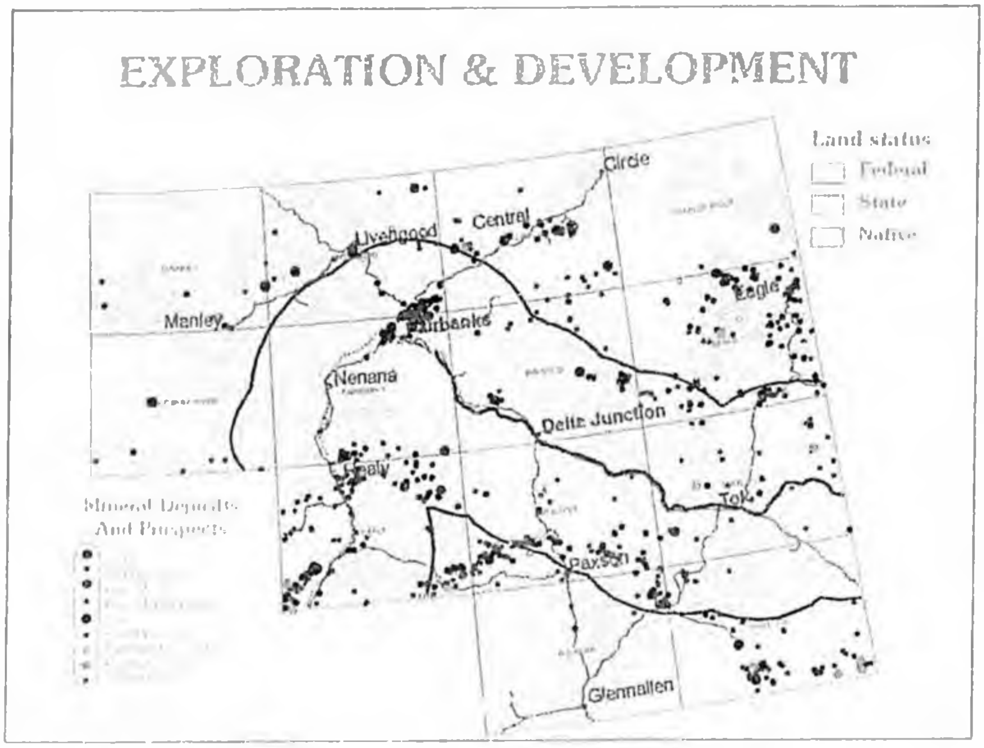
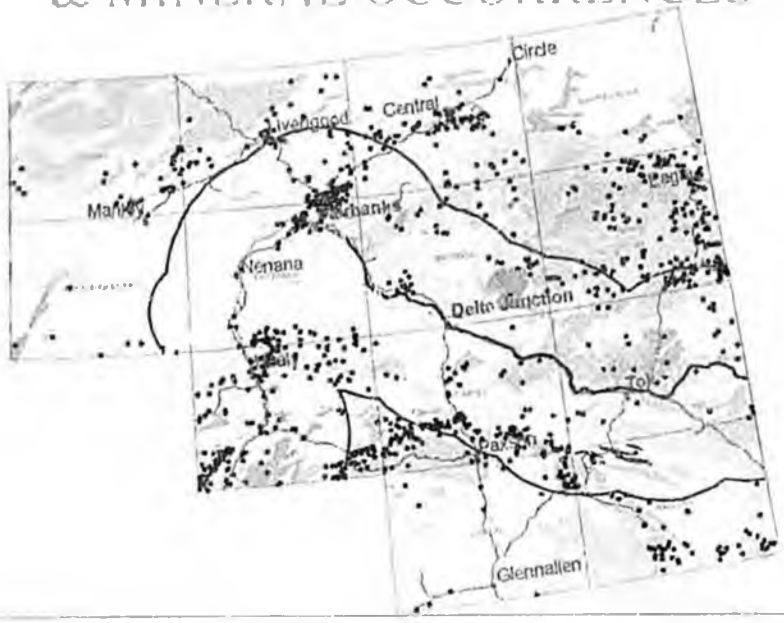
ALASKA LEGISLATURE COMMITTEE FILES 2001-2002 8672

10487 HOUSE TRANSPORTATION 332



In addition to these "significant" deposits, there are scores of lode gold, base metal massive sulfide, copper porphyry, and nickel-copper-PGM, tungsten, and tin prospects within the rail-belt corridor and many others surrounding the corridor.

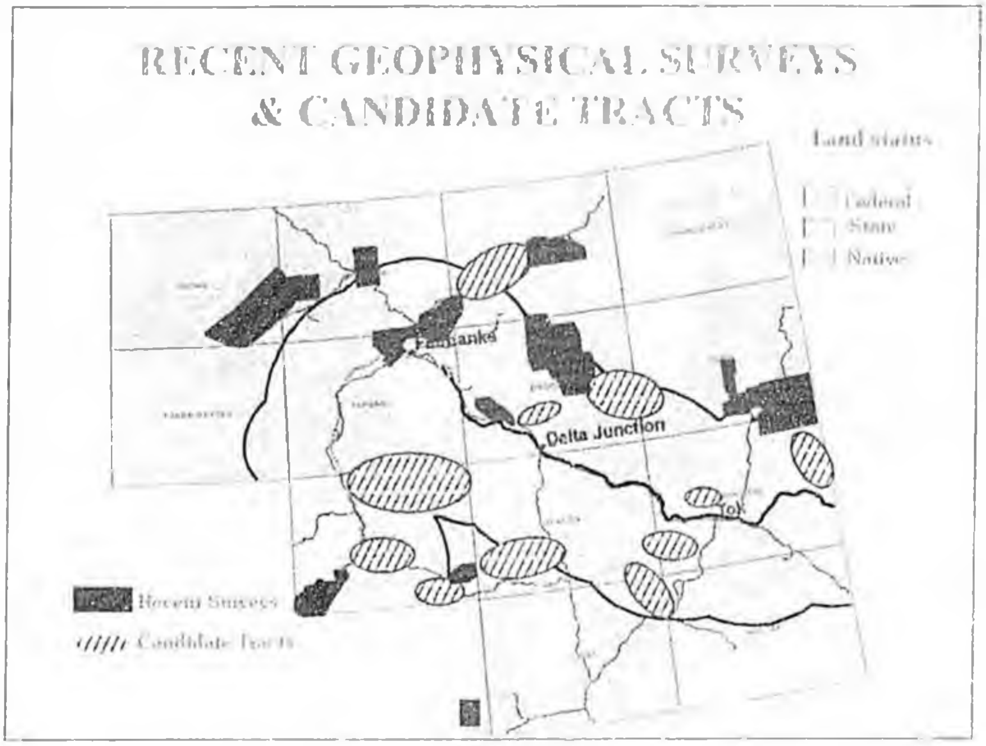
GEOLOGIC FRAMEWORK & MINERAL OCCURRENCES



Placer gold deposits and districts have proved effective in identifying areas hosting significant lode deposits of several mineral commodities. If placer gold occurrences are added to the lode occurrences already shown, one gets a feel for just how widespread indications of mineralization are within East-Central Alaska.

Both lode and placer occurrences exist within a framework of varied and complex geology. By world standards, this geology is very poorly understood. We really have only crude initial hypotheses for most of the East-Central Alaska area. Most of this country has not been geologically mapped at scales useful for detailed mineral exploration.

Much of the geologic mapping that does exist is derived from regional scale (4 mile to the inch) maps that were generated from field data collected between 1950 and 1975.



Beginning in 1993, the state of Alaska has sustained an annual airborne-geophysical/geological ground-truth geologic mapping program in an effort to improve the general knowledge of the geology and mineral resource potential of state lands.

The airborne-geophysical/geological mapping programs are centered on historical mining districts or on lands nominated by various members of the Alaska geological community because of their perceived high mineral potential.

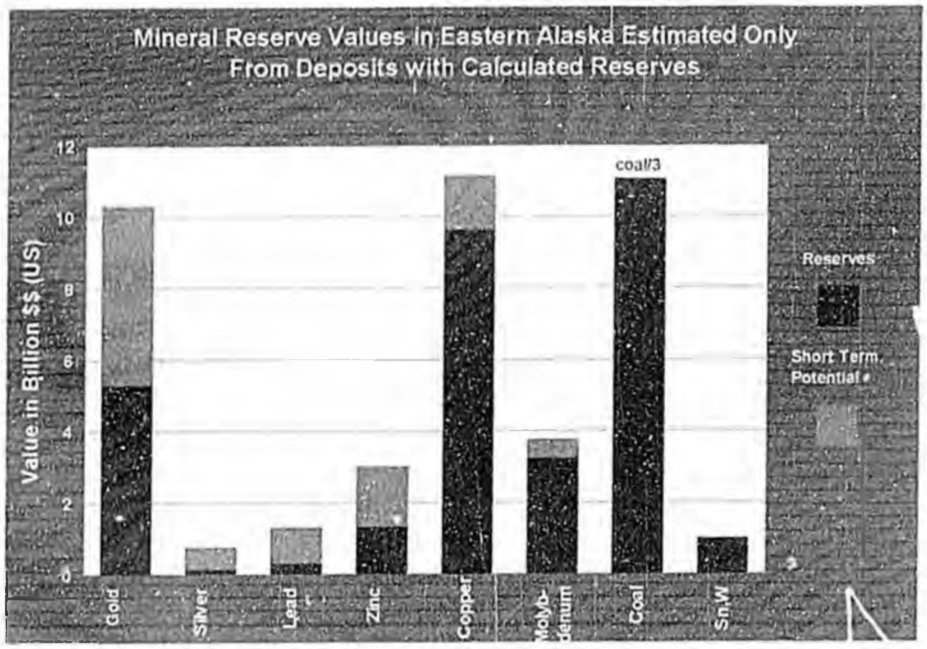
To date, nine tracts have been geophysically surveyed within East-Central Alaska. Modern ground-truth geologic maps at a scale of 1:63,360 (1 inch = 1 mile) are available for six of these tracts. The Fortymile mining district is currently being mapped.

There are 4441 square miles of airborne-geophysical surveys represented by the gray polygons shown in this figure.

These new geophysical and geological data have catalyzed a tremendous private sector investment in mineral exploration and development within East-Central Alaska.

In addition to the nine tracts already surveyed, the proposed rail-belt corridor includes all or portions of eight additional candidate areas: Steese, Salcha, southeastern-Pogo, Sixty-mile Butte, Ladue River, Delta, Mentasta Pass, Broxson Gulch, and Bonnifield.

Completing the remaining surveys is contingent upon special annual appropriations.



From a global perspective, the Tintina Gold Belt has recently been recognized by the mineral industry as an "emergent district." That is, a region in which additions to reserves are expected to follow regularly with continued exploration. This is a young exploration region with a limited knowledge base. There is still a lot of room for success.

There is no doubt that the general corridor of the proposed extension of the Alaska Railroad passes within less than fifty miles of many significant mineral deposits. A useful and responsible next step in developing the railroad extension would be to conduct a full technical corridor analysis in order to optimize the alignment for the extension. Because the corridor for the railroad approximately coincides with the corridor for the proposed natural gas pipeline from Fairbanks to the Yukon border, one analysis could serve both projects for the Alaska portion of the railroad and pipeline.

DNR has submitted a proposed gas line supplemental project that includes some preliminary aspects of a true corridor analysis. DGGS has also worked with the NASA through the Alaska SAR Facility at the University of Alaska Geophysical Institute to acquire a detailed digital elevation terrain model for this corridor. That terrain model will probably be completed by next October. A true corridor analysis requires many layers of data beginning with corridor-wide engineering geology data at a scale of at least 1 inch=1 mile, definitive land status, geologic hazards assessment, and more information on construction materials and other geologic resources. Corridor analyses are routinely conducted for major construction projects in the Lower-48 to maximize project efficiency and minimize adverse impacts. We could benefit from following this strategy in Alaska.

Testimony of Paul Metz, Ph.D., DIC, P.G.
Before the Joint House Committee Hearing on the Status of the Alaska-Canada Rail Link
February 20, 2001

Introduction and Statement of Qualifications

I would like to thank Representative Jeannette James for the opportunity to testify before this joint committee hearing on the US-Canada Rail Link. I am testifying as an individual and my credentials are given in the attached Curriculum Vita. I have undergraduate and graduate degrees in engineering, economic and mining geology, and business administration with an emphasis on engineering economics and finance. I teach courses in geological engineering, mineral exploration, mineral valuation, and mineral economics at the University of Alaska Fairbanks. I have conducted research on the mineral deposits and mining geology of Alaska and on the evaluation of mineral resources in the state and elsewhere. I have worked as a consultant to the mineral industry and have testified as an expert witness in litigation related to the mineral industry including eminent domain proceedings in state and federal court.

Engineering Geology of the Transportation Corridor from Fairbanks to the Canadian Border

In 1996, a proposal was submitted to the Alaska Railroad and later the Alaska Department of Transportation & Public Facilities for the production of engineering geologic maps and derivative geologic hazards maps for the transportation corridor from Seward to Fairbanks. In the summer of 2000 the project was revised to place an emphasis on the transportation corridor from Fairbanks to the Canadian Border as Phase I of the proposal and the corridor from Seward to Fairbanks as Phases II & III. As proposed this was a joint project between the Geological Engineering Program at the University of Alaska and the Alaska Division of Geological and Geophysical Surveys. A precedent for such cooperation was set by a bedrock geologic mapping program initiated in 1981 for the mineral districts in interior Alaska and referred to as the "Interior Mining Project" A summary of the results of that program is attached.

The objectives of the Transportation Corridor Project and the use of multipurpose engineering geological maps are summarized in the follow two attachments. The utilization of the multipurpose engineering geological by design engineers in the public and private sector will result in minimizing the risk and cost of geologic hazards to engineering works constructed in the corridor. These costs include both the capital costs of construction as well as annual maintenance and repair costs associated with the entire spectrum of geologic processes that can degrade engineering works. And most importantly the utilization of such maps minimized the risk of loss of life associated with catastrophic structural or earth failures due to a major hazardous geologic event.

A summary of the project, project history, the project status as of December 2000, and a discussion of the significance of this project was outline in my letter to Dr. Wiltse dated December 4, 2000 and attached herein. The changing economics of an Alaska Natural Gas Pipeline to the contiguous states has resulted in a major change in the economic parameters of the construction of the Extension of the Alaska Railroad to the Canadian Border and the connection to the Canadian Railroad System.

Changes in Mineral Resource Economics within the Transportation Corridor as a Function of the Availability of Natural Gas

Major mineral deposit types found in Alaska within fifty miles of the proposed extension of the Alaska Railroad to the Canadian Border include but are not limited to:

1. Bulk mineable low grade intrusive hosted gold (Fort Knox Type Deposits)
2. High-grade gold quartz veins (Pogo Type Deposits)
3. Bulk mineable moderate grade gold occurrences (Donlin Creek Type Deposits)
4. Porphyry Copper Occurrences
5. Porphyry Copper-Molybdenum Occurrences

6. Coal Deposits (Jarvis Creek Coal Field)
7. High purity limestone deposits for lime and portland cement production
8. Platinum Group Elements and podiform chromite in Alpine Ultramafics (Clinton Creek Type)
9. Platinum Group Elements in Layer Gabbroic Complexes (Paxson Mt.)
10. Precious metal enriched volcanogenic massive sulfide occurrences (Wolverine Complex Type)
11. Antimony-gold vein occurrences (Scrafford Type)
12. Tungsten skarn occurrences (Can-Tung Type)
13. Placer gold and platinum occurrences (Goodnews Bay Type)

The future availability of natural gas as a source of energy could greatly decrease the cut-off grade and thus positively impact the feasibility of developing bulk mineable mineral deposits in the corridor. The economic feasibility of bulk mineable mineral deposits is extremely sensitive to tonnage and grade and energy costs since energy is the single largest operating cost for such deposits. The combination of lower cost energy for what are now stranded mineral resources and the availability of a bulk transportation system would greatly enhance mineral exploration and development in the corridor in East-Central Alaska (see attached maps).

Other Sources of Tonnage for the Alaska Railroad and the Impact of the Economic Feasibility of the Transportation System

The uncertainty of future mineral discoveries should be carefully considered in the economic analysis of the Extension of the Railroad into Canada. Few railroads constructed in the 19th Century had defined markets prior to construction. The Alaska Railroad was constructed in the 20th Century under the same constraint. The only significant certain mineral deposits along the route of the Alaska Railroad prior to construction were the coal deposits in the Matanuska and Nenana Coal Fields and the placer gold deposits in Fairbanks. The deep and low-grade placer deposits in Fairbanks required dredges for their economic feasibility and the railroad was needed to get that equipment into the region. The placer deposits only contained 8 million ounces of gold. Today as a result of numerous gold discoveries since the completion of the "Interior Mining Project" there are over 40 million ounces of proven and drill indicated reserves in interior Alaska. This is 10 million more than the historic gold production of the entire state. Similarly the reserves of both the Greens Creek Mine and the Red Dog Mine have more than tripled since the initial feasibility studies for these projects. The availability of energy and transportation will result in increased mineral reserves at known mineral deposits and new mineral discoveries that cannot even be projected at this time.

Other sources of freight such as value added products from a petrochemical plant in Fairbanks and processed forest products as well as probable passenger revenues must be added to the expected cash flows from the mineral industry. The economic feasibility of the railroad extension should not be limited to the tonnage requirements of the mineral industry.

Effect of Lower Risk of Geologic Hazards with the Extension of the Railroad to Canada versus the Route from Seward to Fairbanks

The transportation corridor from Seward to Fairbanks transects some of the most hazardous geologic terrains in the world. This is a function of the plate tectonic boundary between the Pacific Plate and the accreted terrains along the margin of the North American Plate. By contrast the extension of the railroad into the Yukon Territory and either northern British Columbia or Alberta will transect on older and more stable interior plateau. Thus the rail extension will provide a relatively low risk transportation system for interior and even south central Alaska during future major earthquakes comparable to the March 1964 event. This factor must be included in the final economic analysis of the feasibility of the Extension of the Alaska Railroad. The same must be considered in the analysis of the Alaska Natural Gas Pipeline system.

Summary of the Interior Mining Project

By
Paul A. Metz, Ph.D., P.G.

On February 29, 1980 a joint proposal entitled "Mineral Resource Appraisal of the Interior Alaska Mining Districts was completed by Paul Metz (Mineral Industry Research Laboratory, School of Mineral Engineering, University of Alaska Fairbanks) and Wyatt Gilbert (Alaska Division of Geological and Geophysical Surveys) and was submitted to the Fairbanks North Star Borough as a Capital Improvements Project for fiscal year 1981 (Proposal No. MIRL 80-24 total budget $948,000). The stated objective of the proposed project was "to conduct a mineral appraisal of the interior Alaska mining districts adjacent to or included in the Fairbanks North Star Borough, thus stimulating the establishment and the growth of the mineral industry in the region". The procedure for the appraisal included geological mapping of each district at a scale of 1 inch equals 1 mile, detailed mineral prospect mapping, geochemical sampling of outcrops, stream sediments and heavy mineral concentrates from stream gravel and mineral deposit modeling using trace element, stable isotope, fluid inclusion, and radiogenic isotopic geochemistry. All published geological, geochemical, and geophysical data for the four interior mining districts (Fairbanks, Livengood, Circle, and Richardson) was compiled prior to the field mapping and geochemical sampling.

Fieldwork began in the Fairbanks district in 1981 and the field maps, field notes, and geochemical data were released as public data files as field geologists and laboratory staff produced them. The geologic mapping defined favorable rock units for future mineral discoveries while the geochemical sampling defined specific areas of high potential for future mineral deposit discoveries. The data immediately stimulated individual prospectors, exploration geologists and exploration and mining firms to re-examine the Fairbanks mining district. Prospectors and explorationists began to relocate old placer mining claims and stake new lode mining claims at an unprecedented rate. The fieldwork and laboratory investigations in the Fairbanks District resulted in the definition of 14 new anomalous areas of potential gold mineralization. Joe Taylor and George Johnson, local prospectors, used this data to locate 34 lode claims adjacent to their 19 Fort Knox placer claims near Gilmore Dome. Today those claims have evolved into one of the largest gold mines in North America which employs 250 highly skilled workers, contains an estimated 7.5 million troy ounces of measured and inferred reserves, and produces 1000 troy ounces of gold per day for 365 days per year.

By 1984 the geologic mapping and geochemical sampling of the four districts was completed. Dozens of geologic maps, thousands of geochemical analyses and hundreds of pages of technical reports were published and/or presented at exploration and mining conferences (see Metz and Halls, 1981; Metz and Hawkins, 1981; Metz, 1982, Metz, 1983; Metz, 1984d). In addition to the Fort Knox geochemical anomaly, 62 other geochemically anomalous areas were discovered during the interior mining project investigation. These anomalous areas have been the subject of thousands of new mining claims being staked in the four mining districts.

The Fort Knox Gold Mine is a major producer of new wealth for the Fairbanks Community but more importantly it has demonstrated the economic feasibility of bulk mineable gold production in interior Alaska. This fact has resulted in the expenditure of tens of millions of dollars per year for mineral exploration and development not only in the Fairbanks mining district but in the entire area of interior Alaska from the North Flank of the Alaska Range to the South Flank of the Brooks Range. As a result of the Fort Knox Mine development, another 33 million troy ounces of gold have been discovered in interior Alaska (at $300 per troy ounce the gross value of these discoveries is approximately $ 12 billion). This has resulted in the interior mining districts developing into the single most important region of new gold discoveries in North America since 1980.

Since 1984 over a dozen Master of Science theses and one Doctor of Philosophy dissertation have been completed on the geology and mineral deposits of interior Alaska. Presentations of these works as well the results of exploration and development programs by mining companies at international mining conferences has continued to stimulate and guide private sector investment in mineral exploration in interior Alaska (see Metz and Hamil, 1986; Metz, 1987; Robinson, Smith and Metz, 1990; Metz, 1991). In the interior mining project proposal, the discovery of at least one world class mine was predicted. The Fort Knox Mine fulfilled that prediction however expectations have been greatly exceeded. The gold discoveries at the True North Project, the Golden Summit Project, and at the Pogo Project will result in at least three more major gold mines in interior Alaska in the near future.

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Engineering Geological Mapping
Of the Alaska Transportation Corridors

Phase I

Fairbanks to the Canadian Border

Cooperative Investigation by

The Geological Engineering Program
School of Mineral Engineering
University of Alaska Fairbanks

And

The Alaska Division of Geological and Geophysical Surveys

Objectives:

1. Completion of airborne geophysical and engineering geological maps for the 20 quadrangles (15 minute) transected by the Alaska highway and the proposed route of the Alaska Natural Gas Pipeline and the extension of the Alaska Railroad from Fairbanks to the Canadian Border.

2. Assessment of the soil and rock mechanics of the geological materials in these quadrangles.

3. Completion of geologic hazards maps as derivatives of the engineering geological maps and geophysical maps.

4. Development of a Geographic Information System for all the geotechnical data

5. Provide the regional geological database for the location, permitting, design, and construction, and maintenance of ALL engineering works in the transportation corridor.

Multipurpose Engineering Geological Maps

1. Location and engineering classification of bedrock units

2. Location and engineering classification of soil units

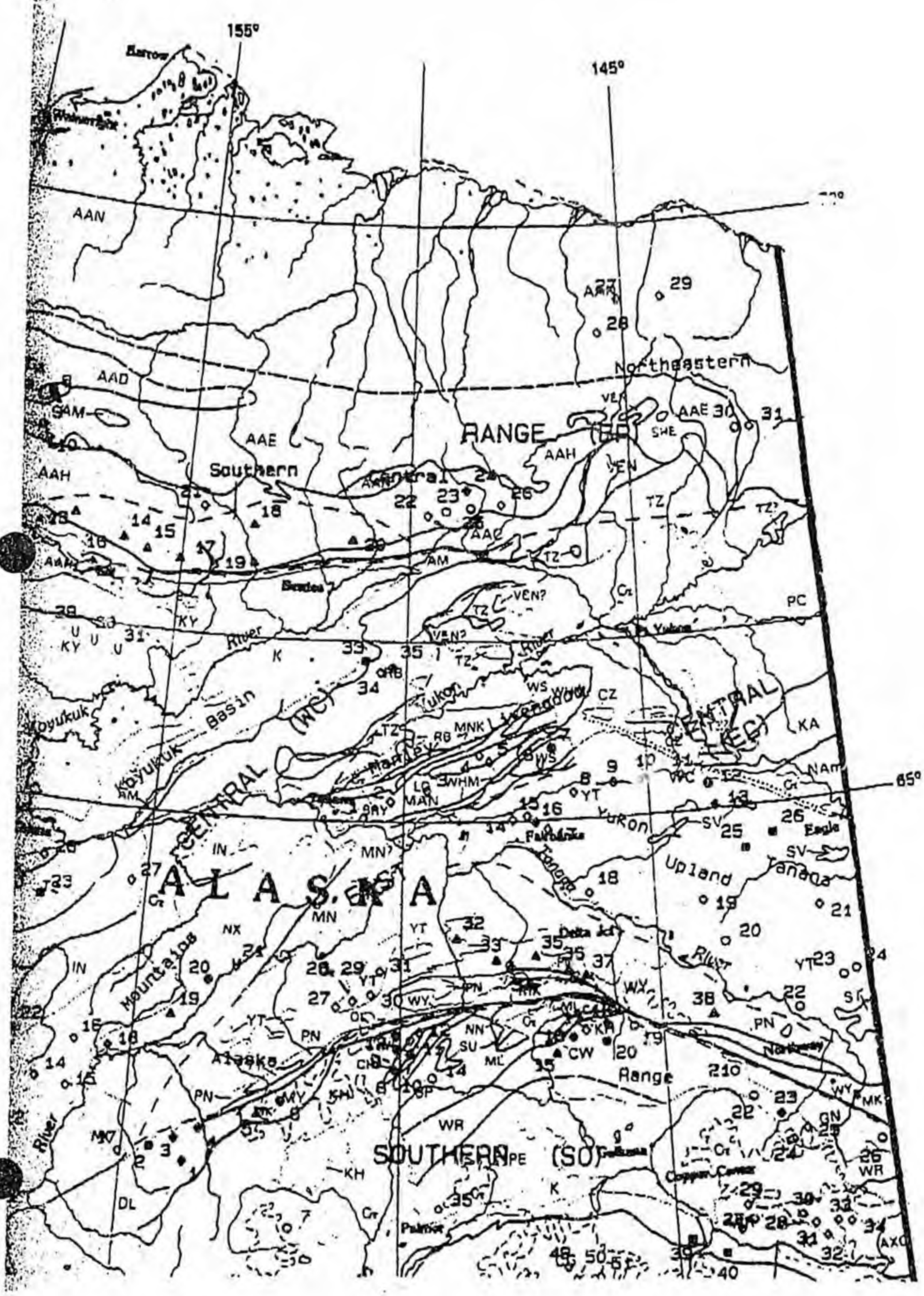
3. Location and orientation of geologic structures

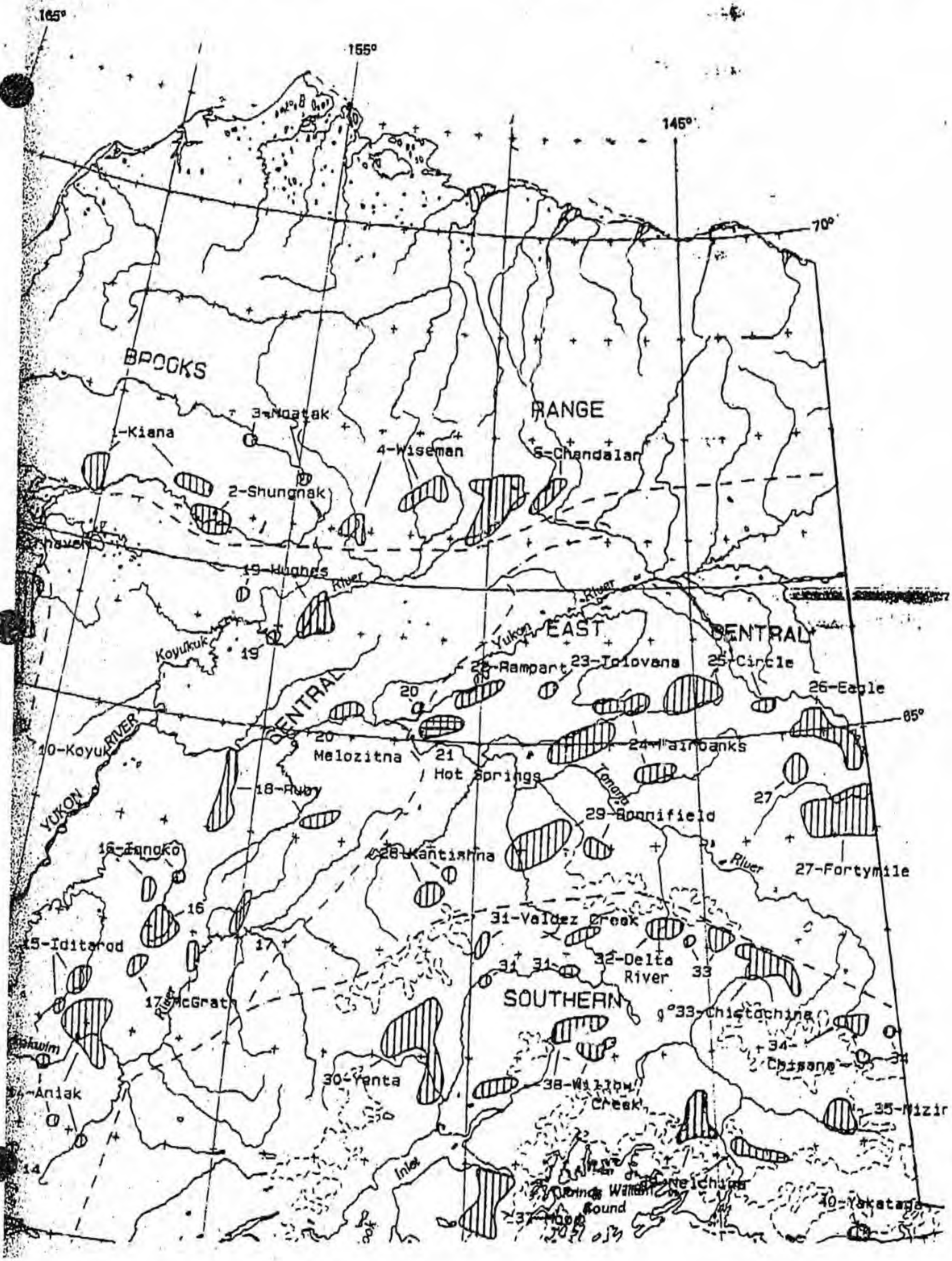
4. Hydrogeological conditions

5. Geomorphological conditions

6. Geodynamic phenomena

   a. Erosion and deposition on floodplains
   b. Aeolian processes
   c. Slope processes
   d. Permafrost and related cryogenic processes
   e. Karstification
   f. Suffusion
   g. Soil liquefaction
   h. Expansive soils
   i. Seismicity and active fault zones
   j. Volcanism


155°
145°
65°
Barrow
AAN
AAD
SAM
AAE
Southern
RANGE
Central
Northeastern
AAH
ALASKA
CENTRAL (WC)
CENTRAL (EC)
Koyukuk Basin
Yukon
Upland
Tanana
Fairbanks
Mountains
Alaska
Range
SOUTHERN (SO)
Copper
Palmer
Eagle
KA
PC
KY
River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BROOKS
RANGE
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2-Shungnak
3-Noatak
4-Wiseman
5-Chandalar
19-Hughes
19
Koyukuk
EAST
CENTRAL
CENTRAL
Yukon
River
22-Rampart
23-Tolovana
25-Circle
26-Eagle
20
20
Melozitna
21
Hot Springs
24-Fairbanks
Tanana
10-Koyuk
YUKON
RIVER
18-Ruby
29-Bonnifield
27
27-Fortymile
River
16-Innoko
28-Kantishna
16
31-Valdez Creek
15-Iditarod
17
31
32-Delta
River
33
17-McGrath
SOUTHERN
33-Chistochina
34-
Chisana
34
Aniak
30-Yenta
38-Willow
Creek
35-Nizir
14
Inlet
Prince William
Sound
40-Yakataga
37-Hope

ALASKA RAILROAD EXTENSION

ROUTE SELECTION
PROJECT X20089

EIELSON TO CANADIAN BORDER

STATE OF ALASKA
DEPT. OF TRANSPORTATION
& PUBLIC FACILITIES
JULY 1979

ALASKA RAILROAD EXTENSION

ROUTE SELECTION

PROJECT #X20089

EIELSON TO

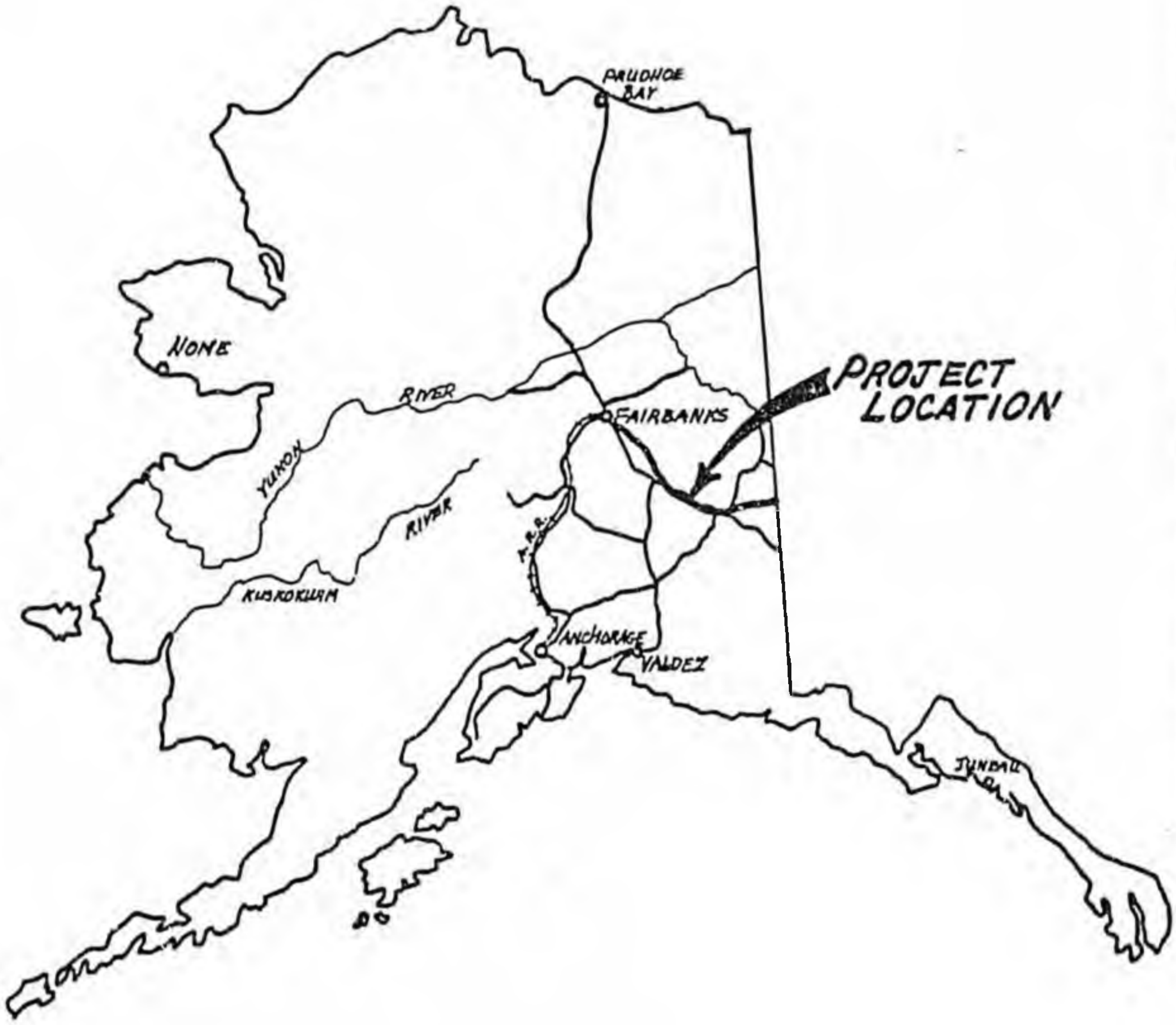
CANADIAN BORDER

STATE OF ALASKA

DEPARTMENT OF TRANSPORTATION

& PUBLIC FACILITIES

JULY 1979


PRUDHOE BAY
NOME
YUKON
RIVER
FAIRBANKS
PROJECT LOCATION
KUSKOKWIM
RIVER
A.R.R.
ANCHORAGE
VALDEZ
JUNEAU

ALASKA RAILROAD EXTENSION
ROUTE SELECTION

Introduction---------------------------------- Page 1

Criteria for Route Selection ------------ Page 2

Route Reconnaissance -------------------- Page 4

Methodology ------------------------------ Page 6

Description of Route -------------------- Page 8

Conclusions ------------------------------ Page 12

Route Maps ------------------------------ Page 13

Appendix -------------------------------- Page 17

Legislation ------------------- Page 18

INTRODUCTION

In the spring of 1977 the first session of the tenth Alaska Legislature passed two bills (HB47 and HB48) which dealt with a proposed extension of the Alaska Railroad to the Canadian border. House Bill 47 charges the Interior Region of the Alaska Department of Transportation and Public Facilities with the responsibility to "delineate a proposed utility corridor for the extension of the Alaska Railroad to the Canadian border..." and further stated that the corridor "shall include a delineation of a proposed railroad right of way".

House Bill 48 appropriated $865,000 from the State's general fund to cover the cost of the work necessary to delineate the utility corridor and railroad right of way. In June of 1977, the governor's office authorized $150,000 of the HB48 appropriation to cover costs of the first phase of the railroad extension project.

The Department performed only a limited amount of route reconnaissance in 1977 since $150,000 would not go far toward accomplishing the project goals. However, in January of 1978, the second session of the Tenth Legislature restored the full $865,000 for use on the project. Time then became an important factor since a great amount of work remained to be done on the project before June 30, 1979, when funding was to expire.

In the early months of 1978 the Department completed the selection of a preliminary route which was described in a report issued in April of that year. The reconnaissance work leading to the preliminary route selection is summarized on the following pages.

5. Environmental Concerns The scope and funding of this route selection project did not provide for a full environmental assessment of railroad construction and operation. However, the Department's Environmental Section as well as other appropriate agencies were consulted in order to maintain an awareness of environmentally sensitive areas and issues which might affect the selection of a railroad route.

6. Right of Way The railroad alignment was placed on public lands wherever possible so as to minimize the costs of right of way acquisition. It is assumed that the railroad right of way will be 300 feet wide.

7. Costs Costs of rail construction were kept in mind and minimized where possible.. However, this study does not include an estimate of construction costs for the proposed rail project.

CORRECTION

THE FOLLOWING DOCUMENT(S)
HAVE BEEN REFILMED TO
ASSURE LEGIBILITY OR PAGINATION

INTRODUCTION

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CRITERIA FOR ROUTE SELECTION

The location of the railroad is really the key to defining the corridor required by HB47 and HB48. The grade and alignment constraints on a railroad location are much more restrictive than for any other transportation mode or utility installation. For this reason, the Department concentrated work on the selection of a railroad location. In effect, a utility corridor will be placed around the best available railroad alignment rather than trying to place a railroad within a pre-selected corridor.

In order to identify the best available railroad location, several factors were considered:

1. Design Standards The railroad should be located so that it can meet grade and alignment standards which are commensurate with the transcontinental rail system standards. The Engineering Department of the Alaska Railroad provided the following recommendations for design standards.

Grades

1%	desirable
1.7%	maximum

Curvature

3°	valley terrain	desirable maximum
6°	mountainous terrain	desirable maximum
10°	absolute maximum	

2. Foundations and Materials The railroad should be located on the best available foundations and in areas where construction materials are readily available. Good foundations are essential in keeping construction and operating costs to a minimum. Funding and time limitations did not allow a program of subsurface investigations and soils analysis. Materials investigations consisted primarily of aerial photo interpretation.

3. Safety Potentially hazardous situations such as highway grade crossings should be avoided whenever possible. The route described in this report crosses the Richardson Highway one time and the Alaska Highway three times.

4. Service to Communities The railroad should be placed such that it will serve local communities and enhance local development plans while still maintaining the "through" nature of the route. This constraint has been adequately met by holding discussions during the reconnaissance phase with Fort Wainwright, Eielson AFB, Fort Greeley, the Delta Junction Chamber of Commerce, Citizens of Tok, the Alaska Department of Fish and Game, and the State Division of Lands. The discussions yielded information that resulted in a location of maximum utility to the agencies and communities who would use the railroad.

5. Environmental Concerns The scope and funding of this route selection project did not provide for a full environmental assessment of railroad construction and operation. However, the Department's Environmental Section as well as other appropriate agencies were consulted in order to maintain an awareness of environmentally sensitive areas and issues which might affect the selection of a railroad route.

6. Right of Way The railroad alignment was placed on public lands wherever possible so as to minimize the costs of right of way acquisition. It is assumed that the railroad right of way will be 300 feet wide.

7. Costs Costs of rail construction were kept in mind and minimized where possible.. However, this study does not include an estimate of construction costs for the proposed rail project.

ROUTE RECONNAISSANCE

Previous developments (highways, pipelines, communications systems, airports) have established a general transportation corridor from the present terminus of the Alaska Railroad at Eielson Air Force Base southeast to the Canadian border. This corridor can be described in broad terms as the valley of the Tanana River or in more narrow terms, as the route of the Richardson and Alaska highways.

A study of topographic and land status maps of eastern Alaska readily shows that the terrain and the associated economic and environmental considerations effectively rule out any general corridor other than the Tanana River Valley. This route study is confined to the Tanana Valley except for the easternmost 50 miles which follow the Ladue River down to the Candian border.

The Ladue border crossing was first proposed in 1942 when the U S. Army Corps of Engineers surveyed a route for a rail connection to Alaska. Interest in that project faded after the end of World War II, but the route chosen at that time has been reaffirmed many times in subsequent years. The Ladue crossing directs the Yukon Territory segment of the railroad route into the broad valleys of the White, Yukon, Pelly, and Liard rivers. The valleys provide a fairly direct route to Watson Lake, Y.T., through which the connecting link to the existing transcontinental rail system will pass.

It should also be pointed out that the Ladue River border crossing allows the easiest and most direct route to Whitehorse, Y.T., should Canada decide to run the rail connection through that city. This study considers only the Ladue River border crossing.

The first step in selecting a railroad route was to study topographic maps and to identify on these the route possibilities that appeared to merit further study by means of aerial photography.

From the map study it was determined that the 108 mile section from Delta Junction to Tok was adequately covered by aerial photographs taken in September 1976 for the purpose of highway reconnaissance. Likewise, the 80 mile segment from Tok to the Canadian border via the Ladue River had previously been photographed in a 1973 rail study. This left only the 75 mile segment from Eielson to Delta Junction lacking in reconnaissance photo coverage. Photographs of this area were scheduled for the fall of 1977.

Map study of the Eielson to Delta Junction area revealed several possible routes including an alignment along the north bank of the Tanana River and several alternatives south of the river. In September 1977 these routes were investigated by a fixed-wing overflight involving the Regional Geologist, Hydrologist, and Reconnaissance Engineer. After this investigation, three routes were chosen as the most promising rail locations, one north of the Tanana River and two south of the river.

All three of these routes were subsequently photographed in color on October 1, 1977. All of the aerial photos mentioned above are at a scale of 1 inch = 1000 feet.

Through the winter of 1977-78 considerable time was spent studying the reconnaissance photographs in an effort to select a preliminary alignment. The route that was selected for further study was plotted on the maps which are included in the back of this report on pages 13 through 16. These are USGS maps with a scale of 1 inch = 4 miles. These maps provide a scale that is manageable for inclusion in the report, but do not show extensive detail in any given area.

The proposed line was also plotted on the larger scale quandrangle maps as well as the reconnaissance aerial photographs.

The route is marked off in miles beginning with Mile 0 at the recently completed railroad bridge over the Chena River floodway near Eielson AFB and ending with Mile 268 at the Canadian border.

METHODOLOGY

Photogrammetric mapping was chosen as the most effective means of selecting a precise route for the railroad. This method allowed a high degree of latitude in final route selection and was adaptable to the time and funding constraints which had been placed on the project. The mapping work was assigned to two consulting firms which were already under contract to provide mapping services to the State of Alaska.

In early April 1978 maps with flight lines drawn along the proposed route were submitted to the mapping consultants. These consultants reviewed the flight lines and laid out ground control schemes that met their mapping requirements. These control schemes were returned to the DOT/PF by the end of April.

Anticipating an early and intensive surveying season, the Department contacted all affected landowners along the route to secure permission to survey across the owners' lands. Permission was granted by all public agencies and private owners with the exception of the Village of Tanacross. While Tanacross did not deny the request for access to its lands, the decision was delayed to the point where the Department could no longer wait due to the need to have ground control panels in place and mapping photos taken before spring foliage obscured the ground.

The result is that the segment of the route passing through Tanacross lands has not been mapped and therefore has not been described in precise terms. The Tanacross lands form a gap in the mapping project from mile 162 near Cathedral Bluffs to mile 195 near the Coast Guard Loran Station east of Tok. The route selected through this 32 mile area is described in the general terms used in the preliminary route study.

During late April and the first part of May of 1978, Department personnel placed the required photo control panels on the ground along the remaining 236 miles of the route.

North Pacific Aerial Surveys photographed the route on May 9, 1978 at a scale of 1"=500' for mapping purposes.

Concurrently with designing the flight lines, the state entered into negotiations to select a ground control survey consultant. The State selected the firms of Stutzman Engineering and DOWL. These firms were contracted to do all of the ground control survey work in a joint venture.

Control survey work began in early June and continued through the summer of 1978. The field survey was primarily a method of controlling the aerial photographs with a secondary benefit of establishing a system of monumentation along the proposed route corridor which could later be used for additional right of way acquisition, construction lay-out, or other surveys as may be deemed essential to the project. The Alaska State Plane Coordinate system was used for horizontal control throughout the project and involves Alaska Zones 2 and 3.

Since the three segments of the route spanned such an extensive area, a great variety of terrain, ground cover, and accessability problems were encountered. Each of the field conditions seemed to dictate how the survey should be conducted and what equipment should be utilized. In all cases, coordinate positions and azimuths were originated from existing Geodetic Survey, U.S. Geological Survey, U.S. Army Corps of Engineers, Bureau of Land Management, and two stations established by the International Boundary Commission. The control traverses or nets were also closed onto other stations of the same origin or previously established monuments which had been derived therefrom. After running a field data traverse through the network from geodetic station to station, a compass adjustment was made to position all intermediate points. The thus derived positions of each new traverse or control station were anticipated to be within 1:30,000 accuracy relative to existing control. Actual field determinations have proven this to have been accomplished.

All vertical control was derived from existing U.S.C.& G.S. or U.S.G.S. Bench Marks. A more detailed discussion of the control survey is presented in a report prepared by the consultants upon completion of the survey work. That report also contains a listing of the positions of all control points.

As the Department received control data from the survey consultants, it was sent to the mapping consultants and the production of contour maps began by mid summer 1978. This was accomplished at a scale of 1" = 100' with a 2' contour interval. The band of mapping varied from 500' to 800'. Over most of the length of the project a 500' wide strip centered on the preliminary route was mapped. In some areas of rough terrain a wider strip of mapping was requested to allow more flexibility in selecting a final railroad route.

As the mapping was received, the Department placed a railroad centerline on it. Occasionally the line is tightly controlled by topography. This is most obvious when climbing from the Tanana River to the Ladue Summit. A 1% "Grade Contour" was laid out on the mapping by starting at the Ladue summit and working down to the highway on the Tanana side. A railroad centerline was then drawn to get the best "fit" to this grade contour. The result is a railroad centerline with a sustained 1% grade and continuous curvature for a distance of about 10 miles.

As the alignment was placed on the mapping, the Regional Geologist and Hydrologist reviewed it and recommended needed changes. When the most desirable "fit" was achieved, the State Plane Coordinates of the tangent intersections were scaled off the contour maps and bearings and distances of the tangents were calculated, as well as all curve data. The line has been stationed from the Eielson toward the Canadian border. All of the alignment and coordinate data has been tabulated and is on file at the Interior Regional Office of the Department of Transportation and Public Facilities.

ROUTE DESCRIPTION

The new railroad bridge over the Chena River floodway near Moose Creek was selected as the starting point for the proposed railroad extension. This point was chosen rather than the end of the present line on Eielson AFB in order to avoid two crossings of the Richardson Highway which would eventually require overpasses, and to keep the main rail line out of the developed and congested area of Eielson. The Moose Creek starting point requires about 6 more miles of new track but makes the resulting main rail line about 2 miles shorter due to the more direct alignment through the Eielson area.

From Mile 0 the route proceeds southeast between the Tanana River and the Richardson Highway. This section is located on old river bars which offer favorable foundation conditions but require several slough crossings.

The route runs close to the Richardson Highway at Mile 19.5 and then turns up the Salcha River to a crossing about 1 mile below the highway bridge. After crossing the Salcha River, the route heads toward the west slope of Flag Hill and the Tanana River crossing at Mile 25.

After crossing the Tanana River, the route stays within one half mile of the river for the next 8 miles (to Mile 34). This is an area of alluvial gravels supporting stands of large white spruce.

From Mile 34, the route swings farther away from the Tanana toward a crossing of the Little Delta River at Mile 38.5. This crossing is about 2 miles above the mouth of the Little Delta near a low ridge. The stream bed at this point is about 2000 feet wide.

After crossing the Little Delta, the route swings back toward the Tanana River and stays close to the river from Mile 40 to Mile 44. Some bank protection will be necessary in this area. From Mile 44 to Mile 51, the route is located on old wooded river bars 0.5 to 1 mile south of the Tanana River. This is an area of unfrozen alluvial gravels with a thin covering of silt.

The route crosses Delta Creek about 2.5 miles upstream from its mouth and then skirts along the southern side of a 3.5 mile ridge which parallels Clear Creek - Clear Creek being on the northern side of the ridge.

From the east end of this ridge, the route follows along low terraces south of Clear Creek to the vicinity of Mile 67.

From Mile 67 to Mile 74, the route is within a mile of the west bank of the Delta River.

The crossing of the Delta River is in the area near Jack Warren Road. The crossing near Jack Warren Road will require bank protection along the east bank of the Delta River between Mile 75 and Mile 78. Bank protection in this area will be of great benefit to the community of Delta Junction since the river has been actively eroding this section of riverbank in recent years.

At Mile 77.5 the route turns east up Jarvis Creek. This general location through the Delta Junction area was chosen after meetings with the Delta Junction City Council and Planning Commission.

Delta Junction to Tok (Mile 78 to Mile 189)

Proceeding southeast from Delta Junction the route crosses the Richardson Highway just north of the Jarvis Creek bridge (Mile 78) and then follows the east bank of Jarvis Creek on Fort Greely lands for about 4 miles. At Mile 82, the route is near the developed area of Fort Greely although a bridge across Jarvis Creek will be necessary to provide access to the fort.

From Mile 82, the route turns easterly remaining on Fort Greely lands for the next 7 miles as a means of avoiding the private property along the Alaska Highway.

Between Mile 86 and Mile 88, the route winds through the broken terrain of a glacial moraine. The route then leaves Fort Greely near Mile 89 and heads southeast paralleling the Alaska Highway for the next 10 miles. Most of the land in this area has been selected by the State of Alaska under the statehood act.

The railroad route crosses the Alaska Highway near Mile 100, eight miles west of the Gerstle River. The route also crosses the proposed Northwest gas pipeline at this point. This crossing places the railroad on the opposite side of the highway from the Gerstle River Campground. After crossing the highway, the route parallels the highway on the north side until reaching the vicinity of the Little Gerstle River.

To avoid the steep, broken terrain of an old glacial moraine, the railraod route follows along the edge of the Tanana River from Mile 114 east of the Little Gerstle River to Mile 120 at the Johnson River. Department Geologists have some misgivings about the foundation conditions in this area and a detailed soils investigation might lead to a decision to shift a section of the alignment higher up the hill away from the Tanana River.

The route crosses the Johnson River near its mouth where the braided stream bed is about 0.5 miles wide. East of the Johnson River the route swings away from the Tanana River across an alluvial fan reaching the vicinity of the Alaska Highway near Dry Creek (Mile 123). For the next five miles the railroad route closely parallels the highway on the north while running along the edge of an alluvial gravel terrace.

At Mile 128 the route swings away from the highway to cross Berry Creek about 0.5 miles downstream from the highway bridge. The DOT/PF also proposes to shift the highway downstream on Berry Creek, however, there should be no conflict between the highway and the railroad.

At Mile 130, the railroad route runs north of a small lake following the same general location as the 1942 railroad survey. The route returns to the vicinity of the highway at Mile 132 and then swings 0.25 miles to the north to follow the edge of an alluvial gravel terrace for the next 4 miles.

Near Mile 137, the route enters Dot Lake Village lands and drops from the terrace to the Tanana floodplain. Over the next 3 miles the route will be partially located on the poor foundations west of Dot Lake.

After reaching Dot Lake (Mile 140) the route parallels the Alaska Highway for the next 8 miles over the flat terrain of an alluvial fan. At Mile 148 near Jan Lake, the railroad route swings away from the highway to the north in order to skirt the steep hills north of the Robertson River. The route reaches the Robertson River at Mile 154 and crosses that stream about 0.5 miles above its mouth. This crossing is about 3500 feet in length and poses some special problems because of the extensive buildups of ice that occur each winter in the Robertson River.

The route remains near the Tanana River for most of the distance between the Robertson River and Cathedral Rapids (Mile 154-164). East of Cathedral Rapids the railroad would contour around the large alluvial fan at the mouth of Yerrick Creek and again reach the vicinity of the Alaska Highway near Moon Lake (Mile 171). From Mile 171 to Mile 174, the route skirts the base of the hills below the highway and then parallels the highway from Mile 174 to Mile 176.

From Mile 176, the railroad route proceeds due east for 12 miles. This places the route south of the Tanacross airfield (Mile 178) and north of the Haines pipeline pump station (Mile 182). This also places the railroad well north of all the development between Tanacross and Tok. The route passes Tok Junction 2 miles to the north at Mile 189.

Tok to Canadian Border (Mile 189 to Mile 268)

From Mile 189 north of Tok Junction, the proposed railroad route runs southeasterly for about 10 miles in a straight line gradually converging with the Alaska Highway alignment. The route crosses the Tok River at Mile 193, passes north of the Coast Guard installation at Mile 194, and crosses the Alaska Highway at Mile 198.5 one mile west of the Tanana River bridge. The route then crosses the Tanana River just upstream from the highway bridge.

East of the Tana a River, the railroad route skirts along the base of the hills passing one quarter mile south of Tetlin Junction and remaining south of the Alaska Highway for the next 5 miles in order to avoid the steep, broken terrain on the hillsides above the highway. At Mile 206, the route crosses to the north side of the Alaska Highway and begins the climb to the Ladue Summit.

The location of the railroad for the next twenty miles is primarily controlled by grade requirements. The line must climb from an elevation of about 1800 feet at Mile 206 to about 2300 feet at the summit (Mile 216). This requires 10.5 miles of sustained 0.9% grade. This section will also have many maximum degree curves and will require many large cuts and fills.

The location of the crossing into the Ladue River Valley (Mile 216) is the same as that selected by the U.S. Army Corps of Engineers in 1943. This is the lowest available access point to the Ladue Valley.

On the Ladue River side of the summit, maximum grades and curves will not be necessary. The route reaches the valley floor at about Mile 220 at an elevation of 2100 feet. From this point on, the route will follow gentle grades and alignment down the Ladue Valley to the Canadian border.

The Ladue Valley is relatively narrow so that there is not a wide choice of route locations. For the most part, the railroad route will follow along the north side of the valley in order to gain the advantage of the southern exposure. The preliminary route reaches the Alaska-Yukon border at Mile 268.5.

CONCLUSIONS AND RECOMMENDATIONS

The work done on this project has resulted in a railroad alignment with essentially river grades and with curves that can be negotiated at 60 mph. The most motable exception is the section in the area of the Ladue summit where grades are still below 1% but where curvature and the length of sustained grade would reduce train speeds to 25 mph. There are a few curves in other locations with a 50 mph design speed.

The Department has attempted to select the best available railroad route while keeping within the limitations imposed by funding and time constraints. It would have been desirable to put more time and effort into several aspects of the route selection - particularly in the area of foundation investigations.

It should be expected that more detailed study in later phases of railroad development could result in recommendations for changes in the location of portions of the proposed alignment.

In spite of the shortcomings of this study, the Department feels that the route that has been selected is basically a sound and viable railroad route.

It is recommended that a 300 foot wide right of way centered on this route be withheld from the many demands being made on the public lands. It is further recommended that the State of Alaska should move to acquire that portion of the right of way that is within private lands as intended by HB47.

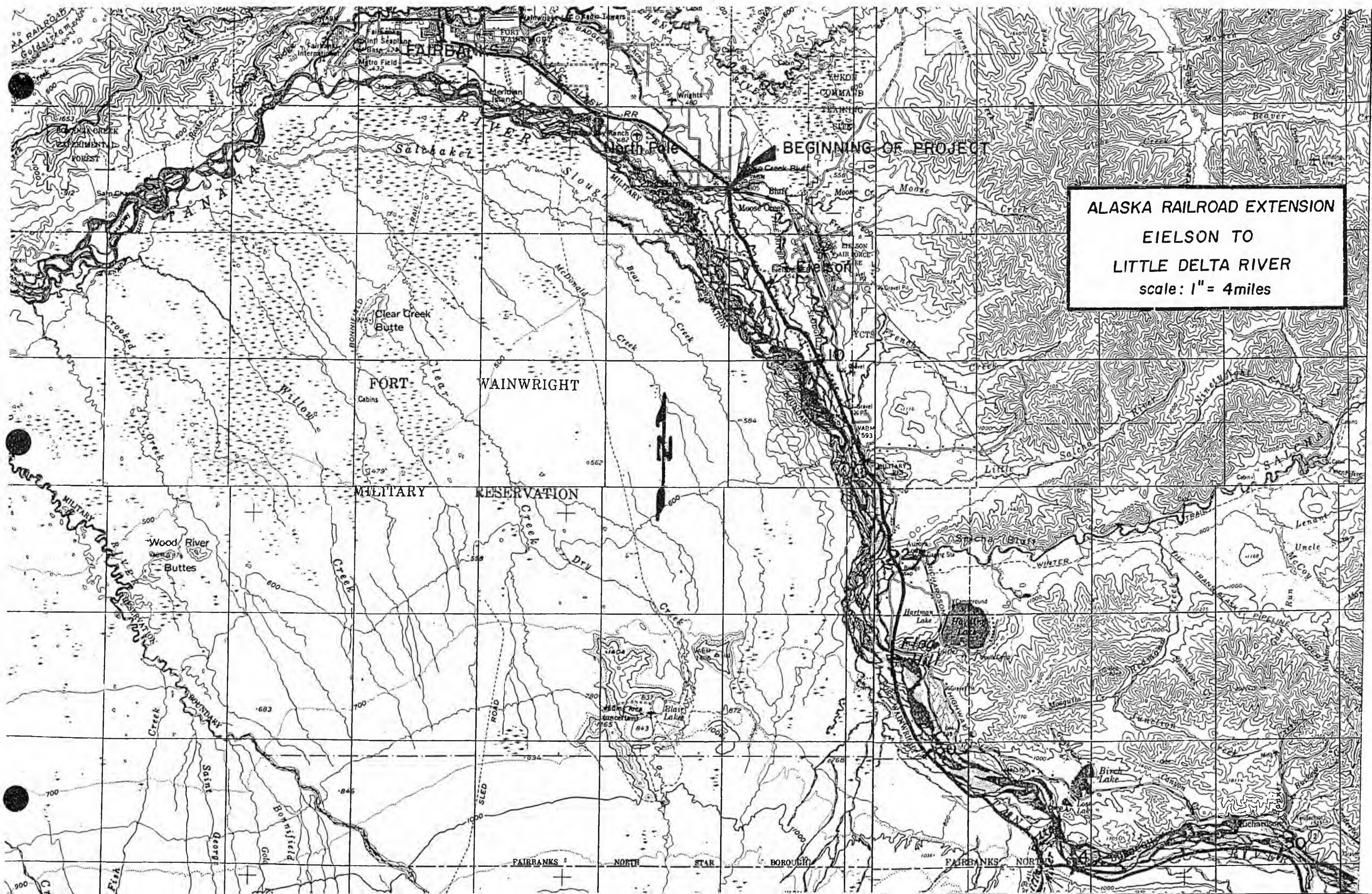
The Department now has on file:

* Aerial photos of the entire route
* Control survey data
* Photogrammatric contour maps of the route
* A tabulation of alignment data
* State Plane Coordinate positions of centerline points

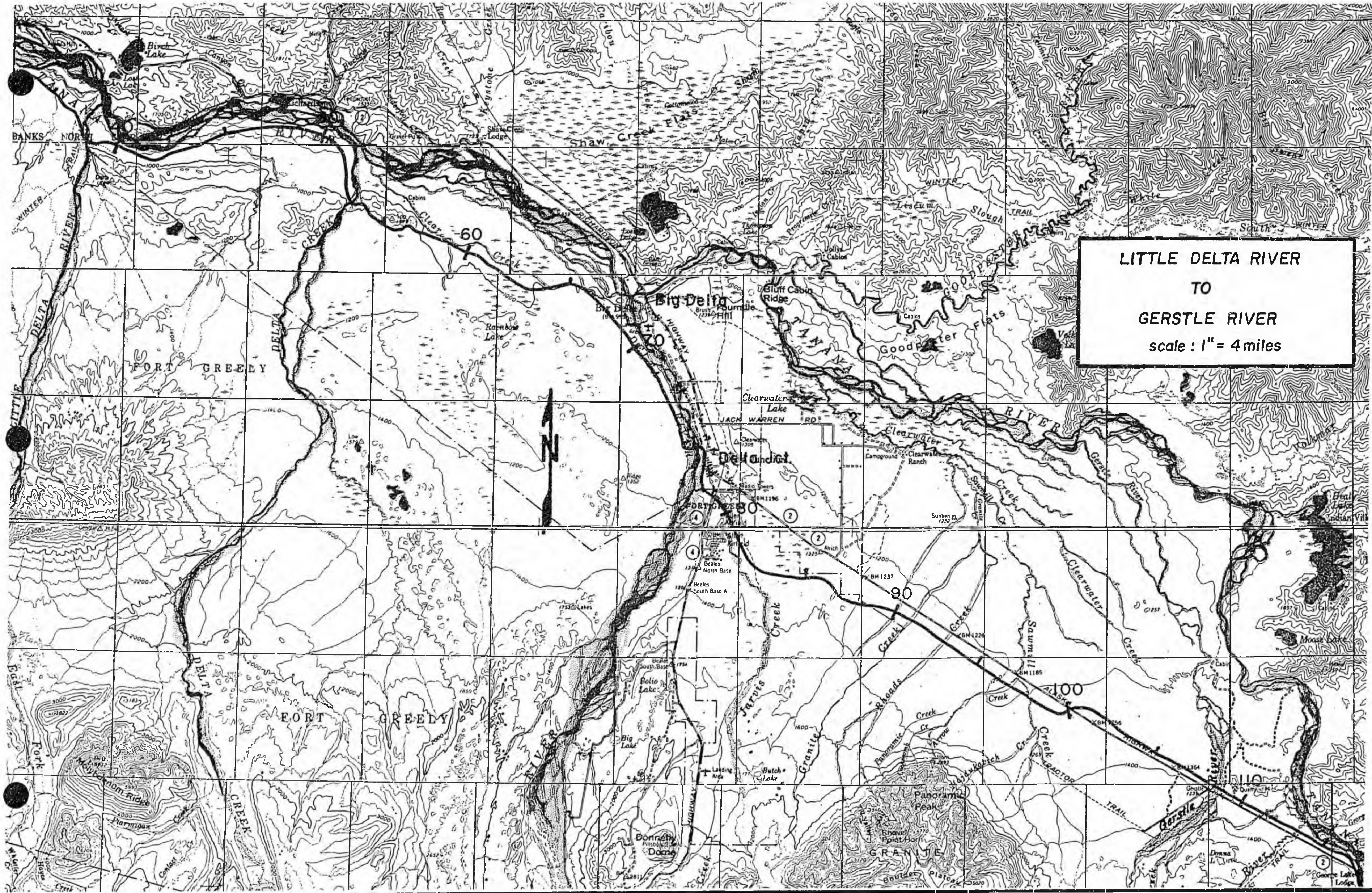
The Alaska State Plane Coordinates of the centerline points constitute a precise legal description of the railroad route.

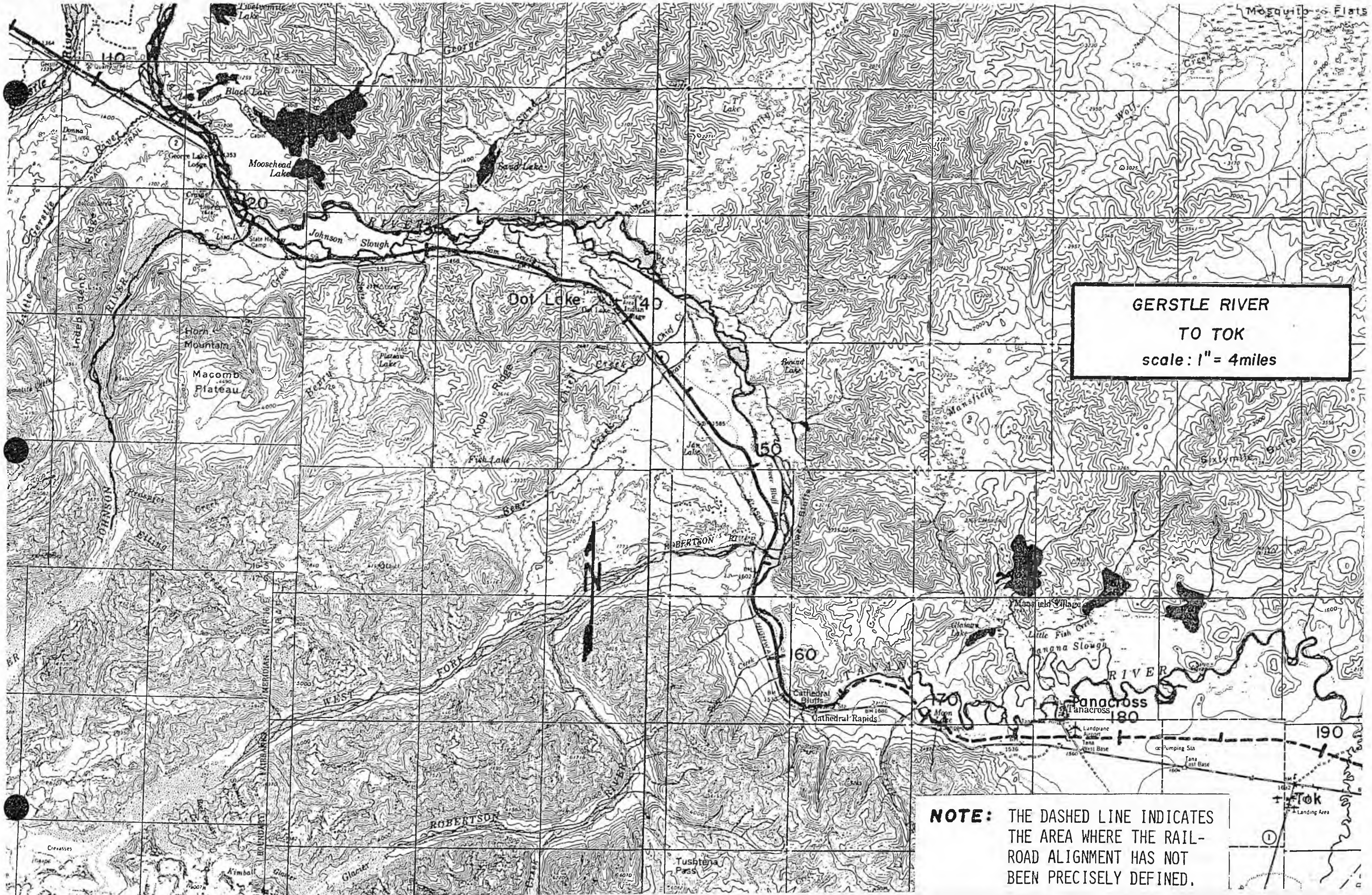
Through the photogrammetric process we also have the capability to produce design cross sections and earthwork quantities from the data already gathered and to make alignment shifts without field surveys. This should speed up the process if the decision is made to proceed to construction on any part of the railroad route.

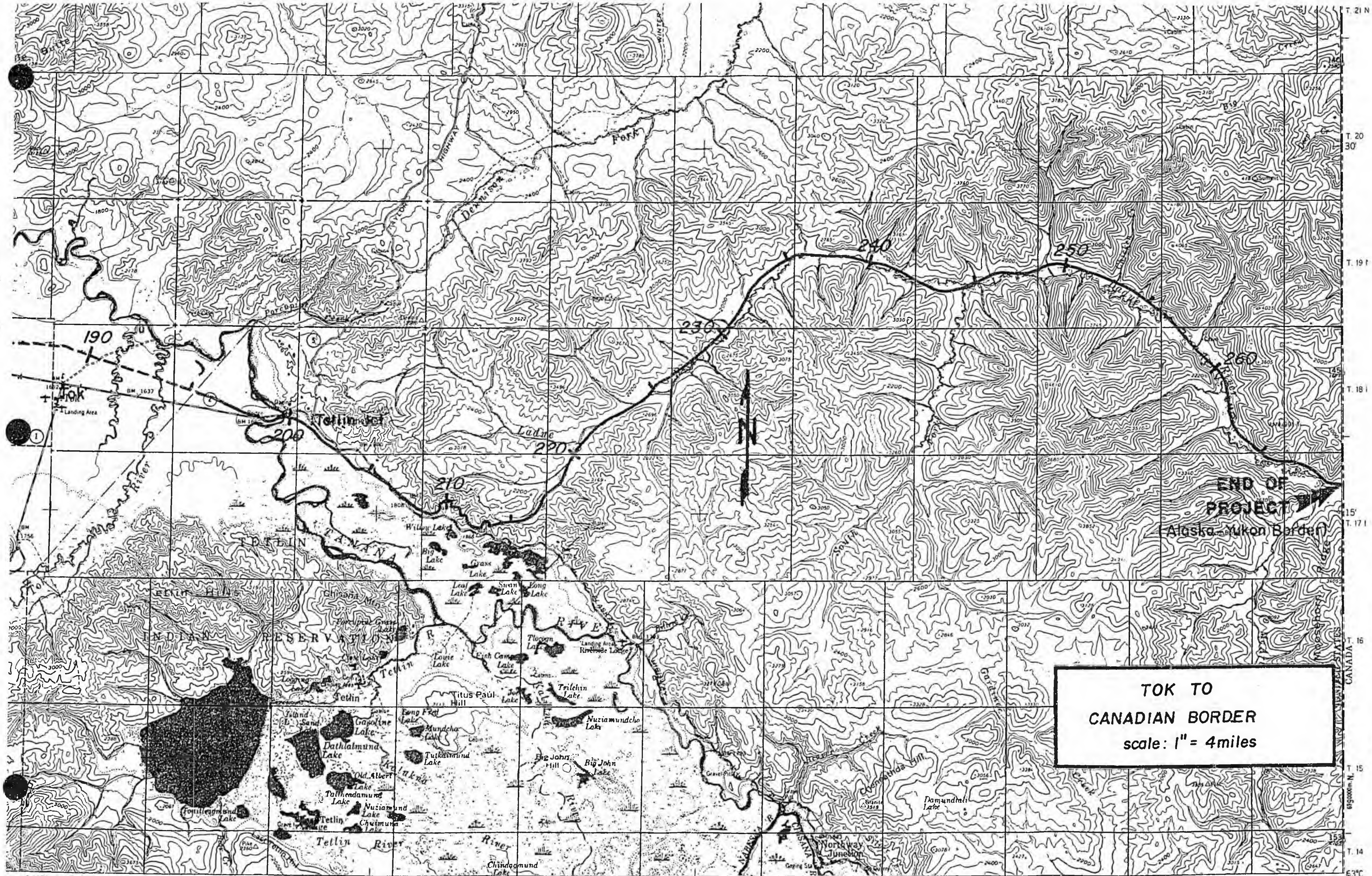
Much of the data gathered for the railroad study will also be of use on highway projects which are planned for the Alaska Highway.



ALASKA RAILROAD EXTENSION
EIELSON TO
LITTLE DELTA RIVER
scale: 1" = 4miles
BEGINNING OF PROJECT
FAIRBANKS
North Pole
Eielson
FORT WAINWRIGHT
MILITARY RESERVATION
TANANA
Clear Creek Butte
Wood River Buttes
Harding Lake
Birch Lake
FAIRBANKS NORTH STAR BOROUGH


LITTLE DELTA RIVER
TO
GERSTLE RIVER
scale : 1" = 4 miles
Big Delta
Delta Junction
Fort Greely
FORT GREELY
Shaw Creek Flats
Goodpaster Flats
TANANA RIVER
DELTA RIVER
LITTLE DELTA RIVER
JACK WARREN RD
Clearwater Lake
Birch Lake
Rainbow Lake
Bolio Lake
Big Lake
Butch Lake
Moose Lake
Healy Lake
Donnelly Dome
Panoramic Peak
Macomb Ridge
Bluff Cabin Ridge
Richardson
Banks
60
70
80
90
100
110


GERSTLE RIVER
TO TOK
scale: 1" = 4miles
NOTE: THE DASHED LINE INDICATES THE AREA WHERE THE RAIL-ROAD ALIGNMENT HAS NOT BEEN PRECISELY DEFINED.
Mosquito Flats
110
120
140
150
160
170
180
190
Dot Lake
Horn Mountain
Macomb Plateau
Mooshead Lake
Sand Lake
George
Johnson Slough
RIVER
Knob Ridge
Fish Lake
ROBERTSON'S RIVER
Mansfield
Sixtymile Butte
Mansfield Village
Tanana Slough
Little Fish Creek
Tanacross
Cathedral Bluffs
Cathedral Rapids
WEST FORK
ROBERTSON
Tushtena Pass
Tok
JOHNSON
Independence Ridge
MERIDIAN
Crevasses
N


TOK TO
CANADIAN BORDER
scale: 1" = 4miles
END OF
PROJECT
(Alaska-Yukon Border)
190
200
210
220
230
240
250
260
Tok
Tetlin Jct
N
Ladue
Fork
Dennison
TANANA
RIVER
TETLIN
INDIAN
RESERVATION
Tetlin
Northway
Junction
Willow Lake
Big Lake
Grass Lake
Leaf Lake
Swan Lake
Long Lake
Gasoline Lake
Dathlalmund Lake
Tetlin River
Chisana
Nabesna
T. 21 N
T. 20
T. 19
T. 18
T. 17
T. 16
T. 15
T. 14

APPENDIX

Introduced: 1/13/77
Referred: State Affairs and Finance

BY SWANSON, BRADLEY, CHATTERTON, HAYES, KELLY, MCKINNON, MEEKINS, MILES, PARR AND PHILLIPS

IN THE HOUSE

HOUSE BILL NO. 47

IN THE LEGISLATURE OF THE STATE OF ALASKA

TENTH LEGISLATURE - FIRST SESSION

A BILL

For an Act entitled: "An Act relating to creation of a utility corridor for extension of the Alaska Railroad; and providing for an effective date."

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ALASKA:

* Section 1. AS 19.05 is amended by adding a new section to read:

Sec. 19.05.122. UTILITY CORRIDOR FOR EXTENSION OF THE ALASKA RAILROAD. (a) The interior division of the department shall delineate a proposed utility corridor for the extension of the Alaska Railroad to the Canadian border. The proposed utility corridor shall include a delineation of a proposed railroad right-of-way.

(b) The commissioner shall, in conformity with the Administrative Procedure Act (AS 44.62), adopt a regulation approving, modifying, or rejecting the proposed utility corridor and railroad right-of-way.

(c) If the commissioner approves or modifies the proposed utility corridor and railroad right-of-way,

(1) the Department of Natural Resources shall classify, or reclassify, and reserve any state land within the utility corridor for use as a utility corridor and railroad right-of-way; and

(2) the department shall exercise its authority under sec. 40 of this chapter to acquire rights-of-way across land within the utility corridor which is subject to the state's power of condemnation.

(d) The requirements of the Alaska Land Act (AS 38.05) relating to classification and reclassification of land are inapplicable to actions taken under this section.

Introduced: 1/13/77
Referred: State Affairs and Finance

BY SWANSON, BRADLEY, CHATTERTON, HAYES, KELLY, MCKINNON, MEEKINS, PARR AND PHILLIPS

IN THE HOUSE

HOUSE BILL NO. 48 am

IN THE LEGISLATURE OF THE STATE OF ALASKA

TENTH LEGISLATURE - FIRST SESSION

A BILL

For an Act entitled: "An Act making a special appropriation to the Department of Transportation and Public Facilities, interior division, for delineation of a utility corridor and railroad right-of-way for extension of the Alaska Railroad; and providing for an effective date."

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ALASKA:

* Section 1. The sum of $865,000 is appropriated from the general fund to the Department of Transportation and Public Facilities, interior division, for the purpose of reconnaissance photography and studies, field surveys, mapping, engineering work, cost comparisons, and office work to delineate a utility corridor and railroad right-of-way for extension of the Alaska Railroad to the Canadian border.

* Sec. 2. The unexpended and unobligated portion of this appropriation lapses into the general fund June 30, 1979.

* Sec. 3. This Act takes effect immediately in accordance with AS 01.10.-070(c).

ALASKA RAILROAD EXTENSIO

Eielson to the Canadian Border

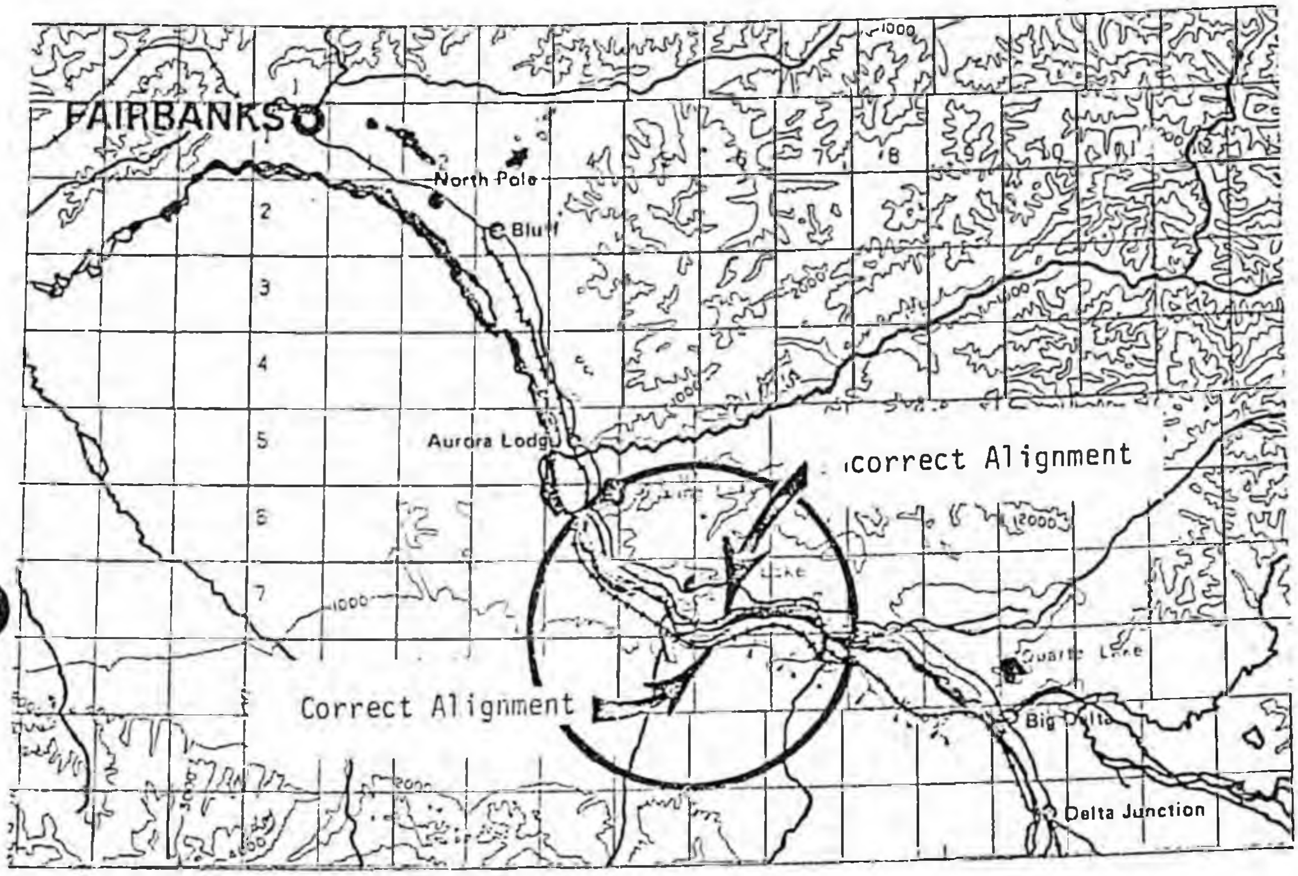
State of Alaska Department of Transportation and Public Facilities

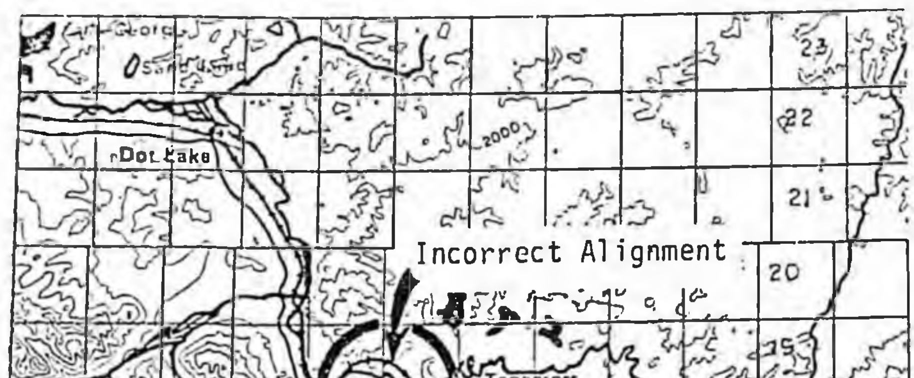
ENVIRONMENTAL ASSESSMENT

JULY 1983

ERRATA SHEET

Figure 4, Project Corridor (base map), and Figures 7 through 12 contain two segments of incorrect railroad alignment. The correct alignment segments are identified below.





ERRATA CONTINUED

The White Pass and Yukon Railroad route, traversing between Skagway AK and Whitehorse YT, is not shown on Figure 2, Existing Railroad Systems in Alaska and Northwestern Canada.

PROJECT R51033

ALASKA RAILROAD EXTENSION

Eielson to the Canadian Border

ENVIRONMENTAL ASSESSMENT

STATE OF ALASKA

DEPARTMENT OF TRANSPORTATION
AND PUBLIC FACILITIES

NORTHERN REGION

Approved for Distribution:

Regional Environmental Coordinator

Concur:

Deputy Commissioner

July 1983

Questions or comments concerning this document may be directed to:

State of Alaska
Department of Transportation
and Public Facilities
2301 Peger Road
Fairbanks, Alaska 99701

Attn: Environmental Section

SUMMARY

At the direction of the Alaska Legislature, the Alaska Department of Transportation and Public Facilities proposes to extend the Alaska Railroad from its present terminus near Eielson Air Force Base to the Canadian border, a distance of approximately 271 miles. The project would provide diverse transportation service possibilities related to regional resource development and, if extended through Canada (by the Canadian Surface Transportation Administration), related to transcontinental shipment. A railroad extension would also afford greater energy efficiency over other transport modes and would connect all of Alaska's major military installations to the railroad system. Proposed project activities would include construction of a single track (mainline), numerous railroad bridges, passing sidings every seven to ten miles, industrial tracks to serve major users not located near terminals or yards, terminal facilities, and a yard or yards to accommodate locomotive and car maintenance shops and switching operations.

In addition to the above preferred project construction alternative, a no-action alternative is considered. Other alternatives are not reasonable.

Significant environmental impacts of the project construction alternative are the commitment of resources for construction, wildlife habitat loss, wetland and floodplain involvement, railroad operation noise and access for natural resource development. The no-action alternative would preclude the possibility of railroad system linkage leading to the contiguous United States. An energy savings, through rail shipment of freight rather than highway or air shipment, would not be realized.

Early project coordination, prior to the initiation of this environmental study, included several Department contacts with agencies and community groups. Identified environmental issues provided guidance for the route location. Further agency coordination during the study identified other areas of project concern. Agency identified areas of concern have included permit acquisitions, potential cultural resource impacts, subsistence pattern changes, and effects on wildlife. Project location and activity concerns will continue to be coordinated during the project development process.

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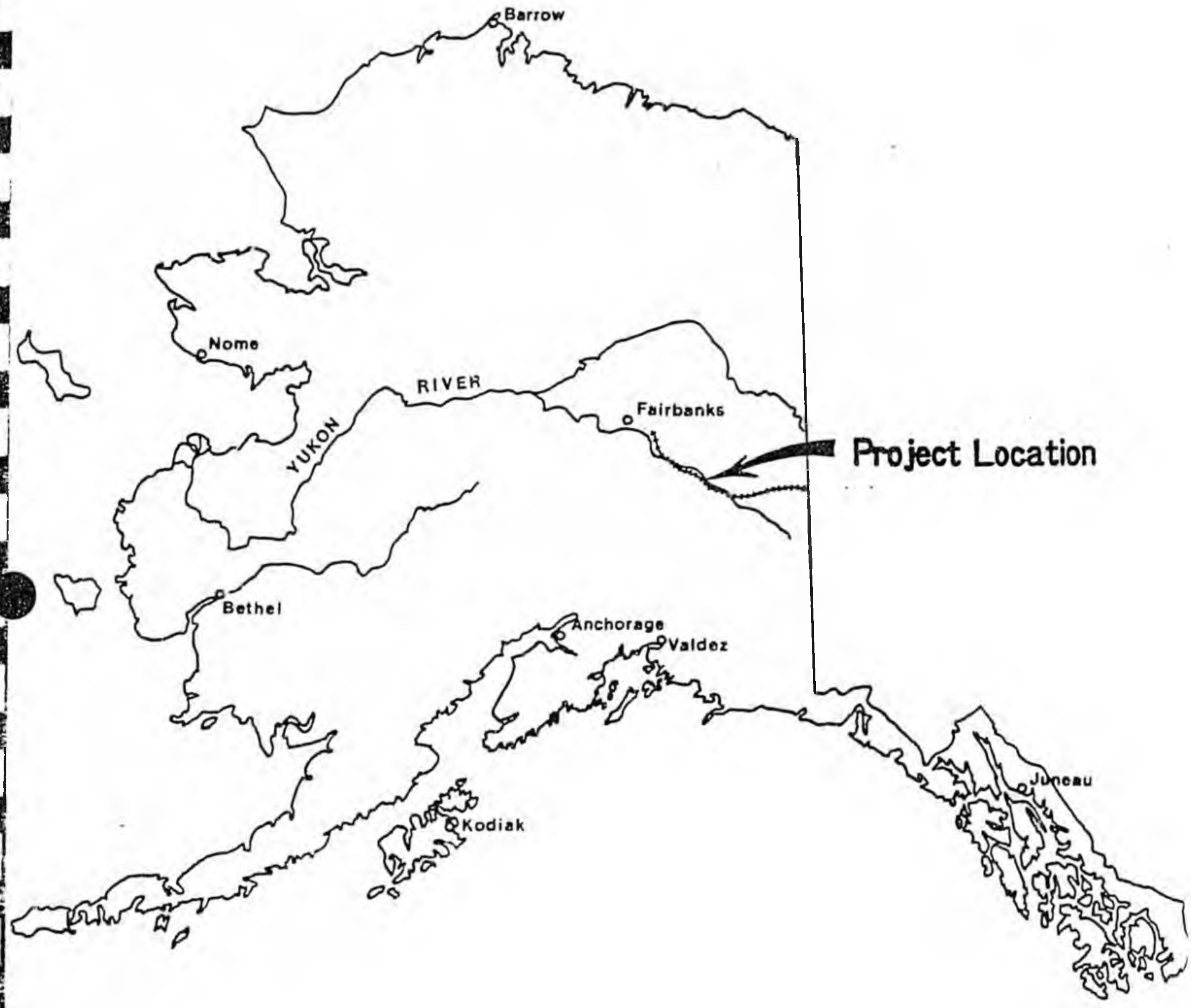


FIGURE 1 - Project Location

PROJECT HISTORY AND PURPOSE

HISTORY

In 1977, the Alaska Legislature passed House Bill 47 which dealt with a proposed extension of the Alaska Railroad. The bill mandated the Interior Region of the Alaska Department of Transportation and Public Facilities to delineate a proposed utility corridor for the extension of the Alaska Railroad to the Canadian border. A July 1981 amendment of House Bill 47 also directed the Department to prepare an environmental study, evaluating the impact of railroad construction.

The idea of an Alaska-Canada transcontinental rail connection to the contiguous United States had existed long before the above legislative intent surfaced. In 1942, the U.S. Army Corps of Engineers surveyed a route for a rail connection. Project interest faded however, after the end of World War II. The Bureau of Land Management, (BLM), Alaska State office, recommended a railroad linkage with Canada in a 1974 report, "Multimodal Transportation and Utility Corridor Systems In Alaska." In 1976, a State-sponsored conference was held to consider the connection of Alaska and Canada by an all rail land route leading to the midwestern and eastern manufacturing centers. The conference reached conclusions that: (1) Alaska was far behind the Yukon Territory and northern Canada in their research on the potential for a rail route and (2) the concept of rail connection between Alaska and Canada looked promising and should be pursued. The Legislature thereafter appropriated funding for preliminary economic studies in 1977, by the Department of Commerce and Economic Development and in 1980, by the Legislative Affairs Agency.

PURPOSE

A rail connection leading to the contiguous United States would provide system linkage and would present diverse transportation service possibilities.

Figure 2 identifies the existing railroad systems in Alaska and northwestern Canada. A feasible connecting route in terms of topographical relief and distance is first from Eielson Air Force Base southeasterly up the Tanana and down the Ladue River valley to the Canadian border, then down the West Fork of the Ladue to the White River, down the White River valley to the Yukon and up the Yukon past the community of Carmacks, then easterly along the Little Salmon and Magundy River drainages to the Pelly River, then up the Pelly and down the Liard River valleys to Watson Lake, south to Dease Lake, and finally southward to the terminus of the existing tracks extending from Prince George.

Transportation service possibilities from a connecting route are dynamic and diverse. The reader is encouraged to consult the preliminary economic studies identified in Appendix A for a more detailed accounting. Basically, the rail connection is being considered as both a regional resource development tool and a transcontinental trunk route.

Historically, railroads have been important development tools in large undeveloped land areas. Railroad access to minerals in the Western United States in the late 19th Century is a typical example. In Alaska, it is probably significant that the largest movements on the existing Alaska Railroad include coal transported from Healy to power plants along the railbelt and gravel moved from Palmer to aggregate companies in Anchorage. Petroleum products and logs from Nenana are also important rail movements. A railroad connection to the contiguous United States might afford additional development opportunities for several energy and natural resource industries including oil, mining, agriculture, and forestry. With surface transportation development, the Alaska Miners Association estimates that hard rock mines in Alaska could produce 2,199,000 tons of minerals and 22,688,000 tons of coal annually. Perhaps 15 to 17 million acres of potential farmland exists in Alaska; over 3.3 million tillable acres are located in the Tanana valley alone. Timber resources of Interior Alaska are comparable to the forests of the Great Lake States and it has been estimated that there is enough timber in the Interior to support approximately ten pulp mills on a sustained yield basis.

The value of these resources alone may not sufficiently amortize the cost of a railroad connection however. Mineral deposits can eventually be worked out. Alaska's extreme climatic conditions can cause agricultural production failures. Timber resources are subject to fire and disease. A transcontinental trunk route though, would serve a wider variety of shippers of all types of consumer and industrial goods, including many shippers not even inside the region. A trunk route would not be seriously affected by changes in regional economy. The trunk line would connect ports like Tokyo, Anchorage and Skagway with other population centers like Fairbanks, Whitehorse, Edmonton, Duluth and Chicago. Transport of products from Japan bound for the midwest, midwest goods being shipped to Japan or Russia, or of eastern U.S. goods for local markets might occur on a transcontinental trunk route. Illustrations in Appendix B indicate some of the products that could move along the route and how the different route segments might be utilized.

Additional merits of a rail connection deserve mention. Alaska has several important military installations. Significant amounts of military freights are shipped into and out of the State. A rail connection would afford more direct military transport and would also connect all of the major military installations, thereby possibly improving national defense. Furthermore, a rail connection would afford greater energy efficiency. With equal amounts of fuel, a railroad can transport more freight per mile than can be moved by either air or highway.

A rail connection entails project commitment by both the State of Alaska and the Canadian Surface Transportation Administration. At the present time the Canadian Government has no plans for construction of the Canadian portion of a rail connection. However, some of the above mentioned transportation service possibilities could still be realized even without Canadian railroad construction. An extension of the existing Alaska Railroad system toward the border would serve regional resource development (e.g., agricultural activity near Delta Junction). It would also connect all of Alaska's major military installations and provide improved energy efficiency over highway and air transport.

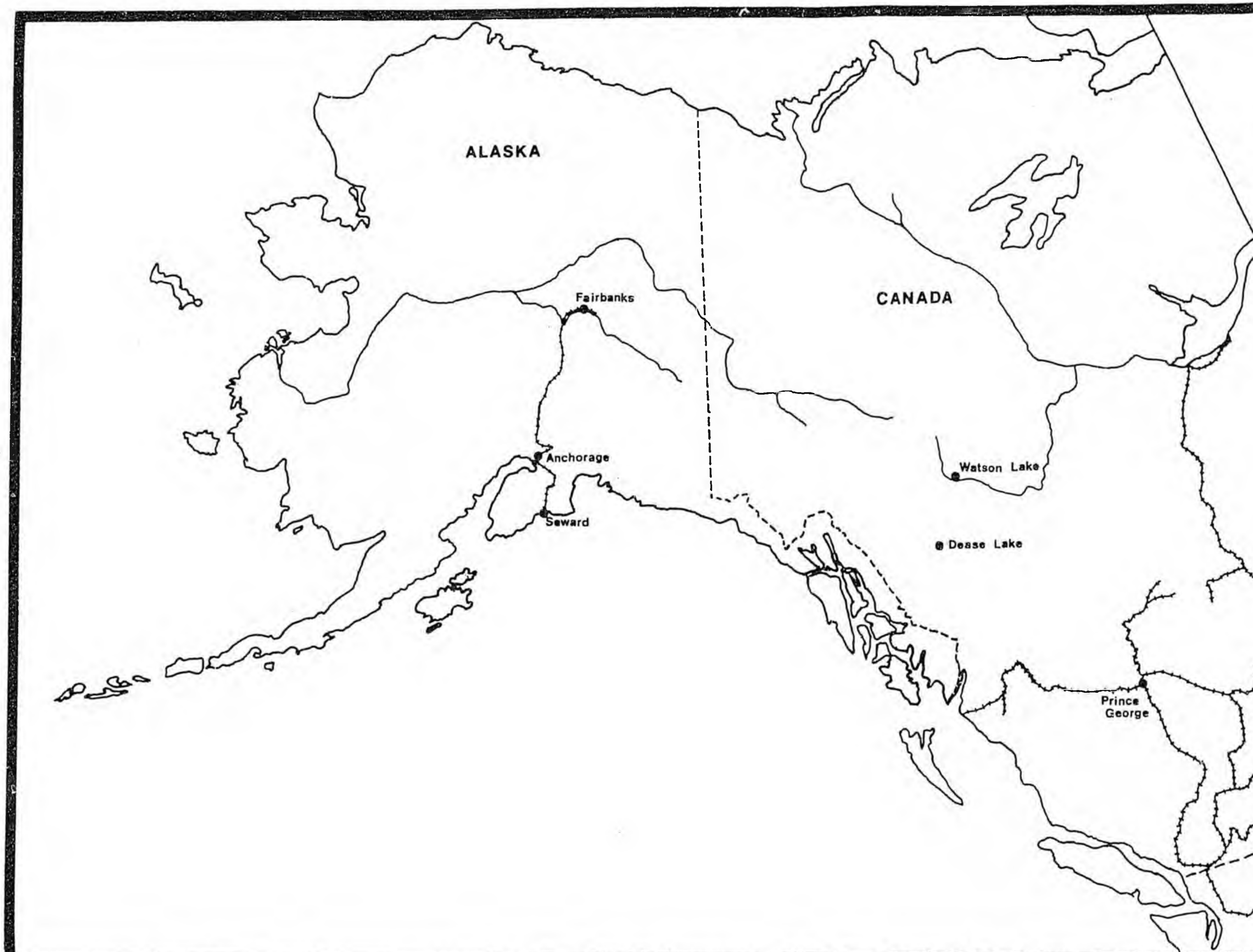


FIGURE 2

Existing Railroad Systems in Alaska and Northwestern Canada

ALTERNATIVE COURSES OF ACTION

Reasonable alternatives considered include a no-action alternative and a project construction alternative.

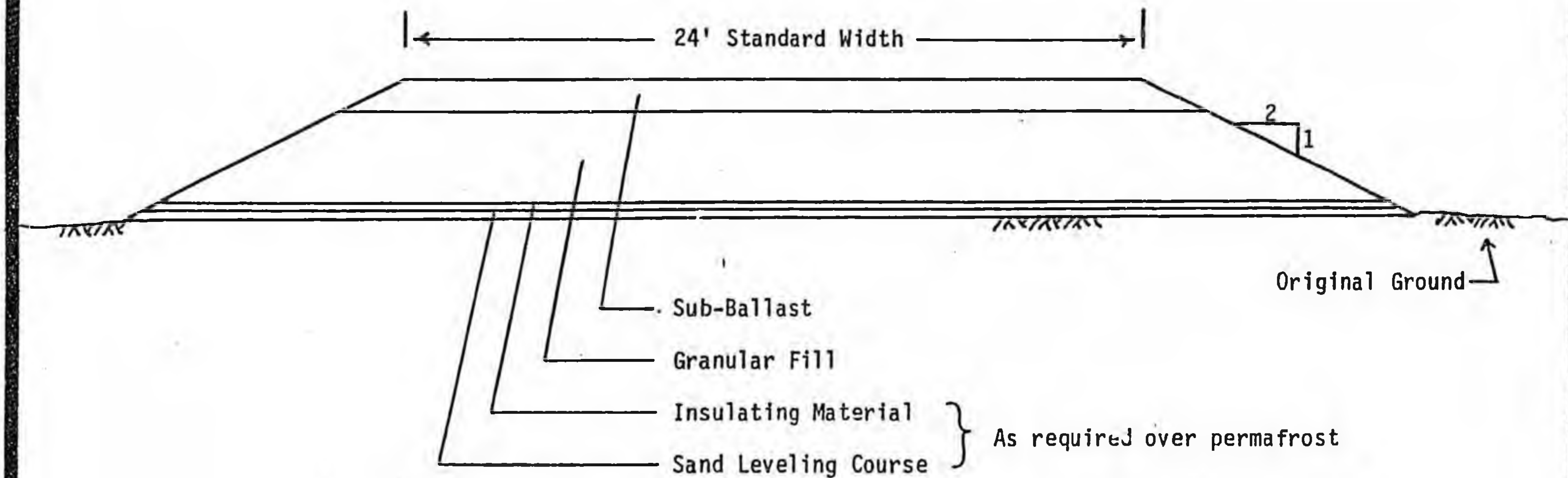
The no-action alternative would exclude any construction of a rail extension from Eielson Air Force Base to the Canadian border.

The alternative for project construction involves placing a single track (mainline) between Eielson Air Force Base and the Canadian border. It also includes necessary railroad bridges, passing sidings (spaced about every 7 to 10 miles so that trains may meet and pass), industrial tracks to serve any major users not located near terminals or yards, terminal facilities, and a yard or yards to accommodate locomotive and car maintenance shops and switching operations.

The proposed mainline track location is described below. It was identified through Department reconnaissance work that began in 1977. Appendix C defines the reconnaissance steps that lead to selection of the proposed route. General specifications for the track and embankment are given in Figure 3. Material source sites for embankment construction and maintenance have not been determined, pending further materials investigations. Right of way width for the mainline track, inclusive of passing sidings, would be 300 ft.

The specific locations for sidings, industrial tracks, and terminal and yard facilities have not been determined at this time. They would be identified during the project design phase. Right of way needs would likely be less than 300 ft. in width at industrial track locations, and greater than 300 ft. at terminal and yard locations.

Project construction would probably involve several construction seasons of work. Functional segments of the route could be placed in operation before construction of the entire route is accomplished. The Canadian border is a legislatively directed project study termini. A project construction alternative with termini of Eielson Air Force Base and an intermediate location (e.g., Delta Junction) is both feasible and probable. An initial intermediate termini may also be more prudent economically and politically.



NOTES

1. Track embankment and bridge structures will be constructed to accommodate cars carrying a load of up to 100 tons each.

2. Fill height will vary depending on foundation soils or floodplain involvement. A 4' minimum is typical over good foundation conditions.

3. Fill slopes will also vary. A 2:1 slope is typical over good foundation conditions.

4. Estimated average quantity of sub-ballast and granular fill: 67,000 cy/mile over good foundation conditions.

FIGURE 3 - General Specifications for Mainline Track and Embankment

ROUTE DESCRIPTION

An existing spur of the Alaska Railroad runs 30 miles southeast from Fairbanks to Eielson AFB. The proposed railroad extension takes off of this spur at the south end of the bridge spanning the floodway for the Chena River Flood Control Project. This beginning point (Mile 0), is five miles northwest of Eielson near Moose Creek Bluff.

From Mile 0 the proposed route runs southeast between the Richardson Highway and the Tanana River traversing old river bars and crossing numerous slough channels. Recent State-disposed agricultural lands surround the alignment from Mile 1.4 to Mile 5.3.

The route remains between the Richardson Highway and the Tanana River up to Mile 20. There are numerous private parcels and homes in this area. Several changes in the alignment have been made to reduce the impacts on these properties. These changes included the introduction of more curvature into the alignment and the shifting of the route across sloughs onto old river bars. At Mile 18.5, the railroad route has been relocated in order to avoid private homes. This location will require bank protection but will provide these homes with protection from erosion which has been severe at this site in recent years.

Near Mile 20, the proposed route turns up the Salcha River to a crossing one mile downstream from the highway bridge. From this point, the route heads toward the Tanana River crossing at the west slope of Flag Hill near Harding Lake.

The railroad route crosses the Tanana River at Mile 24.4. This crossing was chosen early in the route study as by far the best available Tanana crossing and was subsequently considered a fixed point in the route. At Flag Hill, the main river channel is fixed against the hillside and the total width of the active river channel is about ½ mile. In most other areas, the Tanana's braided channels are continually shifting over a channel width of one to 1½ miles.

After crossing the river, the route continues up the Tanana valley traversing the floodplain ½ to one mile away from the river. From Mile 25.2 to Mile 30.1, the route is located on military land (Fort Wainwright). After leaving Fort Wainwright, the route traverses State lands for the next 35 miles.

At Mile 36.5 the route turns south up the Little Delta River to reach a secure site for crossing that stream. The route then continues easterly paralleling the Tanana River for the next 12 miles. At Mile 50, the route again turns away from the Tanana in order to reach a favorable site for crossing Delta Creek. The route crosses Delta Creek at Mile 52.8 and then continues easterly passing south of a three mile long ridge. There is a Federal recreation withdrawal along Clear Creek which runs along the north side of this same ridge and the railroad route has been placed so as to avoid this withdrawal. From the east end of the ridge, (Mile 56.5), the route runs along low terraces about ½ mile south of Clear Creek to the headwaters of the creek near Mile 63.

Near Mile 67, the route passes through some private agricultural lands near the confluence of the Delta and Tanana rivers. The route then runs southeast through State lands along the Delta River.

The route turns across the Delta River at Mile 75 and then runs upstream along the east bank of the river for two miles through the Delta Junction area. The location of the railroad is intended to provide bank protection in an area where stream erosion has been a problem in recent years.

At Mile 77.5, the route turns away from the Delta River and runs along the east bank of Jarvis Creek. The route is situated on military lands from Mile 78 to Mile 88.5. At Mile 82, the route is near the developed area of Fort Greely although a bridge across Jarvis Creek would be necessary to provide direct access to the Fort. From Mile 82 the route turns easterly remaining on Fort Greely lands for the next 6.5 miles as a means of avoiding the private property along the Alaska Highway.

After leaving Fort Greely, the route runs east to the vicinity of the Alaska Highway and then closely parallels the highway for the next four miles. At Mile 99, the route makes an "S" curve in order to cross the highway at an acceptable angle. The route then parallels the highway on the north side for the next 11½ miles. The railroad route has been located so as to be compatible with the route for the proposed Northwest Alaska Natural Gas Pipeline which also parallels the highway through this area.

At Mile 111.5, the railroad route bends around a proposed gas line compressor site and then departs from the vicinity of the highway and runs along the bank of the Tanana River from Mile 114 to Mile 120 at Johnson River. A route higher on the hill was considered on the approach to Johnson River, but the route adjacent to the Tanana was determined to offer the best grades and foundations even though it will encroach on the river in a few places in order to avoid steep, unstable hillsides.

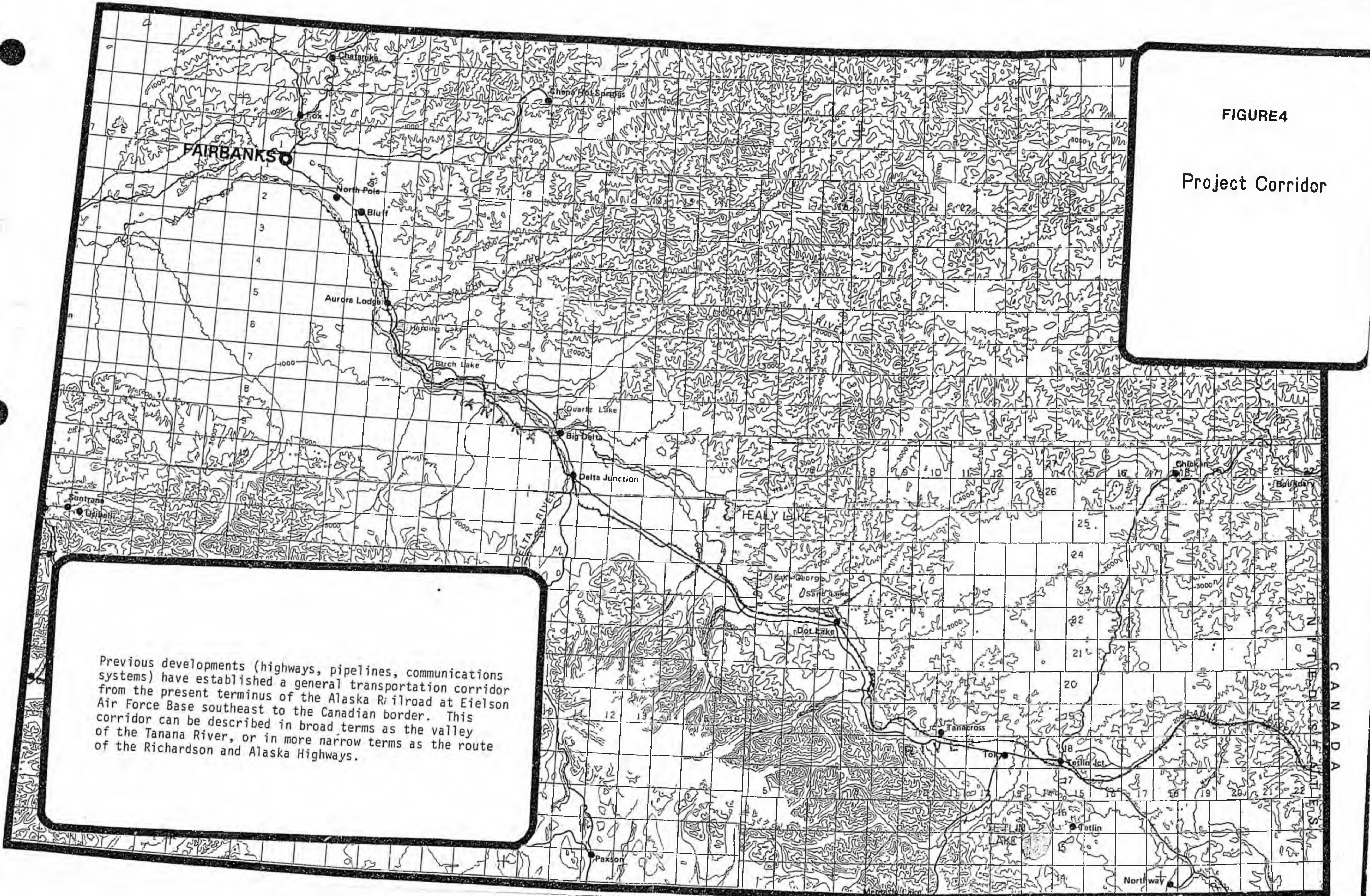


FIGURE4

Project Corridor

Previous developments (highways, pipelines, communications systems) have established a general transportation corridor from the present terminus of the Alaska Railroad at Eielson Air Force Base southeast to the Canadian border. This corridor can be described in broad terms as the valley of the Tanana River, or in more narrow terms as the route of the Richardson and Alaska Highways.

The railroad route crosses the Johnson River near its mouth and then returns to the vicinity of the Alaska Highway at Mile 123.5. The railroad remains north of and parallel to the highway from Mile 123.5 to Mile 128.3.

The railroad route swings away from the Alaska Highway at Mile 130 near Berry Creek and again at Mile 133 in order to maintain the required grades. In the vicinity of Mile 135, the alignment has been adjusted to accommodate a new State subdivision.

From Mile 135 to Mile 145, the railroad route closely parallels the highway. The highway and railroad rights of way actually overlap in the vicinity of Dot Lake in order to minimize the total right of way through the village area.

From Mile 145, the railroad route pulls away from the highway in order to avoid the rough terrain traversed by the highway just north of the Robertson River. The railroad route runs east of the rough terrain and then crosses the Robertson River just above its confluence with the Tanana River. The route remains close to the Tanana River for the next 12 miles in order to maintain acceptable grades through the Cathedral Bluffs area.

From Mile 165, the railroad turns away from the river and converges with the highway near Moon Lake (Mile 171). For the next six miles the route closely parallels the highway.

At Mile 177, the railroad departs from the vicinity of the Alaska Highway and proceeds in a nearly due east direction through the Tanacross and Tok areas. The route is located on section lines for seven miles to Mile 188.5, two miles north of Tok. From this point, the route turns southeast and gradually converges with the highway.

The route passes north of the Coast Guard installation at Mile 195 and enters Tetlin Village lands at Mile 195.5. The route is located on Tetlin lands for the next 21.5 miles.

At Mile 199.4, the railroad route crosses the Alaska Highway and then crosses the Tanana River just upstream from the highway bridge. The route passes ½ mile south of Tetlin Junction and remains south of the highway to Mile 207. At this point, the route again crosses the highway and begins the climb to the Ladue Summit. This section entails ten miles of sustained one percent grade and sharp curves. The Ladue Summit is the highest point on the proposed railroad route at 2300 ft. above sea level.

ENVIRONMENTAL SETTING AND ENVIRONMENTAL CONSEQUENCES

NO-ACTION ALTERNATIVE

Adoption of a no-action alternative would avoid impacts associated with project construction. No surface disturbance or vegetation loss from embankments, yard facilities, or material source sites would occur. There would be no loss of wildlife habitat; subsistence patterns would not be affected. No encroachment into waters, wetlands and floodplains necessary for bridge construction, would ensue. Air quality, noise, archaeologic and visual impacts of the project, though not significant, would none-the-less be precluded with the no-action alternative. No right of way acquisition would be required. Neither would construction materials, equipment, or labor be necessary. Funding would be available for other uses.

No railroad system linkage, leading to the contiguous United States, would be possible with adoption of the no-action alternative. (Even with extension to the Canadian border however, construction of the rail connection within Canada cannot be assured.) Many railroad generated transportation service possibilities would be diminished or eliminated without the system linkage. An energy savings, through rail shipment of freight rather than highway or air shipment, would not be realized as a result of the no-action alternative.

PROJECT CONSTRUCTION ALTERNATIVE

The environment to be affected by proposed railroad construction and operation and the general impacts that may result are identified under the topics that follow.

GEOLOGY AND HYDROLOGY

The majority of railroad corridor area falls within two land resources identified physiographically as the Interior Alaska Lowlands and the Interior Alaska Highlands (Figure 5). The designations are descriptive of the geologic and hydrologic settings.

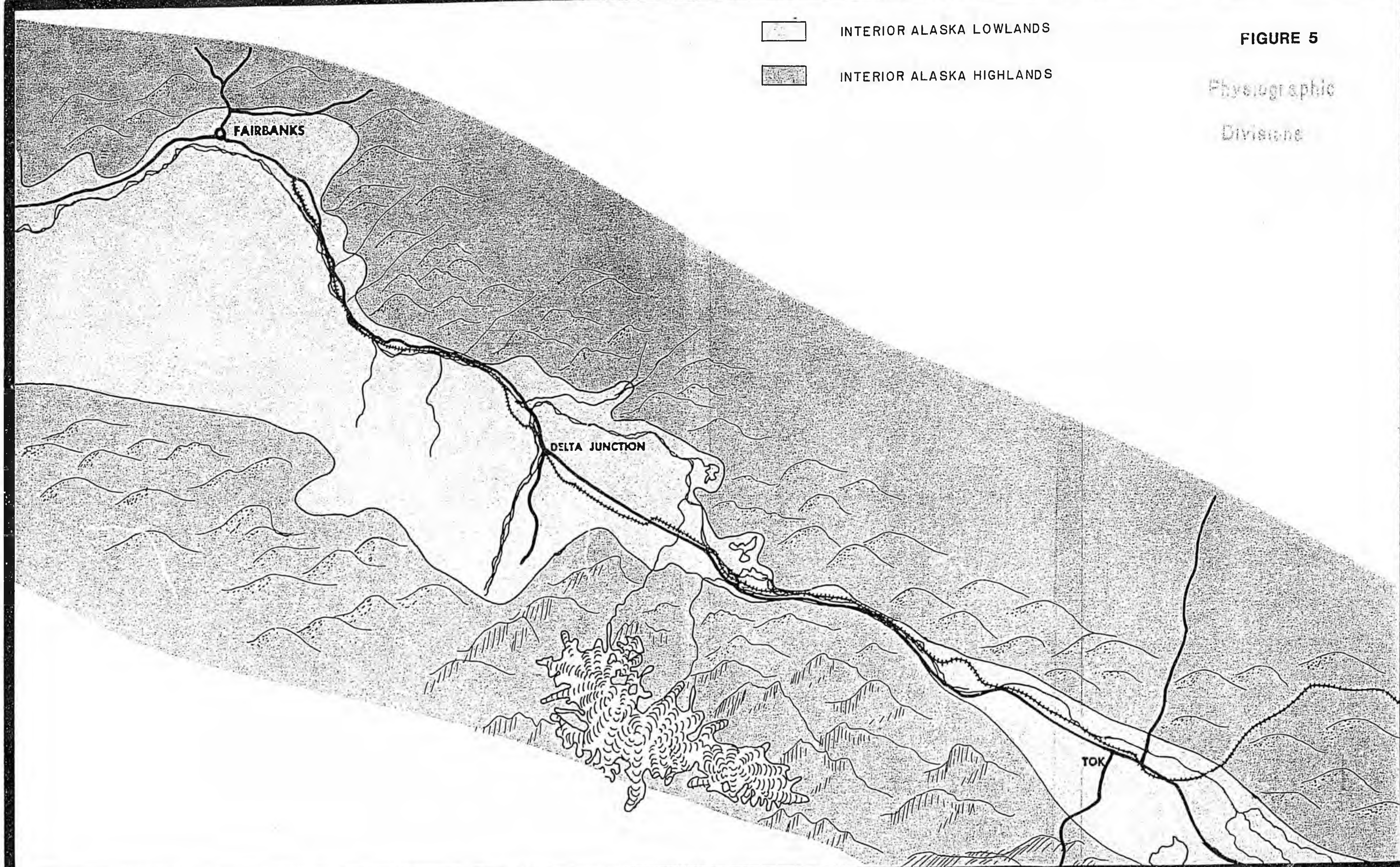


FIGURE 5

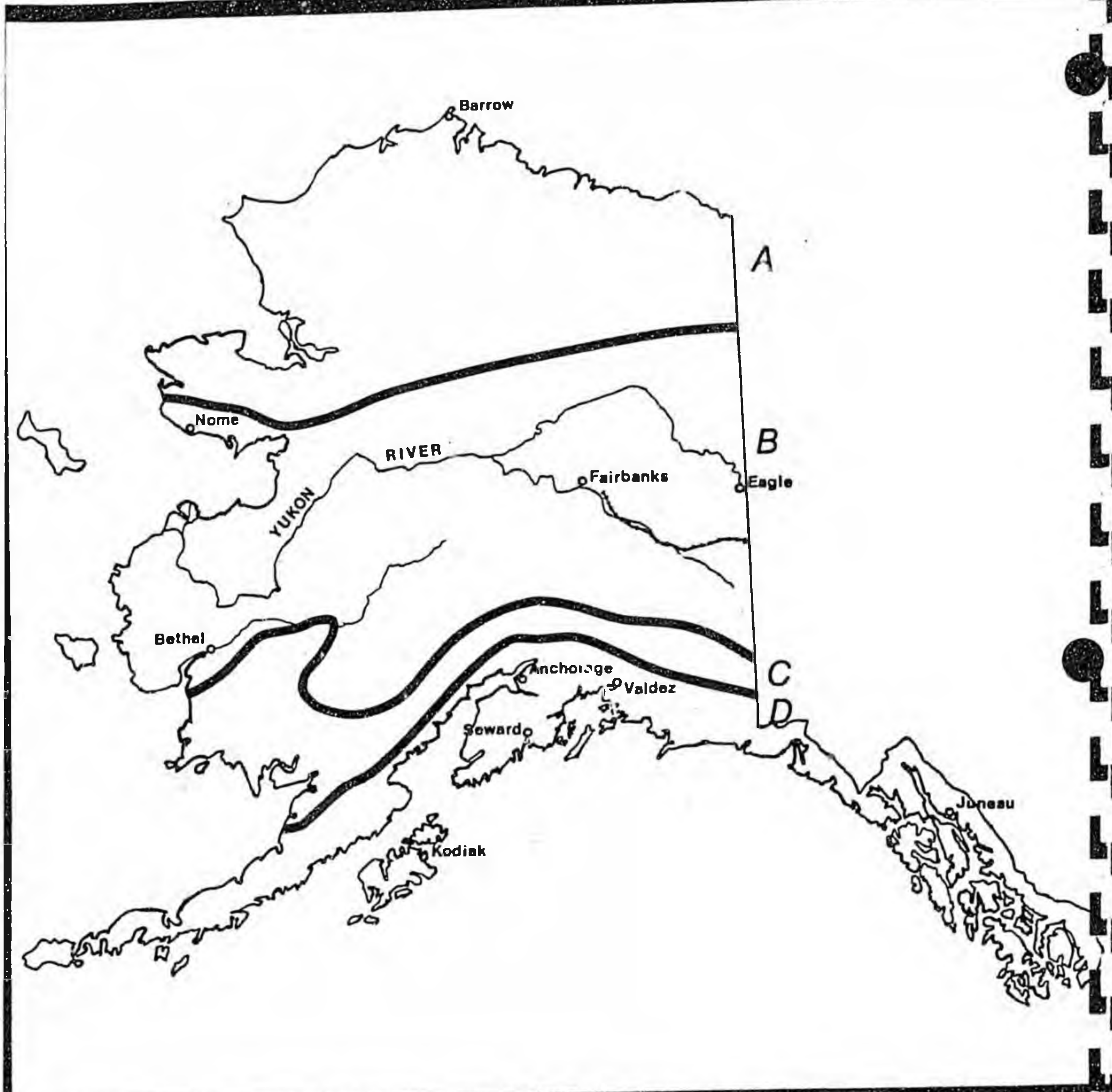
Physiographic Divisions

foundations and in areas where construction materials are readily available. Areas of poor foundations, such as sloughs, marshes, and wetlands, offer prohibitive construction and maintenance costs. Large quantities of gravel and rock would be required for the construction of nearly 270 miles of railroad. In addition, a continual supply of gravel and rock would be necessary for maintenance. Railroad roadbed maintenance, including gravel renewal, is critical in Alaska where the amount of moisture during spring breakup can, if not controlled, make track unusable within a single year. Further material demands could also result from flood or earthquake damages. The abundant alluvial gravels of the Tanana lowland should provide adequate gravel and rock sources for construction, operation and maintenance. Specific mining locations have not been determined, however, pending further materials investigations. Importing gravel materials from longer distances over newly constructed portions of railroad alignment might also prove feasible and cost effective. The Design and Construction Impacts section further addresses project materials needs.

The corridor is entirely within the discontinuous permafrost zone of Alaska (Figure 6). Although the permafrost or permanently frozen ground is discontinuous, the corridor traverses more frozen ground than unfrozen. Typically permafrost exists where there is a mean annual air temperature below freezing. Within similar temperature zones favorable for the formation or preservation of permafrost, other environmental factors such as subsurface drainage and surface insulation, affect the distribution of permafrost. Construction produced changes in the surface environment of frozen ground (e.g., clearing of vegetation, alignment construction) can result in thawing of the permafrost, followed by ground subsidence if the frozen material is unstable. Not all permafrost is thaw unstable; gravel and rock materials can remain stable when thawed. Due to the intensive maintenance required on alignments located over thaw unstable permafrost areas, avoidance of such locations is usually prioritized. Where avoidance is not possible, design measures can reduce, but will never eliminate, above-normal maintenance costs. Within the corridor area, the Ladue River valley, containing loamy alluvial sediments, presents the greatest potential for permafrost problems.

Other geological and hydrological hazards to a railroad alignment that occur in the corridor (Figure 7) include terminal moraine slopes of the Johnson and Robertson Rivers, steep slopes between the Tanana and Ladue River valleys and in the vicinity of Harding Lake, icing on the Johnson and Robertson Rivers, flooding in the Tanana River floodplain, flash flooding of Yerrick and Cathedral Creeks, glacier outburst flooding along several rivers and earthquake damage. Although no major faults associated with earthquake activity are found along the Tanana and Ladue River valleys, surrounding hills and mountains do contain faults and have greater earthquake potential.

The probability of project impact from certain hazards can be minimized by engineering practices when alignment avoidance is not possible; other



PERMAFROST ZONES

A Continuous
B Discontinuous
C Sporad
D No Permafrost

FIGURE 6 - Permafrost Zones of Alaska

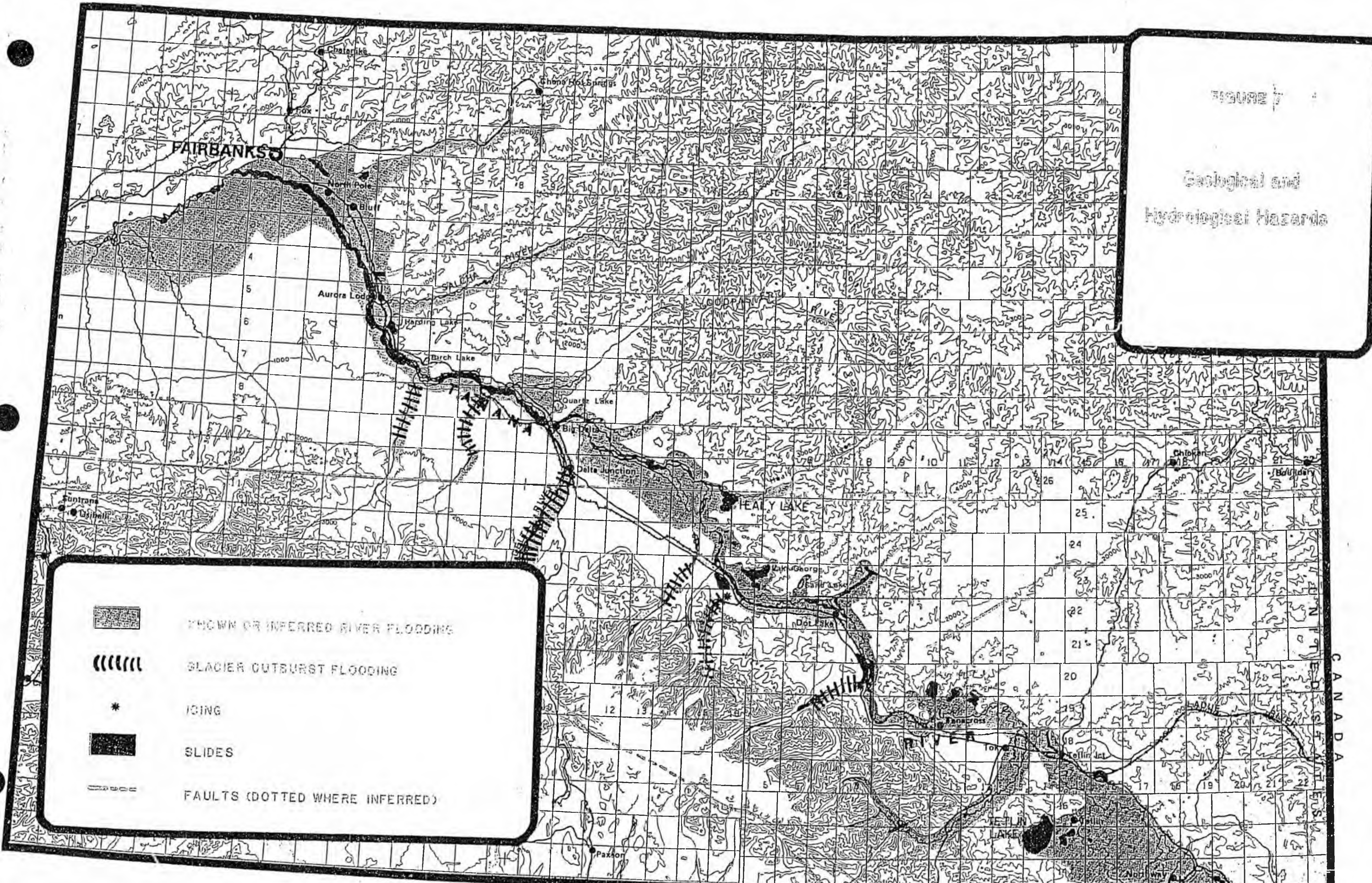


FIGURE 7
Geological and
Hydrological Hazards
KNOWN OR INFERRED RIVER FLOODING
GLACIER OUTBURST FLOODING
ICING
SLIDES
FAULTS (DOTTED WHERE INFERRED)
FAIRBANKS
Chatanika
Fox
Chena Hot Springs
North Pole
Bluff
Aurora Lodge
Harding Lake
Birch Lake
Quartz Lake
Big Delta
Delta Junction
HEALY LAKE
Lake George
Sand Lake
Dot Lake
Tanacross
Tok
Tetlin Jct.
TETLIN LAKE
Northway
Paxson
Chicken
Boundary
SALCHA RIVER
GOODPASTER RIVER
TANANA
RIVER
UNITED STATES
CANADA

hazards are upredictable (e.g. earthquakes) and cost effective mitigation is impractical. Locating an alignment away from the base of steep slopes and constructing backslopes at stable angles will minimize the potential for slope failures. Elevation of tracks (on pile supported bents) or of roadbed across channels and within floodplains where facility overtopping would otherwise be anticipated to occur will minimize icing and flooding hazards.

VEGETATION

The corridor area contains several general plant communities including bottomland spruce-poplar forest, low brush and muskeg bog, lowland spruce-hardwood forest, upland spruce-hardwood forest, moist tundra and alpine tundra (Major Ecosystems of Alaska Map).

The floodplains and low terraces of the Tanana River support the dense white spruce stands occasionally mixed with balsam poplar that comprise the bottomland spruce-poplar community. Vegetative undergrowth is generally dense shrubs including American green alder, thinleaf alder, willow, rose, dogwood, Labrador tea, and berry bushes. Ground cover is usually ferns, bluejoint grass, fireweed, horsetails, lichens, herbs, and mosses.

Low brush and muskeg bog typifies the plant community of the low, wet slough or basin areas within the corridor, including the Salcha drainage and Shaw Creek Flats. Bog vegetation consists of varying amounts of sedges, sphagnum and other mosses, bog rosemary, rose, resin birch, dwarf Arctic birch, Labrador tea, willow, bog cranberry, soapberry, and blueberry.

The lowland spruce-hardwood forest community occurs on extensive areas of glacial outwash plains bordering the south side of the Tanana River. The vegetative community consists of black spruce and tamarack in wet areas and white spruce, black spruce, paper birch, aspen and balsam poplar on knolls. Undergrowth includes willows, dwarf birch, lingonberry, blueberry, rose, Labrador tea, crowberry, bearberry, cotton grass, ferns, horsetail, lichens, and sometimes a thick cover of sphagnum and other mosses.

Upland spruce-hardwood forest occurs on the lower hills and ridges surrounding the Tanana River Valley. This is a fairly dense white spruce, birch, aspen and balsam poplar forest community. Undergrowth consists of mosses and grasses on dry sites and brush on moist slopes. Typical plant species are willow, alder, ferns, rose, highbush cranberry, lingonberry, raspberry, currant, Labrador tea and horsetail.

Moist tundra occurs on the higher foothills of the Alaska Range. Moist tundra is characterized by a wide variety of low growing shrubs, herbs, grasses, and sedges rooted in a mat of mosses and lichens. Species include polar grass, bluejoint, tufted hairgrass, sedges, mosses, alpine-azalea, wood rush, mountain-avens, bistort, horsetail, low-growing willows, dwarf birch, Labrador tea, American green alder, Lapland rosebay, blueberry, and lingonberry.

Alpine tundra is found on mountain slopes and ridges, typically above 3000 ft. in elevation within the corridor area. Vegetation is seldom more than a few inches high. Dominant species usually consist of mountain-avens and lichens and low-growing herbs, grasses and sedges. Associated species are resin birch, dwarf Arctic birch, cassiope, crowberry, alpine-azalea, Labrador tea, mountain heath, moss campion, black oxytrope, and Arctic sandwort.

The above general plant communities are abundantly represented in interior Alaska. Estimated acreages are shown below.

TABLE 1
ESTIMATED AREA IN INTERIOR ALASKA*

Community	Acres (Millions)	Percent of State Total
Bottomland spruce-poplar forest	12.0	67%
Lowbrush and muskeg bog	9.2	88%
Lowland spruce-hardwood forest	23.2	66%
Upland spruce-hardwood forest	43.4	68%
Moist tundra	7.0	11%
Alpine tundra	21.1	25%

*Alaska Regional Profiles, Yukon Region

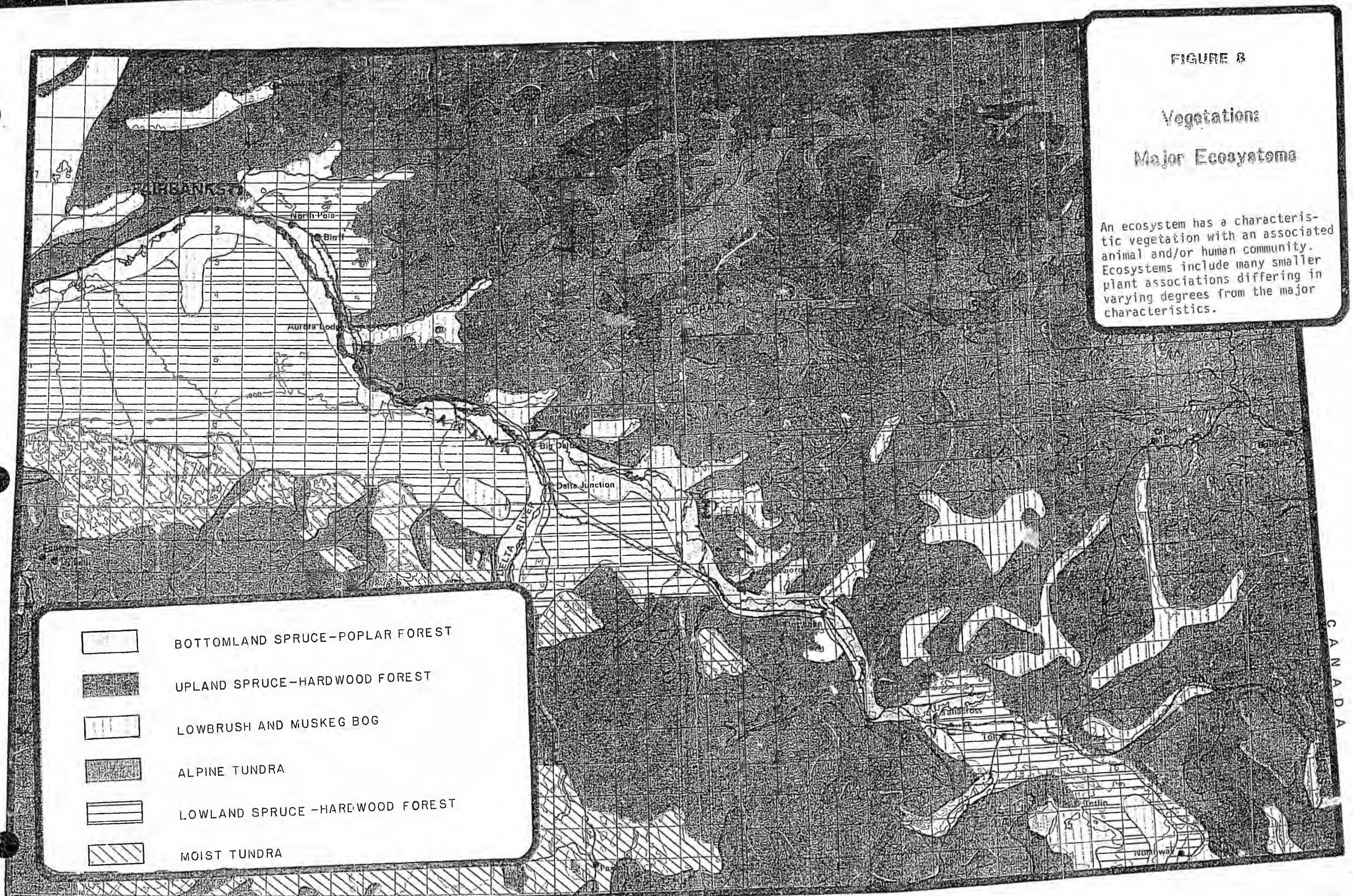


FIGURE 8

Vegetation:

Major Ecosystems

An ecosystem has a characteristic vegetation with an associated animal and/or human community. Ecosystems include many smaller plant associations differing in varying degrees from the major characteristics.

Of the six identified general plant communities, a railroad alignment would primarily impact the bottomland spruce-poplar forest and the lowland spruce-hardwood forest. This is due, in part, to the relationship between the general plant communities (ecosystems) and project engineering constraints. A feasible railroad alignment would be precluded from the tundra communities of higher elevations where steeper gradients predominate. Likewise, poor soil drainage and inadequate foundation strength in the low brush and muskeg bog community would constrain extensive alignment there.

Construction of nearly 270 miles of railroad would require a significant loss of vegetation. Should construction activity and/or railroad right of way clearing standards necessitate removal of vegetation within the entire 300 ft. wide right of way (the most conservative estimate), a loss of 36 acres of vegetation per mile would result. Part of this loss would be temporary, as the area between the edge of right of way and the base of the railway embankment would revegetate by natural succession. However, due to safety and maintenance considerations (e.g., adequate sight distance at curves and road/railroad crossings, removal of trees that could fall and obstruct the tracks, reduced snow drifting and snow removal, etc.) cleared areas would be mechanically or chemically managed to keep vegetation at low growing heights. Impacted forest communities would be replaced, in part, by early successional stage vegetation communities. Additional vegetation loss at material source sites could also occur. The extent of this loss cannot be easily quantified; embankment material availability requires further investigation.

No known listed or proposed threatened or endangered plant species are present in the project area.

Several forested areas within the corridor (on State lands) have been proposed for legislative designation as State Forest Resource Management Areas and Experimental Forest and Watershed Areas (Figure 12). These and remaining corridor forests supply wood for commercial and personal use, and provide for a variety of non-timber uses. A railroad alignment could traverse through proposed State Forest Resource Management Areas. Except for the loss of timber within a 300 ft. wide right of way, no significant adverse impacts or benefits to the management areas have been identified.

AGRICULTURE

No prime or unique farmlands, as designated by the U.S. Department of Agriculture, Soil Conservation Service, occur within the project corridor.[1] The corridor does contain both developed agricultural lands and lands having a potential for agricultural development. Larger tracts of currently farmed agricultural lands can be found east and southeast of Fairbanks and east of Delta Junction. Figure 12 identifies general areas of current farming activity. Potential agricultural areas in the corridor, with soils suitable for farming activity, include most of the Tanana valley lowlands and some upland areas north of the Tanana River. Both regions have soils with 25-50% suitability for farming

[1] The Farmland Protection Policy Act of 1981 assures preservation of prime and unique farmlands. Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides and labor and without intolerable soil erosion, as determined by the Secretary of Agriculture. Prime farmland includes land that possesses the above characteristics but is being used currently to produce livestock and timber. It does not include land already in or committed to urban development or water storage. Unique farmland is land other than prime farmland that is used for production of specific high-value food and fiber crops, as determined by the Secretary. It has the special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high quality or high levels of specific crops when treated and managed according to acceptable farming methods.

(Soils with Agricultural Potential, Alaska, U.S. Soil Conservation Service, 1973). Future agriculture development will be dependent on demands for producible crops and available means of transporting large volumes of foodstuffs to markets.

Established agricultural lands would probably be impacted by a railroad alignment. Physical separation from and loss of equipment access to isolated fields is a potential project impact. The provision of suitable track crossing sites should be accomplished, when practical, to help mitigate this impact.

WILDLIFE

Numerous wildlife species occur within the Tanana Valley. Principal big game species include moose, caribou, Dall sheep, bison, grizzly bear and black bear. Many furbearers, small game and non-game species are present. Waterfowl and raptors also comprise important species.

Rivers, streams and lakes within the Tanana Basin contain numerous fish species including chum, coho and chinook salmon, grayling, round whitefish, northern pike and burbot. Portions of Tanana Basin waters and associated slough areas provide habitat for spawning of anadromous and resident fish, for rearing locations and for overwintering areas.

Descriptions of specific corridor species and potential related project impacts follow. In general, the health of wildlife populations is partly dependent upon the viability of habitat areas utilized by those populations. Adverse habitat impacts produced by the project can result in wildlife population reductions. A railroad alignment within the corridor cannot preclude all wildlife and habitat impacts. A minimum of approximately 1,309 acres of terrestrial wildlife habitat would be permanently lost by construction of nearly 270 miles of railroad track and embankment.[2] Potential adverse impacts can be significantly lessened by alignment avoidance of sensitive wildlife areas and by special treatment during the design and construction of a railroad facility (see project design and construction impacts and mitigation). Enhancement of habitat for specific wildlife species may also result from the project due to the creation of ecotones, "edge areas" where different vegetation communities meet.

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[2] General assumptions for estimation: 4 ft. of embankment fill, 2:1 embankment slopes, 270 miles of length.

Cumulative wildlife impact would exist with the addition of a railroad facility into the Tanana Valley where an oil pipeline and highway already exist. However, proximity of the three facilities would preclude a significant new zone of impacts that would result should a railroad be introduced into a more remote and undeveloped corridor area.

The U.S. Fish and Wildlife Service has indicated that the American Peregrine Falcon is the only known listed or proposed threatened or endangered wildlife species present in the corridor area. Potential project effects on Peregrines are identified under the section entitled Raptors.

Moose

Moose can be found throughout the project corridor but populations are typically more concentrated in several key habitat areas. Those areas of seasonal or year round concentration include Fort Wainwright Military Reservation lands south of the Tanana River, the Salcha River, Shaw Creek Flats and adjacent lands southwesterly across the Tanana, Billy Creek and the Tanana River downstream from Tower Bluffs to the Billy Creek confluence, Mansfield Creek-Lake Mansfield-Little Tanana Slough, Sixtymile Butte, the northeast slopes of Mount Neuberger-Tok River, the lowlands surrounding the Tanana River south of Midway Lake, and the Ladue River from the upper drainage to the South Fork. Densities of moose in the above areas vary with seasonal use but can roughly be estimated at between 1-2 moose per square mile.

General seasonal movements are made by moose between calving grounds, summer feeding areas, breeding grounds, and winter feeding areas. Of the previously identified key habitat areas, Shaw Creek Flats and the lowlands surrounding the Tanana River near Midway Lake are utilized primarily for calving. Low areas are also utilized for winter feeding, principally stream side locations containing willow thickets. Timberline areas such as Sixtymile Butte and the slopes of Mount Neuberger characteristically provide summer feeding and breeding locations.

Project avoidance of moose habitat is not possible. An alignment anywhere within the Tanana River Valley would transect some key habitat areas (e.g., the Salcha River or Fort Wainwright lands, Shaw Creek Flats or adjacent lands to the southwest, the Ladue River habitat). In these locations, railroad construction would cause a displacement of moose. The railroad embankment and material source sites would directly reduce habitat. Stream crossings could encroach on willow thickets utilized as winter food. Construction activities could also result in a wider habitat area becoming unattractive for use. Railroad right of way clearing practices, however, during post construction railroad operation would provide limited long-term feeding areas for moose by keeping vegetation in an early successional stage preferred by moose for food. The remaining significant habitat areas in the corridor could be largely avoided by a railroad alignment.

The Alaska Department of Fish and Game has expressed concern over the possibility of train/moose accidents in the Ladue River Valley, where overwintering moose could utilize railroad tracks for movement while avoiding travel through deep snow. Mean annual snowfall in the valley is approximately 40-50 inches. Actual peak ground depth of snow may be less than 1/3 of that amount. Studies have indicated that snow depths of up to 16.4 inches cause little or no hindrance to moose movement; movement becomes slightly restricted at snow depths of 16.4 to 28.7 inches; movement is definitely impeded at depths greater than 28.7 inches.[3] One can conclude, based on the study data, that snowfall would probably not contribute to a train/moose accident problem in the Ladue River valley.

Caribou

Caribou from three herds, Delta, Macomb and Fortymile, utilize habitats bordering on or within the project corridor. Approximately 6,000 Delta herd caribou occupy the north slopes of the Alaska Range between the Nenana and Delta Rivers; movements by Delta caribou have characteristically remained southwest of the Tanana River and Alaska Highway. An isolated group of about 700 caribou are located in the Macomb Plateau area adjacent to the Johnson River. Little, if any, movement patterns occur. Approximately 2,000 caribou use the lower Fortymile country, north of the Alaska Highway. Fortymile caribou comprising this group characteristically tend to migrate in an east-west direction, moving easterly (roughly between Mount Fairplay and Tetlin Junction) in the fall and westerly again in the spring. The Ladue River country appears to be consistently utilized as winter range. There are indications that during the winter of 1981-82, some Fortymile herd caribou crossed the Alaska Highway near Shaw Creek Flats into Delta herd range. This movement had not previously occurred and the consequences to either herd remains to be seen.

Delta herd caribou are not expected to be impacted significantly by the project. Caribou range is southwest of an anticipated Tanana Valley railroad alignment. Unless traditional movement patterns change

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[3] Coady, John W. 1973. Interior Moose Studies. Vol. I, Project Progress Report, Federal Aid in Wildlife Restoration, Projects W-17-4 and W-17-5

radically, little or no effect on habitat or caribou migrations would occur. Macomb Plateau caribou habitat is also predominantly removed from a valley railroad alignment and no significant railroad project impacts to Macomb caribou are expected. Fortymile caribou would receive greater project impacts. A railroad alignment in the lower Fortymile country would result in habitat loss. Habitat is particularly important in the Ladue River country where caribou overwinter from October to March or April. A direct loss of forage plants from railroad embankment and material sources would be minor in comparison with the total Fortymile caribou range available. However, construction, operation and maintenance activities could result in a larger area of range becoming unattractive to caribou. Although studies have found caribou to become habituated to powerlines after a period of three to seven years, the effect of a railroad on long-term caribou behavior patterns is unknown. Likewise, no data is presently available to indicate whether train/caribou accidents may have occurred in other locations where caribou habitat has coincided with railroad alignments. As with moose, the depth of winter snowfall might be a determinate of the reluctance of caribou to move away from railroad tracks. Known Fortymile caribou calving grounds in the highlands at the heads of the Salcha and Charley Rivers would remain unaffected by the project.

Dall Sheep

Approximately 800 sheep occupy the "north face" area of the Alaska Range, immediately south of the Alaska Highway between the Robertson River and the Glenn Highway. Sheep habitat is primarily above the 3000 foot elevation, winter and summer range within the same general area. Natural mineral licks are present and utilized by the sheep.

No serious impact is anticipated to existing sheep populations in the "north face" area. Grade constraints preclude any railroad alignment from encroaching into the mountainous terrain utilized as sheep habitat. It is unknown whether noise from construction activity or from passing trains on an alignment in the Tanana Valley below the sheep range could have a disturbance effect on sheep. A railroad alignment on the north side of the Alaska Highway would be at least 2-4 miles removed from the nearest sheep habitat.

Bison

A herd of approximately 375 bison inhabit the Delta Junction area. The bison exhibit seasonal movements. A 90,000 acre State preserve southeast of Delta Junction and south of the Alaska Highway provides fall and winter range. Primary calving and early summer range occurs along the banks of the Delta River between its confluence with the Tanana River and the Donnelly area nearly 35 miles upstream. The bison have occasionally wandered west of the Delta River and into agricultural areas northeast of the Alaska Highway.

Construction and operation of a railroad could result in a loss of seasonal bison habitat. An alignment through grassland meadows bordering the Delta River would cause a loss of summer pasturage. An alignment crossing the Delta Junction Bison Range would reduce winter forage. Use of Bison Range land is highly unlikely, however, as other alignment possibilities exist. The Alaska Department of Fish and Game has recommended that an alignment parallel the northern border of the Delta Junction Bison Range (1/4 mile from the Alaska Highway). The railroad embankment, combined with adjacent snow fencing, could then produce a barrier, inhibiting bison from leaving the refuge and crossing over into agricultural lands to the northeast.

Grizzly Bear

Two grizzly bear habitat areas border the Tanana Valley. One area coincides roughly with the southern portion of Fort Greely Military Reservation. The second bear habitat area is south of the Alaska Highway between the Robertson River and the Glenn Highway. Both are alpine or timberline habitats, although grizzly bears may occasionally be found at lower elevations.

Human presence is not well tolerated by grizzly bears and development activity in bear habitat areas can result in a reduction of bear numbers. As with sheep however, grade constraints preclude any railroad alignment from encroaching into the alpine terrain most utilized by bears. Therefore, the probability of any significant impact to grizzly bears is remote.

Black Bear

Black bears are found throughout the corridor area. They favor open forests and are relatively abundant along the Tanana River between Eielson and Big Delta and along several tributaries to the Tanana including the Chena River, the Salcha River, Shaw Creek and the Goodpastor River.

Project avoidance of black bear habitat is not possible. Although black bear tolerate human presence better than do grizzly bears, some black bear displacement would occur from a railroad alignment both due to direct habitat loss (i.e.,embankment, material source sites) and to