DEMPSTER HIGHWAY LATERAL

COMPRESSOR STATION COST ESTIMAT

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CANUCK ENGINEERING LTD.

## VOLUME I

DEMPSTER HIGHWAY LATERAL

COMPRESSOR STATION COST ESTIMATE

CHILLED AND NON-CHILLED

PREPARED FOR

FOOTHILLS PIPE LINES (YUKON) LTD.

BY

CANUCK ENGINEERING LTD.

AND

DILLINGHAM CORPORATION CANADA LTD.

JANUARY 31, 1979

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#### DEMPSTER HIGHWAY COMPRESSOR STATION

#### I. SCOPE OF WORK AND CONCLUSIONS

On December 12, 1978, Foothills Pipe Lines (Yukon) Ltd. authorized Canuck Engineering Ltd. to proceed with the preparation of cost estimates for a typical chilled compressor station (No. 3) in the permafrost zone and a typical non-chilled compressor station (No. 7) for the Dempster Highway Pipe Line. Both stations were to utilize a single 16,000 ISO horsepower gas turbine compressor package for the main high pressure gas unit.

A discussion of the methodology used in the preparation of the estimate is presented in Section II of this report, and the detailed approach and assumptions are outlined in Section III. The station designs are in accordance with CSA Standard Z184-1975 and the NEB PC 1974-807 Gas Pipeline Regulations. The installation portion of the cost estimate has been prepared by the Dillingham Corporation Canada Ltd. who have had extensive experience in the installation of compressor stations and natural gas process plants in Western Canada. The estimate was prepared with the consideration that the contractor would move in and construct a minimum of four stations over a two-year period.

First quarter 1979 material costs were used in the preparation of this estimate and no allowance was made for escalation.

The following summarizes the installed costs for each compressor station:

Station	Subtotal	Contingency	<u>Freight</u>	Total
	\$	\$	\$	\$
Chilled (Stn. No. 3)	26,142,500	916,000	575,000	27,633,500
Non-Chilled (Stn. No. 7)	14,109,500	425,000	325,000	14,859,500

The contingency figure is on materials only and a figure of 10 percent was generally used. Freight costs as shown cover freight of permanent station materials to the jobsite from Edmonton but do not include freight costs of contractor's equipment which is included in the mobilization section of Contractor's Overhead.

It should be noted that the above figures exclude some direct costs as directed by Foothills Pipe Lines (Yukon) Ltd. in their correspondence dated December 21, 1978 to Canuck Engineering Ltd. Foothills Pipe Lines (Yukon) Ltd. must add their own appraisals for those elements that are excluded. The direct costs that are outstanding are discussed in Section II.

In addition, Owner's indirect costs have not been included in this estimate but must be considered by Foothills Pipe Lines (Yukon) Ltd. in order to have a complete assessment of compressor station costs.

Detailed cost estimate summaries for each compressor station are presented in Tables 1 and 2.

TABLE 1

CAPITAL COST ESTIMATE SUMMARY

DEMPSTER HIGHWAY COMPRESSOR STATION NO. 3

CHILLED

	Cost Category	<u>Materials</u>	<u>Installation</u>	<u>Total</u>
		\$	\$	\$
1.	Foundations	452,000	902,000	1,354,000
2.	Buildings	1,125,000	268,000	1,393,000
3.	Gas Compressor Package	3,900,000	67,000	3,967,000
4.	Propane Compressor Packages	3,600,000	99,000	3,699,000
5.	High Pressure Gas Piping	1,587,000	199,000	1,786,000
6.	Other Major Systems	2,367,000	343,000	2,710,000
7.	Utilities	255,000	89,000	344,000
8.	Instrumentation	383,000	52,000	435,000
9.	Electrical	867,000	255,000	1,122,000
10.	Insulation & Painting	124,000	184,000	308,000
11.	Testing, Winterizing & Startup	114,000	83,000	197,000
12.	Miscellaneous	187,000	41,000	228,000
13.	Federal Sales Tax	1,357,500	-	1,357,500
14.	Contractors Overhead	<b>-</b>	8,158,000	8,158,000
15.	Freight (Materials Only)	575,000	<u> </u>	575,000
TOTA		16,893,500	10,740,000	27,633,500
	ludes Contingency of \$916,000 Materials)			

<sup>16.</sup> Tools & Major Spares (Includes FST)

640,000 (optional)

TABLE 2

CAPITAL COST ESTIMATE SUMMARY

DEMPSTER HIGHWAY COMPRESSOR STATION NO. 7

NON-CHILLED

	Cost Category	<u>Materials</u>	<u>Installation</u>	<u>Total</u>
		\$	\$	\$
1.	Foundations	252,000	506,000	758,000
2.	Buildings	741,000	190,000	931,000
	Gas Compressor Package	3,900,000	67,000	3,967,000
4.	Propane Compressor Packages	-	-	-
5.	High Pressure Gas Piping	946,000	126,000	1,072,000
6.	Other Major Systems	536,000	70,000	606,000
7.	Utilities	228,000	89,000	317,000
8.	Instrumentation	114,000	28,000	142,000
9.	Electrical	464,000	179,000	643,000
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11.	Testing, Winterizing & Startup	89,000	44,000	133,000
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13.	Federal Sales Tax	698,500	-	698,500
14.	Contractors Overhead		4,884,000	4,884,000
15.	Freight (Materials Only)	352,000	-	352,000
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On December 12, 1978, Foothills Pipe Lines (Yukon) Ltd. authorized Canuck Engineering Ltd. to proceed with the preparation of cost estimates for a typical chilled compressor station (No. 3) in the permafrost zone and a typical non-chilled compressor station (No. 7) for the Dempster Highway Pipe Line. Both stations were to utilize a single 16,000 ISO horsepower gas turbine compressor package for the main high pressure gas unit.

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7.	Utilities	255,000	89,000	344,000
8.	Instrumentation	383,000	52,000	435,000
9.	Electrical	867,000	255,000	1,122,000
10.	Insulation & Painting	124,000	184,000	308,000
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14.	Contractors Overhead		8,158,000	8,158,000
15.	Freight (Materials Only)	575,000	<u> </u>	575,000
	L ludes Contingency of \$916,000 Materials)	16,893,500	10,740,000	27,633,500

16. Tools & Major Spares
 (Includes FST)

640,000 (optional)

TABLE 2

CAPITAL COST ESTIMATE SUMMARY

DEMPSTER HIGHWAY COMPRESSOR STATION NO. 7

NON-CHILLED

	Cost Category	<u>Materials</u>	<u>Installation</u>	<u>Total</u>
		\$	\$	\$
	<b>.</b>	050 000	505 000	750 000
1.	Foundations	252,000	506,000	758,000
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16. Tools & Major Spares (Includes FST)

360,500 (optional)

#### DEMPSTER HIGHWAY COMPRESSOR STATION

#### II. DISCUSSION

This section of the report reviews the overall approach that was used by Canuck and Dillingham in order to logically prepare the cost estimate for two Dempster Highway Pipe Line compressor stations.

On December 18, 1978, Foothills called a meeting with Canuck to discuss:

- a) the available station design information
- b) certain design parameters
- c) the overall project construction schedule
- d) vendor quotes for the gas turbine compressor packages
- e) items to be included and excluded in the estimate.

A memo of this meeting is attached (dated December 21) and labelled Exhibit 1 in the Appendices.

Canuck was requested to omit the following direct costs from the estimate as they would be handled by Foothills:

- a) Land Acquisition
- b) Access Roads
- c) Site Preparation.

In addition no Owner indirect costs have been included in this estimate, but we draw your attention to the following which Foothills should consider:

- a) Project Management and Engineering
- b) Possible NEB or NPA Costs
- c) Material Inspection and On-Site Inspection
- d) Allocation and Amount of Contingency
- e) Interest During Construction
- f) Possible Assessments or Sales Tax in the Northwest Territories.

The estimate has been prepared using certain cost information provided by Foothills, current costs obtained from discussions with vendors, installation costs provided by Dillingham and current in-house price information available to Dillingham, and Canuck. In addition Dillingham has referred to their historical man-hour installation records from previous compressor station and process plant construction in northeastern and southeastern British Columbia.

The estimate is based on first quarter 1979 prices, and includes the cost of freight to a marshalling area in the vicinity of Edmonton. Freight from Edmonton to the work site is shown as a separate item and is detailed in Section III-15. Federal Sales Tax is shown as a separate item and is summarized in Section III-13.

#### INSTALLATION

The installation cost estimates presented are for the construction of a chilled compressor station (Station 3 - Rock River) at Kilometre Post 380 and a non-chilled compressor station (Station 7 - Stewart Crossing) at Kilometre Post 851 of the proposed Foothills Dempster Highway Lateral Pipe Line. Nine compressor stations are ultimately proposed over the length of the 1172 kilometre pipeline from the Mackenzie Delta to the Foothills 56" mainline near Whitehorse.

The direct costs for a typical chilled and a typical non-chilled station were developed in considerable detail on the basis of conceptual quantities. Building sizes, equipment information, flow diagrams, and pipeline sizes provided by Foothills have been used in developing approximate quantities of work.

These quantities were compared to actual quantities available from the project histories of many stations previously built in British Columbia, Alberta and Saskatchewan. The final range of estimated quantities is considered accurate to within about 15 percent.

The direct labor costs developed are also based upon labor productivities achieved during construction of compressor station facilities in British Columbia, Alberta and Saskatchewan.

The work force on the Dempster Highway Lateral compressor stations has been assumed to have a higher unskilled labor input and lower productivities than the norm.

The range of productivities apparent from previous project histories indicates that many sites have encountered productivities different from the norm. These variations are attributable to site conditions, weather, extreme temperatures, remoteness, equipment availability, material deliveries, extended hours and labor strife.

The impact of these variations as well as the high input of unskilled labor has been considered in assessing realistic productivity units for the Dempster region.

#### SCHEDULE

Historically, mainline compressor stations are constructed within a six-month period and most often during the winter months. The Dempster Highway Lateral stations are considerably larger and because of the remoteness will require extensive mobilization periods to set up construction facilities and construction camps.

The progress schedule for the chilled station is presented on Figure 1 and indicates that the time required is 11 months and for a non-chilled station (Figure 2) is 10 months. Both stations are considered to be constructed concurrently with mobilization occurring in February and March, or alternately the fall of the preceding year.

The Dempster stations are expected to be constructed in 1985 and 1986.

The estimated manpower buildup is shown on Figure 3 for the chilled station and Figure 4 for the non-chilled station. A typical composition of the trades required for the job and their total estimated manhours is shown in Tables 3 and 4.

The direct costs include the straight time construction labor costs of hourly trades employed directly on-site (60 hours per week).

The hourly trade rates are current, in accordance with the British Columbia and Yukon Building Trade agreements and expire April 30, 1980.

The design of the single unit chilled and non-chilled compressor stations for the Dempster Highway Pipe Line is in the preliminary stages. Foothills has furnished Canuck with several drawings from the Maple Leaf Project to serve as a general guide. Canuck has utilized these drawings in modified fashion and has prepared a number of preliminary drawings that were used for estimating purposes. These drawings are attached in Section IV. In certain instances, where definitive information was not readily available, the consultant proceeded by making certain assumptions based on engineering judgment and industry practice. These assumptions are outlined in detail for each category in Section III, and are briefly discussed in the following material.

#### FOUNDATIONS

In order to avoid disturbance of the permafrost the estimate has considered that all heated buildings for the chilled stations will have the floor elevated approximately three feet above grade and it will be supported on friction piles founded below the active zone. In the non-permafrost areas the estimate has considered that foundations will consist of a normal spread footing.

In all cases the foundations conform to the requirements of the National Building Code of Canada.

#### BUILDINGS

All of the station structures with the exception of the living quarters are constructed with welded steel rigid frame sections. The transverse frames are interconnected by bracing systems in the planes of the side walls and the roof. All field connections will be bolted. The wall panelling and roofing will consist of a sandwich material composed of two metal sheets and an insulating core. The buildings will be in compliance with all applicable codes.

#### GAS COMPRESSOR PACKAGE

The gas compressor package was specified by Foothills and was quoted by Cooper Energy Services Ltd. The package consists of one 16,000 ISO horsepower industrial jet engine, a power turbine and a two-stage centrifugal compressor plus auxilliaries. The equipment is of proven design. The turbine will be fitted with inertial air cleaning devices, anticing equipment, inlet and exhaust silencers and an acoustical enclosure. The quotation for this package is presented in Section III-3.

#### 4. PROPANE COMPRESSOR PACKAGE

The propane compressor package was specified by Foothills who selected two Clark DJ50 turbine compressor packages. The packages include two 5500 ISO horsepower industrial jet engines each of which is coupled to a multi-stage propane compressor.

#### 5. HIGH PRESSURE GAS PIPING

The high pressure gas piping layout used for the estimate is shown in isometric drawings FPL39-49-61D and FPL39-49-62D which are included in Section IV. The 30" piping estimate included an inlet gas scrubber, applicable remote operated valving, the chiller headers, an orifice fitting on the discharge piping and the required relief and blowdown piping. All high pressure piping was estimated using -50°F specification materials.

#### 6. OTHER MAJOR SYSTEMS

#### 6.1 CHILLING SYSTEM

The propane chilling system estimate was based on the general design prepared for the Maple Leaf system and modified to fit the reduced flow rates of the Dempster Highway Pipe Line. An isometric drawing of the revised propane system is attached in Section IV. The system consists of three propane chillers and associated controls, vapor lines to the compressors, 12 fin fan condensers, a propane surge tank, an economizer and a large propane storage tank.

#### 6.2 FUEL AND STARTING GAS

The fuel and starting gas system was estimated to incorporate a separate fuel gas regulator building and includes fuel gas measurement, and an alternate source of fuel in the event of a mainline segment shutdown on the upstream or downstream side.

#### 6.3 HEATING AND VENTILATING

The heating system is a conventional hot water-glycol design consisting of a number of modular heater packages selected for the particular station load.

#### 6.4 GAS DETECTION AND FIRE PROTECTION

The gas detection system provides for a number of combustible gas detectors, ultraviolet fire eyes, continuous strip thermistors, ionization detectors and thermal detectors to be installed throughout the station. The main gas compressor building and the control room MCC/switchgear room and generator/boiler room are protected with Halon 1301 systems as is the propane compressor building at the chilled station.

#### 7. UTILITIES

#### 7.1 WATER SYSTEM

The water system estimate was prepared assuming that raw water would be hauled to the station and stored in a 500-barrel tank and that chemical treatment and chlorination would be required for the potable water.

#### 7.2 SEWAGE SYSTEM

The sewage system estimate was based on a vendor quotation for providing a vacuum sewage system with incineration of the collected sewage.

#### 7.3 INLET AIR SYSTEM

Structural steel supports and hardware have been provided for turbine air inlet ducting. The actual ducting, plenums and silencers are part of the turbine manufacturer's supply.

#### 7.4 EXHAUST SYSTEM

As for the inlet air system, all necessary structural steel supports and hardware for the complete exhaust systems have been provided. Again the exhaust ducting and silencers are part of the turbine manufacturer's supply.

#### 7.5 FLARE AND VENT GAS

The flare and vent gas system was based on installing a tapered flare line that runs through the station buildings to pick up combustible gas vents and terminates in a 50-foot flare stack complete with pilots, igniters and controls.

#### 7.6 EMERGENCY FUEL

Provision has been made for diesel fuel storage and supply to the standby diesel fueled electric generating unit. Storage for quantities of gasoline for pipeline vehicles has also been provided.

#### 7.7 CONDENSATE STORAGE

A small condensate storage tank is provided to handle the materials removed from the gas stream by the inlet scrubber. This tank has been included in the high pressure gas piping system.

#### 8. INSTRUMENTATION

#### 8.1 UNIT CONTROLS

Most of the unit controls and instrumentation are included in the cost of the units; however, unit auxiliary panels (based on A.G.T.L. control panel designs) are added to achieve some standardization between the stations and to contain some unit related controls and equipment not supplied by the compressor unit manufacturer.

#### 8.2 PRESSURE, TEMPERATURE, FLOW MEASUREMENT

Pressures that are required for the operation of the main compressor system and the propane compressor system are transmitted to the main control room by electrical signals obtained from pressure transmitters located in instrumentation racks in the compressor buildings. The cost of this portion of the instrumentation includes cost of the instrument racks. Also included in the cost are the pressure gauges and switches located in the same racks.

Temperature monitoring that is required for the operation of the main compressor system and the propane compressor system shall be monitored by use of thermowells, RTD's, signal conditioners and panel meters.

The cost of this portion of the instrumentation includes the cost of the thermowells and RTD's. The cost of the signal conversion and indication is included in the cost of the station control panel (where equipment is mounted).

Flow measurement of the gas and propane is obtained through sensing differential pressures across orifices and temperatures at the orifice. The cost of instruments is included in the costs for temperature monitoring, instrumentation racks and station control panels.

Flow measurements of the fuel gas for the main compressor, propane compressor and utilities are based on turbine meters. The cost of the turbine meters is included in the fuel gas system costs.

#### 8.3 STATION CONTROLS

Station control panels for the main compressor station and the propane station are included in this estimate and the cost covers logic, instrumentation (mounted in panel), indicators, and local push buttons and switches for the operation of the stations in general.

#### 8.4 PROPANE INSTRUMENTATION AND CONTROLS

Instrumentation and control cost estimates for the propane system are "taken off" a flow sheet supplied by Foothills.

#### 8.5 MISCELLANEOUS

Miscellaneous items included in the estimate are items which were unable to be categorized above.

#### 9. ELECTRICAL

#### 9.1 ENGINE GENERATORS (includes Switchgear)

Three (3) 450 KW Caterpillar generator sets have been provided at

Station No. 3. Two (2) of these will be natural gas fired for prime electric power generation and the third will be a diesel fueled standby unit.

At Station No. 7, three (3) 150 KW Caterpillar generator sets will be provided. Again, two (2) will be natural gas fired and the third a diesel fueled standby unit.

Included in the estimate for the engine generators are the associated cooling and starting equipment, engine control panels, switch gear and metering.

#### 9.2 MOTOR CONTROL CENTRE

The motor control centre (MCC) estimate is based on an essential service bus and non-essential service bus segregation. The main compressor and propane compressor unit MCC's are supplied by the unit manufacturer and are included in the unit costs. They are fed from the main MCC.

#### 9.3 CONDUIT CABLE AND FITTINGS

The supply of material and installation of all conduits, wire, cable, trays and consumable electrical materials has been provided for in the estimate.

#### 9.4 UNINTERRUPTIBLE POWER SUPPLY

UPS, which consists of the battery charger, inverter and batteries for the general station, is included in the estimate. The costs of the UPS systems for the main compressor unit and propane compressor units are included in the cost of units.

#### 9.5 LIGHTING FIXTURES

The costs of the materials and installation of interior and exterior building lighting have been provided in the estimate.

#### 9.6 YARD LIGHTING

The cost of the materials and installation of yard lighting on conventional light standards in 12 separate locations around the compressor station yard has been included.

#### 9.7 HEAT TRACING

The cost of heat tracing certain portions of pressure piping installed aboveground has been included in the estimate.

#### 9.8 GROUNDING

The grounding system required for installation in the permafrost areas requires special preparation and these costs have been considered by the consultant.

#### 10. INSULATION AND PAINTING

#### 10.1 INSULATION

This item includes the cost of materials and the installation of insulation to all piping, vessels and equipment.

#### 10.2 PAINTING

This item has provided for the supply and application of all painting requirements to equipment, piping, structural steel, masonry and exposed concrete work.

#### 11. TESTING, WINTERIZING AND STARTUP

#### 11.1 TESTING

This item includes the cost of materials and labor to test the high

pressure gas piping, the propane piping and miscellaneous piping and vessels to the NEB requirements.

#### 11.2 WINTERIZING

This sub-category provides for the labor and material required for snow removal and isolated hoarding and heating. This allowance relates to the protection of concrete, welders' shelters and removing snow. Fuel for heating temporary buildings is included under construction facilities. In addition it provides for the startup and checking of heat tracing, heating systems, winterizing valve operators, etc.

#### 11.3 STARTUP

This sub-category provides for the labor, vendors' servicement and materials required to check out and start up the station and to have it operating in a safe and satisfactory manner.

#### 12. MISCELLANEOUS

This category includes a number of items not otherwise provided for such as safety equipment, site improvements, walkways and furnishings for the living quarters.

#### 13. SALES TAX

This item was also requested by the client to accumulate the Federal Sales Tax on all material required for the station.

#### 14. CONTRACTOR'S OVERHEAD

The discussion of the contractor's overhead costs is presented in detail in Section III-14.

#### 15. FREIGHT

This item was requested by Foothills to accumulate the cost of freight from a marshalling yard in the vicinity of Edmonton to the job sites.

#### 16. TOOLS AND MAJOR SPARES

This category provides for equipping the station with all of the necessary maintenance tools and provides for a number of spare parts for the stations including a spare gas turbine which is prorated to all stations.

TABLE 3

# DEMPSTER HIGHWAY COMPRESSOR STATION COMPOSITION OF TRADE CREWS CHILLED STATION

Category	<u>Manhours</u>
Carpenters	28,000
Laborers	20,000
Cement Masons	4,000
Operating Engineers	20,000
Teamsters	25,000
Ironworkers	16,000
Pipefitters	38,000
Machinists	6,000
Electricians	25,000
Painters	6,000
Insulators	4,000
Sheetmetal	6,000
TOTAL	192,000

DEMPSTER HIGHWAY COMPRESSOR STATION
COMPOSITION OF TRADE CREWS

TABLE 4

## NON-CHILLED STATION

Category	Manhours					
Carpenters	15,000					
Laborers	12,000					
Cement Masons	3,000					
Operating Engineers	11,000					
Teamsters	11,000					
Ironworkers	8,000					
Pipefitters	20,000					
Machinists	4,000					
Electricians	14,000					
Painters	4,000					
Insulators	1,000					
Sheetmetal	4,000					
TOTAL	107,000					



# PROGRESS SCHEDULE

LEGEND

..... ACTUAL PROGRESS DELIVERY DATE -START UP

Dillingham

DESCRIPTION OF ITEM

12

Mobilize Contractor Facilities

Buildings and Utilidors

Gas Compression Package

Propane Compression Package

Gas Chillers

High Pressure Gas System

Chilling System

Other Major Systems

Utility Systems

Electrical Generation Package

Lighting Systems

Power and Control

Instrumentation

Insulation and Fireproofing

Painting

Demobilization

Setup Construction Camp

Piling, Excavation, Sitework

Concrete Foundations

Propane Condensers

Electrical Switchgear & M.C.C.

Testing and Startup

SHEET NUMBER

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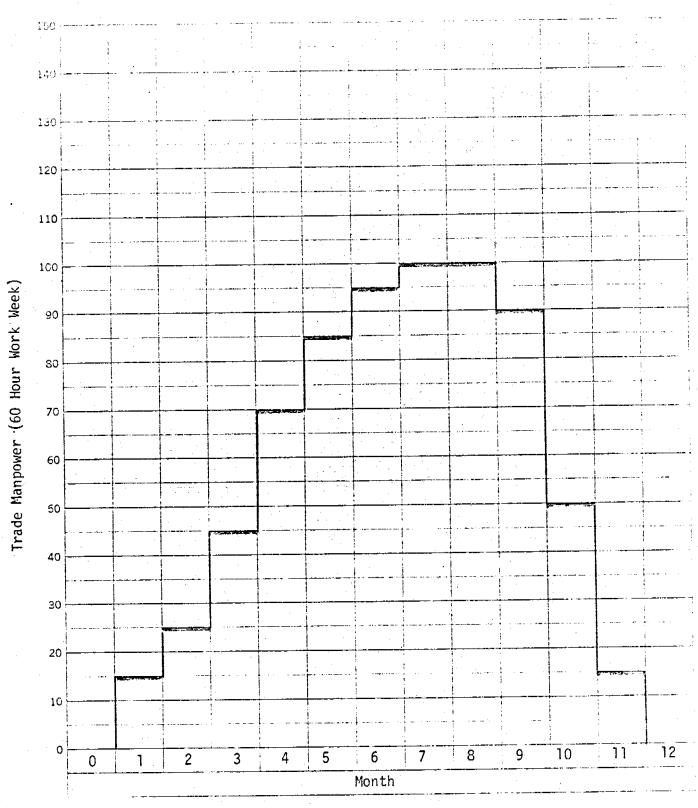


# PROGRESS SCHEDULE

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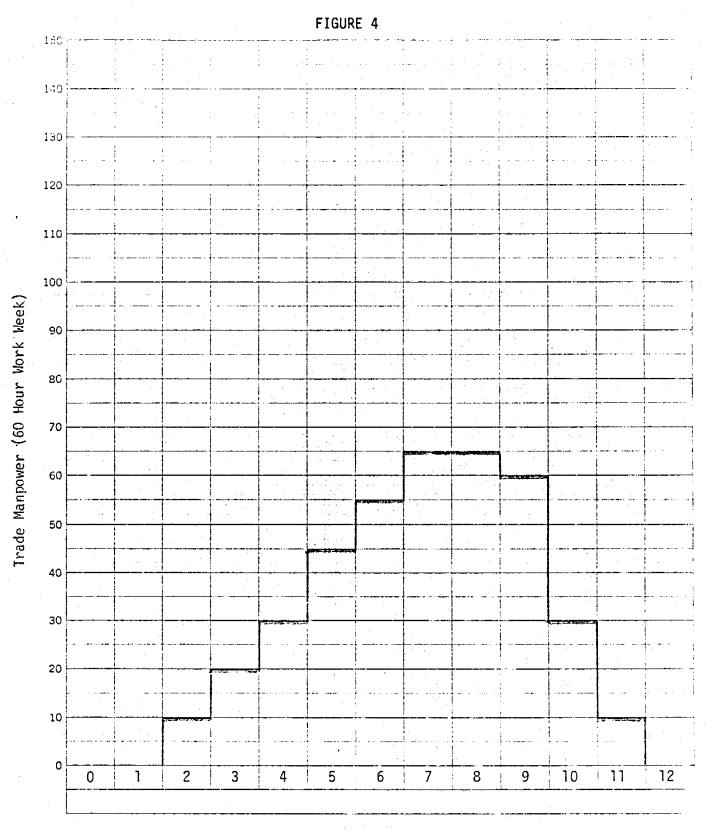
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Foothills Dempster Lateral Chilled Compressor Station Manpower Curve

22 January 1979



Foothills Dempster Lateral Unchilled Compressor Station Manpower Curve

#### DEMPSTER HIGHWAY COMPRESSOR STATION

#### III. BASIS OF THE ESTIMATE

#### GENERAL

This Section of the estimate is divided into sixteen separate cost categories and provides an explanation of the assumptions used in preparing the estimate. Additionally, the itemized materials cost summary sheet, installation man hours and cost summary, the estimated weight of materials and the estimated Federal Sales Tax for each sub-category are also included.

Where revised drawings have been prepared, they are included in Section IV and are referred to in the appropriate subsection.

A contingency generally in the amount of 10 percent has been added to the cost of material due to the preliminary stage of the station design.

#### DEMPSTER HIGHWAY COMPRESSOR STATION

#### III-1 FOUNDATIONS

This estimate included the excavation and backfill of foundations, drilled concrete piling, concrete formwork, reinforcing steel, embedded materials, concrete placement, grouting, insulation and waterproofing. The materials supply for all of these items is (shown separately) included.

The estimate provides for 2600 cubic yards of concrete at the chilled station (No. 3) and 1400 cubic yards at the non-chilled station (No. 7). Reinforcing steel is estimated to require 125 pounds per cubic yard.

#### **COST SUMMARY**

	<u>Chilled</u>	Non-Chilled
Materials	\$ 452,000	\$252,000
Installation	902,000	506,000
Total	\$1,354,000	\$758,000

Estimated Weight of Materials ex Edmonton	1,770,000 lbs.	1,045,000 lbs.
Federal Sales Tax Estimate	\$ 25,000	\$ 13,000

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## ESTIMATE COST SHEET

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Project Dollis. Dempiles Estimate No.

Item No. Date

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## ESTIMATE COST SHEET

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Item No. Date

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### Dillingham Corporation Canada Ltd.

## ESTIMATE COST SHEET

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## ESTIMATE COST SHEET

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# Dillingham Corporation Canada Ltd. ESTIMATE COST SHEET

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# Dillingham Corporation Canada Ltd. ESTIMATE COST SHEET

Project foothill Demphic	Estimate No.
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# Dillingham Corporation Canada Ltd. ESTIMATE COST SHEET

Project foothulk: Demotile Estimate No.

Item No. Dale

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## Dillingham Corporation Canada Ltd. ESTIMATE COST SHEET

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item No.	Account No.	Date	
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# Dillingham Corporation Canada Ltd. ESTIMATE COST SHEET

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### **ESTIMATE COST SHEET**

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#### DEMPSTER HIGHWAY COMPRESSOR STATION

#### III-2 BUILDINGS

This category provides for the supply, assembly and erection of preengineered metal buildings and modular living quarters. Structural steel, insulated wall and roof cladding systems, wood framing, partitions, ceilings and floor systems, overhead cranes, miscellaneous steel and interior furnishings are included.

#### The sizes of buildings provided are as follows:

a) Hi	gh Pressure Gas (	Compress	or	•	60'	X	70'	X	30'
b) Pr	opane Compressor			· -	40'	X	110'	X	30'
c) Ga	s Scrubber			· · ·	20'	X	25'	X	15'
d) Ch	iller Building		**	-	501	X	75'	X	30'
e) Co	ntrol, Utility	. 9		-	60'	X	120'	X	30'
f) St	ores			· .	40'	x	60'	x	14'
g) Li	ving Quarters -	4200 s	quare	feet,	single	9 9	tore	<b>y</b>	
h) Ut	ilidors		•		4001	X	8'	X	8'
i) Fu	el Gas Regulator	and Met	er		20'	X	25 '	X	15'
j) Wa	ter Treating			_	30'	X	40'	X	18'

#### COST SUMMARY

	<u>Chilled</u>	Non-Chilled
Materials	\$1,125,000	\$741,000
Installation	268,000	190,000
Total	\$1,393,000	\$931,000
Estimated Weight of Materials ex Edmonton	974,000 lbs.	727,000 lbs.
Federal Sales Tax Estimate	\$ 60,100	\$ 39,000



## ESTIMATE COST SHEET

Project Foothick - Dem	artic	Estimate No.
· ·	•	Date
Description By aws -	Summary.	Sheet No of

	Description of Work	Unit	Quantity	Hours	Labour	Equipment	Materials	Subcontracts	Job Supplies	Total Cost
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## Dillingham Corporation Canada Ltd. ESTIMATE COST SHEET

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	Description of Work	Unit		Qu	ant	ity		Ho	urs		T	L	abo	ur		E	quit	me	nt		М	late	ria	ls	Subcontracts						Job	Su	ppłi	es		Tot				
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## ESTIMATE COST SHEET

Project Foothins - Dunpitor	Estimate No.
Item No Account No	Date
Description Brildwy   Propara Compressor Buy   40 x 110 = 4400	Sheet No. 2 of 9

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# Dillingham Corporation Canada Ltd. ESTIMATE COST SHEET

Project Foothuis - Da	mpYtir	Estimate N	lo
Item No	Account No.	Date	
Description 600000 -	( Colo Scribby Plac) 30 Kg =	Sheet No.	_3_ of 9

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## ESTIMATE COST SHEET

Project Foothill - Demptor		Estimale No.
Item No.	Account No.	Date
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## Dillingham Corporation Canada Ltd. ESTIMATE COST SHEET

Project Footballs - Dungster

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## ESTIMATE COST SHEET

Project Foothing - Dempater	Estimate No.
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Description Brildwife   STORY BIAC   40' xb0' =	3400 Sheet No. 6 of 9

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# Dillingham Corporation Canada Ltd. ESTIMATE COST SHEET

Project Foothills -	Dempoter	Estimate No	o
		Date	
Description Wildling	- (Free Clas Regulation Mag	) 30 x 25 = 500 St. Sheet No.	7 01 9

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## ESTIMATE COST SHEET

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## ESTIMATE COST SHEET

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#### DEMPSTER HIGHWAY COMPRESSOR STATION

#### III-3 GAS COMPRESSOR PACKAGE

#### III-3.1 GENERAL

This cost estimate provides for the supply of one (1) 16,000 ISO H.P. rated natural gas compressor package complete with auxilliaries. The proposed unit for both the chilled and non-chilled station is a Cooper Bessemer Coberra 3045 gas turbine compressor package.

Please refer to the quotation included in this section from Cooper Energy Services to Foothills Pipe Lines (Yukon) Ltd. dated December 14, 1978 for specific details.

The gas turbine compressor package will be housed in a heated compressor building measuring  $60' \times 70' \times 30'$  eaves, complete with overhead cranes.

#### III-3.2 DESCRIPTION

The gas generator supplied with the Coberra 3045 package will be a Rolls Royce Spey engine with a fuel rate of 7600 BTU/BHP/Hr. at ISO conditions.

The gas pipeline compressor will be a Cooper Bessemer RFA-36 (end suction) two-stage centrifugal compressor designed for a throughput of 1200 MMSCFD and pressure rated at 1440 psig maximum operating pressure.

Included in this gas turbine compressor package costs are the following:

- a) Air inlet filter system including weatherhoods, anti-icing and silencer designed to meet ISO NR55 @ 400 feet radius from the unit.
- b) Exhaust gas system including duct transition and silencer designed to meet ISO N55 @ 400 feet radius from the unit.

- c) Lube/seal oil systems for the gas generator and power turbine/ compressor.
- d) Unit control and unit MCC panels.
- e) Trend monitoring (sensors and transmitters only).
- f) Acoustical enclosure over the gas generator and power turbine only.
- g) Load testing at reduced pressure.

In addition to the above costs, Foothills has added a contingency of \$70,000 as per their December 21, 1978 letter to Canuck Engineering Ltd.

Also, each additional speed line on the gas compressor test would be an extra \$3.675 which has not been included in this estimate.

This gas turbine compressor package would be manufactured and tested in Stratford, Ontario.

#### III-3.3 FUEL GAS

The gas generator will be fueled on natural gas delivered at 500 psig to the Cooper Bessemer skid.

Fuel measurement has been provided by means of a 4" Rockwell T-18 turbine meter. Cost of this meter is included in the station fuel gas system, Section VI of this estimate.

#### III-3.4 LUBE OIL

Included in this estimate is the cost of the initial fill of lube oil for the gas generator and power turbine/compressor. We have allowed

for synthetic type lube oil for the gas generator and mineral type lube oil for the power turbine/compressor.

Stainless steel pipe, valves and fittings have been included in this estimate for hook up of the lube oil systems.

#### III-3.5 MISCELLANEOUS

We have allowed for the supply of necessary small pipe, valves, fittings and tubing for hook up of vent lines, instrument lines, etc.

#### COST SUMMARY

#### Chilled and Non-Chilled Station

Materials	\$3,900,000
Installation	67,000
Total	\$3,967,000

Estimated Weight of Materials ex Edmonton

418,000 lbs.

Federal Sales Tax Estimate

\$486,100

## DEMPSTER COMPRESSOR STATION

### SYSTEM COST SUMMARY SYSTEM No. 5- 1-0 CW/MESSION PLG

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Gas Turbine   conf				
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PACKAGE WEIGHT	388,000 #		OTHER MATERIAL	
			30,000#	
	- Gas Generator	6,000 #		
	- Turbine & SKID	58,000 *	TOTAL WEIGH	(7_ )
	- LO Console & Tank	1	418,000#	
	- Radiator	15,000#	190 tonnes	
	- Compressor	80,000#		
	- Farr Inlet Filter	18,000#		
	- Controls	45,000		
	- Inlet Plenum 4	35,000#		
	Silencer GG 1.0 Con	1		
	- Misc. #1	24,000 #		
	- Misc # 2	30,000#		
	- Misc. #3	25,000#		
	- Lube 0.1	22.000#		
FST @ 12%			\$486,083	
Lube Oil				
- Gas Gen		200 us Gals	\$20/gal	\$ 4,000
- Turb/Comp		2000 us Guls	<i>L</i> .	20,000
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## ESTIMATE COST SHEET

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JAN COMP

7058E Farrell Road S.E., Calgary, Alberta. T2H 0T2

December 14th, 1978.

Foothills Pipe Lines (Yukon) Ltd., Bow Valley Square II, P.O. Box 9083, Calgary, Alberta. T2P 2W4

Attention: Mr. R. M. Lazerte

Dear Rolly:

#### Coberra 3045 Gas Turbine Compressor Unit

Following is pricing information on our Coberra 3045 (formerly Coberra 162).

One only Coberra 3045 Pipeline package as described on Pages 1, 2 and 3 of Section 4220 attached. The one exception is that the Centrifugal Compressor would be an RFA-36 (end suction) rated 1440 psig.

Also included are the following optional items:

Air inlet filter, inertial type separator, with bleed air ducts and motors, complete with snow hoods for winter. climates.

Air inlet silencer designed to meet ISO NR55 at 400 feet radius from the unit.

Exhaust silencer designed for the ISO NR55 at 400 feet radius from the unit.

The above quoted price would be f.o.b. our factory in stratford, Onterio. No government sales taxes are included.

We would estimate that freight from Stratford to Edmonton would be \$30,000. Sales tax should not be added to freight.

Foothills Pipe Lines
(Yukon) Ltd.

- 2 -

December 14th, 1978.

Following are some breakout prices which you wanted.

Station Controls. For a single unit station a station control panel is not necessary.

#### Trend Monitoring.

For the supply of sensors and transmitters only, we would estimate the cost at \$32,000.

#### Enclosure.

Acoustical enclosure over the gas generator and power turbine and mounted on the turbine base. Enclosure is factory assembled and includes interior lighting and ventilating fan. Sound level reduction to 90 dbs. Price would be \$50,300.

Testing. For load testing Cooper Energy Services would prefer to run the closed loop at reduced pressure, i.e. 200 to 300 psia. We can test at all pressure, but this will become very expensive. The reduced pressure closed loop demonstrated compressor performance will completely corelate at full pressure. The brake horsepower output can be demonstrated very easily by using a water brake.

The reduced pressure test would cost between \$20,000 and \$30,000.

Closed loop test instead of standard open loop test includes one speed line with eight points. Price addition \$6,580.

Entra speed lines - eight points per line. Price addition per line \$3.675.

I trust this gives you the information you were looking for.

Yours truly,

R. B. Kerr

RBK/jm Encl.

c.c. W. R. Serimes



## COOPER-BESSEMER

GAS TURBINES

#### COBERRA 162 PIPELINE PACKAGE

PAGE 1

#### STANDARD EQUIPMENT

	ITEM	STANDARD
1.	Base	Fabricated steel subbase designed to mount the gas generator and power turbine.
2.	Gas Generator	Rolls-Royce Spey industrial gas generator, with Wood- ward governor system arranged for natural gas fuel.
		Gas Unit Rating Generator (ISO) Fuel Rate ▶
		Coberra 162 Spey 16,200 BHP 7600 BTU/BHP-Hr
4.	Gas Generator Lube Oil System  Fuel Gas System	<ul> <li>Main oil pump (pump includes supply, scavenge, and governor control oil) driven from gas generator ancillary drive. Low pressure boost pumps are submerged in the reservoir. The main boost pump is hydraulic motor driven and the auxiliary boost pump is electric motor driven.</li> <li>Twin full flow oil filters with switch valve.</li> <li>Reservoir with separate deaeration section.</li> <li>Air-to-oil heat exchanger.</li> <li>Console mounting including shop fabricated piping, valves, gauges and safety switches to complete the system.</li> <li>A. Fuel Gas: Clean, dry, regulated 500 PSIG min. by</li> </ul>
		user.
		<ul> <li>B. System includes the following mounted on the main base:</li> <li>Governor controlled gas valve</li> <li>Isolating and vent valves</li> <li>Strainer</li> <li>Separator</li> <li>Factory assembled piping, manifolds, relief valves and gauges required to complete the system.</li> </ul>
5.	Starting System	A. Starting Gas: Fuel gas from fuel system.
•		<ul> <li>B. System includes the following equipment:</li> <li>Gas operated expansion turbine</li> <li>Pressure regulator for required starter pressure</li> <li>Automatic overriding clutch</li> <li>Starter coupling to gas generator rotor</li> <li>Factory assembled piping and valves to complete the system</li> </ul>

\*Guaranteed subject to 4% tolerance on Fuel Rate, no inlet and exhaust loss.

COBERRA 162

PIPELINE PACKAGE



## COOPER-BESSEMER

GA\$

TURBINES

PAGE 2

#### STANDARD EQUIPMENT

ITEM	STANDARD
6. Power Turbine	<ul> <li>Power turbine with turbine stages overhung from the bearing supports</li> <li>Two journal and one thrust tilting pad type bearings</li> <li>Insulated exhaust hood</li> <li>Mechanical and electronic overspeed safety governor</li> </ul>
7. Centrifugal Compressor	Two-stage pipeline centrifugal compressor with 30" ASA flanges, maximum working pressure of 1200 PSIG, and overhead emergency seal oil tank.
8. Drive Coupling	Continuously lubricated, spacer type flexible coupling with guard.
9. Combined Power Turbine/Centrifugal Compressor Lube Oil and Seal Oil System	- Separate baseplate for system mounting - Compressor shaft driven lube oil and seal oil pumps - Auxiliary motor driven lube oil and seal oil pumps - Twin full flow oil filters, with switching valve - Oil reservoir with low level switch and electric immersion heater - High pressure seal oil trap - Seal pressure regulator - Degassing system for seal oil - Oil-to-air heat exchanger with hydraulic motor driven fans utilizing seal oil as the hydraulic medium - Factory assembled piping and valves to complete the system. Piping runs to and from the radiator to be supplied by user - Console mounted instrument panel including gauges and safety switches
10. Control System	A. Unit Control Panel - solidstate - designed for automatic and remote operation of the turbine-compressor unit. Panel will be free standing, front access, for location by user in a non-hazardous atmosphere. Panel will include: - Control system logic - Programmed digital timer - Safety shutdown and alarm system - Speed, vibration, and temperature monitors - Automatic sequencing of unit valves - Control mode selector for local manual, local automatic, or remote operation Remote start/stop and loading signals are to be

provided by user.



# COOPER-BESSEMER

ĠA5 TURBINES

#### COBERRA 162

#### PIPELINE PACKAGE

PAGE 3

### STANDARD EQUIPMENT

ITEM	STANDARD
10. Control System (continued)	B. Unit Motor Control Center - includes required starters, contactors, and switchgear to automatically control auxiliary motors and heaters located on the turbine-compressor unit.
	C. Unit Power Supply - includes battery (4-hour capacity), battery charger, inverter, AC and DC distribution switchgear to provide required unit control and instrument power.
ll. Inlet Air System	A. Intake plenum chamber with gas generator inlet bellmouth.
	B. Cleaning System - storage reservoir with piping and valves to direct cleaning agent into the gas generator inlet.
	C. Anti-icing System - piping, valves and temperature/humidity switch to admit gas generator compressor air to the inlet guide vanes and nose cone.
12. Factory Tests	A. Mechanical and system test and checkout of turbine-compressor unit and auxiliary systems.
	B. Open loop air performance test of compressor aero-dynamics for new designs.
	C. System test of unit controls to include start and stop sequencing, speed control, instrumentation, and safety shutdown and alarm system where practical.
13. Special Tools	One set of special tools, as required, for turbine-compressor unit maintenance.
14. Service Representative	The services of a Cooper Energy Services service representative to advise and instruct in the installation and starting of the gas turbine-compressor unit are available at additional cost upon customer's request.

#### DEMPSTER HIGHWAY COMPRESSOR STATION

#### III-4 PROPANE COMPRESSOR PACKAGE

#### III-4.1 GENERAL

The cost estimate for this system covers the supply of two (2) Clark DJ50 gas turbine/refrigeration compressor packages rated at 5500 ISO H.P. each. The horsepower ratings and equipment costs were prepared by Foothills as per their letter to Canuck dated December 21, 1978.

#### III-4.2 OPERATION

One Clark unit would serve as the prime refrigeration unit while the other would provide 100 percent backup in the event of failure or maintenance of the first. The propane piping layout of these units reflects this standby configuration.

Both units would be housed in a heated propane compressor building measuring  $40' \times 110' \times 30'$  eaves complete with overhead cranes.

#### III-4.3 DESCRIPTION

The verbal bid received by Foothills from Dresser Clark includes not only the basic turbine/compressor package but also for each unit a unit control panel, unit MCC panel, inlet air and exhaust gas ducting, filters and silencers, gas turbine starter and lube/seal oil system complete with cooler.

These packages would be manufactured in Lethbridge, Alberta. The gas turbine would be a Garrett IE-990 dual shaft machine and the refrigeration compressor a vertically split Clark B type centrifugal compressor. At this time the exact number of stages has not been finalized but would be in the order of 2 to 4 stages. Dresser Clark has stated that their quoted price would cover compressors in this range.

#### III-4.4 FUEL GAS

The Garrett turbine would operate on natural gas fuel delivered at 240 psig. Fuel measurement has been provided by means of a 4" Rockwell T-18 turbine meter. The cost of the meter is covered in the station fuel gas system, Section VI of this estimate.

#### III-4.5 LUBE OIL

Also included in the estimate is the cost of the initial fill of lube oil for each gas generator and refrigeration compressor. We have allowed for synthetic type lube oil for the gas generators and mineral type lube oil for the compressors.

Stainless steel pipe, valves and fittings have been included as well for hook up of the lube oil systems.

#### III-4.6 MISCELLANEOUS

Allowance was made for the supply of necessary small pipe, valves, fittings and tubing for hook up of vent lines, instrument lines, etc.

#### COST SUMMARY

	Chilled Station
Materials	\$3,600,000
Installation	99,000
Total	\$3,699,000
Estimated Weight of Materials ex Edmonton	182,000 lbs.
Federal Sales Tax Estimate	\$ 431,800

## SYSTEM NO. 4 - PLOFFING CONTRESSION PACKAGE

PAGE / OF

TEM	SUPPLEX	SUANTITY	UNIT FRICE	EXTEVISION
CLARK MODEL DISO	DESSER - CLARK	2	1,685.000	\$3,370,000
Gas Turbine / Kefrigaraha			:	
Comp Pra inclusive			FLB Letteridge	
data less FST and			FST extracal2%	
-reight			,	
3				
FREIGHT TO EDMON	TON	2	1500	3,000
	: :			
PACKAGE WEIGHT				
THERE WEIGHT	Main Turbine / Com		65,000 #	1
			20,000	each
	Air Inlet & Exhau	RT SYSTEM		
			85,000#	
	/ 1 0 /		= 170,000# +	ptal
	hube 0,1		12,000#	
/		TOTAL	182,000 \$	
LUBE OIL				
-Gas Gen		700 US Gals	\$20/gal	\$14,000
- Turb/Comp		700 us Gal	\$10/gal	14.00
			<u> </u>	
Lube / Seal Oil		1 10T	15,000	15,000
Pipe, Values, Fittings	304 55)			
Fullers Earth Filter		2	2500	5000
Misc Pipe Values Fi	Hings	1 407	5,000	5 UOO
(Instrument Lines, west	, efc)			
FST @ 1270=	\$431,676			
			SLB-TOTAL	\$3 12/2 000
		CONTINGENO	Y@ 5 %	
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	<u> </u>	E EDIDITA	,	\$3,597,300

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## Dillingham Corporation Canada Ltd. ESTIMATE COST SHEET

Project Foothius -Dempater		Estimale No.
Item No.	Account No	Date
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	Description of Work	Unit		Que	ntit	y	T	Но	urs		T		abo			1	Equ	ipn	ent			Mat	eria	ls	Ţ.	Sub	cont	ract	:5	Jo	<b>b</b> 8	upp	lies		To	otal	Со	sl
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#### DEMPSTER HIGHWAY COMPRESSOR STATION

#### III-5 HIGH PRESSURE GAS PIPING

#### III-5.1 PIPING

For purposes of this cost estimate it was assumed that the mainline contractor would install the scraper traps, mainline block assembly and station side valves (suction and discharge). Therefore costs associated with compressor station piping would commence from inside these side valves. Please refer to isometric Drawing Nos. FPL 39-49-61D and FPL 39-49-62D in Section IV for details of the high pressure gas piping for Station No. 3 (chilled) and Station No. 7 (non-chilled), respectively.

The high pressure gas piping system for both the chilled and non-chilled stations comprises 30" 0.D. yard and unit piping and appurtenances designed for 1440 psig maximum operating pressure and minus (-) 50°F operating temperature with ANSI 600 rated flanges, all as per CSA Z184-1975. The design criteria used in sizing the high pressure gas piping and appurtenances included a maximum 5 psig drop on each of the suction and discharge sides of the gas compressor and maximum gas velocity of 45 fps with a gas flow rate of 1200 MMSCFD @ 1100 psig. SMYS for the pipe was taken as Grade 70 and Grade 60 for fittings. Heat tracing and insulation of the 30" 0.D. piping has been provided for those segments above grade and not housed within the gas compressor or chiller buildings. Costs associated with this are included in the appropriate electrical and insulation sections.

#### III-5.2 SCRUBBER

Natural gas on the suction side of the station passes through an inline recycling type gas scrubber before entering the 36" compressor. The scrubber, housed in a heated building, is equipped with automatic level

controls, which will dump any collected condensates and other foreign particles from the scrubber sump through a cyclone separator to a 500-gallon condensate holding tank. The scrubber is designed to remove 99 percent of all particles 5 microns and larger. It is equipped with ANSI 600 flanges and is constructed of  $-50^{\circ}$ F specification material.

#### III-5.3 VALVING

The 36" natural gas compressor is housed in a heated compressor building and can be isolated from the 30" unit piping by means of 30" suction and 30" discharge unit ball valves complete with electric valve operators. These valves are ANSI 600 rated and suitable for operation to  $-50^{\circ}$ F ambient. A 16" recycle line complete with a 10" recycle control valve is provided to protect the compressor from surge conditions. Instrumentation costs for the surge control and system are included in the instrumentation section of this estimate. Also provided for in this estimate is a 2" unit purge valve and a 2" unit vent valve both automatically controlled from the unit control panel. The unit vent line will discharge into a common header into the flare system. A 30" unit check valve, also ANSI 600 rated and suitable for  $-50^{\circ}$ F operation, has been provided downstream of the unit discharge ball valve to prevent reverse rotation of the compressor.

A 30" compressor bypass line complete with yard check valve has been provided to allow for the uninterrupted flow of gas through the station during a period of compressor shutdown. This would allow the gas stream to pass through the chillers at Station 3, if required, before discharging into the mainline.

#### III-5.4 CHILLERS

Downstream of the gas compressor at Station No. 3, three (3) shell and tube gas chiller units are housed in a heated chiller building. The chillers, designed for 1440 psig maximum operating pressure on the tube side are constructed of  $-20^{\circ}$ F material and are sized to take one-third

of the maximum flow each. Each chiller bundle measures 36" in diameter, is 24 feet long and has a maximum 7 psig pressure drop on the gas side. The gas flow can be diverted through the chillers as required by means of the 30" header system with 24" supply and return lines to each chiller. The 24" - ANSI 600 rated inlet and outlet ball valves, complete with electric valve operators, are provided on each chiller unit for isolation purposes and a 30" chiller bypass line, complete with 30" - ANSI 600 ball valve and electric valve operator, is provided for times when either chilling is not required or maintenance is being performed on the chillers. At Station No. 7 there are no chillers so the gas flows directly from the compressor to the orifice fitting.

#### III-5.5 ORIFICE FITTING

Measurement of the gas flow through both Station Nos. 3 and 7 will be accomplished by means of a 30" - ANSI 600 Junior orifice fitting (-50°F material) located on the discharge side of the station. The orifice fitting itself will be situated below grade in a concrete vault for accessibility as the 30" yard piping will be buried at this point. Instrumentation costs for the gas flow measurement are covered in Section III-8.

#### III-5.6 OVERPRESSURE PROTECTION

Two (2) 8" x 8" dual horn station relief valves are provided on the discharge side of each station to prevent overpressuring, as per CSA Z184-1975. Each relief valve has the capacity to relieve the entire station. Also provided is one (1) 12" station blowdown valve. This valve will be operated by means of a gas hydraulic operator for fail-safe operation. Discharge from these valves will be collected in a common vent header and run over to the flare.

All components are ANSI 600 rated and utilize -50°F material.

#### III-5.7 MISCELLANEOUS

For this estimate it was decided to use  $-50^{\circ}$ F material throughout the high pressure gas piping system. Our reasoning is twofold; one, the expected ambient temperatures of  $-50^{\circ}$ F to  $-70^{\circ}$ F would certainly warrant the use of low temperature materials and two, the premium for low temperature materials ranges from almost nothing to 25% depending on the particular item but when compared to the overall cost of the station, this becomes rather insignificant. For example, the premium for low temperature ball valves is only 4.5% yet total valve costs amount to 36% of the entire system cost.

#### COST SUMMARY (HIGH PRESSURE GAS PIPING)

	<u>Chilled</u>	Non-Chilled
Materials	\$1,587,000	\$ 946,000
Installation	199,000	126,000
Total	\$1,786,000	\$1,072,000
Estimated Weight of Materials ex Edmonton	500,000 lbs.	300,000 lbs.
Federal Sales Tax Estimate	\$ 79,300	\$ 47,300

***************************************	ALK TILER			
PIPE : 30"	CAPITOL PIPE	1000	\$150/ft	\$150,000
(Gr. 70) 24"	· · · · · · · · · · · · · · · · · · ·	200'	1001ft.	20,000
(-50°F) 16"		250'	50/ft	12,500
12"	H. H. Carlos Santa Carlos Carl	100'	35/ft	3,500
2-10"	get	300	20/ft	6,000
				192,000
VALVES (ANSI 600)				
30'Unit Ball (-50°F)	GROVE	2	\$ 50,000	100,000
24" Gas Chiller (-50°F)	GROVE	6	40,000	240,000
30" Chiller Bypass (-50°F)	GROVE		50,000	50,000
30 Unit Check (-50°F)	FWI		52,000	52,000
30" BYPASS Check (-50°F)	FW I		52,000	<i>52,0</i> 00
10" Unit RecyclE(-2008)	FISHER	1	12,000	12,000
2. Unit Purge (-200F)	FISHER		1,100	",1,100
2" Unit Vent (-zoop)	FISHER .		1,100	1,100
8"x8" Stn Relief (-50%)	AGCO	2	12,000	24,000
12" Stn Vent (-50°F)	GROVE		20,000	20,000
Misc, 2"-4"	GROVE	12		20,000
				572,200
FITTINGS (match Pipe)				
30" x 30" x 30" Header	STEEL - FLO	2	\$4000	8,000
30" x 30" x 24" Header	STEEL- FLO	6	3000	18;000
30" × 30" × 16" Head ex	STEEL-FLO	2.	2500	5,000
30" x 30" x 12" Header	STEEL - FLO	3	2000	<u>. 6,000</u>
MISC. TEES 2"-12"	STEEL- FLO	12	500	6,000
30"-45° LLWE ELLS	STEEL - FLO	6	4500	27,000
30"-90° WHE EUS	STEEL- FLO	6	8700	52,200
24" - 90° LRWE EUS	STEEL - FLO	24	7500	180,000
16" - 90° LRWE EUS	STEEL - FLO	4	1200	4,800
Misc. ELLS 2"-12"	STEEL - FLO	/2	500	6,000
				313,000
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TOTAL SUPPLIES	TOUANT TY	JNIT PRICE	
production of the control of the con		<u> </u>	i •
FLANGES (ANSI 600)		h marketin (14) than a contract trademic of the property of	- · · · · · · · · · · · · · · · · · · ·
30" (A350 GLLF2) STEEL - FLO	8	4100	32,800
24" ( " ) STEEL - FLO	18	2500	45,000
12" (") STEEL - FLO	12	1500	18,000
10" (") STEEL - FLO	2	1200	2400
Misc. FLGS 2"-10" STEEL - FLO	20		15,000
36" x30" EXP. FLG STEEL -FLO	2	8,000	16,000
REDUCERS (match pipe)			
16" ×12" (-50°F)	2	600	1200
		· ·	
STUDS, NUTS, GASKETS			
Covers all flanges	1 LOT		\$ 80,000
SUCTION SCRUBBER			
(ANSI 600 - 50°F) PORTA - TEST		65,000	65,000
ANSI 600, -50 P) FORTA - 125 1		05,000	<b>6</b> 5,000
Man Managar			
MISC. MATERIAL			\$ 10,000
Thredolets, Weldolets	1 407		* 10,000
Swages, Nipples, etc			
	- A		
Orifice Fitting (-504)			<u> </u>
30" Daniel Junior Barber ENG	lonly	55,000	\$ 55,000
			-
CYCLONE SEPREATOR	1	15,000	15,000
Condensate Storage	11	10,000	10,000
			365,400
TOTAL CHILLED STN = \$1,586,8	360 (STN NO.3)		
FST @ 5%= \$79,343			
SYSTEM WEIGHT = 250 TONS			
TOTAL NON-CHILLED STN = \$ 945,560	0 (STN. NO.7)		And the state of t
FST @ 570 = 47,278			
SYSTEM WEIGHT = 150 TONS		E B-TOTAL	\$1,442,600
	CONTINGENO	Y 3 /D >	141 01 =
		TOTAL	\$1,586,860
	- 70 -		71,586,860

SYSTEM COST SUMMARY SYSTEM NO HP GAS PIPING - NON-CHILLED STATIONS

ITEM	SUPPLIER	SUANTITY	JULT FRICE	リク ザノゴドメリ
PIPE			·	
30"		1000	\$ 150/K	\$ 150,000
16"		250	50/4	/2,500
/2"		100	35/K	3500
2-/0"		300	20/1	6,000
		<del>-</del>		172000
VALVES				
50" UNIT BALL (-50 F)		2	50,000	100,000
30" UNIT CHECK (-50]		1	52,000	52,000
30" BY-PASS CHECK (-50F)		,	52,000	\$2,000
10" UNIT RECYCLE (-20F)		1	12 000	12,000
2' UNIT PURSE (-20F)		1	1,150	1,100
2" UNIT VEHT (-20F)		1	1100	//80
SX8" St. REUEF (-50F)	· · · · · · · · · · · · · · · · · · ·	2_	12,500	24000
12" STN. VENT (-50F)		,	20,000	20000
41sc. 2"-4"		12		20,000
				282200
FITTINGS				
POX 30 X 30 HEADER		2	4,500	8,000
30×30'× 16" HEADER		2	2500	5,000
SOX 30" X 12" HEADER	V.	3	2000	6,000
MISC TEES 2'-12"		12	-100	6 050
30" - 45° LRHE FLLS		6	4500	27,000
30" - 90" LRWE EUS		6	8700	52,250
(6" 90 LRUE ELLS		4	1200	4,800
MIRC ELLS 2-12"		12	500	6000
				1/5,000
				569200
	*		<u> </u>	
			SUB-TOTAL	
		CONTINGENC		
	-	- 71 -	TOTAL	

## SYSTEM COST SUMMARY

SYSTEM	N8.	

PAGE OF

DYDIEVI NE	·			PAGE 5-
ITEM	SUPPLIER	のロタアプログ	UNIT FRICE	門メー門ノ山・りて
ELANGES				
30" (A 350 GRLF 2)		8	4100	32800
/2'' ( )		12	/500	18,000
10" (11)		2	1200	2,400
Misc 2"-10"		20	_	15:000
36" ×30" EXP. FLG.		2	800	16000
				84,200
REDUCERS				
16" x 12" (-50F)		2	600	.1200
STUDS NUTS GASKETS		•		
COVER ALL FLANGES		1207		60,00
SUCTION SCRUBBER				
(ANSI 600, -50F)		1.	65,000	65000
·				
MISC, MATERIAL				
THREDOLETS WELDOLETS	·	1607	*.	/0,000
SWAGES, NIPPLES, ETC				
	;			
ORIFICE FITTING				
30" DAHTEL JUNIOR (-10F		1	55,000	55000
CYCLINE SEPARATER			15000	15,000
				290,450
·	F.S. Tax 5%	47278		
	WT	150 /	n	
Material 1	•			
			SUB-TOTAL	<u> </u>
		CONTINGENO		
		- 72 -	TOTAL	94556

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## Dillingham Corporation Canada Ltd. ESTIMATE COST SHEET

Project tooklills - Demporty	Estimate	No		
Item No Account No	Date			 
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#### DEMPSTER HIGHWAY COMPRESSOR STATION

#### III-6 OTHER MAJOR SYSTEMS

#### III-6.1 CHILLING SYSTEM

#### III-6.1.1 SYSTEM DESCRIPTION

This cost estimate provides for a conventional propane refrigeration system. The system loads were provided by Foothills in their December 21, 1978 correspondence to Canuck. The condensed or liquid propane flows from the outlet of the condensers to a propane receiver-surge tank and then on demand to the propane economizer. The economizer overhead (flashed vapor) flows to the interstage scrubber for liquid knock out and then to the interstage suction of the compressor for recycling. The liquid propane flows from the economizer to the chillers on demand and the heat of vaporization of the propane chills the high pressure gas in the exchanger bundle. The vaporized propane flows overhead from the chillers, through a compressor suction scrubber to the inlet of the compressor. The high pressure propane is routed to the fin fan coolers where the propane vapor is condensed, and the cycle is repeated.

#### III-6.1.2 PROPANE COMPRESSORS

The two (2) propane turbine/compressor packages were selected by Foothills who also obtained a verbal quote from Dresser Clark for the supply of same. The equipment consists of two Clark DJ50 5500 ISO horsepower gas turbine compressors with auxiliaries. Further details are available in Section III-4.

#### III-6.1.3 PROPANE CONDENSERS

The propane from the compressor discharge is condensed in the 12 condenser bays arranged in a parallel piping configuration. The condenser

load is 71 million BTU's per hour. The condensers will be equipped with two 30 horsepower electric driven fans per bay. The air is discharged through control louvres on top of the condensers. The condenser maximum design pressure is 250 psig.

#### III-6.1.4 PROPANE RECEIVER

The propane receiver is a large horizontal pressure vessel that was designed to provide adequate surge capacity between the propane condensers and the remainder of the system.

#### III-6.1.5 PROPANE ECONOMIZER

The propane economizer is basically a first stage flash vessel that separates the liquid-vapor phases for the new lower equilibrium pressure condition than that which existed in the propane receiver. The vessel is well instrumented and draws propane from the receiver on liquid level control. The liquid flows to the chillers, and the vapor to the interstage connection of the propane compressor.

#### III-6.1.6 PROPANE CHILLERS

The propane chillers are large heat exchangers with the high pressure gas flowing through two pass tubing bundles and the propane surrounding the outside of the tubes. A large vapor release space is provided above the tube bundle. The total chiller load is 4700 tons, split between three vessels at a maximum gas flow rate of 1200 MMscfd.

#### III-6.1.7 PROPANE STORAGE TANK

A propane storage tank with a capacity of 30,000 imperial gallons is provided in the estimate, along with the necessary unloading equipment, propane drier and transfer pump.

III-6.1.8 GENERAL

All of the major equipment costs have been estimated using either vendor written or verbal quotes.

System design pressure is 250 psig and -20°F material has been specified throughout.

III-6.2 FUEL AND STARTING GAS SYSTEM

#### III-6.2.1 GENERAL

The cost estimate for this system is based on a fuel and starting gas supply (4" line) taken off the mainline valve assembly to ensure an uninterrupted supply, then filtering, heating, regulating and metering the gas stream into the appropriate individual systems for distribution to various areas around the compressor stations. All these processes are to be housed in a separate heated 20 foot by 25 foot regulator and meter building, which is a common industrial practice. Please refer to Drawing No. FPL39-49-63D for the fuel gas isometric for Station No. 3 and Drawing No. FPL39-49-64D for Station No. 7.

Piping and equipment for this system has been designed in accordance with CSA Z184-1975. Sizing of lines and equipment was based on ISO fuel ratings of the gas generators and maximum output ratings of the electrical generators and boilers.

#### III-6.2.2 FUEL GAS TIE-IN AND YARD PIPING

The fuel and starting gas supply originates at the mainline valve assembly where a 4" supply line is taken off both sides of the mainline block valve. This ensures an uninterrupted supply of fuel gas even in the case of a compressor station emergency shutdown (ESD) where the entire high pressure yard piping would be vented but the mainline would remain pressurized. In event that the mainline is blown down on either

the upstream or downstream side of the mainline block valve, fuel gas supply would be available without interruption by means of the 4" check valve arrangement in the supply assembly.

From the mainline supply point the fuel and starting gas supply is yard piped to a 20 foot by 25 foot regulator and metering building located in proximity to the compressor station building as shown on plot plan Drawing Nos. FPL39-49-11D and FPL39-49-12D. A relief valve for this segment of the line, located outside the building is vented into a common station gas vent header.

#### III-6.2.3 REGULATOR AND METERING BUILDING

#### III-6.2.3.1 KNOCKOUT DRUM ASSEMBLY

All fuel and starting gas is first passed through a knockout drum to take out the entrained solids and any liquid slugs. This vessel is vented into a common station venting system, header and the condensate disposal line is tied into the station suction scrubber disposal line.

#### III-6.2.3.2 FILTER SEPARATOR ASSEMBLIES

After passing through the knockout drum the fuel and starting gas is passed through a common filter separator utilizing coalescing cartridges. Two filter separators installed in parallel are proposed for uninterrupted service. The pressure vessel venting and blowdown systems are also tied into the common station venting header and the condensate disposal line is tied into the station suction scrubber disposal line.

#### III-6.2.3.3 GAS HEATER ASSEMBLY

The high pressure fuel and starting gas is then heated prior to regulation by utilizing the hot glycol/water mixture from the building heating system as the heating medium. The heater has been sized to provide sufficient heat input to the gas to prevent the formation of hy-

drates. This vessel is also vented into the common station venting header.

#### III-6.2.3.4 GAS REGULATION AND METERING

After being filtered and heated the fuel and starting gas is regulated and metered for distribution via the utilidors to the appropriate areas.

The gas pressure is cut from a maximum supply pressure of 1440 psig to the appropriate supply pressure for each piece of equipment as follows: 500 psig for the main gas compressor unit, 250 psig for the refrigeration compressor units (Station No. 3 only), and 25 psig for utility gas to the electrical generators and hot water boilers. The supply to the boilers would be pressure cut again in the utility building to 11" W.C.

Fuel and starting gas measurement has been provided for the main gas compressor package and the two (2) refrigeration compressor packages by means of separate 4" Rockwell T-18 turbine meters installed in each of the fuel and starter gas supply lines located in the regulator and metering building. These meters will accurately measure fuel gas flows to each of the gas generator packages and coupled with their instrumentation located in the control room will provide a permanent record of fuel and starting gas usage.

Fuel gas to the electric generators and boilers will be measured by means of a common gas utility meter located in the regulator and meter building.

Instrumentation for fuel gas measurement will include microprocessors and recorders.

Suitable pressure relief valves, block and vent valves will be installed in all supply lines, all venting into a common station gas vent header. In the case of a station ESD, piping and valving arrangements have been designed such, that the fuel gas to the main gas compressor unit and refrigeration compressor units will be blocked and vented while the supply gas to the electrical generators and boiler will remain uninterrupted.

#### III-6.2.4 DESIGN PARAMETERS

Fuel and starting gas requirements.

#### III-6.2.4 DESIGN PARAMETERS

Fuel and starting gas requirements.

#### III-6.2.4.1 CHILLED STATION (STATION NO. 3)

1	ı <b>-</b>	C.B. Turbine (Spey)		121,600	SCFH
1	-	Clark DJ50 Refrig. Turbine	•	49,500	SCFH
1	-	Heating System Boiler	-	10,000	SCFH
2	-	Cat. Generators		11,900	SCFH
		TOTAL GAS REQUIREMENTS		193,000	SCFH

#### III-6.2.4.2 UNCHILLED STATION (STATION NO. 7)

1	-	C.B. Turbine (Spey)	-	121,600 SCFH
1	-	Heating System Boiler	-	8,000 SCFH
2	-	Cat. Generators		8,400 SCFH
		TOTAL GAS REQUIREMENTS		138,000 SCFH

#### III- 6.2.5 STATION FUEL AND STARTING GAS CONSUMPTION

Based on 8000 operating hours/year for the gas generators, 8760 hours for the electrical generators and 5760 hours for the boilers, it is estimated that the total annual fuel gas usage will be 1531 MMSCF for the chilled station (Station No. 3) and 1093 MMSCF for the unchilled station (Station No. 7).

The following table outlines fuel gas usage:

#### FUEL GAS CONSUMPTION

	<u>Chilled Statio</u> n MMSCF	Unchilled Station MMSCF
C.B. Turbine 8000 hours @ 121,600 SCF/H	972.8	972.8
Clark DJ50 8000 hours @ 49,500 SCF/H	396.0	, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
Boiler 5760 hours @ 10,000 SCF/H	57.6	in de la companya de la companya de la companya de la companya de la companya de la companya de la companya de La companya de la companya de la companya de la companya de la companya de la companya de la companya de la co
Boiler 5760 hours @ 8000 SCF/H		46.1
Cat. Generators 8760 hours @ 11,900 SCF/H	104.2	<del>.</del>
Cat. Generators 8760 hours @ 8400 SCF/H		73.6
	<u>1530.6</u>	1092.5

#### III-6.3 HEATING AND VENTILATING SYSTEM

#### III-6.3.1 GENERAL

The cost estimate for the heating and ventilating system for both Station Nos. 3 and 7 was prepared on the basis of a "conventional" 60/40

glycol/water heating system comprising a central boiler package of modular design, circulating pumps and unit heaters or convector radiators located in the various buildings.

#### III-6.3.2 CRITERIA

The following criteria as supplied by Foothills was used for calculation of the compressor station heating system load:

- a) Ambient temperature minus (-)  $50^{\circ}$ F
- b) Building inside temperature plus (+)  $70^{\circ}$ F
- c) Building insulation 3" thickness of fibreglass R = 12.6
- d) Building sizes as outlined in Foothills' station building specifications and shown on plot plan drawings FPL39-49-11D (Station No. 3) and FPL39-49-12D (Station No. 7).

The heating system will operate between 160°F to 200°F water temperature and 12 psig system pressure.

#### III-6.3.3 HEAT LOADS

Using the above criteria it was found that the total heat load for Station No. 3 (chilled) was 9,500,000 BTU/Hr. and 5,500,000 BTU/Hr. for Station No. 7 (non-chilled). In addition to the normal building heat loads, these figures include the heat load required for the station fuel gas heater located in the fuel gas regulator and meter building.

#### III-6.3.4 CIRCULATING PUMPS

Pumping philosophy for the heating system at both stations was to split it into two subsystems; one to supply the compressor building, chiller building (Station No. 3 only), propane compressor building (Station No. 3 only), fuel gas regulator building, scrubber building and utilidors, and the other to supply the utility/control building, living quarters, stores building and water treatment building. There will be

100% backup for each pumping system in case of failure of the main pumping units. At Station No. 3 there will be two (2) 15 HP pumps and two (2) 7-1/2 HP pumps whereas at Station No. 7 there will be four (4) 7-1/2 HP pumps.

#### III-6.3.5 BOILERS

It is proposed to utilize boilers of a modular design rather than a single large boiler. This will allow for a more flexible operation of the boiler system since the boilers will incorporate an 8-step electronic controller to bring on only those modules as required at that time. This will also result in a fuel gas saving since unwanted heat will not be generated. Also, by utilizing the modular boiler design, the reliability of the heat supply is improved over the single large boiler since a section of modules could be down for maintenance but the remaining modules would still be available for heat generation.

It is proposed that the modular boilers and circulating pumps (4 total each station) be located in the utility/control building. This would negate the need for explosion proof motors on the circulating pumps.

#### III-6.3.6 PIPING

From pressure drop and velocity calculations it was found that the main heating system supply header for Station No. 3 would be 8" and 6" for Station No. 7. Piping would run in the enclosed, heated utilidors wherever possible. Premolded pipe insulation will be used throughout.

#### III-6.3.7 HEATERS

It is proposed to use unit heaters in all buildings and spaces at both stations with the exception of offices and control rooms in the utility/control building and in the living quarters. Here we propose to use wall-fin convector heaters.

#### III-6.3.8 HEATING MEDIUM

It is recommended that a 60/40 ethylene glycol/water mixture be used as the heating medium for optimum antifreeze protection and good heat transfer capabilities.

Included in this estimate is the cost of the initial fill of ethylene glycol.

#### III-6.3.9 VENTILATION

Suitable roof-mounted power ventilators will be provided for the main compressor building, chiller building, propane compressor building, stores building, and the workshop area and generator/boiler room of the utility/control building.

Costs for these items have been included in the building costs of Section III.2.

#### III-6.3.10 AIR CONDITIONING

A Leibert computer room air conditioning unit has been provided for in this cost estimate. This unit would be supplied with fully automatic controls for strict control of humidity and temperature and to ensure a dust-free atmosphere.

#### III-6.4 FIRE AND GAS DETECTION SYSTEM

#### III-6.4.1 GENERAL

For purposes of this estimate it was decided to provide a very comprehensive fire and gas detection system and Halon 1301 fire extinguishing system for both Station No. 3 and Station No. 7.

The systems provided utilize state of the art technology and introduce the use of a central monitor to act as a watchdog over the entire compressor station and collect the data received from the following devices:

- a) Ultraviolet fire detectors
- b) continuous strip thermistors
- c) ionization detectors
- d) thermal detectors
- e) gas detectors.

The central monitor will be constructed in a nineteen-inch rack configuration for panel mounting. Included in the monitor will be a graphic display. The purpose of the graphic display is to visually display all the functions of the above detecting devices. The central monitor will be located in the control room of the control/utility building. It will have its own independent battery backup to operate all functions during line power failure.

Since each building has its own unique fire problem, the following review will be made of each building according to its fire detection and extinguishing system.

III-6.4.2 CONTROL/UTILITY BUILDING (Station Nos. 3 and 7)

Thermal detectors will be located in the following areas:

- a) offices
- b) instrument laboratory
- c) shop area
- d) small parts storage
- e) generator and boiler room
- f) corridors.

Cross-zoned ionization detectors would be provided in the Control Room and MCC/Switchgear Room. These cross-zoned ionization detectors would

take part in the releasing of the Halon 1301 extinguishing agent in only these rooms. We are also providing a Halon 1301 system in the generator/boiler room to protect the prime power generating units. Adequate numbers of remote pull stations and local alarm bells will be provided throughout both compressor stations.

#### III-6.4.3 MAIN GAS COMPRESSOR BUILDING (Station Nos. 3 and 7)

This building will be provided with the following detectors:

- a) Ultraviolet fire detectors
- b) continuous strip thermistors
- c) gas detectors.

In addition, the turbine package will have the continuous strip thermistor installed in the acoustic enclosure. A Halon 1301 fire extinguishing system will be provided for the turbine acoustic enclosure and the main compressor building.

The ultraviolet detectors will respond to clean burning natural gas fires. To guard against fires with dense smoke, which could blind the ultraviolet detectors, we propose to utilize the continuous strip thermistors. By using the two types of fire detection devices, quick and reliable responses to fires has been achieved.

Gas detectors would be utilized to detect gas concentrations within the main compressor building that first alarm then initiate a station ESD should the upper explosive level be reached.

### III-6.4.4 PROPANE COMPRESSOR BUILDING (Station No. 3 only)

The fire and gas detection system and fire extinguishing system for this building will be identical to that outlined for the main gas compressor building except the gas detectors will be mounted at floor level since propane is heavier than air.

#### III-6.4.5 CHILLER BUILDING (Station No. 3 only)

Since there is a lesser possibility of an ignition source in this building only gas detection will be considered.

Due to the nature of the combustible gases within the chiller building, both natural gas and propane, the gas detectors will be mounted in the ceiling and at floor level.

III-6.4.6 GAS SCRUBBER BUILDING (Station Nos. 3 and 7)

Gas detection only will be provided in this area.

III-6.4.7 FUEL GAS REGULATOR AND METER BUILDING (Station Nos. 3 and 7)

Gas detection only will be provided in this area.

III-6.4.8 COMMUNICATIONS BUILDING (Station Nos. 3 and 7)

Cross-zoned ionization detectors will be utilized to discharge Halon 1301 agent into this building.

III-6.4.9 PROPANE CONDENSERS (Station No. 3 only)

Due to the volatility of propane and its ability to lay at ground level and move in a dense cloud to a possible ignition source, we suggest gas detection could be provided in the area of the condensers. Granted that these units are outdoors, but because of propane's property of being heavier than air should a leak develop gas detectors at or near ground level ringing the condensers could detect this leak. The cost of these detectors has been included in this estimate.

#### III-6.4.10 HELICOPTER PAD

ς.

In case of emergencies we have provided an Ansul SK3000 dry chemical system at the helicopter pad.

#### III-6.4.11 PIPING

Included in this estimate is the necessary pipe and fittings for discharge of the Halon 1301 agent in the various buildings. Conduit and wiring from this system is included in Section III-9, Electrical.

### COST SUMMARY (OTHER MAJOR SYSTEMS)

		Chilled	Non-Chilled
Materials	\$ \$2	2,367,000	\$536,000
Installation		343,000	70,000
Total	<u>\$2</u>	710,000	\$606,000

Estimated Weight of Materials	
ex Edmonton	1,812,000 lbs. 105,000 lbs.
Federal Sales Tax Estimate	\$ 141,800 \$ 42,200

SYSTEM COST SUMMARY
SYSTEM NO. 6 CHILLER FACILITIES PAGE / 0= 5

			1, 1,	
ITEM	SUPPLIER	SUANTITY	UNIT PRICE	EXTEVISION
	RESSOR BUILD	1~67		
24 GATE VALVES	wor	/-	6 000	6000
10" GATE VALUE & OF		/	2500	2500
24" BLOCK VALVE		2	6,000	12000
10" BLOCK VALVE		2	2500	5,000
10 RECYCLE VALVE		2	7,000	14,000
16" BLOCK VALVE		2	4000	8,000
16" CHECK VALVE		2	10,000	20,000
PROPANE RE	CEIVER			
10" GATE VALVE		2	1600	3200
10' BYPASS VALVE 540P		/	7,000	7,000
4" RELIEF VALVE		1	2000	2000
CONDENSERS				
3" GATG VALVE		12	400	4800
2" GATE VALVE		12	250	3,000
PROPANE STO		· · · · · · · · · · · · · · · · · · ·		
+" CHECK YALVE			750	750
4 GATE VALVE		3	600	1800
				90050
,				
	*		SUB-TOTAL	
		CONTINGENO	Y@ %	
		- 88 -	TOTAL	

SYSTEM COST SUMMARY SYSTEM NO. 6 CHILLS TACILITIES

PASE 2 3= 5

	· B CARLER F	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		PAGE 2 of S
ITEM	SUPPLIEZ	GUANTITY	UNIT FRICE	EXTEVE OV
TEES				
24 x 24 x 24	,	3	1500	4500
24×24×12"		2	1500	3000
16 x 16 x 16		2	/,000	2000
14x 16x10		2	1000	2,000
16 x 14 x 3		11	1.000	11.000
10 x 10 x 10		2	206	412
10 x 10 x 8		1	225	225
10 × 10 × 2		11	250	2 750
8 x 8 x 8		2	121	242
2 x 2 x 2		1	27	27
				26,156
ELB-WS				
24"		10	1207	12070
16.		6	463	2778
10^		14	149	2086
8		4	72	288
4"		/2	16	192
3"		24	10	240
2" .		24	6	144
12		3	350	1050
				18,848
FLANGES				
24"		10	661	6610
16"		10	288	2880
10"		. 28	112	3/36
8		8	60	480
4		/8	24	432
3 "		36	18	648
2"		34	14	504
12"		6	220	/320
				16010
			-	
			SUB-TOTAL	Poge 2 61014
	· · · · · · · · · · · · · · · · · · ·	CONTINGENO	Y @ %	
•		- 89 -	TOTAL	

SYSTEM COST SUMMARY SYSTEM NO. 6 CHILLER FACILITIES

PAGE 3 OF

	. 6 CAILLER A	MS/AI//CS		PAGE SOF
ITEM	SUPPLIER	GUANTITY	UNIT FRICE	EXTENSION
BOLT + NUT SETS				
17/8" × 12 3/4		240	4.00	960
18' × 9%		200	38-	760
14 × 8½"		60	3.20	192
1/4 x 8/4"		448	3.00	1344
18 × 7/2"		96	2.80	269
78" X 51/2"		144	1.75	252
34×44		288	1.50	432
78 x 4"		288	1.00	288
				4497
		X.5		
PIPES GR. B				
24" x 1375 W.T		200'	40.25	8050
16 x . 375 WT		800'	29.77	23816
10"x 365 wt		1200'	17.13	20,556
8"x .322 WT		1700	12.72	21624
4" x · 237 w		1200'	5.63	6.756
3" x . 2/6 47		1500	3.88	1940
2" x · 154 wg		700	1.99	1393
1%" X . 145 WT	y e e e e e e e e e e e	500	2.91	1455
1" x 1/33 ~7		500	/.৪৪	940
				86,530
			4.0	
	<b></b>			•
				<u> </u>
	*		SLB-TOTAL	pay 3 91027
		CONTINGENC	Y @ %	
		- 90 -	TOTAL	

SYSTEM COST SUMMARY SYSTEM NO. 6 . CHILLER FACILITIES

\_\_ PAGE 40=5

PROPINE GAS EXCHANGER SAGES 3 105,000 315  CHILIFTE AND SERVICE  36 & 240 CONE  PROPANIE EXCHANGER SAGES 12 60,000 720,  CONDENSER AND SERVICE  14 '× 40 × 16'  TRAINSTER PUNCP 1 6500 6,  45 GDM  PROPANE STOCKAGE CIGAS 1 35,000 35,  TANK AND ISO 30,000 PALS  TOURNE BECKYER CIGAS 1 26,000 26  TANK SOME BECKYER CIGAS 1 26,000 26	
CHILIER AND SERVICE  36 6 × 240 YOUR  TROPANE EXCHANGER SALES 12 60000 7620.  CONDENSER AND SERVICE  14' × 40' × 16'  TRANSFER PUNP 1 6500 6.  45 gpm  PROPANE STOCKAGE CIGAS 1 35,000 35.  TANK ANI ISO 30,000 PALS  TROPANE BECKYER CIGAS 1 26,000 26  TANK 9 SAMES 18000 gals	500
CHILIER AND SERVICE  36 6 × 240 KNG  TROPANE EXCHANGER SALES 12 60000 7620.  CONDENSER HUN SERVICE  14' × 40' × 16'  TROINSFER PUNP 1 6500 6.  45 gpm  Plotane STOCKAGE CIGAS 1 35,000 35.  TANK ANI ISO 30,000 pars  TROINE SECRICE CIGAS 1 26,000 26  TANK SAME 18000 gals	500 000
CHILIETT AND SERVICE  36 6 × 240 CONG  TROPANE EXCHANGER SAIS 12 60.000 720,  CONDENSER AND SERVICE  14 × 40 × 16'  TRANSFER PUNP 1 6500 6,  45 gpm  PROPANE STOCKAGE CIGAS 1 35,000 35,  TANK ANI ISO 30,000 pars  TROPANE RECIEVER CIGAS 1 26,000 26  TANK SAME 1800 gals	500
36 6 × 240 TONE  TROPPANE  EXCHANGER SALES  12 60000 720,  CONDENSER  AND SERVICE  14' × 40' × 16'  TRINSFER PUNP  1 6500 6,  45 gpm  RICHANE STOCKAGE (19A5 1 35,000 35,  TANK ANI 150 30,000 pars  TROPANE BECKVER (18A5 1 26,000 26,  TANK 1- SAME 18000 gals	500
CONTENSER AND SERVICE  14' X 40' X 16'  TRANSFER PUNP 1 6500 6.  45 gpm  PROPANE STOCKAGE CIGAS 1 35,000 35.  TANK ANU ISO 30,000 PALS  TRANK PROPANE RECEVER CIGAS 1 26,000 26  TANK & SADUE 18,000 gals	500
14' x 40' x 16'  TRANSFER FUNP  1 6500 6.  45 gpm  PROPANE STOCKEE CIGAS  TANK ANSI ISO 30,000 pars  PROPANE RECIEVER CIEAS  TANK SAMUES. 18,000 gals	000
TRANSFER PUNP 1 6500 6.  45 GPM  PROPANE STORAGE CIGAS 1 35,000 35.  TANK ANSI ISO 30,000 PALS  PROPANE RECEVER CIBAS 1 26,000 26.  TANK IN SAROUE 18,000 gals	000
45 GPM  Flotane STOCKAGE CIGAS 1 35,000 35.  TANK ANSI ISO 30,000 PALS  FLODANE BECEVER CIGAS 1 26,000 26.  TANK IN SAME. 18,000 gals	000
Flotane STORAGE CIGAS / 35,000 35,  TANK ANSI ISO 30,000 PALS  PROPANE BECKYER CIGAS / 26,000 26,  TANK & SAMUES / 8,000 gals	
TANK ANSI 150 30,000 PALS  PRODANE RECIEVER CIBAS 1 26,000 26  TANK & SAME 18,000 gals	
TANK I SAME 18,000 gals	000
TANK & SARVES 18,000 gals	000
ECONOMIZER ESTIMATES / 27,000 27	
FCONDOVIER FSTUDETEN / 27,000 21	
	7000
YW INLETS - OUTLETS PORT FINIT	
	· · · · · · · · · · · · · · · · · ·
	000
ANSI 150 Juna 16 x 8'	
	500
41×1 150 50mp 16" x 6"	
FRO PANE 16"x 10" MOLE 1 17500 17.	500
	500
PRYER (Bym) SIEVE + DESIGNAT	,
INITIAL PROPERT CIGAS 45,000 gd 0.35 15,	750
CHARGE + MAKE UP	
FEDERAL SALE: 7AX (\$1313,675) at 9% \$65,684	
	250
5/57en wr 1,658/18 W	
SUB-TOTAL /430	6,34/
CONTINGENCY @ 10 % 14 3	3,634
- 91 - TOTAL /579	7975

SYSTEM COST SUMMARY SYSTEM NO. 6 CHILLER FACILITIES

PAGE TOF

SYSTEM NO.	B CHILLER			PAGESSOF
ITEM	SUPPLIEZ	GUANTITY	UNIT FRICE	用メトログルーク
	FACILITY	WE GHTS		
	1B5.			
CHILLER	285,000			
CONDENSERS	660,000			
20/	<u> </u>			
STORAGE TANK	95,000			
210.0446 /4/01				
RECEIVER	40,000			
rescivere .	<del></del>			
ECONOMINE P	20.000			
ECONOMIZER	20,000			
S	27.000			
SCRUBBERS	27,000			
NOVE B	12 000			
DRYER	12,000			
PP- 04 - F	3 /			
PROPANE	206000			
	-/-			
PIPING, FITTINGS	3/3,118			
& VALVES				<u> </u>
	1150			
·	1,658,118 M	1	Tons (Long 7	ps )
		= 830 -	tons (show	Tono)
				· .
	•		SUB-TOTAL	
		CONTINGENC	Y @ %	
		- 92 -	TOTAL	
		<del></del>	<del></del>	

SYSTEM COST SUMMARY SYSTEM No. Fuel Gos Supply

PAGE / OF 9

SYSTEM NO				Page / of S
ITEM	SUPPLIER	QUANTITY	UNIT FRICE	EXTENSION
Fuel Gas 7	ie in & Pipi	00		
A"600 ANSI EFWN V		17	2000	4,000
1 bon ANST Check V.	, , , , , , , , , , , , , , , , , , , ,	Z	750	1500
J'sos" " RFWN Flac		4	47	188
7/8" x 7/2" stud	2/W "	16	2.60	12.
1" Gaskots	//	6	2.60	16
12" x 4" 5x h. 80 Tec	//	2	300	600
1"x1"x 4" Tec	//	1	1500	13
4"90 Ell. Sch. 60	//	6.	1600	3%
4.50.0. 1 0.237 1.1.7	insa IPSCO	170 Ft	563/6	957
D-1500 Pressure		2	100	200
2-4" Insulating A		2	#50	100
, 3			6-Jotal	77/7
		-22	o a vacc	7,17
V 1-10-		-011	12 //	
Lnock out War	p-Filter Seas-	F.6 Heatel -	Megulator 2	(a.) to
the Comp. Blo	ented and how	ised in a	5/dg, 20 X	25 outside
THE COMP. DIE				
Knockout Drum			7 00	72.000
Tw. Instrumentati			200000	2000.
	Crane			
4"600 ANST REVIN.		3	2550	6000
4 GOODNSI Fige. Re			2700	2700
2"600 AMST " "	1 1000 1000 1000 10000	″ /	1500	1500
Z'GOUNNSI R.F.W.N.			209	<u> 209</u>
4"600ANST REWN F	$V = C - G \cap C$ .			
	ge Supply	10	47	470
2 600 ANST " "	96 <u>Supply</u>	6	20	120
4" x1" x 4" Tec Set	96 Supply " 80 "			
4"x1"x1"Tec Sch. 4"90" ELL. Sch.	96 Supply " 1.80 " 80 "	6 3 6	1800	120
4"x1"x1"Tec 5ch. 4"90" ELL. Sch. 2"90" ELL. Sch.	9¢ 5upply " 1.80 " 80 "	6 3	20	120 24 96 26
4"x4"x4"Tec Sch. 4"90" ELL. Sch. 2"90" ELL. Sch. "E"x5/2" Bolls C/2	9¢ 5upply " 1.80 " 80 "	6 3 6	1800	120
4"x4"x4"Tec Sch. 4"90"ELL. Sch. 2"90"ELL. Sch. 2"5"x5/2" Bolls Cl	9¢ 5upply " 1.80 " 80 "	6 3 6 6	20	120 24 96 26
4"x4"x4"Tec Sch. 4"90"ELL. Sch. 2"90"ELL. Sch. 2"50"ELL. Sch. 3""x5"z" Boils Cl	96 Supply " 1.80 " 80 " 80 " W HX "	6 3 6 6 80	20 18 16 16 2.60	120 24 96 26
4"x4"x4"Tec Sch. 4"90"ELL. Sch. 2"90"ELL. Sch. 2"5"x5/2" Bolls Cl	96	6 3 6 6 80 48	20 18 16 6 2.160 1.25	120 96 36 7,08 12 176 11
4" x4" x 4" Tec Set. 4" 90" ELL. Seh. 2" 90" ELL. Seh. 2" 50 ELL. Seh. 3" x 51/2" Bolls Cl	96	6 3 6 6 80 48 10	20 18 16 6 2.60 1,25 2.60	120 24 96 26
4" x4" x 4" Tec Set. 4" 90" ELL. Seh. 2" 90" ELL. Seh. 2" 50 ELL. Seh. 3" x 51/2" Bolls Cl	96	6 3 6 6 80 48 10	20 18 " 16 " 2.60 1.25 2.60 1.85 SLIB-TOTAL	120 34 96 36 7,08 12 170 11

## SYSTEM COST SUMMARY SYSTEM No. Fact Bas Supply (Cont.)

PAGE OF 9

ITEM	SUPPLIER	QUANTITY	UNIT FRICE	EXTENSION
	Pipe IPSCO	150	1000/6	3410
2" x0.218" N.T.Br. 5.	Pipe "	100 + 10	2.14 /c	820
		dub.	dolar	14587
:				, , , , , , , , , , , , , , , , , , ,
Scrubbers	Peco	2	6,500	13,000
4w Instrumentation				
1"600 ANST REWN V.	Grane Supply	4	2,000	8,000
16 B.V. 2000 Serd E	1	2.	76.70	15400
1"B.U. 2000"	, ,, ,,	4	* 34 ~~	13600
2" 600 ANST R. V.	NGCO	1	1500	1580
1 600 " R.V.	"	2	750	150000
"14" Reducer	Crane Supply	4	15.00	60,00
9x2"	" "	/	6.50	6.50
3×2 "	" "	/	5.50	5.50
6 GOO ANSI REWN. F	ge. 11 11	4	107	428
g* " " " "	" 1	8	- 47	* 376
2" " " "	, ,	2	20	- 40
gika"ka" Tee Sch	40 "	5	18.00	9000
4 90° Ell. Sch. 40	, ,	4	7.90 -	32 00
1" 90° E11. Sch.40		12	4.00	18.00
1" Serd. Tee 30	00 1	4	3.90	1600
1" X 4 Sered Nple		12	2.19	1 2100
1/2 90 Serd. Ell.	000 " "	6	13.20	79
1/2 Serd. Tec 3	200 1 1	A	12.40	50
1/2 x 4" Send Nple.	och. 80 .	6	3.40	22
6" Gastels	11 -	4	× 3.00	1200
1" "	11	8	2.60	2100
2" "	11 1	2	1.85	# A 30
1"x 61/2" Studs 2	W VX " "	48	2.60	12500
7/E" x 5 1/2" " "	" "	64	2.60	16700
5/8" × 4" " "	,, ,,	16	1,25	500
	2 Pipe TPSCO	110	563/6	01900
3"0.0 x J 218" WT"	Pipe 11	30'	214/0	2000
			SUB-TOTAL	26 625
		CONTINGENC	Y @ %	
-		- 94 -	TOTAL	

<u>بر</u>

SYSTEM COST SUMMARY SYSTEM No Fuel Gas Supply (Cont.) PAGE 3 OF 9 SUPPLIER ITEM QUANTITY UNIT FRICE EXTENSION 1/2" 0.145" NT. Pipe Gr. B. IPSCO 100 291/c 1" x0.179 WT. Pipe " 3.5 0.0. x 0.216 WT Pipe " 50 "3000" Serd. Unian 6.J. Crane Supply 6.00 27,289 Sub- Total Indirect Heater % Instrumentation 12,000 2,000 500 8,000 2,000 376 4"600 Gaskets 600 ANSI E.U. ABCO "x 4" x 4" Tec 5ch. 40 "90 Ell. Sch. 40 90 Ell. Serd. 3000 F.S. XA Send Note Sch. 80 Pressure Ind. 00 lemp. Ind. "XO.179" WT P.P.C. Gr. B TPSCO 50 Tec Serd. 3000 F.S. 15 SUE-TOTAL CONTINGENCY @ - 95 -TOTAL

SYSTEM COST SUMMARY SYSTEM No. 1 600 Supply - Refrig. Turbine PAGE 4 0= 9

ITEM	SUPPLIER	QUANTITY	UNIT FRICE	アメノ川アルゴロノ
Pressure 1	Repulation a	ed Mile	Muns	
Clark D.J.	7 2 2			3501 Elda
"Frehandin Jac	Sparton	2	300	600
w 1 37 18 2 709				
2 Ficker Big Joe	//	2	300	60000
Sortice Spring 1.314	9			7 00
2" 300 ANST R.V.	<del></del>	/	750	750
2, 2000 Sand. B.V.	Crane Supply		95	1045
2 3000 Urean 6.		6.	15.20	9200
2" Sered Tee		7	19.65	138 00
2" 90° " EII.		4	18.69	7500
1"x1"x2" Tec Sch.		555	18	18
2"x 0.218 WT. Gr. B		250 F1.	214/c	535
0-1000 gang		4	100.00	40000
Temp. Ind.	, , ,		50.00	5000
12" X 2.035 W. T.	1 7	20	11/6	16
2"x 3" Nple Sch. 80		12	6.00	35 24
Misc. Connector		4	2500	25 ov
17/30.00/1/1000	1		25	
Piping Support	11. 1	1	10000	400.00
Thing Juppor	Jianas		700	
For Meler	Rockwell T-18		4,500	4,50000
1002 1100				
WA		Sub-Tol		9,303
	Plus	Sub-Tot	rgency	930
<u> </u>				
			<u> </u>	
		<u> </u>		
			SUB-TOTAL	
		CONTINGENC		
		- 96 -	TOTAL	

SYSTEM COST SUMMARY SYSTEM No. Fuel Gas Supply - C. B. Turbins

PAGE 5 OF 9

3,	CRITEM	SUPPLIER	QUANTITY	UNIT FRICE	EXTENS:OC
••	1 Freier 310-32		2,	1590	# = 400
	5" Firmmer	Crane	/	1000	(T)
	3" Check V.		/	50000	50000
	2 600 AME L'REWN.	B. V. 11	10	1200	12,000 00
	3" " " " Flo		22	* 32	704
	3 600 ANSI Gaske	/s n	24	* 2.00	- 4800
	3/4" x 4 4 5/4 80	12 511x "	176	1.20	210,00
	3"x3"x3" Weld Toe	Cetu40	10	15.30	153,00
	1"x3" Weld Red	<i>"</i>	/ .	93	9300
	3"x1" Swage Nple.	<i>p</i>	4	12.00	43.00
	3" 90° Ell. Sch. A	70 1	12	\$ 10.00.	120.00
	I" x A" Nple Serd.	5ch. 60	4	3.00	8.00
	"h" Note V.	^	4	6.00	24.00
	1/2" X 0.035 WT. To	bing "	20'	77/c	1600
	Misc Connect	075 "		2500	25
	0-1000 gauge	11	4	100	10000
	Tours. Ind.			5000	5000
	Piping Support	Stands	4	100.00	400.00
				•	
	3.50.D. x. 216 Wt. Gr. A		150Ft.	306/c	458
	Gas Meler	Rockwell 1.18	/	4 4,500	4.50000
	•				
			Sui	6-Total	23,257
			w/		
					·
				:	
				SUB-TOTAL	
į			CONTINGENC	y @ %	
			- 97 -	TOTAL	
•			<del></del>		· · · · · · · · · · · · · · · · · · ·

SYSTEM COST SUMMARY
SYSTEM No. Eucl Box Supply - Boiler & 25psig System of 9

ITEM	SUPPLIER	QUANTITY	UNIT FRICE	EXTENSION
	silers (Regu	ator & Meta	1	•
1 Ficher Sinche	Spartari		750	500
Toring 11622)9 1" Ficher 620	Sportan	2	9 125	250
10" or fice Dry 15				
2"300 ap152" R.V.	ABCO	1	750°° 95	2 750°
2 2000 serd P.V.	Crone Supply	11.	95	1045
"3000 Union 6.J.		6.	15.20	920
1"11" Swage Nple.		8	7.45	60
1"x2" Red Weld Tec			6.50	70
7" go Serd FIL. : 2" Serd. Tee 3	2000 F.S. 11	6	18.69	1120
0-1000 gouge		6	19.65	118.0
Temp. Ind.	,, ,,	7	*/00 *50	\$ 50.0
1/2 x0.035 NT		20	77/c	160
Misc. Connector			25.00	75.0
14" Needle V		4	6.00	24.00
•	ing state of the			
	•			
2" 2218 FV. B P.p		400	2/4/0	856
Troing Support	Stands	4	10000	400.0
Gas Meter	(etilete Gas)		120000	12000
	(etility bas)		, , , ,	72,55
		Sub	- Total	5905
				•
		<u> </u>		
		<u> </u>		
	<u>*</u>			
			SUB-TOTAL	
		CONTINGENC		
•		- 98 -	TOTAL	:

SYSTEM COST SUMMARY Super (25 paig System PAGE OF 9

ITEM	SUPPLIER	OLIANTITY	INIT PRICE	EXTENSION
		G(L)Al-(1)		
Boiler (Bo	ler (coons)			
2 Caker Tipe 320	1 Sparton	2,	55000	1100.00
10 3/6" or fice				
2" 2000 Seed. 2.1.	Crane	4	95	380 00
2" 3000 Union 6.J	Gord "	4	15,20	6190
7" " Serd. Tee	"	4	19.65	* 79°0
2" 90° " E1/3	v00** "	4	18.69	7500
2"x3" Nple Sch. 60	TBE	10:	2.92	3000
5"x0.218" fr. B	Pipe	20'	214/6	43
•		•		
Pipe Support	Stands	2	100	200
		Sub-	Total	196800
	A.	us 10% los	tingency	19700
	0	57	557.	108
			Total	227300
Skid mate	1101-16e	ams		
	~X iro	35		·
		er plate	1500	1500
		5% F5	1	75
		,	Total	1575
			1020	
***				
	<u> </u>			
				2
			<u> </u>	
			SUB-TOTAL	
		CONTINGENC		
<u> </u>		- 99 -		
			TOTAL	<u> </u>

SYSTEM COST SUMMARY

SYSTEM NO	FUEL GAS	SUPPLY - CH	LLED STATIO	NPAGE 80= 9
ITEM	SUPPLIER	QUANTITY	UNIT FRICE	EXTENSION
SUMMARY C	F MATERIA	L 6575	: ( CHI	LLED STATION)
1. TIE-IN &	YARD PIPING			7,7/7
2 PECILIAT O	O METER DI			
2 KEGULATOR	& METER BL	DG. :		
a) KNOCK DI	T DRUM A	EFFAR DIV	•	14,587
a) MOCK OF	T DROM A	BEHBLY		7,307
b) SCRUBBE	R ASSEMBLY			27,289
2 4 2 10 20 2 1	7/39 = : / / 2 /			21/20
C) GAS HE	ATER ASSEMBL	Y		23,111
	100-770			
d) GAS REG	ULATING & ME	TERINIG		
i) REFR	IG. TURRINE	•		9303
ii) C.L	TURBINE	Maria de la compansión de la compansión de la compansión de la compansión de la compansión de la compansión de	en de la companya de la companya de la companya de la companya de la companya de la companya de la companya de	23,257
••				
nii) GEA	ERATORS & BO	LERS		5,905
iv) B0	ILER			1,968
e) 5KID M	MATERIAL			1500
			5UBTOTAL	114,637
	•			
	SUBTOTAL :	1/4,637		
CONTIN	GENCY at 102:	11464		
	7.7AL:	* 126,101		
	WEIGHT ( + 207-0) +99	22000 L	w.c	
	(#29,700) at 9%			
Fire low	(# 96401) a15%	# 7.493	SUB-TOTAL	
	Total F.S. Tax	CONTINGENO		
		- 100 -	TOTAL	
		- 100 -		

SYSTEM NO	ST SUMMARY	S - NON-CHIL	LED STATIO	N PAGE 90=9
ITEM	SUPPLIER	BUANTITY	UNIT FRICE	川×十四乙 小 でして
			•	
SUMMARY DA	MATERIAL C	0575 : CA	VON- CHILLED	STATION)
			•	,
1 7/E-N &	YARD PIPING			77/7
2. REGULATOR	A METER BO	VILDING :	, 7	
				1 / /
a) KNOCK-OU	T DRUM ASSE	MBLY		14,587
// 600.00	0 400 - 01			27 289
b) JCKOBBE	R ASSEMBL	7		27,289
c) GAS HE	ATER ASSEMBL	LY		23,111
d) GAS REG	ULATING & MI	TERING :		
<u> </u>	B. TURBINE			23,257
ii) GEN	ERATORS & BOL	L <u>e</u> rs	,	5,905
	1-0			1968
iii) Bol	LER			7,00
e) SKID M	ATERIAI			1500
- <i>y</i> 3 <i>K</i> ( <i>p</i> ) ( <i>y</i>	TO BRIGHT		508707AL	105 334
-		. " .	) OB (8/A C	700,007
	SUBTOTAL:	105.334		
CONT	NGENCY at 10%	/0 533		
	T= TAL	<i>*115,8</i> 67		•
•				
	F. S. Tax 9 % =			
	F. S. Tax 9 % = F.S. Tax 570 =			
	F.S. Tap 570 =	4309		
		4309		
	F.S. Tap 570 =	4309		
	F.S. Tap 570 =	4309	SLB-TOTAL	
	F.S. Tap 570 =	4309		

SYSTEM COST SUMMARY SYSTEM NO 6- HEATING & VENTILATING SYSTEM - CHILLED STN PAGE 1 CT

ITEM	SUPPLIER	QUANTITY	UNIT FRICE	EXTENSION
HOT WATER BOILER	HYDROTHERM	6-MR2700	14,000	\$ 94,000
CIRCULATING PUMPS	S.A . ARMSTRONG	2- 15 HP	3600	7,200
		2- 7/2 40	1300	2,600
H.W. UNIT HEATERS	WESTERN AIL COND.	40		
- Gas Scrubbas Bilda		1		
- Stores Bldg				-
- Gas Comp. Bldg				•
- CHILLER Bldg			4	
- Propose Comp Bldg				•
- Utility Bldg				
- Workshop				
- Gen Room				
- Corridor	. "	West variety		
- F.G. Bldg			a y v.	
Wall Convectors	Western Ale Cons.			
- Utility Bldg		12.		
- Stores				
- Mcc Room		i la Hara		
- Control Room				_
- Office +1	•	•		
- Office # Z				-
- Inst. Lab				1
- Living Quarkis				
- Comm Bldg	**************************************	V		
3				60,000
or Conditioner				
- Control Room	LEIBERT	1	10,000	£ 10,000
				10,000
THYLENE GLYCOL	Harrison - Cross fields	1500 US Gal-	40¢/16	\$ 5,555
	STV35 TIE ID4	Care		
			1.4	169,355
			SUB-TOTAL	
		CONTINGENO		
		- 102 -	TOTAL	

SYSTEM COST SUMMARY
SYSTEM No. 6 HEATING & VENTILITING SYSTEM - CHILLED STATION DADE 2 ==

<del></del>	6 HEATING & VENTI			
ナミス	SUPPLIEZ	<b>プログノー・エク</b>	してい まるので	ピンピ アンドイド
STRAIGHT PIPES	ITT GRINNELL	<u> </u>		23080
TEE JOINIS	√1			16/20
REDUCERS	• 1			273
<u> </u>				
ELBOWS	~1			2,359
LIBONO		Ś		
FLANGES		U ·		956
L K / 11401CO	• •	OV		
BOLT - MILT SETS	• 1	5		720
BOLT + NUT SETS		<u> </u>		1 2 2
11.11-110	i v			932
UNIONS		2		, , , _
CIANT WALLE		0		14,108
GLORE VALVES	•			17,100
		<u>4</u>		9,/28
BALL VALVES	``			7,/20
				280
AUTO AIR VENT	4			200
				/
TEMP. INDICATOR				100
PRESSURE INDICATOR	6.7	<b>_</b> /		200
		<b> </b>		
NIPPLES	<u> </u>			3.864
				72,120
PIPE HANGERS				5,000
4 SUPPORTS				
			SUE-TOTAL	
		CONTINGENO	Y @ 3	<b>S</b>
		- 103 -	TOTA_	

SYSTEM COST SUMMARY
SYSTEM NO 6 HEATING & VENTILATING SYSTEM - CHILLED STATION

ITEM	SUPPLIER	ひにマアトコイン	UNIT FRICE	EXTEVE OV
F. 5	Tax (\$180,180) at 9%	# 16,216		
F. 5	Tax (# 90,943) at 5%	\$ 4547		
	Total	# 20,763		
	WEIGHT	915001	4 = 45 to	ius
			e e e e e e	
			1920 83.000	
			\$ 3 / 4 / 5	
		eg e etert a <b>x</b>	the water	
			and the second	
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		•		
4				
199				
			SLB-TOTAL	246475
		CNTINGENC	Y@ 10 %	24 648
		- 104 -		\$271.123

SYSTEM COST SUMMARY SYSTEM No. 6- Heating & Ventilating System - NON- CHILLED STN PAGE 1 OF

	E - HPATINA & VEMI	<u> </u>		PAGE / OF
ITEM	SUPPLIER	GUANTITY	UNIT FRICE	アメノ川乙のこの人
HOT WATER BOILER	HYDROTHERM	4-MR2400	13,000	\$52,000
CIRCULATING PUMPS	S.A ARMSTRONG	4-7/2 40	1300	5,200
H.W UNIT HEATERS	Western Air Cond.	22		\$ 35,000
Air Conditioner				
CONTROL ROSM	LEIGERT		10000	10,000
ETHYLENE GLYCOL	HARRISON - CROSS FIELDS	1200 US Gal.	. 404/14	4444
			÷	
STRAIGHT PIPES	ITT GRINNELL			14,407
		7		
TEE JOINTS	• • • • • • • • • • • • • • • • • • •		•	3 <i>8</i> 00
REDUCERS	• •		1 8 7	116
ELBONS	<b>U</b> j	d)		1,481
		[ N ]	A. S. Carlotte	
FLANGES				560
BOLTH NUT SETS	• ,	Ь		460
		o o		, ,
(INIONS	• 1	o	- :	580
		4		
GLOBE VALVES	Un.	>		8,996
		ſ		
BALL VALVES	<b>.</b>			5865
AUTO AIR VENT				200
		(		
TEMP. INDICATOR		\\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \		100
PRESSURE INDIVITOR		Ä		200
			SUB-TOTAL	
		CONTINGENO	y @ %	
		- 105 -	TOTAL	
			<del></del>	· · · · · · · · · · · · · · · · · · ·

### SYSTEM COST SUMMARY

SYSTEM NO. \_\_\_\_\_ PAGE OF

SYSTEM N	<u> </u>	<u> </u>		27GE 35
ITEM	SUPPLIER	ロロレアー・エイ	コルバー デマイクミ	エメーロン ゆく
NIPPLES				2499
HANGERS & SUPPOR	2 5			3000
FS.	Tax (#112,420) at 9%.	# 10,118		
F. S. 7	Tax (# 51,379) at 5%	<b>\$</b> 2.569		
	Total	# 12,687		
	WEIGHT	58,7001	2 30 tow	
•				
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		1		
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•				
	,			
		·		
			1	
				148900
		CONTINGENC		
	1.	- 106 -	TOTA	\$163.799

SYSTEM COST SUMMARY

SYSTEM NO. 6 - FIRE AND GAS DETECTION - CHILLED STATION PAGE 1 0= 2

ITEM	SUPPLIER	GUANTITY	UNIT FRICE	EXTENSION
DETECTION DEVICES	LEVITT- SAFETY			\$ 56,690
(UV sensors, gas				
detection thermistors,			1.0	
ionization othermal				
detectors)				
Central Control Panel	LEWITT- SAFETY	1		22,500
			•	
Halon 1301 systems	LEVITY SAFETY	3		29.120
for MCC room Control				
Room & Communication				
BLDG				
			•	
Portable Angul	LEVITY SAFETY	1		31,500
wheeled units				
and hand extinguis	hers			
6				
Halon 1301 syskin	LEVITT SAFETY			38,000
for Compressor Bldg				
Halon 1301 system	LEVITY SAFETY	1		49,000
for Propune Comp. Bldg				
7		. :		
Halon 1301 system	LEVITT SAFETY	1		15,620
for Ekr. Gen Room				•
Gas detection for	LEVITT SAFETY			12,000
area around prepare				
condensers				
ANSUL SK3000 dry	LEVITT SAFETY			40,000
Chemical for helicophe			•	
pod				-
the second second				,
	•		SUB-TOTAL	
		CONTINGENC	Y@ %	
		- 107 -	TOTAL	
			<del></del>	

SYSTEM COST SUMMARY SYSTEM NO. 6 - FILE HAS GOS DETECTION - NON-CHILLED STATION

PAGE 1 DE

TEM	SUPPLIER	GLIANTITY	UNIT FRICE	EXTENSION
, , , , , , , , , , , , , , , , , , , ,		GUART	2.4.1 1 14.6.2	
ALL STEMS ARE	AS PER THUSE A	OR A CHILLET	STATION W	174
THE FOLLOWING	EXCEPTIONS			
DELETE				
Gas detection for	LEVITT-SAFETY		3	(22,000)
area around propane	ì			1201,000
condensers a chille	7 510 9			
Halon 1301 system for	LEVITT-SAFETY			(49,000)
Propane Comp Bldg				
7				
Gas & thermal detec	han			(33,000)
devices in propane				
comp bldg	· :	<u>'</u>		
0				
ENGINEERING BY			10%	(10,400)
LEVITT - SAFETY for			1010	(0,400)
above	,			
2000 E				,
2				
Pupe values + fittings				(6600)
to install above				
			Sub- Total	(\$ 121,000)
			deletions	
			CHILLED STN	352,873
			090cm+	
			NOW- CHILLED STA	\$ 227 873-
			0% Const	
FST @ 9% =	22 000			
r 31 · ω 7 /0 =	22,559			
	000			
SYSTEM WEIGHT =	25,000#			<b>*</b>
				\$ 231,873 €
		CONTINGENO	Y@ 10 %	03,10/
		- 109 -	TOTAL	\$ 255,060

### SYSTEM COST SUMMARY

_		
SYSTEM	NO. 6- FILE AND GAS DETECTION . NON. CHILLED STATION	

PAGE 1 OF 1

TEM  ALL ITEMS ARE A  THE FOLLOWING E  DELETE:	S PER THOSE F		UNIT FRICE	
THE FOLLOWING E		OR A CHILLET	5 74 7.0 N W	174
	ACEPTIONS		· J	
DELETE:				
			· .	
Gas detection for	LENTT-SAFETY			(22,000)
area around propane			·	
condensers a chiller	blda			
	-3			
Halon 1301 system for	LEVITT-SAFETY			(49,000)
Propane Comp Bldg				
1				
Gas & thermal detect	<i>0</i> -0		,	(33,000)
devices in propone				
comp bldg				· · · · · · · · · · · · · · · · · · ·
0				
ENGINEERING BY		a a ve	10%	(10,400)
LEVITT - SAFETY for				
above		* * * * * * * * * * * * * * * * * * * *		
				· ·
Pupe values + fittings		•		(6600)
to install above		· ·		
			Sub- Total	(\$ 121,000)
			de le tions	-
		· ·		
			CHILLED STN	352.873
	· · · · · · · · · · · · · · · · · · ·		090cm+	
			NOW- CHILLED STAY	\$ 227.873-7
			0% Const	
FST @ 9% =	22.559			
SYSTEM WEIGHT =	25,000#			
			SLB-TOTAL	\$ 231,873 €
	-	CONTINGENO		) · ·
		- 109 -	TOTAL	\$ 255,060

### SYSTEM COST SUMMARY

SYSTEM NO.

PAGE 20=2

SYSTEM NO.		·		PAGE 205 d
TEM	SUPPLIEZ	GUANTITY	UNIT FRICE	リクロがクロト大型
ENGINEERING BY			10%	29,443
LEVITT SAFETY				
Pipe, Values and				25.000
Fittings Con				
installation				
		/		
HANGERS + SUPPORTS				4,000
· .				
<u> </u>				
	· · · · · · · · · · · · · · · · · · ·			
			, , , , , , , , , , , , , , , , , , ,	
			-	
FST @ 9% =	34,538			
SYSTEM WEIGHT =	40,000#			
	*		SUB-TOTAL	\$ 352,873
		CONTINGENC	Y@ 10 %	35 287
		- 108 -	TOTAL	\$388,160

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U	D

DOD1-1 13SEP76

### Dillingham Corporation Canada Ltd. ESTIMATE COST SHEET

Project Football - Demptor	Estimate No.
	Date
Description Otter Major Systems (Chinic System)	Sheet No of _2

	Description of Work	Unit	Quantity	Hours	Labour	Equipment	Materials	Subcontracts	Job Supplies	Total Cost
	Cas Chilles 3ta	Hs	315000	450	1600		by cou			
		<u> </u>								
_										
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<u></u>	Propane Pipe Syptem		8000	V   AVV			╉╼╼╾ <b>╀┼╢</b> ╏╏╏	<del>1                                   </del>	<b>1</b>	
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	18m 90s	lba	7119070	16 100	751 600					757 600

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# Dillingham Corporation Canada Ltd. ESTIMATE COST SHEET

Project Footfills - Dempter	Estimate No.
Item No.	Date
Description Other Matin System. Miss	Sheet No. 2 of 2

	Description of Work	Unit		Que	anti	ly		Ho	PUIS	3	T	-	Lab	our	•	Τ	Eq	uipr	nen	t		Ma	teri	ials		Su	bco	ntra	cts	J	ob s	Supi	olies	T	To	tal	Cost	
	Cas Haters	Es	П	T	П	12	10	Ţ	П	20	٦,	(PO)	П	7	20	+	Ť	П	П	Π	40			10			П		П	╁	\   	TT		-	-TT	77		
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<u> </u>	Heating and Vantilation	16		П	TIE	ь	1.0	71	ij	60	. 1	روقي	††	الاد	90	,	+	+	Н	+	70E	╫	╁	4			H	╫	╁┼	├	+	++	Н	+-	$\dashv \downarrow$	##		
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#### DEMPSTER HIGHWAY COMPRESSOR STATION

#### III-7 UTILITIES

#### III-7.1 WATER SYSTEM

The supply of raw and potable water in permafrost areas is highly variable. From published information it appears that the most likely sources would be from lakes or rivers, or from sand and gravel aquifers normally found under large lakes and rivers. Ground water supplies from below the permafrost generally have higher iron and dissolved solids concentrations. Water treatment is estimated to require coagulation, sedimentation, filtration, iron removal and chlorination, and in addition to facilitate treatment the water should be heated to about  $60^{\circ}$ F. For this reason and others, all water storage and treating will be carried out in a heated building. The treating plant will generally be operated on a "batch" basis to maintain sufficient supply in the potable water storage tank. A pneumatic pressure tank is also provided on the potable water supply line.

Both raw and potable water were provided to the living quarters, the storage building and the shop and office building. The raw water supply would be suitable for "Black Water" service and industrial use.

The estimated water requirements were assessed as 60 gallons per man per day. At peak usage this would be 480 barrels per month. On this basis a 500-barrel galvanized cone bottom storage tank was provided. The vacuum sewage system detailed in Section 7.2 was estimated to reduce the water requirements by about 50 percent; however, in order to provide for washing down vehicles, equipment and floors, the storage capacity of 500 barrels was assessed to be reasonable.

#### III-7.2 SEWAGE SYSTEM

#### III-7.2.1 GENERAL

This estimate provides for a vacuum sewage system at each compressor station as quoted by Vacusan. They have presented two (2) alternative methods of collecting the sewage and seven (7) options for disposing of it. Please refer to the Vacusan quotation dated January 12, 1979, Exhibit 5, for specific details.

For this estimate we have chosen the Vacusan system which would collect the black water (toilets and urinals) and grey water (showers, hand basins, etc.) in one common 2" pipe and conduct it to a 600-gallon collection tank prior to disposal. The method of disposal provided in this estimate is to incinerate both the black and grey waters. This, we feel, is the cleanest and safest method from an environmental point of view. It also means that disposal of all sewage can take place on-site and does not rely on hauling to an off-site location and negates the need for a sewage lagoon.

The other options available for collection and disposal of sewage are detailed within the Vacusan quotation and a comparison of costs is outlined in the backup material contained in this section.

#### III-7.2.2 DESCRIPTION

The vacuum sewage system basically comprises a liquid ring vacuum pump, collection tank, interconnecting piping and vacuum toilets. Other fixtures such as urinals, sinks, dishwasher, showers, etc., are easily connected to the system and have been provided in this estimate.

A major benefit in using a vacuum system is the reduction in water usage of approximately 50% over a conventional system. Another benefit is that the collection piping can be run irrespective of gravity and hence

can be installed out of the way in the upper reaches of utilidors and other buildings.

#### III-7.3 FLARE SYSTEM

The estimate for the flare system was based on a tapered gathering line, starting near the propane condensers on overhead supports, running through the propane compressor building, chiller building and gas compressor building, around the communications building to the incinerator pad. The line starts at 4", increases to 6" and finally reaches 8" diameter. The pipe costs were based on minus (-) 50°F specification Grade 35 pipe. Fittings were estimated on a similar quality material.

Pipe supports were included for the runs between buildings and for the run from the compressor building to the flare stack. A 2" fuel gas supply line was run from the gas compressor building to the flare stack and a purge gas line from the propane compressor building to the beginning of the flare line.

The flare stack cost was estimated using an 8" diameter supported stack, 50 feet in height, a refractory lined stainless steel tip, 2 concentric sets of wind deflectors, a flow sensor, automatic ignitor panel, pilot ignitor (2), fuel gas regulating station, stack fuel gas line brackets and 2 pilots.

Tax was calculated at the appropriate rate as previously noted and freight to Edmonton was included.

#### III-7.4 EMERGENCY FUEL

Emergency fuel storage has been provided for the standby diesel generator and gasoline storage has also been provided at each station site for utilization by operations and maintenance crews for both the pipeline and stations.

Diesel fuel storage was sized based on the generator size at each of the chilled and non-chilled stations with the approach taken that storage had to last over one winter in case of substantial requirements on the diesel standby unit. Continuous operation over the entire winter is not anticipated.

All tankage is placed on insulated pads within a dyked area. A transfer system is provided to move the diesel fuel to the standby generators at each station.

### COST SUMMARY (UTILITIES)

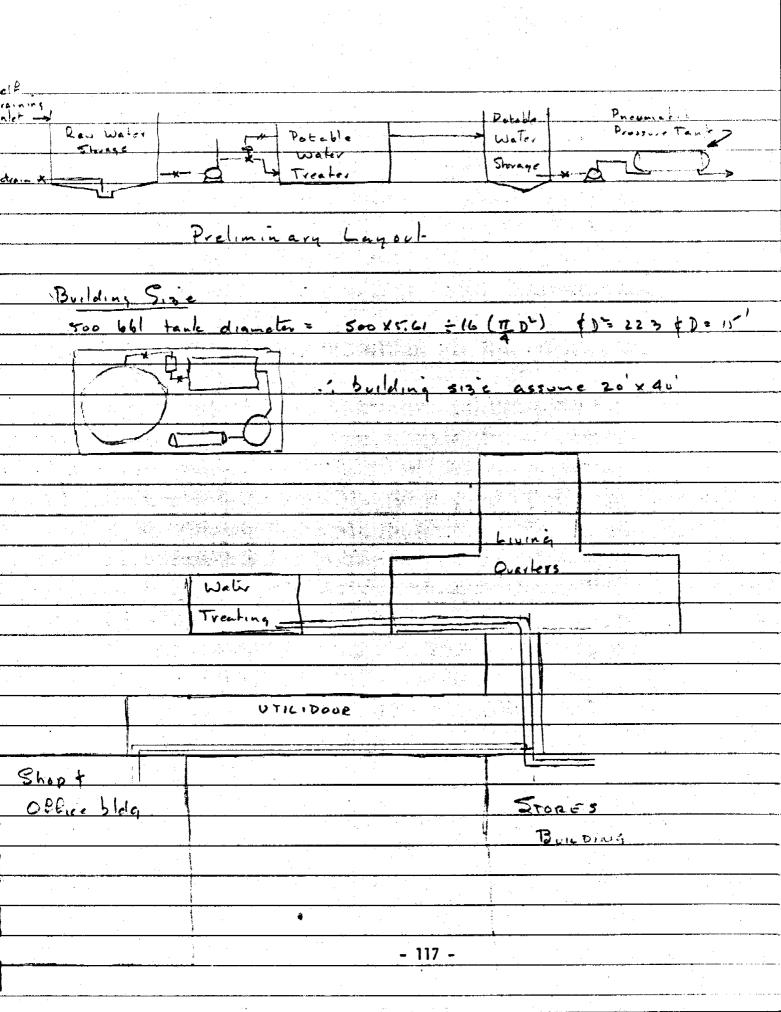
	Chilled		Non-Chilled
Materials	\$255,000		\$228,000
Installation	89,000	· ·	89,000
Total	\$344,000		\$317,000

Estimated Weight of Materials ex Edmonton	139,000 lbs.	122,000 lbs.
Federal Sales Tax Estimate	\$ 15,100	\$ 13,400

### SYSTEM COST SUMMARY SYSTEM NO. WATER TOTAL

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ITEM	SUPPLIER	GUAN"ITY	UNIT FRICE	アクルアルト大田
PAIN MATER STO	CE THAIL DE NA		\$ 11	(3
Possey Mary	TRIBER TIGHT		15 0 = 0	18000
POTABLE WILLTON		•	3 - 7±15 €	
POTRALL WATE	Pressure TANK	1	<u>)</u>	
RAND WALL D.	TOR	1	1505	11.12
DOTABLE MAY	Pump & Moron	,	950	
Pressure Built	2) (~)	2	7.1	150
WATER METER	5(2)	2_	Zro	500
24 PIRE GALVAVII	300	750	4 00/ P	3000
I" PIPE GALUAN		600	25c + :	1500
1" PIDE CORDER		400	16: A	1,14
Vz" PIPE COPPER		600	1000 Ct	600
Mine Covolings +	Shen Hanners	Lot	e de la companya de l	1575
Victors 2" Bron	, 5,	1	85	127/-
VALUES I"	Ser	12	70	600
Marches 11 Sook		24	18	432
Mariner 1/2" Soc	- e F	24_	8	192
Toos Elbows Ca	as nigolei etc	Lor		350
Figure				
Shower - rella		4	140	300
Hat water heaters		3	300	900
Hand Bares		7	71	525
Forest Air Finner		2_	11-00	<b>3</b> 00 %
Kirler Sink		1	1150	15.0
Polamic		•	. ಕಿಲ್	3e ·
Lucitar			Y 0 2	£"25-
Dryer		1	₹ 3	<b>4</b> ***
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And bothroom Co.	ator Marces Divideda	ke lot	7000	2 - 2 - 4 - 4
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		- 116 -	TOTAL	61600



SYSTEM COST SUMMARY
SYSTEM NO. 7 - Sewage System - CHILLED & UNCHILLED STNS.
PAGE 1 OF 2

ITEM	SUPPLIER	GUANTITY	UNIT FRICE	EXTENSION
54	PUL & GREY WATER	C IN ONE PI	TE (This one	tor the
				est, mate)
600 gal Collector Tax	Vacusan			
2HP Vacuum Pump	*	/	<del>                                     </del>	
Sorvice Liquid Tank	••			
2 HP DISCH PUMP	11	1		\$ 17,000
Control Panel	"			
Elec. Equipment	4			
Vacuum Toilets	<b>#</b>	. 5		
Interface Valves	.11	6		
100% standby vocuum 2	mp "	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		2,400
100% standby disch. pun	,		er kan de	3,800
			TOTAL	\$23,200
		12.00		
	DISPOSAL	OPTIONS	AL PERSON IN	
a) Discharge from co	lecting tancs to		nasti dina periodi	
truck . haul to o	cisting savage facil		A September 1981 - 1982	
	00 gal holding to		the state of the section of	3,000
- addnil p	ping			1,000
				\$ 4,000
b) Discharge to so	مرم ا مورم		e in grading and a	
- addn'l p	ona			\$ 4,000
		7 7 9 9		7,000
c) Discharge from co	lecture terms to	•		
an incinerator	•	1		\$40,000
- addn'l pu				1,000
	J			\$ 41,000
d) Discharge to a	small treatment			
	spose in river, etc	1		9,000
	Pina			1,000
	7			\$10,000
		<del> </del>		
	***************************************		SUB-TOTAL	
		CONTINGENC		
		- 118 -	TOTAL	
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### SYSTEM COST SUMMARY SYSTEM NO.\_\_\_\_\_

PAGE 20=2

ITEM	SUPPLIER	GUANTITY	UNIT FRICE	EXTENSIO
Urnals	Crane	2	400	800
2" ABS PIDE		1000'	\$400/ft	4000
1/2" ABS P.OE		100	300/ft	30 <i>o</i>
2-1/2" ABS Fittings		1 407		2000
				\$ 7,100
4				
Vac. vac System	AND DISPOSAL a)	94 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -		\$34,300
Vacoom 373 Feet	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			
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	_	ST SLIMMARY		UNCHILLED STN.	S PAGE / OF 2
ITEM		SUPPLIER	GUANTITY	UNIT FRICE	EXTENSION
	BZ	ACK & GREY WAT	er collecte!	SEPARA TELY	

ITEM	SUPPLIER	GUANTITY	UNIT FRICE	EXTEN®IOU
84	ACK & GREY WAT	R COLLECTED	SEPARA TELY	
BLACK WATER				
300 gal Collection Tone	Vacusan			
1 HP Vacuum Pump	a.			
Service Liquis Tank	II.	1 .		
2 HP DISCH PUMP	•	10000		\$14,000
Control Panel	1/			
Elec. Eaup.	H			
VACUUM TOILETS	•1	క		
Interface Value	h	1		
		e etyteis in		
100% Stadby vacuum Pu	~p	er ed 📗 ræe 🔒		2,000
100% " disch. pun	o **		A STATE OF THE STA	3,800
				\$ 19,800
GREY WATER				
500 gal Collection Ten	64			
2HP Vacuum Pump		1		· ·
Service Liquis Tank			, 1881 The	
2 HP DISCH. PUMP			1.00 (200)	14,000
Interface Value	e e e e e e e e e e e e e e e e e e e	4		
Control Panel			)	
Elec. Equip.	) . <b>H</b>			
				<u>_</u>
100% Standy vacuum		<u> </u>		2400
100% " disch. pun	<i>o</i> "		<u> </u>	3800
		2 8		\$20,200
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BLACK & GREY WAS	EL TOTAL			\$ 40,000
	DISPO	SAL OPTIONS		
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, ,	slack water tak to semage facility	'	<b>)</b>	\$ 8,000
water to some		Discharge gray		
holding take of m	7	320	SUB-TOTAL	
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		- 120 -	TOTAL	

### SYSTEM COST SUMMARY

SYSTEM NO. PAGE 2 OF 2

				PAGEA OF
ITEM	SUPPLIER	QUANTITY	UNIT FRICE	EXTENSION
b) Discharge from	black water to	e to the		
•	Discharge grey w			
	r GE Incineration			40.000
	man to lagoon			5,000
				\$ 45,000
c) Discharge from	black water tak	40 an		
	change from gray u		2 - 2	
	lant for recycling		•	
	water can be re			
most non-potal	le uses such as	Plushing		
· ·	shing vehicles, et			
	k 5-20 treatment			9,000
- Sand f	1		gilen Kalanda Peru	5,000
- addn'l		e to the following		1,000
- Incinar			t de grand	40,000
	water storage ap	essure system	4.7 . 41	20,000
		ું કે અહ્યું માં કે કું કમાં		\$ 75,000
10 Sec. 142 (10 Sec. 144)			Succession (Succession Control of Succession	
Urinals	Crane	4-12 12 12 12 12 12 12 12 12 12 12 12 12 1	400	800
2" ABS Pipe		2000'	400/ft	8000
1/2" ABS P.PE		200'	300/ft	600
2-1/2 ABS Fillings		1107		4000
				13,400
Vacuum System And	DISPOSAL a)			\$ 61,400
** **	., Р)			98,400
, , , , , , , , , , , , , , , , , , ,	" c)			128,400
NOTE: DISA	DSAL b) would pr	obably be the		
	overall from the	, ,		
	I	+ of view		
	•			· · ·
FST @ 5% = \$5	412		SUB-TOTAL	98,400
SYSTEM WEIGHT =	1	CONTINGENO	Y@ 10 %	
		B Edmonton	TOTAL	108,240
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SYSTEM COST SUMMARY SYSTEM NO. FLARE SySTEM - CHILLED STATION

PAGE 1 0= 1

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	ITEM	SUPPLIER	GUANTITY	unit price	EXTENSIOC
	(-50) 24 Pipe	Ipsco	700 Kz	5=18+	# 3 100
	" 4" Pipe	И	625 Fr	800 /P+	500
	" 6" Pine	K	200 /4	1100/6-	2200
	" o" Pice		Sookt	1500/fx	7500
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20)	3"LR 45" Elle		3	60	180
	3" X8" X4" Tres		2	120	240
	8"YL" Reducer			75	75
	6"x6"x4" Tee		2	7	134
	6"x4" Reducer		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	44	44
	4"x4"x4" Tees		12	30	360
	44LR 90° E115		6	20	120
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		nsor, autoumat			
	ienitors ah	el gas regulation	station Pu	el gas line	
		ck ots , 2 pilat			19500
	Purge gas li	ne for Place			3000
	Pine strais a.	a hangers int	de building		4000
	Subtotal Mah	ria			54853
			Round of	PP to	55 000
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		eight weight d	3000 165		
		dmonton Incl	i	Himale	
				SUB-TOTAL	55,000
			CONTINGENC	Y@ 10 %	5,500
			- 122 -	TOTAL	60,500

# CANUCK ENGINEERING LTD. CALCULATION SHEET

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## CANUCK ENGINEERING LTD. CALCULATION SHEET

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SYSTEM COST SUMMARY

_	SI SUMMAR		D STATION	PAGE OF
ITEM	SUPPLIER	SUANTITY	UNIT FRICE	<b>ルメドロノリアメリ</b>
2" DIDE	IPSCO	450 Pt	5-/8+	2250
4 PINE	,	150 ==	8=F+	1200
6 DIDE	•	0 0 0 1	11 = PL	1100
8" DIOE-		500 Pr	1500 64	7500
		the second of		
B"LR 47"EI	Tube Turns	3	60	180
8"x8"x4" Taes		2	120	240
8"x6" Roducers	· ·		75	717
6" x 6" X4" Tees		2	67	134
6"YA" Reducer	. i	1	44	44
AVAXA" Tees		3	30	90
A" LR 90°EIS		4	20	80
	3.50		1 1 1 2 1 2 1 1 T	
To sunoly ma	terial for 5000	nt racks	behaven but	dings
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	E 20 SUMPALS O			6000
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		. Proposition		
To supply a	Place stack 8	"od sunpe	charl 50 Real	in height
	2 sets wind de			
ignitor pane	1, 2 pilot igni	Tor Ruel	ags regular	fine, Rel
gas line on s	lack brackets	and 2 pilo	45	19500
·	<u> </u>			
Purge Carlo	ine for flace			1500
Pive Swaps a	nd hangers			2000
Sub Total M	atorial			41893
		Round	off to	42 000
Sales Tax E	stimate 2900	-		
Estimated R	14lt weight 37	000 lbs		
	<u> </u>		SUB-TOTAL	42000
		CONTINGENC	Y @ 10 %	AZOO
		- 125 -	TOTAL	46200

SYSTEM COST SUMMARY
SYSTEM NO - FLEL STORAGE (CHILLED STA)

PAGE / 0= /

SYSTEM NO.	SUPPLIEZ	QUANTITY		EXTEVSION
				29,100
500 BEL TANK.	NATIONAL TANK	Process of the Control of the Contro	Sollaten: corp	•
2" PIPINS, (DIESEL)		500 FT	8/FT installed	<u> </u>
2" FTGS (-)		LoT		1,200
Pume ( )		lonet	500 installed	<u>500</u>
SUPER TANK (-)		10024	1,000 installed	1,000
GAS PUMP YW PIPING		LOT.	1,500 installed	
12" CULVERTS.		600 FT.	4/PET installed	2, 400
PIT RUN FILL		600 45	15/40 placed	9,000
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Federal Sales	Tex Estimate	- \$ 3,000.00		
Estimated 6	reight -	30,000#		
	•			
			SLB-TOTAL	48 700
		CONTINGENC	Y@ 10 %	1 - 1
		- 126 -	TOTAL	52,500

SYSTEM COST SUMMARY

ITEM	SUPPLIER	いことで!」コン	LAIT FRICE	リンリのアルドスは
500 BAL TANK	NATIONAL TANK	2014	9,800 installed	19,600
2" PIPING (DIRSE)		Too FT.	8/17	4,500
2" FTGS. ( - )		LOT.	<del></del>	1, 200
Pump (-)		lower	500 installed	
SURGE TANK (-)		JONEY	7,000	1,000
Sas Pump & PIPING		LoT	1,500	1, 500
12" CLUBETS		400 FT.	"4/FT ~	1,600
PIT RUN FILL		450 405	15/40 placed	6,700
		, 204 (1) (1)		
4 <sub>0</sub> (4)				
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		Programme Department	a Parket in the	
			A PARAMETER	
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•				
FEDERAL SALES	TAX ESTIMATE	2/00.00		
EST'O WAR		21,000 #		
			SUB-TOTAL	36,100
		CONTINGENC	Y@ 10 %	

## CANUCK ENGINEERING LTD. CALCULATION SHEET

5 for 5 for 150 kew (200 kp) 12 g = 2 kg  (lang 5 50 BBC TANK (Quite from I 5)  i) Chilled 5 fr = 500 = 7 day is the 1- c	(200) 500 BBC TANK (Quite from Is)  i) Chillsof Str = 500 = 7 day - Unix-500 BBC    National Tank    High 500 BBC (3300 + 2200 BBC)    High 500 BBC (3300 + 2200 BBC)    High 500 BBC (3300 + 2200 BBC)    High 500 BBC (3300 + 2) × 50/day    High 500 BBC (3500 + 2) × 50/day    High 500 BBC (3500 + 2) × 50/day    High 500 BBC (3500 + 2) × 50/day    High 500 BBC (3500 + 2) × 50/day    High 500 BBC (3500 + 2) × 50/day    High 500 BBC (500	Date .							<b>5</b> ⊀	· · · ·		<u> </u>		<del></del>	50	!		į	†	o ん		<b>)</b>					/w .	
(Song 500 BBC TANK County from Is)  i) Chilly 5th = 500 = 7 day " Uni -500  ii) Std 5th = 500 = 7 day " Uni -500  National Tank  High 500 BB (300 + 2,200 gent) & Nisku,  High 500 BB (300 + 2) × 50/day  Transl Taylor  500 M of 2" + Day Tourk + Pame  2" @ 5/er (-50°F) cm Field  14 6 7 5 = 13 44 (Field)	(200) 500 BBC TANK (Quite from Is)  i) Chillsof Str = 500 = 7 day - Unix-500 BBC    National Tank    High 500 BBC (3300 + 2200 BBC)    High 500 BBC (3300 + 2200 BBC)    High 500 BBC (3300 + 2200 BBC)    High 500 BBC (3300 + 2) × 50/day    High 500 BBC (3500 + 2) × 50/day    High 500 BBC (3500 + 2) × 50/day    High 500 BBC (3500 + 2) × 50/day    High 500 BBC (3500 + 2) × 50/day    High 500 BBC (3500 + 2) × 50/day    High 500 BBC (500		-			1	<u> </u>	ļ	<u> </u>			-	ļ	ļ -				-	<u> </u>		_	ļ	=	8	w,	2/	/ =	13
(Child she = \frac{50}{19} - 26 day = \frac{1}{2} \text{Use 1-500}  i) Child she = \frac{50}{19} - 26 day = \frac{1}{2} \text{Use 1-500}  Stol she = \frac{500}{19} = 7 day = \text{Use 1-6}  National Tank  High 500 88. (6300 + 2 200 5000 0 Nisker,  Hasale (x 3 days + 2) x 50/day  - Tropali = @ 150x 4 =   500 // Gst  - Tropali = @ 150x 4 =   500 // Gst  - Tropali = @ 150x 4 =   500 // Gst  - Tropali = @ 150x 4 =   - Tro	(12 - 15 500 BBL TANK CONSTRUCTION IS )  i) Chilled 5th = \frac{50}{10} = 26 damp = 5. Uhr 1-500 B  ii) Chilled 5th = \frac{500}{10} = 7 damp = 1. Uhr 1-500 B  National Tents  Vight 500 BBL (3300 + 2200 BERN WISHMAN  Hasale (x300mp + 2) x 50/Jay  + Transpir = Box 4 = 500/Jay  + Transpir = Box 4 = 500/Jay  500 M of 2" + Dag Tourk + Pame.			5 <del>1</del> 0	/_		'	<b>5</b> f					-	1	50	<u>ر د</u>	24	<u>د</u>	(2	י סי	4	<u> </u>			1	1 -	1	
i) Chilly 5/n = 500 = 71 day is the 1-  National Tank  'High 500 88. (3300 + 2,200 @ Niske,  Transle (x 3 days + 2) × 50/day  Transl	i) Chillsof 5tm = \frac{500}{19} = 26 down = \frac{1}{2} Uhe 1 - 500 0  National Tonk  High 500 00 L (350 + 2, 200 00 Nisku, AL  Hasale (x 3 down + 2) x 50/down  Thompson = \frac{500}{10} \frac{1}{2} \tag{500} \tag{4} = \frac{1}{2} \tag{500} \tag{500} \tag{7} \t							-	-	ļ				-											_ =	E 7	, <i>B/</i> 2	>.
i) chilled str = \frac{500}{100} = \frac{7}{100} \frac{1}{100}  Chillsof 5tm = \frac{500}{19} = 26 down = \frac{1}{2} Uhe 1 - 500 0  National Tonk  High 500 00 L (350 + 2, 200 00 Nisku, AL  Hasale (x 3 down + 2) x 50/down  Thompson = \frac{500}{10} \frac{1}{2} \tag{500} \tag{4} = \frac{1}{2} \tag{500} \tag{500} \tag{7} \t			11	2			~	100	Re		<b> </b>	<u> </u>	<u> </u>	/	Φ-	4	,	6		7	<u>ح</u> \			,				
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National Tank  High 500 88. (300 + 2,200 @ Nisker,  Hasale (x Borap + 2) x 50/day  Transit (ast - 2) x 50/day  Fill Gst - 2	National Tank  High 500 88. (300 + 2,200 @ Nisku, A.  Hasale (x3 days + 2) x 50/day  Transition @ 50x 4 =  500 M of 2" + Day Tank + Pare.		:			7								1														
High 500 88. (300 + 2200 @ Nisku,  4( acaple (x 3 days + 2) x 50/day  Trought @ 50x 4 =  500 M of 2" + Day Tank + Pame.	High 500 88. (300 + 2200 @ Nisku, AL  Hacale (x30mp + 2) x 50/day  Trough @ 50x 4 =  500 AB of 2" + Day Toute + Pame.					<u>(1)</u>		\$+	d	<	An		•	5	<u> </u>	=		ר		احا	<b>~</b>		٥	L	ا		ــــ	
High 500 88. (300 + 2,200 @ Nisku,  41 georgle (x 3 olimp + 2) x 50/day  Trought @ 50x 4 =  500 / 6 of 2" + Day Tonk + Pame.	High 500 88. (300 + 2200 @ Nisku, AL  Hacale (x30mp + 2) x 50/day  Trough @ 50x 4 =  500 AB of 2" + Day Toute + Pame.												1										·					:
Hasale (x 3 days + 2) x 50/day  Trong t' @ 50x 4 =  Fill 654 -  Mark Taylor.  500 pl of 2" + Day Taylor.  2" @ 5/FT (-55°F)	Hande (x 3 olimp + 2) x 50/Jay  Trong 1 - 2 - 50x 4 =				Va	rk	<u>.</u>	L	-	τ,	-	太						77.0			ļ							-
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500 ps of 2" + Dog Tank + Pore.	500 Al of 2" + Day Tonk + Pare.  2" @ 5/FT (-50°F)							44	g.	le		X	Bo	Long	<b>-</b>	-	2	)_	*****		O,	J.	y		-			
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500 pt of 2" + Day Tank + Pane.  2" @ 5/=7 (-50°F)	500 RB of 2" + Day Tank + Pane.  2" @ 5/ET (-50°F)				_ <b></b>	2 'د	/_	a	5 Y	m	de	4 7		<u></u>					15		-			-				
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D001-1 138EP76

# Dillingham Corporation Canada Ltd. ESTIMATE COST SHEET

Project FOOTWAY -	Demoster	Estimate No.	
	•	Date	
Description Utility		Sheet No of	

	Description of Work	Unit		Qu	anti	lty		H	our	•		L	.ebc	our			Equ	ııbu	nen	t		Mat	eria	ls -	T	Sub	cor	ulra	cts	Jo	ob (	Sup	plies	в	Te	otal	C	ost	
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#### DEMPSTER HIGHWAY COMPRESSOR STATION

### III-8 INSTRUMENTATION AND CONTROLS

#### III-8.1 UNIT CONTROLS

Controls and instrumentation for the units are part of the package supplied by the unit manufacturer; however, a unit auxiliary panel (UAP) will be added as an interface or extension to achieve some standardization among the various stations and where unit controls may vary from one unit manufacturer to another.

UAP #1 shall be the interface panel for the natural gas compressor unit. Included in the cost of this panel are annunciator, graphic, instrumentation (digital panel meters, surge controller, signal conditioners, patch boards), wiring connectors, relays and timers, instrument cabinet and relay rack structures, wire and miscellaneous components, and the wiring and fabrication of the panel.

UAP #2 shall be the interface panel for the two propane compressors. Included in the cost of this panel are annunciator, graphic, instrumentation (digital panel meters, surge controllers (2), signal conditioners, patch boards), breakers, wiring connectors, relays and timers, instrument cabinet and relay rack structures, wire and miscellaneous components, and the wiring and fabrication of the panel.

# III-8.2 PRESSURE, TEMPERATURE, FLOW MEASUREMENT

Pressures that are required for the operation of the natural gas compressor system and the propane compressor system shall be transmitted by electrical signals obtained from instrumentation racks (IR) located in the compressor buildings.

IR #1 shall be the instrument rack for the natural gas compressor unit and station. Included in the cost of this panel are the station suction,

intermediate (for chilled station) and discharge pressure transmitters and gauges (intermediate pressure being that between the main compressor and chiller and discharge pressure being that after the chiller or discharge pressure to the mainline), differential pressure across the orifice plate, pressure transmitters for the unit suction pressure and eye of the compressor for surge control, pressure switch for shutdown on high discharge pressure, and the conduiting, tubing, structure and fabrication.

IR #2 shall be the instrument rack for the propane compressor units. Included in the cost of this panel for each unit are two suction and one discharge pressure transmitters and gauges, one suction flow orifice differential pressure transmitter, one discharge flow orifice differential pressure transmitter, one pressure transmitter for the eye of the compressor, two pressure switches for shutdown on low suction and high discharge pressure, and the conduiting, tubing, structure and fabrication.

Temperatures which are critical to the operation of the unit shall be taken care of by the unit manufacturer; therefore any RTD's, thermal-couples, transmitters, meters and gauges will be included in the cost of the unit. However, temperature measurement (TM) which is critical to the operation of the pipeline systems is a separate cost.

All gas temperatures are monitored by use of thermowells with RTD's, signal conditioners (R/I) and panel meters.

TM #1 shall be the temperature measurement for the natural gas pipeline system. Included in the cost are suction, intermediate (for chilled station), discharge and orifice temperature thermowells and RTD's. The thermowells and RTD's are located in the field on the pipeline, and signal convertion and metering shall be located in the station control panel (SCP) and are included in the cost of SCP (see SCP).

TM #2 shall be the temperature measurement for the propane refrigeration system. Included in the cost for each unit are two suction, one discharge, one suction orifice and one discharge orifice temperature thermowells and RTD's.

Pressure and temperature gauges located locally, i.e., at point of sensing, are a relatively minimal cost and are included in miscellaneous.

Fuel gas monitoring shall be done using turbine meters, transmitters, flow computers, displays and chart recorders. Included in the fuel gas monitoring (FM #1) cost for the main compressor are one high frequency pulse generator, pressure transducer, RTD temperature detector, and thermowell, flow computer and chart recorder complete with totalizer. The turbine meter cost is included in the fuel gas system cost (see Subsection III-7.2).

Fuel gas monitoring for the propane compressor (FM #2), and utilities (FM #3) shall use the same type of equipment. The cost of mounting of the flow computers and chart recorders shall be included in the cost of the SCP's (see SCP #1 and SCP #2).

#### III-8.3 STATION CONTROL

The station control panel (SCP) contains all logic, instrumentation, indication and local push buttons and switches for the operation of the station in general.

SCP #1 shall be the station control panel for the natural gas compressor system. Included in the cost of SCP #1 are annunciator, station graphic, mounting of fire and gas monitors (cost for monitors included in fire and gas system), mounting of fuel gas flow monitoring equipment for main compressor and utilities (cost of monitors included in fuel gas monitoring system), instrumentation (panel meters, signal conditioners, pressure controllers, power supplies, and patch board), breakers, wiring connectors, relays and timers for logic (valve sequencing, alarms, shutdown

and ESD), instrument cabinet and relay rack structures, wire and miscellaneous component wiring and fabrication of the panel.

SCP #2 shall be the station control panel for the propane refrigeration system. Included in the cost of SCP #2 are annunciator, station graphic, instrumentation (pressure controllers, panel meters, signal conditioners, power supply for instrumentation, patch boards), breakers, wiring connectors, relays and timers for the logic (valve sequencing, alarms, shutdowns and ESD), instrument cabinet and relay rack structures, wire and miscellaneous component wiring and fabrication.

### III-8.4 PROPANE SYSTEM

This portion of the instrumentation and controls estimate was made from a "take-off" from a flow diagram supplied by Foothills in their December 21, 1978 letter and prices were obtained by verbal quotes from various suppliers.

### III-8.5 MISCELLANEOUS

Included in the cost of miscellaneous items are the sensing lines, power gas lines, vent lines, associated valves, pressure and temperature gauges, level switches for water sewage system, audible alarms, etc.

のく此「門文 りひめげ めここうじえず SYSTEM NO B INSTRUMENTATION AND CONTROLS - PAGE 1 - 10 SUPPLIER GUANTITY LINIT FRICE EXTENSION TEM 8.1 UNIT CONTROLS UAP#1 22,500 INCLUDES: INSTRUMENTATION SPARTAN (VERBAL) 6,000 (SURGE CONTROLER (FISHER) DPMS, PATCH BOARDS. ETC.) HISTORICAL ANNUNCIATOR. 4,000 GRAPHIC PUSH BUTTONS, SWITCHES ETC. LOGIC HISTORICAL 3000 ( RELAYS. TIMERS. BASES, TERMINACS. CONNECTORS. BREAKERS ETC.) 8,000 FABRICATION HISTORICAL STRUCTURES MOUNTING, WIRING MISC . COMPONANTS, ETC, MISC. 1,500 = 2,025 97 FST, WEIGHT 1000 LBS. FOB EDMONTON 5\_E-TOTAL 22,500 CONTINGENCY 2 10 % 2250

- 136 -

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SYSTEM COST SUMMARY

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UAP #2				
INCLUDES:	SPARTAN (	(ERBAL)	12,000	-
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DPMS , PATCH B	DAROS,			
ETC.)	•			
			•	
ANNUNCIATOR,	GRAPHIC, HISTORIC	14	6,000	
PUSH BUTTONS,	WITCHES,			
ETC.,	•			
LOGIC	HISTORICA	<u></u>	4,000	
(RELAYS, TIMER	es,			
BASES, TERMIN	acs,			•
CONNECTORS, BRI	<b>ts</b> 9		•	
ETC.)	•			<u> </u>
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SYSTEM COST SUNINIARY

SYSTEM NO	8 INSTRUMENT	ATION AND	CONTROLS	<u> </u>
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3.2. PRESSURE	TEMP, FLOW ME	EASUREMENT		
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SYSTEM COST SUNINARY

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SYSTEM COST SUMMARY

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# DEMESTER LUMPRESSOR STATION

# SYSTEM COST SUMMARY SYSTEM NO

PAGE 7 OF 10

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8.3 STATION	CONTROLS			
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(LOAD CONTROL	(FISHER)			
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SWITCHES, ETC		1107		25,000
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		CONTINGENC	Y@ 10 %	
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SYSTEM COST SUMMARY

SYSTEM NO.	8 INSTRUMENT	ATION AND	CONTROL	PAGE 8 OF
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8.3 CONTINUE	0			
K SCP#2				23,000
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INSTRUMENTATA	ON SPARTAN	(VERBAL)	5.000	
LOAD CONTROL,	(FISHER)		5,000	
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* CHILLED STATI	ION ONLY	- 143 -	TOTAL	25,300

SYSTEM COST SUMMARY
SYSTEM NO 8 INSTRUMENTATION AND CONTROLS PAGE 9 0=/0

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VALVES				
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6"		2	4066	8132
LEVEL GUAGES	FISHER	7	750	5250
SWITCHES		18	500	9000
ALARMS AND				
SHUTDOWNS				
INTRUMENT GA	S TUBING			2500
LEVELTROLS		5	1207	6035
•				
CONTROL PANEL				53,900
INCLUDING PRESSU	ze-			
GUAGES AND DIAL				
THERMOMETERS				
FST @ 9%	= 16.038			
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FOB	EDMONTON			
			SLB-TOTAL	162,035
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		- 144 -	TOTAL	178,200
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SYSTEM COST SUNINARY

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# Dillingham Corporation Canada Ltd. ESTIMATE COST SHEET

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### DEMPSTER HIGHWAY COMPRESSOR STATION

#### III-9 ELECTRICAL

# III-9.1 ENGINE GENERATORS (INCLUDING SWITCH GEAR)

Since no purchased power from a power utility company is available at these sites, the prime power shall be generated by  $2 \times 450$  KW generator sets with a 450 KW generator set as standby at the chilled station and by  $2 \times 150$  KW generator sets with a 150 KW generator set as standby at the non-chilled station.

The generator costs include the supply of two natural gas driven generator sets, one (standby) diesel driven generator set, associated cooling and starting equipment, engine control panels, switch gear and metering.

Miscellaneous items associated with the generators such as exhaust extention etc. are included in miscellaneous (III-9.4).

## III-9.2 MOTOR CONTROL CENTER (MCC)

The MCC shall contain the A.C. distribution system and equipment to provide 480/120/208V power to the various A.C. loads. It shall contain the conventional protective devices and provide a reasonably high degree of flexibility and continuity. Refer to simplified electrical single line Drawing Nos. FPL 39-49-91D and FPL 39-49-92D for details.

Two generators shall normally supply the necessary power requirements. If the standby unit fails to replace a downed generator leaving only one unit to handle the load, the essential services bus will remain powered and the remaining MCC load will be dropped. Not until two generators are in operation will the load be readded.

Using the philosophy that it is more desirable to operate a station at lower capacity than to shutdown completely, splitting of certain loads

shall be done. The condenser fan motors are such loads, by splitting them in half each being feed by separate breakers, if a fault occurred there would be less danger of the entire cooling system being down while the fault was repaired.

## The MCC costs include:

- 1. Essential services bus containing the following:
  - a. main feeders supplying 120/208V distribution transformers, charger and inverter system, airport, etc.
  - b. transformers
  - sub-feeders supplying living quarters, lighting panels, inverter system, etc.
  - d. starters for hot water circulating system pumps, sewage system pumps, generator cooling fans, air conditioner, water supply pumps, etc.
- 2. Main breaker.
- Feeder to non-essential bus.
- 4. Non-essential bus containing feeders to other MCC's, lighting panels and starters for miscellaneous equipment.
- 5. Propane condenser MCC No. 1 containing the starters for 50% of condenser fan motors.
- 6. Propane condenser MCC No. 2 containing the starters for 50% of condenser fan motors.
- Wire, terminals and miscellaneous components.

- 8. Chiller compressor's auxiliary equipment MCC's cost included in chiller compressor's unit costs.
- Main compressor auxiliary equipment MCC cost included in main compressor unit cost.
- 10. Reverse starters for unit valve operators (to be located in chiller compressors and main compressor units MCC's but haven't been included in their costs).

# III-9.3 UNINTERRUPTABLE POWER SUPPLY (UPS)

The UPS shall consist of the battery charger, inverter and battery. There shall be a UPS for the general station duty, a UPS for the main compressor unit, and a UPS for the propane compressor units. The costs of the UPS systems for the main compressor unit and propane compressor units are included in the cost of the units.

The station UPS shall be supplied from the essential services bus and be a parallel redundant system for greater electrical supply reliability.

The battery shall be fed from a parallel redundant battery charger system. Each charger shall be rated to carry the total load but normally will operate in parallel with the second unit sharing the load equally. Should one charger fail, the other unit will carry the load without any transfer delay time. Similarly, the critical A.C. loads shall be fed from a parallel redundant inverter system. A static transfer switch shall be part of the system, therefore, should there be a loss of A.C. output from both inverters, the switch will operate, bypassing the entire D.C. system and connecting the critical A.C. loads directly to the A.C. bus.

The cost of the UPS includes a 24V D.C. battery 800 AH, two battery chargers, two inverters, breakers, controls, transfer switches, panel wiring and fabrication.

## III-9.4 MISCELLANEOUS

Included in the cost of miscellaneous items are the exhaust extentions to the generator units and automatic door closure on release of halon fire suppression system, etc.

## III-9.5 CONDUIT, CABLE AND FITTINGS

The estimate is made on the basis of using conduits throughout the station including those runs which are aboveground (along outside of utilidors). Approximately one-quarter of the installation cost could be saved by using multi-conductor cables (teck cable) instead of conduits (where it is permitted).

Grounding for the non-chilled station is estimated based on installing a ground grid or mat based on a low impedence system. However, ground resistances are much higher in a permafrost area; therefore, a ground system that involves high resistance grounding is necessary at the chilled station. The cost of material and installation for a chilled station is substantially greater.

## III-9.6 LIGHTING

The yard lighting estimate is based on use of high wattage, high efficiency and long life mercury vapour outdoor lamps. Two foot candle average, with slightly higher levels in relatively high traffic areas using 400 and 1000 watt units serves the basis for the number of standards and lamps.

The indoor lighting estimate is based on the lighting requirements for the various buildings using mercury-vapour high intensity discharge type and industrial and commercial fluorescent type fixtures.

SYSTEM COST SUNNARY SYSTEM NO 9 ELECTRICAL

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SYSTEM COST SUMMARY SYSTEM NO 9 ELECTRICAL

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SYSTEM NO 9 ELECTRICAL

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SYSTEM COST SUMMARY SYSTEM NO E-9.7 Electric Heat Tracing

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# DEMPSTET COMPRESSOR STATION II-9.5

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Heating Calle   2d'   100   8 700   16"   10"   800'   181'0   621'		<u> </u>			EXTENSION
Heating Calle   2d'   100   8 700     16"   See'   181'0     8"   100!   621'     6"   1700'   281'0     4"   1200'   2700     2"   400'   1200     1"   500'   1700     1"   500'   1700     \$\frac{1}{2}\text{Propagate Fleet Heat Tracing   16 37'}     Prices include Cable Temperature Controller Thermocoule and Various Pittings     Estimated Freight to Edmintary   1700     \$\frac{1}{2}\text{Propagate the Edmintary   1700     \$\frac{1}{2}Propagate					
16"   500   1810     10"   800'   1810     8'   100'   2810     4"   1200'   2700     3"   500'   1700     2"   400'   1200     1½'   500'   1700     1"   500'   1700     5"   100   100     5"   100   100     5"   100   100     6"   1700   1700     7"   100   1700     8"   100   1700     9"   100   1700     100   1700   1700     100   1700   1700     100   1700   1700     100   1700   1700     100   1700   1700     100   1700   1700     100   1700   1700     100   1700   1700     100   1700   1700     100   1700   1700     100   1700   1700     100   17	Heating Cable	24"	100		# 700*
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# Dillingham Corporation Canada Ltd. ESTIMATE COST SHEET

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## DEMPSTER HIGHWAY COMPRESSOR STATION

## III-10 INSULATION AND PAINTING

### III-10.1 INSULATION

This estimate includes insulation requirements to standards of previously installed stations for the above grade high pressure gas piping and the gas turbine compressor package exhaust ducting at both the chilled and non-chilled stations. Insulation for the propane piping, propane vessels, propane equipment and the propane turbine exhaust ducting is included at the chilled station.

## III-10.2 PAINTING

This item includes the field painting requirements for all exposed piping systems, equipment, building steel, masonry partitions, exposed concrete and miscellaneous architectural features to standards of other previously installed compressor stations.

SYSTEM COST SUMMARY SYSTEM NO. PROPANE SHETEM INSULATION MATLEPAGE OF

ITEM	SUPPLIER	<u> </u>	UNIT FRICE	EXTENSION
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# Dillingham Corporation Canada Ltd.

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# Dillingham Corporation Canada Ltd.

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## DEMPSTER HIGHWAY COMPRESSOR STATION

## III-11 TESTING, WINTERIZING AND STARTUP

### III-11.1 TESTING

The estimate has provided for testing the compressor station high pressure piping and vessels, the propane system piping, vessels and equipment as well as the fuel gas system all in accordance with the NEB requirements.

### III-11.2 WINTERIZING

The estimate has provided for the labor and materials for snow removal, hoarding and the heating of various structures in addition to the protection of concrete during curing.

It also provides for checking out the operation of all heating systems and heat tracing and winterizing valve operators, generator cooling water lines and heating system lines.

### III-11.3 STARTUP

Provision has been made for the construction trade personnel to assist the operating staff and manufacturers representatives with the start up and commissioning of the compressor station facilities. Two-thousand five-hundred manhours were included for the chilled station and 1500 manhours at the non-chilled station for machinist pipefitter and electrical trade support.

### DEMPSTER HIGHWAY COMPRESSOR STATION

## III-12 MISCELLANEOUS

# III-12.1 SITE IMPROVEMENTS

This item includes the final grading of the site, installation of drainage ditches and culverts, the placing of pitrun gravel on the storage areas, finish gravelling of the roadways and parking areas and to install the roadways and parking areas and to install the perimeter fencing. The supply of the materials such as gravels, culverts and fencing is included.

## III-12.2 SAFETY EQUIPMENT

This estimate provides for a number of safety items that pertain to fire fighting and personal safety, such as dry powder extinguishers, water extinguishers, fire blankets, first aid kit, pneolator, safety harness, eye safety shields and goggles, hard hats, rubber boots, flashlights, grounding wires, manually operated gas detectors and replenishment of supplies.

# III-12.3 LIVING QUARTERS FURNISHINGS

This estimate was prepared to assess the cost of providing furnishings and a few recreational facilities for the station living quarters and small items not otherwise provided for. It has been assumed that each occupant will have a separate bedroom, but there would be a community kitchen, living room and recreational area. The equipment may not be all in accordance with Foothills' plan, but it does provide for the basic requirements.

SYSTEM COST SUMMARY

SYSTEM	NO MISCELLANGOUS	 SAFETY	EQUIPMENT
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	MISCELLANGON	2 - 24EETY C	QUIDMENT	PAGE OF
TEM .	SUPPLIER	<b>QUANTITY</b>	UNIT FRICE	EXTENSION
ANSUL K-170	Levitt	5	1843	9215
ANSUL LT A 20	U	10	214	2140
FLS PC Pump Tan		5	79	391-
F-90FG " "		5	155	775
Stretcher	Ц	2	150	300
1st Aid Kit	b	2	31	<b>6</b> 2
Fire Blanket	v	2_	75	150
Preolator	MSA		800	800
Safely Hainers	h evitt		l o-cs	100
Rope & Fasteners	W. The second		50	100
Eye Prolection		lot	50	7.0
Hara hal-s		12	16	120
Gas Detector	MSA	Company of the contract	150	150
Wet Gear	Levite	2	40	80
Sally Flacklights		12	8	96
Grounding Wires		2		30
Mise Supplies		lot	750	750
SI TOTAL SAPA	Equipment			15313
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				·
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		- 166 -	TOTAL	17,600

Ans. 1 K-150 Stock No A 10428 - 1843 X5 = 9215
Ansul LTAZO " " A 14710 - 214 Y)0 : 2100
FLSDC Sq. I'm water pump tenk - 78 6 X x = 204
F-90FG Indian Fire pumb - 154 x5 = 773
Shelelin - 150 x2 = 300
~ 20 mar First and hit - 31- ×2 2 62
Fire blacker 150
Powder Congressioners to 700 x2 1500
14534
Prestata
15334
Rondways 450' + 400' + 550' + 200' + 100' + 500' + 300'
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+100' = 2600' x 25 Gr wide. VK-02-0100 72 B
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Walkways 150 + 50 + 50 + 50 + 71 = 471 4' wide
Walkways 150 + 50 + 50 + 50 + 71 = 471 4' wide
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Walkways 150 + 50 + 50 + 70 + 200 + 50 + 75 = 475 4 with  Flare line 150 + 450 + 200 + 150 + 150 = 1100
Walkways 10+ 40+ 40+ 100 + 50 + 75 = 475 4 with  Flare line 10+ 40+ 200 + 100 + 100 = 100  4' - 10 = A
Walkways 150 + 50 + 50 + 100 + 50 + 75 = 475 4' wide  Flare line 150' + 450' + 200' + 150' + 150' = 1100'  4' - 10 = A  6' =  3' - 25' = C+
Walkways 150 + 50 + 50 + 100 + 50 + 75 = 475 4' wide  Flare line 150' + 450' + 200' + 150' + 150' = 1100'  4' - 10 = A  6' =  3' - 25' = C+
Walkways 150 + 50 + 50 + 50 + 75 = 475 4' with  Flare line 150' + 450' + 200' + 150' + 150' = 1100'  4' - 10 = A  6' -  3" - 25 = Ct
Walkways 150 + 50 + 50 + 50 + 75 = 475' 4'wite  Flare line 150' + 450' + 200' +150' +150' = 1100'  4' - 10 = A  6' - 25 = C+

# DEMPSTER COMPRESSOR STATION

## SYSTEM COST SUMMARY

SYSTEM NO. L. M. Greater Fornishing

PAGE 1 OF 2

SYSTEM NO.	Ling Greets	Formishings		PAGE   OF 2
ITEM	SUPPLIER	GUANTITY	UNIT FRICE	EXTENSION
Zitche~				
Combineds	52,15	lot	1200	1200
Counters	v	101	400	a <sub>o c</sub>
Slove	-	<u>V. 2</u>	200	500
Retrinovalor			90	<b>Q</b> (0)
Deep Freeze			400	Y00
Utensile of Mise Ap	inner:	105	1500	1500
Furniture	•	lot	000	1000
			-	
Bedroome				
Bedad Mattrees	/ 2 2 2	12	200	2400
Dresser, Chair & N		12	300	3600
Linen blankets		12	7,5	900
Carpeling		اک	10-2	1200
Contains etc		12.	70	600
Writing Deck		12	200	2400
Living Room		<u> </u>		
Sola & Chairs		10+	1100	1500
Mise Tables	Jee .	lot and	750	750
Lamps		5	60	300
TV dTape Plager			1600	1600
Radio & Carsota		1	800	200
Pictures Culainis	ete	10 H	1000	1000
Carpet			1000	1000
Rec Room		<u> </u>		
Pool Table		1 2 2	800	800
Table Tennis		1 .	100	100
Games Talla		1	300	300
Cards Puzilos	Camer ete	-ارا	210	2 m3
Chairs		lor	600	boo
Consider			1000	1.12
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		- 168 -	TOTAL	-

### DEMPSTER COMPRESSOR STATION

SYSTEM COST SUMMARY

SYSTEM NO. LIVING QUARTERS FURNISHINGS

PAGE 2 OF 2

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ITEM	SUPPLIER	QUANTITY	UNIT PRICE	EXTENSION
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Graning Four		lot	500	500
Creenhouse		1	3000	3000
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Freight to	Edminton inclu	cled.		
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		- 169 -	TOTAL	34,650

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# ESTIMATE COST SHEET

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### III-13 FEDERAL SALES TAX

The amount of federal excise tax applied to the various materials estimated for the project were as follows:

Item	Rate
Pipe	5%
Fittings	5%
Galvanized Pipe	12%
Copper Pipe	5%
Tanks	9%
Compressor Package	12%
Control Valves and Regulators	5%
Instrumentation	9%
Vessels	9%
Electrical	9%

## III-13 FEDERAL SALES TAX

	Cost Category	Chilled Station	Non-Chilled Station
		\$	\$
1.	Foundations	25,100	13,000
2.	Buildings	60,100	39,000
3.	Gas Compressor Package	486,100	486,100
4.	Propane Compressor Package	431,700	<b>-</b>
5.	H.P. Gas Piping	79,300	47,300
6.	Other Major Systems	141,800	42,200
7.	Utilities	15,100	13,400
8.	Instrumentation & Controls	32,300	8,300
9.	Electrical	74,600	41,900
10.	Insulation & Painting	5,000	1,200
11.	Testing, Winterizing, Startup	1,200	900
12.	Miscellaneous	5,200	5,200
13.	Tools & Major Spares	65,500	35,500
	TOTAL	1,423,000	734,000

### III-14 CONTRACTOR'S OVERHEAD

#### III-14.1 GENERAL

The contractor's overhead costs have been developed to represent salaried labour, unallocated trade labour, temporary structures and plant facilities, construction vehicle and equipment requirements, small tools and consumable supplies, mobilization costs, trade labor burdens and miscellaneous costs related to the construction of four compressor stations (2 chilled and 2 non-chilled) over a 24 month period.

The contractor's markup for the aggregate four stations was assigned to include contractor head office costs, profit and contingency. The markup selected is appropriate for the performance of the construction on a lump sum tender basis.

The contractor's overhead costs have been prorated to the four stations on the basis of total direct manhour content.

The contractor's markup has been prorated to the direct costs and the overhead costs on the basis of total cost.

### III-14.2 FIELD SUPERVISION, ADMINISTRATION

The staffing requirements of a four station project necessitates a field office located in Whitehorse for the project management, planning, purchasing, contracts administration, accounting, payroll, cost control, data processing and other services.

The project staff includes a project manager, two project superintendents, a project administrator, an accountant, a paymaster, a buyer/ expeditor, a cost engineer, a project engineer, two field engineers, two surveyors, stenographic and clerical help.

Staff benefits included are relocation expense, travel expense, living allowance, northern allowance and overtime allowance. Housing is not necessarily provided but is assumed to be available for those staff residing in Whitehorse.

Unallocated trade labor costs include key general trade foremen, first aid attendants, mechanics and warehousemen. Straight time labor costs of these personnel is included in this section; however, the travel costs, subsistence costs and premium time costs are provided for separately elsewhere in those categories.

#### III-14.3 CONSTRUCTION FACILITIES

This item includes the purchase cost of temporary office facilities in Whitehorse and at the sites, first aid trailers, warehouse structures at each site, an equipment shop, and rental of portable concrete batch plant facilities and tool cribs.

The setup and dismantle costs of these facilities is included.

#### III-14.4 CONSTRUCTION CAMP

This item includes the purchase cost of a 120 man camp facility for the chilled station and an 80 man camp facility for the non-chilled station.

Setup, maintenance and removal costs of the camps are included; however, mobilization costs of transport to the sites are included separately elsewhere.

### III-14.5 CONSTRUCTION VEHICLES

This item includes the rental cost of all vehicles related to the project and specifically pickup trucks, crew cabs, buses, ambulances, con-

crete trucks, hiab trucks, fuel and service vehicles. The equipment rentals are based upon contractor owned vehicles assigned to the project sites.

Fuel and maintenance costs are included.

The straight time labor cost of bus drivers, concrete truck drivers, hiab truck drivers and service truck drivers is included. Related travel costs, subsistence costs and premium time costs are included separately elsewhere in those categories.

### III-14.6 CONSUMABLES

This item includes the cost of all consumable tools, expendable supplies, welding gases, welding rod, workmens clothing, office supplies, engineering supplies, safety supplies and other miscellaneous costs. A consumable tool is considered of value less than \$50.00.

Fuel costs, form work materials and temporary materials are not included.

### III-14.7 SMALL TOOLS

This item includes the cost of small tools and minor equipment of value between \$50.00 and \$1,200.00, for all trade personnel on site.

### III-14.8 CONSTRUCTION EQUIPMENT

This item includes the rental cost of all truck cranes, hydraulic cranes, hydraulic backhoes, loaders, bulldozers, compressors, welders, compactors and scaffolding required for the work at site. The equipment rentals are based upon contractor owned equipment assigned to the project sites.

Fuel and maintenance costs are included.

The straight time labor cost of crane operators is included. Related travel costs, subsistence costs and premium time costs are included separately elsewhere in those categories.

#### III-14.9 MOBILIZATION

This item includes the transportation costs related to the mobilization and demobilization of contractor's equipment between Vancouver, Edmonton and the project sites. Specifically the road haul freight costs of temporary buildings and trailers, construction camps, vehicles, cranes, excavating equipment, welders compressors, minor equipment and small tools are included.

The straight time labor costs of crews required to loadout and receive contractor's equipment in contractor's yards in Vancouver and Edmonton are also included.

### III-14.10 TEMPORARY SERVICES

This item includes the cost of setup and removal of temporary water supply, temporary sewage, and waste disposal systems at each site.

Telephone, mobile radio and telex communications are also included.

### III-14.11 BONDS, INSURANCE, PERMITS

This item includes allowances for welder qualification tests, labor and material performance bonds, course of construction insurance, liability insurance and electrical permits.

#### III-14.12 UNION TRAVEL

Trade labor initial and terminal travel time, travel fares and travel expenses have been estimated on the basis of a turnover or equivalent return trip every 30 days.

This item includes related taxi cab and commercial airline fares for travel between Vancouver and Whitehorse. Travel time between Vancouver and Whitehorse has been estimated at seven and one-half hours each way. The additional travel time between Whitehorse and the various compressor station sites will vary considerably. An average travel time between Whitehorse and midpoint along the Dempster Pipeline has been estimated at 10 hours each way via bus travel. Costs of providing alternate transportation to the sites via helicopter from Whitehorse has been considered and costs appear to be comparable. Travel expenses including meals and lodging have been provided for on the basis of two nights for the chilled station and one night for the unchilled station each way.

The costs of union travel are prepared generally in accordance with the guidelines of the trade agreements. These guidelines are not precise and union costs will continue to be negotiable until project agreements are finalized. There continues to be a great cost exposure in this cost allowance.

#### III-14.13 UNION SUBSISTENCE

This item includes the costs of construction camp catering as well as the costs of free room and board provided to tradesmen prior to the setup of the camps. These costs are based upon a 60 hour work week.

### III-14.14 PREMIUM TIME

The estimate has been prepared on the basis of a 60 hour work week. This item includes the cost of the premium portion of overtime at 37.5% of straight time payroll costs.

Trade agreements require an additional meal break when working a 10 hour shift and an allowance of one-half hour per manday is included as a non-productive premium allowance.

### III-14.15 RETROACTIVE ESCALATION

The pipefitter trade agreements currently provide for potential retroactive pay escalation for previous contracts in 1976 and 1978 in the amount of 36 cents per hour. The settlement of this adjustment continues to be deferred. The hourly rates used in the estimate do not include this amount but it is identified here as a probable cost.

In addition, pipefitters will be eligible for a 50 cent hourly premium for work north of 60° latitude and effective May 1, 1979 all trades will receive an average 85 cent increase through to May 1, 1980. These estimated costs have been evaluated and included.

III-14.16 CHILLED STATION

Item	Hours	Labor
Field Supervision, Admin.	21,800	\$1,271,000
Construction Facilities	4,300	214,000
Construction Camp	3,860	552,000
Construction Vehicles	13,500	479,000
Consumables		230,000
Small Tools	<b>-</b>	172,000
Construction Equipment	2,000	1,026,000
Mobilization	2,700	320,000
Temporary Services	1,280	77,000
Bonds, Insurance, Permits	400	180,000
Union Travel	-	923,000
Union Subsistence	-	943,000
Premium Time	-	1,540,000
Retroactive Escalation		231,000
Subtotal	49,840	\$8,158,000

## III-14.17 NON-CHILLED STATION

Item	<u> Hours</u>	Labor
Field Supervision, Admin.	12,260	\$ 780,000
Construction Facilities	2,430	131,000
Construction Camp	2,180	339,000
Construction Vehicles	7,620	294,000
Consumables	•	141,000
Small Tools	-	106,000
Construction Equipment	1,120	630,000
Mobilization	1,540	196,000
Temporary Services	720	47,000
Bonds, Insurance, Permits	220	110,000
Union Travel	<u> -</u>	567,000
Union Subsistence	<u> </u>	456,000
Premium Time	-	945,000
Retroactive Escalation	-	142,000
Subtotal	28,090	\$4,884,000



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# ESTIMATE SUMMARY SHEET

Prepared by 147 Date 27 January 1978

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Estimate No. 3688

**ESTIMATE SUMMARY SHEET** 

Date 24 darray 576 Sheet No. 2 of 2

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Estimate No. 3688

ESTIMATE SUMMARY SHEET

Prepared by MT

Date 27 January 1875 Sheet No. 1 of 2

	Description of Work	Unit	Qua	intity	Hours	Labour	Equipment	Materials	Subcontracts	Job Supplies	Total Cost	Adjustments	Unit Price	Bid Price
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6	Liver Ordetla		111		11312	4 000	┞╌═┦┠╃┦╂╁╉	76909			16550 15750	<del>╏╼╍╏╏╏</del> ╏╄┾┪	╉═┼╂┾╂╌╂┄	\$5000
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.11	Structural (post med above)	<del>                                     </del>	††††	┞╂╂┼╂	╂╂┤┠╂┼┤	╼	<del></del>		<del>      </del>		┞╼╼┋╂┠╂╁╂╂	╌╌╂╂╂╊╂	<del>┞╴╏╏</del> ┞┼	╼┼╂╂┞╂╁╅╃╸╵
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38	station that are a repaired				┇╅┠╊╉╂┨		╼╌╂┨╁╁┣╃╂┥	╶╌╂┧╂╂┠╂╅╽	╼╌┨╂┠┨╂┦┋┪	╌╼╏╏╂╬╞╬┾	╽┄╌╌┧ <i>╄</i> ╏╏╏╏┢ <b>┾</b> ╇┪	╶╍╅┪┪╂╂╂	-  - -	╼┪╢╂╟╇╋┹┩
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Project Footbuls - Demps ter Lateral - Unchilled Compressor Station Estimate No. 3688

**ESTIMATE SUMMARY SHEET** 

Prepared by MJ7 Date 24 Laway 75 Sheet No. 2 of 2

	Description of Work	Unit	Quantity	Hours	Labour	Equipment	Materials	Subcontracts	Job Supplies	Total Cost	Adjustments	Unit Price	Bid Price
3	Field Supervision, Administration Construction Faccilities Construction Camp Construction Whiches Consumently	\$	\$35 6000 \$44 0000 \$75 6000 \$75 0000 \$00 600							745 74000 179 000 179 000 179 000 141 000			
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Project Foothills - Daughte		Estimate No. 3406
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	Description of Work	Unit	C	luanti	ity	Hot	Irs		.abou			uipmen	nt	Ma	erials	s	ubcontr	acts	Job	Supplies		Total	
1.	Overhead Labour						3660		44	900			111				1111	1   1			<u>-</u>		4600
2.	Overhead Labour						24460		160	15 b0 460	i		$\bot \! \! \downarrow \! \! \downarrow$			-Į		111-		200			7.05
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4.	Construction Facilities and Equipment				Ш		7740		63	100		2636	50	!-					+	10600			67 41
5.	Construction Facilities and Equipment		-		- 7		1340			1440		1666.				+-	32.0	20 P		71500			366
6.	Construction Facilities and Equipment		14	++	-		11540			640			200		<del></del>			ACT V		Eb 01			63
. 7. 8.	Construction Facilities and Equipment_ Trade Labour Burdens			++		<del></del>	3000		407	130		1.7	W.V.	:-	++++	: -	+			13750			166
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Item No.	Account No		Date
DescriptionConstruction Facilities	& Equipment		Sheet No. 5 of 9

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Project		Estimate No.
Item No	Account No	Date
Description Construction Faci	lities & Equipment	Sheet No. 6 of 9

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Description Construction Facilities	& Equipment		Sheet No	7of_9

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### III-15 SUMMARY OF FREIGHT WEIGHT EX EDMONTON BY COST CATEGORY

### III-15.1 FREIGHT

An estimate of freight costs for the road haul transportation of all permanent materials from Edmonton to the station sites has been developed. The weights of civil, structural, piping, equipment, electrical and insulation materials have been evaluated and the numbers of load shipments identified.

		Weight in Pounds				
	Cost Category	Chilled	Non-Chilled			
III-1	Foundation	1,770,000	1,045,000			
III-2	Buildings	974,000	727,000			
III-3	Gas Compressor Package	418,000	418,000			
I I I-4	Propane Compressor Package	182,000	•			
III-5	High Pressure Gas Piping	500,000	300,000			
III-6	Other Major Systems	1,811,500	104,700			
III-7	Utilities	139,000	122,000			
111-8	Instrumentation & Controls	26,200	4,900			
111-9	Electrical	197,400	131,500			
111-10	Insulation and Painting	40,000	10,000			
111-11	Testing, Winterization and Startup	150,000	120,000			
III-12	Miscellaneous	67,000	67,000			
111-13	Tools and Major Spares	20,000	16,500			
	TOTAL	6,295,100	3,066,600			



Project Foothius - Demptor	Estimate No.
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# ESTIMATE COST SHEET

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### III-16 TOOLS AND MAJOR SPARES

### III-16.1 TOOLS

The compressor station will be basically self-contained insofar as normal tools and equipment are concerned. We have provided a general list of items that are commonly utilized at larger stations.

### III-16.2 MAJOR SPARES

This estimate has included the costs for a number of spares at each station. The general spares were assigned to Electrical Spares, Instrumentation Spares, Pump Spares, Turbine Spares and Mechanical Spares. In addition two additional categories were considered;

- a) a spare gas turbine power unit estimated at two million dollars, and prorated between 9 stations \$2,000,000 + 9 = \$222,000 per station
- b) a spare refrigeration turbine/compressor unit estimated at one million dollars and prorated between 4 stations = \$250,000 per station.

SYSTEM COST SUMMARY SYSTEM NO

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SYSTEM COST SUMMARY SYSTEM NO. ALAINTONANCE SPACES

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