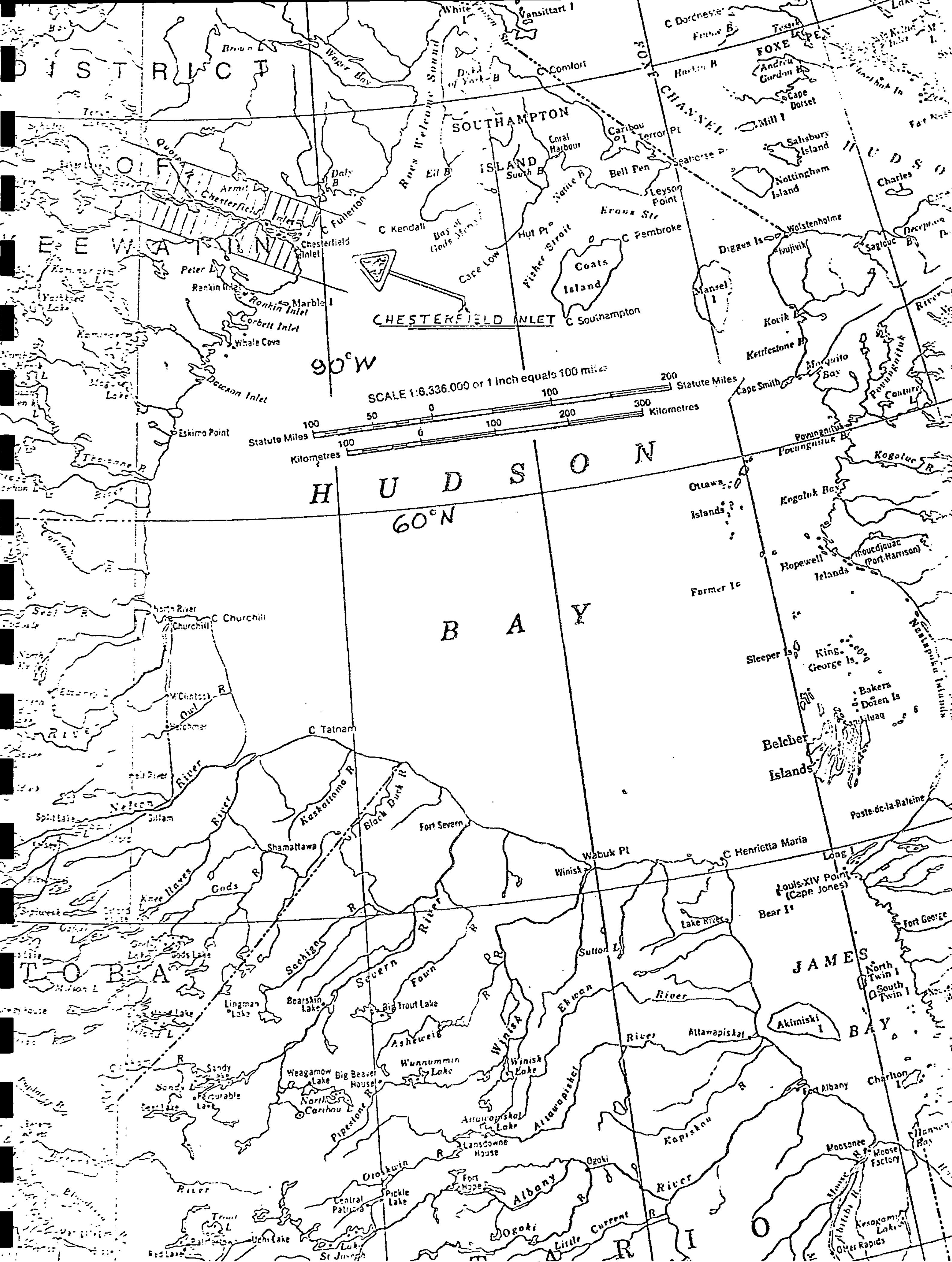
FINAL FIELD REPORT

CHESTERFIELD INLET SURVEY

PROJECT FILE NUMBER 6600-73-5

1974


DISTRICT
OF
KEEWATIN
TOBA
HUDSON
BAY
JAMES
BAY
CHESTERFIELD INLET
90°W
60°N
SCALE 1:6,336,000 or 1 inch equals 100 miles
Statute Miles
Kilometres
100
50
0
100
200
300
SOUTHAMPTON
ISLAND
Coats
Island
Mansel
Akimiski
Belcher
Islands
Ottawa
Islands
Hopewell
Islands
Sleeper Is
King George Is
Bakers
Dozen Is
Salisbury
Island
Nottingham
Island
FOXE
CHANNEL
C Comfort
C Dorchester
Wager Bay
Roes Welcome Sound
C Fullerton
Chesterfield
Inlet
C Kendall
Rankin Inlet
Marble I
Corbett Inlet
Whale Cove
Dawson Inlet
Eskimo Point
Churchill
C Churchill
North River
C Tatnam
Kaskattama R
Black Duck R
Fort Severn
Shamattawa
Gillam
Nelson
Hayes
Gods
Gods Lake
Knee
Sachigo
Severn
Fawn
Winisk
Wabuk Pt
C Henrietta Maria
Sutton L
Lake River
Ekwan
River
Attawapiskat
Attawapiskat Lake
Winisk Lake
Wunnummin Lake
Big Trout Lake
Bearskin Lake
Asheweig
Weagamow Lake
Big Beaver House
North Caribou L
Pipestone R
Lansdowne House
Sandy Lake
Favourable Lake
Lingman Lake
Otoskwin
Fort Hope
Central Patricia
Pickle Lake
Albany
Ogoki
Little Current
Kapiskau
Fort Albany
Moosonee
Moose Factory
Moose R
Abitibi R
Otter Rapids
Kesagami Lake
Charlton I
North Twin I
South Twin I
Bear Is
Fort George
Louis-XIV Point (Cape Jones)
Long I
Poste-de-la-Baleine
Sanikiluaq
Inoucdjouac (Port-Harrison)
Farmer Is
Kogaluk Bay
Kogaluc R
Povungnituk
Povungnituk B
Cape Smith
Mosquito Bay
Kettlestone B
Kovik B
Ivujivik
Wolstenholme
Digges Is
Sagluc B
Deception B
Charles I
Leyson Point
Evans Str
C Pembroke
Fisher Strait
Hut Pt
Cape Low
C Southampton
Bay of Gods Mercy
Coral Harbour
South B
Native B
Bell Pen
Caribou I
Terror Pt
Seahorse Pt
Mill I
Cape Dorset
Andrew Gordon B
Foxe B
Vansittart I
Duke of York B
Eli B
Daly B
Peter L
Armit L
Chesterfield Inlet
Quoich R
Thlewiaza R
Seal R
Owl
M'Clintock R
Herchmer
Split Lake
Uchi Lake
Red Lake
St Joseph
Trout L
Ogoki
ONTARIO

CONTENTS

FOREWORD

The northwestern coast of Hudson Bay between Churchill and Roes Welcome Sound comprises over 300 miles of glacier scarred, gently shelving shoreline - its monotone sameness broken only be the occasional finger-like inward penetration of the seas.

For centuries, the rugged hostile shoreline was unknown; its harsh forbidding climate and limited food resources discouraging all but nomadic Eskimaux who used the products of the sea to supplement a basic caribou diet. As explorers, traders, missionairies, and whalers penetrated the area in the 17th and 18th centuries, they were slowly able to piece together information which partially defined the coastline and adjacent waters.

Today, the rugged bleakness still persists, and the featureless shoreline remains - its monotone colour broken occasionally by mineral pigmentation or developing summer vegetation. Eskimo cairns and abandoned camps still dot the horizon, marking a water route or disclosing a mystique of previous occupation. Except where industrialized man has struck his towers, the "sameness" remains; and, although the land has been detailed by aerial photography, and the surrounding waters have been partially surveyed, the area remains unspoiled and largely unexplored.

The northwestern coastline acts as a buffer between the seas of Hudson Bay and the Keewatin Barren Lands. It has been settled to the extent of four major Eskimo communities: Eskimo Point, Whale Cove, Rankin Inlet and Chesterfield Inlet. Its Precambrian topography is broken by several incisions which penetrate the Barren Lands, and provide navigational access routes deep into the interior. The major incision, a waterway which extends 180 miles into the Barren Lands, is the Chesterfield Inlet - Baker Lake complex.

This report focuses exclusively on Chesterfield Inlet, a 124 nautical mile ribbon of navigable waters joining Hudson Bay to Baker Lake.

HISTORY OF CHESTERFIELD INLET

The earliest recorded mention of CHESTERFIELD INLET was made by Christopher Middleton*, a British navigator, who in 1742 observed the INLET on a southward passage from REPULSE BAY (see attached sketch).

MIDDLETON had been a Captain in the HUDSON'S BAY COMPANY service. In 1741, political inducements persuaded the British Admiralty to mount an expedition to seek a passage joining HUDSON BAY to the PACIFIC OCEAN. MIDDLETON resigned from the COMPANY and took charge of an expedition using two vessels to explore the west coast of HUDSON BAY, north of CHURCHILL. He wintered at FORT PRINCE OF WALES, which was then under construction. In the summer of 1742, he sailed northward with the sloop FURNACE and the pink DISCOVERY, working his way as far north as REPULSE BAY and FROZEN STRAIT.

During his northward passage, MIDDLETON investigated WAGER BAY, ROES WELCOME SOUND, and REPULSE BAY, concluding, unhappily, that neither offered any hope as an access route to the PACIFIC. However, his voyage was not a complete loss, as he accurately charted much of the unknown western coast and proved that SOUTHAMPTON ISLAND was indeed insular. On his return southward in 1742, MIDDLETON noted CHESTERFIELD INLET, but failed to explore it, probably due to its landlocked seaward appearance. When MIDDLETON returned to England, his reports were received with skepticism by his "western passage" sponsors, and he was forced to spend most of his remaining years ashore stoutly defending the conclusions of his explorations.

Meanwhile, while MIDDLETON'S findings were being challenged and treated with mistrust, even by his own marine contemporaries, ARTHUR DOBBS, a successful London Merchant and firm believer in the existence of a northwest passage out of northern HUDSON BAY, obtained funding for a second voyage into the same area. DOBBS had originally backed MIDDLETON'S expedition, but when it did not obtain results acceptable to his beliefs, he set about questioning MIDDLETON'S integrity and qualifications.

The second voyage was to be commanded by MIDDLETON'S ex second-in-command, WILLIAM MOOR. Its purpose was to thoroughly survey WAGER BAY, which the influential few still held was the probable northwest access to the PACIFIC. In 1746, the two vessel expedition left England and wintered at York Factory. WAGER BAY was surveyed in 1747 and the results vindicated the assumptions of MIDDLETON. The party then proceeded southward to CHESTERFIELD INLET where they surveyed 50 miles of the INLET. **

The next exploration of CHESTERFIELD INLET took place in 1760 under the auspices of the HUDSON'S BAY COMPANY, which was anxious to eliminate any future potential competition by proving that HUDSON STRAIT was the only access to HUDSON BAY.

In 1760, WILLIAM CHRISTOPHER sailed the sloop CHURCHILL for 100 miles westward along the INLET. The following year, accompanied by MOSES NORTON, the halfbreed son of the builder of FORT PRINCE OF WALES, CHRISTOPHER sounded the complete INLET as far west as BAKER LAKE. When he reached the fresh, non-tidal waters of BAKER LAKE, he was satisfied that no link with the PACIFIC was possible.

Thus the early exploration of CHESTERFIELD INLET developed, first as a side benefit from an Admiralty program, then as part of a private enterprise, its sponsors hoping to develop trading competition for the Hudson's Bay Company, should an access other than HUDSON STRAIT be found, and thirdly, as a decision by the HUDSON'S BAY COMPANY to consolidate its own position in the BAY.

* *Volume I, Science, History and Hudson Bay gives credit to Middleton for "noting" in 1742 Chesterfield Inlet.*

Pilot of Arctic Canada, Volume I credits "discovering" Chesterfield Inlet to Captain William Moor and Captain Francis Smith, in 1746.

** *Again discrepancies occur between Science, History and Hudson Bay and Pilot of Arctic Canada, Vol. I. Science, History and Hudson Bay notes that Moor noted, but failed to enter Chesterfield Inlet. P. 103, L. 32, whereas the Pilot, Page 47, Line 33, indicates Moor discovered and explored 50 miles of the Inlet.*

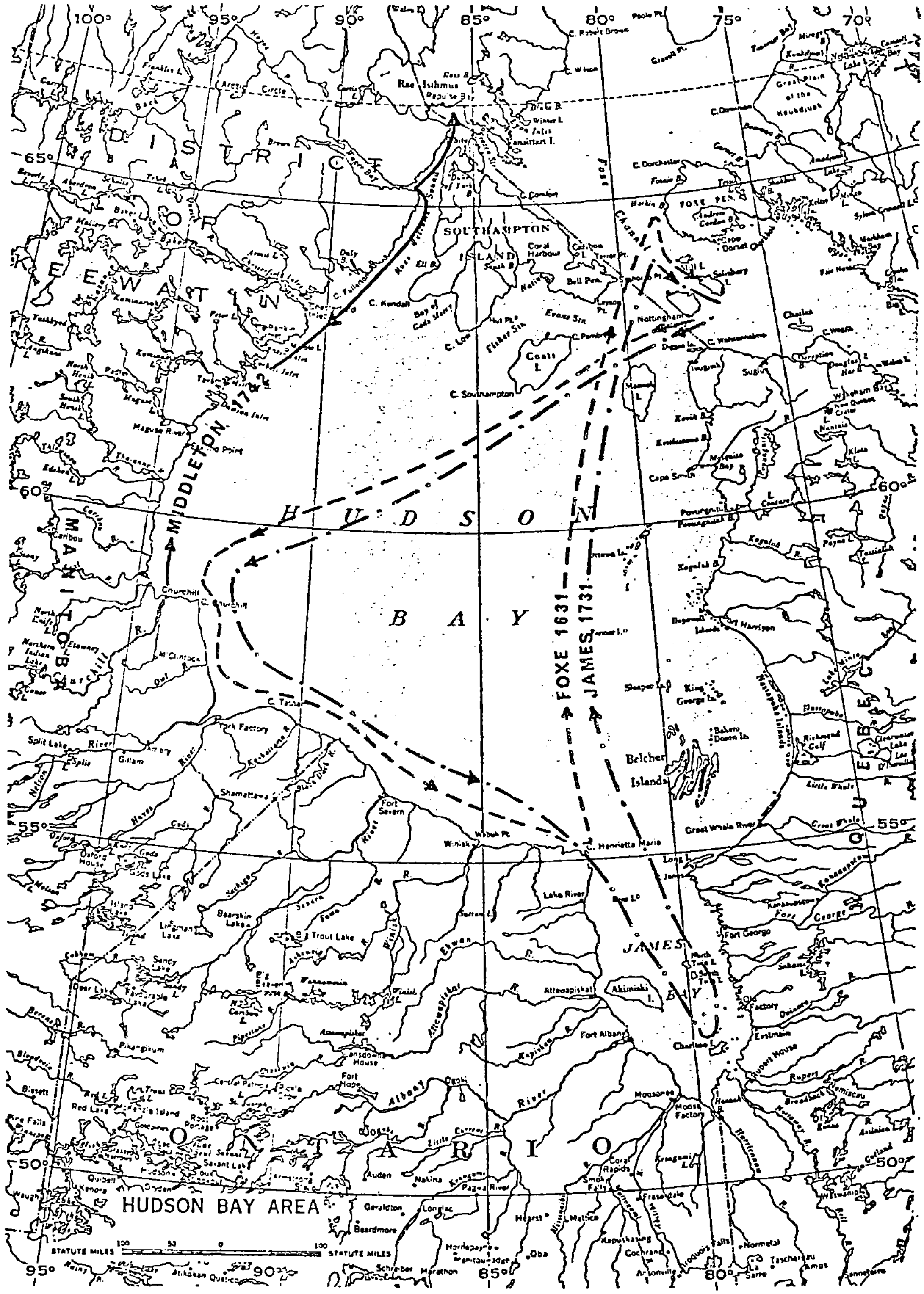


Figure 3. Routes of the explorers Middleton, Foxe and James.

INTRODUCTION

Chesterfield Inlet is a corridor of tidal waters joining Hudson Bay to Baker Lake. The eastern entrance to Chesterfield Inlet can be defined as a line running east-west between Jaeger Point and Promise Island (see Chart 5430). The western end of Chesterfield Inlet can be defined as the most westerly end of Chesterfield Narrows (see Chart 5438). Between these two extremities lie the waters known as Chesterfield Inlet. Along a proposed navigation track, the Inlet measures a total of 227 kilometres (124 nautical miles). Two major bays and numerous rivers contribute to the water system of the Inlet.

The shoreline topography along the Inlet is generally a gentle sloping formation, meeting the Inlet waters at a shallow angle. Few hills along the Inlet surmount 60 metres. Islands and headlands generally blend into the background landscape and are often indistinguishable at long distances. The exposed rock formations reflect hues of black and brown, occasionally broken by splashes of white. The foreshore of the Inlet, and much of the adjacent terrain, are heavily carpeted with mosses, lichens and dwarf shrubbery.

The tidal range along the Inlet varies between a spring range of 3 to 6 metres. Five kilometres from Baker Lake a 3 metre tidal range exists. At Baker Lake, no tidal effect is noticeable. The persistence of the range up to the margin of Baker Lake creates the fast currents of Chesterfield Narrows. A tidal time lag of 5 hours exists between Hudson Bay and Baker Lake.

The currents of the Inlet are strong, especially on the ebb, and are subjected to veering effects from the sinuous nature of the channel beds. The strongest currents prevail at Chesterfield Narrows, where ebb currents up to 7.6 knots were measured during the spring range period of September. A brief slack water period occurs at mid-range of the tide. Elsewhere in the Inlet, ebb currents up to 5 knots can be experienced.

The bathymetry of the Inlet supports a 30 metre channel as far west as Cross Bay. From Cross Bay to a point three kilometres east of Baker Lake, a narrow channel with depths of 20 metres exists. At the Chesterfield Narrows, the north and south edges are bridged by a rock shelf which reduces the navigable depth to a low water figure of 3 metres.

A number of good anchorages exist along the Inlet. The Moore Island area, Robin Hood Bay, the Primrose Island area, and Cross Bay are four example locations where a soft clay bottom and relief from strong currents can be obtained.

While Chesterfield Narrows presents a bottleneck for the access of Baker Lake to vessels drawing in excess of 4 metres, it is feasible for vessels drawing 15 metres to sail westward along the Inlet for at least 200 kilometres.

Eight charts presently provide information for navigation along the Inlet. Due to a limited amount of depth information, a misorientation of the adjacent land mass, and the inaccuracy of much of the data, the charts present at best nothing more than a supplement to common judgement and good luck.

In 1974, the Central Region Hydrographic Division of the Marine Sciences Directorate undertook the task of surveying in detail a navigable channel through the Inlet. The survey will result in new and more accurate charts.

The information provided in this report describes the operation of the survey, and the significance of the collected data. The target of the survey was to provide hydrographic information which would define, both graphically and verbally, a safe navigation route between Baker Lake and Hudson Bay.

Bathymetric, tidal and current information was collected. Potential range lines and beacon positions were accurately surveyed. A Sailing Directions report and a Recommended Aids to Navigation report were prepared. Seven field sheets were completed. Supplemental to the standard survey of Chesterfield Inlet, reconnaissance track sounding was completed across Baker Lake, and an oceanographic program was completed in James Bay.

TECHNICAL INFORMATION SUMMARY

Project Name	Chesterfield Inlet Survey
Project Number	6600-73-5
Project Duration	July 1 - October 17, 1974
Oceanographic Factor	5%

APPLICABLE FIELD SHEETS (see plate #1)

Field Sheet No.	Title	Scale
3850	Sandpiper Island to Big Island	1:25,000
3851	Big Island to Ekatuvik Point	1:25,000
3852	Ekatuvik Point to Promise Point	1:25,000
3853	Promise Point to Primrose Island	1:25,000
3854	Primrose Island to Cross Bay	1:25,000
3855	Cross Bay to Chesterfield Narrows	1:25,000
3856	Ice Hunter Rock to Chesterfield Narrows	1:10,000
80111 T	Baker Lake (Eastern Portion) Reconnaissance (Chart 5438)	1:36,000
80111 T	Baker Lake (Reconnaissance) (Chart 5439)	1:100,000

SPECIAL REPORTS

1. Sailing Directions Report
2. Recommendations for Navigation Aids
3. Tide Gauging Report

CHRONOLOGY OF EVENTS

June 26	J. McCarthy and G. Fenn depart Burlington for Chesterfield Inlet to set up shore site.
July 5	Helicopter CGR arrives at Chesterfield Inlet.
July 9	Staff and crew depart Burlington for Québec City to prepare equipment and supplies for arrival of CCGS NARWHAL.
July 12	Two tide gauges established at Chesterfield Inlet.
July 22	CCGS NARHWAL arrives at Québec City to load equipment, supplies and personnel.
July 27	CCGS NARWHAL departs Québec City for Chesterfield Inlet.
July 30	E. Lewis and B. Waldock arrive at Chesterfield Inlet to commence installation of Hi-Fix positioning system.
August 4	CCGS NARHWAL arrives at Chesterfield Inlet. Calibrate Mini-Ranger and commence launch sounding program with launches SURGE and STURDY.
August 5	Move NARWHAL into Chesterfield Inlet to support survey. Two tide gauge staffs levelled in. E. Lewis departs Chesterfield Inlet for Burlington.
August 6	Assist M.O.T. by radar and radio repairs to CCGS EIDER. Sounding completed to kilometre 20.
August 7	Install tide gauge at Deer Island and move NARWHAL inward to kilometre 55.
August 8	Commence current measuring program.
August 9	Install tide gauge at Barbour Bay and move NARWHAL inward to kilometre 85. Sounding completed up to kilometre 50.
August 11	One Mini-Ranger system out of service with defective receive/transmit unit.
August 12	Regional Hydrographer, A.J. Kerr, arrives to review the survey. Electronic technician, W. Montgomery, arrives and resident technician H. Boyce departs. NARWHAL anchored at Deer Island, adjacent to sounding program.
August 15	Mini-Ranger system repaired. Both launches back on sounding program.

August 16	Lt. Don Winter, United States Lake Survey Center exchange, and G. Fenn, C.H.S., aboard to participate in the survey.
August 18	Move NARWHAL westward to kilometre 90 and anchor at Robin Hood Bay. Sounding completed up to kilometre 80.
August 19	CSL SURGE out of service with fractured transmission. Tide gauge installed at Promise Point.
August 22	Move NARWHAL to kilometre 135. Sounding completed to Promise Point.
August 25	Install tide gauge at Primrose Island.
August 26	Move NARWHAL to kilometre 145. Sounding completed to kilometre 140.
August 27	Mechanic, Max Ames, M.S.D. Ship Division, arrives with clutch plate for SURGE.
August 29	SURGE repaired and away sounding. M. Casey departs for Ottawa.
August 31	Sounding completed to Cross Bay.
September 1	NARWHAL proceeding eastward in response to Search and Rescue message. Search called off at 1300 hours and NARWHAL returned to Deer Island for survey work.
September 4	Ship proceeds to Chesterfield Settlement to discharge P. Richards and G. Fenn, and to take on equipment destined for Fort George, James Bay.
September 5	Ship proceeds to Deer Island. Survey two range lines. Proceed to Ranger Seal Bay in afternoon.
September 6	Establishing ranges at Ranger Seal Bay.
September 7	Move ship to Robin Hood Bay. R. Robitaille aboard from Burlington. Range lines and clean up sounding underway.
September 8	Proceed to Bowser Island for additional range lines and clean up sounding. Commence sounding Cross Bay.
September 10	Ship moved to Cross Bay. Two launches proceed with sounding. Tide gauge installed at kilometre 200.
September 12	Move ship westward to Schooner Harbour, kilometre 205. Helicopter out of service at Churchill.
September 13	STURDY suffers rudder and shaft damage from grounding.

September 15	NARWHAL passes through Chesterfield Narrows into Baker Lake. Proceed westerly across Baker Lake with launches sounding in parallel. Anchored at Baker Lake overnight.
September 16	D. Winter departs at Baker Lake settlement. Proceed easterly along Baker Lake and anchor close to the Chesterfield Inlet entrance.
September 17	Tide gauge installed at kilometre 222. One launch sounding.
September 18	Commence current studies at the Narrows.
September 20	Establish range lines at the Narrows. Sounding completed to Baker Lake.
September 21	NARWHAL passes eastward through the Narrows. Commence clean up sounding and shoals.
September 22	Side scan work conducted at Chesterfield Narrows. Ship proceeds eastward to Cross Bay.
September 23	Proceeding eastward collecting bottom samples and sounding work. Anchored at Akunak Bay overnight.
September 24	Working eastward to Robin Hood Bay.
September 26	All sounding and control work terminated. Proceed to Chesterfield Settlement to load fuel and launches.
September 27	Weigh anchor for Churchill.
September 28	Alongside at Churchill. Discharge 130 empty fuel drums. Three staff and three crew depart for Burlington.
October 1	Depart Churchill for James Bay. Oceanographer and two technicians aboard from Burlington.
October 4	Commence oceanographic program in James Bay.
October 7	Oceanography completed. Anchored at Fort George unloading fuel and supplies. Rendezvous with J. McCarthy (staff) and Computing Devices of Canada personnel. Three personnel depart south.
October 8	Depart Fort George for Povungnituk.
October 10	Anchored at Povungnituk at 1200 hours. Discharging launches and equipment ashore in afternoon. Depart for Dartmouth at 1800 hours.

October 17 Arrive Dartmouth.

NOTE: *During the sounding procedures, August 4 - September 26, the ship board operations were supported by the Chesterfield Settlement based helicopter. The helicopter then proceeded to James Bay to establish horizontal control for the proposed winter hydrographic/gravity program.*

PERSONNEL INVENTORY

1. HYDROGRAPHIC

B. Wright	Hydrographer-in-Charge	July 15 - October 18
M. Casey	Senior Assistant	July 15 - August 29
		September 10 - October 18
R. Langford	Hydrographer	July 26 - October 1
P. Richards	Hydrographer	July 15 - September 4
G. Fenn	Hydrographer	July 1 - August 16 #
		August 17 - September 4 #
J. McCarthy	Hydrographer	July 1 - October 1 #
R. Robitaille	Hydrographer	September 7 - October 1
P. Millette	Development Technician	October 1 - October 7

2. SURVEY ELECTRONICS

B. Waldock	Electronic Technician	July 30 - August 12 #
H. Boyce	Electronic Technician	July 20 - August 14
W. Montgomery	Electronic Technician	August 13 - October 1
I. Padgett	Electronic Technician	October 1 - October 18

3. SHIP DIVISION

J. Delorey	Quartermaster	July 8 - October 17
J. McGirr	Gas Engineer	July 8 - October 7
R. Webber	Coxswain	July 8 - October 17
W. Briggs	Coxswain	July 8 - October 1
W. Bunting	Seaman	July 8 - October 1
C. Smith	Seaman	July 8 - October 1
D. Foley	Coxswain	July 1 - July 16 #

4. HYDRODYNAMICS

G. Pudsey	Oceanographer	October 1 - October 7

5. OTHERS

D. Winter	U.S. Lake Survey Center (Exchange)	August 16 - September 16	
H. Tingley	Helicopter Pilot	July 5 - October 1	#
T. Gaskela	Helicopter Engineer	July 5 - July 18	#
K. Mulrooney	Helicopter Engineer	July 18 - August 26	#
D. Smith	Helicopter Engineer	August 26 - October 1	#

Capt. J. Rose, Officers, Engineers and Crew of CCGS NARWHAL - July 24 - October 18

6. VISITORS

A.J. Kerr	Regional Hydrographer Central Region	August 12 - August 16
E.O. Lewis	Head, Electronics Central Region	July 30 - August 5

- Shore based during this period at Chesterfield Inlet.

EQUIPMENT INVENTORY

1. SHIP

CCGS NARWHAL, operated by the Ministry of Transport, length 252 feet, draft 12 ft., gross tonnage 2064, speed 12 knots, propulsion from twin screw diesels, complement 41 persons (16 deck, 15 engine room, 10 stewards).

2. AIRCRAFT

One Bell 206A Jet Ranger Helicopter, licensed CF-CGR. #

3. LAUNCHES

Two steel hulled, twin screwed, diesel driven, 36 ft. launches, cruising speed 10 knots.
One 20 ft. steel hulled, MONARK craft, outboard driven.

4. ELECTRONIC POSITIONING SYSTEMS

Two Motorola Mini-Ranger III Transmit/Receiver Systems, plus six Transponders. #
One set of MRA-3 Tellurometers. #

5. OPTICAL SYSTEMS

One Wild T-3 Theodolite. #
One Wild T-2 Theodolite. #
Three Wild NA-2 levels. #

6. WATER LEVEL GAUGES

Six Ottboro Pressure Tide Gauges (0-9 metres).

7. CURRENT MEASURING EQUIPMENT

Two Endeco Current Meters, models 110 and 160.

8. COMMUNICATIONS EQUIPMENT

Three Motorola PT-400 VHF Transceivers.
Three Motorola PT-300 VHF Transceivers.
Two Raytheon Sea Watch 12 Channels VHF Transceivers (launch mounted).
Three PYE 122.7 Westminister VHF Aircraft Transceivers.
Three Marconi CH-25 MF/HF Transceivers (launch mounted).

9. NAVIGATION EQUIPMENT (LAUNCHES)

Two Decca DE-217 Radars.
Two Arma-Brown MKIC Gyrometers.

10. SOUNDING EQUIPMENT (LAUNCHES AND SHIP)

Three Ross Model 200 A Metric Sounders plus digitizers.
One Raytheon DE-719 sounder.

11. DATA LOGGING EQUIPMENT

Three HAAPS (Hydrographic Acquisition And Processing System) systems including - 3 Kennedy incremental tape recorders, model 1600; 3 Decca DC-211 digital couplets; 2 Topaz 24 - 110 volt inverters.

12. DATA PROCESSING EQUIPMENT

One Digital Equipment Corp. PDP-8F digital computer.
One Peripheral Equipment Corp. tape drive.
One Digital Equipment Corp. high speed reader.
One ASA-33 teletype console.
One California Instruments AC-AC inverter.

13. OCEANOGRAPHIC EQUIPMENT

Two 0-60 metre bathythermographs
One Foerst Peterson bottom grab
Eight Knudsen bottles plus reversing thermometers
One Secchi disc
One plankton net (18")
One laboratory equipment for dissolved oxygen tritrations

14. OTHERS

Two Parcoll units (four section) #
One Herman Nelson aircraft heater #
Four Petter diesel units coupled to 24 volt alternators #
Two Dietz-Lafond bottom grabs

= - shore based at Chesterfield Inlet

PLANNING AND PREPARATIONS

1. *Field Sheet Scheme*

Preparations were made to survey the Inlet at a 1:25,000 scale using a U.T.M. projection base. This required the creation of six field sheets which would span the complete Inlet between Baker Lake and Hudson Bay. As the field program developed, it became necessary to create an additional field sheet at a 1:10,000 scale in order to adequately define the narrow channels at the Baker Lake end of the Inlet. See Plate #1 for field sheet scheme.

2. *Tide Gauge Program*

Based on recommendations from the Central Region Tidal Section, preparations were made to deploy five Ottboro pressure gauges along the Inlet at 30 kilometre spacings. This spacing was necessary in order to obtain sufficient water level data for the reduction to sounding datum of surveyed depths. (See plate #2 for gauging sites)

3. *Current Studies*

The currents of Chesterfield Inlet were known to be of considerable strength (2-5 knots), and it was thus planned that as much data as possible on the currents would be obtained. Subsequently, two Endeco current meters (Models 110 and 160) were allotted to the survey. (See plate #3 for locations of current measurements)

4. *Sailing Directions Information*

Very little Sailing Direction information was available on the Inlet, and so this element of the survey received considerable emphasis.

5. *Navigation Aids*

In order to make recommendations for the erection of navigation aids along the Inlet, it was planned that beacon sites and range lines would be surveyed at a third order accuracy, and permanently monumented.

6. *Sounding Operations*

Two 36 foot launches (SURGE and STURDY) were allotted to the survey for the sounding program. Each launch was equipped with a Ross 200A metric sounder, and a Mini-Ranger receiver. The launches underwent re-engineering during the 1974 winter in order to improve their handling, their equipment layout, and their cabin comfort.

7. *Horizontal Positioning*

Two Mini-Ranger III systems were purchased in early 1974. It was planned to deploy these systems along the Inlet to provide horizontal positioning for both launches. The systems were evaluated and used on the Lower St. Lawrence survey prior to being shipped to Chesterfield Inlet.

8. *Horizontal Control*

Control requirements for Mini-Ranger operations and NAV AIDS would involve considerable survey work (130 points involved across 230 kilometres of Inlet), so it was planned that a small shore camp would be established at Chesterfield Settlement. This unit (one hydrographer plus assistant) would expedite the control work and assist in the tidal program and the Mini-Ranger transponder shifts.

9. *Data Logging and Processing*

It was planned that all depth data would be logged and processed using the HAAPS System.

10. *Ship Operations*

In order to use the launches to maximum advantage, it was planned that the ship would progress along the Inlet abreast of sounding operations, and thus provide an immediate maintenance and servicing facility. On the survey program, the ship would be used for reconnaissance surveying, bottom sampling, current measurements, and Sailing Directions data.

11. *Shoreline Plots*

The photogrammetry of Chesterfield Inlet was contracted out to the Surveys and Mapping Branch of E.M.&R., who targetted and flew the Inlet and created the shoreline plots.

OPERATIONS AND OBSERVATIONS

1. TIDE GAUGE PROGRAM

The tide gauge program included the deployment of Ottboro pressure gauges at eight locations along Chesterfield Inlet (See Plate 2). These gauges provided water level data which was used to reduce recorded depth values to a Lower Low Water Large Tides datum. The Spring Tide range along the Inlet varied between 3 and 6 metres. A linear regression of the tidal range was not evident. A phase lag of 5 hours 15 minutes existed between Hudson Bay and Baker Lake. A 3 metre Spring Tide range was observed 5 kilometres east of Baker Lake. At Baker Lake, no tide range was evident.

Further information is contained in a report on the Tide Gauge Project Report of the Chesterfield Inlet Survey.

2. CURRENT STUDIES

Current measurements were taken at seven different locations using either the ship or a launch as a stationary platform from which the Endeco current meter could be lowered (See plates 3, 5 and 6)

When possible, measurements were taken over a complete tidal ebb cycle as this produced maximum flow velocities.

At the eastern end of the Inlet (0-60 kilometres) a maximum 2 knot ebb current was registered. However, this was not during a Spring Tide stage. Also, the eastern end of the Inlet incorporates the widest sections of the Inlet which introduce a depreciation in current strengths.

Halfway along the Inlet, abeam of Robinhood Bay, measurements were taken during the Spring Tide stage, and revealed on an ebb tide, current strengths up to 4 knots.

The most important area of the Inlet, from a current studies viewpoint, is the Chesterfield Narrows area. Free drift measurements, using the Mini-Ranger system to accurately determine a drift velocity, were taken from a survey launch. A drift rate of 7.5 knots on an ebb flow was recorded at a Spring Tide stage. Slack water occured approximately at a mid-range period of the tidal cycle.

To fully evaluate the currents of the Narrows, it would entail detailed observations at a scale not possible during the survey. However, some generalities emerged:

(a) Ebb flow currents are stronger than flood currents due to the head pressure of Baker Lake.

(b) The predominating weather conditions affect the tidal current strengths, i.e., a western wind piles up water in the eastern end of Baker Lake, and consequently strengthens the ebb current flow.

(c) Current strengths could reach 9 knots or higher when all conditions combine to produce a maximum hydraulic head at the Baker Lake end of the Inlet.
The chief officer aboard CCGS NARWHAL reported the CCGS SKUA (9 knots speed) being brought to a standstill while attempting to enter Baker Lake through the Narrows.

For further information on the tidal and current structure of the Inlet, refer to Plates 4, 5, and 6.

3. *SAILING DIRECTIONS INFORMATION*

Information to complement the chart data was collected along the Inlet, and in Baker Lake. Navigation hazards, current strengths, anchorages, recommended courses, and prominent topography were defined in order to supplement the regular bathymetric data.

A Sailing Directions report and a 'Recommended Aids to Navigation' report have been prepared.

4. *NAVIGATION AIDS*

The strong veering currents of the Inlet, the limited manoeuvring area, and the absence of prominent definable topographical features, necessitate the erection of navigation aids along the Inlet.

Fourteen beacon positions, and twelve range lines have been surveyed and recommended in a 'Recommended Aids to Navigation Report'.

5. *HORIZONTAL CONTROL OPERATIONS*

A network of primary horizontal control points established along the Inlet by Topographical Survey was used as a base for developing control points for hydrographic purposes (see Plates 7 - 12).

Control points, established to a third order accuracy, were surveyed to (a) provide electrical centres for the numerous Mini-Ranger chains, (b) to provide permanent marks for proposed navigation aids, (c) to verify 1950 hydrographic control in eastern Baker Lake.

Fifty-seven adjusted monumented stations were established and tied to the Topographic network. From these 57 major points, another 75 stations were resected.

A traverse was run in the eastern section of Baker Lake to verify two range lines (Bannerman and Bertrand Point), and to adjust the 1950 control work to a N.A. 1927 datum.

All surveyed points were permanently marked.

6. *SOUNDING OPERATIONS*

All of the preliminary sounding along the Inlet was conducted from the two 35 ft. launches SURGE and STURDY. Each was equipped with a Mini-Ranger III system for continuous positioning, and a Ross 200A sounder for continuous depth data on magnetic tape.

The sounding pattern was to initially sound across the Inlet at a line spacing of 200 metres, halting each line at the 6 metre depth offshore. In depths less than 30 metres, or where a pronounced shoaling was indicated, the line spacing was decreased.

On the basis of preliminary sounding data, a channel was selected and surveyed to C.H.S. specifications. Once the preliminary calcomp plot was printed, the area was scanned for shoal areas and possible navigation aid requirements.

The original positioning scheme was to use long baselines, i.e. 10 km. for the Mini-Ranger systems, thus giving coverage over a large area. But this meant setting the transponders well back from the shoreline where they would have to be serviced exclusively by helicopter. Also, this configuration introduced many shadow areas where reception was unstable. This setup left the two launches dependent upon helicopter service, which was not often available. It was decided to work with smaller baselines close to the shoreline where the transponders could be serviced by boat. This meant surveying numerous control points along the shoreline, but overall, it gave a greater degree of sounding flexibility and efficiency.

All depth data was recorded in metric units using the Ross digitized 200A sounder. The stylus speed was crystal controlled to present an analogue graph reading the true depth.

Digitized depth, position, time and administrative data was logged on magnetic tape at approximate one second intervals using the HAAPS. For further information on launch sounding, see Appendix III.

7. *SHIP OPERATIONS*

The CCGS NARWHAL was used principally as a service and maintenance depot for the sounding launches, and as a mobile home and office for the hydrographic staff. Second to this role, it was deployed on reconnaissance sounding (Chesterfield Inlet and Baker Lake), bottom sampling (Chesterfield Inlet), NavAid feasibility work, and check line sounding.

On September 15th, the NARWHAL passed through the Chesterfield Narrows into Baker Lake and proceeded to track sound across Baker Lake into the Baker Lake Settlement. On September 21st, the ship returned eastward through the Narrows, culminating a record breaking passage as the largest vessel into Baker Lake.

The proximity of the ship to the survey area contributed significantly to the rapid progress of the survey. The immediacy of the ship for both launch and electronic equipment servicing reduced time lost to breakdowns to a minimum. Also, because the ship was always in the immediate area of the sounding program, the 20 ft. 'Monark' craft could be used to good advantage for control work, tidal work and transponder servicing.

8. RECONNAISSANCE SURVEY OPERATIONS

CCGS NARWHAL conducted reconnaissance surveys across Baker Lake between Chesterfield Narrows and the community of Baker Lake. Two tracks, each 50 miles long, were sounded. On each track the two launches SURGE and STURDY sounded parallel tracks 500 metres abeam of the NARWHAL. Using this technique, it was possible to sound a corridor 2500 metres wide across the lake.

9. OCEANOGRAPHIC OPERATIONS

As part of a continuing program, 15 oceanographic stations in James Bay were re-interrogated for dynamic properties. Appendix I describes the oceanographic program.

10. AUTOMATED ACQUISITION AND PROCESSING

The hydrographic-developed HAAPS system was employed for logging and processing sounding data. Both launches were equipped with digitizers, couplers and magnetic tape recorders, such that, at each lapsed second, position, depth, time and administrative data were entered on the magnetic tape.

The tape was processed aboard ship using modified HAAPS software routines on a PDP-8F computer which generated listings on an on-line teletype and a print-out on an on-line Calcomp plotter.

Generally, few major problems were encountered. The biggest problem was filtering out large amounts of erroneous data which accumulated on the magnetic tape. The bad data consisted of both depth and position information, erroneous due to "signal noise" prevailing over a proper signal. For further information on the HAAPS part of the survey, refer to Appendix II.

11. *SHORE PARTY OPERATIONS*

The shore party unit consisted, for most of the survey, of two hydrographers plus a helicopter pilot and engineer. A Bell 206A helicopter was used for the survey work.

The shore component was responsible for establishing control points along the Inlet, assisting in the Mini-Ranger operations, and handling some of the tidal work.

The unit was based at Chesterfield Inlet Settlement, and, except for intermittent periods when the crew would overnight aboard ship, all survey work was conducted from the settlement base.

The helicopter proved an essential component for rapid survey progress. It could have been used to increased advantage had it been located aboard ship. However, this was not possible and thus its work all originated from the Chesterfield Inlet Settlement.

The biggest drawback of over-reliance on helicopter support is (1) that the machine is automatically grounded for the slightest problem which may or may not be remedied immediately, (2) flights can be cancelled for long periods due to weather in which launches can still operate, (3) that the utility of the machine is highly subjected to the qualities and interest of the pilot, (4) that regardless of weather conditions and pilot capacity, the useable time of a helicopter is less than 100 hours per month.

12. PERSONNEL

A hydrographer of three years general field experience could normally be expected to take charge of an automated hydrographic launch. If the hydrographer has limited knowledge of marine navigation and launch handling, he must rely heavily on the capabilities of the coxswain. On the Chesterfield Inlet survey, the two coxswains were experienced, dependable, and very practical. This was very important, as it allowed the hydrographer to concentrate on the survey work without worrying about the launch safety or sounding pattern.

The personnel of a 35 foot launch consisted of a hydrographer, a coxswain, and a seaman. The seaman relieved the coxswain, allowing non-stop sounding procedures.

The processing of the data required a thoroughly knowledgeable hydrographer with a capacity to understand and manipulate the necessary software programs. Processing of data is a tedious job. It requires a person who can look at a printout, scan the printed depths and decide which ones bear a validity check. An appreciation of logical bathymetry is a must. Once probable bad soundings or positions are 'circled', the sounding rolls must be matched against the computer listing; this takes time, patience and a considerable dedication towards a perfect product. The senior assistant , assisted by a senior hydrographer, handled all of the processing.

As part of an exchange program, a member of the United States Lake Survey Centre in Detroit joined the survey and remained with it for four weeks. He displayed above average ability and a keeness to participate. Thus he was given tasks equivalent to senior hydrographer responsibilities. He conducted himself capably and proved a definite asset to the program.

EQUIPMENT PERFORMANCE

1. LAUNCHES - "SURGE" AND "STURDY"

Speed: 10 knots acceptable, but a cruising speed of 16 knots would be preferable. It is noted that the speed of the SURGE was reduced from 14 to 10 knots after 'modifications'.

Power Units: Twin diesels give effective reliable performance.

Range: Present tanks allow continuous 16 hour running.

Cabin Layout: Presently acceptable. A small collapsible plotting table should be part of each launch. The requirement for watertight cabins and a close air conditioning system cannot be over-emphasized.

Electrical Systems: The 12 volt electrical system for the engines and marine lighting proved adequate. The 72 amp, 24 volt alternator was working at capacity, or overloaded, to run all survey equipment plus marine navigation peripherals. Either an increase in power or the use of solid state in some equipment will be necessary in the future.

Hull Design: The installation of 'grasp' rails at waist and head locations is recommended. Also, the installation of grips on the cabin roof would be beneficial. Where possible, deck railings should be installed completely around the main deck at waist level. STURDY incorporated most of these features. SURGE did not.

In rough seas, both launches take a great deal of water over the bow and along the cabin. It is thus stressed that forward hatches, window frames, and electrical ports be made watertight. The SURGE had a tendency to roll; this could be minimized by installing sister keels and fins.

Operational Suitability: The location of the compass, radar, control panel, etc., is good.
Attention should be given towards installing bus wipers on both front windshields and installing a defrosting system.
The cabins presently have a bad tendency to sweat and fog up during closed operations in low temperatures.

2. ELECTRONIC EQUIPMENT SUMMARY

(A) *Communications Equipment*

Most of the communications equipment performed acceptably well. In two instances, either improper installation of poor equipment performance restricted communications to short distances, (a) the VHF marine receiver (Clipper II) installed at Chesterfield Settlement could hear the NARWHAL calling up to 30 miles away but could not respond. The transmitted signal from shore could not be picked up beyond 5 miles, yet NARWHAL was able to communicate with vessels anchored at Chesterfield for at least 30 miles range. (b) the Marconi CH-25 installed ashore had a limiting range of about 40 miles. NARWHAL could communicate with Coral Harbour (250 miles range) but not with Chesterfield (40 miles range). Notwithstanding the possibilities of operator problems or poor radio signal location, it appears that these units performed well below expectations.

(B) *Navigation Equipment*

The DE 217 radar aboard SURGE and STURDY performed well. A Decca 101 would do equally well, be much more portable, and consume a less limited power supply.

The Arma-Brown gyro compasses performed well, except one unit which broke down early in the season and could not be repaired.

(C) *Surveying Equipment*

The Ross sounder used in the launches for both analogue and digital purposes performed generally trouble-free. Aside from standard maintenance and minor mechanical faults, the units did not suffer any down time.

The two Mini-Ranger III systems performed acceptably well, but revealed a few weaknesses, and a subsequent necessity to carry adequate spares. The receiver/transmitter unit gave most of the trouble, and in one case resulted in a system being unserviceable for four days.

The transponders ashore worked trouble-free. On a 90 amp, 24 volt source they operated for approximately 70 hours before new batteries were required. The system in total had the following anomalies:

(a) at 4000 metres, channel 4 would not measure.
(b) in glassy water conditions, an erratic unstable behaviour pattern existed.
(c) an unpredictable drift was noticed in the zero of the range counters.
(d) in close proximity to the transponders (4000 metres) the system updated continuously for a 360° azimuth, but with noticeable error.

CONCLUSIONS AND RECOMMENDATIONS

(1) *Tide Gauge Program*

The information collected in 1974 will be adequate for navigation requirements. A scientiifc analysis may require further gauging.

The Ottboro gauges should be phased out for a more dependable, perhaps digital type unit. Tide gauge equipment is one of the few areas in which we have not advanced dramatically.

(2) *Currents*

Much work remains to compile a comprehensive knowledge of current dynamics in the Inlet. The Chesterfield Narrows is perhaps the most important area to bear a concentrated study of tides and currents. What happens when Baker Lake is at a spring high level? What happens when severe meteorological depressions occur on the lake or when intense westerly winds pile water at the eastern outlet? These and several questions remain unanswered.

(3) *Sailing Directions*

A report will be prepared to assist the navigation of the "new" waters of the Inlet, and to correct and update the information presently supplied.

(4) *Navigation Aids*

A report has been prepared recommending 12 range lines and 14 beacons.

(5) *Horizontal Control*

Adequate control extends along the Inlet to satisfy any foreseeable requirements. All eight tide gauge sites have been permanently "bench marked" and thus a vertical control base will extend along the Inlet.

(6) *Sounding Data*

The sounding program will adequately develop a navigable channel from Hudson Bay to Baker Lake. At Chesterfield Narrows, the navigable depth will be reduced to 3 metres. Between Hudson Bay and Cross Bay, a navigable channel, supporting at least 30 metres of water, exists. The sounding data will be displayed on seven field sheets.

(7) *Launch Operations*

The 35 foot launches proved ideal for working in the north.

The enclosed spacious cabin, the dependable diesel power, the seaworthiness of the craft, and the good field of vision from the cabin are features beneficial to northern operations. Their continued use on arctic programs is recommended.

(8) *Electronic Positioning*

The Mini-Ranger system provided an accurate, flexible and generally reliable positioning facility, and its future use is recommended. In an area such as the Inlet a line of sight, range-range system is ideal. The digital output of the system is a necessary feature. A remote readout could be run from the console to the control deck in front of the coxswain, allowing easy tracking of a particular range arc. The portability, flexibility, and accuracy of the system make it extremely useful for short-range surveys.

(9) *Ship Operations*

The NARWHAL provided a good mobile operations base from which to conduct the sounding program. The ship offered good deck space for quartering and servicing the launches, plus suitable accommodations for crew and staff. Arctic surveys are much more efficiently operated from ship bases.

(10) *Sounding Systems*

The Ross 200 A sounders performed well during the season. Few problems were experienced with either the digital or analogue output sections. The use on future surveys is recommended.

(11) *Logistics*

Emergency spares had to be air expressed from Burlington to Chesterfield Inlet. The service supplied by Transair was lamentably undependable, articles often taking weeks to arrive. It thus becomes imperative to have on hand as many spares and back up systems as possible.

(12) *Shore Operations*

In view of the ship not having a helicopter pad, it was necessary to keep the rotary-winged machine ashore and develop a program to support the survey in areas where mobility was a distinct advantage. The extension of horizontal control along the Inlet, the servicing of tide gauges and Mini-Ranger transponders, and the rapid transport of supplies and people were areas in which the helicopter was a distinct advantage and necessity. The helicopter has, and will continue to, revolutionize survey methods in the arctic.

ACKNOWLEDGEMENTS

The author wishes to thank the Captain and crew of the NARWHAL for their unstinting assistance towards the survey and their confidence in our methods and equipment. Also, I wish to commend the helicopter personnel for their fine efforts.

The service, assistance, and encouragement of all Central Region personnel is likewise acknowledged and appreciated.

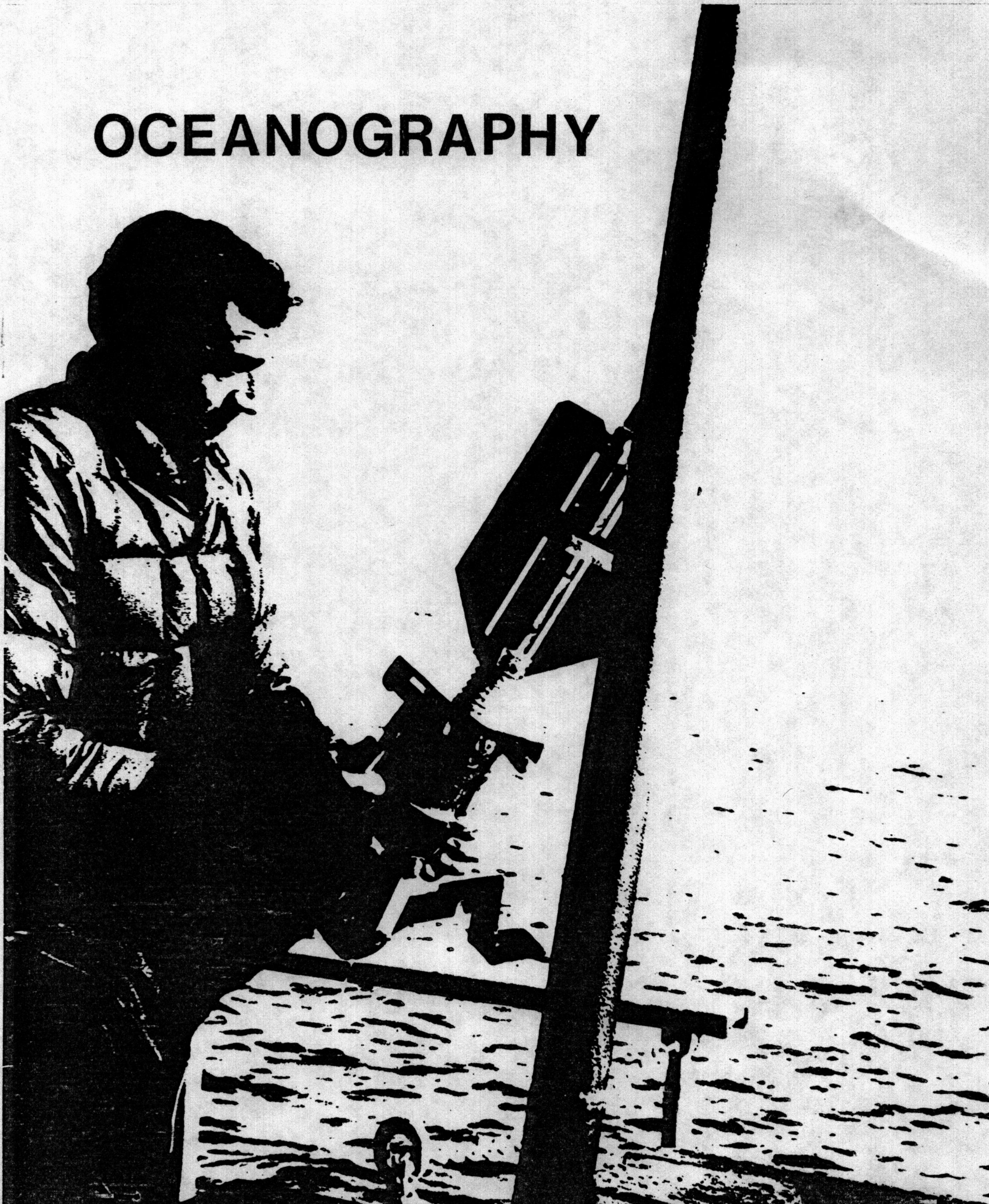
B. Wright

B.M. Wright
January 16, 1975

- OCEANOGRAPHY -

APPENDIX I

OCEANOGRAPHY



JAMES BAY OCEANOGRAPHIC CRUISE - 74

Introduction

Continuing a project initiated in 1972, the Hydrographic Service, as part of its Hudson/James Bay surveying activities, occupied several oceanographic stations in the northern end of James Bay. Results of these observations will be used to monitor the water quality and planktonic marine life in the Bay.

Preparation

The preliminary planning work was carried out by the Research and Development Group of the Marine Sciences Branch. This preparation entailed the selection of the station locations, samples to be taken, the ordering and organizing of the necessary equipment, and the training of one operator for the titration lab. Liaison was also carried out with the Arctic Biological Institute who supplied part of the equipment.

Once assembled, all the necessary equipment was shipped to Chesterfield Inlet.

Cruise

Upon completion of the Chesterfield Inlet Survey, in late September, the CCGS NARWHAL departed for Churchill. Here the remainder of the oceanographic equipment was collected. All of the equipment was unpacked, checked out and organized before departing for James Bay.

Poor weather hampered the sampling throughout the three day cruise.

At each station casts were made for water samples, bottom grabs and plankton tows as well as temperature profiles. The water was sampled for oxygen content, salinity and phytoplankton. The oxygen content samples were analysed on board the ship.

Preliminary Analysis

For the most accurate results, the oxygen analysis must be done as soon as possible after sampling. Thus a shipboard laboratory was set up and the titrations carried out during the course of the cruise.

The procedure used for this analysis was the Strickland and Parsons' method of the "Determination of Dissolved Oxygen".

A computer program was written to solve for the number of millilitres of oxygen dissolved per litre of seawater. These results were compared to those results of the previous years (as recorded in the 1972/73 James Bay Data Reports) as a quality control check.

The other (e.g. salinity, etc.) samples were shipped south for later analysis.

Later Analysis

The salinity, phytoplankton, plankton and zoobenthos (bottom grab) samples were preserved, packaged and shipped to southern facilities for processing.

The salinity samples going were sent to the C.C.I.W. and the remainder to the Arctic Biological Institute at St. Anne de Belleville in Québec.

Conclusion

Due to the extremely windy weather conditions that prevailed both before and during the course of the cruise a considerable amount of mixing of the various layers of water had occured. Thus the results of the cruise might be of dubious value in comparing them to previous years. If this is the case, it will be of more value to try and schedule the cruise earlier in the year to take advantage of the better weather. Or perhaps to abandon the cruise when weather conditions are so poor as to make the sampling results useless.

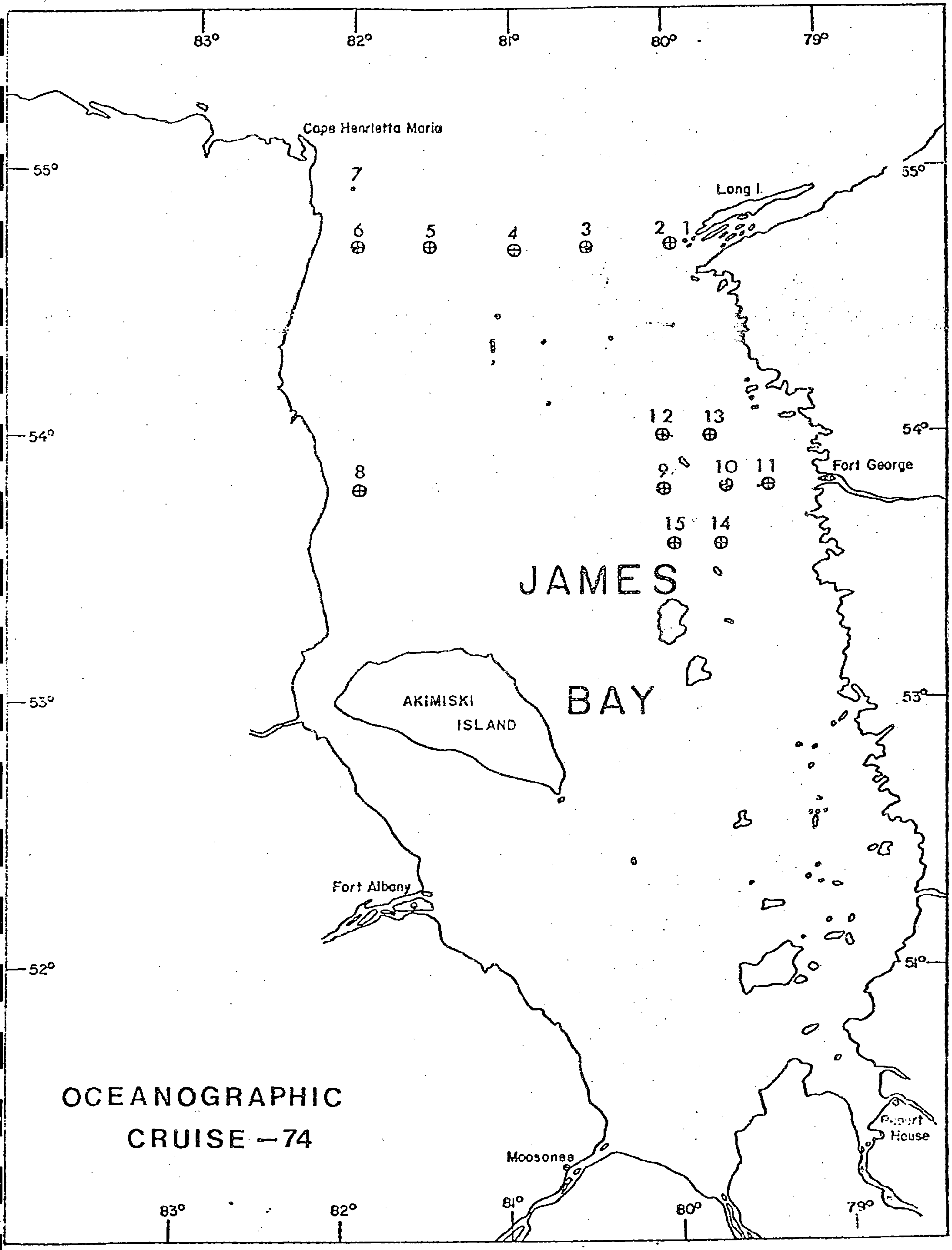
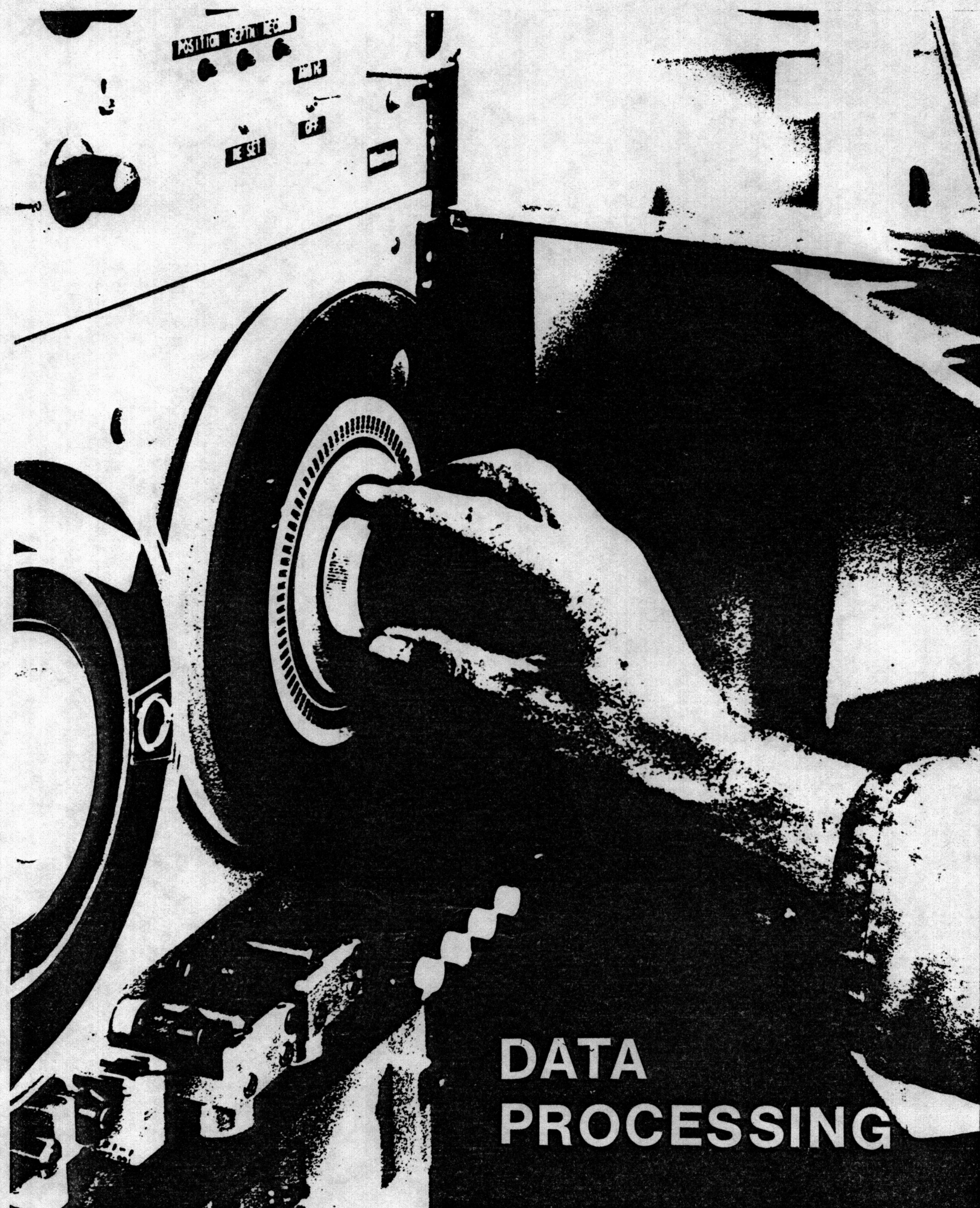


Fig. I Oceanographic Stations

- DATA PROCESSING -

APPENDIX II



DATA PROCESSING

HAAPS REPORT

Introduction

The vast majority of all soundings compiled for the Chesterfield Inlet Survey, were acquired via the HAAPS System. The following is a brief documentation of the equipment and methods used to process these soundings.

Hardware

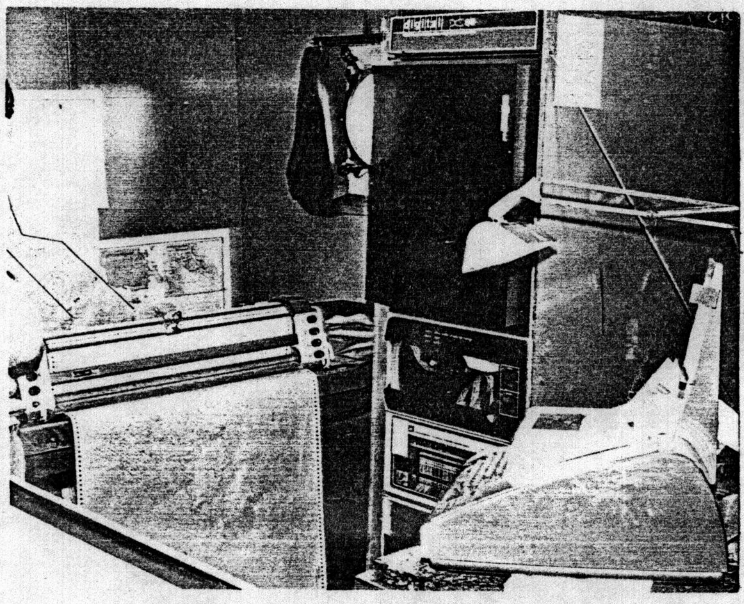
The Chesterfield Inlet Survey Party was assigned three HAAPS loggers and one processor. Loggers were installed into each of the two survey launches, SURGE and STURDY, with the third system used as a back up.

Each logger was comprised of the following equipment:

DCU 211 Digital Control Unit
Kennedy Incremental Tape Drive
Topaz Inverter
Ross Fineline Sounder and Digitizer
Mini-Ranger Positioning System

The HAAPS processor was comprised of the following equipment:

PDP-8f Computer
DEC High Speed Paper Tape Reader/Punch
PEC tape drive
Calcomp 563 drum plotter
Teletype



Software

One of the chief advantages of the HAAPS system is the ease in which the processing software can be modified to suit the particular conditions. Several modifications were made to the main program Magconplot for use in Chesterfield Inlet.

1) as in the Lake St. Clair Survey of 1973, the range/range to UTM routine follows the algorithm as used in program F011, UTM Trilateration.

2) this routine was further modified to give solutions on either side of the baseline connecting the two transponder locations.

3) a range gate was experimented with which rejected all positioning ranges which fell outside of the operator-input minimum/maximum ranges. These minimum/maximum ranges taken from the sounding notes.

4) as magconplot is record dependent in its selected soundings, a modification was written to break down the record size into smaller groups, inside the computer, to result in more soundings selected. This is particularly handy when for one reason or another the record size chosen for logging does not result in sufficient soundings selected to accurately delineate the bottom configuration.

5) Tide reductions via the H/S Reader.

New Programs

During the course of the survey, a series of new programs were written by various members of the staff.

1) Tide Reductions from Hi/Lo
2) Manual Data to HAAPS Format
3) Contour Plot from Raw Data
4) Range vs Time Graph (Stability Test)
5) Sounding Swap (bad depths for good)
6) Station Plot from UTM
7) Station Plot from Range/Range
8) Station Plot from Resection
9) Station Plot from Range/Bearing
10) Oxygen Titrations to Millilitres of O_2/litre
11) Gyro Calibration from Range/Range

Problem Areas

As mentioned in the main body of this report, much time was spent editing out erroneous data from the processed tape. This faulty data fell into two categories: faulty depth data and faulty position data.

Faulty Depths

The faulty depths written onto the magnetic tape were usually the result of sounding in turbulent waters, causing erroneous "noisy" depth data to be accepted. As this faulty data is virtually always shallower than the real depth they were selected as the shoal depths by the processor.

Editing this data called for the manual scaling of the sounding roll and the substitution of this real depth for the faulty one.

Faulty Positions

As noted in the main body of this report, the Mini-Ranger system performed acceptably but its use resulted in the logging of many erroneous positions. These position errors were usually spotted at the time of processing. Once noted, they could be easily dealt with. However, often the erroneous positions would escape this visual check and not show up until later when the Calcomp plots were contoured as an aid in searching for shoals.

The processing of the HAAPS data required the operator to keep a keen eye on both the plot - to search for faulty positions, and the sounding notes - to watch for a change in transponder locations. The nature of the Inlet required the use of many transponder locations. Launches worked both sides of the baselines and, especially in the narrow sections of the Inlet, changed transponder locations many times in one day. In one case, ten (10) times. Each change required the program to be halted and the new locations entered before proceeding.

Conclusions

The HAAPS system worked very well from a reliability standpoint. The system is still very slow and requires much manual editing to remove erroneous data. Both of these areas should be greatly improved in the 2nd generation HAAPS system - INDAPS. Higher processing speed via the use of FORTRAN as the computer language and an on-line computer for the logging, filtering out erroneous data on a real time basis.

LAUNCH OPERATIONS

WITH THE

HYDROGRAPHIC ACQUISITION AND PROCESSING SYSTEM

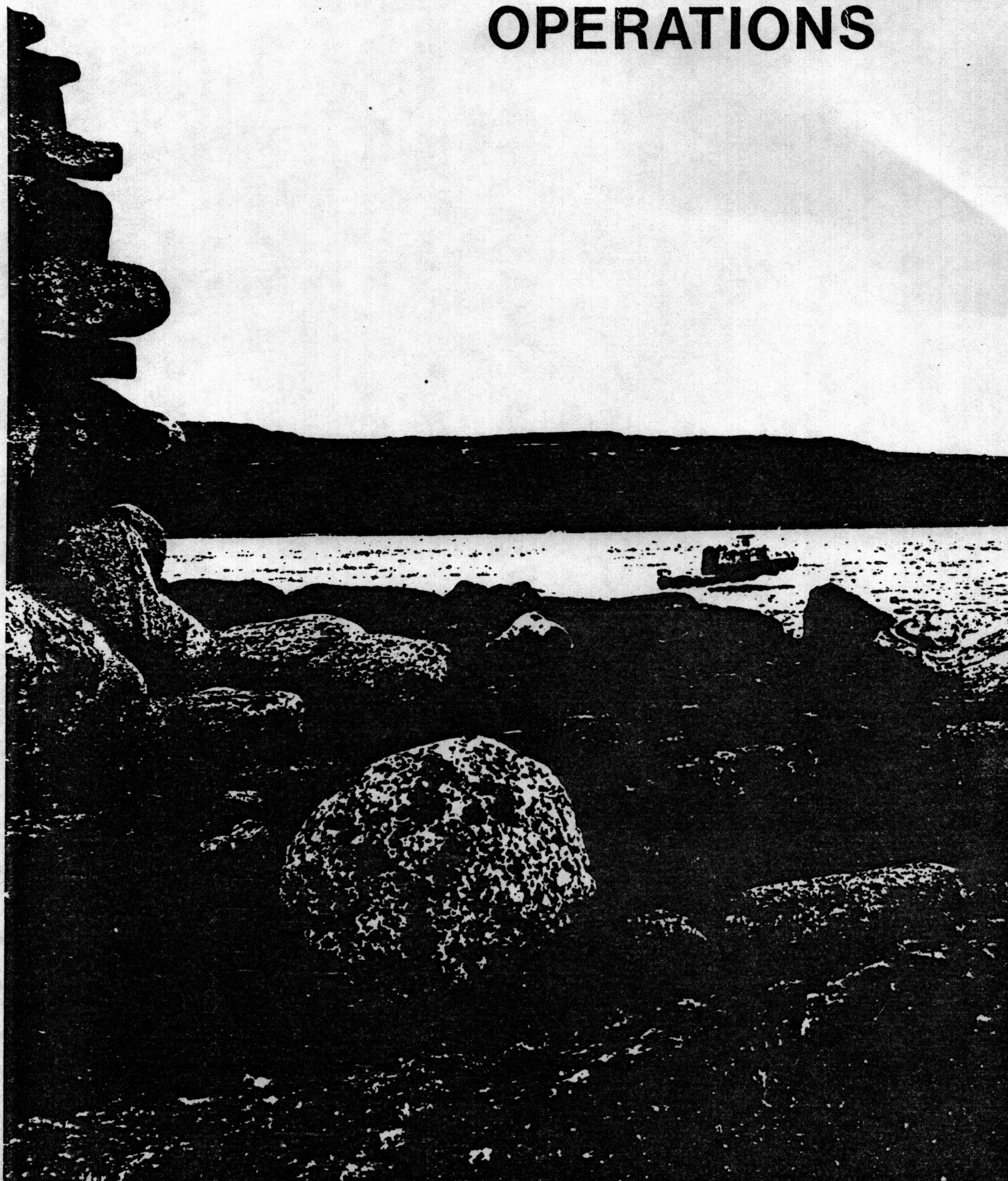
CHESTERFIELD INLET SURVEY

1974

R.A. LANGFORD

APPENDIX III

OPERATIONS



LAUNCH OPERATIONS WITH HAAPS

The standard sounding launch was a 35 foot steel hulled craft, powered by twin diesel engines; the survey equipment carried on board was a Mini-Ranger positioning system, a Ross 200 metric sounder and power converter, a Topaz power converter, Kennedy tape drive, and a D.C.U. 211 digital control unit.

In the Chesterfield Inlet 1974 Survey, it was found that due to the geographic shape of the Inlet it was necessary to have the Mini-Ranger transponders moved about frequently to allow for continuous accurate surveying of the channel.

With this in mind, it became apparent that during the initial sounding procedures, launch boat boards could be effectively used to allow rough plotting of the launch position with respect to shoals, deeps, and channel configurations, while continuous logging of data was recorded by the HAAPS unit. This proved to be very beneficial as it allowed the hydrographer to immediately examine all questionable areas covered that day during the initial sounding operation. As a result there was a large amount of time saved in surveying as we did not have to wait for processing of the sounding to be completed before examining the shoals, etc., which would possibly have required having the transponders repositioned in the area again.

The sounding system used on the launch was the Ross 200A metric sounder which was calibrated to read true depth to 21 metres, with the crystal frequency being noted on the sounding notes. The digitizer for the HAAPS unit was set to record true depth at 6 metres and any depth error in this unit was compensated for in the processing program. The major fault with the sounder/digitizer unit was that in some areas the strong current caused turbulence which showed up as noise or garbage on the sounding graph; and caused the digitizer to show false depths from the minimum blanking depth to the maximum value that could be shown on the digitizer display.

The positioning system on the launch was the Motorola Mini-Ranger III system, which was periodically calibrated over a known distance. The only electronic failure encountered with the unit was breakdowns in the R/T head, which simply put the whole system out. The main problem with using the system was that at certain ranges on calm days a skipping effect caused a wide spread in distance readings, and sometimes no readings at all. As with any range-range system, there was a noticeable positional accuracy change as the launch approached the error ellipse limits of the base line. A small problem encountered occasionally when 2 transponders were on the same code, was that it would be possible to pick up a signal on back coverage of one transponder causing bad positional data.

For the 1974 field season in Chesterfield Inlet, the HAAPS system proved itself again as a great surveying system as it allowed the small man power party to charge ahead in its work, as though there were twice as many people present. From the operational aspects there were no great problems encountered that could not be solved by the hydrographer on the launch, the only drawback to the system is that it is boring for the hydrographer to run when the area being sounded has no great depth changes which require plotting. A benefit derived from the size of the launch was the fact that cassette tape players made an appearance on the launches to provide music to the crew.

- *STATISTICS* -

FIELD REPORT STATISTICS:- MONTHLY..... PROJECT..... FINAL FIELD.XX...

YEAR 1974 FROM JUNE 26 TO OCTOBER 17

Establishment HUDSON BAY SURVEYS

H.I.C. B.M. WRIGHT

	Project Number	Project Number	Project Number	Project Number
Project Name CHESTERFIELD INLET SURVEY	6600-73-5			
Project Name				
Project Name				
Project Name				

Resources:					TOT.
Number of Hydrographers *	7/475				
Number of Scientists *	1/7				
Number of Electronic Technicians *	5/108				
No. of Student Assistants and Casuals *	1/30				
No. of Support Personnel (Ship's Crew, Etc.) *	7/535				
Total Personnel *	21/1155				
Number of Ships	1	CCGS NARWHAL			
Number of Launches	2	SURGE and STURDY			
Number of Land Vehicles	NIL				
Number (and type) of Aircraft	1	HELICOPTER 206A CGR			
Number of Minor Support staff	1	MONARK UTILITY BOAT			
Other (specify)					

* Should provide two figures separated by a slash. The first figure being the average number on strength and the second being the man days.
e.g. number of Hydrographers: 5/100 (an average of 5 Hydrographers spent 100 man days on the project).

FIELD REPORT STATISTICS:- MONTHLY ... PROJECT .... FINAL FIELD ...

YEAR FROM TO

Establishment HUDSON BAY SURVEYS H.I.C. B.M. WRIGHT	Project Number 6600-73-5	Project Number	Project Number	Project Number	To
Time:					
Total operational days.	123				
Days actual field work.	102				
Days lost (weather)	4				
Days lost (Sat. Sun. Holidays)	NIL				
Days lost (Equipment failure)	NIL				
Days lost in Transit	14				
Days lost in port for Supplies, Bunker, etc.	3				
Days lost, other causes	---				
Total Man days in period (staff)	512				
Total Man days worked (staff)	427				
Man days:- (staff)					
(a) Sounding	100				
(b) Shoal Examinations	20				
(c) Wharf surveys	NIL				
(d) Oceanography	20				
(e) Geophysics	NIL				
(f) Tides & water levels	80				
(g) Collecting bottom samples	10				
(h) Horizontal Control	105				
(i) Shorelining & Low Watering	10				
(j) Data processing & office admin.	60				
(k) Sailing directions	10				
(l) Place Names	2				
(m) Current observations	10				
(n) Photo-Ident.	NIL				
(o) Others (specify)	NIL				

FIELD REPORT STATISTICS:- MONTHLY ... PROJECT ... FINAL FIELD ...

YEAR FROM TO

Establishment HUDSON BAY SURVEYS H.I.C. B.M. WRIGHT	Project Number 6600-73-5	Project Number	Project Number	Project Number	To
Sounding (Linear Nautical Miles/KM):					
Ship Sounding	240 N.M.				
Launch Sounding	960 N.M.				
Other (specify)					
Total sounding	1200 N.M.				
Reconnaissance (Track) sounding	300 N.M.				
Area sounded (N.M^2) (Km^2)	250 N.M^2				
	850 KM^2				
Shoals Examined:					
Shoal Examinations (Ship)	NIL				
Shoal Examinations (Launch)	44				
Shoal Examinations (Sweep)	NIL				
Shoal Examinations (other) specify	NIL				
Shoal Examinations (Total)	44				
Navigational Aids:					
Shore Aids Positioned (including ranges)	26				
Floating Aids Positioned	NIL				
Navigational Ranges Sounded	12				
Navigational Ranges Drifted	NIL				
Sector Ranges Positioned	NIL				
Navigational Aids Established	14				

FIELD REPORT STATISTICS:- MONTHLY ... PROJECT ... FINAL FIELD ...

YEAR FROM TO

Establishment HUDSON BAY SURVEYS H.I.C. B.M. WRIGHT	Project Number 5600-73-5	Project Number	Project Number	Project Number	T
Shore Control:					
Signals built	136				
Signals re-built	11				
Towers built	NIL				
Number of Stations occupied	130				
Number of Stations re-occupied	30				
Number of stations permanently marked	126				
Distance Traversed (N.M.) (K.M.)	300 K.M.				
Number of Elevations Measured	126				
Number of Heights Measured	2				
Number of Stations Photo Ident.	NIL				
Other (specify)					
STATIONS BY RESECTION	73				
STATIONS BY TRIANGULATION	6				
STATIONS BY TRAVERSE	57				
Calibrations:					
No. of Calibration Stations:	2				
Lambda, Decca, Hi-Fix, Mini Fix,					
Loran, Decca Navigator,					
No. of E/c's marked and referenced	75				

FIELD REPORT STATISTICS:- MONTHLY ... PROJECT ... FINAL FIELD ...

YEAR FROM TO

Establishment HUDSON BAY SURVEYS H.I.C. B.M. WRIGHT	Project Number 6600-73-5	Project Number	Project Number	Project Number
Tide and Current Data:				
Recording gauges established	9			
Recording gauges recovered	NIL			
Staff gauges established	2			
Bench Marks Recovered	2			
Bench Marks Established	20			
Bench Marks Levelled	20			
Distance Levelled (N.M.) (KM)	2 K.M.			
No. of Current Meters Set Out	NIL			
No. of Current Meters recovered	NIL			
No. of hours of Current Measurements	70			
(Other than with Moored Meters)				
Oceanography:				
No. of Oceanographic stations	15			
Gravity Profiles-survey (N.M.)(KM)	NIL			
Gravity Profiles-track, (N.M.)(KM)	NIL			
Magnetic Profile-survey (N.M.) (KM)	NIL			
Magnetic Profile-track, (N.M.) (KM)	NIL			
Seismic Profile-survey (N.M.) (KM)	NIL			
Seismic Profile-track (N.M.) (KM)	NIL			
Number of Water Samples	50			

YEAR FROM TO

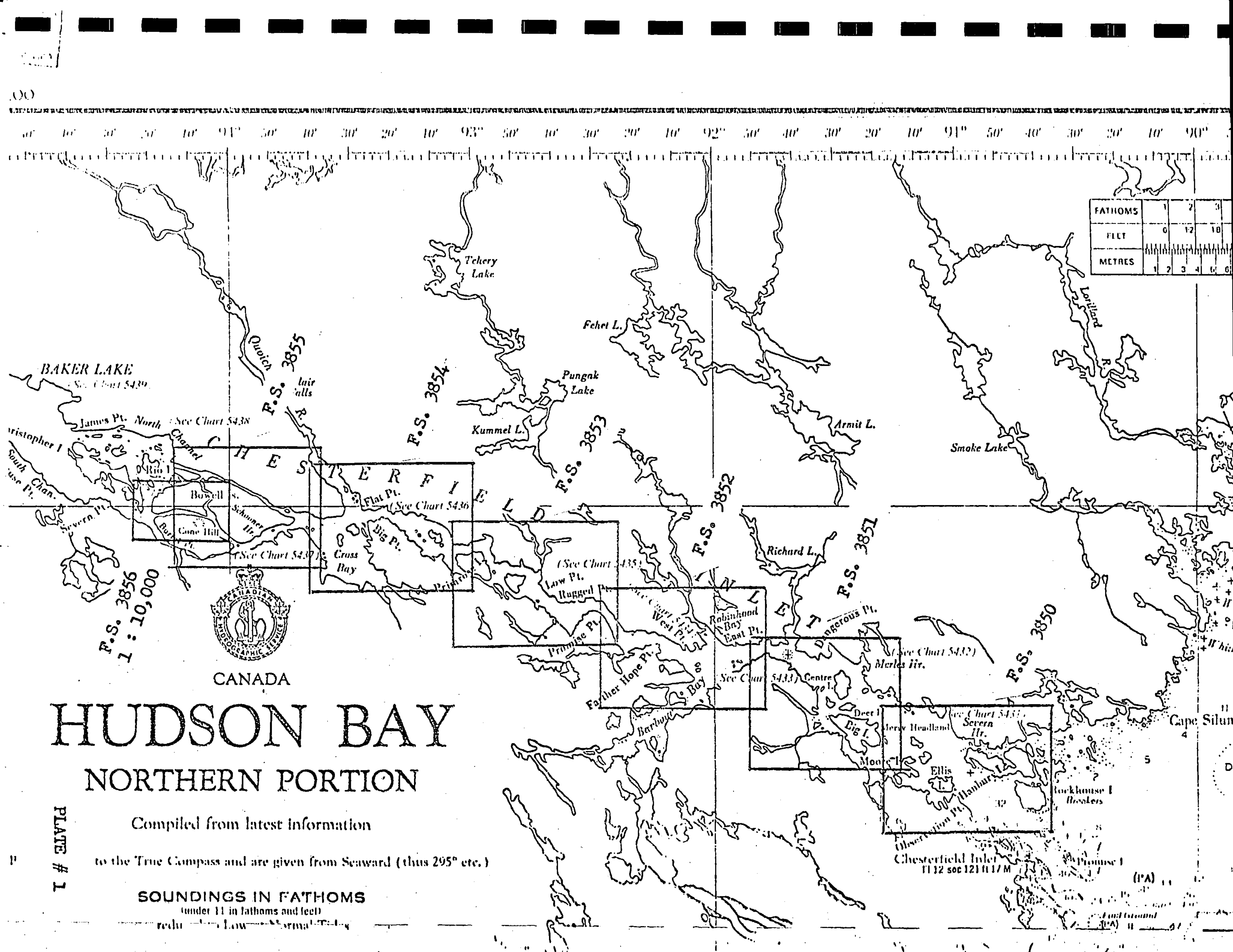
Establishment HUDSON BAY SURVEYS H.I.C. B.M. WRIGHT	Project Number 6600-73-5	Project Number	Project Number	Project Number
Bottom Samples:				
Number of bottom samples (Grab)	125			
No. of bottom samples (underway)	NIL			
No. of bottom samples (Armed Lead)	44			
No. of Cores	NIL			
No. of Samples retained	20			
Miscellaneous:				
No. of Dangers to Navigation, rocks ruins, pilings, etc., fixed.	12			
Shoreline checked (N.M.) (KM)	400 K.M.			
Wharves surveyed	NIL			
No. of Reference buoys streamed	NIL			
No. of Reference buoys recovered	NIL			
No. of Shore Stations Established:	NIL			
Lambda, Hi-Fix,				
Helicopter flying hours	300			

FIELD REPORT STATISTICS: MONTHLY ... PROJECT ... FINAL FIELD ...

YEAR FROM TO

Establishment: HUDSON BAY SURVEYS H.I.C. B.M. WRIGHT	Project Number 6600-73-5	Project Number	Project Number	Project Number	To
Data submitted from the field: (Include file numbers:)					
FIELD SHEETS 3850					
3851					
3852					
3853					
3854					
3855					
3856					
80111 T					
SOUNDING NOTES 70560					
70561					
70562					
70563					
70564					
70565					
70566					
70567					
OBSERVATION NOTES 70568					
COMPUTATION NOTES 70569					
MISCELLANEOUS NOTES 70570					
LEVELLING NOTES 70571					
CURRENT MEASUREMENTS 70572					

PLATES I - 17



CANADA
HUDSON BAY
NORTHERN PORTION
Compiled from latest information
to the True Compass and are given from Seaward (thus 295° etc.)
SOUNDINGS IN FATHOMS
(under 11 in fathoms and feet)
PLATE # 1
FATHOMS
FEET
METRES
BAKER LAKE
James Pt.
North Channel
South Chan.
Severn Pt.
Bowell Is.
Schooner Hr.
Cone Hill
C H E S T E R F I E L D I N L E T
Flat Pt.
(See Chart 5436)
(See Chart 5437)
Cross Bay
Big Pt.
Primrose I.
(See Chart 5435)
Low Pt.
Rugged Pt.
Promise Pt.
West Pt.
Robinhood Bay
East Pt.
Farther Hope Pt.
Barbour Bay
(See Chart 5433)
Centre I.
Deer I.
Big I.
Moore I.
Dangerous Pt.
(See Chart 5432)
Merles Hr.
Severn Hr.
Ellis I.
Hanbury I.
Rockhouse I
Chesterfield Inlet
Cape Silumiut
Tehery Lake
Fehet L.
Pungak Lake
Kummel L.
Armit L.
Richard L.
Smoke Lake
Lorillard R.
Quoich R.
F.S. 3856
1 : 10,000
F.S. 3855
F.S. 3854
F.S. 3853
F.S. 3852
F.S. 3851
F.S. 3850

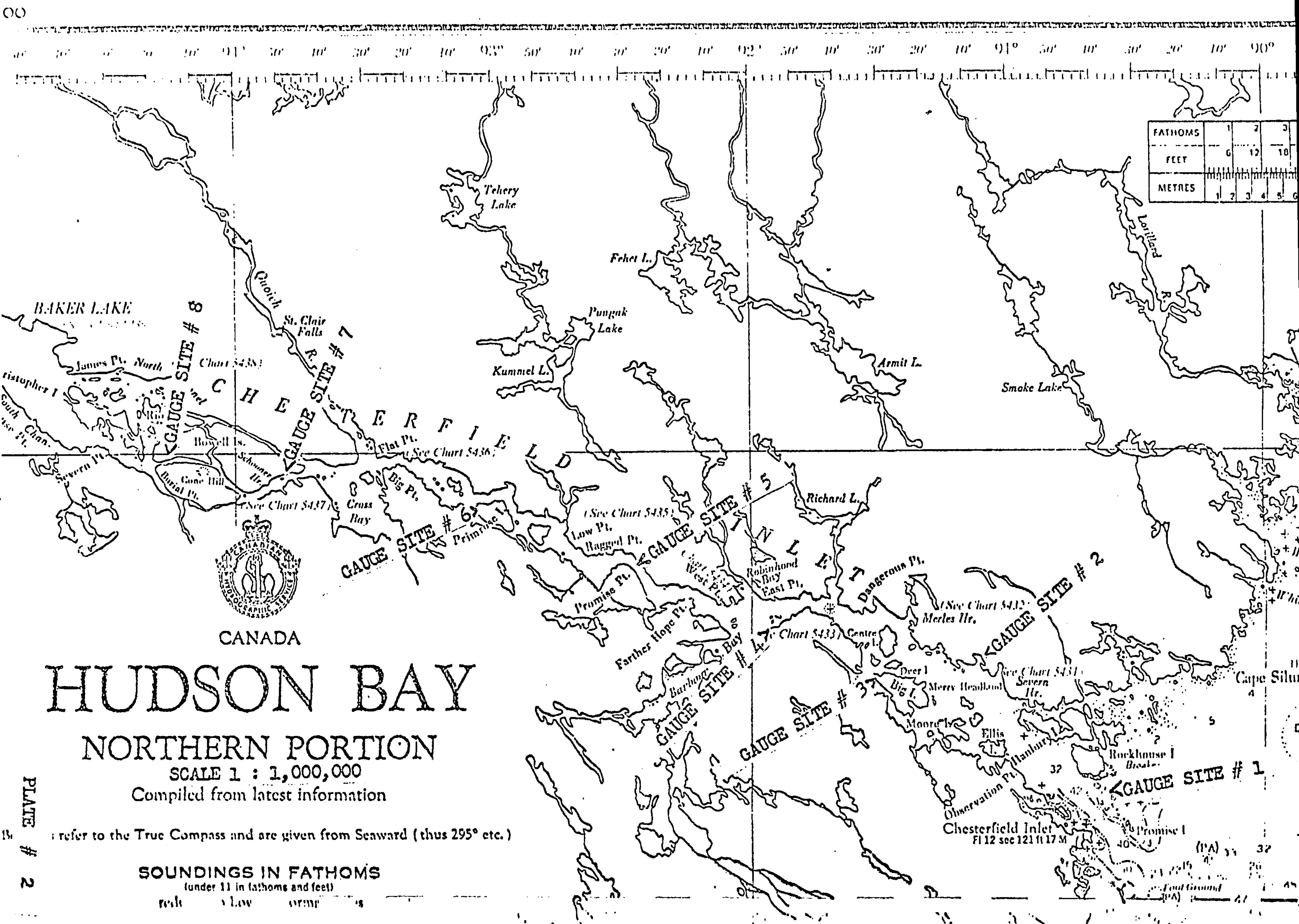
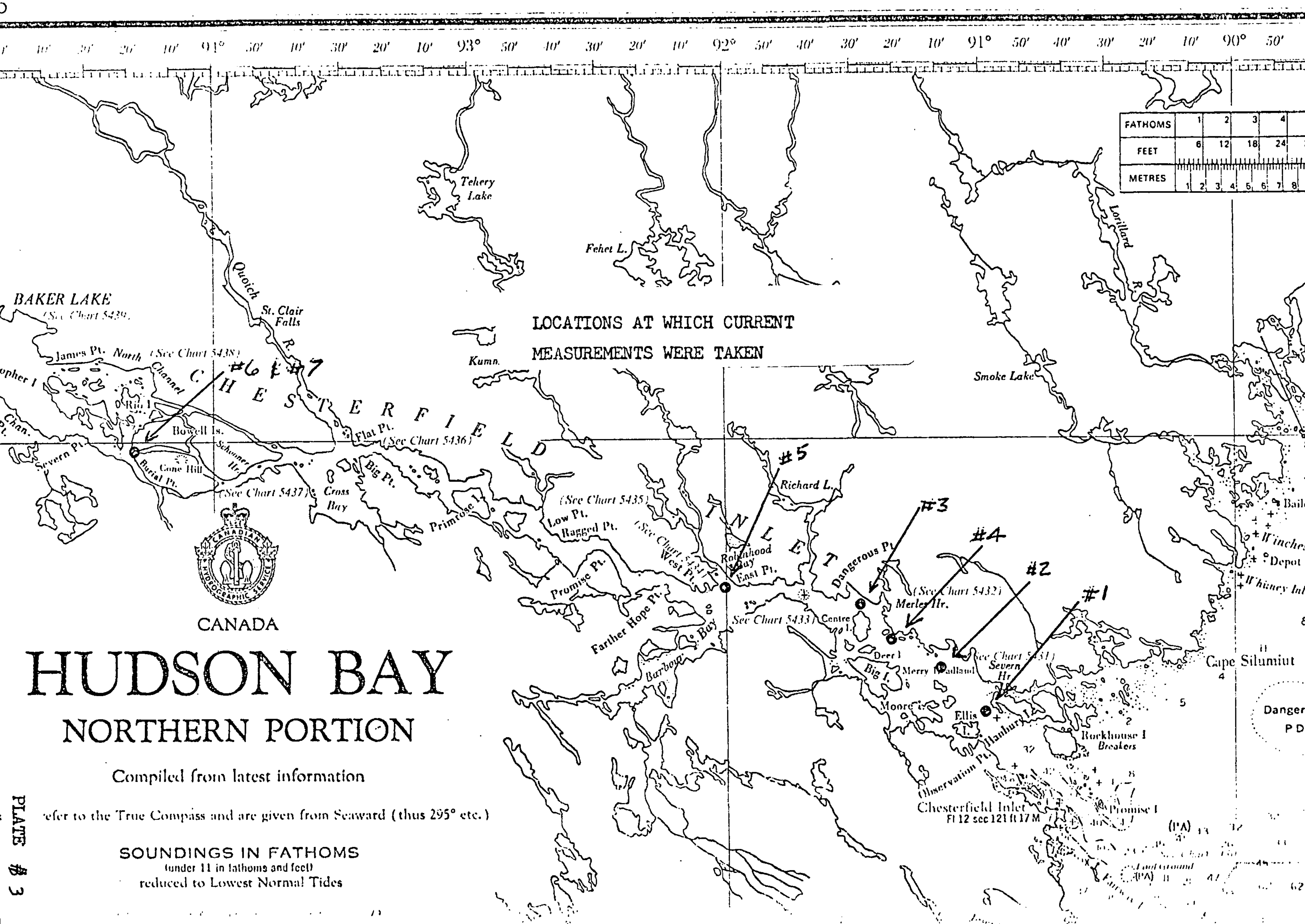

CANADA
HUDSON BAY
NORTHERN PORTION
SCALE 1 : 1,000,000
Compiled from latest information
refer to the True Compass and are given from Seaward (thus 295° etc.)
SOUNDINGS IN FATHOMS
(under 11 in fathoms and feet)
FATHOMS
FEET
METRES
BAKER LAKE
CHESTERFIELD INLET
GAUGE SITE # 8
GAUGE SITE # 7
GAUGE SITE # 6
GAUGE SITE # 5
GAUGE SITE # 4
GAUGE SITE # 3
GAUGE SITE # 2
GAUGE SITE # 1
Tehery Lake
Fehet L.
Pungak Lake
Kummel L.
Armit L.
Smoke Lake
Lorillard R.
Quoich R.
St. Clair Falls
Richard L.
Flat Pt.
Big Pt.
Cross Bay
Primrose
Low Pt.
Ragged Pt.
Robinhood Bay
East Pt.
Dangerous Pt.
Merles Hr.
Promise Pt.
Farther Hope Pt.
Centre I.
Deer I.
Big I.
Merry Headland
Severn Hr.
Ellis I.
Hanbury I.
Rockhouse I.
Observation Pt.
Chesterfield Inlet
Fl 12 sec 121 ft 17 M
Promise I.
Cape Silumiut
Severn Pt.
Burial Pt.
Cone Hill
Boswell Is.
Schooner Hr.
James Pt.
Barbour Bay
(See Chart 5437)
(See Chart 5436)
(See Chart 5435)
(See Chart 5433)
(See Chart 5432)
(See Chart 5431)
CANADIAN HYDROGRAPHIC SERVICE

PLATE # 2



LOCATIONS AT WHICH CURRENT MEASUREMENTS WERE TAKEN

PLATE #3

CHESTERFIELD INLET WATER LEVEL GAUGING PROGRAM 1974

TIDAMOGRAM PLOT

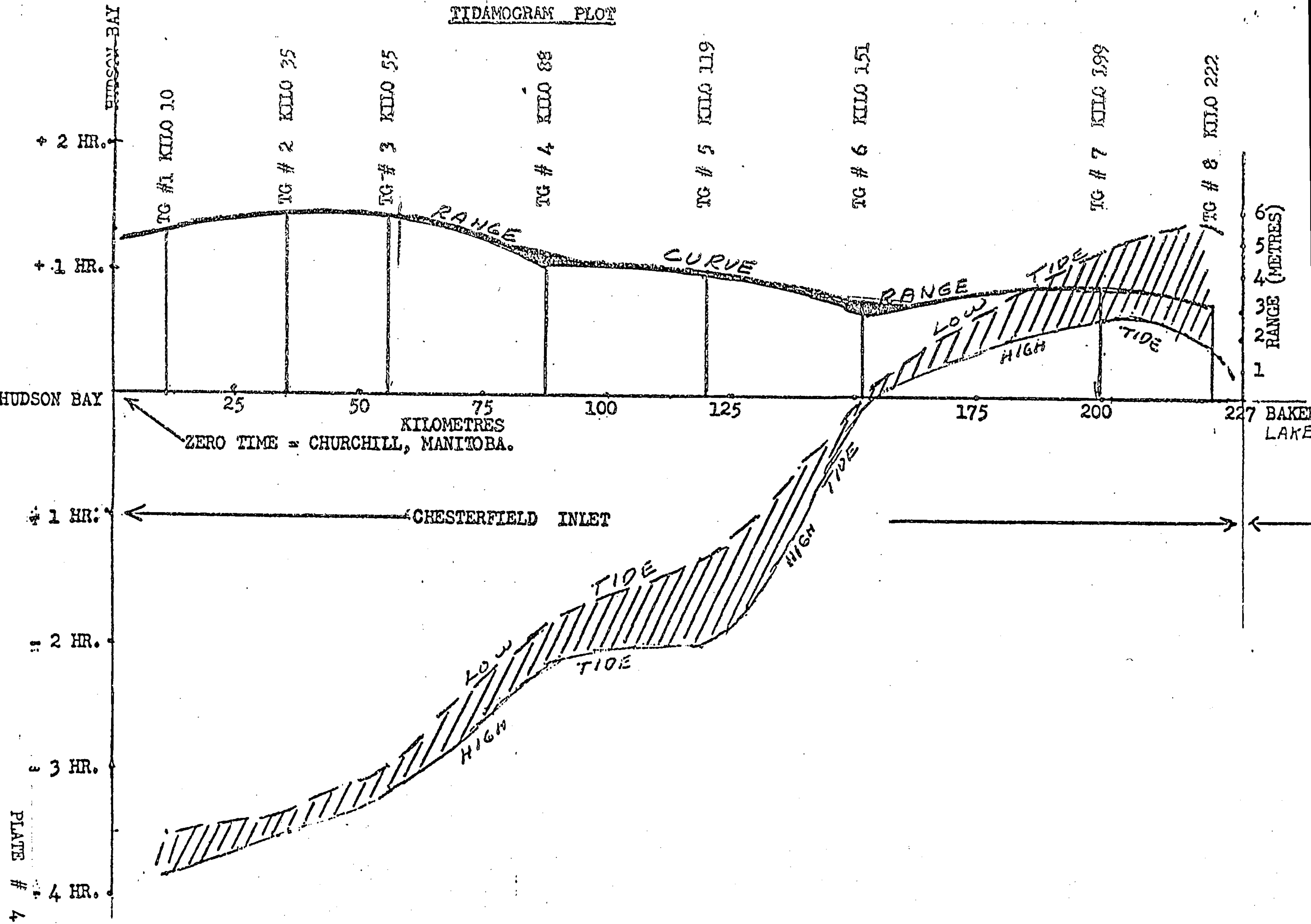


PLATE # 4

SURFACE CURRENT MEASUREMENTS

STATION NUMBER	LOCATION	MEASUREMENT PERIOD	MAXIMUM CURRENT	MINIMUM CURRENT	TIDE DATA	REMARKS
1	63^{o}31'53" 91^{o}00'33"	August 8 1530-1915	1.7 kts. @ 1845	0.4 kts. @ 1530	HT 1310 LT 1915	Measurements from CCGS NARWHAL
2	63^{o}35'56" 91^{o}13'54"	August 12 1445-2345	2 kts. @ 2115	0.1 kt. @ 1745	LT 1030 HT 1630 LT 2230	Measurements from CSL SURGE
3	63^{o}41'51" 91^{o}29'23"	August 13 1500-2330	1.7 kt. @ 2200	0.2 kts. @ 1500	HT 1700 LT 2300	Measurements from CSL SURGE
4	63^{o}38' 91^{o}22'	August 17 0935-2015	1.4 kts. @ 1630	0.2 kts. @ 1300	HT 0945 LT 1545 HT 2215	Measurements from CCGS NARWHAL
5	63^{o}43' 92^{o}	August 20 1400-2130	4 kts. @ 1830	1 knot @ 1400	HT 1245 LT 1915	Measurements from CCGS NARWHAL
6	63^{o}59' 94^{o}18'	Sept. 18 1440-2400	6 kts. @ 2330	Slack water @ 1845 & 2430	HT 1530 LT 2215	Free drift measurements from CSL SURGE
7	63^{o}59' 94^{o}18'	Sept. 20 2330-2410	7.5 kts. @ 2406	N/A	LT 2330	Free drift measurements from CSL SURGE

PLATE 5

CHESTERFIELD NARROWS SUMMARY

OBSERVATION DATE	SLACK WATER TIME	HIGH TIDE TIME *	LOW TIDE TIME *	MAXIMUM CURRENT	TIME OF CURRENT AT MAXIMUM	REMARKS
Sept. 18	18:45	15:30	22:15	6 knots	23:30	No measurements taken from 2100 to 23:30
Sept. 20	20:00	16:50	23:30	7.5 knots	24:00	
Sept. 19	00:30	03:45	22:15 (Sept. 18)			

* - Zulu times for a gauge located 5 kilometres east of Chesterfield Narrows

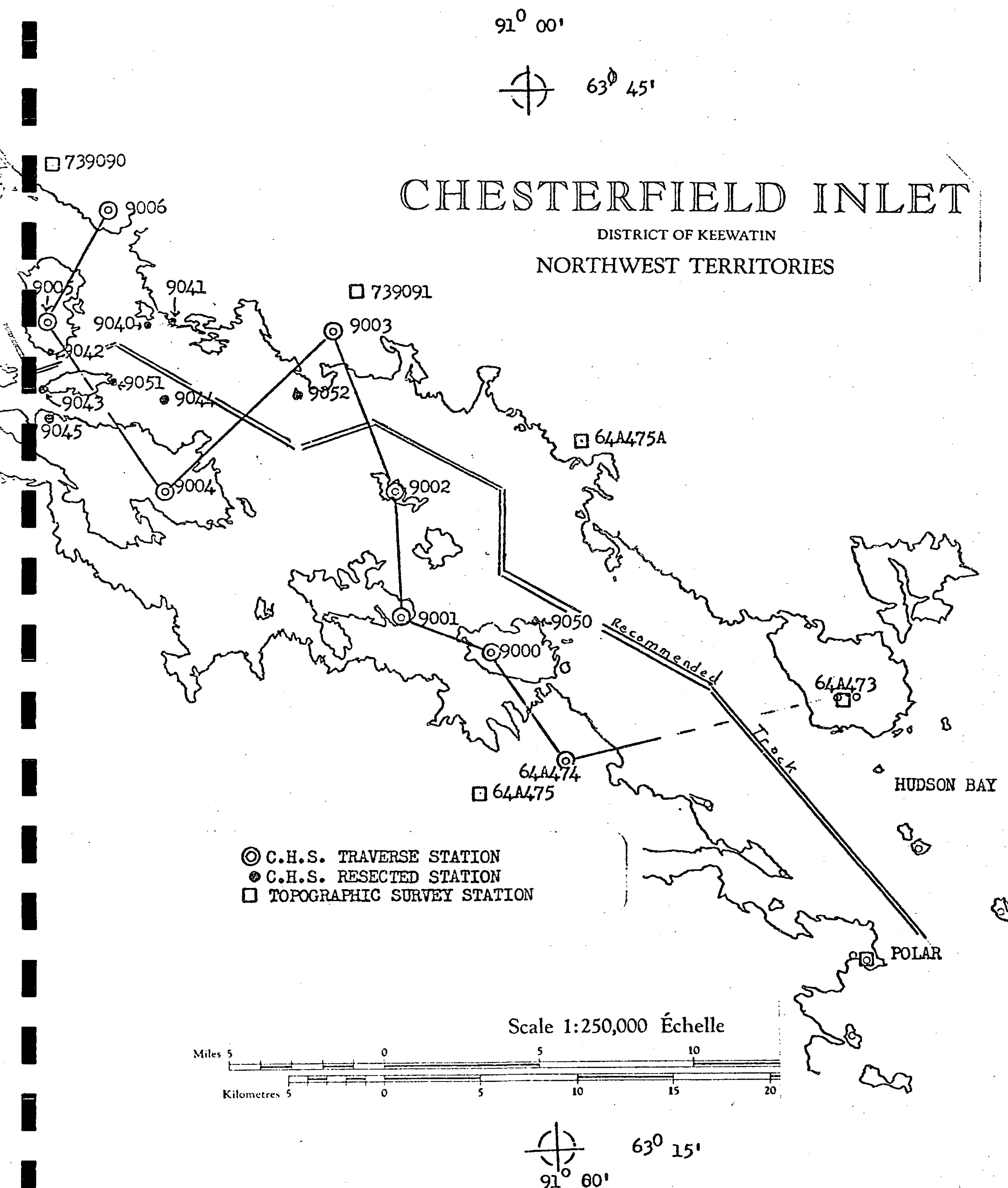

91° 00'
63° 45'
CHESTERFIELD INLET
DISTRICT OF KEEWATIN
NORTHWEST TERRITORIES
739090
9006
9005
9041
9040
739091
9003
9042
9051
9044
9052
9043
9045
64A475A
9004
9002
9001
9050
9000
Recommended Track
64A473
64A474
64A475
HUDSON BAY
C.H.S. TRAVERSE STATION
C.H.S. RESECTED STATION
TOPOGRAPHIC SURVEY STATION
POLAR
Scale 1:250,000 Échelle
Miles 5 0 5 10
Kilometres 5 0 5 10 15 20
63° 15'
91° 60'

PLATE 7

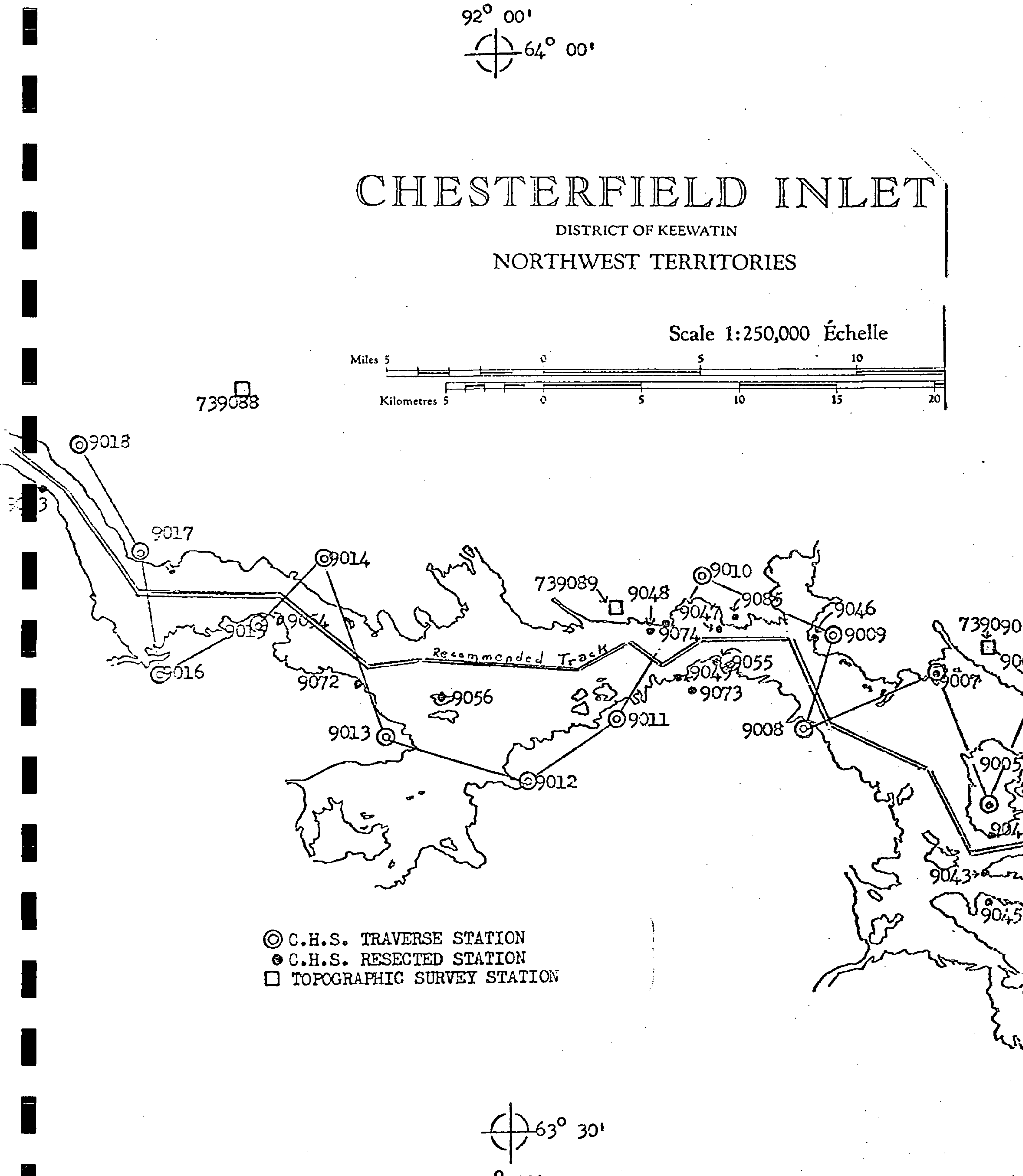
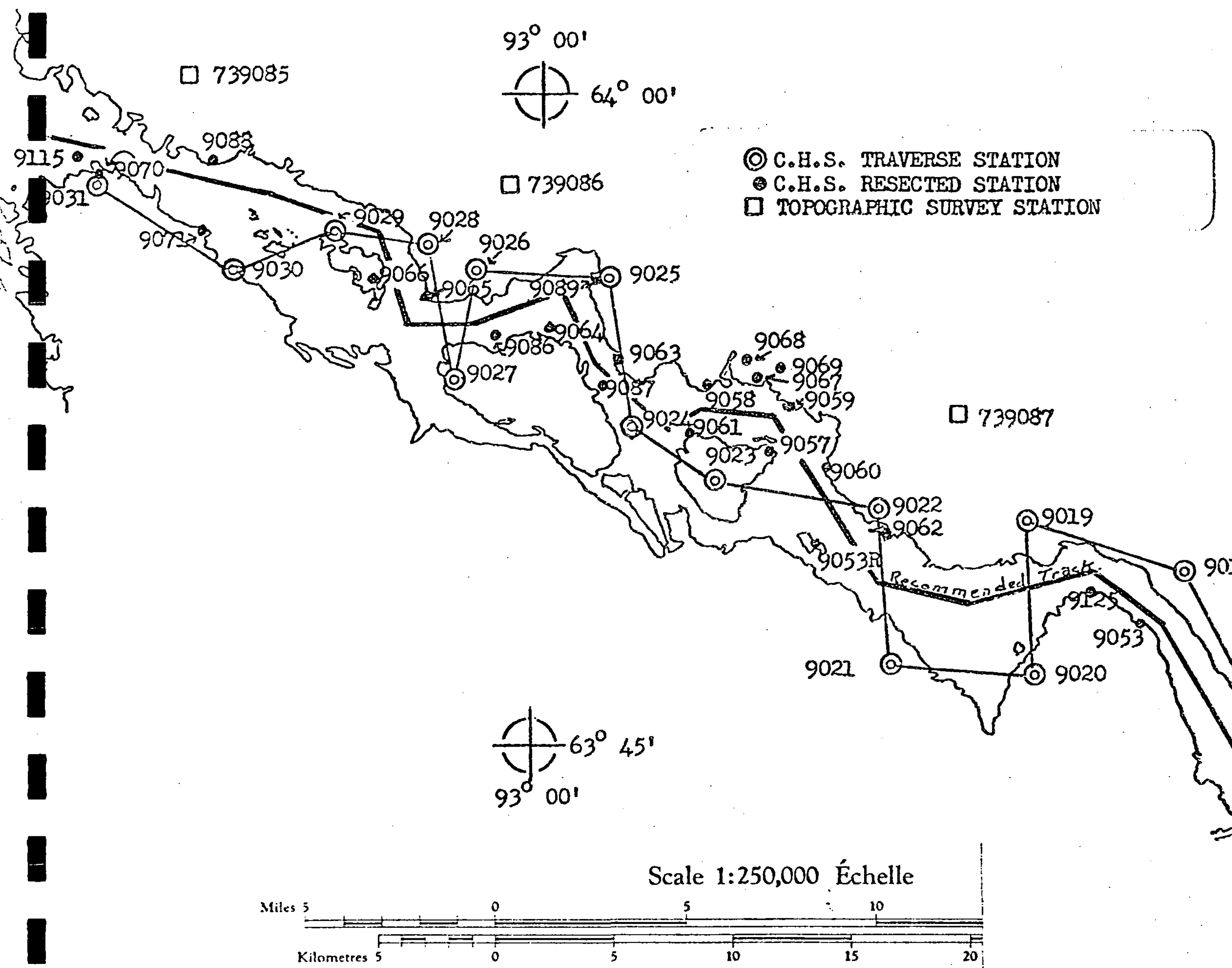

92° 00'
64° 00'
CHESTERFIELD INLET
DISTRICT OF KEEWATIN
NORTHWEST TERRITORIES
Scale 1:250,000 Échelle
Miles 5 0 5 10
Kilometres 5 0 5 10 15 20
739088
9018
9017
9014
9016
9019
9054
9072
9056
9013
9012
9011
739089
9048
9074
9010
9047
9085
9049
9055
9073
9046
9009
9008
739090
9007
9005
9043
9045
Recommended Track
C.H.S. TRAVERSE STATION
C.H.S. RESECTED STATION
TOPOGRAPHIC SURVEY STATION
63° 30'
92° 00'

PLATE 8

CHESTERFIELD INLET

DISTRICT OF KEEWATIN

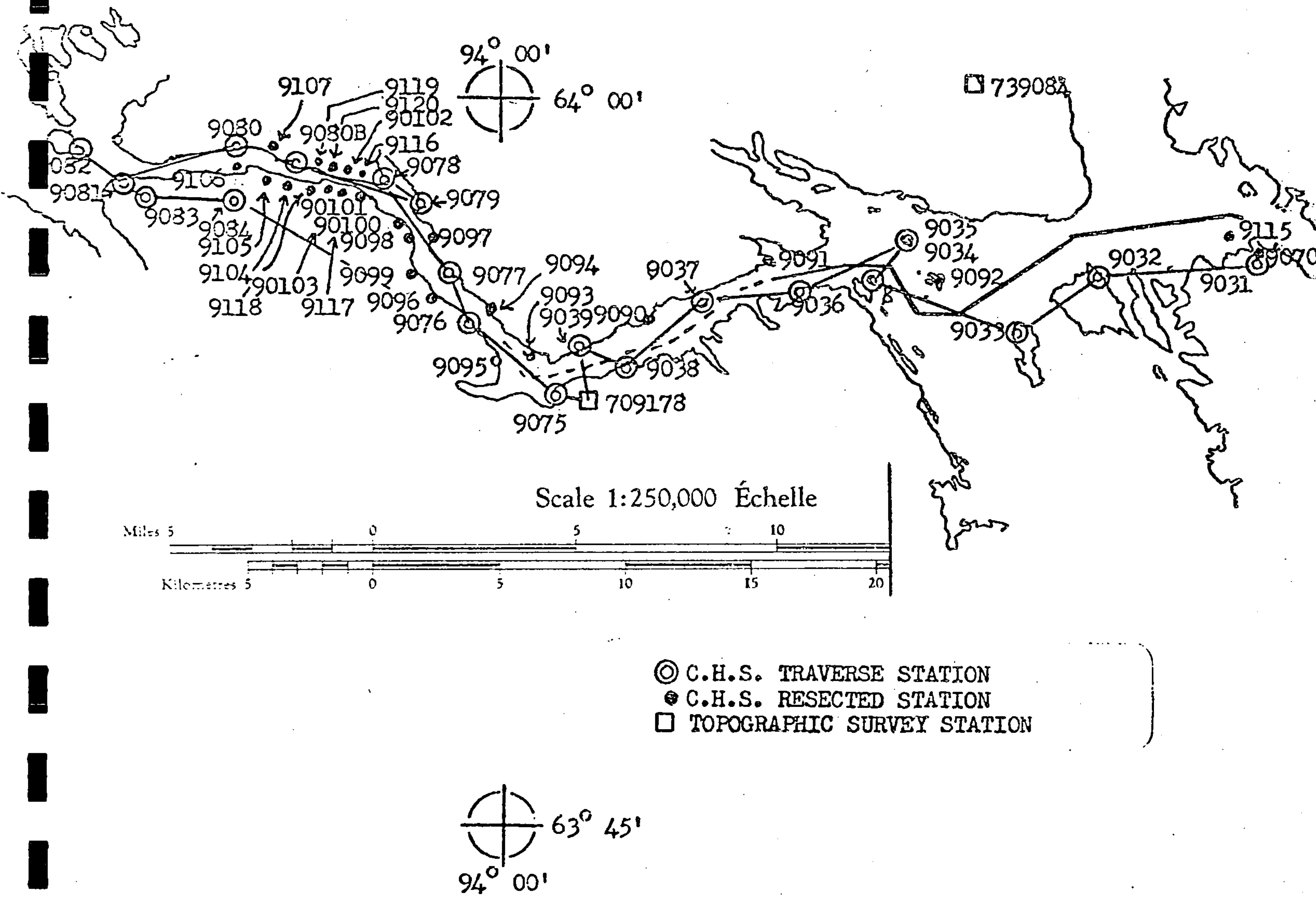
NORTHWEST TERRITORIES

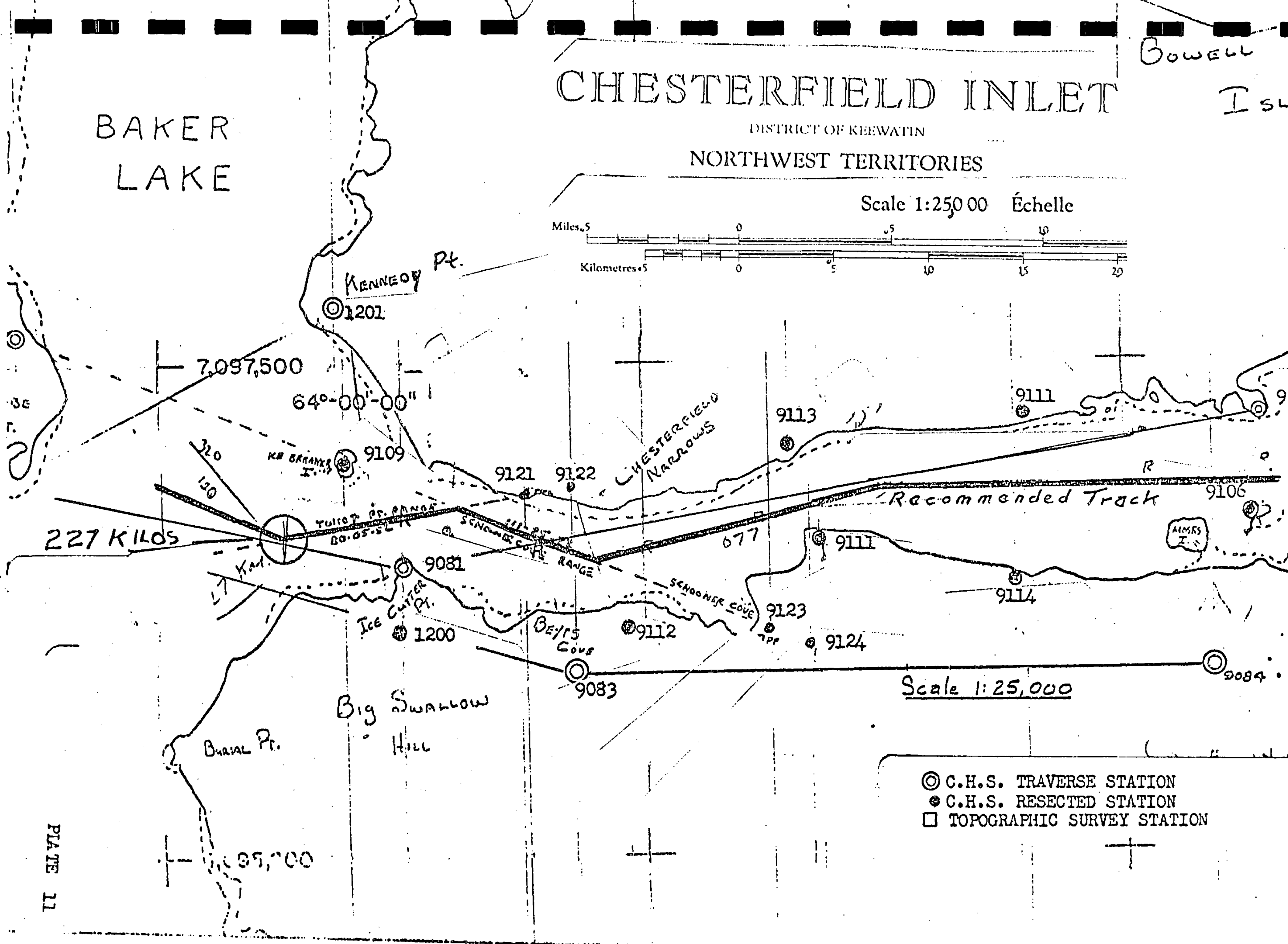


CHESTERFIELD INLET

DISTRICT OF KEEWATIN

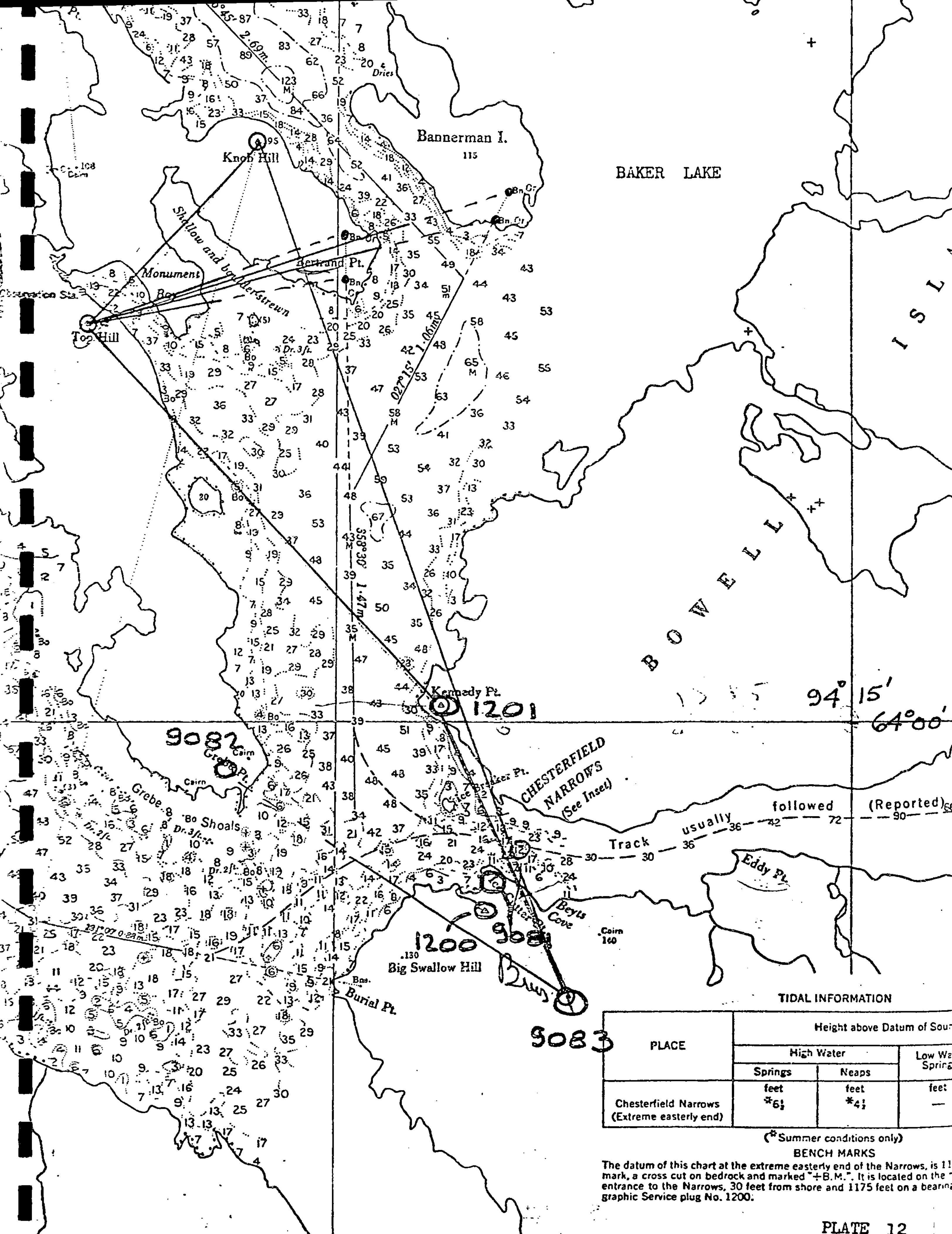
NORTHWEST TERRITORIES





CHESTERFIELD INLET
DISTRICT OF KEEWATIN
NORTHWEST TERRITORIES
Scale 1:250000 Échelle
Miles 5 0 5 10
Kilometres 5 0 5 10 15 20
BAKER LAKE
Bowell Isl
Kennedy Pt.
1201
7,097,500
64°-00'-00"
9109
9121
9122
Chesterfield Narrows
9113
9111
9106
Recommended Track
677
9111
9114
9081
Ice Cutter Pt.
1200
Beys Cove
9112
Schooner Cove
9123
9124
9083
9084
Scale 1:25,000
227 KILOS
320
130
Big Swallow Hill
Burial Pt.
C.H.S. TRAVERSE STATION
C.H.S. RESECTED STATION
TOPOGRAPHIC SURVEY STATION

PLATE 11



TIDAL INFORMATION

PLACE	Height above Datum of Soun		
	High Water		Low Wa Spring
	Springs	Neaps	
	feet	feet	feet
Chesterfield Narrows (Extreme easterly end)	*6½	*4½	—

(*Summer conditions only)

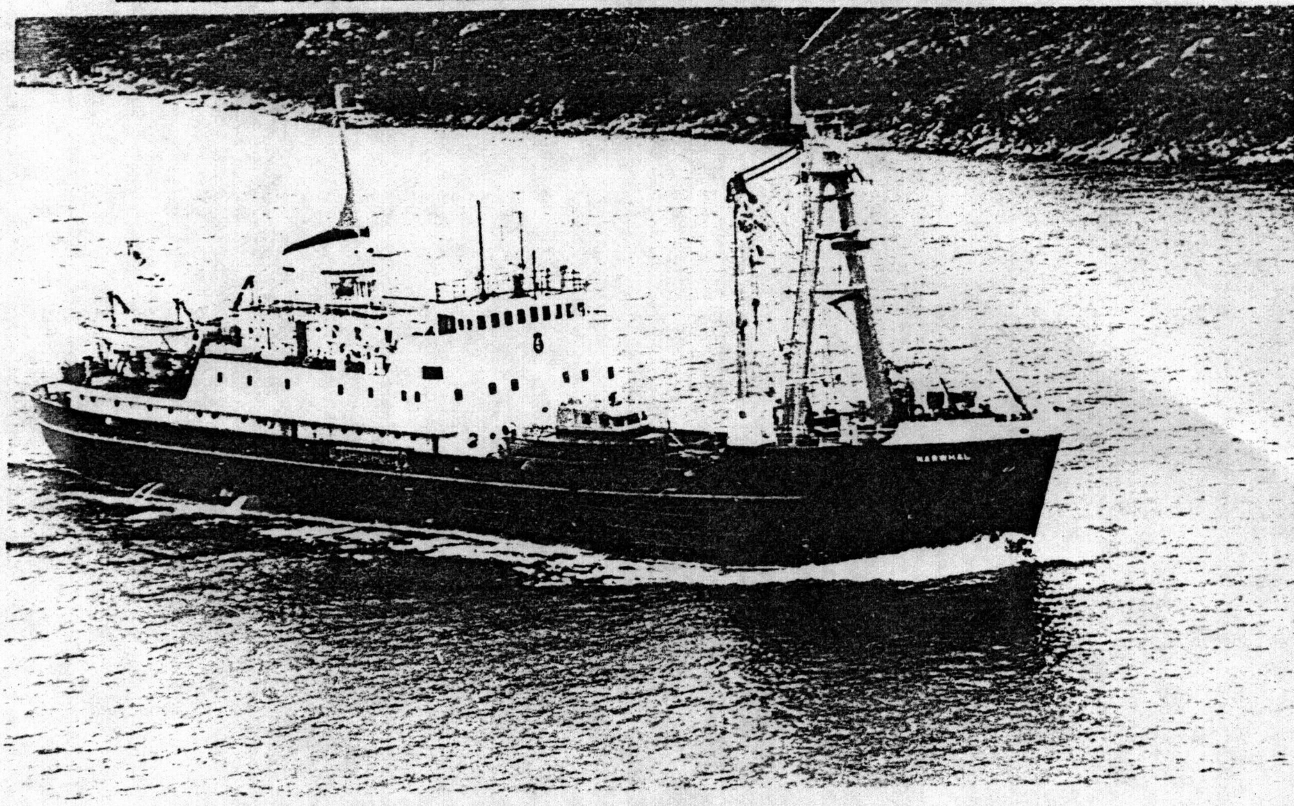
BENCH MARKS

The datum of this chart at the extreme easterly end of the Narrows, is 11 mark, a cross cut on bedrock and marked "+B.M.". It is located on the entrance to the Narrows, 30 feet from shore and 1175 feet on a bearin graphic Service plug No. 1200.

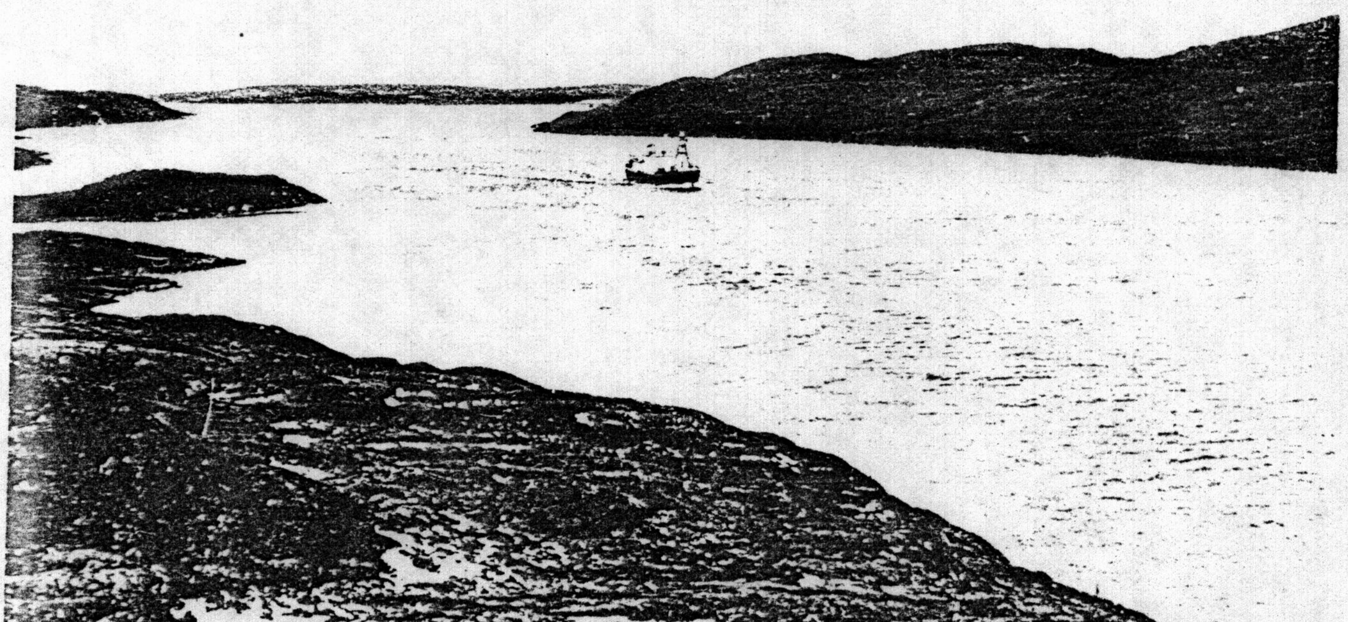
PLATE 12

CCGS NARWHAL ..... LARGEST VESSEL INTO BAKER LAKE

LENGTH 252 feet BREADTH 42 feet DRAUGHT 12.5 feet



NARWHAL IN CHESTERFIELD INLET WITH SURVEY LAUNCH ABOARD



NARWHAL PROCEEDING EASTWARD THROUGH CHESTERFIELD NARROWS

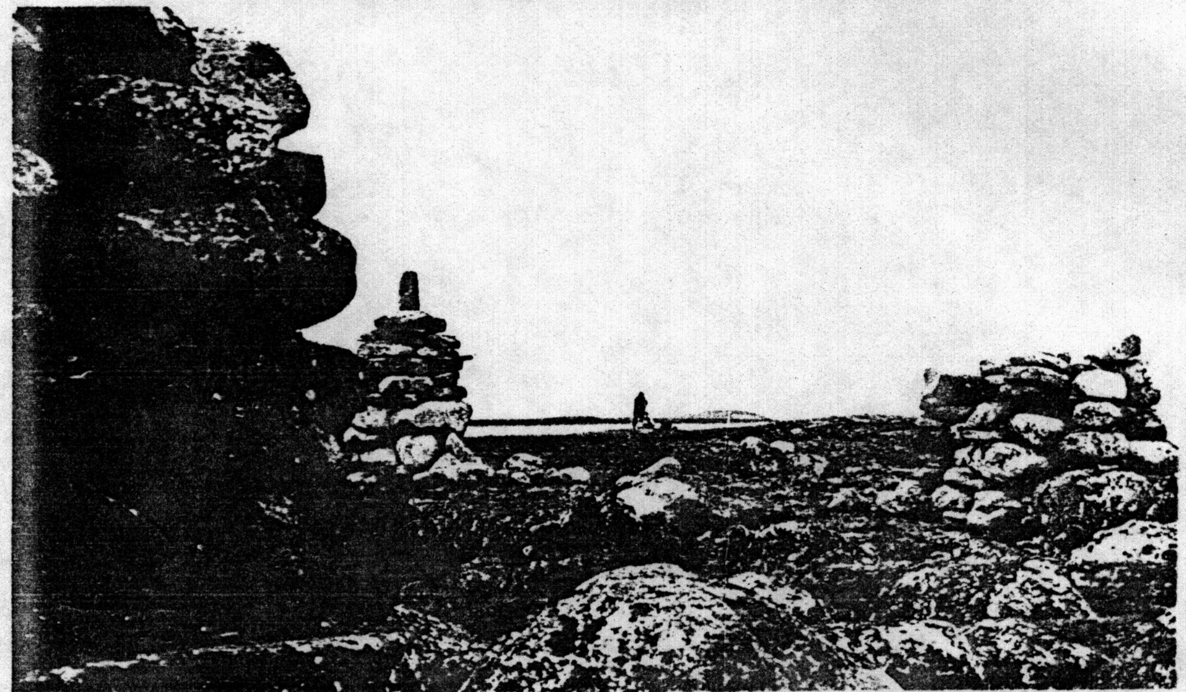
LAUNCHES AND WATERCRAFT USED ON CHESTERFIELD INLET SURVEY

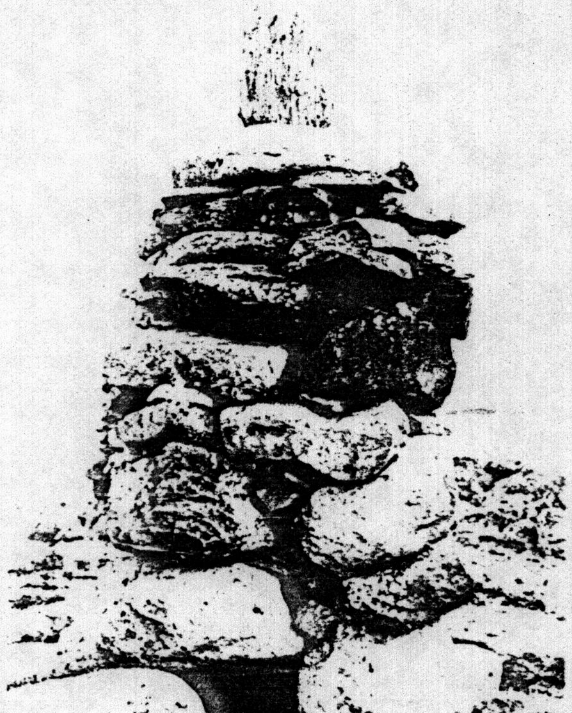
35 FOOT STEEL HULLED SURVEY LAUNCH , ONE OF TWO USED ON SURVEY

20 FOOT STEEL HULLED UTILITY CRAFT

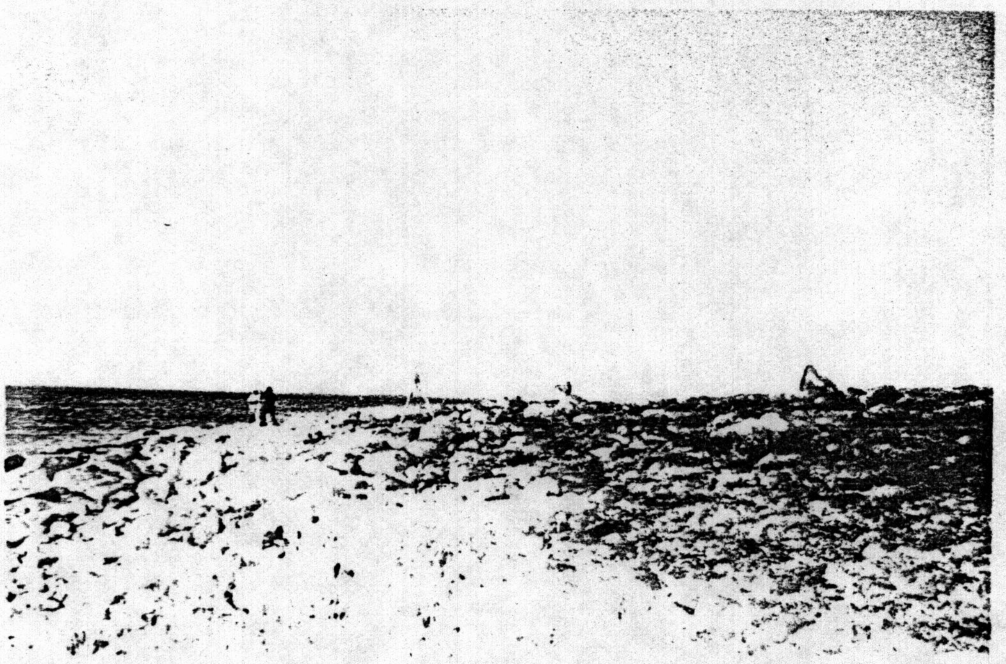
PLATE 14

ESKIMO SIGN POSTS . A CONSPICUOUS FEATURE OF THE CHESTERFIELD INLET LANDSCAPE





TIDE GAUGE INSTALLATIONS AT BARBOUR BAY



SHORELINE FORMATIONS , CHESTERFIELD INLET