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# Remote Sensing Data Summary: Mackenzie Delta - Beaufort Sea — Herschel Island - Sachs Harbour

Environmental Assessment & Design Division  
EPS 3-EC-76-3

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172  
C33  
no. 76-3

Environmental Conservation Directorate  
December 1976

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## REMOTE SENSING DATA SUMMARY:

MACKENZIE DELTA - BEAUFORT SEA — HERSCHEL ISLAND - SACHS HARBOUR

ENVIRONMENT CANADA  
LIBRARY, NOVA COAST PLAZA  
PO BOX 2310 5019-52 ST.  
YELLOWKNIFE, NT X1A 2P7

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LIBRARY  
Environmental Protection Service  
Western & Northern Region

Environmental Assessment & Design Division  
EPS 3-EC-76-3

Environmental Conservation Directorate  
Environmental Protection Service  
Environment Canada  
Ottawa, December 1976

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## **ABSTRACT**

This report documents the remote sensing data up to 1975 available at the National Air Photo Library (NAPL) covering the Mackenzie Delta - Beaufort Sea -- Herschel Island - Sachs Harbour. Guidance is provided on how the original data may be retrieved and an example of the data retrieval procedure is given. The relationship between ground resolution and photographic scale is discussed in order to assist users in deciding if the photography available is of sufficient detail for their purposes. The remote sensing data is presented in table form with index maps showing the area covered by each quadrat used in the tables. Periodic updating is anticipated so as to include data collected after 1975 or held in depositories other than NAPL.



## RÉSUMÉ

Le présent rapport traite des données relatives au delta du Mackenzie, à la mer de Beaufort, à l'île Herschel et à Sachs Harbour qui ont été recueillies, jusqu'en 1975, par télédétection et qui sont emmagasinées dans la photothèque nationale de l'air. Il illustre, à l'aide d'un exemple détaillé, la manière d'extraire ces données. Afin de permettre à l'utilisateur de voir si les détails figurant sur les photographies disponibles répondent à ses besoins, on y discute du rapport existant entre la résolution au sol et l'échelle photographique. Les données obtenues par télédétection sont présentées dans des tableaux, que complètent des cartes de référence montrant les superficies et parcelles de terres indiquées aux tableaux en question. On prévoit une mise à jour régulière afin d'inclure les données recueillies après 1975 ou classées en des endroits autres que la photothèque nationale de l'air.

## TABLE OF CONTENTS

	SECTION
Report Organization	1
Method of Use	2
The National Topographic System	2.1
Addresses of Air Photo Libraries	2.2
Ground Resolution	3
Ordering Index Maps	4
Ordering an NAPL Air Photo Index Map	4.1
Ordering Provincial Air Photo Index Maps	4.2
Film/Filter Combinations	5

## FIGURES

Figure 1	Graph of Scale Number versus Ground Resolution	3
Figure 2	Illustration for Ground Resolution Discussion	3
Figure 3	Illustration for Air Photo Index Discussion	4.1

## TABLES 10

Table 1	Summary of Imagery for the Mackenzie Delta -- Beaufort Sea — Herschel Island -- Sachs Harbour
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## APPENDIXES 20

Appendix 1	Index Maps for Mackenzie Delta -- Beaufort Sea (Table 1)
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## Report Organization

The aerial photography for the areas covered by this report was obtained on separate tasks over a span of several years. The requirements for these tasks varied, and as a result, the imagery was taken at different altitudes utilizing various lenses and film/filter combinations. The resulting highly diverse data, has been tabulated in this report to facilitate the process of data retrieval.

The Table(s) in the report provide a summary of imagery coverages on deposit for this subject area. The data is presented chronologically by quadrats. The quadrats employed are generally those defined for the NTS 1:50,000 map series which provides 16 quadrangles per aerial photo index (generally done on 1:250,000 maps).

The Appendix(es) provide a set of index maps showing the area covered by each quadrat listed in the Table(s). The area of interest covered by this report is irregular but for ease of compilation a simple geometric shape has been defined.

## Method of Use

The Table(s) of the report merely summarize the photography available. Details on specific roll or frame numbers are not provided; however guidance on the procedure to be used in ordering imagery is provided in Section 4.1.

The Table(s) have been divided into columns as follows:

QUADRAT - This column lists the NTS 1:50,000 map quadrangle for which the report data is presented. Any given 1:250,000 air photo index map would be divided into 16 quadrangles. For example, the Ottawa air photo index might be the 31G sheet but the city of Ottawa itself is covered by the 31G/5 quadrangle. For a further discussion of these quadrats see Section 2.1.

**CODE** This column provides details on the available data, giving the film type, flight date, and imagery scale. For example, the CODE for an entry may be:

B/W - 47 - 40,000

→ Scale of photography, i.e. 1:40,000. (For a discussion of ground resolution, i.e. the relationship of photographic scale to the smallest identifiable object on the ground, see Section 3.0)

→ Year the data was collected. In cases where tasks were flown over a number of years, two dates are given e.g. B/W - 47/52 - 40,000

→ Type of film used:

Code

- B/W - black & white
- BIR - black & white infrared
- COL - aerocolour
- CIR - false colour infrared
- RS - multisensor coverage generally by the Canada Center for Remote Sensing (CCRS). RS-72-39 would refer to task number 39 flown in 1972 by CCRS. The film/scale/filter information is listed in the comments column. For example B/W - 40,000 - 525 would be black and white film at a scale of 1:40,000, employing a NAV525 filter. For a discussion of film/filter combinations see Section 5.0.

**LIBRARY** - (abbreviated to "L") this indicates which depository holds the imagery coded and where indexes for this imagery can be obtained. The symbols used are as follows:

- B - British Columbia
- A - Alberta
- S - Saskatchewan
- M - Manitoba
- O - Ontario
- Q - Quebec
- MT - Maritimes
- N - Newfoundland
- C - National Air Photo Library (Ottawa)
- I - Industry

For a list of the addresses of the air photo libraries see Section 2.2.

COMMENTS – This column is used to provide any additional information required.  
This could include:

1. gaps in the coverage;
2. duplicate coverage at the same scale in the same year;
3. delineation of partially covered quadrats or where quadrats do not coincide with the NTS 1:50,000 quadrangles; and
4. details on remote sensing flights.

## 2.1 The National Topographic System

The National Topographic System (NTS) is the system of map sheet reference used in Canada. The NTS is based on the quadrangles of 1:1,000,000 which cover the entire country and includes scales of: 1:1,000,000; 1:500,000; 1:250,000; 1:125,000; 1:50,000; and 1:25,000. The most popular scales for air photo indexes are the 1:250,000 and the 1:50,000 ones, although some 1:500,000 sheets have been employed for early photography.

The primary quadrangles each measure 4 degrees north to south and eight degrees east to west (except north of 80 °N where they measure sixteen degrees east to west). The numbering system gives both the location and scale of the map involved. Using the primary quadrangle 31 as an example, the NTS numbers are read as follows:

31	–	the primary quadrangle (scale = 1:1,000,000)
31 SE	–	a quarter of the primary quadrangle (scale = 1:500,000)
31 G	–	a quarter of the 1:500,000 sheet (1/16th of a primary quadrangle; scale = 1:250,000)
31 G/NE	–	a quarter of the 1:250,000 sheet (1/64th of a primary quadrangle; scale = 1:125,000)
31 G/5	–	a sixteenth of the 1:250,000 sheet (1/256th of a primary quadrangle; scale = 1:50,000)
31 G/5a	–	an eighth of a 1:50,000 sheet (1/2048th of a primary quadrangle; scale = 1:25,000)

For this report the basic indexing unit generally employed is the 1:50,000 scale quadrangle (e.g. 31 G/5). In this way the normal NAPL air photo index map (1:250,000 scale) is divided into sixteen portions giving finer detail than by simply describing the entire 1:250,000 sheet (e.g. 31G).



## 2.2 Addresses of Air Photo Libraries

The addresses of air photo libraries are as follows:

### British Columbia:

Director of Surveys and Mapping Branch,  
Department of Lands, Forests and Water Resources,  
Victoria, B.C.

### Alberta:

Director Technical Division,  
Alberta Lands and Forest,  
National Resources Bldg.,  
Room 325,  
109<sup>th</sup> Street and 99<sup>th</sup> Ave.,  
Edmonton, Alberta.  
T5K 1H4

### Saskatchewan:

Lands and Surveys Branch,  
1260-8<sup>th</sup> Avenue,  
Regina, Saskatchewan.  
S4R 1C9

### Manitoba:

Director of Surveys,  
Department of Mines, Resources and Environmental Management,  
1007 Century Street,  
Winnipeg, Manitoba.  
R3H 0W4

### Ontario:

Photo Library,  
Administrative Services Branch,  
Whitney Block, Room 3501,  
Queen's Park,  
Toronto, Ontario.

### Quebec:

Ministère des Terres et Forêts,  
Service de la Cartographie,  
1995 Ouest, Boul. Charest,  
Québec 12, Québec.

Maritimes – New Brunswick, Nova Scotia, Prince Edward Island:

Mr. Neale Lefler,  
Maritime Resource Management Service,  
Box 310,  
Amherst, Nova Scotia.

Newfoundland:

Department of Forestry and Agriculture,  
Building 810,  
Pleasantville,  
St. John's, Newfoundland.  
A1A 1P9

Ottawa – National Air Photo Library:

615 Booth Street,  
Ottawa, Ontario.  
K1A 0E9

The relationship between the scale of a photograph and the size of the smallest object on the ground which can be observed and identified on the photograph is a complex one. It should be noted that unless an object is imaged on the film no amount of enlarging or image enhancing will make it visible. This scale/size relationship is referred to as ground resolution and can be affected by such factors as film type, film processing, camera filter, camera lens, lens aperture, type of shutter, shutter speed, aircraft speed, lighting conditions, atmospheric conditions (visibility) and the amount of contrast between the object and its surroundings.

Laboratory tests of film resolution usually involve a test pattern of parallel black and white lines of varying size, but this does not simulate real world conditions. The results of such a test are quoted as lines per mm which is a measure of the number of long parallel alternating black and white line pairs which can be identified and counted in a space 1 mm wide. For example, a resolution of 100 lines/mm means that 100 alternate pairs of black and white lines of the same width can be identified and counted in the space of 1 mm.

An alternate method employed by the military involves a series of doughnuts of varying size with a center of very similar grey tone to the outer ring. The test pattern is photographed from the air, providing a test of the complete system (film, filter, lens, and camera) under operating conditions. The doughnut shape with small variation in grey tone better approximates real world conditions than a series of parallel black and white lines which are never encountered in aerial photographs. Using this method it has been determined that 25 lines/mm is the maximum resolution obtainable under operating conditions if there is minimum contrast between the object and its surroundings.

Using this resolution of 25 lines/mm, a value for ground resolution 'G' can be calculated. The value of G indicates the minimum size of an object on the ground recorded and identifiable on the film. It is calculated as:

$$G = \frac{S}{304.8R}$$

where

- G = ground resolution
- S = scale number (i.e. the second half of the representative fraction for a scale of 1:10,000 the scale number is 10,000)
- R = object resolution
- 304.8 = conversion factor

Strandberg, C.H., (1967) *Aerial Discovery Manual*, New York, Wiley and Sons Inc., pp. 10-12.

If for example  $S = 1000$  and  $R = 25$  lines/mm, then

$$G = \frac{1000}{304.8 \times 25} = 0.131 \text{ ft/line}$$

This means that objects 0.131 feet in diameter or larger will be imaged on the film, but are not necessarily identifiable. Figure 1 provides a graph of the relationship between photographic scale and ground resolution if the object resolution is assumed to be 25 lines/mm.

As a general rule, in order to identify and determine any details about an object, the shortest dimension of the smallest component of the object must be resolved on the film. Consider for example, the gully represented in Figure 2; if the ground resolution of the photograph is 3.5 feet, the gully could be detected on the photograph but not recognized. At a ground resolution of 1.5 feet it could be recognized but no fine detail made out, whereas at a ground resolution of 0.4 feet all the features of the gully could be identified and described.

#### **4            Ordering Index Maps**

Aerial photography index maps were the source of the data presented in this report. They were too numerous to be included; however, in order to obtain the imagery covering a specific area of interest, the detailed information contained on the index maps is required. Imagery is annotated with a roll number indicating the flight line and a frame number indicating the specific photograph on the flight line. NOTE: THE GENERAL INFORMATION CONTAINED IN THIS REPORT IS NOT SUFFICIENT TO ORDER IMAGERY DIRECTLY. The index maps must first be viewed to determine the roll and frame numbers of the imagery required.

The Photo Libraries have a complete record, and copies on file, of all imagery collected. To obtain the specific index sheet, which lists the roll and frame numbers of the required imagery, the following details must be provided:

1.    The NTS 1:250,000 sheet numbers for the area of interest. (Alternatively an area could be defined by co-ordinates of longitude and latitude). Where possible include a map outlining the study area.
2.    The type of imagery required (black and white, black and white infrared, aero-colour, or false colour infrared).
3.    The year the task was flown to obtain the imagery.
4.    The scale of the imagery in case the same type of imagery is available at different scales.

Figure 1: Graph of Scale Number vs Ground Resolution

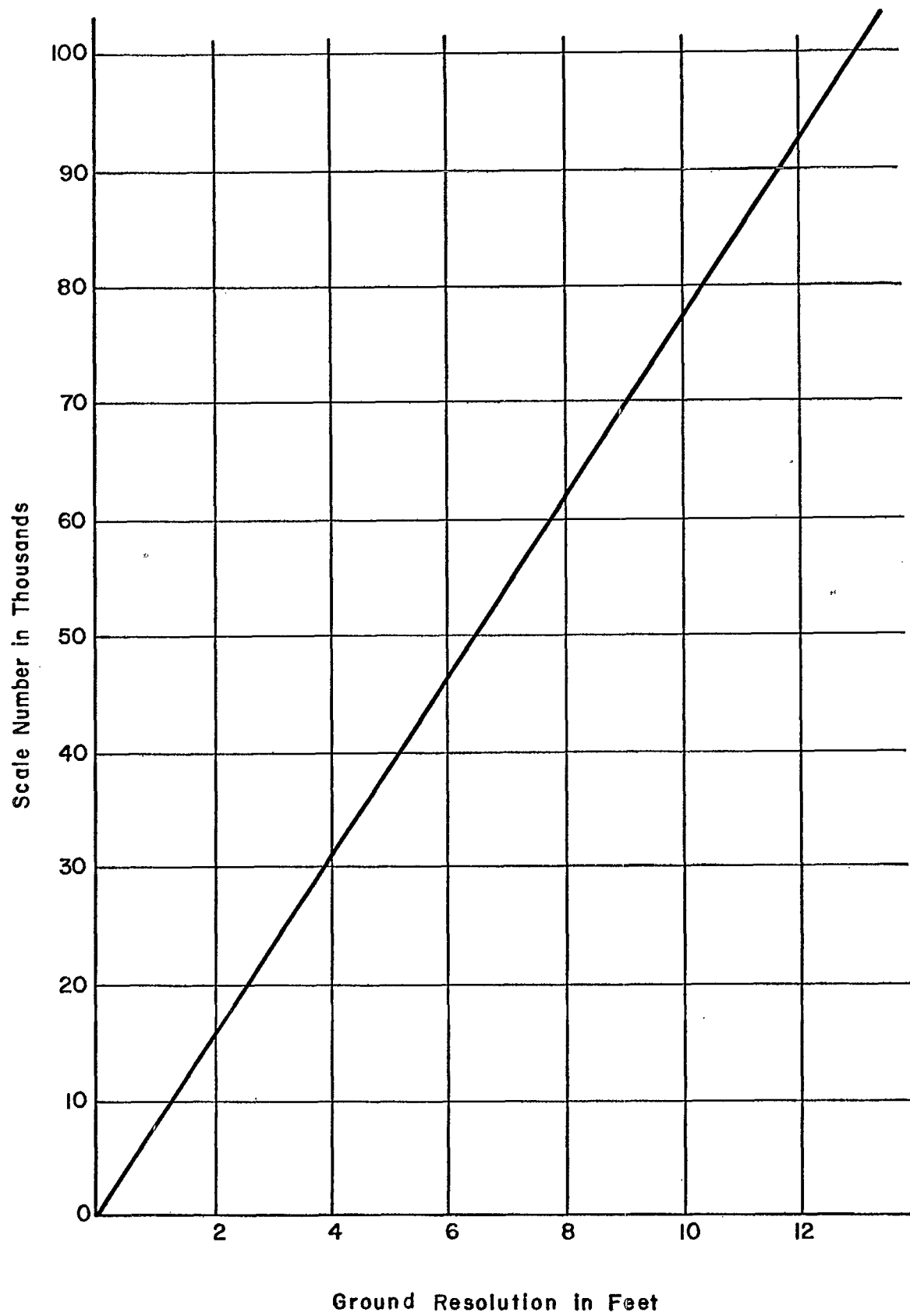
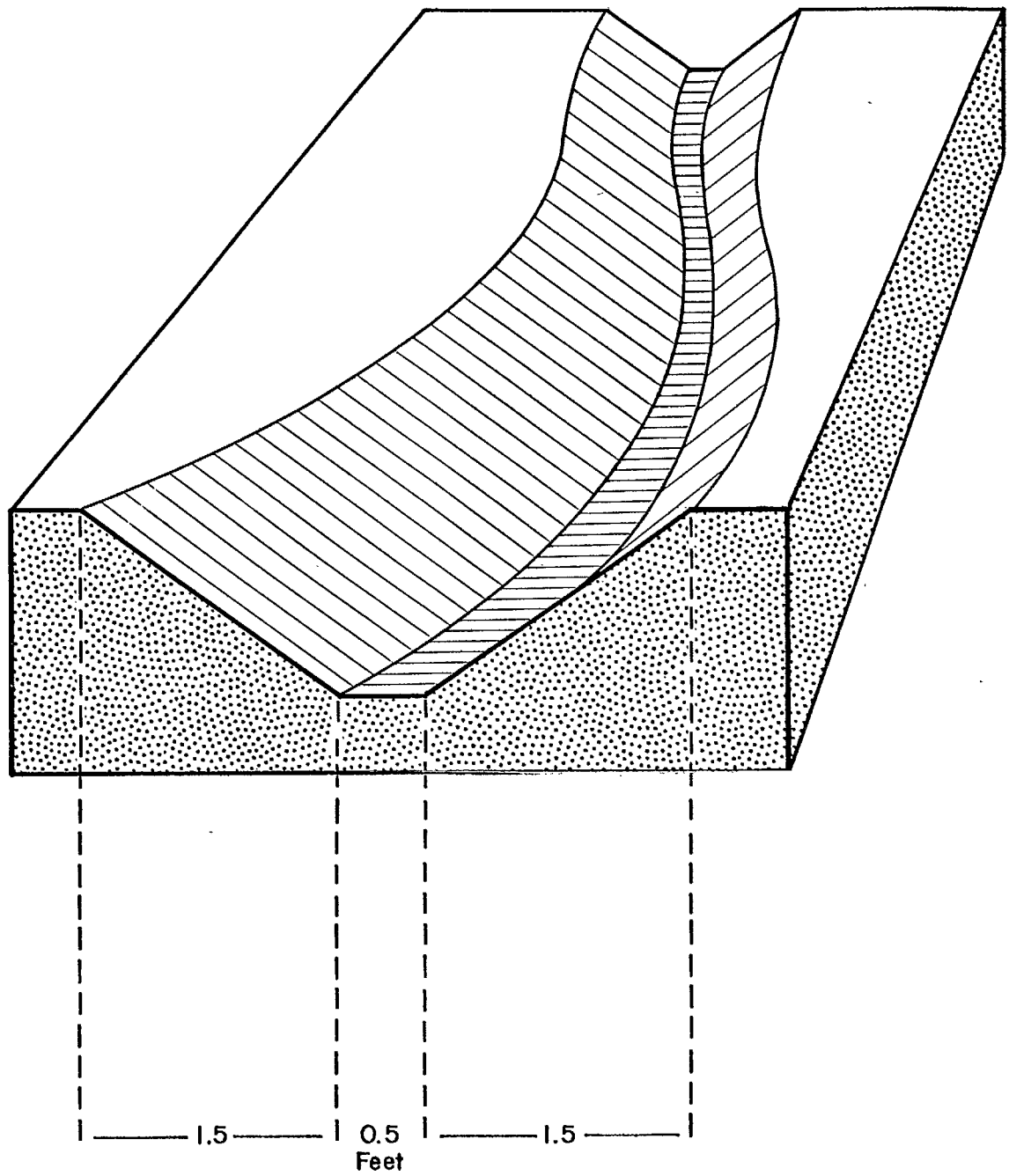




Figure 2: Illustration for Ground Resolution Discussion



#### 4.1 Example of ordering an NAPL Air Photo Index Map

For a procedural demonstration it has been decided to obtain imagery for Loon River, NWT. A project is being undertaken to study stream bank stability and the meandering of the stream. The following requirements have been placed on the study.

- A. An up-to-date map is to be produced to an accuracy of  $\pm 4$  feet for 2 miles upstream from where the highway crosses the stream to 10 miles below the stream crossing.
- B. Annual maps of streambank morphology must be produced for the period 1969 to 1974 at an accuracy of  $\pm 2$  feet for 2 miles up and downstream.

The procedure for first ordering index maps and subsequently air photos would be as follows:

1. Consult the appropriate section of the Table(s) to determine what photography is available, remembering the constraints listed above. The photography must have a minimum scale of 1:31000 (see Figure 1) for requirement (A) and 1:15000 for requirement (B).
2. Make a list of the photography which covers the study area:
  - Requirement A: B/W-73-13400
  - Requirement B: B/W-69-12200
  - B/W-72-12800
  - B/W-73-13400
  - B/W-74-12000

Note: The other photographic coverages may have been rejected because they either duplicate the examples listed or are of too small a scale. The B/W-73-13400 imagery was chosen for requirement A; duplicate coverage for requirement B would simply be an additional cost, thus this imagery will be used for both requirements A & B. Also, maps cannot be produced for 1970 or 1971 because imagery does not exist.

3. Requisition four index maps from NAPL, one for each task coverage. The following information should be sent in a covering letter along with the requisition:

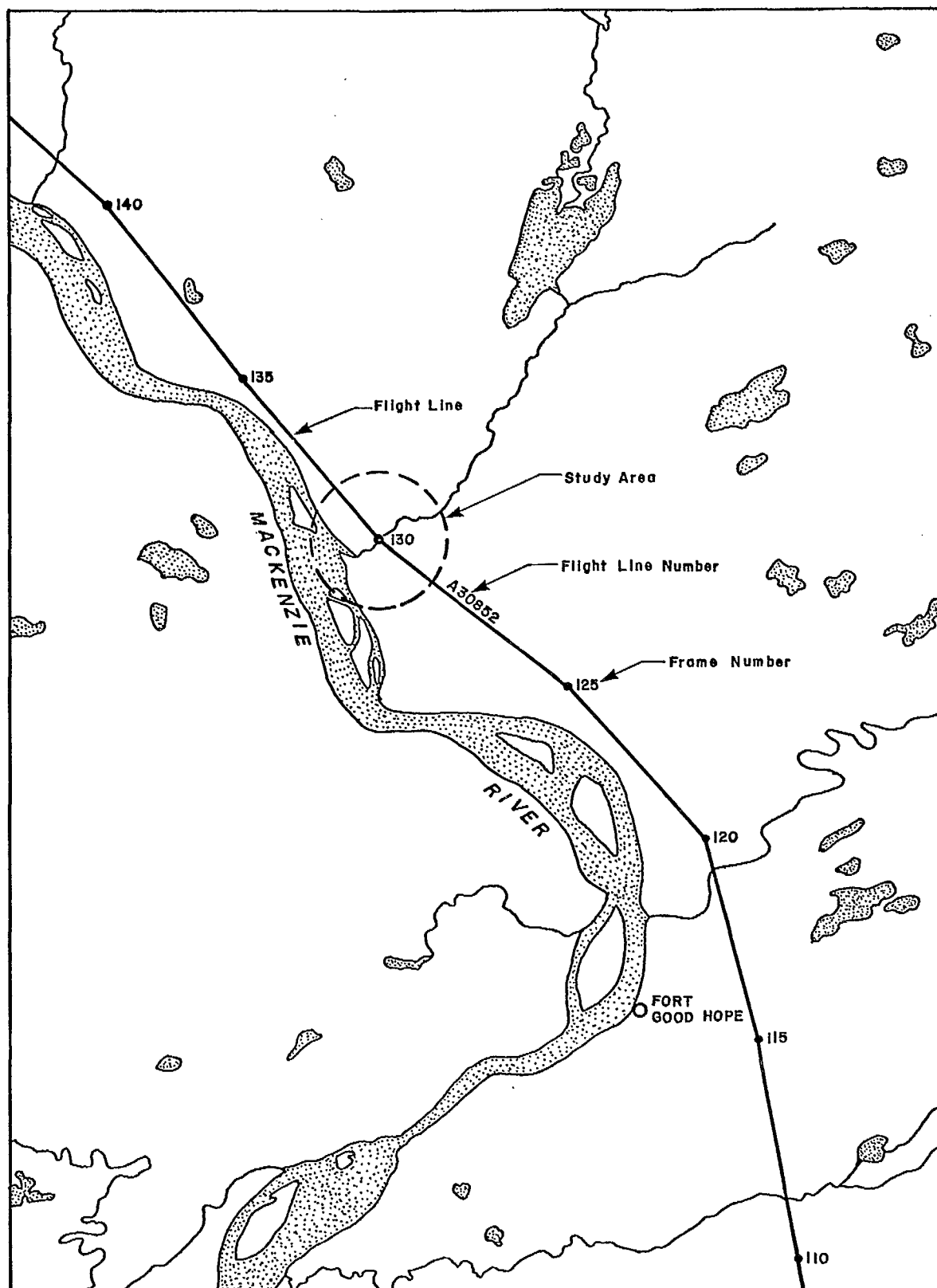
Index maps of the 106I sheet are required for the following black and white photographic coverages:

- 1969 at a scale of 1:12200
- 1972 at a scale of 1:12800
- 1973 at a scale of 1:13400
- 1974 at a scale of 1:12000

Request an up-to-date price list of photography at the time of ordering the index maps.

4. Review the index maps and determine the roll and frame numbers for those images which provide coverage for the study area. The frames plotted and numbered on the flight line indicate frame centers (Note: not all frames are shown). In order to derive as much information as possible from the photography, stereo coverage should be acquired for the study area and caution must be taken to ensure that total coverage is obtained. A portion of the map for the B/W-74-12200 imagery has been included (Figure 3); for the example project, the following imagery would have to be requisitioned:

Figure 3: Illustration for Air Photo Index Discussion



5. Requisition the required imagery from NAPL.

**NOTE -** The imagery on file with NAPL can be viewed at 615 Booth Street, Ottawa. If researchers do not wish to purchase the imagery which they require for small projects, it can be examined and interpreted there.

#### 4.2 Ordering Provincial Air Photo Index Maps

The method is basically the same as that outlined in Section 4.1 above, except for step 3. In addition to the NTS map sheet number (1061) a map showing the longitude and latitude of the study area should be included in case the provincial library does not use the 1:250000 map series as a base.

#### 5 Film/Filter Combinations

The photographic portion of the electromagnetic spectrum extends from .30  $\mu\text{m}^1$  to 1.2  $\mu\text{m}$  and can be roughly divided as follows:

Blue	.40-- .50 $\mu\text{m}$
Green	.50-- .60 $\mu\text{m}$
Red	.60-- .70 $\mu\text{m}$
Near Infrared	.70-- .90 $\mu\text{m}$

Normal black/white and colour films are sensitive from .40 to .70  $\mu\text{m}$  while infrared and false colour infrared films are sensitive from .40 to .90  $\mu\text{m}$ .

Filters are used to block out selected portions of the electromagnetic spectrum. In this way haze can be reduced or some aspect of the terrain enhanced. The most commonly used filters have almost 100% transmittance (i.e. a photo window) as follows:

<sup>1</sup> 1  $\mu\text{m}$  = one thousandth of a millimeter

FILTER	PHOTO WINDOW
1.4 AV	anti-vignetting
12 (Vinten Minus Blue)	.34 $\mu\text{m} +$
12 + 44 (Vinten 500-600 or LANDSAT Band 4)	.50-.60 $\mu\text{m}$
25 A (Vinten 600-700 or LANDSAT Band 5)	.60 $\mu\text{m} +$
58	.50-.60 $\mu\text{m}$ and .70 $\mu\text{m} +$
89 B (Vinten 700-800 or LANDSAT Band 6)	.70-.80 $\mu\text{m}$
500 (Wild)	.50 $\mu\text{m} +$
520 (Wild)	.52 $\mu\text{m} +$
525 (Wild)	.525 $\mu\text{m} +$
540 (Wild)	.54 $\mu\text{m} +$
700 (Wild)	.70 $\mu\text{m} +$
HF3	.40 $\mu\text{m} +$
Skylight (Vinten Clear)	.34 $\mu\text{m} +$
Vinten 800-900	.80-.90 $\mu\text{m}$

For Remote Sensing purposes, film/filter combinations are used to enhance an image or to record only a preselected band of radiation.



10    TABLE 1

MACKENZIE DELTA – BEAUFORT SEA

HERSCHEL ISLAND – SACHS HARBOUR

Quadrat	Code				L	Comments
97G/9	B/W	-	61/62	-	103500	C shoreline Banks Is.
	B/W	-	58	-	60000	C shoreline
97G/15	B/W	-	75	-	5800	C 125°00' - 125°30' 71°58' - 72°00'
	B/W	-	72	-	7600	C Sachs Harbour
	B/W	-	68	-	4800	C 125°00' - 125°30' 71°58' - 72°00'
	B/W	-	64	-	12000	C 1 line Sachs Harbour
	B/W	-	61/62	-	10350	C N.E. portion
97H/3	B/W	-	60/62	-	96600	C Banks Is.
	B/W	-	58	-	56000	C Banks Is.
97H/4	B/W	-	60/62	-	96600	C Banks Is.
	B/W	-	58	-	56000	C Banks Is.
97H/5	B/W	-	60/62	-	96600	C Banks Is.
	B/W	-	58	-	56000	C Banks Is.
97H/6	B/W	-	60/62	-	96600	C Banks Is.
	B/W	-	58	-	56000	C Banks Is.
97H/7	B/W	-	60/62	-	96600	C Banks Is.
	B/W	-	58	-	56000	C Banks Is.
	B/W	-	50	-	40000	C DeSalis Bay
97H/10	B/W	-	60/62	-	96600	C Banks Is.
	B/W	-	58	-	56000	C Banks Is.
	B/W	-	50	-	40000	C DeSalis Bay
97H/11	B/W	-	60/62	-	96600	C Banks Is.
	B/W	-	58	-	56000	C Banks Is.
97H/12	B/W	-	60/62	-	96600	C Banks Is.
	B/W	-	58	-	56000	C Banks Is.
97H/13	B/W	-	60/62	-	96600	C Banks Is.
	B/W	-	58	-	56000	C Banks Is.
97H/14	B/W	-	60/62	-	96600	C Banks Is.
	B/W	-	58	-	56000	C Banks Is.

Quadrat	Code				L	Comments	
97H/15	B/W	-	60/62	-	96600	C	Banks Is.
	B/W	-	58	-	56000	C	Banks Is.
98A/1	B/W	-	61	-	100000	C	all
	B/W	-	60	-	100000	C	120°45' → East only
98A/2	B/W	-	61	-	100000	C	all
	B/W	-	58	-	58000	C	121°15' → West only
98A/3	B/W	-	61	-	100000	C	all
	B/W	-	58	-	58000	C	all
98A/4	B/W	-	61	-	100000	C	all
	B/W	-	58	-	58000	C	all
98A/5	B/W	-	61	-	100000	C	all
	B/W	-	58	-	58000	C	all
98A/6	B/W	-	61	-	100000	C	all
	B/W	-	58	-	58000	C	all
98A/7	B/W	-	61	-	100000	C	all
	B/W	-	58	-	58000	C	121°15' → West only
98A/8	B/W	-	61	-	100000	C	all
	B/W	-	58	-	58000	C	120°45' → East only
98B/1	B/W	-	61/62	-	103500	C	all
	B/W	-	58	-	60000	C	all
	B/W	-	50	-	40000	C	2 lines N.W.-S.E. diagonal
98B/2	B/W	-	72	-	7400	C	1 line along 72°00' 125°00' - 125°30'
	B/W	-	61/62	-	103500	C	125°45'→East only
	B/W	-	58	-	60000	C	125°30'→East only
	B/W	-	50	-	40000	C	N.E. corner only
98B/7	B/W	-	61/62	-	103500	C	125°45'→East only
	B/W	-	58	-	60000	C	125°30'→East only
	B/W	-	50	-	40000	C	Lennie Harbour

Quadrat		Code		L	Comments
98B/8	B/W	61/62	103500	C	all
	B/W	58	60000	C	all
107B/9	B/W	73	60000	C	132°40'→West only
	B/W	72	54000	C	132°45'→West only
	B/W	70	70000	C	all
	B/W	69	12000	C	68°35'→North only
107B/10	B/W	75	12000	C	1 line along 133°50'
	B/W	75	12000	C	133°15' - 133°30'
					68°40'→N
	B/W	73	60000	C	all
	B/W	72	12800	C	central
	B/W	72	12000	C	1 line along 133°30'
					68°42'→N only
	B/W	72	12000	C	133°20' - 133°30'
					68°40'→North only
	B/W	72	12000	C	S.W. corner only
	B/W	72	36000	C	central corridor
	B/W	72	54000	C	all
	B/W	71	12800	C	South central
	B/W	70	70000	C	133°15'→West only
	B/W	69	12000	C	1 line along 133°15'
					68°35'→North only
	BIR	69	12000	C	133°20' - 133°45'
					68°40'→South only
107B/11	B/W	67	40000	C	Southwest corner
	B/W	47	40000	C	1 line along 134°00'
	B/W	74	10000	C	1 line Reindeer Depot
	B/W	73	60000	C	all
	B/W	72	20000	C	Peter Lake
	B/W	72	37600	C	S.E. corner only
	COL	72	20000	C	Peter Lake
	B/W	72	54000	C	all
	B/W	67	40000	C	Middle Channel
	B/W	65	12000	C	Reindeer Depot portion at 20000
	B/W	55	16000	C	1 line N.E. corner
107B/12	B/W	47	40000	C	1 line along 135°00'
	B/W	74	60000	C	1 line along 135°45'
	B/W	73	60000	C	all
	B/W	52	68000	C	1 line along 135°55'

Quadrat	Code			L	Comments
107B/13	B/W	- 74	- 60000	C	1 line along 135°45'
	B/W	- 73	- 60000	C	all
	B/W	- 52	- 68000	C	1 line along 135°55'
107B/14	B/W	- 75	- 20000	C	1 line S.W. portion
	B/W	- 75	- 36000	C	N.E. corner only
	B/W	- 73	- 60000	C	all
	COL	- 72	- 20000	C	Peter Lake
	B/W	- 67	- 40000	C	Middle Channel
	B/W	- 55	- 16000	C	1 line central
	B/W	- 47	- 40000	C	1 line along 135°00'
107B/15	B/W	- 75	- 12300	C	Parson's Lake
	B/W	- 75	- 12300	C	Eskimo (Husky) Lakes
	B/W	- 75	- 36000	C	133°45'→West only
	B/W	- 74	- 20500	C	133°35' - 133°55'
					68°50'→North only
	B/W	- 73	- 60000	C	all
	B/W	- 72	- 12000	C	1 line along 133°30'
					68°50' South only
	B/W	- 72	- 12000	C	central corridor 68°45'→N
	B/W	- 72	- 36000	C	except N.W. portion
	COL	- 72	- 20000	C	Parsons Lake
	B/W	- 70	- 70000	C	133°15'→East only
	B/W	- 69	- 12000	C	1 line along 133°20'
	B/W	- 47	- 40000	C	1 line along 133°00'
107B/16	B/W	- 73	- 60000	C	132°40'→West only
	B/W	- 72	- 36000	C	N.W. corner only
	B/W	- 70	- 70000	C	all
107C/1	B/W	- 75	- 13000	C	1 line Eskimo Lakes
	B/W	- 75	- 36600	C	132°30'→East only
	B/W	- 74	- 60000	C	1 line along 69°05'
	B/W	- 73	- 60000	C	all
	B/W	- 72	- 36000	C	1 line S.W. corner
	B/W	- 72	- 54000	C	all
	B/W	- 70	- 70000	C	corridor 132°00'-132°15'
	B/W	- 70	- 70000	C	1 line 69°00'
	B/W	- 47	- 40000	C	1 line along 133°00'



Quadrat	Code			L	Comments
107C/2	B/W	- 75	- 12000	C	S. central only
	B/W	- 75	- 13000	C	S.E. corner only
	B/W	- 75	- 36600	C	all
	B/W	- 73	- 60000	C	all
	B/W	- 72	- 12000	C	133°30'→East only
	B/W	- 72	- 36000	C	not N.W. portion
	B/W	- 72	- 54000	C	all
	CIR	- 72	- 20000	C	2 lines South central
	B/W	- 70	- 70000	C	1 line along 69°05'
					133°30'→East only
	B/W	- 69	- 12000	C	South central only
	BIR	- 69	- 12000	C	1 line South central
	BIR	- 69	- 12000	C	N.E. corner
107C/3	B/W	- 75	- 16800	C	1 line East Channel
	B/W	- 75	- 17800	C	1 line East Channel
	B/W	- 75	- 36600	C	134°45'→East only
	B/W	- 74	- 10000	C	2 lines central - East Channel
	CIR	- 74	- 20000	C	South central only
	B/W	- 73	- 60000	C	all
	B/W	- 72	- 54000	C	all
	B/W	- 71	- 52000	C	1 line along 69°03'
	B/W	- 67	- 40000	C	2 lines N.W.-S.E. diagonal
	B/W	- 51	- 70000	C	1 line along 134°45'
					69°45'→North only
	B/W	- 47	- 20000	C	1 line along 135°00'
107C/4	B/W	- 75	- 10000	C	Garry Island
	B/W	- 73	- 60000	C	all
	B/W	- 72	- 54000	C	all
	B/W	- 71	- 52000	C	1 line along 69°03'
	B/W	- 54	- 70000	C	135°35'→West
	B/W	- 52	- 70000	C	1 line along 136°00'
107C/5	B/W	- 75	- 10000	C	Garry Island
	B/W	- 73	- 60000	C	69°47'→South only
	B/W	- 72	- 54000	C	all
	B/W	- 52	- 70000	C	S.W. corner
107C/6	B/W	- 75	- 10000	C	Garry Island
	B/W	- 75	- 36600	C	134°45'→East only
	B/W	- 73	- 60000	C	69°26'→South only
	B/W	- 72	- 54000	C	all
	B/W	- 67	- 40000	C	S.E. corner only

Quadrat	Code			L	Comments
107C/7	B/W	- 75	- 10000	C	Tuktoyaktuk
	B/W	- 75	- 36600	C	all
	B/W	- 74	- 3000	C	Tuktoyaktuk
	B/W	- 74	- 4000	C	Tuktoyaktuk
	B/W	- 74	- 4800	C	Tuktoyaktuk
	B/W	- 74	- 6000	C	1 line along 69°27'
	B/W	- 74	- 7200	C	Tuktoyaktuk
	B/W	- 74	- 20000	C	69°23'→South only
	CIR	- 74	- 10000	C	Tuktoyaktuk and Whitefish Station
	B/W	- 72	- 12000	C	133°30'→East only
	B/W	- 72	- 36000	C	S.E. corner only
	B/W	- 72	- 54000	C	all
	RS	- 71	- 219	C	B/W 123000 14AV Tuktoyaktuk
	BIR	- 69	- 12000	C	133°15'→East only
	B/W	- 67	- 40000	C	N.W. portion
107C/8	B/W	- 75	- 10000	C	Tuktoyaktuk
	B/W	- 75	- 12400	C	west half only
	B/W	- 75	- 36600	C	132°30'→West only
	B/W	- 74	- 3000	C	Tuktoyaktuk
	B/W	- 74	- 4800	C	Tuktoyaktuk
	B/W	- 74	- 6000	C	1 line along 69°27'
	B/W	- 74	- 7200	C	Tuktoyaktuk
	B/W	- 74	- 20000	C	Tuktoyaktuk
	CIR	- 74	- 10000	C	Tuktoyaktuk
	B/W	- 73	- 56000	C	132°33' - 132°38' 69°25'→North only
	B/W	- 73	- 60000	C	69°23'→South only
	B/W	- 72	- 36000	C	1 line Tuktoyaktuk
	B/W	- 72	- 54000	C	all
	RS	- 71	- 219	C	B/W 12300 14AV Tuktoyaktuk
	B/W	- 70	- 4800	C	Tuktoyaktuk
	B/W	- 70	- 20000	C	Tuktoyaktuk
	B/W	- 68	- 6000	C	Tuktoyaktuk
	B/W	- 68	- 24000	C	Tuktoyaktuk
	B/W	- 68	- 2400	C	Tuktoyaktuk
	B/W	- 67	- 40000	C	1 line Tuktoyaktuk
	B/W	- 66	- 12000	C	Tuktoyaktuk
	B/W	- 47	- 40000	C	1 line along 133°00'

Quadrat	Code			L	Comments
107C/9	B/W	- 74	- 60000	C	69°32' → North only
	B/W	- 72	- 54000	C	all
	B/W	- 67	- 40000	C	1 line Kugmallit Bay
	B/W	- 50/52	- 40000	C	all
	B/W	- 47	- 40000	C	Hutchison Bay
107C/10	B/W	- 74	- 60000	C	69°32' → North only
	B/W	- 72	- 54000	C	all
	B/W	- 67	- 40000	C	Kidluit Bay
	B/W	- 50/52	- 40000	C	all
107C/11	B/W	- 74	- 60000	C	69°32' → North only
	B/W	- 72	- 54000	C	all
	B/W	- 67	- 40000	C	Hansen Harbour
	B/W	- 50/52	- 40000	C	all
	B/W	- 47	- 40000	C	Hansen Harbour and Hooper Island
107C/12	B/W	- 74	- 60000	C	S.E. portion only
	B/W	- 72	- 54000	C	all
	B/W	- 50/52	- 40000	C	all
	B/W	- 47	- 40000	C	Pelly Island
107C/13	B/W	- 50/52	- 40000	C	69°50' → South only
107C/14	B/W	- 74	- 60000	C	69°47' → South only
	B/W	- 72	- 54000	C	1 line Pullen Island
	B/W	- 50/52	- 40000	C	69°50' → South only
	B/W	- 47	- 40000	C	Pullen Island
107C/15	B/W	- 74	- 60000	C	69°47' → South only
	B/W	- 50/52	- 40000	C	69°50' → South only
107C/16	B/W	- 74	- 60000	C	69°47' → South only
	B/W	- 50/52	- 40000	C	69°50' → South only
107D/3	B/W	- 70	- 70000	C	all
	B/W	- 65	- 50000	C	all

Quadrat	Code				L	Comments	
107D/4	B/W	-	72/74	-	60000	C	131°45'→West only
	B/W	-	72	-	54000	C	131°45'→West only
	B/W	-	70	-	70000	C	all
	B/W	-	65	-	50000	C	S.E. corner only
107D/5	B/W	-	72/74	-	60000	C	131°45'→West only
	B/W	-	72	-	54000	C	131°45'→West only
	B/W	-	71	-	52000	C	all
107D/6	B/W	-	71	-	52000	C	all
	B/W	-	65	-	50000	C	except N.W. corner
107D/9	B/W	-	65	-	50000	C	all
107D/10	B/W	-	71	-	52000	C	129°45'→West only
	B/W	-	65	-	50000	C	all
107D/11	B/W	-	71	-	52000	C	all
	B/W	-	65	-	50000	C	except N.W. portion
107D/12	B/W	-	72/74	-	60000	C	131°45'→West only
	B/W	-	72	-	54000	C	131°45'→West only
107D/13	B/W	-	71	-	52000	C	all
107D/14	B/W	-	71	-	52000	C	all
107D/15	B/W	-	75	-	5000	C	Nicholson Peninsula
	B/W	-	75	-	21000	C	1 line Nicholson Peninsula
	B/W	-	71	-	52000	C	129°45'→West only
	B/W	-	70	-	4800	C	Nicholson Peninsula
	B/W	-	70	-	20000	C	Nicholson Peninsula
107D/16	B/W	-	75	-	5000	C	Nicholson Peninsula
	B/W	-	75	-	21000	C	Nicholson Peninsula
	B/W	-	70	-	4800	C	Nicholson Peninsula
	B/W	-	70	-	20000	C	Nicholson Peninsula
	B/W	-	65	-	50000	C	except N.W. corner
107E/1	B/W	-	53	-	70000	C	corridor 128°12' - 128°22'
	B/W	-	53	-	70000	C	128°15'→East only
	B/W	-	52	-	40000	C	1 line along 128°03' 70°12'→South only

Quadrat	Code				L	Comments
107E/2	B/W	-	50	-	40000	C 129°25'→West only
107E/3	B/W	-	50	-	40000	C all
	B/W	-	50	-	40000	C 131°00'→East only
107E/8	B/W	-	53	-	70000	C corridor 128°12' - 128°22'
	B/W	-	53	-	70000	C 128°15'→East only
	B/W	-	52	-	40000	C line along 128°15'
						70°24'→North only
	B/W	-	50/52	-	40000	C 128°15'→East only
107E/9	B/W	-	50	-	40000	C 1 line along 128°10'
	B/W	-	53	-	70000	C 128°12' - 128°22'
						70°40'→South only
	B/W	-	53	-	70000	C South East corner only
	B/W	-	52	-	40000	C 1 line along 128°15'
						70°38'→South only
117A/9	B/W	-	50/52	-	40000	C South East corner only
	B/W	-	50	-	40000	C 1 line along 128°10'
						70°37'→South only
	B/W	-	74	-	54000	C all
	B/W	-	72	-	54000	C all
	RS	-	72	-	39	C CIR 127700 520
						B/W 127700 25A
						B/W 127700 12 + 58
						BIR 127700 89B
117A/10						CIR 127700 12
						N.W. - S.E. diagonal
	B/W	-	70	-	12000	C 136°45'→West only
	B/W	-	51/56	-	68000	C all
117A/10	B/W	-	74	-	54000	C all
	B/W	-	72	-	54000	C all
	RS	-	72	-	39	C CIR 127700 520
						B/W 127700 25A
						B/W 127700 12 + 58
						BIR 127700 89
						CIR 127700 12
						N.W. corner only
	B/W	-	70	-	12000	C all
	B/W	-	51/56	-	6800	C all

Quadrat	Code			L	Comments
117A/14	B/W	- 75	- 56000	C	East half
	B/W	- 74	- 54000	C	all
	B/W	- 72	- 54000	C	all
	B/W	- 70	- 12000	C	all
	B/W	- 70	- 24000	C	N.E. corner East half
	B/W	- 51/56	- 68000	C	all
117A/15	B/W	- 75	- 56000	C	East half.
	B/W	- 74	- 10000	C	East half
	B/W	- 74	- 10000	C	1 line along 68°55' 137°20'→East
	B/W	- 74	- 54000	C	all
	B/W	- 72	- 54000	C	all
	B/W	- 72	- 5000	C	East half Shingle Point
	RS	- 72	- 39	C	CIR 127700 520 B/W 127700 25A B/W 127700 12 + 58 BIR 127700 89B CIR 127700 12 N.W. - S.E. diagonal
	B/W	- 70	- 12000	C	all
	B/W	- 70	- 20000	C	1 line diagonal Shingle Point
	B/W	- 51/56	- 68000	C	all
117A/16	B/W	- 74	- 10000	C	1 line along 68°55' 136°55'→West
	B/W	- 74	- 54000	C	all
	B/W	- 72	- 54000	C	all
	RS	- 72	- 39	C	CIR 127700 520 B/W 127700 25A B/W 127700 12 + 58 BIR 127700 89B CIR 127700 12 1 line along 136°00' 68°55'→South only
	B/W	- 70	- 12000	C	136°45'→West only
	B/W	- 51/56	- 68000	C	all
117D/1	B/W	- 74	- 60000	C	all

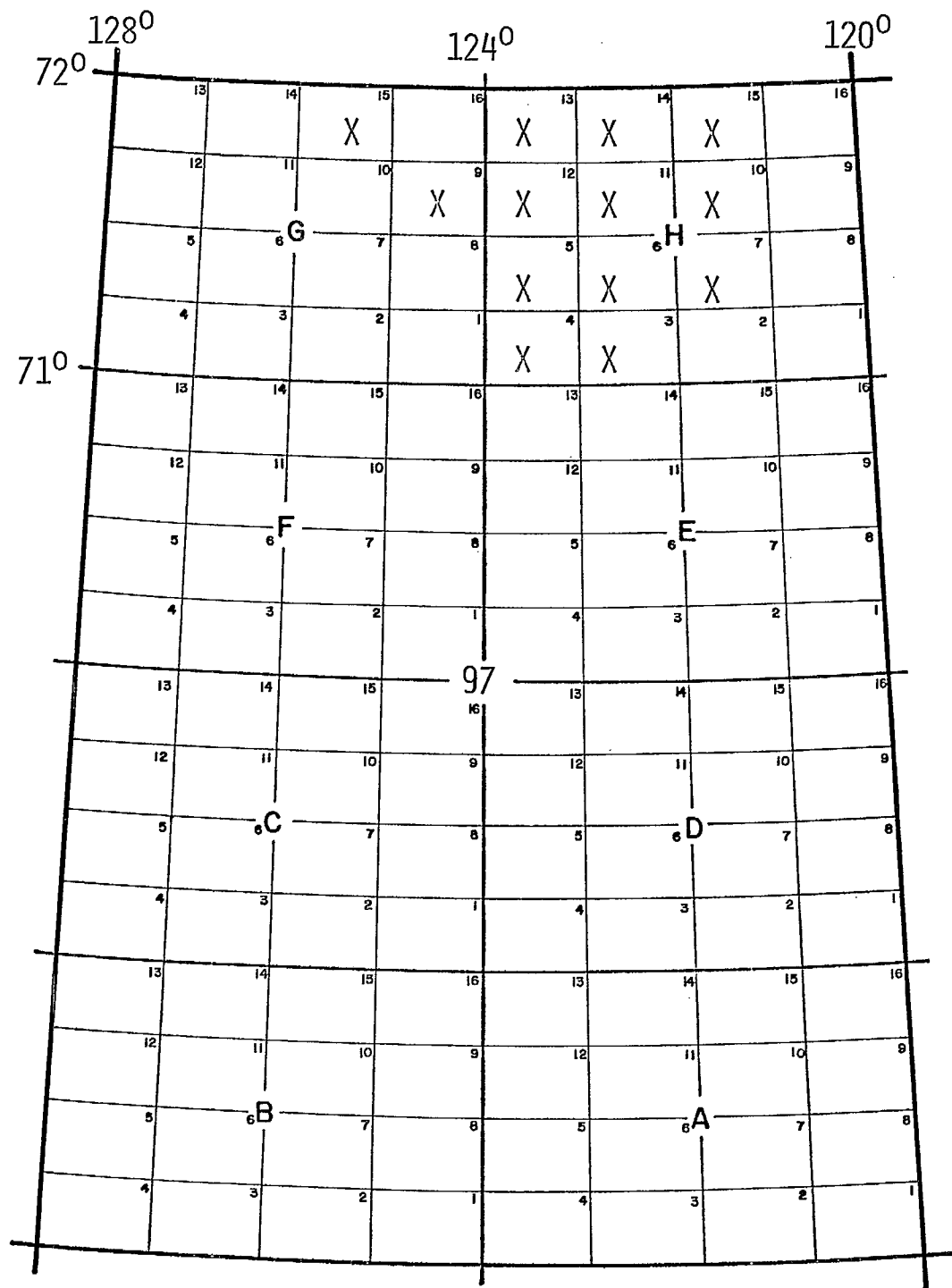
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	B/W	- 72	- 54000	C	East half - Oliver Islands
	B/W	- 52	- 68000	C	1 line along 136°00'
117D/2	B/W	- 74	- 60000	C	all
	B/W	- 72	- 54000	C	West half
	RS	- 72	- 39	C	CIR 127700 520
					B/W 127700 25A
					B/W 127700 12 + 58
					BIR 127700 89B
					CIR 127700 12
					S.W. corner
	B/W	- 70	- 24500	C	shoreline
	B/W	- 51/56	- 68000	C	shoreline
117D/3	B/W	- 74	- 60000	C	all
	B/W	- 72	- 54000	C	all
	RS	- 72	- 39	C	CIR 127700 520
					B/W 127700 25A
					B/W 127700 12 + 58
					BIR 127700 89B
					CIR 127700 12
					not N.E. corner
	B/W	- 70	- 12500	C	all
	B/W	- 70	- 24500	C	shoreline
	B/W	- 51/56	- 68000	C	all
117D/4	B/W	- 75	- 57000	C	all
	B/W	- 74	- 60000	C	all
	B/W	- 72	- 54000	C	East half
	RS	- 72	- 39	C	CIR 127700 520
					B/W 127700 25A
					B/W 127700 12 + 58
					BIR 127700 89B
					CIR 127700 12
					all
	B/W	- 70	- 12500	C	East half
117D/5	B/W	- 75	- 57000	C	all
	B/W	- 72	- 54000	C	all

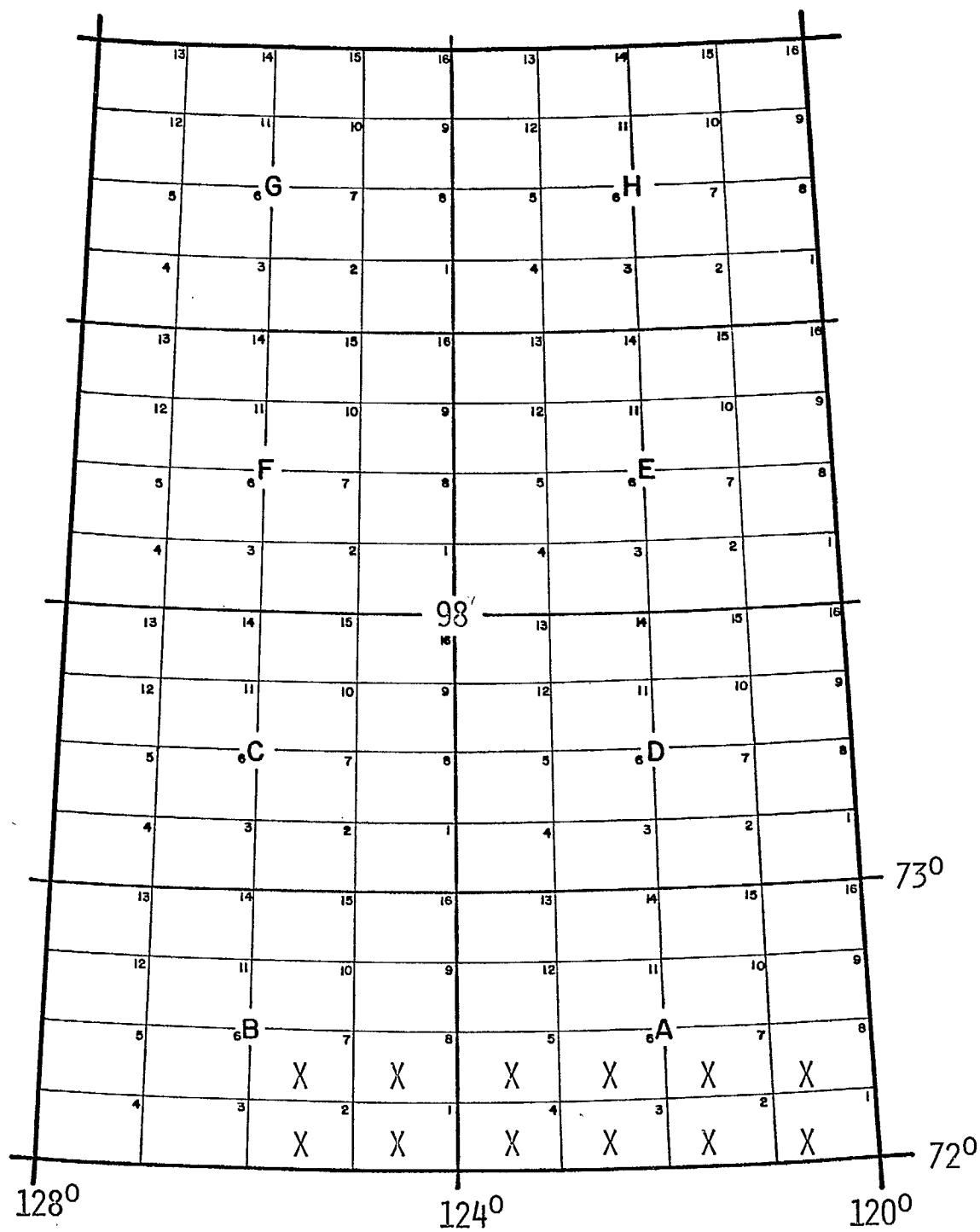
Quadrat	Code			L	Comments		
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					B/W	127700	25A
					B/W	127700	12 + 58
					BIR	127700	89B
					CIR	127700	12
					S.W. portion		
	B/W	- 70	- 12500	C	all		
	B/W	- 70	- 24500	C	shoreline		
	B/W	- 51/56	- 68000	C	shoreline		
117D/6	B/W	- 72	- 54000	C	all		
	RS	- 72	- 39	C	CIR	127700	520
					B/W	127700	25A
					B/W	127700	12 + 58
					BIR	127700	89B
					CIR	127700	12
					S.W. corner		
	B/W	- 70	- 12500	C	all		
	B/W	- 70	- 24500	C	shoreline		
	B/W	- 51/56	- 68000	C	shoreline		
117D/11	B/W	- 72	- 54000	C	Herschel Is.		
	B/W	- 70	- 12500	C	Herschel Is.		
	B/W	- 66	- 12000	C	1 line Herschel Is.		
					along 69°35' 138°47' →W		
	B/W	- 51/56	- 68000	C	Herschel Is.		
117D/12	B/W	- 75	- 57000	C	all		
	B/W	- 72	- 54000	C	69°40' →South only		
	B/W	- 70	- 12500	C	69°40' →South only		
	B/W	- 70	- 24500	C	S.W. Herschel Is.		
	B/W	- 51/56	- 68000	C	shoreline		

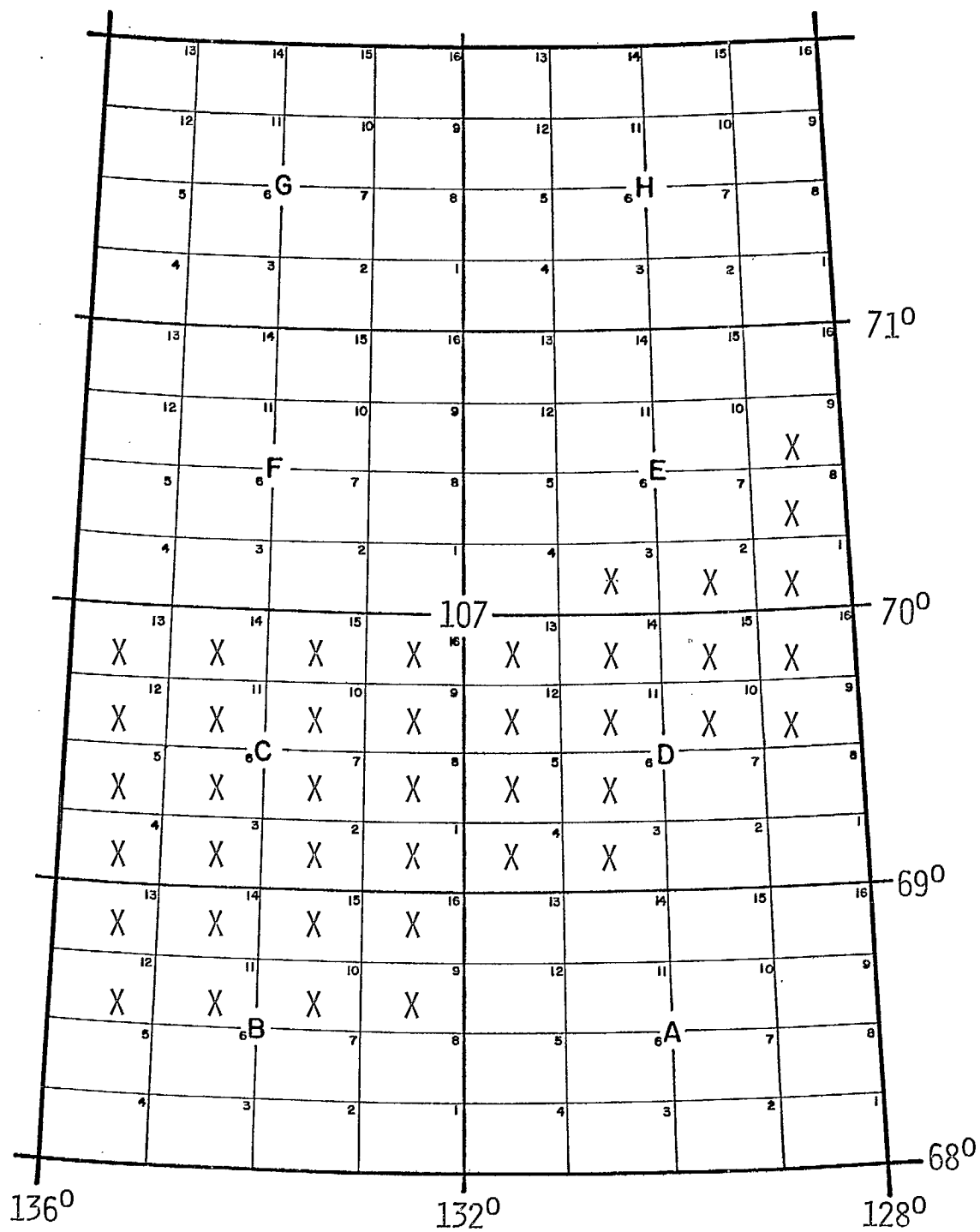


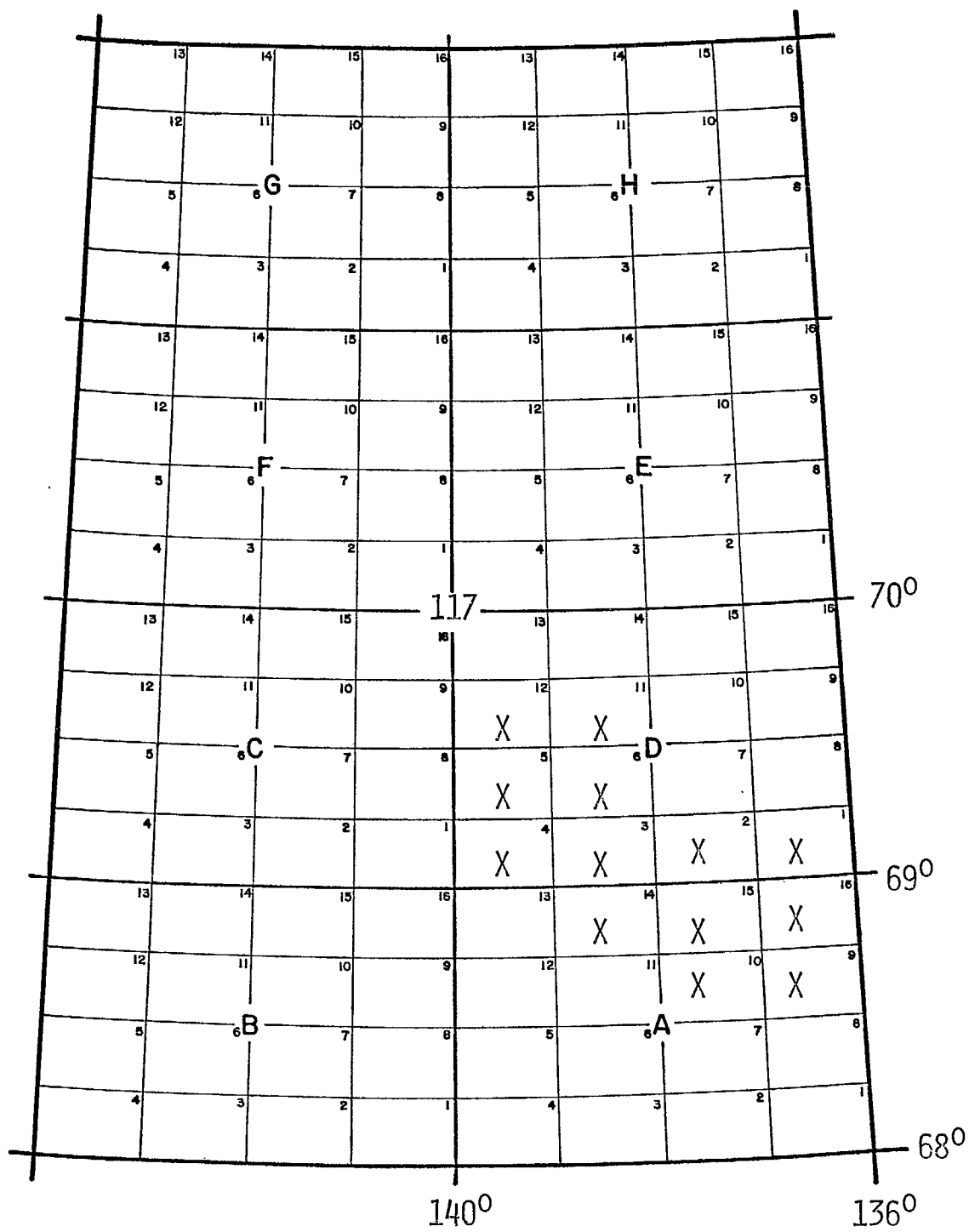
**SECTION 20**

**APPENDIX 1      INDEX MAPS FOR THE MACKENZIE DELTA – BEAUFORT SEA**

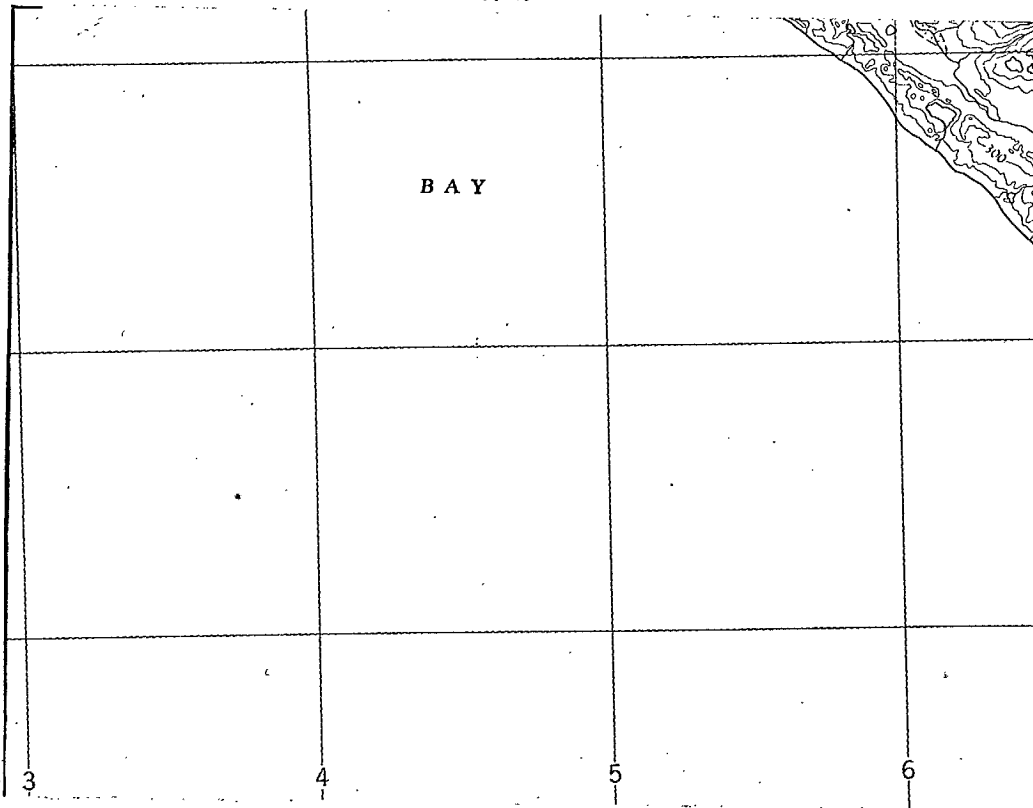




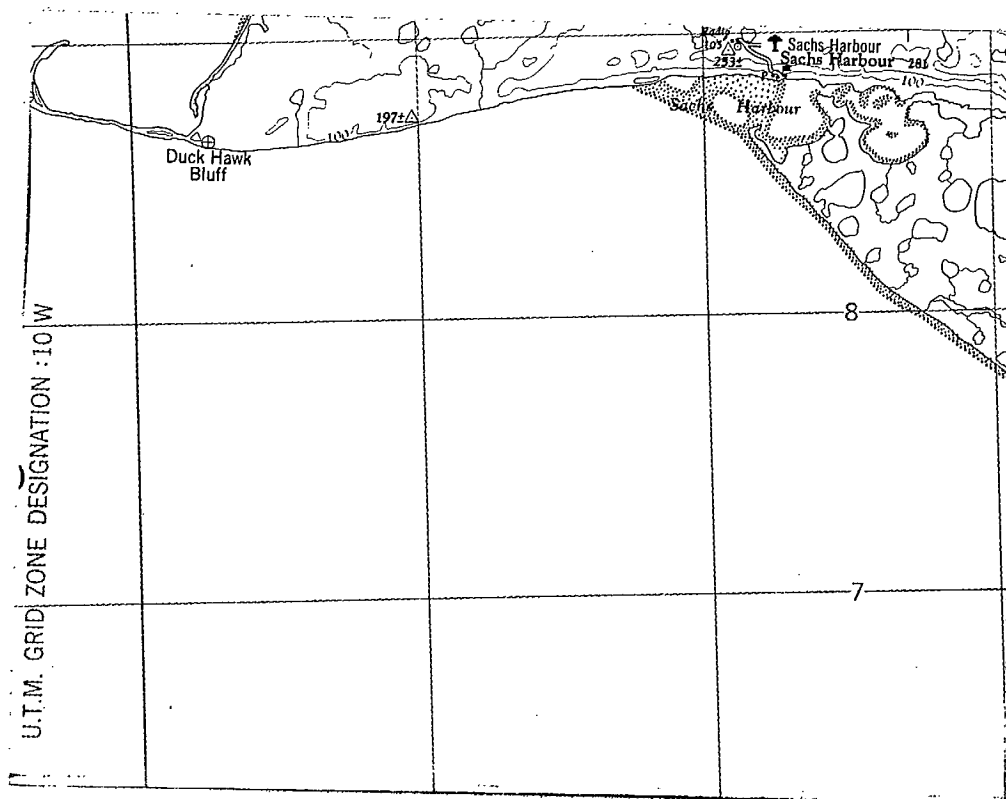




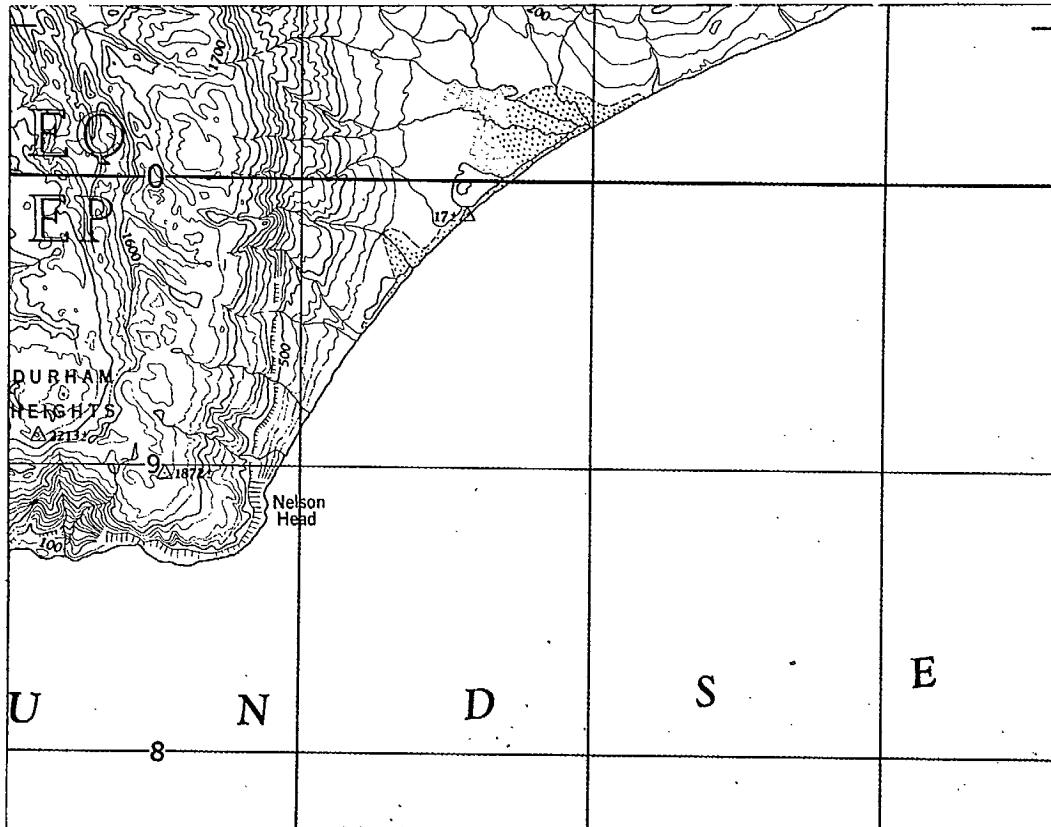
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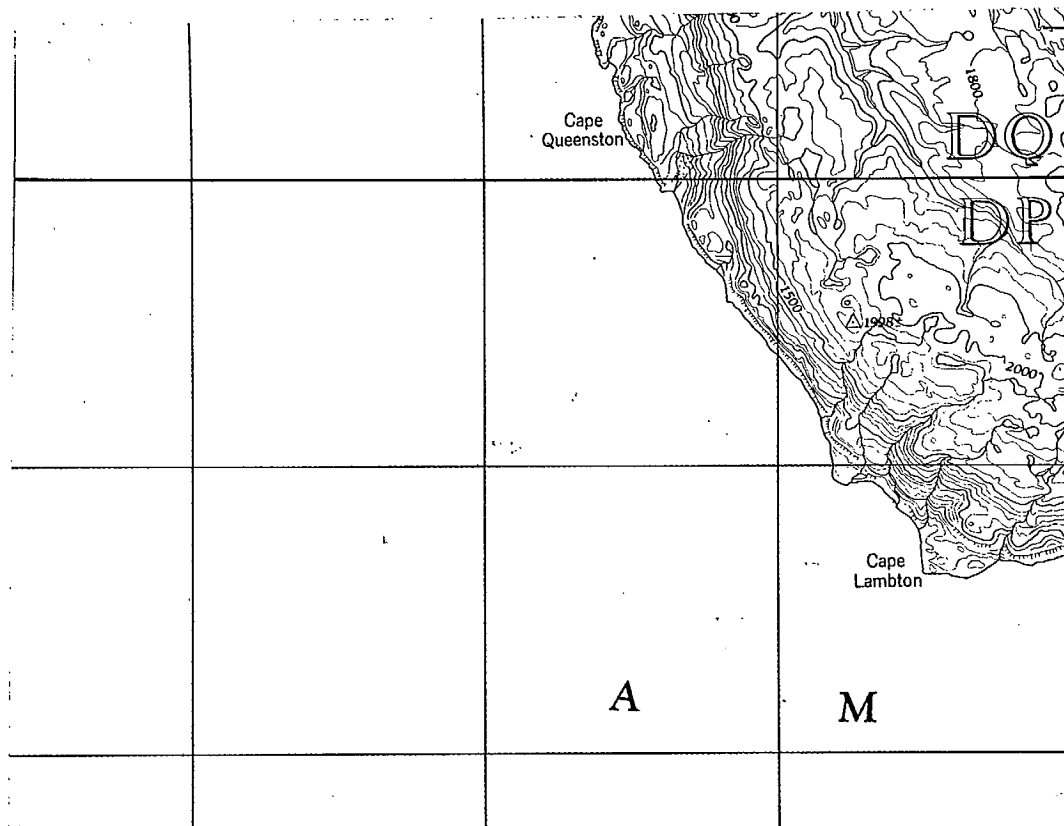
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97H/3



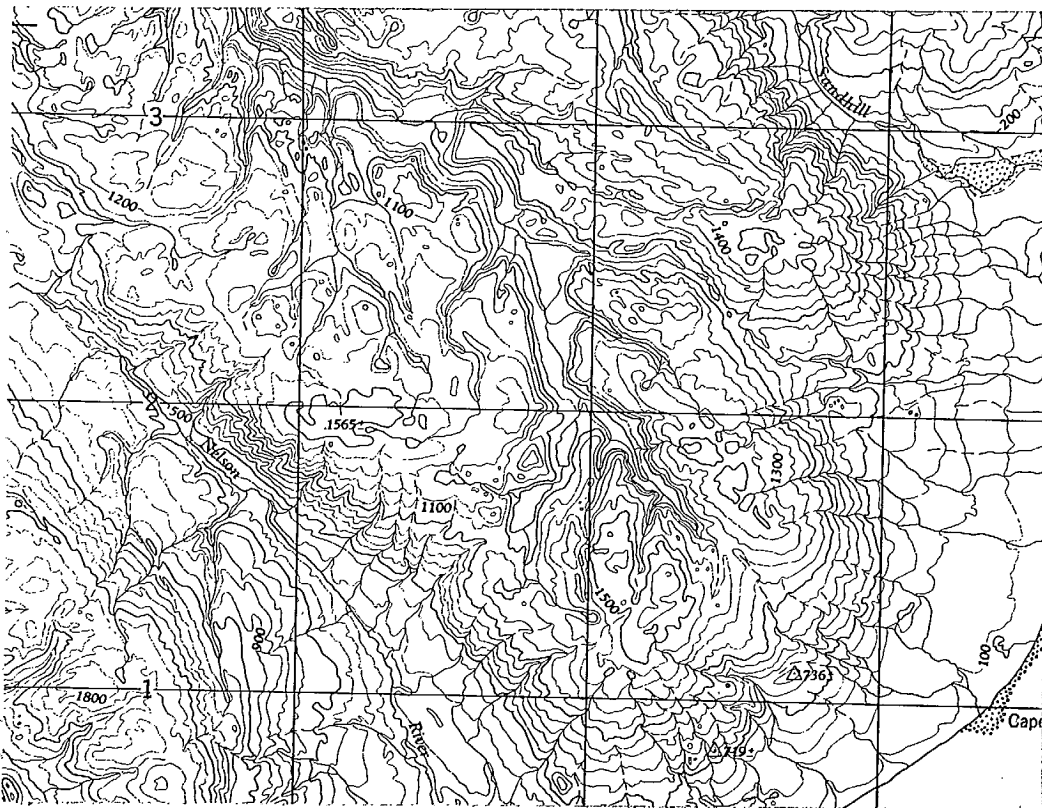
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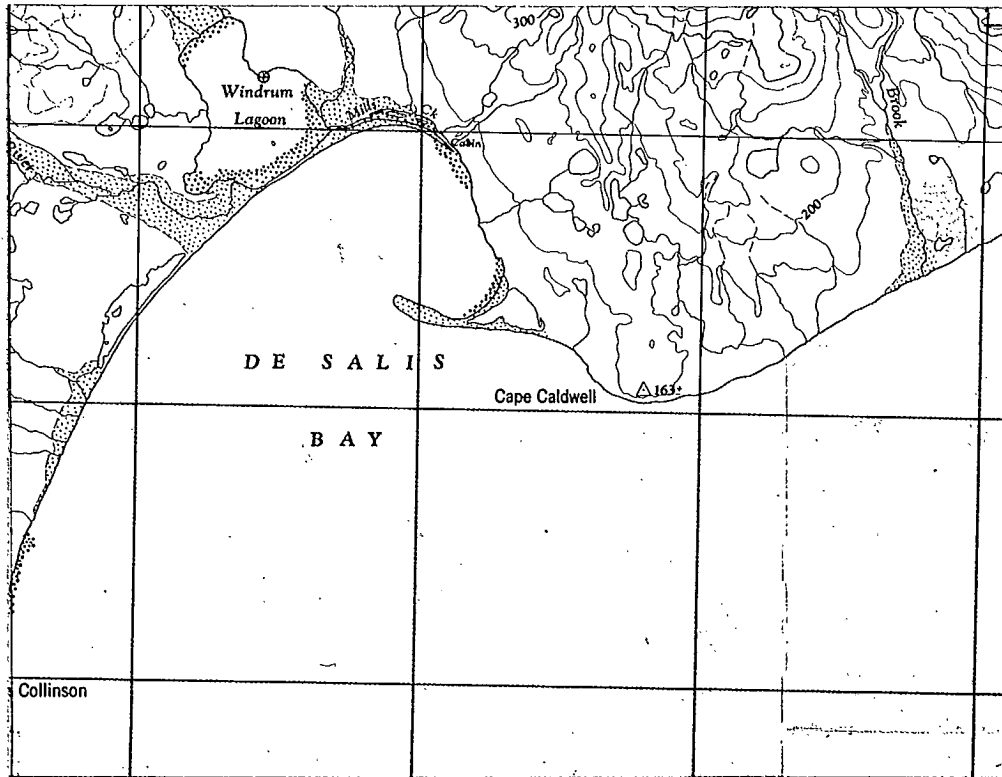


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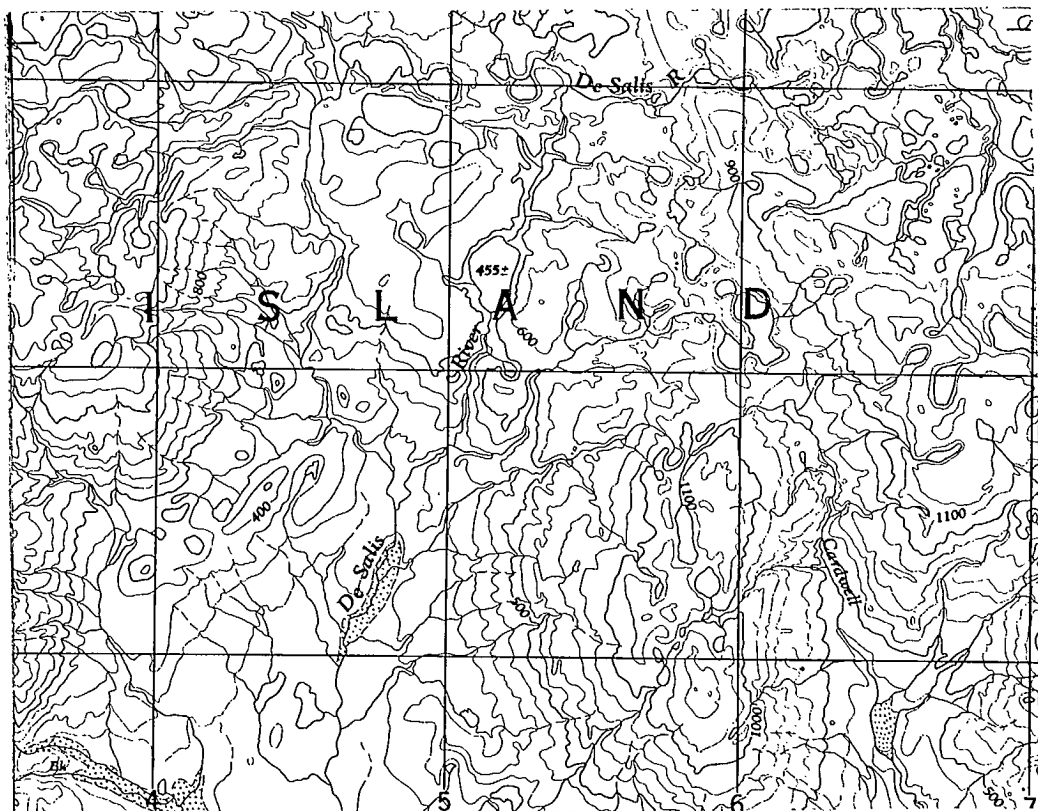




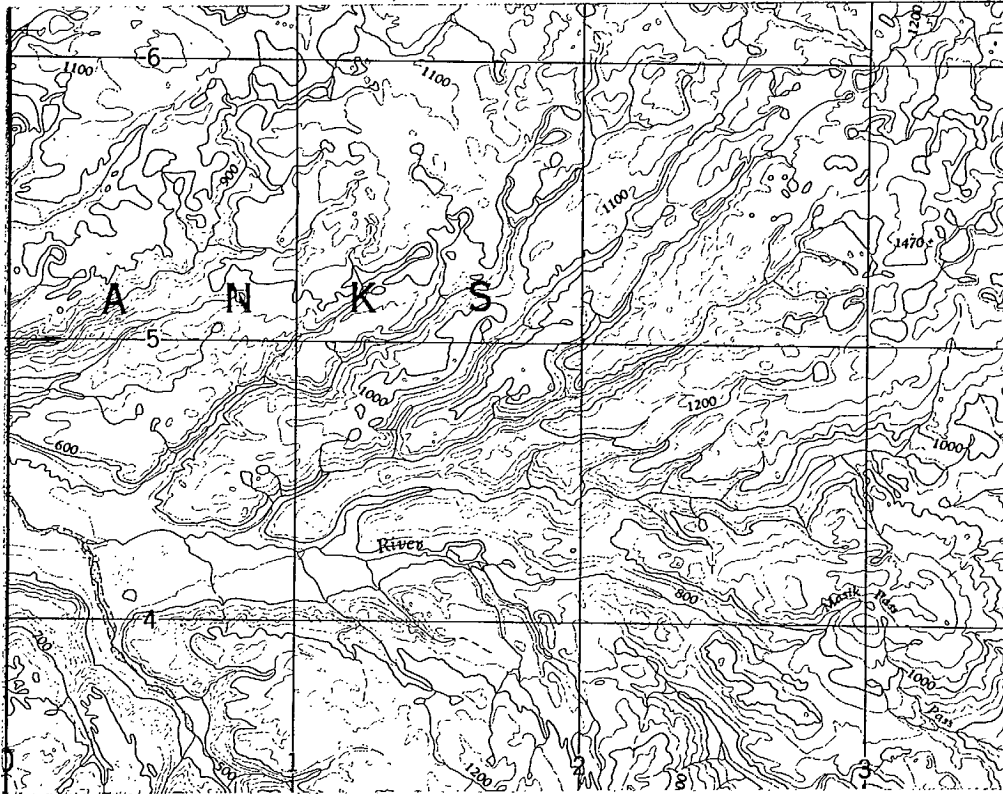
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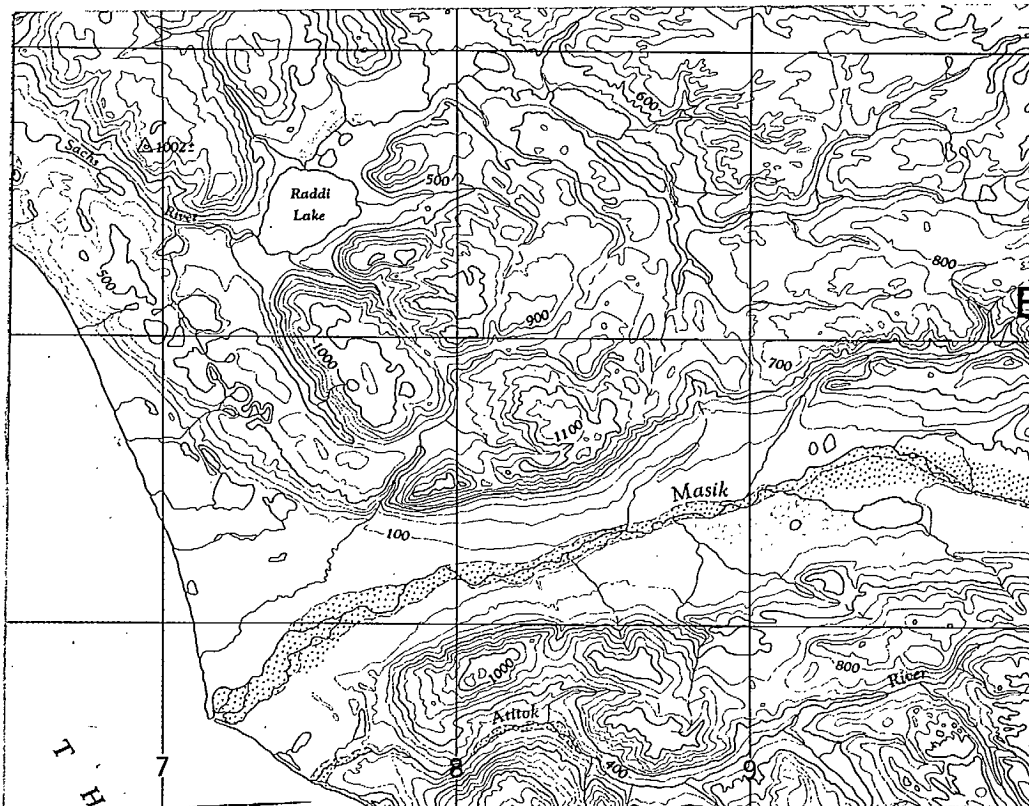
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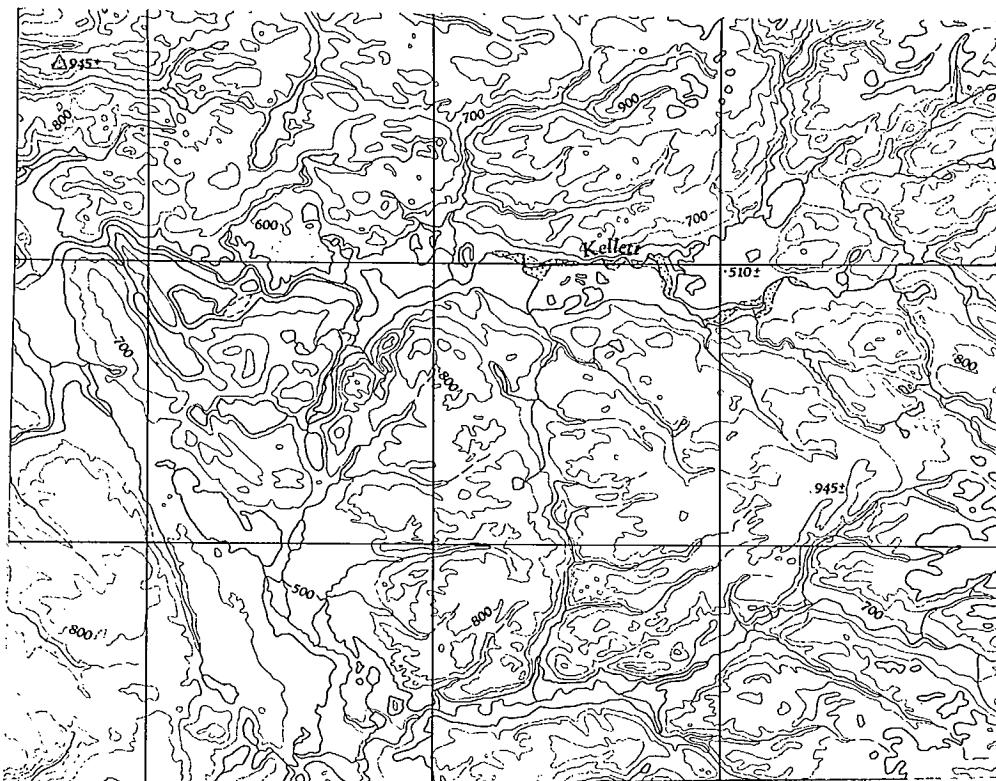
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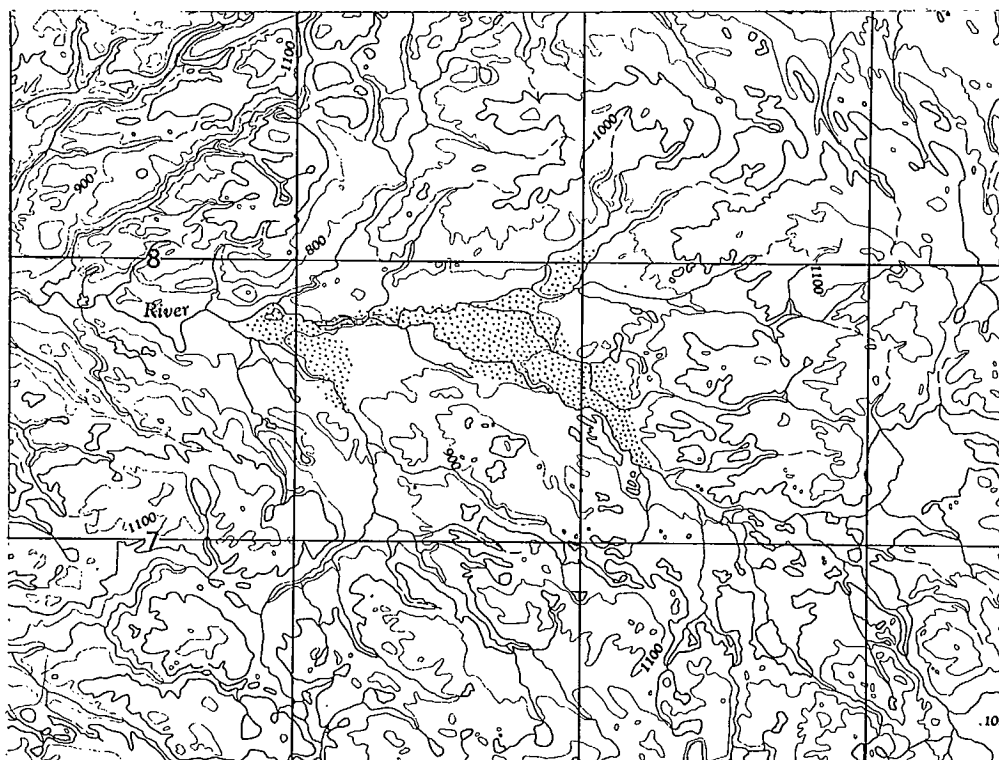
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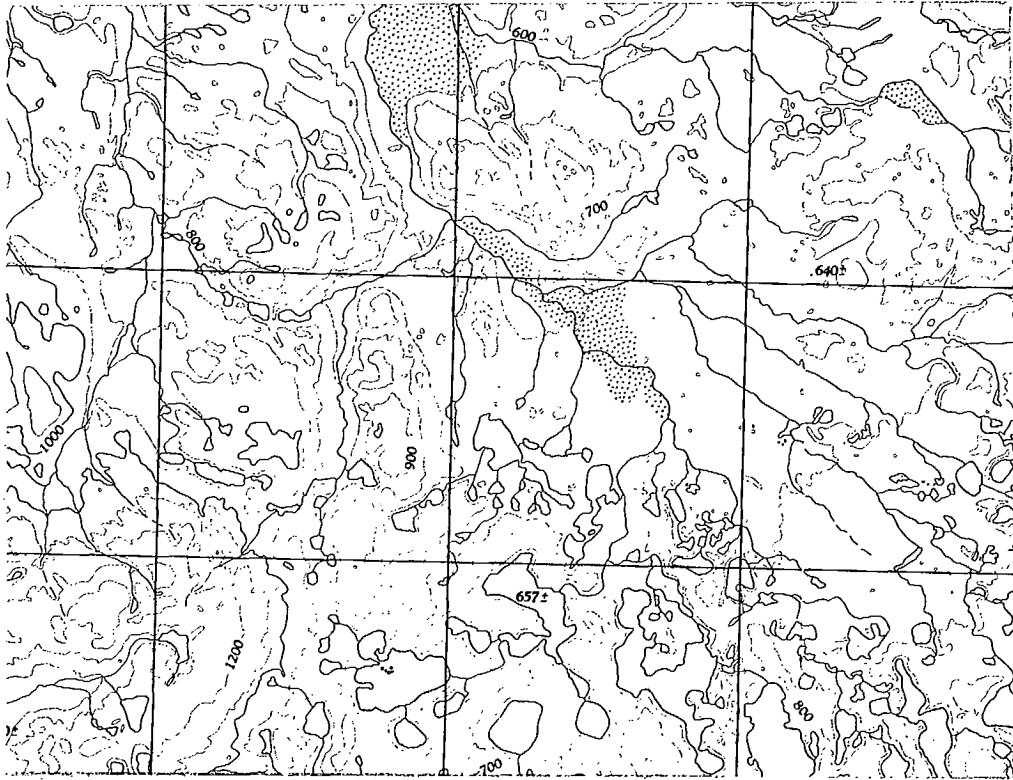
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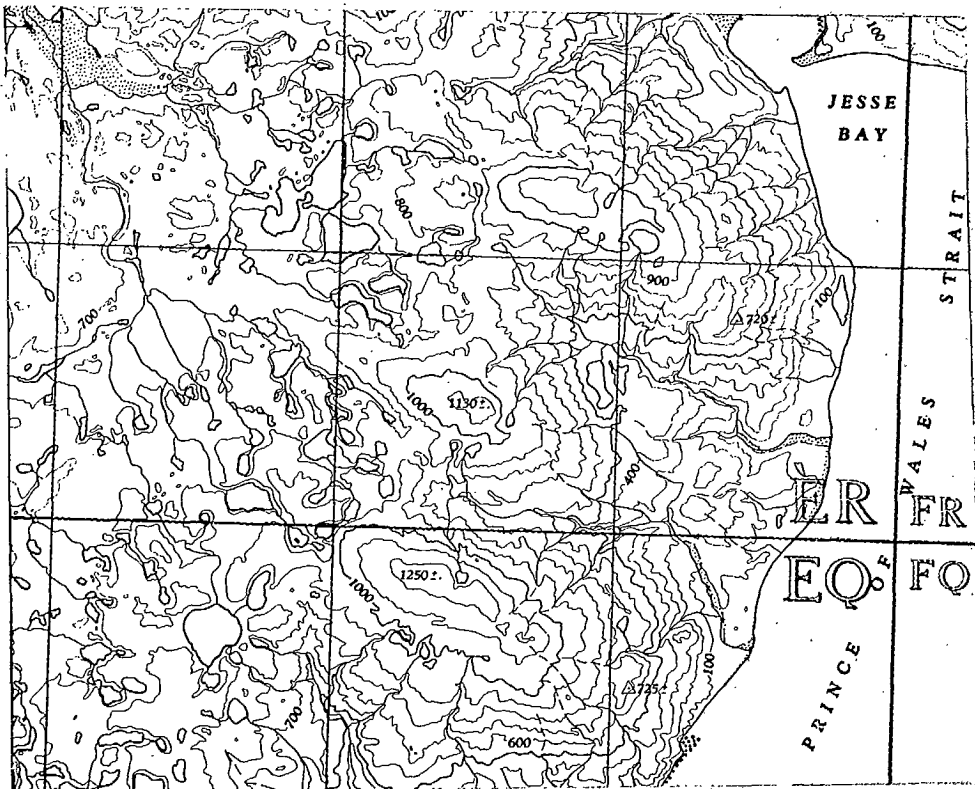
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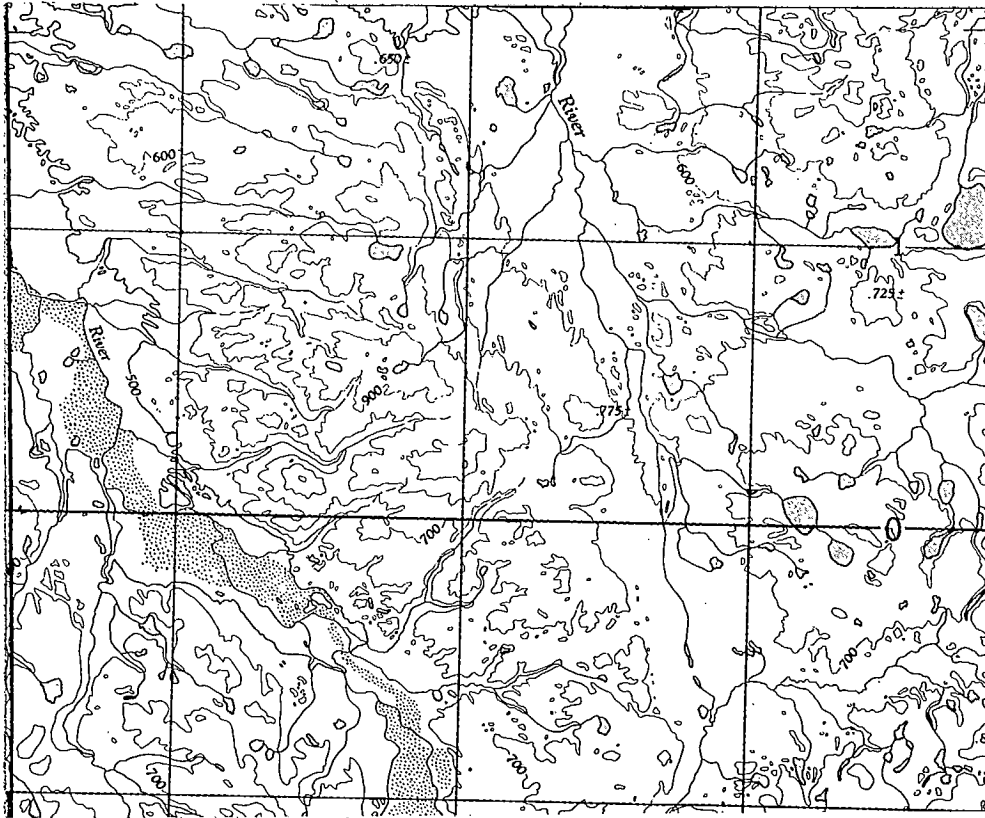
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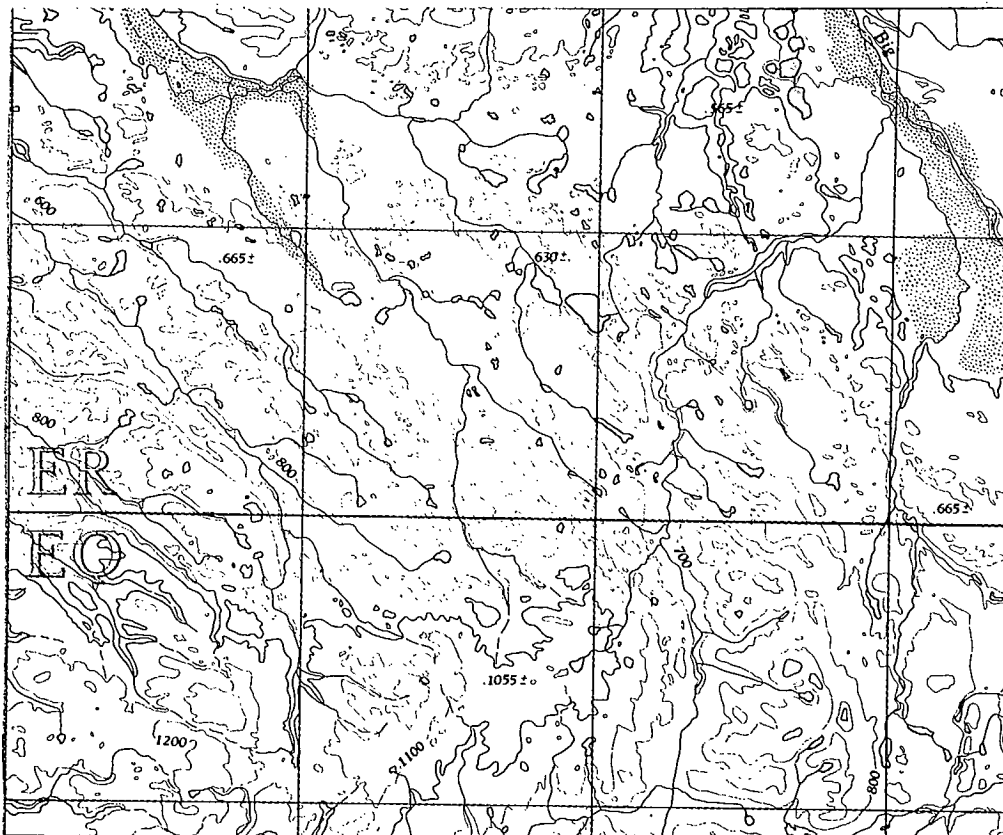
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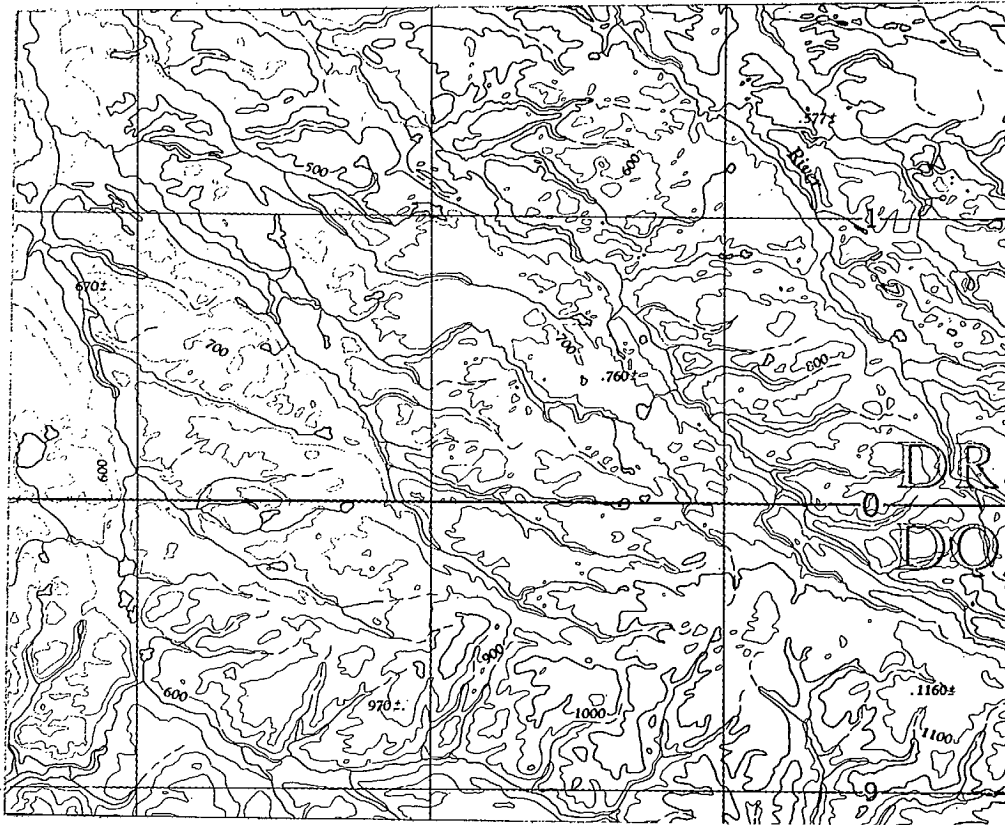
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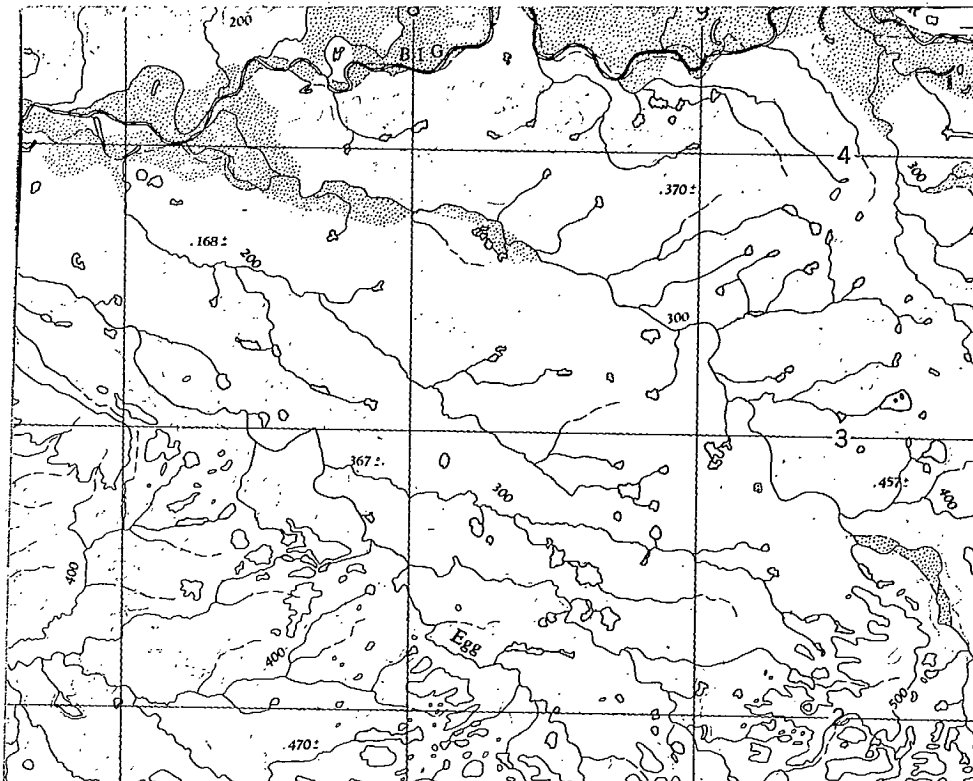
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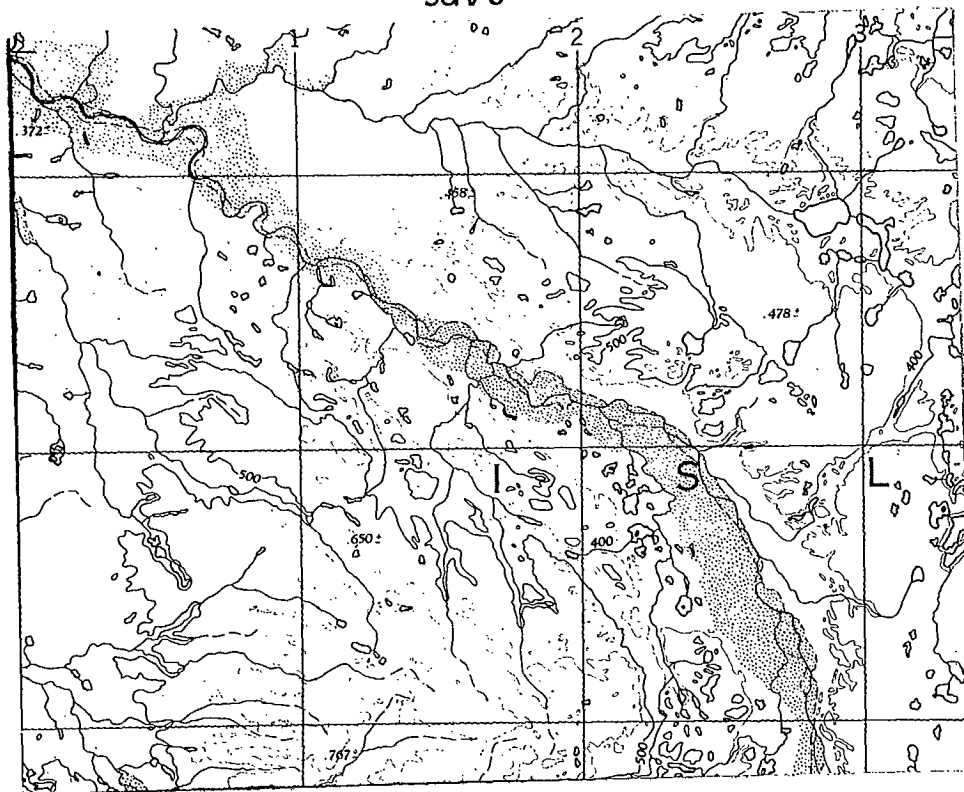
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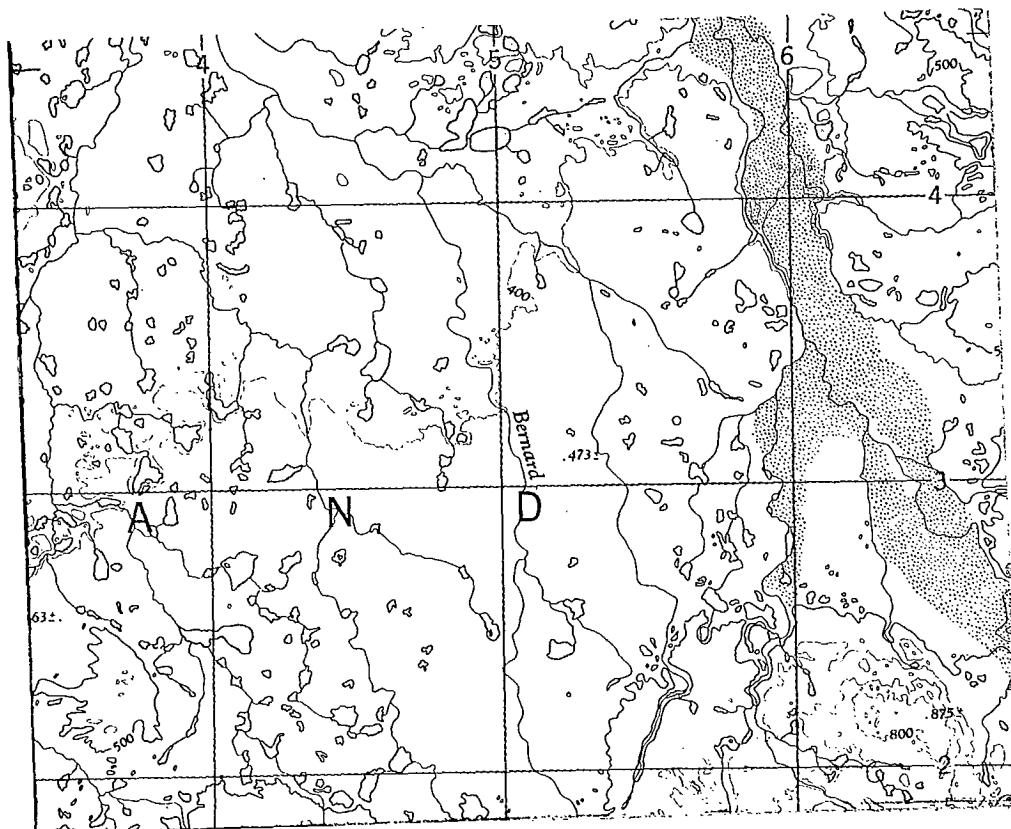
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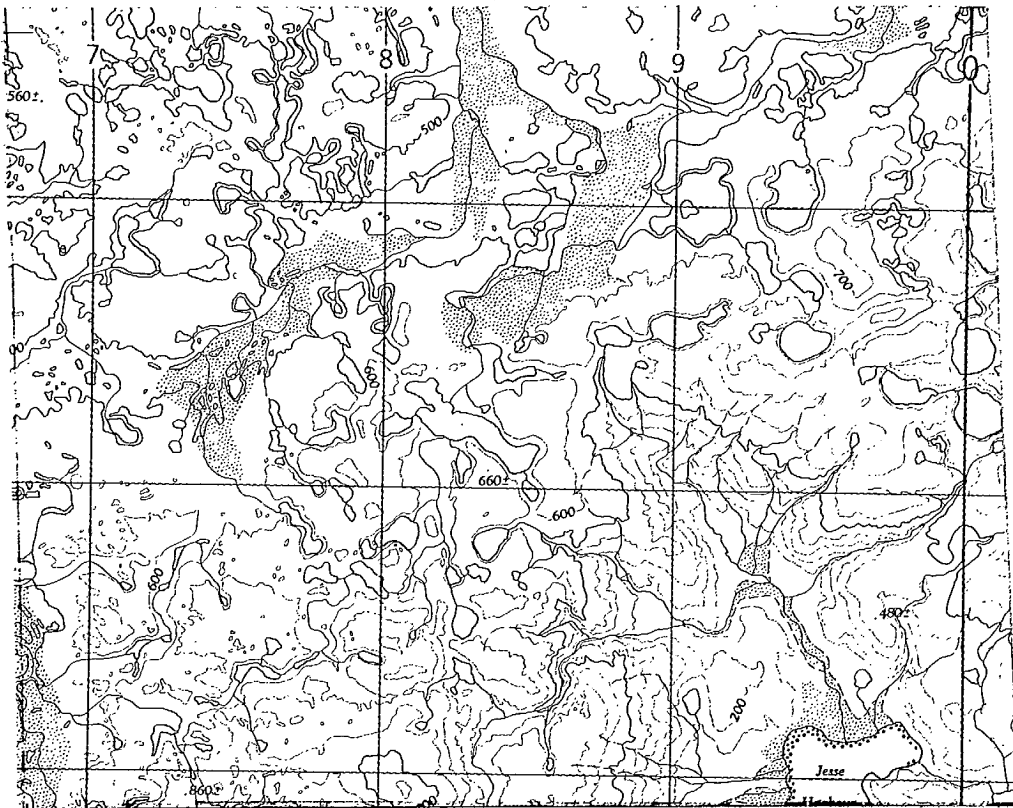
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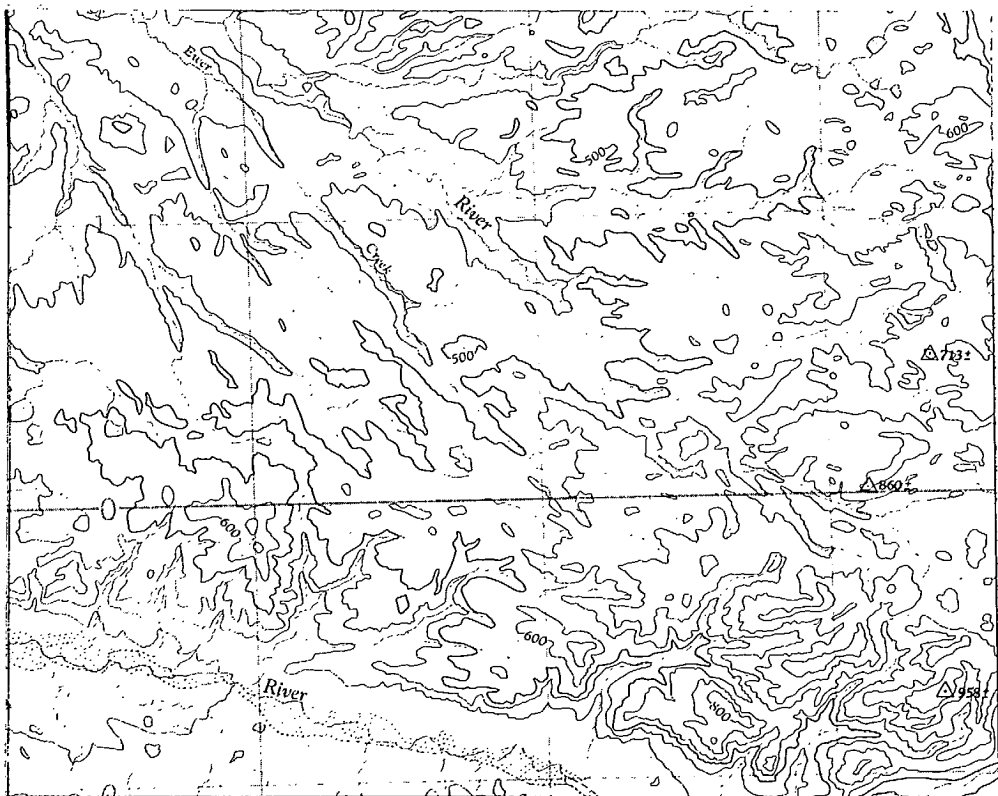
98A/7



98A/8

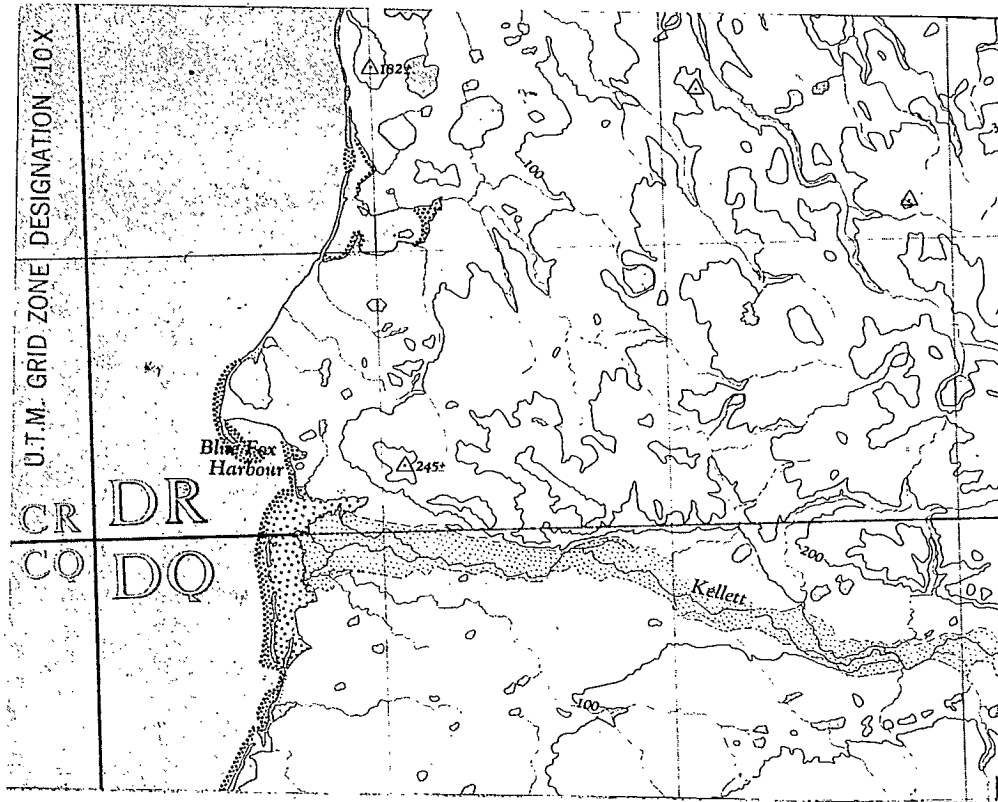


98B/1

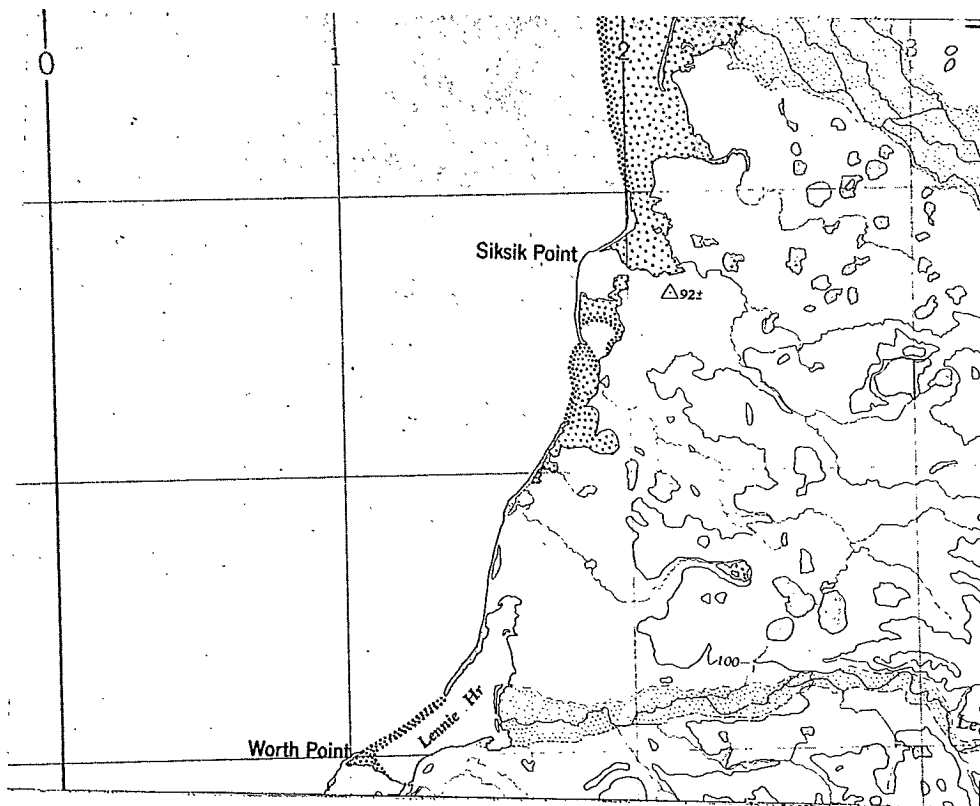




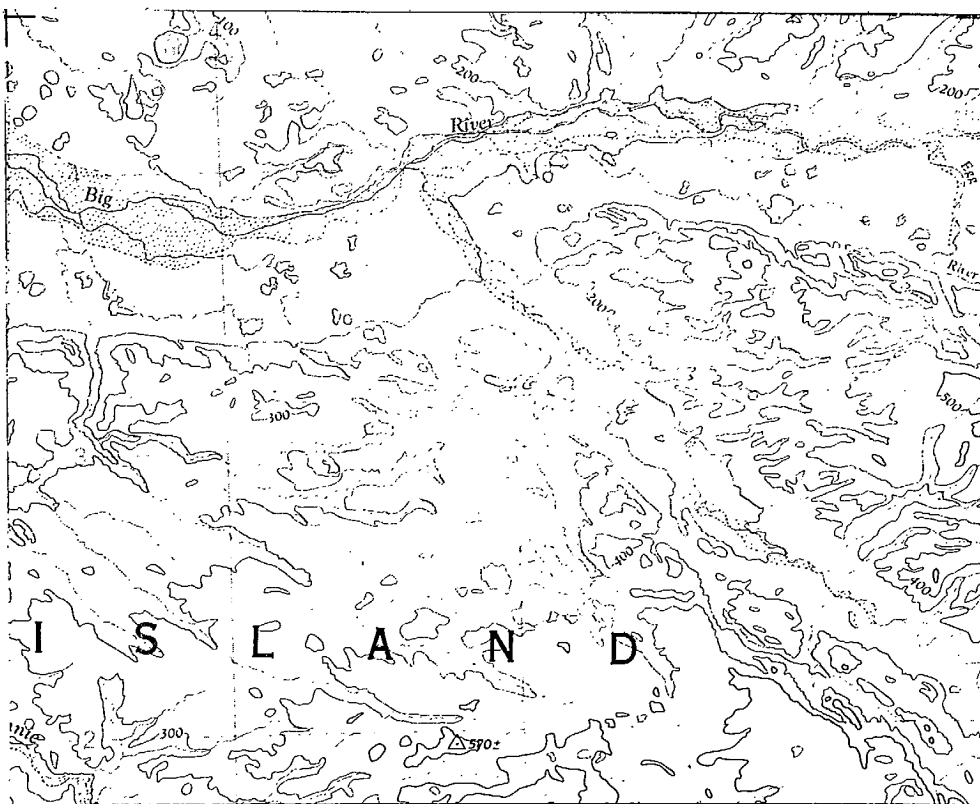
98B/2



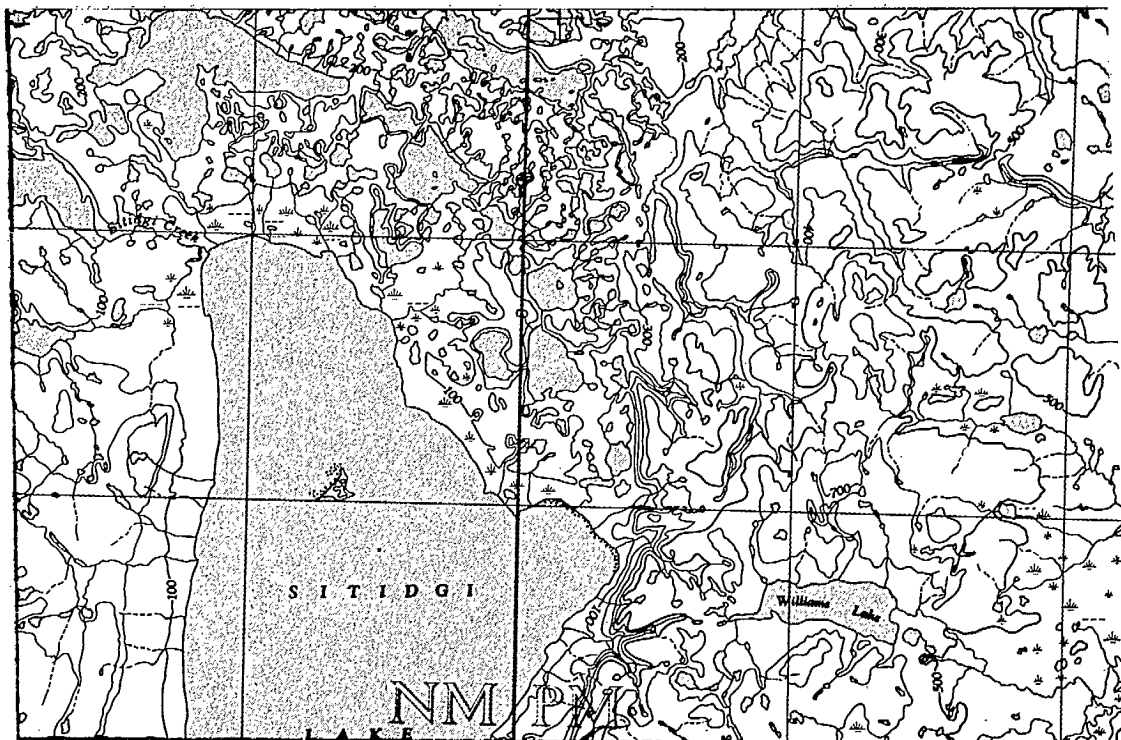
98B/7



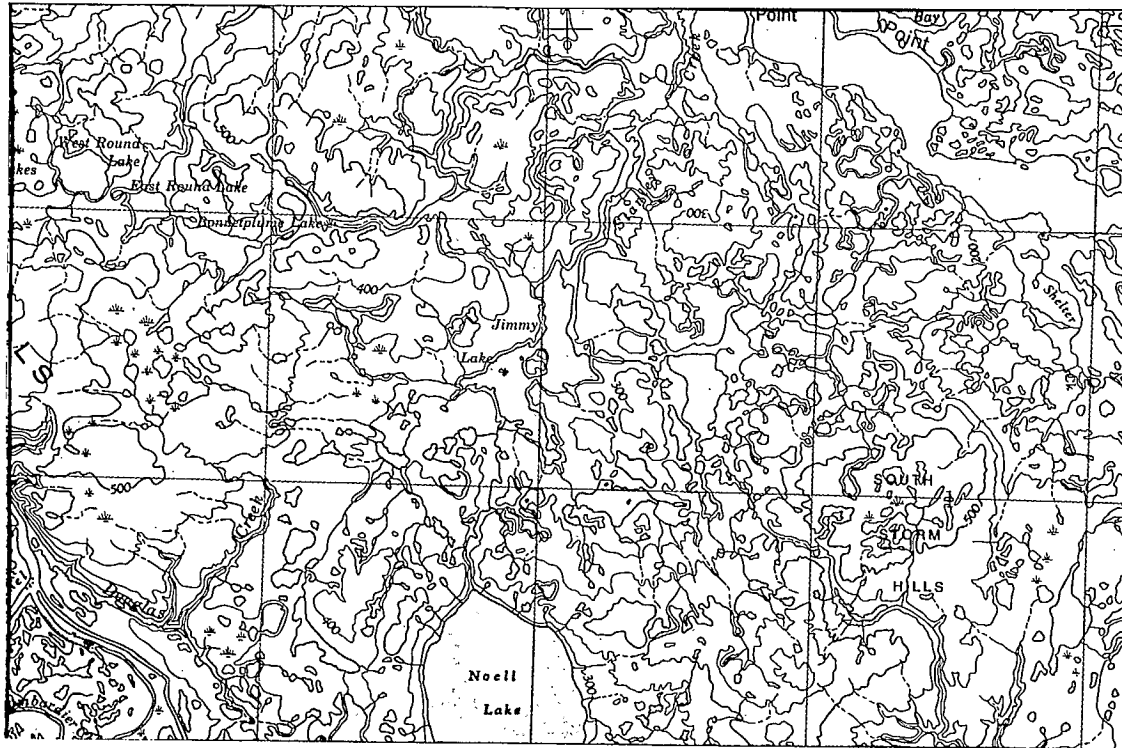
98B/8



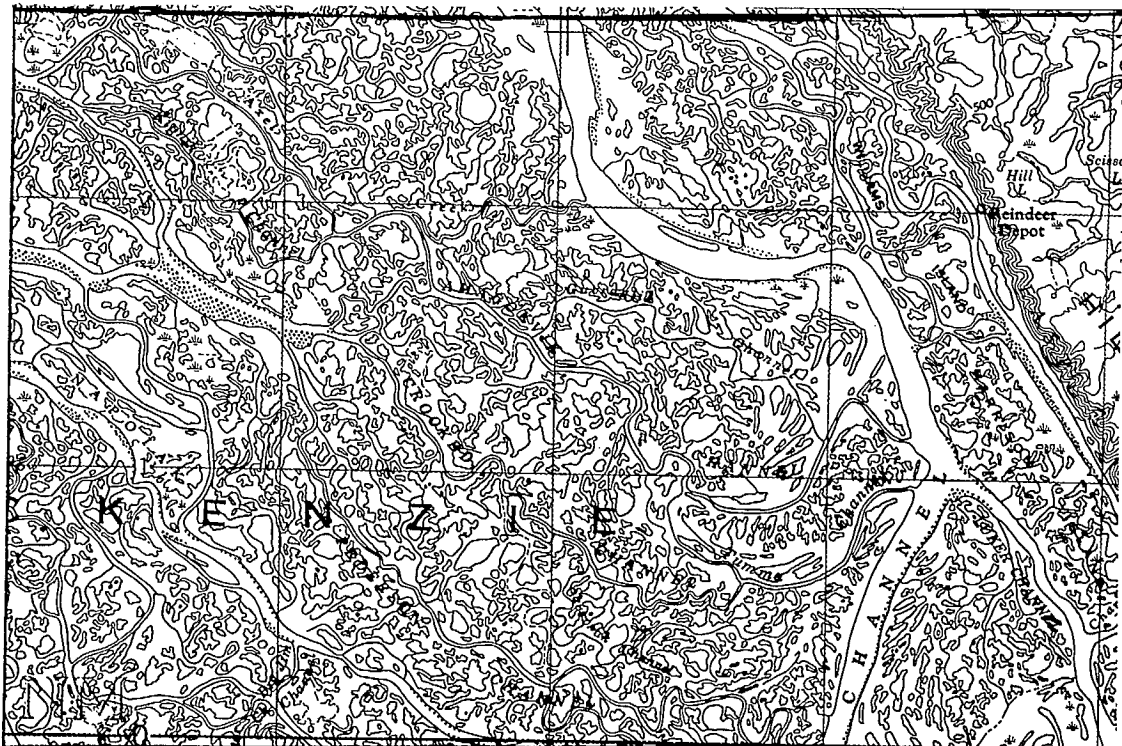
107B/9



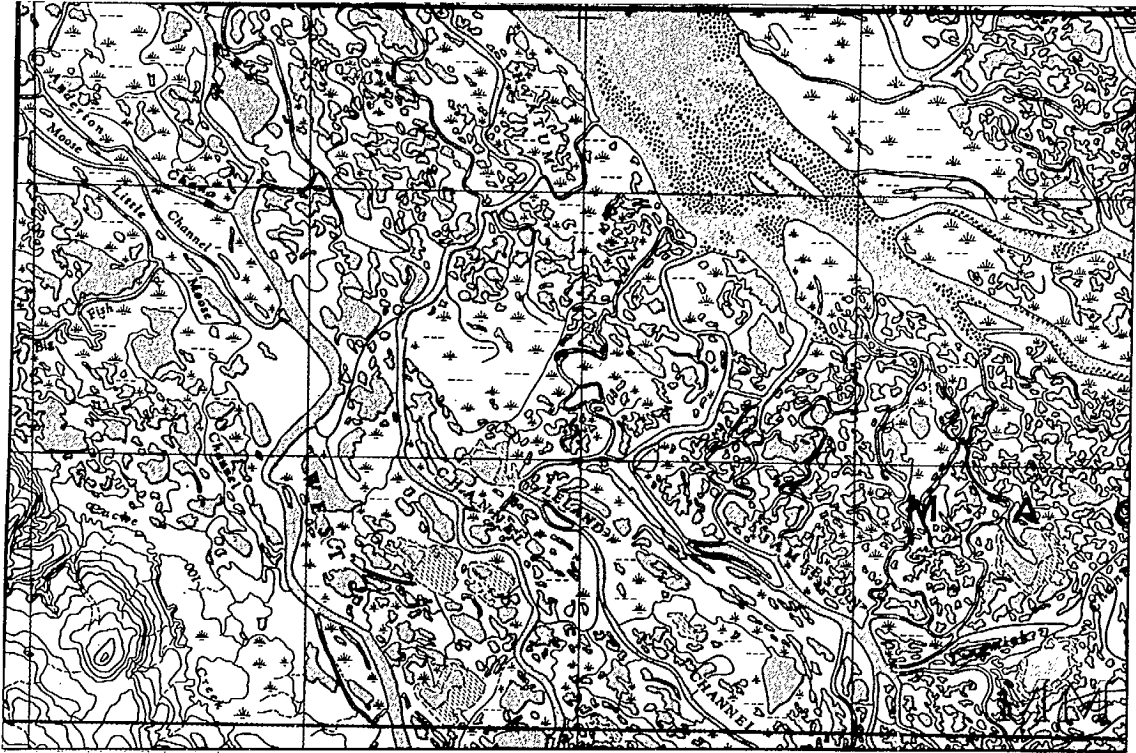
107B/10



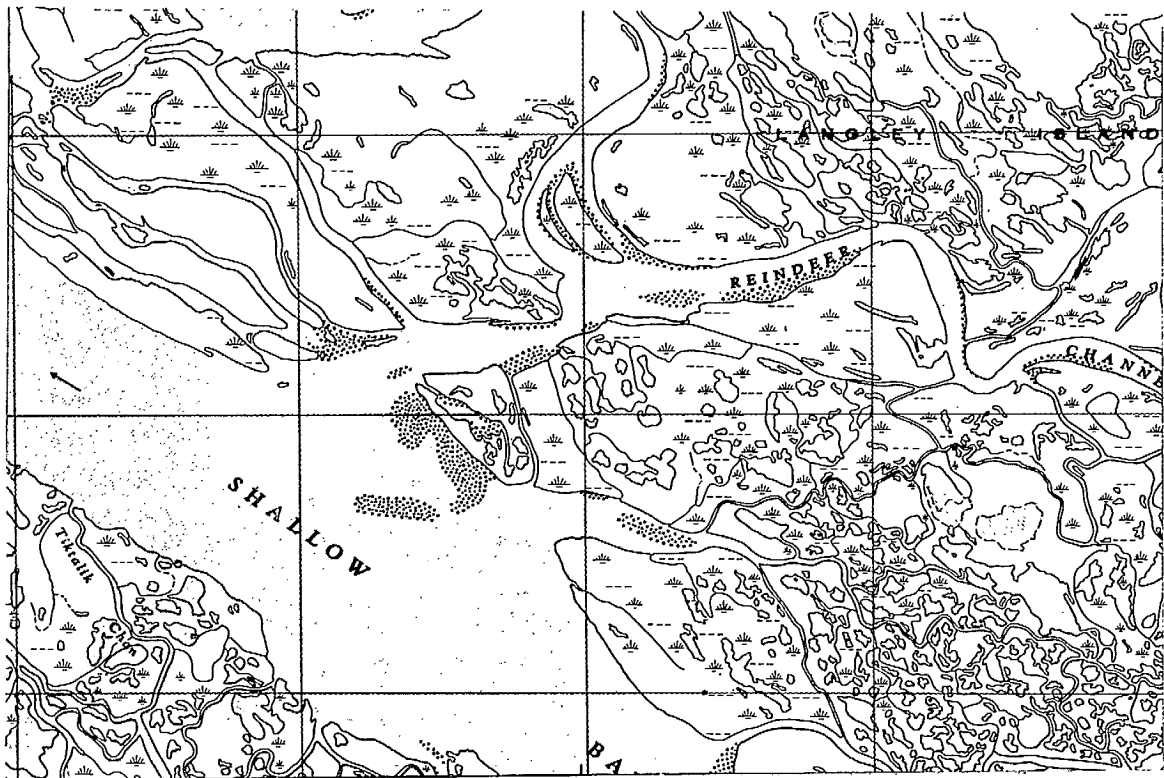
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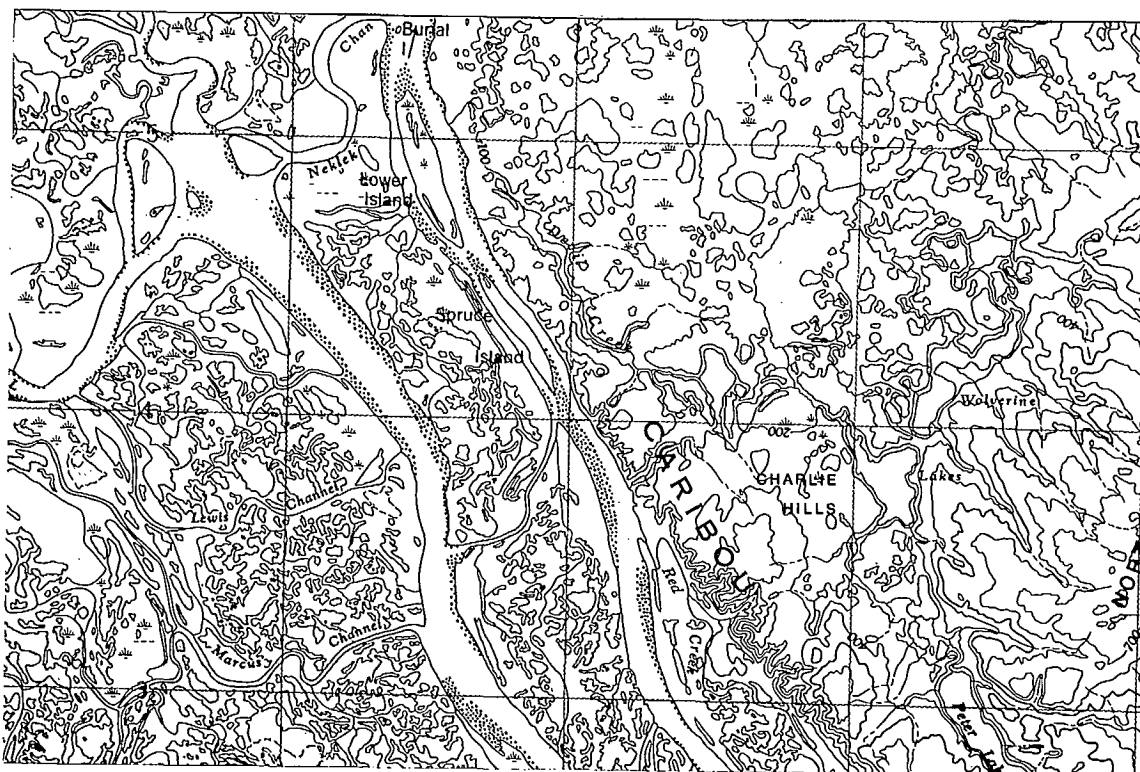
107B/12



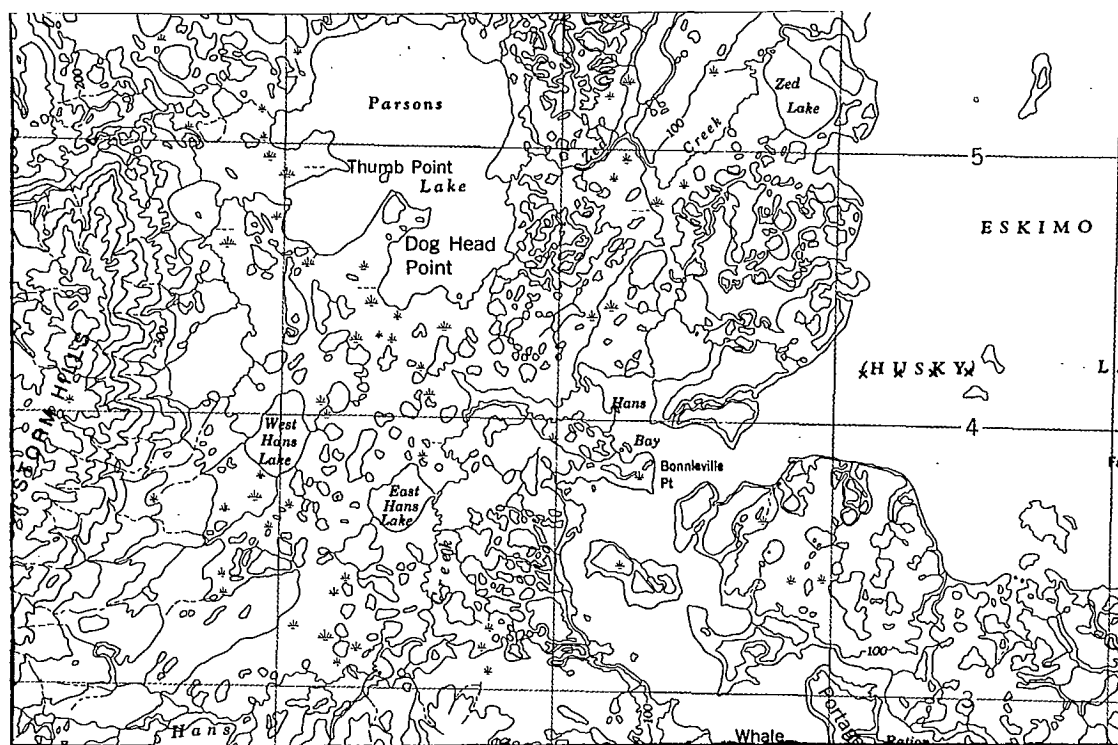
107B/13



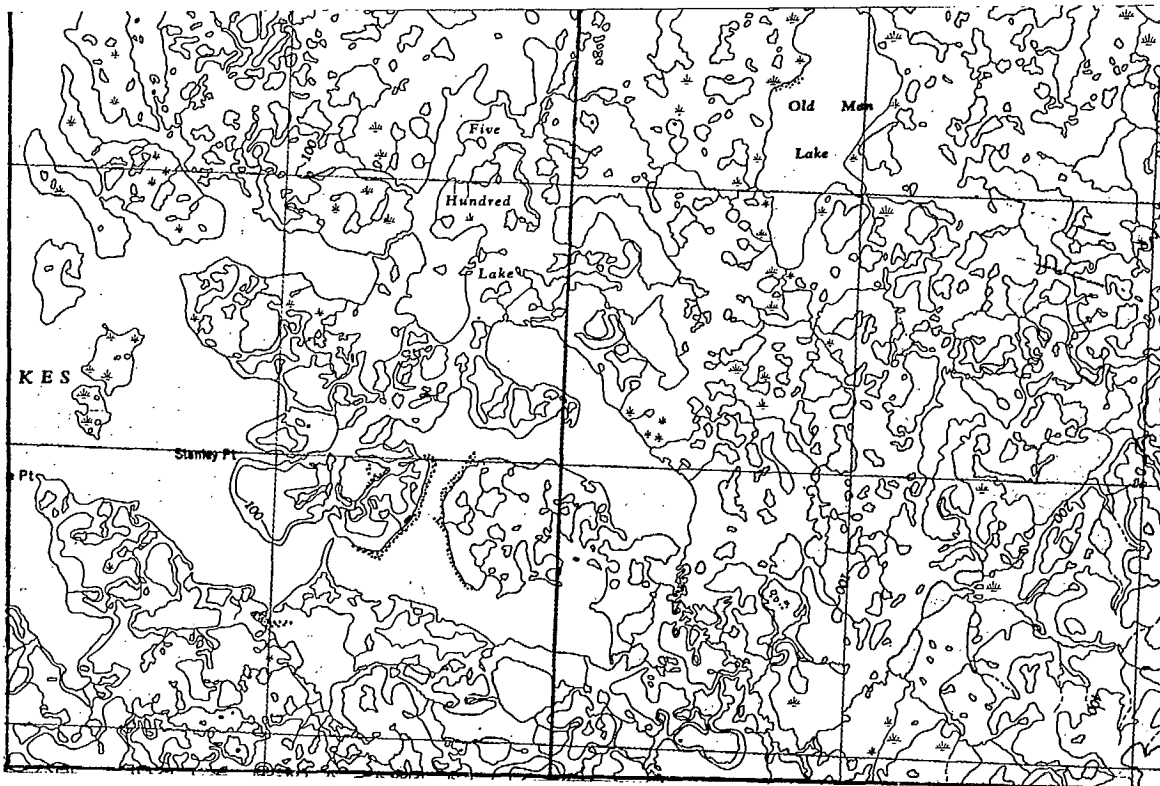
107B/14



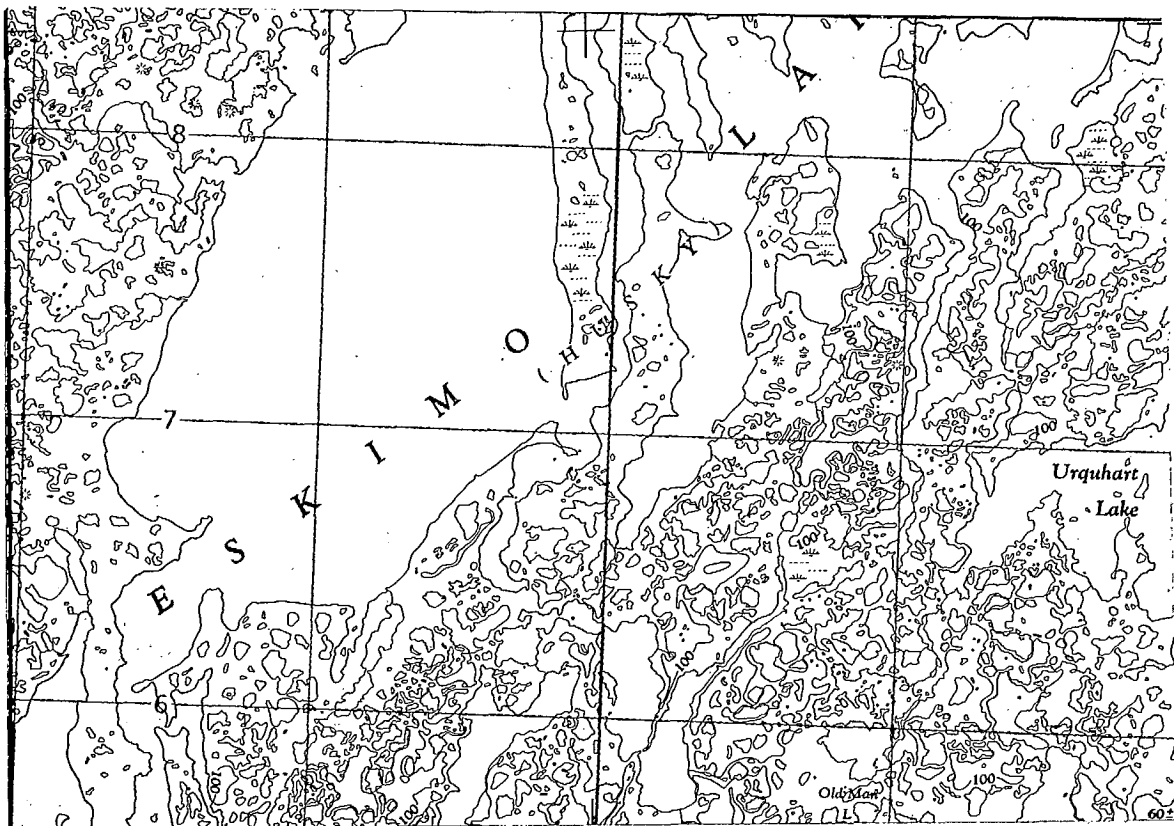
107B/15



107B/16

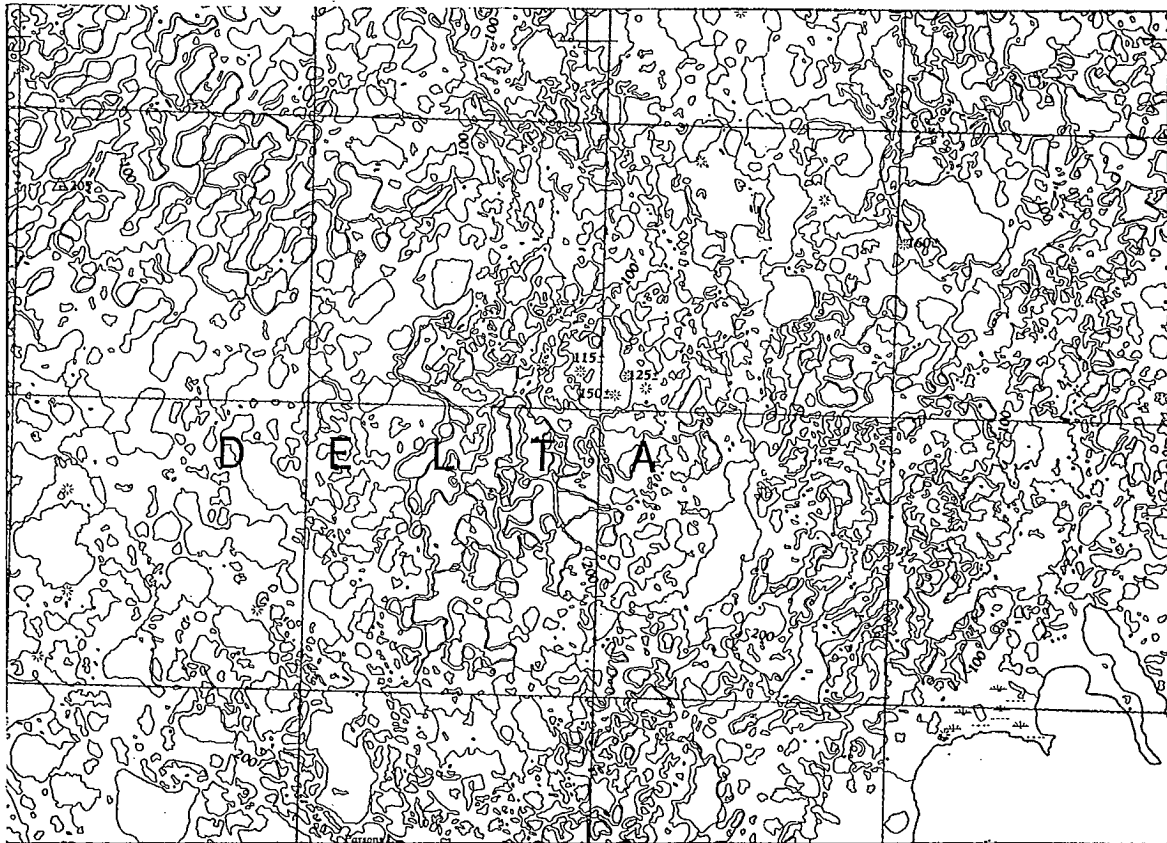


107C/1

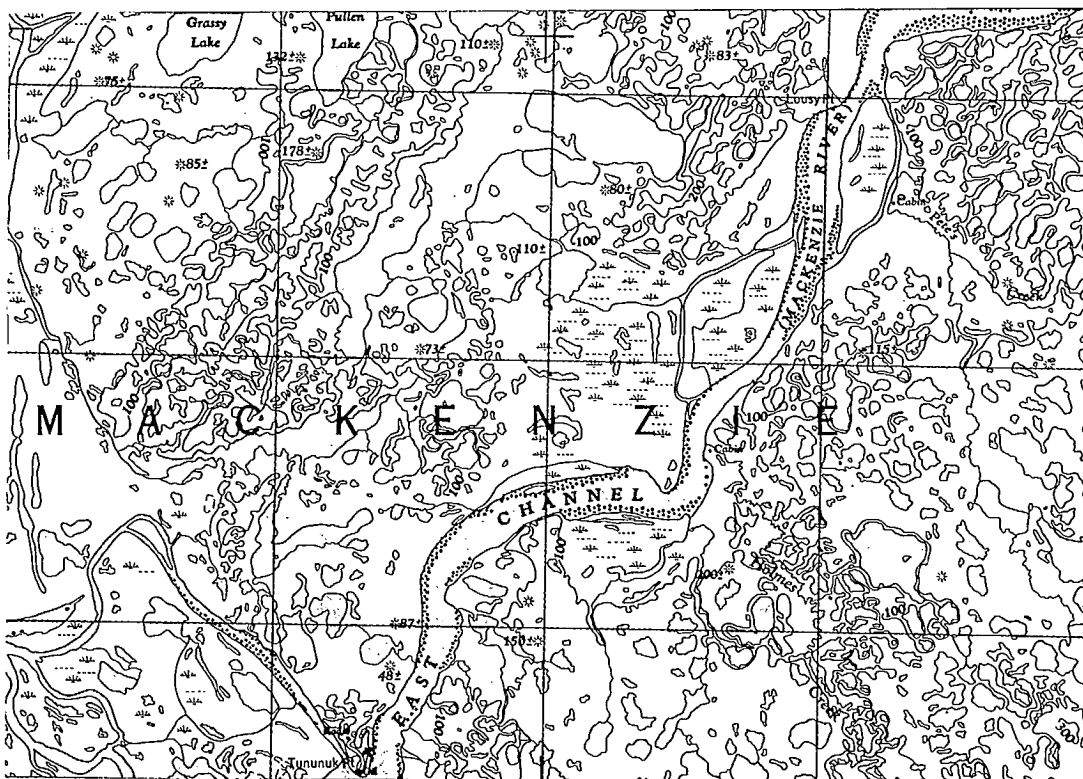




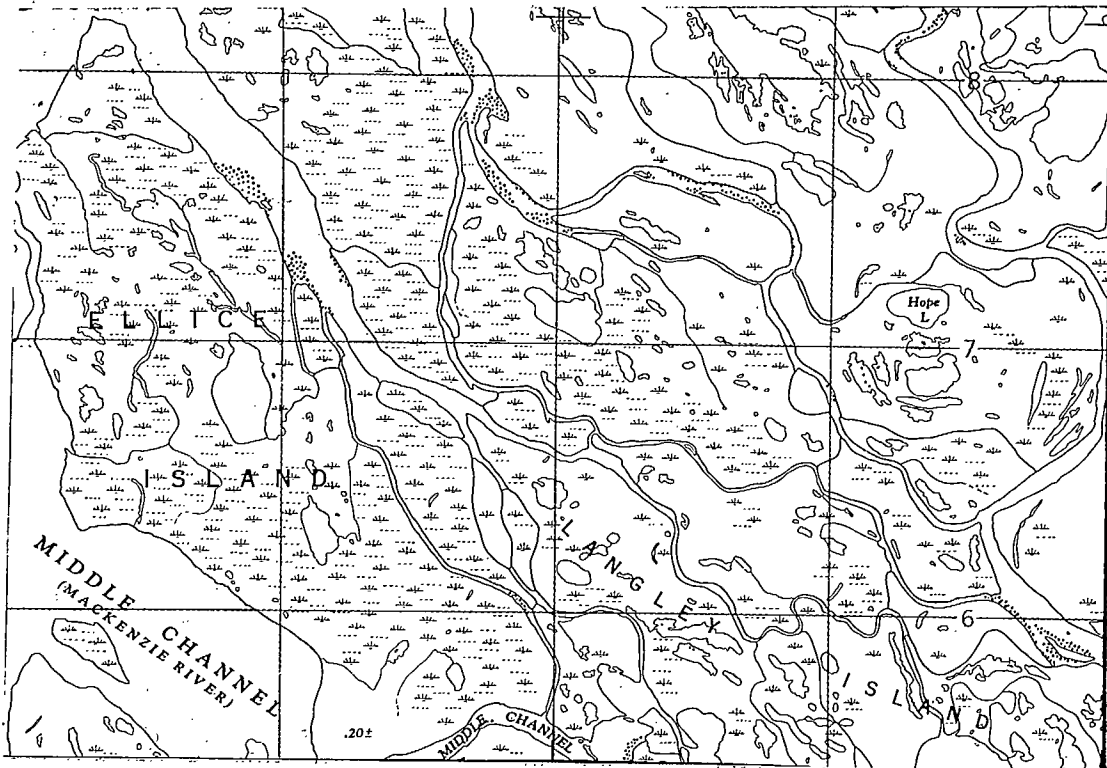
107C/2



107C/3



107C/4

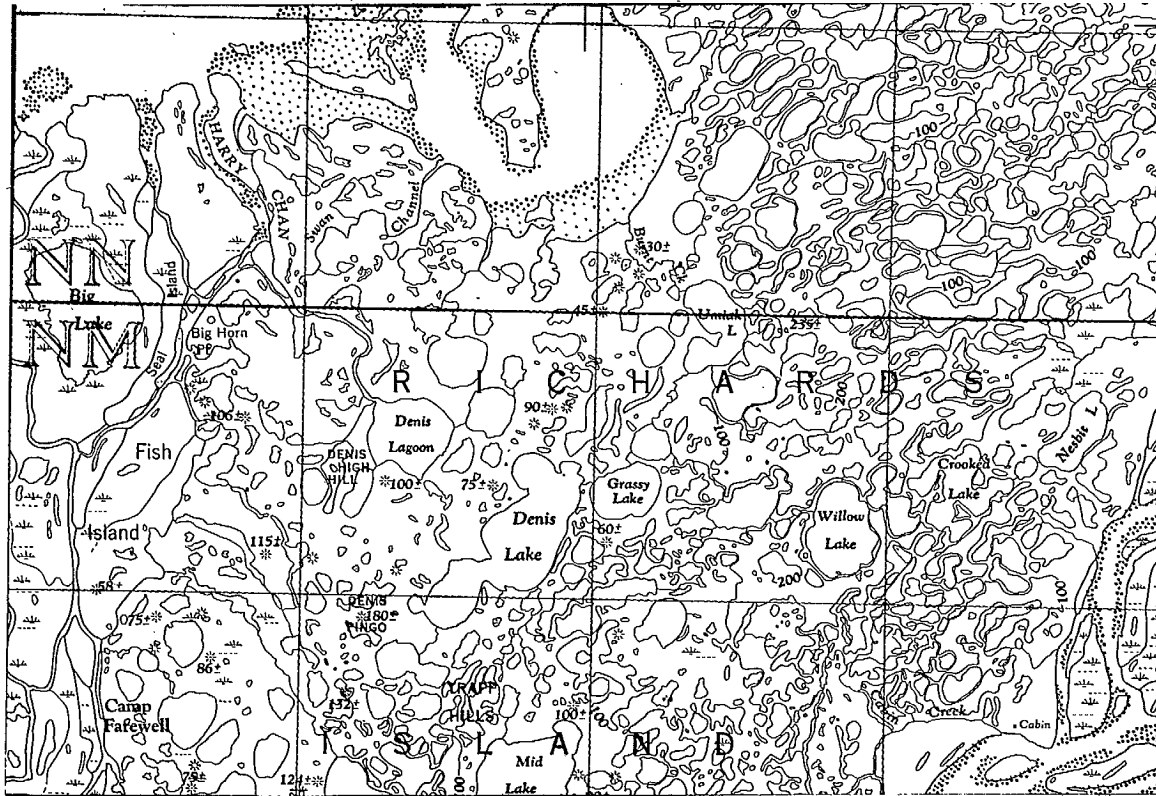


107C/5

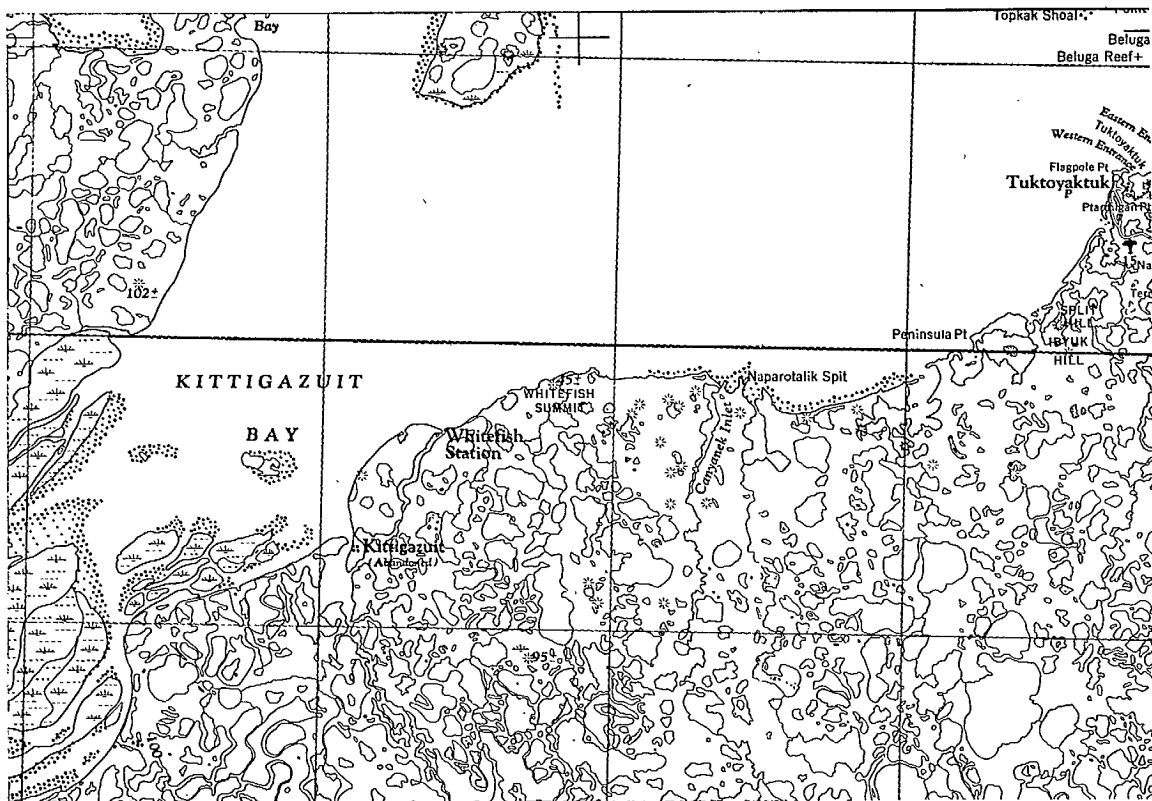




107C/6

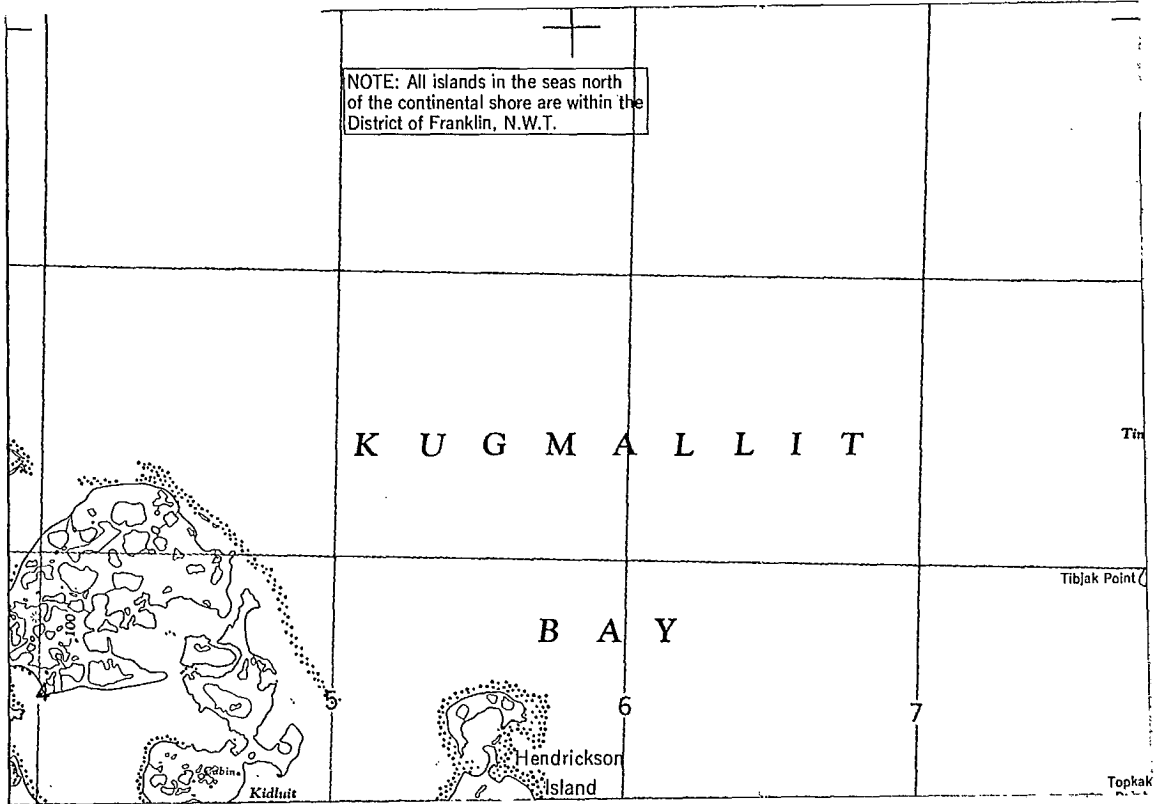


107C/7

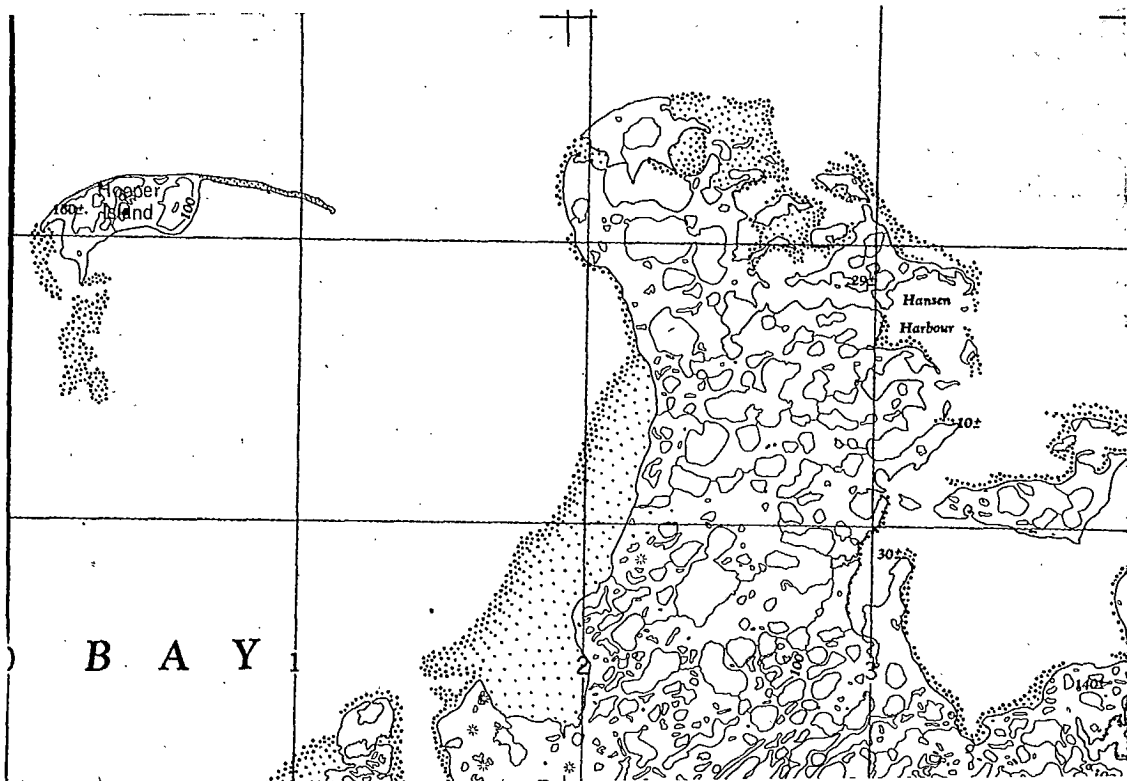


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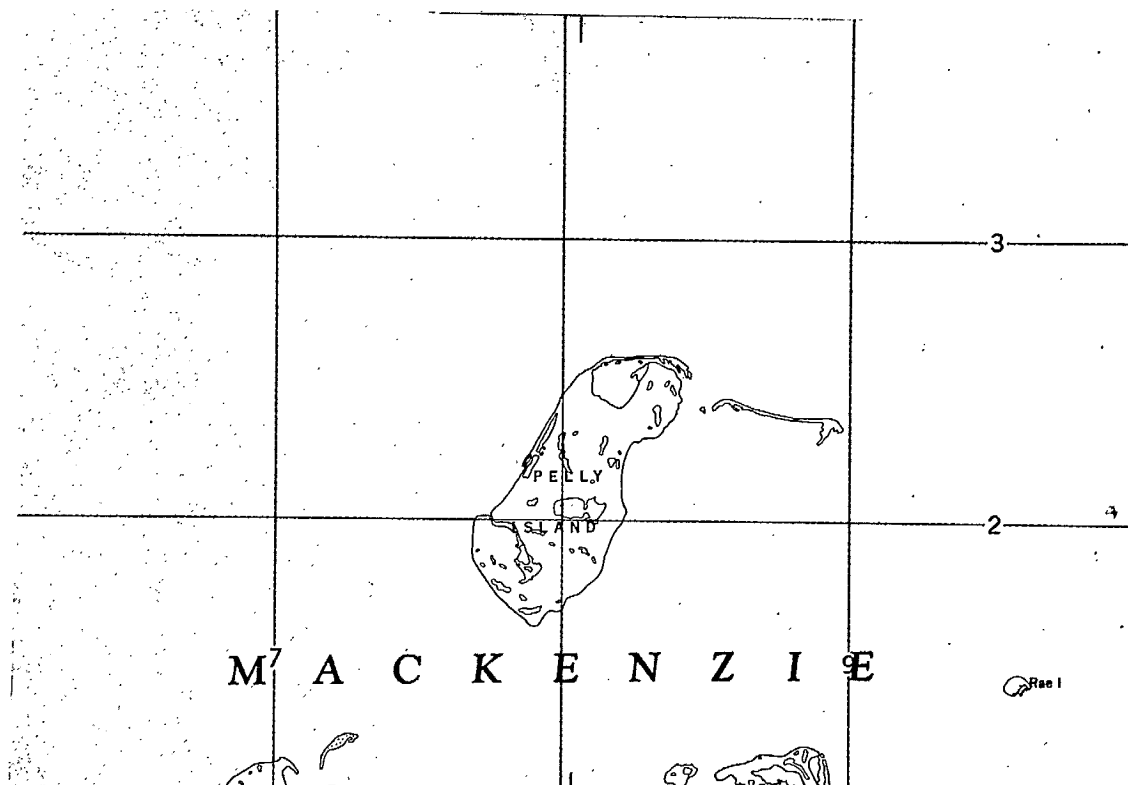
107C/10



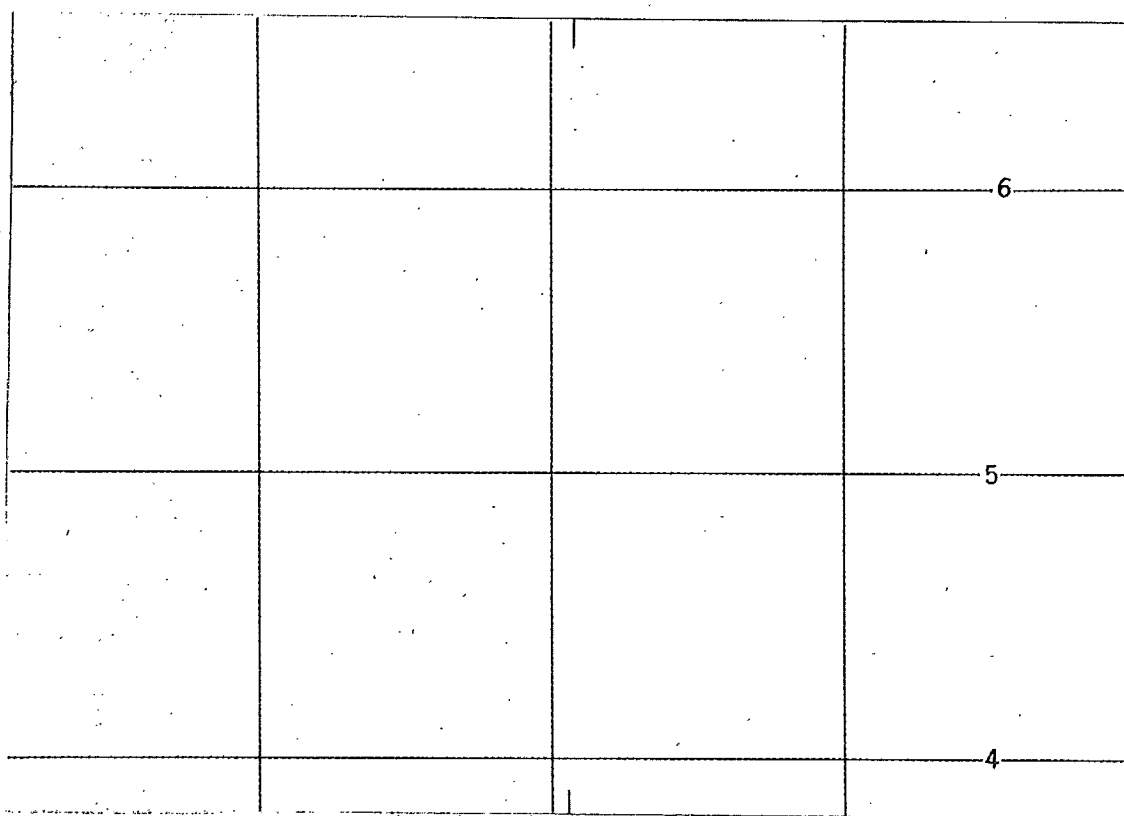
107C/11



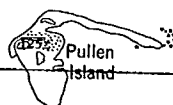
107C/12



107C/13



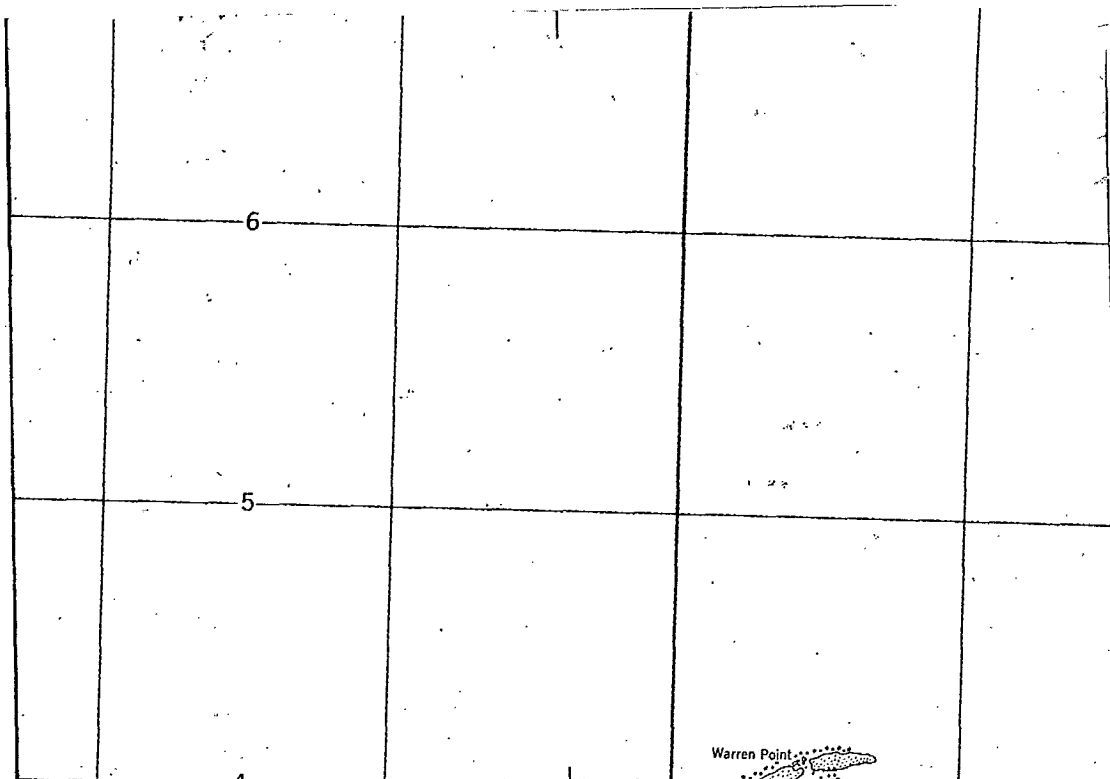
107C/14

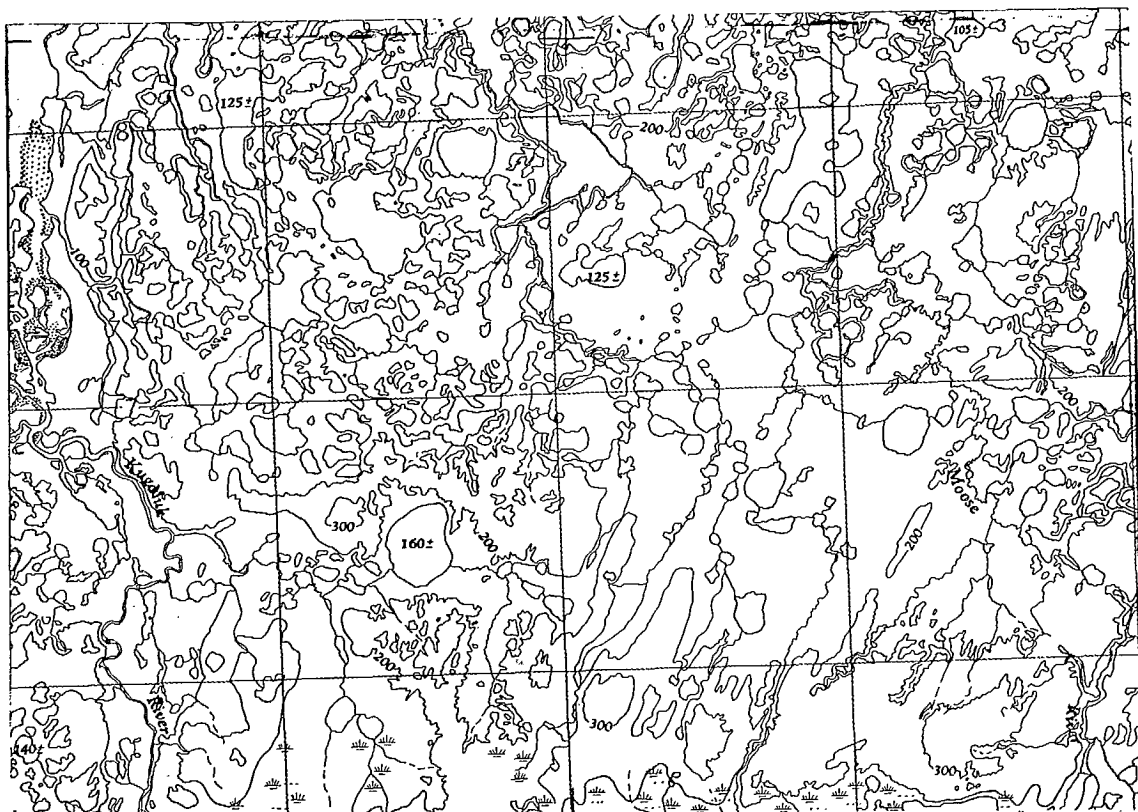
107C/15

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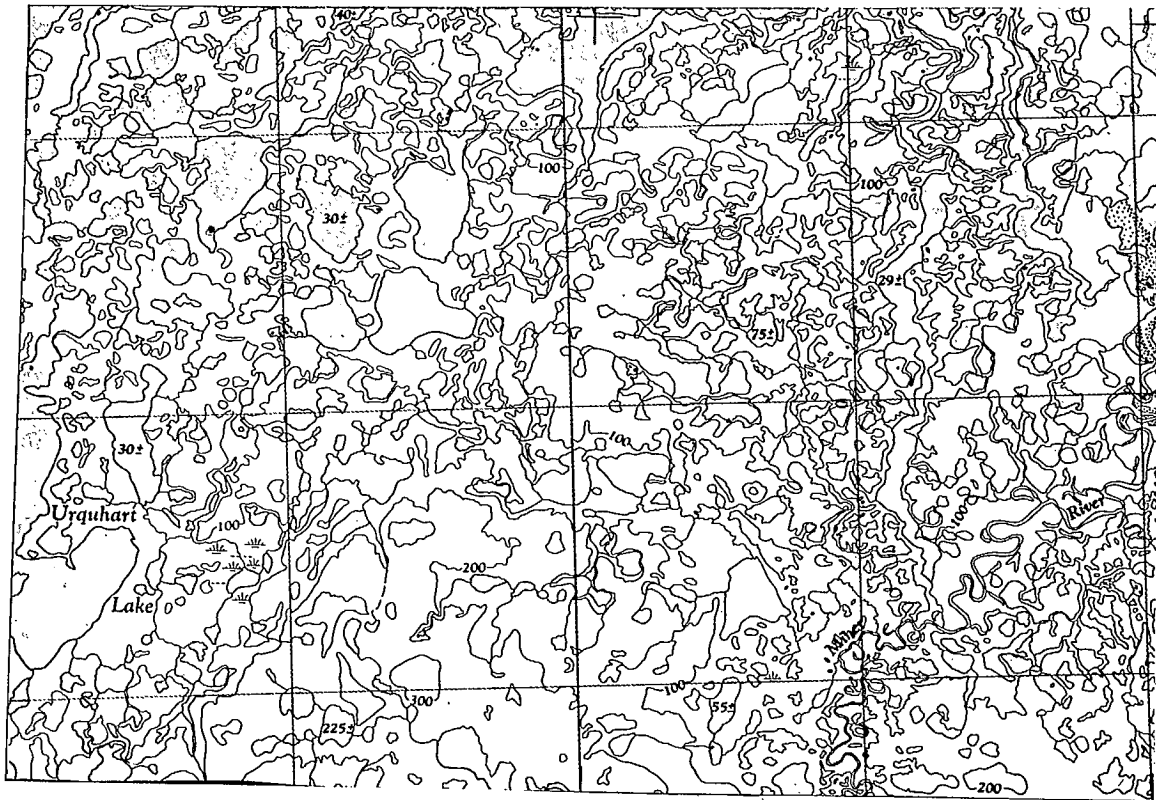
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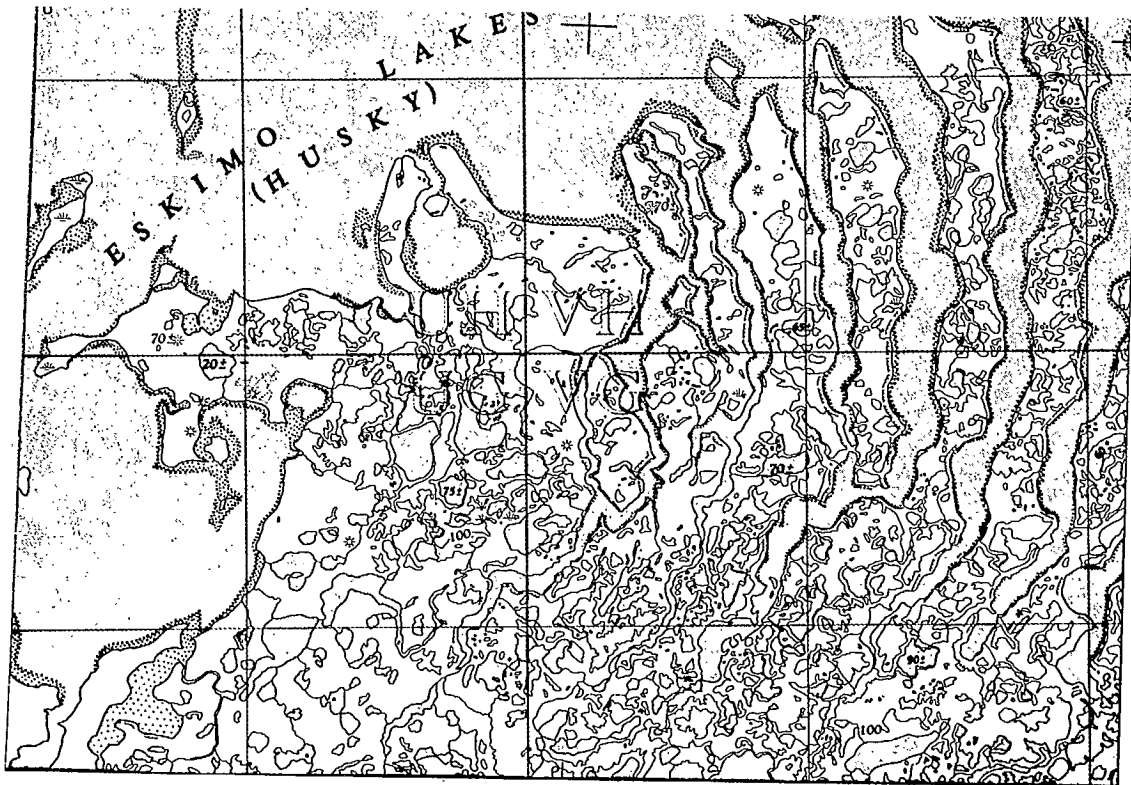
107D/3



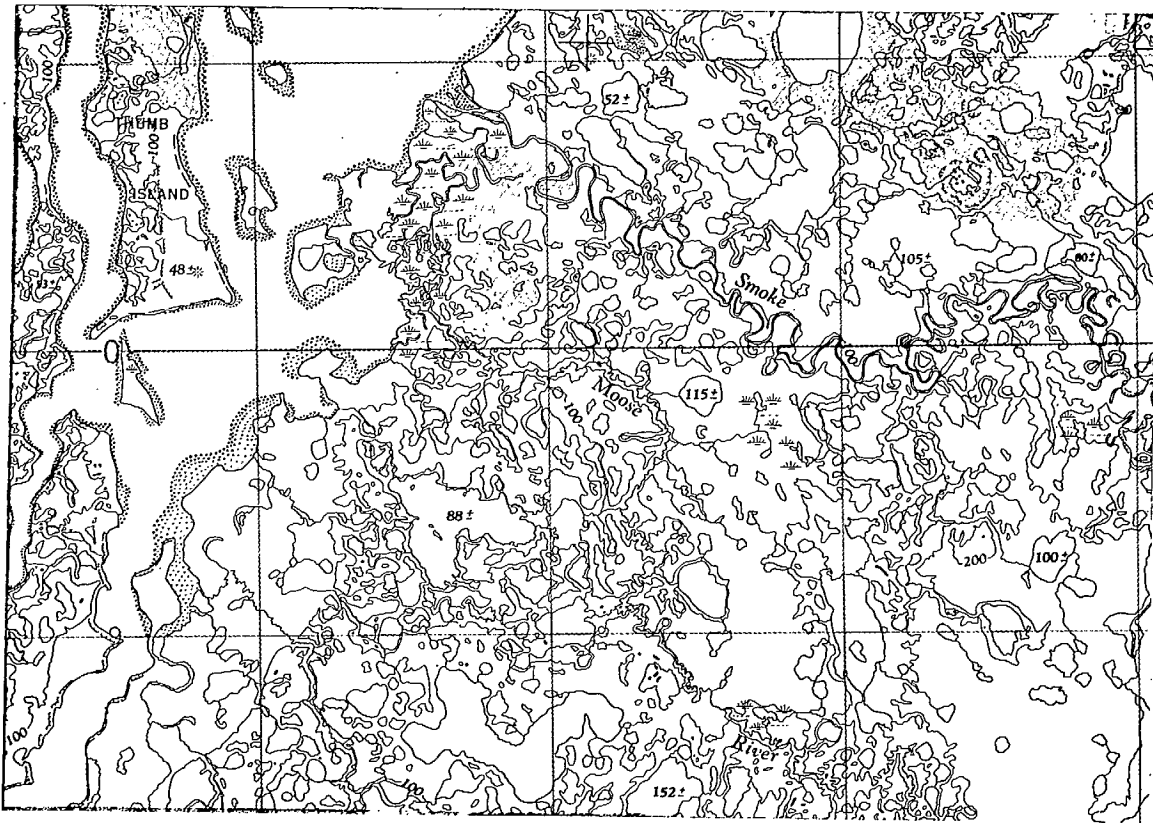
107D/4



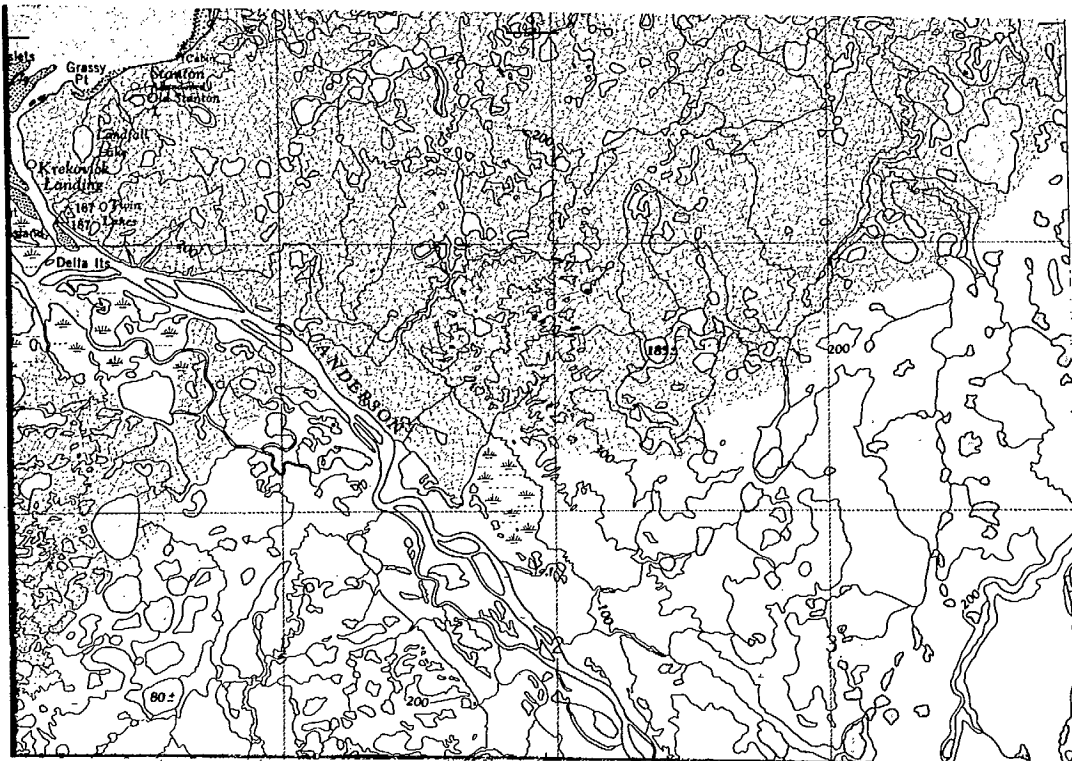
107D/5



107D/6



107D/9

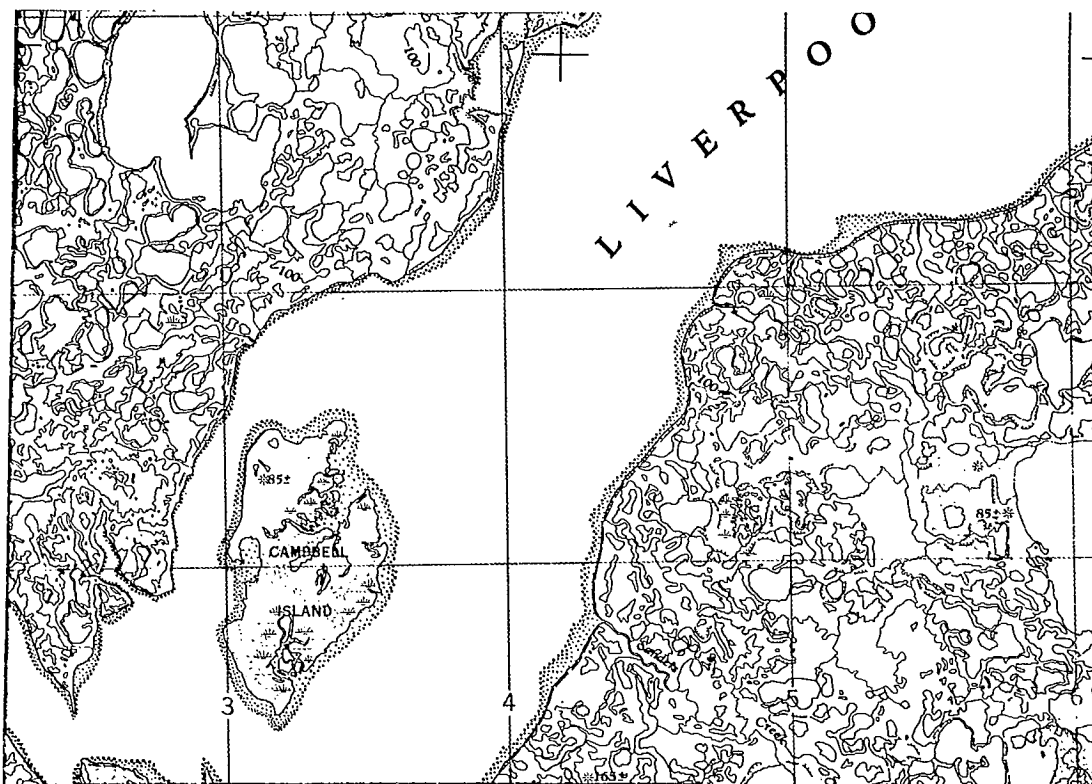




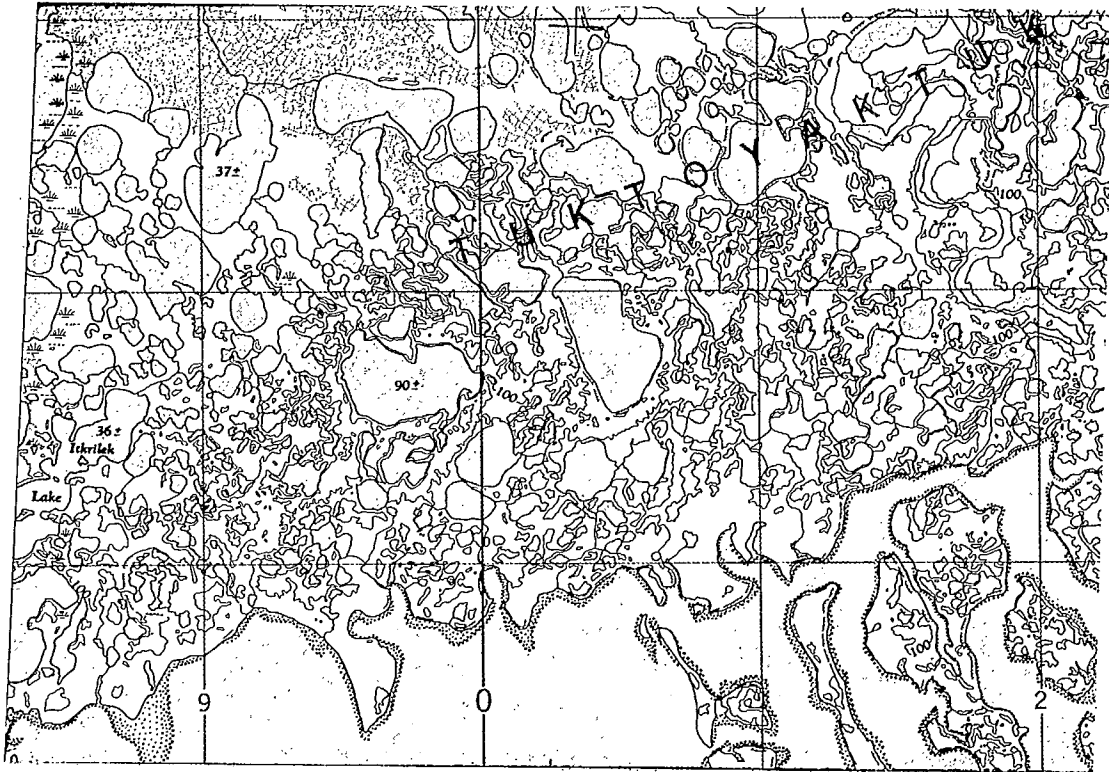
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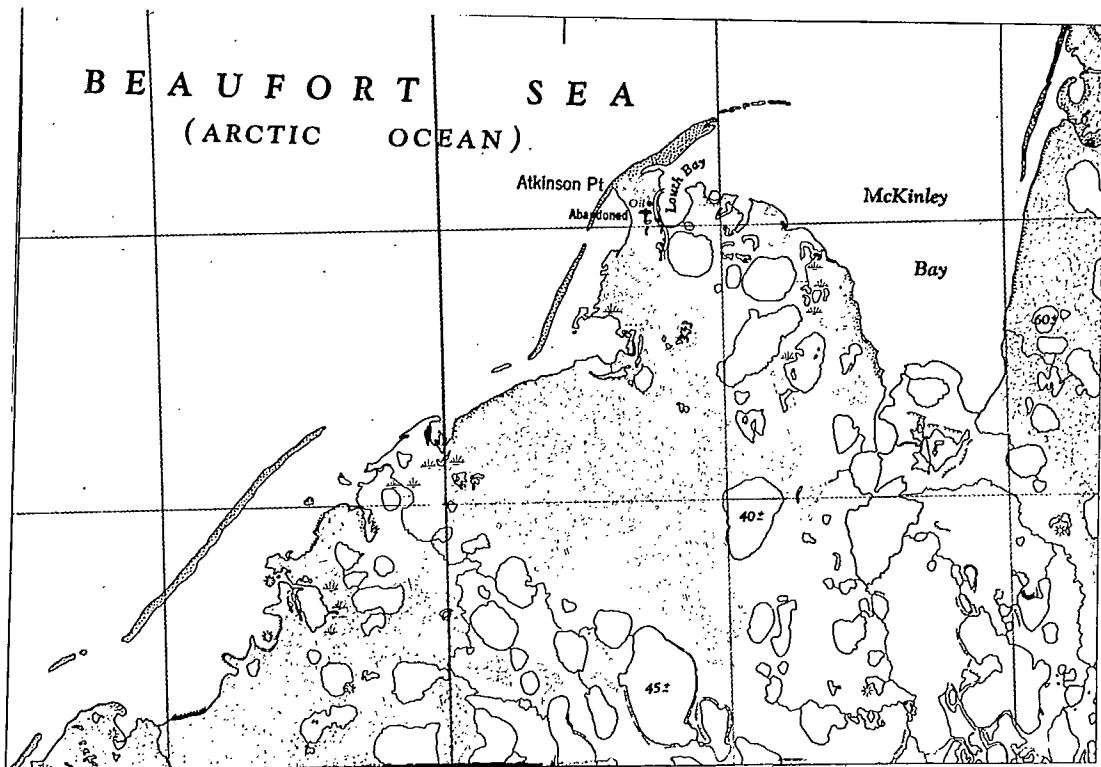
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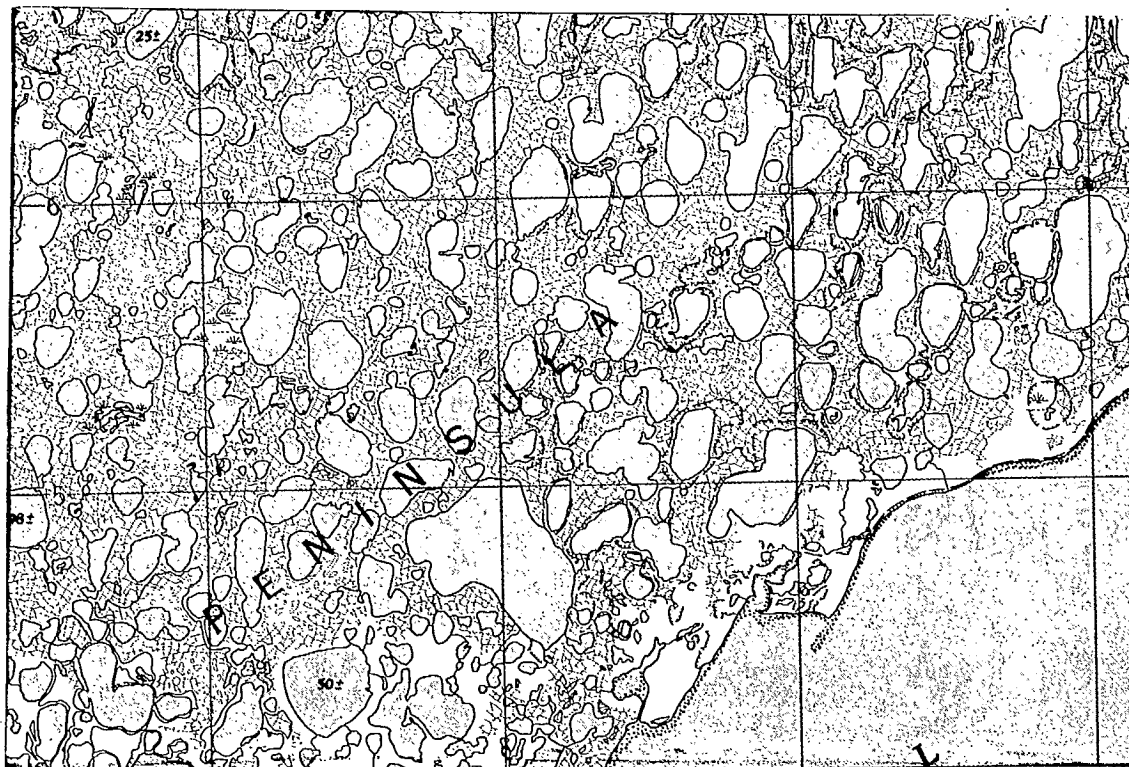
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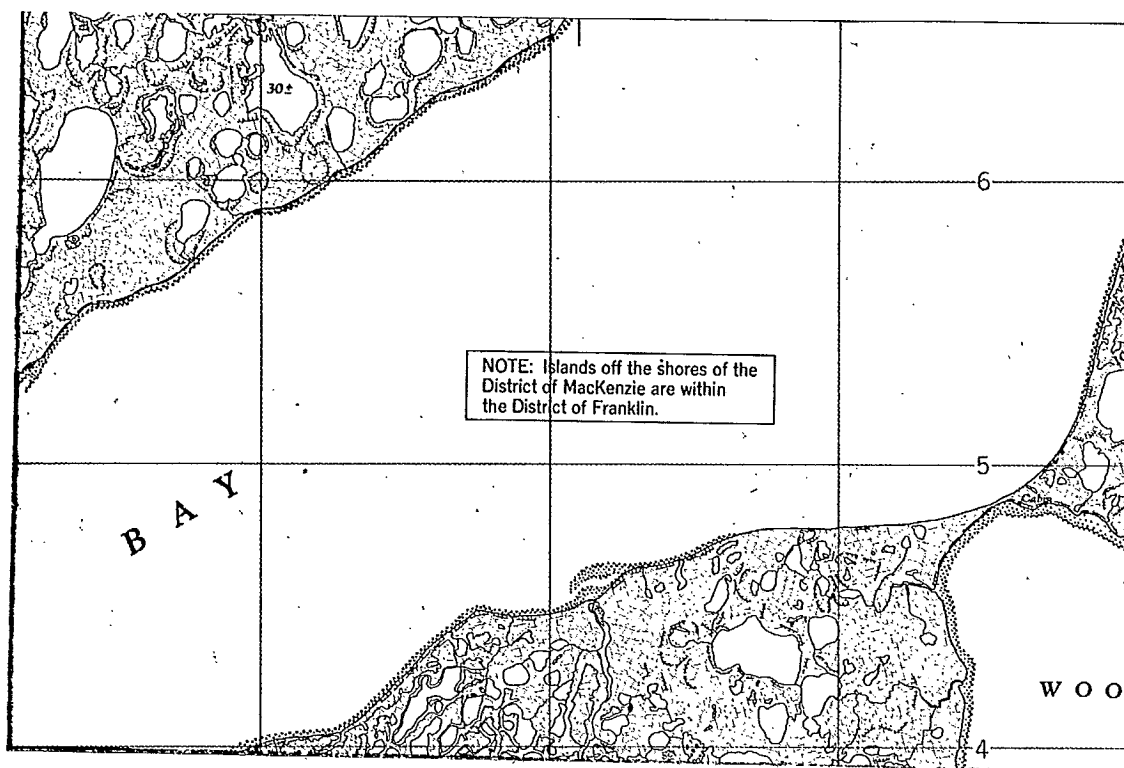
107D/13



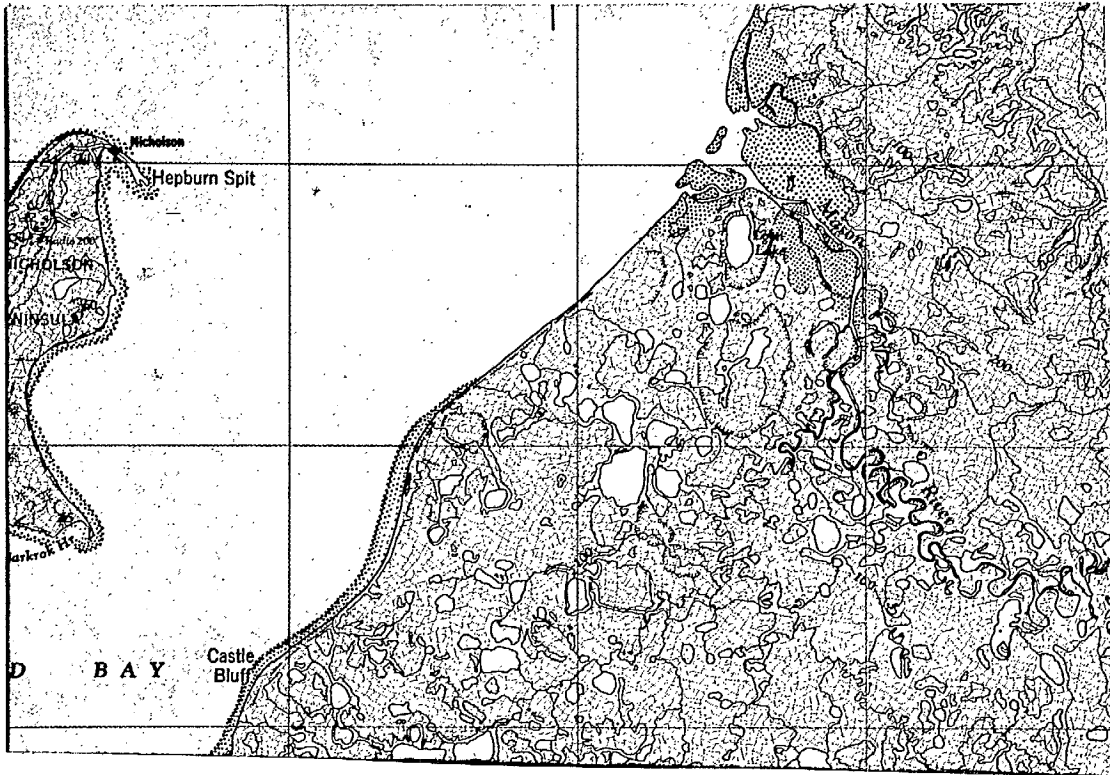
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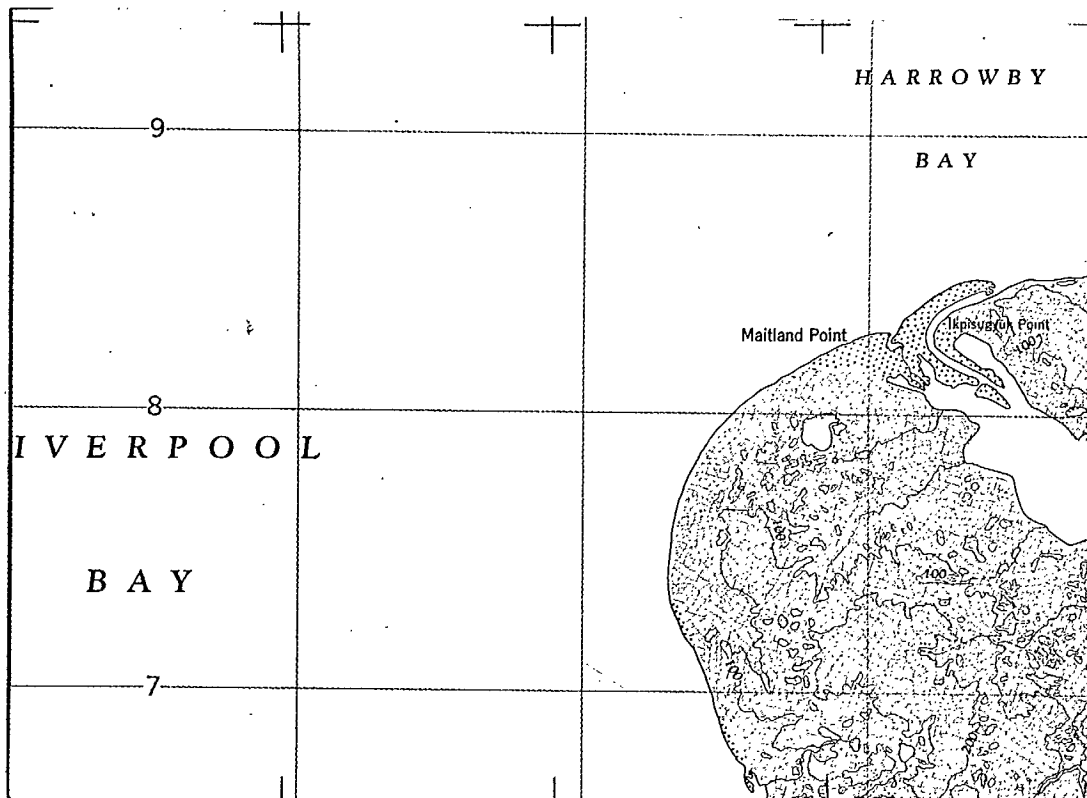
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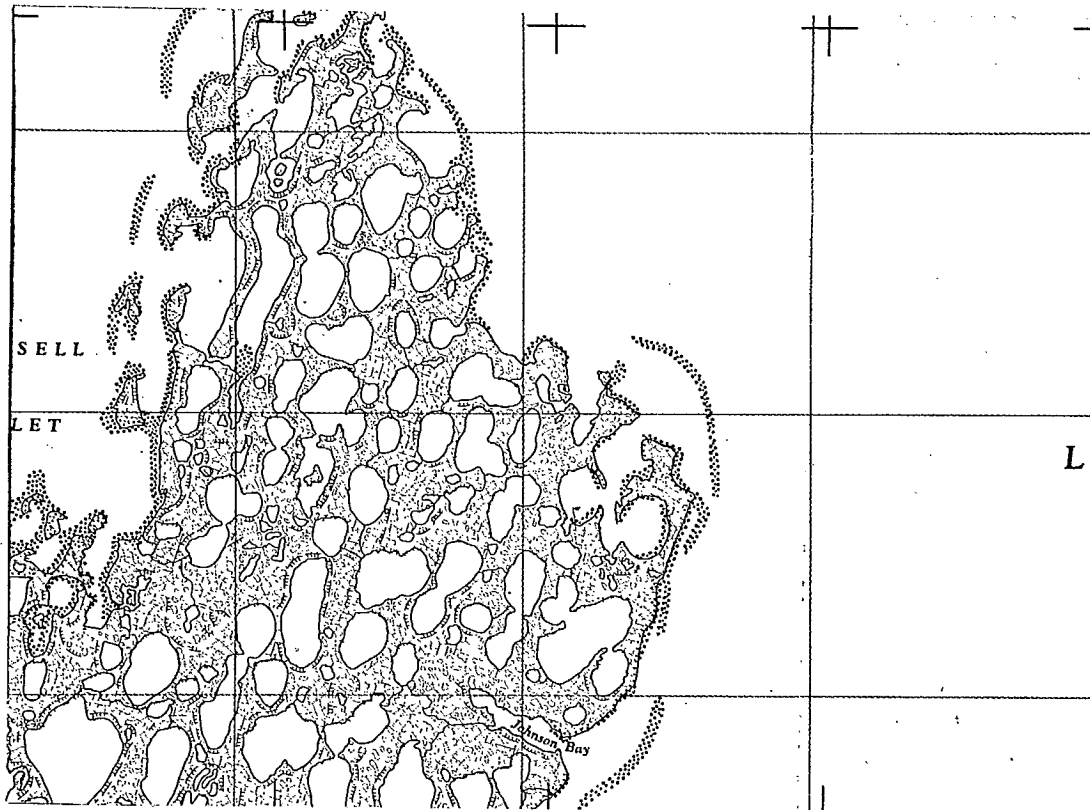
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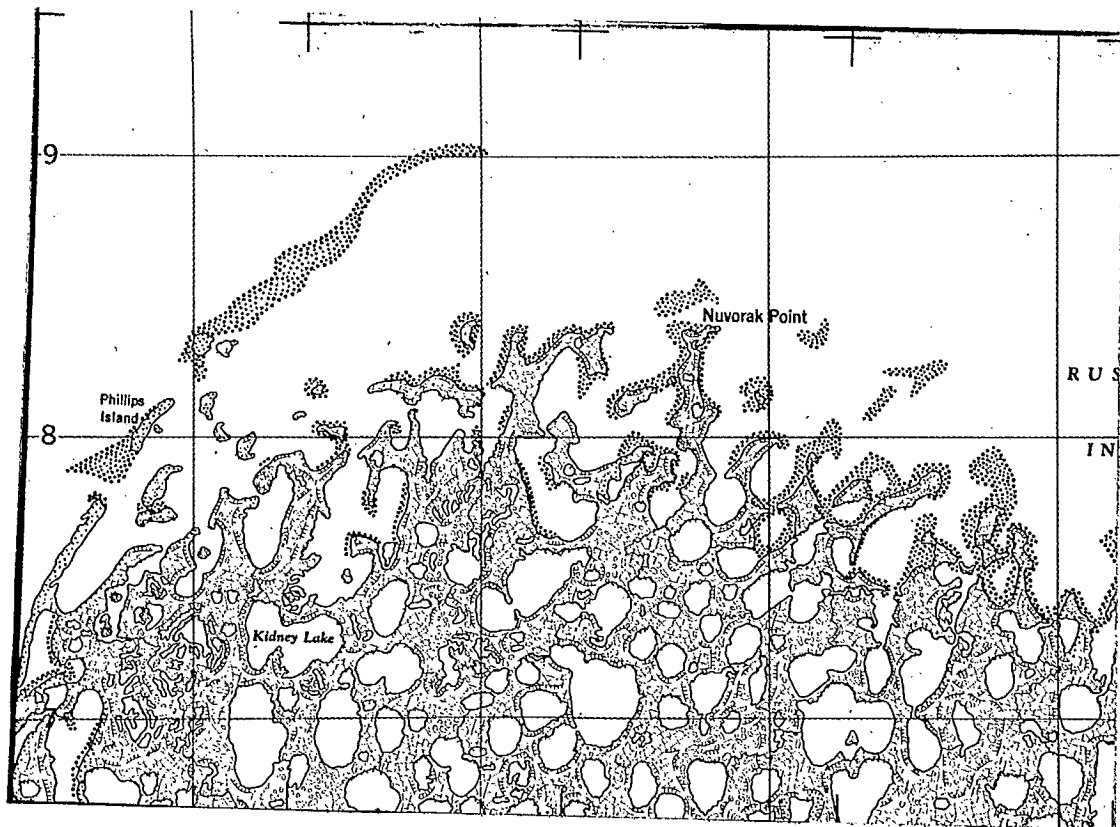
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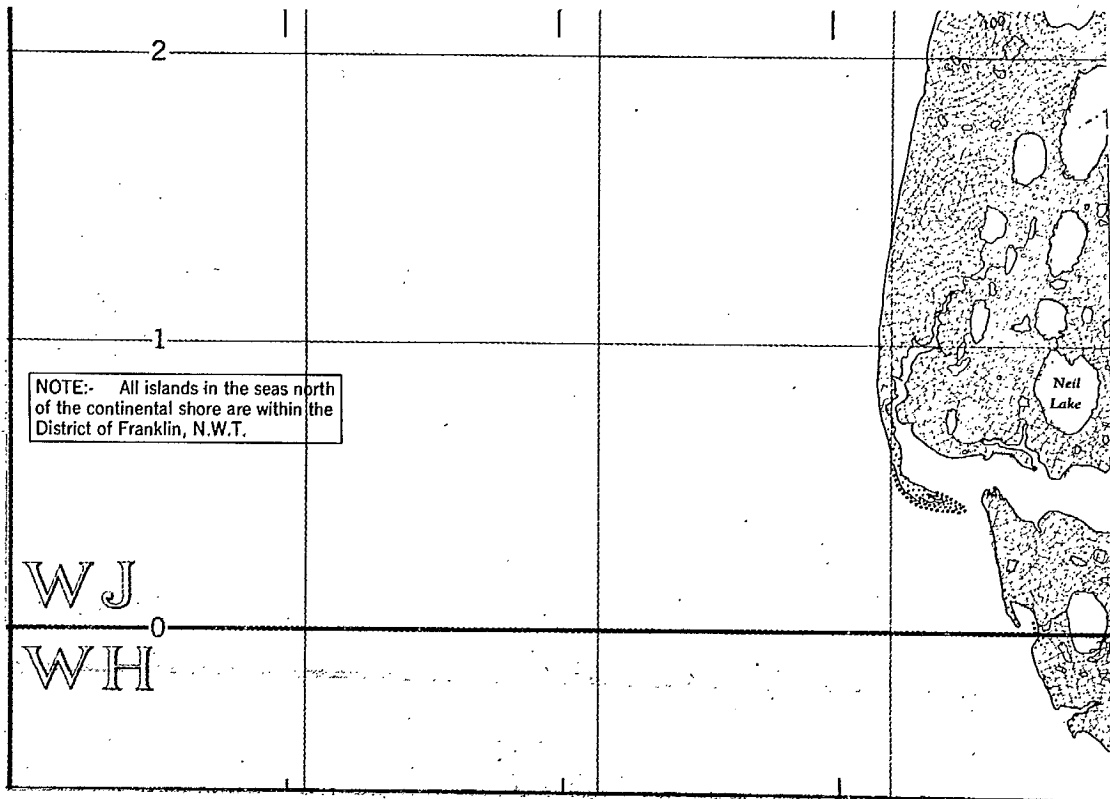
107E/2



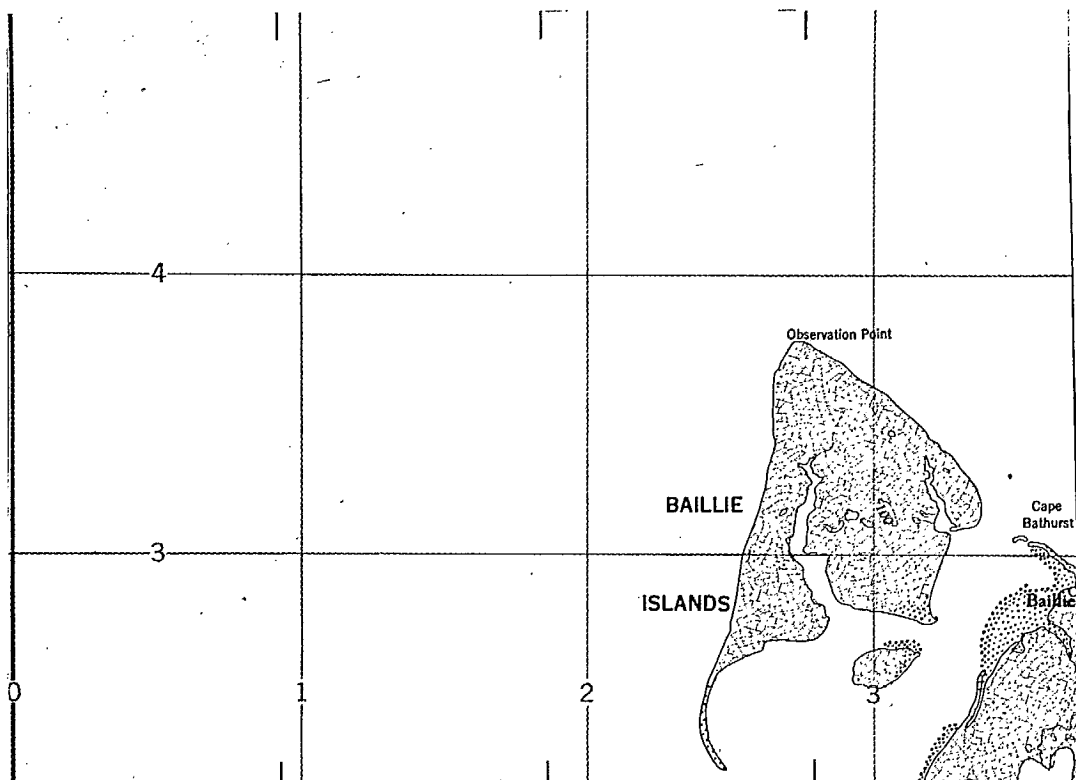
107E/3



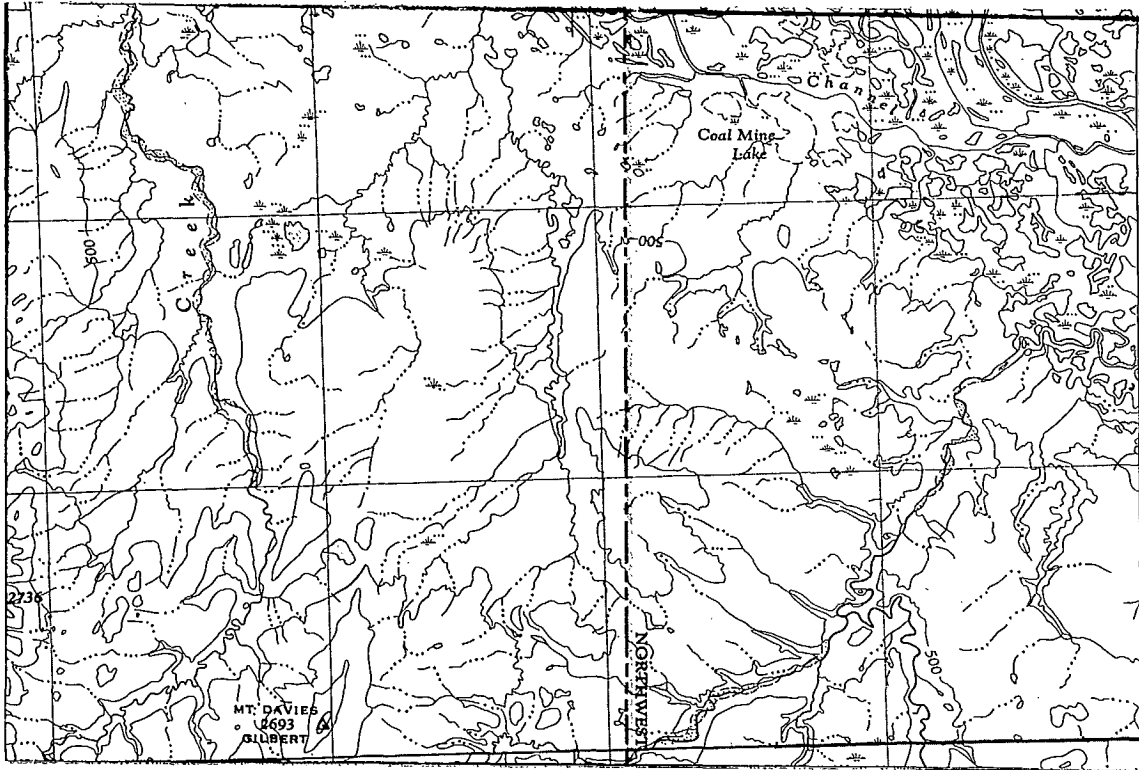
107E/8



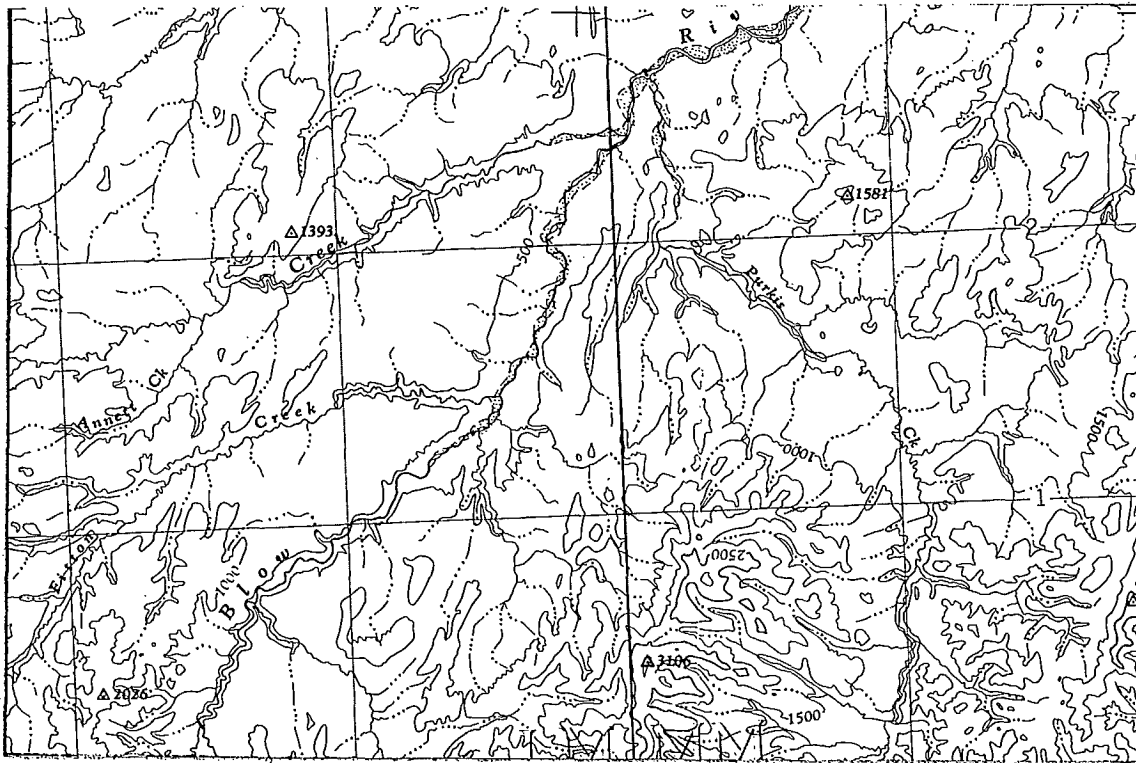
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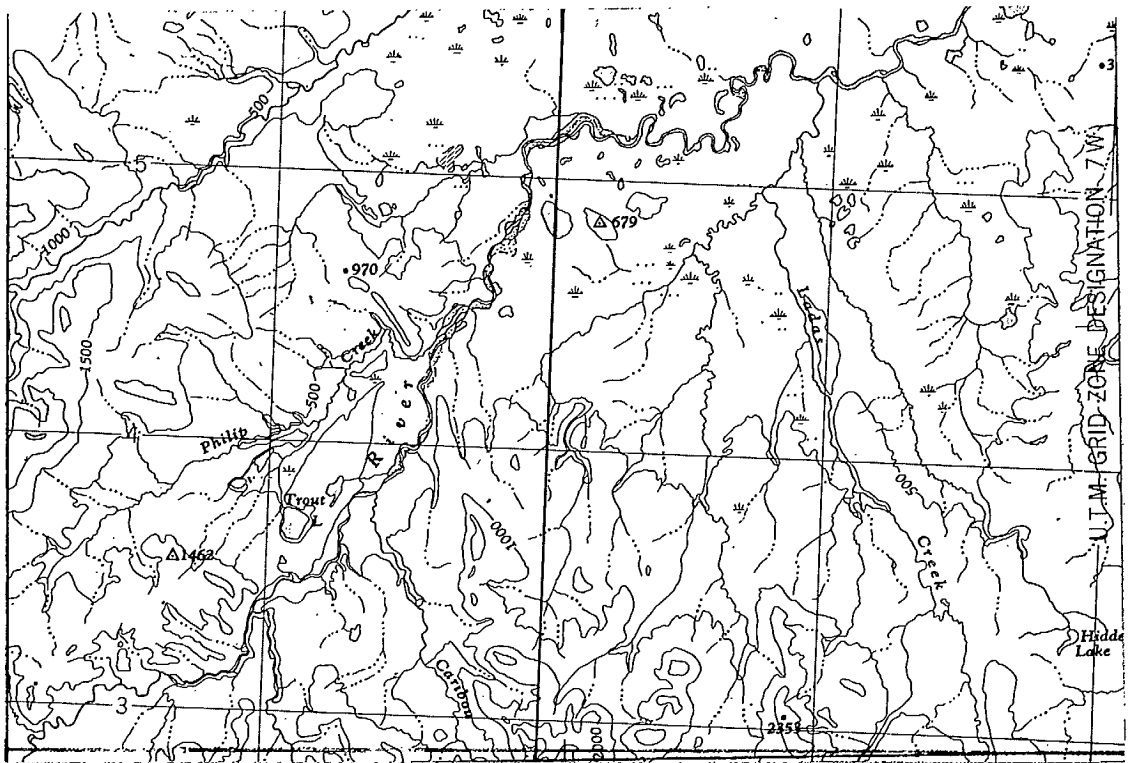
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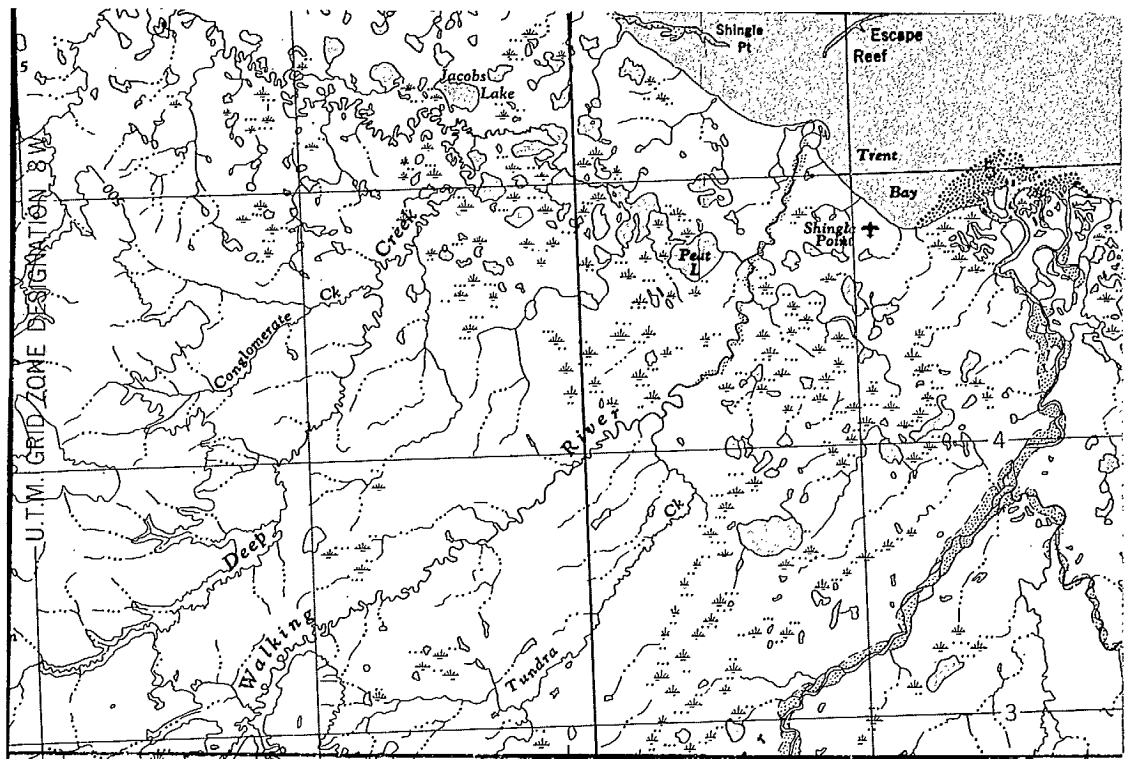
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117A/14

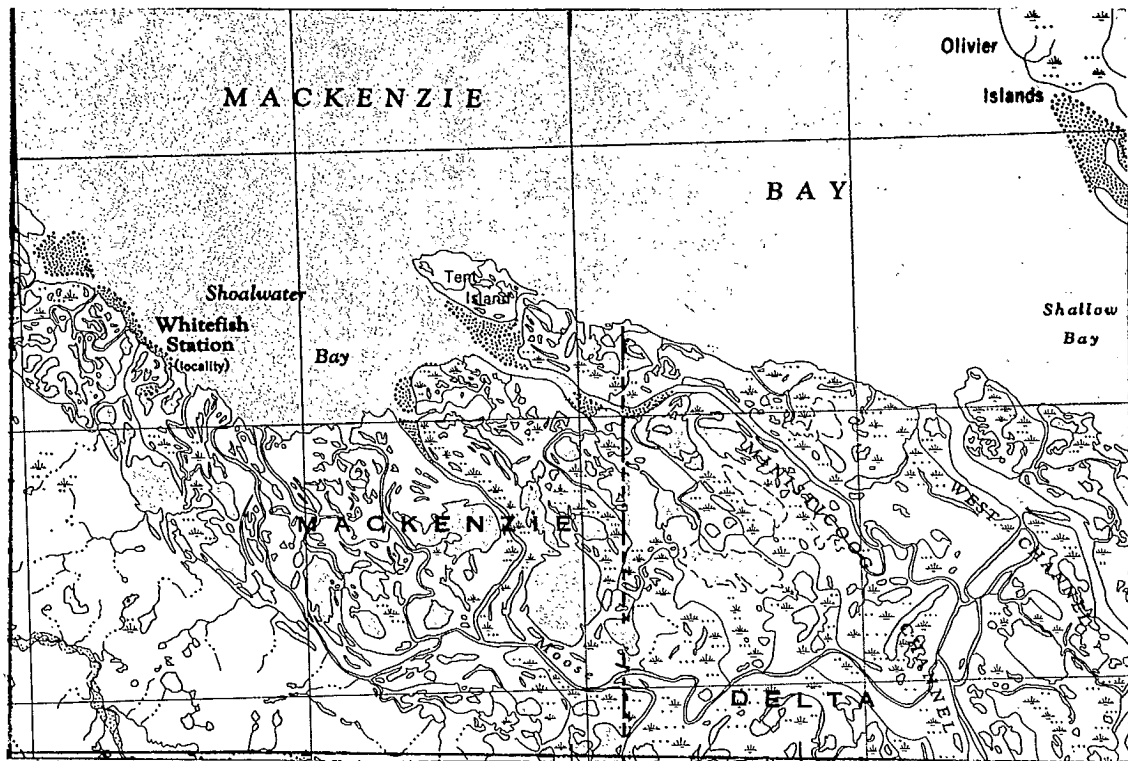


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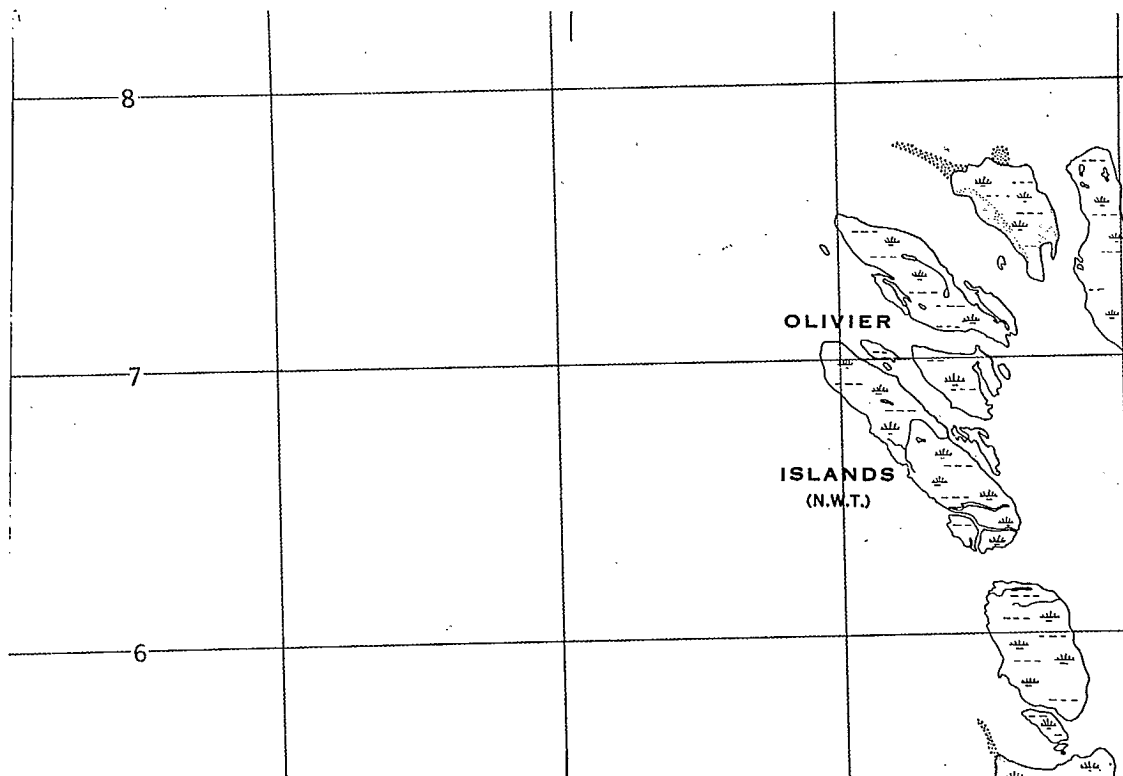




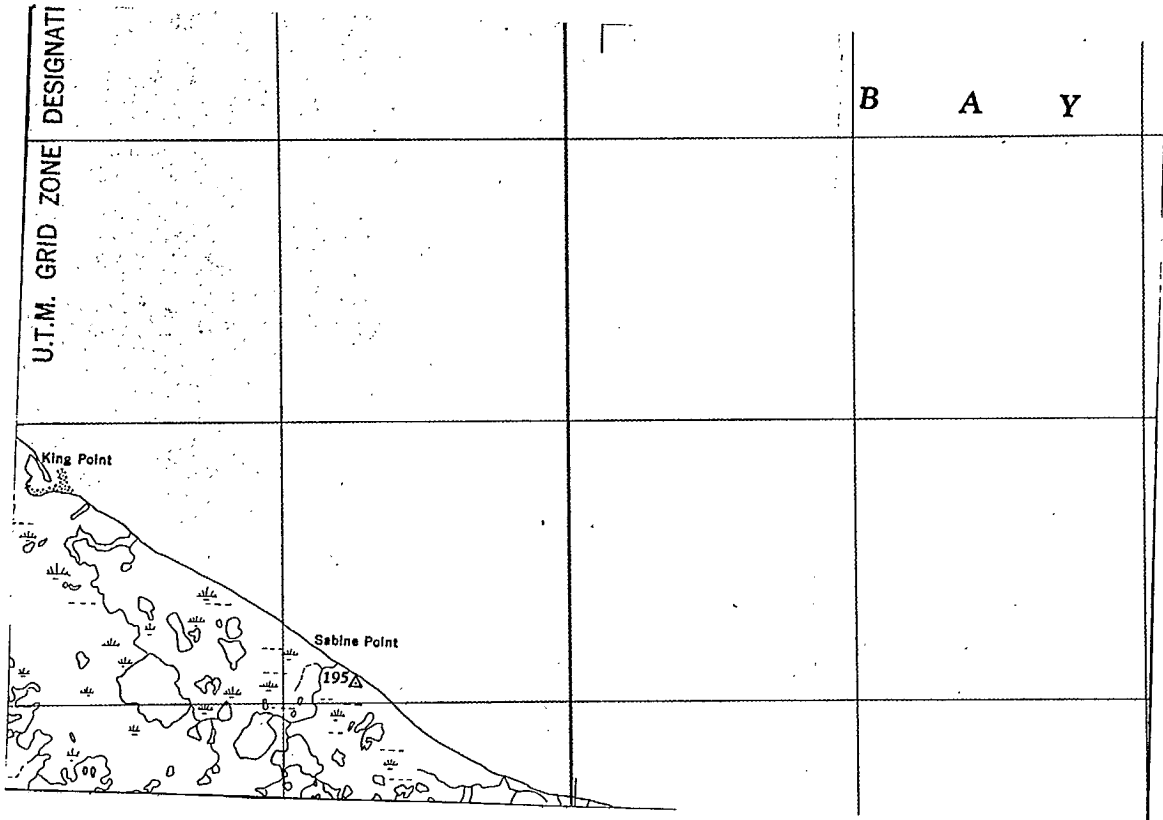
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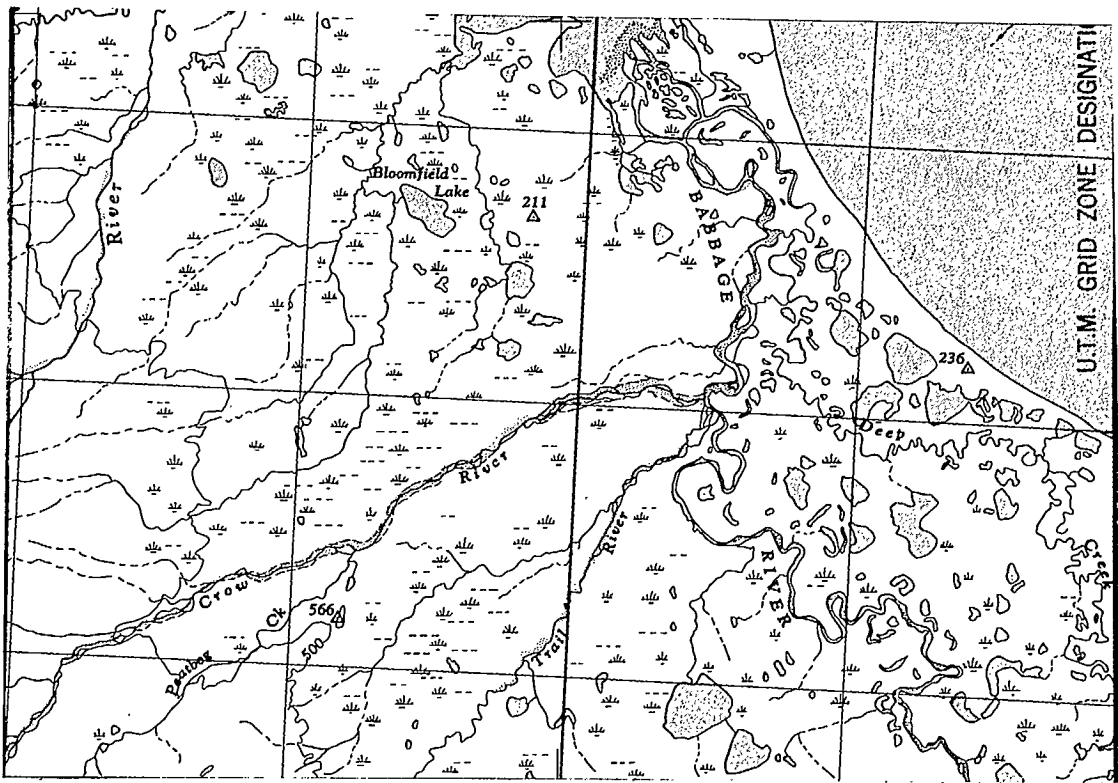
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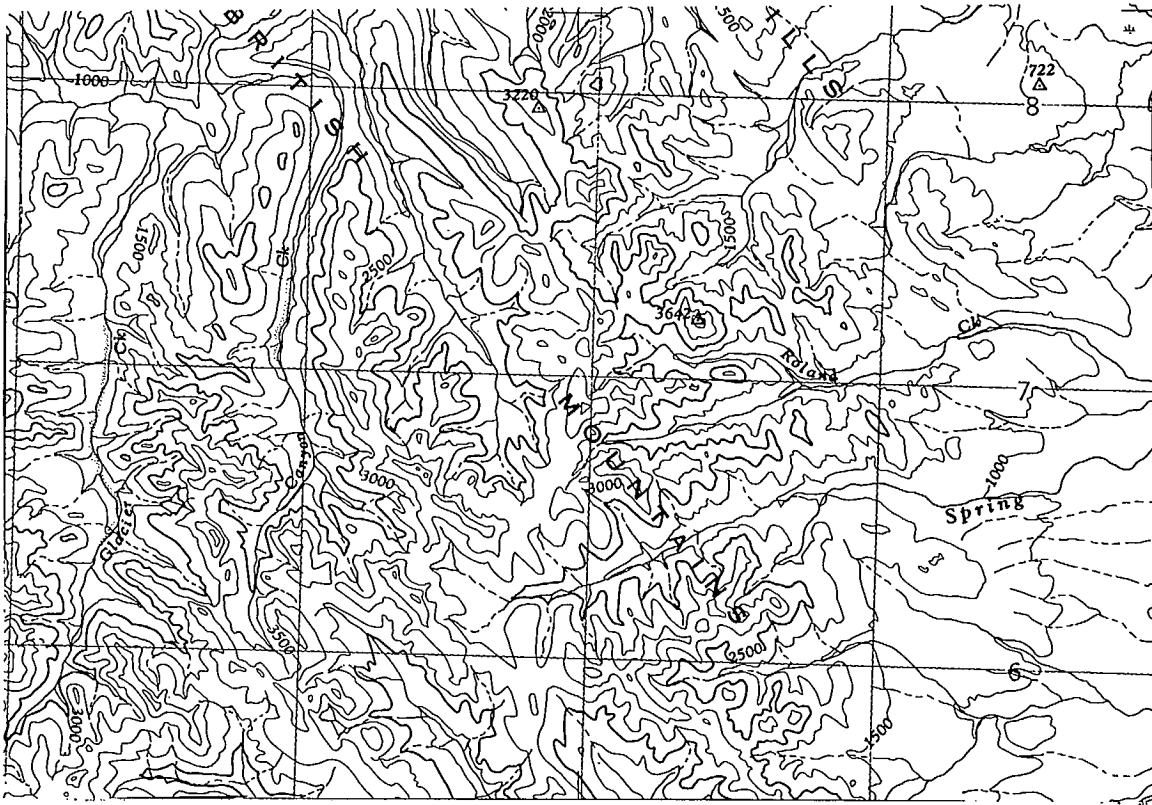
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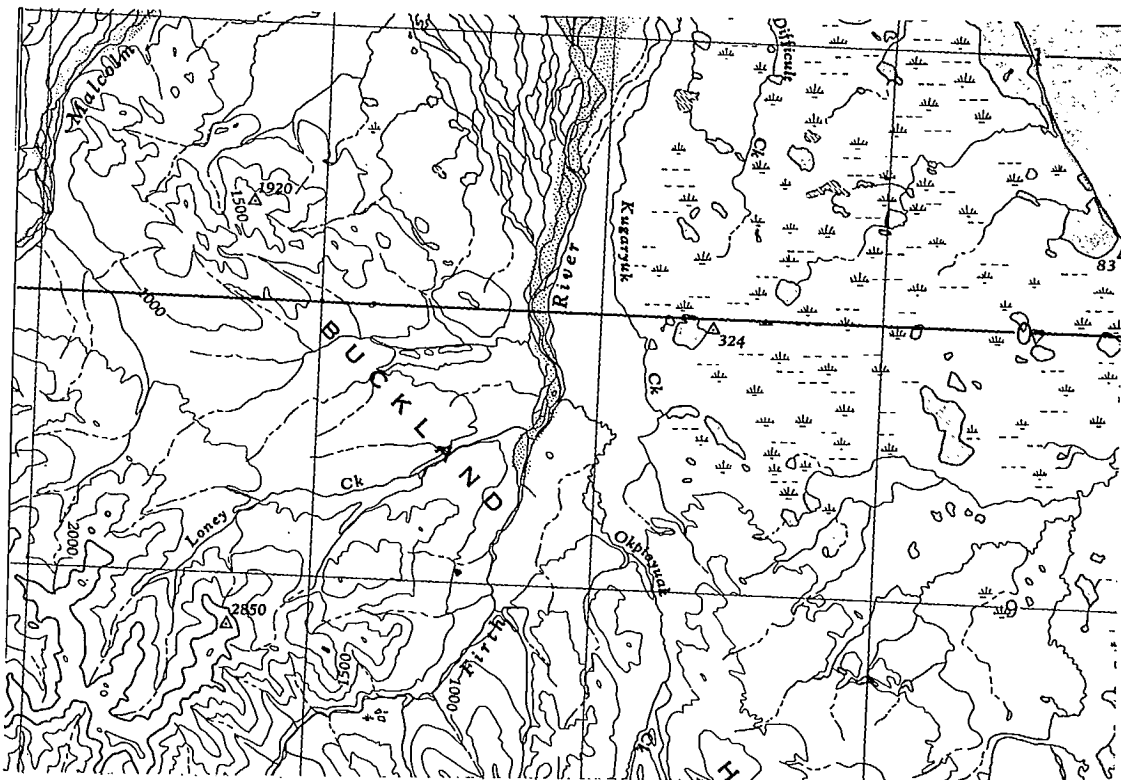
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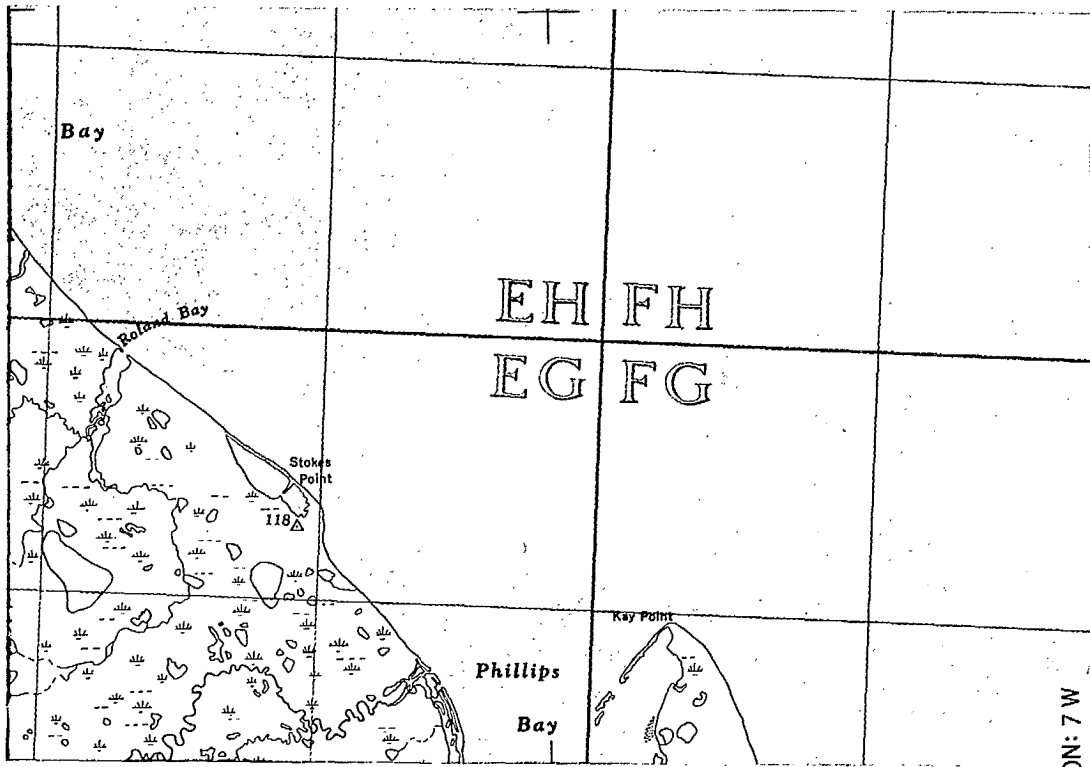
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117D/5



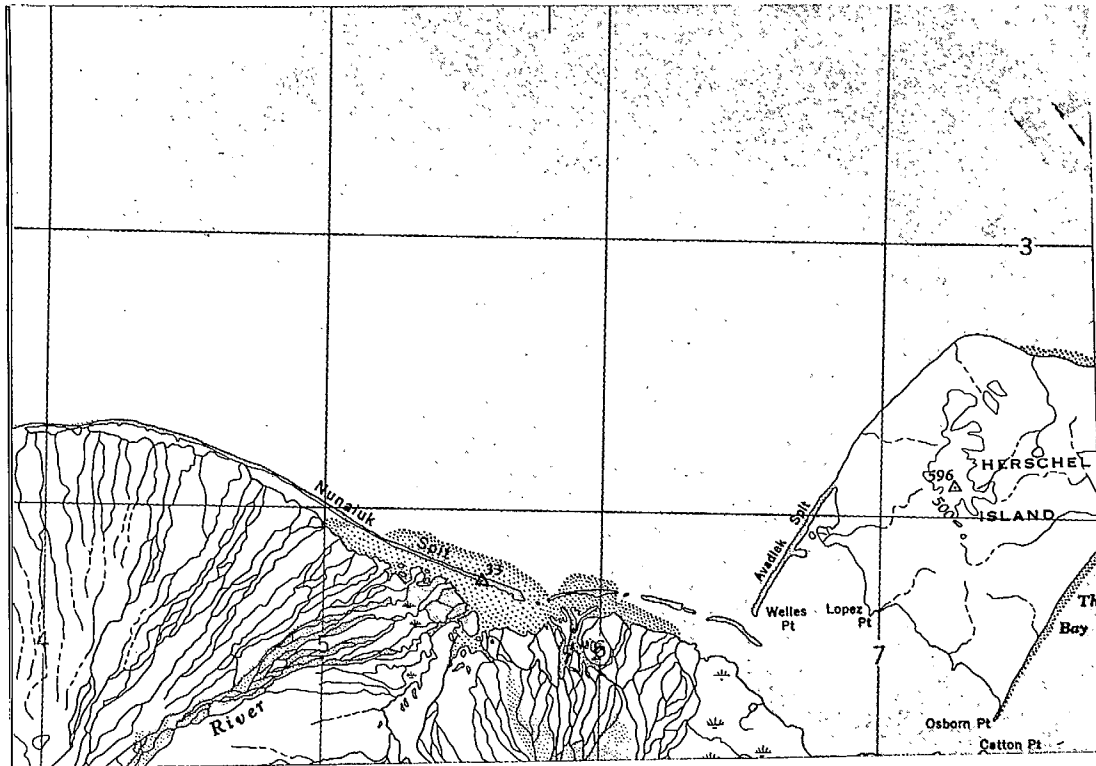
117D/6



117D/11



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