Capping Survey at the
New London Disposal Site
February 3, 1989

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CAPPING SURVEY AT THE NEW LONDON DISPOSAL SITE FEBRUARY 3, 1989

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1.0 INTRODUCTION

The New London Disposal Site covers a one square nautical mile area located approximately two nautical miles south of the mouth of the Thames River, Connecticut. This site, centered at latitude 41 16.1'N and longitude 72 04.6'W, has been monitored since 1977 by the New England Division (NED) of the Army Corps of Engineers. This study focuses on a subsection of the New London Disposal Site which received an estimated 13,000 cubic meters of contaminated dredged material (at buoy location 41 16.425'N and 72 04.320'W) from the Thames River Shipyard in October 1988. A precision bathymetric survey and a REMOTS® sediment profile survey were performed at this location after disposal of the contaminated material to document the distribution of dredged material. The results were used to develop a capping plan intended to provide complete coverage of the contaminated sediment with clean material (SAIC, 1988).

From October 1988 through January 1989, clean sediment was deposited at six disposal points over the observed distribution of contaminated dredged material (Table 1). The number of scow loads of cap material to be deposited at each disposal point was planned to achieve a desired cap thickness of 50-100 cm over the contaminated material. After completion of the capping operation, on February 3, 1989 a bathymetric survey was performed to delimit the distribution and thickness of capping material over the previously disposed contaminated dredged material. From the results of this survey, the capping operation and the potential need for additional cap material at the location were assessed.

2.0 METHODS

On February 3, 1989, a precision bathymetric survey was conducted at 25 m lane spacing over an 800 X 800 m area centered at the coordinates of the disposal buoy. The precision navigation required for the survey was provided by the SAIC Integrated Navigation and Data Acquisition System (INDAS). This system uses a Hewlett-Packard 9920 series computer to collect position, depth, time, and date information for subsequent analysis as well as for providing real-time navigation for the helmsman. Positions were determined to an accuracy of $\pm$ 3 m from ranges provided by a Del Norte Trisponder System. Shore stations for this system were established in Connecticut at known benchmarks at Millstone Point and New London Lighthouse. A detailed description of the navigation system and its operation can be found in DAMOS Contribution #60 (SAIC, 1989).

Depths were determined to a resolution of 3.0 cm (0.1 ft) using an Odum DF3200 Echotrac Survey Recorder with a narrow beam 208 kHz transducer. The speed of sound used in depth calculations was determined from water temperature and salinity data measured by an Applied Microsystems CTD probe, model STD-12. A complete description of this instrument and its operations are given in DAMOS Contribution #66 (SAIC, 1990). The speed of sound determined from CTD casts and the transducer depth were entered into the fathometer to adjust the depth values being transmitted to the computer. During analysis, raw bathymetric data were standardized to Mean Low Water by correcting for changes in tidal height occurring during the survey. A detailed discussion of the bathymetric analysis technique is given in DAMOS Contribution #60 (SAIC, 1989).

3.0 RESULTS

The contour plot from analysis of the 1989 bathymetric data revealed a highly variable topography of old disposal mounds resulting from dredged material disposed in previous years, as well as from cap material disposed at the buoy location (Figure 1). The clearly visible north-south contours running along the western border of the survey area delimited the eastern flanks of the old disposal mound NL-RELIC. The NL-III mound was seen along the southern border of the survey area. The western flanks of the NL-II mound were also shown on the eastern limits of the survey area. Changes in topography resulting from capping material deposition were indicated by comparison of this contour plot with the results of the October 1988 post-disposal survey (Figure 2).

Most of the capping material was evident in the area to the southeast of the buoy. At roughly 150 m south of the buoy, the cap layer showed a minimum depth of 14.8 m, in comparison to the 1988 minimum depth of 15.5 m at this location. Another topographic high of 15.6 m was detected 140 m southeast of the buoy in the 1989 contour plot, 0.6 m higher than the 16.2 m shown at this location in the 1988 contour plot. While this capping layer was relatively steep-sided in parts, it showed several isolated topographic highs. This reflected both the areal extent of the underlying disposal mound as well as a spatial variation in cap thickness ranging from 10 to 70 cm. It should be noted that in 1988 the western part of NL-II showed a minimum elevation of 15.5 m, whereas in 1989 the very western part of the mound showed a minimum elevation of 15.2 m. This indicated an extension of the cap layer to the edge of NL-II with a thickness of approximately 30 cm in this area.

To determine cap thickness a depth difference plot was prepared by subtracting the depth matrix of the October 1988 bathymetric survey from that of the February 1989 survey (Figure 3). The cap material clearly showed a roughly circular and continuous distribution varying in thickness from 10 to 80 cm. This depth difference comparison resulted in a calculation of 28,270 m^3 of cap material detected at the site. According to scow log records an estimated 59,517 m^3 of cap material was deposited between October 1988 and January 1989 (Table 2).

4.0 DISCUSSION AND CONCLUSIONS

The objective of the February 1989 bathymetric survey at the New London Disposal Site was to assess the distribution of capping material and verify coverage of the previously disposed contaminated dredged material. Changes in depth from 10 to 80 cm were determined by comparison of the bathymetric surveys from 1988 and 1989 (Figure 3). Several isolated topographic highs were identified in the distribution of cap material, indicating a notable variation in cap thickness. The areas of greater thickness within the cap layer probably represent disposal efforts to locate scows at the six recommended disposal points within the area.

Examination of the distribution of cap thickness in relation to the six recommended disposal points revealed that cap material was clearly deposited at points "D" and "E". These were the locations of the two thickest parts of the cap layer, having cap material accumulations of 80 cm (Figure 3). Cap thicknesses of 50 to 60 cm were also established to the southwest of these two disposal points. However, point "A" was intended to have received the most scow loads of cap material because of the contaminated dredged material thickness at this point (Table 1). The depth difference contour plot indicated only 20 cm of cap material here. At disposal points "B", "C", and "F" only 10 cm of cap material appeared to have been deposited (Figure 3).

The erratic topography of the cap layer generally reflects the spatial distribution of the recommended disposal points (Figure 3). However, detected cap thicknesses surrounding these locations suggests a consistent shift in cap material deposition to the southeast. The largest volumes of cap material were reportedly disposed of at points "A" and "B" (Table 2). However as already noted, the two thickest parts of the cap layer actually detected are located at points "D" and "E". These points are offset to the southeast of points "A" and "B". Similarly at point "F" little cap material was indicated in the depth difference contour (Figure 3), yet a localized cap layer of 40 cm was detected just south of this disposal point. Similar topographic highs in the cap material distribution were indicated south of disposal points "D" and "E" (Figure 3). This suggests that some offset was consistently affecting the positioning accuracy of cap material deposition during the capping operation. Most likely this was due to a consistent Loran error, resulting in the cap layer effectively covering the majority of the contaminated dredged material with the exception of the northern and western borders of its distribution.

Depth difference calculations from the pre- and post-disposal bathymetric surveys of contaminated material revealed the distribution of material requiring capping (Figure 4). The mapped distribution of dredged material indicated from the REMOTS® survey of this area conducted in October 1988 confirmed this distribution detected by bathymetric techniques, and extended it roughly 50 m to the south, east and west (SAIC, 1988). Superimposing this distribution of dredged material as detected by the REMOTS® survey of October 1988 over the cap distribution detected in 1989 again confirmed that most of the contaminated material did receive some cap material (dashed line, Figure 3). However, at disposal point "A", 70 cm of contaminated material apparently received only 20 to 30 cm of cap material (Figures 3 & 4). In addition, at disposal point "F" 10 to 20 cm of contaminated dredged material was apparently capped by only 10 cm of clean material based on the 1989 bathymetric depth difference plot (Figure 3).

The depth difference plot from the pre- and post-disposal bathymetric surveys of contaminated material indicated a small deposit located roughly 150 m southwest of the buoy (near point "C", Figure 4). Although this material fell outside the mapped distribution of dredged material verified by the 1988 REMOTS® survey, it was recommended that this deposit be capped in addition to the main disposal mound because of the substantial amount of material detected here in the depth difference comparison (SAIC, 1988). This location should have been covered by scow loads of cap material deposited at point "C". However, the 1989-1988 depth difference plot indicated little or no cap material at this location. It should be noted that bathymetric surveys are limited in their ability to detect thin layers of sediment typical of disposal mound flank deposits. Thus, it is likely that the actual borders of the cap layer extend further than indicated in the bathymetric depth difference contour plot, covering locations such as disposal point "C". However it is unlikely that such flank layers would be thicker than the minimum change in depth detectable by bathymetric techniques (10 cm).

It appears that additional capping material is required at certain locations along the northern and western borders of the disposal mound. It is recommended that additional material be deposited at locations "A", "B", "C", and "F" in order to cover the contaminated material with a sufficiently thick layer of clean material (between 50 to 100 cm). However, because of discrepancies between the recommended disposal point locations and the actual distribution of cap material detected, it is recommended that greater navigational control be employed during disposal of this additional cap material. This could be achieved through either the use of better navigational systems (e.g., shore-based microwave), or the temporary deployment of a disposal buoy at each of the locations requiring additional capping material.

5.0 REFERENCES

SAIC. 1989. Monitoring Cruise at the New London Disposal Site, July 1986. U.S. Army Corps of Engineers, New England Division, Waltham, MA. DAMOS Contribution #60 (SAIC Report # SAIC-86/7540&C60).

SAIC. 1988. Bathymetry and REMOTS® Surveys at the New London Disposal Site, October 1988. (SAIC Report # SAIC-88/7547&215).

SAIC. 1990. Monitoring Cruise at the New London Disposal Site, July 1987. U.S. Army Corps of Engineers, New England Division, Waltham, MA. DAMOS Contribution #66 (SAIC Report # SAIC-88/7511&C66).

TABLE 1

Proposed Capping Plan for the Thames River Shipyard Disposal Project

Station	# Scow Loads	Latitude	Longitude	LORAN-C Xray	LORAN-C Yankee
A	13	41° 16.423	72° 04.270	26133.0	43976.5
B	12	41° 16.416	72° 04.176	26132.2	43976.3
C	7	41° 16.359	72° 04.373	26133.8	43976.2
D	6	41° 16.378	72° 04.235	26132.6	43976.1
E	6	41° 16.385	72° 04.137	26131.7	43976.0
F	6	41° 16.416	72° 04.325	26133.5	43976.5

TABLE 2

Actual Capping Operation For the Thames River Shipyard Disposal Project Completed January 23, 1989

Station	# Scow Loads	Total Volume Disposed According to Scow Logs (M^3)
A	16	20,579
B	14	12,087
C	9	7,765
D	8	6,655
E	10	6,655
F	10	5,776

Total Volume Disposed According to Scow Logs - **59,517m^3**

Total Volume Detected in Bathymetric Depth Difference Calculation - **28,270m^3**

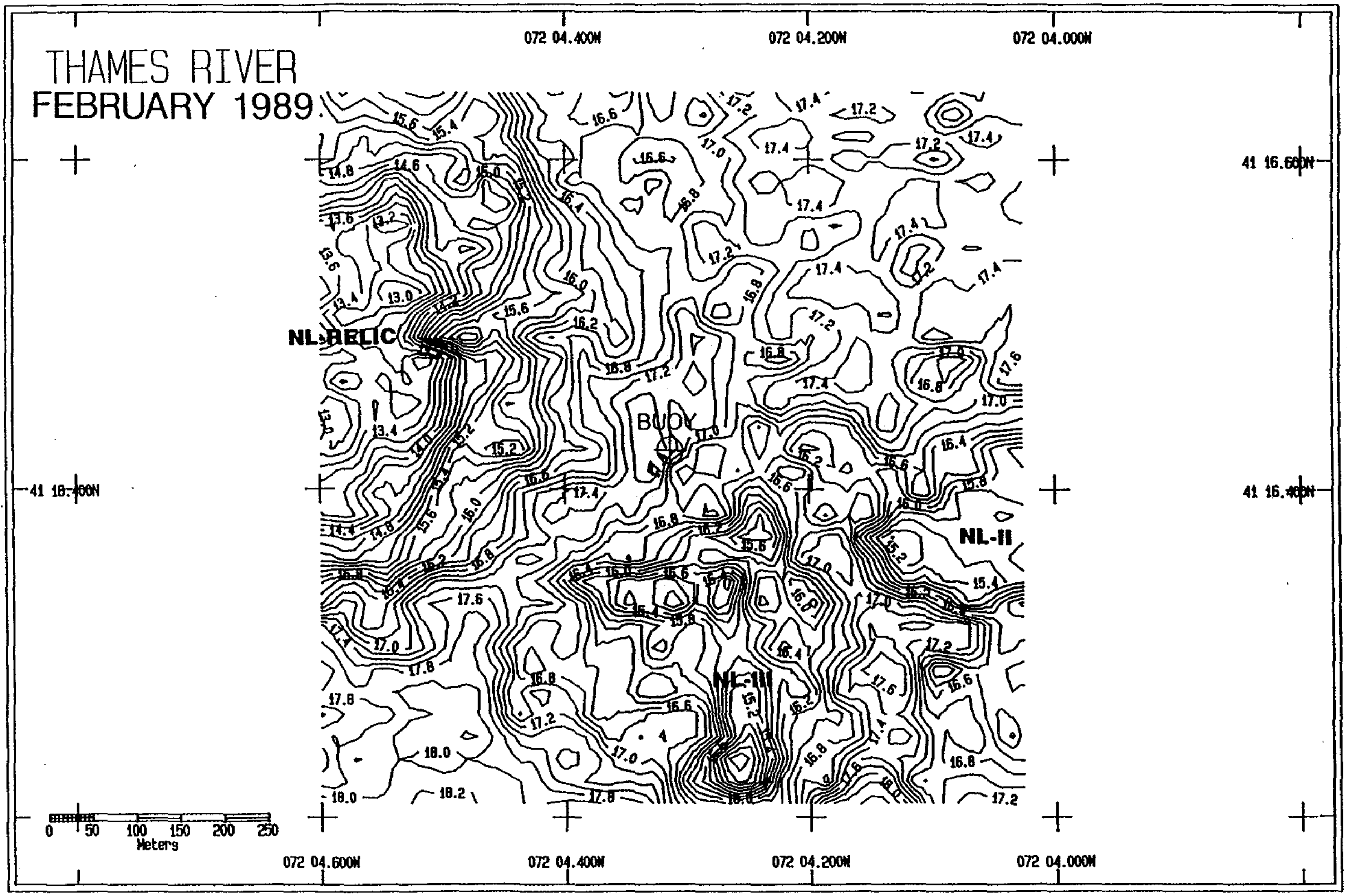

Figure 1 Post-capping bathymetric contour plot of the Thames River Shipyard Disposal Location, February 1989. Contours at 0.2 m intervals.

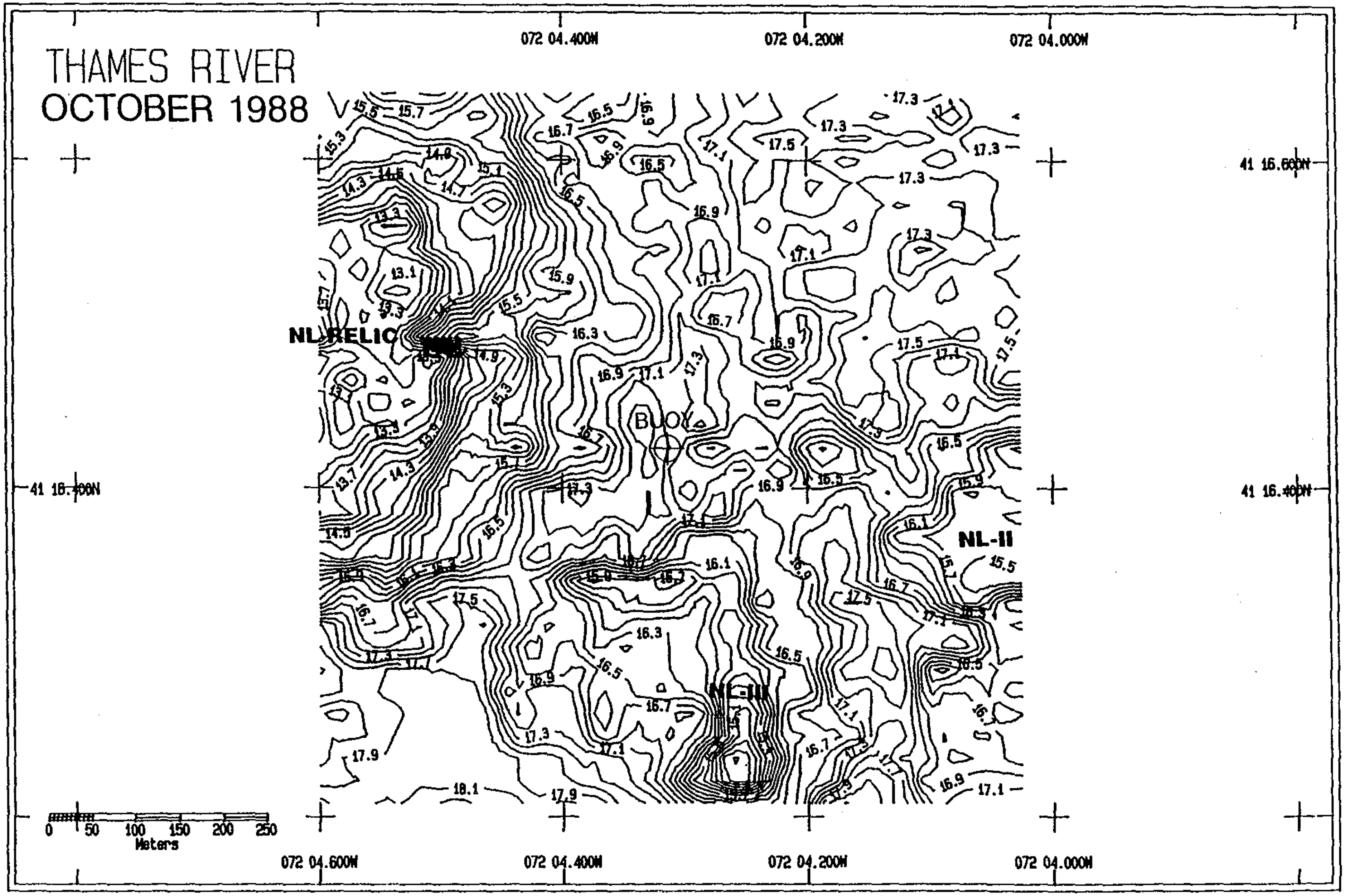

Figure 2 Post-disposal bathymetric contour plot of the Thames River Shipyard Disposal Location, October 1988. Contours at 0.2 m intervals.

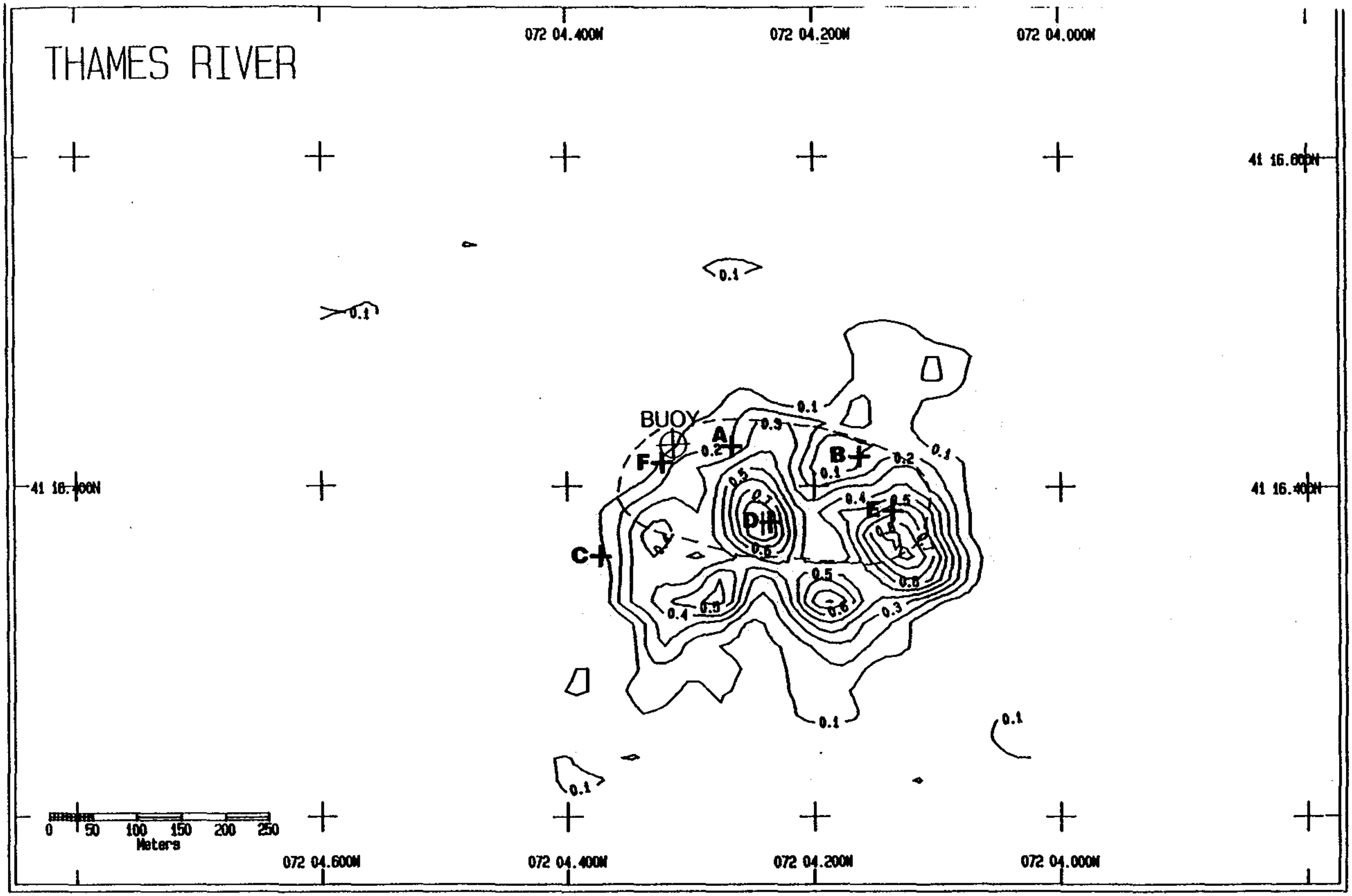

Figure 3 Depth difference contour plot of the Thames River Shipyard Disposal Location, showing the distribution of cap material, February 1989 - October 1988. The dashed contour line indicates the mapped distribution of contaminated dredged material as detected by the REMOTS survey of October 1988. Points "A" - "F" are the disposal point locations recommended in the Thames River Shipyard capping plan (SAIC, 1988).

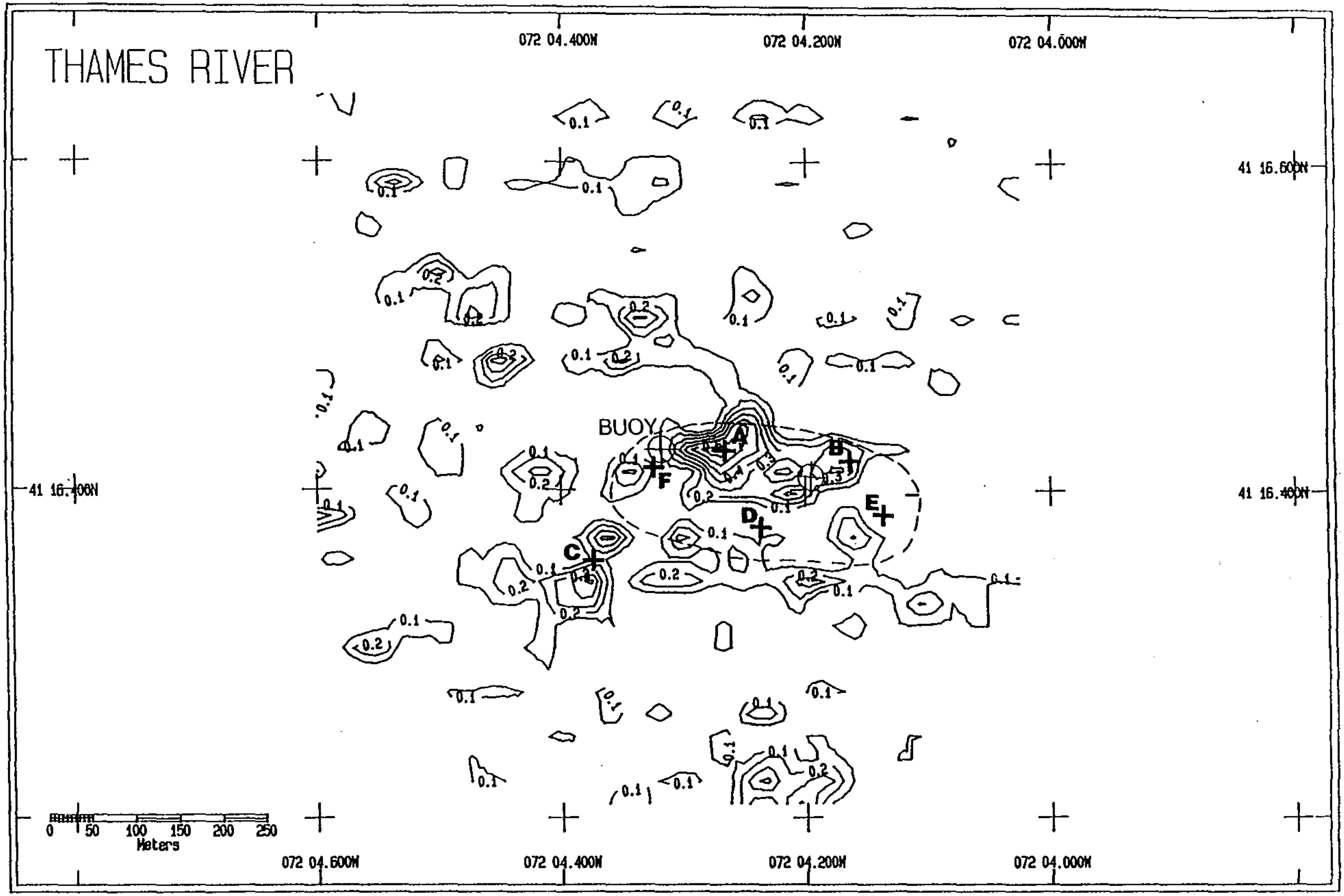

Figure 4 Depth difference contour plot of the Thames River Shipyard Disposal Location, showing the distribution of contaminated dredged material, October - August 1988. The dashed contour line indicates the mapped distribution of contaminated dredged material as detected by the REMOTS survey of October 1988. Points "A" - "F" are the disposal point locations recommended in the Thames River Shipyard capping plan (SAIC, 1988).