FINAL FIELD REPORT
THUNDER BAY SURVEY
1974
(LAKE SUPERIOR)

H.I.C. - F.L. DE GRASSE
SUB-PARTY CHIEF - J.V. CROWLEY

CONTENTS

PERSONNEL

STAFF

F.L. DeGrasse	Hydrographer-in-Charge
J.V. Crowley	Sub-Party Chief
R.R. Solvason	Hydrographer

CREW

S. Toohy	Acting Coxswain
H. Tucker	Seaman

LIST OF MAJOR EQUIPMENT

1 office trailer
2 boat trailers

1 Chevrolet carryall
1 Botved launch HUSTLE
1 Boston Whaler MONICA
1 Sportyak punt

2 Edo 9040 echo sounders
1 Raytheon DE-719
1 Hydrodist Positioning System

INTRODUCTION

Thunder Bay and much of the north end of Lake Superior was first surveyed by Mr. W.J. Stewart between 1903 and 1905. The harbour area east to about 89°05' (W) was again sounded by Mr. L. Quick in 1959. He examined a shoal area on Hare Island Reef the next year, after it had been found by a ship. In 1973, Mr. J.F. McCarthy established horizontal control around the bay in preparation for the 1974 Contract Survey. He also sounded the wharves just north of the Keefer Terminal at a scale of 1:1000 (F.S. 3823).

The 1974 Thunder Bay Survey was mainly a contractual operation conducted by Canadian Engineering Surveys Co. Ltd., an Edmonton based firm under contract to the Canadian Hydrographic Service. C.H.S. also fielded a four man, one launch party to 'monitor' the Contractor's work, and to conduct various peripheral surveying jobs not covered by the Contract.

CANADIAN ENGINEERING SURVEY (CES) OPERATION

The Contractor was responsible mainly for producing three field sheets to C.H.S. standards. Their involvement was essentially in the matters of sounding, shoal examining, bottom sampling and drafting of the final documents. For $109,542.00, they were to produce, by December 31, 1974, one field sheet at a scale of 1:50,000 and two at 1:15,000. C.H.S. provided the field sheet base plots and shoreline plots.

C.E.S. operated one 24 foot launch fixing by Motorola's two range Mini-Ranger system. An automatic logger printed the range readings on demand from a clock - usually every 30 seconds on the 1:50,000 work sheet. The sounder (Raytheon or Elac, depending on the depth) was fixed manually. The logger print-out and the sounder graph notations comprised the only sounding notes.

Fixes were plotted later in the office after being converted by calculator to Universal Transverse Mercator co-ordinates. Each 30 second fix was plotted and labelled in pencil on a plastic ten centimetre grid sheet. The sounding graph was scaled and reduced for water level on the roll. The field sheet was then inked by a draftsman with a Leroy lettering set.

This system may have worked in open water and at a smaller scale. For conventional hydrography, it did not stand a chance. Plotting could not keep up with sounding, inking fell far behind plotting. Late in the season, more personnel were brought in to try to finish the job. While some gains were made in the inking and plotting there was no chance to finish. C.E.S. failed to complete the field work on any of the three sheets. No shoals were examined. Only a few bottom samples were taken. Many gaps were left in the sounding coverage, particularly in small bays and inshore areas. However, most of the regular sounding coverage was completed. The field sheets have been submitted and partial payment has been made based on an estimated percentage of work performed. A report written by C.E.S. is to be submitted shortly. Persumably it will contain the details of their operation - their personnel, statistics, etc.

CANADIAN HYDROGRAPHIC SERVICE OPERATION

When I arrived in Thunder Bay in mid-June, I delivered the three field sheet base plots to the Contractor's representative who had arrived a week earlier. Shoreline plots for these sheets were only partially done as horizontal control did not extend to their limits. The extension of this network was to occupy us for much of the summer.

In late June, we trailered two boats from Burlington to Thunder Bay. We set up our office trailer, left by J.F. McCarthy from the 1973 survey, on a corner of the M.O.T. wharf. Captain W. Forbes, the M.O.T. Sub-Agent, supplied us with workshop space and wharfage. He and his staff were most co-operative throughout the summer.

Vertical Control

Our first field work of establishing a water level staff and checking into three old bench marks ran into some minor difficulties. We ran four lines of levelling between "Poar-4" and "347-E" and two between "347-E" and "Poar-5". The results are listed below:

B.M.	Values supplied by Tides & Water Levels Section		Our 1974 Levelling Results	Geodetic Surveys 1974 Values (I.G.L.D.
	I.G.L.D.	Geodetic		
POAR-4 (1967)	611.778	611.901		611.614
difference =	4.680	4.607	4.616 4.565 4.563 4.576 mean = 4.580	4.576
347-E	607.098	607.294		607.038
difference =	0.680	0.678	0.652 0.645 mean = 4.648	0.670
POAR-5 (1967)	607.778	607.972		607.708

We have since accepted the latest Geodetic value of 607.038 (IGLD) for B.M. 347-E. Since our sounding datum of 600.00 (IGLD) is 7.038 below the B.M. and the zero of the staff was set 7.158 feet below the B.M., there is a correction of -0.120 ft. to be applied to the staff reading to obtain a correct reduction. This tallies well with the permanent gauge readings which we monitored daily. Readings from the permanent gauge were used for sounding reductions.

Horizontal Control

A considerable amount of control work was required despite the efforts of the 1973 party. We triangulated positions for all the M.O.T. lights on the waterfront and all but Thunder Cape Light in the survey area. We also cut in several water towers, chimneys, and radio towers. Elevations were obtained for all intersected points.

We positioned ranges at the entrances to McKellar and Mission Rivers. Failure to get 'sun shot' confirmation of azimuth of the inverse computations plagued us until the end of the field season. A computer program supplying the sun azimuth was eventually found to be wrong. It has since been re-written by Mr. G. Macdonald.

	True Bearing at Front Range	
	Inverse	Sun Shot (mean)
Mission Channel Range	289-09-02.1	289-08-55.0
McKellar River Range	267-55-12.0	267-55.20.6

Because C.H.S. was responsible for the shoreline plots and shoreline was to be drawn from aerial photos projected by a Caesar-Saltzman projector, it was necessary to establish a considerable amount of additional control. We ran three main traverses and re-observed some 1973 stations. We sent the pin-pricked photos, sketches and plots to the regional office where Mr. R. Treciokas drew the shoreline. The completed plots were turned over to the Contractor in September.

We monumented eight new stations:

8918	GRAN
8919	LARK
8920	RHIL
8921	MARV
8922	BACK
8923	EASY
8924	CAVE
8925	SPUR

C.E.S. also monumented two new stations (with our monuments) and positioned an Ontario Government gravity plug.

8926	SKIN
8927	BRUN

Echo Sounding

The planning of the sounding operation was rather confusing. We inherited plans for several 1:1000 sheets inside the harbour and two 1:5000 sheets outside. The 1:5000 sheets, which had been drawn, did not quite meet the 1:15,000 sheets of the Contractor. In May, the 1:1000 and 1:5000 plans were scrapped, with the latter being replaced by a single 1:10,000 sheet. Verbal instructions were to sound only "check lines" on this sheet and await instructions from the regional office. Our plans then, on leaving for the field, were to produce one field sheet and that sheet to probably consist of only check lines. While we also intended running check lines and examining some shoals in the Contractor's territory, we anticipated inking the results on their sheets. As it turned out, we submitted seven field sheets.

Number	Scale	Title
3863	1:50,000	Thunder Bay Check Lines
3864	1:15,000	Approaches to Thunder Bay Harbour
3865	1:10,000	Thunder Bay - Mission River to Bare Point
3866	1:10,000	Hare Island Reef
3867	1:2,000	Approach to Kaministikwia River
3868	1:2,000	Shoal Area ½ Mile West of the Welcome Islands
3869	1:2,000	Shoal Area ¼ Miles East of Mission Channel Entrance Light

Field Sheets 3863, 3864, 3865, 1975

These three field sheets contain mostly "check lines" which were inked separately when it was decided to abandon the plan of inking on the Contractor's sheets. Field Sheet 3865, which confirmed the 1959 work of Mr. L. Quick, also contains some detailed coverage of McKellar River and Mission Channel Ranges. It shows the new positions of the M.O.T. lights and buoys. On this sheet, we fixed by sextants until after we received a Hydrodist set from Mr. E. Thompson. Fixing on F.S. 3863 and F.S. 3864 was all by Hydrodist.

Field Sheet 3866, 1975

At the south end of Thunder Bay, there is a three fathom sounding charted on Hare Island Reef. When we were unable to find this three fathom shoal where it is charted on Field Sheet 2301, we decided to make a small field sheet of Hare Island Reef at a scale of 1:10,000. We fixed by Hydrodist on theodolite lines conned from station "HARE" on Hare Island. The shoals we found are the same as on Mr. L. Quick's 1960 sheet. The three fathom spot on the chart is incorrect.

Field Sheets 3867, 3868, 3869

These three sheets were attempted partially to evaluate the technique of fixing with two theodolites and partially to better delineate three shoal areas. Field Sheet 3867 was done before the Hydrodist arrived and the other two after it became unserviceable. They are all on a scale of 1:2,000. Field Sheet 3867 was a shoal exam of a 27 foot sounding which showed up on one of Mr. L. Quick's sounding lines. We found 26 feet. Field Sheets 3868 and 3869 comprised areas that the Department of Public Works reported as being dredged in 1960. They had dredged off shoals found by Mr. Quirk, but the new depths had not been published on Chart 2314.

While the method of fixing by two theodolite cuts is an old one, the availability of portable radios and electronic calculators may make it more practical now that it was in the past. A brief description is enclosed in App. "C".

Revisory

In mid-September, there was an incident in which a ship struck an overhead wire on the Kaministikwia River. In response to a request from Capt. W. Forbes of M.O.T., we measured the clearance of the wire, finding it to be 115 ft. in contrast to the 142 ft. charted. We subsequently checked the two other clearances on these channels, finding both to be higher than charted. The data were sent to Headquarters and have been published in Notices to Mariners.

Location	Clearance in Feet	
	Charted (2314)	Measured 1974
Near mouth of Mission River	140 ft.	115 ft.
Near CPR Sheds	142 ft.	149 ft.
Near swing bridge over Kaministikwia River	132 ft.	142 ft.

Wrap-up

As it became increasingly apparent that the Contract survey could not be completed, we were instructed to leave the heavy equipment in Thunder Bay in anticipation of a 1975 survey. In mid-October, we pulled the HUSTLE and the Boston Whaler and blocked them up for the winter. Most of our equipment was shipped to CCIW via CN Express, some came home in the carryall and the rest was stored at Thunder Bay. On October 18th, the staff and crew left for home. I departed on November 5th, and the Contractor packed it in on November 14th.

RECOMMENDATIONS AND COMMENTS RE THUNDER BAY CONTRACT SURVEY

1. The practice of drawing shoreline by Caesar-Saltzman projector from photo-identified contact prints should be discontinued. Shoreline plots should be drawn by conventional photogrammetric techniques whenever possible.

2. Because of the uneven bottom topography and problems the contractor had in the area Thunder Cape to Middlebrun Point, consideration should be given to charting at a larger scale.

   It should be noted that some of the Contractor's bathymetry had to be discarded on checking.

3. Except for the possible exception of small scale, offshore bathymetry, the practice of 'Leroying' soundings on the field sheet, as done by the Contractor, should not be continued.

4. The cost of monitoring and checking doubtful data of a contract charting project is considerable - this is especially so with a company of limited experience.

5. Field Work Remaining to be Done: (approximations only)

FIELD SHEET	AREA	LINES MILES	SHOALS	BOTTOM SAMPLES	% OF FIELD WORK REMAINING
3860	A	20	48	31	18%
3860	C	5	80	14	45%
3860	D	100	17	5	100%
3861	B	90	35	60	60%
3862	B	125	20	32	
	Totals =	340	200	142	

Based on an estimate of 50 miles or 50 bottom samples or 10 shoals per launch per day, there are approximately 30 launch-days work remaining. The same criteria applied to the original estimates gives 78 launch-days for completion. Therefore, the FIELD work is about 67% complete (the above estimates do not include down time for weather and unserviceable equipment).

CONTRACTOR'S REPORT

Canadian Engineering Surveys Co. Ltd.

Management & Consulting Engineers

Legal Surveyors

Off-shore & On-shore Electronic Positioning Services

HEAD OFFICE
8th Floor Melton Building
10310 - Jasper Avenue
EDMONTON, CANADA
T5J 1Y8

Calgary (403) 264-2151

Edmonton (403) 424-7385
Telex 037-3850

Our File: C-7540

Your File:

December 12th, 1974.

FINAL REPORT, 1974 SEASON

PROJECT NO. 6600-73-3

PROJECT: CONTRACT SURVEY OF THE THUNDER BAY AREA OF LAKE SUPERIOR.

DESCRIPTION:

The field operations commenced on June 3rd with the crew leaving Edmonton and travelling by truck to Thunder Bay. We took with us a Mini Ranger system and conventional survey equipment.

We arrived in Thunder Bay on the afternoon of June 5th and informed the boat dealer that we were in town and confirmed that the STARCRAFT was ready. We also got in touch with our local boat driver. The STARCRAFT was put in the water the following morning after being equipped to D.O.T. standards. The remainder of the week was spent arranging for equipment, docking and supplies.

On June 8th Dave Roberts (C.E.S., Halifax Manager) arrived to help in setting up equipment and procedures. We spent from the 8th until the 24th of June getting our equipment ready, testing it and looking for shore station sites. We also ran some levels to the tops of islands in Area "A". We ran two sounding lines after our depth sounder arrived but with the problems we encountered running without a printer, we decided to wait for the printer before doing any more sounding. We met with V. Crowley on June 15th and he gave us the field sheets. Dave Roberts left the 21st but another equipment operator arrived from Edmonton to keep the manpower at the same level.

cont'd.

The data logger equipped Mini Ranger system was installed on the 24th of June and we checked it out that day with the Motorola representative on board.

We started sounding on the 25th of June, running from 6:00 a.m. until the winds came up in the early afternoon, usually around 2:00 p.m. We decided to start working in Area "A" which would give us long lines but keep us near to Thunder Bay in case of problems. We continued working like this with only minor problems until July 31st. During the period it became obvious that the amount of data coming in, it averaged about 30 miles per day, could not be processed quickly enough. We brought another man from Edmonton to work strictly on drafting and data processing.

On the 31st of July the stern drive unit on the STARCRAFT broke but we had the STARCRAFT back in the water on the 2nd of August. By this time we had the initial sounding completed west of Thunder Cape and had started some work in Area "C". We realized we should get onto the main lake while the weather held so we ran lines in Area "C" until the depth exceeded the range of our echo sounder. We then finished Area "A" and started working in the shallow areas of Area "C". On the 10th of August we had the ELAC LAZ 17 echo sounder and had started on the deep areas again. At that point we concentrated on Area "C". We put all of our transponders into the area in order to give us better baselines which are a problem there. We also pulled the draftsman off the back log of data in Area "A" so that the drafting would keep up to the field work in Area "C". We would then be able to do shoal examinations as soon as the initial sounding was complete. On August 29th we left the STARCRAFT at Silver Islet to cut down on the travelling time.

On Sept. 12th the stern drive unit in the STARCRAFT broke again and due to part supply problems it wasn't available until the 25th. We took advantage of this time by putting some more control monuments on the south shore of Sibley Penninsula. We also ran elevations on the rocks in that area. We had by this time finished the soundings in deep areas of Area "C" and only the shallow areas remained to be completed.

cont'd.

After the STARCRAFT was repaired we continued to work in Area "C" but by then the weather had deteriorated and we couldn't make full use of its productivity. On Oct. 7th two additional men arrived from Edmonton and as we had an additional M.R.S. we decided to set up the smaller boat for use in Area "C" and bring the STARCRAFT back to Thunder Bay to work in Areas "B" and "D" where it could get more work done. We also rented another boat, brought in a Cubic Auto tape and an additional crew from Halifax, which included Dave Roberts, to do bottom sampling exclusively. The additional manpower and equipment did not improve production due to the poor weather we were having.

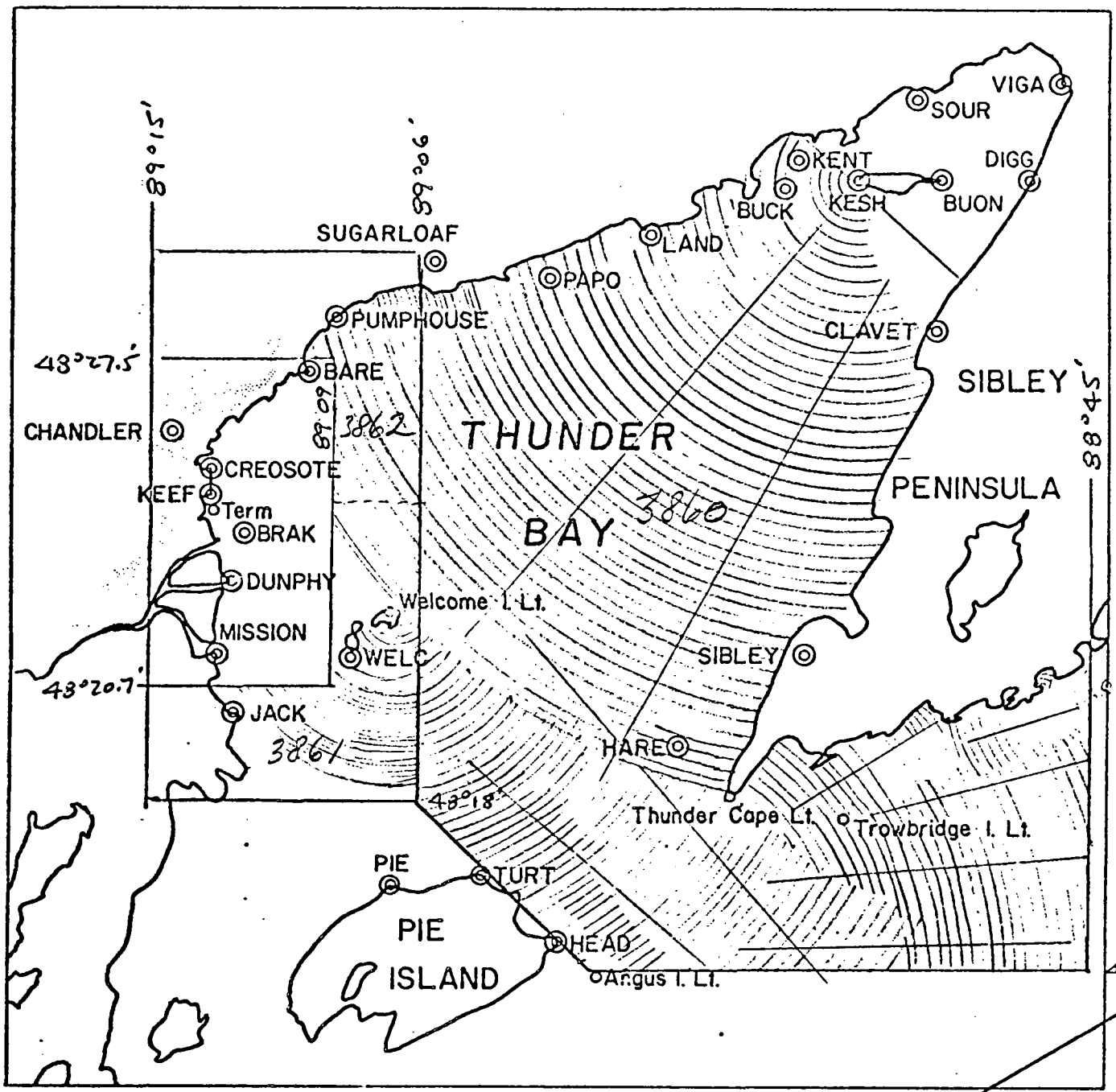
On the 26th of Oct. we decided to cut the crews back and get rid of the extra equipment. We would keep the STARCRAFT and one boat crew to work on cleanup and check lines until the weather shut them right down.

The weather closed in completely on the 10th and by the 15th of November we had the boat in winter storage, the equipment shipped out therefore the personnel left Thunder Bay that day.

In Edmonton the drafting was completed, checked over and the sounding rolls indexed. The title blocks were added to the field sheets and all of the data was shipped to Burlington on the 9th of December.

A copy of "Field Report Statistics" Summary is attached.

David Morgan.



HORIZONTAL CONTROL

Thunder Bay, Lake Superior

1:250,000

MILES

5 0 5 10 15 20

SOUNDING COMPLETED 1974

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

YEAR 1974 FROM June TO November

C-7540

Establishment Canadian Eng.Surveys.

H.I.C. ———

	Project Number	Project Number	Project Number	Project Number	
Project Name Contract Survey of the Thunder Bay Area of Lake Superior	6600-73-3				
Project Name					
Project Name					
Project Name					
Resources:					TOT
Number of ~~Hydrographers~~ Engineers *	1/150				
Number of ~~Surveyors~~ Equipment Op. *	2/300				
Number of Electronic Technicians *	1/3				
No. of Student Assistants and Casuals *	1/150				
No. of Support Personnel (Ship's Crew, Etc.) *	1/150				
Total Personnel *	5/750				
Number of Ships	0				
Number of Launches	1				
Number of Land Vehicles	1½				
Number (and type) of Aircraft	0				
Number of Minor Support staff	1¼				
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 1974 FROM June TO November

Establishment Canadian Engineering Sur H.I.C. ____	Project Number 6600-73-3	Project Number	Project Number	Project Number	To
Time:					
Total operational days. June 3-Nov.15	165				
Days actual field work.	75				
Days lost (weather)	46				
Days lost (Sat. Sun. Holidays)	0				
Days lost (Equipment failure)	13				
Days lost in Transit	4				
Days lost in port for Supplies, Bunker, etc.	27				
Days lost, other causes	0				
Total Man days in period (staff)	751				
Total Man days worked (staff)	490				
Man days:- (staff)					
(a) Sounding	193				
(b) Shoal Examinations	0				
(c) Wharf surveys	N/A				
(d) Oceanography	N/A				
(e) Geophysics	N/A				
(f) Tides & water levels	0				
(g) Collecting bottom samples	2				
(h) Horizontal Control	12				
(i) Shorelining & Low Watering	0				
(j) Data processing & office admin.	264				
(k) Sailing directions	N/A				
(l) Place Names	N/A				
(m) Current observations	N/A				
(n) Photo-Ident.	N/A				
(o) Others (specify)					
Elevations of Rocks	12				
Range Surveying	7				

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

YEAR 1974 FROM June TO November

Establishment Can. Engineering Surveys H.I.C. _____	Project Number 6600-73-3	Project Number	Project Number	Project Number	Tot
Sounding (Linear Nautical Miles/~~XX~~):					
Ship Sounding	N/A				
Launch Sounding	1331(N.M.)				
Other (specify)	N/A				
Total sounding	1331(N.M.)				
Reconnaissance (Track) sounding	N/A				
Area sounded ($N.M^2$) (~~XXX^2~~)	200 ($N.M.^2$)				
Shoals Examined:					
Shoal Examinations (Ship)	N/A				
Shoal Examinations (Launch)	0				
Shoal Examinations (Sweep)	N/A				
Shoal Examinations (other) specify	0				
Shoal Examinations (Total)	0				
Navigational Aids:					
Shore Aids Positioned (including ranges)	2				
Floating Aids Positioned	3				
Navigational Ranges Sounded	1				
Navigational Ranges Drifted	-				
Sector Ranges Positioned	-				
Navigational Aids Established	-				

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

YEAR 1974 FROM June TO November

Establishment Can. Engineering Surveys H.I.C.	Project Number 6600-73-3	Project Number	Project Number	Project Number	To
Shore Control:					
Signals built	0				
Signals re-built	0				
Towers built	0				
Number of Stations occupied	6				
Number of Stations re-occupied	-				
Number of stations permanently marked	3				
Distance Traversed (MXXX) (K.M.)	19 k m				
Number of Elevations Measured	3				
Number of Heights Measured	0				
Number of Stations Photo Ident.	3				
Other (specify)	0				
Calibrations:					
No. of Calibration Stations:					
Lambda, Decca, Hi-Fix, Mini Fix,	N/A				
Loran, Decca Navigator,	+ 6 -				
No. of E/c's marked and referenced	N/A				

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

YEAR 1974 FROM June TO November

Establishment Can. Engineering Surveys H.I.C. ——	Project Number 6600-73-3	Project Number	Project Number	Project Number	To
Tide and Current Data: N/A					
Recording gauges established	N/A				
Recording gauges recovered	"				
Staff gauges established	"				
Bench Marks Recovered	"				
Bench Marks Established	"				
Bench Marks Levelled	"				
Distance Levelled (N.M.) (KM)	"				
No. of Current Meters Set Out	"				
No. of Current Meters recovered	"				
No. of hours of Current Measurements	"				
(Other than with Moored Meters)					
Oceanography:					
No. of Oceanographic stations	N/A				
Gravity Profiles-survey (N.M.) (KM)	"				
Gravity Profiles-track, (N.M.) (KM)	"				
Magnetic Profile-survey (N.M.) (KM)	"				
Magnetic Profile-track, (N.M.) (KM)	"				
Seismic Profile-survey (N.M.) (KM)	"				
Seismic Profile-track (N.M.) (KM)	"				
Number of Water Samples	"				

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

YEAR 1974 FROM June TO November

Establishment Can. Engineering Surveys H.I.C.	Project Number 6600-73-3	Project Number	Project Number	Project Number	Tot
Bottom Samples: Number of bottom samples (Grab)	0				
No. of bottom samples (underway)	0				
No. of bottom samples (Armed Lead)	8				
No. of Cores	0				
No. of Samples retained	0				
Miscellaneous: No. of Dangers to Navigation, rocks ruins, pilings, etc., fixed.	0				
Shoreline checked (N.M.) (KM)	0				
Wharves surveyed	0				
No. of Reference buoys streamed	0				
No. of Reference buoys recovered	0				
No. of Shore Stations Established:	0				
Lambda, Hi-Fix,	N/A				
Helicopter flying hours	0				

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

YEAR 1974 FROM June TO November

Establishment: Can. Engineering Surveys H.I.C. ———	Project Number 6600-73-3	Project Number	Project Number	Project Number	To
Data submitted from the field: (Include file numbers:)					
Field Sheet 3860					
Field Sheet 3861					
Field Sheet 3862					
Sounding Rolls for Above					
File 70581 Fixes					
File 70582					
(See Attached submission letter)					

POST CONTRACT EVALUATION REPORT

(SUBMITTED TO DEPT. OF SUPPLY AND SERVICES)

POST CONTRACT EVALUATION REPORT

(submitted to Department of Supply and Services)

BASIC DATA (TO BE COMPLETED BY S.C.M.)

CUSTOMER DEPARTMENT: DOE/CCIW

SCIENTIFIC AUTHORITY: Mr. A.J. Kerr

BRIEF TITLE OF CONTRACT: Hydrographic Survey, Thunder Bay

CONTRACT SERIAL: 0SQ4-0034

CONTRACT PERIOD: 3 May, 1974 to 31 December, 1974

CONTRACT VALUE AND TYPE: $75,083.40 (firm price)

CONTRACTOR: (NAME AND CITY ONLY)

Canadian Engineering Surveys Co. Ltd.
Edmonton
Alberta

CLASSIFICATION OF CONTRACTOR

(I.E. - INDUSTRY - PRIMARY, SECONDARY, SERVICE. UNIVERSITY, NON-PROFIT INSTITUTION OR INDIVIDUAL, CHECK WITH SIS)

PART 1 - EVALUATION OF PROJECT BY SCIENTIFIC AUTHORITY

	EXCEEDED EXPECTATIONS	GOOD ENOUGH	BELOW EXPECTATIONS
1. DID CONTRACT ACHIEVE RESULTS REQUIRED?			X
2. HOW DID CONTRACTOR MANAGE PROJECT?			X
3. DID CONTRACTOR MEET TIME SCHEDULES?			X
4. DID CONTRACTOR MAKE ANY SIGNIFICANT TECHNICAL CONTRIBUTION?			X
5. WHAT WAS THE QUALITY OF THE CONTRACTOR'S REPORTS?			X
6. AS A RESULT OF THE PROJECT DO YOU FORESEE:	PROBABLE	POSSIBLE	UNLIKELY
(A) ANY SPIN-OFF BENEFITS IN TERMS OF ENHANCED CAPABILITY, PRODUCTS OR GROWTH:		X	
(B) ANY POTENTIALLY PATENTABLE TECHNOLOGY:			X
(C) ANY FOLLOW ON CONTRACT WORK BY YOUR DEPARTMENT OR OTHER AGENCY:	X		

(KINDLY EXPAND OR EXPLAIN ON SEPARATE PAGE WHERE APPROPRIATE)

SEPARATE PAGE ATTACHED: YES ..... NO .....

SIGNED: A.J. Kerr

(SCIENTIFIC AUTHORITY)

APPENDIX A

- STATISTICS -

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

YEAR 1974 FROM JUNE 14 TO NOVEMBER 6

Establishment THUNDER BAY SURVEY

H.I.C. F.L. DE GRASSE

SUB-PARTY CHIEF J.V. CROWLEY

	Project Number	Project Number	Project Number	Project Number	
Project Name THUNDER BAY SURVEY	6600-73-3				
Project Name					
Project Name					
Project Name					
Resources:					TOT.
Number of Hydrographers *	2/259				
Number of Scientists *	N/A				
Number of Electronic Technicians *	N/A				
No. of Student Assistants and Casuals *	N/A				
No. of Support Personnel (Ship's Crew, Etc.) *	2/243				
Total Personnel *	4/502				
Number of Ships	N/A				
Number of Launches	2				
Number of Land Vehicles	1				
Number (and type) of Aircraft	N/A				
Number of Minor Support staff	1				
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 _____ H.I.C. _____	Project Number	Project Number	Project Number	Project Number	To
Time:					
Total operational days.	146				
Days actual field work.	59				
Days lost (weather)	17				
Days lost (Sat. Sun. Holidays)	25				
Days lost (Equipment failure)	5½				
Days lost in Transit	4				
Days lost in port for Supplies, Bunker, etc.	N/A				
Days lost, other causes	35½				
Total Man days in period (staff)	259				
Total Man days worked (staff)	218				
Man days:- (staff)					
(a) Sounding	48				
(b) Shoal Examinations	4				
(c) Wharf surveys	N/A				
(d) Oceanography	N/A				
(e) Geophysics	N/A				
(f) Tides & water levels	6				
(g) Collecting bottom samples	3				
(h) Horizontal Control	24				
(i) Shorelining & Low Watering	N/A				
(j) Data processing & office admin.	63				
(k) Sailing directions	N/A				
(l) Place Names	1				
(m) Current observations	N/A				
(n) Photo-Ident.	1				
(o) Others (specify) REVISORY	3				
MISC. FIELD	7				
DEMOBILIZING & TRANSIT	26				
MONITORING	32				

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

YEAR FROM TO

Establishment _____ H.I.C. _____	Project Number	Project Number	Project Number	Project Number	To
Sounding (Linear Nautical Miles/KM):					
Ship Sounding	N/A				
Launch Sounding	431.1 nm				
Other (specify)	N/A				
Total sounding	431.1 nm				
Reconnaissance (Track) sounding	N/A				
Area sounded ($N.M^2$) (Km^2)	200 nm^2				
Shoals Examined:					
Shoal Examinations (Ship)	N/A				
Shoal Examinations (Launch)	8				
Shoal Examinations (Sweep)	N/A				
Shoal Examinations (other) specify	N/A				
Shoal Examinations (Total)	8				
Navigational Aids:					
Shore Aids Positioned (including ranges)	15				
Floating Aids Positioned	24				
Navigational Ranges Sounded	2				
Navigational Ranges Drifted	N/A				
Sector Ranges Positioned	N/A				
Navigational Aids Established	N/A				

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

YEAR FROM TO

Establishment H.I.C.	Project Number	Project Number	Project Number	Project Number	To
Shore Control:					
Signals built	8				
Signals re-built	22				
Towers built	N/A				
Number of Stations occupied	8				
Number of Stations re-occupied	25				
Number of stations permanently marked	8				
Distance Traversed (N.M.) (K.M.)	51.5 nm				
Number of Elevations Measured	31				
Number of Heights Measured	10				
Number of Stations Photo Ident.	41				
Other (specify)					
ASTRONOMICAL OBSERVATIONS	3				
Calibrations:					
No. of Calibration Stations:	N/A				
Lambda, Decca, Hi-Fix, Mini Fix,	N/A				
Loran, Decca Navigator,	N/A				
No. of E/c's marked and referenced	N/A				

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

YEAR FROM TO

Establishment H.I.C.	Project Number	Project Number	Project Number	Project Number	T
Tide and Current Data:					
Recording gauges established	N/A				
Recording gauges recovered	N/A				
Staff gauges established	1				
Bench Marks Recovered	3				
Bench Marks Established	N/A				
Bench Marks Levelled	3				
Distance Levelled (N.M.) (KM)	1.5 nm				
No. of Current Meters Set Out	N/A				
No. of Current Meters recovered	N/A				
No. of hours of Current Measurements (Other than with Moored Meters)	N/A				
Oceanography:					
No. of Oceanographic stations	N/A				
Gravity Profiles-survey (N.M.) (KM)	N/A				
Gravity Profiles-track, (N.M.) (KM)	N/A				
Magnetic Profile-survey (N.M.) (KM)	N/A				
Magnetic Profile-track, (N.M.) (KM)	N/A				
Seismic Profile-survey (N.M.) (KM)	N/A				
Seismic Profile-track (N.M.) (KM)	N/A				
Number of Water Samples	N/A				

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

YEAR FROM TO

Establishment _____ H.I.C. _____	Project Number	Project Number	Project Number	Project Number	Tot
Bottom Samples:					
Number of bottom samples (Grab)	N/A				
No. of bottom samples (underway)	N/A				
No. of bottom samples (Armed Lead)	46				
No. of Cores	N/A				
No. of Samples retained	N/A				
Miscellaneous:					
No. of Dangers to Navigation, rocks ruins, pilings, etc., fixed.	N/A				
Shoreline checked (N.M.) (KM)	5				
Wharves surveyed	N/A				
No. of Reference buoys streamed	N/A				
No. of Reference buoys recovered	N/A				
No. of Shore Stations Established:	N/A				
Lambda, Hi-Fix, _____ _____	N/A				
Helicopter flying hours	N/A				
POSITIONING SYSTEMS USED: HYDRODIST					
SEXTANT TWO THEODOLITES					

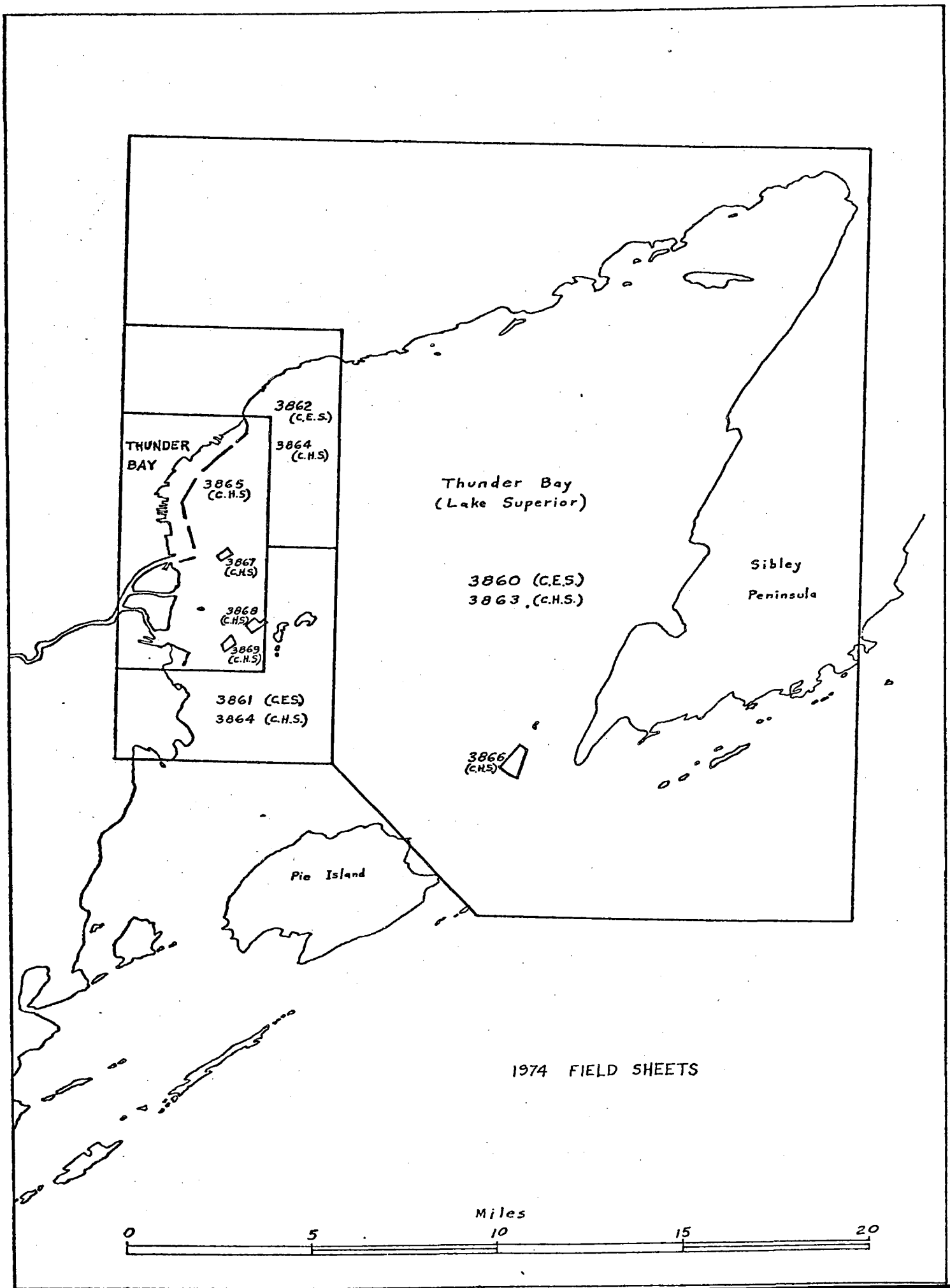
FIELD REPORT STATISTICS: MONTHLY ... PROJECT ... FINAL FIELD ...

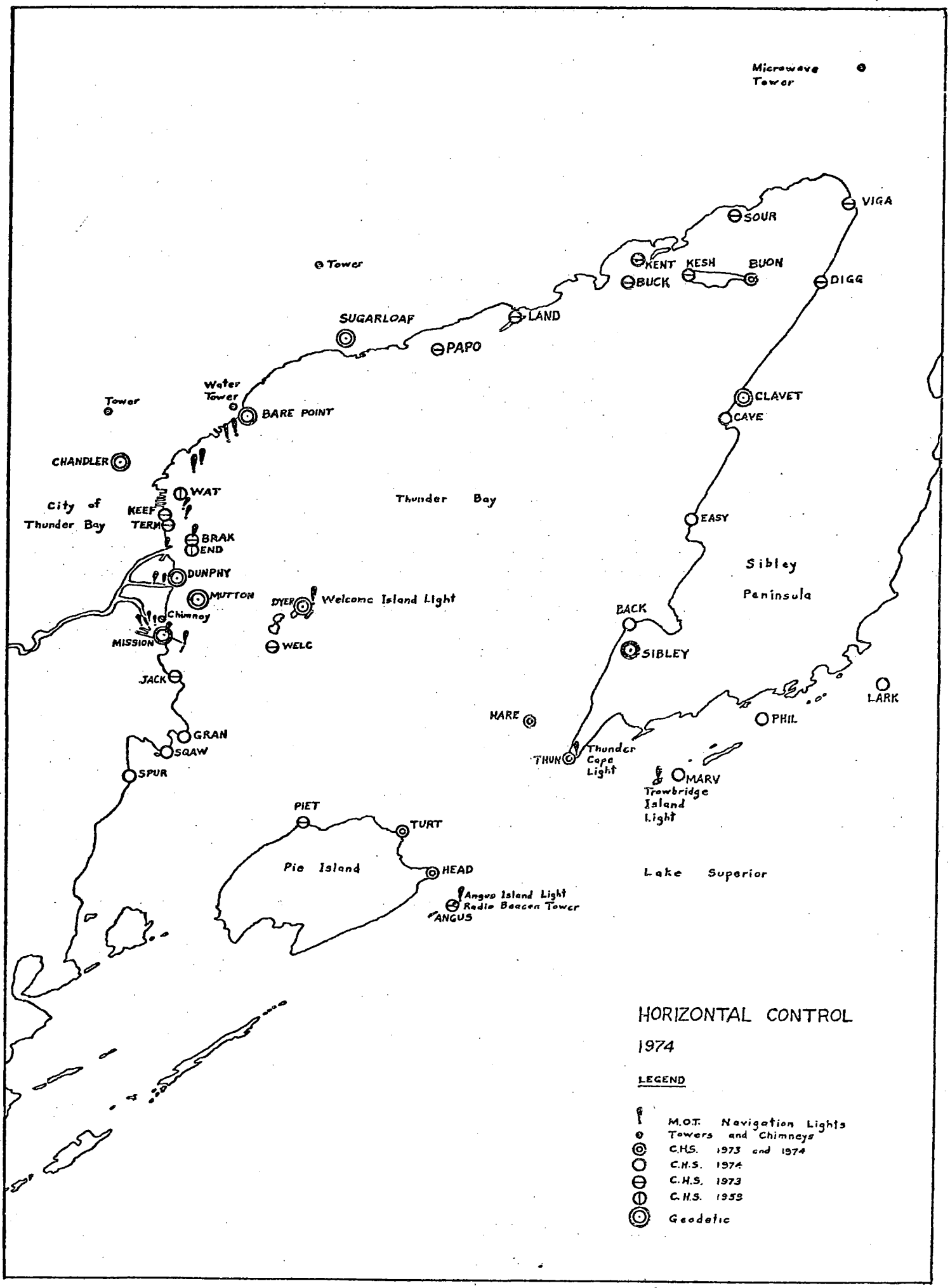
YEAR FROM TO

Establishment: H.I.C.	Project Number	Project Number	Project Number	Project Number	To
Data submitted from the field: (Include file numbers:)					
Sounding notes 70576					
Observation notes 70577					
Levelling notes 70578					
Miscellaneous notes 70579					
Computation Notes 70590					
Thunder Bay check lines F.S. 3863					
Approaches to Thunder Bay Hrb. F.S. 3864					
Thunder Bay-Mission River to Bare Pt. F.S. 3865					
Hare Island Reef F.S. 3866					
Shoal Area ½ mile west of Welcome Island F.S. 3868					
Approach to Kaministikwia River F.S. 3867					
Shoal Area 1¼ miles east of Mission Channel Entrance Light F.S. 3869					
Light Descriptions					
Sounding Rolls					
Boat Boards					
Station Descriptions					

APPENDIX B

- SKETCHES -


3862
(C.E.S.)
THUNDER
BAY
3864
(C.H.S)
3865
(C.H.S)
Thunder Bay
(Lake Superior)
3867
(C.H.S)
3860 (C.E.S.)
3863 (C.H.S.)
Sibley
Peninsula
3868
(C.H.S)
3869
(C.H.S)
3861 (C.E.S)
3864 (C.H.S.)
3866
(C.H.S)
Pie Island
1974 FIELD SHEETS
Miles
0
5
10
15
20

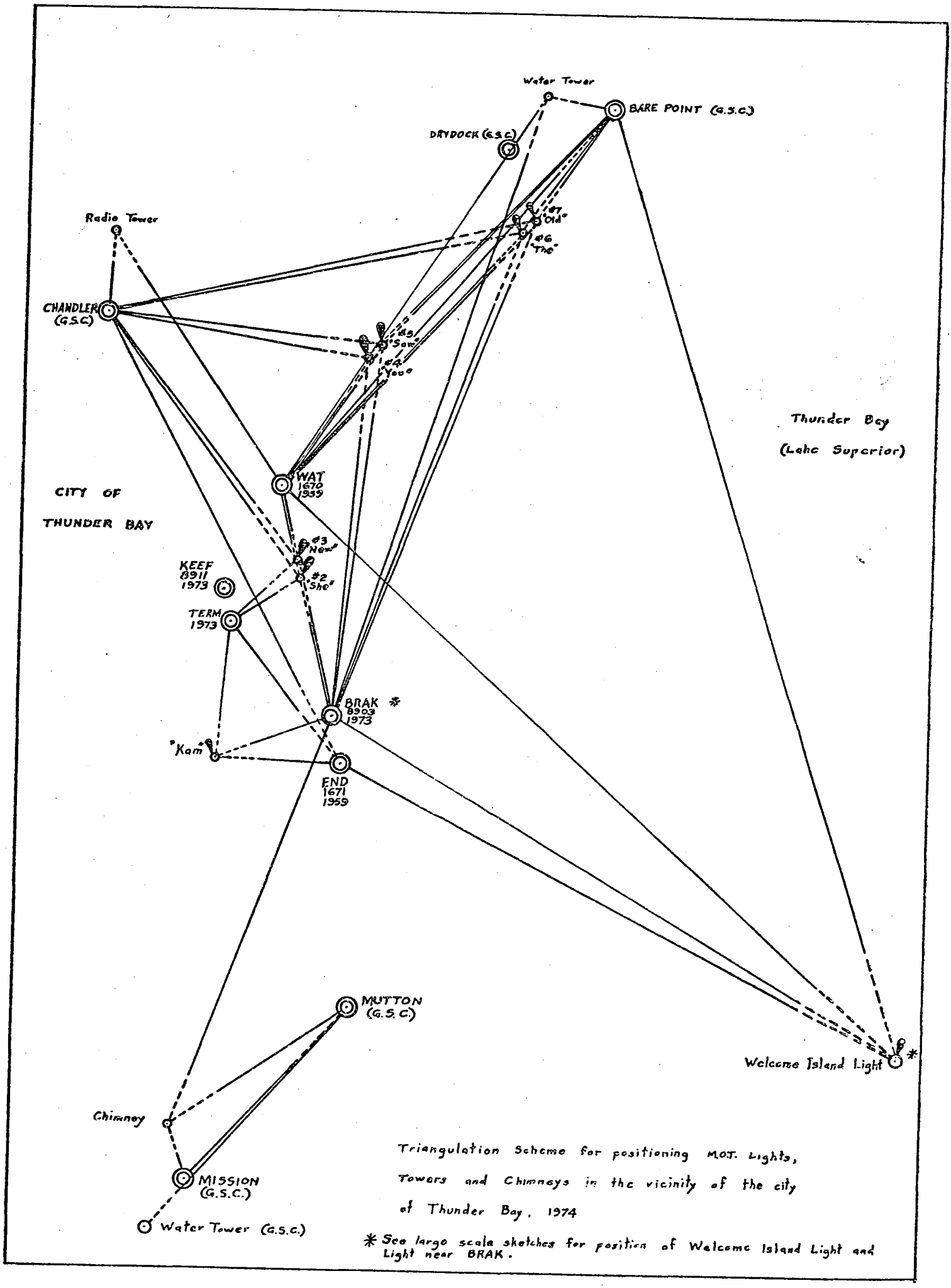


HORIZONTAL CONTROL

1974

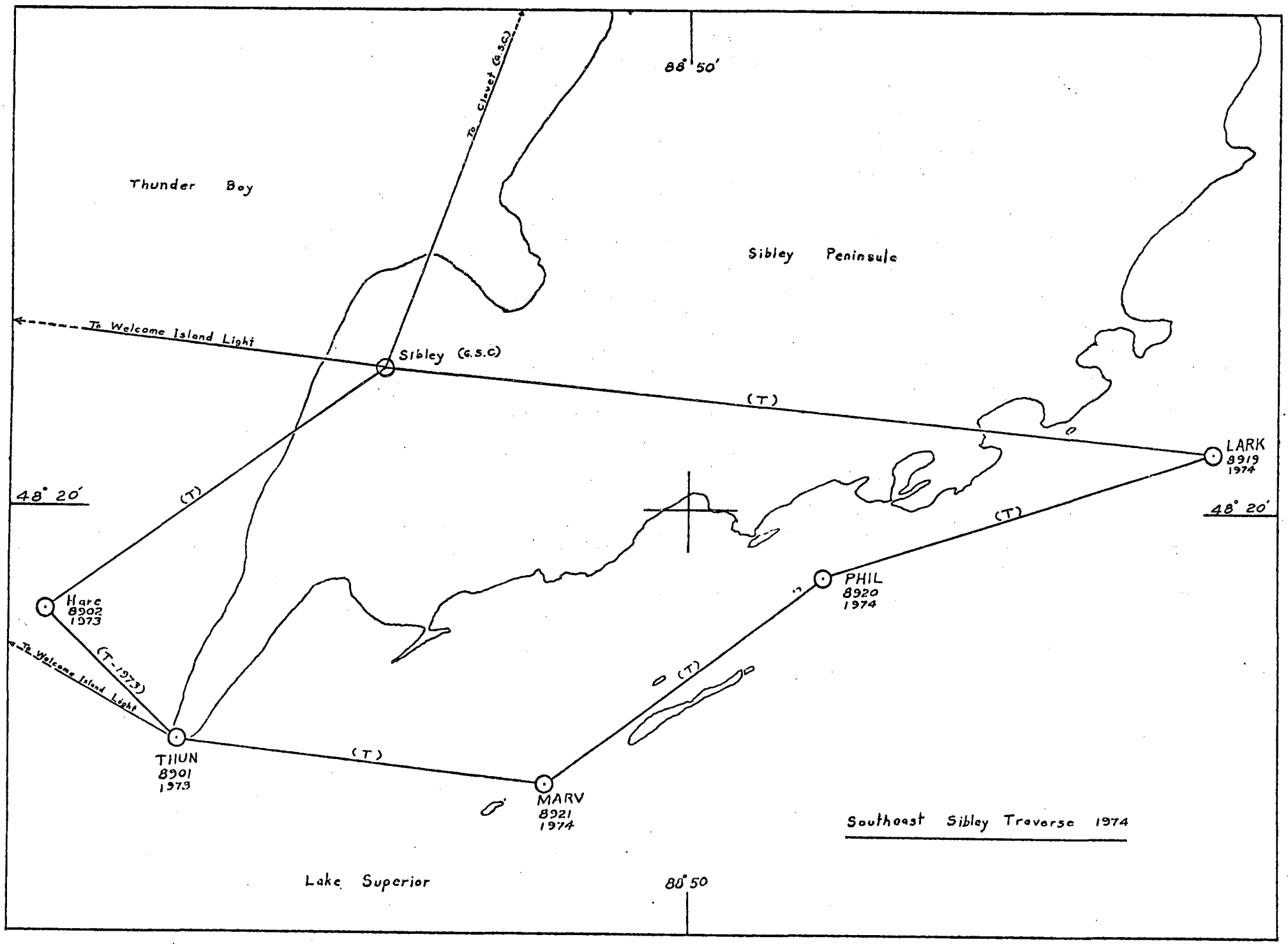
LEGEND

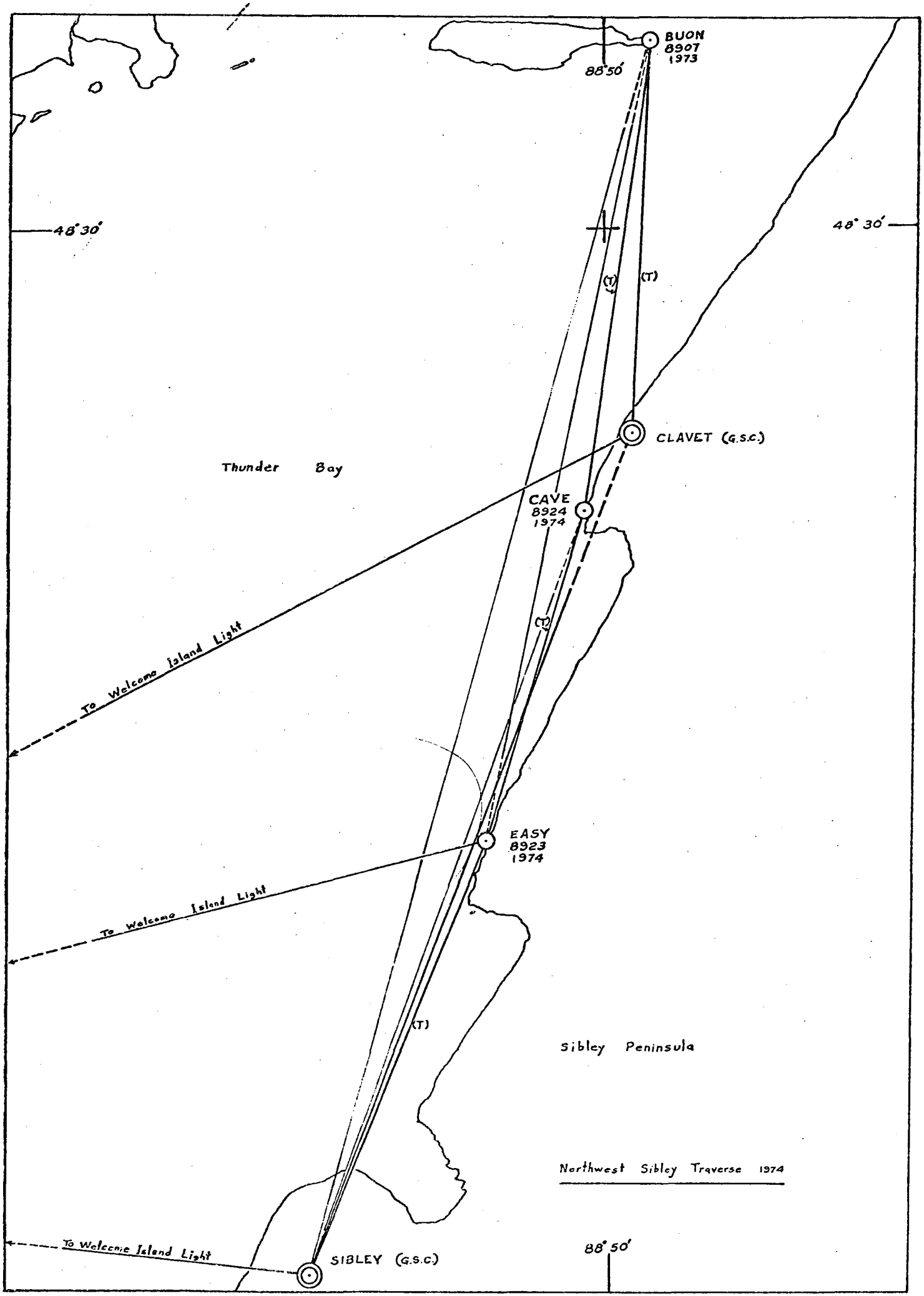
- M.O.T. Navigation Lights
- Towers and Chimneys
- C.H.S. 1973 and 1974
- C.H.S. 1974
- C.H.S. 1973
- C.H.S. 1953
- Geodetic

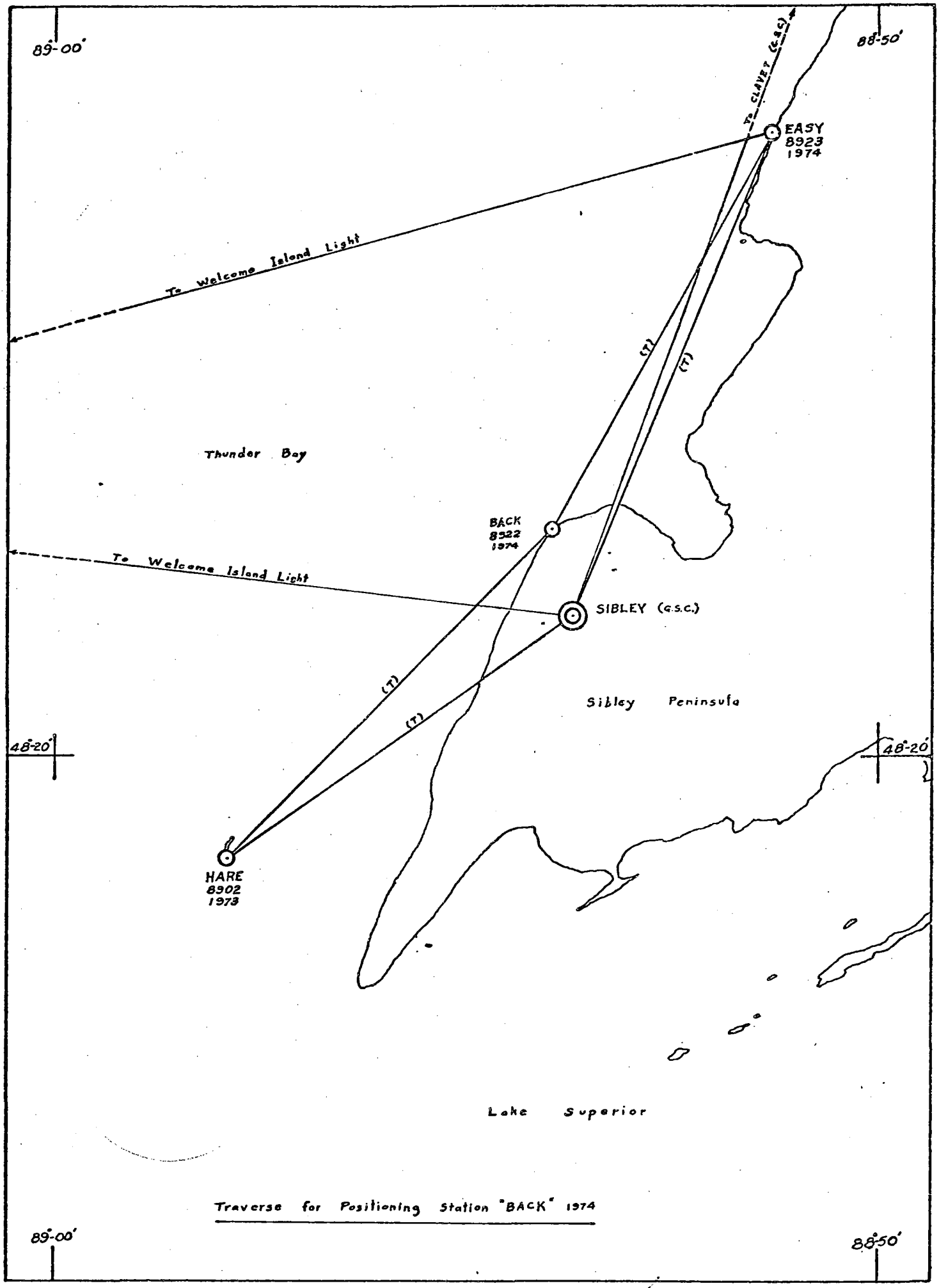


Triangulation Scheme for positioning M.O.T. Lights, Towers and Chimneys in the vicinity of the city of Thunder Bay, 1974

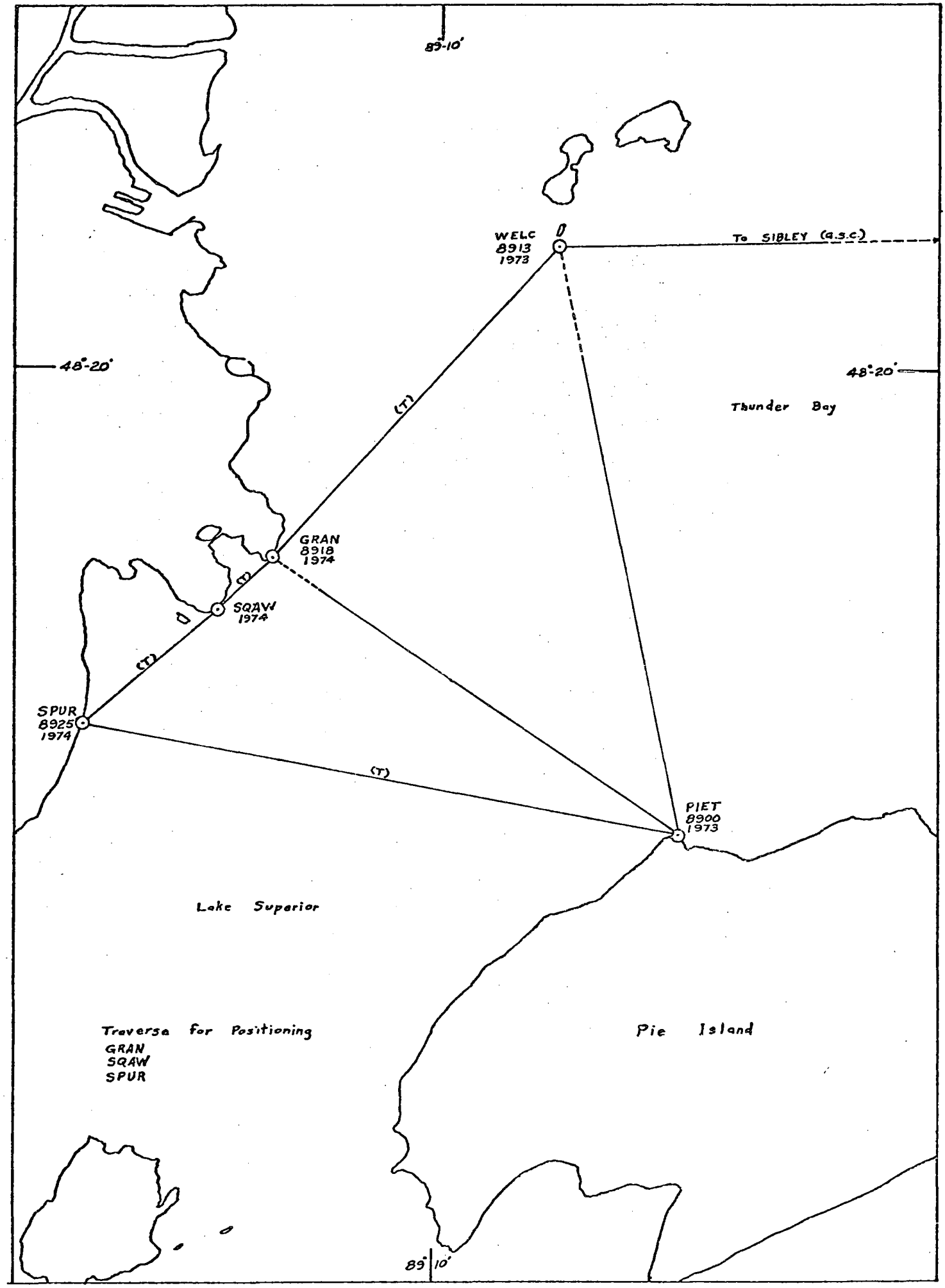
* See large scale sketches for position of Welcome Island Light and Light near BRAK.

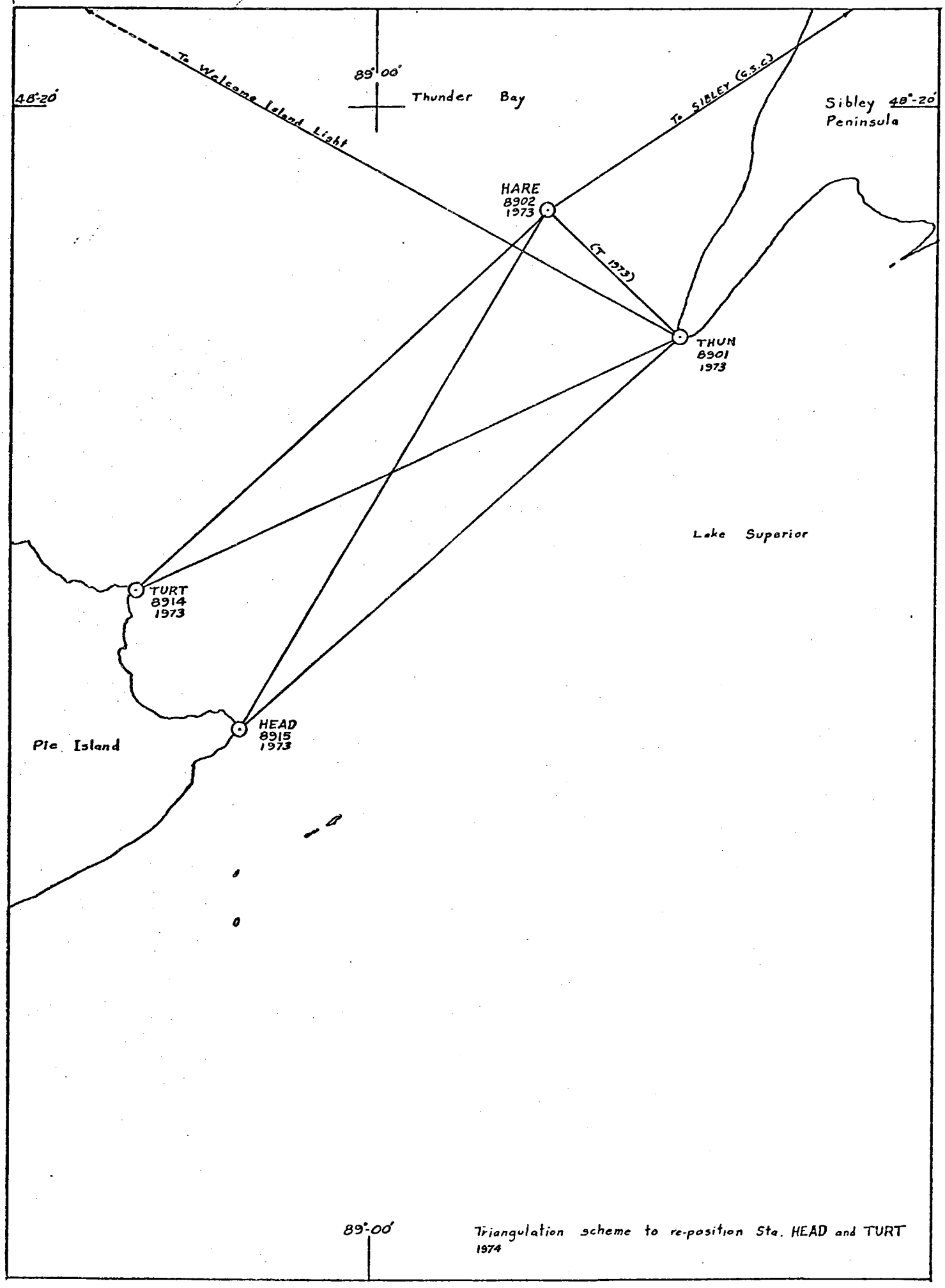

To Clevet (G.S.C.)
88° 50'
Thunder Bay
Sibley Peninsula
To Welcome Island Light
Sibley (G.S.C.)
(T)
LARK
8919
1974
48° 20'
(T)
48° 20'
(T)
PHIL
8920
1974
Hare
8902
1973
(T-1973)
To Welcome Island Light
(T)
(T)
TIIUN
8901
1973
(T)
MARV
8921
1974
Southeast Sibley Traverse 1974
Lake Superior
88° 50


BUON
8907
1973
88°50'
48°30'
48°30'
(T)
(T)
CLAVET (G.S.C.)
Thunder Bay
CAVE
8924
1974
(T)
To Welcome Island Light
EASY
8923
1974
To Welcome Island Light
(T)
Sibley Peninsula
Northwest Sibley Traverse 1974
To Welcome Island Light
SIBLEY (G.S.C.)
88°50'

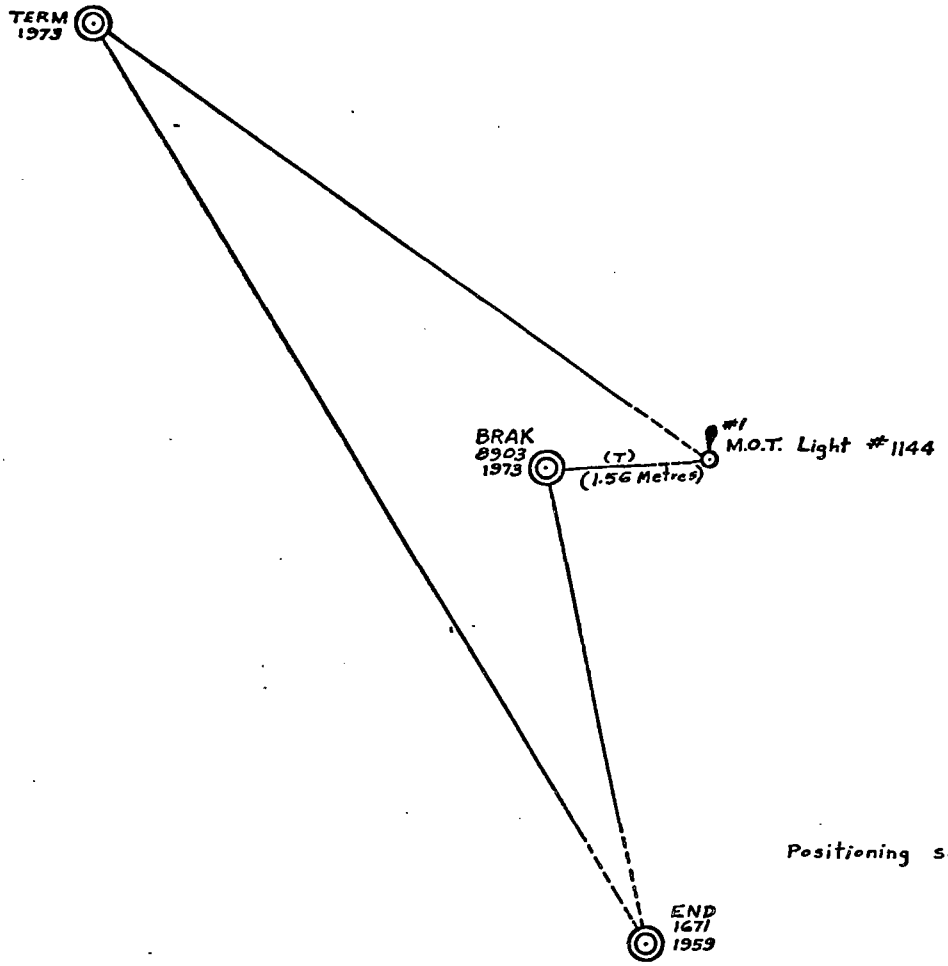


Traverse for Positioning Station "BACK" 1974

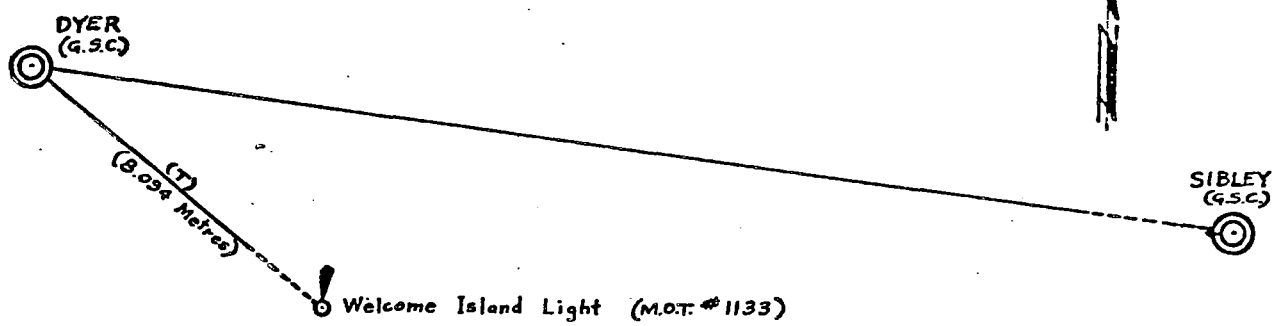

89°-10'
WELC
8913
1973
To SIBLEY (a.s.c.)
48°-20'
48°-20'
Thunder Bay
(T)
GRAN
8918
1974
(T)
SQAW
1974
(T)
SPUR
8925
1974
(T)
PIET
8900
1973
Lake Superior
Traverse for Positioning
GRAN
SQAW
SPUR
Pie Island
89° 10'



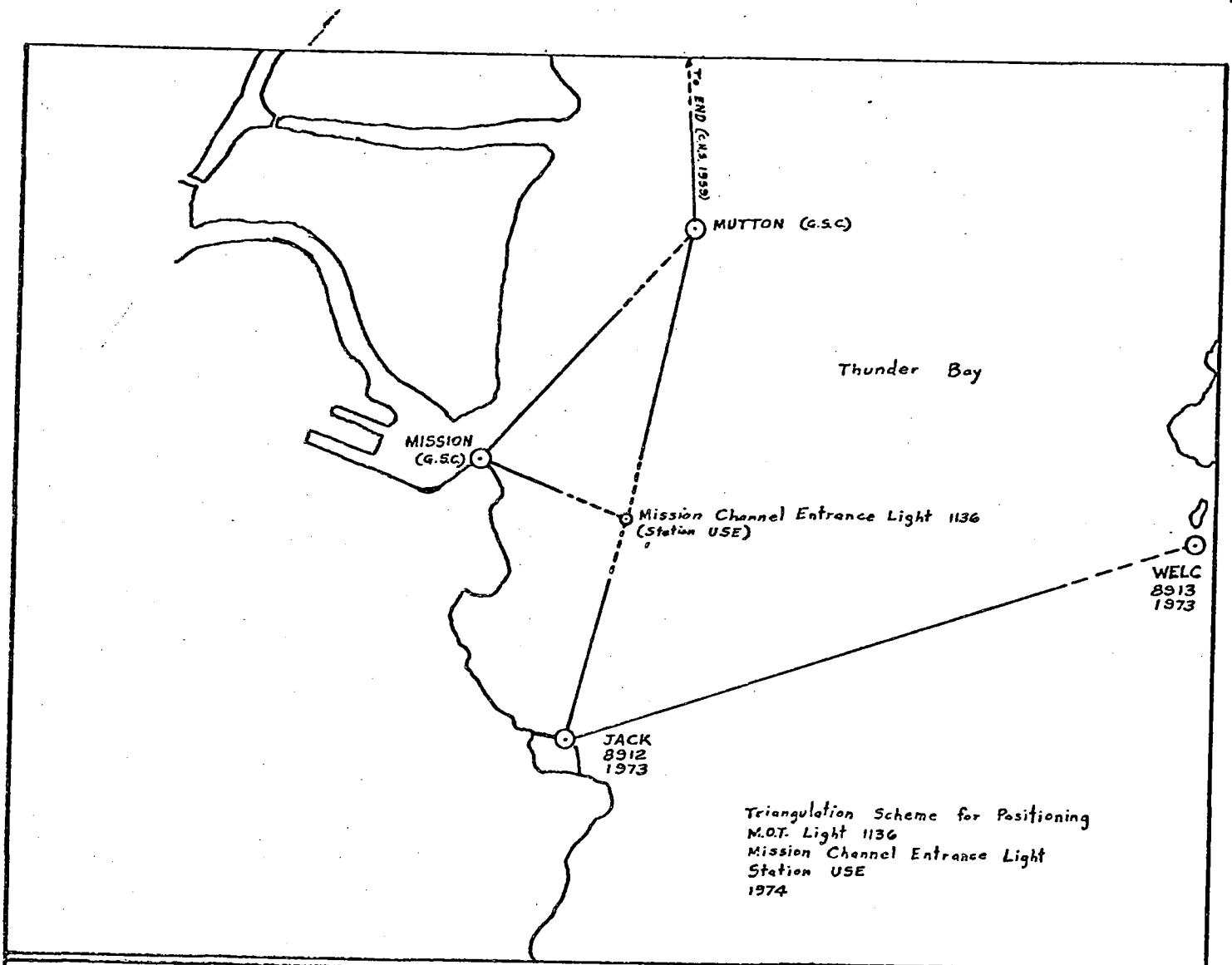
Triangulation scheme to re-position Sta. HEAD and TURT
1974

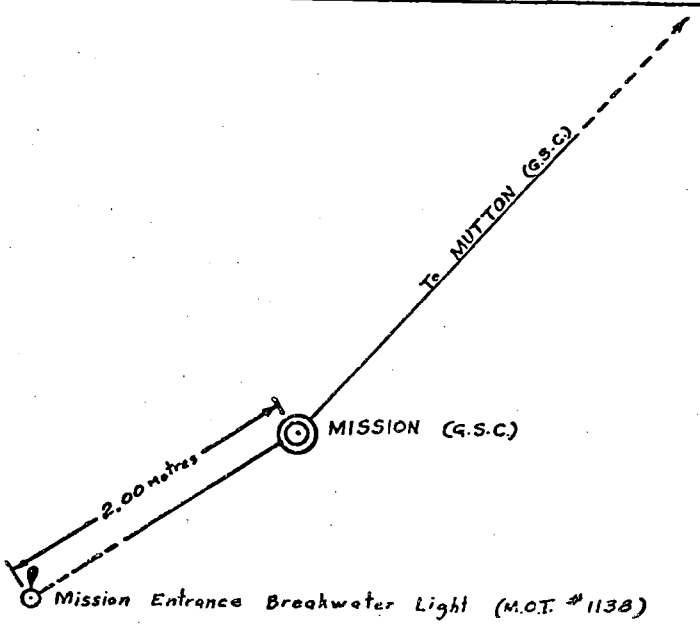


Positioning scheme for M.O.T. Light #1144

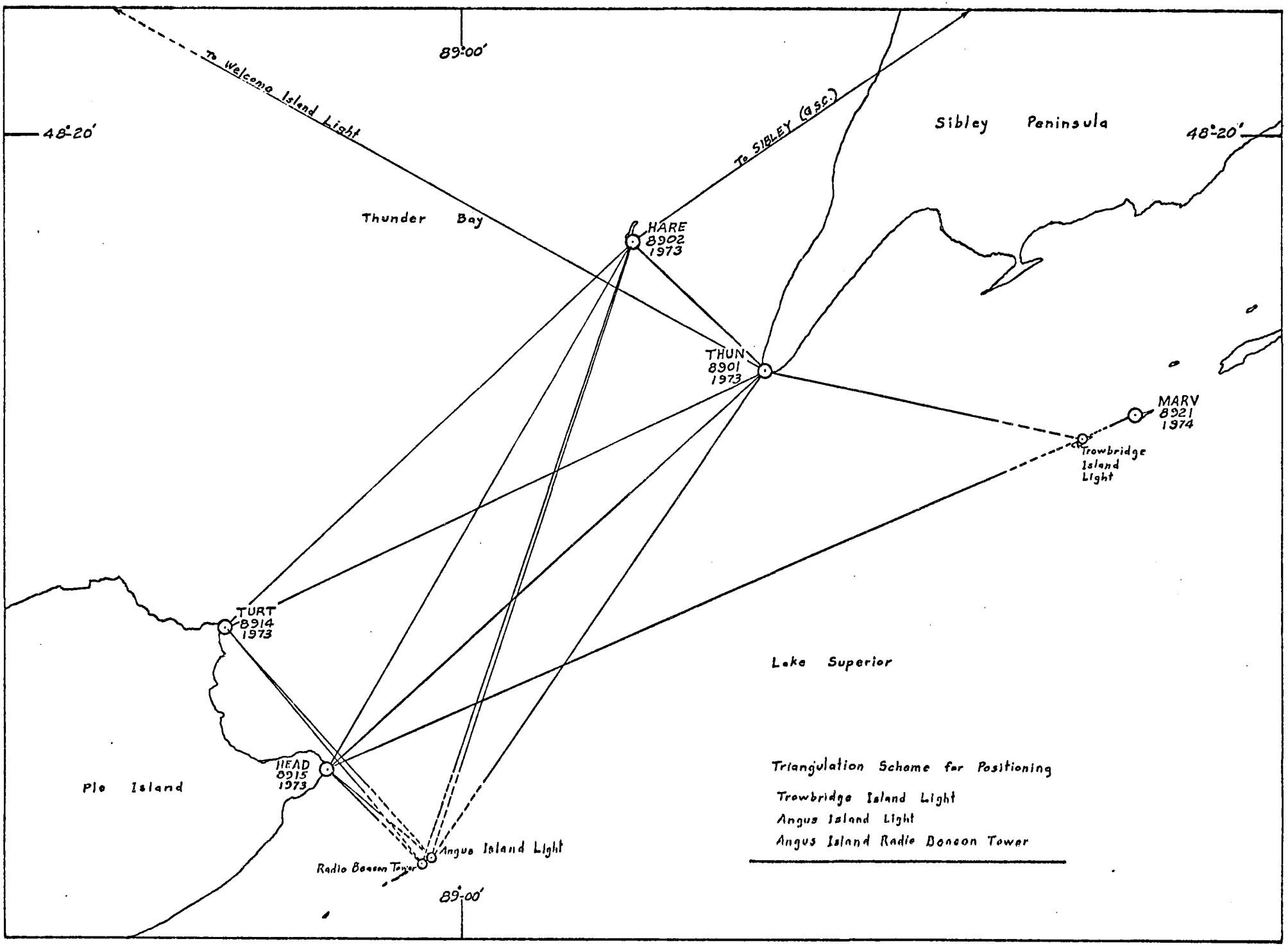


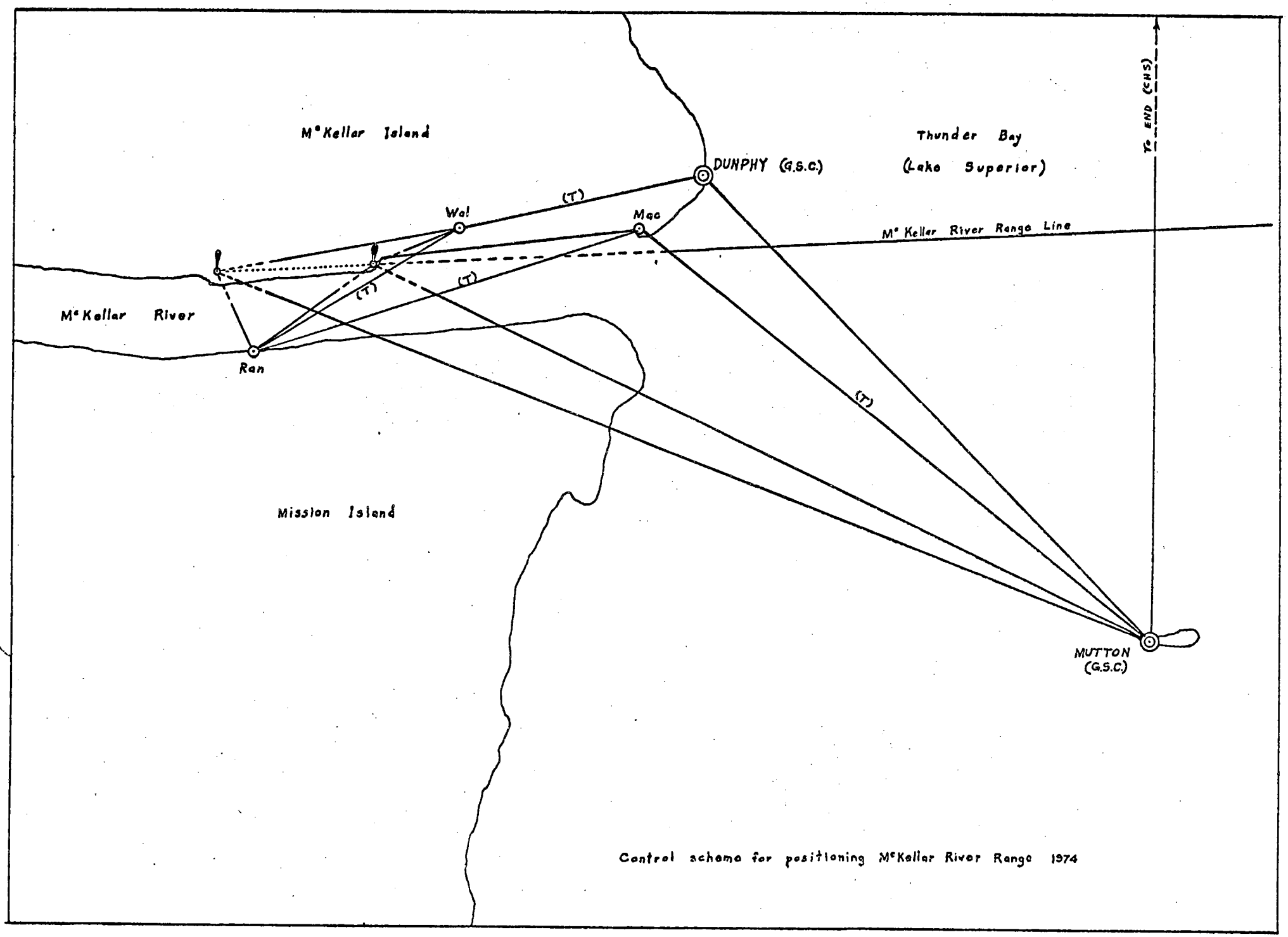
Positioning scheme for Welcome Island Light (M.O.T. #1133)



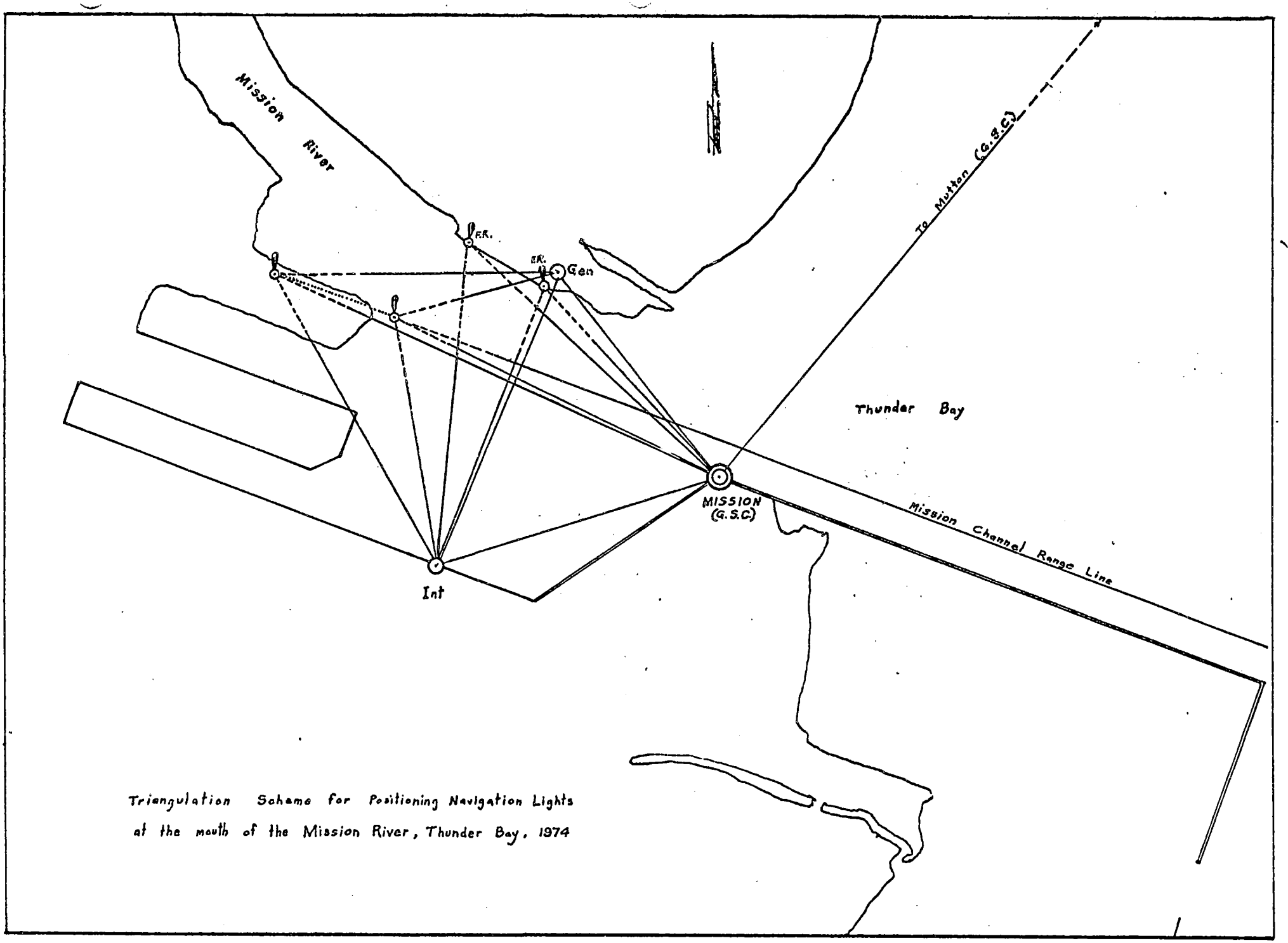


Positioning scheme for Mission Entrance Breakwater Light (M.O.T. #1138)

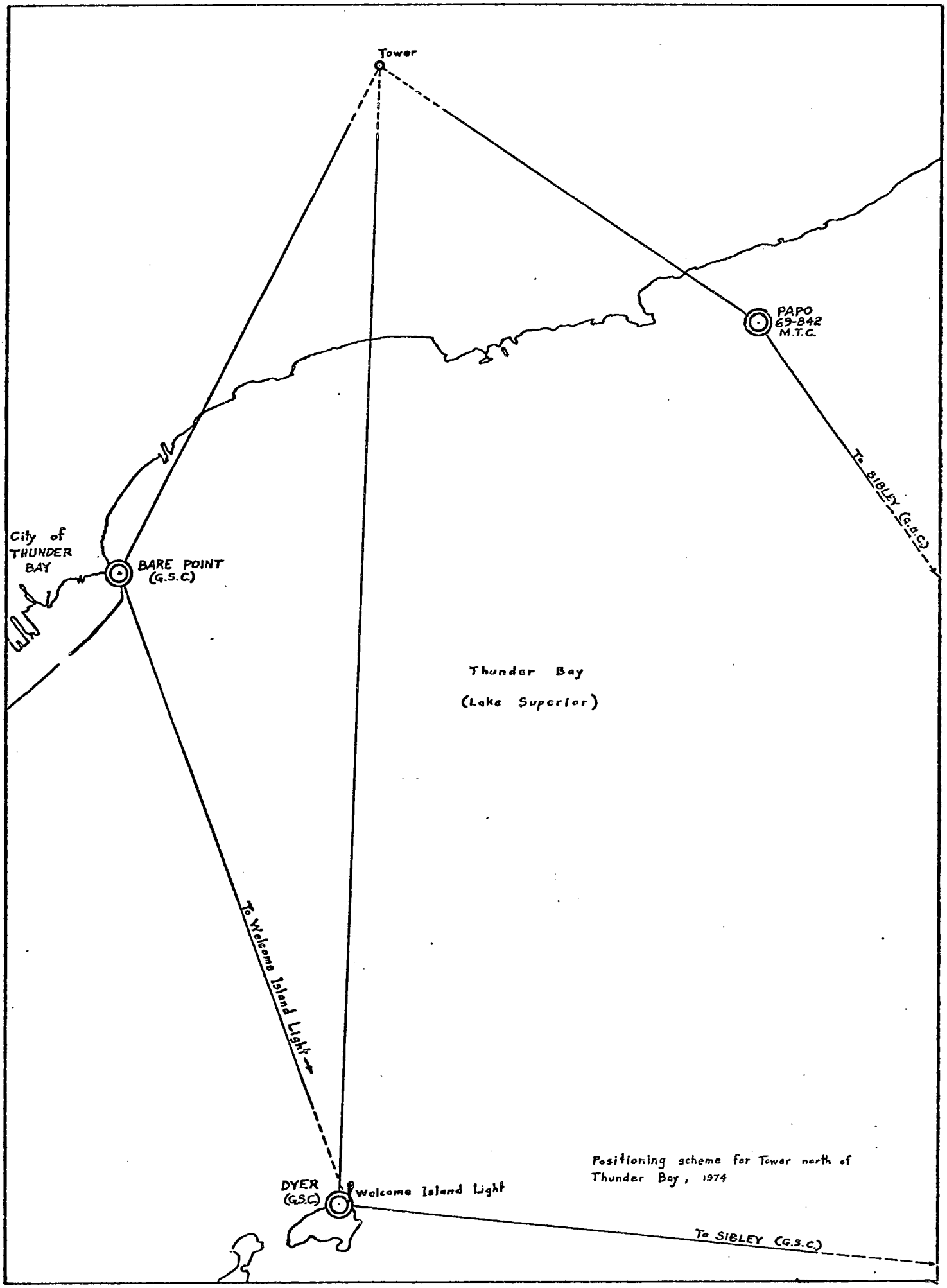

89°00'
To Welcome Island Light
To SIBLEY (GSC)
48°20'
Sibley Peninsula
48°20'
Thunder Bay
HARE
8902
1973
THUN
8901
1973
MARV
8921
1974
Trowbridge
Island
Light
TURT
8914
1973
Lake Superior
HEAD
8915
1973
Pie Island
Angus Island Light
Radio Beacon Tower
89°00'
Triangulation Scheme for Positioning
Trowbridge Island Light
Angus Island Light
Angus Island Radio Beacon Tower



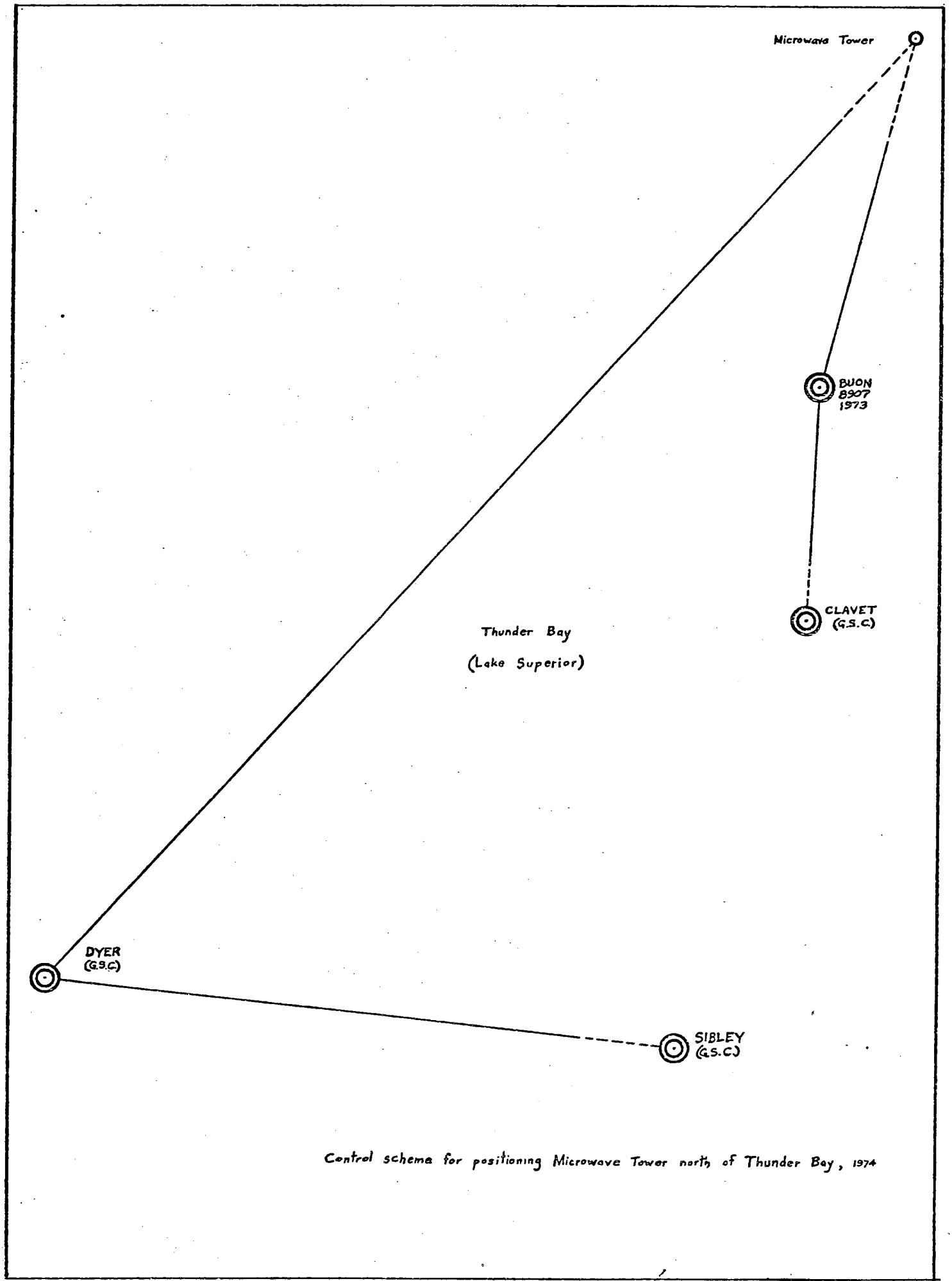
Control scheme for positioning McKellar River Range 1974



Triangulation Scheme for Positioning Navigation Lights at the mouth of the Mission River, Thunder Bay, 1974



Positioning scheme for Tower north of Thunder Bay, 1974



Control scheme for positioning Microwave Tower north of Thunder Bay, 1974

APPENDIX C

- POSITIONING WITH TWO THEODOLITES -

POSITIONING WITH TWO THEODOLITES

Positioning a sounding launch with two simultaneous theodolites cuts is an old technique which we revived this summer to sound three large scale sheets (F.S. 3867, 3868 and 3869). It is a little awkward and somewhat demanding but it is accurate and requires no expensive or exotic equipment.

General Description

Two theodolites (Wild T-2's) are set up at two control points which are situated in such a position that they provide strong intersections at the area to be sounded. 90^{o} cuts are ideal but much smaller angles are acceptable depending on scale and range. Each instrument man orients his theodolite so the plate is zeroed on grid north. To do this, it is necessary to know beforehand the grid azimuth to the proposed reference object. The T-2 is set to read this value when pointed at the R/O. Because the T-2 is not designed for setting angles, this may seem a little tedious but it can be done. We used a U.T.M. projection ignoring (t-T) correction. Since the theodolites are oriented, the instrument men are reading, setting, and recording grid azimuths directly on the T-2 scale.

Each instrument man has a portable 2-way radio (Motorola PT-300) and is in constant communication with the launch and the other instrument man. From one station, the launch is conned onto a line running towards or away from it. This man talks to the coxswain continually, giving enough starboard and port instructions to keep the launch within acceptable limits of the cross-hair. The other instrument man sets a pre-determined grid azimuth (which is the same as the T-2 scale reading), on his instrument and calls the fix as the launch's transducer crosses the vertical cross-hair.

On a typical set up, we were running lines at increments of 6 ft. to 10 ft. of an arc and fixing every degree. At a scale of 1:2,000 and ranges between 2 and 3 miles, this gave us standard line coverage and fix spacing of 7 to 9 divisions. These parameters, incidentally, must all be decided before

leaving the office. In face, except for the numbering, every fix and line may be drawn on the boatboard beforehand. For convenience in plotting, we used no odd seconds. All of our lines were run on even minutes of arc; all the fixes on full degrees.

Since our control stations did not fall on the field sheets, we had to plot the grid azimuth cuts around the perimeter of a 10 centimetre grid sheet and join up the dots.

Check lines were run by reversing the functions of the shore stations. For convenience in inking, some thought should be given to running these between spacings on the regular coverage.

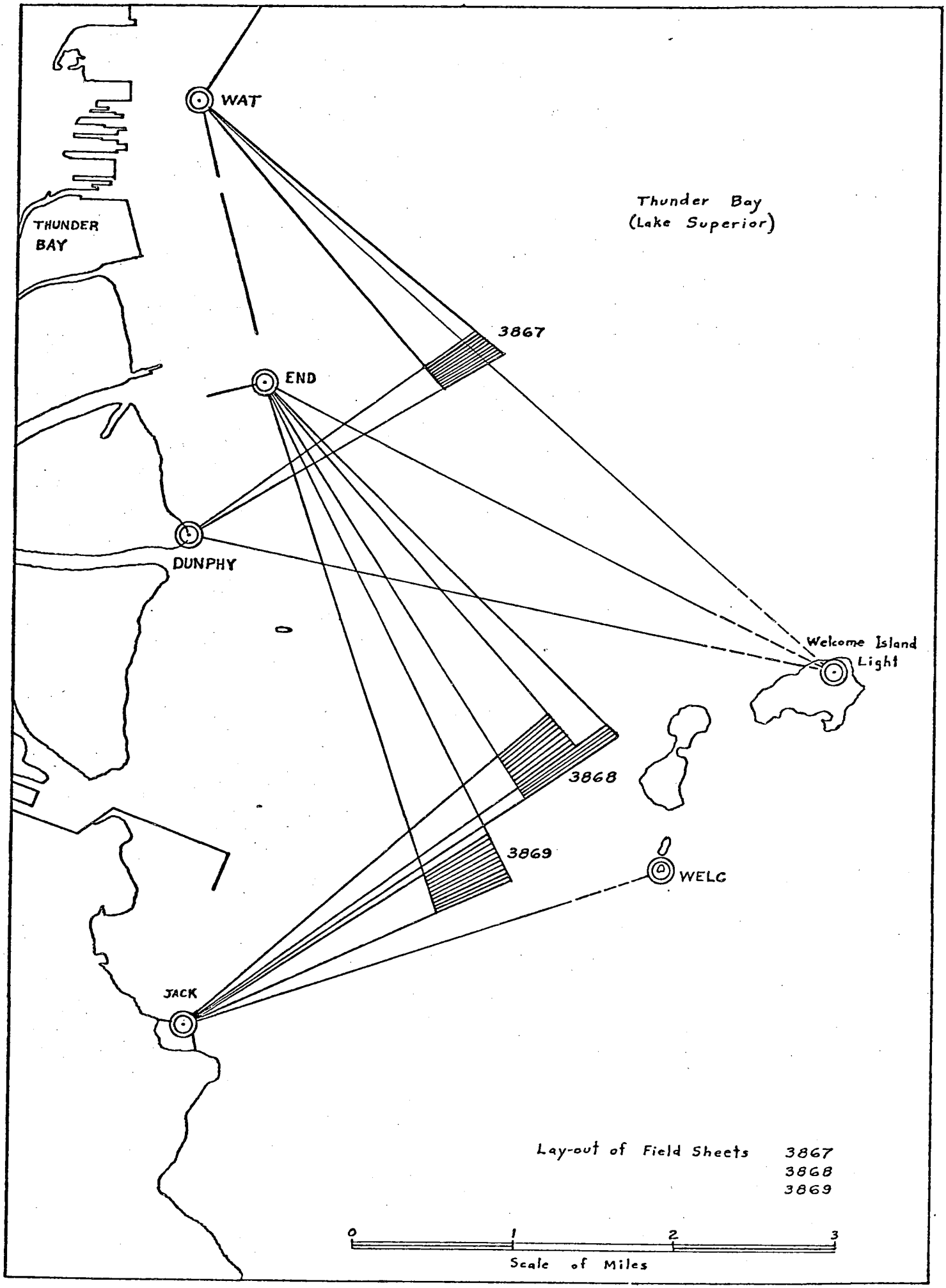
Range is limited to line of sight. We worked to about 3 miles from a station six feet high. Six or eight miles could probably be achieved from higher set ups.

Accuracy is mostly a function of coxswain skill and coxswain-conner rapport. The largest error seems to be perpendicular to the sounding line. It may have approached 10 feet at times on our sheets. The accuracy lobe theory is exactly the same as for a range/range set up. Because the conning error of the boat is comparatively large, the instrument error may safely be disregarded (with care, a T-2 can be set within several seconds of arc. If if were in error by as much as ten seconds, at three miles the pointing error would be about 10½ inches). Plotting error is of the same order as the control plotting.

The chief advantages of this method seem to be: (1) the high accuracy attainable and (2) the fact that it uses readily available equipment. Disadvantages include the necessity to co-ordinate three remotely situated parties, the utilization of three hydrographers on one sounding operation and the fact that the instrument man's job requires constant attention - it is very tedious and demanding.

We did not try separate shoal examinations on bottom sampling, but there seems no reason why these operations should not work satisfactorily.

The finished sheet has a pleasing appearance with soundings arranged in straight lines in two dimensions.


WAT
THUNDER BAY
Thunder Bay
(Lake Superior)
3867
END
DUNPHY
Welcome Island
Light
3868
3869
WELC
JACK
Lay-out of Field Sheets
3867
3868
3869
0
1
2
3
Scale of Miles


LAKE
3868