During the week of June 30th, 2012 the mayor of the Hamlet of Coral Harbour reported to GCS that the water level in the lakes around the Airport Road at the entrance to the hamlet was rising at an alarming rate. This was due to a fast spring melt and moderate rain for over two weeks..

The hamlet mobilized equipment belonging to airports and local dump trucks.

The hamlet proceeded to place fill along the Airport Road to help prevent it from washing out.

The water overflowed in to the wetlands area and flowed down stream to the lowest elevation which is near the Fuel Storage Facility. Two 1000mm ø CMP culverts are located across the Airport Road in this area. These culverts could not handle the excessive water run-off and the existing road washed out in two areas on both sides of the existing Fuel Storage Facility tank farm. The washout also caused damage to the Fuel Storage Facilty's re-supply Pipeline.
The hamlet mobilized equipment and installed culverts and gravel fill to repair the areas that washed out. The Road to the Airport was closed for about a week while repairs were done.

According to the mayor this has happen four times in the last 6 or 7 years. The hamlet is seeking financial assistance from the GN to raise this road by a meter and install additional culverts or to consider installing a bridge to prevent this from happening again in the future.

The following are some pictures of the damage and the amount of water in the area. The hamlet has completed temporary repairs and the road to the airport is open. Water levels have receded to normal seasonal levels.


07/04/2012 09:22

# APPENDIX B

## AIRPORT TO TOWN ROUTE LOCATION (AIRPHOTO ANALYSIS ASSOCIATES 1971)

Airphoto
Analysis
Associates

# ROUTE LOCATION
# SOUTHAMPTON
# ISLAND
# N. W. T.

CORAL HARBOUR AREA

Airport → Town



PREPARED for

TECHNICAL SERVICES BRANCH

DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT

OTTAWA

APRIL, 1971

AIRPHOTO ANALYSIS ASSOCIATES

ROBERT G. TRESS,
M.A. Sc., Dip. U & R. Pl., P.Eng.

CONSULTANTS LIMITED
859 COLLEGE STREET
TORONTO, ONTARIO
AREA CODE 416 531-4720
Cable: 'AIRPHOTO'

GARRY T. HUNTER,
M.A. Sc. P.Eng.

April 1, 1971.

Mr. P. Edridge,
Department of Indian Affairs
and Northern Development,
400 Laurier Street,
Ottawa, Ontario.

Re: Airphoto Interpretation
Southampton Island, N.W.T.
Your File No. 548-5-118
Your Contract No. 225-70
Our File No. 70-111

Dear Sir:

We have completed our airphoto interpretation study and report at Southampton Island, N.W.T. in accordance with your terms of reference outlined in Contract No. 225-70 of February 9, 1971.

We have presented alternative routes for highway and electrical facilities considering engineering problems associated with the construction of each facility. Before finalizing selection of route alternates, further study is required. This study should comprise:

a) Field investigations conducted on or shortly after maximum flood discharge of the Post River (late June).

b) Further office studies and refinement of design principles for alternative routes available, including preparation of large scale maps from the existing aerial photographs illustrating detailed quantities and construction techniques for the alternative powerline and roadway routes.

c) Review with the client.

d) Selection of final route for required facilities.



We trust that you will concur with our thinking after review of the enclosed maps and reports. We welcome your comments.

Yours truly,

Garry T. Hunter

Garry T. Hunter, P.Eng.

GTH/lm/encl.

TABLE OF CONTENTS

## TABLE OF FACTOR MAPS



## TABLE OF CHARTS AND TABLES

# INTRODUCTION:

Southampton Island lies at the north of Hudson Bay. The settlement of Coral Harbour (64°08' N., 83°10' W.) is located on a small inlet at the head of South Bay, on the south coast of Southampton Island. A department of Transport airstrip lies about 6 miles inland to the northwest of Coral Harbour.

Access to this airstrip is gained by Transair from Churchill, Manitoba and Nordair from Frobisher Bay. Freight for either the settlement or the Dept. of Transport establishment is imported by ship in the summer months. Snafu Beach provides an off landing area for these ships. Oil supplies are transported to the Dept. of Transport facilities via pipeline from Snafu Beach. Freight is transported by road to Coral Harbour and to the airstrip. The road to the airstrip is reasonably direct. That to the settlement is little more than an improved trail, is circuitous and crosses three rivers. In early summer the road is frequently washed out.

Dept. of Transport has a large power house at the air field which can provide power in excess of their demands. There is a smaller Territorial Government

power house at the settlement of Coral Harbour which is working at capacity.

The feasibility of providing additional power to Coral Harbour by a power line from the D.O.T. establishment and the improvement of access between the settlement, Snafu Beach and the air field are under consideration.

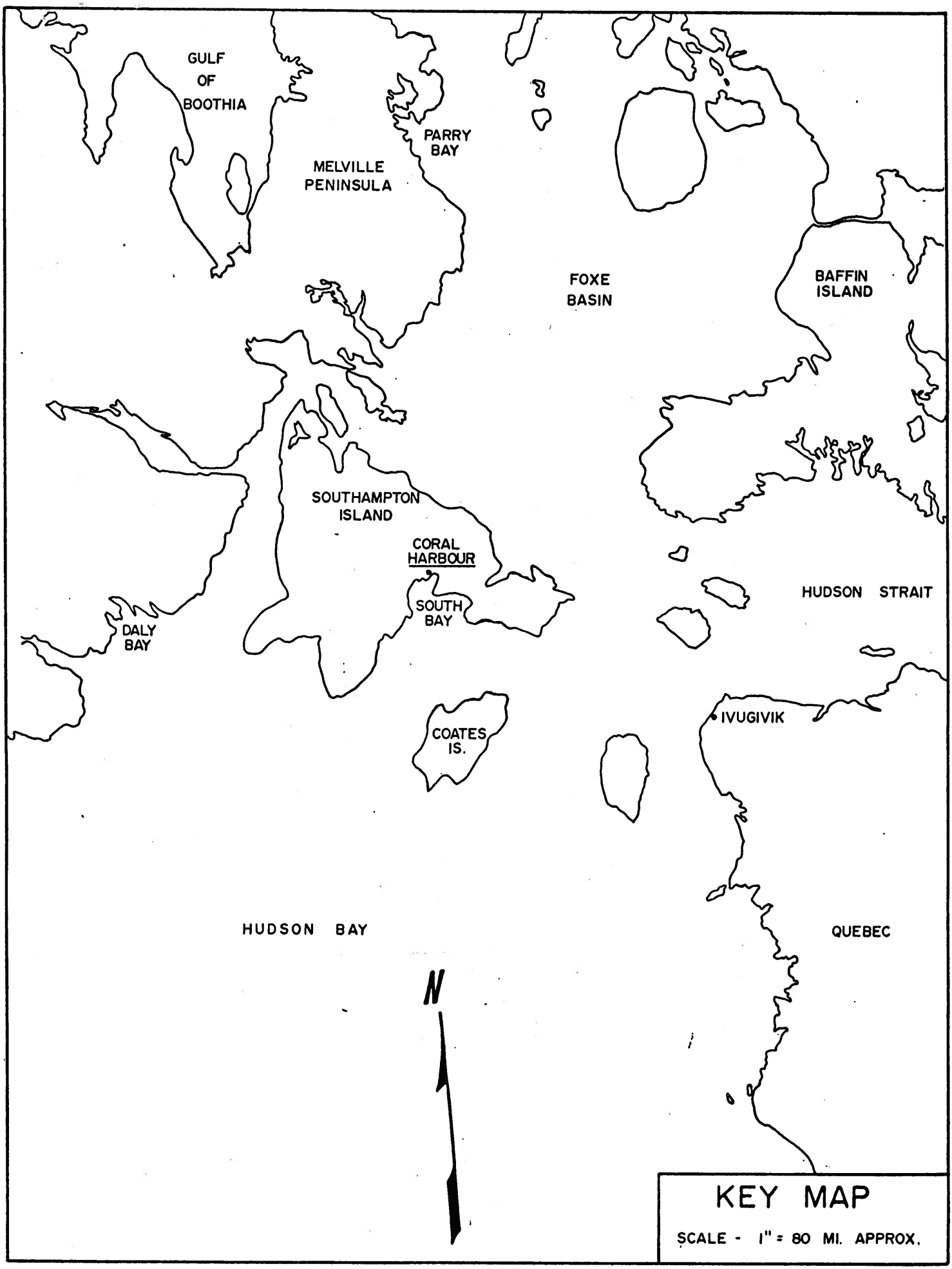
It is the purpose of this work to determine by means of airphoto interpretation:

a) a more direct route from Snafu Beach to Coral Harbour

b) a direct route from the D.O.T. powerhouse to the settlement of Coral Harbour as an alternative to following the road.

c) the location, outline and possible volume of deposits of granular materials suitable for road construction near the recommended routes.

d) the best method of resolving wash out problems caused by the Post River without adversely affecting the water supply to the settlement of Coral Harbour.


GULF
OF
BOOTHIA
PARRY
BAY
MELVILLE
PENINSULA
FOXE
BASIN
BAFFIN
ISLAND
SOUTHAMPTON
ISLAND
CORAL
HARBOUR
SOUTH
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DALY
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IS.
HUDSON BAY
QUEBEC
N
KEY MAP
SCALE - 1" = 80 MI. APPROX.

## PROCEDURE:

Work has been performed utilizing standard airphoto interpretation techniques without field verification.

Recent black and white vertical aerial photographs (1" = 1000' approximate scale) form the basis for the above route location. Appropriate black and white reproductions were prepared using 1:250,000 National Topographic Series maps for scale control.

# DISCUSSION

## GEOLOGY:

The study area is composed of two distinct types of physiographic provinces. These consist of:

1. Precambrian Rock Upland
2. Paleozoic Sedimentary Rock Lowland

Bedrock consists of Precambrian granite and granite gneiss on the Precambrian Upland. This province includes the entire south-eastern portion of the study area. The granite outcrops in low ridges. Foliation is quite common trending in a north-south direction. Intervening lows are filled with glacial tills consisting of sands, silts and clays as well as numerous boulders. These lows everywhere accomodate shallow ponds and flood overflow channels. A number of eskers and small moraines are deposited on these Precambrian rocks.

Outliers of paleozoic limestone may be seen in river channels near the D.O.T. airstrip. This outlier is protected by low topographic ridges to the east, west and north. Superimposed on these limestones are numerous post Pleistocene raised beaches and glacial outwash deposits (western and northern portions of the study area).

These beaches between the previously described topographic ridges were formed by storm waves from Hudson Bay. Glacial moraines and outwash deposits formed a ready source of granular material. Separating the beach ridges are finer textured fore-shore deposits of sands and silts. These are readily seen along the roadway from Snafu Beach to the D.O.T. establishment.

Landforms of this region, as do most, around the Hudson Bay Shoreline exhibits the characteristics of recent emergence from the sea as a result of post glacial uplift. Uplift is estimated at a rate of 2 - 3 feet per century.

CLIMATE:

TEMPERATURE:

Means and extremes of temperatures are plotted on Figure C-1.

FREEZING DEGREE DAYS:

Freezing degree days are plotted on a monthly basis for mean daily temperatures (Figure C-2). Calculated freezing and thawing indices are 8007 and 1064 respectively.

For a period from 1949 - 1959 the following degree day values are recorded at Coral Harbour Airport:

| AVERAGE | EXTREMES HIGH | EXTREMES LOW | |
|---|---|---|---|
| 8539 | 9510 | 7666 | Freezing Index |
| 1175 | 1487 | 1021 | Thawing Index |
| 262 | 501 | 323 | Accumulation of freezing degree-days during the first 30 days of the freezing season. |
| | From Sept. 27/56 | From Sept. 8/55 | |
| 201 | 309 | 97 | Accumulation of thawing degree-days during the first 30 days of the thawing season. |
| | From June 8/56 | From May 28/54 | |

PRECIPITATION:

Monthly precipitation values are plotted on Figure

# TEMPERATURE

| | ANNUAL |
|---|---|
| 1/ MEAN DAILY TEMPERATURE | 11.6 |
| 2/ MEAN DAILY MAXIMUM | 19.0 |
| 3/ MEAN DAILY MINIMUM | 4.1 |
| 4/ MAXIMUM TEMPERATURE | 79.2 |
| 5/ MINIMUM TEMPERATURE | -61.0 |

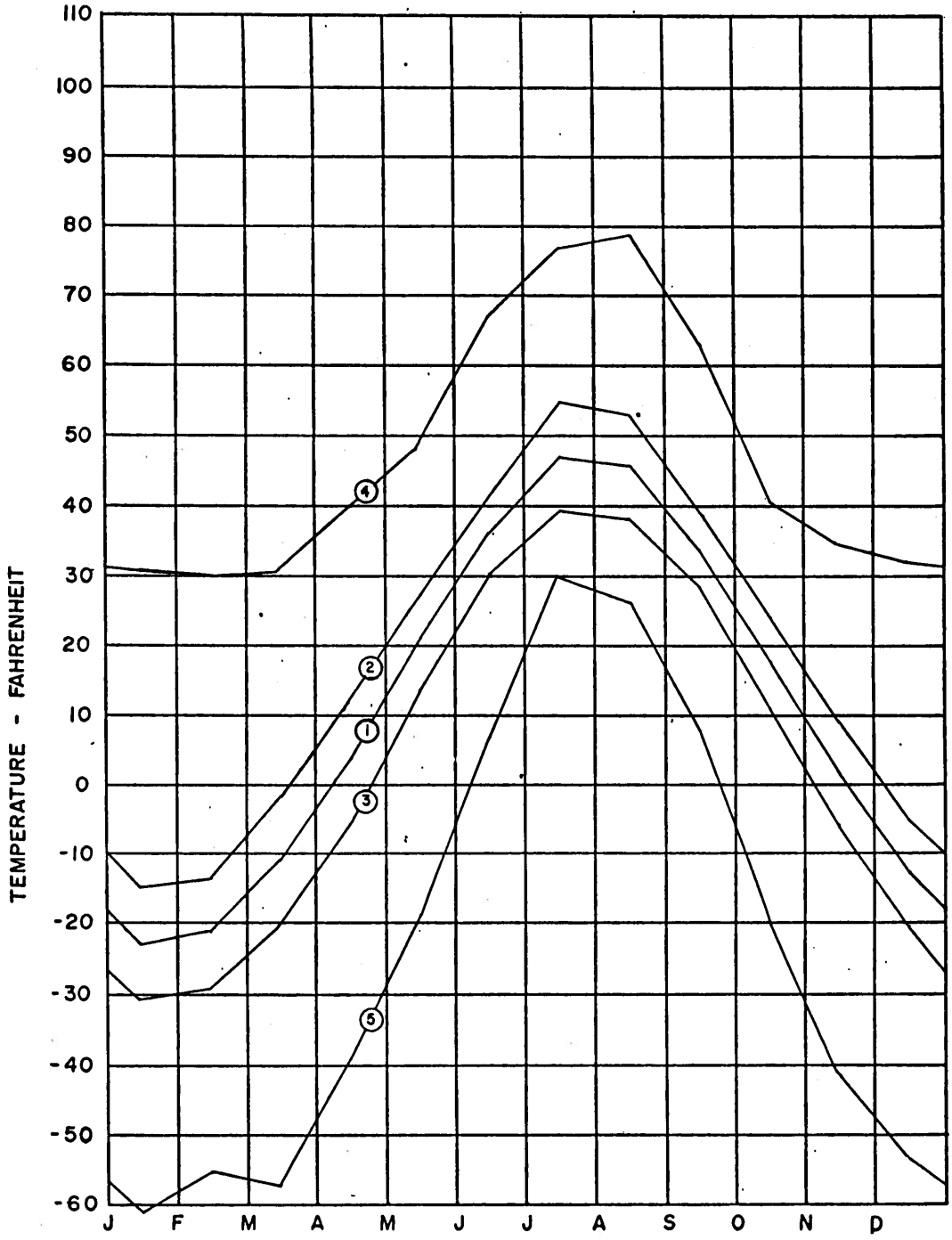



FIG. C-1

# FREEZING AND THAWING INDICES

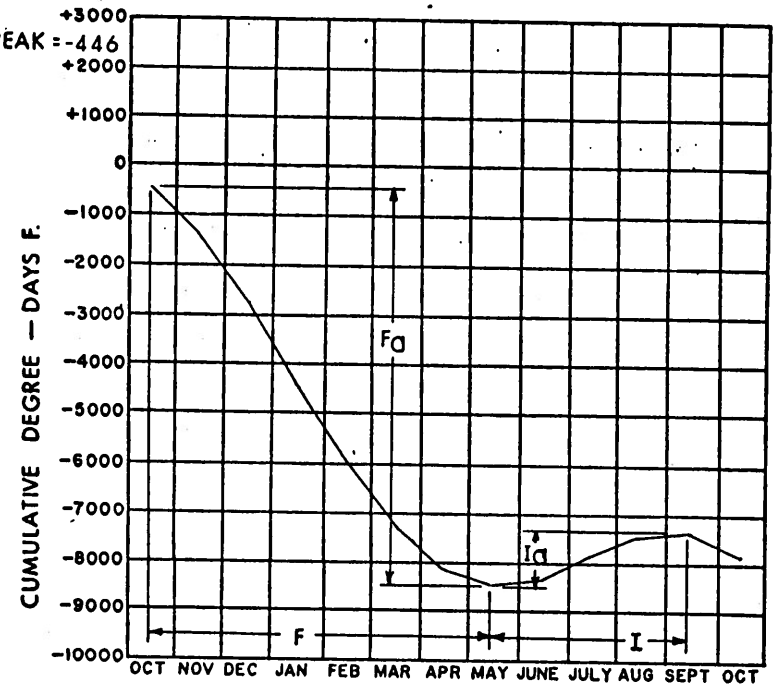
FREEZING INDEX
Fa = 8449 - 446
= 8003 DEG. DAYS

FREEZING SEASON (F)

THAWING INDEX
Ia = 8449 - 7385
= 1064 DEG. DAYS

THAWING SEASON (I)

VALUE AT PEAK = -446




VALUE AT PEAK = -7385

VALUE AT LOW POINT = -8449

GROWING DEGREE DAYS

FROST FREE DAYS 45

MEAN DATE OF LAST AND FIRST FROST JUNE 28 — AUGUST 13

FIG. C - 2

## PRECIPITATION

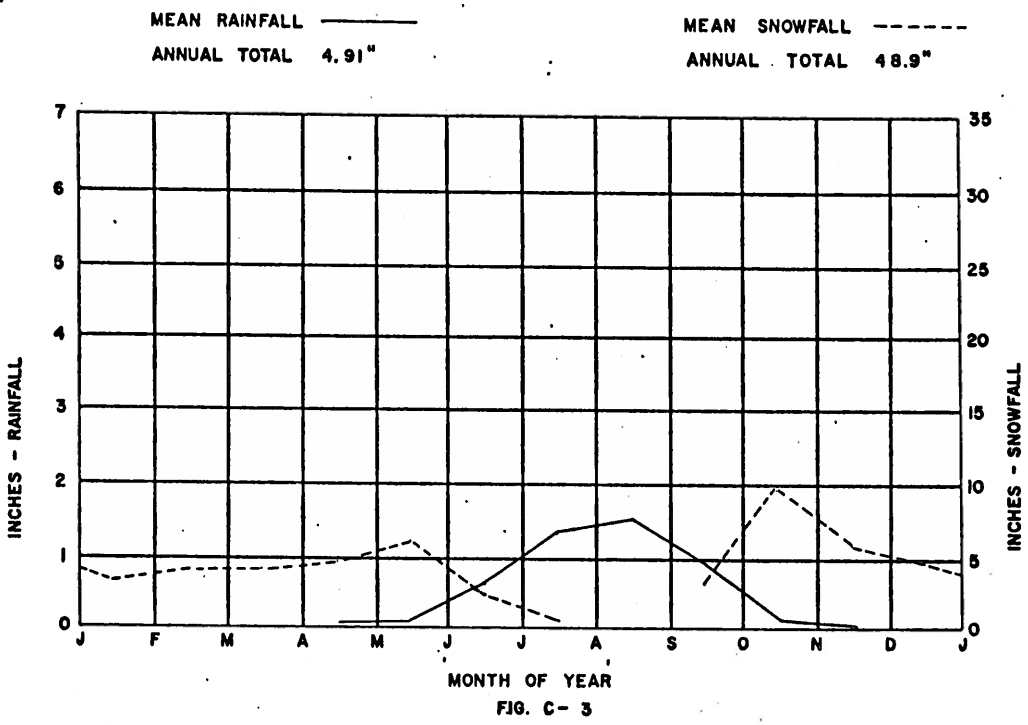



FIG. C- 3

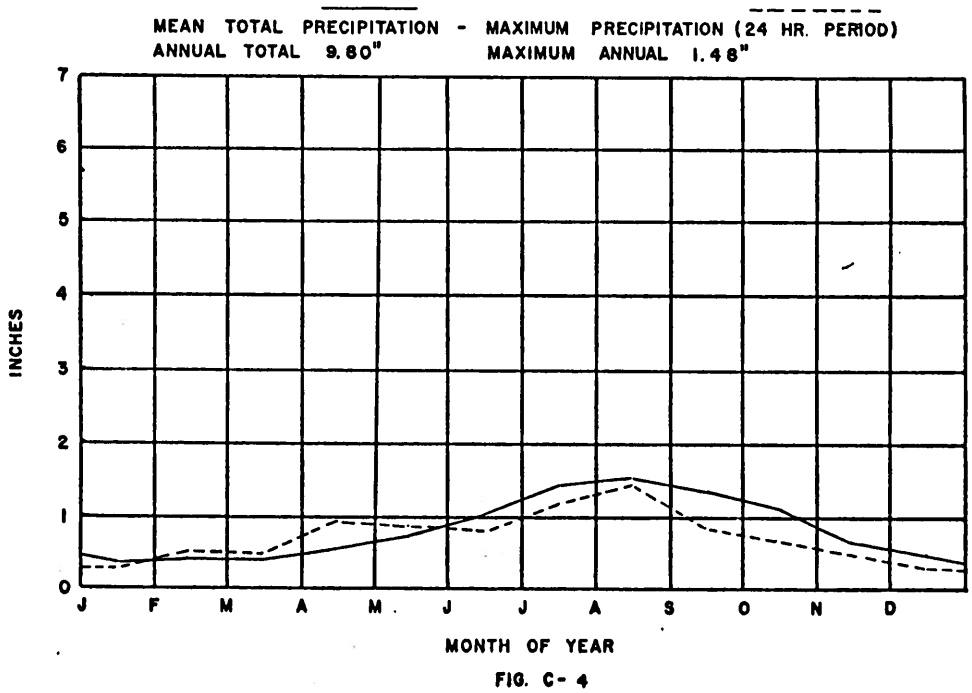



FIG. C- 4

C-3 and C-4.

| | |
|---|---|
| Number of Days with Measureable Rain | 34 |
| Number of Days with Measureable Snow | 78 |

Maximum recorded precipitation values for a 24 hour period are illustrated on Figure C-4 on a monthly basis.

The maximum precipitation for a 24 hour period is 1.48" and occurs in the month of August. The following ratios for maximum precipitation are calculated for data at Coral Harbour Airport.

$$\frac{6\ Hr}{24\ hr} - 0.6$$

$$\frac{48\ Hr}{24\ Hr} - 1.2$$

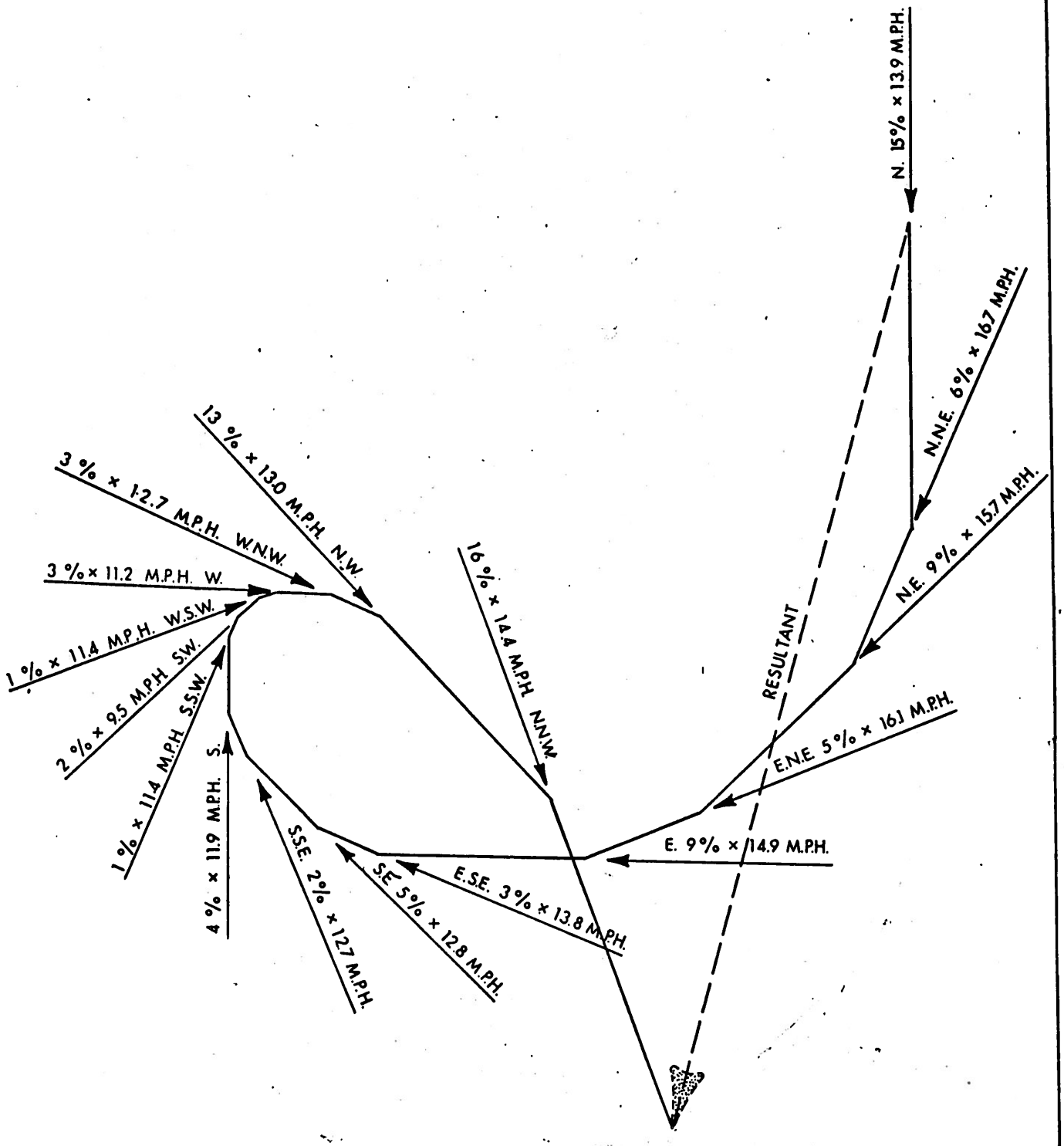
$$\frac{72\ Hr}{24\ Hr} - 1.2$$

The annual lake evaporation calculated for Southampton Island is 9 - 10". Water surplus values calculated for this region are 0. (A figure which does not agree with field observations.)

FREEZING RAIN:

Frequencies of freezing precipitation in the Arctic are quite low and confined usually to the September - October period when occurences at most stations average less than 25 hours.

# CORAL HARBOUR — WIND




WIND DRAG DIAGRAM
(ANNUAL)
FREQUENCY X INTENSITY

FIG. C – 5

WIND:

A wind vector diagram has been constructed from data available for Coral Harbour Airport (Figure C-5). Although the prevalent winds are from the north-west, the resultant for all winds is from the NNE as shown. Where frequency X intensity is a factor in engineering design, this value should be used rather than "prevailing" wind direction.

The maximum observed hourly speed is 90 m.p.h. from the north-east.

The computed probable maximum gust for this speed is 122 m.p.h. measured 129 mph

BLOWING SNOW (Coral Harbour Airport):

Blowing snow frequency from 5 percent in October to a maximum 16 percent in December. North-east winds are most likely to cause blowing snow conditions. The frequency of visibility 6 miles or less averages 20 - 25 percent for the October to May months for blowing snow.

PERMAFROST:

Permafrost features are evident on unconsolidated soils of the region. These features include raised polygons and surface cracks. Polygons occur in topographic

lows slightly above the prevailing summer water table. It is unlikely that permafrost extends to any great depth, at least below the 200 foot surface contour in the Coral Harbour area, due to the recent emergence of the land from beneath the waters of Hudson Bay. Those areas which have been and are permanently inundated should have little permafrost or subsurface ice-lensing. This inference has not been field verified. However, the high freezing indices and polygons indicate that permanently frozen ground and ice lensing does exist in the upper strata. Potential ice lensing and permafrost conditions must be considered for any route crossing fine textured unconsolidated soils which prevail in the topographic lows of the area.

TOPOGRAPHY AND DRAINAGE:

Detailed topographic information is not available for the study area. The area generally consists of low topographic ridges with intervening swales. Swales are poorly drained and subject to frequent flooding and ponding. Topographic ridges are windswept well drained and dry.

Regional drainage of the eastern portion of the study region is provided by the Post River. Drainage at best is 'disarranged' and poorly organized. The Post River has one or two channels for summer flow but during the spring snow melt, numerous other channels operate to accomodate overflowing floods. It is probable that most channels ponded with water in the autumn freeze solid during the winter. With snow melt and spring rains, runoff must be accomodated in new channels before thawing of anchor ice begins. This creates an extremely disorganized drainage system which is difficult to accomodate in any route location.

HYDROLOGY:

i) RECENT FLOODS:

Any route providing year round access between Coral Harbour and either Snafu Beach or the D.O.T. airstrip must cross the Post River.

The existing route from Coral Harbour to Snafu Beach traverses seven to ten potential or past flood channels of the Post River. Aerial photography obtained August 14, 1969, illustrates three wash-outs had occured previous to the flight mission. Measurements and interpretation of the photographs indicate that wash-outs are 30, 100, and 120 ft. in width. Depths are estimated at 3, 2 and 3 feet respectively. Assuming wash-outs occurred more or less concurrently this would give a total cross-section for the volume of flow of 650 sq. ft. The bed load of the streams (12 - 18 in. boulders) suggests velocities of up to 8 ft./sec. prevailing during maximum flow periods. The average flow velocity, however would probably be 4 - 5 ft./sec. The peak flow for 1969 appears to be the order of 2500 to 3500 cubic feet/sec.

ii) WATERSHED (Total Runoff):

It is difficult to check the above figure accurately.

The Post River has a watershed of 129 square miles (Figure C-6). The total precipitation on this watershed is 67,000 acre ft. per year. Although calculated annual lake evaporation is 10" and water surplus is 0. It is unlikely that losses due to evaporation and evapo-transpiration are greater than 10 percent.

Due to the permafrost, little infiltration of surface water can be expected. Even in granular terrain, although local infiltration occurs, seepage channels are obvious at the margins of deposits.

The average annual discharge is estimated at 90 c.f.s., 50 c.f.s. from snow melt and 40 c.f.s. from rainfall.

Rivers fed mainly by surface runoff in permafrost regions have a most uneven distribution of annual flow. Records for large rivers in Russia indicate that 84% of the volume is discharged in the spring, 14% in the summer and only 2% in winter. In some dry years and in especially severe winters the river may freeze solid. Ice varies from 5 - 6 feet in thickness. The ratio of high to low flow was 1:12,000.

The above figures are no doubt representative and valid for the Post River.

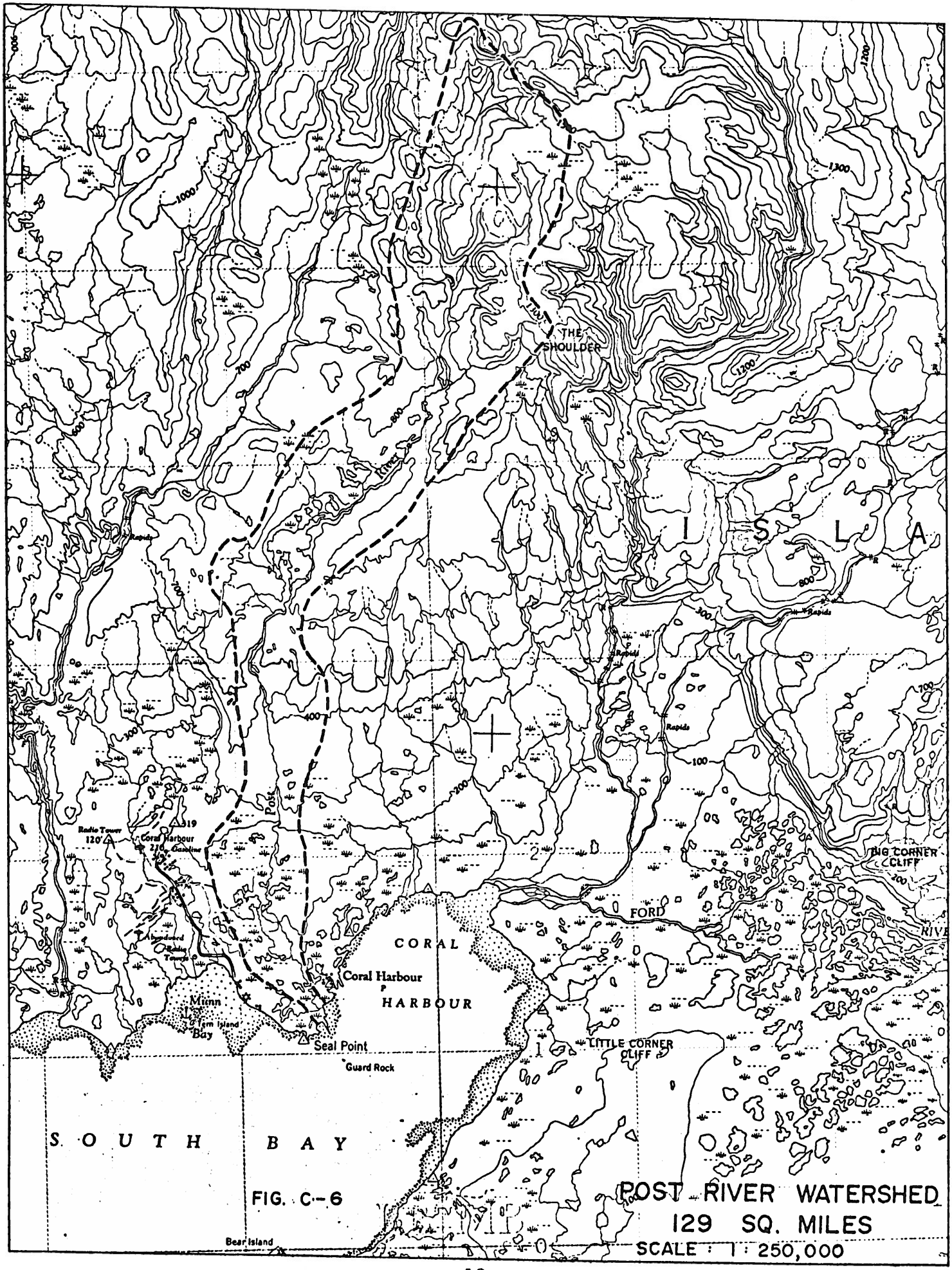



FIG. C-6

POST RIVER WATERSHED
129 SQ. MILES
SCALE : 1 : 250,000

iii) FLOOD HYDROGRAPH:

The maximum recorded 24 hr. precipitation occurs in August (1.48"). A flood hydrograph for the Post River has been calculated for this rainfall utilizing 6 hr., 48 hr. and 72 hr. ratios. Time of concentration has been estimated for the watershed at 80 hrs. This figure was derived by dividing the watershed into two sections and assuming an average flow velocity of 1 ft./sec. and 0.5 ft./sec. for the upper 13.5 mile steeper channel and 26.5 mile milder gradient in the lower watershed respectively.

A triangular hydrograph was calculated from the following relationships:*

$$Tp = \frac{D}{2} + 0.6\ Tc$$

$$Tb = 2.67\ Tp$$

$$Qp = 484\ \frac{AQ}{Tp}$$

Tp = time to peak in hours

D = Rainfall excess period (hrs.)

Tc = Time of Concentration (hrs.)

Tb = Time of length of base of hydrograph (hours)

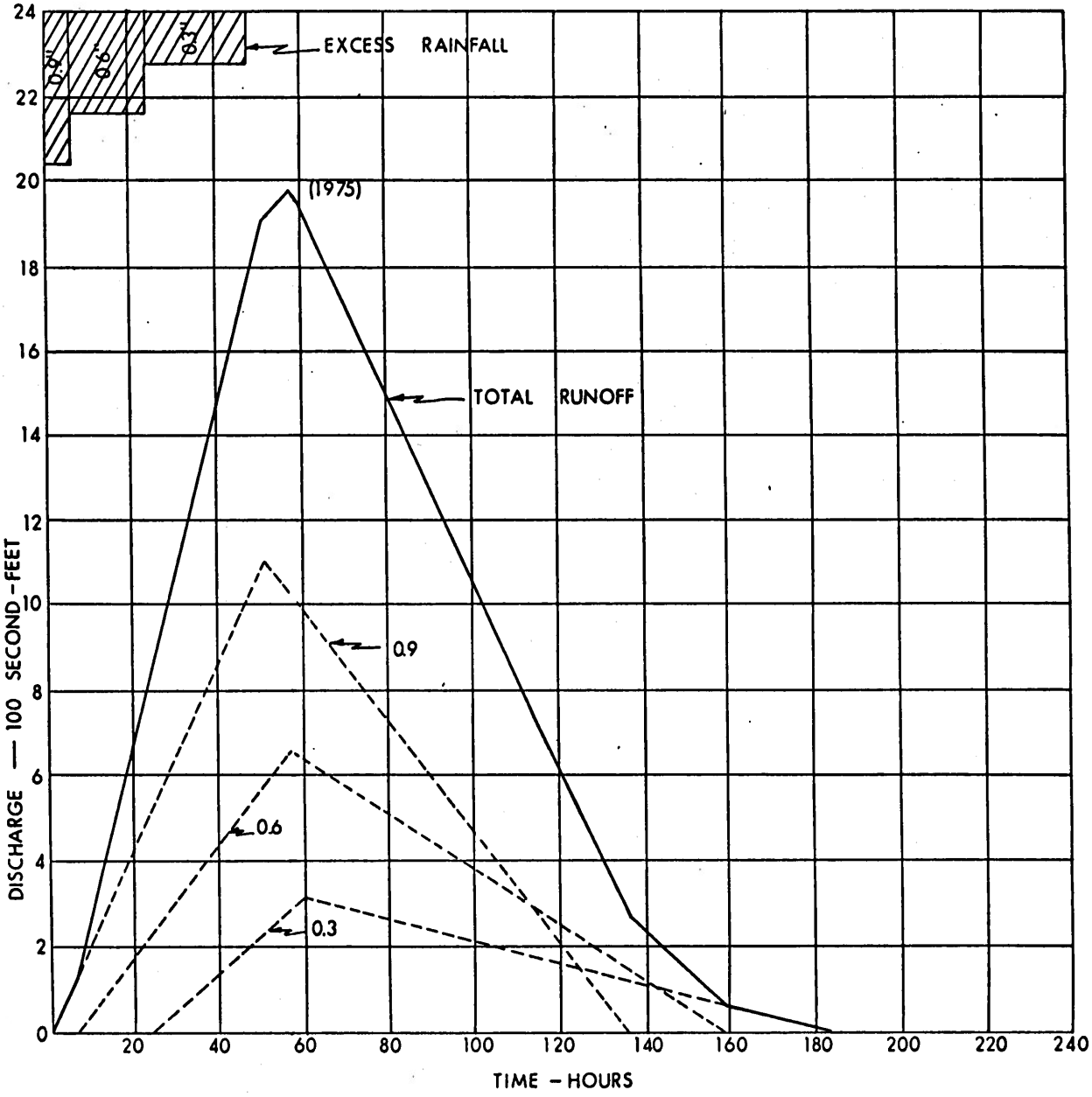
Qp = Volume of runoff (inches)

A = Area of watershed (sq. miles)

The above approach is 'generalized' at best. The equations were developed for southern watersheds. Its application in this instance is questionable, but it at

* Design of Small Dams, U.S. Dept. of the Interior, Bureau of Reclamation.

# CORAL HARBOUR




TRIANGULAR HYDROGRAPH FOR THE UNGAUGED POST RIVER WATERSHED,

FIG. C - 7

least will indicate the order of magnitude of a flood originating from maximum rainfall. It is assumed that all rainfall is excess and will runoff immediately in the storm period. This will give the most severe condition, however it is recognized that some basin storage exists along the Post River.

The calculated peak discharge is 1975 c.f.s. (See Figure C-7). This value is considerably less than that calculated for the 1969 flood which caused wash-outs in the existing road. Thus this flood is not significant and there is little point in refining the above calculation.

iv) SNOW MELT:

Flood conditions of the Post River are the result of snow melt possibly combined with rain. A rough estimate of snow melt may be determined by correlation of snow melt with air temperature or degree days. Average degree day factors for a melt period range between 0.06 and 0.15 in per degree day,* if the basin is completely snow covered. The factor increases with time after the beginning of melt if computed from stream flow, largely because of the detention of early melt water in the

* Hydrology for Engineers, Linsley, Kohler, Paulhus; McGraw-Hill.

snow. As the snow cover becomes patchy the factor again decreases.

The Post River watershed has a southerly aspect Figure C-6. Melting can be expected to occur rather rapidly. The figure of 0.10 inches of snow melt per degree-day appears to be a valid estimate. The maximum accumulation of thawing degree days for the first 30 days of the thawing season is listed in the meteorological records as 309 for June 8. 1956. This is an average of 10 degree-days per day. At this rate the 4.9" (water equivalent of snow) would melt in about 5 days. (1 in/day). Peak discharge for snowmelt for the previous triangular hydrograph formulae assuming an excess of 4.0" (0.9" of basin storage) would be:

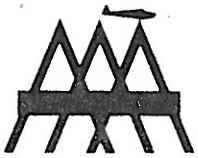
$$Tp = \frac{5 \times 24}{2} + 0.6 \times 80$$

$$= 60 + 48$$

$$= 108$$

$$Qp = \frac{484 \times 129 \times 4.0}{108} = 2320 \text{ second-ft. or c.f.s.}$$

Combining a maximum precipitation of 0.83" for 24 hours for June we get a triangular hydrograph proportional to the previous (Figure C-7). The peak discharge would be $\frac{.83}{1.48} \times 1975 = 1109$ c.f.s. If the rainfall and snowmelt peak discharges were coincident the maximum flow of the Post River near the sea would be 3400 c.f.s.



The calculated volume of snow melt coincident with maximum 24 hr. precipitation yields a value similar to that estimated from the 1969 aerial photographs. We recommend that the upper limit 3500 c.f.s. be used for design of drainage structures. Thus for flow velocities of 4 ft./sec., an opening of 900 sq. ft. plus ample room for passage of flow ice would be required.

RIVER CROSSINGS:

Due to the numerous channels prevalent, the Post River can not be crossed with less than three structures.

From the hydrological analysis of the Post River, crossings should provide for unobstructed flood flows of 3500 c.f.s. at a minimum of three river crossings. Crossings should be clear span with sufficient free board to prevent ice jamming. The channels should be cleared of snow and ice prior to spring snowmelts and flood flows. Where more than three crossings of channels are necessary, it must be assumed that flood flows will utilize a combination of different channels on different years. Most crossings should be designed to freely discharge 1500 c.f.s. with free passage of snow and ice.

ROADWAY DESIGN:

Granitic rock, eskers, outwash and granular beach ridges prevailing in the area provide good roadway foundations. Deep glacial and shallow marine and lacustrine fine textured soils are relatively poor foundation in this region of continuous permafrost. Where subsurface ice lensing prevails approximately 80 - 100 inches * of gravel base (thawing index 1000) is required to prevent thawing and subsequent deformation of the roadway. Only 2 - 3 ft. of gravel will be required on level upland rock surfaces.

Eskers and moraines in the study region are generally well drained, surface cracking at some locations, however, suggests some ice lensing may be present (local silts). These areas can be bypassed. Some grading is required through esker and moraine landforms. Where beach ridges are prevalent, only grading is required. In all cases the roadway profile must be maintained above the surrounding terrain to prevent accumulation of drifting snow.

* Data from Engineering Manual of Military Construction, U.S. Corps of Engineers Part 15, Chapter 3.

SANITATION AND WATER SUPPLY:

The garbage dump near the D.O.T. establishment drains dangerously close to the D.O.T. water supply. This garbage disposal area should be removed.

At Coral Harbour, the existing roadway already diverts some flow away from the water supply lake.

## RECOMMENDATIONS

The existing powerline route appears to be the best choice where conventional overhead lines supported by poles are used.

It is somewhat premature to recommend the proper roadway alternate as field verification must yet be conducted. These would best be carried out in late June or early July. The alternates on Factor Map No. 1 allow a sufficient number of choices. After field verification routes should be compared by preliminary design calculation of quantities and sizes of drainage structures necessary.

ROUND TRIP MEMORANDUM
GOVERNMENT OF CANADA

NOTE DE SERVICE ALLER RETOUR
GOUVERNEMENT DU CANADA

Return to / Renvoyez à: Construction Div (Jackson)

File No. (originator) – Dossier nº (source):

From / De: Physical Planning Div Mr Eldridge

File No. (addressee) – Dossier nº (destinataire):

Subject – Sujet: Road Location - Southampton Island N.W.T. Report by Airphoto Analysis Associates

Comments:

(1) The report is brief but perhaps as comprehensive as can be expected from an airphoto study.

(2) We have no particular views or comments of our own. We concur generally with points made by the Consultants

(3) We suggest you might refer this to Engineering Services Division for their comments, since the work is in the pre-Construction stage.

Signature

Reply – Réponse

Jim Jackson TPC4
12/7/71.

Signature Date

2 REPLY / REPONSE

Please return this copy to originator.
Veuillez retourner cet exemplaire à la source.

Fold | Plier – 1
Fold | Plier – 2
Fold | Plier – 3