

PROJECT REPORT
SUDBURY PHOTOGRAMMETRIC
AND
POSITIONING SYSTEMS TEST AREA

SUDBURY, ONTARIO

OCTOBER 29 - NOVEMBER 5, 1973

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LIST OF STAFF

Staff

P. Davies	Hydrographer	October 29 = November 5
J. Medendorp	Hydrographer	October 29 = November 5

Crew

R. Gammon	Quartermaster	October 29 = November 5
D. Greenway	Coxswain	October 29 = November 5

M.O.T. (Helicopter)

L. Benton	Pilot	November 2 = 5
M. Tackas	Engineer	November 2 = 5

LIST OF MAJOR EQUIPMENT

- 1 1972 Rambler Station Wagon
- 1 1970 Chevrolet 1½ ton truck
- 2 T2 Theodolites
- 4 Tellurometers
- 1 Cobra Drill (Rock)
- 1 High speed impact ¼" drill
- 1 Honda 1 Kcy. generator
- 35 Complete plywood targets
- 1 205 Jet Ranger Helicopter "C.G.R."

NARRATIVE

Mr. J. Watt, Canada Centre for Remote Sensing, requested 27 targets be surveyed horizontally and vertically in the Sudbury area. Specifications as to the general areas, and type of targets, etc. were received, and an analysis of the survey began. The job consisted of two parts:

- a) repair and flag 26 targets from N.R.C. survey.
- b) survey 27 new positions, target and flag.

The three new areas were Falconbridge, East Sudbury and Stinson. These areas were located on flight lines through the original test area (see sketch). Each group of 9 stations were to be on a 3000 foot grid, approximately. Due to the topography and the type of distance measuring system that we employed, viz., MRA-3 Tellurometers. This was difficult to achieve.

Falconbridge

Six stations were established and surveyed by truck, the remaining three by helicopter. These nine stations are on Falconbridge Mining property. Permission to locate the control points was obtained from Mr. G. Reed. Due to a misunderstanding, he was unaware of our needs to locate on their property. Once the task was explained they were more than helpful. He supplied us with a surveyor for an hour to show us the local control, etc.

The permanent marks for the targets that are in soil are 4 feet 1 inch square iron bars, supplied by Falconbridge Mining Company. Six of these targets can easily be driven to by vehicle and the other three by snowmobile or helicopter.

Stinson

This area is between Wahnapiatae and Stinson along Highway 17 east of Sudbury. The stations straddle No. 17 highway and the C.P. Railway tracks. Permission was obtained to locate the stations near houses. Two of these stations can be reached easily by vehicle, the rest by helicopter. It would be very hard to reach by snowmobile. These stations were all put in by helicopter. Permanent marks are 'Drill Holes'.

East Sudbury

Because this area is densely populated and extensive highway construction was in progress, the two most westerly rows of targets were moved east by the same amount. One station can be driven to readily by vehicle; the rest were located and surveyed by helicopter. Permanent marks are 'Drill Holes'.

N.R.C. Test Area

The 26 stations chosen by Mr. J. Watt, C.C.R.S., were painted and marked by a flag. Number 273 could not be identified. Number 287 was marked in lieu of it.

The targets used for this survey were built in the woodworking shop at C.C.I.W. They were painted white and red.

The one inch dowling was cut to 5 foot lengths and a flourescent red flag attached to each. The shop did a fine job and made the field work much easier.

A high impact, $\frac{1}{4}$ " drill was rented from a company in Hamilton, and the Electronics Shop supplied us with a 1 Kc. Honda generator. "RAWL" fasteners were employed to secure the

targets to rock. I might add that this method worked very well; it was fast and economical: 100 fasteners cost \$10.00. The carboloid bits for the drill did not last very long in this type rock. A dozen were used for nearly 250 holes.

Horizontal Control

All the horizontal control points established originated from the latest Geodetic tabulated positions obtained from M.S.D.'s Nautical Geodesy Section. Some positions have azimuth checks to other stations and some are dead end shots (no check). Accuracy obtained should be third order or better (1:10,000).

Vertical Control

All elevations originated from Geodetic elevations. Vertical angles were taken on left and right face and adjusted for curvature and refraction. Checks on elevations are in the order of ± 0.25 feet.

Helicopter

Helicopter C.G.R. arrived $3\frac{1}{2}$ days late due to high winds and bad weather in general. A total of 10 flying hours were used. The pilot did his best to manipulate the time left before the 100 hour check. This would have meant grounding the machine for 3 days. The close proximity of Sudbury Airport to the working area helped to expedite the survey. The majority of the time the helicopter was sitting idle while staff and crew worked installing targets or surveying.

COMMENTS

If these targets are to be recovered in the winter (February) 1974, I suggest that a helicopter be retained to assist in the job. If two days notice is given before the test flight starts, a helicopter can go around and clean snow off the targets; most of them will be wind-swept and clear. The ones in the low lying areas will have to be shovelled off. To do this with a snowmobile will take considerable time. Also, once you get back in the hills a snowmobile would have difficulty in reaching the control points.

It is estimated that one to two days would be required to clear the targets by helicopter.

The values for the new targets and the elevations are tabulated. The elevations are in feet and metres. These values were also plotted on a U.T.M. grid at 1:25,000 by Calcomp Plotter. Mr. P. Richards changed an existing program so that the plotter did not join up the positions.

LIST of 27 NEW TARGETS
POSITIONS IN U.T.M. & GEOGRAPHIC

*****G
PROGRAM F003 UTM-GEOGRAPHIC APRIL 30/71

ENTER C/M81 FOR NEW C/M, CTRL-C, THEN GO

STN. NORTH. EAST. LAT. LONG.

01	5158629.21	513923.45	46	34	58.975	80	49	5.7820
02	5159136.23	514158.91	46	35	15.383	80	48	54.663
03	5159807.82	514014.61	46	35	37.152	80	49	1.3702
04	5159684.84	514754.04	46	35	33.111	80	48	26.634
05	5159131.143	514818.65	46	35	14.913	80	48	24.266
06	5158458.58	514665.78	46	34	53.390	80	48	30.922
07	5158527.40	515765.75	46	34	55.530	80	47	39.231
08	5159291.62	515630.38	46	35	20.046	80	47	46.104
09	5160170.10	515552.84	46	35	48.512	80	47	49.642
51	5150491.58	507876.10	46	30	35.683	80	53	50.424
52	5151541.19	507917.20	46	31	9.6871	80	53	48.431
53	5152467.29	507843.14	46	31	39.694	80	53	51.851
54	5152343.54	509101.20	46	31	35.628	80	52	52.807
55	5151484.78	509329.19	46	31	7.7944	80	52	42.168
56	5150278.68	508982.19	46	30	28.736	80	52	58.537
57	5150418.83	510620.20	46	30	33.191	80	51	41.667
58	5151441.84	510659.78	46	31	6.3320	80	51	39.725
59	5148776.98	521023.66	46	29	39.117	80	43	33.776
32	5149591.86	521220.35	46	30	5.4958	80	43	24.415
33	5150297.88	521392.93	46	30	28.350	80	43	16.202
34	5150267.92	522317.17	46	30	27.271	80	42	32.840
35	5149686.21	522016.83	46	30	8.4605	80	42	47.032
36	5149066.61	522038.67	46	29	48.384	80	42	46.113
37	5148833.56	523105.99	46	29	40.705	80	41	56.085
38	5149531.29	523279.35	46	30	3.2885	80	41	47.827
39	5150200	523220	46	30	24.961	80	41	50.491
59	5152455.59	510252.47	46	31	39.199	80	51	58.760

POSITION APPROXIMATE.

ELEVATIONS OF TARGETS.

(1973)

	No.	HEIGHT OF FLAG	ELEVATION OF TARGETS.	
CON BRIDGE	1	3.73 (feet)	1156.74 (FEET)	352.57 (METRES)
	2	4.33 "	1132.33 "	345.13 "
	3	4.00 "	1127.89 "	343.78 "
	4	4.16 "	1117.95 "	340.75 "
	5	3.95 "	1163.62 "	354.67 "
	6	4.02 "	1087.94 "	331.60 "
	7	4.02 "	1043.44 "	318.04 "
	8	3.96 "	1051.00 "	320.34 "
	9	3.55 "	1017.39 "	310.10 "
STINSON	31	4.46 "	953.12 "	290.51 "
	32	4.42 "	911.00 "	277.67 "
	33	4.25 "	971.52 "	296.12 "
	34	4.08 "	897.91 "	273.68 "
	35	4.04 "	884.80 "	269.69 "
	36	4.52 "	852.51 "	259.84 "
	37	4.23 "	976.79 "	297.72 "
	38	4.33 "	947.50 "	288.80 "
	39	4.27 "	947.33 *APPROX.	288.74 "
T SUD BURY	51	4.29 "	1037.64 "	316.27 "
	52	3.81 "	870.13 "	265.22 "
	53	4.44 "	1006.24 "	306.70 "
	54	4.63 "	1006.12 "	306.66 "
	55	4.58 "	1005.60 "	306.50 "
	56	4.52 "	908.39 "	276.88 "
	57	4.40 "	925.97 "	282.24 "
	58	4.00 "	864.27 "	263.43 "
	59	4.50 "	898.13 "	273.75 "

ORIGINAL SUDBURY PHOTOGRAMMETRIC

TEST AREA

List of stations repaired and a red flag inserted in a drill hole near the centre of the target.

205	76	281
5	124	287- (used in lieu of #273. Number
19	138	266 could not be identified)
1	38	297
24	63	306
42	135	285
31	95	
214	232	
82	263	
74	274	

Most of these 26 stations were repainted white. If a station was in a swamp, it was repaired and painted. Most of the plywood was in bad shape.

APPENDIX A

PLOT OF FALCONBRIDGE TARGETS

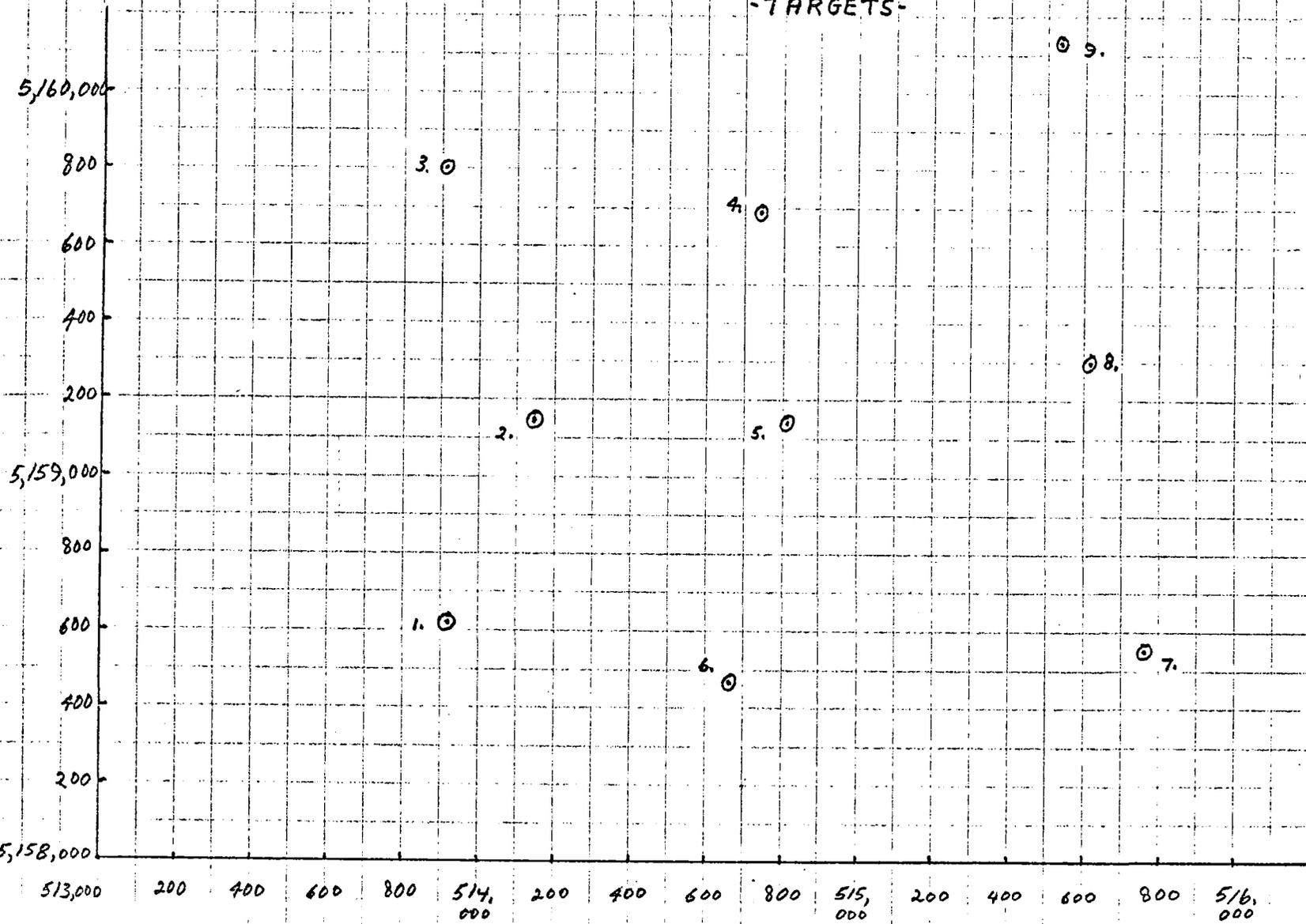
PLOT OF STINSON TARGETS

PLOT OF EAST SUDBURY TARGETS

FALCONBRIDGE

U. T. M.
GRID

-TARGETS-



1:16,000 APPROX.

U.T.M.

GRID
- TARGETS -

5,150,000

5,149,000

5,148,000

800
600
400
200
800
600
400
200
800
600
400
200

520,000 200 400 600 800 521,000 200 400 600 800 522,000 200 400 600 800 523,000 200 400 600

33

34

39

POSITION
APPROXIMATE

32

35

38

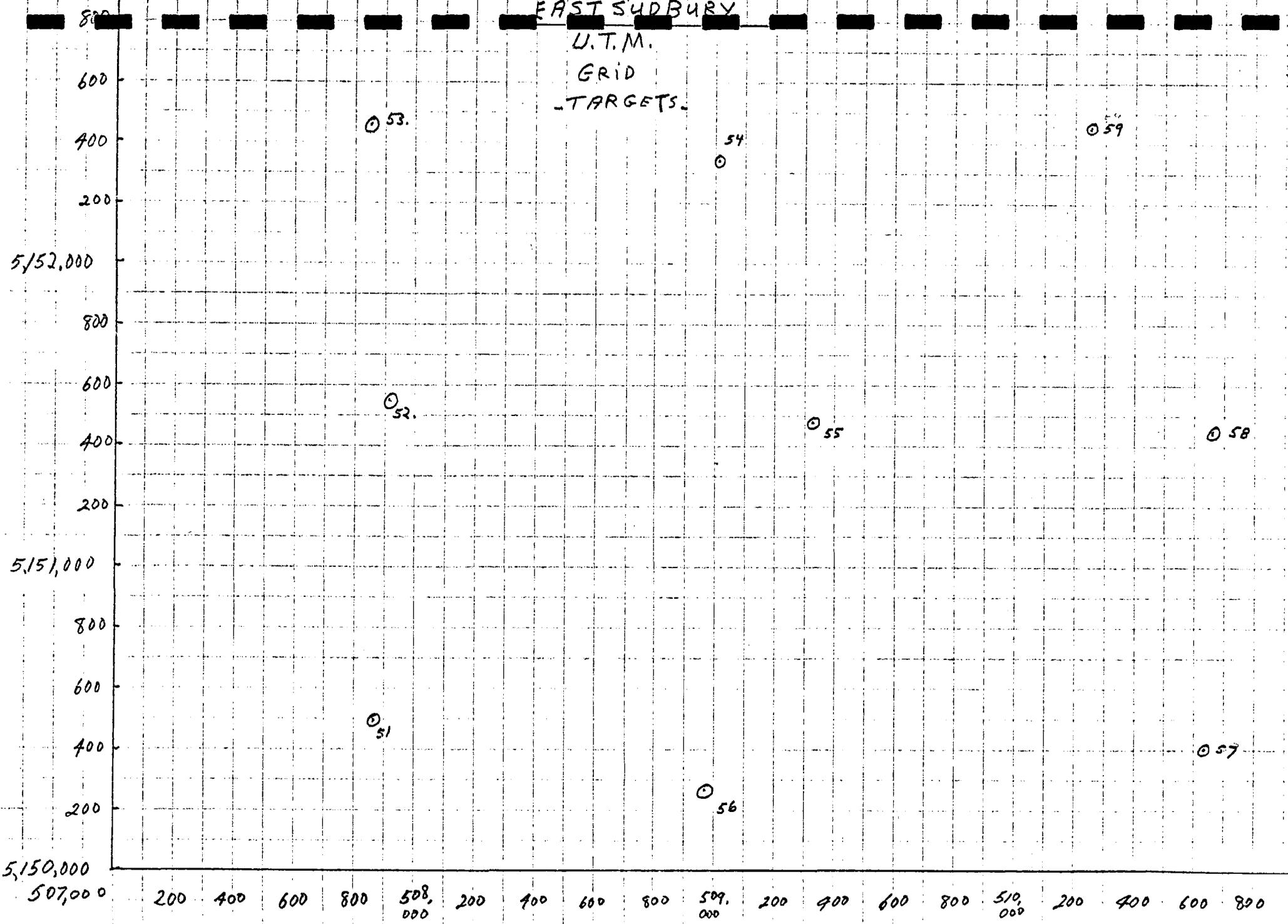
36

37

31

1:16,000 APPROX.

EAST SUDBURY
U.T.M.
GRID
-TARGETS-

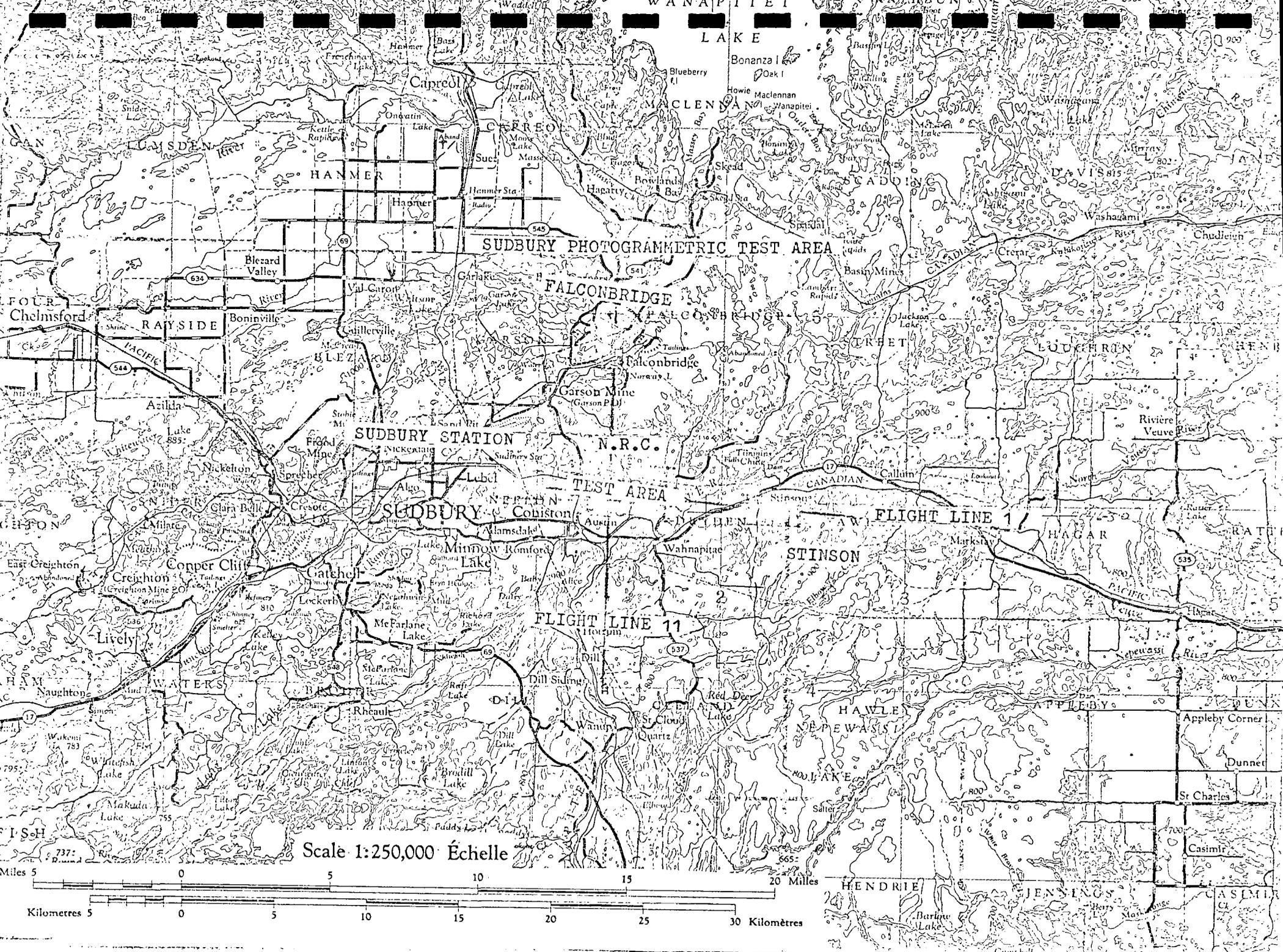


1:16,000 APPROX.

APPENDIX B

CHART - GENERAL AREA (1:250,000)

U.S. GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
WASHINGTON, D.C. 20506

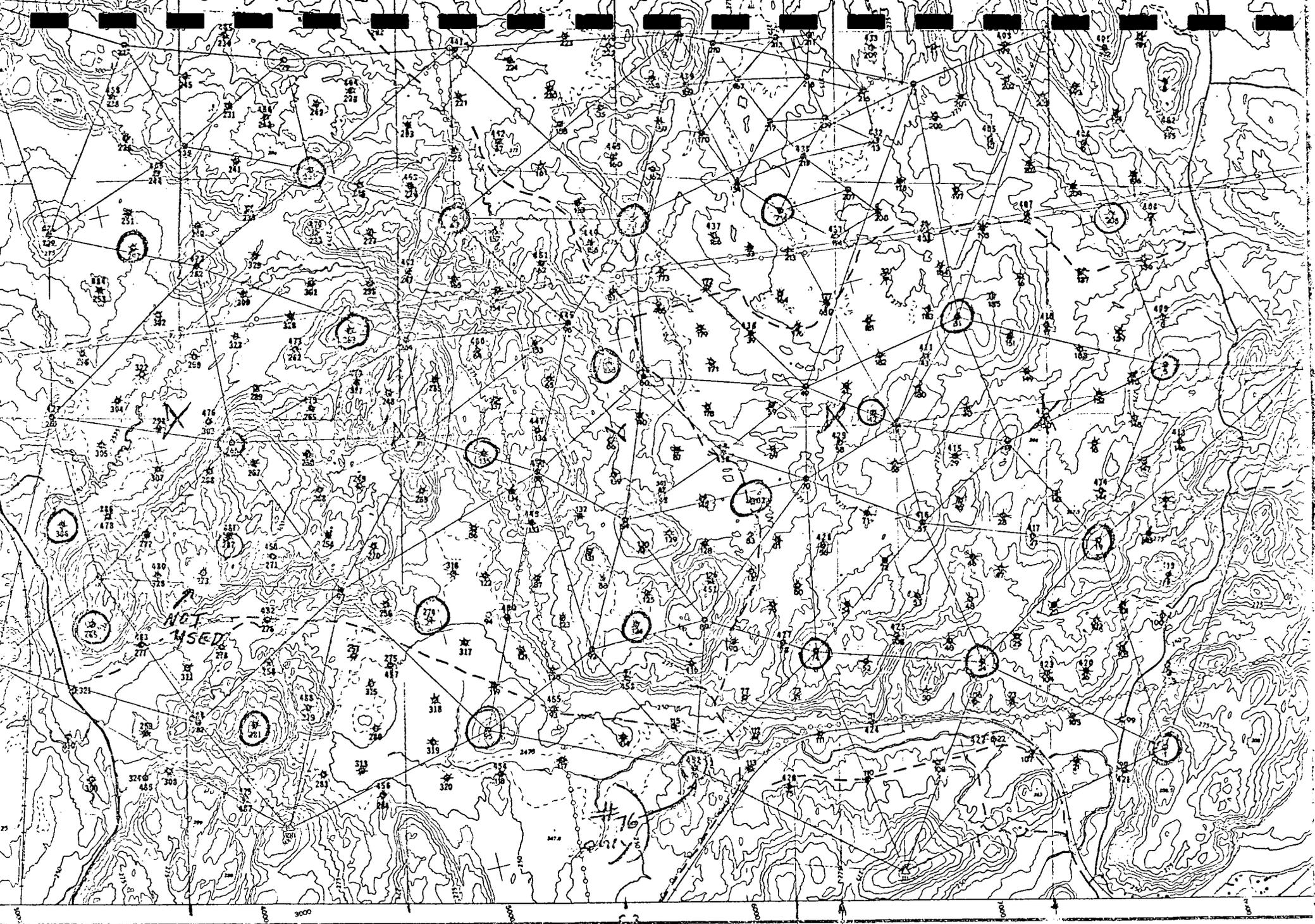


Scale 1:250,000 Échelle



APPENDIX C

SUDBURY PHOTOGRAMMETRIC TEST AREA (1966)



SUDBURY PHOTOGAMMETRIC TEST AREA

PRODUCED BY THE PHOTOGAMMETRIC RESEARCH

c2

c1

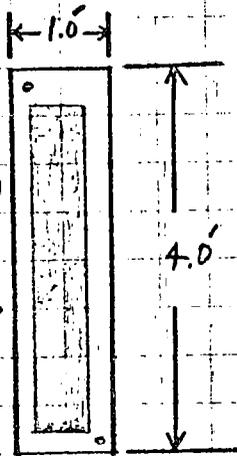
APPENDIX D
SKETCH OF TARGETS

SADBURY PHOTOGRAMMETRIC TEST AREA

TARGETS

1. MOUNTED ON ROCK

$\frac{1}{4}$ " plywood

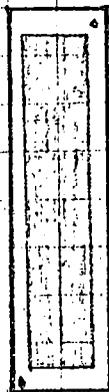


SHADED AREAS RED
REST WHITE.

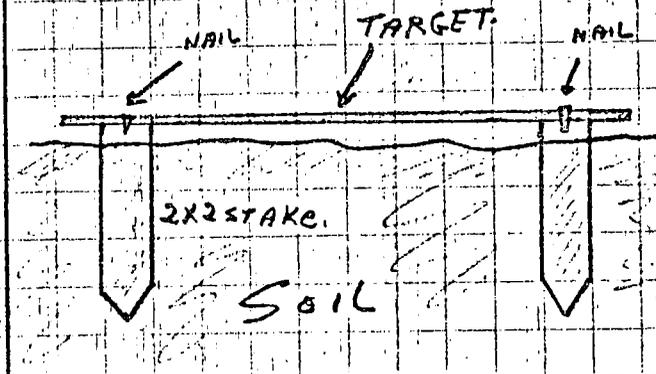
2.0'

FASTENERS.

DRILL HOLE



2. MOUNTED ON SOIL



SCALE $\frac{1}{2}$ " = 1 foot.
(1:24)

APPENDIX E

STATISTICS

1. Name of Ship

2. Type of Ship

3. Date of Departure

4. Date of Arrival

5. Name of Captain

6. Name of Chief Officer

7. Name of Hydrographic Officer

8. Name of Surveyor

9. Name of Assistant Surveyor

10. Name of Steward

11. Name of Surgeon

12. Name of Engineer

13. Name of Chief Steward

14. Name of Cook

15. Name of Cabin Boy

16. Name of Deck Hand

17. Name of Stowaway

18. Name of Passenger

19. Name of Crew

20. Name of Ship

21. Name of Ship

22. Name of Ship

23. Name of Ship

24. Name of Ship

25. Name of Ship

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

YEAR 1973 FROM OCT. 29 TO NOV. 5

Establishment GREAT LAKES SURVEYS

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

Project Name	Project Number	Project Number	Project Number	Project Number
SUDBURY PHOTOGRAMMETRIC & POSITIONING SYSTEM TEST AREA				
Project Name				

Resources:

Number of Hydrographers	* 2/16										TO
Number of Scientists	* N/A										
Number of Electronic Technicians	*										
No. of Student Assistants and Casuals	* N/A										
No. of Support Personnel (Ship's Crew, Etc.)	* 2/16										
Total Personnel	* 4/32										
Number of Ships	N/A										
Number of Launches	N/A										
Number of Land Vehicles	2										
Number (and type) of Aircraft	1										
Number of Minor Support staff	N/A										
Other (specify)	N/A										

* 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

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

YEAR

FROM

TO

Establishment _____	Project Number	Project Number	Project Number	Project Number	
H.I.C. _____					
<u>Time:</u>					
Total operational days.	8				
Days actual field work.	6				
Days lost (weather)	NIL				
Days lost (Sat. Sun. Holidays)	NIL				
Days lost (Equipment failure)	NIL				
Days lost in Transit	2				
Days lost in port for Supplies, Bunker, etc.	N/A				
Days lost, other causes					
Total Man days in period (staff)	16				
Total Man days worked (staff)	12				
Man days:- (staff)					
(a) Sounding	N/A				
(b) Shoal Examinations	N/A				
(c) Wharf surveys	N/A				
(d) Oceanography	N/A				
(e) Geophysics	N/A				
(f) Tides & water levels	N/A				
(g) Collecting bottom samples	N/A				
(h) Horizontal Control	90%				
(i) Shorelining & Low Watering	N/A				
(j) Data processing & office admin.	10%				
(k) Sailing directions	N/A				
(l) Place Names	N/A				
(m) Current observations	N/A				
(n) Photo-Ident.	N/A				
(o) Others (specify)	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
<u>Sounding (Linear Nautical Miles/KM):</u>					
Ship Sounding	N/A				
Launch Sounding	N/A				
Other (specify)	N/A				
Total sounding	N/A				
Reconnaissance (Track) sounding	N/A				
Area sounded (N.M ²) (Km ²)	N/A				
<u>Shoals Examined:</u>					
Shoal Examinations (Ship)	N/A				
Shoal Examinations (Launch)	N/A				
Shoal Examinations (Sweep)	N/A				
Shoal Examinations (other) specify	N/A				
Shoal Examinations (Total)	N/A				
<u>Navigational Aids:</u>					
Shore Aids Positioned (including ranges)	N/A				
Floating Aids Positioned	N/A				
Navigational Ranges Sounded	N/A				
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	Project Number	Project Number	Project Number	Project Number	To
M.I.C.					
<u>Shore Control:</u>					
Signals built (DOWLING AND FLAG)	32				
Signals re-built	--				
Towers built	--				
Number of Stations occupied	20				
Number of Stations re-occupied	--				
Number of stations permanently marked	27				
Distance Traversed (N.M.) (K.M.)	20 NM				
Number of Elevations Measured	40				
Number of Heights Measured	30				
Number of Stations Photo Ident.	--				
Other (specify)	--				
<u>Calibrations:</u>					
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
<u>Tide and Current Data:</u>				
Recording gauges established	N/A			
Recording gauges recovered	N/A			
Staff gauges established	N/A			
Bench Marks Recovered	N/A			
Bench Marks Established	N/A			
Bench Marks Levelled	N/A			
Distance Levelled (N.M.) (KM)	N/A			
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			
<u>Oceanography:</u>				
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			

