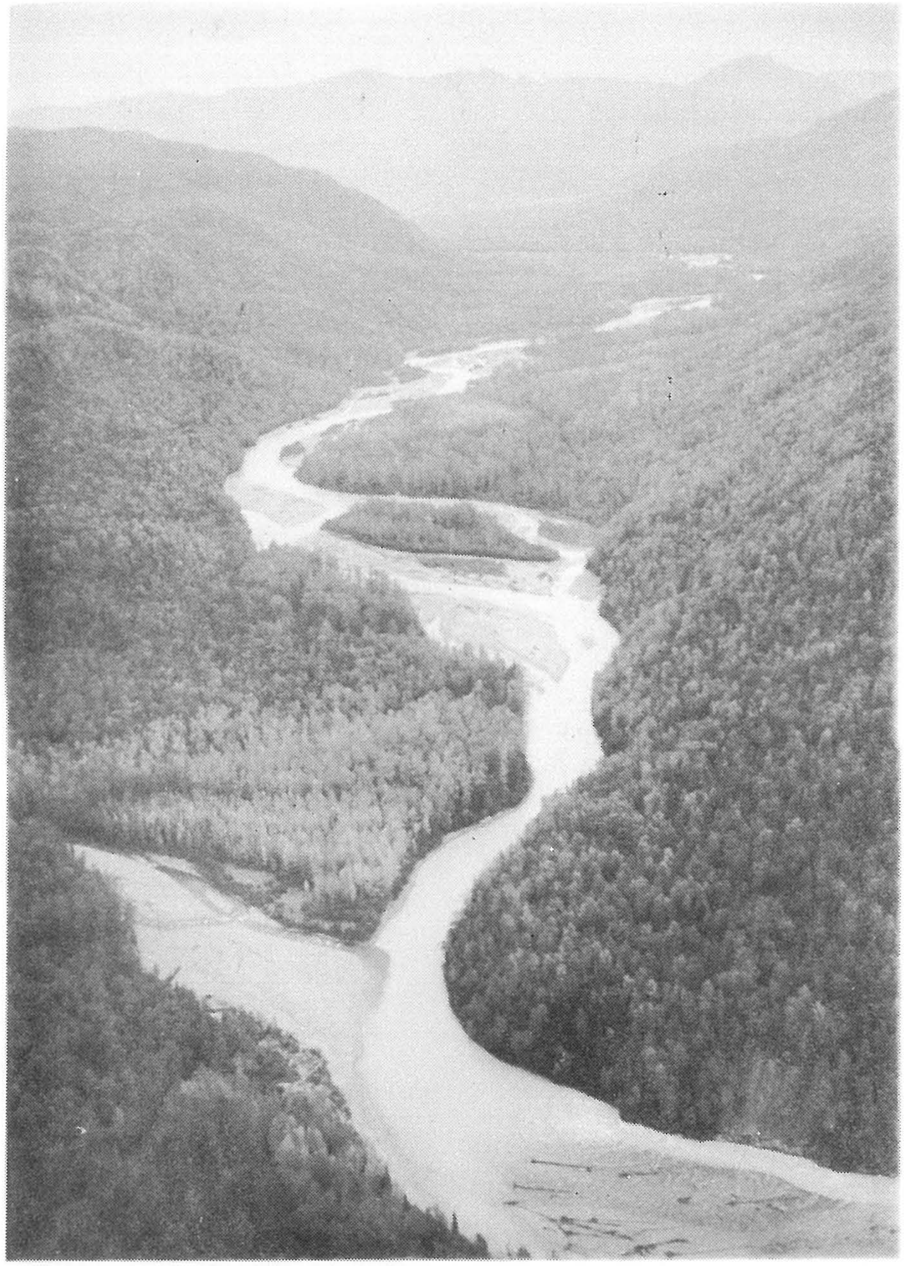
"Goldstream Hills". On the slopes, the predominant vegetation is birch-white spruce, on poorly drained areas and some north-facing slopes; black spruce predominate.

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.

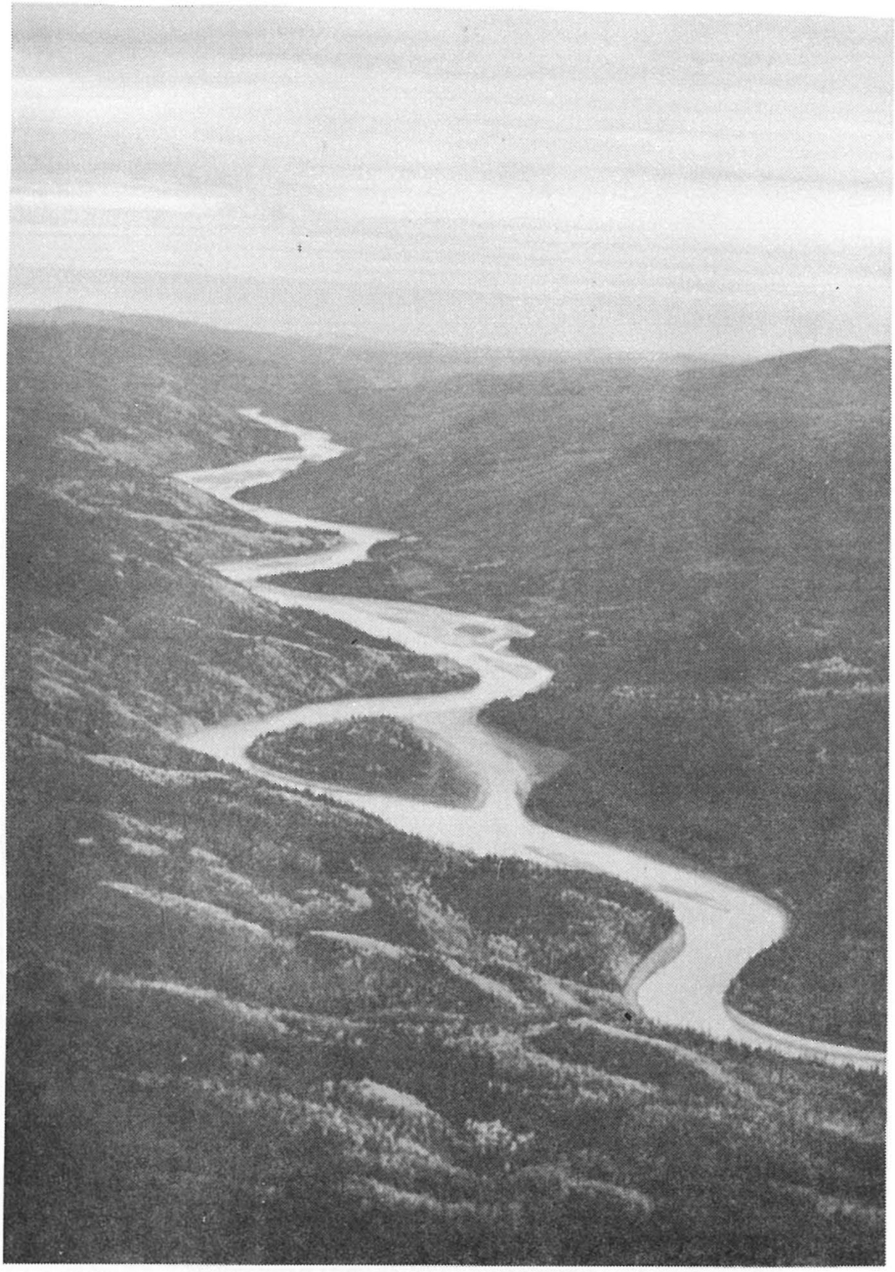
Lower Moody Creek at confluence with Healy Creek (top of photo). Unstable slopes are evident.

Looking north from western end of Denali Highway. Typical low brush and muskeg biomes. Trees are black spruce.

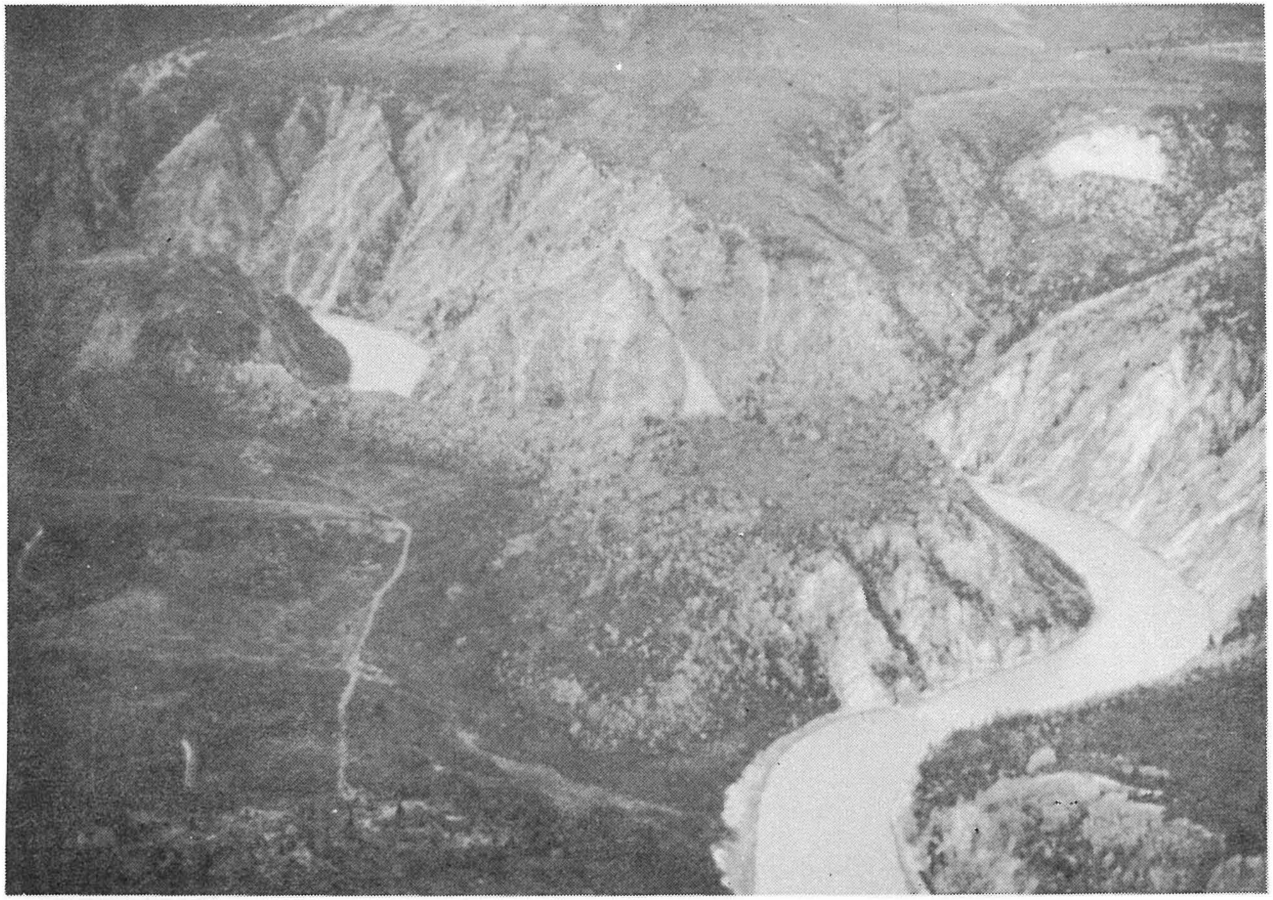
Aerial view looking west along Denali Highway and Nenana River to Cantwell. Note that forests are limited to the terrace slopes and levees of the river channel.

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.

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.

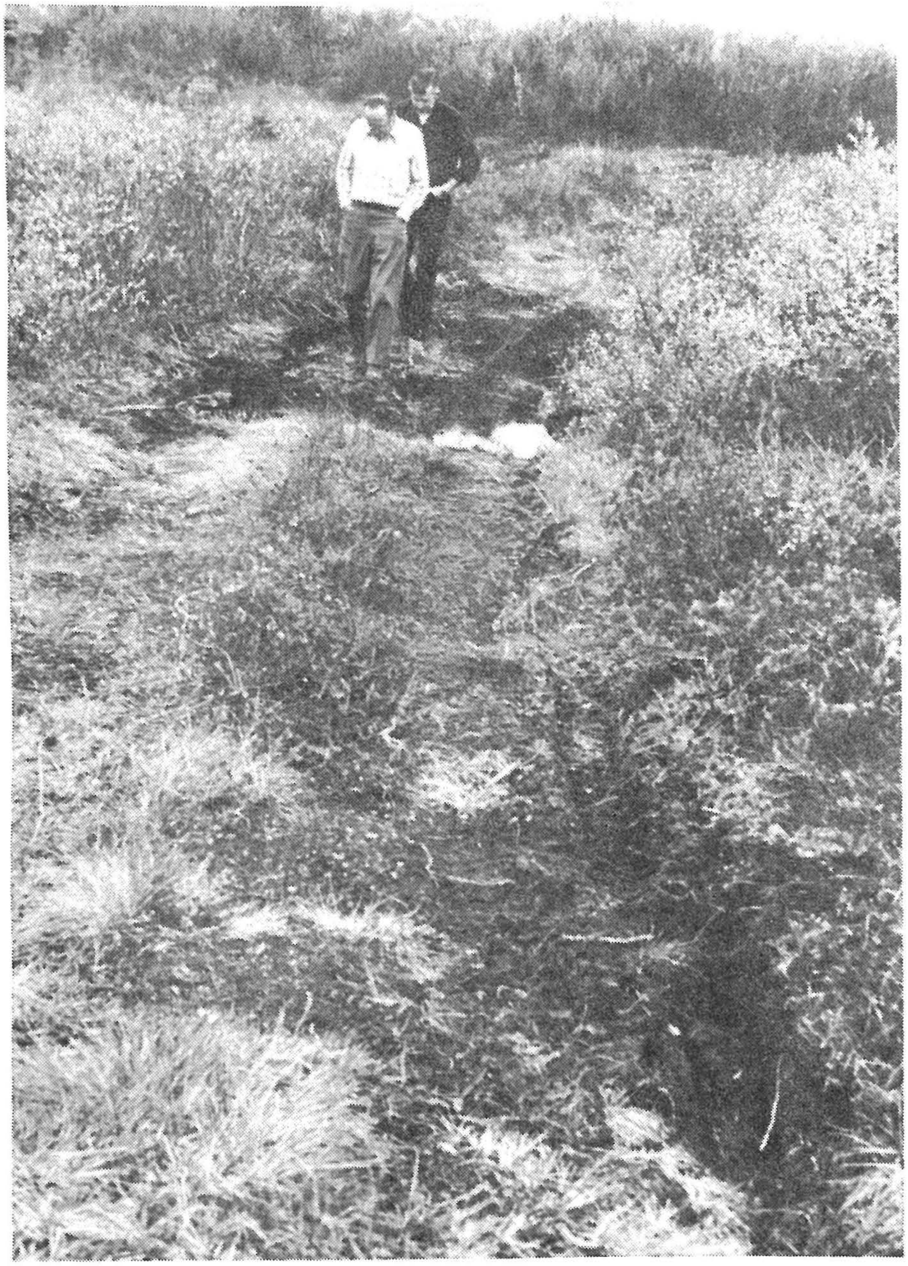


Susitna River between Watana and Vee damsites. Heavier vegetation, in this case upland spruce-hardwood forest, is limited to the valley slopes, the vegetative biome on the upper plateaus is generally moist tundra, muskeg, and alpine tundra.



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.

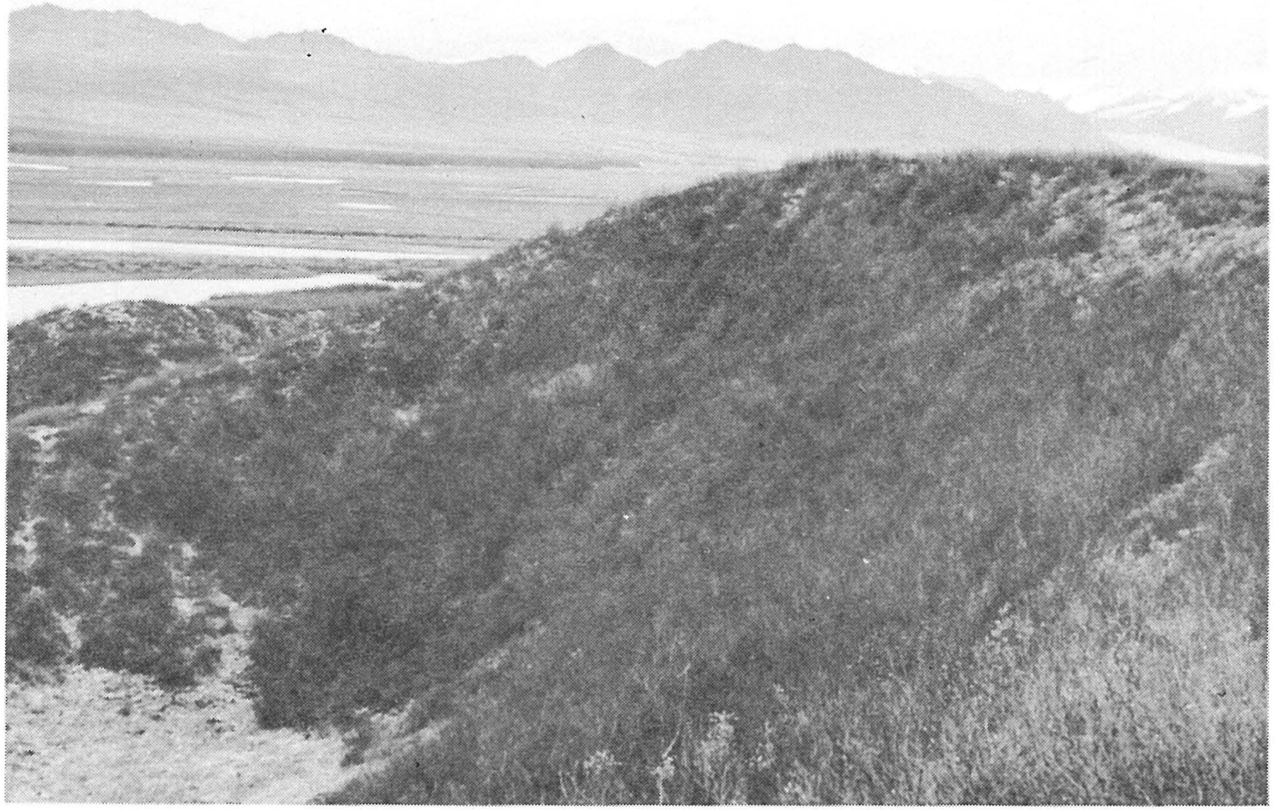
Moist tundra near Butte Lake; looking north to Monahan Flats and Alaska Range. ATV tracks are visible in the foreground; these tracks start from the Denali Highway, which crosses the flats in the background.



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 reltaivel 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.

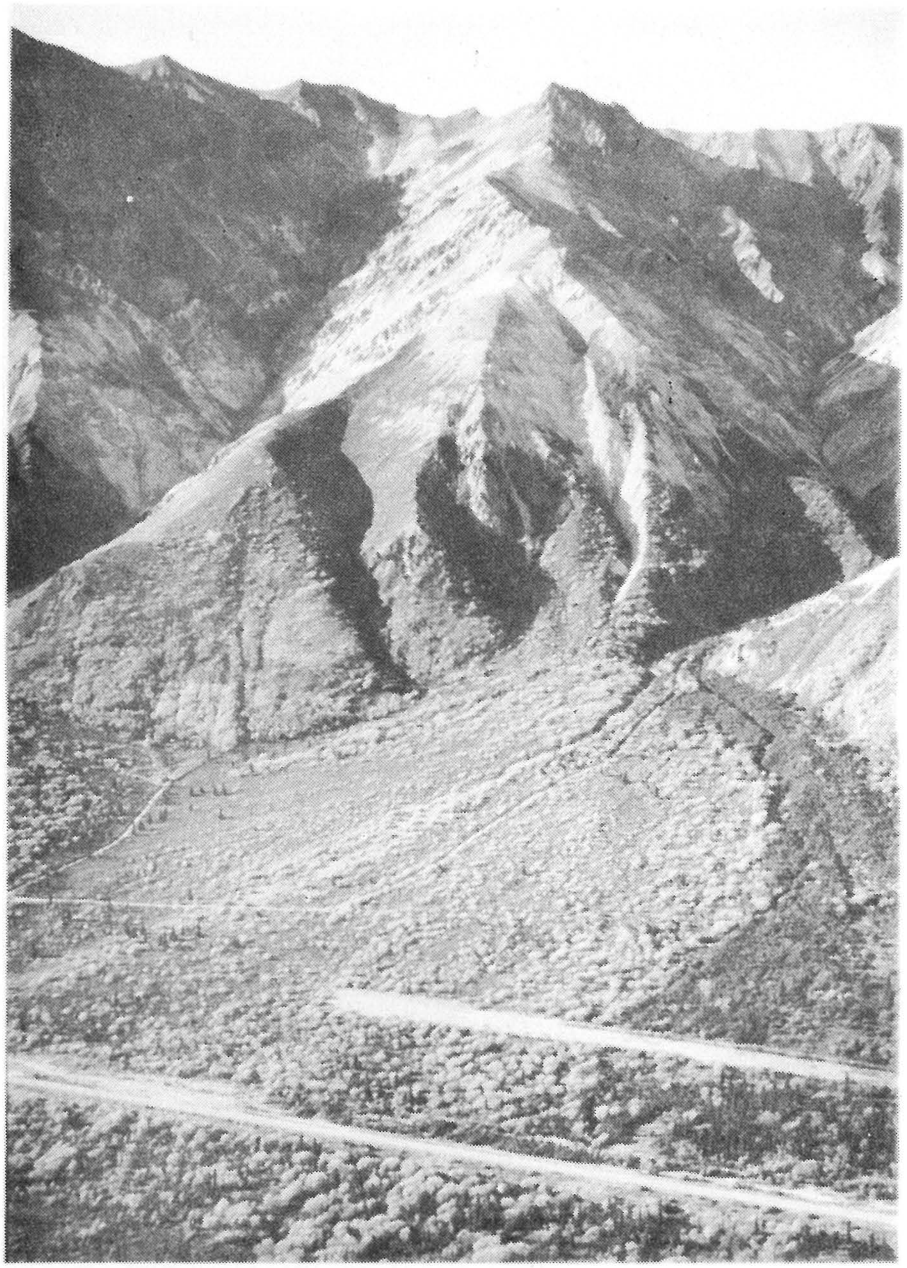
Uplands near Sourdough on the Richardson Highway. This is typical of the plateau bordering the Copper River lowland on the north and east. Poorly drained, it supports many lakes, the largest of them in the Lake Louise complex.

The Lake Louise plateau. Biomes are predominantly lowland spruce-hardwood and muskeg. These uplands are underlain by continuous permafrost.

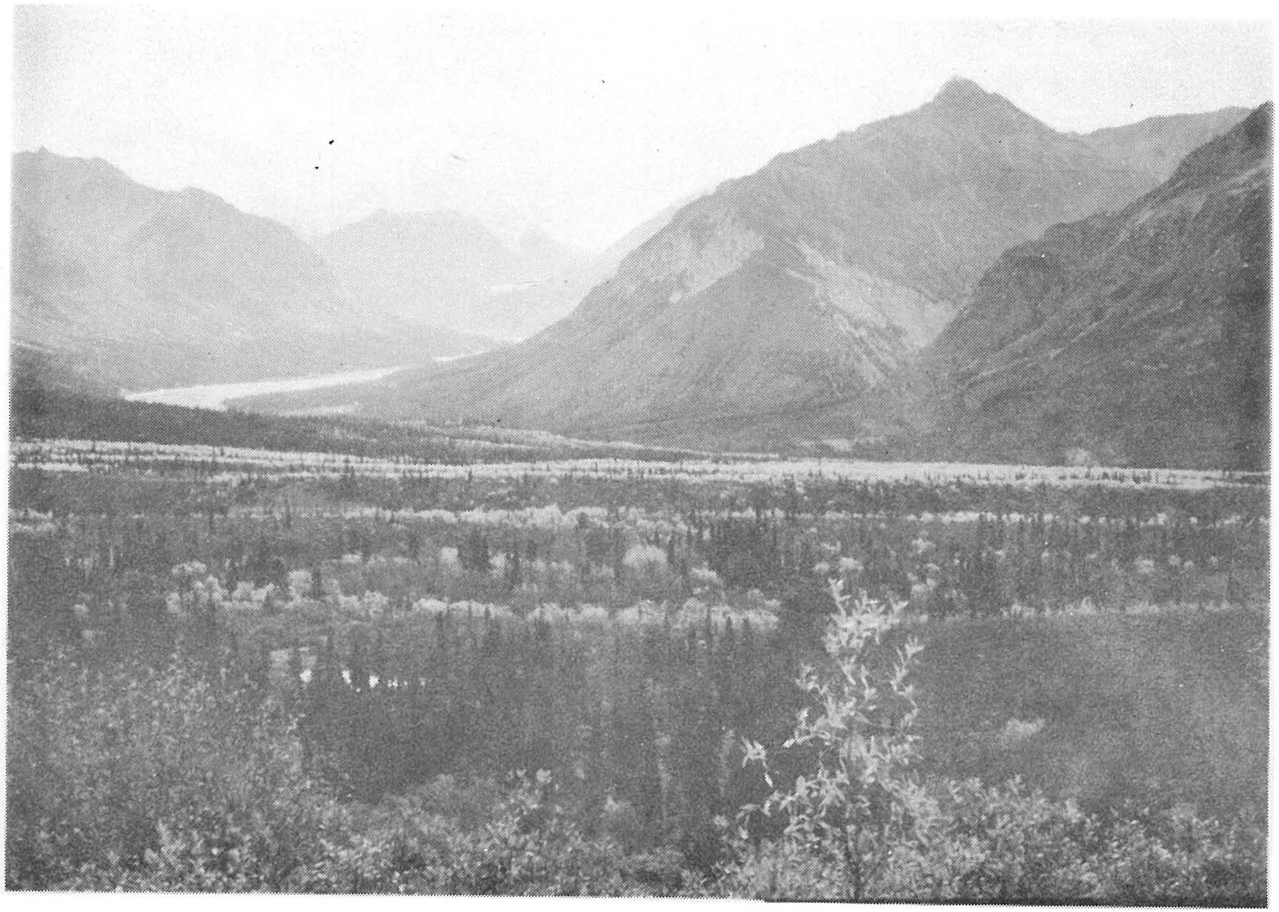
The Copper River lowlands, a large basin underlain by permafrost.

Tazlina River as seen from the Glenn Highway.

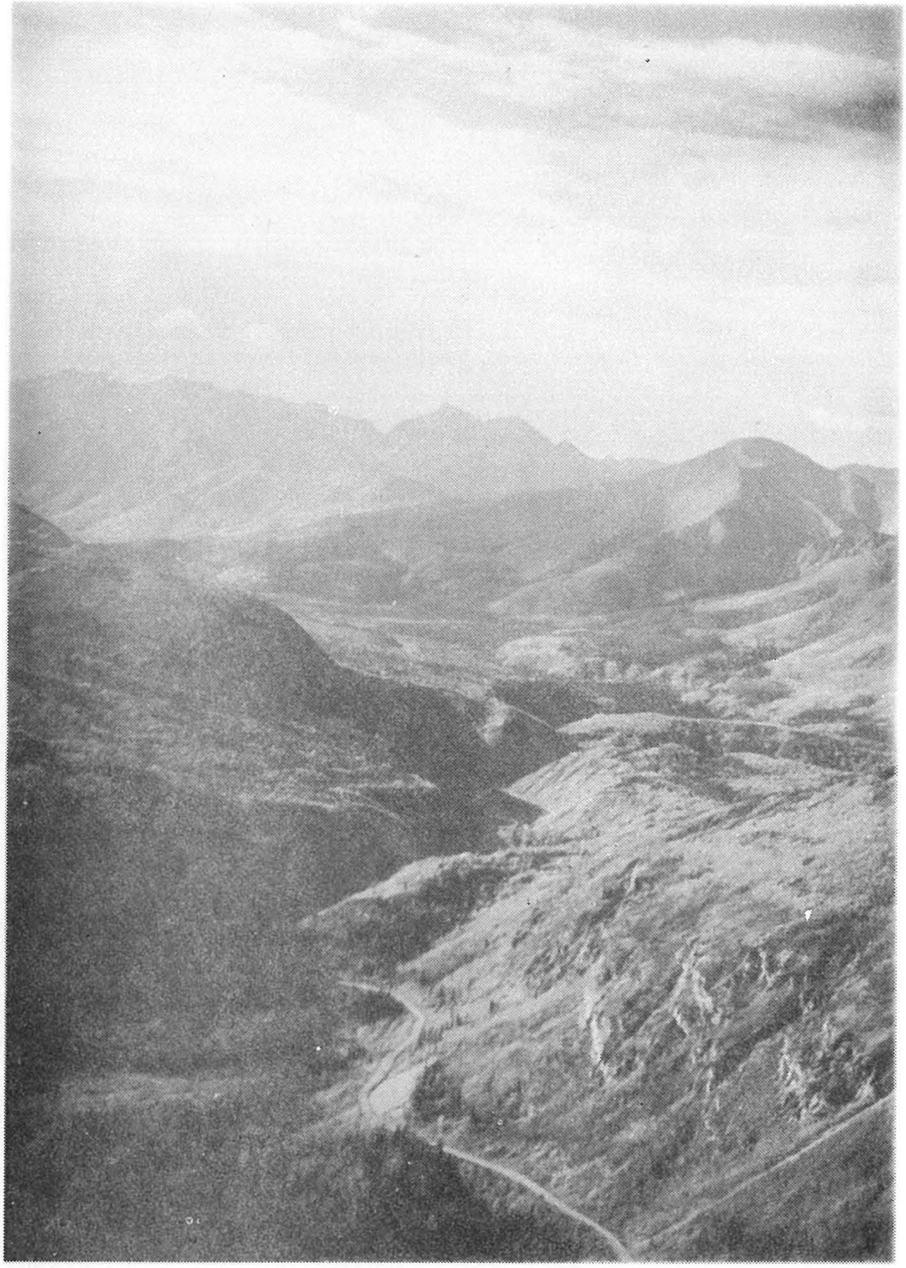
Tahneta Pass area between the Tazlina and Matanuska River drainages. Lakes and muskegs are indicative of poor drainage. The mountains are part of the Chugach Range.



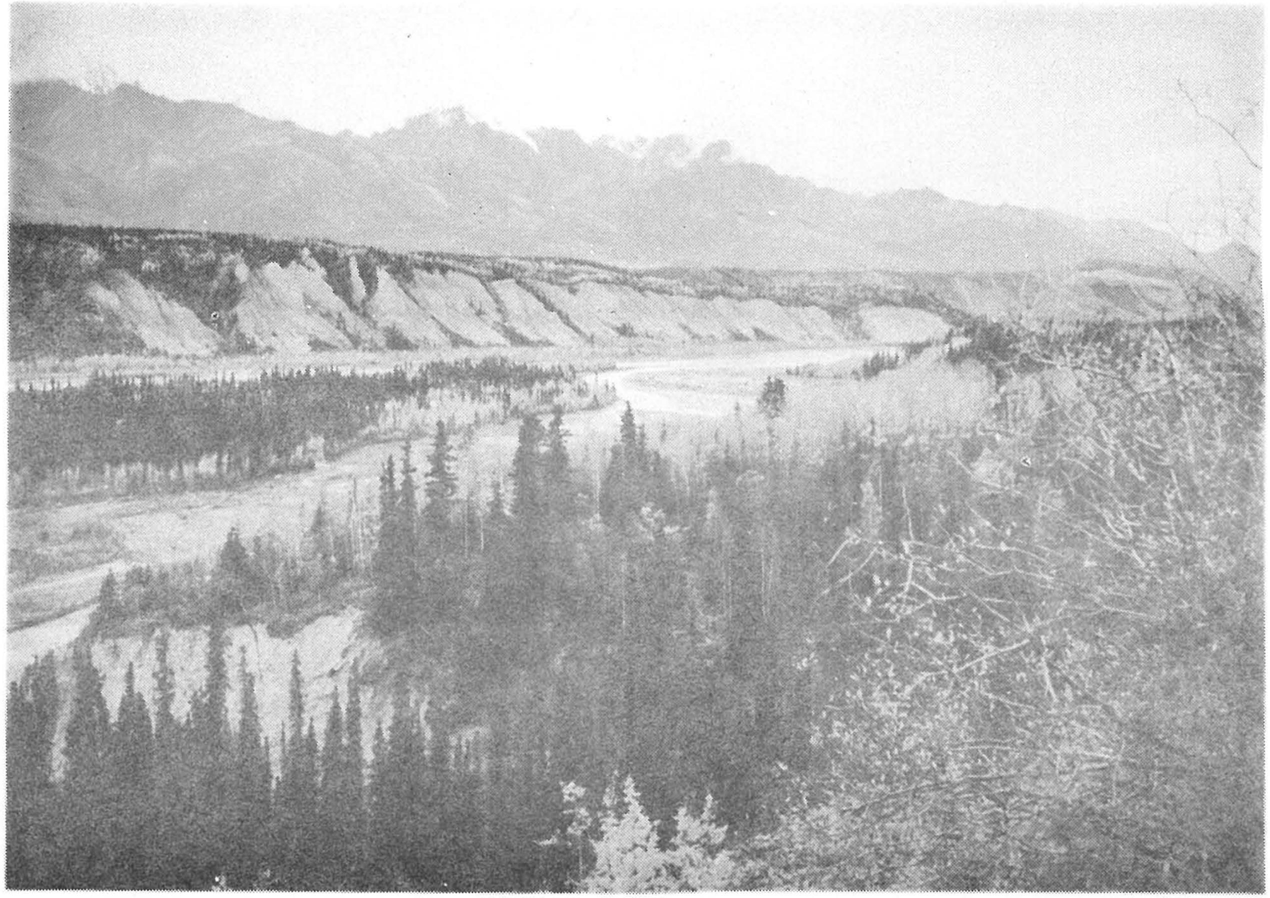
Talkeetna Mountains; Glenn Highway runs across the lower portions of the photo. The Matanuska valley is bordered on the north by the Talkeetna Range, on the south by the Chugach.



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.



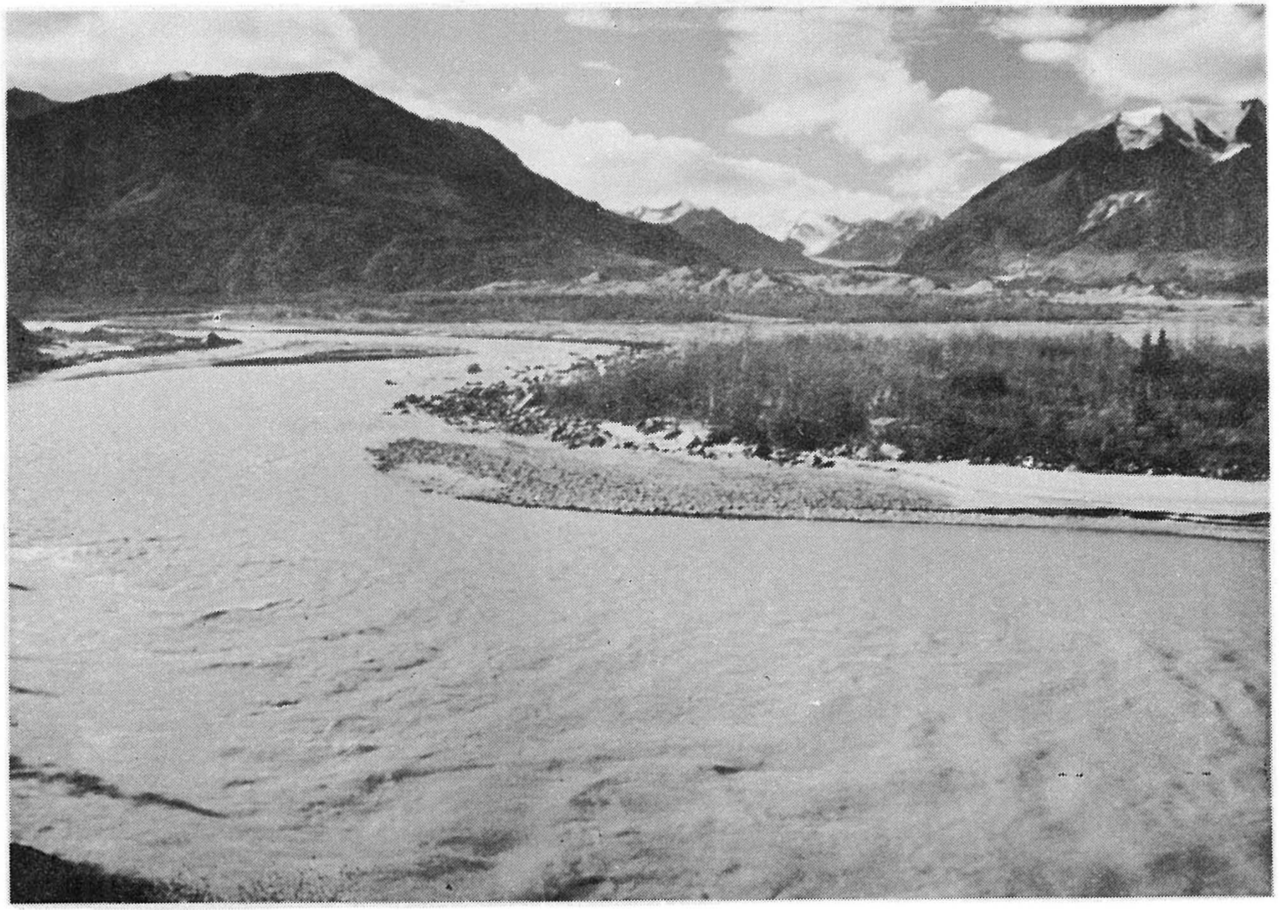
Matanuska River and Chugach Range. The Matanuska River has a braiding channel due to the high silt load from the Howell and Matanuska Glacier, and the glacial tributaries entering from the Chugach Range.

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.

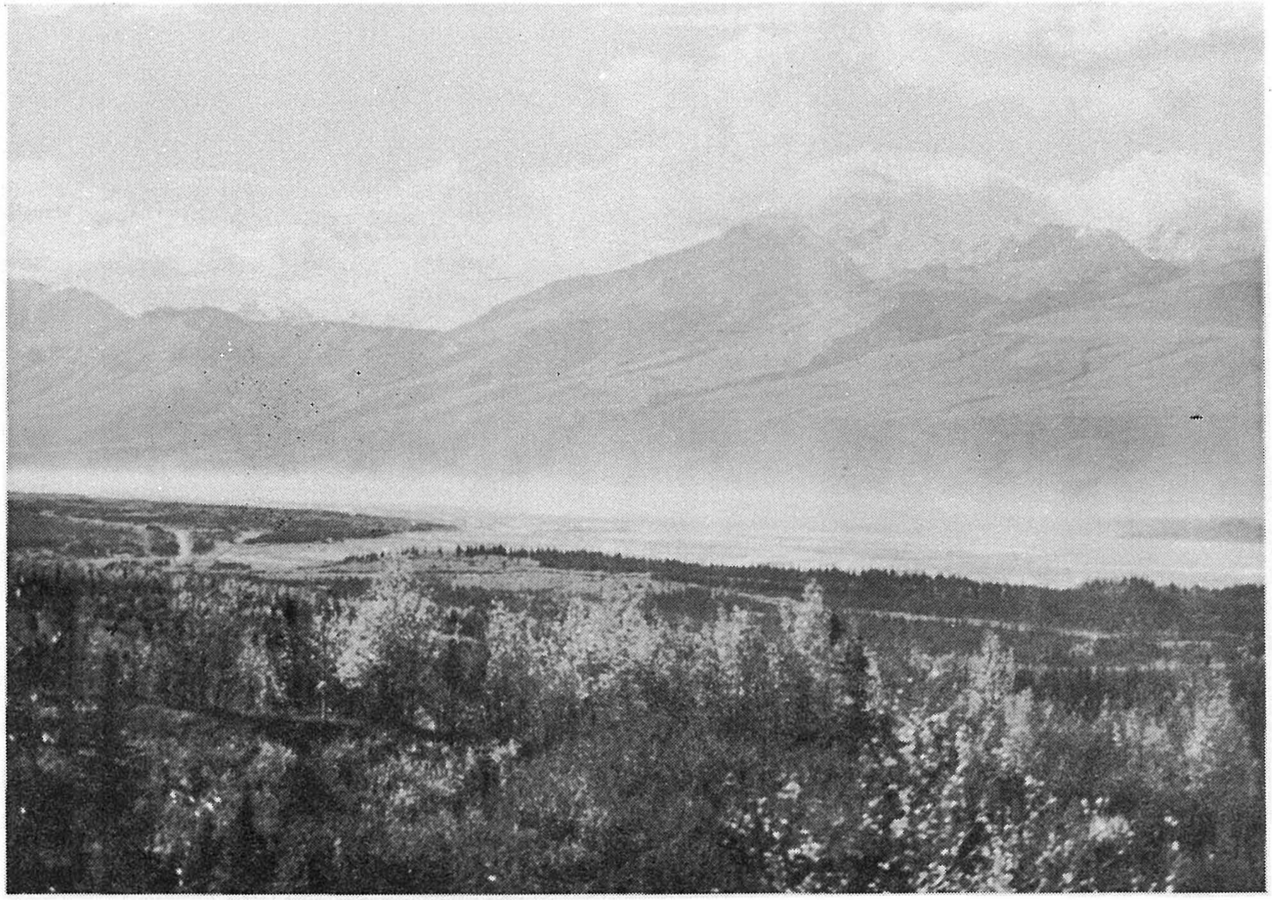
Rainbow Ridge, as seen from the south. The Richardson Highway crosses under the ridge from right to left. The slope of the ridge is a series of adjoining talus cones some of which are unstable.



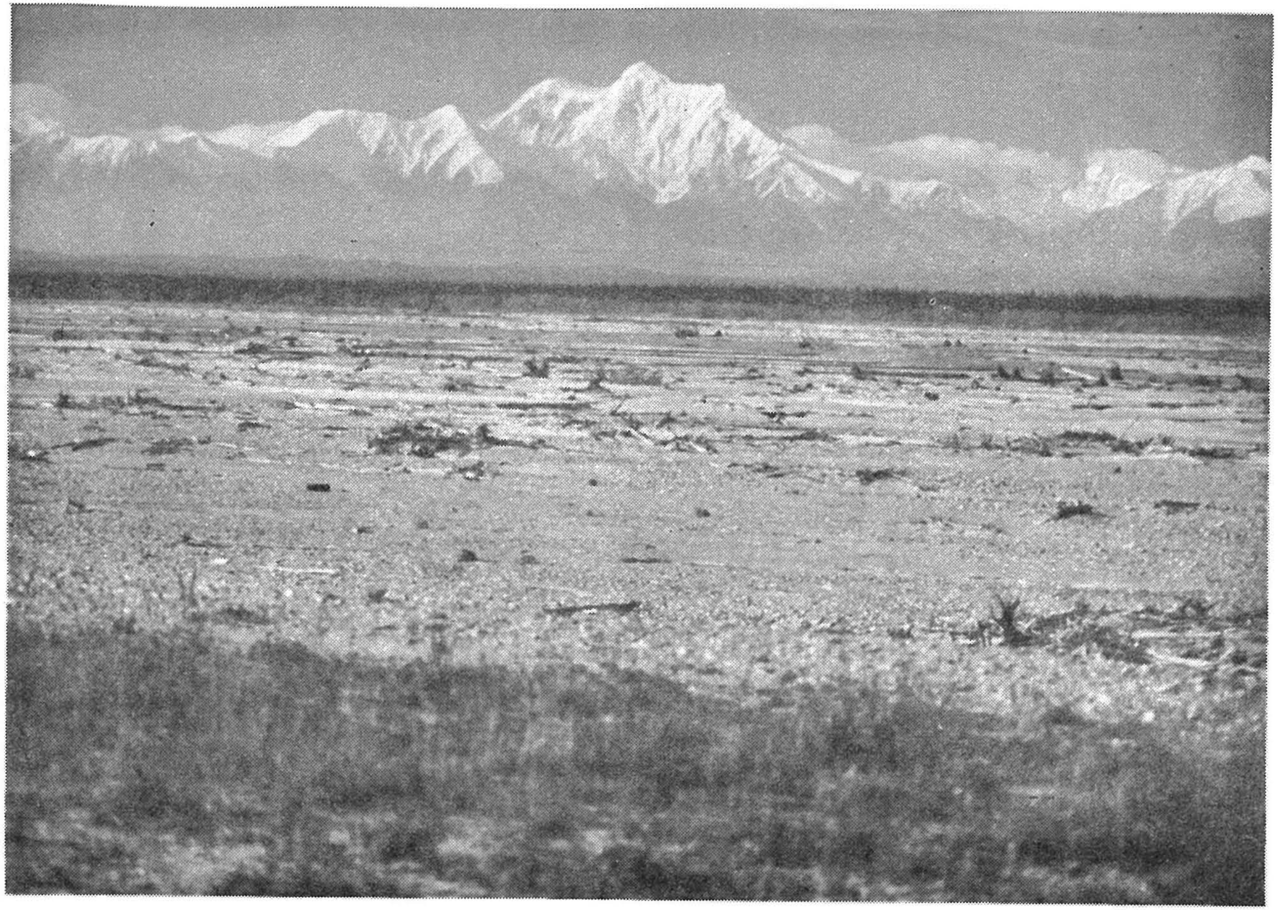
Delta River by Black Rapids Glacier. The glacier is partially visible in the upper center of the photo. The Delta River carries considerable glacial silt, resulting in aggradation and braiding of the channel.

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.

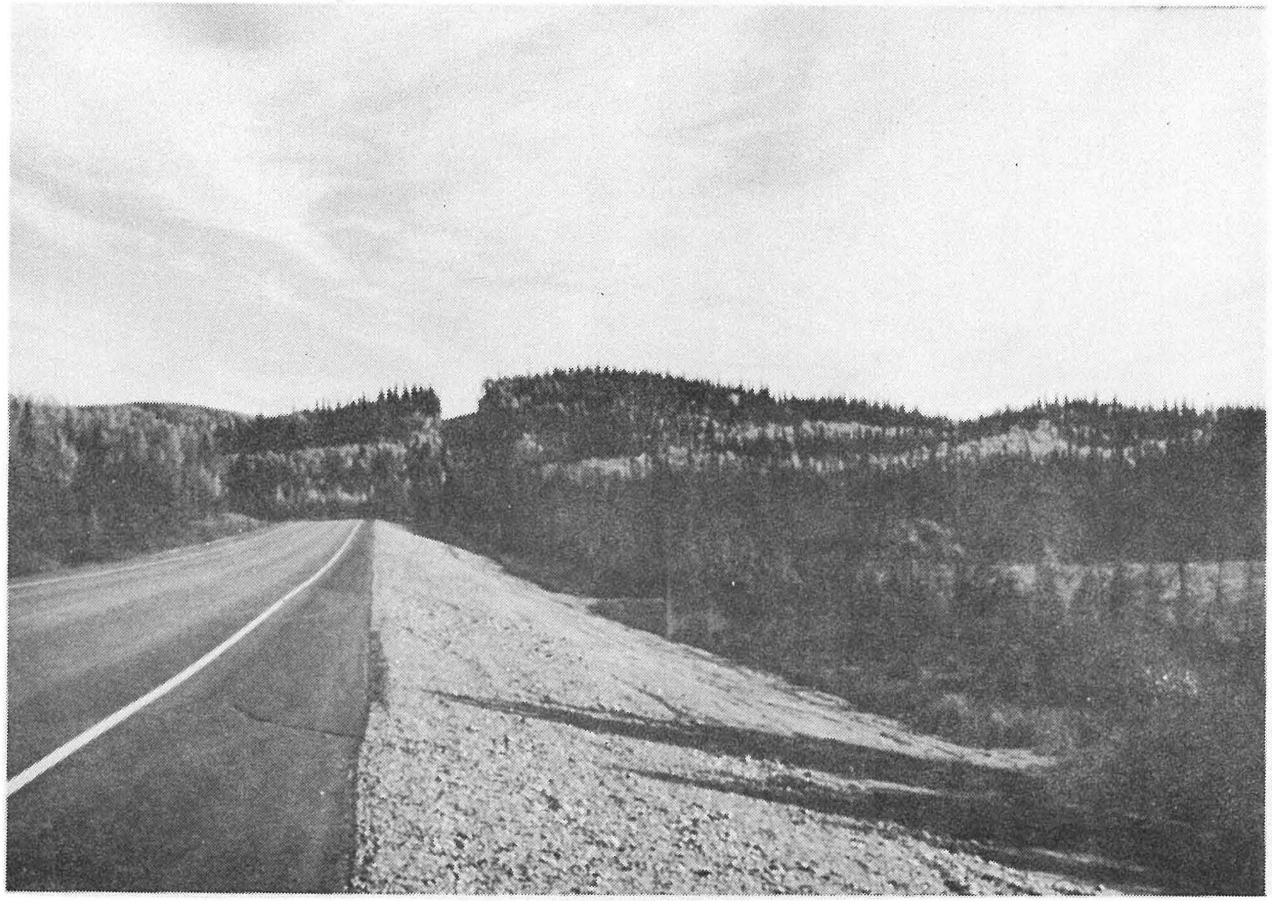


Another view of the Delta River as seen from near Donnelly Dome.
Again, the blowing dust from the channel is evident.

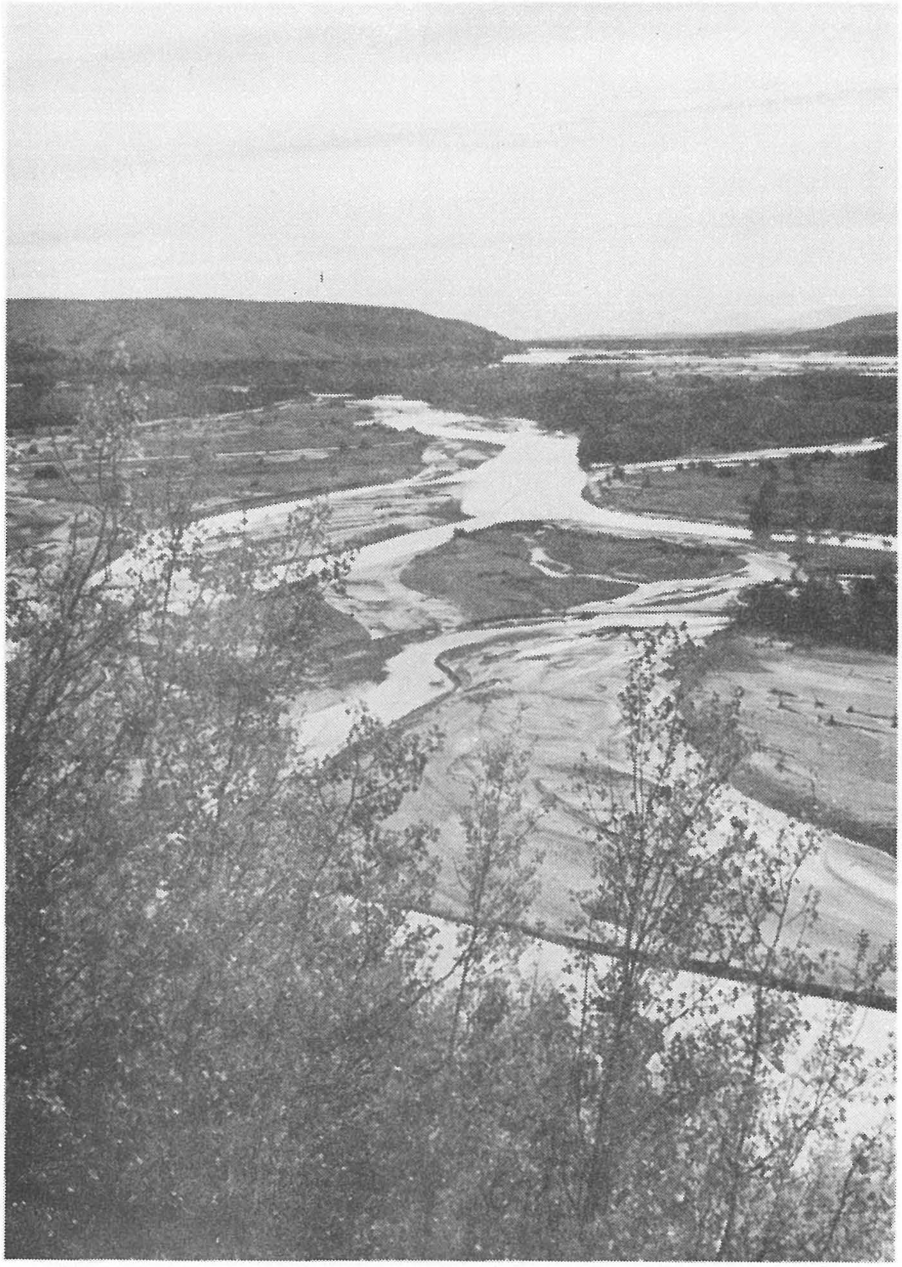


Alaska Range from Big Delta, taken with telephoto, In the foreground is the Delta River channel, which near here joins the Tanana River.

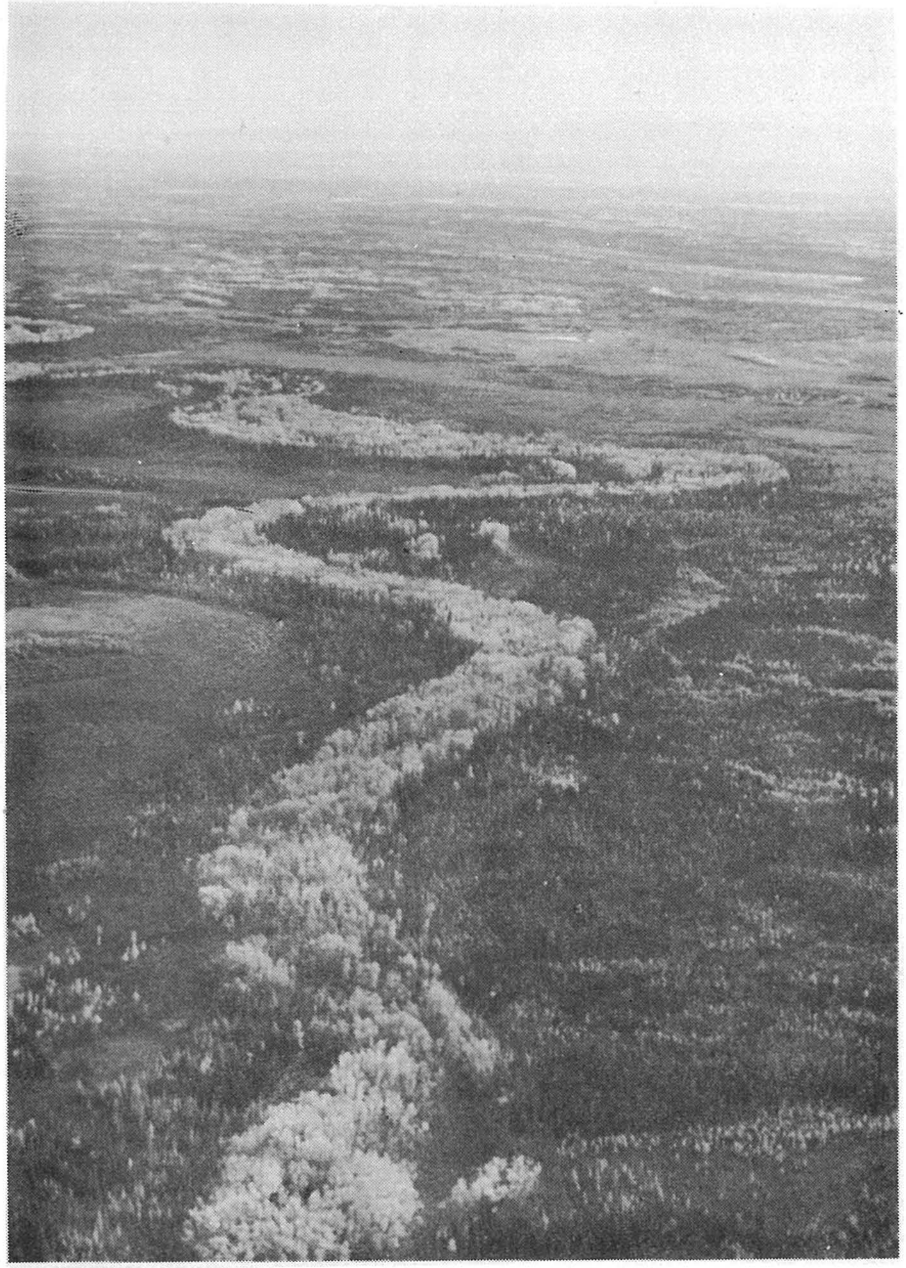
Farm near Delta Junction. Some attempt at farming is made in the Clearwater Lake area, but agriculture is relatively unimportant except for the lower Matanuska Valley area.



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.