DRAFT
Work Plan

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May 6, 1985

Mr. Alan D. Randall
Senior Project Manager
Regulatory Branch
Department of the Army
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254

Dear Mr. Randall:

Please find enclosed revisions of the preliminary impact assessment for the New Bedford superfund project. We have attempted to incorporate all suggested revisions and to clarify comments as appropriate.

Cordially,

Gary R. Sanford, Ph.D.

PRELIMINARY IMPACT ASSESSMENT

NEW BEDFORD SUPERFUND PROJECT
IN-HARBOR CONTAINMENT AND
HYDRAULIC CONTROL

REMEDIAL ACTION
FOR
THE UPPER ACUSHNET RIVER ESTUARY

Prepared for

U.S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION
424 TRAPELO ROAD
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MAY, 1985

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1. INTRODUCTION

Sanford Ecological Services (SES) has been directed by the Corps of Engineers, New England Division (NED), under contract DACW33-85-D-0002 and Delivery Order No. 0007 to prepare a preliminary impact assessment of two alternative remedial action plans dealing with the New Bedford Harbor. The remedial action alternatives have been prepared for the Environmental Protection Agency by NUS Corporation (NUS, 1984) to address contamination issues of mudflats and sediments of the Acushnet River Estuary north of the Coggeshall Street Bridge. Contaminants include extremely high levels of polychlorinated biphenyls (PCBs) and heavy metals.

Since the remedial action alternatives will impact aquatic and wetland systems, NED is required to evaluate these alternatives under Section 404 of the Clean Water Act. The following material represents a preliminary assessment of impacts. One of the primary objectives has been to evaluate a broad range of potential impacts in order that future studies may focus on critical issues relative to the regulatory mandates of NED. Hence the following material represents an abbreviated discussion of a wide range of impact issues.

1.1 CHARACTER, LOCATION, AND PURPOSE OF WORK

Two remedial alternatives, (1) hydraulic control and (2) dredging with disposal in an in-harbor containment site, are considered below. Both alternatives would attempt to isolate hazardous materials in a way that would eliminate or minimize the potential for human exposure and exposure to biotic communities. A non-removal action (hydraulic control) would contain contaminated sediments in-situ by isolating sediments from the resuspension and transport action of the Acushnet River flow, and covering the sediments with clean materials. A removal action would require dredging contaminated sediments and isolating them within a controlled shoreline disposal site.

Proposed work would be located within the Acushnet River Estuary extending northward from the Coggeshall Street Bridge to the Tarkiln Hill Road Bridge. This area is located within the communities of New Bedford, Acushnet, and Fairhaven. (see Figures 1 & 2)

1.2 ENVIRONMENTAL SETTING

Unless otherwise indicated, the following descriptions have been extracted or synthesized from the NUS report (1984)

1.2.1 Surface Water

The principal water bodies in the area include the Acushnet River Estuary, New Bedford Harbor, and Buzzards Bay. The mouth of the Acushnet River, a tidal estuary forming New Bedford Harbor, discharges into the northwestern side of Buzzards Bay. The

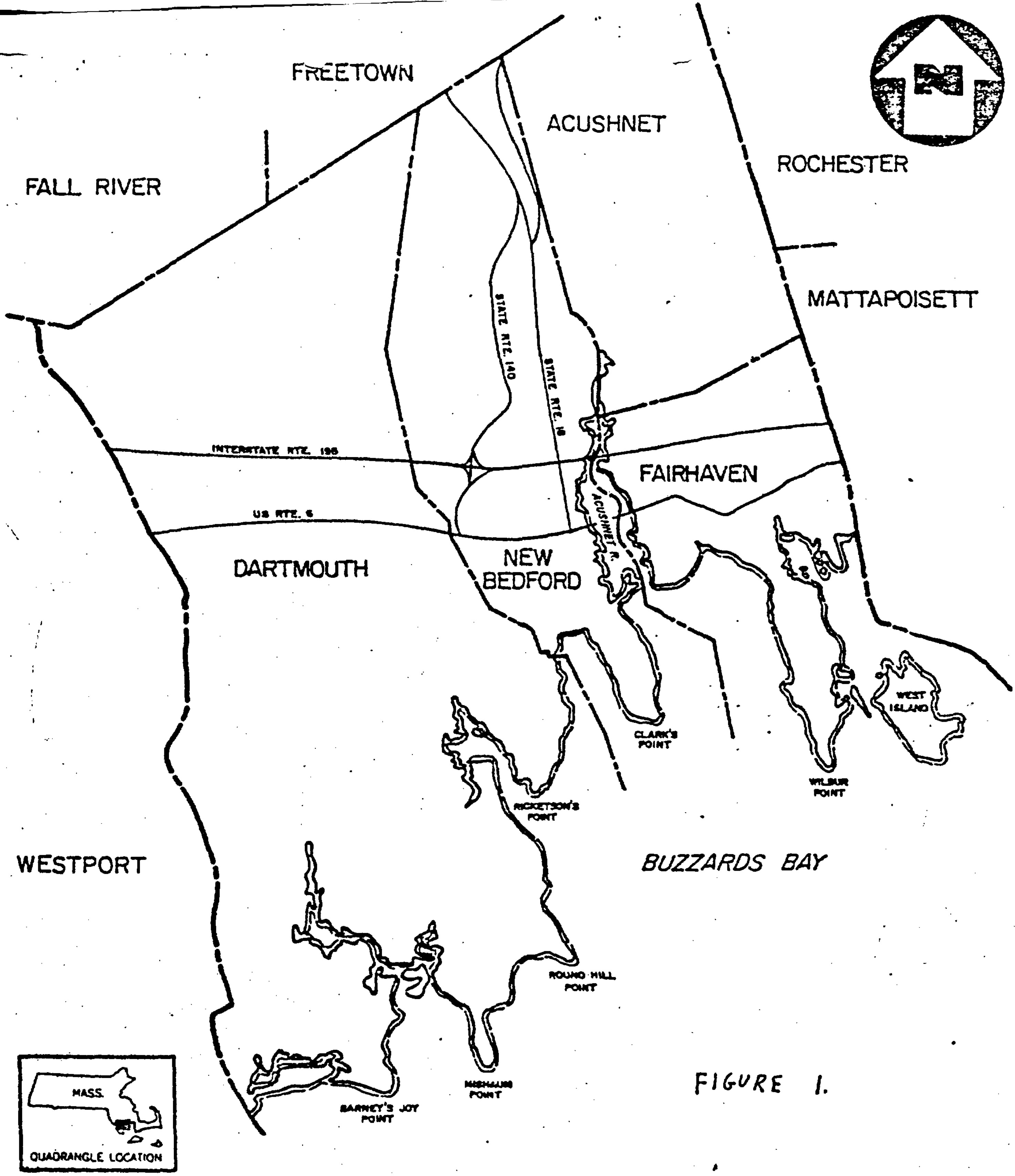
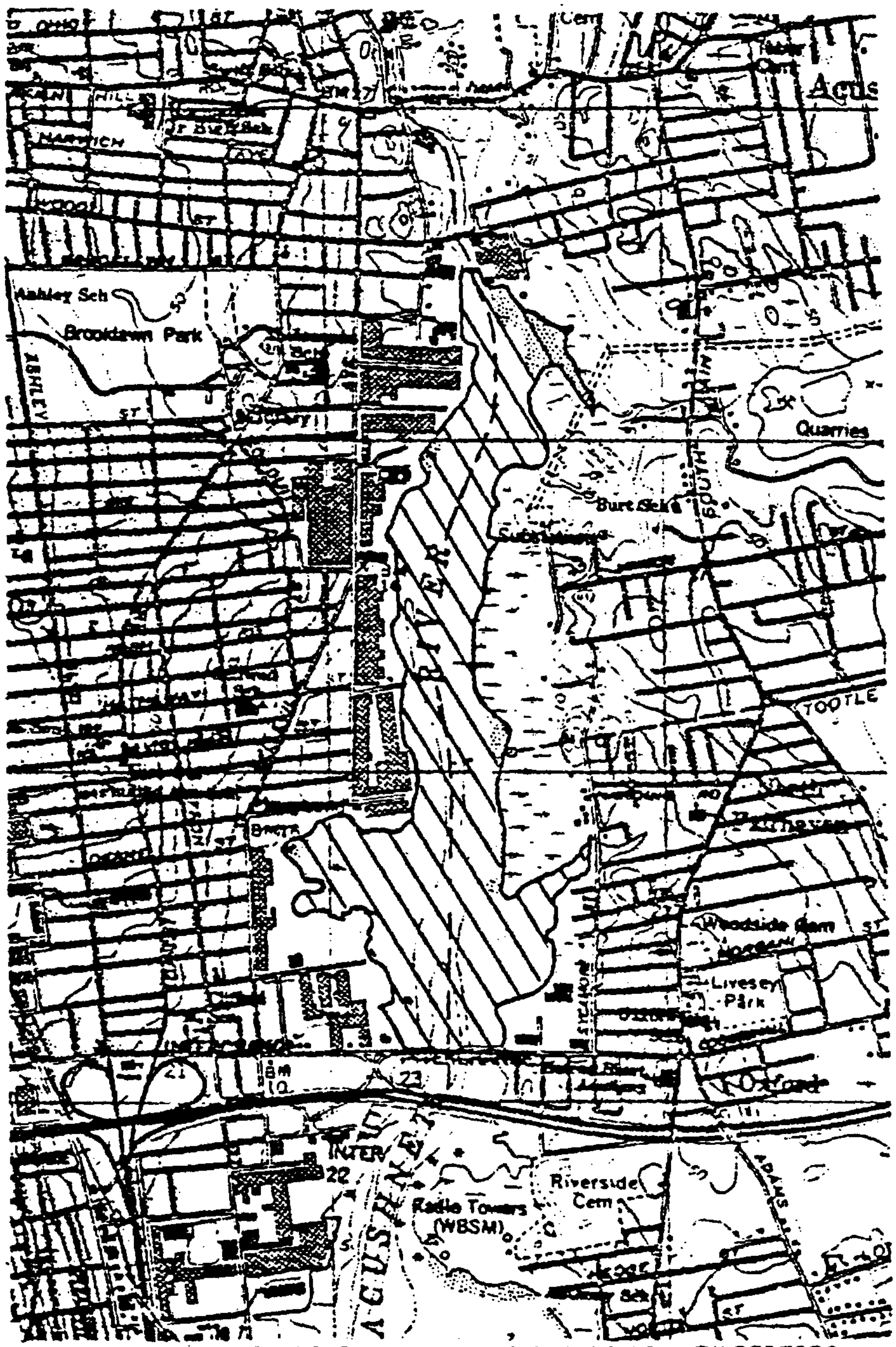


FIGURE 1.

[redacted]

LIMITS OF STUDY AREA
NEW BEDFORD SITE, NEW BEDFORD, MA
SCALE: 1" = 2.2 MILES

NUS CORPORATION
A Halliburton Company



BASE MAP IS A PORTION OF THE U.S.G.S. NEW BEDFORD NORTH, MA QUADRANGLE (1979), 7.5 MINUTE SERIES, CONTOUR INTERVAL 10'.

LEGEND

HOT SPOT AREA

(AS DEFINED FOR THIS STUDY)

FIGURE 2.

HOT SPOT AREA

NEW BEDFORD SITE, NEW BEDFORD, MA

SCALE: 1" = 2000'

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NUS CORPORATION

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area of the estuarine portion of the river above the Coggeshall Street Bridge is approximately 202 acres at mean high water (mhw). The width averages 850 to 950 feet along the length of the river channel with a minimum of 300 feet at the head and a maximum of 2200 feet downstream. The greatest depths are associated with the main channel, which trends northward through the center of the basin. The main channel has a mean low water (mlw) depth of 18 feet at the constricted opening of the Coggeshall Street Bridge. The depth quickly decreases to 6 feet and then to 2 feet at the head of the estuary. Depths become rapidly shallow both east and west of the main channel, as water depths are commonly less than 3 feet at mlw in these areas. Mean tidal range is 3.8 feet. Mean sea level is equal to a local tide level of 1.6 feet above mlw. The mlw volume of the estuary is estimated to be 255,524,000 cubic feet and the tidal prism to be 65,664,000 cubic feet. Flushing time within the estuary is approximately 18.2 hours.

The Acushnet River has an estimated mean annual freshwater discharge of 30 cfs. This flow over a 6.5-hour ebb or flood tide represents approximately 1 percent of the average tidal prism. River flows vary from 0 during dry periods, to less than 0.5 cfs for the predicted 7-day, 10 year low flow, to 1,350 cfs for the 100-year storm flood. The river is a major source of sediments to the estuary. Sedimentation rates have been estimated to currently range between 1.7-4 centimeters/year.

1.2.2 Groundwater

The area is underlain by Proterozoic Eon plutonic, intrusive, and metamorphic rocks. The rocks are moderately deformed and highly faulted. The geomorphic features in the region of Buzzard's Bay indicate a north-south lineation in the underlying bedrock.

Most of the urban New Bedford and Acushnet/Fairhaven area is covered by drumlin and ground moraine composed of basal till. The till contains mostly silt, sand, and boulders. The areas along the Acushnet River are covered by both kame deltas and outwash deposits. North of the Acushnet area, kame deltas, consisting of gravels, sands, silts, and clays formed in temporary glacial lakes. The kame deposits generally overlie till. The river banks in New Bedford and Fairhaven consist primarily of outwash deposits of fine to coarse gravel.

Marsh areas are underlain by tidal peat deposits that consist of organic silt, silt, and sand. These organic deposits generally overlie the glacially deposited soils. Three groundwater zones can be identified in such areas, including groundwater flow in the bedrock, a water table and flow through the unconsolidated deposits, and a perched groundwater system that overlies the relatively impermeable, confining peat layers.

The regional groundwater flow direction is toward the harbor from both the east and west. However, during dry periods when water table elevations have declined, the harbor can recharge the groundwater through permeable bottoms. During high tide, a negatively sloping gradient is established in an inland direction. At low tide, the gradient reverses direction with flow toward the harbor. It is unlikely that any groundwater recharge from the harbor penetrates more than 1000 feet east or west of the shoreline since any reversed gradient would not exceed the general regional gradient toward the harbor.

Groundwater withdrawn from outwash deposits along the Acushnet River Estuary would be saline. Groundwater in these deposits is not, therefore, the source of local water supplies.

1.2.3 Biotic Resources

Both wetland and aquatic ecosystems are present in the study area. The estuary is dominated by demersal fish such as American eel, winter flounder, scup, summer flounder, windowpane flounder, and tautog. Alewives and blue back herring migrate through the estuary to spawn in the freshwater of the Acushnet River (Crouch, G., personal communication). Although the NUS (1984) report indicates few benthic macrofauna in the hot spot areas north of the Coggeshall Street Bridge, invertebrate demersal and epibenthic fauna are present and abundant in many locations north of the bridge. Abundant populations of the ribbed mussel were observed by SES scientists at the salt marsh edge just below tall salt marsh cordgrass (SES, 1985). Additionally, the New Bedford Shellfish Officer (Bourge, B., personal communication) has indicated the presence of oysters, soft shelled clams and hard shelled clams.

Four major cover types may be emphasized within the estuary basin (SES, 1985): (1) tidal flats, (2) salt marsh, (3) reed marsh, and (4) upland areas. Aerial photographs have been used to evaluate wetland areas (EPA, March, 1985). Twenty-five distinct units were observed covering a total of 50.07 acres. Tidal flats constituted approximately 0.83 acres, however this type could be more extensive if tidal levels were high when the photographs were taken. Nineteen units on the photographs may be placed within the category salt marsh. Salt marsh constituted an area of 45.85 acres. Two reed marsh areas were identified covering a total of 3.39 acres.

SES examined wetland and upland areas during a one day field investigation in February, 1985 (SES, 1985). It was noted that the estuary and marshes on the eastern shore of the study site showed at least the expected levels of bird populations for an unpolluted site. Species diversity and abundance, plus the algae and invertebrate food resources surveyed during the visit did not indicate severe degradation of the site. Invertebrate abundance appeared to be reasonably high. The state of the vegetation did not indicate severe stress.

1.3 CHARACTER OF RESOURCES IMPACTED

Remedial action alternatives would impact all estuary resources including wetlands. PCB and metal contamination has been found throughout the estuary. Primary concern has been focused on contamination of biota and sediments. Median PCB concentrations for various finfish are well above the FDA action level of 2 ppm (maximum PCB concentration considered safe for human consumption). Eel tissue has exhibited concentrations in excess of 500 ppm. Lobster tissue concentrations have often been measured in excess of 50 ppm (NUS, 1984).

The most severe sediment contamination has been observed in the western and northern parts of the estuary. PCB concentrations typically have exceeded 1,000 ppm (dry weight) and 100,000 ppm in localized areas. Elevated concentrations of heavy metals are also of concern. (For example: copper >1,000 ppm; arsenic >50 ppm; lead 300-500 ppm; zinc >600 ppm; mercury >2.5 ppm; chromium 400-500 ppm; nickel >150 ppm; cadmium >20 ppm.) (Data from NUS,1984.)

Such very high contamination levels are not consistently present through the estuary and associated wetlands. Recent sampling (NUS, March 6, 1985) within wetland resources on the eastern shore of the estuary have indicated PCB levels ranging from 0 to 20.2 ppm. Of 10 sample locations, 3 were negative for PCBs, 2 were between 0 and 10 ppm, while 5 were above 10 ppm. NUS (April 8, 1985) also screened metal concentrations within the salt marsh system. Results suggest that copper, lead, zinc and chromium should be more closely investigated. Relatively lower concentrations of PCBs may explain the presence of a diverse biotic community.

1.4 RELATIONSHIP TO EXISTING USES

Currently the estuary is closed to the taking of fish and shellfish. While such a measure reduces the probability of contaminant exposure to large segments of the population, the threat of exposure is still present. Current use is primarily restricted to boating, recreation, and open space. The proximity of human activity to uncontrolled contaminant sources offers a continuing threat to human welfare.

The estuary and associated wetlands support a diverse biotic community and hence offers an opportunity for wildlife observation, educational and scientific endeavors, and the amenities of open space in an area which is otherwise highly developed. The Massachusetts Natural Heritage Program (see attached April 19, 1985 correspondence) has identified a Fairhaven conservation area located on the eastern side of the estuary within the project impact area.

The non-aquatic biotic community, if contaminated, offers a pathway by which PCBs may enter either humans or pets such as cats and dogs. For example, SES scientists counted 150 Scaup and

24 black duck during the one day site visit (SES, 1985). These ducks are hunted in the East. The ducks may carry contaminants to considerable distances, (for example, black ducks may migrate as far north as Canada). Local rodent populations, if contaminated, may provide a PCB pathway to pet cats and dogs.

1.5 ALTERNATIVES

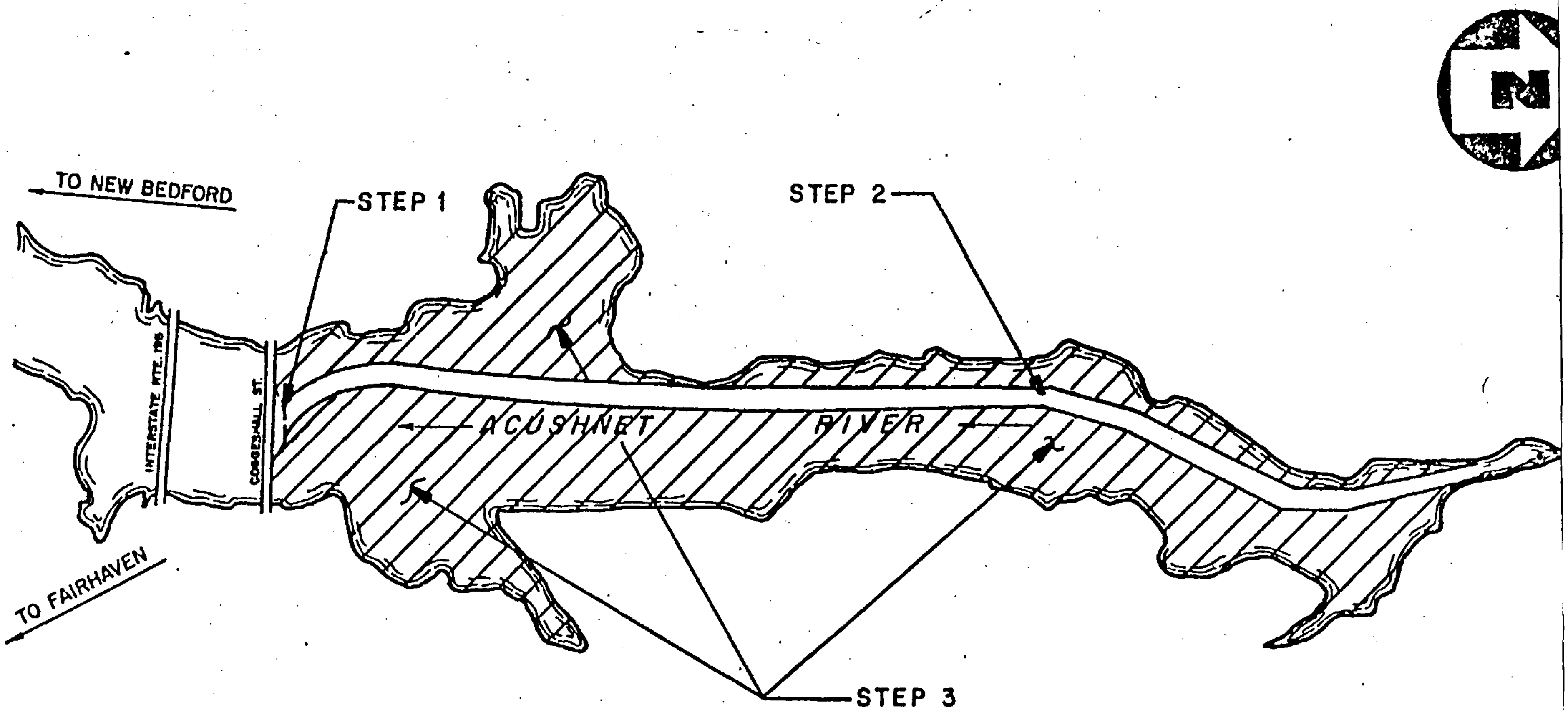
Unless otherwise indicated, the following descriptions have been extracted or synthesized from the NUS report (1984)

1.5.1 Hydraulic Alternative

This alternative involves the construction of a lined earthen and rockfill channel along the western shoreline to bypass the freshwater flows of the Acushnet River Estuary from a point upstream of the hot spot area to a point below the Coggeshall Street Bridge. The purpose is to isolate the contaminated sediments from the resuspension and transport action of the river flow. Embankment heights will be constructed to elevations suitable to prevent overtopping during flood conditions, except near the harbor opening beneath the Coggeshall Street Bridge where the embankment height will be lowered to allow a tidal exchange between the lower harbor and the estuary. The harbor bottom in the remaining open-water areas will be covered with clean sediments in order to isolate the contaminated sediments from the water column. The covering will reach a depth of between 3 and 4 feet. Sediment dispersal control will be implemented prior to construction. Figures 3 and 4 illustrate the hydraulic control alternative.

1.5.2 Dredging with Disposal in an In-harbor Containment Site

In this alternative, sediments with PCB contamination levels in excess of 1 ppm will be dredged from the estuary and disposed in an in-harbor containment site along the eastern shore in the northern part of the estuary (primarily wetlands). An impermeable membrane liner option may be selected to aid in isolating the contaminated sediments. Such an option would entail dredging within wetlands, placement of liner, and then placement of contaminated sediments. Before any dredging begins, sediment dispersal control will be installed at the harbor opening beneath the Coggeshall Street Bridge. The cove on the western shore of the upper harbor will be developed into a temporary containment site by construction of an earthen retaining embankment. Sediments from the proposed location of the in-harbor containment site embankment will be dredged and pumped tp the temporary containment site. If the liner option is chosen, sediments from the permanent containment site would also be temporarily contained in the cove. The in-harbor containment site embankment will next be constructed of earthen materials to isolate the contaminant area from the Acushnet River Estuary and harbor waters. Dredging of the remaining areas outside of the embankment in the upper harbor will then proceed with the materials being pumped to the permanent containment site; previously dredged sediments contained in the temporary site will be concurrently pumped to the permanent site. All supernatant water in both containment sites will be removed for subsequent treatment. Finally, the permanent containment site will be capped to further isolate the contaminants. Figures 5 and 6 illustrate the in-harbor containment alternative.



STEP 1– INSTALL SEDIMENT DISPERSAL CONTROL.

STEP 2– CONSTRUCT DOUBLE EMBANKMENT CHANNEL (APPROXIMATE ALIGNMENT INDICATED).

STEP 3– CAP SEDIMENTS. ▨

0 1000 2( )

SCALE IN FEET

FIGURE 3.

PLAN VIEW OF HARBOR ILLUSTRATING HYDRAULIC CONTROL ALTERNATIVE NEW BEDFORD SITE, NEW BEDFORD, MA

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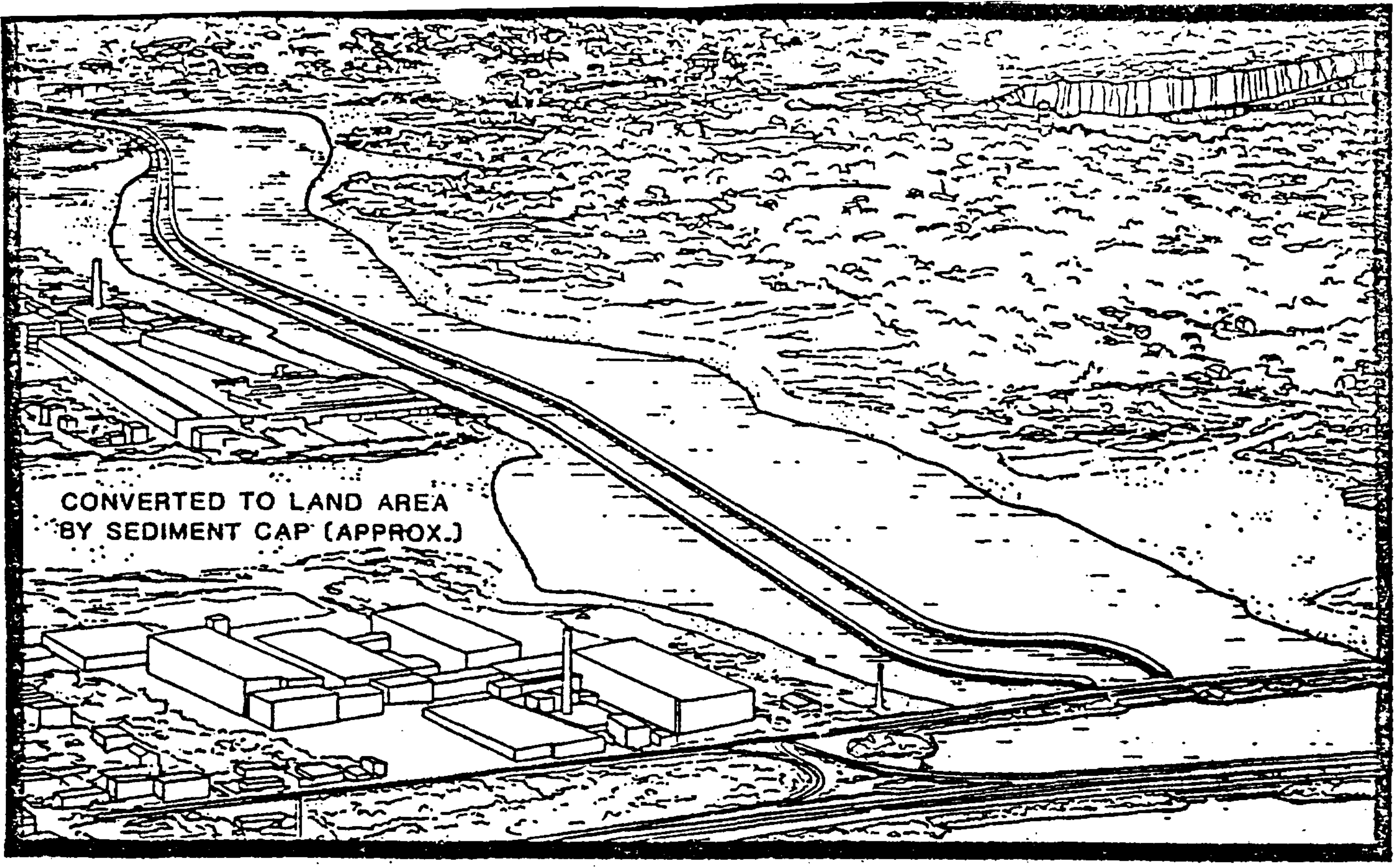
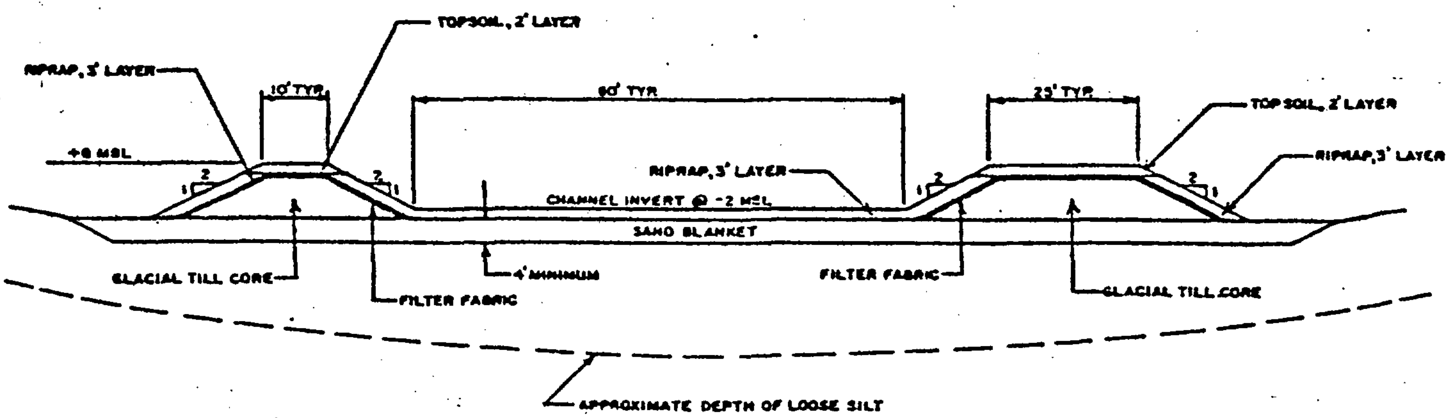
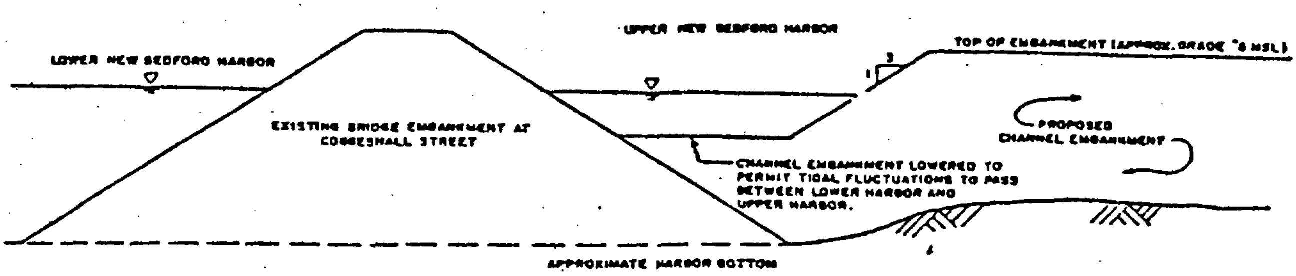
NUS CORPORATIO

A Halliburton Compa





TYPICAL CHANNEL CROSS-SECTION



CHANNEL PROFILE NEAR BRIDGE

FIGURE 4.

[redacted]

ARTIST'S CONCEPTION
AND TYPICAL CROSS-SECTIONS
HYDRAULIC CONTROL ALTERNATIVE
NEW BEDFORD SITE, NEW BEDFORD, MA

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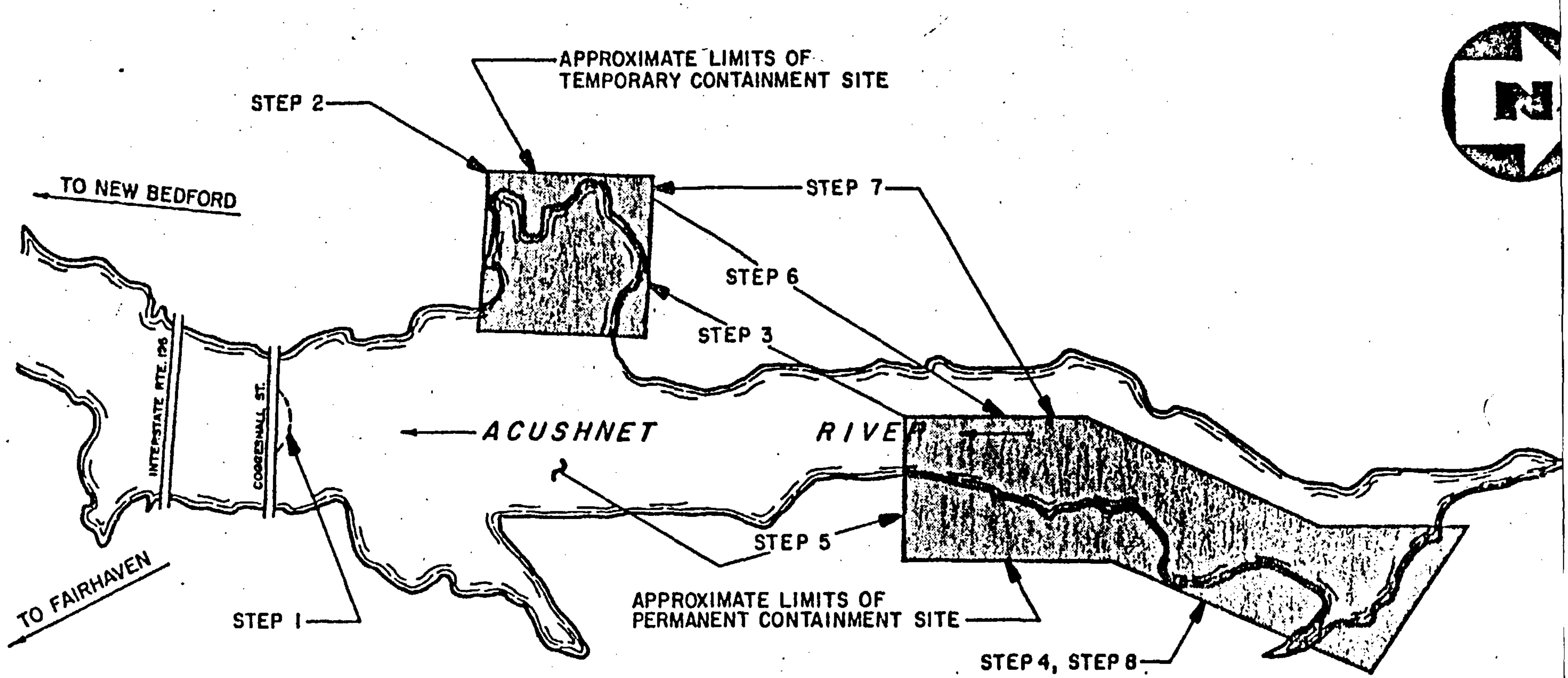


STEP 1 – INSTALL SEDIMENT DISPERSAL CONTROL.

STEP 2 – CONSTRUCT TEMPORARY CONTAINMENT SITE.

STEP 3 – DREDGE BENEATH EMBANKMENT. HOLD IN TEMPORARY CONTAINMENT SITE.

STEP 4 – CONSTRUCT PERMANENT CONTAINMENT SITE.

STEP 5 – DREDGE-DISPOSE IN PERMANENT CONTAINMENT SITE.

STEP 6 – TRANSPORT SEDIMENTS FROM TEMPORARY CONTAINMENT SITE TO PERMANENT CONTAINMENT SITE.

STEP 7 – TREAT WATER.

STEP 8 – CAP CONTAINMENT SITE.

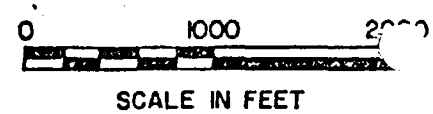
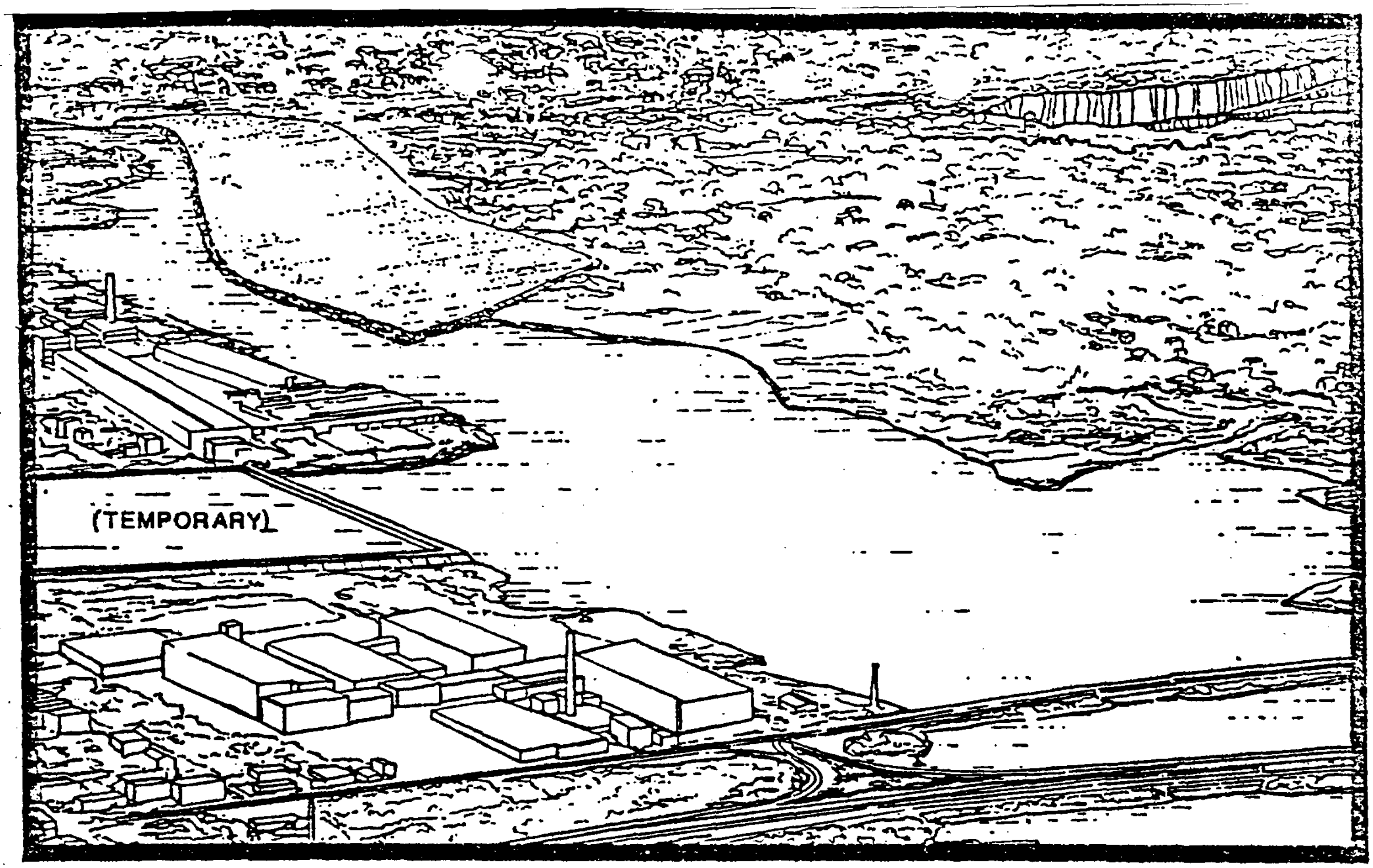


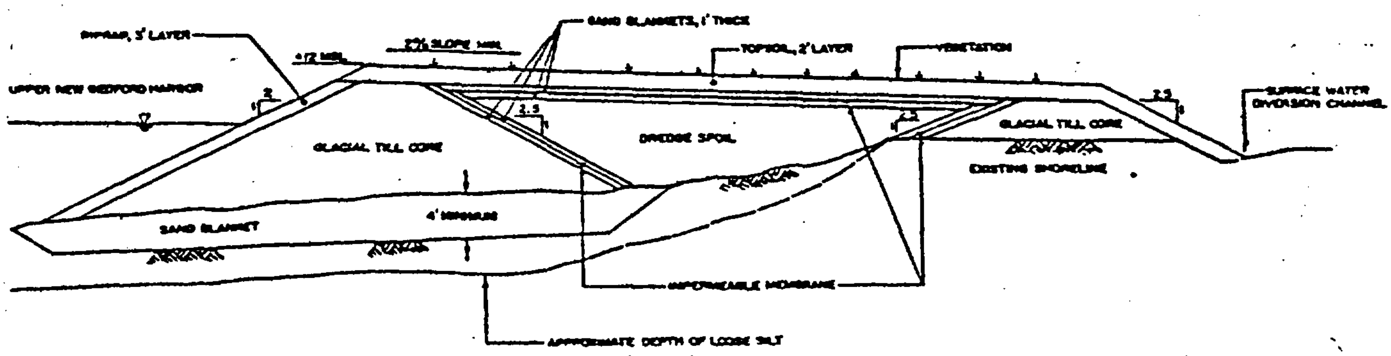
FIGURE 5.

[redacted]

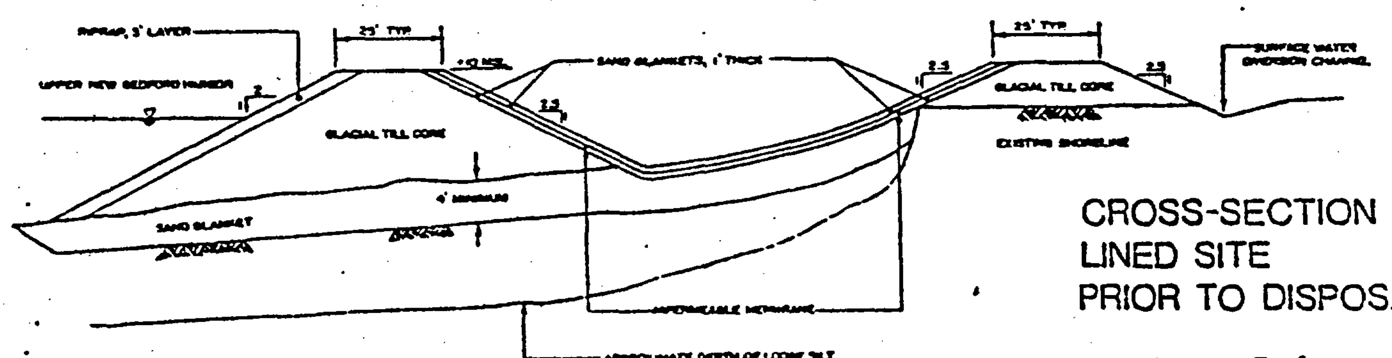
PLAN VIEW OF HARBOR ILLUSTRATING
IN-HARBOR CONTAINMENT ALTERNATIVE
NEW BEDFORD SITE, NEW BEDFORD, MA

NUS CORPORATION
A Halliburton Compar





CROSS-SECTION
UNLINED SITE AFTER CAPPING



CROSS-SECTION
LINED SITE
PRIOR TO DISPOSAL

FIGURE 6.

[redacted]

ARTIST'S CONCEPTION
AND TYPICAL CROSS-SECTIONS
IN-HARBOR CONTAINMENT ALTERNATIVE
NEW BEDFORD SITE, NEW BEDFORD, MA

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2. ASSESSMENT OF IMPACTS

2.1 IMPACTS ON PHYSICAL/CHEMICAL CHARACTERISTICS OF THE AQUATIC ECOSYSTEM

The project would:

(X) change the physical and chemical characteristics of the substrate.
(X) change the substrate elevation or contours.
(X) cause erosion, slumping or lateral displacement of the surrounding substrate.
(X) change water fluctuations.

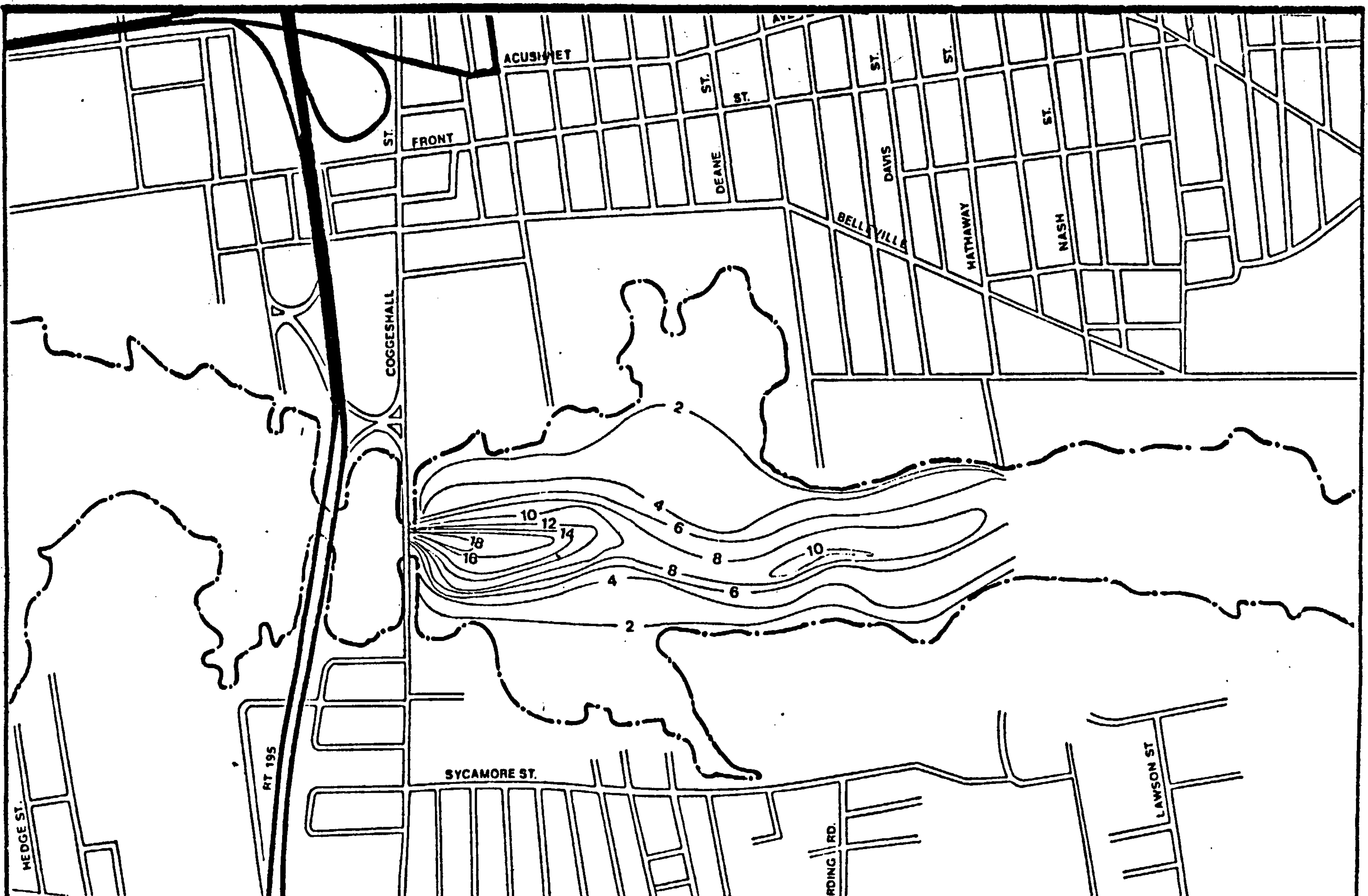
Comment:

(HYDRAULIC CONTROL)

Placement of clean sediments over the existing substrate (capping) of open-water and wetland areas outside the proposed lined earthen and rockfill channel will change the substrate from organic silt and sandy silts to sand or sandy gravel. Elevations along the proposed channel embankments and in the remaining open-water areas will increase 3 to 4 feet. The result of this action would be an ecosystem in which the existing fauna and flora would be replaced by types tolerant of the new substrate and elevation. Since much of the estuary is less than 3 feet deep mlw, the amount of open water would be substantially decreased. A lack of detailed bathymetry prevents an accurate description of such impacts. Jason Cortell and Associates (1982) has developed bathymetry for a portion of the area (see Figure 7). A comparison of this bathymetry which is relative to mlw with Figure 6 suggests that the rendering in Figure 6 is based upon high water. Detailed bathymetry of the entire estuary is needed in order to quantify potential impacts. Such a map should illustrate 1 foot contours and be overlayed on a 1 foot contour topographic map of on-shore features.

The placement of the channel and the clean fill will cause the dispersement of some sediments. However, the amount of sediment dispersement and the resulting effects will be determined by the time required to implement this alternative and the effectiveness of the sediment dispersal control measures.

The construction of a channel along the western shoreline will isolate the area behind the channel from the river flow. This action will result in a change in water fluctuations, especially during flooding events. In addition, the placement of a layer of clean sediments in the open-water areas will alter the depth of water. The extent of intertidal zone will be determined by the surrounding finished topography.



WATERFRONT PARK
New Bedford, Massachusetts

Bathymetry

FIGURE 7.

JASON M. CORTELL AND ASSOCIATES INC.

0' 500' 1000'

[redacted]

(DREDGING)

Dredging will alter the physicochemical characteristics of the surface sediments within the estuary, particularly during dredging operation. Dredging will not only change the physical characteristics of the sediments by altering its particle size distribution, but will change the pH and oxidation-reduction potential of the sediments. These changes can result in transformations of certain metals and organic compounds which will influence their solubility and/or bioavailability. The degree of alteration will depend on physical disruption caused by the dredging activities and the physical and chemical characteristics of the subsurface sediments. Information on circulation and currents within the estuary, as well as physical and chemical characterization of sediments which will be exposed after dredging, will be required in order to evaluate long term changes in substrate.

The substrate elevation within the open-water areas will decrease approximately 3 to 4 feet as a result of this alternative. Portions of adjacent wetlands which contain PCB concentrations in excess of 1 ppm would also be lowered 3 to 4 feet. Additional substrate changes will occur within the temporary and permanent containment sites as a result of the disposal of dredged material and eventual capping. As with the hydraulic alternative, a quantitative assessment of the degree of impacts must await detailed bathymetry and on-shore topographic mapping. However substrate elevation changes are likely to occur over an area which is in the order of 235 acres.

The dredging operation will cause some slumping or lateral displacement of sediments along the perimeter of the dredging limits. However, this slumping of sediments should be a temporary affect of the dredging operations.

Alterations in the 100 year flood level may occur as a result of lost flood storage capacity within the disposal site. Further hydraulic information is required to evaluate this possibility. The extent of intertidal zone will be determined by the surrounding finished topography.

These changes would affect:

(X) currents, circulation or drainage patterns.
(X) suspended particulates and turbidity.

Comment:

(HYDRAULIC CONTROL)

The placement of the proposed channel will effectively narrow the width of the existing channel. As a result, the existing currents and circulation patterns will be altered. The overall flow and circulation patterns in the inner harbor are primarily forced by conditions in the Outer Harbor and Buzzards

Bay, and these should not change. However, this action may result in increased localized current velocities - especially along the area of the proposed channel during flood conditions. The amount of time for a complete exchange of water within the basin would also be affected.

Placement of the channel and the clean sediment cap will generate a certain amount of suspended particulates and turbidity in the water column. This will be especially pronounced during the placement of the proposed channel prior to the capping of the sediments in the open-water areas.

(DREDGING)

Construction of the containment sites (temporary and permanent) will affect the drainage patterns of the area as well as the localized currents and circulation within the northern portion of the estuary. The overall flow and circulation patterns in the inner harbor are primarily forced by conditions in the Outer Harbor and Buzzards Bay, and these should not change. However, this action may result in increased localized current velocities - especially along the area of the embankment during flood conditions. The amount of time for a complete exchange of water within the basin would also be affected.

Dredging of the estuary will increase suspended particulates and turbidity in the water column. The magnitude of this increase and its significance with respect to the biota in the outer harbor will depend largely on the operational conditions of the dredging (cutterhead revolution rate, operator training, timing, sediment type, etc.) as well as the expected efficiency of the proposed sediment dispersal control (Barnard, 1976). A memo prepared by M. R. Palermo and N. R. Fancingues (Waterways Experiment Station) has indicated that the sediment dispersal control (weir and silt curtains) may be ineffective. It can be expected that the very small particulates will account for the majority of the suspended solids and turbidity resulting from the dredging operations. It is these small particulates which may contain a large percentage of PCBs (US EPA, 1983).

The production of an oil-like sheen has been identified as a potential result of dredging operations. Palermo and Fancingues have suggested that previous observations of sheen may be related to surface runoff and bear little relationship to dredging operations. However they recomended further evaluation.

These changes, would in turn, affect:

(X) water quality (clarity, odor, color, taste, D.O. levels, nutrient levels, toxins, pathogens, viruses, etc.).
(X) water temperatures.
(X) salinity gradients.
(X) thermal stratification.

Comment: (HYDRAULIC CONTROL)

Water quality conditions will be affected by the increased levels of suspended solids and turbidity during implementation of this alternative. The placement of 3 to 4 feet of sandy sediments over the existing organic silt and silty sand will cause the resuspension of some particulate associated contaminants (PCBs, metals). In addition, other temporary water quality changes would be expected such as increased oxygen demand and increased nutrients. This alternative would eventually result in the isolation of PCB and heavy metals contaminated sediments from resuspending and transport action of the river flow. Isolation of the western shoreline area from the influence of the Acushnet River will change the hydrographic characteristics of this area, resulting in a more homogeneous salinity and temperature structure.

(DREDGING)

Dredging of the estuary will have an effect on the water quality of the estuary. In addition to increases in suspended solids and turbidity, this action will also result in some temporary changes in the levels of nutrients, dissolved oxygen, pH, metals and PCBs in the water column. The environmental effects of such changes will depend on the extent of these changes and the effectiveness of the control measures to prevent any contamination beyond the harbor opening.

Dredging will have a temporary affect on the hydrographic characteristics (temperature, salinity) of the estuary. The development of the permanent containment site will result in the elimination of the existing tidal flats and marsh area and the creation of an upland system. The containment area would not experience any tidal exchange.

2.2 IMPACTS ON SPECIAL AQUATIC SITES

The changes presented in section 2.1 would occur in:

( ) sanctuaries and/or refuges.
(X) wetlands.
(X) mudflats.
( ) vegetated shallows.
( ) coral reefs.
( ) riffle and pool areas.

Comment: In the study area between the Coggeshall Street

Bridge and the Tarkiln Hill Road Bridge, the no action alternative poses moderate to extensive adverse impacts through continued heavy metal and PCB presence in sediments. Elevated levels of PCBs have been found in fish and shellfish (NUS, 1984). PCB concentration within food chains leading to birds and terrestrial mammals may potentially occur, however this possibility requires evaluation based upon tissue analyses.

(HYDRAULIC CONTROL)

Hydraulic Control and Sediment Capping will deposit 3-4 feet of clean fill on estuarine surfaces and potentially a portion of existing wetlands thus destroying all non-mobile benthic life and severely impacting mobile forms (e.g. fish, aquatic birds). In the long term, different aquatic habitats, reduced in area, will result from the channelized river and elevated underwater substrates. Recolonization may be expected in the long term for varying percentages of the habitat. The type and extent of particular communities which develop will be dependent upon substrate elevation and hence can not be quantitatively assessed without proposed contour information.

Other adverse impacts include construction disturbance, estimated at 1.3 years (NUS, 1984).

Benefits to the aquatic sites remaining after the proposed treatment principally arise from the isolation of PCB and heavy metal pollution from the water and biological communities.

(DREDGING)

Dredging and associated containment constructions will essentially eliminate benthic communities. Recolonization may be expected in the long term for varying percentages of the habitat. The type and extent of particular communities which develop will be dependent upon substrate elevation and hence can not be quantitatively assessed without proposed contour information. However it would appear that a greater amount of aquatic and/or wetland habitat will develop with a dredging action than with hydraulic control. Proposed in-harbor containment sites will convert up to 35 acres of wetlands and mudflats (including salt marsh and phragmites reed marsh) to artificial uplands at least +8 feet above mean sea level.

Other adverse impacts include construction disturbance, estimated at 2.7 to 5.3 years (NUS, 1984).

Further cumulative impacts may result from in-harbor disposal if remedial actions are taken below Coggeshall Bridge. Wetland areas adjacent to the proposed containment site would be prime candidates for the disposal of dredged materials from any additional remedial action.

Benefits to the aquatic sites remaining after the proposed treatment principally arise from the virtual elimination of further PCB and heavy metal pollution from the water and surface sediments.

The special aquatic site provides benefits including:

(X) flood control.
(X) water purification.
(X) food chain production and nutrient export.
(X) storm, wave, and erosion buffers
(X) aquifer recharge
(X) habitat for fish and other aquatic organisms.
(X) wildlife habitat.

Comment: Flood storage capacity is presently available within the estuary basin between sea level and the 100 year flood elevation. In-harbor disposal would displace some flood storage capacity. The hydraulic alternative would pass 100 year storm flows from the Acushnet river into the upper harbor thus slightly decreasing flood levels within the estuary (NUS, 1984). It is assumed that ocean flooding from hurricanes would be effectively minimized by the existing hurricane barrier.

Wetlands (particularly the salt marsh) may be presumed (and is by state regulations) to remove contaminants (e.g. uptake of N and P, removal of suspended particulates, immobilization of heavy metals, etc.). Although PCBs are relatively stable with long half lives in the natural environment, there is some evidence to indicate that transformation of PCBs is promoted under anaerobic conditions (EPA, 1983). Such conditions would prevail within wetland substrates. However transformation of PCBs may lead first to more toxic compounds (polychlorinated dibenzofurans) prior to degradation to innocuous chemicals.

The wetlands which would be impacted by the proposed remedial actions provide primary production for both aquatic and terrestrial food chains in the Acushnet Estuary. A preliminary survey of the site by SES scientists indicated the presence of detritus, algae, filter feeders, benthic invertebrates and vetebrate taxa. Relative abundances of taxa along the eastern side of the estuary did not appear to show severely depauperate flora or fauna relative to expected abundance in non-polluted, but otherwise similar areas.

The wetland complex, particularly vegetated areas, provides a buffer zone which reduces erosion and damage from storms and waves that might otherwise occur to adjacent upland and developed areas.

Salt water intrusion into the groundwater system both east and west of the estuary may occur up to 1000 feet from the shoreline (NUS, 1984). The controlling factors have not been well documented. Of particular concern is the influence of relatively impermeable peat substrates and potential perched groundwater systems on groundwater exchange between the estuary and adjacent uplands. Such information may be of value in evaluating projected groundwater movement through the containment site.

Habitat for fish and other aquatic organisms may be assumed to be reasonably productive, from the numbers of top consumers observed feeding in this habitat, predominantly waterfowl (Anatidae) and gulls (Laridae).

Terrestrial/aquatic and terrestrial food chains in the salt marsh, reed marsh, marsh-upland fringe and upland vegetation types were examined in the area of the proposed permanent containment sites (SES, 1985). As expected because of the season, animal life was sparse at all trophic levels in February, but primary production as estimated from vegetation height and density was not severely depauperate. Wildlife habitat in these vegetation types seemed similar to that in unpolluted areas. Construction, especially dredging, would increase water turbidity, cause disturbance, interrupt food chains and eliminate extensive acreage of wildlife habitat. Benefits to the remaining (or new resulting) habitats after remedial action would arise chiefly from long term reduction of pollutants in the food chain. Although currently not predictable, it is expected that contaminant reductions within the biotic community would require a number of years (NUS, 1984).

2.3 IMPACTS ON BIOLOGICAL CHARACTERISTICS OF THE AQUATIC ECOSYSTEM

The changes in sections 2.1 and 2.2 would adversely impact:

(X) endangered or threatened species, or critical habitat for such.
(X) fish, mollusks or other aquatic organisms through:

( ) removal.
(X) temporary displacement.
(X) permanent displacement or lowered numbers through changes in overall suitability of habitat in terms of substrate, temperatures, water quality, etc.
(X) interfering with spawning migrations.

Comment: On 22 February 1985 an immature Peregrine Falcon was observed flying over the estuary and salt marshes (SES, 1985). This species is currently recognized as a Federally Endangered Species by the U.S. Dept. of the Interior, and State Endangered on the draft list of the Massachusetts Division of Fisheries and Wildlife. If the study area comprised part of the regular wintering range of this endangered species, the disturbance and habitat alterations proposed might be cause for concern. However, local ornithologists have stated that this Peregrine Falcon was not a winter resident; a likely conclusion in southern Massachusetts. The Massachusetts Natural Heritage Program (personal communication) has no records of Peregrine Falcon nesting activities near the estuary.

Fish, mollusks and other aquatic organisms would clearly suffer major displacement and loss of numbers due to all channelling, dredging, and/or aquatic sediment capping operations. Impacts would include removal by dredging, covering of their habitats by fill, impoundments and capping. Water turbidity may also cause reductions in some species, e.g. fish, if extreme turbidity occurs over prolonged periods. Mobile species may be able to recolonize aquatic habitat after construction ceases, depending on the degree of habitat alteration.

Both Alewives and blue back herring migrate through the estuary to spawn in the freshwater of the Acushnet River (Crouch, G., personal communication). Implementation of either remedial action could potentially impair this migration. Both alternatives incorporate the use of silt curtains near the Coggeshall Street Bridge. Although a two foot passage underneath the curtains would allow some migration, an evaluation of the effect of the curtains on migration should be made.

(X) Or other wildlife in terms of:

- (X) breeding and nesting habitat.
- (X) escape cover.
- (X) travel corridors.
- (X) food supplies.
- ( ) competition from nuisance species.
- (X) reduced plant species diversity and interspersion of habitat types.

Comment: The marshes would be eliminated in the short term and reduced in size in the long term by either alternative. These marshes are breeding habitat for a limited number of bird and mammal species, e.g. Red-winged Blackbird, Song Sparrow, probably Meadow Vole and Skunk. Transition zones above high water mark will provide breeding habitat for many more species. Due to the building developments on both shores, the vegetated margins provide suitable wildlife corridors along the estuary. The diverse flora provides varied wildlife food and cover at all times of the year.

2.4 IMPACTS ON HUMAN USES

The impacts in sections 2.1, 2.2, and 2.3 would adversely affect human uses of the resource, through degradation of:

- ( ) existing or potential water supplies.
- (X) recreational or commercial fisheries.
- (X) other water-related recreation.
- (X) aesthetics of the aquatic ecosystem.
- (X) parks, national and historic monuments, national seashores, wilderness areas, research sites, and similar preserves.

Comment: Currently the area is closed to fishing. Illegal taking of fish or shellfish may pose a hazard to a limited population. Implementation of either remedial alternative may result in a reduction in contaminant loading sufficient to reopen the area to fishing. However, populations of fish or shellfish can be expected to be reduced compared to existing conditions due to a reduction of viable habitat. Such a reduction would be most severe for the hydraulic alternative.

Recreational boating would be impacted by the remedial alternatives during construction and post construction. A reduction in size of the boating area would occur and be most pronounced for the hydraulic alternative.

The estuary and associated wetlands presently offer open space amenities within an otherwise developed setting. Either alternative would result in a reduction of aquatic and wetland resources which are currently protected from development by state and federal laws.

The Massachusetts Natural Heritage Program has identified a tidal flat area north of the Coggeshall Bridge and south of the proposed containment site as a conservation area owned by the town of Fairhaven (see attached letter). The conservation area is potentially within the impact zone of either remedial alternative.

2.5 OTHER CONCERNS:

The proposal will impact:

( ) energy consumption or generation.
(X) navigation.
(X) safety.
(X) air quality.
(X) historic resources
(X ?) noise.
( ) land use classification.

Comment: Small craft navigation may be impacted as a result of the hydraulic alternative which would create extensive areas of shallow water and a relatively deep river channel.

Resuspension of contaminated sediments which escape down river would be a source of contamination and potential health hazard to people utilizing the harbor.

The major transport mechanism of PCBs through the air is by volitalization. The in-harbor containment alternative would temporarily expose contaminated sediments to the air where volitalization could occur.

Contaminants within the in-harbor containment site may be subject to leaching. This phenomenon may not be pronounced, especially if a liner is installed, but should nevertheless be evaluated.

The Massachusetts Historical Commission (V. Talmage, March 12, 1985) has indicated that at least one known archaeological site occurs in the project planning area in Acushnet. Additional, previously unrecorded sites may also be present. The MHC has requested that an archaeological reconnaissance survey be conducted.

Increase in noise from construction equipment can be expected. The severity of such impacts is dependent on a number of factors, including the locations and types of noise receptors. No comments can presently be offered related to this issue.

2.6 EVALUATION AND TESTING

( ) The permit will be conditioned to require the applicant to use fill from a clean upland source. Therefore, no further evaluation under this section is necessary.

(X) The applicant proposes to discharge dredged material or use fill from other than a clean upland source. The following is an evaluation of the need for testing, testing performed, and evaluation of results:

Comment: Clean fill for capping purposes under the hydraulic alternative will be derived from sediments in Buzzards Bay. It has been assumed in previous impact discussions that such a source would provide clean fill. This assumption should be evaluated. Furthermore, the impact of sediment removal from the bay should also be evaluated.

2.7 ACTIONS TO MINIMIZE ADVERSE EFFECTS

The following actions will be taken to minimize adverse environmental effects:

The remedial action alternatives are, in themselves, programs to minimize adverse environmental effects presented by continued exposure of heavily contaminated sediments to both humans the the biotic communities within the estuary. These alternatives, however, will cause major disruptions to natural ecosystems.

Steps proposed to minimize impacts of the alternatives are largely concerned with preventing contaminants from migrating into the upper harbor (sediment control and water treatment). M. R. Palermo and N. R. Francingues (Waterways Experiment Station) have indicated that the sheet pile and double silt curtains will not be effective. They have not recommended the sheet pile weir and have recommended the use of silt curtains only for asthetic benefit.

Other mitigation measures which would minimize disruption of existing ecosystems deserve consideration, including a reduction in the area which would be treated (eg. excluding areas of wetland with low contaminant levels), and a consideration of alternative in-harbor disposal sites and configurations. The creation of replacement wetland habitat should also recieve consideration.

3. COMMONWEALTH OF MASSACHUSETTS WETLANDS PROTECTION ACT

3.1 RESOURCE CLASSIFICATIONS

Based on Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00), seven resource categories are present in the upper Acushnet River estuary. These are: (1) land under the ocean, (2) banks of or land under the ocean, river, or creek that underline an anadromous fish run, (3) coastal beach, (4) salt marsh, (5) land containing shellfish, (6) coastal bank, and (7) bordering vegetated wetland.

3.1.1 Land Under the Ocean

Land under the ocean in the Acushnet river estuary north of the Coggeshall St. Bridge constitutes approximately 202 acres of sandy silt sediment at mean high water (NUS, 1984).

3.1.2 Banks of or Land Under the Ocean, River, or Creek that Underline an Anadromous Fish Run

Alewives (Alosa pseudoharengus) and blue back herring (Alosa aestivalis) migrate through the Acushnet River estuary to spawn in the freshwater of the Acushnet River (Crouch, C., US FWS, personal communication). It is likely that adult fish and their fry feed in the upper estuary.

3.1.3 Coastal Beaches

Coastal beaches as defined in 310 CMR 10.27 (2) (b) include tidal flats. Tidal sand and mud flats are present primarily along the eastern shore of the Acushnet River estuary. Two major tidal flat areas are present, one in an embayment across from Aerovox near the mouth of the Acushnet River and the other along the eastern shoreline south of the substation (see EPA, 1985 report for more detail).

3.1.4 Salt Marsh

Along the eastern shore of the upper Acushnet River estuary is a 45.85 acre band of salt marsh (US EPA, 1985 Wetlands Interpretation Acushnet River Estuary Interim Report). The salt marsh is dominated primarily by grasses, (Distichlis spicata, Spartina patens, and Spartina alterniflora). Vegetative growth appeared normal during a February 1985 site visit by SES scientists (SES, 1985). Numerous mosquito ditches and creeks cut across the salt marsh providing nursery habitat and feeding grounds for estuarine forage finfish.

3.1.5 Land Containing Shellfish

Land containing shellfish includes the banks of the salt marsh at the seaward edge of the emergent vegetation and adjacent tidal flats. Abundant populations of the ribbed mussel (Geukensia demissa) were observed present at the salt marsh edge just below the tall salt marsh cordgrass (Spartina alterniflora) (SES, 1985). Oysters (Crassostrea virginica), soft shelled clams (Mya arenaria), and hard shelled clams (Mercenaria mercenaria) are also present (Bourge, B., New Bedford Shellfish Officer, personal communication).

3.1.6 Coastal Banks

Coastal banks are defined in 310 CMR 10.30 (2) as the "side of any elevated landform, other than a coastal dune, which lies at the landward edge of a coastal dune, land subject to tidal action, or other wetland." Along the Acushnet River estuary north of the Coggeshall St. Bridge there are manmade seawalls and rock covered banks as well as vegetated coastal banks landward of the salt marsh vegetation.

3.1.7 Bordering Vegetated Wetland

A few small stands of common reed (Phragmites ausralis) were scattered throughout the upper estuary and a more extensive stand was present at the mouth of the Acushnet River. Phragmites vegetated areas covered only 3.39 acres (US EPA, 1985 Wetlands Interpretation Acushnet River Estuary Interim Report). Phragmites is considered primarily a freshwater species, however, it can encroach on high salt marsh. Spartina grass must be present for a resource area to be classified as a salt marsh, therefore, the Phragmites stands although subject to brackish water and tidal action must be classified as bordering vegetated wetland (Hartley, J., DEQE, personal communication).

3.2 STATUTORY INTERESTS

The Wetlands Protection Act identifies and protects seven statutory interests. Current state regulations identify which of the seven interests are likely to be significant for any given wetland resource category. Table 3.1 identifies the resource categories present in the estuary and their presumed significant statutory interests.

TABLE 3.1 WETLAND RESOURCE CATEGORIES AND PRESUMED SIGNIFICANT STATUTORY INTERESTS.

RESOURCE CATEGORY	STATUTORY INTEREST						
	PUBLIC & PRIVATE WATER SUPPLY	GROUND WATER SUPPLY	FLOOD CONTROL	STORM DAMAGE PREVENTION	PREVENTION OF POLLUTION	PROTECTION OF LAND CONTAINING SHELLFISH	PROTECTION OF FISHERIES
LAND UNDER THE OCEAN			X	X		X	X
BANKS OF OR LAND UNDER THE OCEAN, RIVER, OR CREEK THAT UNDERLINE AN ANADROMOUS/ CATADROMOUS FISH RUN							X
COASTAL BEACH			X	X			
SALT MARSH		X		X	X	X	X
LAND CONTAINING SHELLFISH						X	X
COASTAL BANK			X	X			
BORDERING VEGETATED WETLAND	X	X	X	X	X		X

3.3 IMPACTS ASSOCIATED WITH REMEDIAL ALTERNATIVES

3.3.1 Public and Private Water Supply

It is presumed that bordering vegetated wetlands are significant to public and private water supply. However, in the present situation the reed marsh is just upgradient of salt marsh. No potable water supplies are present which could be influenced by the reed marsh. Although the estuary could be considered a water supply (eg. source of process water), the reed marsh does not affect the quantity of water in the estuary. Water quality is considered separately under the prevention of pollution interest. Hence it is assumed that the reed marsh does not function to protect a public or private water supply.

3.3.2 Ground Water Supply

Section 10.32(1) of the state regulations states: "The underlying peat also serves as a barrier between fresh ground water landward of the salt marsh and the ocean, thus helping to maintain the level of such ground water." Little information is available on the groundwater exchange between the salt marsh and adjacent upland groundwater other than that the influence of the estuary may extend 1000 feet east or west of the estuary (NUS, 1984). Impacts to groundwater associated with either of the remedial action alternatives remains unknown. The presence of a perched groundwater table on the peat is possible (NUS, 1984) but is unconfirmed. The influence of peat dredging on the underlying aquifer is unknown. This information would also be of importance in evaluating potential groundwater movement through the contaminated sediments of the in-harbor disposal area.

3.3.3 Flood Control

Flood storage capacity is presently available within the estuary basin between sea level and the 100 year flood elevation. In-harbor disposal would displace some flood storage capacity. The hydraulic alternative would pass 100 year storm flows from the Acushnet river into the upper harbor thus slightly decreasing flood levels within the estuary (NUS, 1984). It is assumed that ocean flooding from hurricanes would be effectively minimized by the existing hurricane barrier.

3.3.4 Storm Damage Prevention

Currently, the wetland resources around the perimeter of the estuary afford storm damage protection (wave erosion, etc.) to adjacent upland and developed areas. The hydraulic alternative would also protect adjacent areas from storm damage. However, an increase in velocity would occur within the proposed channel (NUS, 1984) which would result in scouring within the channel.

The in-harbor disposal alternative would reduce the amount of wetlands, particularly salt marsh, available to reduce storm damage. The containment area, however, would be designed to withstand erosion and would itself act as a buffer zone to protect existing upland areas.

3.3.5 Prevention of Pollution

Wetlands (particularly the salt marsh) may be presumed to remove contaminants (e.g. uptake of N and P, removal of suspended particulates, immobilization of heavy metals, etc.). Although PCBs are relatively stable with long half lives in the natural environment, there is some evidence to indicate that transformation of PCBs is promoted under anaerobic conditions (EPA, 1983). Such conditions would prevail within wetland substrates. However transformation of PCBs may lead first to more toxic compounds (polychlorinated dibenzofurans) prior to degradation to innocuous chemicals.

Either remedial alternative would lead to significant reductions in the extent of wetlands. The hydraulic alternative would appear to result in greater reductions of wetlands over the long term. Elevations would be increased 3 to 4 feet over an area of approximately 235 acres (hydraulic control). The number of acres converted to upland by this process can not be quantitatively assessed without detailed topographic and bathymetric information. However, it is likely that more than 35 acres would be converted to upland. The in-harbor containment alternative, by comparison, would increase elevations by 8 feet over about 35 acres.

3.3.6 Protection of Land Containing Shellfish

Marshes and tidal flats in the upper Acushnet River contain oysters, soft shelled clams and hard shelled clams (Bourge, B., personal communication). The following factors are critical to the protection of land containing shellfish: shellfish, water quality, water circulation, and the natural relief, evaluation [sic] or distribution of sediment grain size (Wetlands Protection Act Regulations).

Both remedial alternatives would destroy existing shellfish either by covering them with four feet of fill or dredging them out of the estuary. Recolonization can be expected, however the amount of new habitat will be dependent upon final elevations.

3.3.7 Marine Fisheries

A number of fish species including winter flounder, mackeral, bluefish, bait fish, and pollock feed in the upper Acushnet River estuary. Many juvenile fish were observed in spring at the waters edge among the blades of tall salt marsh cordgrass (<u>Spartina alterniflora</u>) in the proposed temporary containment site on the western shore of the estuary (Crouch,G., personal communication). In addition, alewives and blue back herring migrate through the upper Acushnet River estuary to spawn in the Acushnet River.

The following factors (Wetlands Protection Act Regulations) are critical to the protection of these marine fisheries: water circulation, distribution of sediment grain size, water quality, finfish habitat, the relief and elevation of the land, and the growth, composition and distribution of salt marsh vegetation.

Water circulation and existing currents will be altered by the placement of the proposed earthen and rockfill lined channel (hydraulic alternative). Current velocities may become very high in the vicinity of the channel during flood conditions. The capping of the open-water and wetland areas will change the sediment grain size from organic silt and sandy silts to sandy gravel. The installation of silt curtains may impair the migratory efforts of alewives and blue back herring.

Water quality will decline due to increased suspended solids and the addition of pollutants (PCB's and heavy metals) during the construction of the channel and capping of the sediments, however, this alternative will eventually result in the isolation of the contaminated sediments from resuspension and transport by the Acushnet River. The capping will increase the elevation of the open-water areas and wetlands from 3 to 4 feet. This would convert much of the salt marsh and reed marsh to upland vegetation and reduce open-water habitat destroying feeding grounds and nursery habitat.

The in-harbor containment alternative would have similar impacts during the program, but fish would be expected to return after completion of remedial action. A reduction in habitat would result. This reduction would not be as severe as with the hydraulic alternative.

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