NORTHERN SASKATCHEWAN TRANSPORTATION REVIEW

DEPARTMENT OF REGIONAL
ECONOMIC EXPANSION

AUGUST 1973

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PREFACE

This study was performed for the Department of Regional Economic Expansion over the period May-August 1973 by Mr. W.R. Anderson. It is intended to serve as an input to joint federal-provincial development planning for Northern Saskatchewan. Considerable work on northern transportation planning had been done by the Department of Highways and Transportation, Saskatchewan; especially by Mr. A.A. Jones of the Planning section of the Department. This study, conducted in conjunction with Mr. Jones, reviews and summarizes the results of planning to data on the highways and air modes. In terms of the air mode this study investigated alternative northern air systems and a system is recommended based on this investigation.

SUMMARY

This study reviews transportation in Northern Saskatchewan (north of the Department of Northern Saskatchewan jurisdictional boundary but including air linkages to Saskatoon and Regina). Transportation is reviewed in the context of the two modes which are relevant to the area, highway and air, including a marine service across Lake Athabaska as an extension to the highway system. Other aspects of transportation in the area such as freight movement to Uranium City are also covered.

A factor to be emphasized in connection with this area is the need to decrease remoteness of settlements, (particularly those isolated from road connections) thus improving the mobility psychological and physical, of the population.

The rationale for this review is to serve as input to federal-provincial joint development planning in northern Saskatchewan. Transportation is germane to development planning both in terms of a service function requiring responsiveness to demand and elimination of service deficiencies as these may restrict development and in terms of development facilitation through provision of transportation services. This report is intended to review transportation planning in the area to date and was prepared in conjunction with the Saskatchewan Department of Highways and Transportation.

In the case of the air mode a number of alternative systems are evaluated in light of present system deficiencies.

...

The cost implications of these alternatives are examined and a system which is the most suitable is recommended. Physical facilities are also reviewed in light of planning to date by the DHT and the Canadian Aviation Transportation Administration regional office. Requirements for physical airport and ancillary facilities are priorized.

In the case of the highway mode the review of transportation planning shown in this study is based on work to date by the DHT which was accepted as rationally derived and further evaluation of highways by the Department of Northern Saskatchewan which has indicated additional and modified road requirements to those indicated by the DHT. Internal provincial departmental highways programs had not yet been resolved at the time of this review.

Air Services

In the present system poor service results from use of obsolescent aircraft, ex. the DC-3. Slow progress in replacement of aircraft has been due to fixed traffic flows which inhibit growth in aircraft utilization hours.

Advantages of older aircraft types, using reciprocating engines have been,

(i) rugged uncomplicated design, with relatively simple maintenance procedures,

(ii) ability to operate from short rough airstrips.

Such aircraft are slow, cannot increase earnings without added cost to customers, overhaul costs increase, without increase in time between overhauls, with difficulty in obtaining parts.

Use of expensive turbine powered aircraft requires potential expansion of the market and past traffic growth in northern Saskatchewan has been insufficient to justify investment. Operators in northern Canada in general have acquired new types of aircraft (jet and turbo-prop); following this trend, operators in northern Saskatchewan are purchasing new types of equipment over time. Increases in use of aviation services are resulting in a demand for increased coverage of navigation aids, and imporved airport facilities.

The air system was examined as follows:

The existing system, using DC-3's on northern links to Uranium City, Stony Rapids, Wollaston, Cluff Lake, amongst others, and the Twin Otter on southern links, was outlined

and costed. This cost structure is used as a model into which other aircraft are introduced for comparison.

Alternatives evaluated are as shown in Table S-1. The recommended system uses two Hawker-Siddely 748 aircraft for northern service and one Twin Otter in addition for southern links. This is essentially a mainline system and three regional feeder services are also recommended centred on Buffalo Narrows, La Ronge and Uranium City. The recommended system is shown in figure S-1. Airfield improvements required indicated by aircraft suitability including two forestry base airfields (Buffalo Narrows, Meadow Lake) are recommended and are detailed in Table S-2 as are requirements for additional navigation aids.

TABLE S-1

ALTERNATIVE MAINLINE AIR SERVICE

	SYSTEM	ANNUAL DIRECT OPERATING COST	ANNUAL REVENUE	EVALUATION
1.	Existing system DC-3 on northern links, Twin Otter on southern links	$755,000	$921,000	Poor service
2	Hawker-Siddely 748 to provide northern weekly service	$829,000	$921,000	Economically feasible but inadequate level of service provided
3	Fokker 28 to provide more frequent service but requires HS748 based in Prince Albert	$1,640,000	$1,107,000	Good Service but high cost and number of aircraft types involved.
4	Two HS 748 aircraft and one Twin Otter for southern links.	$1,424,000	$1,107,000	Recommended as being best option

As indicated the alternatives examined were not mutually discrete but were derived incrementally in improvements to the present system until an alternative providing the required service at minimal cost was reached.

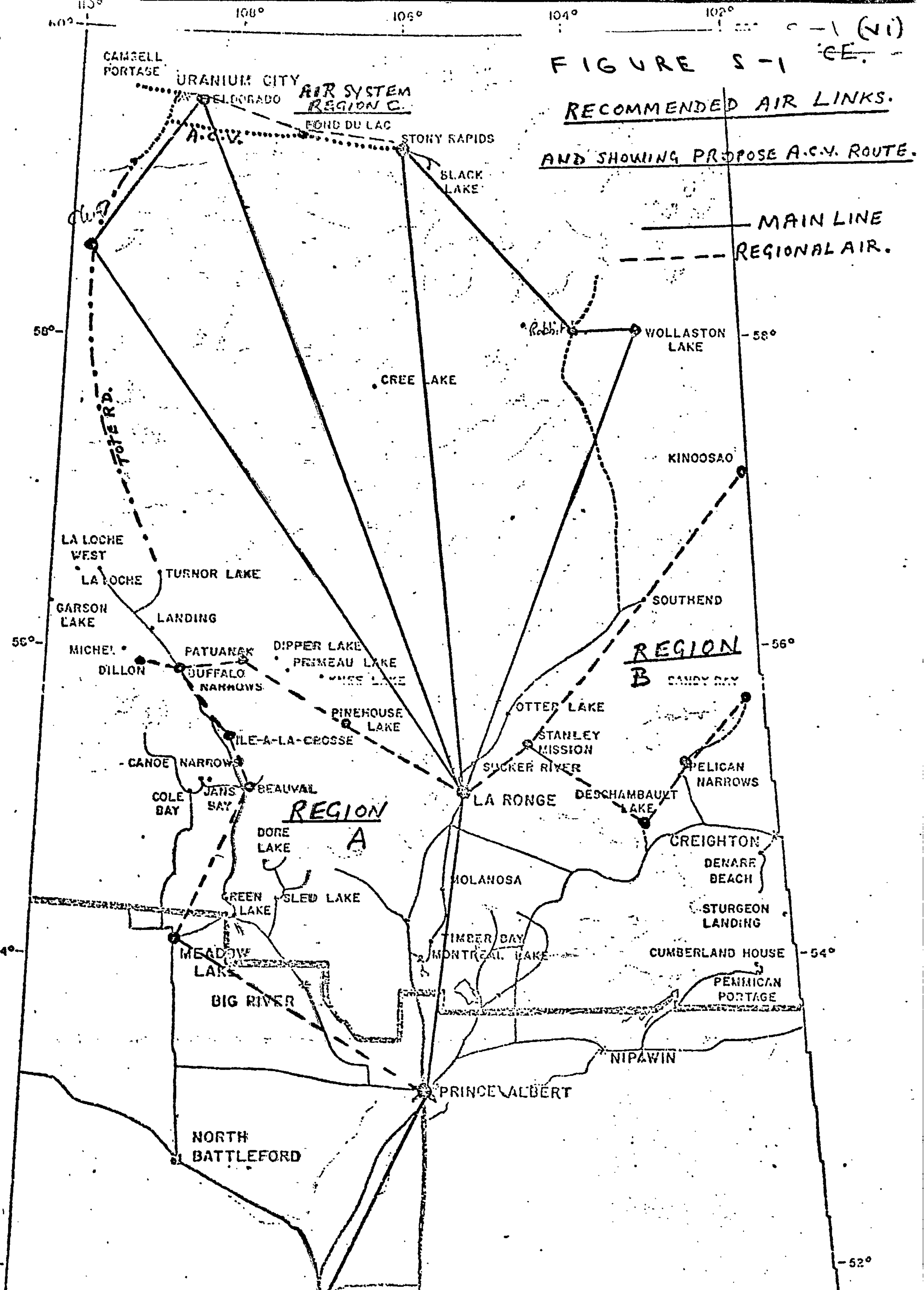

FIGURE S-1
RECOMMENDED AIR LINKS.
AND SHOWING PROPOSE A.C.V. ROUTE.
MAIN LINE
REGIONAL AIR.
AIR SYSTEM REGION C.
A.C.V.
TOTE RD.
REGION A
REGION B
108°
106°
104°
102°
60°
58°
56°
54°
52°
CAMSELL PORTAGE
URANIUM CITY
ELDORADO
FOND DU LAC
STONY RAPIDS
BLACK LAKE
WOLLASTON LAKE
CREE LAKE
KINOOSAO
LA LOCHE WEST
LA LOCHE
TURNOR LAKE
GARSON LAKE
LANDING
SOUTHEND
MICHEL
DILLON
PATUANAK
BUFFALO NARROWS
DIPPER LAKE
PRIMEAU LAKE
PINEHOUSE LAKE
OTTER LAKE
STANLEY MISSION
ILE-A-LA-CROSSE
CANOE NARROWS
SUCKER RIVER
PELICAN NARROWS
COLE BAY
JANS BAY
BEAUVAL
LA RONGE
DESCHAMBAULT LAKE
DORE LAKE
CREIGHTON
DENARE BEACH
MOLANOSA
GREEN LAKE
SLED LAKE
STURGEON LANDING
TIMBER BAY
MONTREAL LAKE
MEADOW LAKE
CUMBERLAND HOUSE
PEMMICAN PORTAGE
BIG RIVER
NIPAWIN
PRINCE ALBERT
NORTH BATTLEFORD

Highways

Requirements exist for highway improvement. These include highway connections to the most northern parts of the province, to provide good roads for freight-trucking, private automobiles, resource development, with emphasis on forestry and mineral extraction. Planning involves upgrading of some gravel roads to pavement, some winter roads to gravel and provision of access roads.

The proposed DHT highway plan is shown in figure S-2. From a review of the rationale for the plan on transportation service criteria it appears to be supportable, however, as mentioned earlier the DNS has evaluated additional and modified requirements.

The DHT highways plan is composed of three elements; a surfacing program for 620 miles of highway, a northern highway upgrading program and a transportation facility program.

Highway requirements are detailed in Table S-3 as are proposed DHS revisions and additional highway requirements.

As part of the study a hovercraft service across Lake Athabaska was examined in relation to a ferry/winter road service and the latter was forced to be for more economic and is therefore recommended.

Summary of Recommendations and Estimated Costs

A. Air Services

1. A mainline air system using two Hawker-Siddeley 748 turbo prop aircraft (1 Twin Otter now in operation) *The subsidy is expected to become negligible over a 10 year period as traffic growth occurs	Capital Cost	$3,300,000
	Annual Subsidy	$500,000
2. Regional air services Three feeder systems: centred on Buffalo Narrows, east of La Ronge; centred on Uranium City. Using Islander aircraft.	Capital Cost	$5-600,000
	Annual Subsidy	$55,000
*3. Airfield improvements	Capital Cost	$6-7,000,000
*4. Navigation Aids	Capital Cost	$1,400,000

*See Table S-2 for detail

B. *Highways

1. Surfacing program for 620 miles of highway	Capital Cost	$28,000,000
2. Northern Highway upgrading program	Capital Cost	$8,600,000
3. Northern transportation facility provision program	Capital Cost	$11,300,000
4. DNS additional proposals under item 3 due to higher standards of facility provision, additional major facilities and additional access roads.	Capital Cost	$33,000,000
5. Forestry access roads		$3,200,000
6. Ferry service across Lake Athabaska vessel, terminal and winter roads.	Capital Cost	$500,000
	Annual Subsidy	$160,000

*See Table S-3 for detail.

TABLE S-2

AIRPORT AND ANCILLARY FACILITIES

Category	Priority	Facilities	Estimated Cost
1. Mainline route	high	La Ronge	$4,000,000
	high	Rabbit L, Wollaston L. Cluff L., Stony Rapids	$650,000
2. Feeder centred on Buffalo Narrows	high	Meadow L., Buffalo Narrows Patuanak, Pinehouse Dillon, Ile a-la-Crosse, Beauval	$550,000
	low	Turnor L., Green L., Canoe Narrows/Cole Bay, Dore L., La Loche	$350,000
3. Feeder east of La Ronge	high	Stanley Mission	$100,000
	med.	Cumberland House, Southend Kinoosao, Island Falls Pelican Narrows, Deschambault	$500,000
4. Feeder centred On Uranium City	med.	Camsell Portage, Fond-du-Lac	$190,000
			$6,340,000
5. Navigation aids	high	10 locations, see report	$1,400,000
6. Additional cross-wind runways to be considered (not included in recommendations	very high	5 locations, see report	$3,150,000
	high	5 locations, " "	$600,000
	med.	9 locations, " "	$578,000
	low	7 locations, " "	$432,000
			$4,760,000

TABLE S-3

HIGHWAY AND ANCILLARY FACILITIES

Category	Hwy.	Location	Requirement	Dept.	Estimated Cost
1. Northern Highway	2	Jct. 264-La Ronge north 20 miles	G&P	H	$5,700,000
	55& 155	Big River to Ile a-la-Crosse	G&P	H	$5,000,000
Surfacing	120	Jct. 55 to Big Sandy L.,	G&P	H	$7,300,000
Program	106	Jct. 55 to Creighton	OT	H	$10,000,000
					$28,000,000
2. Northern Highway	109	Jct. 3 to Jct. 163	G&P	H	$1,678,000
	155	Ile a-la-Crosse to La Loche	G&O	H	$2,842,000
Upgrading	224& 104	Meadow L. to Canoe Lake	G&O	H	$1,246,000
Program	tote roads		G	H	$1,120,000
	155	Bridge at Buffalo Narrows			$1,350,000
	163	Shoal Lake I.R. West	G	H	364,000
					$8,600,000
3. Northern Facility Provision		-Turnor Lake to Cluff L. to south shore L. Athabaska		H&N	$12,250,000
		-S. Shore L. Athabaska to Stony Rapids		N	$4,750,000
DHT + DNS Programs amalgamated		-Stony Rapids-Wollaston L.		N	$8,500,000
		-La Ronge-Beauval		N	$6,250,000
		-access to Stanley Mission		H&N	$1,200,000
		-access to Pinehouse		H&N	$1,200,000
		-access to Patuanak		H&N	$1,160,000
		-access to Dillon		H&N	$1,500,000
		-Big River to Meadow L (sawmill)		H	$2,000,000
		-Kinoosao to Lynn Lake		N	$ 690,000
		-Sturgeon Landing		N	$1,640,000
		-Meridian Bridge on Onion L. road		N	$1,500,000
		-other access roads to settlements		N	$1,700,000
4. Forestry access roads					$44,340,000
					$3,200,000

G-Grading, not necessarily entire length
P-staged paving or 8"AC
S-staged asphalt base
o-oiling
OT-oil treatment
H-DHT
N-DNS
H&N-DHT with DNS modifications proposed

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INTRODUCTION

The objective of this review is to assess transportation in northern Saskatchewan in terms of required improvements.

The assessment falls naturally into three categories. These are

A. Air Services and related facilities

B. Highways

C. Lake Athabaska system

The principle issues to be considered include:

1. provision of improved air access to remote northern communities, by use of more modern aircraft types,
2. adequacy of airfields for provision of satisfactory service,
3. requirements for more numerous navigation aids,
4. keeping system costs to a minimum while providing high quality service at lowest possible cost, and to avoid price discrimination against a captive market,
5. providing alternate modal systems where necessary and feasible,
6. provision of highway access to settlements, where it does not exist, and is justified to decrease or eliminate isolation,
7. the need for access roads to resource areas,
8. the construction of an all-weather inter-connecting and intermodal network to serve northern Saskatchewan.

PART A

AIR SERVICES AND RELATED FACILITIES

1. Introduction

In considering existing services, it was first necessary to establish a definition of the existing system,

a) scheduled and charter operations,

b) the linkages,

c) the link flows, passengers and freight for both schedule and charter work.

To rationalize the flows, it was found easier to use an equivalency method to represent freight quantities as passengers. The equivalence was usually based on aircraft capacity, e.g. each 250 lbs. represents one equivalent passenger for the DC-3 airplanes, while 165 lbs. was used on some other occasions.

The existing system employs DC-3 aircraft, aging, obsolescent machines, on the mainline system, (see Figure 1), and by a variety of smaller aircraft mostly on a charter basis, on subsidiary routes, e.g. DHC-2 Beaver, DHC- Otter, DHC Twin Otter, Cessna 180, Cessna 185, using wheels, floats or skis. A weekly scheduled service is offered to the subsidiary regions using a DHC-2 Beaver.

It was decided to examine possible new scheduled services, based on a two-level framework using modern aircraft to service the communities. The primary one would use:

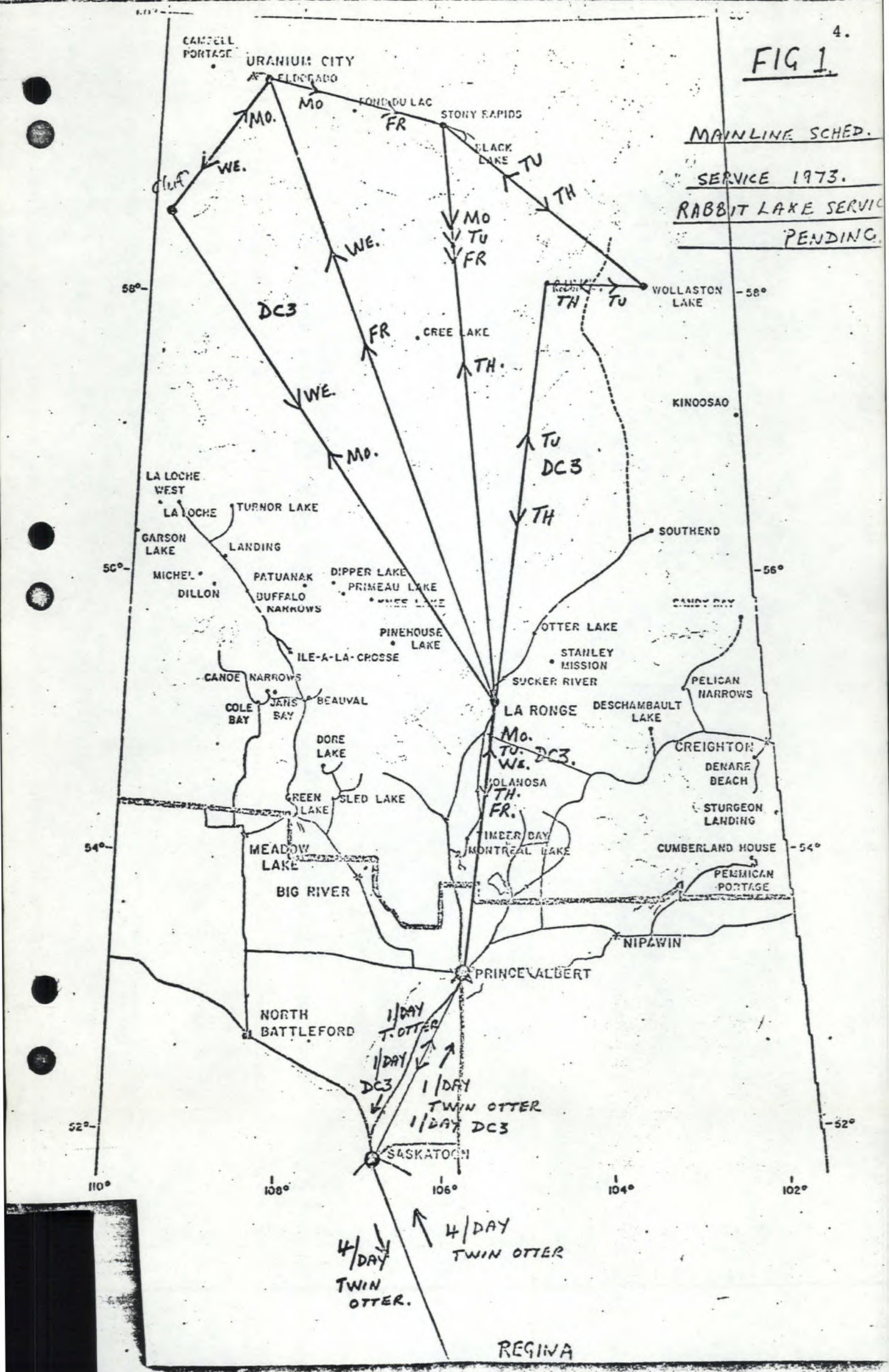
a) turbo-prop aircraft, or

b) twin-jet aircraft,

on the main linkages. A linkage in this context is defined as the total connection from a wholesale distribution centre to destination, e.g. Saskatoon to Uranium City.

FIG 1.

MAINLINE SCHED.
SERVICE 1973.
RABBIT LAKE SERVIC
PENDING.



The secondary system will use small feeder aircraft on local regional service. Northern regional services at present are seen as falling into three potential geographic systems:

a) The area centered on Buffalo Narrows, including Dillon, Patuanak, Pinehouse, Ile a la Crosse, Beauval, Meadow Lake, etc.

b) The settlements east of La Ronge, including Stanley Mission, Deschambault, Pelican Narrows, Southend, Kinoosao, etc.

c) The northern-most region, centered on Uranium City and including Stony Rapids, Fond du Lac and Camsell-Portage.

Consideration has been given to airfield improvements at all points in each system, to accommodate aircraft suggested for service.

Due to exigencies of time, the main concentration in the study has been on the mainline route patterns. For regional services reference can be made to a study by A.A. Jones, Location Engineer, Department of Highways, Saskatchewan, "Recommendations for improved transport services to the mid-north-west portion of Saskatchewan, generally described by Prince Albert - Meadow Lake - La Loche - La Ronge", i.e. covering sub-system A. A brief costing examination has, however, been done on sub-system C in connection with proposed services on and around Lake Athabaska. The "mainline" system serves

Regina, Saskatoon, Prince Albert, La Ronge, Rabbit Lake, Wollaston Lake, Stony Rapids, Uranium City and Cluff Lake.

Investigation of aircraft capability was carried out using the present price structure pertaining to the scheduled Norcanair service with DC-3 and DHC Twin Otter airplanes, To do this the schedule operation was briefly analyzed and costed, (see Tables 1 and 2), and two new aircraft types,

a) the Hawker-Siddeley 748, turbo-prop,

b) the Fokker 28, twin jet,

were tested within that price structure. Following that, consideration was given to:

i) increased frequency of scheduled service,

ii) increased costs associated with (i),

iii) the possibility of attracting an increased percentage of potential traffic at present price levels,

iv) diversion of traffic from other routes to this system, by reduction of fares.

The Hawker-Siddeley 748 and Fokker 28 were tested as being representative turbo-prop and jet aircraft with some background in the northern environment, and due to difficulties of obtaining suitable data on other airplanes in the time available. Similar aircraft types may, after due examination, be found eminently suitable for service in northern Saskatchewan.

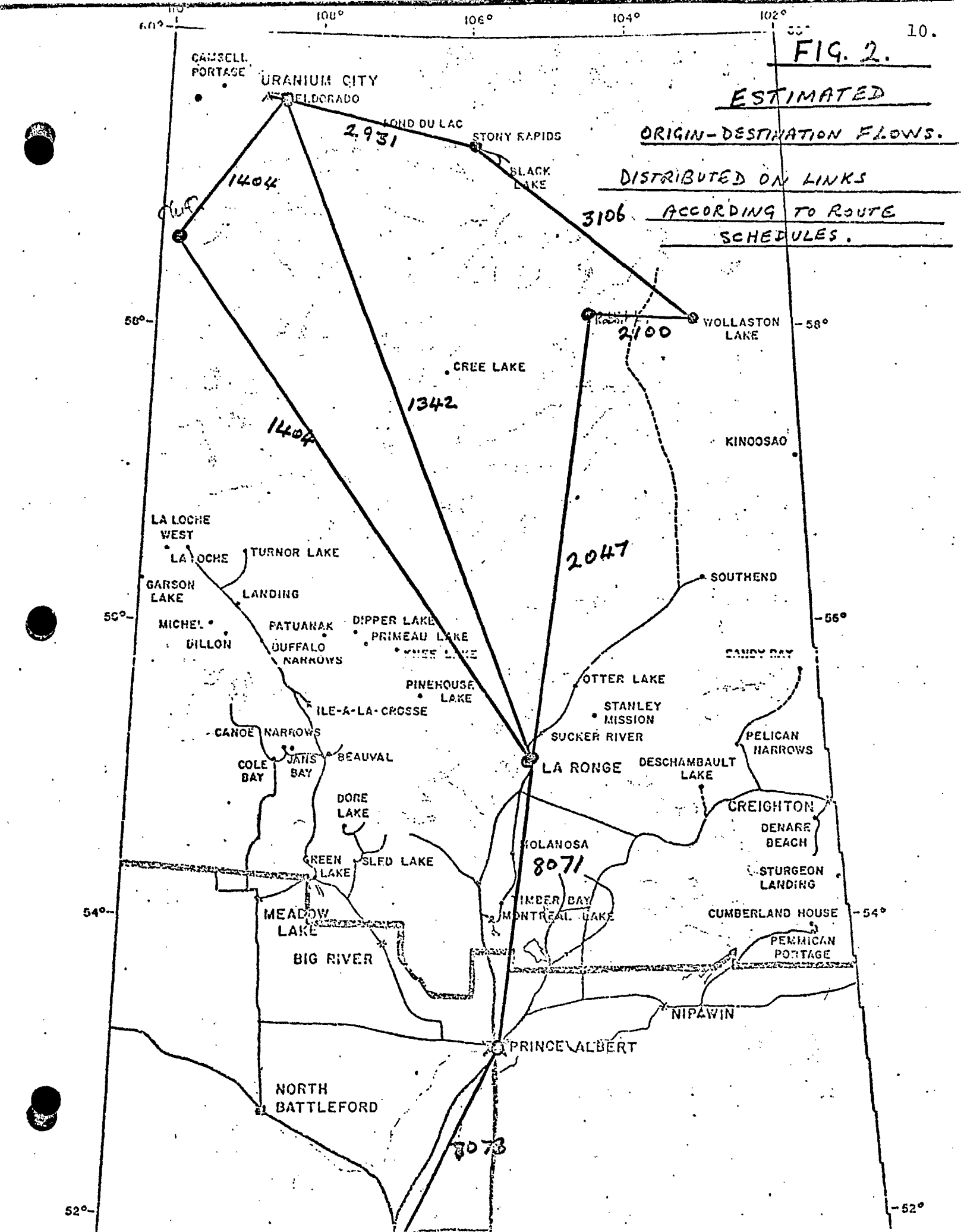
Table 2 below, uses distance between nodes to produce block times. Block times are used to obtain aircraft utilization hours per year. The total annual passenger capacity is the product of link frequency/week X capacity of the aircraft (DC-3, 28, passengers) X 52 (weeks per year).

The origin destination passenger flows were distributed along the links in the system, according to the route scheduled frequencies. (See Figure 2)

The greatest capacity and passenger flows are on the two southern links, and the La Ronge - Stony Rapids link. The first two are links to and from large population centres, the third because the operation of four flights along this route shows through flows from other node points. The load factor is generally low, ranging from 0.24 to 0.72.

FIG. 2.

ESTIMATED ORIGIN-DESTINATION FLOWS. DISTRIBUTED ON LINKS ACCORDING TO ROUTE SCHEDULES.



3. Alternative Improved Mainline Air Services

a. Modifications to services by use of chartered aircraft to serve mining developments

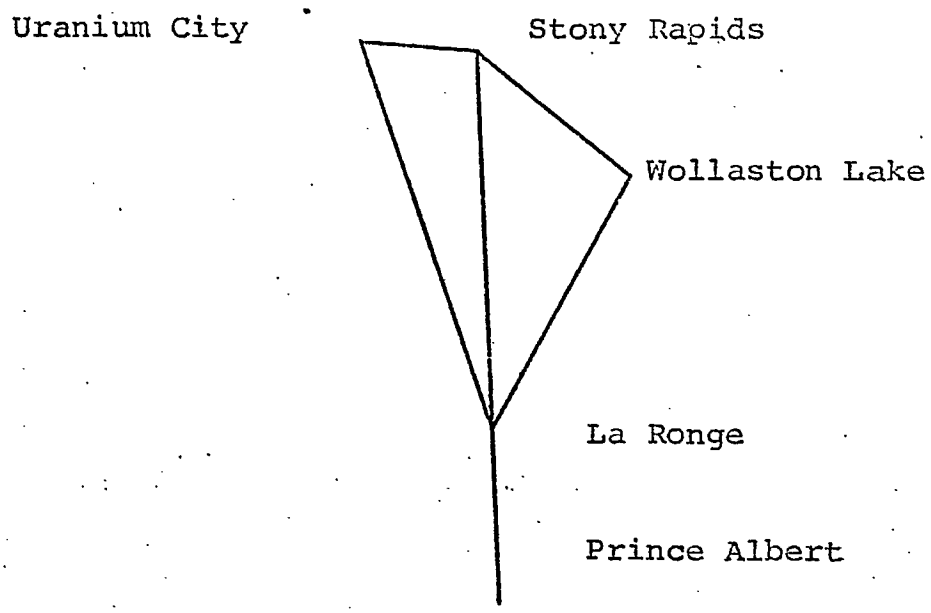
Assumptions were made concerning airlift of operatives from mining developments at Cluff Lake and Rabbit Lake by chartered aircraft. This being so, some modifications should be made to the scheduled system and the revenue.

Charter lift of operatives between Prince Albert - Cluff Lake, Prince Albert - Rabbit Lake.

Cluff Lake to Prince Albert	Rabbit Lake to Prince Albert	Prince Albert to Cluff Lake	Prince Albert to Rabbit Lake
Demand 2400 pass/yr. ↓	↓	↑	↑
i.e. pass. 46/wk. ↓	↓ 46/wk.	↑ 46/wk.	↑ 46/wk.
DC-3 services required			
↓ 1/wk.	↓ 1/wk.	↑ 1/wk.	↑ 1/wk.

Reduction in revenue in the scheduled system on account of this change would only amount to about $38,000. Revenue reduced to approximately $921,000.

The route for the scheduled service has now been reduced to:



An approximate operating cost reduction of $21,000. per year can now be deducted from the scheduled system. Direct operating cost/year is reduced to $755,000.

Cost for Cluff Lake/ Rabbit Lake Charter

Prince Albert to Cluff Lake =

2.45 (hrs/wk) X 4 Flts/wk X 52 = 509.5 hrs/yr.

Prince Albert to Rabbit Lake =

2.28 (hrs/wk) X 4 Flts/wk X 52 = 474.2 hrs/yr.

Total 984 hrs/yr.

Annual utilization hours for DC-3 charter = 984.

Direct operating cost/yr. = 984 X 158.30 =

$155,767

The overall direct cost of the existing scheduled system is taken to be $755,000; revenue $921,000; gross estimates.

b. Replacement of DC 3 by HS 748

Having estimated the direct operating cost of the existing system, the Hawker-Siddeley 748 was tested on the route linkages, retaining the same price structure. For route patterns and frequencies see Figure 3. Service is provided from Saskatoon to Prince Albert, La Ronge, Wollaston Lake, Stony Rapids and Uranium City; the two mining developments are left to a chartered operation by this airplane. Service from Regina to Saskatoon is provided by a DHC Twin Otter as in existing system. There is a reduction in frequency of service to as little as one per week on some links, while the overall load factor is seen to be low. (See Table 3 below.)

FIG. 3

ROUTE PATTERN & FREQUENCIES.
HS. 748.
FROM SASKATOON.

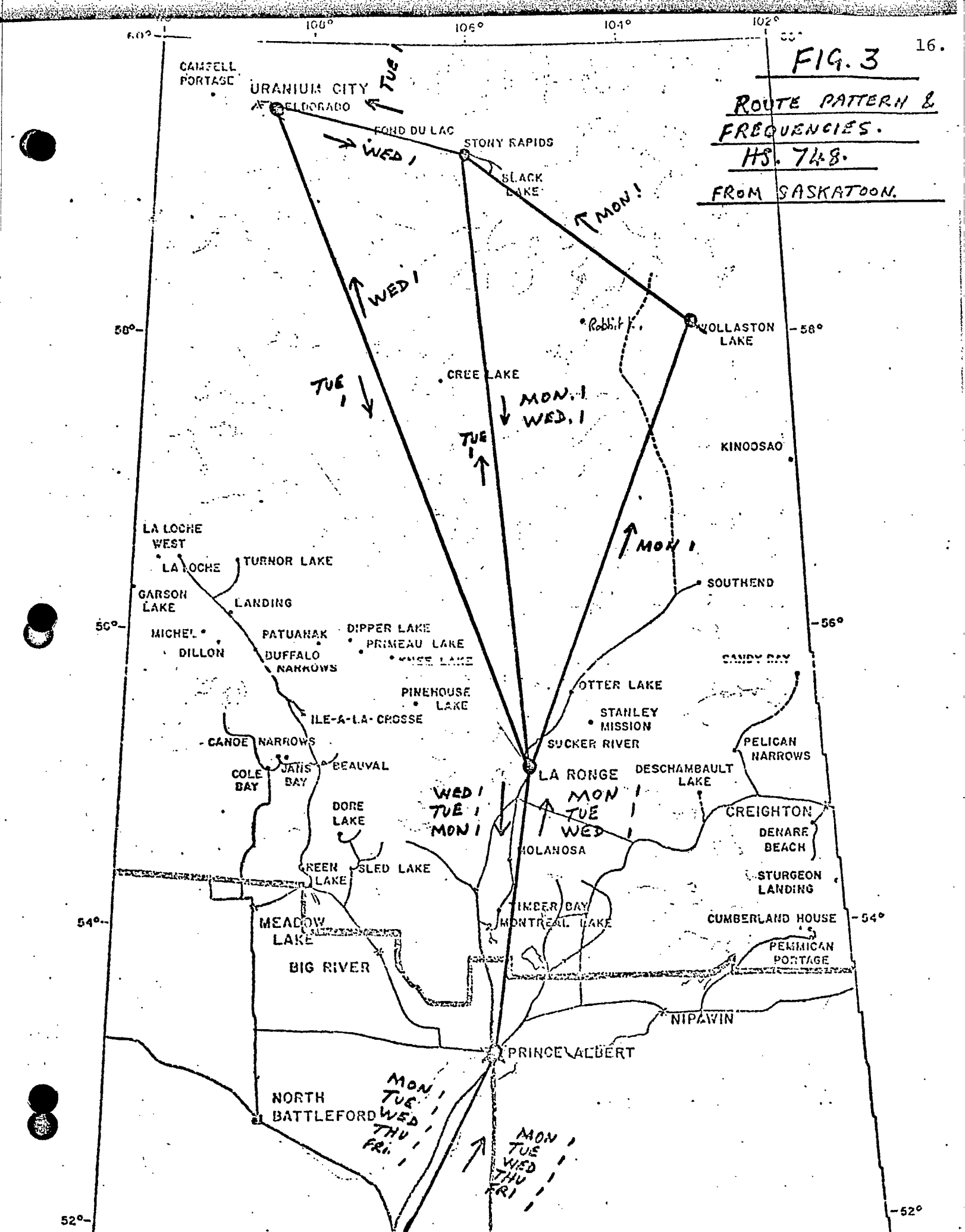


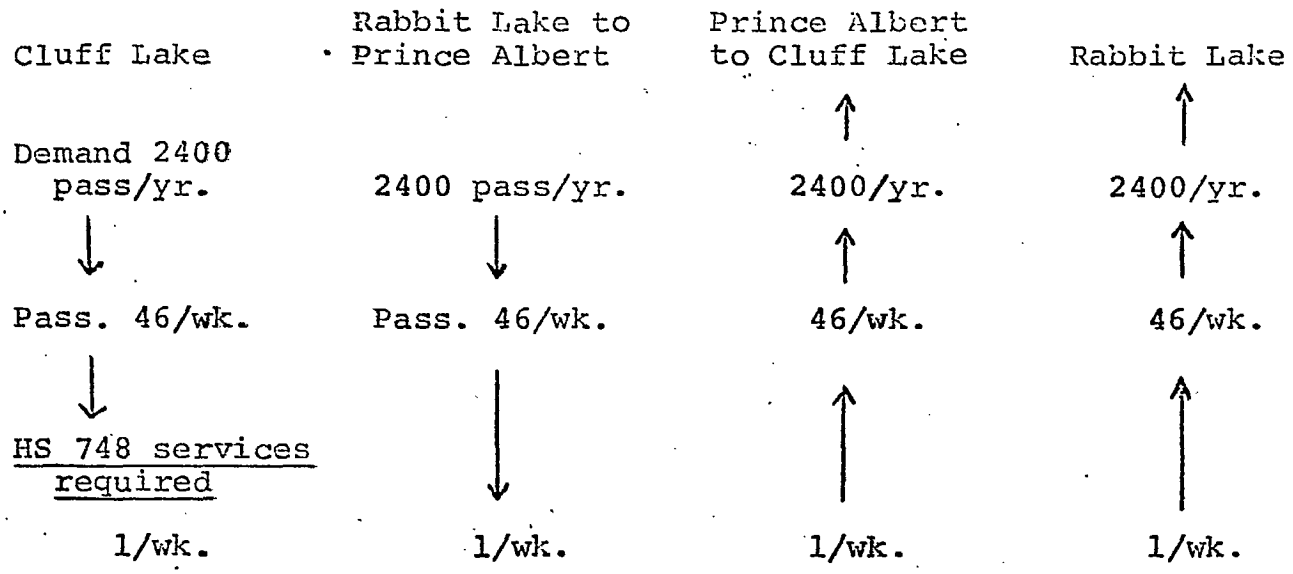
TABLE 3

Block Times and Load Factors for the Hawker-Siddeley 748 Under the Existing Price Structure

Link	Distance (S. Miles)	Frequency Per Week	Block Time Link	Block Time Total	Capacity Passenger	Link Flow	Load Factor
skatoon - Prince Albert	85	10	0.58	5.80	29,120	7073	0.24
rince Albert - La Ronge	132	6	0.74	4.44	17,472	8071	0.46
Ronge - Wollaston Lake	221	1	1.04	1.04	2,912	1759	0.60
llaston - Stony Rapids	125	1	0.72	0.72	2,912	2818	0.97
Ronge - Stony Rapids	288	3	1.28	3.84	8,376	3337	0.40
ony Rapids - Uranium City	96	2	0.61	1.22	5,824	2818	0.48
Ronge - Uranium City	329	2	1.43	2.86	5,824	2497	0.43
				19.92			

nual Utilization for Scheduled Service: 19.92 (hrs/wk) X 52 = 1036 hrs/yr.

Provision of Charter Service to Mining Sites



Annual Utilization hours

Cluff Lake =	170 hrs/yr.
Rabbit Lake =	158 hrs/yr.
Total	328 hrs/yr.

Total Utilization for HS 748

Scheduled Service	1,036
Charter	328
	1,364 hrs/yr.

Direct operating cost HS 748/hr. = $\frac{\$252,460}{1364} + 197$

= $382

(Direct cost, charter segment, 328 hrs. X 382 = $125,296)

Scheduled service;

Annual direct operating cost: 1036 X 382	=	$395,752
approximately equal to		$400,000
Annual direct operating cost DHC Twin Otter (Regina-Saskatoon)	=	$429,000
Direct Cost for Scheduled System	=	$829,000

On a gross estimate this compares favourably with the cost of DC-3, Twin Otter system, approximately $800,000.

CONCLUSIONS

PRO.	CON.
1. Provides a fast, more comfortable aircraft, hence, some time-savings.	1. Reduction in frequency provides a meagre service to northern communities.
2. Compares favourably with the cost of DC-3 operation.	2. Such reduction could cause potential decrease in link flows, hence, impairing load factor further.

PROPOSAL

If a higher annual utilization were possible, this aircraft could prove more favourable than the DC-3; hence a higher frequency will be examined, which may generate higher flows.

c. Examination of Fokker 28 aircraft

The Fokker 28 was examined under the existing system and price structure. Frequency of service was as for the Hawker-Siddeley 748, in Figure 3. In this case the aircraft is seen as providing 65 seats. Hence, the load factors are very low on most links. See Table 4 below.

An additional estimated cost of $234,000 is shown on the cost of the existing DC-3 system ($989,000 - $755,000 = $234,000).

Conclusions

The F-28 is less favourably suited compared to the DC-3 cost structure.

Although time is saved, and a comfortable aircraft offered, the service is reduced, which in turn promises a potential reduction in traffic volume for the scheduled system.

The F-28 would only be viable if utilization can be increased. Under the present price structure an approximate utilization of 1,200 hours/year would be required to achieve a 'break-even' situation. Allowing for 5% growth over 10 years, it appears that within the present structure, using Saskatoon as a southern base, this aircraft would still lose over $30,000 per year.

TABLE 4

Block Times and Load Factors for F28 Jet Aircraft
Under Existing Price Structure

Link	Distance (S. Miles)	Frequency Per Week	Block Time Link	Block Time Total	Passenger Capacity	Link Flow	Load Factor
askatoon - Prince Albert	85	10	0.42	4.20	33,800	7073	0.21
rince Albert - La Ronge	132	6	0.51	3.06	20,280	8071	0.40
a Ronge - Wollaston Lake	221	1	0.69	0.69	3,380	1759	0.52
ollaston Lake - Stony Rapids	125	1	0.50	0.50	3,380	2818	0.83
a Ronge - Stony Rapids	288	3	0.81	2.43	10,140	3337	0.33
tony Rapids - Uranium City	96	2	0.45	0.90	6,760	2818	0.42
a Ronge - Uranium City	329	2	0.89	1.79	6,760	2497	0.37
				13.56 hrs/wk.			

NNUAL UTILIZATION ON SCHEDULED SYSTEM = 13.56 X 52 = 705 hrs/yr.

nnual utilization hours on Schedule system: = 13.56 (hrs/wk) X 52 = 705 hrs/yr.

nnual utilization for Charter (Cluff/Rabbit) = 200
TOTAL ANNUAL UTILIZATION = 905 hours

ased on 905 hours annual utilization, direct hourly operating cost is estimated to be = $\frac{\$446,375}{905} + \$300 = \$793$

nnual direct operating cost = $793 X 705 = $560,000
nnual direct operating cost Twin Otter segment = 429,000
cheduled System Total D.O.C. $989,000

d. Assumed Replacement of the Present System by a HS 748 and Twin Otter Service based in Regina

This service proposes a frequency of 20 aircraft per week between Regina and Saskatoon, 3 by HS 748, 17/week by a Twin Otter, and 1/week by HS 748 to northern settlements. For details of frequencies see Figure 4.

Direct cost of potential new service.

Hawker-Siddeley 748

Utilization on scheduled service = 1,165 hrs/yr.

Utilization for Cluff/Rabbit Lake Charter = 328
Total 1,493 hrs/yr.

Direct hourly operating cost - $\frac{\$252,460}{1493}$ + \$197 = \$366

Annual direct cost of Scheduled Service by HS 748

= 1,165 X 366

= \$426,501

DHC Twin Otter

Total utilization on schedule (Regina - La Ronge) = 2,699 hrs/yr.

Direct cost = 2,699 X \$136.78 + 62,875 = \$432,044

Total annual direct operating costs for this schedule = \$426,501 + 432,044 = \$858,545.

The revenues produced by the scheduled service, existing system are: DC-3 + Twin Otter: \$921,000.

Viability of a Hawker-Siddeley/Twin Otter Service at These Frequencies of Service:

Direct operating costs of system displayed in Figure 4, approximately equal to $906,000. Revenues under present price structure, approximately equal to $921,000.

This leaves $15,000 disposable for overheads (buildings, organization, ticketing, promotion, etc.). Initially, this system would operate at a loss.

Over 10 Year Period

Estimating a 5% annual growth, over 10 years, this will produce an increase in revenue of 25%. There is no cost increase because of available surplus capacity in the system.

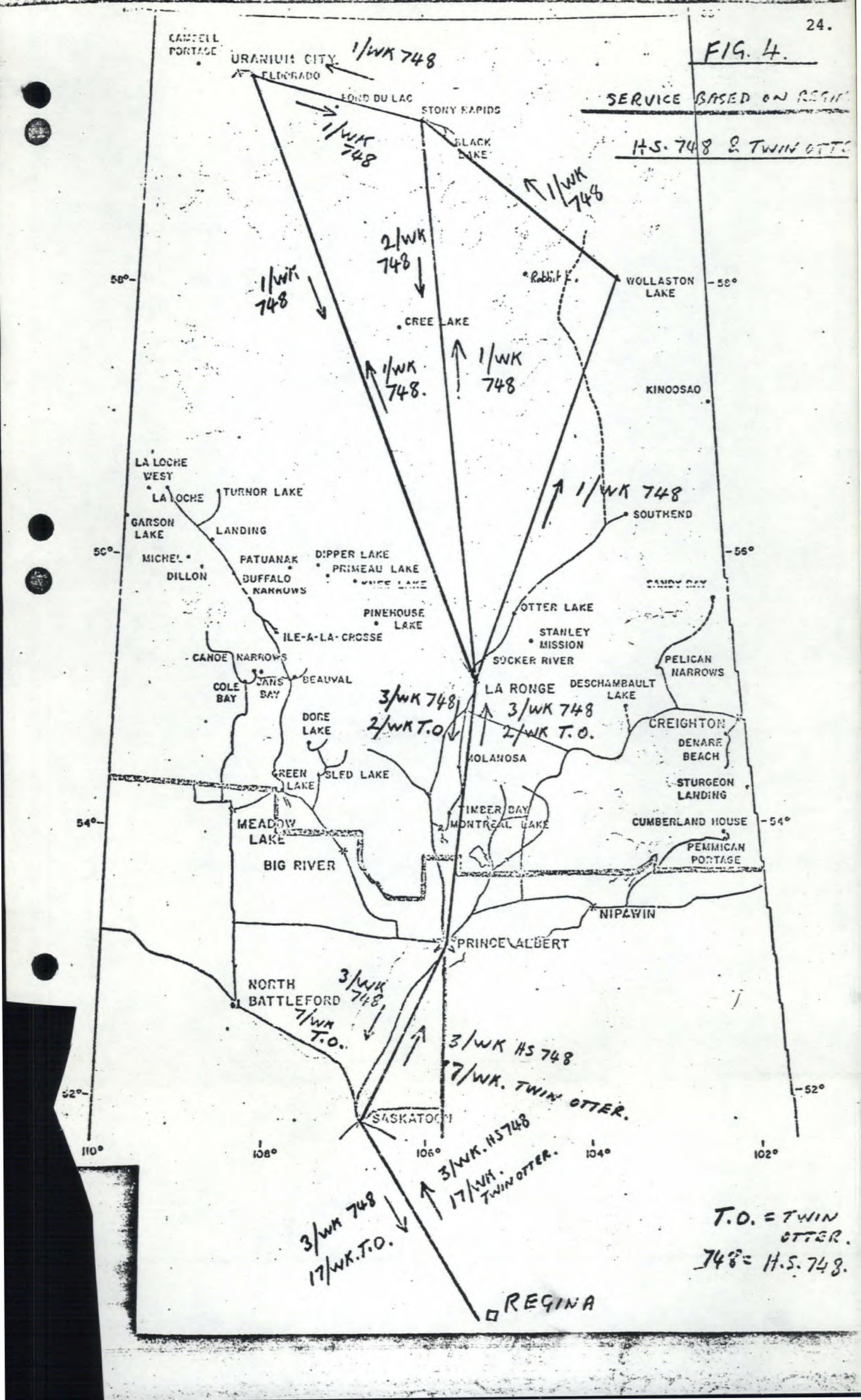
10 years average revenue at present day price structure	=	$1,151,250
10 years average direct cost	=	906,000
Surplus		$ 245,000

Conclusions

Over 10 years this would be a feasible economic service as proposed in Figure 4. However, as for proposals in Figure 3, the reduction in frequency of service to the far northern settlements is detrimental and could result in a reduction in passenger flows.

FIG. 4.

SERVICE BASED ON BOTH H.S. 748 & TWIN OTTER



T.O. = TWIN OTTER.

748 = H.S. 748.

The faster, modern aircraft does produce time-savings, e.g. on a typical trip Uranium City - Regina direct, time savings are 6 hours - 4.8 hours = 1.2 hours. The capital, Regina also receives benefit from the augmented service. This HS 748 Twin Otter system will introduce a total saving of 8,500 passenger hours per year over the present DC-3 Twin Otter service.

e. Fokker 28 assessment for a more frequent scheduled service

A single Fokker 28, twin jet, was tested on a system from Regina-Saskatoon-Prince Albert-La Ronge-Uranium City-Cluff Lake-La Ronge-Prince Albert-Saskatoon-Regina. It was proposed to service the links north of La Ronge on a daily basis, including the northeastern links on alternate days. One aircraft was unable to supply this more frequent service and still have time, in any one day, to provide a day time charter service for operatives from Cluff Lake and Rabbit Lake. Time from Regina back to Regina is approximately 8 hours, allowing for time on the ground. See Table 5.

There is no justification for two jet aircraft on the northern links, so, to provide more adequate service, a combination of one Fokker 28, and one Hawker-Siddeley 748 was examined, in conjunction with a Twin Otter on southern links. This employs the F-28 on the main north-south run, Regina to Uranium City to Regina and the HS 748 on the northeastern scheduled run, plus charter work, and based in Prince Albert. See Figure 5.

Direct operating cost/hour = $\frac{\$252,460}{1592}$ + \$197 = \$356

Annual direct operating cost for schedule (HS 748) = 1264 X 356 = \$449,984.

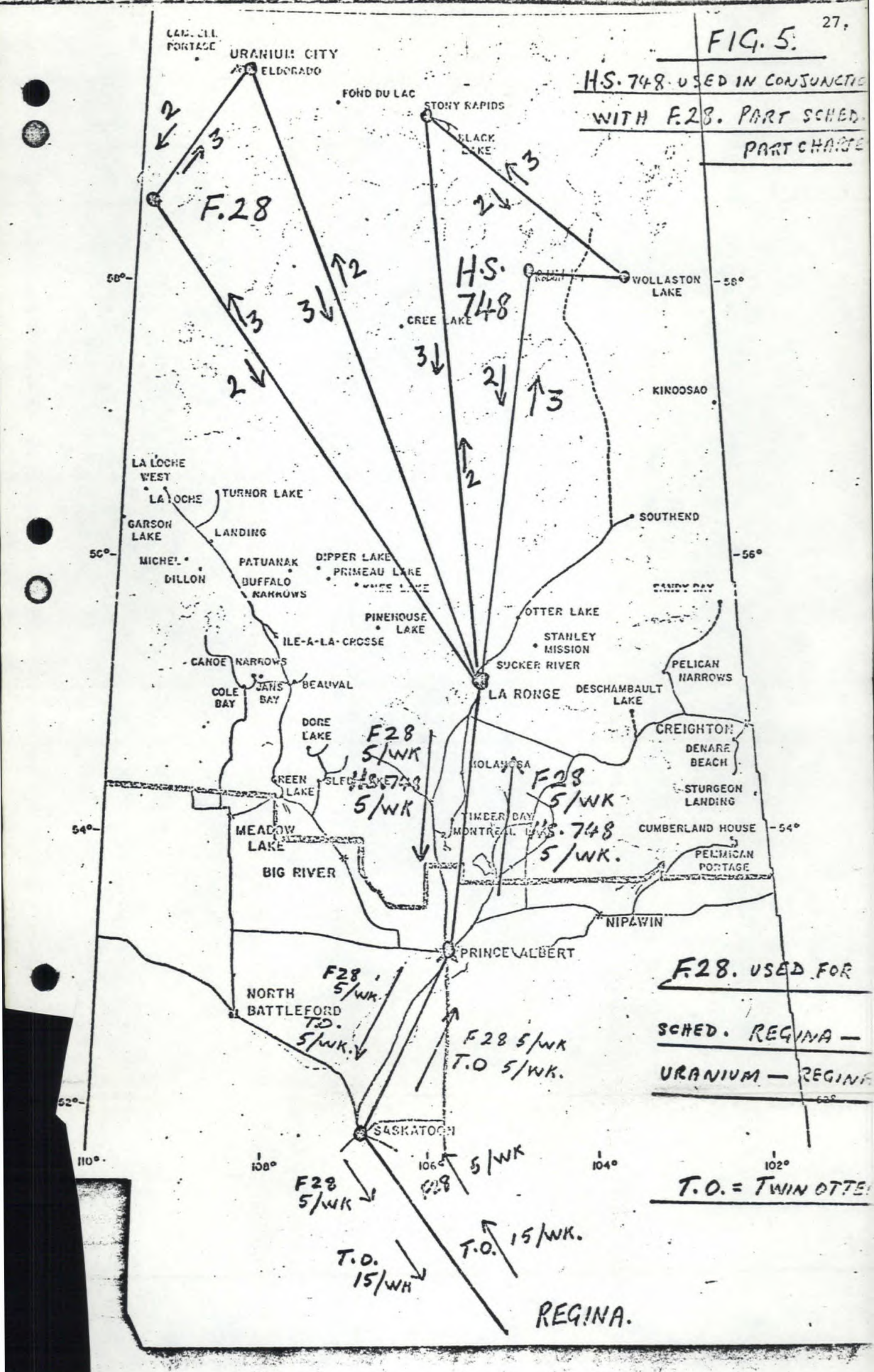


FIG. 5.
H.S. 748 USED IN CONJUNCTION WITH F.28. PART SCHED. PART CHARTER
CAM. CEL. PORTAGE
URANIUM CITY
ELDORADO
FOND DU LAC
STONY RAPIDS
BLACK LAKE
F.28
H.S. 748
WOLLASTON LAKE
CREE LAKE
KINOOSAO
LA LOCHE WEST
LA LOCHE
TURNOR LAKE
GARSON LAKE
LANDING
MICHEL
DILLON
PATUANAK
DUFFALO NARROWS
DIPPER LAKE
PRIMEAU LAKE
SOUTHEND
SANDY BAY
OTTER LAKE
PINEHOUSE LAKE
ILE-A-LA-CROSSE
STANLEY MISSION
CANOE NARROWS
SUCKER RIVER
PELICAN NARROWS
COLE BAY
JANS BAY
BEAUVAL
LA RONGE
DESCHAMBAULT LAKE
DORE LAKE
CREIGHTON
DENARE BEACH
F28 5/WK
GREEN LAKE
STURGEON LANDING
TIMBER BAY
MONTREAL LAKE
CUMBERLAND HOUSE
MEADOW LAKE
BIG RIVER
PELICAN PORTAGE
NIPAWIN
PRINCE ALBERT
NORTH BATTLEFORD
T.O. 5/WK.
SASKATOON
REGINA.
T.O. = TWIN OTTER
110°
108°
106°
104°
102°
58°
56°
54°
52°

TABLE 5

Utlisation hours for F28 and HS 748 A/C Used in Conjunction

F28 Schedule Link	Distribution	Block Time Hours	Frequency/week	Utilisation Hours/Year
Regina - Saskatoon	148	0.54	10	280
Saskatoon-Prince Albert	85	0.42	10	218
Prince Albert-La Ronge	132	0.51	10	265
La Ronge - Uranium City	329	0.89	5	231
Uranium City - Cluff Lake	92	0.44	5	114
Cluff Lake - La Ronge	276	0.79	5	205
			Total	1313
H.S. 748 Schedule Link				
Prince Albert-La Ronge	132	0.73	10	380
La Ronge-Rabbit Lake	228	1.07	5	278
Rabbit Lake-Wollaston	20	0.33	5	86
Wollaston-Stoney Rapids	125	0.71	5	185
Stoney Rapids-La Ronge	288	1.29	5	335
			Total	1264

Utilisation hours Hawker-Siddeley 748

Charter Service - Rabbit Lake/Cluff Lake	= 328 hours/year
Scheduled services	=1264 hours/year
Annual Total utilisation	=1592 hours/year

Fokker 28

Total annual utilization on schedule = 1313 hours.

Direct operating cost/hour = $\frac{446,375}{1313} + 300 = \$640.$

Annual direct operating cost for schedule = 1313 X 640 = $840,320

DHC Twin Otter

Annual utilization = 2106 hours.

Direct operating cost/hour = 2106 X $136.78 + $62,875 = $350,934

Total direct cost of scheduled service = $449,984 + $840,320 + $350,934 = $1,641,238.

The total cost for this system is estimated at $1,641,238 at present day flow levels. Revenues expected would be $1,107,000 (see Table 7), as derived for increased potential. There could be an added revenue increment due to service provided by the F-28.

Scheduled Service Only

	Present Day Flows		Average Annual Subsidy for Next 10 Years at 5% Annual Growth
Cost	$1,641,238		$1,641,238 (No extra cost due to capacity)
Revenue	$1,107,000	(Table 7)	$1,383,000
Subsidy	$ 534,238		$ 258,238

It is not considered that the time savings and other benefits from the F-28, combined with the large increase in capital cost, are commensurate with the increment in subsidy.

This system introduces three different aircraft types for what is basically one mainline service, hence, large increase in cost for spares, maintenance, etc.

f. Assessment of HS 748 for a more frequent scheduled service

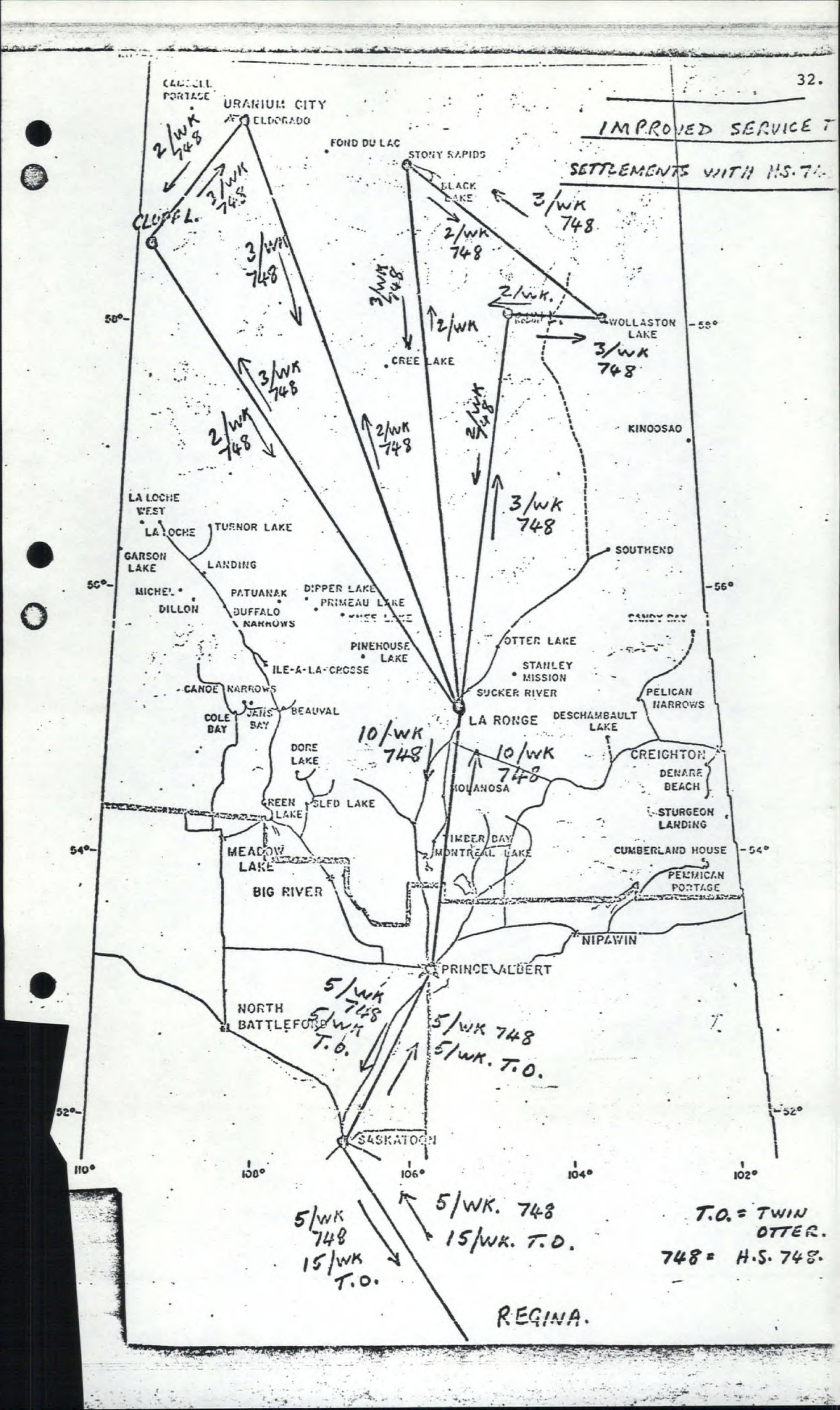
Examination of the suitability of this airplane for an increased frequency of service on the system links north of La Ronge, with Twin Otter service on the southern links.

The service provided by a single Hawker-Siddeley 748, illustrated in Figure 4, is the maximum which could be performed by one aircraft, leaving two days in each week for daylight charter airlift from Cluff Lake and Rabbit Lake. A DHC Twin Otter was employed on the southern links in conjunction with one HS 748, both operating from Regina.

In examining increased service to northern settlements, it was decided to confine the Twin Otter to service between Regina and Saskatoon. Use of a second HS 748 is suggested, to back up on scheduled service and to fulfill any charter obligations necessary, thus extending the benefits of fast modern aircraft to all communities in the system. See Figure 6.

The existing system offers 2 flights a week to the most northern settlements. It is now possible to assess the possibility of offering an augmented service using modern aircraft. The service examined offers:

a) two flights a day from Prince Albert to La Ronge,


IMPROVED SERVICE T
SETTLEMENTS WITH H.S. 74
CAMECO PORTAGE
URANIUM CITY
ELDORADO
FOND DU LAC
STONY RAPIDS
BLACK LAKE
CLUFF L.
WOLLASTON LAKE
CREE LAKE
KINOOSAO
SOUTHEND
LA LOCHE WEST
LA LOCHE
TURNOR LAKE
GARSON LAKE
LANDING
MICHEL
DILLON
PATUANAK
DIPPER LAKE
PRIMEAU LAKE
BUFFALO NARROWS
SANDY BAY
PINEHOUSE LAKE
OTTER LAKE
ILE-A-LA-CROSSE
STANLEY MISSION
CANOE NARROWS
SUCKER RIVER
PELICAN NARROWS
COLE BAY
JANS BAY
BEAUVAL
LA RONGE
DESCHAMBAULT LAKE
DORE LAKE
CREIGHTON
DENARE BEACH
GREEN LAKE
SLED LAKE
STURGEON LANDING
MEADOW LAKE
MONTREAL LAKE
CUMBERLAND HOUSE
BIG RIVER
PEMMICAN PORTAGE
NIPAWIN
PRINCE ALBERT
NORTH BATTLEFORD
SASKATOON
REGINA.
2/WK 748
3/WK 748
10/WK 748
5/WK 748
5/WK T.O.
15/WK T.O.
T.O. = TWIN OTTER.
748 = H.S. 748.
58°
56°
54°
52°
110°
108°
106°
104°
102°

b) one flight a day from Prince Albert to La Ronge to Uranium City,

c) one flight per day to Wollaston Lake and Stony Rapids,

d) a scheduled stop at Cluff Lake and Rabbit Lake in addition to charter,

e) service directly in and out of Regina using the HS 748.

In sum, this system provides an improved scheduled service with one HS 748, the second fulfills the charter contract, and acts as a back-up.

Table 6 shows the utilization hours and frequencies.

Estimation of Revenue Improvements

It is considered that due to the increased frequency, speed, added comfort and convenience, there is potentially an additional percentage of total link flows to be captured by this new scheduled service. For a gross estimate of this percentage increase in flows and revenue see Table 7.

TABLE 6

Derivation of Annual Utilization Hours for Twin Otter and Hawker-Siddeley 748 on Improved Frequency Schedule

Link	Dist. S. Mls.	Block Time T. Otter	Block Time H.S. 748	Freq/Wk. T. Otter	Freq/Wk. H.S. 748	Utilization/Yr. T. Otter	Utilization/Yr. H.S. 748
Regina-Saskatoon	148	1.10	0.79	30	10	1716	411
Saskatoon-Prince Albert	85	0.75	0.58	10	10	390	302
Prince Albert-La Ronge	132		0.74		20		770
La Ronge-Rabbit Lake	228		1.09		5		283
Rabbit Lake-Wollaston Lake	20		0.33		5		86
Wollaston Lake-Stony Rapids	125		0.72		5		187
Stony Rapids-La Ronge	288		1.28		5		333
La Ronge-Uranium City	329		1.43		5		372
Uranium City-Cluff Lake	92		0.59		5		153
Cluff Lake-La Ronge	276		1.25		5		325
			Annual Utilization Hours			2106	3222

Annual Total Utilization for DHC Twin Otter = 2106 hours
Annual Total Utilization for HS 748 (2 A/C) = 3222 hours
Annual Total Assumed for Charter Work = 500 hours
Total HS 748 Hours = 3722/year

Cost

Direct operating cost, Twin Otter = 2106 X $136.78 + 62,875 = $350,934 annual
Direct operating cost, HS 748/hr. = 2(A/C) X 252,460 + 197 = $333/hr.

Direct schedule operating cost for 2 X HS 748 = 333 X 3222 = $1,072,925
Total for scheduled operation = $1,423,860

Conclusions

The improved service shown in Figure 6 indicates:

1. Service improved to a daily flight for most northern communities.
2. Modern aircraft offer shorter travel time, comfort, convenience.
3. Regina has been connected directly to northern Saskatchewan by larger modern aircraft.
4. Service between Prince Albert and La Ronge (now a government centre to 10 a week.)

1. The service will require substantial subsidy.

Present day cost	$1,423,860
Estimated improved revenue	$1,107,000
Required	$ 316,680

2. Average annual subsidy over 10 years, allowing 5% annual growth.

Present day cost (no extra cost due surplus capacity)	1,423,860
Revenue	1,383,750
Required	$ 40,110

Since this paper was written it appears that Norcanair, the licensed Class 2 carrier for scheduled operation in Saskatchewan, has acquired one Hawker-Siddeley 748 to be operated from Regina via La Ronge to the far northern settlements. It is understood that operation of a second Hawker-Siddeley 748 is under consideration. Service is due to start September 17, 1973.

TABLE 7

Potential Revenue Increase Due to Increased Traffic Capture, Derived from Table 1

Regina Service to North, Desire Line	% Schedule of Total Original Service	For Improved Service	Revenue Growth Factor	Original Revenue $	Potential Improved Revenue $
askatoon - Prince Albert	-			84,000	84,000
askatoon - Wollaston	-			3,500	3,500
egina - Saskatoon	-			360,000	360,000
rince Albert - Wollaston	-			22,000	22,000
rince Albert - La Ronge	0.29	0.70	2.4	53,200	128,000
rince Albert - Stony Rapids	0.39	0.50	1.28	63,000	81,000
rince Albert - Uranium	0.65	0.80	1.23	113,000	139,000
rince Albert - Cluff Lake	-			12,000	12,000
rince Albert - Rabbit Lake	-			13,000	13,000
a Ronge - Wollaston	0.45	0.80	1.78	87,000	155,000
a Ronge - Stony Rapids	0.39	0.50	1.28	35,000	45,000
a Ronge - Uranium	0.65	0.80	1.23	52,000	64,000
ollaston - Rabbit Lake	-	-		265	500
					$1,107,000

Total Potential Improved Revenue $1,107,000

g. Potential for diversion of established Edmonton Uranium City Traffic Flows

Most of the passenger and freight flows to Uranium City originate in Edmonton, following an inter-modal system, via

a) air for passengers and some freight,

b) highway and water for most general freight and bulk fuel.

In order to improve economic prospects for air transportation services between northern and southern Saskatchewan centres, some diversion of that traffic to Saskatchewan based systems is necessary. To achieve this a comparable price structure is necessary to that pertaining between Edmonton and Uranium City.

A preliminary estimate shows that the fare from Uranium City to Saskatoon would need a reduction from the present $67 to about $40, and general freight from $12.50/100 lbs. to $10/100 lbs., or less. Such a reduction on one link would call for others.

A gross estimate of revenue loss on all northern links in the system, due to fare reduction, indicates that a 40% reduction would create a decrease (loss) of $266,000 income. Using an average fare of $40 per passenger, Uranium City to Saskatoon, this would mean that $\frac{266,000}{40}$ = 6,650 passengers should be diverted. This is approximately 20% of the present Edmonton-Uranium City flow.

Any decision concerning reduction of fares depends on the availability of subsidy, and the potential for diverting traffic flows. About 10% diversion of Edmonton traffic would be required to break even. This takes no account of any small incremental costs for handling extra traffic, there is already surplus capacity on the airplane; or benefits from any multiplier effects due to increased spending within the province.

An extra study of the firmness of ties between Uranium City and Edmonton would be required, to establish business/monetary ties, family ties, etc.

h. Conclusions and Recommendations

To provide improved quality of service to mainline northern communities, a service on the lines of one of those examined, is essential. Of those, a system using two Hawker-Siddeley 748 airplanes in conjunction with the DHC Twin Otter, seems to fulfill most of the requirements.

It replaces service provided by aging, obsolescent aircraft with faster, modern aircraft; offers travel comfort and convenience between distant settlements; allows adequate capacity for expansion of service. This proposed system connects the main southern centres, Regina and Saskatoon, directly to the northern parts of the province.

A subsidy would be required to operate the system.

Regarding availability of the aircraft, the manufacturers point out that under the Export Credit arrangements, (E.C.G.D.) in the U.K., 10% down on the selling price of the aircraft, the balance over 8 years at 6½% to 7% is standard financing. No doubt similar arrangements apply to other aircraft and countries of manufacture.

While the above comments may not have direct bearing on DREE assistance programs, this examination of aircraft suitability has provided criteria necessary to decisions on airstrip development, in particular those concerning runway length and bearing strength. It is suggested that, in the light of desired provincial growth, these developments should be provided by a provincial carrier.

4. Feeder Services

It was proposed above that air transportation in northern Saskatchewan should be developed as a two-tiered system. Localized regions have been referred to earlier as A, B and C; a feeder service in these areas is suggested based on use of the Britten-Norman BN2A Islander. The Islander is a twin engined, ten seat, nine passenger aircraft, with a payload of 2,000 lbs.

A.A. Jones, in a study entitled "Recommendations for Improved Transport Services to the Mid-North-West Portion of Saskatchewan, generally described by Prince Albert - Meadow Lake - La Loche, Beauval", has examined the capabilities of the Islander for that area. Appendix 3 shows some extracts from that study, including maps. Map, Figure 1, (A.A. Jones) illustrates the present system. Map, Figure 5, (A.A. Jones) depicts the proposed BN2A Islander service. Table 3 (A.A. Jones) shows the aircraft utilization, passenger flows and load factors. Passenger equivalents are based on freight @ 165 lbs./passenger, added to present passenger flows. Table 5 (A.A. Jones) provides an economic summary for provision of an Islander service in Region B, based on an annual cost of $91,000 and requiring an annual subsidy of $26,500.

No direct analysis has yet been done for Region B, to the east of La Ronge including Stanley Mission, Deschambault, Pelican Narrows, Southend, Kinoosao. However, a similar system would apply; airfield improvements have been suggested, in line with the A.A. Jones study.

For Region C, based on Uranium City, serving Camsell-Portage, Fond du Lac and Stony Rapids, a Britten-Norman Islander service was estimated to cost about $59,000 per year. That analysis is shown later in association with transportation on and around Lake Athabaska.

5. Airport Improvements

Examination of the suitability of certain aircraft to perform a mainline function leads to the investigation of the ability of the associated airfield system to sustain the service.

The ability of the mainline airfields (Prince Albert - La Ronge - Rabbit Lake - Wollaston Lake - Stony Rapids - Uranium City - Cluff Lake) to support the existing DC-3 system is self-evident. It was necessary to evaluate the airfield size, surface condition and bearing capacity in relation to the minimum requirements of

a) the turbo-prop, Hawker-Siddeley 748

b) the twin jet, Fokker 28.

In close association with the mainline system it was necessary to evaluate airstrips serving settlements in the geographic regions designated A, B and C, bearing in mind the suggestion to use a Britten-Norman Islander airplane. (See Figure 7 for airfield locations)

Examination of the feasibility of the HS 748 and F-28 showed that a service using two of the former was more efficient. This being the case, mainline airfields should be designed to handle this airplane; it requires, as a minimum, 4,400 ft. X 100 ft. compacted gravel. However, considering future jet services, and present day

potential requirements for occasional jet traffic, it was decided to recommend that runways be constructed with that in view. The F-28 requires 5,000' X 150' compacted gravel, preferably pavement; hence, the recommendation is for 5,000' X 150' with oil treatment. These figures are for 1,500 ft. A.M.S.L. and conform to requirements for northern settlements. Airfields at Prince Albert and Uranium City already fulfill these demands.

Airstrips in the feeder zones, geographic Regions A, B and C are required to accommodate the Britten-Norman BN2A Islander. The excellent S.T.O.L. characteristics of this aircraft specify a maximum requirment of 1,500 ft. for accelerating stop conditions, as prescribed for licensing standards for runways. Doubtless other aircraft, with requirements for longer runways will continue to use these settlement airfields, so that the Islander cannot be considered as the "critical aircraft".

A compromise proposal is for 3,000 ft. X 100 ft. gravel, preferably oil treatment, to accommodate other unspecified aircraft. It was decided to discount use of the DC-3 to these settlements, which could not support its use over any long period. The DC-3 has a limited future in the north.

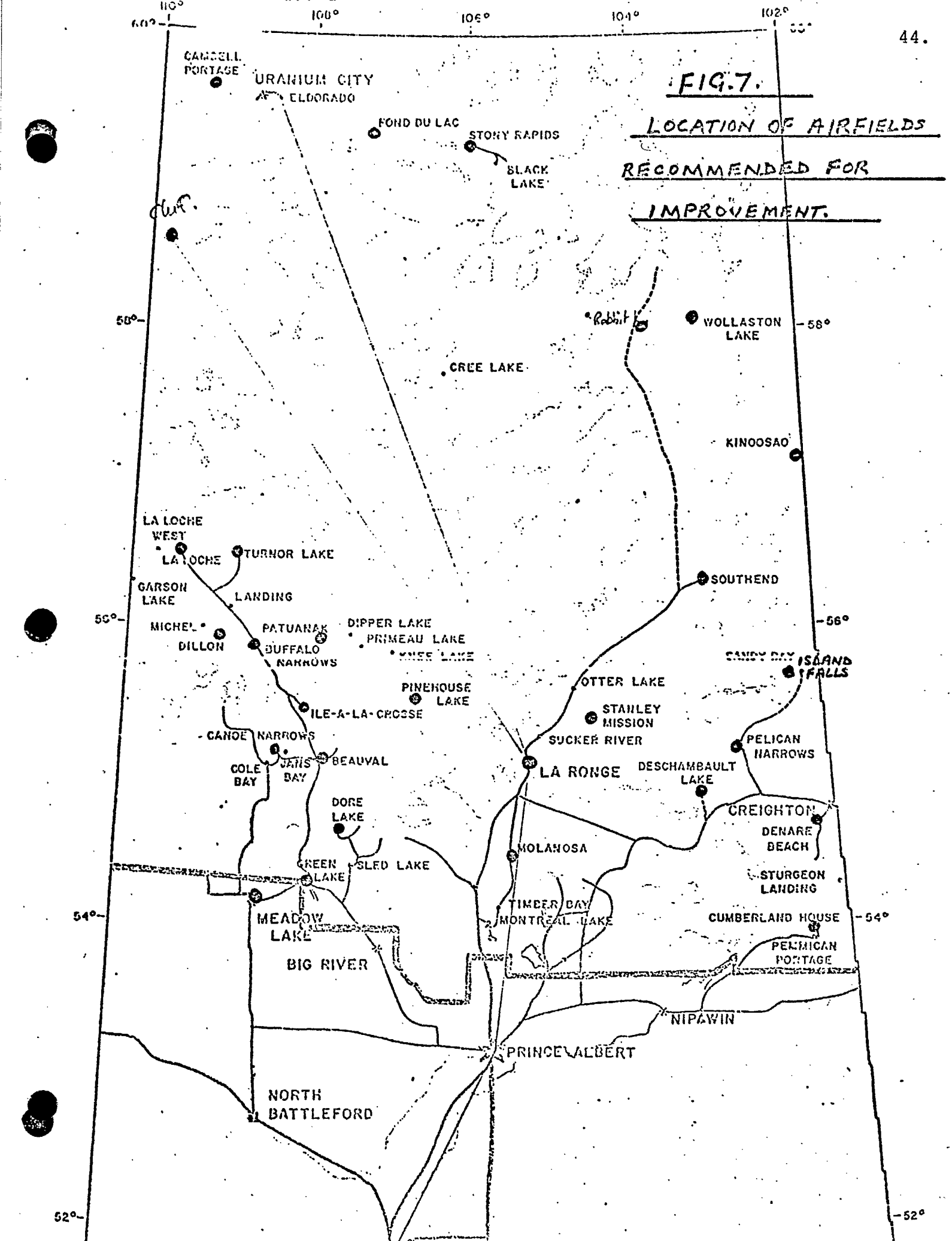


FIG. 7.

LOCATION OF AIRFIELDS RECOMMENDED FOR IMPROVEMENT.

Only one runway has been accounted for in the accompanying table, at all locations, except at Rabbit Lake where two runways constructed by Gulf Minerals already exist, however, of these suggested standards, the systems can supply a Class 2 service with the Hawker-Siddeley 748, and a Class 3 service with the BN2A Islander. Ultimately, a Class 1 service would be hoped for with two runways at each location, as specified in the M.O.T. draft report, "Aerodrome Standards and Physical Characteristics".

Table 8 shows present conditions at all airfields in the mainline and regional systems, with recommended improvements. The total cost for these improvements is $6,345,000.

Buffalo Narrows is a base for forest fire fighting operations, used by Canso aircraft. An expansion in this role is proposed for the future. A 4,000 ft. all-weather airstrip, with oil treatment, is considered adequate at this time, Cost estimate is $70,000.

Meadow Lake

This airfield plays an important role in projected forestry developments. It will be used by Canso and other aircraft for firefighting. A 4,000' by 100' all-weather strip with oil treatment, is recommended. Approximate cost is $80,000. M.O.T. have already an agreement to upgrade the airfield to the west of the town.

Both Buffalo Narrows and Meadow Lake should be given priority for a second runway, in view of forestry and other developments.

Table 8, outlining present airport conditions, and recommended improvements, was prepared by Saskatchewan Department of Highways and Transportation for the Federal Ministry of Transport, July 1973.

ECOMMENDED AIRSTRIP	APPROXIMATE COST ESTIMATE($)	NOTES
3000' x 100' O.T.	70,000	Consider relocation nearer to settlement. D.N.S. budget $18,000 here in 1973.
4000' x 100' O.T.	100,000	D.N.S. budget $6,000 in 1973 for dust proofing. Higher std. runway proposed here due to fire base and trade centre role.
3000' x 100' O.T.	100,000	
3000' x 100' O.T.	70,000	
4200' x 150' O.T.	50,000	Stabilize and oil treatment; Mokta installed runway.
3000' x 100' O.T.	80,000	
-	-	Low warrant due to proximity to Flin Flon.
3000' x 100' O.T.	80,000	
3000' x 100' O.T.	80,000	
3000' x 100' O.T.	70,000	
3000' x 100' O.T.	90,000	
3000' x 100' O.T.	70,000	
3000' x 100' O.T.	70,000	D.N.S. budget $17,000 here in 1973.
3000' x 100' O.T.	70,000	
3000' x 100' O.T.	100,000	

TABLE # 8

PRESENT AIRPORT CONDITIONS

	AIRPORT LOCATION	POPULATION (1971/72)	VFR OR IFR	LIGHTS	A.G.C.	OWNER & OPERATOR	RUNWAYS	ORIENTATION	LENGTH (ft.)	WIDTH (ft.)	SURFACE TYPE	NOTES
1	Beauval	438	VFR	x	x	Private	1	NW-SE	2000	-	-	Located 5 miles from settlem
2	Buffalo Narrows	1128	VFR	x	✓	D.N.S.	1	10-28	3300	200	Turf	
3	Camsell Portage	87	-	-	-	-	-	-	-	-	-	No airport
4	Canoe Narrows	455[b]	-	-	-	-	-	-	-	-	-	"
5	Cluff Lake	200(est)	VFR	x	x	Private	1	-	4800	150	Gr.	
6	Cumberland House	1016	VFR	x	x	D.N.S.	2	09-27 18-26	4700 2800	300 300	Sod	
7	Denare Beach	351	-	-	-	-	-	-	-	-	-	No airport
8	Deschambault	195	-	-	-	-	-	-	-	-	-	No airport
9	Dillon	451	-	-	-	-	-	-	-	-	-	No airport
10	Dore Lake	100	VFR	x	x	D.N.S.	1	E-W	-	-	Gr.	
11	Fond-du-lac	328	VFR	x	x	D.N.S.	1	10-28	2600	75	Gr.	
12	Green Lake	453	VFR	x	x	D.N.S.	1	N-S	2150	200	Sod	
13	Ile-a-la-Crosse	1001	VFR	x	x	D.N.S.	1	N-S	2800	-	Sod	
14	Island Falls	494	VFR	x	x	Private	1	NE-SW	1700	150	Clay	
15	Kinoosao	119	-	-	-	-	-	-	-	-	-	No airport

ECOMMENED AIRSTRIP	APPROXIMATE COST ESTIMATE($)	NOTES
3000' x 100' O.T.	70,000	
5000' x 150' PVT.	4,000,000	Includes one paved runway, apron, taxi way, and terminal building. Cross-strip need should be asessed.
4000' x 100' O.T.	85,000	Upgrade the site to the west of town.
-	-	Do not recommend for upgrading. Do so only if recreational oriented flying is considered justification.
3000' x 100' O.T.	70,000	ARDA grant of $36,000. Airport presently under construction.
3000' x 100' O.T.	70,000	
3000' x 100' O.T.	80,000	D.N.S. budget $16,000 in 1973.
5000' x 200' O.T.	100,000	Stabilize Gulf strip; oil treatment.
3000' x 100' O.T.	100,000	
3000' x 100' O.T.	100,000	Sited with potential for expansion due to possibility for future 'mainline' scheduled service.
5000' x 150' O.T.	250,000	
3000' x 100' O.T.	70,000	
5000' x 150' O.T.	250,000	
TOTAL	$ 6,345,000	

TABLE #, CONTINUED

PRESENT AIRPORT CONDITIONS

	AIRPORT LOCATION	POPULATION (1971/72)	VFR OR IFR	LIGHTS	A.G.C.	OWNER & OPERATOR	RUNWAYS	ORIENTATION	LENGTH (ft.)	WIDTH (ft.)	SURFACE TYPE	NOTES
16	La Loche	1261	VFR	x	x	D.N.S.	1	N-S	2600	200	Sand	
17	La Ronge	2507	IFR	✓	✓	D.O.H.	2	18-36	4100	150		
								13-31	3100	150	Gr.	
18	Meadow Lake	3435	VFR	x	x	Private	1	E-W	2500	170	Sod	Located ½ mi. s. & 2 miles of town
19	Meadow Lake		VFR	x	x	Town of Meadow Lake	1	07-25	3200	150	Gr.	Located east of town
20	Molanosa	214	VFR	x	x	Private	2	E-W	1600	75		
								N-S	1600	75	Sod	
21	Patuanak	310	-	-	-	-	-	-	-	-	-	No airport
22	Pelican Narrows	810	VFR	x	x	Private	1	N-S	-	-	Gr.	
23	Pinehouse	427	VFR	x	x	D.N.S.	2	NW-SE	3300	200		
								NE-SW	2800	200	Gr.	
24	Rabbit Lake	200(est.)	VFR	x	x	Private	2	-	5000	200		
									500	200	Gr.	
25	Southend	275	-	-	-	-	-	-	-	-	-	No airport
26	Stanley Mission	916	VFR	x	x	D.N.S.	1	N-S	-	-	Sod	
27	Stony Rapids	657[a]	VFR	x	✓	D.N.S.	1	05-23	3680	150	Gr.	
28	Turnor Lake	276	-	-	-	-	-	-	-	-	-	No airport
29	Wollaston Lake	339	VFR	x	x	D.N.S.	1	16-34	4000	120	Oil/Gr.	

Notes: [a] Includes Black Lake population
[b] Includes Cole Bay population

Airfield Development Priorities

Main Line

High Priority

La Ronge
Rabbit Lake
Wollaston Lake
Stony Rapids
Cluff Lake

Cost: $4,650,000

Region A.

High

Meadow Lake
Buffalo Narrows
Pinehouse
Patuanak
Dillon
Ile-a-la-Crosse
Beauval

Cost: $555,000

Medium

Low

Turnor Lake
Green Lake
Canoe Narrows/Cole Bay
Dore Lake
La Loche

Cost: $350,000

Region B.

High

Stanley Mission

Cost: $100,000

Medium

Cumberland House
Southend
Kinoosao
Island Falls
Pelican Narrows
Deschambault

Cost: $500,000

Region C.

Medium

Camsell Portage
Fond du Lac

Cost: $190,000

TOTAL COST: $6,345,000

Additional Runways

As indicated earlier, single runways have been proposed initially at the foregoing locations, except at Rabbit Lake. Some settlements have a very high priority due to prevailing winds, increased traffic by tourist aircraft and modern larger-aircraft, which require a well oriented runway.

Consideration should be given to planning and location of these cross strips when construction of main runways begin.

Priorities for Additional Runways

Very High	High	Medium	Low
La Ronge	Patuanak	Beauval	Green Lake
Meadow Lake	Pinehouse	Ile-a-la-Crosse	Dore Lake
Buffalo Narrows	Wollaston	Dillon	Canoe Narrows
Stony Rapids	Cluff Lake	Kinoosoa	La Loche
Uranium City	Stanley Mission	Southend	Turnor Lake
		Cumberland House	Camsell-Portage
		Island Falls	Fond du Lac
		Pelican Narrows	
		Deschambault	
$3,150,000	$ 600,000	$ 578,000	$ 432,000

Total Cost of additional runways = $4,760,000

Cost is assumed approximately equal to 80% of cost of initial runway.
La Ronge cross-strip taken to cost $1,300,000.
Uranium City cross-strip taken to cost $1,500,000 (gross estimate)
Cluff Lake cross-strip taken to cost $200,000.

Airport Buildings

It was not possible to do any complete evaluation of the need for buildings and other facilities at airports. However, each airfield ought to have a minimum shelter building, waiting room, ticketing facilities. Air carriers will probably provide these at most points, as well as transportation of passengers from airfield to settlement.

Airfield Lighting

Most of these airports are scheduled for a daily V.F.R. service, except for possible I.F.R. requirements on southern links, eg. into La Ronge, Prince Albert where lighting systems already exist. Uranium City has a lighting system installed. Priority consideration is suggested for Meadow Lake and Buffalo Narrows due to growth of traffic at these points.

6. Navigation and Landing Aids

Four non-directional radio beacons (N.D.B.'s) established by the Ministry of Transport are established in northern Saskatchewan at:

Prince Albert
La Ronge
Creek Lake
Uranium City

Two privately installed N.D.B.'s owned by Norcanair are located at:

Wollaston Lake
Stony Rapids

It is generally acknowledgedthat this coverage is probably the minimum provision for safe operation. Demands are heard from various sources for more and better navigation aids, e.g.,

air carriers,
private flyers,
Chambers of Commerce
mining interests,

and emphasizing the paucity of present installations.

An evaluation of the existing sites using the D.O.T. rating form, 26-0181, for comparison purposes shows all present installations to have high priority. Potential sites similarly evaluated, fell into high and moderate priority categories.

Although such a generalized evaluation has limited application in remote areas, with very small populations, and where traffic is often confined to light aircraft, it is felt that the minimum requirement for aids, will justify

standard N.D.B.'s at:
- Buffalo Narrows
- Meadow Lake
- Wollaston Lake
- Stony Rapids
- Rabbit Lake
- Cluff Lake.

These are important points on present and proposed scheduled air routes, with significant spatial location. Anticipated cost is $500,000. An average N.D.B. costs $70,000 as per D.O.T. form, 26-0181, maintenance about $10,000/year.

It was felt that we had insufficient data and background information to assess needs for establishment of V.O.R. On a general basis it is recommended that V.O.R. be installed at Prince Albert, La Ronge, Cree Lake and Uranium City, a system which would provide a minimum coverage to the northern areas.

The Ministry of Transport has long range plans for installation of V.O.R. at:

Prince Albert,	1974-75	V.O.R.
	1980	I.L.S.
La Ronge	1976-77	V.O.R.
Cree Lake	Beyond 1980	V.O.R.

Another evaluation is recommended of V.O.R. requirements, with a view to early installation of V.O.R. at all these points, thus avoiding an "initial staging" installation of N.D.B.'s which are regarded as obsolescent.

The approximate cost for V.O.R. systems at:

Prince Albert
La Ronge
Cree Lake
Uranium City
Buffalo Narrows
Meadow Lake
Wollaston Lake
Stony Rapids
Rabbit Lake
Cluff Lake,

is $1,400,000.

PART B

HIGHWAYS

1. Introduction

Under the existing system a number of communities and sites lack road access. These are:-

	Pop. 1971	
Camsell Portage	87	
Uranium City-Eldorado	2153	
Fond du Lac	328	
Stony Rapids	186	
Black Lake	471	
Cluff Lake (winter road)	200	(est. for future)
Rabbit Lake (all-weather road by 1974)	200	(est. for future)
Wollaston Lake	339	
Cree Lake	47	
Kinoosao (Co-op. Point, Road access from Manitoba)	119	
Dillon	451	
Patuanak	310	
Pinehouse	427	
Southend	275	
Stanley Mission	916	

(See Figure 8)

All these communities are served by air systems of varying degrees of frequency. One of the principle aims of proposals in this program is to lessen the isolation characteristics of such settlements, by providing additional access modes.

The Saskatchewan Provincial government has a long range (5 year, 1974-78) program which comprises a package for upgrading existing highways, rebuilding and surfacing new links, including access roads to remote settlements.

The stated objectives are:

a) to provide access to remote communities,

b) encourage resource development,

c) promote tourism,

d) increase safety factors,

e) minimize total system costs,

f) improve quality and reduced user cost,

g) increase user comfort.

This Northern Transportation Program (Highways), is divided into four parts viz. (See Appendix 4)

		$ Cost (Millions)
1.	Northern Highway Surfacing Program	28.00
2.	Northern Transportation Facility Provision Program	13.40
3.	Northern Road Upgrading Program	8.60
4.	Timber Road Program	3.20
		$53.20

Under 1 a total of 620 miles of highway would be graded and/or surfaced.

Under 2 a tote road (225 miles) would be constructed from Turnor Lake to south shore Lake Athabasca: Cost $5,750,000;

all-weather roads to settlements Dillon, Pinehouse, Stanley Mission Cost $3,001,000;

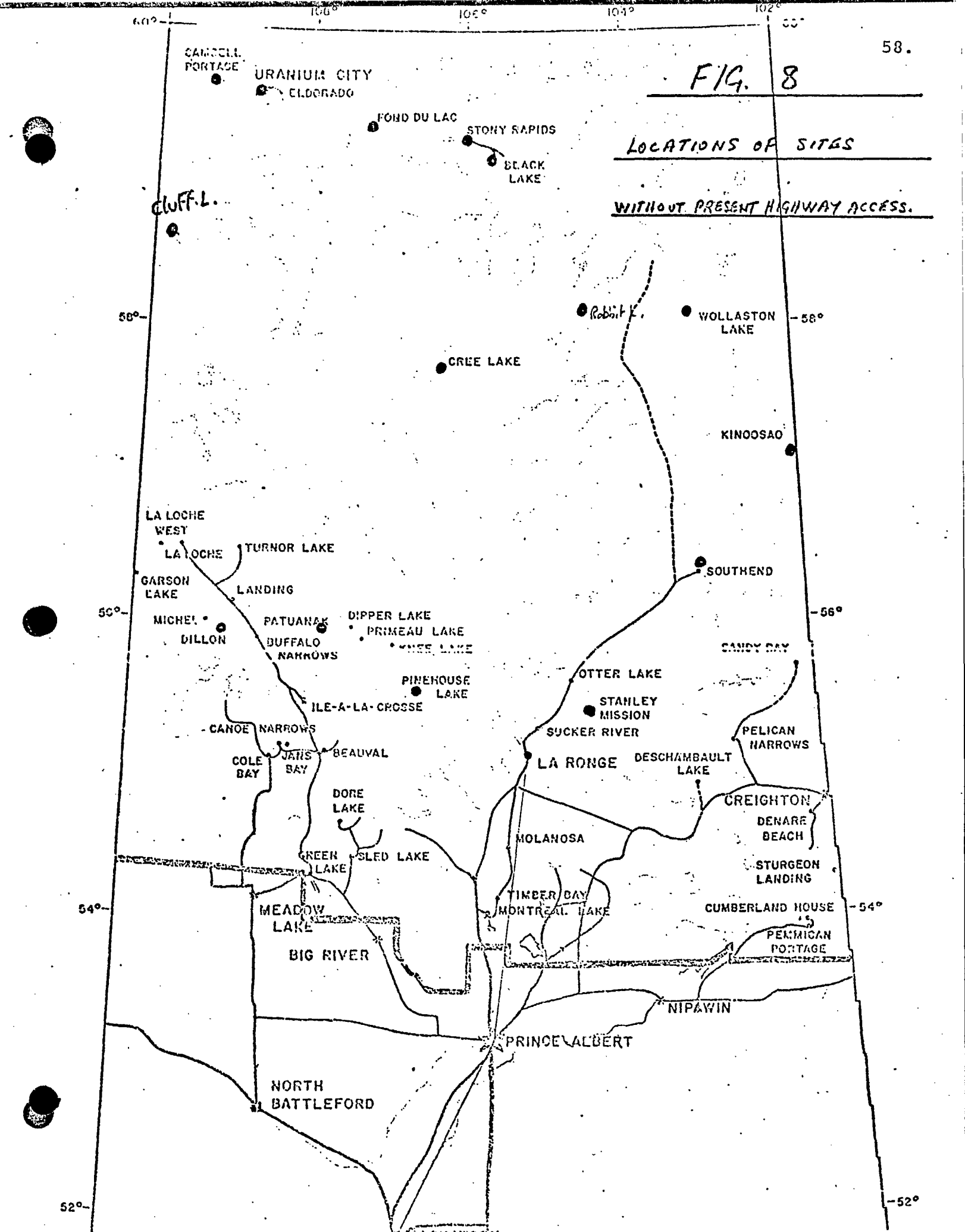
a new road from Big River to Meadow Lake Sawmill Cost $2,000,000;

Also included under 2 is capital cost of a Hovercraft (A.C.V.), with 1 year operating subsidy $2,000,000.

Not itemized, but to be requisitioned is $1,000,000 for the Beauval-Patuanak all-weather road. Operation of the Hover-

FIG. 8

LOCATIONS OF SITES WITHOUT PRESENT HIGHWAY ACCESS.



craft is costed below and not recommended.

Under 3. 281 miles of highway would be upgraded or surfaced.

Under 4. A number of legal agreements by the Province of Saskatchewan concerning timber roads with the Meadow Lake Sawmill, Simpson Timber Company, and the Prince Albert Pulp Company, involves construction or purchase of timber roads from the private sector. Federal funding is unlikely to be involved, except if these forestry roads, whose location is not known, inter-relate with other highways.

The Department of Northern Saskatchewan has also prepared a program of road improvements as shown in Appendix 5. This program adds to and modifies the DHT plan as follows:

Northern Facility Provision DHT	-Turnor Lake to Cluff L. to south shore L. Athabaska	H&N	$12,250,000
	-S.Shore L. Athabaska to Stony Rapids	N	4,750,000
	-Stony Rapids-Wollaston L.	N	8,500,000
	-La Ronge-Beauval	N	6,250,000
DNS programs amalgamated	-access to Stanley Mission	H&N	1,200,000
	-access to Pinehouse	H&N	1,200,000
	-access to Patuanak	H&N	1,160,000
	-access to Dillon	H&N	1,500,000
	-Big River to Meadow L. (sawmill)	H	2,000,000
	-Kinoosao to Lynn Lake	N	690,000
	-Sturgeon Landing	N	1,640,000
	-Meridian Bridge on Onion L. road	N	1,500,000
	-other access roads to settlements	N	1,700,000
			$44,340,000

Modifications include a higher standard facility from Turnor L. to S. Shore L. Athabaska, major new proposed facilities and additional access roads.

*H - DHT
N - DHS
H&N - DHT modified by DNS

2. Access Roads under the DHT plan

Access roads to: Dillon
Patuanak
Pinehouse
Stanley Mission

are either under construction or have been recommended. The first three are discussed in "Recommendations for improved Transport Services to Mid-North-West portion of Saskatchewan", by A.A. Jones.

Dillon

A low standard 18-20 foot gravel-surfaced, all-weather road from Vermette Lake to Dillon was evaluated. 28 miles @ $18,000/mile. Initial construction cost, $504,000, incremental outlay $68,000/year. An alternate access to Dillon via the southern end of Peter Pond Lake, across the Niska Channel shows 38 miles of construction costing $684,000, incremental costs $92,000/year.

Patuanak

The Department of Northern Saskatchewan proposes an all-weather access road from Beauval, costing $929,000, with incremental outlay for construction and maintenance $13,000/year.

All-weather roads to Dillon and Patuanak would facilitate and speed up the export of lumber products from the sawmills.

Pinehouse

An all-weather gravel road connecting Pinehouse to the new forestry road near Pisew Lake, is estimated to cost $1,044,000 for 58 miles, continuing the orientation of travel towards La Ronge and Prince Albert. Depending on the financing, and equipment provided, these highways will take between 1-3 years to complete.
Map, Figure 7 (A.A. Jones) outlines these roads. (See Appendix 3.)

TOTE ROAD ACCESS (A.A. JONES)

Settlement	Pop. 1971	Road Cost $	Ann. Rd. Cost $	Average 20 Year Savings	Average 20 Year Benefits	Ratio of Benefits/ Annual Cost
Patuanak	310	930,000	130,000	45,000	118,000	0.91
[illegible]llon	451	504,000	68,000	29,000	65,000	0.96
Pinehouse	427	1,044,000	140,000	84,000	140,000	1.00

This table enables a quick assessment of roads to the other remote settlements, where detailed evaluation is curtailed due to time.

Stanley Mission

This settlement is served by a DHC-3 Otter once a week from La Ronge, more frequently by chartered aircraft. There is a turf airstrip, but most air traffic is on floats. It comes under recommendations for service to Region B, with a BN2A Islander, feeder aircraft, hence, a recommendation for a new gravel runway, 3,000' X 100'. There is seasonal access by a winter road.

An all-weather surfaced access road, 20 miles costing $1,494,000 has been proposed. Road access is recommended, due to the population size (916, 1971) and provision of another access to the Churchill River system. However, the provision of a surfaced highway seems to be out of proportion, considering the gravel surfaced roads recommended for the other three settlements discussed above.

An all-weather gravel road is recommended, in the short term, to cost between $800,000 and $1,000,000. It may be of interest to note that community opinion in Stanley Mission is not unanimous about the beneficial effects of a highway.

With implementation of the transportation facilities program, only these communities will remain lacking road access:

(Camsell Portage
(Uranium City/Eldorado
(Fond du Lac
(Stony Rapids
Southend
Wollaston Lake
Kinoosao (Co-op Pt.)
Cree Lake

The first four are on Lake Athabasca and are discussed below with reference to transportation in region C (centred on Uranium City).

Southend (Pop. 275)

This community is divided, part living on Big Island; part having been moved to the mainland close by. The mainland portion is served by a new spur access road from Highway 102; the island portion has only seasonal direct access by winter road.

Southend is included in the proposed regional feeder air schedule, for region B.

A detailed evaluation of either installation of a ferry, or building a causeway is recommended.

Kinoosao (Pop. 119)

This small settlement has road access to Lynn Lake, Manitoba. It is included in the feeder service proposed for region B, by BN2A Islander with provision of an airstrip.

Provision of an all-weather access road is not recommended due to high cost, low benefit, for a tiny population; a winter road would cost about $56,000/year.

No upgrading in surface access is proposed due to the proximity of the trade centre Lynn Lake; improved connection with centres in southern Saskatchewan will be provided by the improved scheduled air service.

Wollaston Lake (Pop. 339, 1971)

Wollaston is serviced by the DC-3 schedule from La Ronge and Stony Rapids. It is included in the mainline proposal using the Hawker-Siddeley 748 aircraft.

For an all-weather road running south of Wollaston Lake, 60 miles, a gross estimate is $1,800,000. Expected benefits are not thought to justify this expenditure.

A winter road is recommended, from a point near the Rabbit Lake (Collins Bay) across the Lake, 25 miles at about $800/mile. Cost $20,000 per year.

Cree Lake (Pop. 47)

Cree Lake is remote with a tiny population. It is connected to the outside by charter aircraft. Road access is not justified by the small population, nor could a regional air service be sustained. A form of local subsidy for charter may be considered.

3. Conclusions

The highway development program put forward by the DHT proposes oil treatment, bituminous surfacing, gravel and weather roads, which can be justified on economic grounds, e.g. the gravel road to La Ronge performs badly in rainy weather. It carries substantial tourist traffic, supply trucks, and pulp timber trucks along much of the route.

With regard to provision of new access roads to settlements an economic justification may be difficult. However, much of the justification for such access depends on intangible factors, one of which is remoteness. One of the reasons for this study is to encourage attempts to decrease the remoteness of isolated settlements. If any "cut-backs" in the highway development program are necessary, the trade-off must be made between oil treatments for main highways and new access roads. The latter must take precedence. (Refer Appendix 4)

PART C

LAKE ATHABASKA SYSTEM

1. Evaluation of Hovercraft Service

It is proposed to connect the system of settlements on the northern shore of Lake Athabaska to southern Saskatchewan trade centres, by highway. (See Figure 10 for locations). At present, a winter road runs from Turnor Lake, via Cluff Lake to the south shore of Lake Athabaska, somewhere close to William Point; thence across the lake to Uranium City. It is intended to construct an all-weather, gravel tote road, along this route to William Point. (William Point used for ease of reference). One proposal for year round access to Uranium City, and settlements Camsell-Portage, Fond du Lac and Stony Rapids, is to operate an air cushion vehicle (Hovercraft) service, to carry passengers and freight from William Point.

The bulk of freight and passenger traffic to Uranium City is along the Uranium City - Edmonton linkage; heavy freight is water-borne along the Athabaska River/Lake system in summer, passenger and air freight by aircraft throughout the year. A brief examination of the feasibility of a hovercraft system on Lake Athabaska is carried out below.

A hovercraft service must operate on direct relation to a new all-weather road from Turnor Lake to William Point.

Cost of road $5,625,000, over 10 years @ 8% = $568,000/yr.
+ Maintenance = 135,000
$703,000/yr.

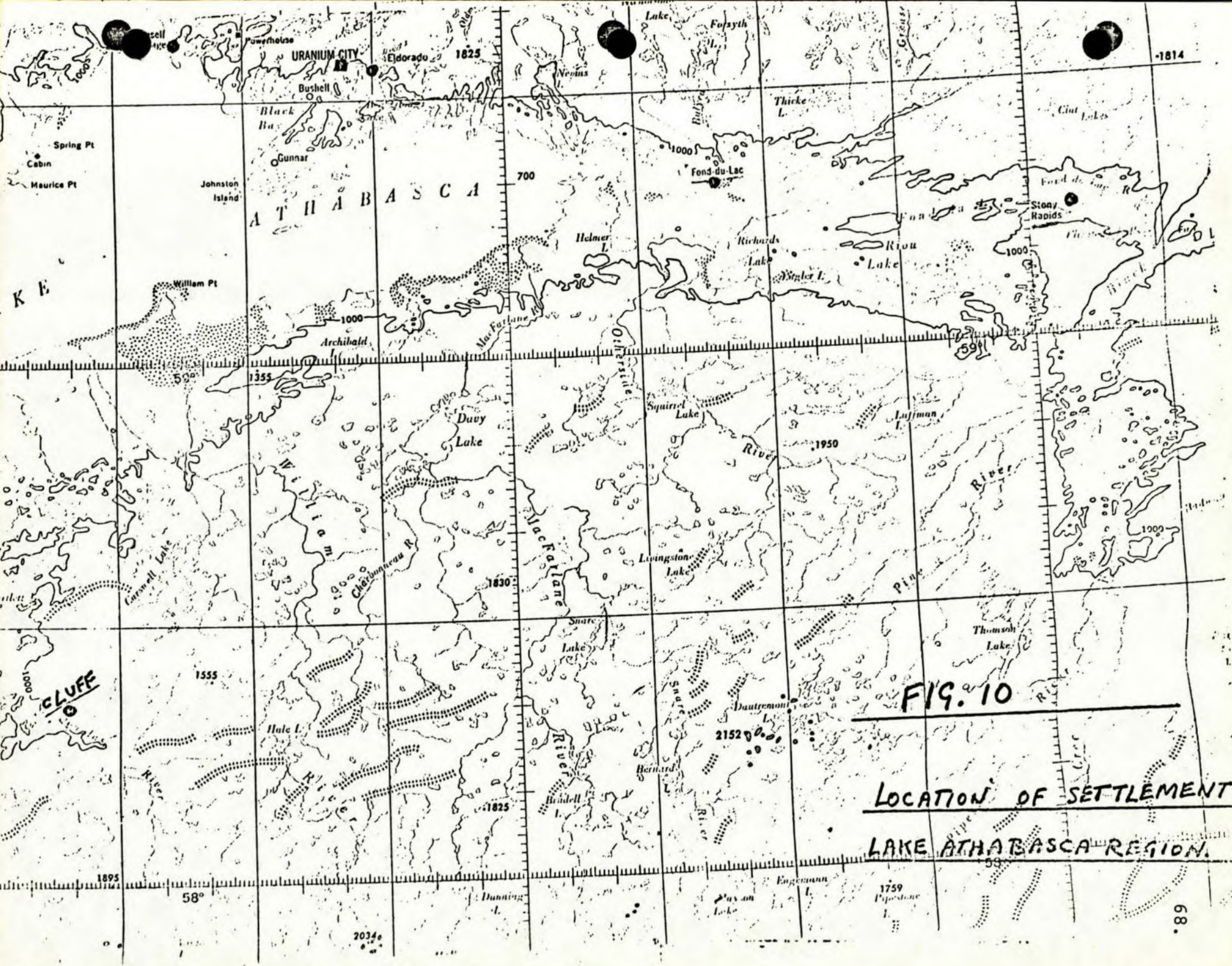


FIG. 10

LOCATION OF SETTLEMENTS
LAKE ATHABASCA REGION.

In assessing a hovercraft service, newly generated traffic and a potential diversion of traffic from the Edmonton - Uranium City orientation to a Saskatoon - Uranium City system, along the new road, must be accounted for. Such diversion will depend on price structures from Saskatoon. The proposed service by air cushion vehicle would replace the alternate regional air service using a BN2A Islander based on Uranium City, and must be considered in relation to it.

Table 9 shows the frequencies and block times of a hovercraft system on Lake Athabasca. See Figure 11.

The Bell Aerospace Voyageur air cushion vehicle was used for this study. It has a payload of 25 tons, cruises at 50 m.p.h. for a range of about 630 miles. On deck it can accommodate several passenger cars, small trucks, containerized traffic. It is not large enough to carry semi-trailers such as will operate on the tote road, (74,000 lbs.). Capital cost is $1,250,000. (See Appendix for data.)

Table 9

Link	Distance	Freq./Wk.	Block Times Hrs. Link	Block Times Hrs. Total/Wk.
William Point to Uranium City	35	10	0.87	8.7
Uranium City to Camsell-Portage	24	6	0.65	3.9
Uranium City to Fond du Lac	75	10	1.67	16.7
Fond du Lac to Stony Rapids	53	10	1.23	12.3
			Total	41.6 hrs/wk.

Some allowance was made to allow for extra mileage due to winter conditions (ice ridges, etc.)

Annual utilization = 41.6 X 52 (wks/yr) = 2163 hrs/yr.,

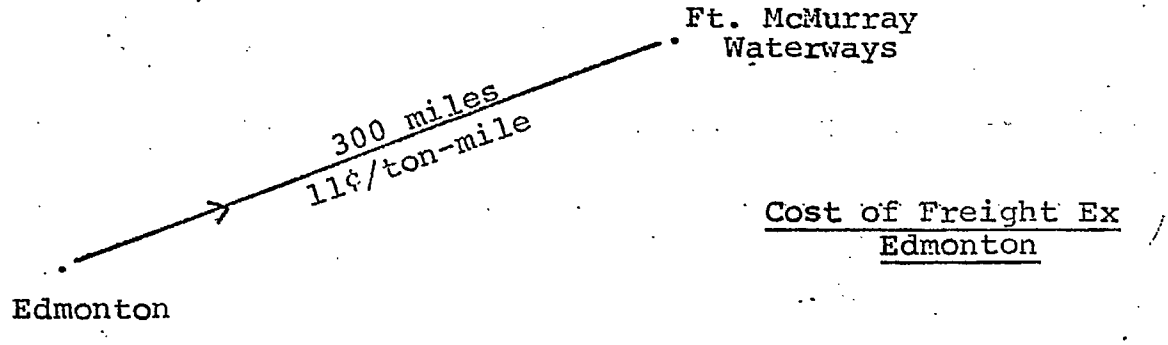
Direct Cost of Operation = 2163 X $236/hr. = $510,468
Fixed Cost = 269,700
Total $780,168/yr.

To operate this service on a break even basis, the revenues must approximate the hourly operating cost;

$$\frac{\$780,168}{2163 \text{ hrs.}} = \$361$$

In order to estimate the quantity which would have to be diverted to a southern Saskatchewan supply centre to ensure a breakeven operation for a hovercraft service, the cost of transporting goods from Edmonton to Uranium City must be ascertained, to be compared to a corresponding cost from Saskatoon. See Figure 12 for flows on the Edmonton - Uranium City and associated linkages.

Figure 13



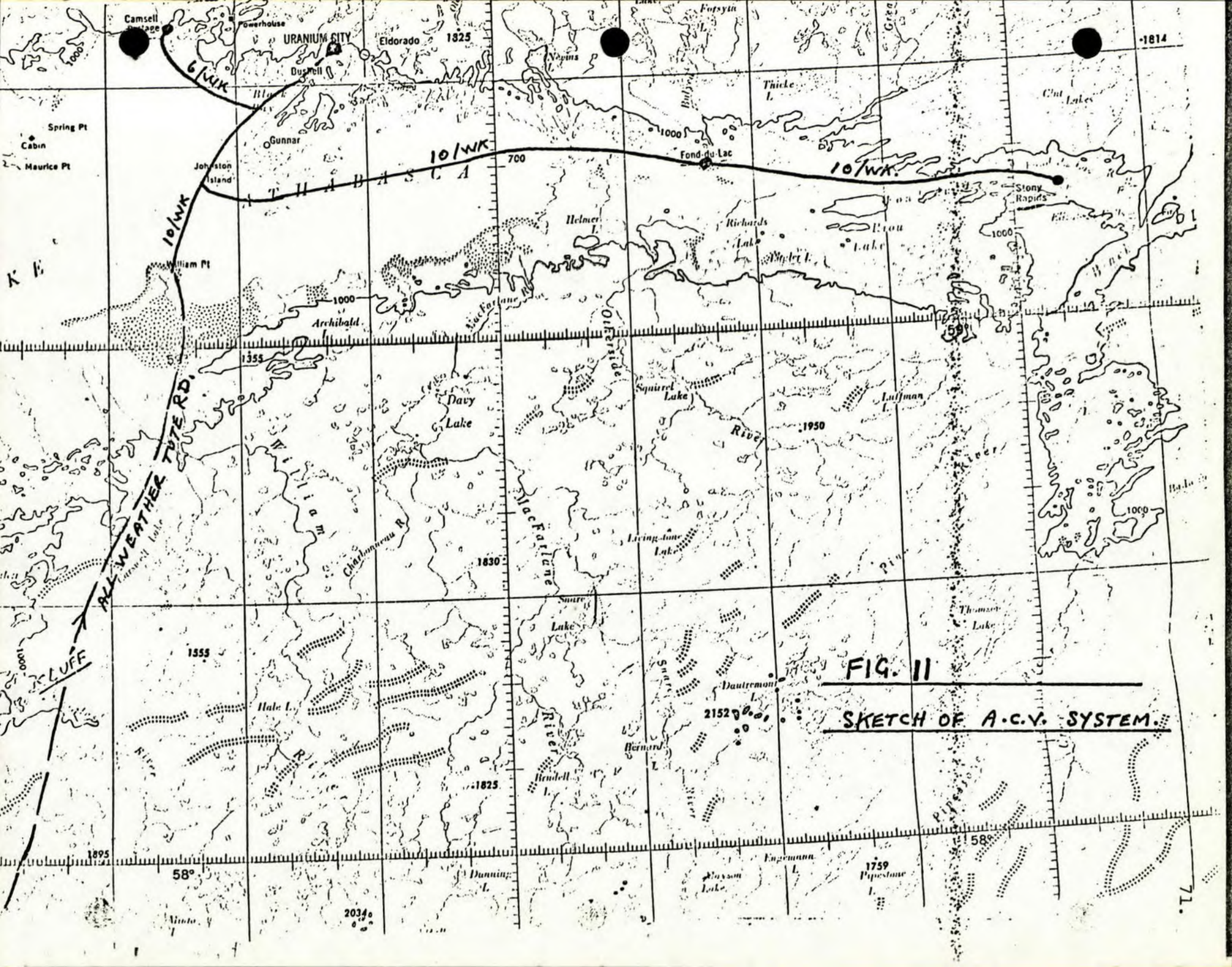


FIG. 11

SKETCH OF A.C.V. SYSTEM.

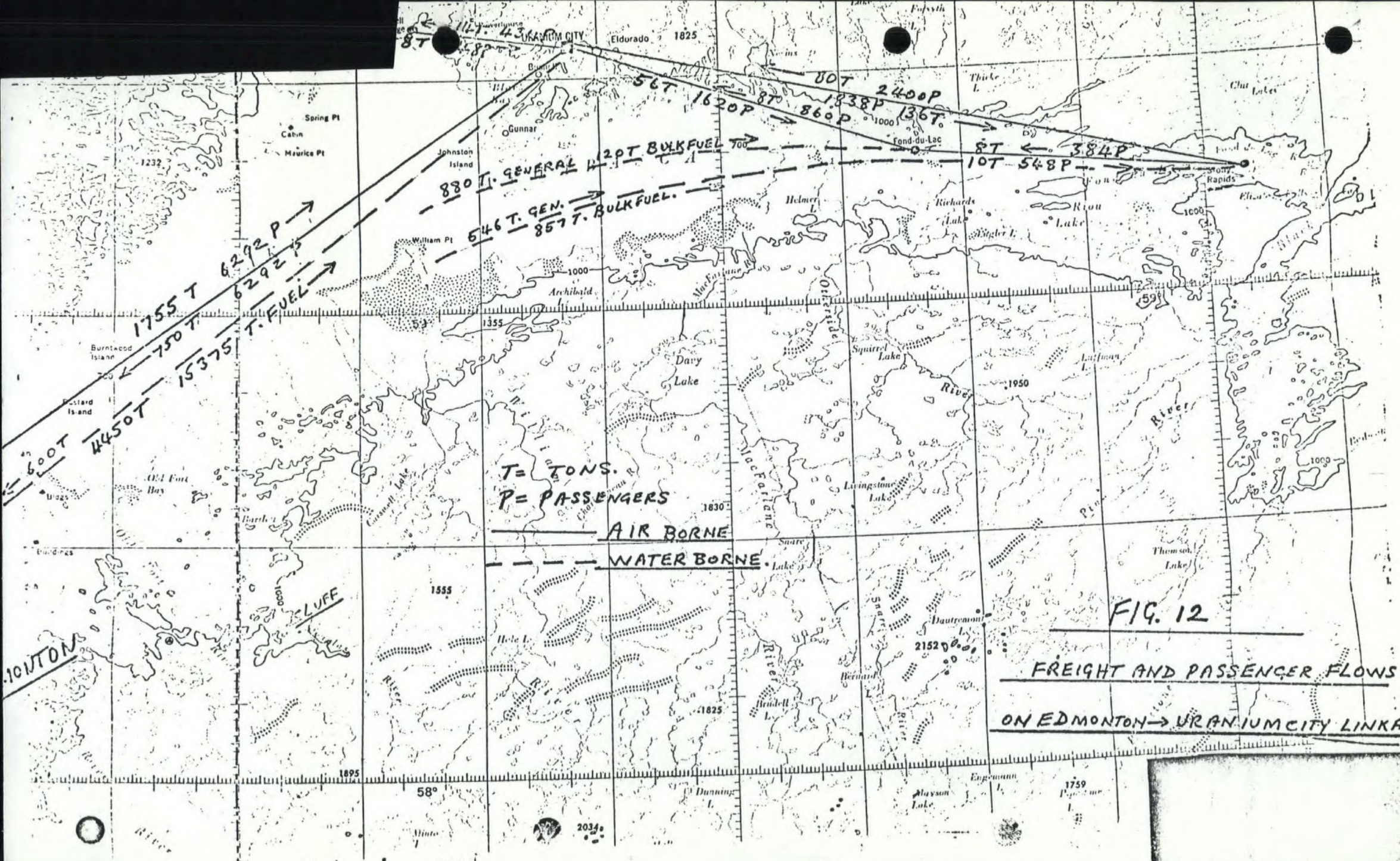


FIG. 12

FREIGHT AND PASSENGER FLOWS

ON EDMONTON→URANIUM CITY LINKAGES

Edmonton --> Ft. McMurray. For general merchandise an average rate of 11¢ per ton mile is assumed. i.e. $33/ton.

Ft. McMurray --> Uranium City by river-barge; average rate of $1.50/100 lb., general freight = $30/ton.

Hence, freight from Edmonton to Uranium City, rate = $63/ton/

Edmonton to Fond du Lac, general freight rate = $71.20/ton.

Edmonton to Stony Rapids, general freight rate = $74.00/ton.

(note: There are winter inventory warehousing costs on top of these freight rates.)

An average distance of 620 miles is used, following the highway to Turnor Lake, then the new tote road to William Point via Cluff Lake.

620 miles at average 11¢/ton-mile = $68/ton.

This means that to truck goods from Saskatoon to William Point (on south shore Lake Athabasca) costs approximately the same as from Edmonton to Uranium City by truck and barge, including trans-shipment at Waterways.

Hence, from this gross cost estimate, it is evident that hovercraft costs, when added to freight rates from Saskatoon, would have to be traded off against:

a) winter warehousing inventory costs inherent in Edmonton based system,

b) multiplier effects on Saskatchewan economy,

c) diversion of sales to Saskatchewan.

Thus, if the hovercraft operation were offered as a free service across Lake Athabasca, freight trucked north from Saskatoon would scarcely compete with that from Edmonton.

An estimate is now made of income to the hovercraft system;

(i) operating between Uranium City, Camsell-Portage, Fond du Lac and Stony Rapids, where the hovercraft is seen to replace the air service. (Note that on the proposed mainline service a route between Uranium City and Stony Rapids is not included; i.e. left to a regional air service.)

(ii) assuming that 10% of Edmonton oriented traffic has been diverted to the new system.

In discussing (i) the flows between those northern settlements will be used, i.e. transferred to the A.C.V. service. The existing air fare structure is used, and the assumption made that 80% of the total flows can be attracted to the hovercraft system. See Figure 14 for 80% flows on regional system.

Current schedule air fares/rates.

	One Way Passenger	Freight/ton
Uranium City to Camsell-Portage	$ 7	$ 56 (est.)
Uranium City to Fond du Lac	$10	$ 71 "
Fond du Lac to Stony Rapids	$ 9	$ 71 "

Table 10

A.C.V. (Hovercraft) Revenue on Local System.

Link	Pass. Revenue	Freight Rate	Total
Uranium City to Camsell-Portage	625 @ $7 = $ 4,375	17.6 @ $56 = $ 986	$ 5,361
Uranium City to Fond du Lac	6026 @ $10= $60,260	224 @ $71 = $15,904	$76,164
Fond du Lac to Stony Rapids	4236 @ $9 = $38,124	187.2 @ $71 = $13,277	$51,401
			$132,926

The revenue under the existing fare structure is estimated at $132,926. This means that the cost of ($780,000 - $133,000) providing the A.C.V. service is approximately $647,000; a very high subsidy. It is due to operation of a large vehicle at too high a frequency, combined with a low load factor (average of 0.1). The frequency of service, one way, requires a reduction to possibly two a week from five a week. This would result in a load factor which is still expressed as a percentage of the total flow captured. That flow would probably continue to fall because of the reduced frequency of service.

Discussion of (ii), takes account of potential new revenue generated on the tote road, which would include income from traffic diverted from Edmonton.

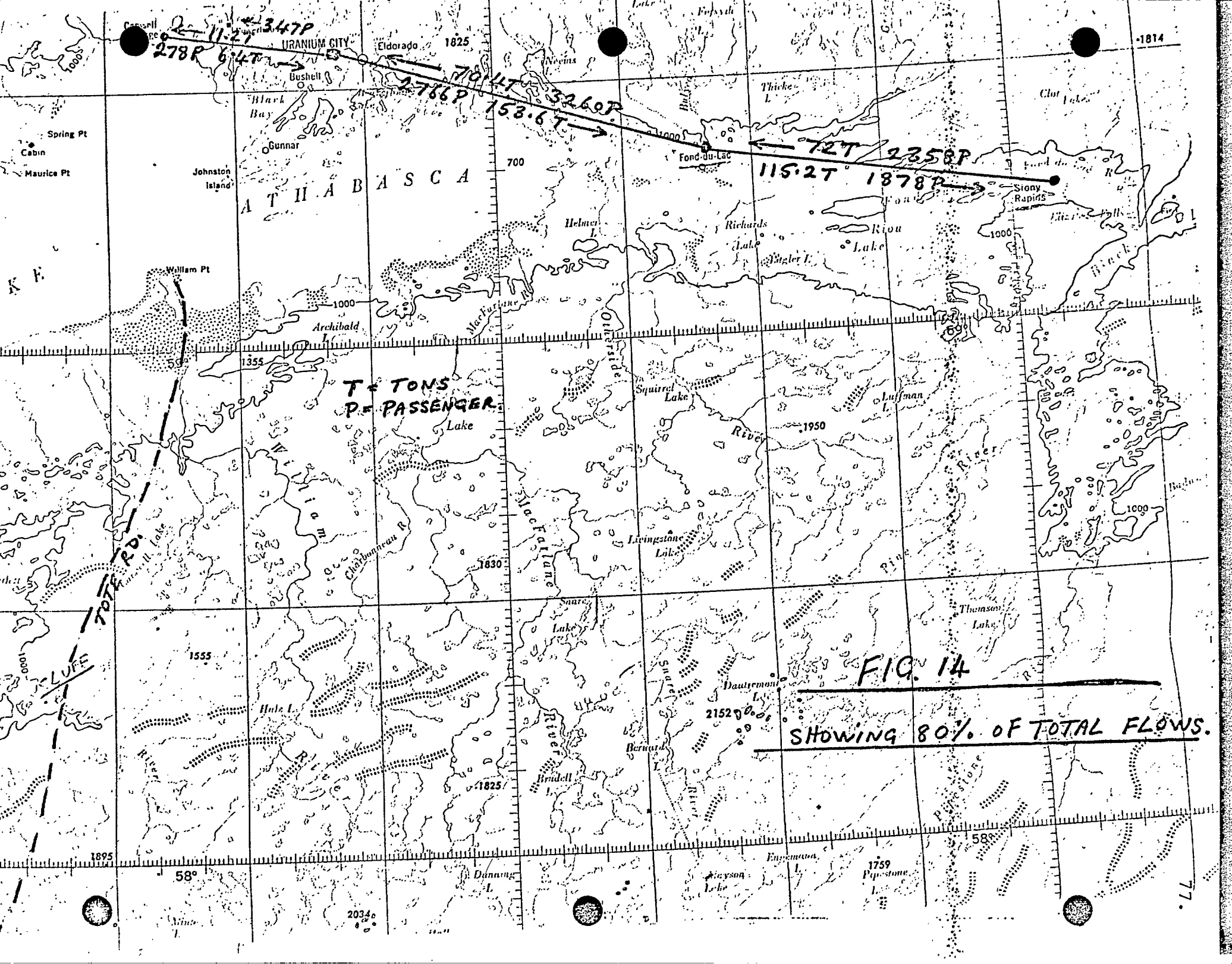


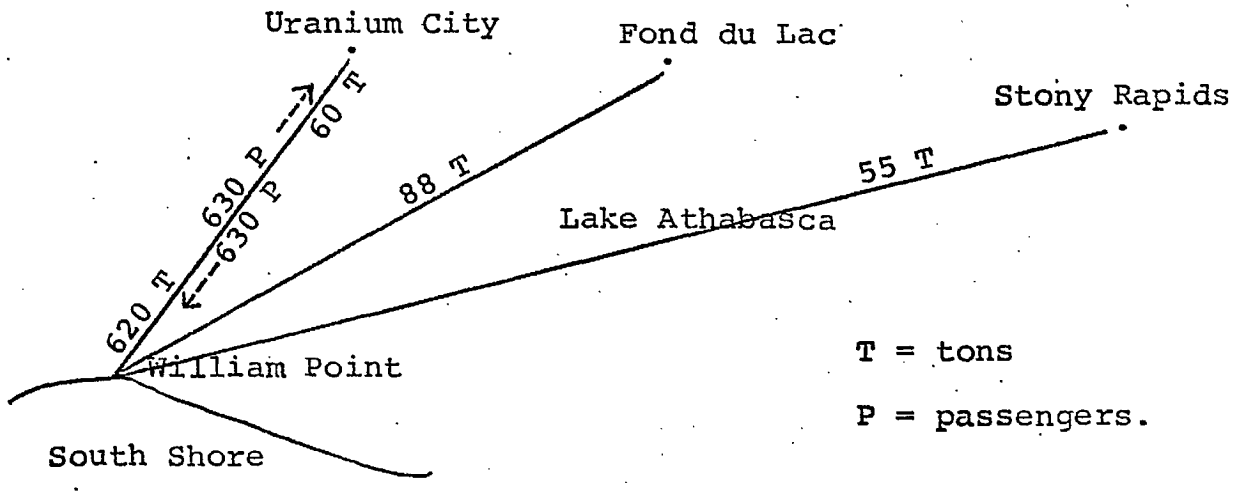
FIG. 14

SHOWING 80% OF TOTAL FLOWS.

For initial analyses, revenue accruing if 10% of Edmonton oriented traffic were diverted, is now examined. The initial cost comparison showed the Saskatchewan supply base in an unfavourable light, i.e. even if a free A.C.V. service were provided, a very low diversion figure could be expected.

Figure 15 shows flows across Lake Athabasca if 10% diversion were achieved.

Figure 15



	Passenger Revenue @ 20¢/seat mile	Freight Revenue $1.50/ton mile	Total
William Point to Uranium City	1260 @ $7 = $ 8,870	680 @ $52 = $35,360	$ 44,180
William Point to Fond du Lac	---	88 @ $97 = $ 8,536	8,536
William Point to Stony Rapids	---	55 @ $180= $ 9,900	9,900
		Total	$ 62,616

If a 10% diversion of Edmonton based traffic results in a revenue of $62,616, then 100% diversion of that traffic, plus local revenue would be required to enable the A.C.V. operation to "break even". The A.C.V. service total cost is roughly $780,000, local revenue $133,000, 100% diversion of Edmonton traffic $630,000.

This estimate was based on high uncompetitive aircraft rates, so that probably no diversion could be achieved.

Assuming a total diversion of Edmonton based traffic to an A.C.V. system and also assuming

i) freight capacity for A.C.V. to be 25 tons,

ii) passenger capacity 150,

the load factor on links in the system would be:

William Point to Uranium City	0.85
Uranium City to Camsell-Portage	0.02
Uranium City to Fond du Lac	0.20
Fond du Lac to Stony Rapids	0.11

1. A load factor 0.85 would be achieved providing that 100% of Edmonton oriented traffic were diverted, based on a frequency of one trip each way/day, William Point to Uranium City.
2. Assuming capture of all local flows to Camsell, Fond du Lac, Stony Rapids, the load factor would be

extremely low. A reduction in service to at most 2/week from 5/week would be necessary.

3. Operation and cost of A.C.V. would then be altered to:

	Total Freq./wk.	Hrs./wk.
William Point to Uranium City	10	8.7
Uranium City to Camsell-Portage	4	3.6
Uranium City to Fond du Lac	4	6.68
Uranium City to Stony Rapids	4	4.92
Total		22.9 hrs./wk.

Direct cost reduced to 22.9 X $236 + $269,700 = $550,700.

4. If all traffic moved north from Saskatoon via the tote road and then on the proposed hovercraft, and if the air fare structure were still used, a break even position could be achieved.

Such air rates would be competing with road and barge prices, and would not be competitive. Little, if any, traffic would be captured. It would be necessary to reduce rates to 8¢ - 11¢/ton mile, particularly on the William Point - Uranium City link, hence, involving heavy subsidy.

2. Alternatives to a Hovercraft Service

Alternative 1

Surface traffic to Uranium City hinges on the all-weather tote road from Turnor Lake to William Point on south shore of Lake Athabaska. An alternative to an air cushion vehicle is:

a) a winter road across the lake from William Point,

b) a ferry vessel from William Point for use during the open water period,

c) a year round regional scheduled air service, based on use of the proposed BN2A Islander.

Examination of the freight costs on the tote road to William Point has shown that freight trucked there costs about the equivalent of the cost from Edmonton to Uranium City.

a) Winter Road Across Lake Athabaska

In assessing winter road service across the lake, the operating costs of vehicles using it must be included, to make the study comparable with that done on the hovercraft. Construction and maintenance costs:

35 miles @ $800/mile	$28,000/year
Annual traffic operating costs (120 days x 15 veh/day x 35 mls x $0.10 factor)	6,300
	$34,300/year

b) Cost of Proposed Ferry Boat Service

Estimated capital cost of ferry, motors, minimum payload 75,000 lbs.	$500,000
Annual amortized cost over 10 years @ 8% with 25% residual value	$ 56,000/yr.
Annual operating and maintenance, salaries, housing, etc., (estimated assuming 140 day operation)	$ 70,000/yr.
	$126,000/yr.

c) Regional Air Service for Uranium City, Fond du Lac, Stony Rapids, Camsell-Portage

The traffic flows are assumed to be the same as for the A.C.V., Table 10, i.e. 80% of total flows on the links. (See Figure 14). Expressed as passenger equivalents at 165 lbs. of freight equals one passenger, the flows are

Figure 16

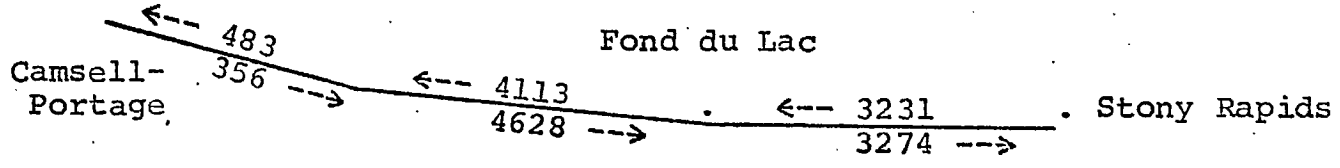


Table 11

Derivation of Block Times on Regional Air Service, Region C.

Link	Dist.	Freq/ Wk.	Times Link	Times Week	Ann. Flow	Cap.	Fare	Load Factor	Revenue
Uranium City to Camsell-Portage	27	4	0.32	1.28	839	1872	3.70	0.45	$ 3,104
Uranium City to Fond du Lac	49	20	0.45	9.00	8741	9360	5.90	0.93	$51,572
Fond du Lac to Stony Rapids	48	20	0.45	9.00	6505	9360	5.80	0.70	$37,729
		Total		19.28/wk.				Total	$92,405

Fare based on $1.00 + 10¢ per air seat mile.

Annual utilization 19.28/wk. X 52 = 1002.5

Direct variable costs (Islander)@ $32/hr. =	$32,080
Fixed costs	27,000
Direct operating costs	$59,080
(Including costs for administration, profit, etc.)	$30,540
which shows an expected break even position in this region.	$89,620

Costs for Lake Athabasca System

Cost for winter road	$ 34,300
Cost for ferry service	126,000
Cost Regional Air Service	59,000
Total	$219,000/year.

(Note that some consideration must be given to capital cost for provision of an airfield at Camsell-Portage - $100,000

and improvements at Fond du Lac airstrip, $90,000.)

This $218,000 per year provides:

a) a regional scheduled air service,

b) a winter road, good for up to 90 days use,

c) a ferry for the remainder of the year.

Access will, however, be hindered for some weeks during freeze-up and melt, depending on the capabilities for the ferry vessel.

An air cushion vehicle service on Lake Athabasca would be very expensive. For a daily service on the main link, and two a week on the other links it costs $550,000. In order to attract traffic from the Edmonton - Uranium City connection, revenues would have to be reduced to a minimum. The gross estimate of potential revenue generated under present conditions is $150,000 per year, hence, an annual deficit of at least $400,000 - $650,000.

The air cushion vehicle operation would capture a large component of intra-regional air service traffic, as well as some passengers and freight from the Edmonton side. It would provide fast service across Lake Athabasca throughout the year, improving the service to Uranium City and the settlements. It would, however, require trans-shipment of freight for large semi-trailer vehicles, that is provided for on the Edmonton-Uranium City service.

The winter road with ferry service would provide service except during "freeze-up" and "break-up", i.e. late October to mid-December, and mid-April to early June. It would enable all vehicles, including large trucks and semi-trailers to cross the lake; it is a much cheaper system, and can virtually break even on operating costs, while still attracting some traffic from the Edmonton flows. The regional air service by a BN2A Islander can be compared to the present schedule and charter service, presented earlier in this paper.

In summary, this alternative to the hovercraft system is recommendable.

Benefits of This System for the Northern Transportation Supply Service

All-weather tote road from Turnor Lake, in association with a winter road and/or ferry:

Benefit:- this provides a tangible, direct link with southern Saskatchewan;
improved access along the linkage, increase in sales in the province with multiplier effects;
reduction in warehousing/inventory costs.
The regional air service will provide efficiencies over the current air system.

Transport cost savings will not result, when compared with the present supply system from Edmonton.

Benefits must be compared to the annual cost of the tote road and ferry.

Tote Road, 225 miles @ $25,000/mile	=	$5,625,000
$5,625,000 over 20 years @ 8%	=	$ 568,000/yr.
Maintenance		$ 135,000/yr.
		$ 703,000
Cost of ferry service		$ 126,000
Cost of winter road		$ 34,000/yr.
		$ 863,000/yr.

Alternative 2. - Access from the Eastern Sector

Discussion has centered on access to the Lake Athabasca region along the western axis, i.e., the all-weather tote road via Cluff Lake.

An all-weather road is being constructed along the eastern axis, north to Wollaston Lake to end at Rabbit Lake (Collins Bay) mining site in 1974.

It seems desirable to examine this route as a potential road access to Uranium City and the Lake Athabasca settlements.

Included here is a precursory evaluation of an all-weather road from Rabbit Lake to Eldorado (highway access from there to Uranium City exists), based on one done by A. Jones, Department of Highways, Saskatchewan.

All-weather road Rabbit Lake to Stony Rapids: 130 miles at $30,000/mile (est.)	$ 3,900,000
Stony Rapids - Fond du Lac - Uranium City (Eldorado) 110 miles at $60,000/mile (est.)	$ 6,600,000
Total for road	$10,500,000
Annual amortized cost of the tote road, assuming 20 years at 8%	$ 1,060,000/yr.
Annual maintenance cost, 240 miles @ $600/mile	$ 144,000
Annual cost of winter road from Turnor Lake to Cluff Lake. (This would continue as a winter road if eastern access were adopted)	$ 128,000
Total	$ 1,332,000/yr.

1. Road access throughout year to Lake Athabasca settlements is provided, avoiding use of hovercraft, ferry or winter road. However, Uranium City, instead of being a distribution centre for the region, is now the terminus.
2. The road distance from Saskatoon to Uranium City is increased by over 100 miles, compared to access via Cluff Lake - William Point. Operating costs to road users would increase by $50,000 - $60,000 per year, as well as several hours travel time.
3. Frequency would be reduced on the proposed regional air service, perhaps drastically due to easy highway access.
4. Access to Cluff Lake would revert to winter road status.

5. This, alternative costs about $470,000 more than the proposed western access via Cluff Lake tote road. This route is not recommended.

A tote road with ferry operation to Uranium City and winter road was costed by A. Jones at $784,000. This would offer poorer service all around except to Stony Rapids and Fond du Lac, and is not recommended.

3. Conclusions

The far northern settlements, would at this time, be better served by the proposed all-weather road from Turnor Lake via Cluff Lake to south shore Lake Athabaska; then by a combination of ferry and winter road.

It would provide a direct road link from southern centres to the far north of the province. In opening up the area it could provide a stimulus for further development; will produce some increase in purchase of consumer goods, hence, some multiplier effects on the provincial economy.

Its non-economic role will increase mobility, reduce isolation, and improve provincial cohesion. Under this system it is difficult to see much price saving or diversion of trade/traffic from the established links to Alberta.

APPENDICES

Hawker-Siddeley 748 - Series 2A

Maximum structure limited payload	12,677 lbs.
Maximum landing weight	43,000 lbs.
Maximum take-off weight	44,495 lbs.
Take-off, balanced field length	4,400 ft.
Landing field length	3,620 ft.
Typical cruise	274 m.p.h. - 279 m.p.h.
Range, maximum payload	564 S. miles (good for all study links)
Range, full fuel, and 6,260 lbs. Reserves for 45 mins. hold at 10,000 ft. and 230 S. miles diversion.	1,667 S. miles

Passenger capacity, 40 - 60.
Cap. used for study = 56.

Block Speed/Time v. Distance (assumed cruise speed approximately 280 m.p.h.)

Dist.	Block Speed	Block Speed in Hours
50	114	0.44
100	161	0.62
150	188	0.80
200	206	0.97
250	217	1.15
300	226	1.33
350	232	1.51

Maneuvre time, T.O. and Ldg. - 8 mins. each (added 0.26 hrs. to each block time)

Operating Costs

Direct Operating Costs (D.O.C.)

Maintenance	= $72.00/hr.
* Crew cost	= 50.00/hr.
Fuel and oil	= 75.00/hr.
D.O.C.	$197.00/hr.

Fixed costs (insurance, depreciation, interest)

Depreciation (capital cost $1,650,000 over 10 years @ 8%, 25% residual value)	=	$184,760/yr.
Insurance: 3% of capital cost	=	49,500/yr.
Liability Insurance ($325/seat)	=	18,200/yr.
		$252,460/yr.

* For crew costs assumed, to operate one aircraft on the system:

Annual utilziation = 2,500 hours

Pilots	2
Co-Pilots	2
Hostesses	2

Airfield requirements taken to be:

4,400 ft. X 100 ft. gravel (min.) at 1,500 ft. A.M.S.L.
Dust palliative desirable, e.g. oil treated surface.

Fokker 28, 1,000 c.

Maximum structure limited payload	16,900 lb.
Maximum landing weight	59,000 lb.
Maximum take-off weight	65,000 lb.
Take-off, gross weight	5,000 ft.
Landing, maximum weight, approximately	3,700 ft.
Best cruise (25,000 ft.)	519 m.p.h.
Range maximum payload	600 S. mls.
Reserves, 30 minutes hold at 5,000 ft., 230 miles diversion.	
Passenger capacity 65 (used for study)	

Block Speed/Time v. Distance

Distance	Block Speed	Block Time in Hours
50	138	0.36
100	217	0.46
150	273	0.55
200	307	0.65
250	337	0.74
300	357	0.83
350	376	0.93

Maneuvre time, T.O. and Ldg. = 8 mins. each (added 0.26 hrs. to each block time)

Operating Costs

Direct operating costs;

Maintenance	=	$110
Crew, fuel, other direct expenses	=	$190
		$300/hour.

Fixed costs;

Depreciation (capital cost $3,000,000 over 10 years @ 8%, 25% residual value)	=	$335,250
Insurance - 3% of capital cost	=	90,000
Liability insurance ($325/seat)	=	21,125
		$446,375/year.

Airfield Requirements:

5,000' X 150' gravel (min.) at 1,500 ft. A.M.S.L.

Note. D.O.C.

The best estimate of costs for the F-28 were given as 75% of DC-9 costs. Hence, D.O.C. were taken as 75% of DC-9 costs defined in Volume 1. Northern Saskatchewan Transportation Study.

DC-3

Payload	6,000 lbs.
Passengers	28

Block Speed/Time v. Distance (cruise speed 175 m.p.h.)

Distance	Block Speed	Block Time
50	91	0.55
100	120	0.83
150	134	1.12
200	143	1.40
250	148	1.69
300	152	1.97
350	155	2.26

Maneuvring time, take-off cruise, landing, 0.26 hours added.

Operating Costs

Direct operating costs: $ 158.30/hour.

(D.O.C. includes salaries, fuels, landing fees, other flying expenses, labour for maintenance, materials, etc. from Vol. 1. Northern Saskatchewan Transportation Study. A.A. Jones)

de Havilland Canada, Twin Otter

Payload	4,000 lbs.
Passengers	19

Operating Costs

Direct Costs (from Vol. 1, Northern Saskatchewan Transportation Study by A.A. Jones)

Flying costs	=	$ 77.78/hour
Maintenance	=	$ 59.00/hour
		$136.78/hour

Fixed Costs

Depreciation (capital cost $400,000 over 10 years, 8%, 25% residual value)	= $ 44,700/yr.
Insurance - .3% of capital cost	= 12,000/yr.
Liability insurance ($325/seat)	= 6,175/yr.
	$ 62,875/yr.

S.T.O.L. Characteristics

Air Cushion Vehicle

Bell Aerospace-Voyageur Hovercraft.

Maximum payload	50,250	lb.
Maximum speed	54	m.p.h. (calm water)
Cruise speed	50	m.p.h. (used for study)
Maximum range	633	S. mls.
Cargo deck area	1,320	S. ft.

Capital Cost $1,250,000.

Operating Costs

Direct operating cost:

Maintenance	=	$136/hour
Fuel/oil	=	$100/hour
		$236/hour

Fixed costs

Crew, approximately equal to	$ 80,000/year
Depreciation (capital cost $1,250,000 over 10 years, 8% to 25% residual)	139,700/year
Insurance (passengers and craft - 4% initial cost)	50,000
Total	259,700/year.

1. — GENERAL

Rates, schedules and all other information published herein are subject to tariff regulations and change without notice. Canadian Airlines is not responsible for damages resulting from failure of planes to depart or arrive at times stated herein. Rates quoted herein are in Canadian currency.

2. — BAGGAGE ALLOWANCE

Checked baggage: 2 pieces or 40 lbs — one of which the sum of length plus the greatest width plus the greatest height does not exceed 62" and one of which the same measurement does not exceed 55". Unchecked baggage: one piece only, small pieces the combined dimensions of which (length plus total width plus total height) do not exceed 115". Any excess baggage may will be assessed for baggage in excess of free allowance.

Any article which may cause annoyance to other passengers may not be carried in the cabin.

3. — LIABILITY

Canadian Airlines assumes no liability other than as specified in its tariffs published and filed pursuant to law.

4. — CHILDREN

Each child under two years of age and not occupying a seat will be carried for 10% of the adult fare. Each child under two years of age for whom seats are reserved and each person twelve years or over twelve years will be charged one half of the full applicable adult fare accompanied by an infant.

5. — RESERVATIONS

Passengers may purchase tickets now on a two-way reservation. Reservations not confirmed at this time are automatically cancelled. Don't be a no show. If you change your plans, cancel your reservation so that someone else can have that seat. The company reserves the right to refuse service to anyone.

6. — PASSENGER CHECK-IN

Passengers are requested to check in at the ticket counter twenty (20) minutes before flight departure to allow for completion of check-in procedures. Departures will not be delayed to accommodate late arriving passengers.

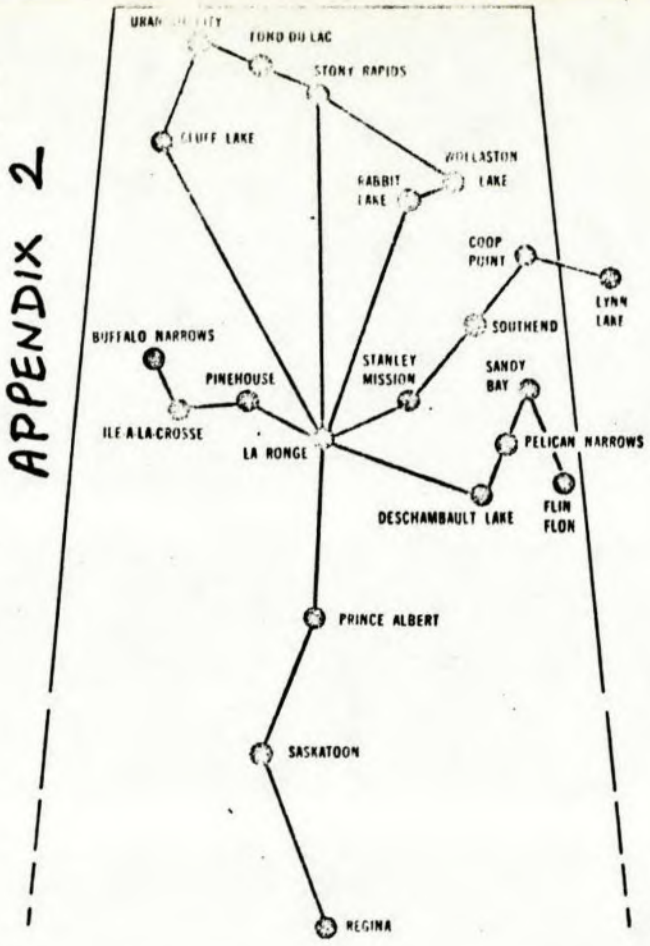
7. — AIR EXPRESS — AIR CARGO

Shipments must be delivered to the airport one (1) hour before flight departure.

Special arrangements must be made for shipments of unusual size or nature.

8. — GROUND TRANSPORTATION

Scheduled ground service is available between downtown ticket offices and the airport at passenger's expense. Canadian Airlines does not operate such services.



CHARTER SPECIALISTS

FROM BASES AT:

Saskatoon — Prince Albert — La Ronge — Stony Rapids — Uranium City — Buffalo Narrows

AIRCRAFT

Twin Engine —	Single Engine —
DC-3/C47S	OTTERS
CANSOS	BEAVERS
BRISTOL FREIGHTERS	CESSNAS
TWIN OTTERS	
AZTECS	

FLEET OF OVER 25 AIRCRAFT

Direct communications maintained between all bases to book and arrange your flight.

anywhere with

NORCANAIR

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"SASKATCHEWAN SERVICE"

FLIGHT SCHEDULES

SOUTH SERVICE

Flight No.	Depart.	Arrive
To: SASKATOON — $12.00		
71 DC	8:45 a.m.	9:25 a.m.
73 TO	8:05 p.m.	8:45 p.m.
To: REGINA — $26.00		
74 DC-TO	8:45 a.m.	11:05 a.m.
78 TO	6:05 p.m.	10:10 p.m.
To: REGINA — $20.00		
72 TO	7:10 a.m.	8:15 a.m.
74 TO	10:00 a.m.	11:05 a.m.
76 TO	4:10 p.m.	5:15 p.m.
78 TO	9:05 p.m.	10:10 p.m.
To: PRINCE ALBERT — $12.00		
71 DC	9:30 a.m.	10:30 a.m.
75 TO	7:05 p.m.	7:45 p.m.
To: SASKATOON — $20.00		
71 TO	8:55 a.m.	9:40 a.m.
73 TO	1:05 p.m.	2:10 p.m.
75 TO	5:35 p.m.	6:40 p.m.
77 TO	10:30 p.m.	11:35 p.m.
To: PRINCE ALBERT — $26.00		
71 TO-DC	8:55 a.m.	10:30 a.m.
75 TO	5:35 p.m.	7:45 p.m.

All above flights operate daily except Saturday and Sunday.
Equipment: TO – Twin Otter DC – DC-3

Air Express all points 10¢ per lb. Min. — $7.00.
Air Cargo rates available – Min. — $10.00

RESERVATION OFFICES AND INFORMATION

Saskatoon — Phone 652-7711
TWX 610-731-1311
Regina — Phone 525-8711
TWX 610-721-1347
Prince Albert — Phone 764-4271
Telex 074-29236
TWX 610-751-1294
La Ronge — Phone 425-2441
TWX 610-751-1393
Uranium City — Phone 3-3511

NORTH SERVICE

EFFECTIVE MAY 16, 1973

Frequency And Flight Numbers	NORTHBOUND Mon 511 A.M.	Tues 512 A.M.	Wed 513 A.M.	Thurs. 514 A.M.	Fri. 515 A.M.
Prince Albert Lv.	11:00	11:00	11:00	11:00	11:00
La Ronge Ar.	11:50	11:50	11:50	11:50	11:50
	P.M.	P.M.	P.M.	P.M.	P.M.
La Ronge Lv.	12:20	12:20	12:20	12:20	12:20
Cluff Lake Ar.	2:00				
Cluff Lake Lv.	2:20				
Rabbit Lake Ar.	(Pending)				
Rabbit Lake Lv.					
Wollaston Lk. Ar.		1:50			
Wollaston Lk. Lv.		2:10			
Stony Rapids Ar.		3:00		2:00	
Stony Rapids Lv.					
Uranium City Ar.	3:00		2:30		2:30

ALL TIMES SHOWN ARE CENTRAL STANDARD TIME.

Frequency And Flight Numbers	SOUTHBOUND Mon 521 P.M.	Tues 522 P.M.	Wed 523 P.M.	Thurs. 524 P.M.	Fri. 525 P.M.
Uranium City Lv	3:20		3:20		3:20
Stony Rapids Ar	4:00				4:00
Stony Rapids Lv.	4:20	3:20		2:20	4:20
Wollaston Lk. Ar.				3:10	
Wollaston Lk. Lv.				3:30	
Rabbit Lake Ar.	(Pending)				
Rabbit Lake Lv					
Cluff Lake Ar.			4:00		
Cluff Lake Lv.			4:20		
La Ronge Ar.	6:00	5:00	6:00	5:00	6:00
La Ronge Lv.	6:20	6:20	6:20	6:20	6:20
Prince Albert Ar.	7:10	7:10	7:10	7:10	7:10

"Our Family Fare is a good value"

PASSENGER FARES AND EXPRESS RATES 51-52

Between And	Prince Albert	La Ronge	Stony Rapids	Uranium City	Wollaston Lake	Cluff Lake
Prince Albert		15.00 .14	55.00 .35	55.00 .36	50.00 .35	50.00 .35
La Ronge	15.00 .14		47.00 .25	49.00 .28	42.00 .24	42.00 .25
Stony Rapids	55.00 .35	47.00 .25		20.00 .10	20.00 .10	33.00 .15
Uranium City	55.00 .36	49.00 .28	20.00 .10		40.00 .20	13.00 .14
Wollaston Lake	50.00 .35	42.00 .24	20.00 .10	40.00 .20		53.00 .25
Cluff Lake	50.00 .35	42.00 .25	33.00 .15	13.00 .14	53.00 .25	
Rabbit Lake	—	—	—	—	—	—

Air Cargo rates available Min. charge — $10.00
Economy rates for 1000 lb lots

From LA RONGE — Departure 09:00 hrs. — Round trip

Trip 21-22 — Every Tuesday to Deschambault — Pelican Narrows — Sandy Bay — Flin Flon

Trip 31-32 — Every Wednesday to Pinehouse Lake — Ile-a-la-Crosse — Buffalo Narrows

Trip 41-42 — Every Friday to Stanley — Southend — Coop Point

From URANIUM CITY — Departure 09:00 hrs. — Round trip.

Trip 51DV - 52DV — Every Tuesday and Thursday to Fond-du-Lac and Stony Rapids

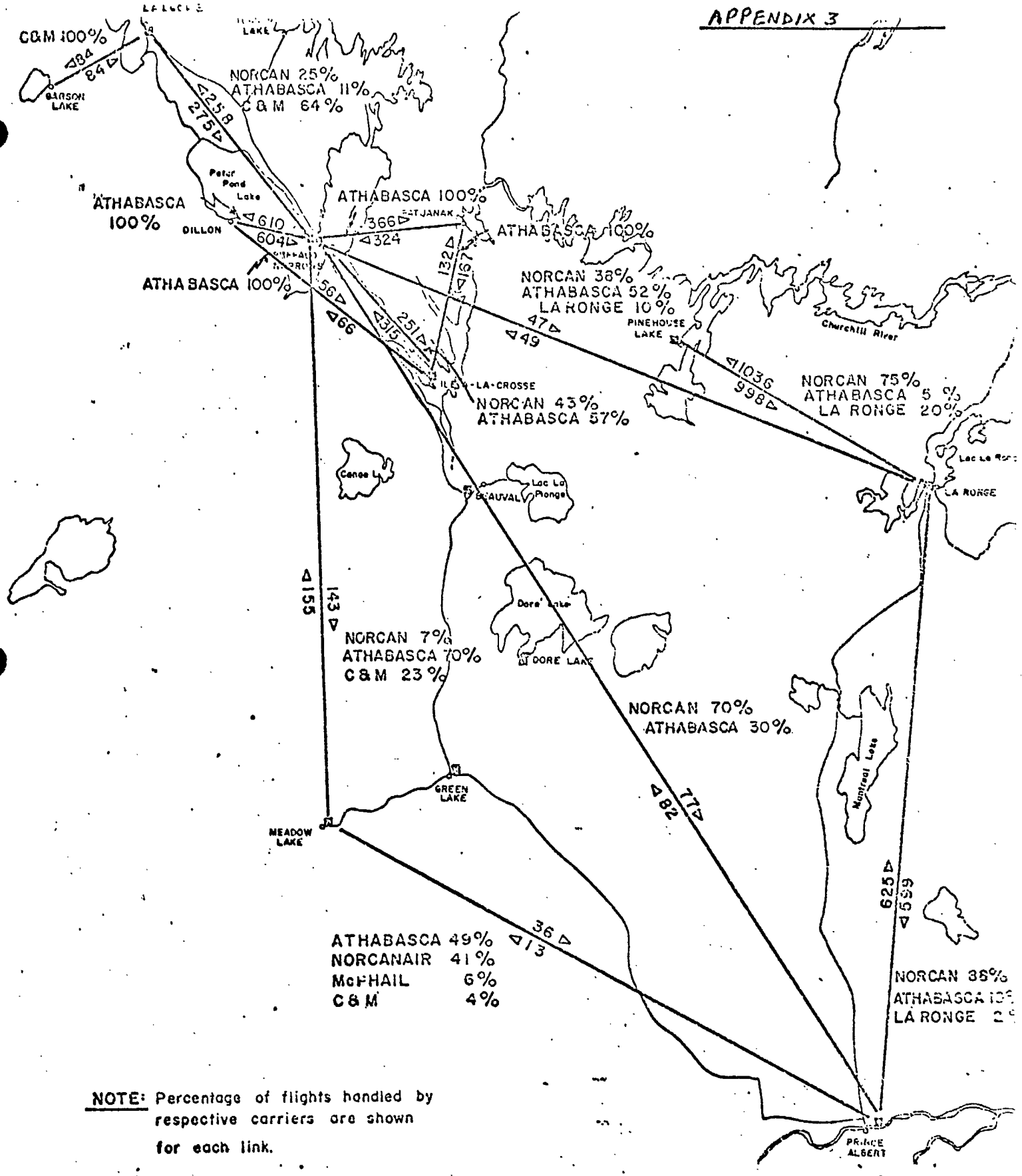
Fares	La R.	Des.	P.H.	S.B.	P.H.	I.C.	Sta.	S'end.
La Ronge	—	18.00	19.00	24.00	13.00	21.00	7.50	24.00
Deschambault	18.00	—	6.00	12.00	--	—	—	—
Pelican Narr.	19.00	6.00	—	9.00	—	—	—	—
Sandy Bay	24.00	12.00	9.00	—	—	—	—	—
Flin Flon	28.00	13.00	13.00	13.00	—	—	—	—
Pinehouse Lake	13.00	—	—	—	—	11.00	—	—
Ile a La-Crosse	21.00	—	—	—	11.00	—	—	—
Buffalo Narr.	27.00	—	—	—	16.50	8.00	—	—
Stanley	7.50	—	—	—	—	—	—	17.00
Southend	24.00	—	—	—	—	—	17.00	—
Co-op Point	37.00	—	—	—	—	—	30.00	15.00

Fares	F.L.	S.R.
Uranium City	10.00	20.00
Fond du Lac	—	9.50
Stony Rapids	9.50	—

Air Express Rates on Request. Minimum Charge $4.00.

Passenger Fares and Express Rates [illegible] onal services as published in Norcanair Tariff.

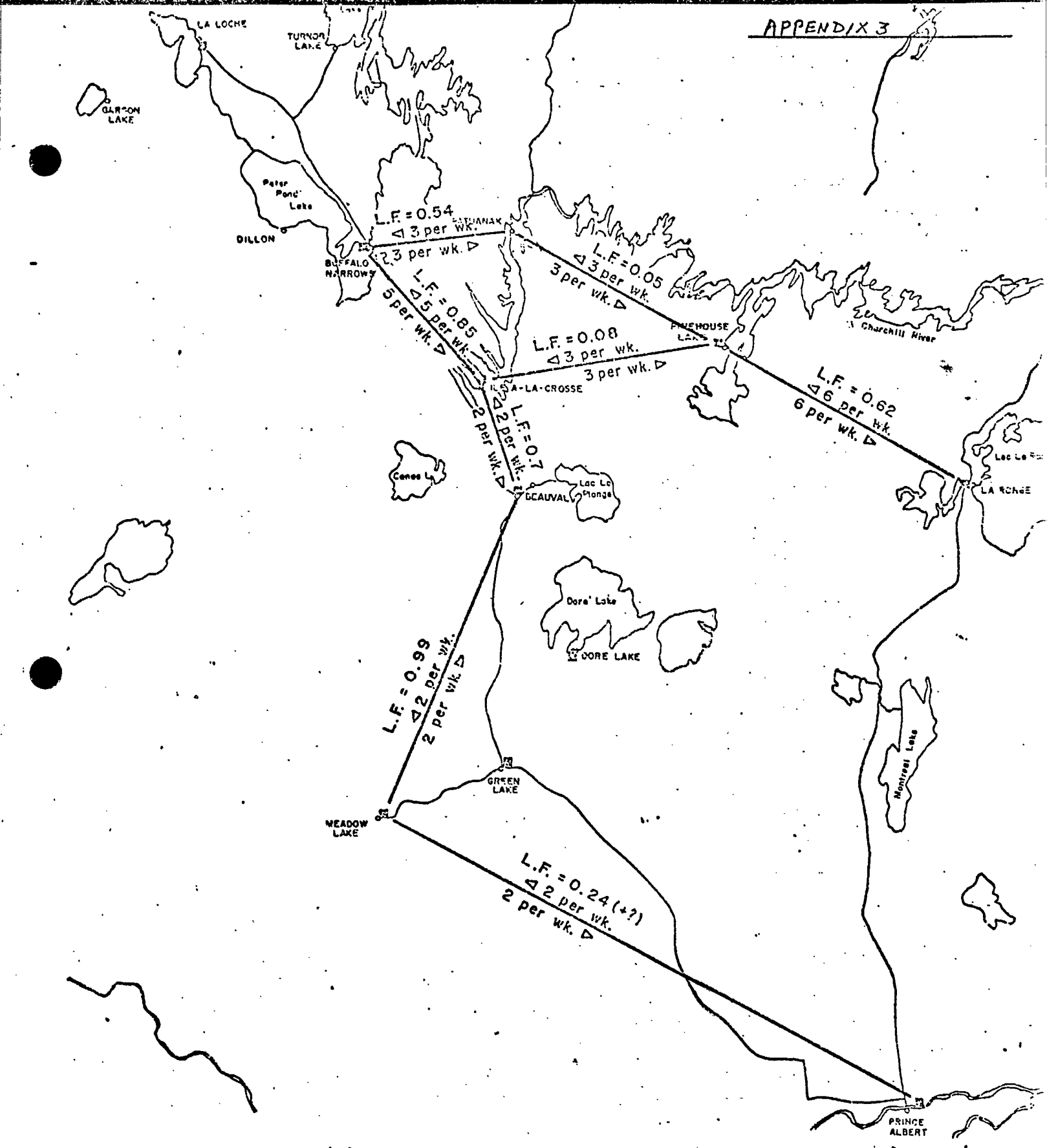
APPENDIX 3



NOTE: Percentage of flights handled by respective carriers are shown for each link.

MAP FIGURE 1 [A. A. JONE

INTER COMMUNITY FLIGHTS (1971)



MAP FIGURE 5 [A.A. JONES]

NOTE: 1. ▷ show frequencies per week.
2. L.F. = 0.5 is projected load factor.

PROPOSED SCHEDULED AIR SERVICE USING BN – 2A ISLANDER

TABLE #3 [A.A. JONES]

Islander scheduled route service

Link	Service Freq. Each way per week	Aircraft[1] Utilization (hours)	Service Capacity on link. (Pass. Equivs.)	% of total link volume captured by sched.	Projected[2] Flow (Pass. Equivs.)	Load Factor
B.N. - Pat.	3	69	2700	60	1469	0.54
Pat. - Pinehouse	3	117	2700	60	124[4]	0.05
Pinehouse - La Ronge	6	270	5400	90	3330[3]	0.62
Pinehouse - Ile-a-la-C.	3	117	2700	60	223[4]	0.08
B.N. - Ile-a-la-C.	5	140	4500	90	3841	0.85
Ile-a-la-C. - Beauval	2	40	1800	40	1263	0.70
Beauval - Meadow L.	2	112	1800	40	1788	0.99
Meadow L. - P.A.	2	200	1800	40	437[5]	0.24[5]
		Total 1065				

Note: 1. Based upon 50 weeks per year and 130 m.p.h. block speed.

2. Includes diversion from road.

3. Based upon passenger priority over freight and no fish haul. Refer to 'Transport service for Pinehouse' for further details.

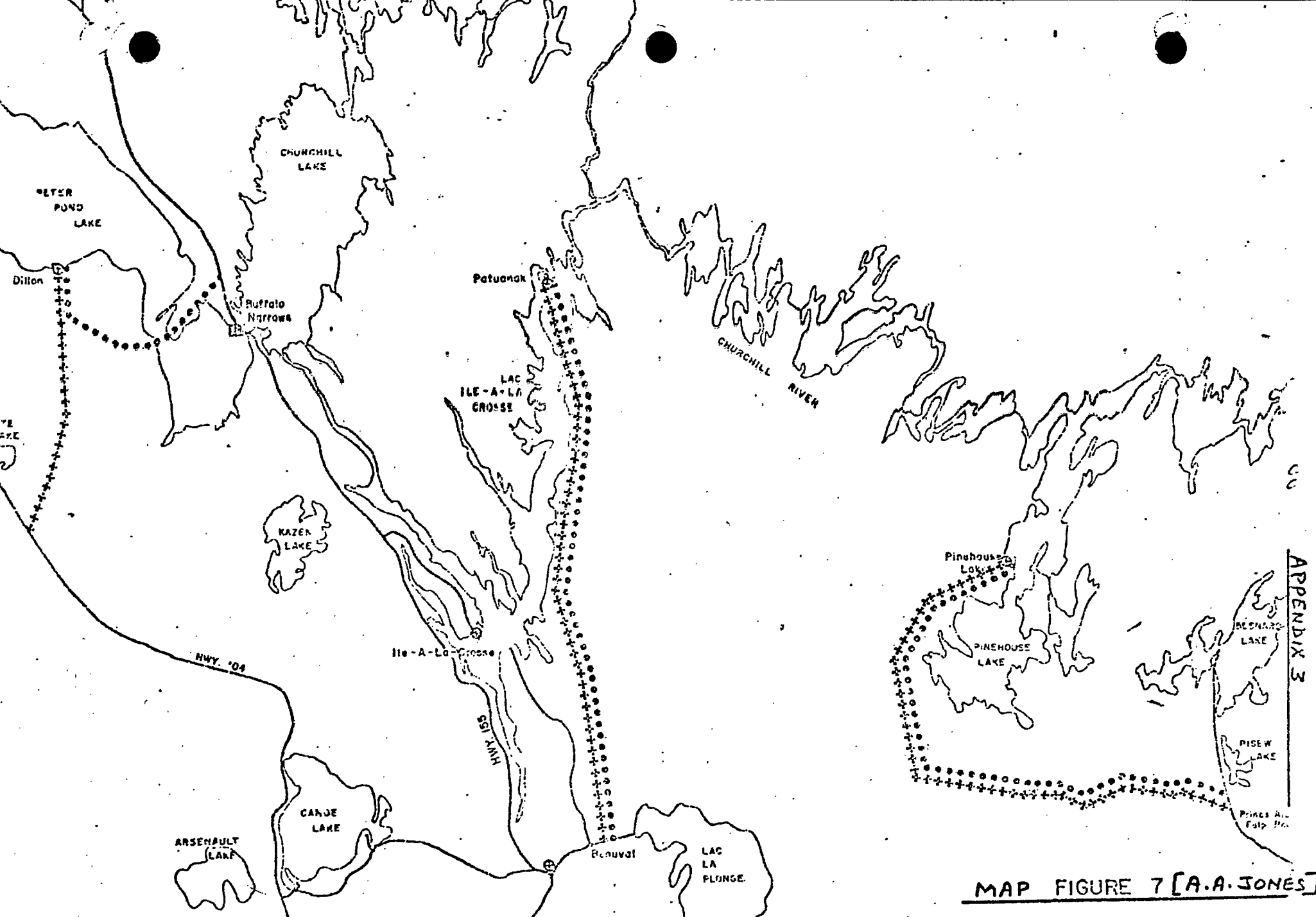
4. Does not account for any increased movements due to D.N.S. establishment in the north.

5. Does not account for any diversion from road.

TABLE #5 [A.A. JONES]

Economic Summary for Provision of Scheduled Service by Islander

Costs:	Annual cost for provision of service	= $91,600
	Annual forecast revenues at the price structure defined in Table 1	= $65,100
	Annual required subsidy	= $26,500
Benefits:		
	Savings to travellers diverting from taxi	= $ 3,700
	Savings to travellers diverting from passenger car	= $ 3,100
	Savings due to diversion from charter aircraft	= $30,200
	Total Annual Savings	= $37,000
	Additional benefits associated with new trips generated by the air service (excluding future growth)	= $ 1,900
	Total Annual Benefit (1972)	= $38,900



NOTE: 1. +++ Recommended all-weather road
2. ••• Recommended short-term winter road access
3. 4000' x 100' all weather, oiled surfaced airstrip
4. 3000' x 100' all weather, oiled surfaced airstrip

APPENDIX 3

MAP FIGURE 7 [A.A. JONES]

RECOMMENDED ROAD AND AIRPORT IMPROVMENTS

APPENDIX 4.

NORTHERN HIGHWAY SURFACING PROGRAM
DETAILED COSTS

HWY. NO.	SECTION LIMITS	LENGTH MILEAGE	COST ($ MILLIONS)		
			GRADING	SURFACING	TOTAL COST
2	Jct. 264 to La Ronge	102	-	4.1[1]	4.1
2	La Ronge to 20 miles North	20	0.8	0.8[1]	1.6
		122			5.7
55	Big River to Green Lake	46	1.2	0.2[2]	1.4
155	Green Lake to Ile A La Crosse	130	3.0	0.6[2]	3.6
		176			5.0
120	Jct. #55 to Candle Lake	20	-	1.0[3]	1.0
120	Candle Lake to Jct. #106	37	-	2.3[3]	2.3
120	Jct. #106 to Big Sandy Lake (Mile 88)	40	1.0	3.0[3]	4.0
		97			7.3
106	Mile 88 to Mile 112 (Silica Haul)	26	-	0.8[4]	0.8
106	Mile 112 to Jct. #135	68	-	3.8[4]	3.8
106	Jct. #135 to Creighton	45	-	2.4[4]	2.4
106	Jct. #55 to Mile 25	25	-	0.7[4]	0.7
106	Mile 25 to S. Jct. #120	18	-	0.4[4]	0.4
106	S. Jct.#120 to Mile 62	19	-	0.8[4]	0.8
106	Mile 62 to N. Jct. #120	24	-	1.1[4]	1.1
		225			10.0
Total Program		620			28.0

[1] Staged Pavement or 8" AC @ $40,000/mile

[2] Oiling @ $5,000/mile

[3] 2404 Staged Asphalt base

[4] Oil Treatment

COMPETING PROGRAM

The hovercraft service and the Cluff Lake tote road projects are interdependent. Both, therefore, compete with other programs for the transportation sector dollar. The provision of all-weather roads are projects which compete with other programs for fund allocation.

NORTHERN TRANSPORTATION FACILITY PROVISION PROGRAM
DETAILED COSTS

PROJECT	DESCRIPTION	RATE (DOLLARS)	LENGTH (MILES)	TOTAL COST (DOLLARS)
1	Winter Road construction from Turnor Lake to South shore of Lake Athabasca	$1,000/mile/yr	276 max.	$650,000
2	Tote Road construction from Turnor Lake to South shore of Lake Athabasca	$25,000/mile	225	$5,750,000
3	New road from Big River to Meadow Lake Sawmill	Grading at $25,000/mile Oiling at $5,000/mile	55	$2,000,000
4	Capital Cost of Hovercraft 1 year operating subsidy			$1,500,000 $ 500,000
5	All weather road construction from Cummins Lake to Dillon (Extension of Highway 104)	Grading at $18,000/mile	28	$500,000
6	All weather road construction from Pisew Lake to Pinehouse Lake	Grading at $19,000/mile	53	$1,007,000
7	All weather road construction from Jct. #2 into Stanley Mission	Grading and Surfacing at $83,000/mile	18	$1,494,000
Total	Program Period Cost Total Federal Reimbursements Provincial Program Period Cost Total Provincial Annual Cost Total			$13,400,000 $ 6,700,000 $ 6,700,000 $ 1,340,000

APPENDIX 4.

NORTHERN HIGHWAY UPGRADING PROGRAM
DETAILED COSTS

HWY. NO.	SECTION LIMITS	LENGTH (MILES)	COST ($ MILLIONS)		
			GRADING	SURFACING	TOTAL COST
109	Jct. #3 to Jct. #163	54	1,358,000	320,000[2]	1,678,000
155	Ile-a-la-Cross Turnoff to Buffalo Narrows Ferry	27	668,000	134,000[1]	802,000
155	Buffalo Narrows to La Loche	68	1,700,000	340,000[1]	2,040,000
104	2.34 miles N.E. of Jct. #224 to Flotten Lake	12	305,000	61,000[1]	366,000
104	Meadow Lake Sawmill Road to Canoe Lake	16	400,000	80,000[1]	480,000
224	Jct. #104 to Waterhen River (north of Goodsoil)	30	250,000	150,000[1]	400,000
Tote roads	25 percent (56 miles) of existing tote roads (Hwys. 102, 105 or 135)	56	1,120,000	-	1,120,000
155	Bridge at Buffalo Narrows				1,350,000
163	Shoal Lake I.R. - West	18	364,000	-	364,000
	Total Program	281	6,165,000	1,085,000	8,600,000

[1] Oiling at $5,000/mile

[2] Bituminous Surfacing at $40,000/mile