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From: RICH CAVAGNERO
To: remedy review board
Date: 7/10/96 9:42am
Subject: New Bedford Harbor NPL Site - Region I

MEMORANDUM

DATE : July 10, 1996

SUBJ : New Bedford Harbor NPL Site

FROM : Richard Cavagnero, Chief, Technical and Support Branch
Office of Site Remediation and Restoration - Region I

TO : Remedy Review Board

You should have all received or will shortly receive an information package via either pouch mail or express mail sent on July 9th. If you don't get it, please call or LAN me and I'll try to track it down or send out another one.

Attached are three memos providing information in advance of the August consideration of this site by the Board. The first is a memo highlighting the major remedy selection issues as Region I views them. The next two are two WP versions of the actual information package (minus the maps, figures, etc.) prepared by RPM Dave Dickerson. I also plan to add this to Lotus Notes later this week.

There will likely be some minor, supplemental material sent out in a week or two, but I believe Dave's write-up covers the background pretty thoroughly.

Please feel free to call, LAN, or Lotus Notes any questions you have in advance of the conference call.

My number is (617) 573-9641. Dave Dickerson's number is (617) 573-5735
THANX

CC: , RTPMAINHUB.WPXGATE.HURD-MICHAEL, RTPMAINHUB.WPXGAT...

MEMORANDUM

DATE : July 9, 1996

SUBJ : New Bedford Harbor NPL Site - Major Issues/Context

FROM : Richard Cavagnero, Chief, Technical and Support Branch
Office of Site Remediation and Restoration - Region I

TO : Remedy Review Board

The following is a short summary of the major issues as Region I sees them.

1. This Site was listed on the NPL as the State of Massachusetts' highest priority and it remains the Region's highest priority NPL Site.

2. The tentative decision before you is the result of a very lengthy and intensive, professionally facilitated Community Advisory Group (CAG) process to work with the Agency in the development of its cleanup proposal **before** the public release of a preferred alternative. It was conducted under Region I's Community Empowerment Superfund Reform Initiative and as part of the national Administrative Reforms.

The intent of this CAG process was to avoid a repeat of the operable unit 1 Hot Spot incineration ROD implementation setback in which the community, two years after ROD signing, reversed its support for the remedy at the 11th hour (the project was out to bid and a contract had actually been awarded). This resulted in a decision by EPA to reconsider the incineration portion of the hot spot remedy (the hot spots have since been dredged and are currently being stored in a Confined Disposal Facility (CDF) awaiting an amended ROD decision on their ultimate fate). By developing this cleanup decision in tandem with the CAG and with the Congressional delegation, EPA has worked to build broad community and Congressional support for the cleanup approach outlined herein.

The CAG process recently culminated in a Memorandum Of Agreement between EPA and all of the external stakeholders, including the MA DEP, the Federal and State natural resource trustees, the Mayor and City Council of New Bedford, representatives of the other Cities and Towns abutting the Harbor, various State elected officials, and members of three community advisory groups, in which all parties agreed to the conceptual remedy of dredging and CDF disposal presented herein. The final agreement will be transmitted shortly pending receipt of all signature pages. Thus, the Region has in a sense already negotiated this proposed remedy with the community, including our Congressional delegation. The time is very ripe for the Region to go forward with the proposed plan while we are arguably at the zenith of public support for the Agency's cleanup efforts.

3. New Bedford Harbor is Region I's most sensitive NPL site from an Environmental Justice perspective. The community is largely poor and minority (Portuguese, African/American). The local economy based on commercial fishing and lobstering has been devastated by the closing of shellfish beds and other fishing bans as a result of the severe Harbor contamination in addition to the closing of George's Bank due to overfishing. In addition, the nature of the population significantly impacts the human health risk assessment in that community consumption patterns of fish and shellfish, and thus ingestion of contaminants via biota, is (or was) much greater than that for a typical sports fisherman scenario.

4. The Region believes that the cost estimates for the proposed remedy, as well as for the other alternatives, are much better than normal at this point in the process due to the fact that the Region has just completed the Hot Spot dredging/CDF project and learned a great deal about the actual costs of ambient air monitoring, dredging production rates/downtime, CDF construction costs, etc.

5. The Region concluded early on that the volume of sediments that would require remediation to allow attainment of the ambient water quality criterion (AWQC) for PCBs soon after remediation was astronomical and that we would need to develop alternative levels that could be practicably achieved and allow for attainment of the AWQC within a "reasonable" period of time. Lacking any Agency guidance or NCP discussion of what would be a reasonable timeframe, the Region looked at 10 years to achieve substantial risk reduction, a timeframe considered reasonable for groundwater restoration in the NCP. We also believed that these volumes precluded any serious consideration of sediment treatment rather than containment (waters from the dredging will be treated prior to discharge). The major thrust of the CAG effort was to convince the community to accept this premise of a containment remedy and to get their concurrence on the CDF locations.

Thus, the primary issue for the Region was what cleanup level was reasonable and achievable, knowing that "complete" remediation was unachievable. This issue is complicated by the fact that the need for remedial action is driven by both ecological risk and human health risk, with neither outweighing the other as a driving force. Another complicating factor is the fact that much of the contamination is located in a very sensitive and productive salt marsh; the need to dredge this area and the extent of dredging had to be balanced against the need to preserve this area and thus minimize the short term disruption from any dredging operation. EPA worked extensively with NOAA and DOI and with the State trustees to arrive at cleanup levlels to balance these concerns. (Note: NOAA has been the lead for Trustee issues at this site.)

(END)
DND 7/15/96

I. Background

The 18,000 acre New Bedford Harbor site is an urban tidal estuary contaminated with PCBs, a class B2 probable human carcinogen, and heavy metals, most notably cadmium, copper and lead. Two electronics industries in the area used PCBs in their manufacturing processes from the 1940s to the 1970s. These facilities discharged PCB-containing waste into the harbor either directly or via the City's antiquated sewerage system (especially from combined sewer overflows). Direct PCB discharges from these facilities have been eliminated due to subsequent enforcement actions. In 1979, due to elevated PCB levels in harbor finfish, shellfish and lobster above FDA criteria, the state Department of Public Health placed restrictions on lobstering and fishing within the site (see Figure 1). The site was proposed for addition to the NPL in 1982, and it was finalized on the NPL in 1983.

Remedial dredging and shoreline disposal of the PCB-contaminated sediment was first proposed by EPA in the mid-1980s. Due to concerns about sediment resuspension and disposal facility leakage, however, EPA and the Army Corps of Engineers initiated a series of engineering and pilot studies to investigate the effectiveness of various dredging and disposal techniques. These studies concluded that cutterhead dredging was a protective method of dredging, and that worst-case leakage rates from unlined shoreline disposal facilities would be insignificant (see additional leakage discussion in Section V.B below).

In 1990, the first or "hot spot" ROD (ROD 1) for the site was issued which called for the dredging and treatment of sediments with greater than 4,000 ppm PCBs. This 4,000 ppm threshold was selected since it represented a maximum impact for minimal effort scenario: almost half of the total mass of site PCBs would be removed by dredging less than 5 acres. Maximum reported PCB concentrations for these hot spot areas were in the 100,000 to 200,000 ppm (10 to 20%) range, and the selected treatment method was on-site incineration. At about the mobilization stage, however, a reversal in public support for incineration - from the congressional level, local government and citizen groups - forced us to abandon incineration as a viable treatment approach for this site. This heated controversy spawned the initiation of a professionally mediated community Forum process as an attempt to find common ground with the local community. The Forum group has met regularly since December 1993 and is comprised of a wide variety of site stakeholders including citizen group leaders, local and state elected officials, and representatives from the NRD trustee agencies, the state DEP and EPA.

Through the Forum process we were able to convince the community that, at a minimum, removal of the hot spot sediments from the river made sense. Dredging of these 14,000 cubic yards of sediment was performed from April 1994 to September 1995. These sediments are being temporarily stored at a shoreline facility near the Coggeshall Street bridge (see Figure 2) while treatability studies on potential alternative technologies are pursued. ROD 1 will have to be amended upon completion of these studies to finalize the ultimate treatment approach. Remedial action costs to date including current treatability studies for these sediments total about $30 million.

The proposed remedy discussed herein for the second ROD (ROD 2) will cover the entire upper and lower harbor areas of the site, as well as two small contaminated areas just south of the hurricane barrier (see Figures 2 and 3). Since the hot spot dredging left residual PCB levels around 4,000 ppm, these areas will be addressed again as part of ROD 2. A third and final ROD (ROD 3) for the entire but less-contaminated outer harbor area will be issued once additional characterization of this area is completed. A time frame for this characterization and decision-making for ROD 3 has not yet been established.

Cost recovery litigation for the site concluded in 1992 with three cash-out type consent decrees totaling $99.6 million, $20 million of which was allocated for natural resource damages. Depending on the degree of ecological protectiveness of ROD 3, an additional $10 million may be allocated to natural resource damages. The "special account" set up strictly for remedial activities currently contains approximately $56 million (not counting interest), of which on the order of $10-$15 million will be required for treatment and closure of ROD 1.

II. Site Characteristics and Risks

New Bedford Harbor is a partially mixed estuary with low fresh water inflows. The harbor has a long history of industrialization, including whaling, textiles, and metal finishing, and is home to one of the country's largest commercial fishing fleets. The City of New Bedford with a population of approximately 100,000 lies on the western shore of the harbor, while the more residential, semi-rural Towns of Acushnet and Fairhaven lie on the eastern shore (see Figure 4).

Heavy metal and PCB sediment contamination generally follows a decreasing gradient from north to south, though the gradient for PCBs is much steeper than for metals (see Figures 5, 6, 7 and 8). Current maximum PCB concentrations in sediment are in the 4,000 ppm range since this was the definitional threshold and post-dredging residual level for the hot spot areas. Although sedimentation of 2-3 cm annually occurs within the harbor, a net seaward PCB flux of approximately 0.23 kg (0.5 lb) per day continues in the water column at the Coggeshall Street bridge. PCBs have bioaccumulated and biomagnified within the marine food chain to levels above both the FDA seafood consumption threshold of 2 ppm and a site-specific consumption threshold of 0.02 ppm. These criteria differ because the FDA criteria is based on national patterns of seafood consumption, and the site-specific criteria is based on aboveaverage local consumption rates.

The human health risks of most significance posed by the site are from ingestion of PCB-contaminated seafood and from direct contact with PCB-contaminated sediments. As noted earlier, the degree of seafood contamination at the site prompted the Mass. Dept. of Public Health in 1979 to place various fishing restrictions on 18,000 acres of otherwise productive fishing grounds (see Figure 1). Table 1 lists lifetime carcinogenic risks for seafood, which range from 2.4 in 10,000 (for clams once a month) to 1 in 700 (for daily lobster with tomally included). This table also lists the tissue PCB levels used to determine these risks, which range from 0.23 to 2.3 ppm. Note that this table understates site risks to the extent that the tissue data used are from the outer harbor area. Using lifetime probable exposure scenarios (e.g., not including tomally), Table 2 lists the site's total carcinogenic and non-carcinogenic health risks: The carcinogenic risks range from 4.9 in 10,000 to 3.7 in 1,000, and the non-carcinogenic Hazard Indices range from 1.83 to 20.57. Note that the risk numbers from Area 4 on Table 2 are not included here since this Area is actually south of the site boundary. Also note that Area 1 corresponds geographically to the areas covered by ROD 2, so that the risks from this operable unit are at the upper end of this range spectrum.

Ecological risks were primarily evaluated using a joint probability analysis, which compared the probability of PCB exposure to the probability that PCBs at different concentrations would be toxic to a specific specie. This analysis was supplemented by site-specific sediment toxicity tests, benthic species richness data, and comparison of PCB levels in the harbor to EPA water quality standards. Overall, the PCB concentrations in sediment and sediment pore water were found to be highly toxic to at least some members of all major taxonomic groups, and PCBs were highly suspected of damaging the harbor's integrity as an integrated, functioning ecosystem. Some ecological risks due to exposure to metals were also identified, but were considered negligible compared to the risk from PCBs. For comparison, water column PCB levels at Coggeshall Street are typically one to two orders of magnitude above the chronic ambient water quality standard (AWQC) for protection of marine fish of 0.03 ug/l. Note that the PCB AWQC for protection of human health through fish consumption (at a 10^{-6} risk level) is three orders of magnitude LOWER than this 0.03 ug/l level.

III. <u>Development of Cleanup Levels</u>

The development of cleanup levels for the harbor included an assessment of the cleanup goals required to remedy both the ecological and human health risks discussed above. In summary, residual sediment PCB levels that were judged to be protective of the marine ecosystem were one to two orders of magnitude lower than those judged to be protective of human health. PCB levels that would be acceptable from an ecological standpoint ranged from 0.1 to 1 ppm, while the level representing a 10^{-5} dermal contact carcinogenic risk was calculated to be 10 ppm. The 10^{-5} risk level was used since the state MCP, an identified ARAR, uses this standard as an acceptable total site risk level. (Since food chain modelling indicates that it will take ten years or more for PCB levels in seafood to decrease to the FDA level, the human health discussion in this section focuses on dermal contact and incidental ingestion risks only. Issues associated with the fishing ban and contaminated seafood consumption risks are discussed in more detail in section VI.D.)

Unfortunately the widespread level of PCB contamination in the harbor ruled out a 1 ppm cleanup level for a variety of reasons. The areal extent of the upper and lower harbor contaminated at 1 ppm or above is about 1000 acres, and the volume of sediments contaminated at or above this level is a staggering 2.1 million cubic yards or more. The installation and preservation of a shallow underwater cap for this large of an area was considered highly unreliable and extremely damaging to the various harbor habitats, especially the large saltmarsh on the eastern shore of the Acushnet River (see Figure 4). Similarly, for a dredging-based remedy, the limited amount of suitably located land (or for that matter water) available for disposal of this enormous volume of sediments, combined with the many other competing interests for land or water use, presented insurmountable implementability problems. One example of these competing interests is the need for a non-open water disposal solution for the 1 million cy of less-contaminated shipping channel sediments. A dredging-type remedy using a 1 ppm cleanup level would also destroy the valuable harbor wetlands as well. As a result, more realistic cleanup levels of 10, 50 and 500 ppm were evaluated.

The evaluation of a 10 ppm cleanup level, however, also pointed to serious difficulties in terms of the areal extent and volume of sediments contaminated at this level. Remediation at 10 ppm PCBs throughout the upper and lower harbor would entail approximately 926,000 cy of sediment spread over a 400 acre area. Though not quite as severe as with a 1 ppm cleanup level, the implementation issues associated with a 10 ppm level would nevertheless be of the same, highly problematic nature. If this 10 ppm sediment cleanup level could be implemented, hydrodynamic modeling predicted that the chronic PCB AWQC of 0.03 ug/l would be met throughout the site within ten years after the completion of dredging.

A 50 ppm harbor-wide cleanup level on the other hand would involve significantly less sediments, about 350,000 cy. The risks to human health from dermal contact with 50 ppm PCB sediments would range from $1x10^{-5}$ for adults to $5x10^{-5}$ for young children. In contrast to the 10 ppm level, however, the hydrodynamic model predicted that only the outer harbor and the southern most third of the lower harbor would attain the chronic PCB AWQC ten years after the completion of dredging.

For the 500 ppm scenario, the model predicted very little difference between it and the no-action alternative. At the ten year mark of a 500 ppm cleanup, the model estimated that only those areas 1200 feet south of the hurricane barrier and beyond would attain the chronic PCB water quality standard.

Eventually, after conferring with the natural resource trustees and others, a hybrid approach was developed which called for a 10 ppm cleanup level in the upper harbor proper, a 50 ppm level in the upper harbor saltmarshes, and a 50 ppm level in the lower harbor. This approach, which would include the two small areas just south of the hurricane barrier near the Cornell-Dubilier plant (see Figures 1 and 3), would entail about 600,000 cy of contaminated sediment spread over about 180 acres. The hybrid approach addresses the implementability considerations discussed above, as well as current and future water use issues since most of the lower harbor (but not the upper harbor) is a state-designated port area. As such, the commercial nature of the lower harbor is expected to continue indefinitely, with a commensurate degree of water quality degradation regardless of PCB contamination.

IV. Our Preferred Alternative

The proposed remedy essentially consists of a dredging and containment approach using the hybrid cleanup levels discussed above, combined with physical/chemical treatment of decanted seawater. Sediments above the target cleanup levels would be dredged and disposed in four CDFs on the western shore of the harbor (see Figure 3). These CDFs would also offer the potential for beneficial reuse as greenways or commercial marine facilities, depending on their location. Figures 4 (a photo) and 9 (a photosimulation) show before and after depictions of the upper harbor CDFs, respectively. Off-site disposal of the dredged sediment was ruled out due to the CERCLA and NCP provisions favoring on-site remedies, the lack of existing TSCA or RCRA disposal facilities in New England, and the lack of state acceptance and permitting for new offsite disposal facilities.

More specifically, for the upper harbor portion of the site (north of the Coggeshall Street bridge) the remedy would entail:

- construction of CDFs A, B and C in contaminated areas for containment of dredged sediments. The placement of these CDFs avoids the need to dredge the underlying 95,000 cy of contaminated sediment. The side walls of these CDFs would be lined, but not the bottoms, since in-situ sediment permeability approaches 10^{-7} cm/sec. Figure 10 shows a more detailed plan view of these three CDFs, and Figure 11 shows a cross-sectional view of CDFs A and B at the locations indicated in Figure 10;

- cutterhead dredging of approximately 433,000 cy of sediment in areas with greater than 10 ppm PCBs (about 128 acres), except...
- ... in salt marsh areas along the eastern shore of the upper harbor, a 50 ppm action level would be used to minimize salt marsh destruction;
- treatment of the seawater decanted from the sediments in the CDFs (the sediments at arrival are only about 5% solids);
- construction of a synthetic impermeable cap once sufficient sediment consolidation has taken place (about 3 years after initial placement)
- long term monitoring and maintenance of CDFs;

For the lower harbor portion of the site (south of the Coggeshall Street bridge to the hurricane barrier and two small areas just south of the barrier), the remedy would entail:

- construction of CDF D in a contaminated area for containment of dredged sediments (avoids dredging 31,000 cy of underlying contaminated sediment). This CDF would be constructed for potential future use as a commercial marine facility, as shown in plan view in Figure 12. As with the upper harbor CDFs, side wall liners but not a bottom liner would be included;
- cutterhead dredging of approximately 45,000 cy in areas outside of CDF D greater than 50 ppm sediment PCBs; and
- as with the upper harbor CDFs, decanted seawater would be treated, a final cover would be constructed over the CDF, and a comprehensive monitoring and maintenance program would be implemented.

In summary, the overall benefits of the remedy are that a) direct contact human health risks throughout the site would be mitigated immediately upon the completion of dredging, b) ecological risks would be mitigated (i.e., the chronic PCB AWQC would be attained) in the upper and most if not all of the lower harbor ten years after the completion of dredging, and c) the fishing ban could be lifted for most seafood (i.e., most likely for shellfish, possibly for flounder, but not for lobster) at the ten year mark. The estimated cost for these benefits (i.e., the estimated cost for the proposed remedy) is approximately $127,000,000. It should be noted, however, that potentially more stringent discharge criteria (especially for copper) for the treated supernatant may increase this cost estimate significantly. A summarized breakdown of this cost estimate is shown in Table 3.

In addition to the above remedial elements, the state DEP has requested an enhancement of the remedy, based on 40 CFR 300.515(f), which would include an additional 1 million cy or so of lower and outer harbor sediments from the maintenance dredging of navigational channels. Although these navigational sediments fall below the proposed target cleanup levels for PCBs (and thus do not overlap the sediments slated for remedial dredging), they are still contaminated with metals and low levels of PCBs. As a result, open water disposal of these sediments is not an option. The region supports this enhancement and is currently awaiting concurrence from EPA headquarters. If this enhancement occurs, the 28,000 cy of sediment from the two areas of remedial dredging just south of the hurricane barrier (see Figure 3) would most likely be disposed of in a large "navigational" CDF just north of this barrier on the western shore. The state has represented that it will pay for all implementation costs of this remedy enhancement.

As a result of more than one year of consensus building negotiations with the community Forum group, our preferred alternative enjoys broad local support. The communities' original concerns revolved around the lack of sediment treatment and the safety and locations of proposed CDFs. The entire Forum group now endorses the remedy, and has signed an agreement to this effect, including support for the locations of CDFs A - D (see Attachment 1). In addition, U.S. Congressman Barney Frank has recently written to Carol Browner strongly supporting the preferred remedy and the proposed navigational enhancement (see Attachment 2). The state DEP and the state and federal natural resource trustees also support the remedy and have helped build local support for it.

For comparative purposes, many other Superfund and non-Superfund sites across the country have used CDF-based remedies for contaminated sediment. Superfund sites that we are aware of with completed CDFs include the Waukegan Harbor site in Michigan (CDFs for PCBs completed in 1993) and the Commencement Bay Sitcum Waterway site in Washington (CDF for metals and organics completed in 1994).

V. Other Alternatives

Nine other final remedial alternatives were developed as part of the Feasibility Study for this operable unit, as summarized below:

A. Non-Removal Options

Alternative 1: Minimal/No-Action

- No dredging, treatment or capping of contaminated sediments would take place;
- Institutional controls (e.g., limits on shoreline use, fishing bans, warning signs, fencing etc.) would be used to limit potential exposure;
- Environmental monitoring and site reviews would take place to track site conditions over time.
- Estimated cost: $9,400,000

Alternative 2: Capping & Dredging of Contaminated Shipping Channels

- Sediments in both the upper and lower harbor with greater than 10 ppm PCBs would be capped in place with three to five feet of clean sand;
- Approximately 187 acres in the upper harbor and 170 acres in the lower harbor would be capped;
- Institutional controls would be required to minimize long term cap disturbance, especially in shallow and shoreline areas;
- Since capping of the contaminated sediments above 10 ppm PCBs within the shipping channels would not be permissible, CDFs B and C would be required for disposal of these sediments.
- Estimated cost: $143,800,000

B. Removal Options Using a 10 ppm PCB Action Level

Alternative 3 & 3d: Dredge, Dewater and On-site Disposal

- Sediments in both the upper and lower harbor with greater than 10 ppm PCBs would be dredged and placed in CDFs A - D, as well as in an additional large island CDF north of Popes Island (for alternative 3d, which includes a mechanical dewatering step that alternative 3 does not, a smaller additional CDF would be needed rather than the large island CDF);

- Discounting the contaminated sediments underlying the CDFs which we believe would not need to be dredged, approximately 769,000 cy (for Alternative 3) or 744,000 cy (for Alternative 3d) would be dredged.
- Water drained from the sediments would be treated to remove contaminants prior to discharge back to the harbor;
- The dredged sediments could be mechanically dewatered prior to final disposal to reduce the volume of disposal facilities required (again, this dewatering step is the characteristic which distinguishes Alternative 3 from 3d);
- A long-term CDF monitoring and maintenance program would be implemented to ensure the integrity of the CDFs over time;
- Estimated cost: Alternative 3 - $159,800,000
Alternative 3d - $197,600,000
- **Note: parts of this alternative (i.e., the 10 ppm action level for the upper harbor, and the disposal of sediments in shoreline CDFs) are incorporated into EPA's proposed remedy.**

Alternative 4: Dredging, Solidification, and On-Site Disposal

- Similar to Alternative 3, but would include treatment of the dredged sediments using solidification or cement-like agents;
- The total volume of dredged sediments would increase due to the addition of the solidification reagents.
- New preliminary information from the 1996 hot spot treatability studies suggests that solidification might not be effective in preventing PCB leakage, especially for the high concentrations tested in the hot spots.
- Estimated cost: $308,700,000

Alternative 5: Dredging, Solvent Extraction, and On-Site Disposal

- Also similar to Alternative 3, but would include treatment of the dredged sediments using solvent extraction technology to remove PCBs;
- The extracted PCB mixture would be treated on-site to destroy

the PCBs;

- If testing of the treated sediments determined that leaching of residual metals was excessive, the sediments would be solidified prior to disposal to immobilize the metals.

- Estimated cost: $540,300,000

Alternative 6: Dredging, Incineration and On-Site Disposal

- Also similar to Alternative 3, but would include treatment of the dredged sediments using on-site incineration to destroy the PCBs (note that this alternative, and for that matter the entire FS for this operable unit were developed prior to the hot spot incineration controversy);

- If testing of the treated sediments determined that leaching of residual metals was excessive, the sediments would be solidified prior to disposal to immobilize the metals.

- Estimated cost: $582,300,000

C. Removal Options Using Other PCB Action Levels:

Alternative 7: Capping (50-500 ppm) and CDF Disposal (>500 ppm) in the Upper Harbor; Minimal/No-Action in the Lower Harbor

- Sediments in the upper harbor with 50-500 ppm PCBs would be capped with approximately three feet of sand;

- Sediments in the upper harbor greater than 500 ppm PCBs would be dredged and disposed of in CDFs A and B;

- Sediments in the lower harbor would be left in place untouched, and institutional controls and long-term monitoring would be implemented;

- Water drained from the sediments in the CDFs would be treated to remove contaminants prior to discharge back to the river.

- Estimated cost: $82,600,000

Alternative 8: Site Wide Dredging at 50 ppm PCBs with CDF Disposal

- Sediments with greater than 50 ppm PCBs in both the upper and lower harbor (including two areas just south of the hurricane barrier) would be dredged and disposed of in CDF D;

- Approximately 360,000 yd^3 of contaminated sediment would be dredged;

- Water initially drained from the sediments would be treated to remove contaminants prior to discharge back to the river;

- A long-term CDF monitoring and maintenance program would be implemented to ensure the integrity of the CDFs over time;

- Estimated cost: $92,600,000

- **Note: parts of this alternative (i.e., the 50 ppm action level for the lower harbor, and CDF disposal) are incorporated into EPA's proposed remedy.**

Alternative 9: Dredging and CDF Disposal for 50-500 ppm PCBs, Treatment for >500 ppm PCBs

- Sediments with between 50 to 500 ppm PCBs would be dredged and placed in CDFs, sediments with greater than 500 ppm PCBs (which occur only in the upper harbor) would be treated with either incineration or solvent extraction;

- CDF D would be used for disposal of both the treated and untreated sediments;

- Water drained from the untreated sediments would be treated to remove contaminants prior to discharge back to the river;

- If testing of the treated sediments determined that leaching of residual metals was excessive, the sediments would be solidified prior to disposal to immobilize the metals.

- Estimated cost: $177,000,000

VI. Issues

A. Why did we select the preferred alternative over the other alternatives?

In a nutshell, the preferred CDF-based containment remedy was selected because, of the four general types of remedies (no-action, capping, CDFs without treatment and CDFs with treatment), it alone was both protective and cost-effective. The overall site risks preclude the no-action approach, and the creation and preservation of a large, adequately thick cap was considered highly unreliable and very damaging to near shore habitat. Treatment of the sediments, on the other hand, did not offer significantly increased benefits to human health and the environment beyond a containment approach to warrant the hundreds of millions in treatment costs that would be required. The discussion under Issue B below presents more fully why we believe the CDF-based containment approach is protective, and why the potential amounts of leakage would be insignificant.

In addition to these four basic types of remedial approaches, two other hybrid concepts proceeded through detailed evaluation. One hybrid, Alternative 7, called for capping upper harbor sediments between 50 and 500 ppm, CDF-disposal for upper harbor sediments above 500 ppm PCBs, and no-action for the lower harbor. This alternative is not preferred due to the previously-discussed concerns about capping, and since it would be unacceptbly less protective than the proposed remedy. The other hybrid approach, Alternative 9, called for treatment for sediments above 500 ppm PCBs (which occur only in the upper harbor), and CDF-disposal for all other sediments between 50 and 500 ppm PCBs. The main reasons this alternative is not preferred is because we do not believe that treatment is cost-effective or necessary, and since this alternative would be less protective for the upper harbor (with a 50 ppm versus a 10 ppm cleanup level).

These and the other final alternatives are compared against the NCP nine criteria in Table 4. Note that this is a draft of a table that will be presented in the proposed plan, and thus the table may change as it gets finalized. The proposed plan is currently scheduled for September 1996.

B. <u>How much will the CDFs leak? Why aren't bottom liners being used</u>?

Over the long term, the worst-case, total amount of leakage from all CDFs is estimated (based on computer modeling) to be approximately **0.008** pounds of PCBs per day. The actual leakage amounts will be much less than this since the model deliberately assumed that the bottom of the CDFs would not restrict leachate flow at all. Significant restrictions to sub-surface leachate flow will occur naturally for two reasons: 1) the silty, fine-grained nature of the underlying harbor sediments and 2) the process of "self-weight consolidation" wherein the dredged sediments will compress upon themselves over time to form an impermeable-like material.

To put this 0.008 lb/day leakage amount into perspective, consider that recent sampling shows that **0.5** pounds per day of PCBs currently migrate seaward in the water column at the Coggeshall Street bridge. Thus, even though the 0.008 lb/day CDF leakage figure is biased-high, it nevertheless represents over a 98% reduction in contaminant migration based on the current amount of PCB flux.

Also, counter to what one might expect, the amount of leakage from the CDFs decreases with time. This is due to the fact that once in the CDFs, most of the PCB loss is associated with the release of pore water during compaction. The amount of pore water released decreases with time, so that the amount of PCBs lost also decreases with time. The initial 2-3 year period after disposal in the CDFs is considered to be the period of most loss of pore water and associated PCBs. The model estimated that worst-case PCB losses during this initial period would be approximately **0.36** pounds of PCB per day. Thus the estimated short-term initial rate of leakage is orders of magnitude more than the estimated long-term rate (0.36 lbs/day verses 0.008 lbs/day), but is still less than (or about equal to) the current flux rate of 0.5 lb/day discussed above.

Side wall liners and the use of wick drains (to remove pore water for treatment) have been included in the conceptual CDF design as an engineering response to minimize leakage, especially in the short term. However, given that the sediment hydraulic conductivity approaches 10^{-7} cm/sec, and the fact that the reliability of a liner constructed in saturated conditions cannot be guaranteed, we are not proposing a liner for the bottom of the CDFs. Furthermore, a bottom liner is not an ARAR for these facilities, since TSCA regulations at 40 CFR 761.60(a)(5)(iii) allow for alternative disposal methods (i.e., other than incineration or chemical waste landfilling) for dredged material with PCB concentrations of 50 ppm or greater, if approved by the Regional Administrator.

Finally, the potential for leakage of metals from the CDFs has also been addressed. Because laboratory leaching studies pointed to copper as the metal of most concern, similar computer modelling was performed to estimate potential copper leakage rates. These estimates were orders of magnitude less than the estimates for PCB leakage: the long term estimate for copper leakage was 0.0002 lb/day and the short term estimate for the first two to three years was 0.01 lb/day.

C. <u>How long will it take to achieve ambient water quality standards for PCBs throughout the site</u>?

Although the hydrodynamic modelling performed for the site did not specifically include the "hybrid" cleanup levels included in the proposed remedy, we suspect that it will take about ten years to attain site wide compliance with the chronic AWQC of 30 ng/l. Per the model results the only area in question is the area from just north of the Coggeshall Street bridge to just south of the Route 6 bridge: the model run using a 10 ppm sitewide cleanup level showed this area below 30 ng/l at year ten, but the model run using a 50 ppm sitewide cleanup level showed this area below 40 ng/l at year ten. The predicted water column PCB level in this area under the proposed remedy would be expected to be somewhere between these two levels. Current water column concentrations in this area are one to two orders of magnitude higher than these levels.

For comparative purposes, these model predictions represent a significant improvement over the no-action alternative. The model predicted a no-action scenario in which water column concentrations of 1,634 ng/l at year "zero" would fall to 850 ng/l at year ten. We certainly recognize the limitations of the model and do not view the results as absolute predictions, but we believe the model estimates are helpful for comparing alternatives and in assessing the qualitative impact of the various remedial alternatives.

D. Can the ban on local seafood be lifted once the ROD 2 dredging has been completed?

Once area seafood reaches a tissue PCB level of 2 ppm, which modeling estimates to be 10 years or more after dredging depending on specie, the FDA-based ban on fishing could be lifted. However, it is important to understand that educational programs and other institutional controls (e.g., "limited fishing" signs) would have to be maintained since the site-specific local consumption-based level of 0.02 ppm would not be reached within 10 years. In other words, the ban could probably be lifted 10 years after dredging, but local fisherman would have to be instructed to limit their local fish intake to a (to be determined) safe amount.

E. How would the enhanced remedy involving navigational dredge spoils, if approved, be implemented?

While the full details have yet to be worked out, it is envisioned that the state DEP would be the lead agency for this effort. The DEP would use state funds to cover the costs of the enhancement. Conceptually, the DEP would contract directly with the Army Corps to design and build the necessary CDF(s), and to manage the dredging of the federal navigational channels. At the same time, EPA would be using the Corps to implement ROD 2, with the expectation that the two efforts could be coordinated to improve the logistics and efficiency of certain operations. For example, the less-contaminated navigational sediments could be used as preliminary cap material at CDF D, and at least a portion of the design effort for the remedial CDFs could be transferred to the design for the navigational CDFs.

F. Will the site's "special account" be able to cover all remaining remedial costs?

At some point during implementation of the second ROD, we will have to access the national fund in order to finish remedial action. The site's special account currently has a balance of about $56 million, not including interest (which as a result of a recent decision will begin accruing to the site account rather than the national fund). An estimated $10-15 million of this amount will be required for full implementation of ROD 1. Additional, as yet undetermined amounts will be required for implementation of ROD 3 (although remedial expenditures for ROD 3 are expected to be minimal compared to ROD 2). Thus unless the no-action alternative is selected for ROD 2, the site's special account will be insufficient to cover site expenses.

G. Do we have a monitoring program in place to evaluate the long term effects of dredging?

As a result of a cooperative effort with EPA's marine research laboratory in Narragansett, RI, a comprehensive, statistically rigorous long term monitoring program has been designed and implemented. The overall objective of this program is to monitor the post-remediation ecological recovery of the entire 18,000 acre site over the long term (i.e., 30 years). Parameters measured include sediment chemistry, tissue chemistry, sediment toxicity, and benthic species richness, among others. A baseline round of sampling for this program was performed prior to the hot spot dredging, and a second round was performed in the fall of 1995 after this dredging was completed. Additional rounds will be performed at important milestones during the remedial process (e.g., prior to the start of ROD 2 dredging). This monitoring data will be evaluated and peer-reviewed to assess the degree of improvement to the benthic ecosystem.

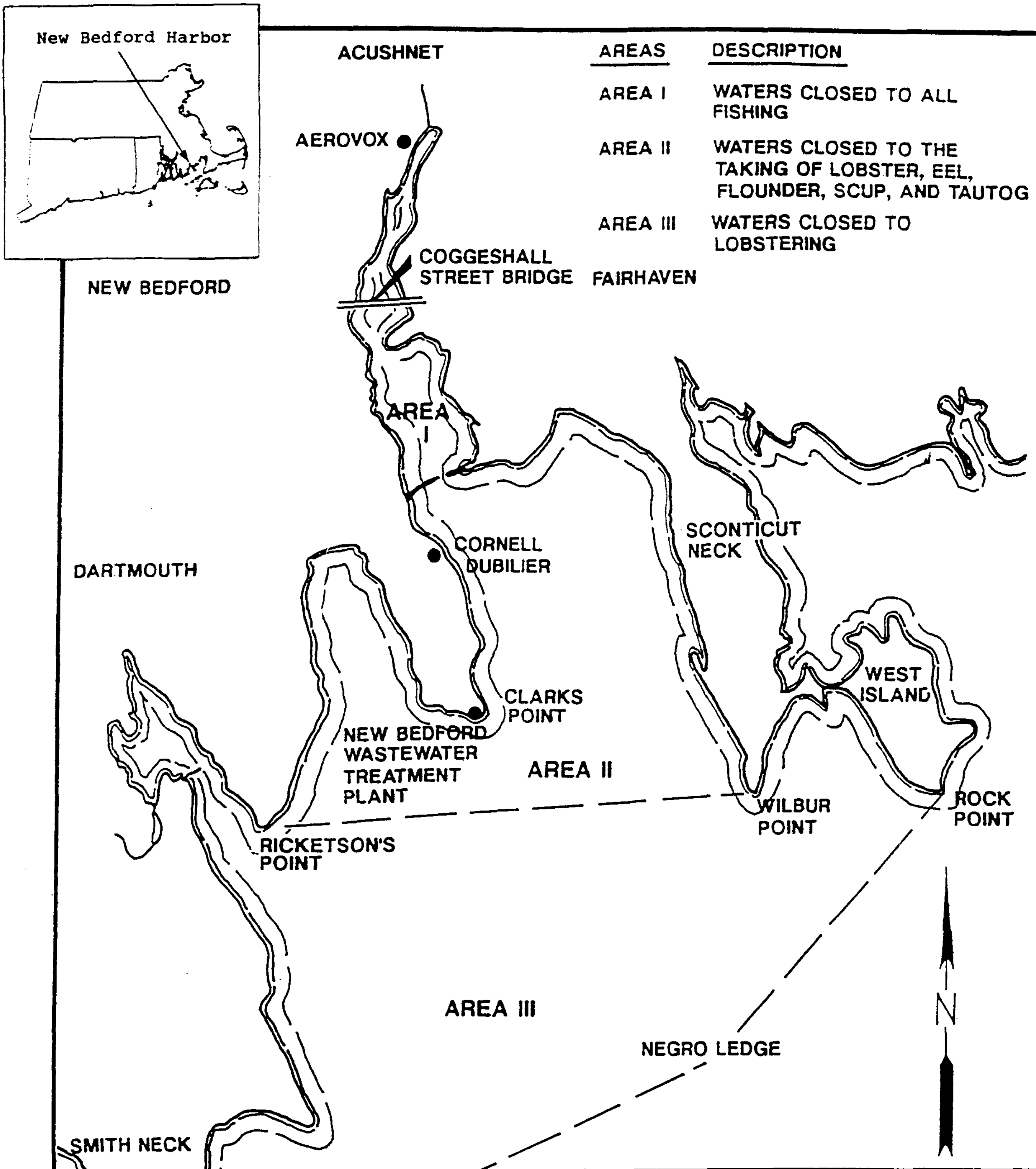


FIGURE 1

NEW BEDFORD HARBOR

FISHING CLOSURE AREAS

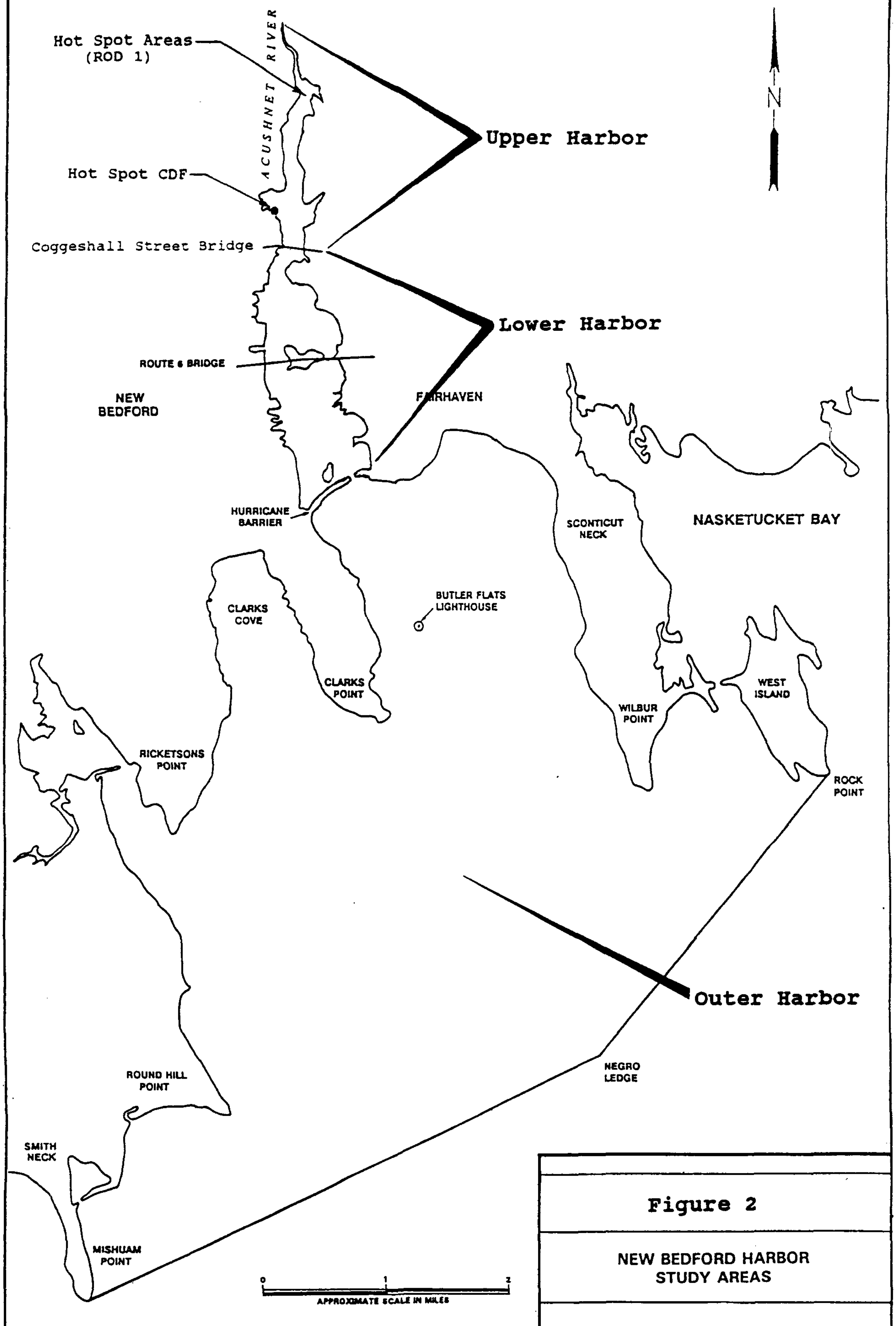
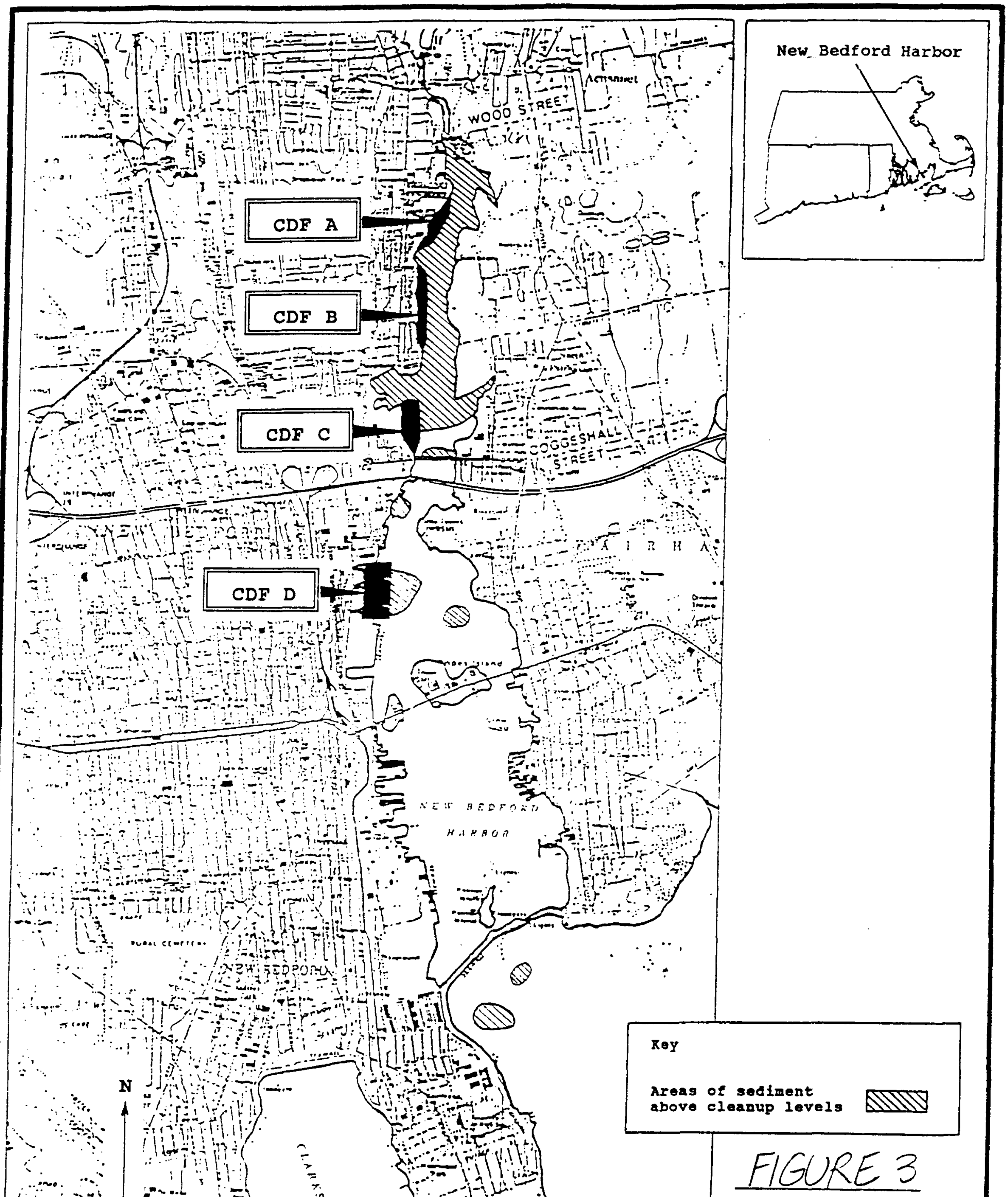


Figure 2

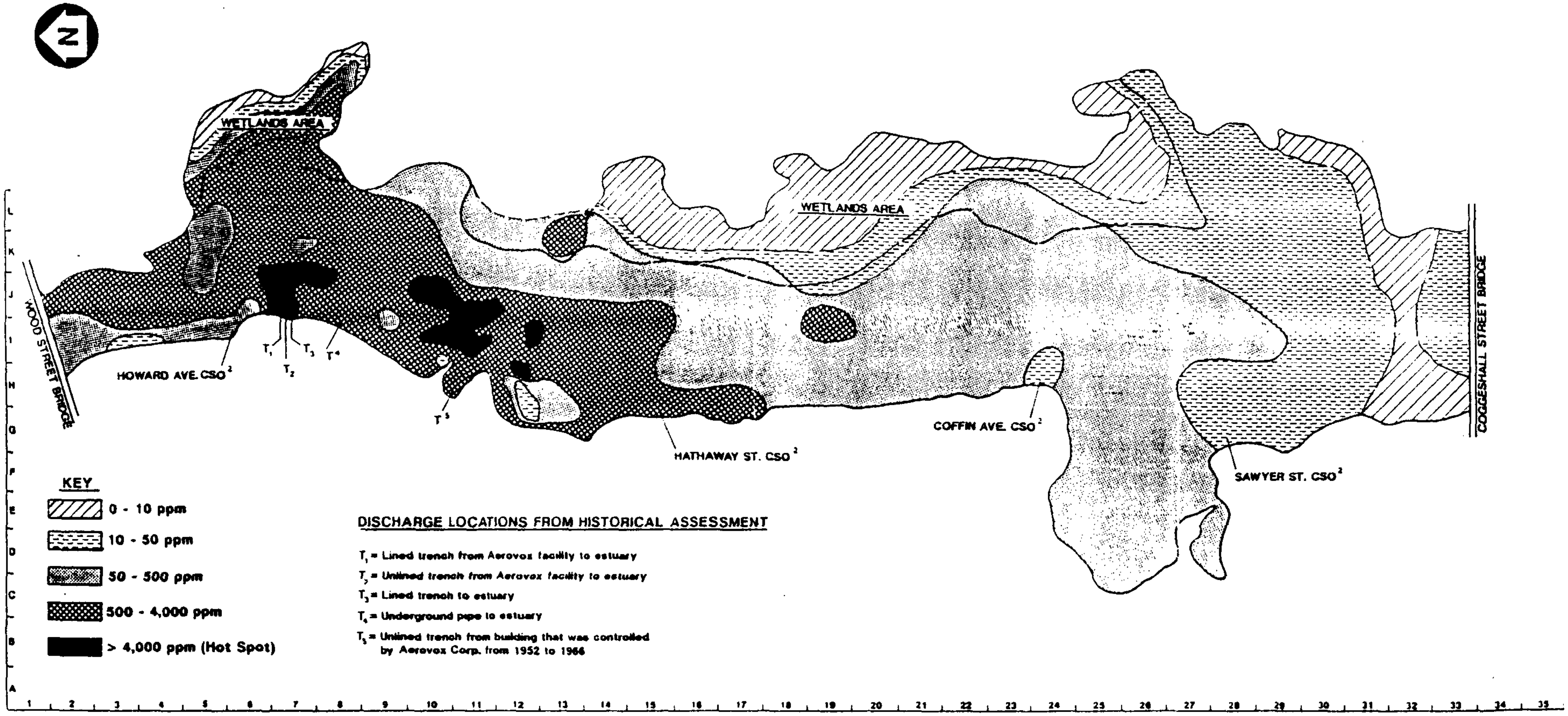
NEW BEDFORD HARBOR
STUDY AREAS



New Bedford Harbor ROD II

Proposed Dredging Areas and CDFs

Figure 4



REFERENCES

1. Historical Assessment of Aerovox - PCB Related Facility - New Bedford, Massachusetts.
2. Combined Sewer Overflow (CSO) locations from City of New Bedford sewer system map.

0 400 800 1,200 FEET

4959-25

Figure 5

INTERPRETATION OF TOTAL PCB CONCENTRATIONS *
DEPTH: ZERO TO 12 INCHES
ESTUARY AND LOWER HARBOR AND BAY
FEASIBILITY STUDY
NEW BEDFORD HARBOR

* SUM OF AVAILABLE AROCHLOR DATA

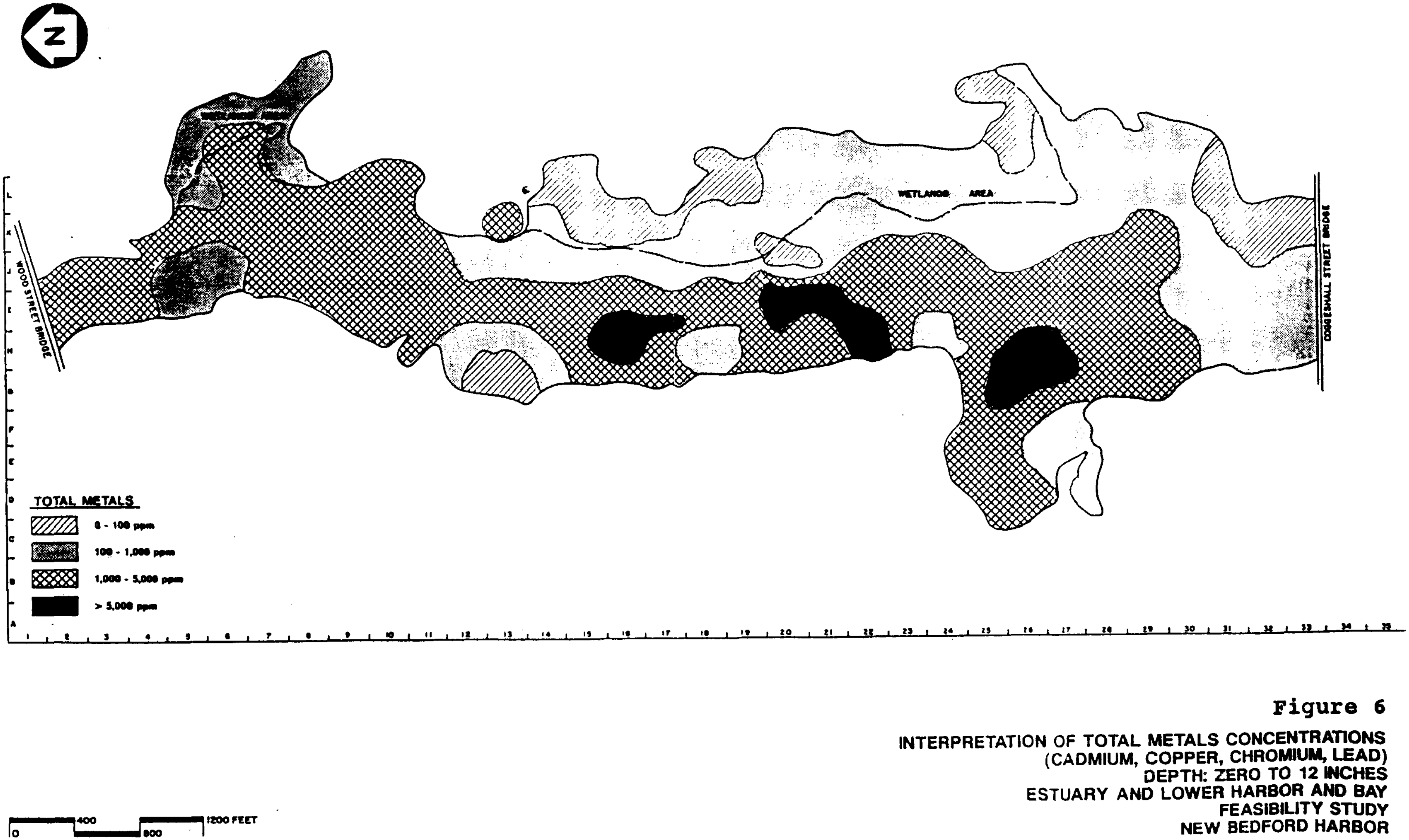


Figure 6

INTERPRETATION OF TOTAL METALS CONCENTRATIONS
(CADMIUM, COPPER, CHROMIUM, LEAD)
DEPTH: ZERO TO 12 INCHES
ESTUARY AND LOWER HARBOR AND BAY
FEASIBILITY STUDY
NEW BEDFORD HARBOR

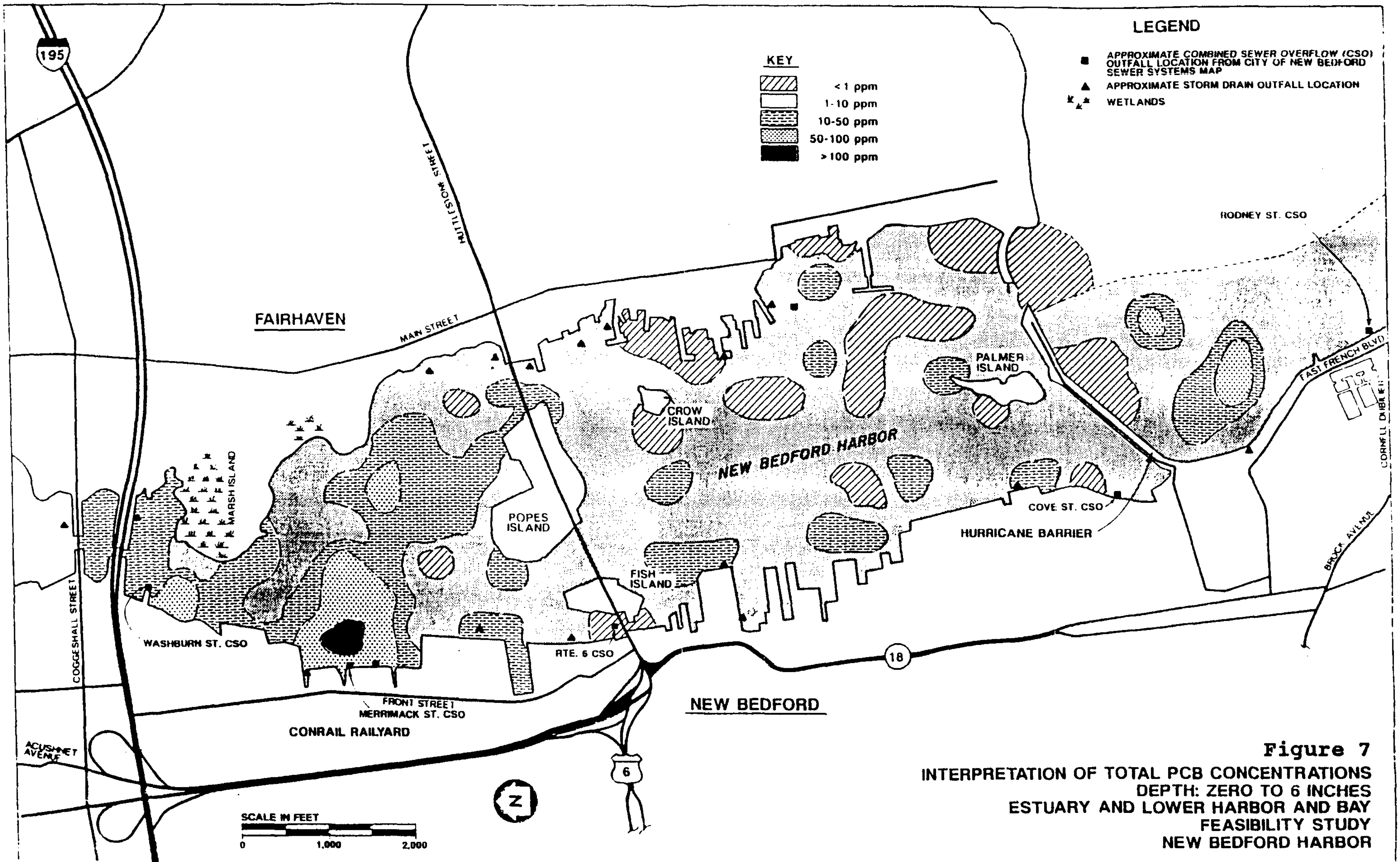
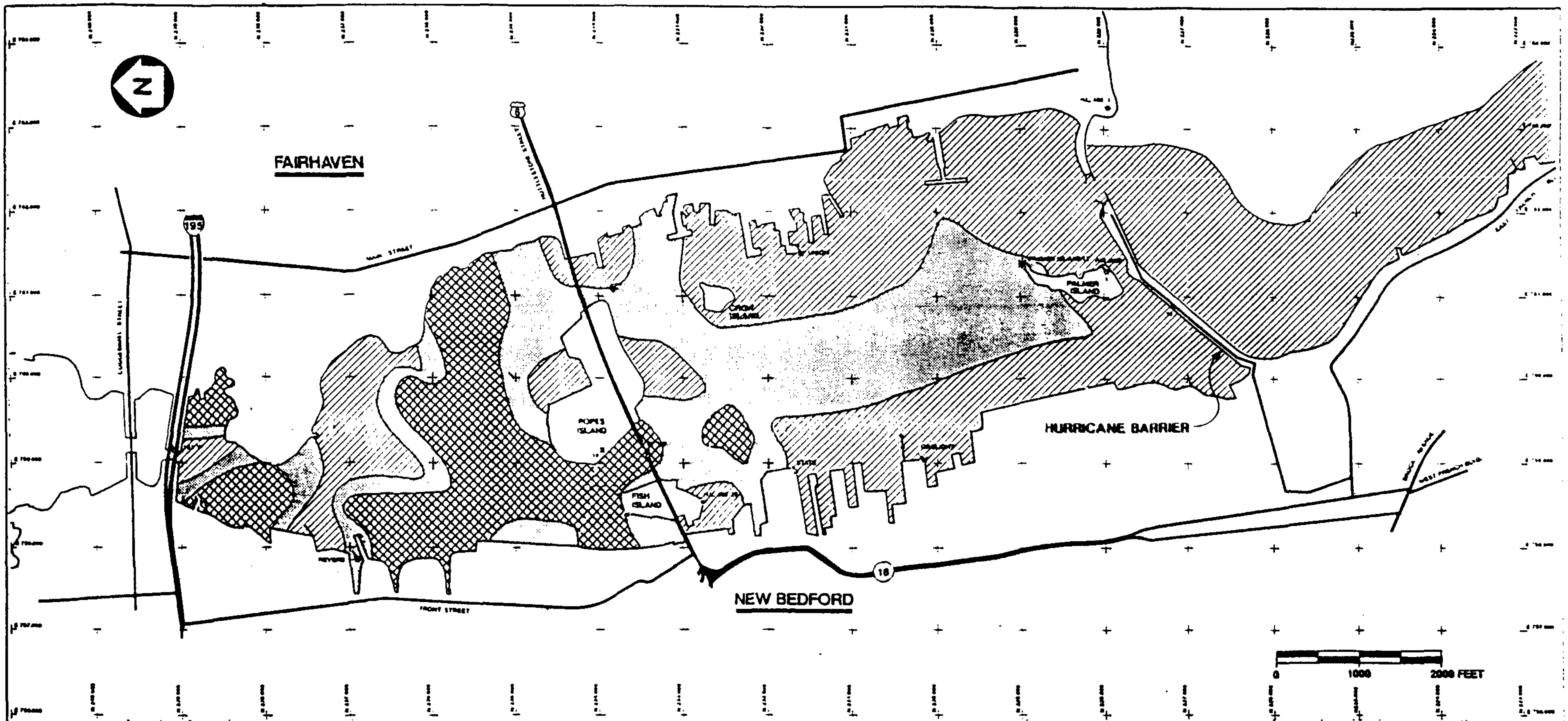


Figure 7

INTERPRETATION OF TOTAL PCB CONCENTRATIONS
DEPTH: ZERO TO 6 INCHES
ESTUARY AND LOWER HARBOR AND BAY
FEASIBILITY STUDY
NEW BEDFORD HARBOR

4959-25



KEY

0 - 500 ppm

500 - 1000 ppm

>1000 ppm

FIGURE 8
INTERPRETATION OF TOTAL METALS CONCENTRATIONS, ZERO TO 6 INCHES
(CADMIUM, CHROMIUM, COPPER, AND LEAD)
LOWER HARBOR AND BAY
FEASIBILITY STUDY
NEW BEDFORD HARBOR

Figure 9: Photosimulation of Future CDFs

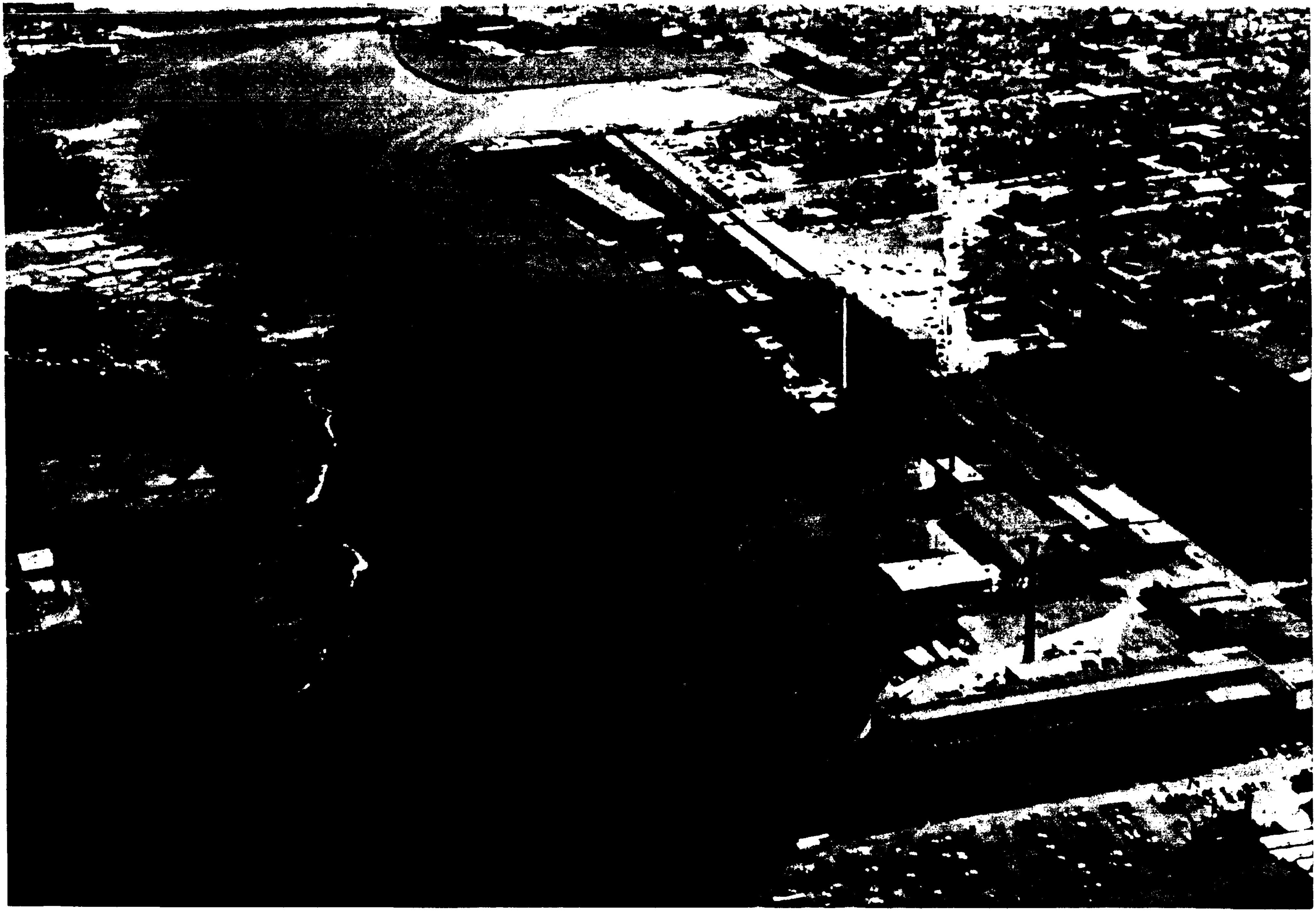
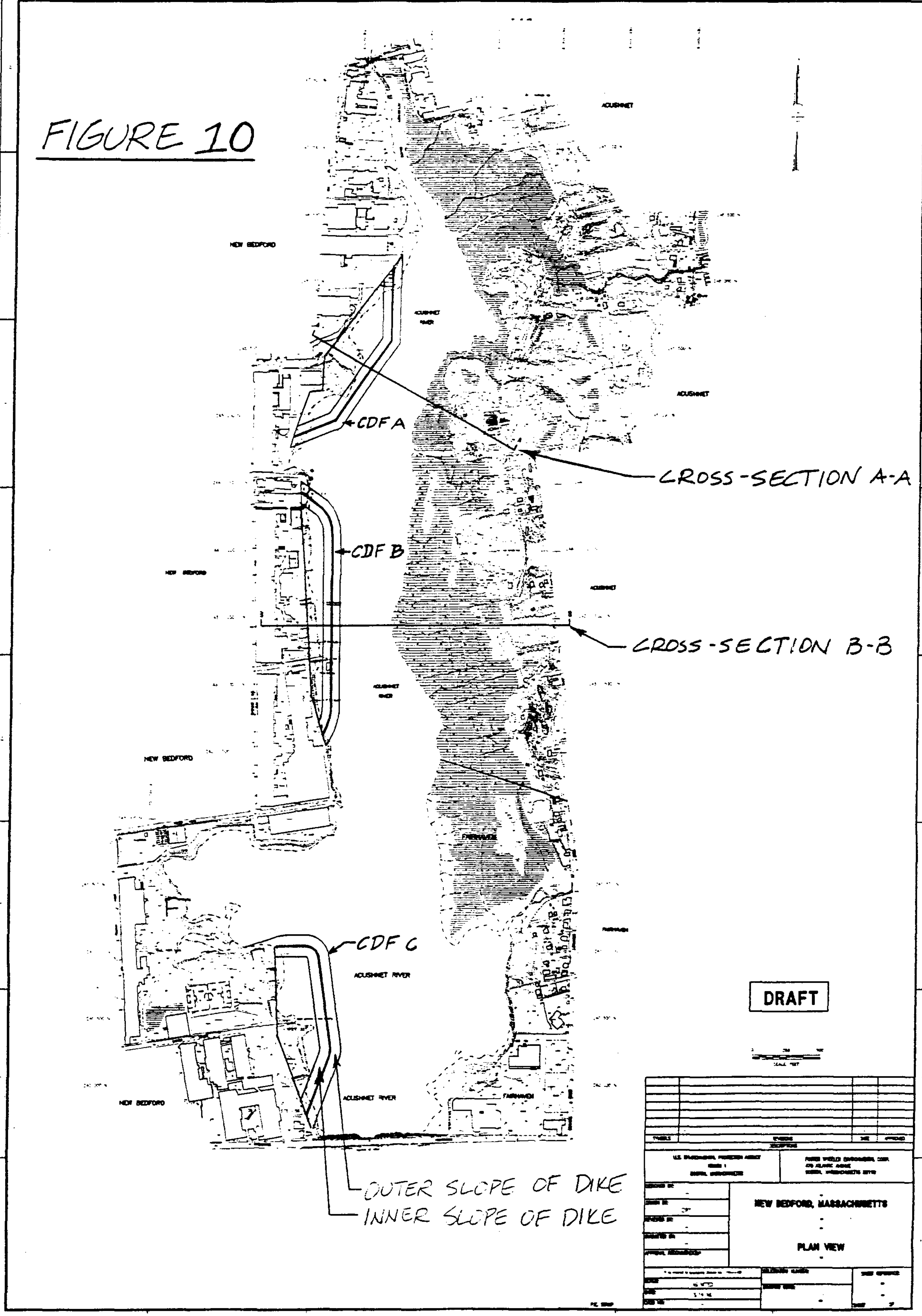


FIGURE 10


ACUSHNET
NEW BEDFORD
ACUSHNET RIVER
CDF A
ACUSHNET
CROSS-SECTION A-A
CDF B
NEW BEDFORD
ACUSHNET
CROSS-SECTION B-B
ACUSHNET RIVER
NEW BEDFORD
FAIRHAVEN
CDF C
ACUSHNET RIVER
FAIRHAVEN
NEW BEDFORD
ACUSHNET RIVER
FAIRHAVEN
OUTER SLOPE OF DIKE
INNER SLOPE OF DIKE
DRAFT
SCALE FEET
NEW BEDFORD, MASSACHUSETTS
PLAN VIEW

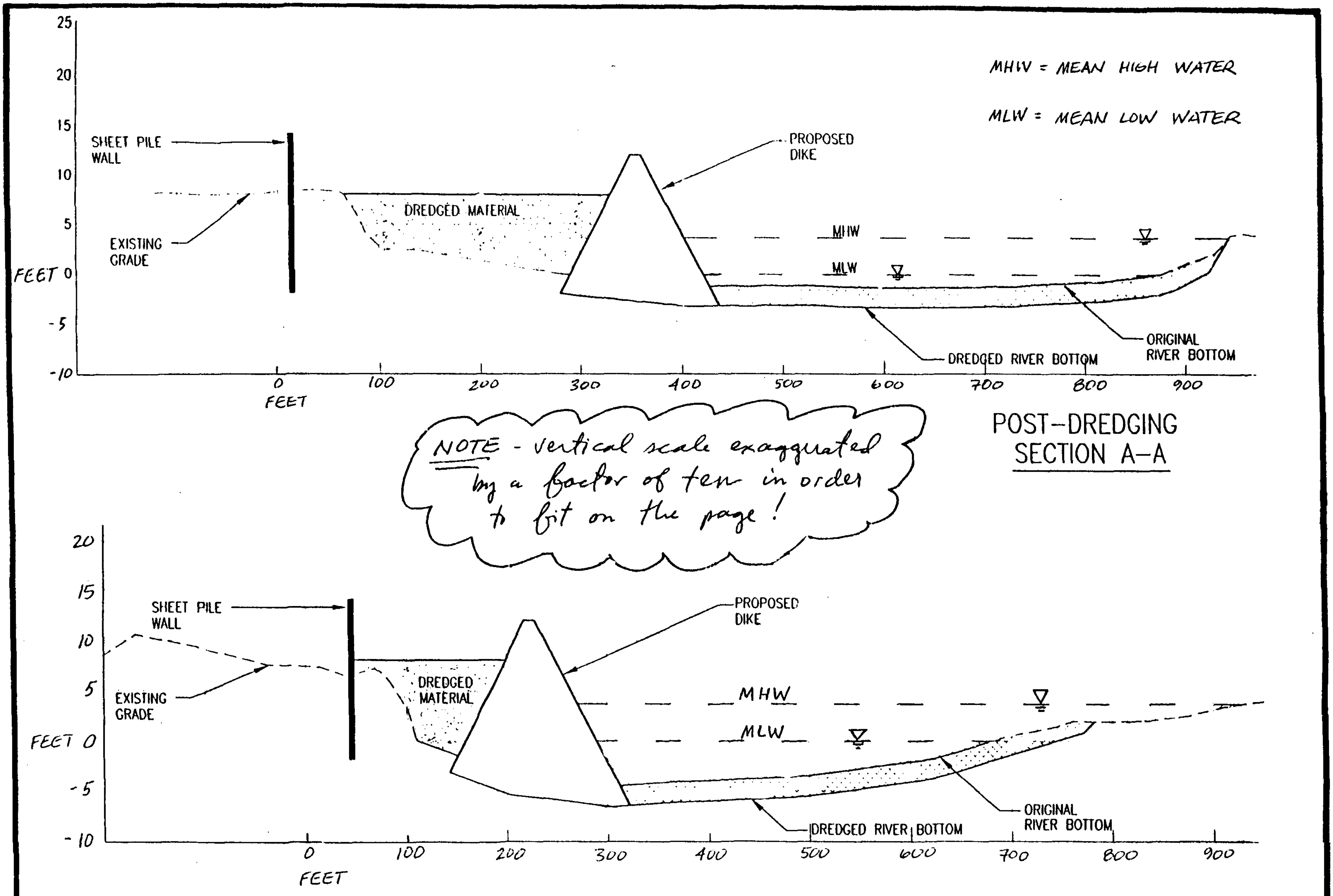


Figure 11 - NBH Superfund Site
Cross-sectional Views of CDFs A & B

FIGURE 12

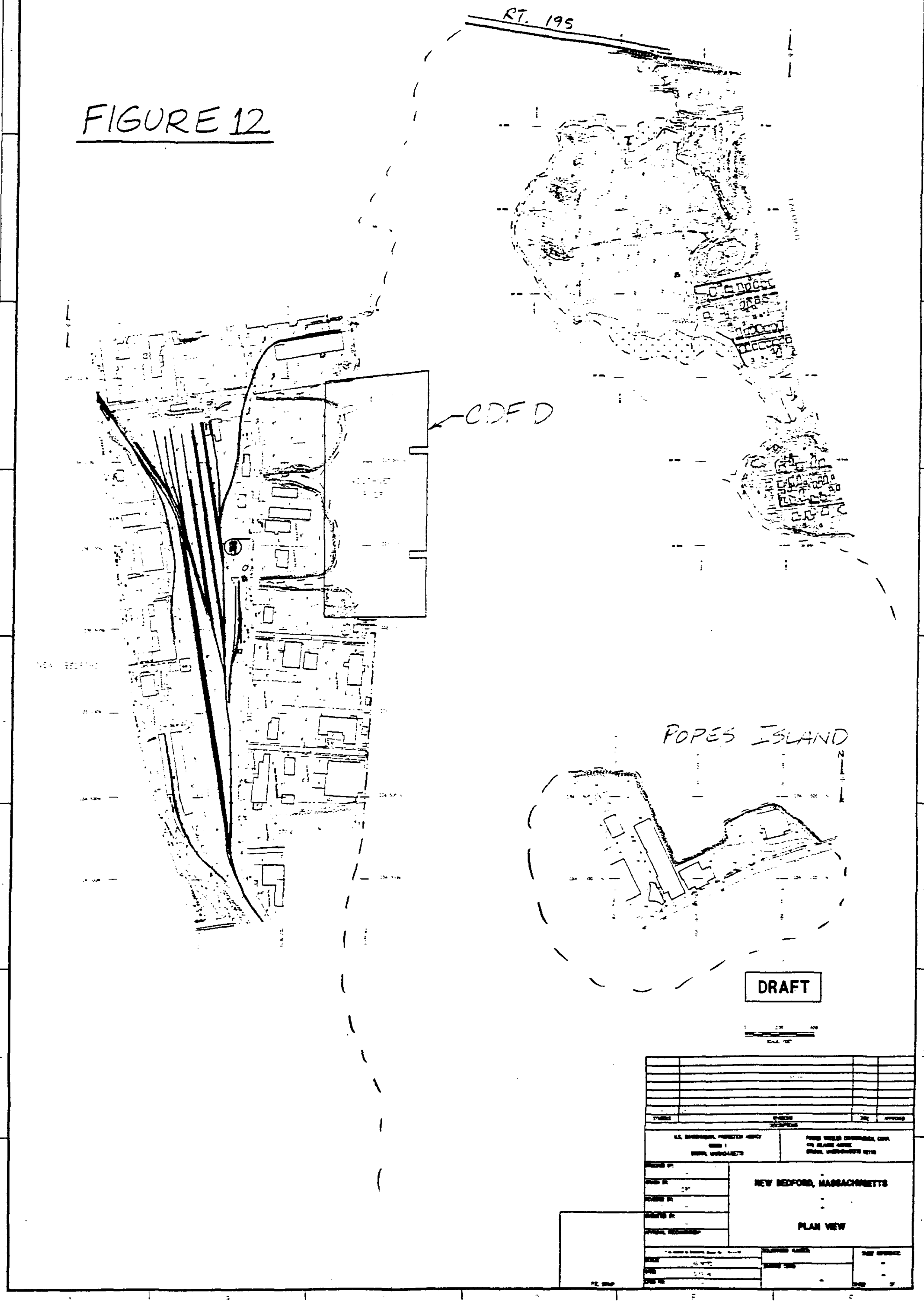

RT. 195
CDF D
POPES ISLAND
DRAFT
NEW BEDFORD, MASSACHUSETTS
PLAN VIEW

Table 1

Lifetime Carcinogenic Public Health Risks
Ingestion of Contaminated Biota

Source	PCB Concentration (ppm[1])	Frequency of Exposure	Lifetime Risk (70 years)
Lobster[2]	2.3	Daily	7 in 100
		Weekly	1 in 100
		Monthly	2.5 in 1000
Flounder	0.371	Daily	1 in 100
		Weekly	1.7 in 1000
		Monthly	4 in 10,000
Clam	0.231	Daily	7 in 1000
		Weekly	1 in 1,000
		Monthly	2.4 in 10,000

Notes:
[1] All biota concentrations are mean values from the DPH Fishing Closure Area II.
[2] Lobster edible tissue includes the tomalley.

Reference:
"Draft Final Baseline Public Health Risk Assessment," EC Jordan/Ebasco, 1989.

Table 2

SUMMARY TABLE OF TOTAL SITE CARCINOGENIC AND NONCARCINOGENIC RISKS - PROBABLE EXPOSURE SCENARIO; NEW BEDFORD, MASSACHUSETTS.

AREA 1 (1)

	Cancer Risk	Hazard Index
YOUNG CHILD		
Ingestion of biota	7.65E-04 (2)	17.00 (3)
Ingestion of sediments (4/5)	1.50E-05	3.40
Direct Contact/Sediments (5)	7.50E-06	0.17
Total	7.88E-04	20.57
OLDER CHILD		
Ingestion of biota	7.65E-04	8.50
Ingestion of sediments	NE	NE
Direct Contact/Sediments	9.50E-05	0.06
Total	8.60E-04	8.56
ADULT		
Ingestion of biota	4.40E-04	4.90
Ingestion of sediments	NE	NE
Direct Contact/Sediments	3.75E-05	0.02
Total	4.78E-04	4.92
LIFETIME		
Ingestion of biota	3.18E-03	
Ingestion of sediments	4.02E-05	
Direct Contact/Sediments	4.29E-04	
Total	3.65E-03	

AREA 2

	Cancer Risk	Hazard In
YOUNG CHILD		
Ingestion of biota	3.43E-04 (2)	9.43
Ingestion of sediments (4/6)	2.00E-06	1.20
Direct Contact/Sediments (6)	2.65E-06	0.02
Total	3.48E-04	10.65
OLDER CHILD		
Ingestion of biota	3.43E-04	4.77
Ingestion of sediments	NE	NE
Direct Contact/Sediments	2.60E-06	0.01
Total	3.46E-04	4.77
ADULT		
Ingestion of biota	2.00E-04	2.67
Ingestion of sediments	NE	NE
Direct Contact/Sediments	1.00E-06	0.01
Total	2.01E-04	2.68
LIFETIME		
Ingestion of biota	1.45E-03	
Ingestion of sediments	2.00E-06	
Direct Contact/Sediments	1.08E-05	
Total	1.46E-03	

Table 2 (continued)

SUMMARY TABLE OF TOTAL SITE CARCINOGENIC AND NONCARCINOGENIC RISKS - PROBABLE EXPOSURE SCENARIO;
NEW BEDFORD, MASSACHUSETTS.

AREA 3

		Cancer Risk	Hazard Index
YOUNG CHILD			
Ingestion of biota (2)		1.93E-04	6.40
Ingestion of sediments		NA	NA
Direct Contact/Sediments		NA	NA
	Total	1.93E-04	6.40
OLDER CHILD			
Ingestion of biota		1.93E-04	3.23
Ingestion of sediments		NE	NE
Direct Contact/Sediments		NA	NA
	Total	1.93E-04	3.23
ADULT			
Ingestion of biota		1.10E-04	1.83
Ingestion of sediments		NE	NE
Direct Contact/Sediments		NA	NA
	Total	1.10E-04	1.83
LIFETIME			
Ingestion of biota		4.91E-04	
Ingestion of sediments		NA	
Direct Contact/Sediments		NA	
	Total	4.91E-04	

AREA 4

		Cancer Risk	Hazard Index
YOUNG CHILD			
Ingestion of biota (2)		6.07E-05	4.23
Ingestion of sediments		NA	NA
Direct Contact/Sediments		NA	NA
	Total	6.07E-05	4.23
OLDER CHILD			
Ingestion of biota		6.07E-05	2.13
Ingestion of sediments		NE	NE
Direct Contact/Sediments		NA	NA
	Total	6.07E-05	2.13
ADULT			
Ingestion of biota		3.43E-05	1.23
Ingestion of sediments		NE	NE
Direct Contact/Sediments		NA	NA
	Total	3.43E-05	1.23
LIFETIME			
Ingestion of biota		2.50E-04	
Ingestion of sediments		NA	
Direct Contact/Sediments		NA	
	Total	2.50E-04	

1. These Areas correspond geographically to the subdivision of the New Bedford Harbor depicted in Figure 1.
2. Cancer risks for ingestion of biota reflect the mean values for the three species evaluated under the weekly ingestion, chronic exposure, probable scenario.
3. Hazard indices for ingestion of biota reflect the mean values for the three species evaluated.
4. Ingestion of sediments was only evaluated for young children.
5. Hazard indices and carcinogenic risk for direct contact with and ingestion of sediments in Area 1 represent the mean values estimated for chronic exposure to sediments from Areas I and II in Tables 4-2, 4-3, 4-7 and 4-8.
6. Hazard indices and carcinogenic risk for direct contact with and ingestion of sediments in Area 1 represent the mean values estimated for chronic exposure to sediments from Areas III in Tables 4-2, 4-3, 4-7 and 4-8.

NE - not evaluated.
NA - data not available.

Exposure to sediments in Areas 3 and 4 were not evaluated in this risk assessment.

Table 3

COST ESTIMATE: ALTERNATIVE - 10
DREDGE/DISPOSE
NEW BEDFORD HARBOR

ACTIVITY	COST
I. DIRECT COSTS	
A. Dredging	$22,320,348
B. Dewater/Water Treatment	$27,123,051
C. CDF Construction	$27,121,318
D. Air Monitoring	$10,472,000
TOTAL DIRECT COST (TDC)	$87,036,717
II. INDIRECT COSTS	
A. Health & Safety (@ 5% of TDC) Level D Protection	$4,351,836
B. Legal, Administration, Permitting (@ 10% of TDC)	$8,703,672
C. Engineering (@ 10% of TDC)	$8,703,672
D. Services During Construction (@ 10% of TDC)	$8,703,672
E. Turnkey Contractor Fee (@ 15% of TDC)	$13,055,508
TOTAL INDIRECT COST (TIC)	$43,518,359
SUBTOTAL COSTS	$130,555,076
CONTINGENCY (@ 20% of TDC + TIC)	$26,111,015
TOTAL CAPITAL COST	$156,666,091
PRESENT WORTH - 1996 (@ 7% for 8 years)	$116,937,529
O&M COST (CDFs) (Present Worth @ 7% for 30 years upon completion)	$1,017,846
MONITORING PROGRAM (Present Worth @ 7% for 30 years)	$8,695,122
TOTAL COST - ALTERNATIVE - 10	$126,650,497