DAMOS

DISPOSAL AREA MONINITORING SYSTEM

ANNUAL DATA REPORT - 1978

SUPPLEMENT B

PORTLAND DISPOSAL SITE

Naval Underwater Systems Center

Newport, Rhode Island

New England Division
Corps of Engineers
Waltham, Massachusetts

May 1979

DAMOS

DISPOSAL AREA MONITORING SYSTEM
ANNUAL DATA REPORT - 1978

SUPPLEMENT B
SITE REPORT - PORTLAND

Naval Underwater Systems Center
Newport, Rhode Island

New England Division
Corps of Engineers
Waltham, Massachusetts

May 1979

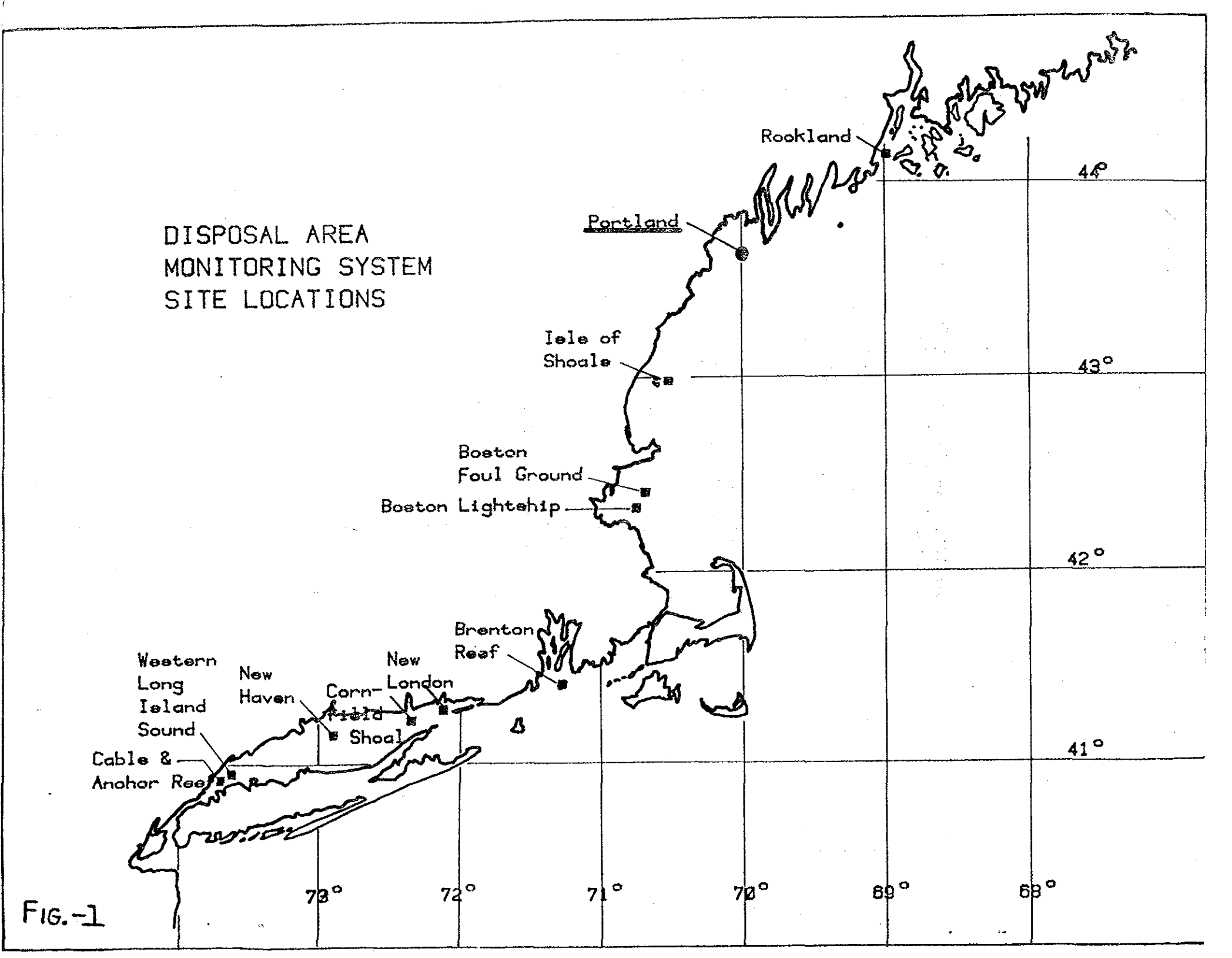

DISPOSAL AREA
MONITORING SYSTEM
SITE LOCATIONS
Rookland
Portland
Isle of
Shoals
Boston
Foul Ground
Boston Lightship
Brenton
Reef
New
London
Corn-
field
Shoal
New
Haven
Western
Long
Island
Sound
Cable &
Anchor Reef
44°
43°
42°
41°
73°
72°
71°
70°
69°
68°

FIG.-1

DISPOSAL AREA MONITORING SYSTEM

This is one of a series of site specific data reports resulting from the DAMOS program, now two years in progress. DAMOS is the culmination of nearly a decade of prior study efforts, actually preceding NEPA, which have been directed towards the understanding of the effects of and the responsible management of the ocean disposal of dredged materials in New England waters as they fall under the authority ot the New England Division of the Corps of Engineers. The individual site reports henceforth will be updated approximately on an annual bases as additional knowledge is gained, at least with respect to those sites where significant disposal activities will have occurred.

PORTLAND, MAINE

Background

The Portland Disposal Area being studied by DAMOS has not yet been designated as a regional disposal site. Prior to this report three major surveys have been conducted in the area off Portland to determine the best location for future disposal of dredge spoils. In 1974 Normandeau Associates studied a site north of Hue and Cry Valley, and in 1976 NUSC conducted a survey in the valley itself that resulted in a second proposed disposal area. When this point was suggested to local fishermen it met with severe opposition and a third site in a historical disposal site north of the Portland lightship was suggested. In August, 1977, NUSC conducted a broad bathymetric and side scan survey of the third site. Data from this survey were used to designate four potential sites within the area and these were presented to state, local and fishing representatives in November, 1977. At that meeting a location in the center of the site was defined and the area incorporated into the DAMOS program as a one mile square centered at 43° 34.1'N, 70° 1.8'W (Fig. B-1).

Bathymetry

This site was surveyed on 13 December, 1977, (Fig. B-2 (a-k)) and on 17 May, 1978 (Fig. B-3 (a-h)). Navigation control for the site was provided by trisponder stations located at Portland Head Light and the Prouts Neck Fire Control Station.

The topography in the area is extremely rugged and consists of bedrock outcrops surrounded by fine sand and mud (Fig. B-4). The side scan record shown here covers the area designated as the disposal site and clearly shows

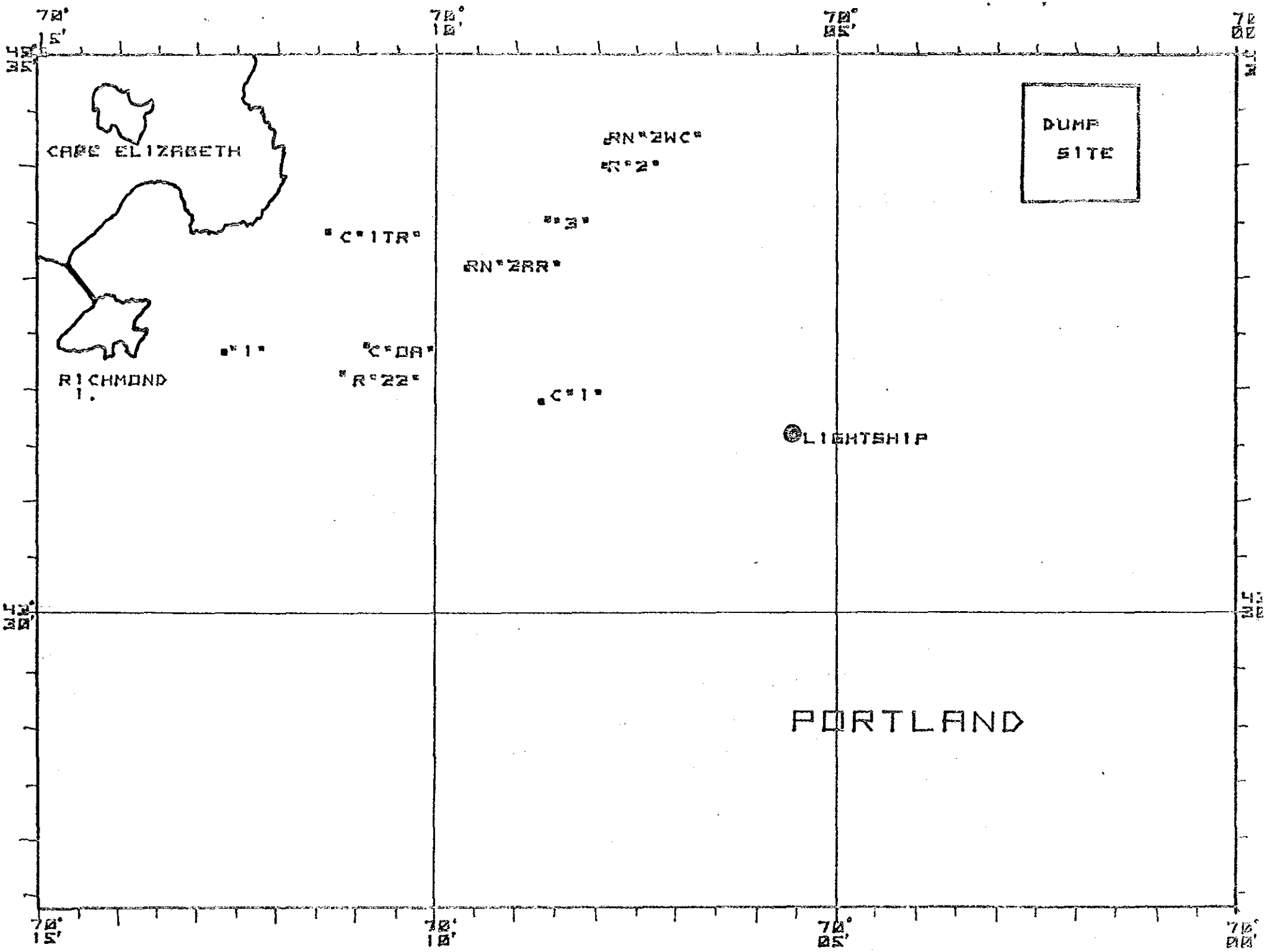

70° 15'
70° 10'
70° 05'
70° 00'
43° 35'
43° 30'
43° 25'
CAPE ELIZABETH
"C" 1TR"
"3"
RN"2WC"
"R"2"
RN"2RR"
DUMP
SITE
"1"
"C"DA"
RICHMOND
1.
"R"22"
"C"1"
LIGHTSHIP
PORTLAND

Fig. - B-1

PORTLAND, MAINE
DECEMBER, 13, 1977
LANE INTERVAL: 50M
GRID RESOLUTION: 52X52M
CONTOUR INTERVAL: 2M
DATUM: MLW

0 300 600
SCALE (M)

R-2

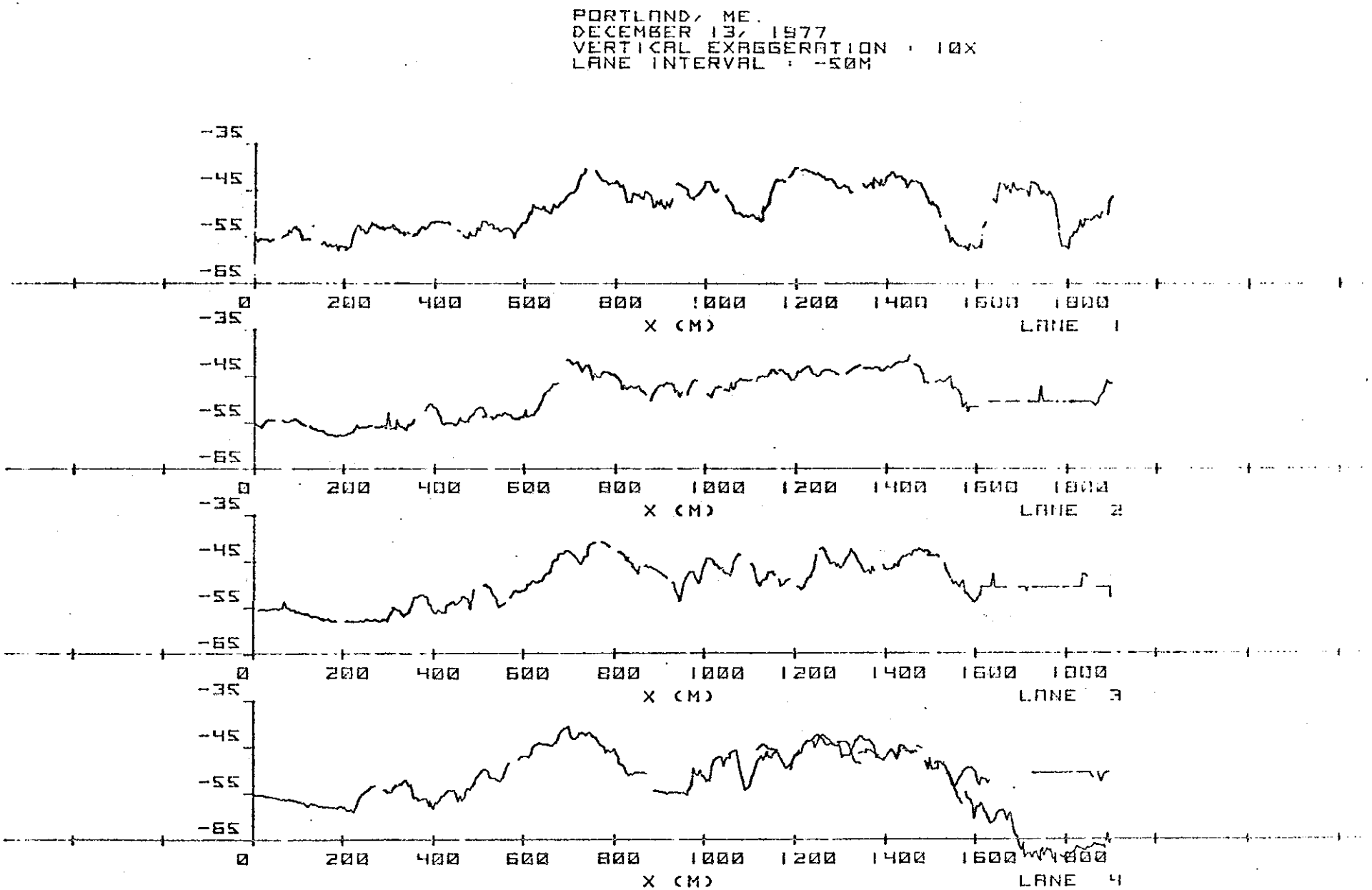
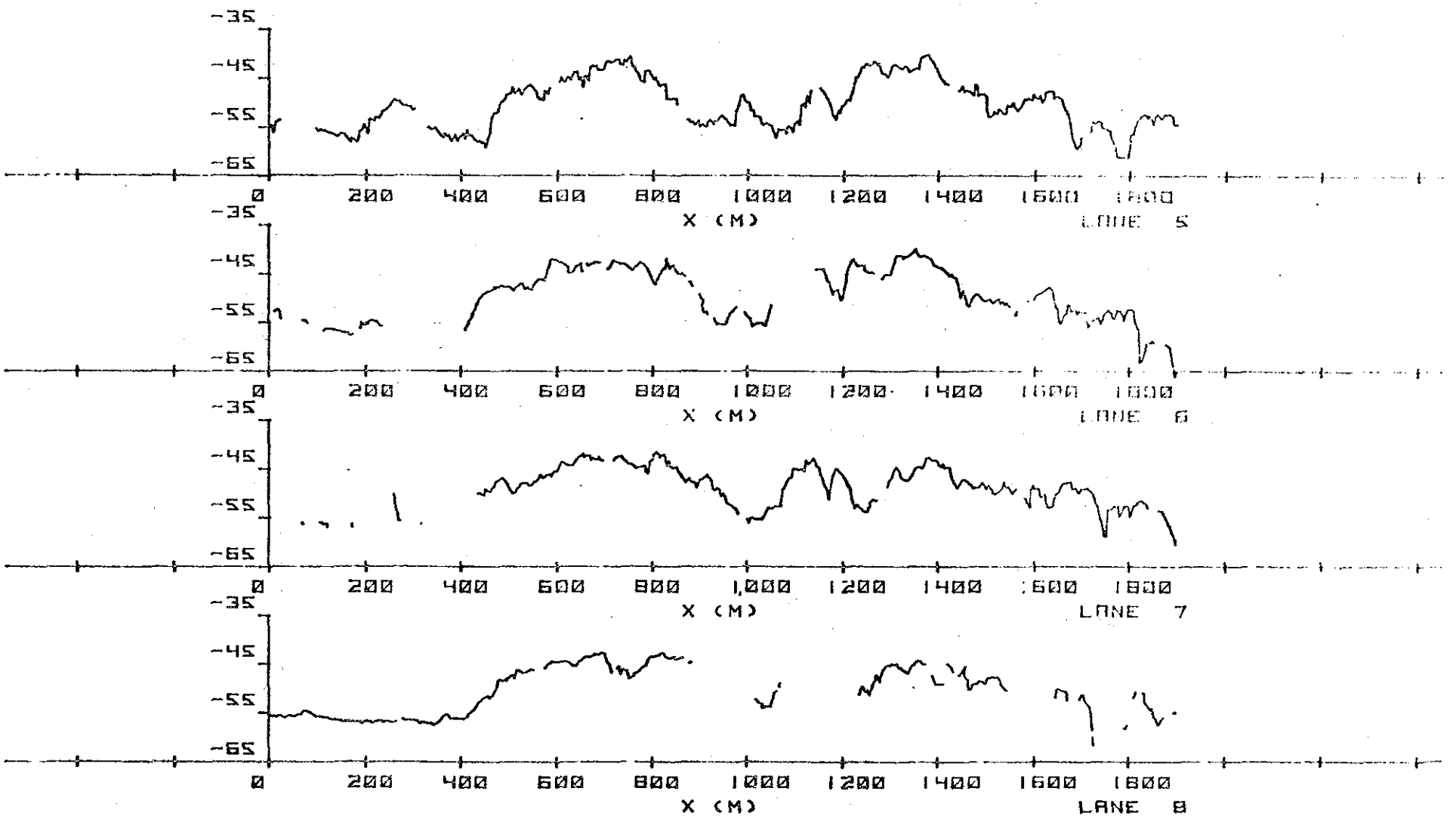

PORTLAND, ME.
DECEMBER 13, 1977
VERTICAL EXAGGERATION = 10X
LANE INTERVAL = -50M
-35
-45
-55
-65
0
200
400
600
800
1000
1200
1400
1600
1800
X (M)
LANE 1
LANE 2
LANE 3
LANE 4

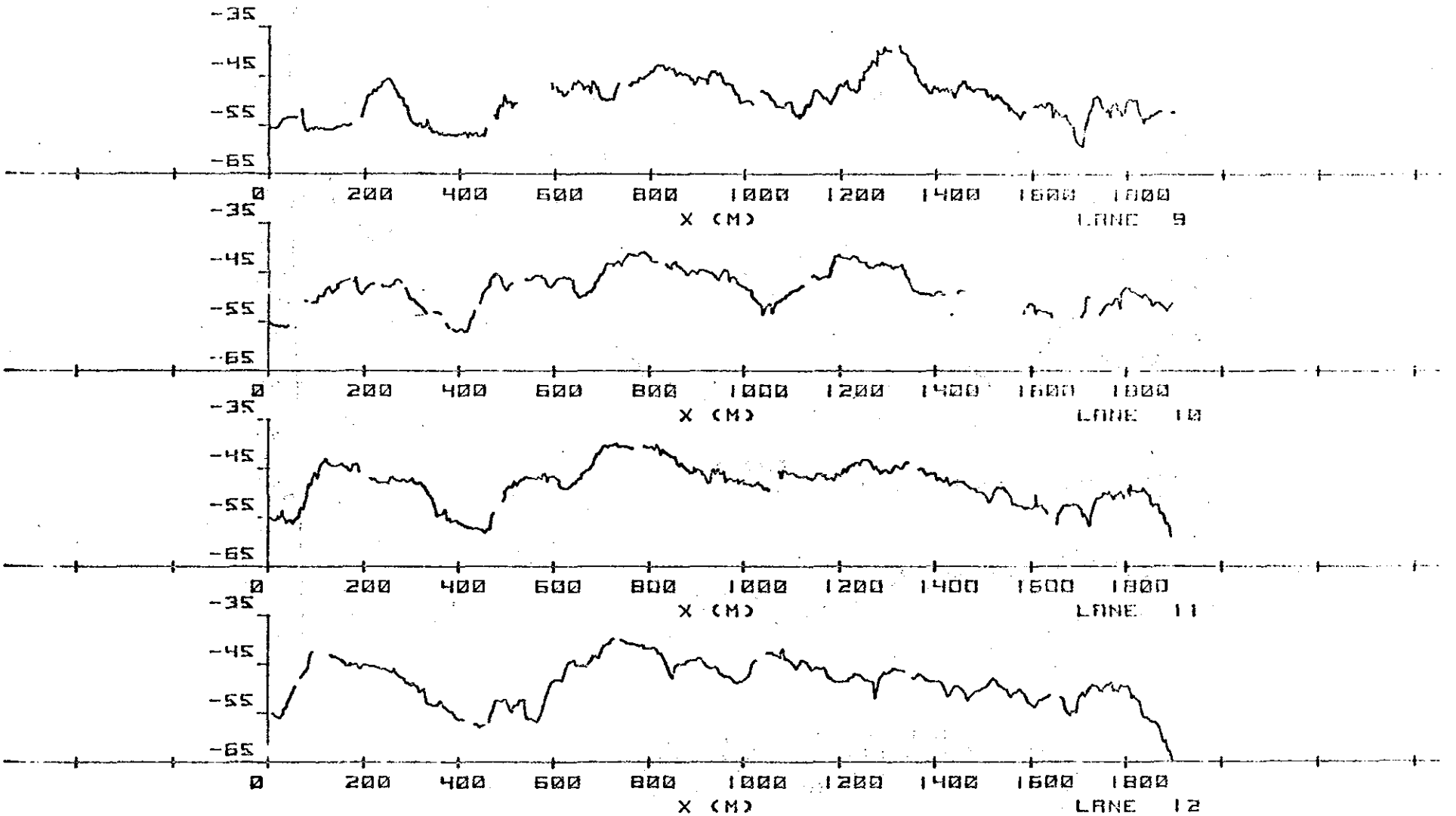
Fig. B-2A

PORTLAND, ME.
DECEMBER 13, 1977
VERTICAL EXAGGERATION = 10X
LANE INTERVAL = .50M

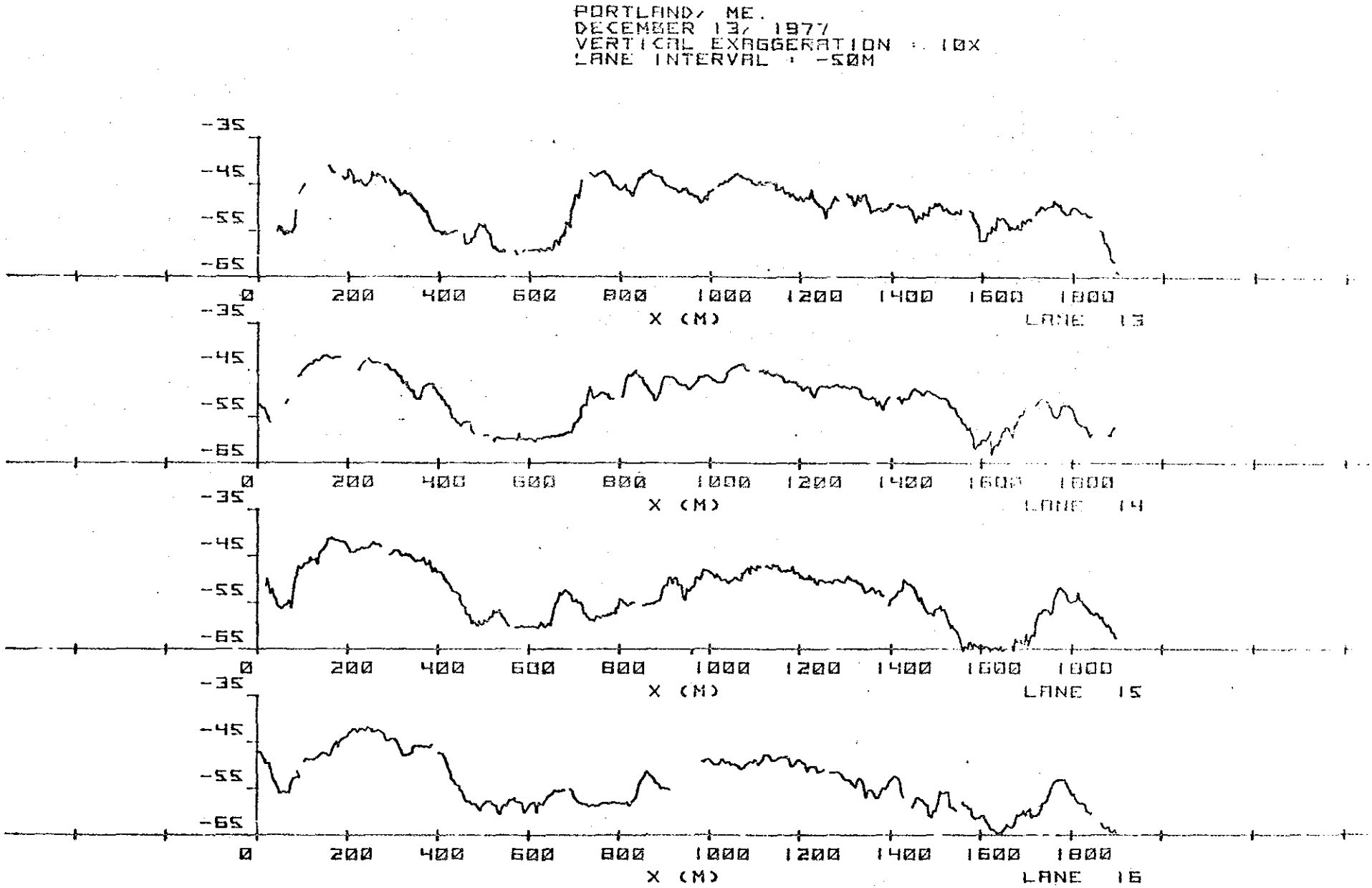


B-26

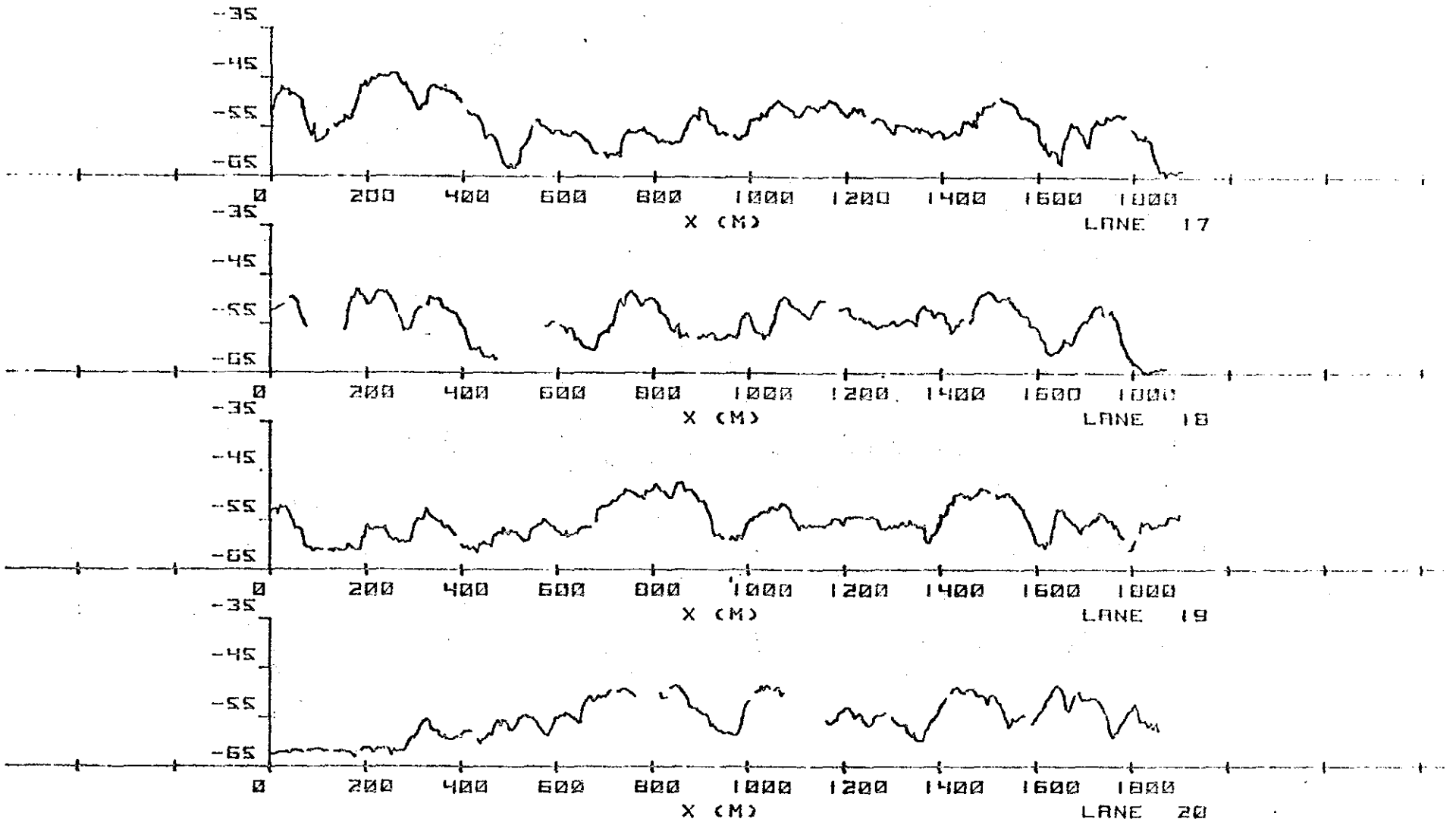
PORTLAND, ME.
DECEMBER 13, 1977
VERTICAL EXAGGERATION = 10X
LANE INTERVAL = -50M



B-2c

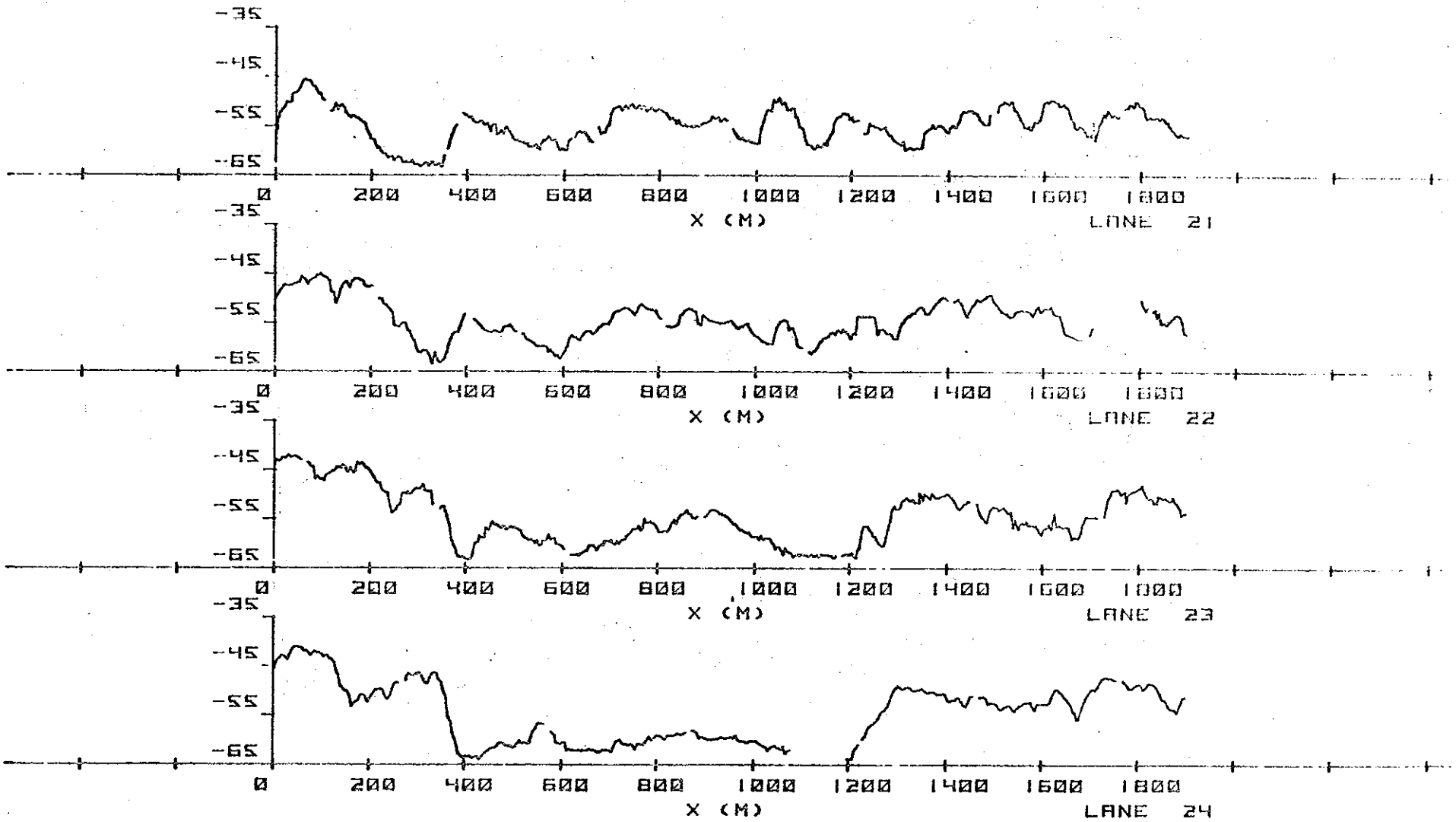

PORTLAND, ME.
DECEMBER 13, 1977
VERTICAL EXAGGERATION = 10X
LANE INTERVAL = -50M
-35
-45
-55
-65
0
200
400
600
800
1000
1200
1400
1600
1800
X (M)
LANE 13
LANE 14
LANE 15
LANE 16

B-20


PORTLAND, ME.
DECEMBER 13, 1977
VERTICAL EXAGGERATION = 10X
LANE INTERVAL = -50M
-35
-45
-55
-65
0
200
400
600
800
1000
1200
1400
1600
1800
X (M)
LANE 17
LANE 18
LANE 19
LANE 20

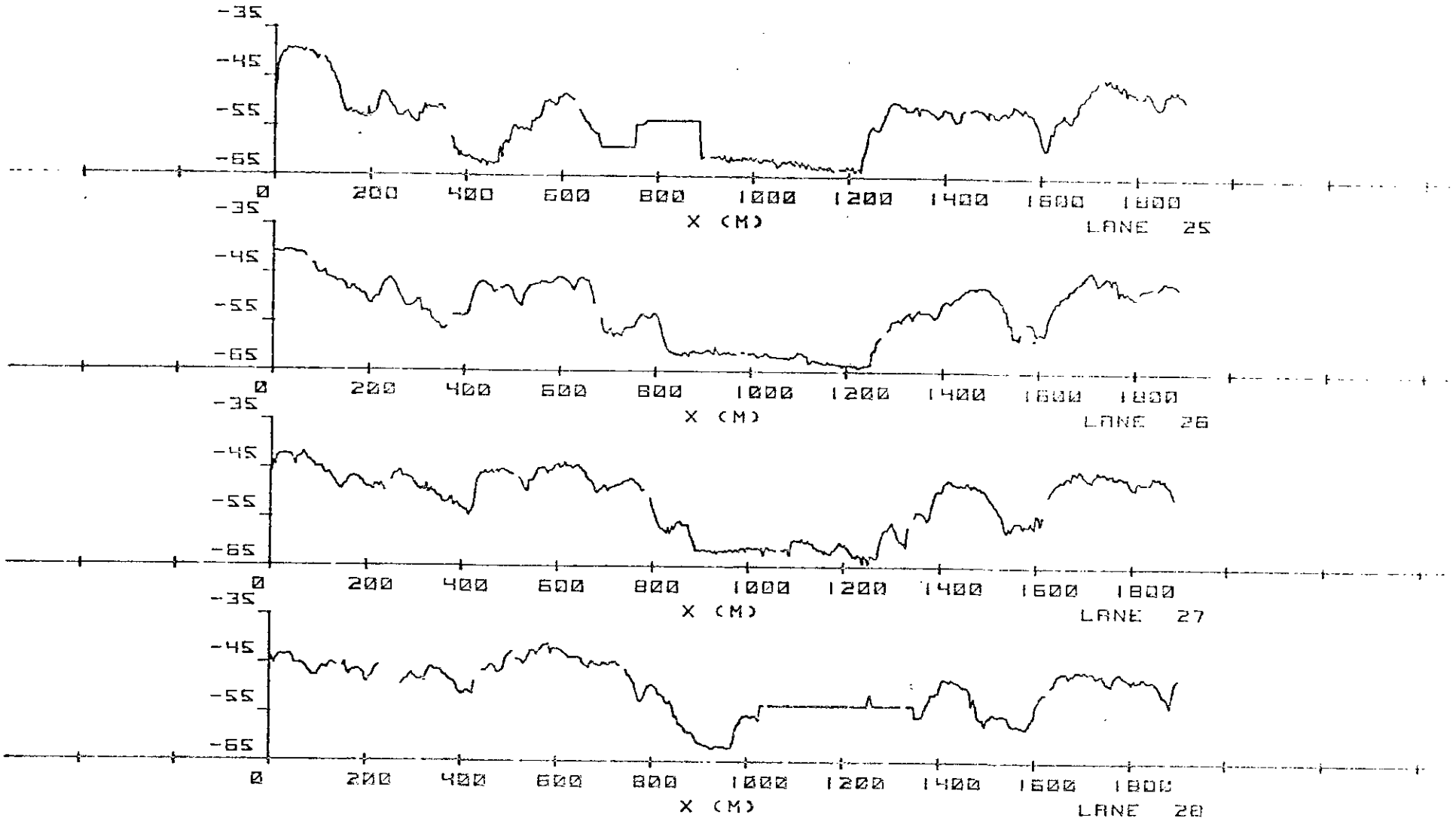
B-2E

PORTLAND, ME.
DECEMBER 13, 1977
VERTICAL EXAGGERATION = 10X
LANE INTERVAL = -50M

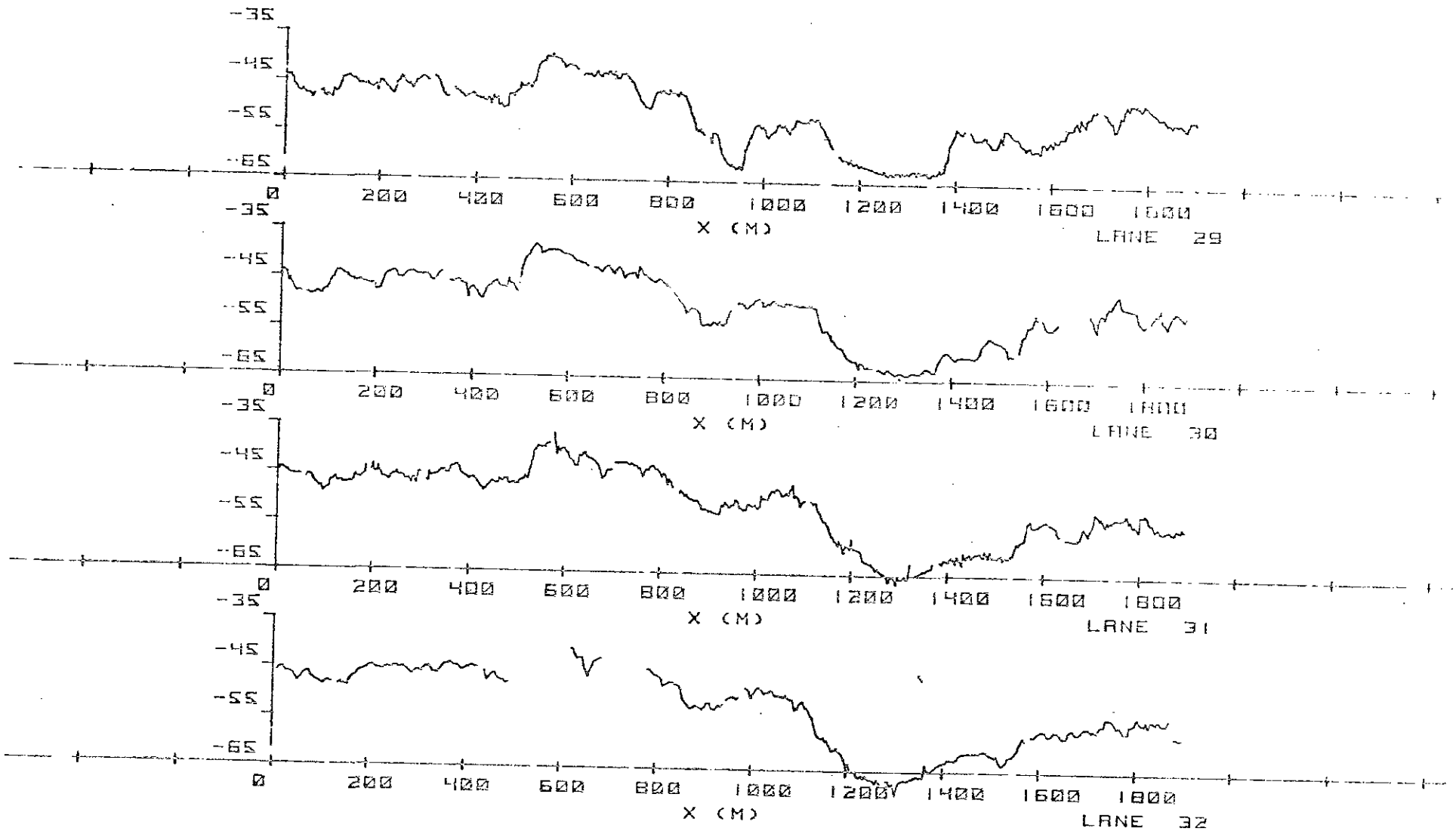


B-3F

PORTLAND, ME.
DECEMBER 13, 1977
VERTICAL EXAGGERATION = 10X
LANE INTERVAL = -50M

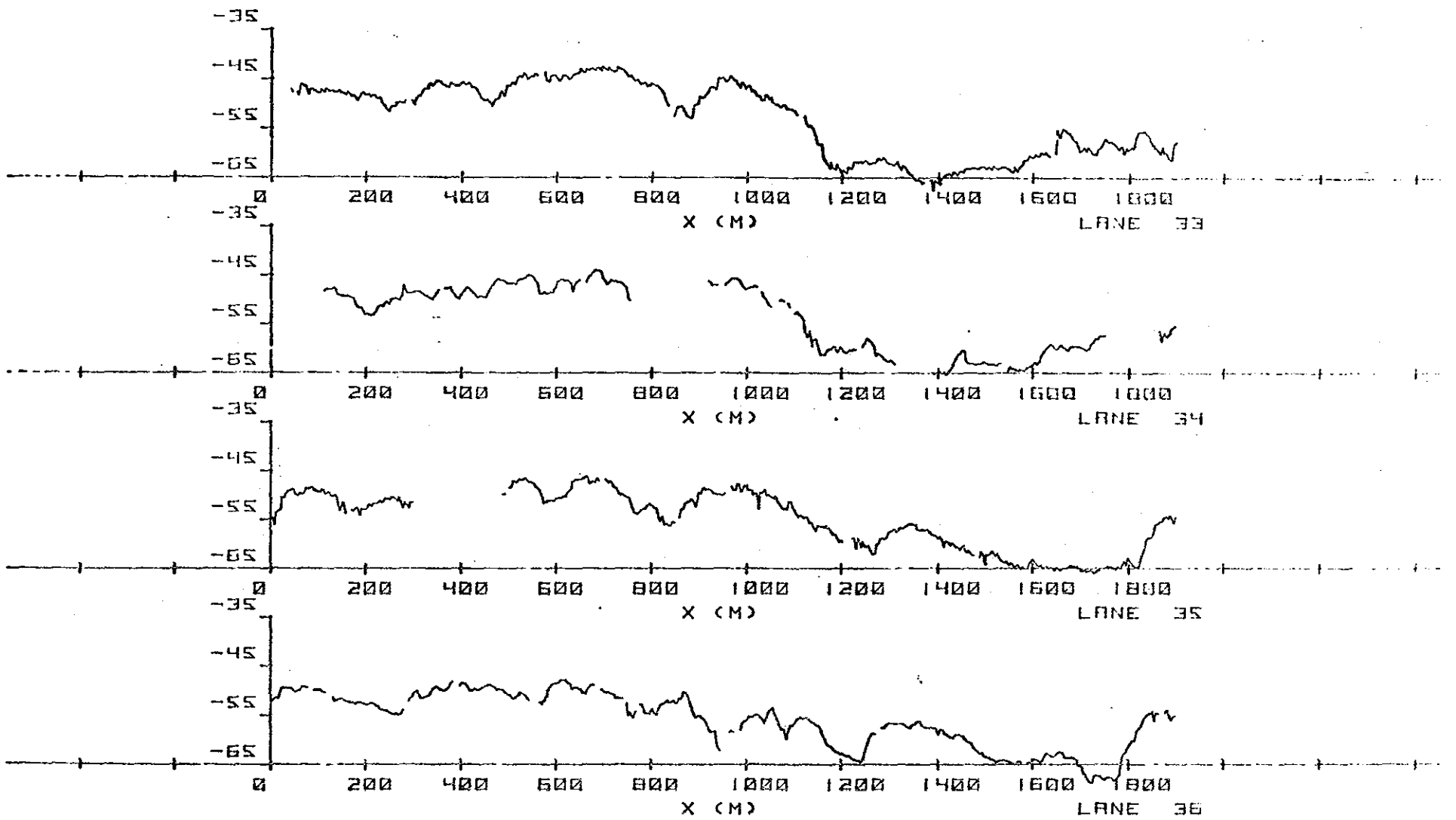


PORTLAND, ME.
DECEMBER 13, 1977
VERTICAL EXAGGERATION = 10X
LANE INTERVAL = -50M

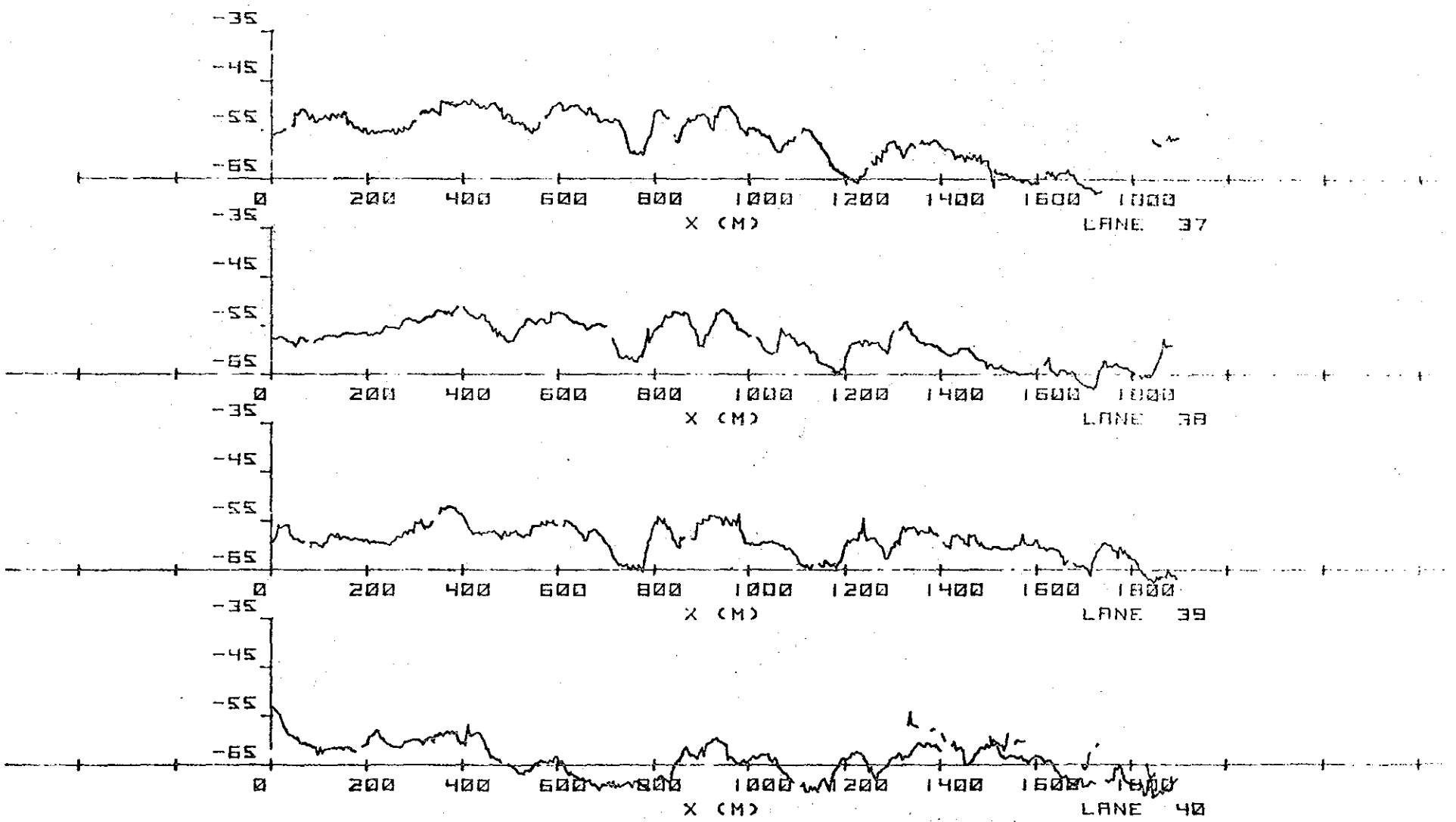


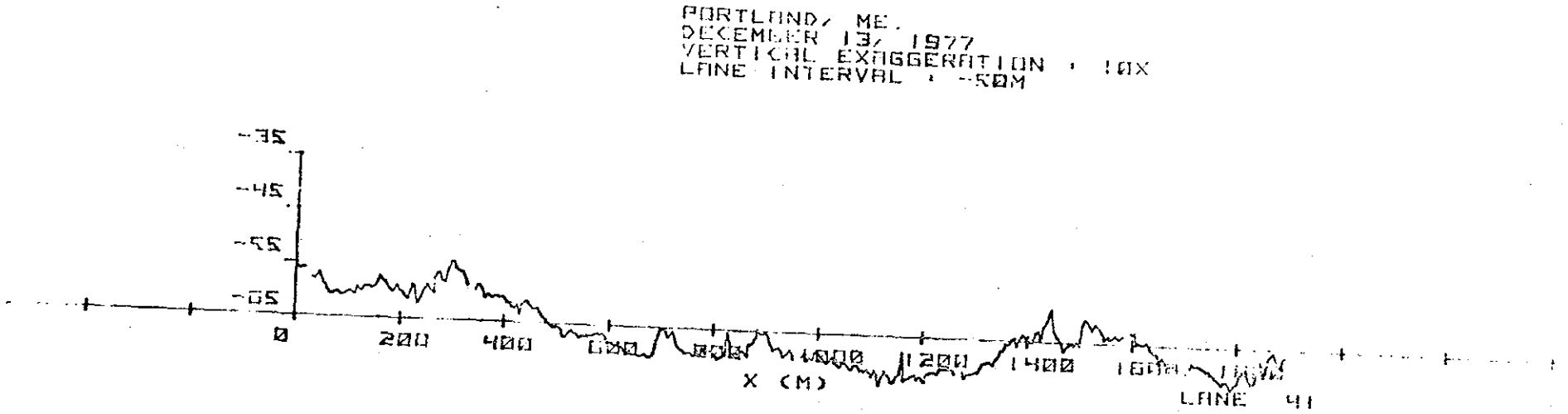
B-3H

PORTLAND, ME.
DECEMBER 13, 1977
VERTICAL EXAGGERATION = 10X
LANE INTERVAL = -50M

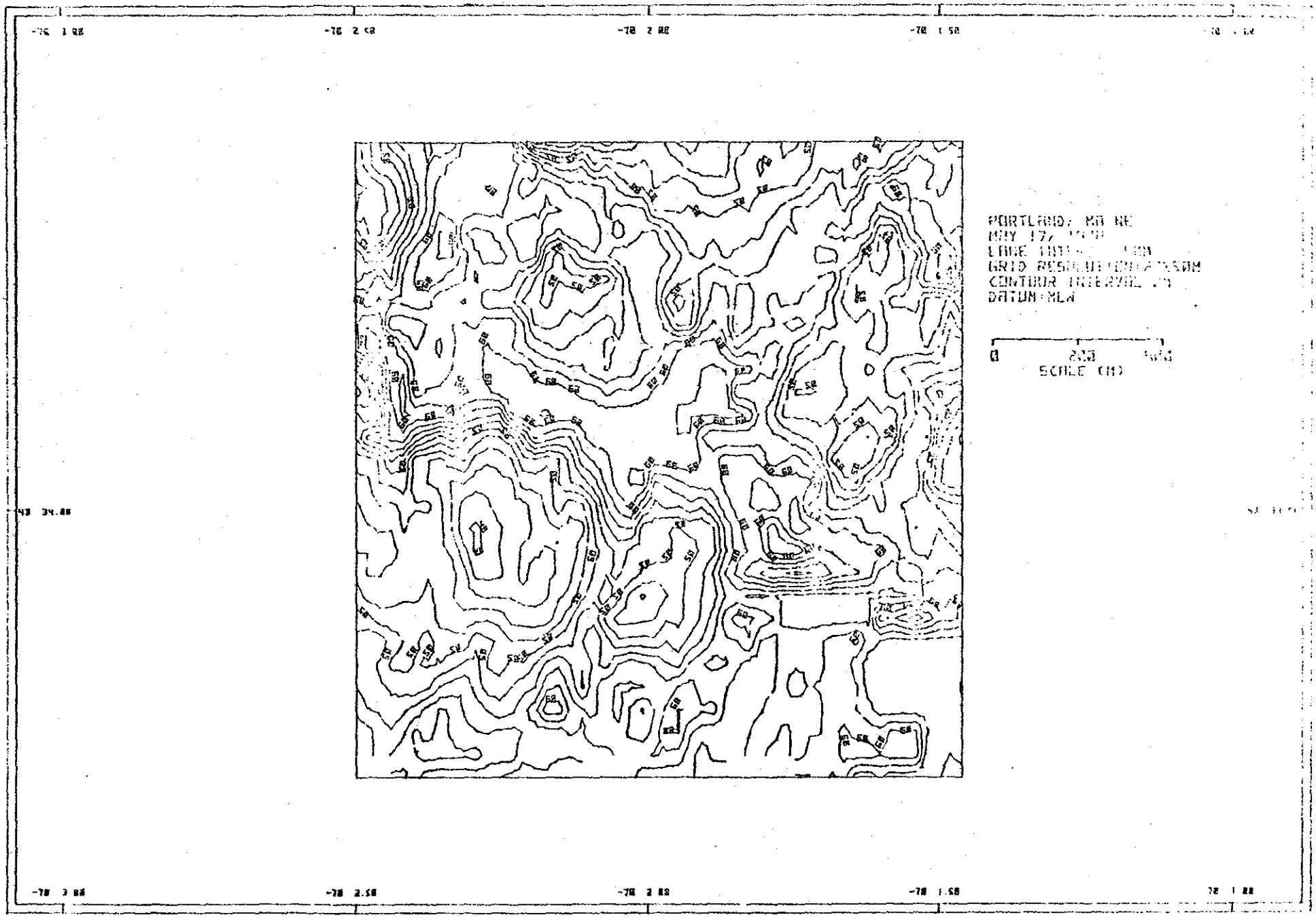


8-31

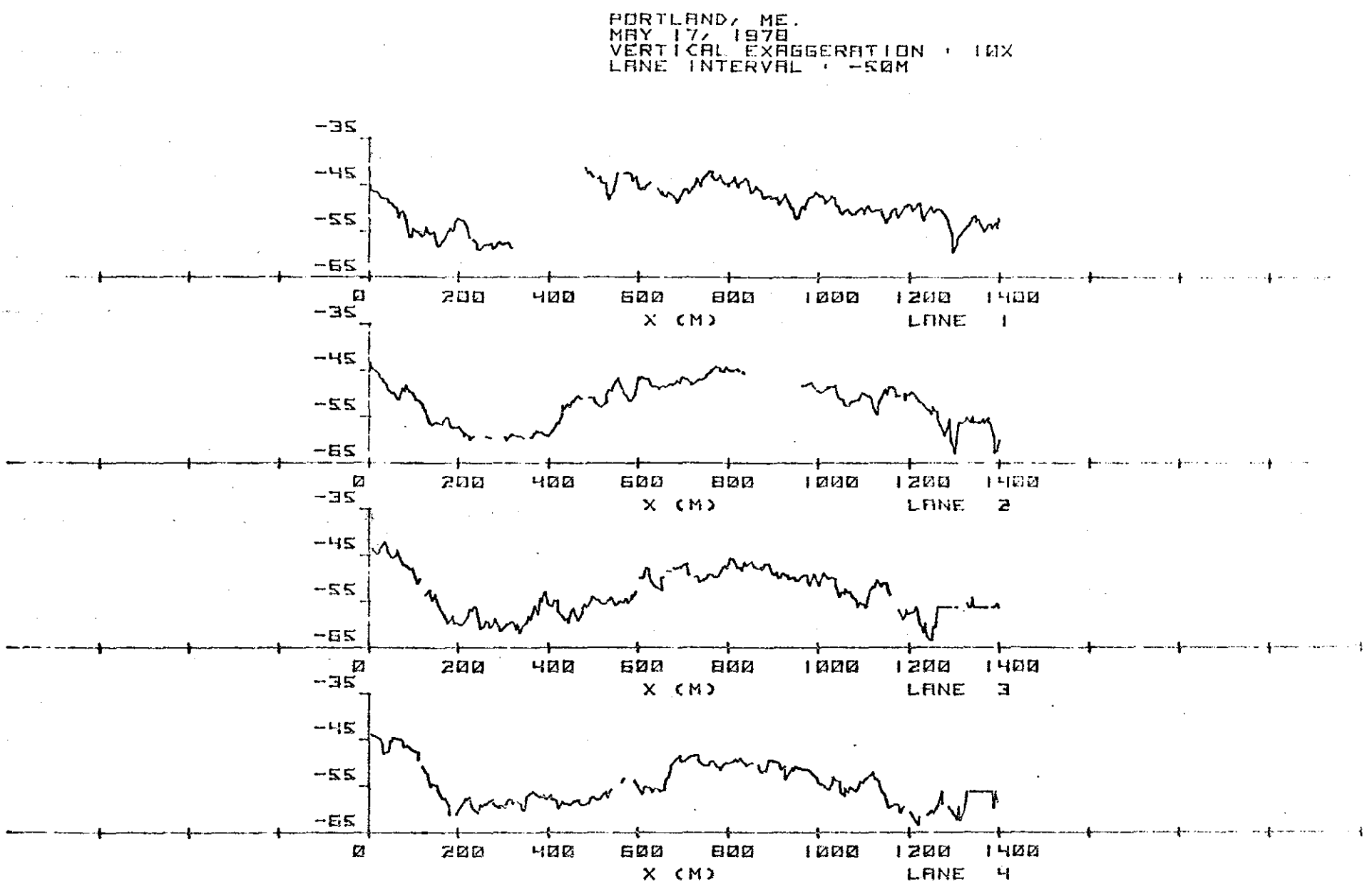

PORTLAND, ME.
DECEMBER 13, 1977
VERTICAL EXAGGERATION = 10X
LANE INTERVAL = -50M
-35
-45
-55
-65
0
200
400
600
800
1000
1200
1400
1600
1800
X (M)
LANE 37
LANE 38
LANE 39
LANE 40


PORTLAND, ME.
DECEMBER 13, 1977
VERTICAL EXAGGERATION = 10X
LINE INTERVAL = 50M
-35
-45
-55
-65
0
200
400
1200
1400
X (M)
LINE 41

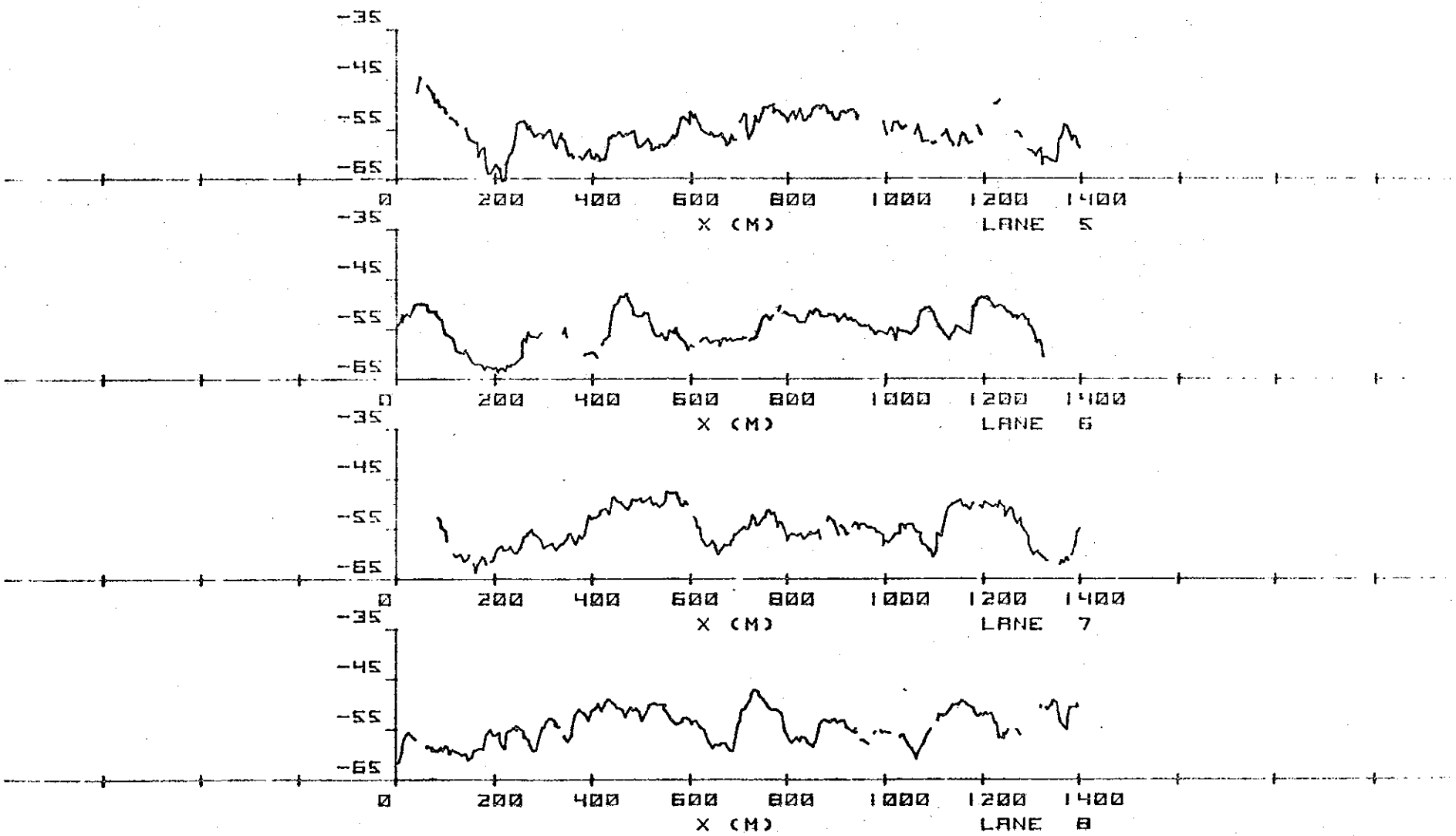
B-2K

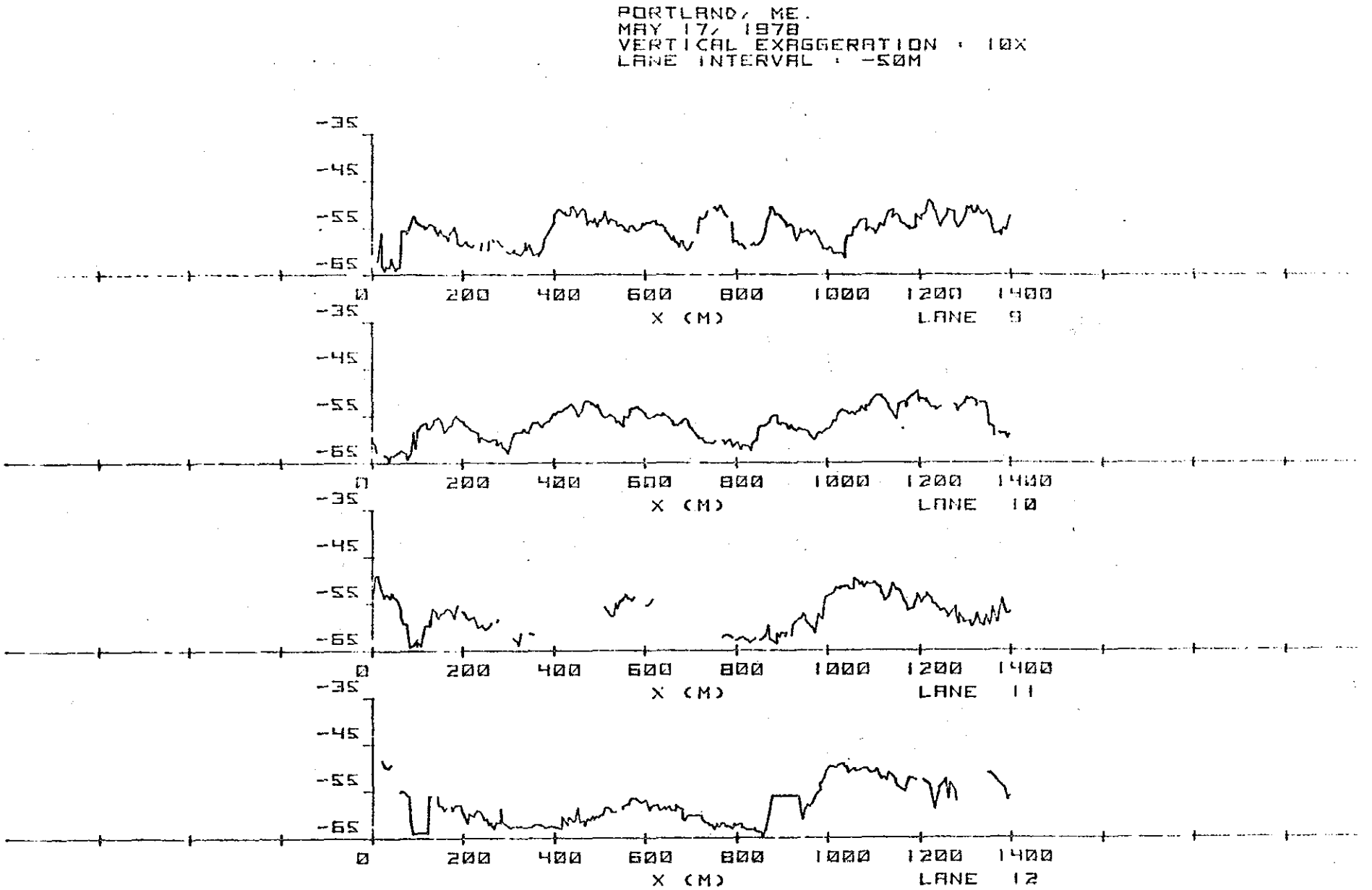

PORTLAND, MA NE
MAY 17,
LANE INT
GRID RESOLUTION
CONTOUR INTERVAL
DATUM:MLW
0
200
400
SCALE (M)

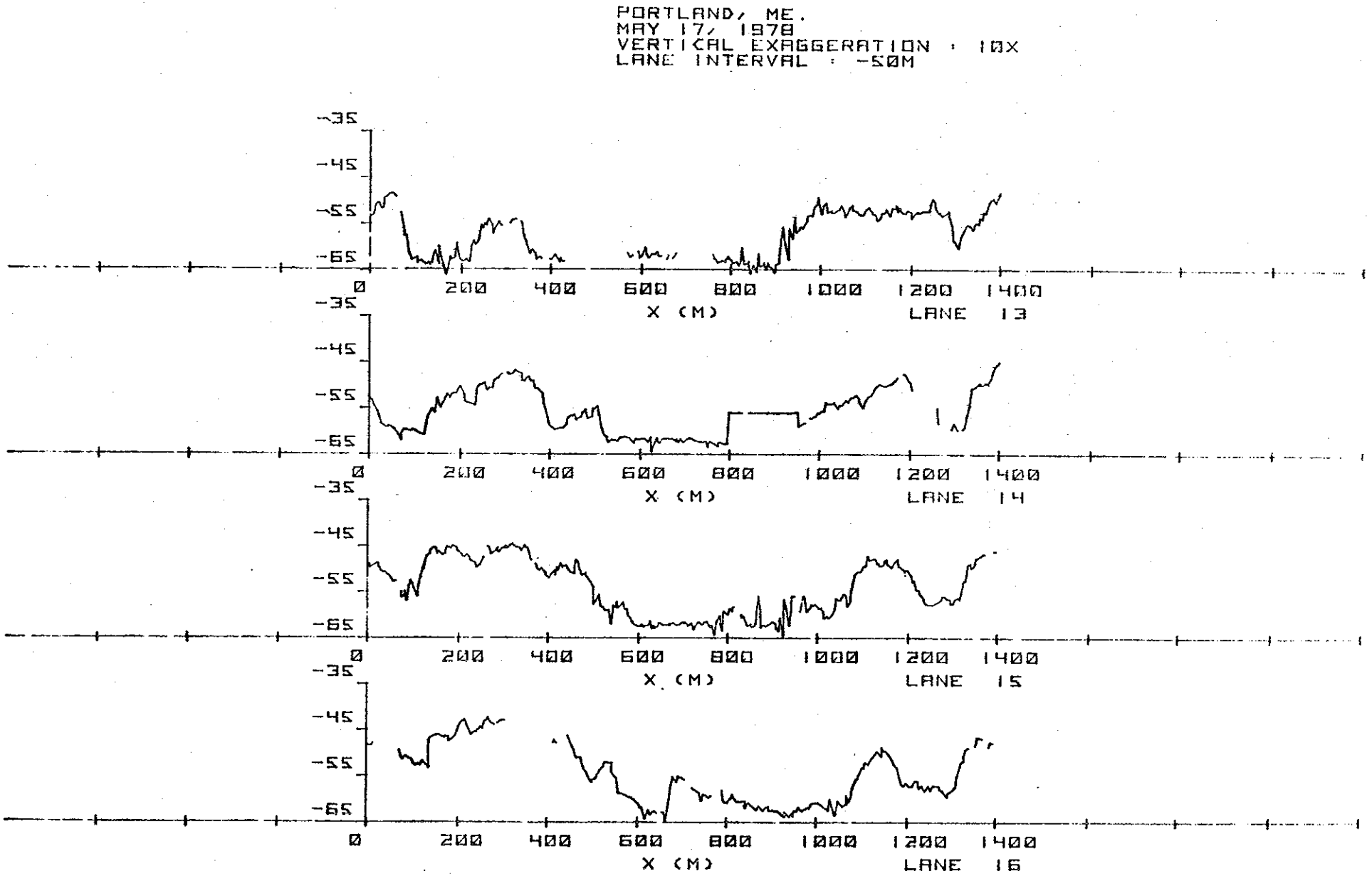
B-3


PORTLAND, ME.
MAY 17, 1978
VERTICAL EXAGGERATION = 10X
LANE INTERVAL = -50M
-35
-45
-55
-65
0
200
400
600
800
1000
1200
1400
X (M)
LANE 1
LANE 2
LANE 3
LANE 4

R-3a

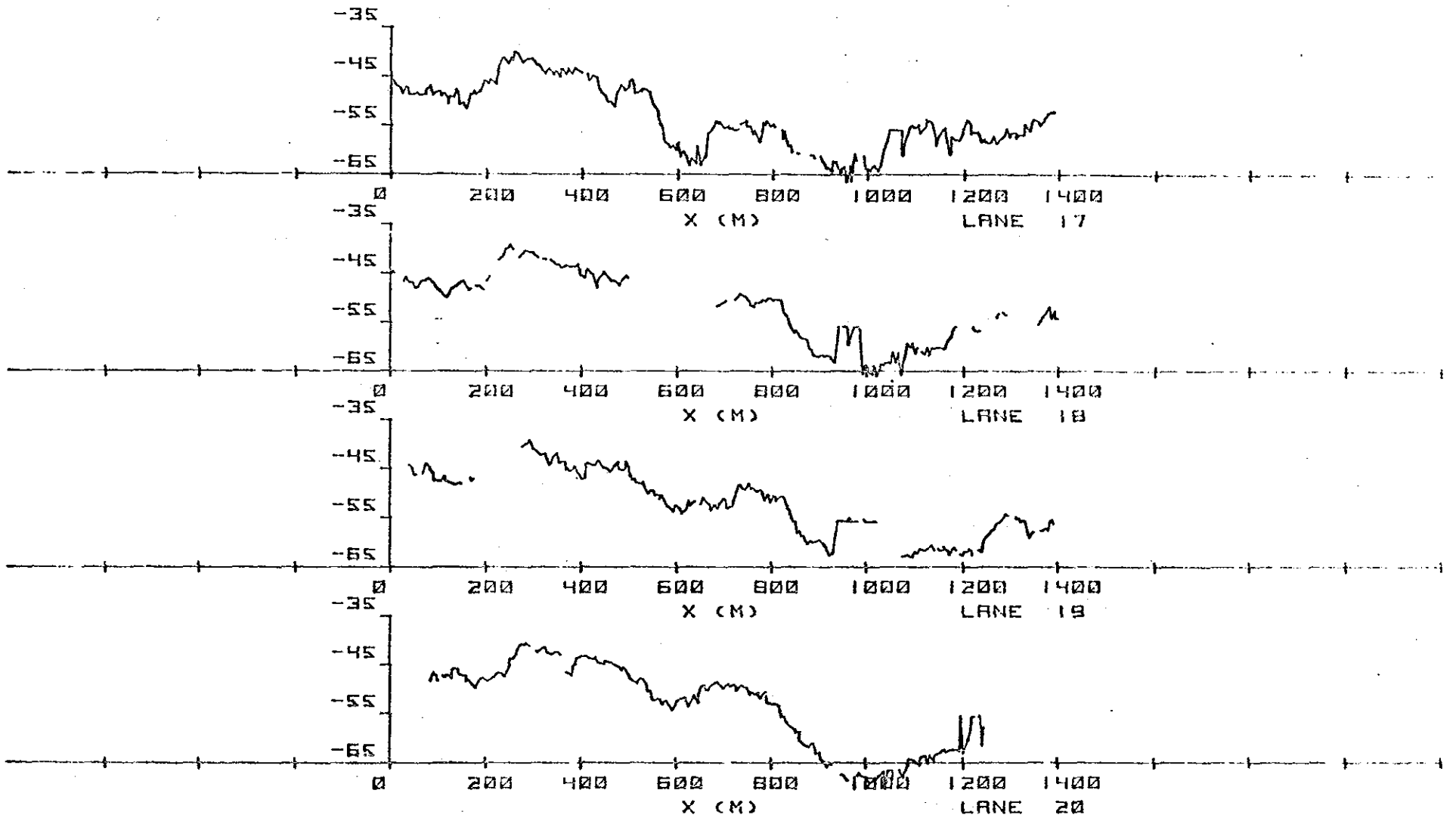

PORTLAND, ME.
MAY 17, 1978
VERTICAL EXAGGERATION = 10X
LANE INTERVAL = -50M
-35
-45
-55
-65
0
200
400
600
800
1000
1200
1400
X (M)
LANE 5
LANE 6
LANE 7
LANE 8


PORTLAND, ME.
MAY 17, 1978
VERTICAL EXAGGERATION = 10X
LANE INTERVAL = -50M
-35
-45
-55
-65
0
200
400
600
800
1000
1200
1400
X (M)
LANE 9
LANE 10
LANE 11
LANE 12

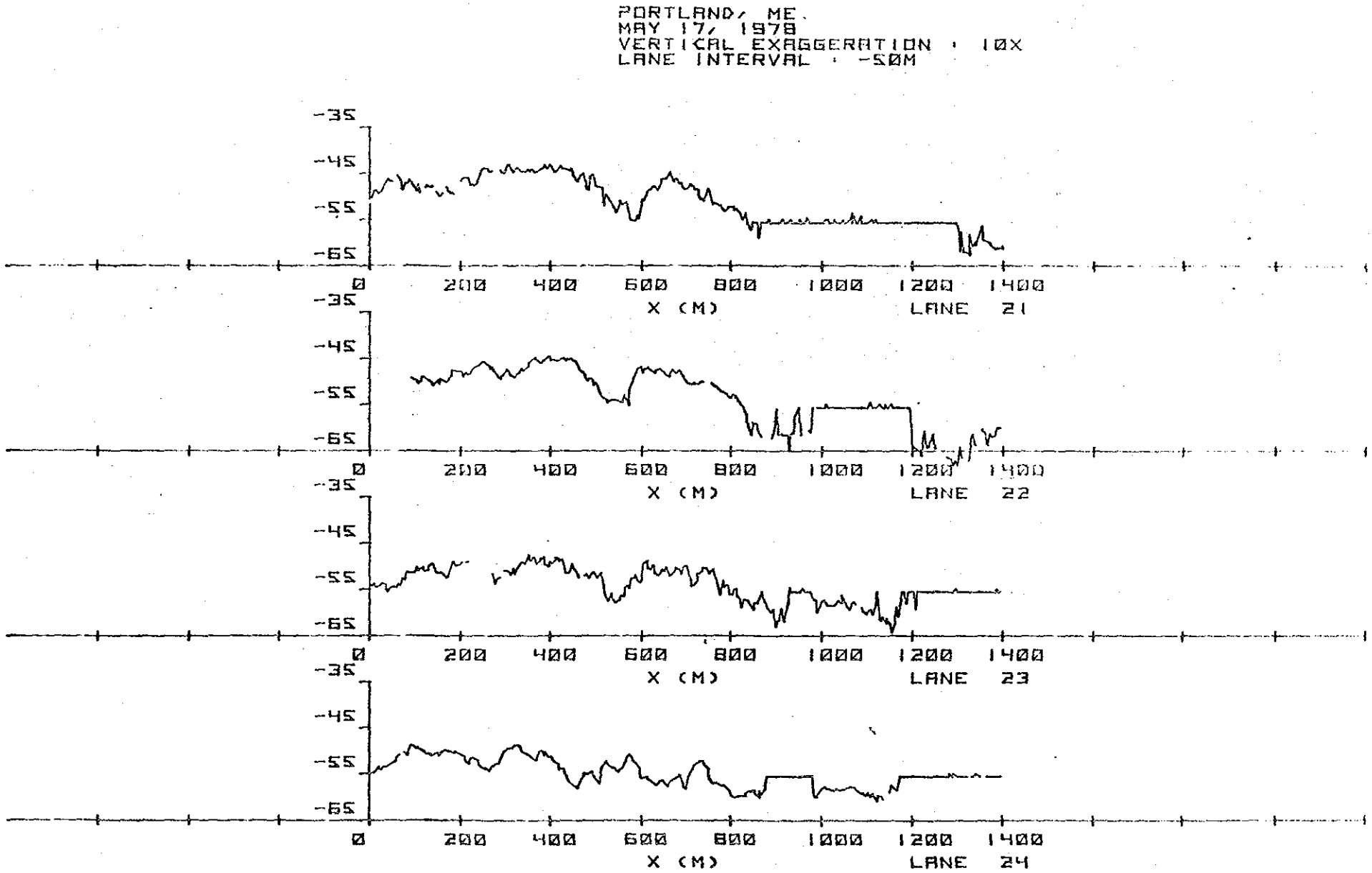

PORTLAND, ME.
MAY 17, 1978
VERTICAL EXAGGERATION = 10X
LANE INTERVAL = -50M
-35
-45
-55
-65
0
200
400
600
800
1000
1200
1400
X (M)
LANE 13
LANE 14
LANE 15
LANE 16

B-3d

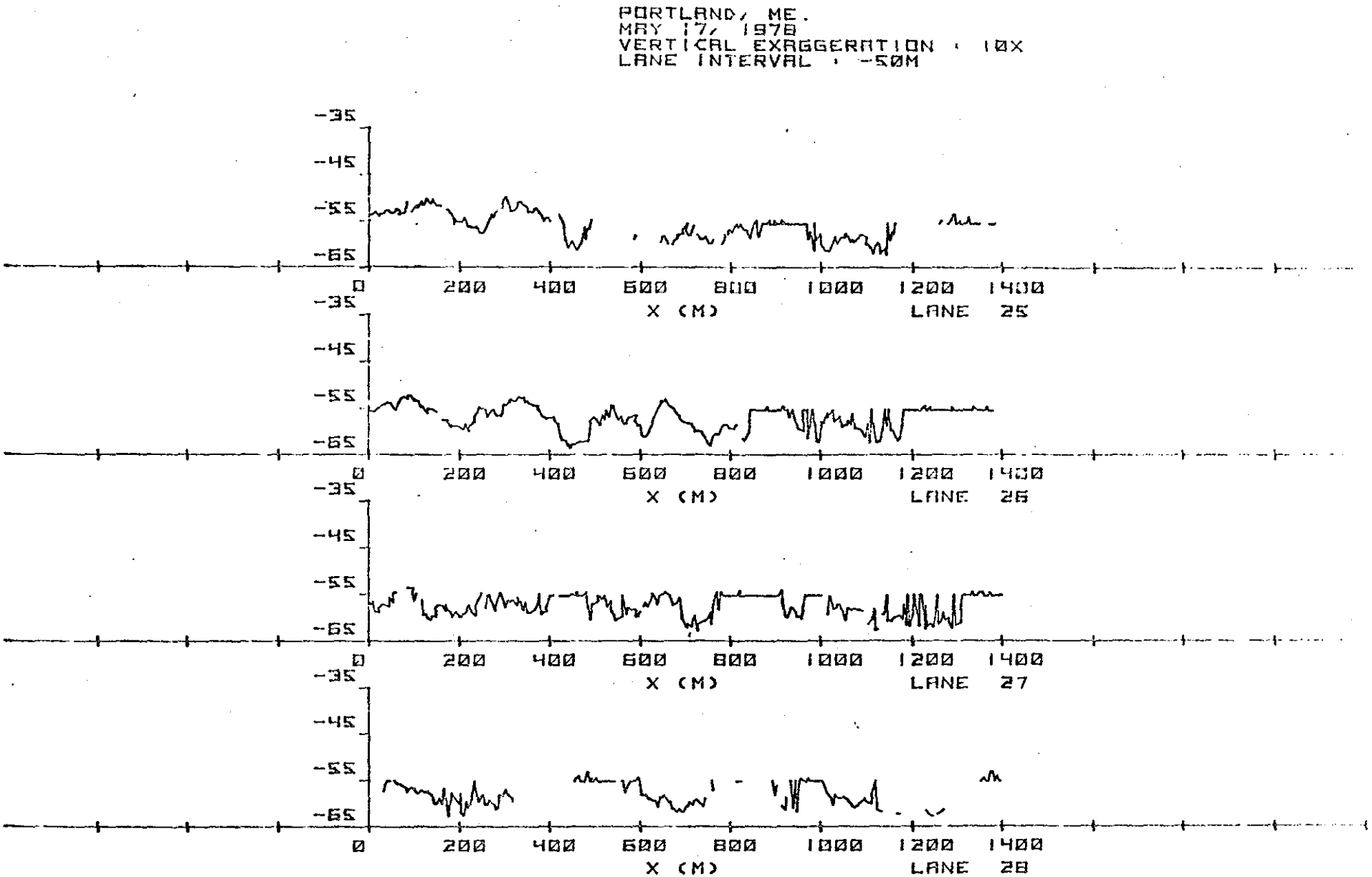
PORTLAND, ME.
MAY 17, 1978
VERTICAL EXAGGERATION = 10X
LANE INTERVAL = -50M

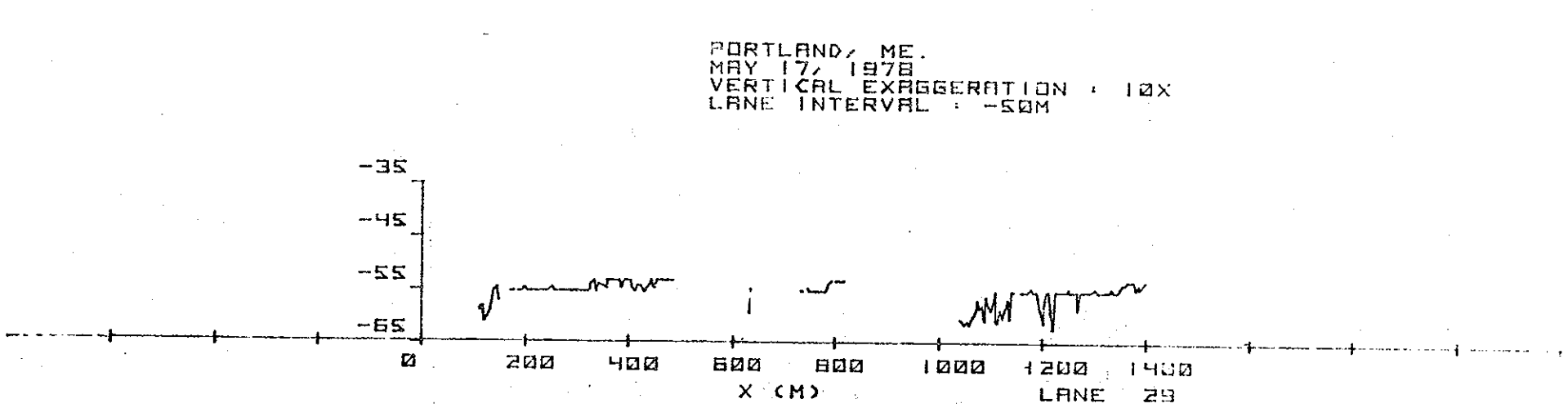


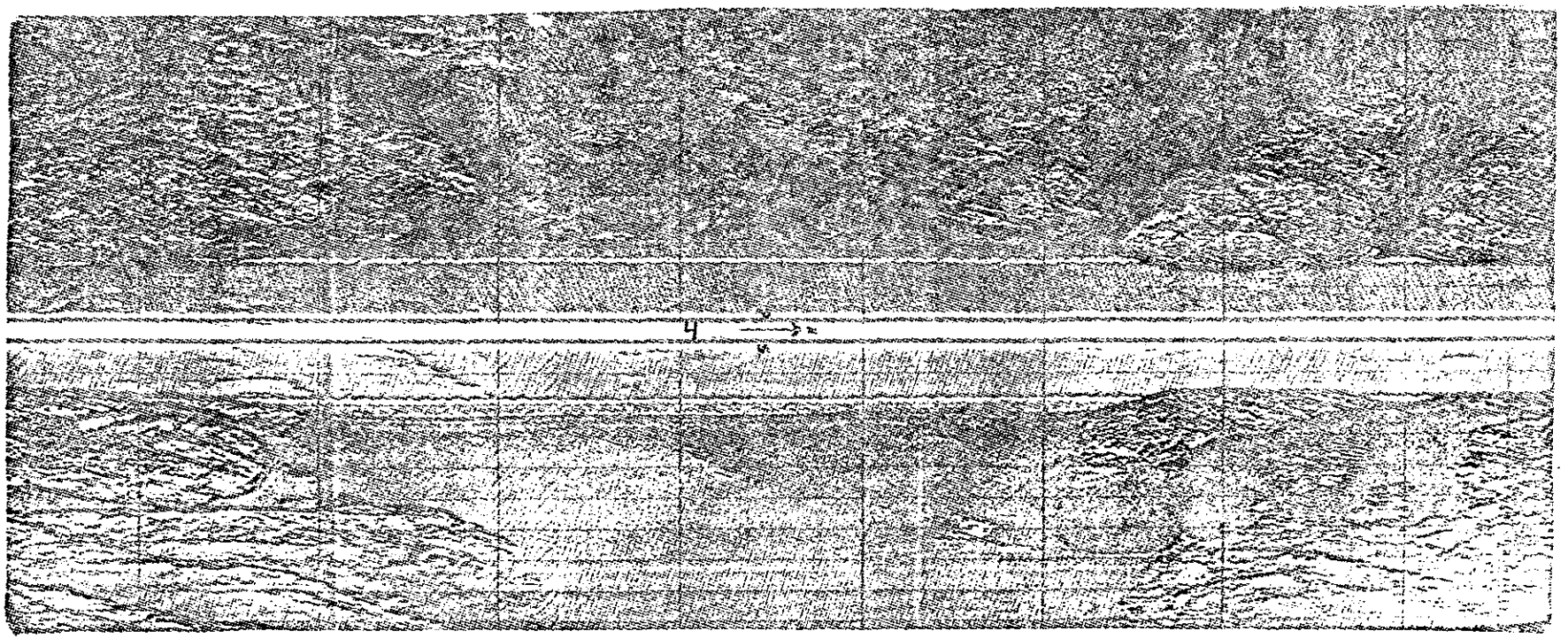
B-3.E


PORTLAND, ME.
MAY 17, 1978
VERTICAL EXAGGERATION = 10X
LANE INTERVAL = -50M
-35
-45
-55
-65
0
200
400
600
800
1000
1200
1400
X (M)
LANE 21
LANE 22
LANE 23
LANE 24

B-3F


PORTLAND, ME.
MAY 17, 1978
VERTICAL EXAGGERATION = 10X
LANE INTERVAL = -50M
-35
-45
-55
-65
0
200
400
600
800
1000
1200
1400
X (M)
LANE 25
LANE 26
LANE 27
LANE 28


PORTLAND, ME.
MAY 17, 1978
VERTICAL EXAGGERATION = 10X
LANE INTERVAL = -50M
-35
-45
-55
-65
0
200
400
600
800
1000
1200
1400
X (M)
LANE 29



(Fig. 1)

Fig. 4

the unconsolidated sediment in the basin indicating fine material and a low energy environment. The December survey indicated that the proposed disposal site is a depression outlined by the 60 meter contour level just south of the chart center.

A smaller area was covered in the May survey since the rugged topography of the area would certainly prohibit detection of small amounts of spoil deposited at significant distances from the disposal point. The proposed disposal site was again evident as a basin in the center of the bathymetric chart. The basin can be seen in profile on lanes 11 through 14 of the May survey (Fig. B-3 (c + d)).

Currents

Long term current measurements were obtained at 43° 34'N, 70° 02'W in the center of the proposed disposal area. The meter was installed on a taut wire mooring 1.5 meters above the bottom and recorded at 2 minute intervals from 5 August to 26 September 1978. The speed and direction versus time, probability density distribution and motion ellipses for these data are presented in Figure B-5 (a-d). Note that the probability density distribution and motion ellipses are cumulative so that the distribution and ellipse on the final figure (B-5d) represents the entire data record.

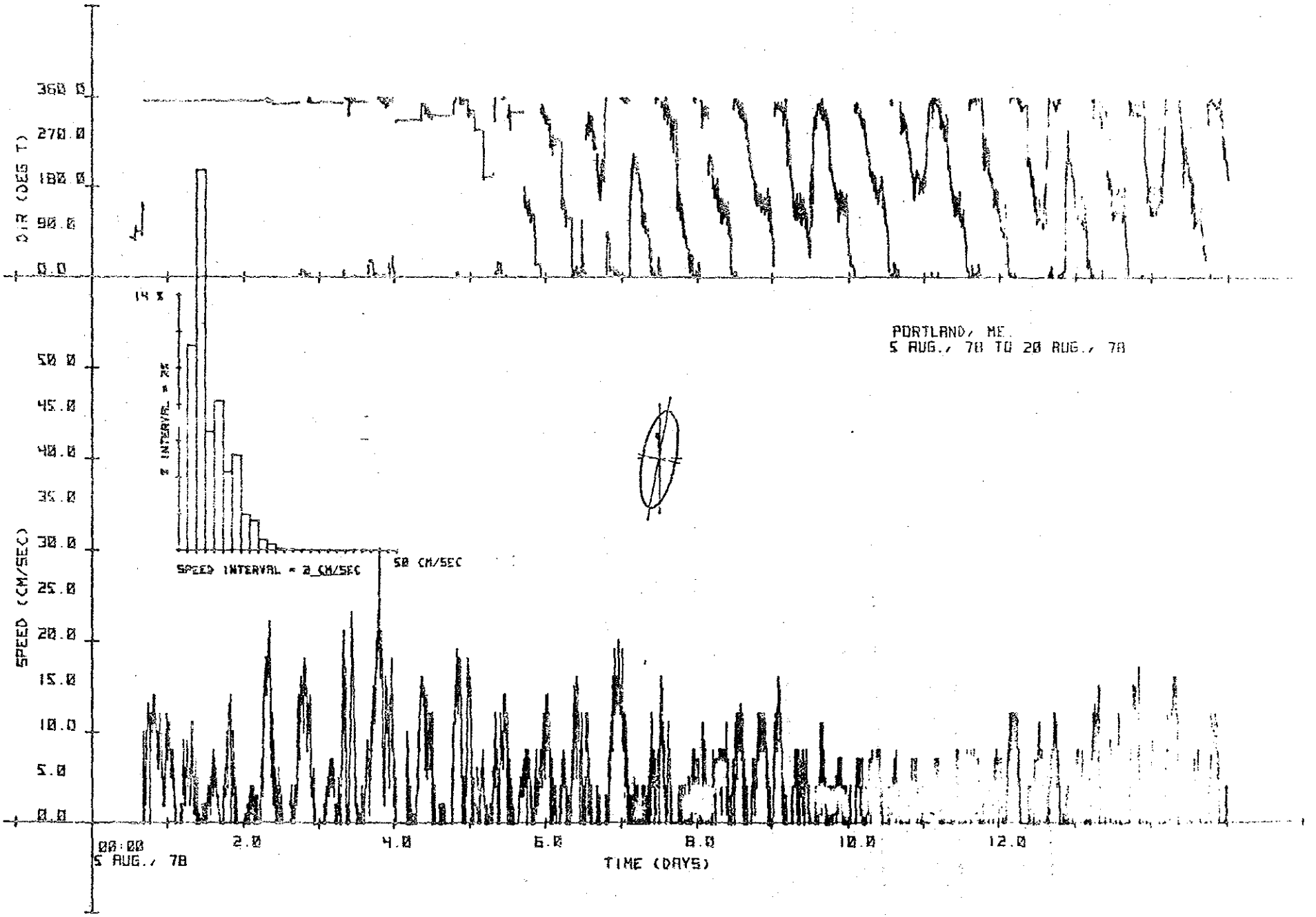
The data for the Portland current meter record are summarized in Table B-1. There are several significant features shown by these data that reflect on the utilization of the Portland disposal site as a containment site for dredge spoil disposal. Most important of these is the horizontal kinetic energy, which at Portland, has the lowest value measured in all the New England disposal sites.

TABLE B-1

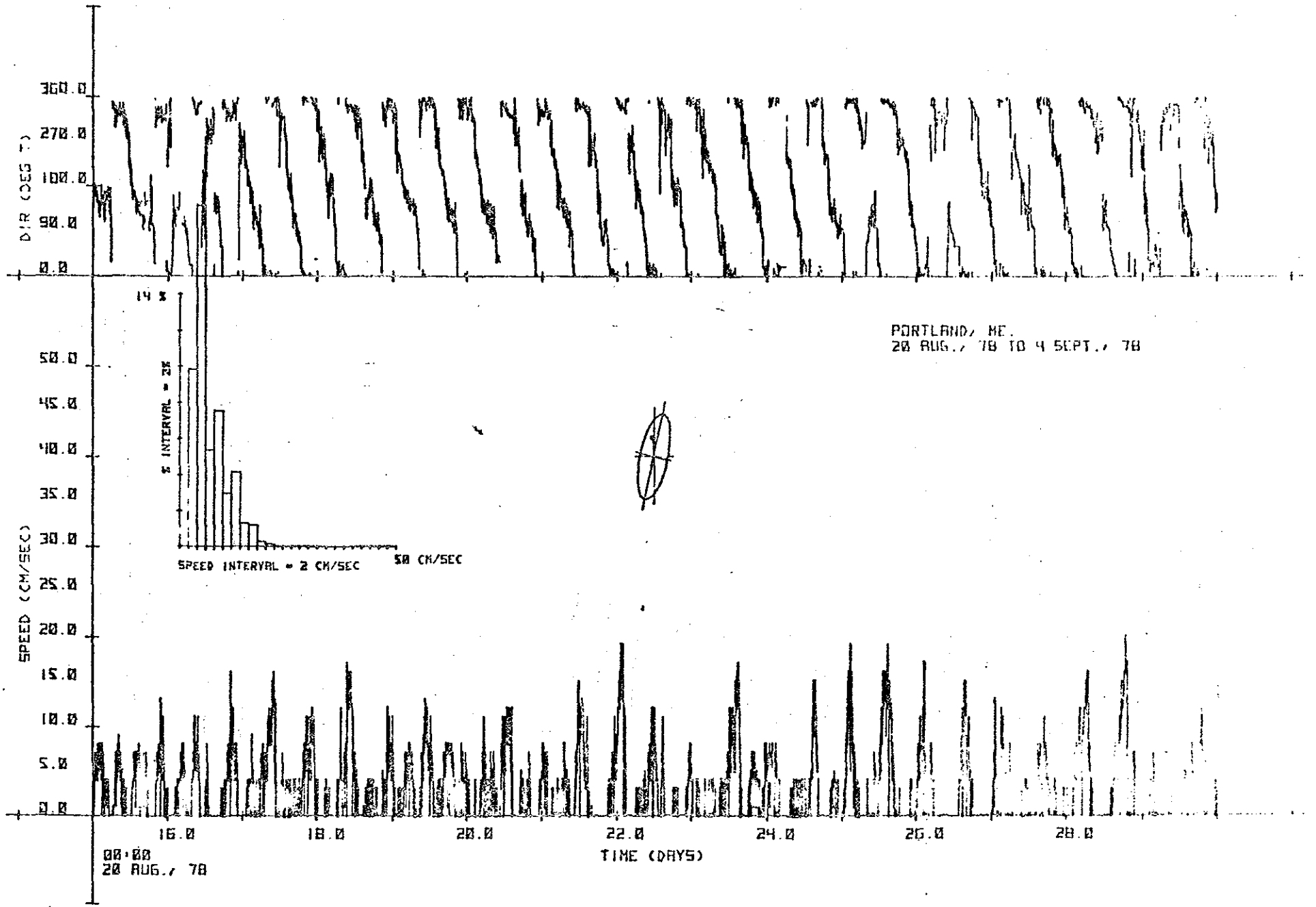
	Total OBS. Current	Tidal Current Inc. Mean	Residual Current	Mean Current
Semi-major axis (cm/sec)	4.7	3.50	3.54	-
Semi-minor axis (cm/sec)	1.7	0.87	1.53	-
Direction (oT)	016	015	013	-
Horizontal Kinetic energy (dynes/sec)	12.50	6.50	7.44	1.45
10% Highest speeds (cm/sec)	13.6 9.0	-	-	-
Peak speed (cm/sec)	-	6.29	-	-
Average maximum speed (cm/sec)	-	5.10	-	-

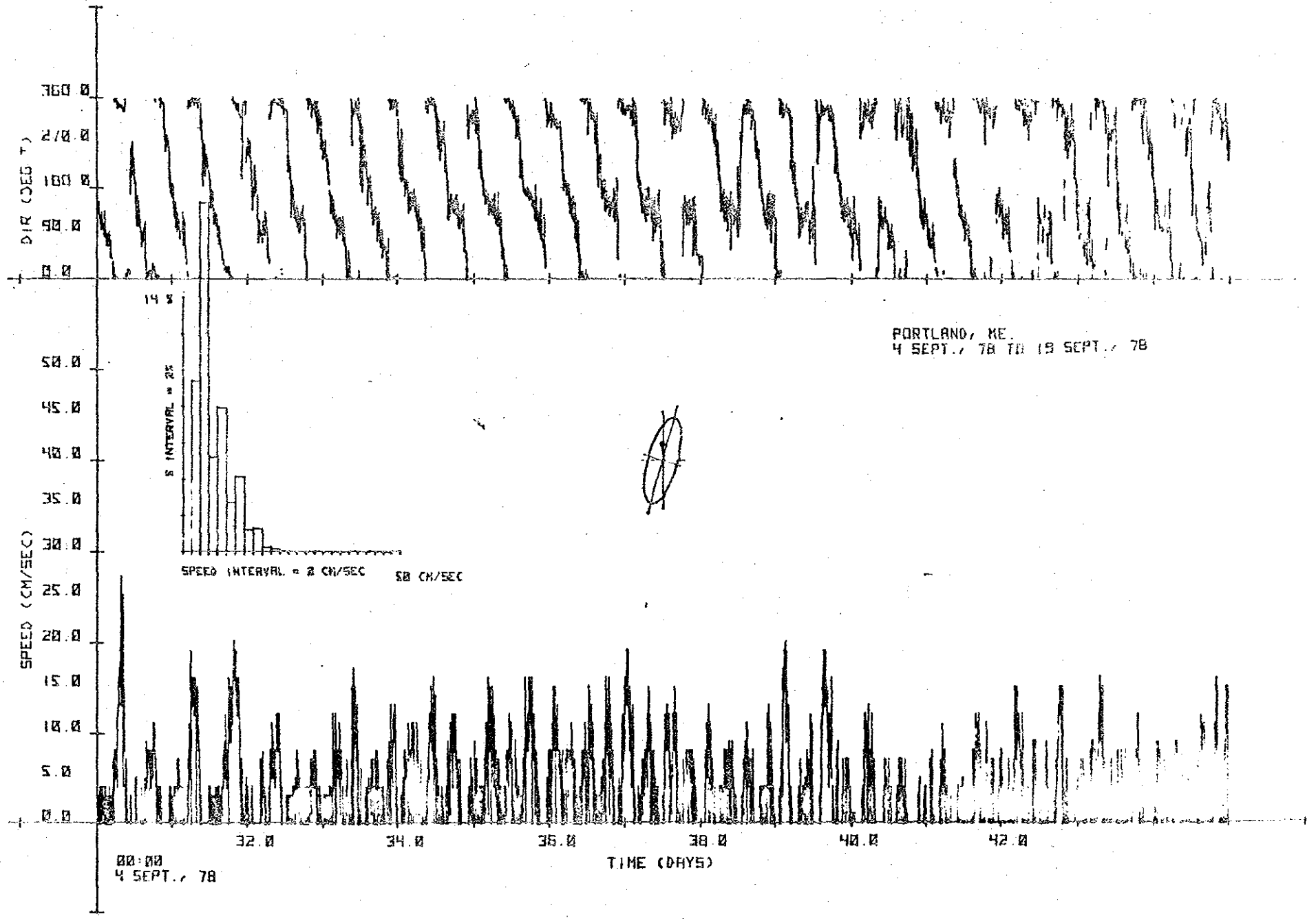
Furthermore, when this energy is broken down into the tidal and residual components, the random motion is actually greater than that due to tidal forces. Although the lower percentage of tidal flow would reduce the potential for prediction of currents, the lower absolute value of the currents is well below any threshold values for erosion of sediment.

The 10% highest speed measured during this sampling period was 13.6 cm/sec, also below threshold erosion velocities. Wave action should have minimal effect

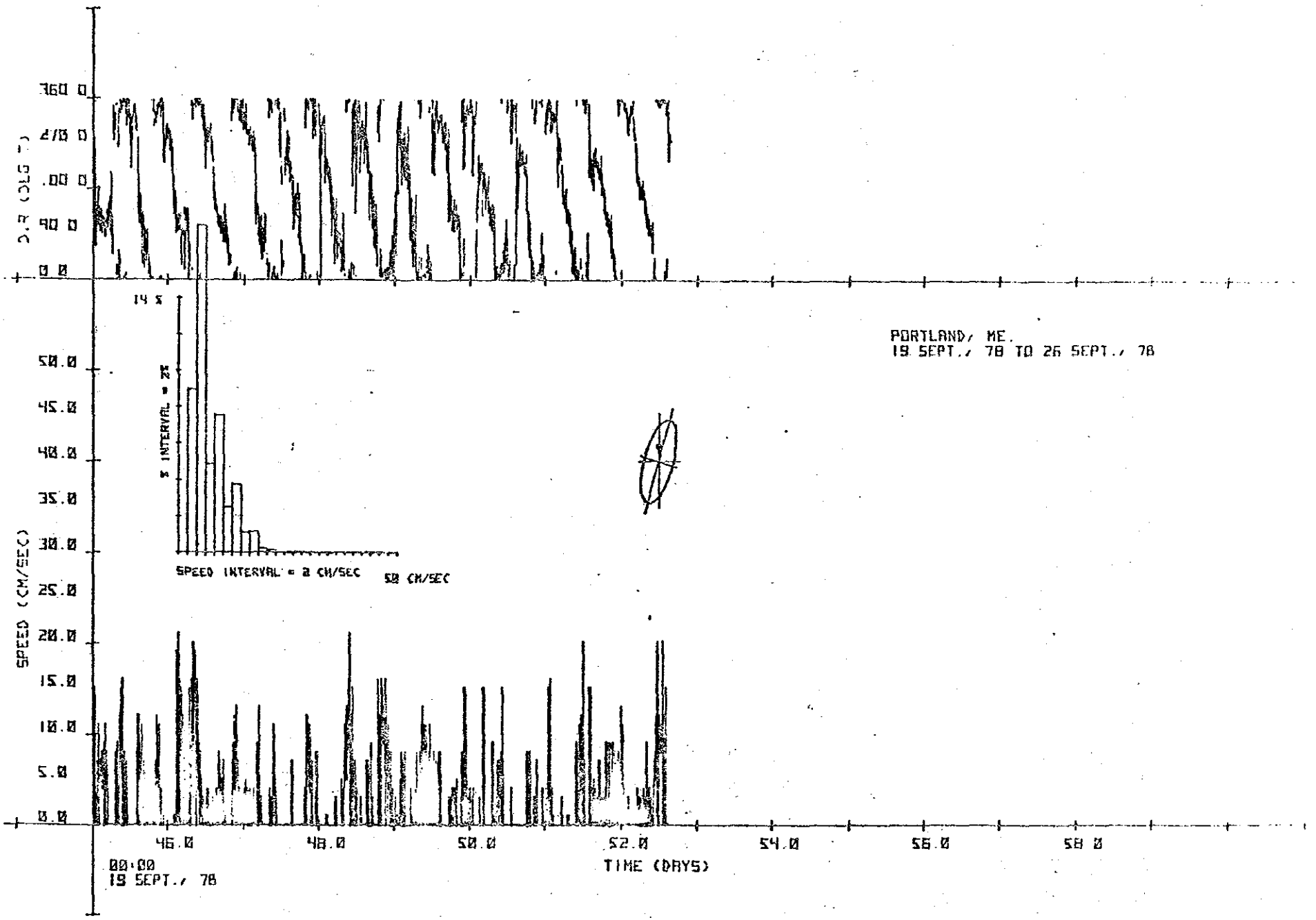

DIR (DEG T)
360.0
270.0
180.0
90.0
0.0
14 %
2 INTERVAL = 2%
SPEED INTERVAL = 2 CM/SEC
50 CM/SEC
PORTLAND, ME.
5 AUG., 78 TO 20 AUG., 78
SPEED (CM/SEC)
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
00:00
5 AUG., 78
2.0
4.0
6.0
8.0
10.0
12.0
TIME (DAYS)

B-52


DIR (DEG T)
360.0
270.0
180.0
90.0
0.0
14 %
% INTERVAL = 2%
SPEED INTERVAL = 2 CM/SEC
50 CM/SEC
PORTLAND, ME.
20 AUG., 78 TO 4 SEPT., 78
SPEED (CM/SEC)
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
16.0
18.0
20.0
22.0
24.0
26.0
28.0
00:00
20 AUG., 78
TIME (DAYS)


DIR (DEG T)
360.0
270.0
180.0
90.0
0.0
N
14 %
5 INTERVAL = 2%
SPEED INTERVAL = 2 CM/SEC
50 CM/SEC
PORTLAND, ME.
4 SEPT., 78 TO 19 SEPT., 78
SPEED (CM/SEC)
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
32.0
34.0
36.0
38.0
40.0
42.0
TIME (DAYS)
00:00
4 SEPT., 78

B-5c


360 0
270 0
180 0
90 0
0 0
D.R (DEG T)
14 %
% INTERVAL = 2%
SPEED INTERVAL = 2 CM/SEC
50 CM/SEC
PORTLAND, ME.
19 SEPT., 78 TO 26 SEPT., 78
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
SPEED (CM/SEC)
46.0
48.0
50.0
52.0
54.0
56.0
58.0
TIME (DAYS)
00:00
19 SEPT., 78

B-5d

on the sediment since depths at the proposed disposal site are greater than 60 meters, The net result of these data is a strong indication that the Portland disposal area should contain dredge spoils with little danger of dispersion.

Sediments

Sediments taken from the propsed disposal site were generally fine sands, therefore, heavy metal analysis was generally not attempted on these samples. One sample from the site was analyzed and is presented with data from Portland Harbor in Table B-2. There are no reference samples due to the fact that all areas except the proposed site are composed of rock and gravel. Iron to other metal ratios are presented for the Portland samples. There appears to be no enrichment in metal levels compared to iron in the harbor. The harbor samples are however, more concentrated in all metals (including Fe) compared to the proposed dump site.

Biochemical Studies

Mussels from Bulwark Shoals were used as reference samples and placed at the proposed Portland disposal site on May 14, 1978 at 43° 33' 55.5"N, 70° 01' 58.3"W, Data from analyses of these samples are presented in Table B-3 and shown graphically in Fig. B-6. The only metals exhibiting any significant differences from the original sample are Feand Cd from the reference site. A lack of difference between the baseline station and the proposed disposal area is significant since it indicates that changes occurring after disposal may be attributed to dredge spoil interactions with more confidence.

TABLE B-2

SURFACE SEDIMENT ANALYSIS

PORTLAND MAINE

SAMPLING	Cd	Co	Cr	Cu	Fe*	Hg	Ni	Pb	Zn	Vol/Sol	Oil/Grease
	All metals ppm									(%)	(ppm) x 10^3
MAY 1978											
PD (dump)	.40	4.7	24	3.1	.89	.025	13	7.9	22	3.4	nil
TB 7 turn base	2.3	11	57	41	2.3	.38	36	77	139	11.5	2.1
PH 4 harbor CG	1.2	11	64	39	2.5	.52	37	71	131	21.6	6.8
PRPH harbor	.62	11	62	28	2.2	.31	33	53	104	16.0	.8
DPH harbor	.22	14	48	16	2.6	.37	32	15	76	4.5	nil

*All Fe values multiply by 10^4

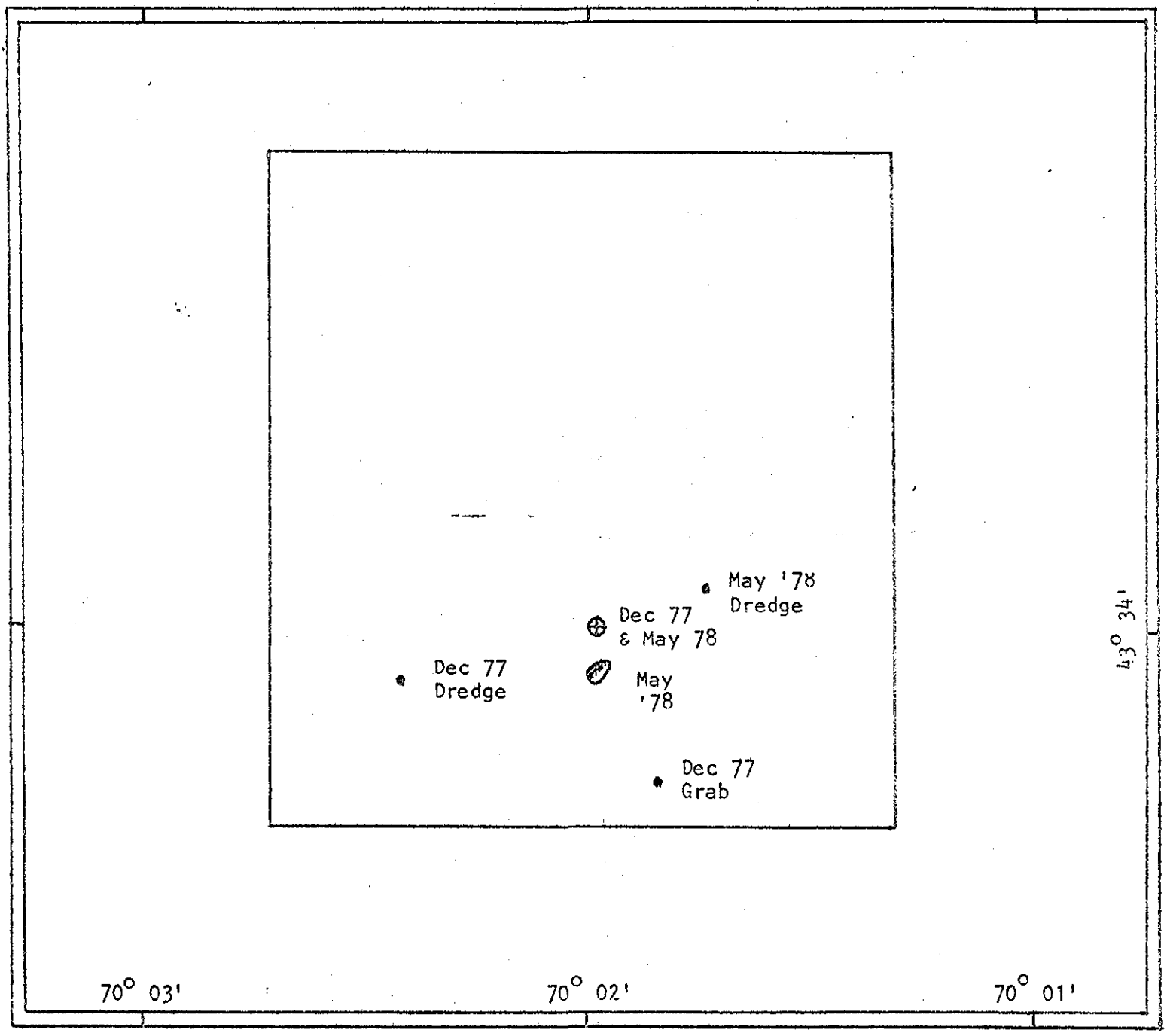
TABLE B-2a

SAMPLE LOCATIONS

SITE: Portland, Me.

DATE	DISPOSAL SITE: CURRENT METER	MUSSELS	BENTHIC SAMPLES DREDGES	BENTHIC SAMPLES GRABS	REFERENCE SITE MUSSELS	BENTHIC SAMPLES DREDGES	BENTHIC SAMPLES GRABS
15/Dec/1977	43°34'00.3" 70°01'58.4"		43°33'55" 70°02'25.5"	43°33'45.4" 70°01'50.7"			
18/May/1978	43°34'00.3" 70°01'58.4"	43°33'55.5" 70°01'58.3"	43°34'4?.3" 70°01'44.0"		43°35'09.7" 70°03'51.3"		
19/Nov/1978	"BOLT" G 15457 R 23396				43°35'09.7" 70°03'51.3"		

Portland



⊕ Current Meter Mussell Cage Benthic Samples

TABLE B-3. HEAVY METAL CONCENTRATIONS (PPM) IN MODIOLUS MODIOLUS FROM BULWARK SHOALS DEPLOYED AT PORTLAND DISPOSAL SITE (NORTHERN NEW ENGLAND).

DATE	LOCATION		CD	CR	CU	HG	PB	ZN	FE
8-15-77	BULWARK SHOALS	$\bar{x}$	12.79	1.77	30.35	0.558	16.17	458	152
		S.D.	5.96	0.39	3.07	0.235	4.51	137	38
5-14-78		$\bar{x}$	9.17	3.69	31.43	0.378	10.21	700	276
		S.D.	0.65	0.40	2.80	0.025	1.13	10	14
8-5-78		$\bar{x}$	51.05	1.75	33.00	0.727	10.74	372	179
		S.D.	13.08	0.05	6.77	0.038	0.38	122	9
8-5-78	PORTLAND	$\bar{x}$	22.00	1.34	25.64	0.493	8.36	365	208
		S.D.	11.35	0.35	0.86	0.011	2.25	13	14

Benthic Macrofauna

Numeric density data for the predominant species of benthic animals found at the Portland site are given in Table B-4. Details on the benthic population are given in the main body of the DAMOS report. As more data become available, more site specific information will be presented.

Fisheries

As part of an ongoing program to increase the communication between the Corps of Engineers and fishing interests an effort was made to include fishing interests in the selection of the Portland disposal site. Previous to choosing the site now being studied, ten fishermen from various parts of Casco Bay were interviewed by telephone. The Maine Department of Marine Resources and the National Marine Fisheries Service port agent were also contacted. The natural history of key species and recent catch records were examined.

Following the choice of a site, key fishermen were seen in person. These include the operator of an inshore dragger and two lobstermen with detailed knowledge of the site. Arrangements are being made to obtain fisheries records from 10 x 10 minute squares near the study area from the NMFS. Lobstering is the major fishery in the dump site area. Attempts will be made to obtain catch data from commercial fishermen; however, it is doubtful that a full sampling program can be developed since the area is fished only in the cold months.

Finfish

Dragging in this area is restricted to continuous stretches of relatively smooth bottom. In choosing a possible disposal site it was considered desirable

TABLE B-4

DAMOS BENTHOS - TABLE OF NUMERIC DENSITY DATA

STATION PORTLAND, MAINE — DATE 15 DECEMBER 1977

PREDOMINANT SPECIES	DREDGE 1	DREDGE 2	NUMBER 3	TOTAL	MEAN	STD DEVIATION	COEFF. OF DISPERSION	95 PERCENT CONF. LIMITS OF MEAN	NUMERIC RANK	% OF TOTAL	CUMUL % OF TOTAL
1. Astarte undata	70	4	52	126	42.0	34.1	27.7	0-126.7	1	18.3	18.3
2. Cyclocardia borealis	41	2	12	55	18.3	20.3	22.5	0- 68.7	2	8.0	26.3
3. Astarte subaequilatera	27	2	22	51	17.0	13.2	10.2	0- 49.8	3	7.4	33.7
4. Lumbrineris fragilis	12	1	27	40	13.3	13.1	12.9	0- 45.8	4	5.8	39.5
5. Arctica islandica	3	0	35	38	12.7	19.4	29.6	0- 60.9	5	5.5	45.0
6. Ninoe nigrippes	10	0	25	35	11.7	12.6	13.6	0- 43.0	6	5.1	50.1
7. Ampharete acutifrons	12	1	15	28	9.3	7.4	5.9	0- 27.7	7	4.1	54.2
8. Unciola irrorata	5	0	17	22	7.3	8.7	10.4	0- 28.9	8	3.2	57.4
9. Goniada maculata	7	0	14	21	7.0	7.0	7.0	0- 24.4	9	3.1	60.5
0. Nephthys incisa	10	1	7	18	6.0	4.6	3.5	0- 17.4	10	2.6	63.1
1. Ophiura sarsi	11	1	6	18	6.0	5.0	4.2	0- 18.4	10	2.6	65.7
2. Myriochele heeri	6	0	8	14	4.7	4.2	3.8	0- 15.1	11	2.0	67.7
3.											
4.											
5.											
6.											
7.											
8.											
TOTAL	214	12	240	466	155.3	124.8	100.3	0-465.3			
TOTAL NO. OF SPP. PER DREDGE	54	18	50	71	40.7	19.7		0- 89.6			
SPECIES DIVERSITY (H')	3.08	2.78	3.29	9.15	3.05	0.26					
EQUITABILITY (J!)	0.77	0.96	0.84	2.57	0.86	0.10					

TOTAL NO. OF INDIVIDUALS THIS STN = 687

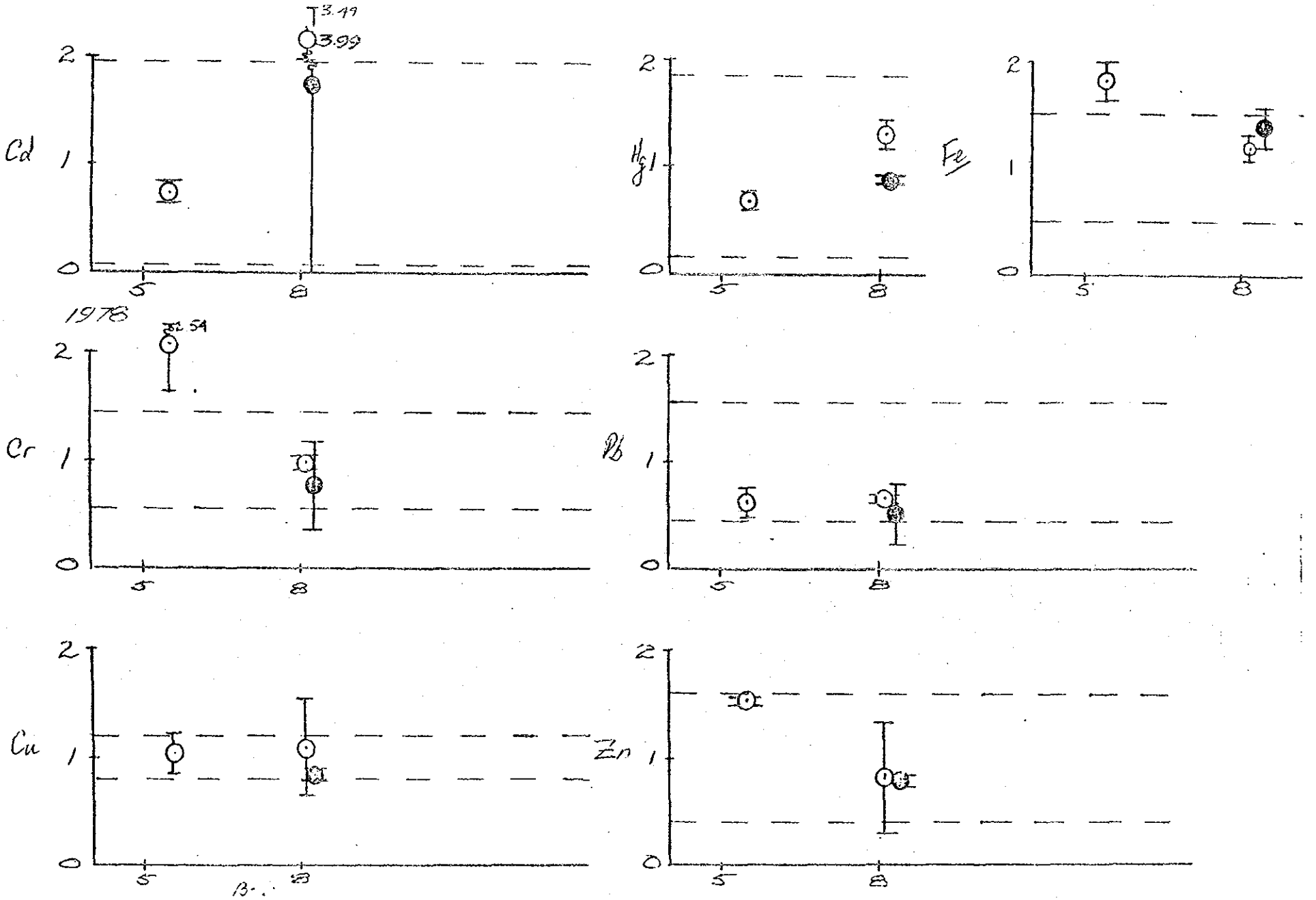


Figure B-6. Temporal variation in the ratios of heavy metals in Modiolus modiolus from Bulwark Shoals (O) deployed at Portland disposal site (●). Broken lines depict the 95% confidence limits of the baseline data.

to avoid all dragging areas and to locate the area at least a mile from any tow path and in an area where topography and current speed and direction would prevent transport toward dragging grounds. Dragging grounds near the study area are shown in Figure B-7.

The "edge of the bottom" is the primary dragging ground in this area. In the summer, ten inshore vessels may fish here on a given day for dab (Hippoglossoides platessoides) and gray sole (Glyptocephalus cynoglossus). In the winter and early spring these are joined by larger vessels. On a given day as many as 25 vessels might fish here. These are based mainly in Portland and Cundys Harbor with a few coming from Biddeford. The catch is cod (Gadus morrhua), haddock (Melanogrammus aeglefinis), and other groundfish.

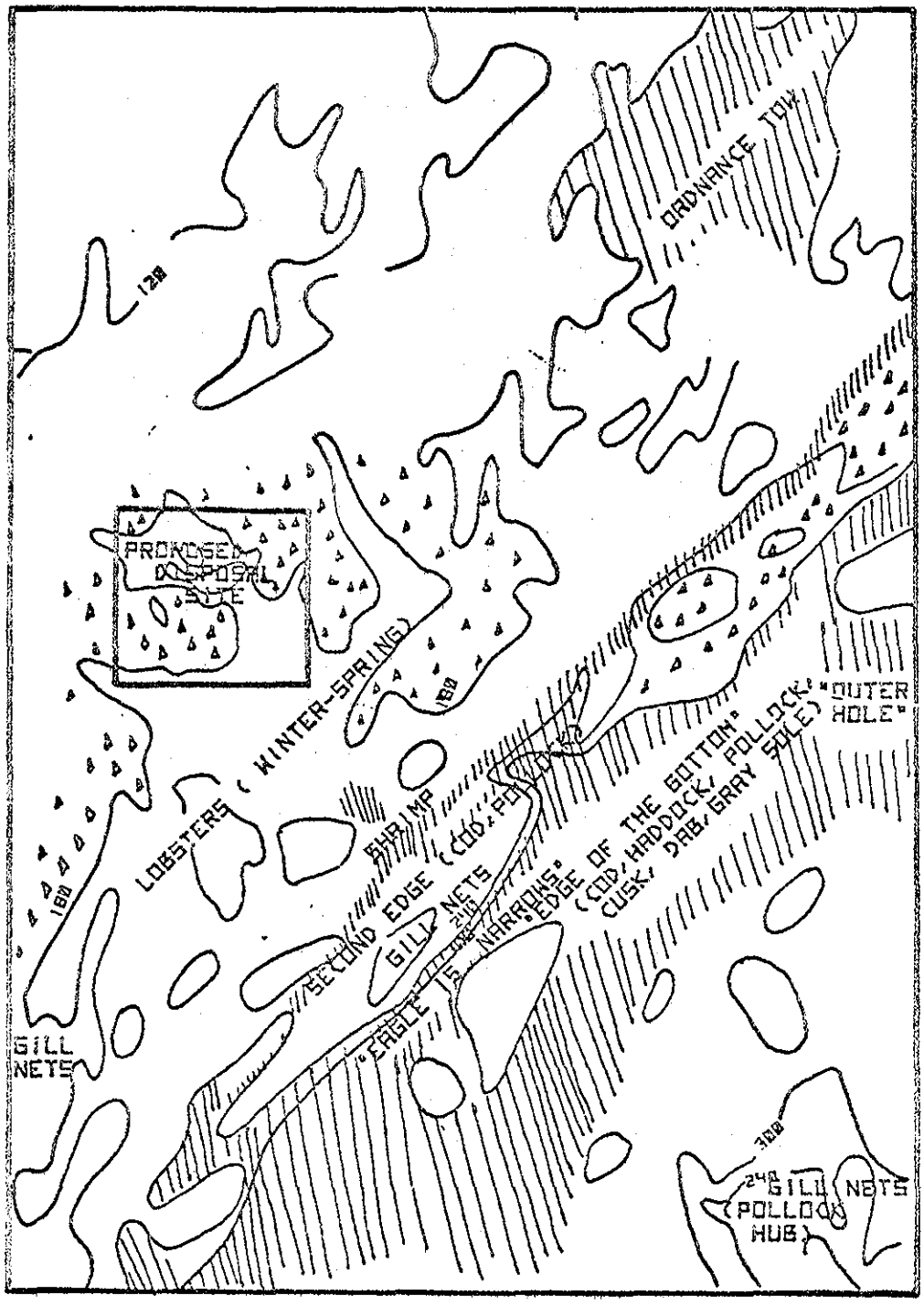
A portion of the "edge of the bottom"; "eagle island narrows", is constricted by an offshore mound. The "ordnance" tow is a relatively important ground two miles northeast of the proposed site. A less important ground consisting of a series of narrow passages lies inside and parallel to the "edge of the bottom". This "second edge" is fished by approximately five vessels for cod or pollock.

The proposed disposal site is over four miles northwest of "Hue and Cry Gulley", a narrow tow of considerable importance to individual Portland based inshore vessels.

Tub trawling (fishing with long baited lines) was historically carried out on rough bottoms with an abudance of invertebrate fish food. These traditional fishing areas were mapped by Rich, 1930 (Fishing Grounds of the Gulf of Maine, U.S. Comm. Fish., 1929, App. 3). Little tub trawling is now carried out in this area.

The traditional grounds used by hook and line fisheries are on broken bottom with well developed growth of fouling organisms and are probably feeding and

FISHERIES IN THE VICINITY OF THE PROPOSED PORTLAND DISPOSAL SITE



shelter areas for fish (juvenile cod are reported between the "edge of the bottom" and Cod Ledges). Dragging grounds are areas smooth enough to fish on and may be located near a feature which concentrates migrating fish. Subtle pollution effects would be more important on feeding grounds than on a dragging ground such as the "edge of the bottom" where fish are concentrated by a sudden change in depth.

The sport fisheries in this area include some bottom fishing from party boats on the White Horse grounds southwest of the dump site and a wider ranging fishery for giant tuna. A tendency of tuna to cross Casco Bay in the "edge of the bottom" area was reported.

Shrimp

The "edge of the bottom" and the "inner edge" have been productive grounds for northern shrimp. It was reported that this area still yielded catches when shrimp had disappeared from other areas of the coast. The shrimp fishery is now closed. The shrimp fishery is based on egg carrying females. Eggs probably hatch in this general area.

Lobsters

The proposed disposal site is offshore of most of the Casco Bay lobster fishery. Most of the vessels begin fishing in less than 70 meters of water in the late spring as lobsters move shoreward toward warmer water. Fishing is most intense in mid-summer in water less than 20 meters deep around the Cod Ledges and shorewards.

At the disposal site lobstering is carried out from November to April when lobsters are not active in the colder shallow waters. The deep water also gives gear protection from storm waves. Prices are high at this time, but weather

conditions are dangerous, and it is hard to keep a regular schedule.

A lobsterman who had to leave his gear in the deeper water over the summer of 1977 because he was rigged for deep water found that some lobsters remained there throughout the summer. He pulled them once a week and caught about half what shallow water drags would have caught in a regular three-day set (0.5-0.7 lobsters/trap rather than 1.1-1.5 lobsters/trap). In the offshore area the lobsters shed in the fall rather than mid-summer.

One fisherman reported that rock crabs (Cancer borealis) are not found this far out. Another reported catching "queen" or "spider" crabs (Lithodes maia) in deeper parts of the area.

In 1977 there were three lobstermen making use of the proposed site in the winter (from Portland, South Harpswell, and Baily Island). At least three more have fished near this area in previous years. All the lobstermen fishing here may run as many as 3,000 pots although one man has the majority of pots. Typical pot spacings are 1- pot strings set in lines of 100-110 pots per mile running NE-SW. It is thus possible that several hundred pots could be placed in the proposed disposal site.

One person fishing the dump site area in 1977 will not be fishing there in 1978. While there is a possibility of one or two vessels moving into the area in 1978, the number of vessels fishing the site will remain small.

Lobster landings at Portland have been slowly increasing in recent years, but this probably represents an expansion of effort rather than an increase in productivity. Lobstermen report that their catches in deep water have been stable over up to seven years. It would probably be possible to detect large local changes in lobster density caused by spoil disposal. The monthly landings

show that the winter (deep water) catch is a small fraction of the annual total.

In many disposal areas winter dumping is advisable to avoid interference with recreation and fisheries; at this site summer dumping (May-October) would minimize impact on the offshore lobster fishery and draggers. Tow boats would have to follow a fixed route so that pots could be placed to avoid them.