STATUS REPORT DISPOSAL OPERATIONS
AT THE CENTRAL LONG ISLAND SOUND
DISPOSAL SITE

DISPOSAL AREA MONITORING SYSTEM (DAMOS)

FIELD VERIFICATION PROGRAM (FVP)

GEOPHYSICAL ASPECTS OF CAPPING OPERATIONS

CONTRIBUTION 25

MAY 1983

US Army Corps of Engineers
New England Division

SCIENCE APPLICATIONS, INC.

STATUS REPORT
DISPOSAL OPERATIONS AT THE CENTRAL LONG ISLAND SOUND DISPOSAL SITE

20 MAY 1983

CONTRIBUTION #25

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1. INTRODUCTION

During the spring of 1983, a series of dredging and disposal operations have occurred utilizing the Central Long Island Sound Disposal Site. A major effort has been made under the DAMOS program to monitor these disposal operations at four different locations within the CLIS site. These locations and associated operations are defined as follows:

- MQR Site - Disposal of approximately 1 million m^3 of sediment from New Haven Harbor dumped using a Loran-C navigation control system
- Cap Site 1 - Disposal of approximately 25000 m^3 of sediment from Black Rock Harbor to be capped by silt from New Haven
- Cap Site 2 - Disposal of approximately 30000 m^3 of sediment from Black Rock Harbor to be capped by sand from the outer channel of New Haven
- FVP Site - Disposal of approximately 55000 m^3 of sediment from Black Rock Harbor

An overview of the CLIS disposal site showing the relative positions of the disposal points and the extent of survey coverage is presented in Figure 1-1. All of these sites have been studied in detail using replicate precision bathymetric surveys, side scan sonar, precision grab sampling and diver observations as well as additional, more specialized observations in some cases.

This report is being compiled to provide a summary of data obtained during the period of disposal in order to assess the effectiveness of the disposal operation. Consequently, all data have not yet been reviewed for accuracy, and in the case of replicate bathymetric surveys, fully corrected for tide and sound velocity. However, even though absolute values of depths may not

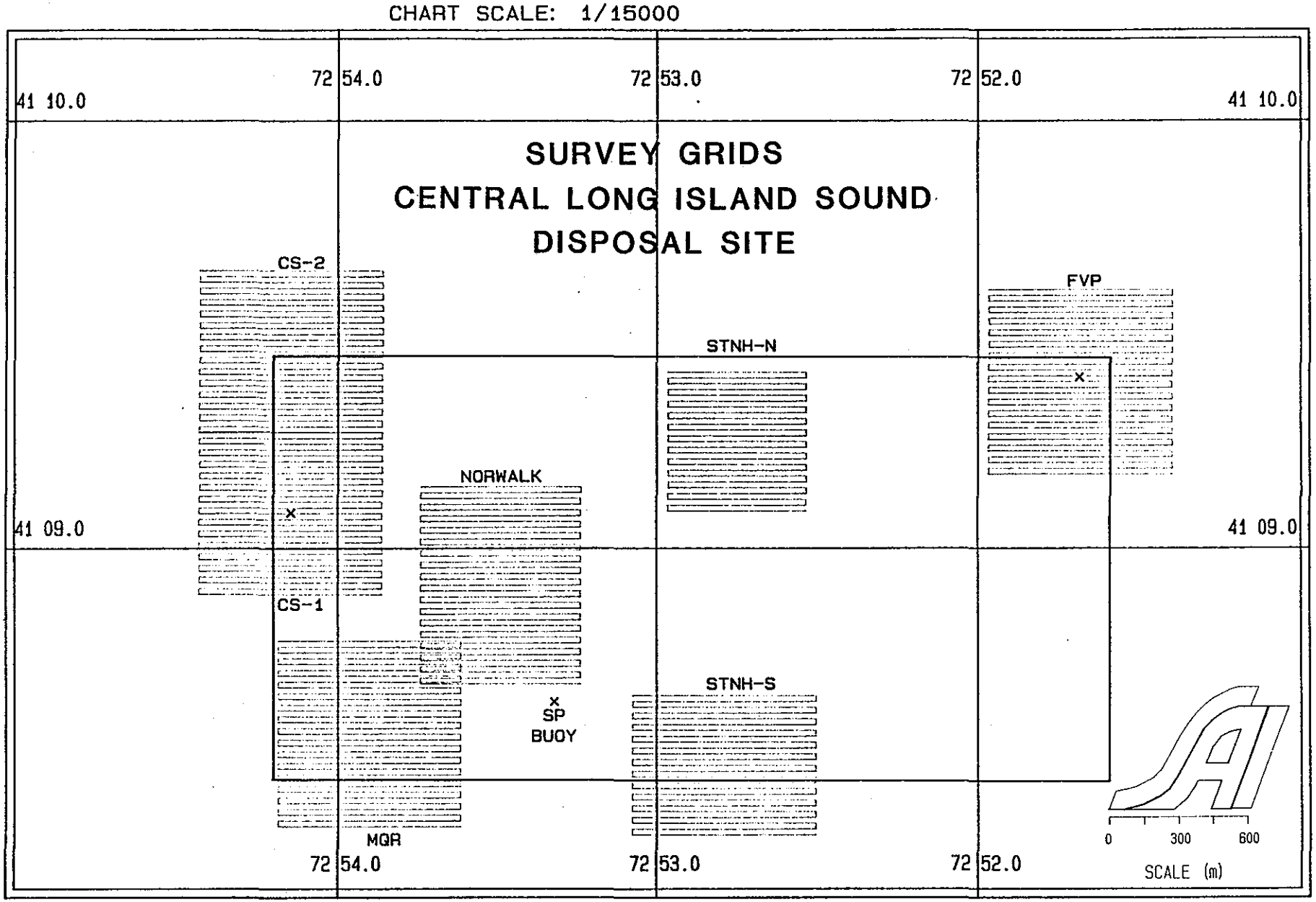
CHART SCALE: 1/15000
72 54.0
72 53.0
72 52.0
41 10.0
41 10.0
SURVEY GRIDS
CENTRAL LONG ISLAND SOUND
DISPOSAL SITE
CS-2
CS-1
NORWALK
STNH-N
STNH-S
FVP
SP
BUOY
MQR
41 09.0
41 09.0
72 54.0
72 53.0
72 52.0
0
300
600
SCALE (m)

Figure 1-1

be fully corrected, the relative differences between surveys are valid and comparisons to determine distribution and thickness of dredged material can be made with confidence.

A summary of the work conducted at the CLIS Disposal Site during recent months is presented in Table 1-1. The following sections provide a quick look summary of data from each site. Further amplification and interpretation of results will be provided in future reports. After completion of disposal operations in June, additional work at the CLIS site will consist of intensive post disposal monitoring and subsequent periodic cruises to monitor long term effects.

2. MILL & QUINNIPIAC RIVER DISPOSAL SITE (MQR)

During the spring of 1982, sediment from the Mill River in New Haven was capped with additional material from the Quinnipiac River. Figures 2-1 and 2-2 present bathymetric charts before and after that operation. The mound created by the capping operation is readily apparent in Figure 2-2 as an elliptical shaped elevation with axes of 300 m and 180 m and a maximum elevation of approximately 1.5 m. Figure 2-3 shows the same site 9 months after disposal and immediately prior to initiation of the present New Haven project. Very little change had occurred over this period indicating a stable containment situation.

Initial disposal at the MQR site in 1983 consisted of point dumping a small quantity of sediment from Bridgeport Harbor, which was relatively high in heavy metal and organic content. This material was then capped by the large volume of

Table 1-1
Summary of Field Observations
Obtained at the CLIS Disposal Site

Date	Site	Operation
3-19-82	MQR	Display Disposal Buoy
3-23-82	FVP	Initial Baseline Survey Diving & TV Reconnaissance Sediment Grab Samples
3-24-82	MQR	Baseline Survey
4-21-82	MQR	Interim Survey Diver Observations
4-23-82	FVP	Display Daisy
4-24-82	FVP MQR	Reconnaissance Side Scan Survey Sediment Samples
6-1-82	FVP	Baseline Survey
6-2-82	MQR FVP	Sediment Samples Sediment Samples
6-3-82	MQR FVP	Remove Buoy Post-Disposal Survey Side Scan Survey
8-23-82	FVP	Sediment Samples Diver Observations
8-24-82	FVP	Sediment Samples REMOTS Photography
8-25-82	FVP	REMOTS Photography
8-26-82	FVP	REMOTS Photography
8-27-82	FVP	REMOTS Photography
8-30-82	MQR CLIS REF	Monitoring Survey Biological & Sediment Samples
9-3-82	FVP MQR	Remove DAISY & Reset Diver Observations

12-7-82	FVP	Diver Observations EPA Sediment Samples Underwater TV
12-8-82	FVP	Reset DAISY EPA Biological Samples
12-10-82	FVP MQR	Sediment Samples Baseline Survey Diving Operations
12-11-82	FVP MQR	Water Sampling Monitoring Survey
1-25-83	MQR	REMOTS Survey
2-28-83	FVP	Deploy Mussel Cages (UCONN)
3-1-83	FVP	Deploy Mussel Cages (EPA) Diver Observations
3-4-83	FVP MQR	Biological Samples Diver Observations Deploy Disposal Buoy
3-15-83	FVP	Deploy Disposal Buoy REMOTS Survey
4-5-83	CS#1	Baseline Sediment Survey
4-6-83	CS#1 CS#2	Baseline REMOTS Survey Deploy CS#1 Disposal Buoy Deploy Deflection & Erosion Stakes Baseline REMOTS Survey Baseline Sediment Survey
4-7-83	CS#1 CS#2	Baseline Bathymetric Survey Baseline Side Scan Survey Baseline Bathymetric Survey
4-8-83	CS #1 CS#2 FVP	Deploy Diver TRansect Lines Deploy Compaction Stakes Deploy Deflection Stake Remove DAISY Sediment Samples at CLIS-REF
4-18-83	CS#2 FVP	Deploy Disposal Buoy Deploy Compaction Stakes Deplot DAISYS (2)

4-22-83	FVP	Water Column Sampling Retrieve Mussels (EPA)
4-23-83	FVP	Retrieve Mussels Sediment Chemistry Samples Sediment Erosion Test Samples
4-26-83	FVP	Recycle DAISY's Interim Side Scan Survey
4-27-83	CS#1 MQR CS#2	Post Black Rock Diver Observations Bathymetric Profiles over Mound Density Probe Measurements
4-28-83	CS#1 CS#2 FVP	Post Black Rock Bathymetric Survey Interim Bathymetric Survey Interim Bathymetric Survey
5-4-83	FVP	Sediment Distribution Survey
5-5-83	FVP	Interim Bathymetric Survey Side Scan Survey
5-6-83	MQR CS#1 FVP	Interim Bathymetric Survey Sediment Distribution Survey Sediment Distribution Survey
5-10-83	CS#2 MQR	Sediment Distribution Survey Sediment Distribution Survey
5-11-83	CS#2 CS#1	Side Scan Survey Diving Observations Diving Observations
5-18-83	CS#2 FVP	Diving Observations Post Disposal Diver Observations
5-19-83	FVP	Post Disposal Baseline Bathymetric Survey
5-23-83	FVP	Water Column Sampling

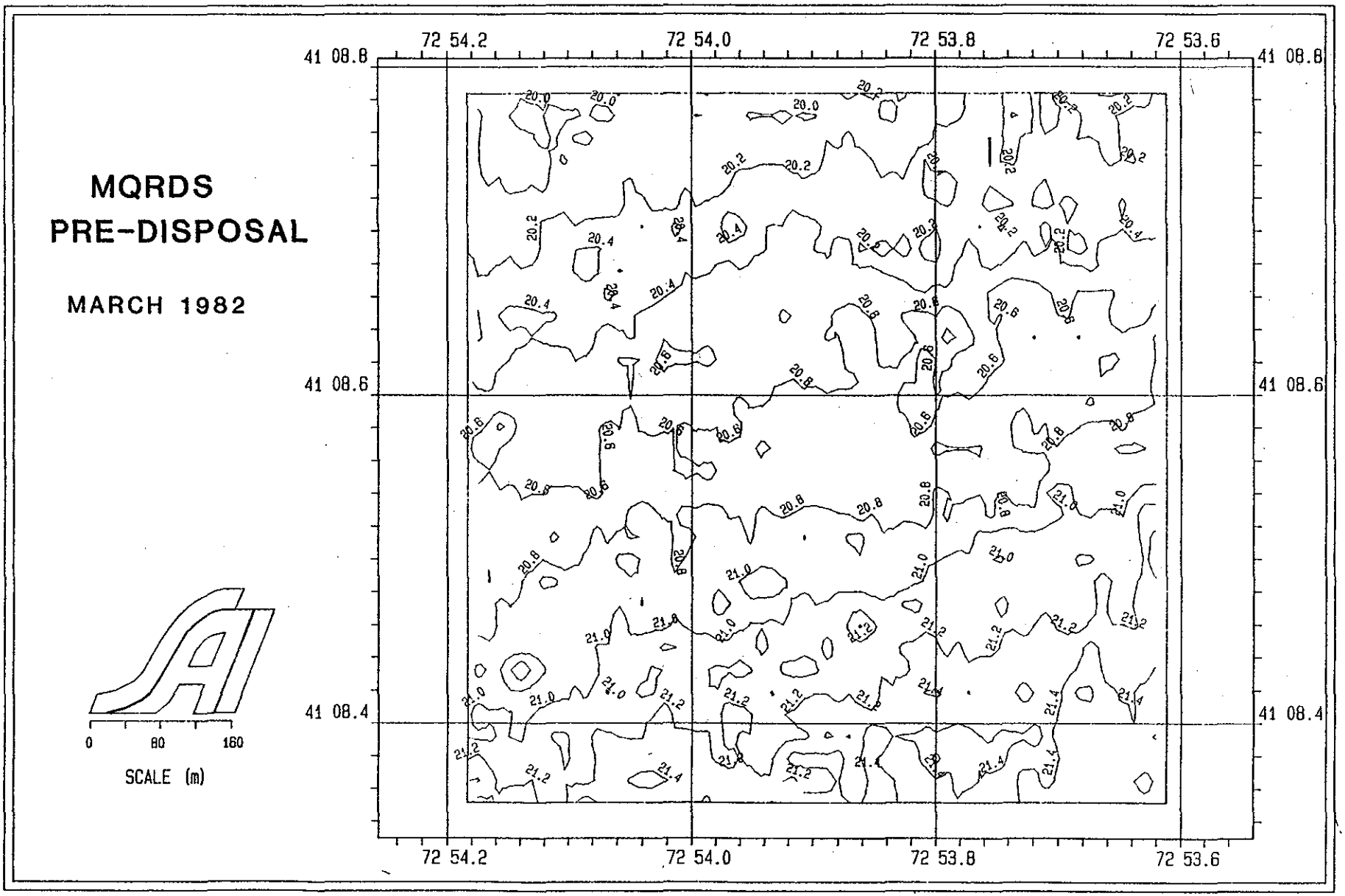
MQRDS
PRE-DISPOSAL
MARCH 1982
72 54.2
72 54.0
72 53.8
72 53.6
41 08.8
41 08.6
41 08.4
0
80
160
SCALE (m)

Figure 2-1

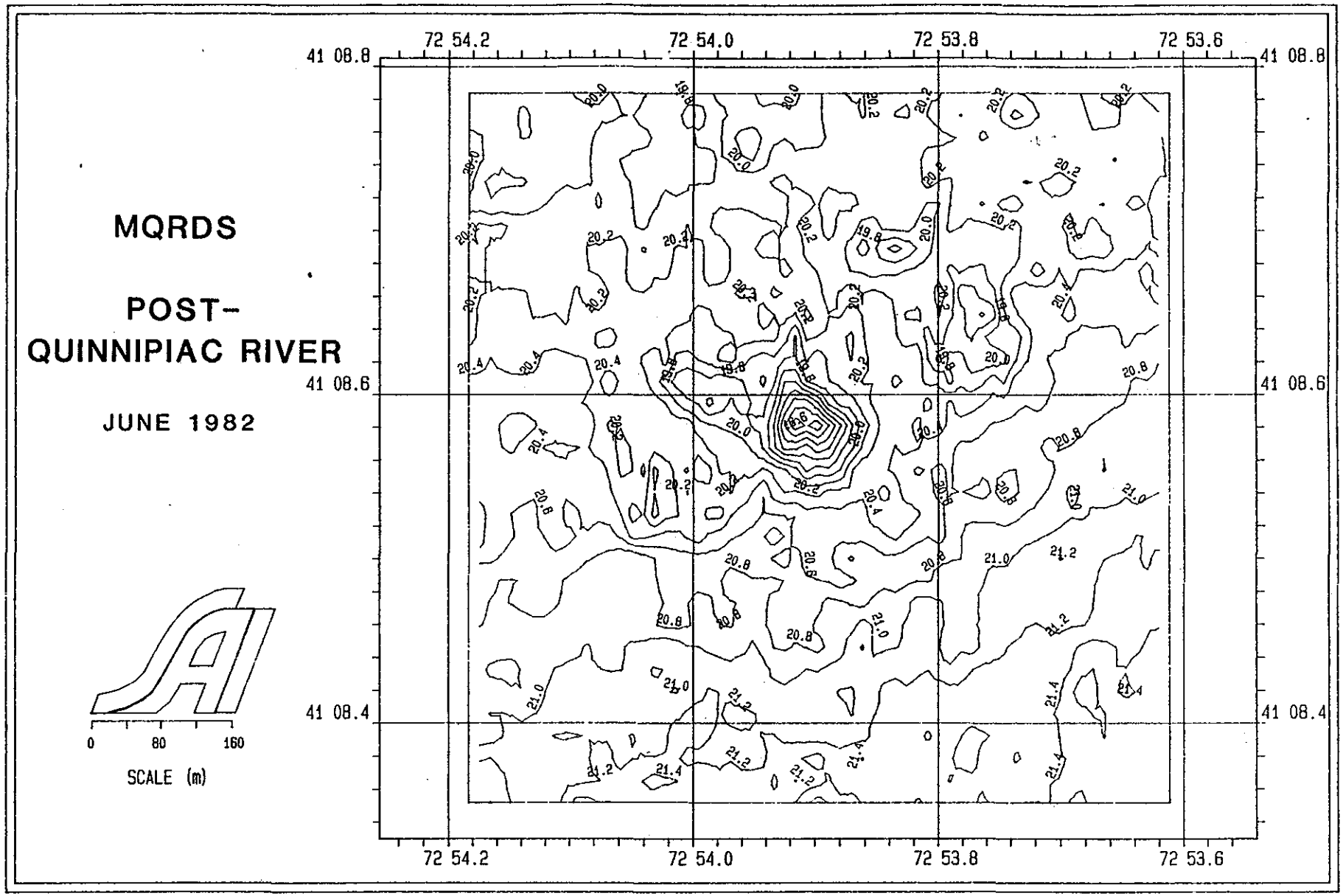
MQRDS
POST-
QUINNIPIAC RIVER
JUNE 1982
72 54.2
72 54.0
72 53.8
72 53.6
41 08.8
41 08.6
41 08.4
0
80
160
SCALE (m)

Figure 2-2

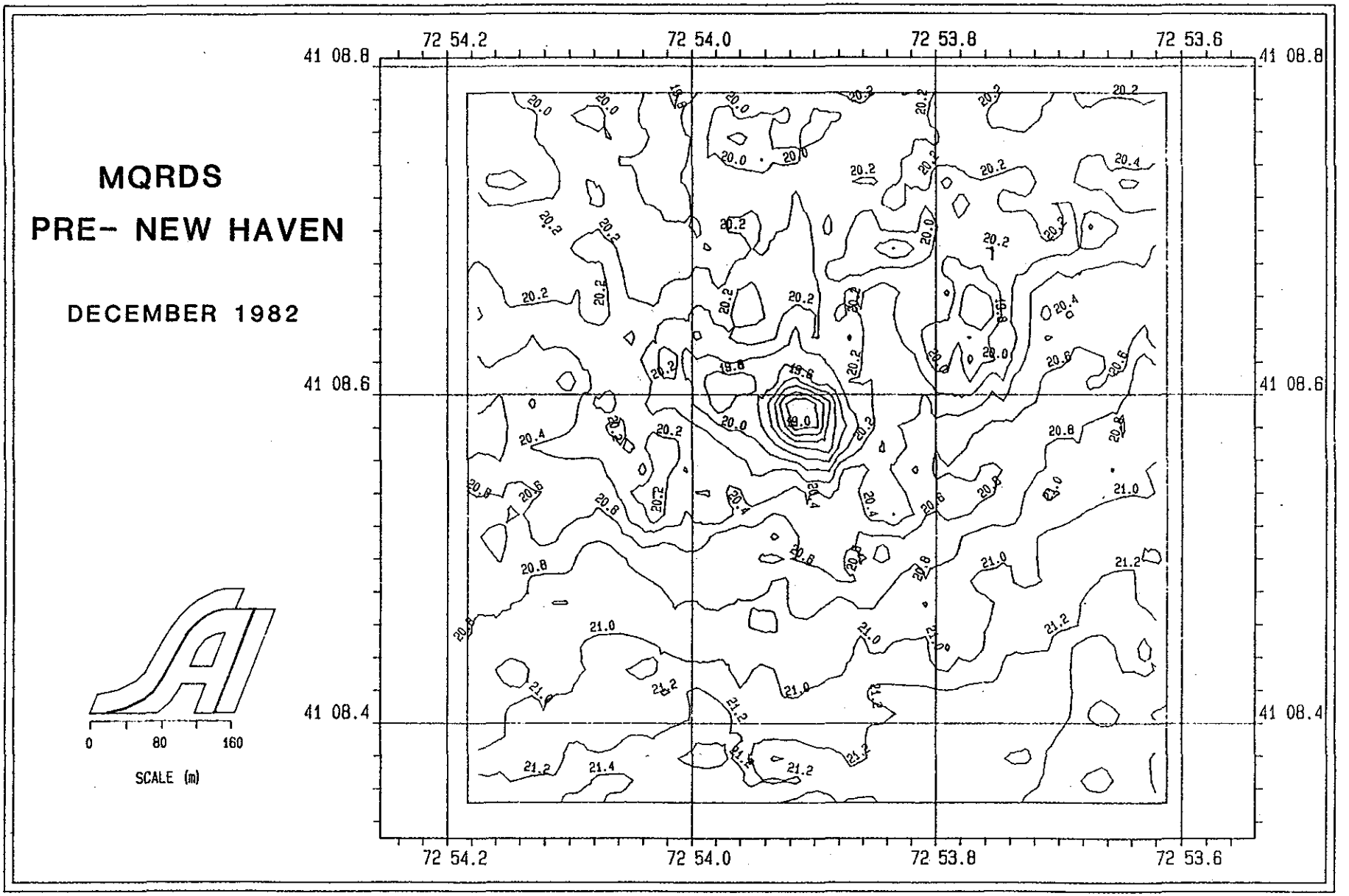
MQRDS
PRE- NEW HAVEN
DECEMBER 1982
72 54.2
72 54.0
72 53.8
72 53.6
41 08.8
41 08.6
41 08.4
0
80
160
SCALE (m)

Figure 2-3

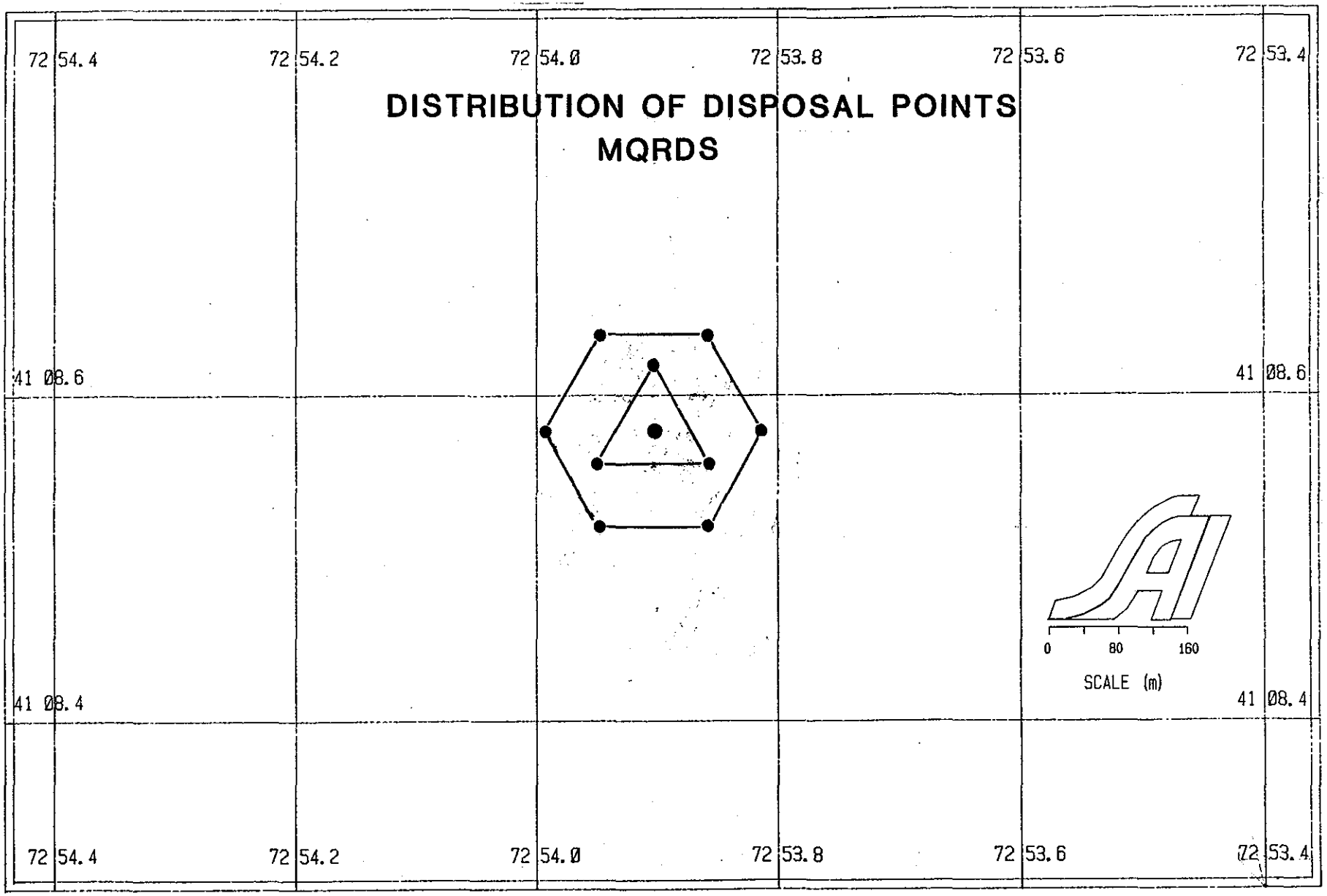
72 54.4
72 54.2
72 54.0
72 53.8
72 53.6
72 53.4
DISTRIBUTION OF DISPOSAL POINTS
MQRDS
41 08.6
41 08.6
41 08.4
41 08.4
0
80
160
SCALE (m)
72 54.4
72 54.2
72 54.0
72 53.8
72 53.6
72 53.4

Figure 2-4

sediment dredged from New Haven Harbor.

Based on the results of previous capping operations with New Haven material, and because of the large volume of sediment to be dredged, a Loran-C controlled navigation system was used to spread the capping sediment over a larger area rather than develop a steep sided mound using point dumping procedures. This navigation system consisted of a remote Loran-C receiver and telemetry unit mounted on the scows which transmitted the scow position to a computerized control system aboard the tug. This control system provided the helmsman with a visual display of his course made good and present position with respect to the designated disposal point.

A total of ten different disposal points were specified as shown in Figure 2-4. The computer then sequenced through these points and directed the helmsman to the correct location. The system also provided a record of the ship's track to and from the disposal site and the exact location of dumping for each scow load.

Although some problems were experienced due to loss of Loran-C signals, the system was successful in distributing the dredged material over the designated area. Figure 2-5 is a contour chart of an interim bathymetric survey conducted on May 6, 1983. At this time, approximately 70% of the dredging had been completed and the mound at the MQR site had expanded to a roughly circular configuration with a diameter of 400 m and an average thickness of approximately two meters.

Following completion of the bathymetric survey, a series of grab samples were obtained on N-S and E-W transects

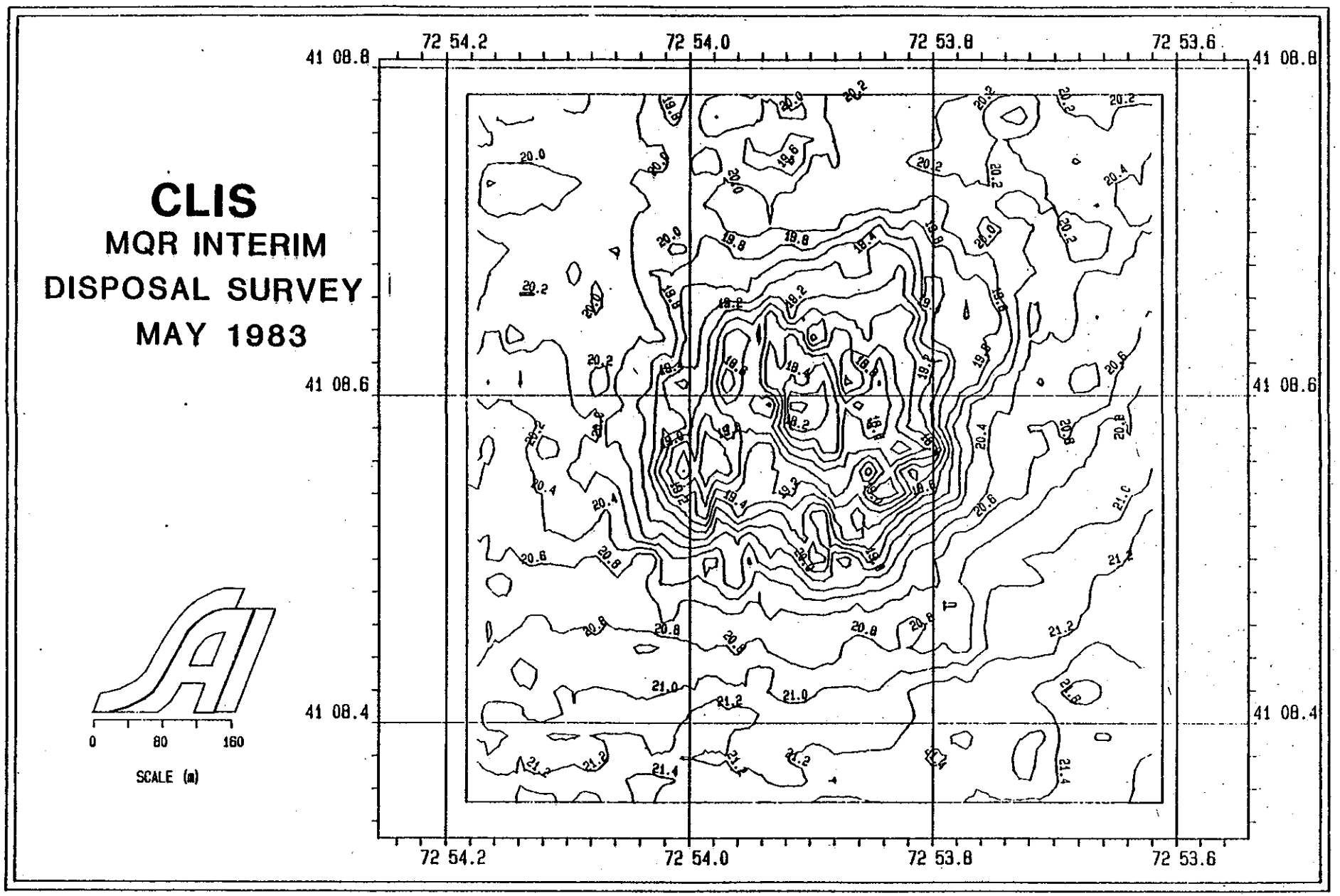
CLIS
MQR INTERIM
DISPOSAL SURVEY
MAY 1983
72 54.2
72 54.0
72 53.8
72 53.6
41 08.8
41 08.6
41 08.4
0
80
160
SCALE (m)

Figure 2-5

across the mound. As in previous capping operations, the thickness of dredged material decreases rapidly beyond the flanks of the mound to 1-2 cm at distances of 400 m from the center of the site. Traces of material were present, however, at distances of up to 1000 meters, particularly on the west transect.

In summary, the disposal of New Haven material at the MQR site was accomplished efficiently and effectively so that a large volume of material was dumped in a relatively small area, providing uniform cover without creating a steep-sloped conical mound which would be more susceptible to wave action and, consequently, less stable as a cap. Controlled distribution of disposal points appears to be an effective method for placement of cap material.

3. CAP SITE 1

As part of an ongoing program at the Waterways Experiment Station of the Corps of Engineers, a two part capping study was initiated at the CLIS Disposal Site. The first portion of this program is an assessment of the geophysical aspects of the capping procedures and the techniques used to monitor the physical containment of the material. A second portion will address the efficiency of different capping materials in isolating the biota and water column from the contaminants in the sediment being capped.

To conduct this study, two small mounds of Black Rock material were deposited using point dumping techniques with a taut-wire buoy at locations on the western margin of the CLIS site (Fig. 1-1). Cap Site 1 material will be covered with silt

from New Haven harbor and Cap Site 2 sediment with sand from the outer portions of New Haven.

A baseline bathymetric survey (Fig. 3-1) of Cap Site 1 on 7 April, 1983 indicated a relatively flat bottom sloping only .5 m from north to south over the survey area. This survey was made a few days after disposal operations began and a slight elevation is apparent in the south center of the survey.

A side scan sonar survey conducted on the same date indicates a predominant soft, silty bottom interspersed with concentrations of rough, high reflectance sediment (Fig. 3-2). The frequency of occurrence for these high reflectance areas increases toward the east in the general area of permit disposal operations at the "SP" buoy and the previous Norwalk disposal operation. At the extreme east of the survey, the entire surface is composed of high reflectance material (Fig. 3-3).

In the area immediately south of the disposal buoy dredged material on the bottom results in another area of high reflectance (Fig. 3-4) with characteristic crater signatures indicating the location of actual dumping.

The combination of bathymetric and side scan data obtained at the site support the observation that initial disposal operations were not tightly controlled through dumping with the buoy immediately north of the scow. After emphasis was placed on the importance of point dumping, the subsequent operations were conducted close to the buoy and the Post-Black Rock disposal survey (Fig. 3-5) indicates a small mound less than 200 meters in diameter and approximately one meter thick was formed south of the buoy.

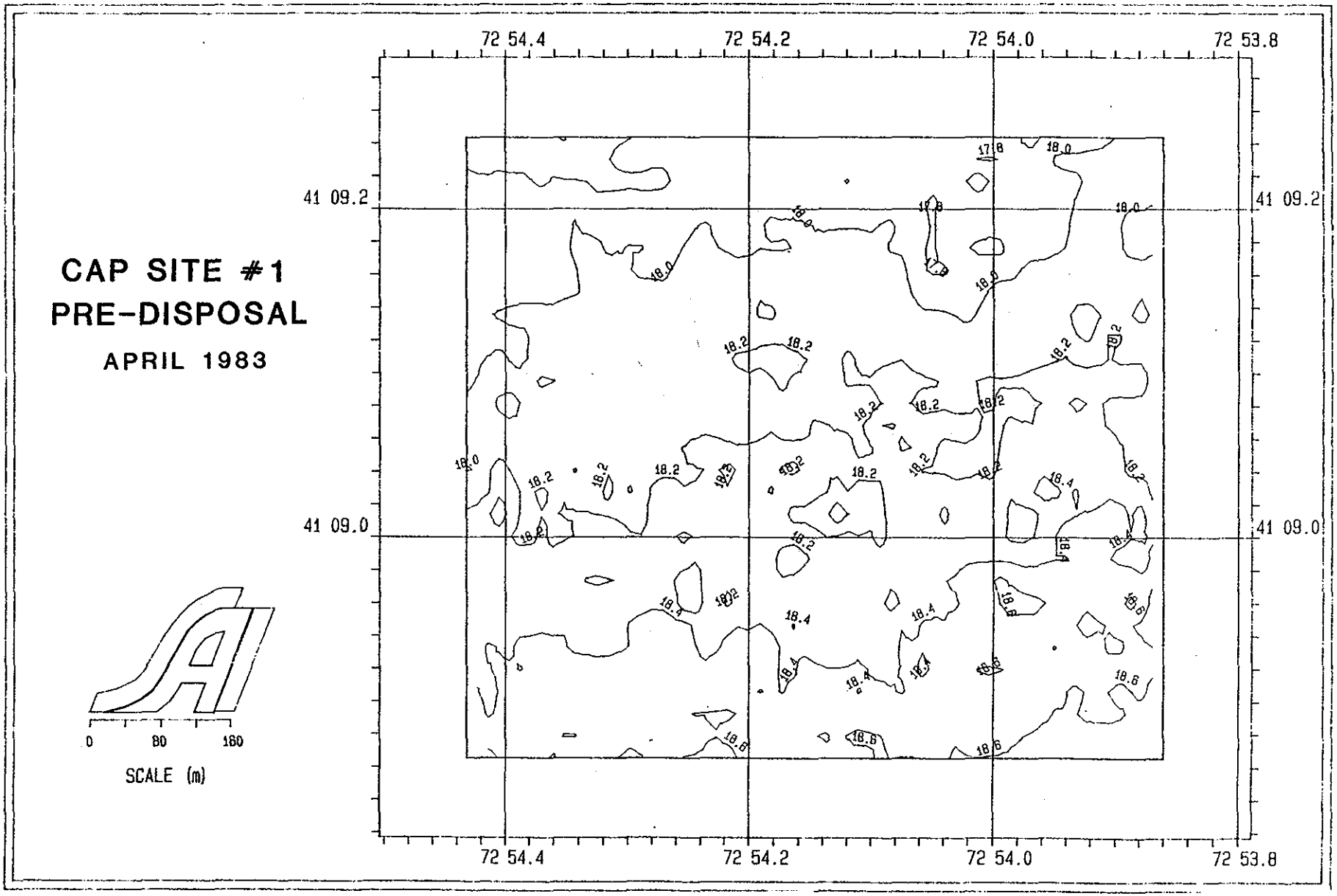
CAP SITE #1
PRE-DISPOSAL
APRIL 1983
72 54.4
72 54.2
72 54.0
72 53.8
41 09.2
41 09.0
0
80
160
SCALE (m)

Figure 3-1

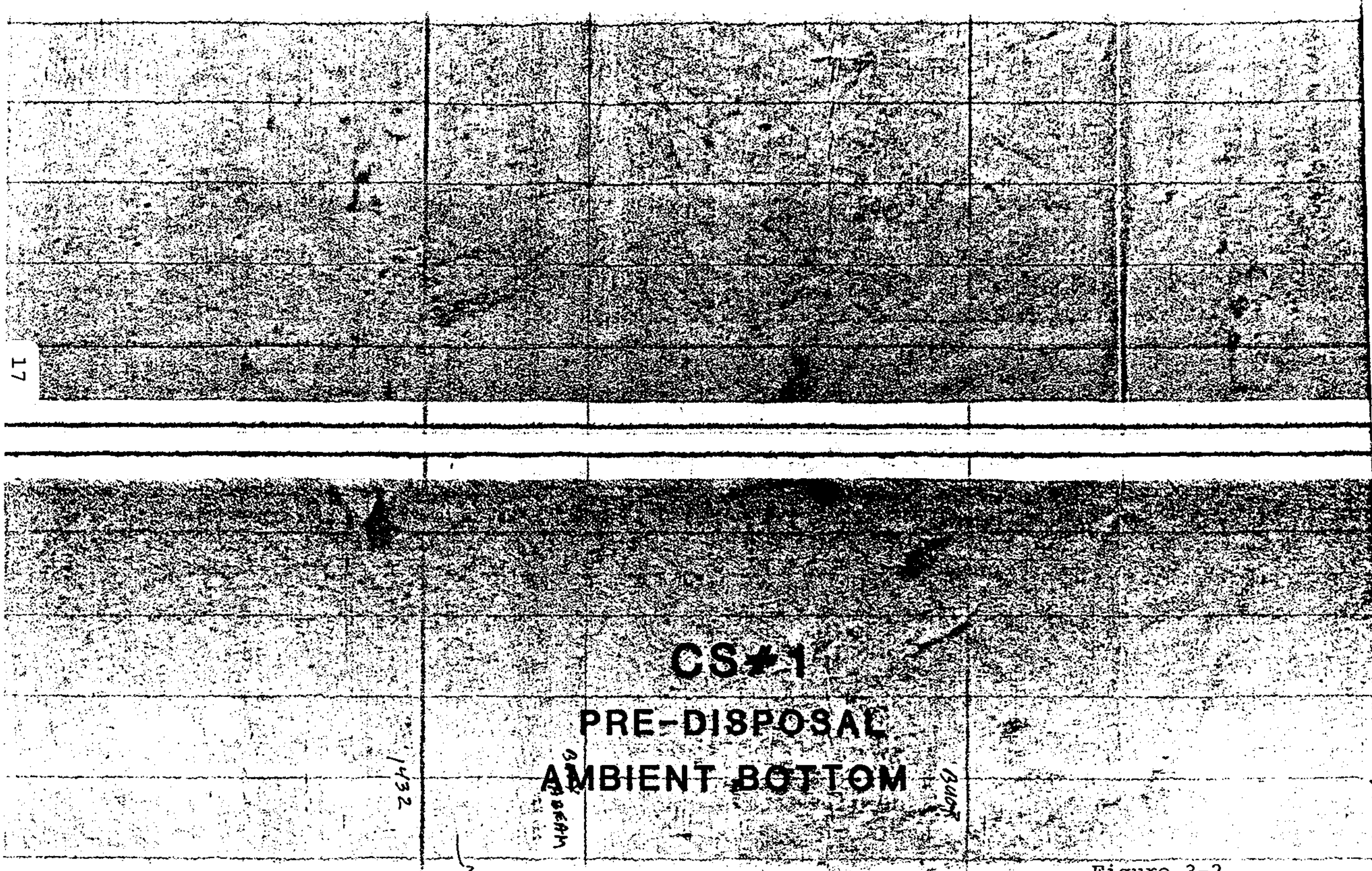

Figure 3-2

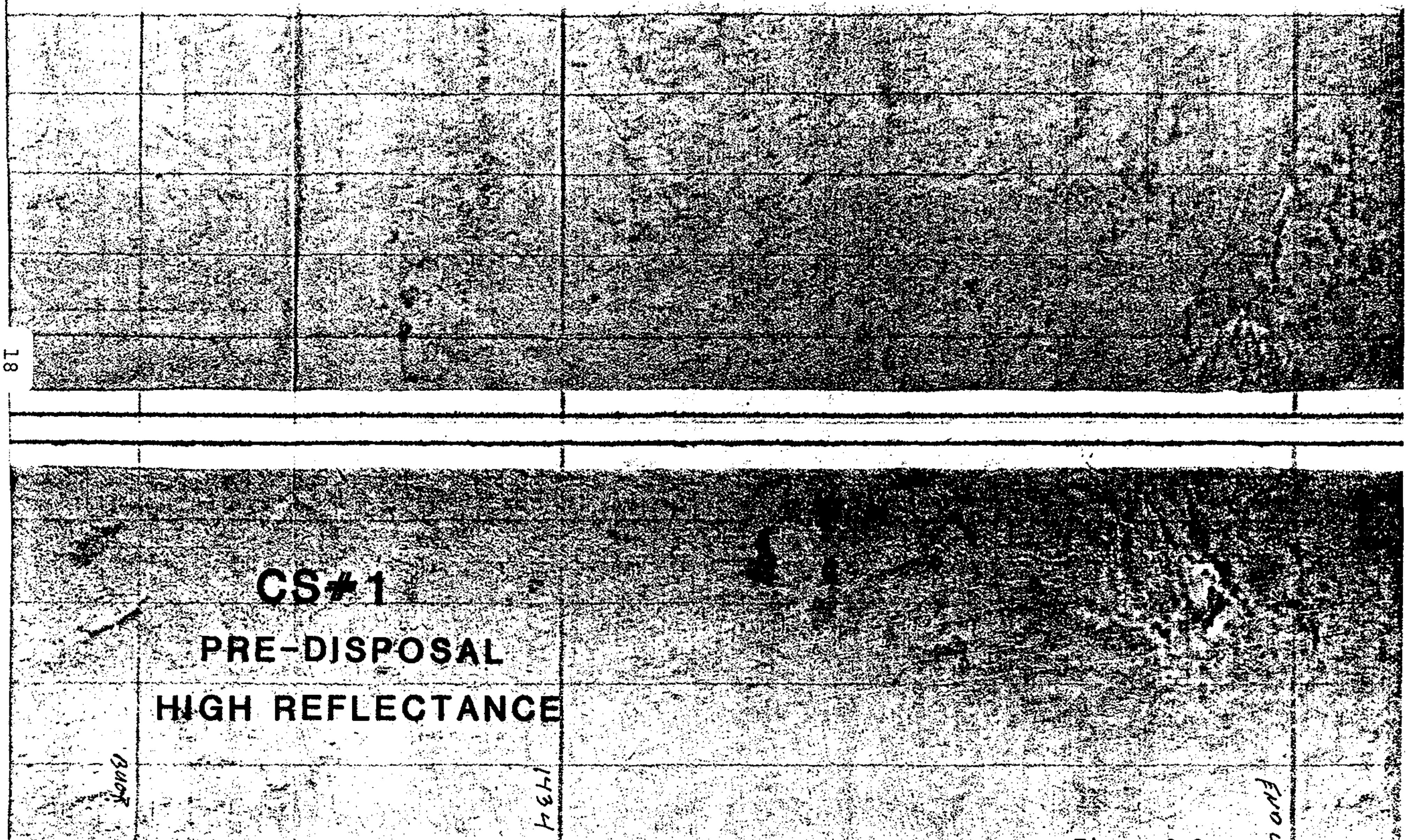

Figure 3-3

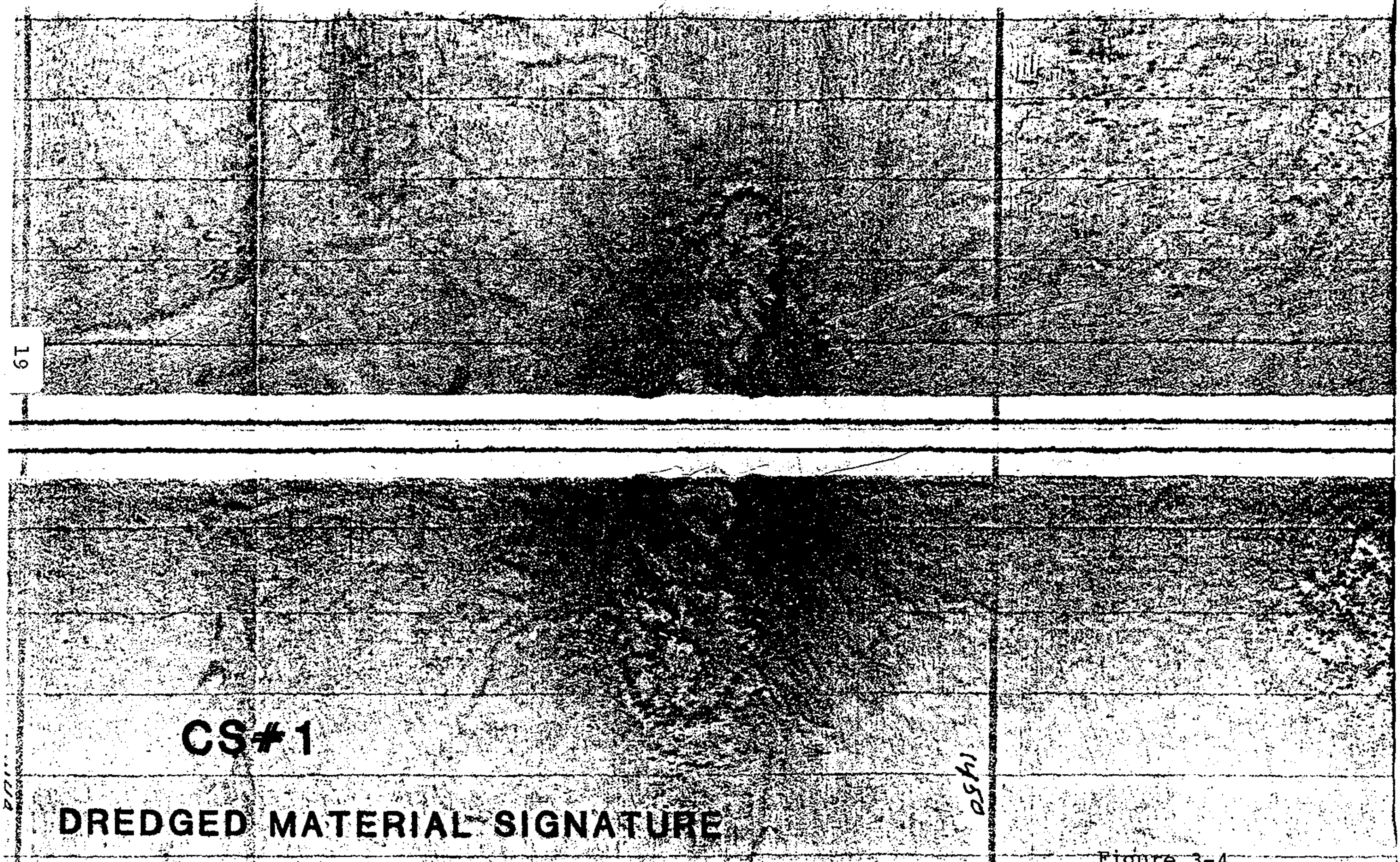

Figure 3-4

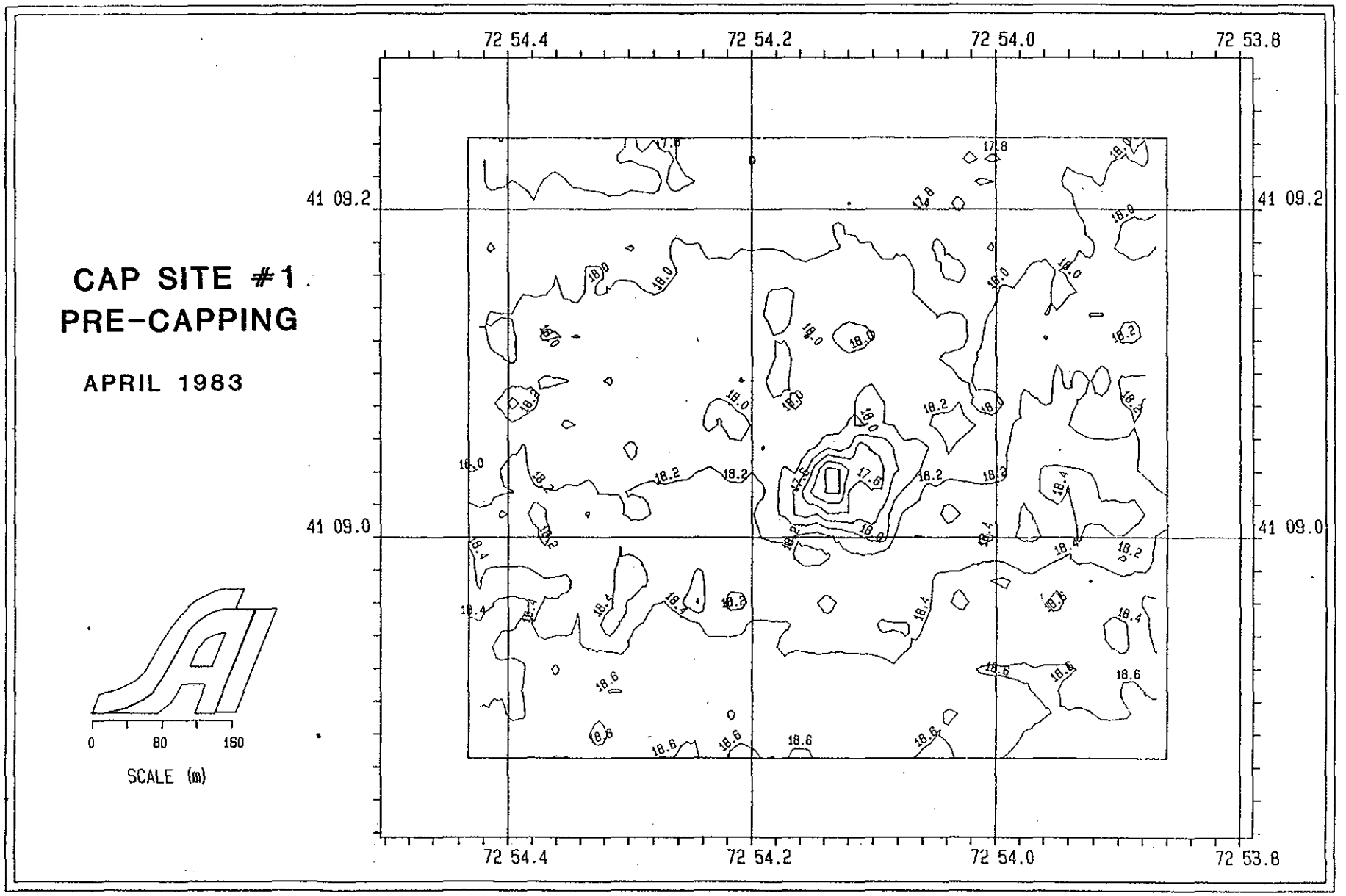
CAP SITE #1
PRE-CAPPING
APRIL 1983
72 54.4
72 54.2
72 54.0
72 53.8
41 09.2
41 09.0
0
80
160
SCALE (m)

Figure 3-5

Diver observations at this site showed the presence of cohesive dredge material at distances approaching 200m south of the bouy; however, some of this material may also have been the result of dumping at the MQR site which is immediately adjacent to CS 1. Attempts to deploy compaction stakes in natural bottom, which were long enough to penetrate and extend above the mound, appear to have failed. No stakes were found after completion of the disposal operation.

4. Cap Site 2

Cap Site 2 was established 700 m north of Cap site 1 to provide a site for capping with sand material. The baseline survey (Fig. 4-1) indicates a more complex topography than the CS1 site, but still maintains a slope with a depth difference of one meter from north to south across the site. A shoal area with a topographic relief of one meter is also present in the northeast corner of the site. Sediment samples in that area were a coarse sand, indicating the possible presence of previous disposal in the area.

An interim survey of the CS2 site (Fig. 4-2) was conducted on 28 April, 1983 and indicated the presence of an elliptical mound approximately 200 meters long in the east-west direction and 100 meters across in the north-south direction. Total elevation of the mound was generally less than one meter, and may reflect a lack of cohesion in sediments from the upper Black Rock Harbor area.

A side scan survey of the site taken on 11 May, 1983 revealed a bottom very similar to that observed at Cap Site 1,

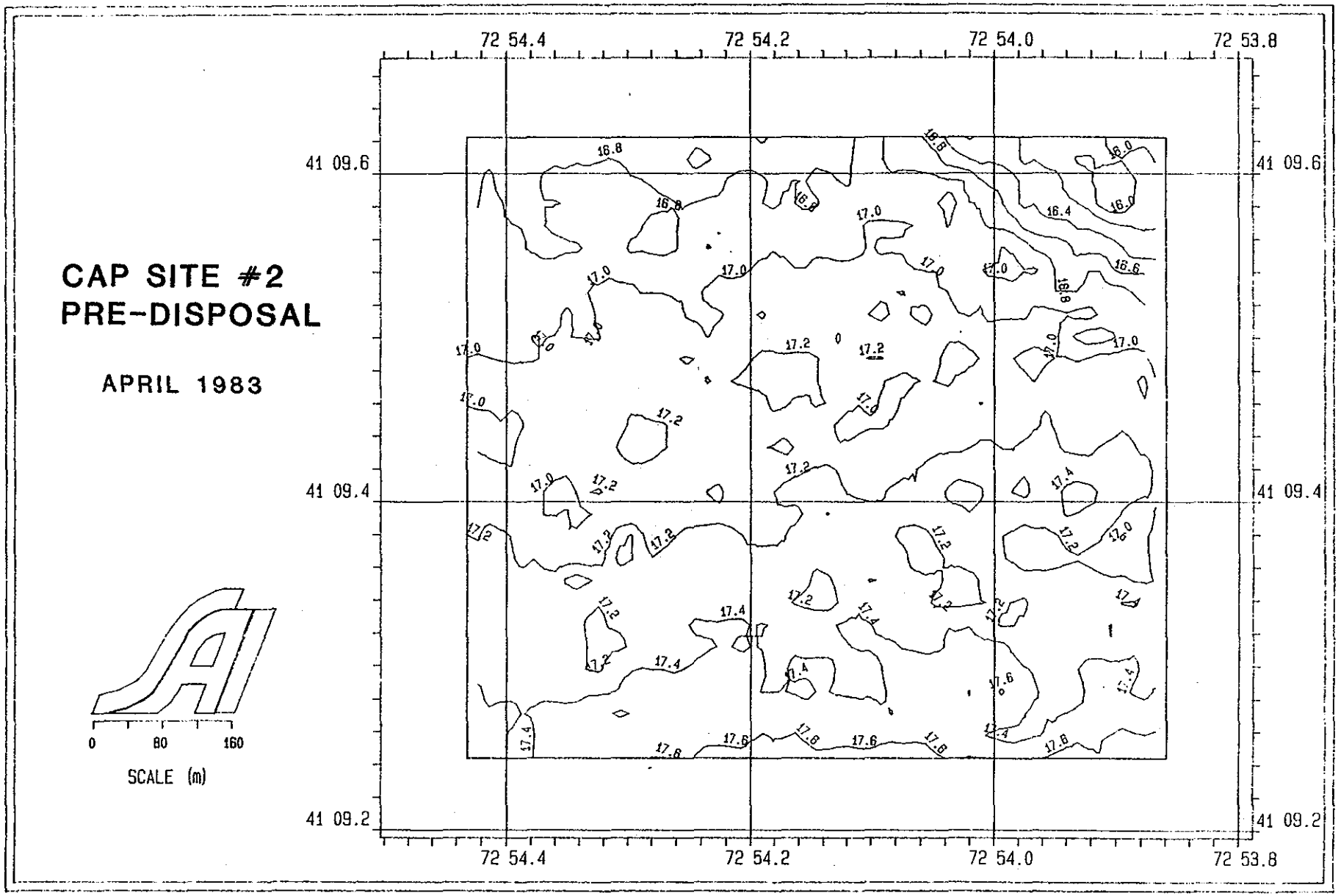
CAP SITE #2
PRE-DISPOSAL
APRIL 1983
72 54.4
72 54.2
72 54.0
72 53.8
41 09.6
41 09.4
41 09.2
0
80
160
SCALE (m)

Figure 4-1

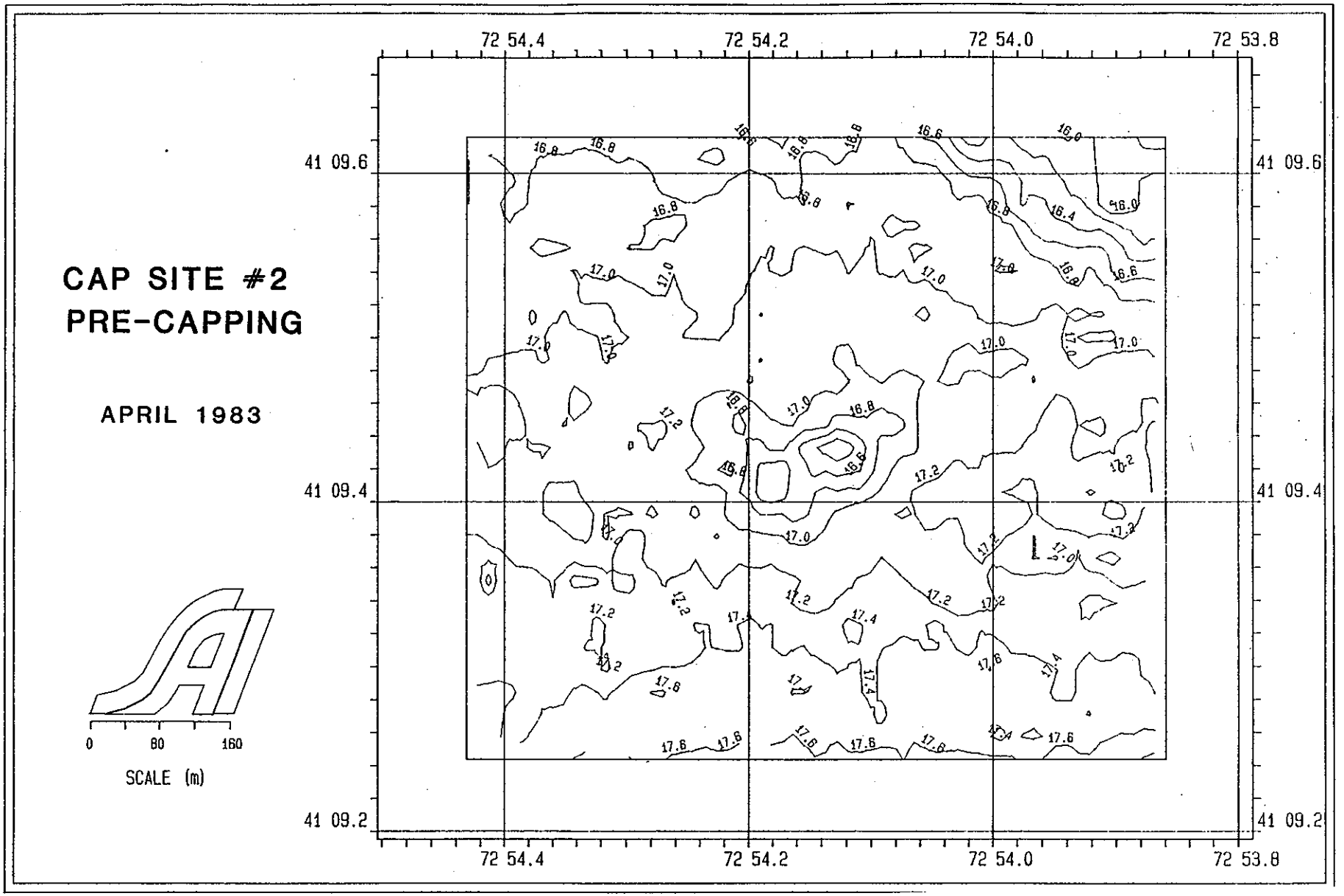
CAP SITE #2
PRE-CAPPING
APRIL 1983
72 54.4
72 54.2
72 54.0
72 53.8
41 09.6
41 09.4
41 09.2
0
80
160
SCALE (m)

Figure 4-2

but with more frequent high reflectance areas and complete high reflectance on the east and northeast margins.

In summary, Cap Site 2, while similar to the Cap Site 1 area on the baseline survey, may require special care in placement of the cap, since the material dumped at the buoy appears to have spread out over a larger portion of the bottom. A significant amount of material has been dumped since the interim survey was completed, and a Post-Disposal survey is planned for the near future to assess the results of the entire operation.

5. FVP

The disposal operation at the site selected for the Field Verification Program (FVP) has received the most attention of all the areas because of the large scope of the joint program between the Corps and EPA and because of the potential impact of dumping contaminated sediments from Black Rock Harbor at the CLIS site without subsequent capping procedures. Although most of the FVP program is oriented toward biological tests to assess impacts of disposal, the initial stages of the program do reflect an emphasis on determining the distribution and physical properties of the material at the site.

Several baseline surveys have been conducted at the FVP site and results have previously been reported in DAMOS Contribution #23, describing the Site Selection of the FVP Site. The last survey conducted prior to initial disposal operations took place on 10 December, 1980 and is shown in Figure 5-1. As discussed previously, the bottom at the site has a gentle slope

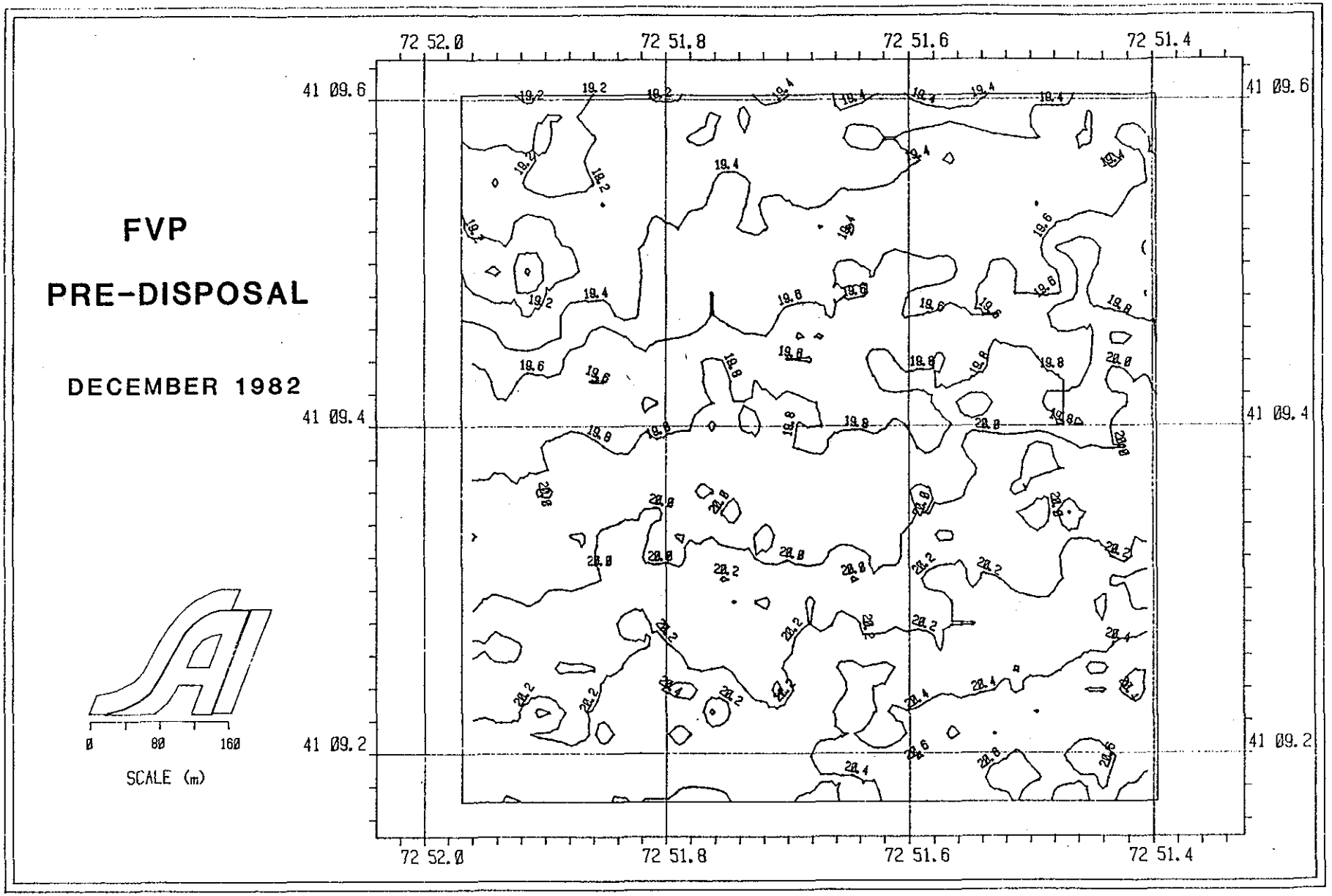
FVP
PRE-DISPOSAL
DECEMBER 1982
72 52.0
72 51.8
72 51.6
72 51.4
41 09.6
41 09.4
41 09.2
0
80
160
SCALE (m)

Figure 5-1

toward the south with a depth difference of one meter over the extent of the survey area.

A second side scan survey was conducted over the area on 26 April, 1983, which showed no change from previous surveys. The bottom at the site was generally a fine low reflectance silt with occasional concentrations of high reflectance zones, particularly toward the western margin of the site. The mud furrows discovered in earlier surveys oriented parallel to the direction of tidal flow were still present in the vicinity of the disposal buoy (Fig. 5-2) and to the south and east portions of the survey area.

On 28 April, 1983, an interim survey was conducted to assess the conditions of the site as the first loads of sediment were deposited. The results of this survey (Fig. 5-3) indicated that a small mound had formed in the vicinity of the disposal buoy and therefore, that additional disposal should create the desired mound.

A second interim bathymetric survey and associated side scan survey were conducted on 5 May, 1983, after disposal of approximately 35000 m^3 of dredged material had been completed. The results of this survey (Fig. 5-4) were also satisfactory as a small mound approximately 150 m in diameter had formed at the buoy with a topographic relief of more than one meter. Sediment samples taken at the same time revealed a covering of several centimeters thickness extending out to a range of 200 m on the east and slightly farther on the west side of the mound. This covering consisted of fine black organic silt with a high water content and low cohesiveness, which appeared to be quite fluid

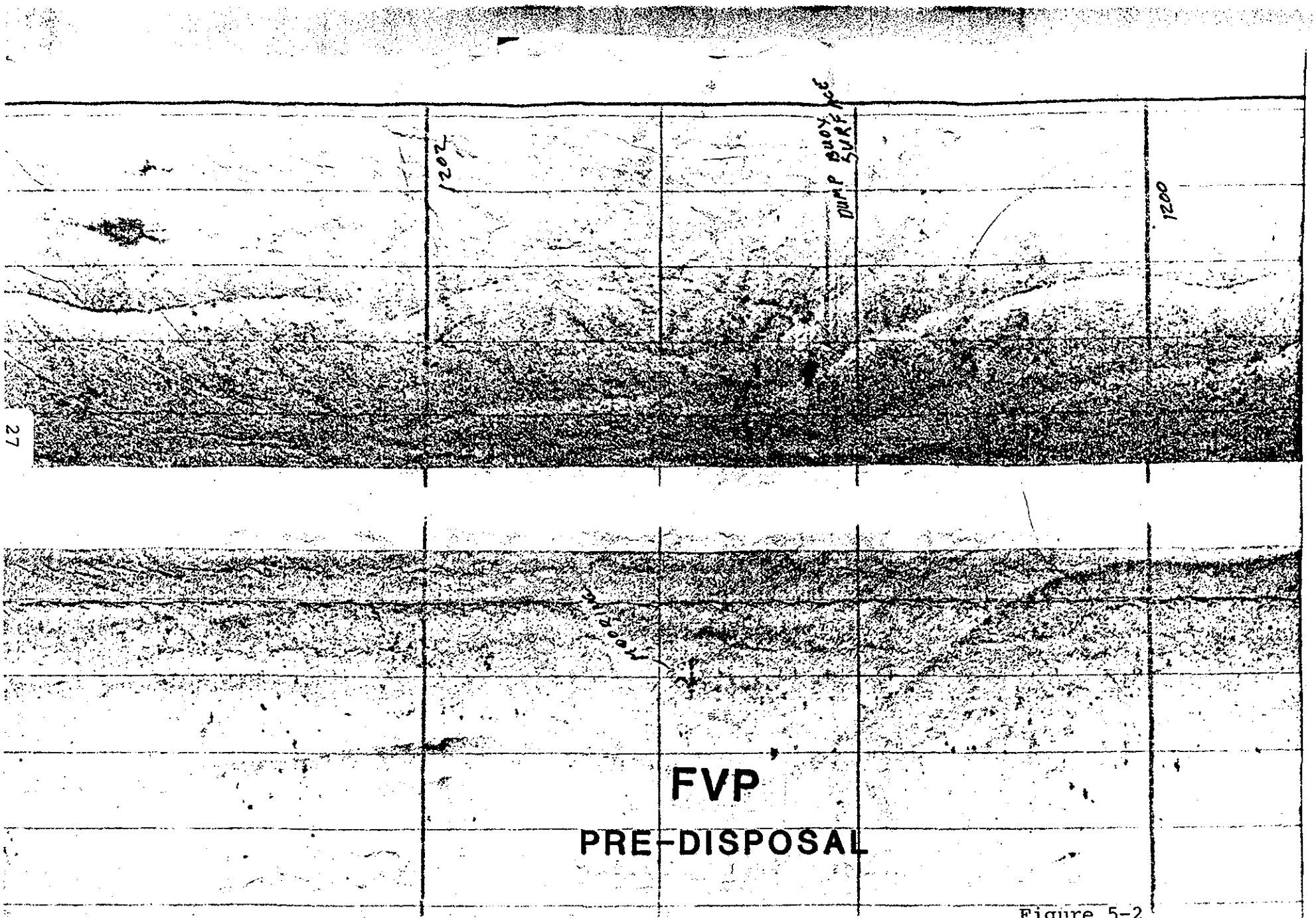

Figure 5-2

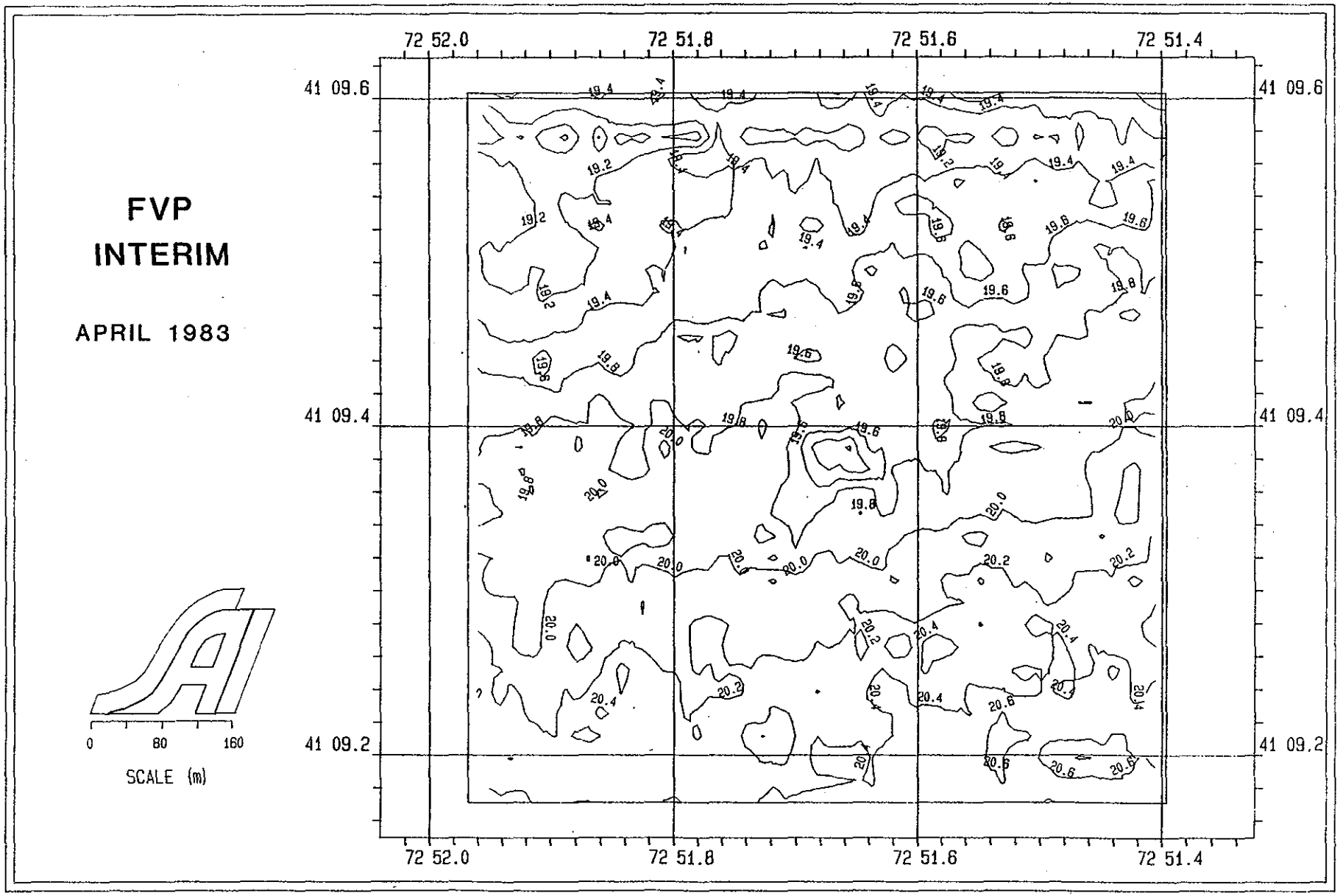
FVP
INTERIM
APRIL 1983
72 52.0
72 51.8
72 51.6
72 51.4
41 09.6
41 09.4
41 09.2
0
80
160
SCALE (m)

Figure 5-3

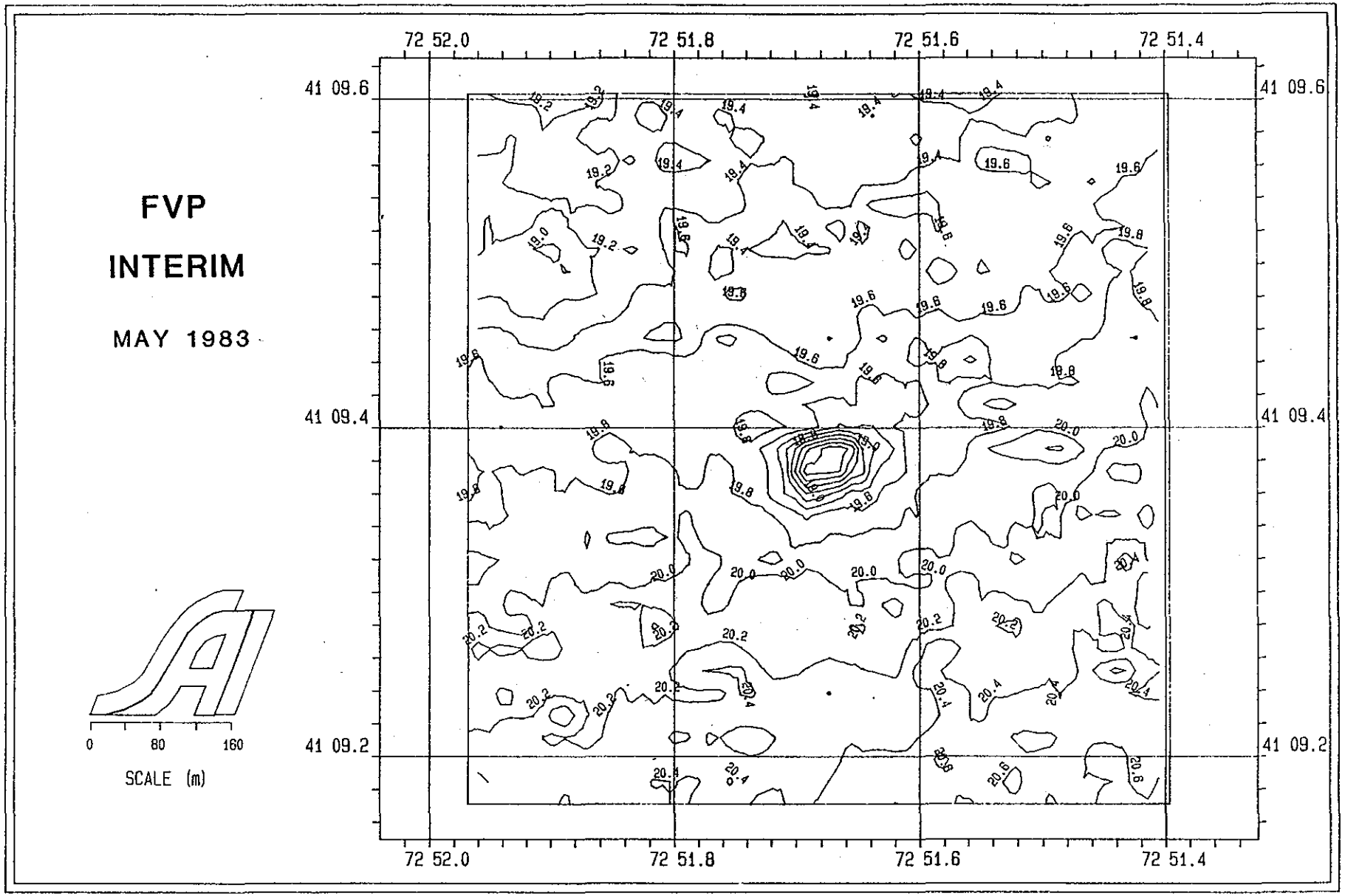
FVP
INTERIM
MAY 1983
72 52.0
72 51.8
72 51.6
72 51.4
41 09.6
41 09.4
41 09.2
0
80
160
SCALE (m)

Figure 5-4

and mixing with the natural fluff layer at the site.

The side scan survey conducted on the same day revealed some interesting results. The mound created by the disposal operation was conspicuous as a region of high reflectance superimposed on the natural mud furrows at the site (Figs. 5-5 - 5-6). An interesting feature is also shown in Figure 5-7 , which indicate an area of high reflectance created by leakage from the scow after disposal. The record shows the track of the scow as it left the disposal point heading south and then turning and proceeding west. This track probably reflects only the most recent dumping operation and apparently this material mixes with the natural sediment in a short time because only one track can be seen. However, this leakage does provide a mechanism for dispersion of some amount of contaminants even if the point dumping operation is successful.

Following completion of the FVP portion of Black Rock Harbor dredging, a Post Disposal Baseline survey was conducted on 19 May, 1983. This survey (Fig. 5-8) indicated that approximately 55,000 m^3 of material, measured by scow displacement, had formed a small elliptical mound slightly less than 200 meters in diameter and slightly more than two meters thick. Vertical profiles through the center of the mound (Fig. 5-9) support this observation. Problems with tracking the fathometer record by the on-board digitizer make the values on lane 18 invalid, however, post survey analysis of the analog record will provide correct data for future profiles and volume calculations.

Sediment samples taken after completion of the survey

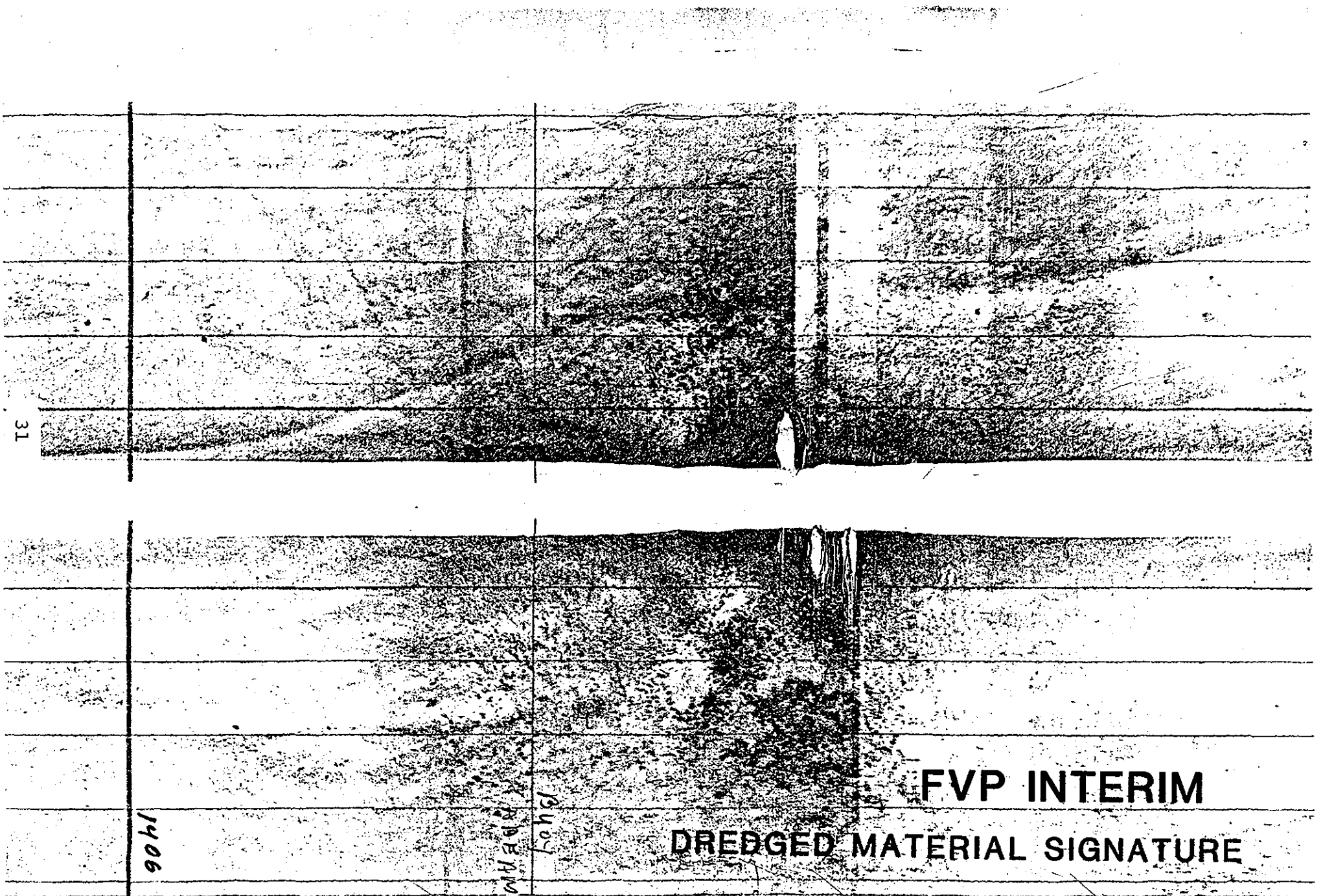

Figure 5-5

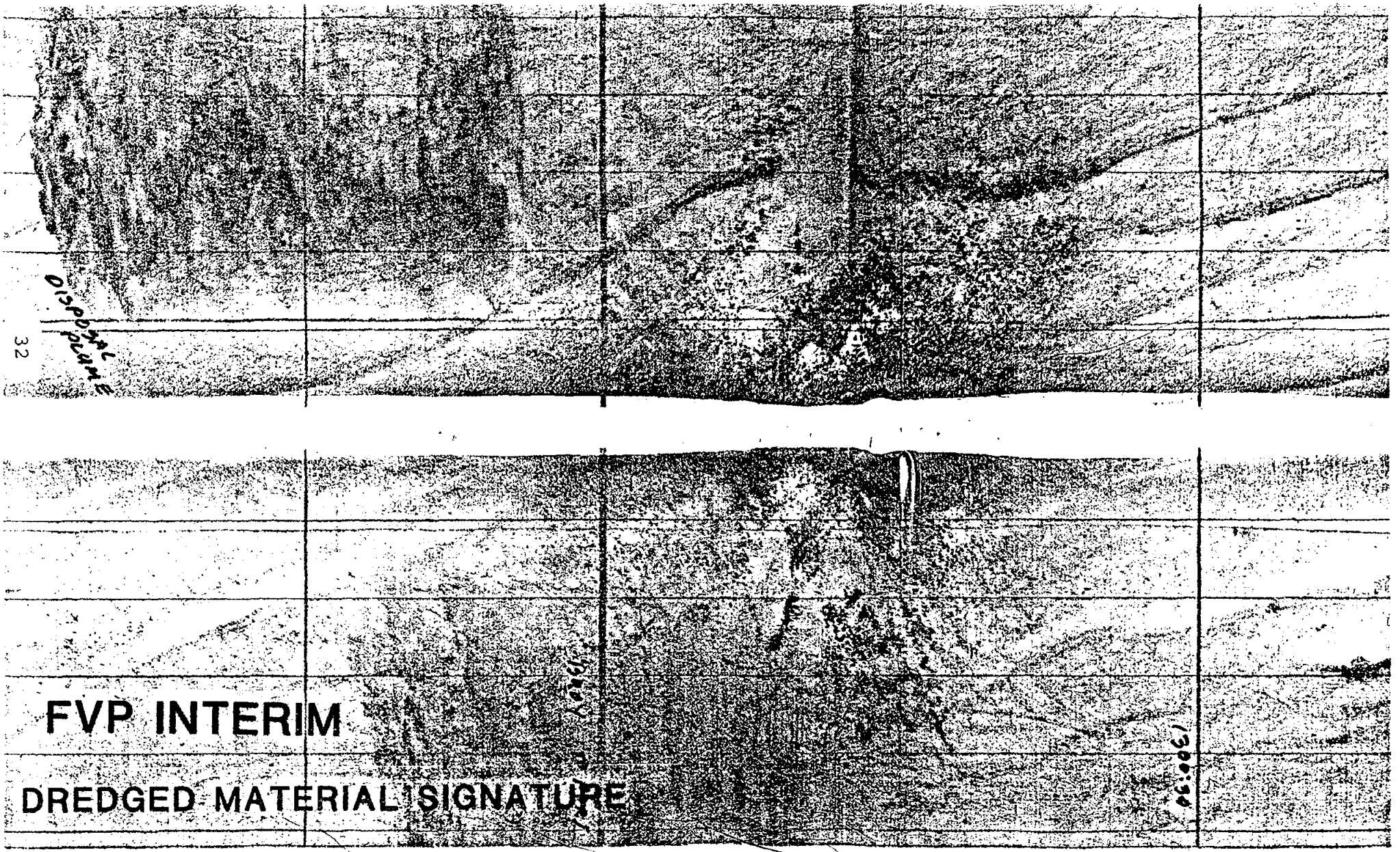

Figure 5-6

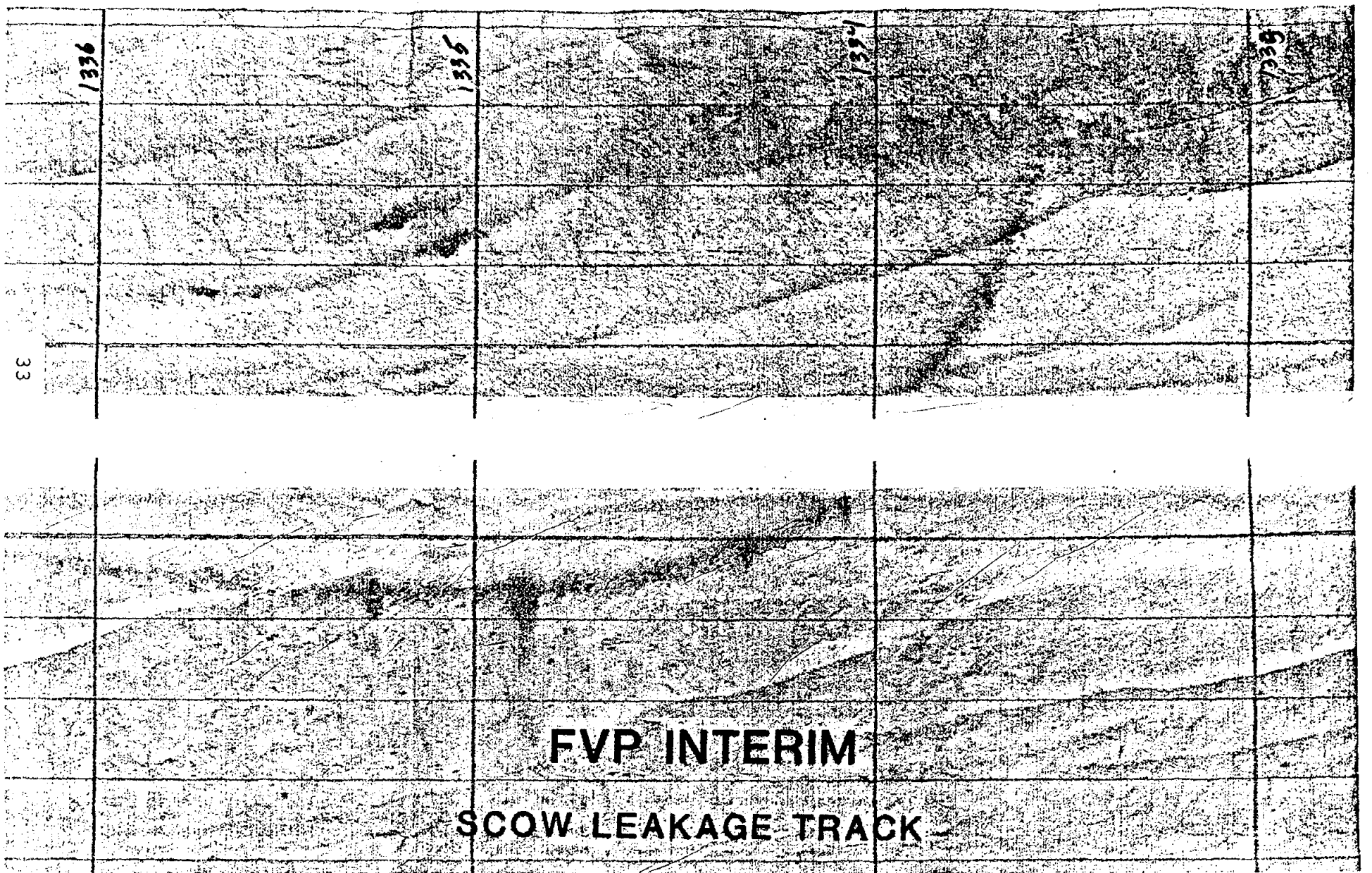

Figure 5-7

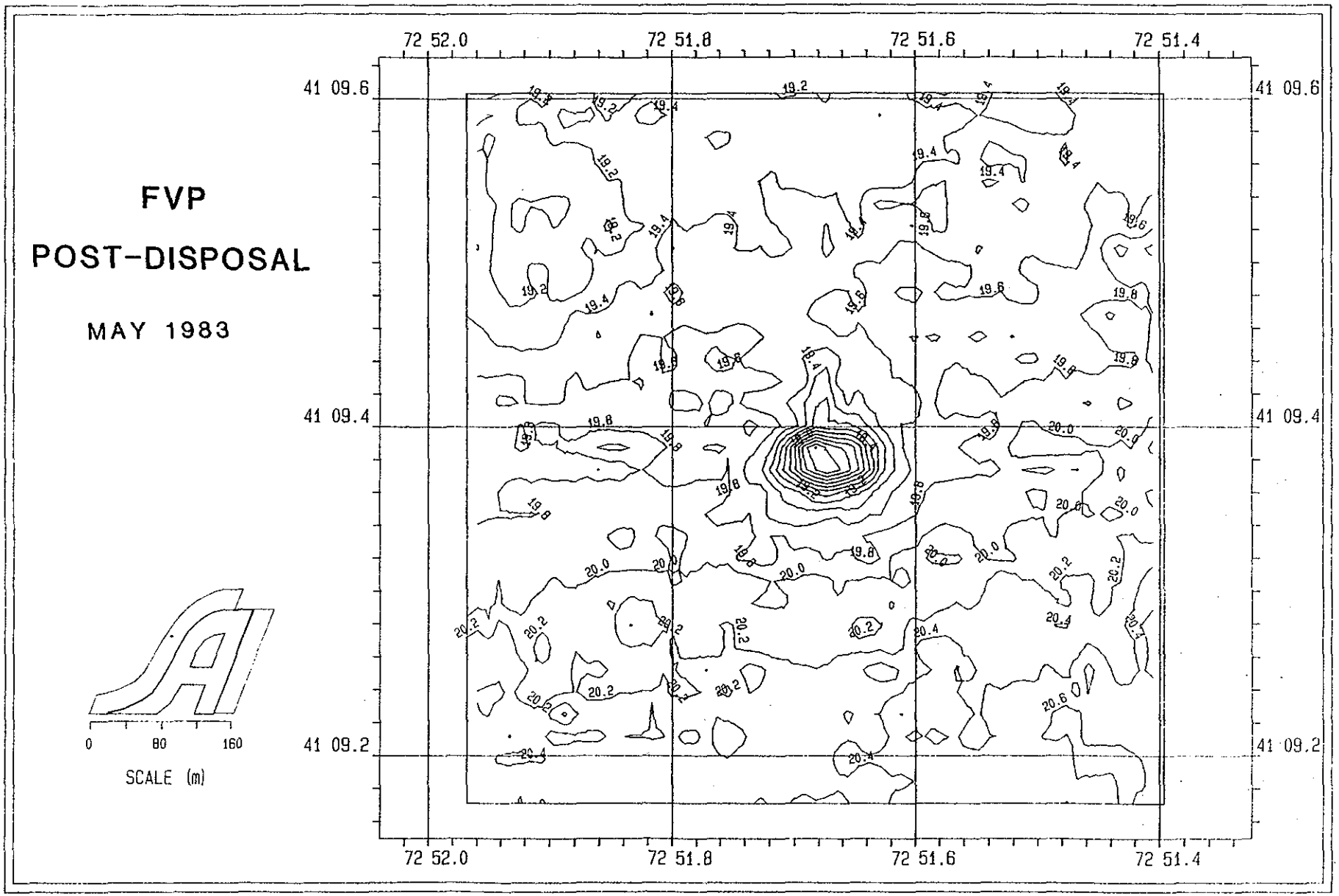
FVP
POST-DISPOSAL
MAY 1983
72 52.0
72 51.8
72 51.6
72 51.4
41 09.6
41 09.4
41 09.2
0
80
160
SCALE (m)

Figure 5-8

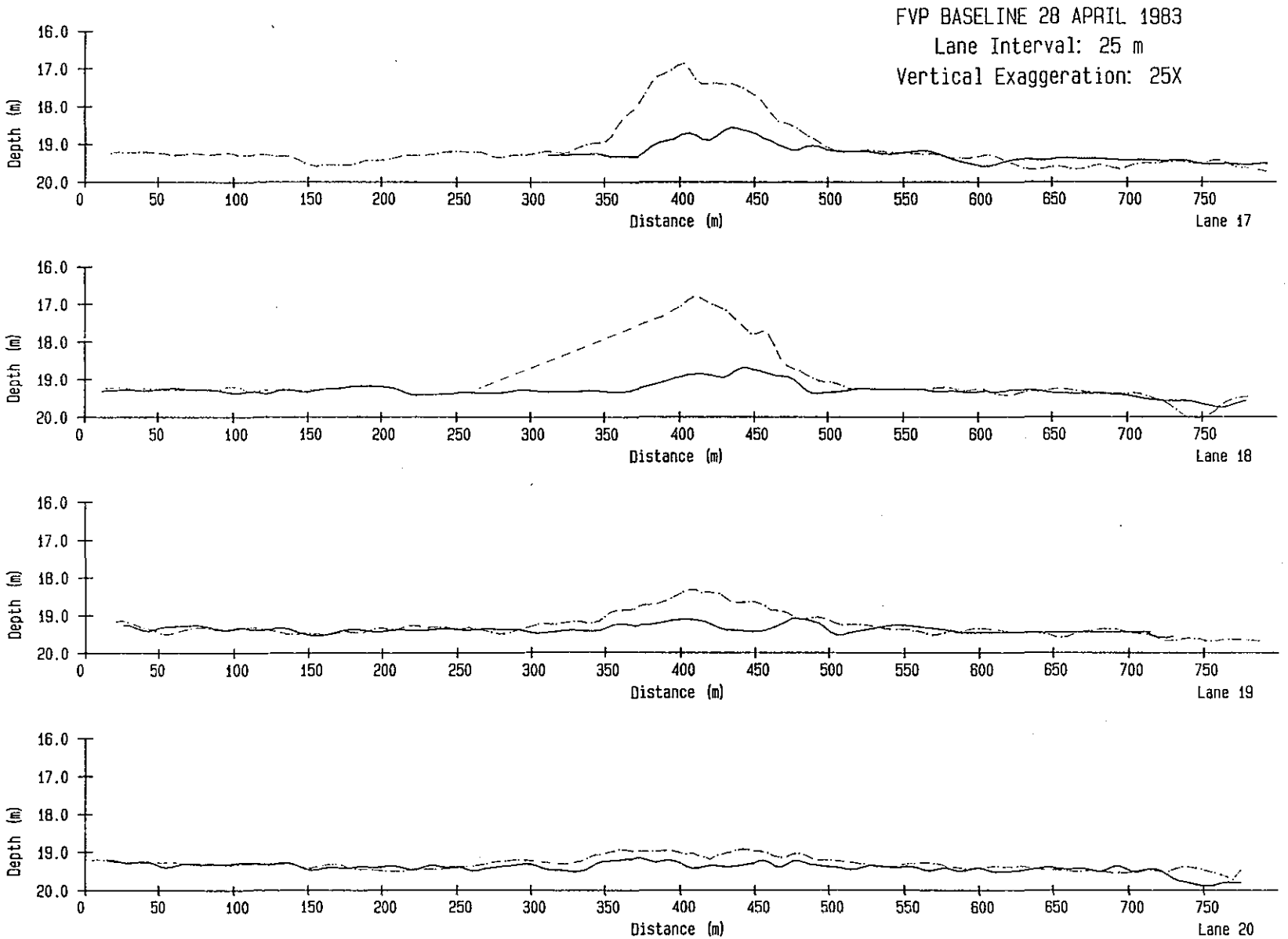
FVP BASELINE 28 APRIL 1983
Lane Interval: 25 m
Vertical Exaggeration: 25X
Depth (m)
16.0
17.0
18.0
19.0
20.0
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
Distance (m)
Lane 17
Lane 18
Lane 19
Lane 20

Figure 5-9

indicated the presence of Black Rock material to distances of less than 400 m in the north-south direction, just a trace at 400 m east, but substantial covering of material at 400w. At ranges less than 400 m the same black organic silt observed during the interim survey was present with varying thicknesses up to 5 cm at ranges of between 200 and 300 m.

Although the mussel cage buoys at the 1000 m E station were moved and there are indications that dredged material may have been dumped in that vicinity, it does not appear that any Black Rock material was deposited. The samples indicative of dredged material at 1000 m E are spotty and contain relatively coarse sediment which probably came from another dredging location.

In summary, the disposal operation at the FVP appears successful; however, the potential for movement of sediment does exist because of the high water content, fluid muds on the margins of the mound. Careful monitoring during the immediate post-disposal period is essential to assess the potential impact should this movement occur.