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# Automated Procedures for Area, Length and Point Location Computations

SECOND EDITION

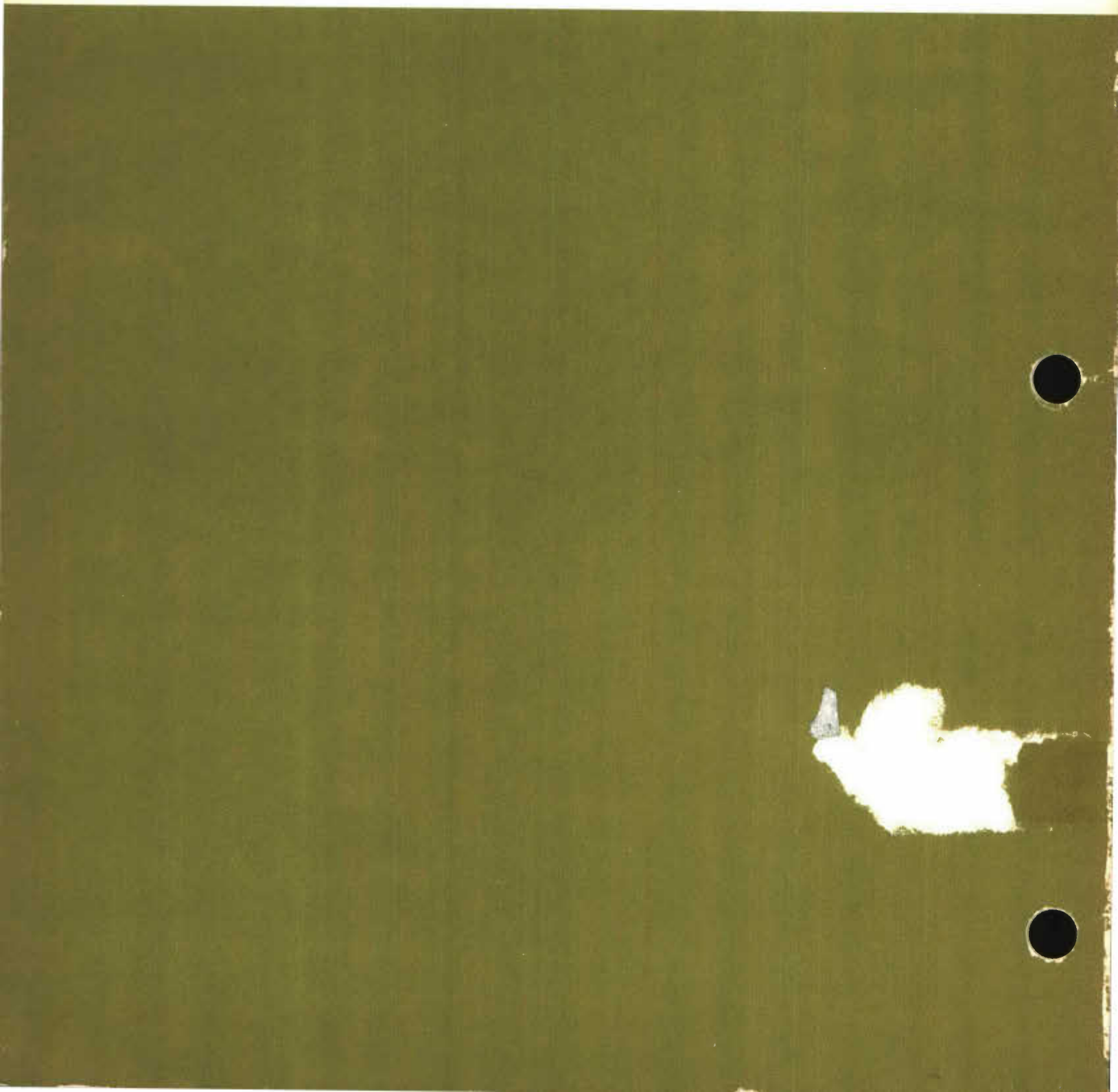
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*INLAND WATERS DIRECTORATE,  
WATER RESOURCES BRANCH,  
OTTAWA, CANADA, 1977.*

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MEMORANDUM TO: Hydrometric Program Users  
FROM: System Engineer  
SUBJECT: Mapping Program

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With the metric conversion, a new computer program, called MAP, has been received from Ottawa and is implemented onto our computing system. This program is a replacement of the existing drainage area program, DAREA and is designed to calculate the followings in English or Metric units:

- a). the area of a region on the earth's surface;
- b). the length of a path on the earth's surface; and
- c). the latitude and longitude of a point on the earth's surface.

The control cards required to execute the MAP program are as follows:

Multipunched Card, 6-7-8-9 on column 1.

MAPPING,CM33000,T100.

ACCOUNT,N1368AA,password.

PROJECT,N1368.

GET,MAP.

MAP.

Multipunched Card, 7-8-9 on column 1.

DATE Card

Other data cards

.  
. .  
. .  
. .

99 Card

Multipunched Card, 6-7-8-9 on column 1.

To prepare the input deck for this program, please refer to the publication entitled 'Automated Procedures for Area, Length and Point Location Computations' which is available from the library.

July 11, 1977.

*T. Cheng*



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**SECOND EDITION**

***INLAND WATERS DIRECTORATE,  
WATER RESOURCES BRANCH,  
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# CONTENTS

	Page
1. Introduction . . . . .	1
2. Machine Configuration and Timing . . . . .	2
3. General Description. . . . .	3
3.1 Area . . . . .	3
3.2 Length . . . . .	3
3.3 Point Location . . . . .	4
4. Operating Instructions for Digitizing a Map. . . . .	5
4.1 Initial Hardware Set-up. . . . .	5
4.2 Area Computations. . . . .	5
4.3 Length Computations. . . . .	6
4.4 Point Location Computations. . . . .	6
5. Card Formats . . . . .	8
5.1 Date Card. . . . .	8
5.2 Map Card . . . . .	8
5.3 Digitizer Co-ordinate Card . . . . .	9
5.4 Sequence Reset Card. . . . .	9
5.5 End of Area/Length Card. . . . .	9
5.6 End of Map Card. . . . .	9
5.7 End of Run Card. . . . .	9
5.8 Test Point Card. . . . .	10
5.9 Digitizer Program Card . . . . .	10
6. Preparing Data for a Computer Run. . . . .	11
6.1 Area Deck Set-up . . . . .	11
6.2 Length Deck Set-up . . . . .	11
6.3 Point Deck Set-up. . . . .	12
6.4 Complete Deck Set-up . . . . .	14
7. Output Listings. . . . .	16
7.1 Area Listings. . . . .	16
7.2 Length Listings. . . . .	17
7.3 Point Listings . . . . .	18
8. Quality Checking . . . . .	19
9. Error Messages . . . . .	20

## 1. INTRODUCTION

This manual was prepared by Mr. L.C. Ades and Mr. G. Lamontagne, Computer Programmers and Mr. M. Krol, Systems Analyst, and approved by Mr. W.J. Ozga, Head, Data Control Section, Applied Hydrology Division. In this manual, the Water Survey of Canada is provided with a set of detailed instructions on how to use the MAP program.

The MAP program is a set of computer procedures designed to calculate:

- (a) the area of a region on the earth's surface;
- (b) the length of a path on the earth's surface;
- (c) the latitude and longitude of a point on the earth's surface.

In order for the MAP program to work, the region, path or point must be located on the map and then digitized using a Gradicon digitizer. Correct operation of this machine yields punched computer cards which, when placed in the appropriate sequence and processed by the MAP program, will calculate actual areas, lengths or locations. Detailed instructions for digitizing necessary to produce the punched input cards, and for arranging these cards to permit MAP program operation are included in this manual.

This manual replaces the "Manual of Procedures for Automating Drainage Area Computations" dated October 31, 1969.

## 2. MACHINE CONFIGURATION AND TIMING

The MAP computer program has been tested on a Univac 1108, a CDC 6400 and an IBM 360/85. These tests indicate that the program requires 12,300 words on a CDC or Univac machine and 62,000 bytes of core on the IBM. The peripheral equipment necessary includes a card reader, a 132 character printer, and one scratch tape or storage area on disk or drum.

The standard test data consists of 18 area computations, 24 length computations and 147 point computations. Approximately 630 cards are read and 900 lines are printed.

The time required to process the test data is as follows:

a) Univac 1108	:	11.70 seconds
b) CDC 6400	:	3.85 seconds
c) IBM 360/85	:	4.05 seconds



### 3. GENERAL DESCRIPTION

This portion of the manual gives a general description of the computation procedures, the input data, and the output listings for area, length and point location calculations, using the MAP program.

#### 3.1 Area

The principle by which the MAP program can compute areas is that the boundary of a known area, called the map area, is digitized on the Gradicon and then all unknown areas which are digitized are related to the map area. The known area (the earth area represented by the map) can be calculated using the equation for Smithsonian Geographical Tables provided the latitude and longitude of the corners of the map are given.

Input data for area computations consists of a "Map" card (76-027), a "Map Co-ordinate" card (76-011), a number of "Area Co-ordinate" cards (76-011), and an "End of Area...97" card (68-013). The "Area Co-ordinate" cards (76-011) with an "End of Area...97" card (68-013) may be repeated for as many areas as are desired on that map.

The "Area Co-ordinate" cards (76-011) contain the x-y co-ordinates which delineate the unknown area. This unknown area may be digitized up to 10 times. When digitizing the perimeter of an area, the contour should be handled in straight line segments because the program assumes straight lines between x-y co-ordinates.

These cards, when processed by the MAP program, produce an output listing which shows; the map name, number, area and scale; and the statistics on each digitized area on the map. Each time that a particular area is digitized one print line of statistics is produced. The last line of each area is for the mean. The statistics include the area identification, the perimeter, the actual area and the percent deviation from the mean area. The percent deviation from the mean is used as an aid in quality checking the results.

#### 3.2 Length

The principle by which the MAP program can compute lengths is that the boundary of a known area, called the map area, is digitized and then the ratio of the known area to the digitized area yields a scale of the map which, when multiplied by unknown digitized lengths, gives the actual length.

Input data for length computations consists of a "Map" card (76-027), a "Map Co-ordinate" card (76-011), a number of "Length Co-ordinate" cards (76-011), and an "End of Length...97" card (68-013). The "Length Co-ordinate" cards (76-011) with an "End of Length...97" card (68-013) may be repeated for as many lengths as are desired on that map.

The "Length Co-ordinate" cards (76-011) contain the x-y co-ordinates which delineate the unknown length. This unknown length may be digitized up to 10 times. The digitizing of the length should be handled in straight line segments because the program assumes straight lines between x-y co-ordinates.

These cards, when processed by the MAP program, produce an output listing which shows; the map name, number, area and scale; and the statistics on each digitized length on the map. Each time that a particular length is digitized one print line

of statistics is produced. The last line of each length is for the mean. The statistics include the length identification, the actual length and the percent deviation from the mean length. The percent deviation from the mean is used as an aid in quality checking the results.

### 3.3 Point Location

The basic principle by which the Map program can compute point locations is that the unknown point is located on a map which has its northings and eastings based on the Universal Transverse Mercator Map Projection System. Given the latitude and longitude of the corners of the map, the MAP program must convert them to U.T.M. co-ordinates. Using analytic geometry, it is then very easy to calculate U.T.M. co-ordinates for any digitized point location. As the last step the program converts the northings and eastings of the digitized point to latitude and longitude.

Input data for point location computations consists of a "Map" card (76-027); a "Map Co-ordinate" card (76-011); a series of test point cards, "Digitized Test Point" cards (76-011) and "Test Point" cards (76-028); followed by as many "Desired Point" cards (76-011) for as many point locations as desired on that map.

The series of test point cards must be terminated by a blank "Test Point" card (76-028). There can be only one point location on each "Desired Point" card (76-011).

These cards, when processed by the MAP program, produce an output listing which shows; the map name, number, area and scale; latitude and longitude of the corners of the map; the test point section; and the digitized point section. The test point section, which is included for quality checking, contains actual and computed latitude and longitude of test points, and the digitized point section contains the latitude and longitude of the digitized points.

## 4. OPERATING INSTRUCTIONS FOR DIGITIZING A MAP

### 4.1 Initial Hardware Set-up

#### 4.1.1 Card Punch

1. Turn on the card punch; place cards in the hopper.
2. Set Print switch to Print;  
Set Punch/Verify switch to Punch;  
Set Load Prog/Load Data switch to off.
3. Set Auto/Manual switch to Manual.
4. Press Skip key twice to clear previously stored data.
5. Set Load Prog/Load Data switch to Load Prog.
6. Insert digitizer program (drum) card into the auxiliary feed.
7. Press the Feed key. The program will be loaded into memory and automatically selected to the back stacker. This program is set to punch numerics. Thus it is necessary to press the Alpha button when entering an alphabetic character.
8. Set Load Prog/Load Data switch to off.
9. Press the Feed key. A card will be fed into the machine.
10. The red light will come on so simply press the Clear button.

#### 4.1.2 Control Console

11. Raise the Circuit Breaker located at the lower left-hand corner.
12. Press the Power pushbutton of the display if not visible.
13. Press the System Reset pushbutton.
14. Position the cursor in the lower left-hand corner of the table just within the working area.
15. Press the X and Y Reset pushbuttons to establish the origin in the lower left-hand corner of the table.
16. Enter the last two digits of the year of the data in the two left most fixed address switches on the auxiliary keyboard.
17. Set the Record Mode to Point.
18. Set the Co-ordinate Value to Abs.
19. Set the Scale to 1:1.
20. To set the card counter to the desired number, press the Run/Preset/Clear switch down to clear the counters (it will return to the Preset position). The four push-buttons on the right are used to set the card number at any desired value. Now press the Run/Preset/Clear switch up to Run so the card counter will accumulate.
21. Perform section 4.2 for area computations or section 4.3 for length computations or section 4.4 for point computations.

### 4.2 Area Computations

22. Key punch the map number left justified in columns 1 to 7. This number will be duplicated on the next card. Key punch the remainder of this card according to the "Map" card (76-027), but do not key punch beyond column 71.
23. Set the Auto/Manual switch to Auto.
24. Press the Prog Alt switch to allow transfer of data from the Gradicon.
25. Eject the card by pressing the Skip button on the auxiliary keyboard.
26. Set the Record Mode to Point.
27. Digitize the four corners of the map starting with the northwest corner

- and going clockwise.
28. Press the Skip button on the auxiliary keyboard.
  29. Set Auto/Manual switch to Manual.
  30. Press the Home key.
  31. Keypunch the area identification left justified in columns 1 to 7. This identification will be duplicated on subsequent runs.
  32. Set Auto/Manual switch to Auto.
  33. Press the Prog Alt switch to allow the transfer of data from the Gradicon.
  34. Press the Skip button on the auxiliary keyboard; the card column indicator should now be at column 9.
  35. Digitize the area.
  36. Press the Skip button on the auxiliary keyboard.
  37. Repeat steps 35 and 36 for each delineation of the same area.
  38. Insert an "End of Area...97" card (68-013) after the last card in the stacker.
  39. For each additional area repeat steps 29 to 38.
  40. If there is no further map processing go to step 45.
  41. Insert an "End of Map...98" card (68-014) after the last card in the stacker.
  42. Set Auto/Manual switch to Manual.
  43. Press the Home key.
  44. Perform section 4.2 for each area computation, or section 4.3 for each length computation, or section 4.4 for each point computation.
  45. Insert an "End of Run...99" card (68-015) after the last card in the stacker.

#### 4.3 Length Computations

To digitize a map length follow the instructions in section 4.2 but replace all occurrences of the word "area" by the word "length".

#### 4.4 Point Location Computations

22. Keypunch the map number left justified in columns 1 to 7. This number will be duplicated on the next card. Keypunch the remainder of this card according to the "Map" card (76-027), but do not keypunch beyond column 71.
23. Set the Auto/Manual switch to Auto.
24. Press the Prog Alt switch to allow transfer of data from the Gradicon.
25. Eject the card by pressing the Skip button on the auxiliary keyboard.
26. Set the Record Mode to Point.
27. Digitize the four corners of the map starting with the northwest corner of the map and going clockwise.
28. Press the Skip button on the auxiliary keyboard. If there are no test points go to step 35.
29. Digitize one test point.
30. Press the Skip button on the auxiliary keyboard.
31. Keypunch the latitude and longitude of the test point according to "Test Point" card (76-028).
32. Press the Prog Alt switch.
33. Press the Skip button on the auxiliary keyboard.
34. Repeat steps 29 to 33 for each additional test point.
35. Eject one blank card by pressing the Skip button on the auxiliary keyboard.

36. Set Auto/Manual switch to Manual.
37. Press the Home key.
38. Key punch the point identification left justified in columns 1 to 7.
39. Set Auto/Manual switch to Auto.
40. Press the Prog Alt switch.
41. Press the Skip button on the auxiliary keyboard; the card column indicator should now be at column 9.
42. Digitize one point.
43. Press the Skip button on the auxiliary keyboard.
44. Repeat steps 36 to 43 for all the desired points.
45. If there is no further map processing go to step 50.
46. Insert an "End of Map...98" card(68-014) after the last card in the stacker.
47. Set Auto/Manual switch to Manual.
48. Press the Home key.
49. Perform section 4.2 for each area computations or section 4.3 for each length computation or section 4.4 for each point computation.
50. Insert an "End of Run...99" card (68-015) after the last card in the stacker.

## 5. CARD FORMATS

### 5.1 Date Card (Format 68-001)

<u>Column(s)</u>	<u>Description</u>
1-4	"DATE"
5	blank
6-16	current date, e.g. Julbb6b1976 for July 6, 1976 ("b" stands for a blank); the month is represented by its first three letters; the day and year are right justified in columns 11 and 16, respectively
17-80	blank.

### 5.2 Map Card (Format 76-027)

<u>Column(s)</u>	<u>Description</u>
1-7	map number, up to 7 alphanumeric characters, e.g. A1B2C3
8	blank
9-17	latitude and longitude of the northwest corner of the map (a) columns 9-10 contain the degrees of latitude (b) columns 11-12 contain the minutes of latitude (c) columns 13-15 contain the degrees of longitude (d) columns 16-17 contain the minutes of longitude
18	blank
19-27	latitude and longitude of the southeast corner of the map (a) columns 19-20 contain the degrees of latitude (b) columns 21-22 contain the minutes of latitude (c) columns 23-25 contain the degrees of longitude (d) columns 26-27 contain the minutes of longitude
28	blank
29	units of measurement blank - metric (kilometres) 1 - English (miles) 2 - acres
30	blank
31	type of computation blank - Area L - Length P - Point
32	blank
33-71	map name left justified
72-73	blank
74-75	last two digits of the year as entered in the two left most fixed addresses of the auxiliary keyboard
76	blank
77-80	card sequence number inserted by the digitizer.

5.8 Test Point Card (Format 76-028)

<u>Column(s)</u>	<u>Description</u>
1-7	point identification, up to seven alphanumeric characters, e.g. A1B2C3
8	blank
9-17	latitude and longitude of the test point (a) columns 9-10 contain the degrees of latitude (b) columns 11-12 contain the minutes of latitude (c) columns 13-15 contain the degrees of longitude (d) columns 16-17 contain the minutes of longitude
18-73	blank
74-75	last two digits of the year as entered in the two left most fixed addresses of the auxiliary keyboard
76	blank
77-80	card sequence number inserted by the digitizer.

5.9 Digitizer Program Card

<u>Column(s)</u>	<u>Punches</u>	
1	0	(zero)
2-7	12-1	(letter A)
8	11	(- sign)
9	blank	
10-71	12	(+ sign)
72	12-1-2	

5.3 Digitizer Co-ordinate (or Map Co-ordinate or Area Co-ordinate or Length Co-ordinate or Desired Test Point or Desired Point) Cards (Format 76-011)

<u>Column(s)</u>	<u>Description</u>
1-7	map number or area identification or length identification, as applicable, up to seven alphanumeric characters, e.g. A1B2C3
8	blank
9-72	co-ordinates from the digitizer; up to eight sets of 4-digit (x-y) co-ordinates in tenths of millimeters
73	blank
74-75	last two digits of the year as entered in the two left most fixed addresses of the auxiliary keyboard
76	blank
77-80	card sequence number inserted by the digitizer.

5.4 Sequence Reset Card (Format 68-012)

<u>Column(s)</u>	<u>Description</u>
1-7	map number or area identification or length identification, as applicable, up to seven alphanumeric characters, e.g. A1B2C3
8-75	blank
76	"R" (for reset card)
77-80	sequence number of the following card; this will save repunching cards when a sequence error is detected. This reset card is used only with the "Digitizer Co-ordinate" cards (76-011).

5.5 End of Area...97 (or End of Length...97) Card (Format 68-013)

<u>Column(s)</u>	<u>Description</u>
1-2	"97"
3-8	initials of digitizer operator
9-80	blank.

5.6 End of Map...98 Card (Format 68-014)

<u>Column(s)</u>	<u>Description</u>
1-2	"98"
3-80	blank.

5.7 End of Run...99 Card (Format 68-015)

<u>Column(s)</u>	<u>Description</u>
1-2	"99"
3-80	blank.



## 6. PREPARING DATA FOR A COMPUTER RUN

### 6.1 Area Deck Set-up

Figure 1, area computation, shows how the data cards for two areas from the same map are to be arranged. The cards are placed in the following order:

(a) Map card (76-027)

This card contains the map number, the latitude and longitude of the northwest and southeast corners of the map, the units to be printed on the output listings, a blank which is left in column 31 to indicate an area computation, and the name of the map.

(b) Map Co-ordinate card (76-011)

This card contains the map number which is checked against that from the "Map" card (76-027), four pairs of x-y co-ordinates and a card sequence number. The x-y co-ordinates represent the position on the table of the four corners of the map.

(c) Area Co-ordinate cards (76-011)

These cards contain the area number, eight pairs of x-y co-ordinates and a card sequence number. A complete set of these cards represent the digitizer output for one delineation of the area's perimeter. Up to 10 delineations may be used to increase the accuracy of the calculations. Additional cards or corrections may also be entered into this section by placing "Sequence Reset" cards (68-012) before and/or after the additions or corrections.

(d) End of Area...97 card (68-013)

This card contains the number 97 and the initials of the person digitizing the area. It is used to signal the end of the area.

### 6.2 Length Deck Set-up

Figure 1, length computation, shows how the data cards for two lengths from the same map are to be arranged. The cards are placed in the following order:

(a) Map card (76-027)

This card contains the map number, the latitude and longitude of the northwest and southeast corners of the map, the units to be printed on the output listings, the letter L in column 31 to indicate a length computation, and the name of the map.

(b) Map Co-ordinate card (76-011)

This card contains the map number, four pairs of x-y co-ordinates and a card sequence number. This set of x-y co-ordinates represents the position on the table of the four corners of the map. From them the program can compute the scale of the map.

(c) Length Co-ordinate cards (76-011)

These cards contain the identification code (river code or station number) which is checked against the first card for this length deck, eight pairs of x-y co-ordinates and a card sequence number. A complete set of these cards represent the digitizer output for one delineation of the length. Up to 10 delineations of the same length can be assembled and averaged. Additional cards or corrections may also be entered into this section by placing "Sequence Reset" cards (68-012) before and/or after the additions or corrections.

(d) End of Length...97 card (68-013)

This card contains the number 97 and the Digitizer's Initials. It is used to signal the end of the length.

### 6.3 Point Deck Set-up

Figure 1, point computation, shows how the data cards for three points from the same map are to be arranged. The cards are placed in the following order.

(a) Map card (76-027)

This card contains the map number, the latitude and longitude of the northwest and southeast corners of the map, the units to be used on the output listings, the letter P in column 31 to indicate a point location computation and the name of the map.

(b) Map Co-ordinate card (76-011)

This card contains the map number, four pairs of x-y co-ordinates, and a sequence number. These co-ordinates represent the position on the table of the four corners of the map.

(c) Test Point cards

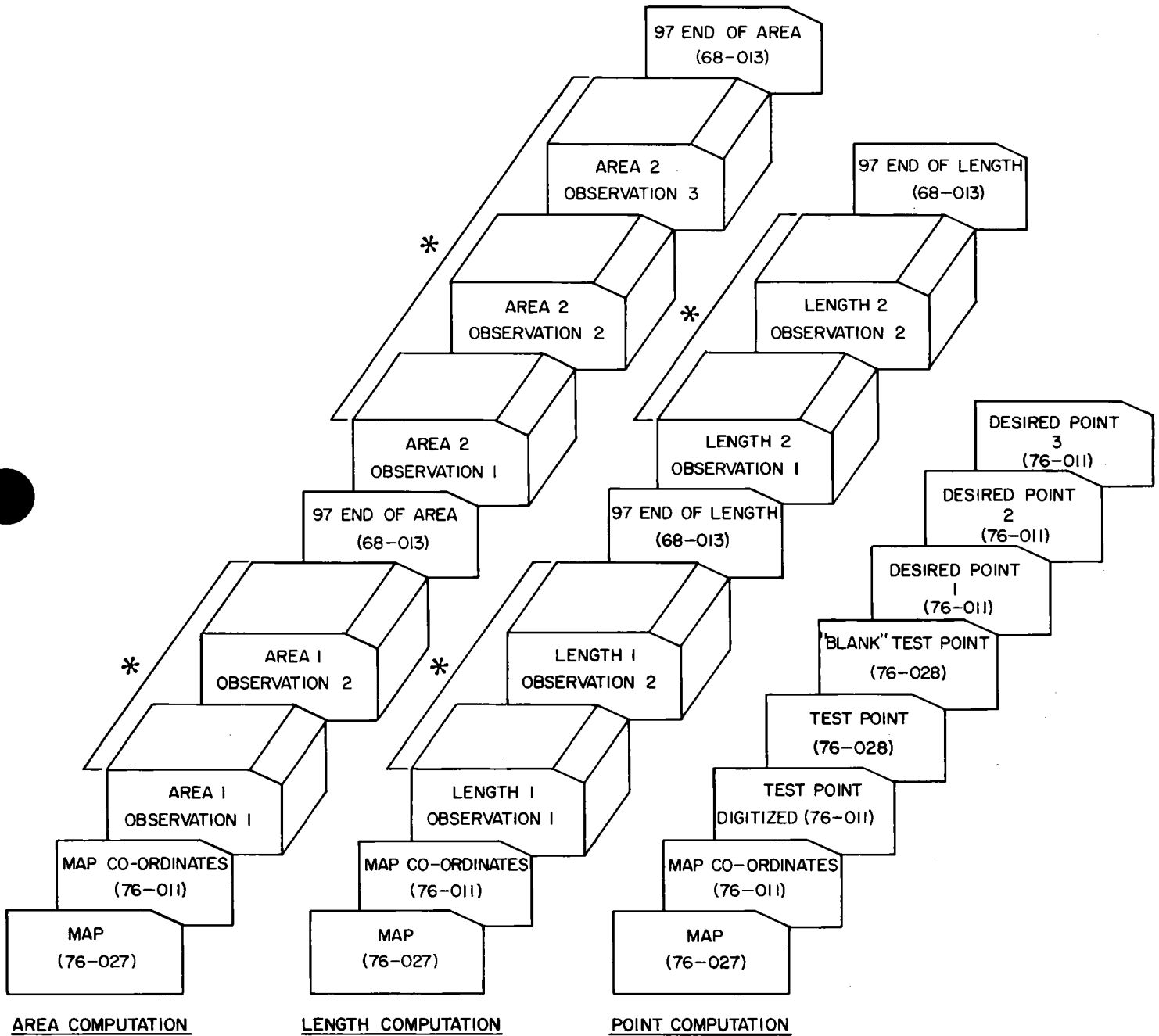
This set of cards contains two different types of cards: "Digitized Test Point" cards (76-011) and punched "Test Point" cards (76-028). The digitized cards contain one pair of x-y co-ordinates for the test point. The "Test Point" card (76-028) contains the latitude and longitude for the preceding digitized point. These cards are used for a quality check.

A blank "Test Point" card (76-028) is inserted to terminate test point computations and is required even when there are no test point cards.

(d) Desired Point cards (76-011)

These cards contain digitized x-y co-ordinates from the digitizer. For each pair of co-ordinates a point location will be computed.

FIGURE I  
MAP DECKS



\* DIGITIZER CO-ORDINATE CARDS (76-011)

#### 6.4 Complete Deck Set-up

The program can process data from more than one map in a computer run as figure 2 indicates. Figure 2 also points out that it is possible to have area data, length data and point data together in a single deck set-up provided that only one type of data is used per map. The program does not allow for mixed data (e.g. point and area) between the "Map" card (76-027) and the corresponding "End of Map" card (68-014).

Figure 2 shows a complete deck set-up for a computer run. The cards are placed in the following order:

(a) Control Cards

Computer Centre control cards are used to retrieve the MAP program from disk or drum storage and to give control to the MAP program.

(b) Date Card (68-001)

The "Date" card (68-001) contains the current date and is a required card for every computer run.

(c) Map Decks

The "Date" card (68-001) is followed by at least one map deck. The decks are arranged as shown in figure 1. Every map deck, except the last one, is followed by an "End of Map ... 98" card (68-014). This card indicates the end of the map deck just read and that another map deck follows.

(d) End of Run...99 (68-015)

The "End of Run ... 99" card (68-015) indicates the end of the computer run. The last map deck is followed by this card instead of the "End of Map ... 98" card (68-014).

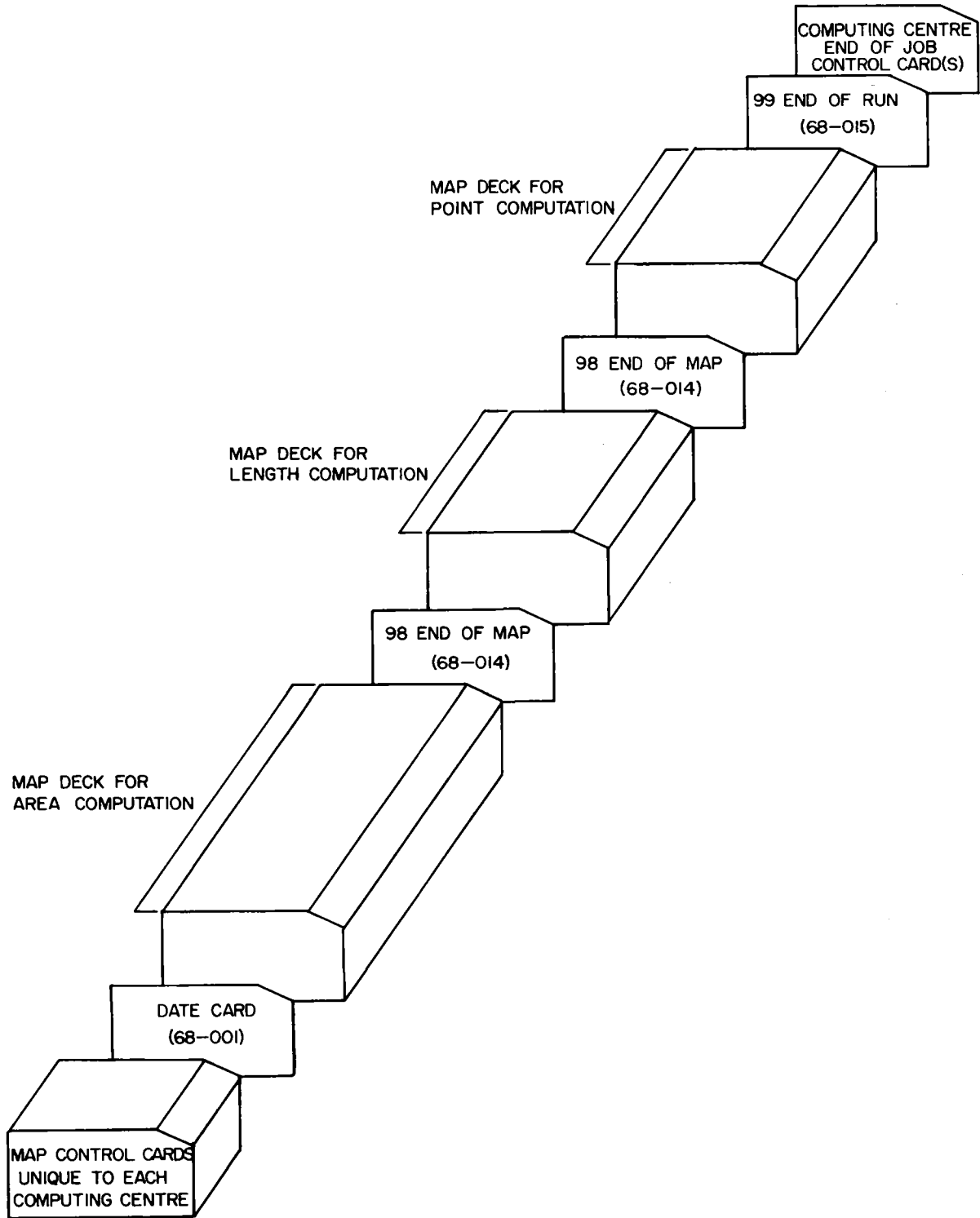
(e) Control cards

The Computer centre end of job cards are used to indicate that the MAP program is finished.

Figure 1 shows map decks for area, length, and point computations respectively. In order to prepare one of these map decks, perform the instructions for digitizing a map as outlined in section 4 of this manual.

FIGURE 2

DECK SET-UP FOR A COMPUTER RUN



7. OUTPUT LISTINGS

7.1 Area Listings

The output listing for the area computation contains two sections; the map statistics and the area statistics.

The map statistics section contains the name, number, area and scale of the map.

The area statistics section contains paragraphs on each digitized area. Each time an area is digitized one print line is produced. It includes the area identification, the area, the perimeter and the percent deviation from the mean. The last line of each area is for the mean values and the initials of the individual who digitized the area.

WATER SURVEY OF CANADA  
JAN 25 1977 PAGE 7  
OTTAWA, ONT.

AREA COMPUTATIONS

MAP NAME = SUMMERLAND, B.C.  
MAP NUMBER = 82E/12W  
MAP AREA = 193.929 SQ MILES  
SCALE OF MAP = 1/50000

AREA STATISTICS

IDENTIFICATION	AREA (SQ MILES)	PERCENT DEVIATION FROM MEAN	DIGITIZED BY	PERIMETER (MILES)
L3775	0.503	0.55	G.LAMO	3.00
L3775	0.499	-0.24		2.99
L3775	0.498	-0.32		2.99
L3775	0.500	N/A		3.00
MEAN FOR				
L3759	0.065	0.01	97 CARD MISSING	1.01
L3759	0.065	-0.01		1.02
L3759	0.065	N/A		1.01
MEAN FOR				

WATER SURVEY OF CANADA  
JAN 25 1977 PAGE 8  
OTTAWA, ONT.

AREA COMPUTATIONS

MAP NAME = SUMMERLAND, B.C.  
MAP NUMBER = 82E/12W  
MAP AREA = 502.247 SQ KILOMETRES  
SCALE OF MAP = 1/50000

AREA STATISTICS

IDENTIFICATION	AREA (SQ KILOMETRES)	PERCENT DEVIATION FROM MEAN	DIGITIZED BY	PERIMETER (KILOMETRES)
L377548	1.295	-0.16	97 CARD MISSING	4.83
L377548	1.297	-0.00		4.81
L377548	1.299	0.17		4.81
L377548	1.297	N/A		4.82
MEAN FOR				
L3759	0.167	0.04	97 CARD MISSING	1.64
L3759	0.166	-0.60		1.63
L3759	0.168	0.70		1.65
L3759	0.166	-0.58		1.63
L3759	0.169	1.29		1.64
L3759	0.166	-0.86		1.63
MEAN FOR				
L3759	0.167	N/A	97 CARD MISSING	1.63
L477352	0.630	-0.01	G.LAMO	3.18
L477352	0.633	0.32		3.18
L477352	0.629	-0.31		3.17
L477352	0.631	-0.00		3.18
L477352	0.631	N/A		3.18
MEAN FOR				

## 7.2 Length Listings

The output listing for the length computation contains two sections; the map statistics and the length statistics.

The map statistics section contains the name, number, area and scale of the map.

The length statistics section contains paragraphs on each digitized length. Each time a length is digitized one print line is produced. It includes the length identification, the length, and the percent deviation from the mean. The last line of each length is for the mean value and the initials of the individual who digitized the length.

WATER SURVEY OF CANADA  
JAN 25 1977 PAGE 1  
OTTAWA, ONT.

### LENGTH COMPUTATIONS

MAP NAME = SUMMERLAND, B.C.  
MAP NUMBER = 82E/12W  
MAP AREA = 502.247 SQ KILOMETRES  
SCALE OF MAP = 1/50000

### LENGTH STATISTICS

	LENGTH IDENTIFICATION	LENGTH (KILOMETRES)	PERCENT DEVIATION FROM MEAN	DIGITIZED BY
	5000FT	6.599	-0.08	
	5000FT	6.627	0.35	
	5000FT	6.585	-0.28	
MEAN FOR	5000FT	6.604	N/A	G.LAMO
	SC4K	3.973	0.03	
	SC4K	3.973	0.03	
	SC4K	3.968	-0.09	
MEAN FOR	SC4K	3.973	0.03	97 CARD MISSING
	SC4K	3.971	N/A	
	SC3MIL	4.793	0.03	
	SC3MIL	4.788	-0.08	
	SC3MIL	4.793	0.03	
MEAN FOR	SC3MIL	4.793	0.02	G.LAMO
	SC3MIL	4.792	N/A	

WATER SURVEY OF CANADA  
JAN 25 1977 PAGE 2  
OTTAWA, ONT.

### LENGTH COMPUTATIONS

MAP NAME = SUMMERLAND, B.C.  
MAP NUMBER = 82E/12W  
MAP AREA = 193.929 SQ MILES  
SCALE OF MAP = 1/50000

### LENGTH STATISTICS

	LENGTH IDENTIFICATION	LENGTH (MILES)	PERCENT DEVIATION FROM MEAN	DIGITIZED BY
	5000FT	4.092	N/A	97 CARD MISSING
	SC3MIL	2.982	0.08	
	SC3MIL	2.979	-0.03	
	SC3MIL	2.979	-0.03	
MEAN FOR	SC3MIL	2.979	-0.03	G.LAMO
	SC3MIL	2.979	N/A	
	SC4K	2.469	0.03	
	SC4K	2.469	0.03	
	SC4K	2.469	0.03	
MEAN FOR	SC4K	2.466	-0.09	G.LAMO
	SC4K	2.468	N/A	

### 7.3 Point Listings

The output listing for the point location computation contains three sections; the map statistics, the test point section and the digitized point section.

The map statistics section contains the name, number, area and scale of the map and the latitude and longitude of the corners of the map.

The test point section contains actual and computed latitude and longitude of points included for quality checking.

The digitized point section consists of lines containing up to three point locations. Each point has its identification, latitude and longitude printed.

WATER SURVEY OF CANADA  
JAN 25 1977 PAGE 3  
OTTAWA, ONT.

#### POINT LOCATION COMPUTATIONS

MAP NAME = SUMMERLAND B.C.  
MAP NUMBER = 82E/12W  
MAP AREA = 502.247 SQ KILOMETRES  
SCALE OF MAP = 1/50100

#### THE CORNERS OF THE MAP

ACTUAL NORTHWEST			COMPUTED NORTHEAST			ACTUAL SOUTHEAST			COMPUTED SOUTHWEST		
LATITUDE	LONGITUDE		LATITUDE	LONGITUDE		LATITUDE	LONGITUDE		LATITUDE	LONGITUDE	
DEG. MIN. SEC.	DEG. MIN. SEC.		DEG. MIN. SEC.	DEG. MIN. SEC.		DEG. MIN. SEC.	DEG. MIN. SEC.		DEG. MIN. SEC.	DEG. MIN. SEC.	
49 45 0	120 0 0		49 45 0	119 45 0		49 30 0	119 45 0		49 30 0	120 0 0	

#### TEST POINT

ACTUAL POINT			COMPUTED POINT		
LATITUDE	LONGITUDE		LATITUDE	LONGITUDE	
DEG. MIN. SEC.	DEG. MIN. SEC.		DEG. MIN. SEC.	DEG. MIN. SEC.	
49 30 0	119 55 0		49 30 0	119 55 0	

#### LOCATION OF DIGITIZED POINTS

POINT NO.	LATITUDE	LONGITUDE	POINT NO.	LATITUDE	LONGITUDE	POINT NO.	LATITUDE	LONGITUDE
	DEG. MIN. SEC.	DEG. MIN. SEC.		DEG. MIN. SEC.	DEG. MIN. SEC.		DEG. MIN. SEC.	DEG. MIN. SEC.
1	49 30 0	120 0 0	2	49 31 0	120 0 0	3	49 32 0	120 0 0
4	49 33 0	120 0 0	5	49 34 0	119 59 59	6	49 35 0	119 59 59
7	49 36 0	119 59 59	8	49 37 0	119 59 59	9	49 38 0	119 59 59
10	49 39 0	119 59 59	11	49 40 0	119 59 59	12	49 40 59	119 59 59

WATER SURVEY OF CANADA  
JAN 25 1977 PAGE 5  
OTTAWA, ONT.

#### POINT LOCATION COMPUTATIONS

MAP NAME = MEIGHEN ISLAND(N1/2)  
MAP NUMBER = 560B  
MAP AREA = 1193.190 SQ KILOMETRES  
SCALE OF MAP = 1/50100

#### THE CORNERS OF THE MAP

ACTUAL NORTHWEST			COMPUTED NORTHEAST			ACTUAL SOUTHEAST			COMPUTED SOUTHWEST		
LATITUDE	LONGITUDE		LATITUDE	LONGITUDE		LATITUDE	LONGITUDE		LATITUDE	LONGITUDE	
DEG. MIN. SEC.	DEG. MIN. SEC.		DEG. MIN. SEC.	DEG. MIN. SEC.		DEG. MIN. SEC.	DEG. MIN. SEC.		DEG. MIN. SEC.	DEG. MIN. SEC.	
80 15 0	100 15 0		80 15 0	98 35 0		79 55 0	98 35 0		79 55 0	100 15 0	

#### LOCATION OF DIGITIZED POINTS

POINT NO.	LATITUDE	LONGITUDE	POINT NO.	LATITUDE	LONGITUDE	POINT NO.	LATITUDE	LONGITUDE
	DEG. MIN. SEC.	DEG. MIN. SEC.		DEG. MIN. SEC.	DEG. MIN. SEC.		DEG. MIN. SEC.	DEG. MIN. SEC.
1	79 56 32	99 58 12	2	79 56 12	99 54 6	3	79 57 22	99 22 51
4	79 55 13	98 53 55	5	79 55 18	98 59 44	6	79 54 59	98 38 41
7	80 15 0	100 12 51	8	80 14 9	100 14 53	9	80 15 0	100 3 22
10	80 14 59	98 47 11	11	80 14 58	98 37 41	12	80 14 50	98 34 48



## 8. QUALITY CHECKING

- (a) Each area should be digitized at least three times and the largest percent deviation from the mean of any one of the delineations should not be greater than one percent. If the greatest deviation is greater than one percent, then the set of cards for this area should be discarded, and the area should be redigitized.
- (b) Each length should be digitized at least three times and the largest percent deviation from the mean of any one of the delineations should not be greater than one percent. If the greatest deviation is greater than one percent, then the set of cards for this length should be discarded, and then the length should be redigitized.
- (c) For point location computations, verify the computed location of the test points with the actual punched values. The maximum allowable deviation for either latitude or longitude is three seconds.
- (d) For point location computations, ensure that the correct latitude and longitude is given for the northwest and the southeast corners of the map.

## 9. ERROR MESSAGES

This section refers to errors found by the MAP computer program. The program cannot directly recognize the different types of cards that make up the input deck. When the input cards are in the correct sequence the program reads the cards correctly because each card tells the program what type of card to expect next. If some cards are missing, mispunched or misplaced the program will normally print the correct error message and point to the source of error. However, the error in question might cause the program to make the wrong assumption about the card following the one that is in error and issue error messages for cards that would normally be correct had the original error not occurred. Whenever the program prints out an error message that does not seem to apply to the card in question, one must go back and find out why the program expected a different type of card.

The following notations are used in the description of the error messages:

- (a) NNNN indicates numeric data such as a card sequence number
- (b) AAAA indicates alphanumeric data such as the date

Following is a list of error messages that may appear in the output listings.

1 \*\*\* INVALID DATE CARD \*\*\* AAAA AAAA AAAA AAAA

The 16 A's are a copy of the contents of columns 1 to 16 of the first card.

This message indicates that columns 1 to 4 do not contain the word "DATE". The MAP program assumes that columns 5 to 16 contain a valid date and uses the contents of the columns 5 to 16 for the date on the output listings. Therefore this card must be checked carefully.

2 \*\*\* INVALID COMPUTATION CODE A \*\*\*

This message indicates that an invalid code was detected for the type of computation in column 31 of the "Map" card (76-027). The symbol "A" represents the invalid character. The only valid codes are " " for Area, "L" for Length, "P" for Point.

3 \*\*\* ALL DATA DELETED FOR THIS MAP \*\*\*

This message appears when an error has been made in the map set-up. That is, there is an error on the "Map" card (76-027) or the "Map Co-ordinate" card (76-011). All processing for this map is by-passed.

4 \*\*\* INVALID UNIT CODE A \*\*\*

This message appears when the unit code, in column 29 of the "Map" card (76-027) is invalid. The program will choose the unit of kilometres as the default. The symbol "A" represents the invalid character. The only valid codes are " " for Kilometres, "1" for miles, "2" for acres.

5 \*\*\* SEQUENCE ERROR \*\*\* CARD NO. NNNN FOLLOWS CARD NO. MMMM \*\*\*

This message indicates that the cards have been mixed up or that a "Sequence Reset" card (68-012) has been omitted. It is not necessary that the cards for all the delineations of an area or length be in exact sequence. It is only necessary that the cards for each separate delineation be in sequence. If a sequence error occurs in one area or length, any other area or length on this map will still compute correctly.

6 \*\*\* IDENTIFICATION IS NOT CONSISTENT \*\*\*

The identification given on a card is not consistent with the identification for the area, length or test point being processed. After this message the contents of the incorrect card are printed.

7 \*\*\* ALL DATA DELETED TO NEXT AREA/LENGTH \*\*\*

This message appears if a critical error has occurred within an area deck or a length deck. Processing for the current area or length is by-passed.

GA  
23  
A45  
1977

Ades, L.C.  
Automated procedures for area,  
length and point location  
computations.

DATE DUE	BORROWER'S NAME

GA  
23  
A45  
1977

Ades, L.C.  
Automated procedures for area,  
length and point location  
computations.

Library/IM Centre  
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Calgary District Office



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