LEG. FINANCE - BILLS 1977 - 1978 615
HCR 132 thru HCR 142

RECORDS CERTIFICATION

I, the undersigned, an employee of the State of Alaska, do hereby certify that the microfilm images on this microform are accurate reproductions of the original records of the State of Alaska as accumulated during the regular course of business, and that it is the established policy and practice of this State to microfilm its records and to dispose of the original records after microfilm reproductions have been made.

James O. Smith
Signature of Camera Operator

2/8/90
Date

02-513 (REV 8/78)

COMMITTEE REPORT

5/3/76

SENATE

Mr. President: Date 5/25/76

The Committee on Finance has had HCR 132 waste disposal exigencies in Barrow and Bethel under consideration. A Majority of the members of the Committee

(X) recommends it DO PASS

( ) recommends it DO NOT PASS

( ) recommends it BE REPLACED WITH CS FOR _____ AND THAT CS FOR _____ DO PASS

( ) "and" recommends it BE REFERRED TO THE _____ COMMITTEE

( ) reports it back WITHOUT RECOMMENDATION

( ) "other"

Members signing the Majority report:

Members NOT concurring in the Majority report:

_____ recommends:

_____ recommends:

_____ recommends:

_____ recommends:

_____ recommends:

_____ Chairman

Introduced: 4/16/76
Referred: Health,Education & Social Services

IN THE HOUSE BY THE FINANCE COMMITTEE

HOUSE CONCURRENT RESOLUTION NO. 132

IN THE LEGISLATURE OF THE STATE OF ALASKA

NINTH LEGISLATURE - SECOND SESSION

Relating to the waste disposal exigencies in Barrow and Bethel.

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

WHEREAS the sewage and trash disposal systems in Barrow and Bethel are utterly inadequate; and

WHEREAS the present system of waste disposal in these communities presents a grave threat to the health of the people living in Barrow and Bethel; and

WHEREAS the incidence of hepatitis and other illness caused by inadequate waste disposal has increased dramatically in recent years; and

WHEREAS solutions to the waste disposal problems in Barrow and Bethel are very expensive; and

WHEREAS the financial resources in these communities are inadequate for solving the problems; and

WHEREAS steps must be taken without delay to alleviate the problems in order to avert the threat of an epidemic of hepatitis and other illness at spring breakup;

BE IT RESOLVED by the Alaska State Legislature that the Governor is respectfully asked to request the Alaska Department of Health and Social Services and the Alaska Department of Environmental Conservation to immediately undertake steps to solve the waste disposal and health crises in Barrow and Bethel; and be it

FURTHER RESOLVED that the Department of Health and Social Services and the Department of Environmental Conservation begin planning, in cooperation with the United States Public Health Service, for a long-range solution to

the health, trash and sewage disposal problems in Barrow and Bethel.

Introduced: 4/16/76
Referred: Health,Education &
Social Services

IN THE HOUSE BY THE FINANCE COMMITTEE

HOUSE CONCURRENT RESOLUTION NO. 132

IN THE LEGISLATURE OF THE STATE OF ALASKA

NINTH LEGISLATURE - SECOND SESSION

Relating to the waste disposal exigencies in Barrow and Bethel.

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

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FURTHER RESOLVED that the Department of Health and Social Services and the Department of Environmental Conservation begin planning, in cooperation with the United States Public Health Service, for a long-range solution to

the health, trash and sewage disposal problems in Barrow and Bethel.

Introduced: 4/16/76
Referred: Health, Education & Social Services

IN THE HOUSE BY THE FINANCE COMMITTEE

HOUSE CONCURRENT RESOLUTION NO. 132

IN THE LEGISLATURE OF THE STATE OF ALASKA

NINTH LEGISLATURE - SECOND SESSION

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the health, trash and sewage disposal problems in Barrow and Bethel.

THE LEGISLATURE OF THE STATE OF ALASKA
FISCAL NOTE
Second Session - Ninth Legislature

I. REQUEST
Bill No. HCR 132 and HJR 70
Title: Waste Disposal Barrow and Bethel
Requested by: Senator Ray (Fennel) Date: 05/25/76
Return Date Requested: 05/25/76
Agency: Environmental Conservation Program: Water Programs

II. FISCAL DETAIL
Budget Request Unit(s) Affected: Water Programs, Northern Reg. Off., Southcentral Reg. Off.

A. EXPENDITURES: (Thousands of dollars)

	OBJECT	FY 76	FY 77	FY 78	FY 79	FY 80	FY 81
100	PERSONAL SERVICES						
200	TRAVEL						
300	CONTRACTUAL						
400	COMMODITIES						
500	EQUIPMENT						
600	LAND & STRUCTURES						
700	GRANTS, CLAIMS, ETC.						
	TOTAL		-0-				

B. FUNDING: (Thousands of dollars)

GENERAL FUND						
FEDERAL FUNDS						
OTHER						

C. POSITIONS:

PERMANENT/TEMPORARY	/	/	/	/	/	/
MAN MONTHS (P./T.)	/	/	/	/	/	/

III. ANALYSIS (See Fiscal Note Preparation Instructions, Section III)

HJR 70 and HCR 132 direct the Department to participate in a joint study with the U.S. Public Health Service and the Alaska Department of Health and Social Services to resolve the sewage and solid waste disposal problems at Bethel and Barrow. The cost of participating in the requisite studies will include manpower and travel costs which can be borne out of the Department's normal operating budget, therefore, the Department will require no additional funds to conduct the study. The capital costs to implement the findings, once the study is completed, could conceivably exceed $50,000,000. However, the federal government and to some extent local government will undoubtedly share in these costs. Therefore, we cannot estimate the eventual impact on the State for capital construction

IV. ATTACHMENTS

V. DATE: 05/25/76 PREPARED BY: for R. L. Eagle, Director, Management Services

Original: Legislative Finance
cc: Budget and Management
Prime Sponsor (First Legislator Named)

H/S 50

THE LEGISLATURE OF THE STATE OF ALASKA
FISCAL NOTE
Second Session - Ninth Legislature

I. REQUEST
Bill No. HCR 132 and HJR 70
Title: Waste Disposal Barrow and Bethel
Requested by: Senator Ray (Fennel) Date: 05/25/76
Return Date Requested: 05/25/76
Agency: Environmental Conservation Program: Water Programs

II. FISCAL DETAIL
Budget Request Unit(s) Affected: Water Programs, Northern Reg. Off., Southcentral Reg. Off.

A. EXPENDITURES: (Thousands of dollars)

	OBJECT	FY 76	FY 77	FY 78	FY 79	FY 80	FY 81
100	PERSONAL SERVICES						
200	TRAVEL						
300	CONTRACTUAL						
400	COMMODITIES						
500	EQUIPMENT						
600	LAND & STRUCTURES						
700	GRANTS, CLAIMS, ETC.						
	TOTAL		-0-				

B. FUNDING: (Thousands of dollars)

GENERAL FUND						
FEDERAL FUNDS						
OTHER						

C. POSITIONS:

PERMANENT/TEMPORARY	/	/	/	/	/	/
MAN MONTHS (P./T.)	/	/	/	/	/	/

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V. DATE: 05/25/76 PREPARED BY: R. L. Eagle, Director, Management Services

Original: Legislative Finance
cc: Budget and Management
Prime Sponsor (First Legislator Named)

H/S 50

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James O. Smith
Signature of Camera Operator

2/18/93
Date

02-519 (REV 8/78)

COMMITTEE REPORT

SENATE

4/28/76

Mr. President: Date _____

The Committee on Finance has had HCR 137 am congratulating, honoring and apologizing to Paul Roberts under consideration. A Majority of the members of the Committee

( ) recommends it DO PASS

( ) recommends it DO NOT PASS

( ) recommends it DO PASS WITH ATTACHED AMENDMENT(S)

( ) recommends it BE REPLACED WITH CS FOR _____ AND THAT CS FOR _____ DO PASS

( ) "and" recommends it BE REFERRED TO THE _____ COMMITTEE

( ) reports it back WITHOUT RECOMMENDATION

( ) "other"

Members signing the Majority report:

_____ _____ _____

_____ _____ _____

_____ _____ _____

_____ _____ _____

Members NOT concurring in the Majority report:

_____ recommends:

_____ recommends:

_____ recommends:

_____ recommends:

_____ recommends:

_____ Chairman

Introduced: 4/27/76
Made a Special Order of
Business

IN THE HOUSE BY THE RULES COMMITTEE

HOUSE CONCURRENT RESOLUTION NO. 137 am

IN THE LEGISLATURE OF THE STATE OF ALASKA

NINTH LEGISLATURE - SECOND SESSION

Congratulating, honoring, and apologizing to Paul Roberts.

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

WHEREAS Paul Roberts, a newcomer to the State of Alaska from the 50th State of Hawaii, embarked on a 750-mile hike from Anchorage to Keno, Yukon Territory, which he completed in 36 and 1/2 days without the aid of any transportation aids; and

WHEREAS, in order to prove that as a cheechako he could survive the rugged conditions of this Great Land, he entered into an agreement with eleven individuals that he would receive a total reward of $6,000, to be deposited with the Royal Canadian Mounted Police, if he completed the trip in 48 days according to terms agreed upon; and

WHEREAS, upon completing his hike in full compliance with the terms and spirit of the agreement, Paul Roberts received only $2 and a note containing racial slurs against himself from the eleven individuals; and

WHEREAS it is the pride and tradition of Alaska to welcome newcomers who do not harm in any way our great land and respect our beautiful land as we Alaskans respect it and live for its fine offerings; and

WHEREAS Paul Roberts has not only suffered from unjust maliciousness and unforgiveable racism, but he has also been denied deserving recognition for an accomplishment widely admired and highly esteemed by Alaskans; and

WHEREAS the injustices perpetrated by these individuals against Paul Roberts are considered an affront to all Alaskans who pride themselves on the Alaskan camaraderie and tradition of the sourdough and who disdain the abusive behavior of persons who do not respect their fellow men and Alaskans;

BE IT RESOLVED that the Alaska State Legislature congratulates Paul Roberts for his great accomplishment in hiking through Alaska and Yukon Territory and for his apparent appreciation of the Alaskan wilderness; and be it

FURTHER RESOLVED that the Legislature is outraged by the crude and crass behavior displayed towards Paul Roberts; and be it

FURTHER RESOLVED that the Legislature apologizes to Paul Roberts on behalf of the people of Alaska for his mistreatment; and be it

FURTHER RESOLVED that the Legislature is pleased to make Paul Roberts an honorary resident of Alaska.

A COPY of this resolution shall be sent to Paul Roberts.

ALASKA STATE LEGISLATURE

NINTH... Legislature SECOND... Session

HOUSE CONCURRENT RES NO. ..137..

By ..THE RULES COMMITTEE.....

Congratulating, honoring, and apologizing to Paul Roberts.

Paul Roberts

Introduced in the House 4/27, 19.76

HISTORY IN THE HOUSE

19	76	
		Read first time and referred to Committee on
Apr	27	Made a Special Order of Business
		Reported back with recommendation that
Apr	27	Read second time and
		Considered on final passage
		Read third time and
Apr	27	PASS Adopted — Effective Date
		Yeas — Yeas
		Nays — Voice Vote — Nays
		Absent — Vote — Absent
		Excused — Excused
		Reconsideration
		PASS — Effective Date
		Yeas — Yeas
		Nays — Nays
		Absent — Absent
		Excused — Excused
Apr	27	Reported correctly engrossed
"	27	Signed by Speaker
"	27	Sent to Senate

Irene Cashen
CHIEF CLERK OF THE HOUSE

HISTORY IN THE SENATE

1976		
		Read first time and referred to Committee on
Apr	28	Senate
		Reported back with recommendation that
		Read second time and
		Read third time and
		PASS — Effective Date
		Yeas — Yeas
		Nays — Nays
		Absent — Absent
		Excused — Excused
		Reconsideration
		PASS — Effective Date
		Yeas — Yeas
		Nays — Nays
		Absent — Absent
		Excused — Excused
		Reported correctly engrossed
		Signed by President
		Returned to House

SECRETARY OF THE SENATE

HISTORY IN THE HOUSE

19	
	Received from Senate
	Reported correctly enrolled
	Sent to Governor
	..... By Governor
	Filed with Lt. Governor
	Chapter No. .....

31-002

Introduced: 4/27/76
Made a Special Order of
Business

IN THE HOUSE BY THE RULES COMMITTEE

HOUSE CONCURRENT RESOLUTION NO. 137 am

IN THE LEGISLATURE OF THE STATE OF ALASKA

NINTH LEGISLATURE - SECOND SESSION

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Introduced: 4/27/76
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Introduced: 4/27/76
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James O. Smith
Signature of Camera Operator

2/8/90
Date

02-519 (REV 8/78)

Bound reports are to be returned to the Royal Oil & Gas Board on the completion of the hearings in HFC.

142

1 for ~~CR~~

Rest of stuff are on file at R.O.G.B.

NORTHWEST PIPELINE CORPORATION

F. J. BECRAFT
DIRECTOR
GAS PROCUREMENT

P.O. BOX 1526
SALT LAKE CITY, UTAH 84110
801 - 534-3577

May 6, 1976

Representative Nels Anderson
State of Alaska
Pouch V
Juneau, Alaska 99811

Dear Mr. Anderson:

Northwest Pipeline Corporation has undertaken the engineering and environmental studies necessary to make competent applications to the Federal Power Commission for the construction and operation of an alternative Arctic gas transmission system - the Fairbanks Corridor Pipeline System.

Briefly stated, the Fairbanks Corridor Pipeline System would be designed to transport Prudhoe Bay gas through a 42" pipeline parallel to the Alyeska pipeline system from Prudhoe Bay to Delta Junction. From Delta Junction to Fort Nelson, B. C., the pipeline route would be adjacent to the Alcan Highway. At Fort Nelson, a portion of the gas would be diverted into expanded Westcoast Transmission Company, Ltd. facilities for delivery to Sumas, Washington. The remainder of the gas would be transported via a 36" pipeline from Fort Nelson to Zama Lake, Alberta, for delivery to Empress through expanded facilities of Alberta Gas Trunk Line, Ltd.

The Mackenzie Delta gas, when available, would be transported by the proposed Foothills Pipe Lines, Ltd. 42" pipeline system from Mackenzie Delta to the 60th parallel, where it would deliver gas to a proposed Alberta Gas Trunk Line (Canada) system which would connect to the existing Alberta Gas Trunk Line system at Zama Lake. The connection at Zama Lake would supply Mackenzie Delta gas to the expanded Alberta Gas Trunk Line system and, through an exchange with Prudhoe Bay gas, the expanded Westcoast Transmission Company system.

Enclosed is a detailed report of the engineering and environmental aspects of this proposed pipeline system, an Arctic gas transmission system that, in our opinion, is greatly preferable to either the trans-Alaska project proposed by El Paso or the Gas Arctic project in terms of the environmental impact, construction feasibility, and ultimate cost of service. Further, from the viewpoint of Alaska, we believe that the Fairbanks Corridor Route has a far greater opportunity for approval than the El Paso project.

We urge that Alaska keep its options open and defer committing its Prudhoe Bay royalty gas irrevocably to the support of a trans-Alaska line until the benefits of the Fairbanks Corridor Route can be fully assessed. The potential availability of the royalty gas, or a portion thereof, is necessary to justify the substantial investment required to prosecute complete applications and is also necessary to retain the full support of the Pacific Northwest marketing area. It is also extremely important, in our view, that Alaska does not evidence disapproval of our project by the act of firmly committing its royalty gas to the trans-Alaskan route.

We shall appreciate your consideration of our proposal and shall be available at any time to discuss our project with you or to answer any questions you may have. Our decision on whether to proceed will be made immediately and we shall keep you apprised of our progress.

Very truly yours,

F. J. Becraft

FJB/ds

FAIRBANKS CORRIDOR PIPELINE SYSTEM

A VIABLE ALTERNATIVE

The following is a discussion of the two earlier proposals for transporting arctic gas to the lower U. S. and Northwest Pipeline Corporation's proposed Fairbanks Corridor Pipeline System which is being presented as a viable alternative which satisfies the major objectives with the least detrimental socio-economic and environmental impacts.

By Land or By Sea?

After many months, even years, of investigation and analysis, the facts seem to favor the selection of an Alaskan/Canadian pipeline from Prudhoe Bay to the lower 48 states rather than a trans-Alaska pipeline/LNG tanker system from Prudhoe Bay to southern California. More specifically, as it now stands, the Arctic Gas Pipeline system would most likely be selected over the El Paso LNG System.

- The LNG System would result in considerably higher transportation cost than would the pipeline system.
- The LNG System would be based on a relatively new technology scaled up to sizes not yet tried or proven, therefore, cost estimates cannot be as reliable as those for a more conventional pipeline.
- According to El Paso's initial filing, the LNG System could not be ready to deliver gas as early as a Pipeline System.
- The economics and design of the LNG System are such that phasing in gas production up to full design levels over several years, as may well be the case, would be prohibitive in view of the anticipated low return on investment at reduced load factor operation.

- Future expansion of an LNG System consisting of such large components would be more difficult and more costly than it would be for the Pipeline System.
- The LNG liquefaction plant site would be in the very active earthquake zone along the southern Alaskan coast.
- In the event of catastrophe, a pipeline with its dispersion of facilities is more easily and quickly reinstated to service than is a liquefaction facility or LNG tanker, particularly where all of the facilities are concentrated in one plant and the tankers are often docked at the adjacent marine terminal.
- The LNG System is dependent upon the displacement "theory" for transferring the gas from the Westcoast to the rest of the United States. Alaskan oil production and transportation is already experiencing difficulty with a similar concept.
- The cost of service for the LNG System would be more sensitive to future inflation than it would be for the Pipeline System because of the higher percentage of labor in the LNG System operating costs.
- The LNG System, under optimistic assumptions, would consume nearly twice as much gas as would a Pipeline System for delivering a comparable volume.
- The LNG System has apparently failed to gain the political and industrial support needed to assure a timely implementation of an arctic gas delivery system.

In summary, it is improbable that the El Paso LNG System will be selected for arctic gas delivery to the lower U. S. because it fails to offer the same degree of reliability, security, expansibility, timely implementation, economic and geographic benefits as does a Pipeline System.

If By Land. Which Route?

Although the Pipeline System is and should be the preferred method of transporting arctic gas from Prudhoe Bay to the lower U. S., the proposed Arctic Gas Pipeline route from Prudhoe Bay and Mackenzie Delta to the U. S. is not necessarily the preferred route. The alternative, now being supported by Northwest Pipeline Corporation for a pipeline traversing the Fairbanks Corridor, has been given considerable attention and the facts brought to light suggest that it offers the most rational, economic and feasible method of coming near satisfying the majority of the interests in a manner that is beneficial to the consumers and the economy in Alaska as well as the lower U. S.

What the Federal Power Commission says:

The environmental staff of the Federal Power Commission, after an in depth review of the environmental data and analysis, arrived at the following conslusions in regard to the El Paso LNG and Arctic Gas Pipeline Systems as reported in the Final Environmental Impact Statement:

Although the Arctic Gas Pipeline proposal is more environmentally preferable to the El Paso LNG proposal, it was strongly recommended that neither proposal be approved, but rather that the Fairbanks Corridor route, exclusive of the Mackenzie Delta lateral, was the preferred route for delivery of Prudhoe Bay gas. In addition, if Mackenzie Delta gas becomes available, it was suggested that the Foothills Pipe Lines Ltd. project could be constructed for delivery of that gas to existing Westcoast Transmission Company and Alberta Gas Trunk Line facilities.

What the Department of the Interior says:

The Department of the Interior has submitted their Final Environmental Impact Statement in which they have made direct comparison of the various

alternative routes proposed for the Arctic Gas System. Although not specifically recommending any particular route, this report reveals that a pipeline constructed along the Fairbanks Corridor route would pose the least detrimental environmental impact. In addition, it has also received favorable economic analysis from the Department of Interior.

What the Environmental Groups say:

In prepared testimony before the Senate Committees on Interior and Commerce, both the Environmental Policy Center and the Wilderness Society have come out with strong support for the Fairbanks Corridor route alternative.

The Fairbanks Corridor Route

All of the foregoing discussion relating to the Fairbanks Corridor alternative has been based upon that alternative as presented by the Alaskan/Canadian Arctic Gas Pipeline applications. A major economic and environmental improvement could be made to the Fairbanks Corridor Route, as presented, by utilizing existing Canadian pipelines in Alberta and British Columbia instead of constructing an entirely new system across Canada.

The Fairbanks Corridor Pipeline System proposed by Northwest, as illustrated in Figure 1, would be designed to transport Prudhoe Bay gas through a 42" pipeline parallel to the Alyeska pipeline system from Prudhoe Bay to Delta Junction. From Delta Junction to Fort Nelson, B. C., the pipeline route would be adjacent to the Alcan Highway. At Fort Nelson, a portion of the gas would be diverted into expanded Westcoast Transmission Company, Ltd. facilities for delivery to Sumas, Washington. The remainder of the gas would be transported via a 36" pipeline from Fort Nelson to Zama Lake, Alberta, for delivery to Empress through expanded facilities of Alberta Gas Trunk Line, Ltd.

The Mackenzie Delta gas, when available, would be transported by the proposed Foothills Pipe Lines, Ltd. 42" pipeline system from Mackenzie Delta to the 60th parallel, where it would deliver gas to the proposed Alberta Gas Trunk Line (Canada) system which would connect to the existing Alberta Gas Trunk Line system at Zama Lake. The connection at Zama Lake would supply Mackenzie Delta gas to the expanded Alberta Gas Trunk Line system and, through an exchange with Prudhoe Bay gas, the expanded Westcoast Trnasmission Company system.

The tremendous advantages of this proposed arctic gas delivery system arises from the large scale use of existing roadways, rights-of-way, utility corridors and Canadian pipeline facilities. It is to this pipeline system, as described above, that the following advantages are ascribed:

- Lowest investment for delivering Prudhoe Bay gas to the United States. (Figure 2)
- Lowest transportation cost for delivering Prudhoe Bay gas to the United States. (Figure 2)
- Supported by federal and private environmental groups.
- Year-round construction possible in some areas; up to 9 months most areas.
- Earliest completion and delivery date - three years from date of permit receipt.
- Provides economic growth base for Alaskan interior (Fairbanks).
- Can be designed for economic operation at the lower gas production rates realistically expected during the first few years of production.
- Permits economical phasing in as additional gas supplies develop along the north slope. (Mackenzie Delta gas via Foothills Pipe Lines)

- Reduced cost and phased construction enhance financibility.
- Proven 42" pipeline technology assures greater reliability.
- More conventional pipeline construction lends itself to competitive bidding and more reliable cost estimates resulting in fewer cost overruns.
- Only approximately 65 miles of highly sensitive, non-stable, fragile soil to be traversed as compared to approximately 460 miles of similar conditions along the Arctic Gas Pipeline prime route.
- Crosses several potential gas fields within the State of Alaska.
- Follows existing all weather roads and utility corridors.
- Year-round access to all areas in event of emergency.
- Potential for sharing operating costs with Alyeska.
- Avoids the uncertainties regarding the Canadian Native Claims Settlement issue.

In short, the Fairbanks Corridor Pipeline System, as proposed by Northwest, has many of the advantages of both the Arctic Gas System and Trans-Alaska LNG System with few of the disadvantages of either system.

It is timely, in light of the Department of Interior's and FPC's environmental Statements, to commence prosecution of a formal application for the Fairbanks Corridor Pipeline System. Planning and preparation of an application with the FPC to construct and operate a pipeline system along the Fairbanks Corridor route in Alaska has commenced and Northwest has received the cooperation of Westcoast Transmission Company, Ltd., and Alberta Gas Trunk Line Company, Ltd. in planning for the transportation of the gas through Canada. Northwest has also received the support of the major natural gas distribution companies serving the Pacific Northwest region for this project.

In the event that a satisfactory commitment of Alaskan royalty gas is made to Northwest, an application will be submitted within three months of the commitment date.

FIGURE 1

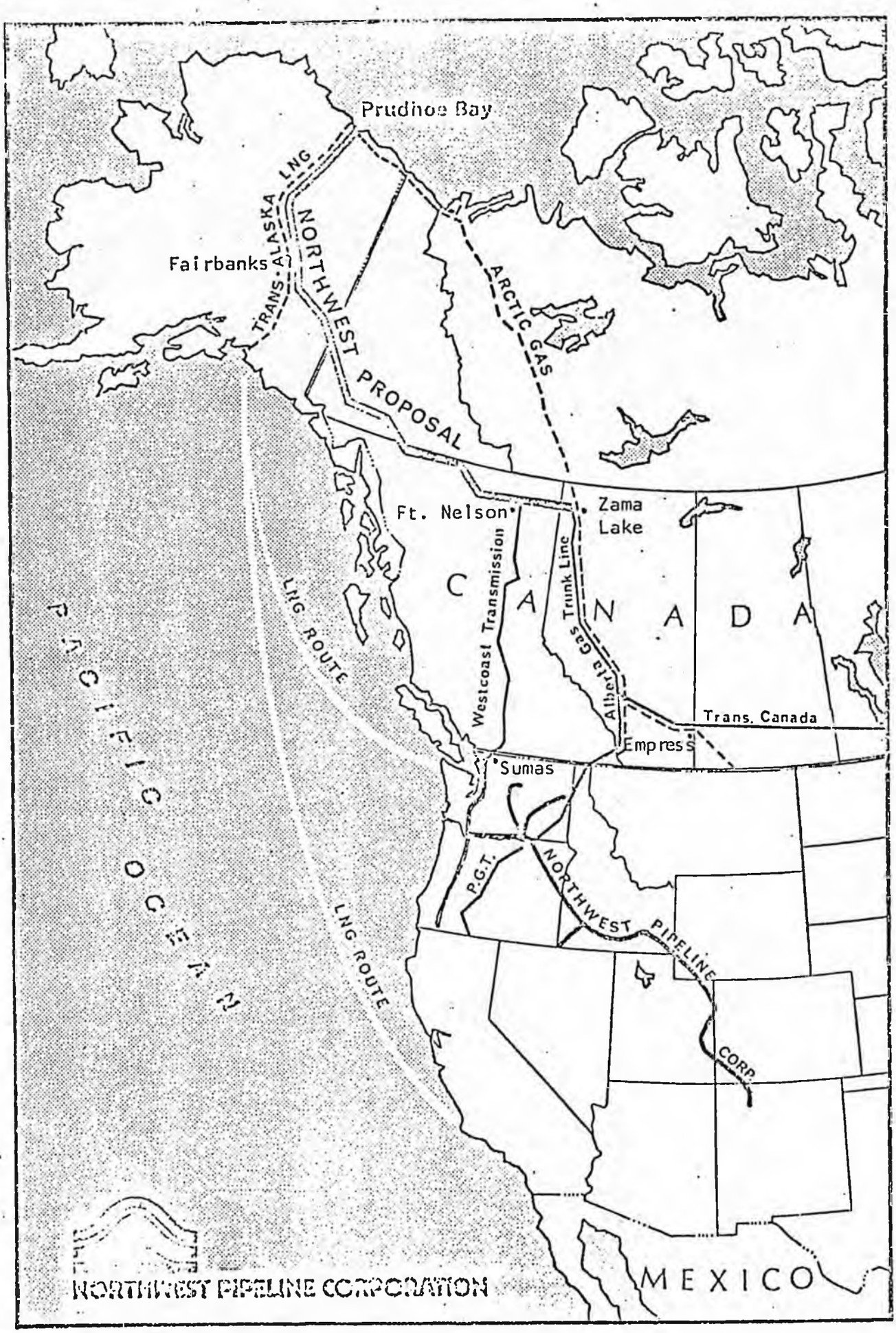
Prudhoe Bay
TRANS-ALASKA LNG
Fairbanks
NORTHWEST PROPOSAL
ARCTIC GAS
Ft. Nelson
Zama Lake
Westcoast Transmission
Alberta Gas Trunk Line
CANADA
LNG ROUTE
Trans. Canada
Empress
Sumas
P.G.T.
NORTHWEST PIPELINE
CORP.
PACIFIC OCEAN
LNG ROUTE
MEXICO
NORTHWEST PIPELINE CORPORATION

FIGURE 2

ARCTIC GAS DELIVERY SYSTEMS

COST COMPARISONS

	El Paso LNG	Arctic Gas Project	Northwest Fairbanks Corridor	
			Prudhoe Bay only	Prudhoe & Delta
Volumes (Billion Cubic Feet Per Day)				
Prudhoe Bay Supply	3.2	2.25	2.4	2.4
MacKenzie Delta Supply	-	2.25	-	1.6
Delivered to U. S. Border	2.8	2.1	2.2	2.2
Capital Investment ($ Billion)				
1975 Constant Dollars	$7.62	$6.68	$4.65	$6.84
Unit Transportation Cost ($ per MMbtu)	$1.48	$1.04	$1.00	$1.02

The volume, investment and unit cost data shown above for the Arctic Gas Project and the Northwest Fairbanks Corridor reflects the facilities for deliveries at Sumas, Washington or Kingsgate, British Columbia for gas destined for U. S. western regional markets, and at Empress, Alberta for deliveries through Saskatchewan to the U. S. mid-western and eastern regions. The facilities for delivery from Empress, Alberta to mid-western and eastern U. S. markets would be the same with either project. The figures shown for the El Paso LNG Project are for delivery of the gas to the first pipeline interconnection in California, after regasification. The facilities and costs required for displacement within the U. S. have not been included.

The unit transportation costs for the Arctic Gas Project and the Northwest Fairbanks Corridor are for delivery at Kingsgate, British Columbia and Sumas, Washington, respectively. These costs are for the third year of operation and do not include the cost of purchased gas or fuel.

ENGINEERING AND ENVIRONMENTAL OVERVIEW

ARCTIC GAS PIPELINE SYSTEMS

Prepared for:
NORTHWEST PIPELINE CORPORATION

Prepared by:
GULF INTERSTATE ENGINEERING COMPANY

April 14, 1976

CONCLUSIONS

I. Construction Feasibility and Cost Estimate

The conclusions that can be drawn from our review and analysis of the construction feasibility and overall cost of the proposed Fairbanks Corridor route for the transportation of Prudhoe Bay gas are as follows:

a) The route is entirely feasible from a construction viewpoint. Construction over a large part of the route would be conventional summer construction. Because of the ease of construction along the proposed route, system costs and schedules can be developed with a high degree of confidence.

b) Gas could commence to flow thru the system three years after receipt of the necessary governmental approvals.

c) Energy Systems Engineering Ltd. (ESEL) estimated total cost, in 1975 dollars, at $4,650,349,000 for Prudhoe Bay gas and $6,836,063,000 for both Prudhoe Bay and Mackenzie Delta gas.

d) ESEL estimated total capital system costs, escalated to the year of investment, at $6,151,943,000 for Prudhoe Bay gas and $9,308,986,000 for both Prudhoe Bay and Delta gas.

e) Rule-of-thumb calculations indicate that 1975 cost of service (without fuel gas) is in the order of $1.00 per MMBtu for Prudhoe Bay gas at ultimate flows at Sumas, Washington and Empress, B.C. At an assumed BTU content of 1145 Btu/ft.^{3}, the cost of service would be approximately $1.15 per MCF.

II. Environmental

The conclusion that can be drawn from our review of the data tabulated under References, Part IV of this report, is that, from an environmental viewpoint, construction of a pipeline along the Fairbanks Corridor route will provide the most acceptable means of transporting Prudhoe Bay gas to the lower 48 states. Major points supporting this conclusion are as follows:

a) By employing common pipeline corridors, experience and engineering, the Fairbanks Corridor is merely an addition to the environmental effects of the existing pipeline systems in Alaska and parts of Canada.

b) The existing data and stipulations which define the Alyeska pipeline are directly applicable to the Fairbanks Corridor pipeline in Alaska.

c) Previous work done on the Haines products pipeline and the Alcan Highway provides some environmental data pertinent to the proposed Fairbanks Corridor line.

d) A reservoir of private and governmental personnel has developed the expertise to protect all segments of the environment in and around the Alyeska line. These people can readily apply their knowledge to the Fairbanks Corridor line.

e) Environmentally acceptable construction could be performed year-round on approximately 80% of the Fairbanks Corridor line.

f) Emergency/contingency plans exist for the Alyeska line. Comparable plans can be readily initiated for the Fairbanks Corridor line.

III. Socio-Economic

The conclusion that can be drawn from our review of the data tabulated under References, Part IV of this report, is that, from a socio-economic viewpoint, construction of a pipeline along the Fairbanks Corridor route will provide the best means for transporting Prudhoe Bay gas to the lower 48 states. Major points supporting this conclusion are as follows:

a) Construction of the proposed Fairbanks Corridor pipeline would provide continued employment for an established Alaskan work force.

b) Construction of the Fairbanks Corridor line would extend present income levels and provide permanent economic benefits to Alaska.

c) The towns and cities near the Alyeska pipeline are better able to handle the influx of construction activities. There are existing medical, housing, emergency and community facilities in Fairbanks and Whitehorse that are already developed.

d) The Fairbanks Corridor pipeline will provide significant increases in the Alaska tax base.

e) The Fairbanks Corridor pipeline will transport natural gas to Fairbanks and other interior communities, including either of the two areas presently proposed as the site of a new capital of Alaska.

f) The proximity of the Fairbanks Corridor route to the Petroleum IV and other Western Alaskan reserves will provide a means of transporting gas from those reserves.

g) The wages paid to operations and maintenance personnel will provide a continuing benefit to residents of Alaska.

INTRODUCTION

Northwest Pipeline Corporation retained Gulf Interstate Engineering Company to provide:

a) A review and expert opinion of the construction feasibility and overall cost of transporting Prudhoe Bay and Mackenzie Delta gas via the Fairbanks Corridor pipeline system as was presented recently by Foothills Pipe Lines Ltd. in response to a request by a joint committee on Commerce and Interior and Insular Affairs of the U. S. Senate. In addition, comments on the construction feasibility of the prime Arctic Gas Pipeline route were requested.

b) An overview of the environmental and socio-economic aspects of the "Fairbanks Corridor" pipeline system and the prime Arctic Gas Pipeline route for transporting Prudhoe Bay and Delta gas to the lower 48 states.

The construction feasibility and cost review were subcontracted to Energy Systems Engineering Ltd. and are contained herein as Part III.

The environmental and socio-economic overview was prepared by the Environmental and Regulatory Affairs Department of Gulf Interstate Engineering Company and is contained herein as Part IV.

CONSTRUCTION AND COST ANALYSIS
FAIRBANKS CORRIDOR PIPELINE SYSTEM

Performed for:

GULF INTERSTATE ENGINEERING COMPANY

Prepared by:

Energy Systems Engineering Ltd.
#101, 205-9th Avenue S. E.,
Calgary, Alberta T2G 0R3

April 14, 1976

TABLE OF CONTENTS

1.0 INTRODUCTION

This report summarizes the results of a review and analysis of the construction feasibility and overall cost of a proposed "Fairbanks Corridor" pipeline system for the transmission of natural gas from Prudhoe Bay to the Canada/U.S. border at Sumas, Washington, and to Empress on the Alberta/Saskatchewan border. Northwest Pipeline Corporation requested that Gulf Interstate Engineering Company (GIEC) provide an independent evaluation of the construction feasibility, overall costs, environmental aspects and socio-economic impact of the concept that was presented recently by Foothills Pipe Lines Ltd. (FPL) in response to a request by a Joint Committee on Commerce and Interior and Insular Affairs of the U. S. Senate. Energy Systems Engineering Ltd. (ESEL) subcontracted those portions of the study related to construction feasibility and overall costs.

1.1 Terms of Reference

The study was to be conducted in accordance with the following terms of reference:

a) ESEL was to gather and collate all construction and cost data available through information filed by Canadian Arctic Gas Pipeline Ltd. (CAGPL), El Paso Alaska Company, and Foothills Pipe Lines Ltd. (and associated systems). In addition, all the construction and cost details of the Fairbanks Corridor Concept were to be made available directly by Foothills and its member companies. All of the above material was to be used to provide the necessary cost backup for examining the proposed system.

b) ESEL was to assess the proposed system from a construction feasibility and timing standpoint.

c) ESEL was to assess the costs of the proposed system, and provide an estimate based on previous arctic pipeline cost estimates, as well as independent investigations of cost parameters. Costs were to be presented in terms of 1975 and escalated dollars, and a "rule-of-thumb" cost of service was to be provided.

1.2 Sources of Data

Due to a time constraint, no original cost data were generated during the study; costs were examined using existing in-house data, FPL working papers, and previous arctic pipeline submission costs. Current arctic pipeline practices and costs were examined, and the possible impact of the Alyeska project was assessed. Marine Pipeline Construction of Canada Limited provided assistance in the areas of construction timing, spread requirements, and construction costs. Material used in assessing the costs of the proposed system included the following:

a) El Paso Submissions re: proposed Trans-Alaska pipeline.
b) Foothills Pipe Lines Ltd. Application to the NEB.
c) FPL working papers re: the Fairbanks Corridor Alternative.

These sources and other references are detailed in Appendix "A".

1.3 System Concept

The specific Fairbanks Corridor examined in the study was put forward by Foothills Pipe Lines Ltd., and all system natural gas flows, fuel requirements, deliveries and facility requirements presented by FPL were used as the basis for system analysis. The total system provides for the movement of Prudhoe Bay gas and Mackenzie Delta gas. The system required for Prudhoe Bay gas

would come on stream first (1981), followed by Delta gas two years later (1983). The system volume buildups are detailed in Table 1 - 1 (FPL Table). The volumes of the total system analyzed in the study are projected to 1985 with a total of 4 BCFD, consisting of 2.4 BCFD from Prudhoe Bay and 1.6 BCFD from the Delta. The system from the Delta to the 60th parallel would be capable of handling an ultimate feed of 2.4 BCFD when fully powered.

The system as presented by FPL, is detailed in Tables 1 - 2 and 1 - 3. Prudhoe Bay gas would be transported by a 42" pipeline parallel to the Alyeska pipeline system to Delta Junction. There it would leave the Alyeska route and parallel the Alcan highway, following the Haines Pipeline Corridor, to the U.S./Canada border. The 42" line would continue to parallel the highway from the border to Fort Nelson, B.C., where it would feed 31% of the gas into expanded Westcoast Transmission Company Limited (Westcoast) facilities for transport to Sumas. The remainder of the gas (69%) would be carried via a 36" line from Fort Nelson to Zama Lake, where it would feed expanded Alberta Gas Trunk Line Limited (AGTL) facilities for transport to Empress.

The Mackenzie Delta gas would be transported by the proposed FPL 42" system from the Delta to the 60th parallel, where it would feed the AGTL (Canada) system. AGTL (Canada) would transport the gas to the Zama Lake/AGTL connection, where it would feed the AGTL system, and an exchange would take place with the Prudhoe Bay system gas (see Table 1 - 1).

FAIRBANKS CORRIDOR
GAS BALANCE
(MMCFD AND BBTUD)

DESCRIPTION	IN-SERVICE JAN.1/81 Prud.Gas MMCFD @ 1145 BTU	BBTU/DAY	IN-SERVICE JAN.1/82 Prud.Gas MMCFD @ 1145 BTU	BBTU/DAY	IN-SERVICE JAN.1/83 Delta Gas MMCFD @ 1043 BTU	Prud.Gas MMCFD @ 1145 BTU	BBTU/DAY	IN-SERVICE JAN.1/84 Delta Gas MMCFD @ 1043 BTU	Prud.Gas MMCFD @ 1145 BTU	BBTU/DAY	IN-SERVICE JAN.1/85 Delta Gas MMCFD@ 1043 BTU	Prud.Gas MMCFD @ 1145 BTU	BBTU/DAY
Prud.B.-Alaska/Yukon Brd.													
Receipt	1,000.0	1,145,000	1,500.0	1,717,500		2,000.0	2,290,000		2,400.0	2,748,000		2,400.0	2,748,000
Fuel	11.3	12,938	23.0	26,335		44.5	50,952		79.6	91,142		79.6	91,142
Delivery	988.7	1,132,062	1,477.0	1,691,165		1,955.5	2,239,048		2,320.4	2,656,858		2,320.4	2,656,858
Alaska/Yuk.Brd.-Ft.Nelson													
Receipt	988.7	1,132,062	1,477.0	1,691,165			2,239,048		2,320.4	2,656,858		2,320.4	2,656,858
Fuel	8.1	9,275	19.4	22,213		45.6	52,212		80.2	91,829		80.2	91,829
Delivery	980.6	1,122,787	1,457.6	1,668,952		1,909.9	2,186.835		2,240.2	2,565,029		2,240.2	2,565,029
Split @ Ft. Nelson													
31% to WCT	304.0	348,080	451.9	517,426		592.1	677,955		694.5	795,202		694.5	795,202
69% to AGTL	676.6	774,707	1,005.7	1,151,526		1,317.8	1,508,881		1,545.7	1,769,827		1,545.7	1,769,827
Ft.Nelson-Zama Lake													
Receipt of Prud.Gas	676.6	774,707	1,005.7	1,151,526		1,317.8	1,508,881		1,545.7	1,769,827		1,545.7	1,769,827
Less Exchange to WCT						198.6	227,374		255.1	292,040		327.9	375,480
Fuel			4.8	5,496		4.7	5,381		8.0	9,160		6.6*	7,557
Delivery	676.6	774,707	1,000.9	1,146.031		1,114.5	1,276,126		1,282.6	1,468,627		1,211.2	1,386,790
Rich. Is. -60th Parallel													
Receipt					800.0		834,400	1,200.0		1,251,600	1,600.0		1,668,800
Gas to Communities								7.5		7,823	9.9		10,326
Fuel					4.7		4,902	10.8		11,264	26.8		27,952
Delivery					795.3		829,498	1,181.7		1,232,513	1,563.3		1,630,522
60th Par.-Zama Lake													
Receipt					795.3		829,498	1,181.7		1,232,513	1,563.3		1,630,522
Fuel					1.0*		1,043	3.0*		3,129	2.0*		2,086
Delivery					794.3		828,455	1,178.7		1,229,384	1,561.3		1,628,436
Zama Lk.-Empress													
Receipt	676.6	774,707	1,000.9	1,146,031	794.3	1,114.5	2,104,581	1,178.7	1,282.6	2,698,011	1,561.3	1,211.2	3,015,226
Less Exchange-WCT					218.0		227,374	280.0		292,040	360.0		375,480
+Exch.given to Prud.gas						198.6	227,374		255.1	292,040		327.9	375,480
Fuel	27.1*	31,029	40.0*	45,800	23.1*	52.5*	84,206	35.9*	61.5*	107,861	48.1*	61.6*	120,700
Delivery	649.5	743,678	960.9	1,100,231	553.2	1,260.6	2,020,375	862.8	1,476.2	2,590,150	1,153.2	1,477.5	2,894,526
Ft.Nelson-Sumas (WCT)													
Receipt	304.0	348,080	451.9	517,426	218.0	592.1	905,329	280.0	694.5	1,087,242	360.0	694.5	1,170,862
Fuel													
Delivery													

Mar 76 * Estimated

TABLE 1 - 1 FPL

TABLE 1 - 2

FAIRBANKS CORRIDOR PIPELINE SYSTEM - FACILITIES SUMMARY

FOR PRUDHOE BAY NATURAL GAS

Section	Ultimate Vol. MMCFD	In service Month/Yr.	Dist. Mi.	Dia. In.	Wall Thk. In.	No. of Sta.	Hp. for Compress.	Hp. for Chilling
Alaska: Prudhoe Bay to Alaska/Yukon border	2,400	Jan./81	730	42	0.540	14	371,000	210,000
Yukon & B.C.:-Alaska/ Yukon border to Ft. Nelson	2,320	Jan./81	792	42	0.540	17	461,3000	75,000
B.C. & Alta.:-Ft. Nelson to Zama	1,545	Jan./81	144	36	0.450	2	53,000	-
Westcoast - looping on an existing system through to Sumas, Wash.	695	Jan./81	770(1)	36	0.375	n/a(2)	-	n/a(2)
AGTL - looping on an existing system through to Empress, Alta.	1,545	Jan./81	780(1)	42	0.375	n/a(2)	-	n/a(2)

NOTES: (1) Total distance of transportation, not miles of actual loop installed.

(2) n/a Not available - these numbers could not be abstracted from the information received by GIEC.

ESEL/GIEC
April 14/76

TABLE 1 - 3

FAIRBANKS CORRIDOR PIPELINE SYSTEM - FACILITIES SUMMARY

FOR MACKENZIE DELTA NATURAL GAS

Section	Ultimate Vol. MMCFD	In Service Month/Yr.	Dist. Mi.	Dia. In.	Wall Thk. In.	No. of Sta.	Hp. for Compress.	Hp. for Chilling
Foothills - Mackenzie Delta area to 60°N	1,600(1)	Jan./83	817	42	0.540	8	212,000	120,000
AGTL (Canada) - 60°N to Zama, Alta.	1,560	Jan./83	81	42	0.469	1	30,000	-
B.C. & Alta. - Ft. Nelson to Zama	360	Jan./83	144	36	0.450	2	53,000	-
Westcoast -looping on an existing system through to Sumas, Wash.	360	Jan./83	770(2)	36	0.375	n/a	-	n/a
AGTL - looping on an existing system through to Empress, Alta.	1,200	Jan./83	780(2)	42	0.375	n/a	-	n/a

NOTES: (1) Ultimate Volume as at Jan. 1/85. Facilities can be expanded to maximum of 2,400 MMCFD.

(2) Total distance of transportation, not miles of actual loop installed.

2.0 SUMMARY

Examination of the Fairbanks Corridor Route concept as presented by Foothills Pipe Lines Ltd. indicates that the proposed system is entirely feasible from a construction standpoint. Some of the positive aspects relating to the proposed route include the following:

a) The pipeline route parallels existing all-weather roads; i.e., the Alaskan highway from Delta Junction to Prudhoe Bay and the Alcan Highway from Fairbanks to Fort Nelson.

b) A sophisticated communications system exists along the entire route.

c) The existing Alyeska pipeline work pad could be utilized (subject to negotiations with the owner).

d) An existing products pipeline right-of-way can be utilized from Haines Junction to the junction with the Alyeska pipeline near Delta Junction, a distance of approximately 400 miles.

e) Existing construction facilities along the Alyeska pipeline (camps, air strips, etc.) can be utilized (subject to negotiations with the owner).

f) Construction experience exists along the Fairbanks Corridor Route which could allow competitive bidding. This should have the effect of reducing and controlling construction costs.

g) Alaskan and sub-arctic construction techniques along the proposed route have been developed and this information can be used in determining engineering design, alistic costs, and construction requirements along the proposed pipeline route.

h) Construction equipment along the Alyeska pipeline is in place and available for use (subject to negotiations with the owner).

i) Minimum amount of construction required on the coastal plain of the Beaufort Sea.

j) Use of the Alyeska pad from Prudhoe Bay to Delta Junction would allow pipeline construction to be scheduled over a nine-month period from March 1 to December 1.

k) Pipelining along most of the route from Delta Junction to Fort Nelson would be conventional summer construction, thus eliminating many of the uncertainties in arctic pipeline cost estimating.

l) Use of excess capacity coupled with an incremental looping program in the existing Alberta Gas Trunk Line System and Westcoast Transmission System should yield the lowest delivered energy cost.

The overall effect of the above features of the subject route and system is that cost estimates and construction schedules can be developed with a high degree of confidence as compared to a system that follows a route that does not enjoy the same advantages.

The cost of the total system is given in Table 2 - 1, and totals are shown below:

	1975 Cost	Escalated Cost
Prudhoe Bay Gas System Costs	$4,650,349,000	$6,151,943,000
Delta Gas System Costs	2,185,714,000	3,157,043,000
Total	$6,836,063,000	$9,308,986,000

The above costs include an estimate of the impact of the cost escalations and problems encountered by the Alyeska project. In the opinion of ESEL/GIEC, submissions by CAGPL and El Paso have not fully recognized these problems. Our estimates, therefore, do not provide a good comparison with the estimates of other systems. To obtain a common-basis comparison of cost estimates, CAGPL and El Paso estimates should be

increased substantially. The Prudhoe Bay system estimates include the Fort Nelson - Zama Lake interconnection costs, but credit would probably be received in terms of tariff charges to FPL as part of a Zama Lake exchange agreement. Costs of the expanded AGTL and Westcoast systems have been allocated in terms of the volume throughputs of the two sources.

A cost of service calculation, in terms of 1975 dollars, has been developed for the Fairbanks Corridor concept.

Transportation costs have been developed on the basis that the existing Westcoast Transmission system, Alberta Gas Trunk Line system, and the connecting link between Fort Nelson and Zama are "shared" facilities. It does not represent the rates which would be applicable if only the Prudhoe Bay gas were transported, or if only the Mackenzie Delta gas were transported. The transportation costs indicate roughly the prorated (by volume) costs and corresponding rates that can be attributed to either major gas source area. Calculations are included in Appendix "B", and the transportation costs are summarized below:

	Transportation Cost - $/MMBtu
Prudhoe Bay Gas (1984 volumes)	
a) Delivered to Sumas	1.00
b) Delivered to Empress	1.05

TABLE 2 - 1

FAIRBANKS CORRIDOR PIPELINE SYSTEM - CAPITAL COST ESTIMATE

SUMMARY

	1975 Costs	Escalated Costs (000's) 1978	1979	1980	1981	1982	1983	1984	Total
Alaska Section - Prudhoe Bay Gas	$ 2,265,698	635,085	1,209,398	784,998	224,785	76,612	-	-	2,930,878
Alaska/Yukon Border to Fort Nelson - Prudhoe Bay Gas	1,450,770	346,804	748,288	489,403	208,272	100,711	4,080	-	1,897,558
Existing Systems Expansion Prudhoe Bay Gas	933,881	-	112,370	542,153	223,915	206,333	194,073	44,663	1,323,507
Total Cost for Prudhoe Bay Gas	$ 4,650,349	981,889	2,070,056	1,816,554	656,972	383,656	198,153	44,663	6,151,943
Total Cost for Mackenzie Delta Gas	2,185,714	-	97,900	621,700	977,505	1,080,753	267,008	112,177	3,157,043
TOTAL COST FOR FAIRBANKS CORRIDOR	$ 6,836,063	981,889	2,167,956	2,438,254	1,634,477	1,464,409	465,161	156,840	9,308,986

ESEL/GIEC
April 14/76

3.0 ALASKA SECTION

3.1 System Facilities

The Alaska portion of the system would consist of 730 miles of pipeline crossing the State of Alaska from Prudhoe Bay to the Alaska/Yukon border. The route of the proposed pipeline parallels that of the Alyeska system as far as Delta Junction. From Delta Junction to the border, the pipeline parallels the Alcan highway and utilizes an existing pipeline right-of-way.

System inputs over the buildup years would be as follows:

	Input MMCFD @ 1145 Btu
January 1, 1981	1,000
January 1, 1982	1,500
January 1, 1983	2,000
January 1, 1984	2,400

The pipe considered was 42" OD x 0.540" wall, Grade 70, with a low-temperature specification. Maximum operating pressure would be 1250 psi, and the system at 2,400 MMCFD would require 14 compressor stations of 26,500 hp each, with additional refrigeration horsepower required at all stations.

3.2 Construction Program

The construction of the pipeline system required for the initial gas flow will take three years from the date of permit receipt, the first year being devoted to equipment and material move-in. The construction of additional compressor stations will follow, as field deliverability increases to require additional capacity.

The successful and economic construction of a pipeline system in Alaska, as in any frontier region, is subject to a number of concerns. These include logistics and construction support problems, labor scarcity and cost, weather hazards, and, in the case of arctic pipeline construction, design and construction problems associated with a fragile environment and permafrost. The route for the Fairbanks Corridor System which parallels the Alyeska system to Delta Junction and then follows the Alcan Highway to the border, has a number of positive aspects relating to construction, including:

a) The presence of existing all-weather roads adjacent to the proposed route provide year-round access.
b) A sophisticated communication system exists along the route.
c) Existing camps, air strips, etc., on that portion of the line between Prudhoe Bay and Delta Junction (subject to negotiations with owner).
d) An existing pipeline right-of-way from Delta Junction to Haines Junction (Yukon) can be utilized.
e) Construction equipment along the Alyeska right-of-way is available for use (subject to negotiations with owner).
f) Geotechnical data and environmental data from Prudhoe Bay to Delta Junction is available.
g) Archeological sites from Prudhoe Bay to Delta Junction have been located.
h) The existing Yukon River Bridge was designed to support a second pipeline.

The presence of the facilities and equipment required for the Alyeska project must be a major determinant in the selection of a pipeline system for Prudhoe Bay gas. A major part of the

cost of the Alyeska project is in coordinating and providing civil works and logistics required for pipeline and station construction. In their examination of the Fairbanks Corridor concept, FPL have assumed that camps, equipment, and stockpile sites required for Alyeska could be utilized for the gas line. They have also formulated their construction concept on the use of the Alyeska pad for pipeline construction. The use of this pad offers many advantages in terms of construction costs. The chief advantage lies in the scheduling of pipeline construction; construction can be accomplished from March 1 to December 1, a period of nine months.

Previous construction programs proposed by El Paso and CAGPL assumed that the pipeline construction would take place during the winter months. These construction programs have a number of problems associated with them, including the following:

a) Equipment - merely keeping equipment running during the winter months of an arctic construction project can be a major problem. At -50^{o}F, machines must be kept running 24 hours per day, fuel requirements are immense, oil no longer flows, batteries freeze up, metal becomes brittle, plastic cannot flex, and the results of these problems are reflected in decreased productivity and increased costs.

b) Labor - productivity of labor during the winter months of northern Alaska or Canada is generally much lower than in the summer months.

c) In northern latitudes there is no daylight in late December and early January. Construction in darkness during -50^{o}F weather could be unsafe and impractical. The right-of-way would have to be lighted, which would be impractical for a pipeline

construction spread. Pipeline construction is a sequential series of operations, and to maintain the required production rates for economical installation, crews must be properly spaced to allow for variations in crew productivity.

d) Pipeline workers have traditionally taken several weeks off during the winter over the Christmas season. It would be very difficult to schedule effective construction during this period.

e) Winter construction requires the use of snow roads for equipment movement and ditching operations. The capability of providing snow roads on the schedule required for pipeline construction is uncertain. Any failure to provide the required snow roads would be reflected by a decrease in spread productivity and an increase in construction cost.

Decrease in construction productivity can have far-reaching consequences apart from the obvious increase in costs. Failure to achieve the required production in a season could delay the pipeline project for a year or more.

Use of the existing facilities associated with the Alyeska project removes a number of uncertainties which have become a major consideration in arctic pipeline construction. Logistics are simplified, a large part of the civil works requirements for a frontier construction project are unnecessary, and costs become more predictable. The use of the existing pad and summer construction make the project more manageable, and scheduling more certain.

The construction of the Alaska portion of the Fairbanks Corridor System has been assessed on the following basis:

a) Use of the existing Alyeska facilities (i.e., camps, construction pad, Yukon River Bridge, access roads) along the Alyeska corridor for 540 miles to Delta Junction.

b) Use of the Alcan Highway for right-of-way access, and the abandoned Haines line right-of-way for construction from Delta Junction to the Alaska/Yukon border (190 miles). It has been assumed that there would be no requirement for a gravel pad on this portion of the system.

Construction of the Alaska portion of the Fairbanks Corridor System would require six construction spreads working 137 days through the summer seasons for two seasons. The production requirements have been allocated over an assumed 745 miles (730 miles + 2% terrain and wastage) as follows:

Spread	M.P.*	Miles	Average Production	Season
1	0 to 110	110	2,100 ft./day	May 15 to Sept. 30
2	110 to 225	110	2,200 ft./day	May 15 to Sept. 30
3	225 to 345	120	2,300 ft./day	May 15 to Sept. 30
4	345 to 467	122	2,350 ft./day	May 15 to Sept. 30
5	467 to 600	133	2,550 ft./day	June 1 to Oct. 15
6	600 to 745	145	2,800 ft./day	June 1 to Oct. 15

Average production 2,400 ft./day.

* M.P. - 0.0 is at Prudhoe Bay

* M.P. - 745 is at the Alaska/Yukon border

The daily spread production has been based upon visual inspection of the pipeline route, discussions with Gulf Interstate personnel familiar with the Alyeska project, and with Foothills Pipe Lines Ltd. construction people.

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Pipeline construction has been scheduled for summer work. Clearing and grading operations would be scheduled for early spring through to late fall ahead of the mainline operations. Road and pad maintenance would be a year-round construction requirement.

The section from Delta Junction to the Alaska/Yukon border would be, for the most part, conventional summer construction. It was assumed that no pad would be required. Muskeg areas in this section would be scheduled for late winter installation.

The Atigun Pass and major river crossings along the route would be constructed with crews separate from the mainline pipeline operations.

3.3 Cost Estimates

Most of the costs developed for the Alaska portion of the Fairbanks Corridor system have been based upon 1975 costs submitted to the Federal Power Commission by El Paso Alaska Company during direct testimony, November 7, 1975. An independent analysis of pipeline construction costs has been performed by Marine Pipeline Construction of Canada Ltd., based upon previous estimates made in regard to arctic pipelining. Pipe prices used by El Paso were confirmed by suppliers.

Due to a time constraint, no significant original work could be attempted on the cost estimates. Costs were necessarily factored from filed information, or from existing in-house data related to other projects. The basic approach to the estimate for the Alaska portion of the system has been to modify the El Paso costs (with the exception of pipeline construction costs), using engineering judgment and factors based on differences between the two systems. The El Paso system would be a 42" pipeline operating

at 1680 psi, with a pipe wall thickness of 0.750 inches. The system includes 12 stations, 11 refrigerated, with two 23,400 hp compressor units at each station. Adjustments were made for refrigeration and compression horsepower, number of stations, tons of steel, line length, etc.

Total pipe tonnage for the El Paso system would be in the order of 730,000 tons, with a unit cost of approximately $775 per ton landed at Anchorage. Pipe for the Alaska portion of the proposed Fairbanks Corridor system would total approximately 485,000 tons, due to the lighter wall thickness (0.540 wall) and the shorter length of the system.

Particular emphasis has been placed upon the cost of pipeline construction, due to the escalation of costs experienced by the Alyeska project. The methodology used to arrive at spread costs was to convert the cost components of a typical northern Canada summer construction spread (i.e. labor, materials, fuel, equipment costs) to a per foot basis, and then apply the appropriate factors for differences in production and wage rates, etc., to establish representative estimated basic costs. To this total were added unit costs to allow for problems peculiar to the Alaska terrain and environmental restrictions.

Estimates have been developed in terms of 1975 dollars, and escalated to the year of installation or equipment purchase. Escalation factors used have been taken from the Foothills NEB filing, and are summarized below:

Composite Escalation Rates	Percentage Change From Prior Year 1976	1977	1978
Pipeline Materials	6.5	5.9	5.0
Pipeline Installation	8.0	7.2	6.4
Land, Freight, Communications	7.5	5.2	4.8
Compressor & Meter Station Materials	6.5	5.6	4.9
Compressor & Meter Station Installation	9.2	8.2	7.2
Operations & Maintenance Facilities Materials	7.5	5.6	5.2
Operations & Maintenance Facilities Installation	9.2	8.2	7.2
O & M and Support Facilities Equipment	6.4	5.0	4.5
Support Facilities Construction	8.5	7.4	6.6
Project Average	7.2	6.1	5.4

The foregoing composite escalation rates have been derived from estimated escalation rates for particular categories, i.e. line pipe, construction wages and salaries, construction machinery and equipment, etc. It has been assumed that the high level of inflation has peaked and will approach historical rates in succeeding years to 1978, then will remain constant.

Estimates include a 5% contingency, and an allowance for the cost of funds required during construction (AFC), at an annual rate of 12½%.

A summary of the system capital costs is given in Table 3 - 1. Total system costs are given below:

1975 Cost	Escalated Cost
$2,265,698,000	$2,930,878,000

There are many uncertainties involved in predicting construction costs in Alaska at this time, due to the lack of detailed analyses of the Alyeska cost escalations, and an assessment of how these costs will impact future pipeline construction. The estimates

TABLE 3 - 1

FAIRBANKS CORRIDOR PIPELINE SYSTEM - CAPITAL COST ESTIMATE - ALASKA SECTION

730 Miles - 42 Inch - 0.540" - Foothills Design Basis - 14 Stations, Format & Categories Modified After El Paso Filing

	1975	Escalated Costs (000's)					
	Costs	1978	1979	1980	1981	1982	Total
Land & Land Rights	184	218	-	-	-	-	218
Rights-of-Way	4,249	5,035	-	-	-	-	5,035
Structures & Improvements	52,567	-	20,183	15,587	39,557	-	75,327
Pipeline - materials	489,655	289,876	304.320	-	-	-	594,196
- installation	786,720	193,848	515,695	329,242	-	-	1,038,785
Stations - materials	184,282	-	66,161	50,231	125,496	-	241,888
- installation	72,380	-	-	30,561	23,727	60,546	114,834
Measuring Stations	5,339	-	-	7,111	-	-	7,111
Communications	8.900	-	5,527	5,794	-	-	11,321
General Plant	11,996	1,007	8,643	5,752	-	-	15,402
Sales Tax	650	385	404	-	-	-	789
TOTAL DIRECT JOB COSTS	$1,616,922	490,369	920,933	444,278	188,780	60,546	2,104,906
Engineering & Constr.	64,431	14,539	38,677	26,985	1,780	4,541	86,522
Temporary Facilities	23,200	27,817	-	-	-	-	27,817
Services & Supplies	-	-	-	-	-	-	-
Field Staff	8,560	2,636	4,937	2,388	1,017	406	11,384
Field Overhead	12,126	3,678	6,907	3,332	1,416	454	15,787
TOTAL INDIRECT JOB COSTS	$ 108,317	48,670	50,521	32,705	4,213	5,401	141,510
Engineering Supervision Home Office Services Purchasing & Expediting Overhead	48,509	14,711	27,628	13,328	5,663	1,816	63,146
TOTAL OFFICE COSTS	$ 48,509	14,711	27,628	13,328	5,663	1,816	63,146
Contract Project Mgmt. Fee	24,254	7,356	13,814	6,664	2,832	908	31,574
Intangible Plant	8,158	8,158	-	-	-	-	8,158
Subtotal-Direct+Indirect+ Office	$1,806,160	569,264	1,012,896	496,975	201,488	68,671	2,349,294
Contingency @ 5%	90,308	28,463	50,645	24,849	10,074	3,434	117,465
AFC	369,230	37,358	145,857	263,174	13,223	4,507	464,119
TOTAL	$ 2,265,698	635,085	1,209,398	784,998	224,785	76,612	2,930,878

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developed during this study are based upon the knowledge of Gulf Interstate personnel with experience in Alaskan construction, and upon the assessment of Marine Pipeline Construction of Canada, of the cost of the special construction required to overcome these problem areas. The costs, in the opinion of ESEL/GIEC, reflect the best estimate available at this time, utilizing the construction concept of summer work on the existing pad, and including an allowance for a number of general concerns. These concerns include the following:

a) A large amount of civil work is required for haul road repair and pad maintenance; i.e.,for low water crossings, pad composition, 24-hour winter haul road maintenance in the Atigun Pass, and 18 to 24-hour washing down of the haul road during summer months for dust control (common also to the Alaskan highway through the Yukon and northern B.C.).

b) A number of non-standard construction items encountered by Alyeska may carry over into future pipeline construction. These include deep ditches in the flood plains area, elaborate spur-dike construction, and a very expensive revegetation program.

c) Extra construction costs which have not been allowed for in most arctic pipeline estimates include:

- the failure of "arctic ditchers" to perform to expectations, necessitating blasting for excavation in permafrost areas.

- much of the material being excavated has a tendency to pull like rock; as a result, instead of a standard ditch, a rock-type ditch is obtained.

- equipment repair costs are escalated considerably in frontier areas.

- most of the ditch excavated cannot be dewatered economically, and a large number of concrete weights are required.

- pipe coating over the ditch is very expensive in the winter due to the necessity of heating the inside and outside of the pipe to get a good bond.

- since ditch cannot be dug with conventional ditching machines, spoil is rough, and select fill material is being used to prevent damage to the pipe coating.

- final clean-up is a very costly operation, because the spoil is too wet to work in the summer, and in the winter it is frozen and cannot be moved.

- due to environmental restrictions, stream crossings can be made only at certain times of the year, thus interrupting the normal sequence of construction operations.

d) Numerous labor problems have been encountered on the Alyeska project which could be encountered by future pipeline projects. On the average, these problems have occurred more frequently than on past projects. They include:

- a climate which appears to have a marked effect on the productivity of men and equipment, and on the labor rates expected by the unions.

- the inability to get the ditch required for overall spread production has significantly increased the number of people per spread, and has resulted in a corresponding increase in support staff.

- labor relations can have a considerable impact on productivity and labor rates. Because pipeline construction is a sequential operation, overall productivity is drastically affected by the failure of any one crew to obtain the required production.

e) Unexpected environmental restrictions have caused problems for contractors. There is more than one environmental inspection team per spread, and each has a different area of responsibility. A system of checks and balances appears to be necessary to ensure that contractors are not totally subject to the interpretation of the guidelines by an individual inspector.

f) On any large construction project, contractor cost control is very important. Contractors must be motivated on future arctic pipeline projects to assume cost responsibility, as it is unlikely any project management organization can keep costs down without definite economic incentive for the contractor groups.

The differences between previous trans-Alaska pipeline estimates and the ESEL/GIEC estimate are chiefly in the following areas:

a) A contingency allowance has been included for modifying the existing Alyeska construction facilities

where necessary to provide for the installation of the additional line. These costs are difficult to define at this time, and may change considerably in future estimates. Substantial savings in construction costs will result if no modifications are required.

b) River crossings and associated environmental restraints and construction requirements make this a major cost item. Costs included in the ESEL/GIEC estimate include 45 million dollars for river crossings.

c) Costs have been included for the fabrication and installation of 100,000 concrete weights (30% of the line).

d) Costs for select fill have been included in the estimates in permafrost and rock areas.

e) An allowance has been included for pad maintenance and haul road maintenance.

f) Costs have been included for drilling and blasting permafrost (30% permafrost assumed).

g) An important cost difference is caused by a spread production of 2,400 feet per day, a result of the problems itemized previously.

Further examination of the costs of the Alyeska project may reveal that costs will be lowered through knowledge of arctic construction gained on the Alyeska project. The scale of operations of a 48" hot oil line requiring aboveground construction, and a 42" gas line are significantly different.

The 42" project would be much more manageable, and the learning-curve effect on costs could be considerable. The use of berm techniques, rather than attempting to make ditch, could increase production considerably.

It should be noted that the impact of the problems encountered in the Alyeska pipeline construction has not, in our opinion, been fully considered by Alaskan Arctic Gas or by El Paso submissions. To obtain a common-basis comparison with these systems would require a substantial increase in their cost estimate. There are many unknowns and many opinions generated in cost estimating in Alaska at this time, and these costs are worthy of a detailed examination in the near future.

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MP	533	26,500	aerial cooler
MP	572	26,500	aerial cooler
MP	617	29,200	aerial cooler
MP	667	29,200	aerial cooler
MP	715	29,200	aerial cooler
MP	767	29,200	aerial cooler

Note 1: 00 is at Alaska/Yukon border
792 is at Fort Nelson, B.C.

As in the Alaska section, construction of the pipeline system required for the initial gas flows would take three years, the first year of which would be devoted to civil work construction and equipment and material move-in. The construction of additional compressor stations will follow as field deliverability increases to require additional capacity.

The pipeline route of this section of the system would be adjacent to the Alcan Highway, simplifying logistics and construction. Pipe would be moved into stockpile sites in the winter, and construction would, for the most part, be conventional summer construction. The route lies in the southern fringes of the discontinuous permafrost zone, and permafrost is not expected to be a major problem. Pipeline through muskeg areas (the major part on the Fort Nelson end) would be laid using conventional winter construction techniques.

Construction of the system would require three construction spreads working over a two year period. The proposed construction scheme would break the system into 9 sections. These are described as follows:

Section 1 - MP	00 to MP	50 =	50 miles	winter construction
Section 2 - MP	50 to MP	168 =	118 miles	summer construction
Section 3 - MP	168 to MP	286 =	118 miles	summer construction
Section 4 - MP	286 to MP	404 =	118 miles	summer construction
Section 5 - MP	404 to MP	522 =	118 miles	summer construction
Section 6 - MP	522 to MP	642 =	120 miles	summer construction
Section 7 - MP	642 to MP	692 =	50 miles	summer construction (mountainous)
Section 8 - MP	692 to MP	742 =	50 miles	winter construction
Section 9 - MP	742 to MP	792 =	50 miles	winter construction

The spreads would be assigned to these segments as described below:

Spread "A" - 286 miles

Commences February 1, 1979 on Section 1; complete April 30, 1979.
Continue to Section 2 June 1, 1979; complete October 15, 1979.
Commence Section 3 June 1, 1980; complete October 15, 1980.

Spread "B" - 218 miles

Commence January 15, 1979 on Section 8; complete April 15, 1979.
Continue to Section 7 June 1, 1979; complete October 15, 1979.
Commence Section 6 June 1, 1980; complete October 15, 1980.

Spread "C" - 288 miles

Commence January 15, 1979 on Section 9; complete April 15, 1979.
Continue to Section 5 June 1, 1979; complete October 15, 1979.
Commence Section 4 June 1, 1980; complete October 15, 1980.

The following section describes the production rates and general assumptions behind these rates:

Production Rates & General Breakdown

Spread "A"

Section 1 - Set up for an average production rate of 4200 feet per day or 65 (65' av.) jts/day. This is to be constructed during the winter of 1979 because of the amount of muskeg areas to be encountered.

Section 2 - Set up for an average production rate of 5000 feet per day or 77 (65' av.) jts/day. Clearing is to be done during the winter of 1979, and allowance has been made for extra supervision, camp, etc. Balance of construction operations are to be carried out during the summer of 1979.

Section 3 - Set up for an average production rate of 5000 feet per day or 77 (65' av.) jts/day. Clearing is to be done during the winter of 1980 and allowance has been made for extra supervision, camp, etc. Balance of construction operations are to be carried out during the summer of 1980.

Spread "B"

Section 8 - Same rates and scheduling as Section 1 of Spread "A".
Section 7 - Set up for an average production rate of 2720 feet per day or 42 (65' av.) jts/day. This section is approximately 25% rock ditch. Main reasons for low production are rock ditch, grade and limited access. Clearing on this section is to be done during the winter of 1979.

Section 6 - Same rates and scheduling as Section 3 of Spread "A".

Spread "C"

Section 9 - Same rates and scheduling as Section 1 of Spread "A".
Section 5 - Same rates and scheduling as Section 2 of Spread "A".
Section 4 - Same rates and scheduling as Section 3 of Spread "A".

Production rates given above are those required as an average over the total work period. Crews were sized to achieve higher production rates to allow for 25% loss of production.

The pipeline construction rates are based upon visual inspection of the route, and on the construction experience of Marine Pipeline Construction of Canada Ltd. Pipeline construction in the Fort Nelson area has been successfully and economically completed in the past, and the Fort Nelson area is served by both rail and highway. Canadian experience in muskeg pipeline construction is considerable, and this would present no new problems. The construction of a 792 mile 42" line over a two year period is well within the capabilities of Canadian contractors, and it is anticipated that bidding for this project could be put on a competitive basis, and a high degree of contractor cost responsibility could be established.

4.3 Cost Estimate

Cost estimates have been based upon the filed costs for the Foothills Pipe Line Ltd. system, and upon FPL working papers for the Fairbanks Corridor system. The basic approach to the estimate of the Alaska portion of the system has been followed in the estimates of this portion of the system; i.e., FPL system costs have been adjusted for differences in the two systems, an independent analysis has been made of construction costs, and pipe prices have been checked through contact with suppliers.

There are many similarities between the proposed Foothills system and the Fairbanks Corridor system, since the same design approach has been used for both systems; i.e., same pipe diameter, wall thickness, similar lengths, same number of stations of similar size, etc. The chief differences in the cost of facilities are in the reduced requirements for support facilities; i.e., general civil works, and in pipeline construction costs.

Construction cost estimates have been obtained by adjusting the costs of a typical arctic pipeline summer spread for the construction concepts and production rates described previously. Direct construction cost estimates for the nine sections of the line were as follows:

			1975 costs
Section 1	50 miles - $72.07/ft	=	$ 19,027,000
2	118 miles - 50.36/ft	=	31,375,000
3	118 miles - 50.36/ft	=	31,375,000
4	118 miles - 50.36/ft	=	31,375,000
5	118 miles - 50.36/ft	=	31,375,000
6	120 miles - 50.36/ft	=	31,929,000
7	50 miles - 86.00/ft	=	22,704,000
8	50 miles - 74.07/ft	=	19,555,000
9	50 miles - 72.07/ft	=	19,027,000
	792 miles = 4,182,000 ft		$237,742,000

The above costs include move-in and move-out, mobilize and de-mobilize, supervision and field office, service and equipment repair, all normal main line operations including testing, rip-rap allowance, camp and catering costs, clothing and incentive pay, an allowance for 10% permafrost blasting, and a 5% contingency.

The following costs not included in the spread breakdown were added to the above spread costs:

	1975 costs
supply and haul weights	$33,600,000
water crossings	30,000,000
select backfill	7,650,000
mainline valves	800,000
compressor station tie-ins	3,240,000
cathodic protection	594,000
rock grade	6,390,000
rock ditch	13,520,000
	$95,794,000
Overall Cost	$333,536,000

Foothills pipe costs were used in the estimate, but direct system costs (1975 base) could be increased by as much as 70 million dollars by possible changes in the pipe specifications. It is possible, however, that relaxing the low-temperature specifications on the southern half of the system where gas chilling no longer takes place could significantly decrease the total system pipe costs.

Estimates have been developed in terms of 1975 dollars, and escalated to the year of installation or equipment purchase, using the previously recorded escalation factors. Contingency and AFC have been added. A summary of the system capital cost is given in Table 4 - 1. Total system costs are given below:

1975 Cost	Escalated Cost
$1,450,770,000	$1,897,000,000

A general comment on the cost disparity between construction costs on the Alaska portion of the line and the costs of the system from the Alaska/Yukon border to Fort Nelson is in order. It is possible that the Alyeska project costs will have some impact on costs and construction practices in northern Canada. The wages in Alaska are twice as high as in the Yukon. In addition, production in Alaska has been slowed as a result of problems discussed previously. These differences result in a labor cost ratio from Alaska to the Yukon of approximately 4 to 1. It is possible that the wages on the Canadian side of a common pipeline project would be increased toward the Alaska costs. No allowance has been made for this possiblity, as it is very difficult to assess at this time.

TABLE 4 - 1

FAIRBANKS CORRIDOR PIPELINE SYSTEM - CAPITAL COST ESTIMATE - ALASKA/YUKON BORDER TO FORT NELSON

792 Miles-42 Inch-0.540"-Foothills Design Basis-17 Stations, Format & Categories Modified After Foothills Pipe Lines Ltd. Filing

	1975 Costs	Escalated Costs (000's) 1978	1979	1980	1981	1982	1983	Total
Land	$ 1,867	339	944	508	518			2,309
Land Rights	1,244	632	753	137	-	-	-	1,522
Pipeline Materials	321.772	209,536	179,985	-	-	-	-	389,521
Pipeline Installation	351,196	3,647	306,289	159,875	-	-	-	469,811
Compressor Station Materials	147.098	-	34,467	51,641	108,240	-	-	194,348
Compressor Station Instl.	81,174	-	-	22,224	34,682	73,097	-	130,003
Support Facilites	125,000	62,100	50,312	29,652	15,050	6,416	3,420	166,950
O&M Facilities - Material	16,566	6,518	6,857	2,869	4,832	-	-	21,076
- Installation	8,918	-	3,991	4,279	1,825	3,130	-	13,225
- Equipment	7,334	-	4,474	4,675	-	-	-	9,149
Meter Stations - Material	2,055	-	2,544	-	-	-	-	2,544
- Installation	4,100	-	-	5,970	-	-	-	5,970
Communications & Control	13,000	2,370	8,073	5,859	-	-	-	16,302
Subtotal	$ 1,081,324	285,142	598,689	287,689	165,146	82,643	3,420	1,422,729
Pre-permit	10,000	12,000	-	-	-	-	-	12,000
Head Office & Pre-operations	30,000	3,600	10,900	18,200	6,600	-	-	39,300
Engineering @ 4%	43,250	11,405	23,948	11,508	6,606	3,306	137	56,910
Contingency @ 5%	54,060	14,257	29,934	14,384	8,257	4,132	171	71.135
AFC	232,136	20,400	84,817	157,622	21,663	10,630	352	295,484
TOTAL	$ 1,450,770	346,804	748,288	489,403	208,272	100,711	4,080	1,897,558

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5.0 EXPANSION OF EXISTING SYSTEMS, AND SYSTEMS REQUIRED FOR MACKENZIE DELTA GAS

5.1 Expansion of Westcoast Transmission Company, Ltd., and Fort Nelson to Zama Line

The Westcoast Transmission system is the main natural gas transmission system in British Columbia. The system which will be transporting Prudhoe Bay and Delta gas (via exchange) currently transports approximately 1300 MMcfd. The major sources are all in B.C.; however, there is an existing interconnection with the AGTL system.

The existing system has a receipt point at Fort Nelson (point of receipt for arctic gas) and an existing delivery point at Sumas (point of delivery for arctic gas). The facilities required to move arctic gas will consist of looping and installation of additional compression. The total distance from Fort Nelson to Sumas is approximately 770 miles.

The pipeline and compression design and construction is conventional 36" pipelining and will require only a small amount of winter construction in the northern sections.

Unlike the AGTL system, Westcoast has not forecast significant declines in their existing gas sources and as a result there is not a great cost saving associated with the utilization of spare capacity. However the utilization of existing facilities allows the installation of facilities to be incremented and spread over a longer period of time; capacity can be readily added as required.

The additional facilities required for the Westcoast portion of the Prudhoe Bay volumes were determined incrementally by direct comparison of a base case which consisted of Westcoast estimated capital expenditures over the forecast period with no Prudhoe Bay volumes.

The receipt volumes and corresponding loop required for the arctic gas are listed below:

Year	Prudhoe Bay MMcfd	MacKenzie Delta MMcfd	Total MMcfd	Pipeline Loop
1981	304	0	304	163.8 mi - 36"
1982	452	0	452	143.0 mi - 36"
1983	592	218	810	247.9 mi - 36"
1984	695	280	975	78.1 mi - 36"
1985	695	360	1,055	83.4 mi - 36"
				716.2 mi - 36"

The cost estimates for the additional facilities were based on 1975 cost of pipe, current vendor quotes for compression and 1973 bid costs (escalated to 1975) for installation.

The total Westcoast estimate was for the installation of 20 separate looping sections. Compression costs were estimated on the basis of three typical installations which cover the three different situations that Westcoast forecast for adding compression.

Escalation factors used by Westocast in their comparison of costs were much higher (8% per year throughout) than those used by FPL and AGTL. As a result for the purposes of this evaluation, all of Westcoast's costs were converted back to 1975 values and and re-escalated by the factors used by FPL and AGTL.