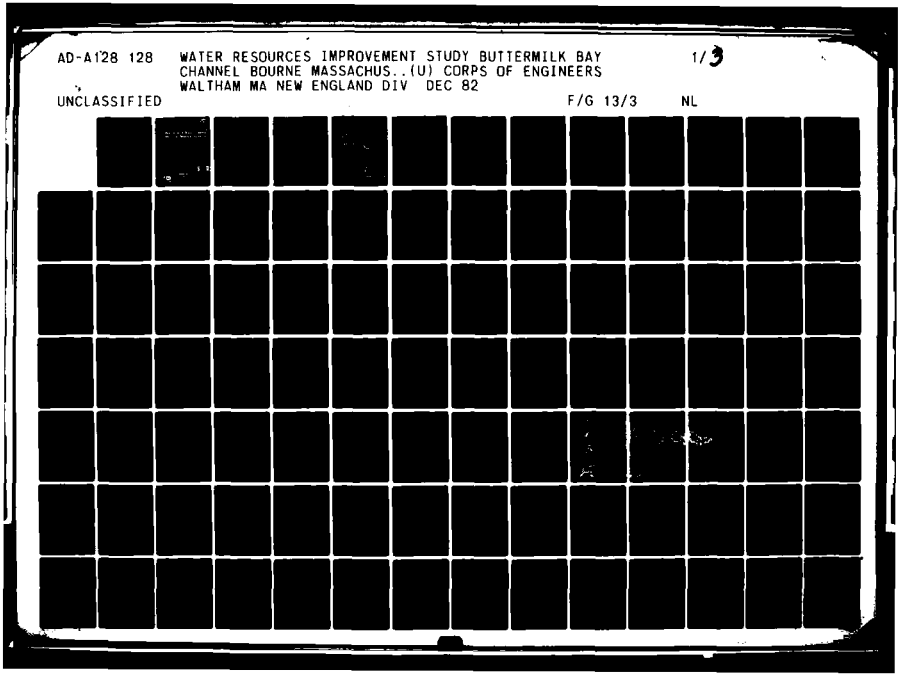
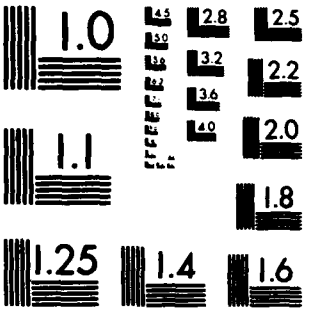
AD-A128 128 WATER RESOURCES IMPROVEMENT STUDY BUTTERMILK BAY CHANNEL BOURNE MASSACHUS..(U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV DEC 82 1/3

UNCLASSIFIED F/G 13/3 NL





Small Navigation Project
Detailed Project Report
and
Environmental Assessment

Buttermilk Bay Channel
Bourne, Massachusetts

US Army Corps
of Engineers
New England Division

DECEMBER 1982

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A128128 / 3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Water Resources Improvement Study, Buttermilk Bay Channel, Bourne, Mass; Small Navigation Project, Detailed Project Report, and environmental Assessment.	5. TYPE OF REPORT & PERIOD COVERED Detailed Project Report / 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. Army Corps of Engineers New England Division	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Dept. of Army, Corps of Engineers New England Division 424 Trapelo Road, Waltham, Mass. 02254	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS NEDED 424 Trapelo Road Waltham, Mass. 02254	12. REPORT DATE December 1982 / 13. NUMBER OF PAGES 200
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)	15. SECURITY CLASS. (of this report) Unclassified / 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Unlimited Distribution; Approved for Public Release

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Cover title reads: Buttermilk Bay Channel, Bourne, Massachusetts.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Channel improvements	Dredging
Channels (Waterways)	Dredged Material Disposal
Channel stabilization	Harbor facilities
Channel improvements	Mooring

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Study investigates the need to construct an extension of the Federal Buttermilk Bay Channel, Bourne, Massachusetts for recreational and Navigational purposes. The recommended plan entails a channel extension 2,500 feet long of which only 300 feet would require dredging. The channel would be 80 feet wide and have a depth of -6 feed at near low water(mlw). Approx. 1,350 cubic yards of sand and gravel and 10 large boulders buried beneath the channel would be removed. The project has a benefit-cost ratio of 1.9:1 for construction.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

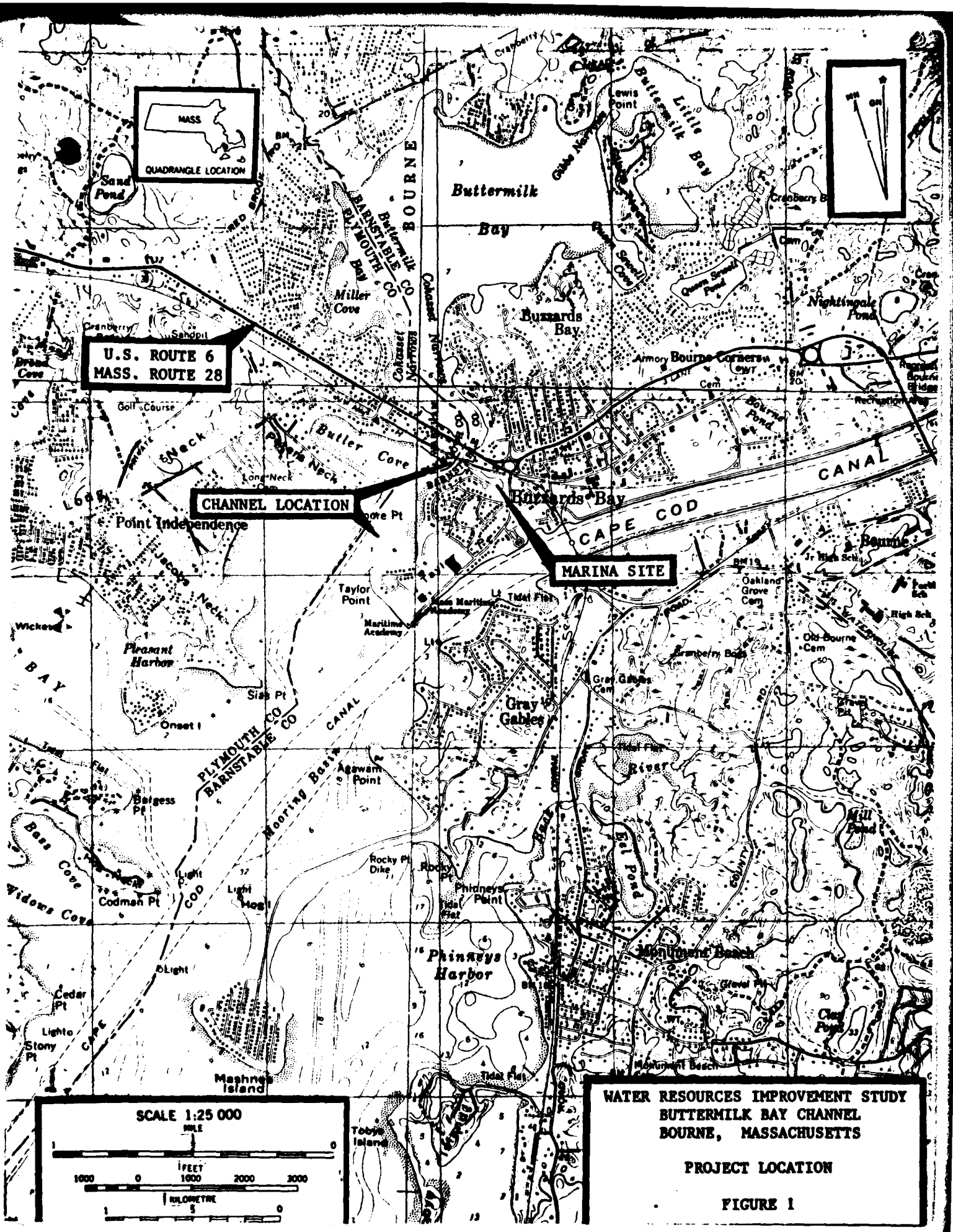
WATER RESOURCES IMPROVEMENT STUDY

BUTTERMILK BAY CHANNEL

BOURNE, MASSACHUSETTS

SMALL NAVIGATION PROJECT
DETAILED PROJECT REPORT
AND ENVIRONMENTAL ASSESSMENT

PREPARED BY:
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION



WATER RESOURCES IMPROVEMENT STUDY
BUTTERMILK BAY CHANNEL
BOURNE, MASSACHUSETTS

PROJECT LOCATION

FIGURE 1

SYLLABUS

This study investigates the need to construct an extension of the Federal Buttermilk Bay Channel, Bourne, Massachusetts, for recreational navigation purposes. The proposed improvement will assure safe navigational access from the existing Federal channel in Buzzards Bay to the public marina proposed by the town of Bourne at Taylor Point. The town anticipates that the public marina will help reduce the shortage of mooring facilities on Cape Cod while stimulating the local economy.

The recommended plan entails a channel extension 2,500 feet long, only the upper 300 feet of which would require dredging. Sufficient existing depths in the lower 2,200 feet of the channel require only the marking of a jurisdictional channel. The extension would proceed northeasterly from the upstream limit of the existing Federal channel to a point opposite the entrance to the proposed Bourne marina. The channel would be 80 feet wide and have a depth of -6 feet at mean low water (mlw). Approximately 1,350 cubic yards of sand and gravel would be removed and 10 large boulders buried beneath the channel.

The Federal Government will prepare plans for construction of the Federal channel extension. Local interests have prepared plans for construction of their marina to be financed by the town of Bourne, the Commonwealth of Massachusetts and the Farmers Home Association. Channel improvements will be identified separately, as construction costs will be shared equally by local interests and the Federal Government. It is expected that maintenance dredging of the channel will be required every 15 years and would be accomplished by the Federal Government as needed, subject to the availability of maintenance funds.

The first cost of construction of the proposed Federal improvement project is presently estimated at $121,000. The local cost-share would be 50 percent or $60,500, since the project would only benefit recreational boating.

Based upon prospective waterway use, the recommended plan is justified. Annual benefits of $35,000 when compared to annual costs of $18,000 yield a benefit-cost ratio of 1.9:1 for construction.

WATER RESOURCES IMPROVEMENT STUDY
BUTTERMILK BAY CHANNEL
BOURNE, MASSACHUSETTS

SMALL NAVIGATION PROJECT
DETAILED PROJECT REPORT AND ENVIRONMENTAL ASSESSMENT

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

WATER RESOURCES IMPROVEMENT PROJECT

BUTTERMILK BAY
BOURNE, MASSACHUSETTS

SMALL NAVIGATION PROJECT
DETAILED PROJECT REPORT AND ENVIRONMENTAL ASSESSMENT

INTRODUCTION

This is a detailed engineering and economic feasibility study of channel improvements for small recreational craft at Buttermilk Bay, Bourne, Massachusetts. Buttermilk Bay is a tidal estuary approximately 3,500 feet long with an average width of 800 feet. As indicated in Figure 1, the project area is located at the southern end of the Cape Cod Canal next to the village of Buzzards Bay. The proposed channel improvements would extend from the existing Federal channel in Buttermilk Bay 2,500 feet northeasterly to a proposed public marina.

The waters surrounding southeastern Massachusetts, Cape Cod and the islands offer some of the best boating along the coast of New England. Boating enthusiasts come from all over the Northeast to enjoy the area's facilities. In Buzzards Bay this popularity has resulted in a shortage of facilities for all recreational boating. Moorings and other services for transient craft, including those cruising in Newport, the Elizabeth Islands, Nantucket, Martha's Vineyard and the Buzzards Bay area, are in particularly short supply. The 150-slip marina planned by the town of Bourne will help meet the demand for recreational boating. The proposed Buttermilk Bay Channel would assure navigational access from the existing Federal channel in Buzzards Bay to the mouth of the marina in Cohasset Narrows.

STUDY AUTHORITY

This detailed project report was authorized and submitted under the general authority contained in Section 107 of the 1960 River and Harbor Act, as amended.

SCOPE OF THE STUDY

In preparing this detailed project report, investigations were made in:

1. Determining the navigational needs of the study area
2. Developing alternative channel improvement plans
3. Evaluating the economic, social and enviromental impacts of the alternative plans

4. Recommending channel improvements that are economically feasible, socially beneficial and environmentally acceptable.

All studies were made in the depth and level of detail required to permit optimum plan selection and to determine its feasibility.

The initial steps in the study process included a comprehensive inventory of available information, performance of topographic and hydrographic surveys, environmental sampling and testing, and preparation of base plans. Extensive efforts were expended to contact public officials and interested parties to provide information and to seek public input into the study process. Based upon available information, baseline conditions were determined to assist in formulating planning objectives and constraints. Preliminary improvement plans were developed and evaluated. Based on comments received, three alternative plans were selected for more detailed study.

STUDY PARTICIPANTS AND COORDINATION

Investigation of the advisability of making navigation improvemer to the Buttermilk Bay Channel required close coordination between the . England Division, Corps of Engineers and various other Federal, state and local agencies. Coordination with the selectmen of the town of Bourne was especially important to assure that the project scope would be consistent with the plans for the municipal marina.

In 1966, the Taylor Point Study Committee requested that the Corps of Engineers construct a channel to their proposed public marina. Public hearings were subsequently held by the Corps on 18 November 1970 and later on 15 November 1972 to discuss navigation improvements. A preliminary draft environmental impact statement and detailed project report were prepared in 1973. However, since no decision was reached regarding disposal of dredged material, the study remained inactive pending the town of Bourne's resolution regarding marina development.

In July 1977, the Bourne Board of Selectmen requested that the Corps of Engineers reactivate its study to construct the Buttermilk Bay Channel. The town also indicated its willingness to accept dredged material for disposal at the Bourne sanitary landfill. A final environmental impact statement (EIS) was circulated in October 1977 by the Massachusetts Department of Environmental Quality Engineering (DEQE), Division of Waterways, for the Bourne marina.

In 1979 the Corps of Engineers updated its previous studies of the Buttermilk Bay Channel. Coordination has been maintained with various environmental and planning agencies. A meeting was held on 2 May 1979 with local officials to present recent study findings including environmental considerations and the project construction estimate.

The New England Division, Corps of Engineers issued a permit to the town of Bourne on 2 July 1981 to construct the marina at Taylor Point. A copy of this permit is contained in Appendix 1 of this report.

A meeting was held between the Corps, the town of Bourne, interested State and Federal agencies and private consultants, in December 1981 where this meeting a more advanced marina plan was proposed. The scope of the new plan along with recent changes in Federal planning regulations necessitated reformulation of alternative plans for the Federal project. This study and report was developed as a result of those efforts and represents a reduced scope of improvement over those recommended in previous studies.

PRIOR STUDIES AND IMPROVEMENTS

The original basis for this project is House Document No. 552, 80th Congress, 2nd Session, dated 20 February 1948, which discussed navigation improvements in Buzzards Bay. A detailed project report for small navigation project and a preliminary draft environmental impact statement were prepared for Buttermilk Bay Channel by the Corps of Engineers in 1973. The DEQE circulated a final EIS for the Bourne marina in 1977.

House Document #552 was the original authorization document for the existing Federal project in Buttermilk Bay. The original study was authorized by the River and Harbor Act of 2 March 1945. A preliminary investigation was completed on 4 August 1945 and a survey report was completed on 20 March 1946. The survey report concluded that the formation of a shoal across the natural channel leading to Buttermilk Bay was largely due to the Federal construction of the Cape Cod Canal, which had changed the tidal currents in Buzzards Bay. A Federal project was adopted and constructed which consists of a channel, 100 feet wide, -7 feet deep at mlw, extending about 4,000 feet northwest and then northeast from the Cape Cod Canal. The existing Federal project is shown in Figure 2.

THE REPORT

This detailed project report consists of a main report and supporting appendices: Appendix 1 describes the public marina project; Appendix 2 summarizes public views and responses; Appendix 3 contains supporting engineering data and analyses; and Appendix 4 contains an economic and social analysis of the various plans of improvement.

A Draft Detailed Project Report is prepared by the New England Division following completion of the detailed study process. The Draft Report then is circulated for public and agency review. All interested Federal, State and local agencies and concerned private interests are given an opportunity to review and comment on this draft document. The town of Bourne is asked to determine whether the recommended plan suits their needs and to determine their ability to meet the eight items of local assurance, including the cost sharing requirements. Following the close of the review period, and assuming concurrence with the report by

the town of Bourne including the ability to meet the local assurances, a final report is prepared. All relevant comments received during review are incorporated into the Final Detailed Project Report. Any identified needs for further study are completed and the results included in the final document. The Final Detailed Project Report is then submitted by the New England Division to the Office of the Chief of Engineers (OCE) in Washington, D.C. for the final review. Following the incorporation of any comments by OCE into the report the document is approved and the recommended plan is authorized for construction by the Chief of Engineers under the authority of Section 107 of the 1960 Rivers and Harbors Act, as amended. The project would be constructed upon the availability of funds.

PROBLEM IDENTIFICATION

This portion of the report discusses the nature and scope of the problems necessitating channel improvements, and establishes the planning constraints that direct subsequent planning tasks.

EXISTING CONDITIONS

Resources and Economy of Study Area

The towns of Bourne and Wareham, located on both sides of Buttermilk Bay Channel, have historically been dependent upon the ocean. With more than 90 miles of tidal shoreline, both towns have become summer resort communities. Recreational boating, therefore, is an important activity. With the Cape Cod Canal less than a mile away, the proposed public marina would attract cruising boats and other craft, supply marine services and provide both seasonal and transient docking facilities. It would also stimulate the economy of Buzzards Bay Village, located close to the proposed marina in the town of Bourne.

Buttermilk Bay Channel is located immediately northwest of the southern end of Cape Cod Canal at the northeastern extent of Buzzards Bay. The natural channel extends through Cohasset Narrows, connecting an existing Federal channel with the 750-acre Buttermilk Bay (see Figure 1). The sandy shoreline of Cohasset Narrows is residentially developed.

The locality is shown on nautical chart NOAA #13236 and on U.S. Geological Survey quadrangle sheets titled Pocasset, Onset, Wareham and Sagamore. The mean tidal range is 4.0 feet; the spring range is 5.1 feet. Prevailing winds during the boating season are from the southwest with winds of highest velocity, excepting hurricanes, coming from the northeast and northwest. Land along the north, east and south sides of the proposed channel provide good protection from wind and wave action. The average January temperature is 29°F; the average July temperature is 71°F. Precipitation averages 47 inches.

The town of Bourne is bisected by the Cape Cod Canal and has shoreline along both Buzzards Bay to the southwest and Cape Cod Bay to the northeast. Bourne is located 55 miles from Boston at the base of Cape Cod. The Buzzards Bay shoreline is well developed with little vacant land. Interior sections extend to 200 feet in elevation and are characterized by rolling hills with vegetation typical of sandy soils. Bourne has a tidal shoreline of 39.6 miles.

Bourne is well served by both highways and local roads. All Cape Cod-bound vehicular traffic must cross the Cape Cod Canal at either the Sagamore Bridge or the Bourne Bridge, both located in Bourne. Highways leading to the Cape are State Routes 3, 6, 25 and 28. Part of Bourne's economy is based upon highway-related businesses and tourist attractions along these main arteries.

Human Resources

Barnstable County, of which Bourne is a part, is a well-known summer vacation area. Beaches, stately homes, art colonies and quaint fishing villages provide some of the attraction. This county is growing quickly, both as a residential area for retired persons and as a bedroom community for metropolitan Boston commuters. During the decade 1960 to 1970 the population of Barnstable County increased 37.5 percent from 70,286 to 96,656, while the population of Bourne decreased 9.8 percent from 14,011 to 12,636. Between 1970 and 1980 Barnstable County experienced a 53 percent rise in population to reach 147,925 while Bourne's population increased 9.8 percent to 13,874 regaining its losses from the previous decade. These Federal census figures, however, reflect the population at Cape Cod military bases, including personnel levels at Otis Air Force Base. The summer population in 1980 was estimated at 33,954, a 250 percent increase over the year-round level. The median age of Bourne residents in 1970 was 25.1; that year residents aged 65 and above accounted for 9.0 percent of the town's population. The 1970 per capita income in Bourne was $2,681. Of the 8,061 persons 16 years old and over in 1970, 3,542 or 44 percent were in the civilian labor force.

Development

Bourne was established in 1640 and incorporated in 1884 at which time it separated from the town of Sandwich. Although the town's early economic base was centered around fishing and coastal industries, manufacturing, dairying, and cranberry industries later developed. Summer tourism and resort industries currently contribute to a significant portion of the economy. The largest employer is the government sector, accounting for 30.3 percent of all jobs. In 1980, wholesale and retail trades employed 29 percent of the town's employees. The service industry followed with 16 percent of the workers. In 1980 the total annual payroll of 347 firms reporting in Bourne was $36,894,000.

Present Navigation

Buttermilk Bay is split into two sections by a fixed span railroad bridge. Only small outboards can go upstream of the bridge into the upper bay because of the bridge's clearance restriction. The small basin, which is the site for the proposed marina, is not currently utilized for navigation because of depth limitations.

An existing Federal channel constructed in 1953 leads north into the lower bay from the Cape Cod Canal channel. This channel has an authorized width of 100 feet and a depth of -7 feet mlw across the sand spit that grew westward from the southern end of Taylor Point after the canal was constructed. This existing channel, as shown in Figure 2, follows the natural channel for a distance of about 4,000 feet upstream of the canal, ending at a point opposite the daybeacon south of Peters Neck.

CONDITIONS IF NO FEDERAL ACTION IS TAKEN

Without the Federal proposed project, development of the marina would most likely occur; however, its full usage would most likely not occur. Without the proposed Federal channel, navigation to and from the marina would be restricted by the stage of the tide. The natural channel has a minimum depth of 3 feet at mlw over a width of 20 feet. This presents a very hazardous situation at low tides, and causes vessels to wait for proper tides to navigate the channel. At present, transient vessels attempting to transit the Cape Cod Canal must lie to and wait for the ebb tide which flows west to east through the canal. Damages will result from grounding of vessels attempting to navigate the shallow channel and collision of boats due to the width restrictions.

Vessels attracted to the new marina would have shallow drafts and would not likely be cruising sailboats or large, deep draft vessels. A more indepth economic analysis of the without project condition is contained in Appendix 4.

Many boaters choose to anchor in the Federal mooring basin which adjoins the canal to the south and wait several hours on their boats for the turn of the tide. The close proximity of the locally proposed Taylor Point Marina to the canal is expected to attract many transient boaters who would use the marina facilities and patronize local commercial establishments in the village of Buzzards Bay. Other alternatives for transients are limited by overcrowded conditions at the area's other private marinas.

Because of the volume of recreational traffic transiting the canal, it is estimated that as much as 25 percent of the marina slips will be taken up by transient boats. Most of these vessels would prefer to leave the marina at about the same time so as to catch the most favorable tide in the Canal. Because of the width of the existing natural channel in the area of the basin, these 25 or so vessels would be forced to wait their turn to leave the basin one at a time. The larger cruising sailboats which frequent the area would not be able to gain access to the basin because of the depth restriction, except at high tide, when depths of 7 feet would afford a somewhat risky access for vessels in the class which draw 6 to 6.5 feet.

Swift tidal currents flood and drain Buttermilk Bay in the area immediately below the Conrail Railroad Bridge at the marina entrance. In the past many small boats passing into or out of Buttermilk Bay have been driven aground on the shoal and boulders east of the natural channel by these currents. Damages incurred by these boats as a result of groundings include chaffing and structural damage to the keel and hull, damage to engines and gear, and sinking of boats. The chance of such collisions occurring to vessels exiting or entering the marina basin would be greater than the chance now risked by boats travelling Buttermilk Bay for several reasons. The boats using the marina would generally be larger and have

greater drafts than those which transit Buttermilk Bay. Boats using the marina would have to cross directly over the shoal and boulder area and would undertake a greater risk. Boats transiting the marina entrance would be travelling at a greater angle to the direction of current flow and would be more susceptible to being driven out of the narrow confines of the natural channel. With no Federal project marina boats would also be travelling at a speed of 2 knots in this area and would remain in the hazardous area longer than boats passing under the bridge. A more indepth economic analysis of the without project condition is contained in Appendix 4 of this report.

PROBLEMS AND NEEDS

The problem in the project area is a lack of recreational berthing space, especially for transient craft. There is a distinct need for more marina space. In order to address this problem the town of Bourne and the Commonwealth of Massachusetts propose to construct a 150-slip marina providing a moderate level of recreational boating services. After studies were performed by the town and the Commonwealth, a site in Buttermilk Bay was chosen. The problem with this site is that unless the Buttermilk Bay Channel is dredged, the proposed marina would not sustain full usage. Boulders and shallow conditions limit access to the marina site to only shallow draft boats as water depths at the marina entrance are approximately 3 feet at MLW. The larger craft for which the marina has been planned would experience delays due to tidal restrictions and channel congestion. Unmarked boulders and the sandy shoal create hazardous navigation conditions which cause damages to the existing powerboat fleet and would cause greater damage to the deeper draft boats using the marina. The need then is to construct a safe channel of adequate design to assure a safe entrance into the public marina, to reduce tidal delays, channel congestion and the risk of grounding damage, and assure a safe harbor during storms for transient craft from Buzzards Bay and the nearby Cape Cod Canal. (For more detailed information concerning the public marina project see Appendix 1.)

PLANNING CONSTRAINTS

Planning constraints are those parameters that can place limitations on any proposed plan of improvement. As limitations, they are used to direct plan formulation and restrict impacts cutting across a broad spectrum of concerns. This study has identified several concerns associated with the development of Buttermilk Bay. However, these concerns were related to the development of the marina by state and local interests and not to the proposed Federal access channel (Appendix 1).

FORMULATION OF PRELIMINARY PLANS

Formulation of preliminary plans is based on the premise that the municipal marina at Taylor Point would be under construction before implementation of any Federal improvement. Alternative locations for the proposed marina were addressed in the final environmental impact statement circulated by the Commonwealth of Massachusetts, Department of Environmental Quality Engineering. The marina location at Taylor Point was selected based upon economic and environmental considerations, availability of land suitable for navigation, and community support, among other factors (see Appendix 1).

It is not feasible to accomplish the project goals by implementing nonstructural solutions, due to the constraints, concerns, and objectives. Location of the marina in another area is precluded by the constraints and objectives used to determine the marina location. Appendix 1 details the rationale as developed by local interests for the location of the marina. Structural measures would generally involve variations on dredging the Cohasset Narrows to provide access to the marina site.

PLAN FORMULATION RATIONALE

The first step in the formulation of alternative plans was to make projections of the number, type and size of boats expected to use the municipally operated Taylor Point marina. The projected fleet characteristics were needed to establish the design vessels for both the channel and the marina.

The projected recreational fleet characteristics were based upon a detailed survey of marinas considered representative of conditions in the Buzzards Bay area. The observed fleet dimensions were categorized separately for sail and motor craft. It is anticipated that the proportion of sailboats in the projected fleet will increase due to anticipated long-term changes in the availability and cost of petroleum-based fuels, and current local and regional trends in the recreational boating industry. Appendix 4 contains the results of the marina survey, the characteristics of the projected fleet and an assessment of the economic benefits of the proposed improvement.

It was determined that a channel depth of -6 feet at mlw would be sufficient, based on the sizes and classes of vessels expected to use the marina and those presently based in Buttermilk Bay. This depth would eliminate all tidal delays for all but the largest class of sailboats, for which the existing delay would be reduced.

Based on the pattern of use and volume of traffic anticipated it was decided to study two channel widths in detail. A 60-foot width was found to be sufficient to handle the anticipated volume of permanent traffic after the marina's full utilization is realized. An 80-foot-wide channel

was found to be more effective in handling traffic since it would provide for three travel lanes and would allow all boats to travel at greater speed. This would also allow the outbound boats headed for the canal simultaneously to travel two abreast, reducing channel transit time. It was also determined that the risk of a vessel incurring damages through being grounded on the shoal and boulder area by the strong tidal currents at the north end of the channel could be reduced by widening the channel in this area.

DESCRIPTION OF ALTERNATIVE PLANS

Three alternative plans were developed and studied in detail. They address to different degrees the need to provide more efficient access to the public marina and reduce damages currently experienced by the existing powerboat fleet. These plans are shown on Figure 3.

Plan A entails a channel extension 2,500 feet long, only the upper 300 feet of which would require dredging. Sufficient existing depths in the lower 2,200 feet of the channel require only the marking of a jurisdictional channel. The extension would proceed northeasterly from the upstream limit of the existing Federal project to a point below the railroad bridge and opposite the entrance to the marina basin. The channel would be 60 feet wide and 6 feet deep at mlw. Plan A requires the removal of 800 cubic yards of sand and gravel and the burial of six boulders beneath the channel.

Plan B entails a channel extension over the same 2,500 feet as Plan A using the same alignment and 6 foot depth. A channel width of 80 feet is included in Plan B. As with Plan A dredging would be required only in the upper 300 feet of the channel. Sufficient existing depths in the lower 2,200 feet of the channel require only the marking of a jurisdictional channel. Plan B requires the removal of 1,350 cubic yards of sand and gravel and the burial of 10 boulders beneath the channel. This plan would entail removal of 1,350 cubic yards of ordinary material and burial of 10 boulders beneath the channel.

Plan C involves an 80-foot-wide channel, 6 feet deep, as in Plan B. In addition, Plan C incorporates a widened upper end of the channel to reduce adverse effects of the strong tidal currents flowing through the narrows. Plan C entails the removal of 2,700 cubic yards and the burial of 20 boulders beneath the channel.

All three plans involve open water disposal of dredged sand and gravel at the Buzzards Bay dump site, located 9.8 miles south of the project site, southeast of Cleveland Ledge and opposite West Falmouth. The location of this site is shown in Figure 4. This site was last used in May 1980 for disposal of 37,000 cubic yards of mud and sand dredged from the berthing area at the Massachusetts Maritime Academy, at the south end of Taylor Point. While a suitable upland disposal site was identified, project construction utilizing ocean disposal was determined to be far less costly. A detailed cost comparison of upland vs. ocean disposal is provided in Appendix 3.

ASSESSMENT AND EVALUATION OF DETAILED PLANS

This section analyzes the three improvement alternatives selected for detailed study. Evaluation of the alternatives is based on their impacts on existing conditions such as ease of navigation and the environmental, social and cultural resources of the study area.

GENERAL ASSESSMENT AND EVALUATION OF PLANS AND IMPACTS

The general impacts of the three improvement alternatives selected for detailed study are evaluated below. Impacts unique to each alternative are assessed and evaluated in subsequent sections of this report.

Dredging Impacts

Dredging operations would result in increases in suspended sediments and removal of benthic organisms. These effects would be temporary and entirely local. However, due to the sandy nature of the material, any turbidity would be minimal and quickly dispersed into the water column.

The predominant benthic species expected to be displaced by dredging of a channel would be scallops, quahogs, softshell clams and possibly lobsters. This condition would be temporary as the dredged areas would be recolonized within a few months after dredging. More mobile forms such as finfish would avoid the work area and should not be seriously affected. Photosynthetic processes and dissolved oxygen levels would be reduced for a short period of time. Other invertebrate species that would be removed and destroyed during dredging include polychaetes, amphipods and shrimp. Shellfish spawning would not be affected since dredging is not planned during that time.

Disposal Impacts

Disposal impacts would be minimal because of the coarse, clean nature of the material to be removed and the small volume of material proposed for removal under each plan. The maximum amount of material that would be removed is 2,700 cubic yards of clean sandy gravel. Disposal would temporarily bury the existing benthic community covered by the spoil pile at the disposal site. Recolonization of the area by benthic organisms would occur soon after disposal. Motile forms such as finfish and crabs would be able to move out of the area. The turbidity plume created by the disposal operation would be temporary and would quickly settle because of the coarse nature of the spoil. Point dumping would minimize the extent of bottom area that would be affected. The limited scope of dredging and disposal would require construction operations lasting only about 2 weeks.

The Buzzards Bay dump site was most recently used in May 1980. Approximately 37,000 cubic yards of mud, sand and gravel was dumped by the State of Massachusetts following dredging of berthing areas and access

channels at the Massachusetts Maritime Academy. A more detailed analysis of ocean disposal and the impacts of the various alternatives is contained in the Environmental Assessment.

Shoreline Impacts

None of the alternative plans would impact the adjacent shoreline.

Economic Impacts

Economic impacts of the proposed alternatives consist primarily of the direct costs of project implementation and the resultant recreation benefits. The level of project costs is dependent upon such factors as the quantity of dredged material, the degree of mobilization and demobilization, the amount of equipment, cost and wage rates, anticipated dredging rates, and supervisory, administrative and other factors.

Benefits for each alternative have been calculated based on the number of vessels expected to use the area with the implementation of the alternative. Calculations of the project's benefits are based on the total number of vessels expected to use the waterway and the time saved each boat by the dredging of the channel. The present marina design is expected to hold 150 vessels. The benefits attributable to the project are based on reduced tidal delays, reduced channel congestion and a reduction in damages to vessels due to grounding. The monetary amount is the difference between existing usage and future usage based on the percentage of time that each class and size of boat would be able to safely navigate the channel. The method and assumptions used to calculate the benefits to the fleet and detailed benefit-cost calculations are contained in Appendix 4.

Social Impacts

The social impacts of the various plans relate primarily to boating safety, which would increase with removal of any portion of the shoal. There would be a reduced risk of injury and property damage as well as increased recreational opportunity. Impacts during construction would be minimal since activity would be scheduled to avoid the peak boating season. Construction activities are estimated take 2 weeks which would result in minimum impacts on the surrounding area.

MITIGATION REQUIREMENTS

No mitigation requirements are associated with construction of the Federal channel. There are, however, several mitigation requirements associated with the proposed local marina project, which are discussed in detail in Appendix 1.

IMPLEMENTATION RESPONSIBILITIES

Cost Allocation

One hundred percent of the project cost is allocated to the construction of the recreational channel and navigation aids. There are no other components to the Federal project.

Cost Apportionment

The Federal government is responsible for 50 percent of the first cost of construction of the channel and 100 percent of the cost for all future channel maintenance as required. Local costs will include 50 percent of the first cost of construction and 100 percent of all necessary shoreline protection structures, construction of the marina basin and facilities and all public access roads and parking areas as required. Federal and local costs vary for each of the alternatives.

Federal Responsibilities

The Federal project consists only of dredging and maintaining the access channel. The Federal project does not include any marina facilities, shoreline protection, or site work at any land disposal areas.

Non-Federal Responsibilities

Local requirements are contained in Section 221 of the River and Harbor Act of 1970.

Principal non-Federal responsibilities include a 50-percent share of construction costs for recreational projects; provision, operation and maintenance of a public landing; and maintenance of suitable dredged material disposal areas with necessary retaining dikes. All the local requirements for this project are specified in the "Recommendation" section of this main report.

The following sections of this report assess and evaluate impacts specific to the individual alternative plans.

VIEWS OF OTHERS

Various Federal, State and local agencies have, during the study process and review of this document, been afforded the opportunity to comment on the proposed alternatives and express their views and concerns relative to the project. General comments dealt principly with the method of disposal and season of construction. The use of the upland disposal site was the method preferred by the majority of State and Federal agencies. When analysis showed however, that this method would greatly increase cost, the agencies expressed no objections to the planned ocean disposal. The limiting of the construction season to 15 September thru 15 May, so as not to adversely affect the existing fish and shellfish populations in the area, was the general concensis.

PLAN A

IMPACT ASSESSMENT

Plan Description

Plan A (Figure 3) entails providing a channel extension 2,500 feet long, only the upper 300 feet of which would require dredging. Sufficient natural depths in the lower 2,200 feet require only the marking of a jurisdictional channel. This would provide a channel with a width of 60 feet from the upstream end of the existing Federal channel to a point immediately below the railroad bridge at the marina entrance. The channel would be dredged to a depth of 6 feet at mlw. Approximately 800 cy of material would be removed from the upper portion of the channel. This material would be taken from a shoal located near the bend into the proposed marina. Approximately 6 boulders ranging in size from 32 to 168 cubic feet would be buried beneath the channel.

Dredging Impacts

Impacts on water quality and benthic habitat would be minimal because of the negligible amount of material that would be removed. Increases in suspended sediments in the water column would be temporary. Benthic organisms associated with the dredge sediments would be removed from the site. Motile species such as finfish would avoid the work area. The dredge area would be recolonized soon after operations have stopped.

Disposal Impacts

The 800 cubic yards of material would be removed by a clamshell bucket, placed in a scow and towed 9.8 miles south to the Buzzards Bay dump site for open water disposal. The present character of the Buzzards Bay dump site would not be significantly changed because of the small amount of material to be dumped. The material would be point-dumped at a buoy, which would minimize dispersion of the material. Marine life at the disposal site would be temporarily impacted, and those organisms unable to escape would be lost. Recolonization would begin soon after disposal operations ceased.

Impacts on Navigation

Plan A would provide for somewhat increased utilization of the Cohasset Narrows into the proposed marina. Plan A would remove a small portion of the existing shoal area, thereby reducing damages to both the existing and anticipated fleets.

Economic Impacts

Dredging and disposal costs are calculated based upon ocean disposal. The estimated first cost of Plan A is $102,000. The equivalent annual cost for amortization (based on 7-7/8%, 50-year project life) including annual project maintenance is $15,000. The project benefits include a

reduction in lost recreation time and reductions in vessel damages. On an average annual basis these benefits amount to $26,000. The economics of the plan are discussed in further detail in Appendix 4.

Annual costs and benefits are shown below.

Annual Cost	Annual Benefits	B/C Ratio	Net Benefits
$15,000	$26,000	1.7:1	$11,000

EVALUATION AND TRADE-OFF ANALYSIS

Plan A would provide an adequate channel to the marina for the permanent fleet both now and in the foreseeable future. Plan A would provide only a small reduction in damages to the existing and projected fleets since it removes only a small portion of the shoal and boulder area. Plan A would have no significant adverse environmental impacts because of the small amount of material to be dredged (800 cubic yards).

COST APPORTIONMENT

The local share of the costs of the Federal project for Plan A is estimated at $51,000. This amount is 50 percent of the first cost of dredging and disposal.

PUBLIC VIEWS

Views of Federal Agencies

Federal agencies have expressed no concerns specifically pertaining to the dredging provided for in Plan A. Appendix 1 summarizes agency views on the proposed marina. Letters received from Federal agencies relative to the Federal project are shown in Appendix 2.

Views of Non-Federal Agencies

Non-Federal agencies have expressed no specific views or concerns pertaining to the dredging provided for in Plan A, other than those addressed previously in the general assessment section.

PLAN B

IMPACT ASSESSMENT

Plan Description

Plan B involves dredging a channel along the same 2,500-foot alignment as Plan A. The channel would be 80 feet wide with a depth of -6 feet at mlw. The channel would require dredging of approximately 1,350 cubic yards of material and burial beneath the channel of 19 boulders ranging in size from 168 to 32 cubic feet. As with Plan A, the material would be removed by a clamshell dredge and disposed of at the Buzzards Bay dumpsite.

Dredging Impacts

Although an additional 550 cy of material would be removed under this plan, as opposed to Plan A, impacts on water quality and benthic habitat would be minimal. Increases in turbidity would be temporary and local. The dredged area would be recolonized soon after operations have ceased.

Disposal Impacts

The 1,350 cubic yards of material would be removed by clamshell bucket, placed in a scow and towed 9.8 miles south to the Buzzards Bay dump site for open water disposal. Impacts on the marine environment at the dumpsite would be the same as discussed for Plan A. The additional 550 cy of material that would be disposed would not result in any significant increases in adverse impacts.

Impacts on Navigation

Plan B would provide for greater ease of navigation than Plan A because of the wider channel. Plan B would also allow outbound vessels headed for the canal to leave simultaneously to transit the channel two abreast, thereby saving time to each boat.

Economic Impacts

Dredging and disposal costs are based upon ocean disposal. The estimated first cost of Plan B is $121,000. The equivalent annual cost (based on 7-7/8%, 50-year project life) including annual maintenance is $18,000. The annual project benefits including reductions in lost recreation time and reductions in vessel damages are estimated at $35,000.

Annual costs and benefits are shown below.

Annual Cost	Annual Benefits	B/C Ratio	Net Benefits
$18,000	$35,000	1.9:1	$17,000

EVALUATION AND TRADE-OFF ANALYSIS

Plan B would provide an adequate channel to the marina both now and in the foreseeable future. Plan B would provide safer and more efficient access to the marina area than Plan A due to the additional width. Plan B would have no long-term adverse impacts related to the dredging. Ocean disposal of only 1,350 cubic yards of material would result in only minor short-term impacts.

COST APPORTIONMENT

The non-Federal cost share of Plan B is estimated at $60,500, or 50 percent of the first cost of construction.

PUBLIC VIEWS

Plan B, as the recommended plan, received the majority of comments from interested agencies and the public. Summaries of these comments and copies of correspondence are contained in Appendix 2. In general, there were no objections expressed to the recommended plan.

Views of Federal Agencies

Federal agencies consulted during the study process which expressed specific views pertaining to the recommended plan are as follows: U.S. Environmental Protection Agency and the National Marine Fisheries Service concurred with the recommended plan. The U.S. Fish and Wildlife Service would have preferred upland disposal but expressed no objection to ocean disposal. The U.S. Coast Guard had no comment on the estimates for navigation aids.

Views of Non-Federal Agencies

The town of Bourne concurred with the findings presented in the draft report by letter dated 19 October 1982. They indicated that they had their required cost-share amount already allocated.

State agencies consulted included: the Division of Waterways, co-sponsors of the proposed marina; the Division of Water Pollution Control, which issued a Water Quality Certificate for this project; the Office of Coastal Zone Management, which concurred with the New England Division's determination of Federal consistency with State coastal policies; and the Department of Environmental Management, which had no objection to the proposed improvement.

PLAN C

IMPACT ASSESSMENT

Plan Description

Plan C as stated previously entails the same 80-foot-wide, 2,500-foot-long, 6-foot-deep channel as in Plan B. Plan C also includes widening the 300-foot-long upstream end of the channel across the bend to a maximum of 180 feet. Approximately 2,700 cy of material would be removed, and approximately 20 boulders would be buried under the channel. The material would be removed by a clamshell bucket dredge and disposed of at the Buzzards Bay dump site.

Dredging Impacts

Dredging would suspend and expose the dredged sediments to the water column, resulting in a temporary increase in turbidity. Turbidity would be limited because of the sandy nature of the material. Benthic organisms associated with the dredged sediments would be destroyed and removed from the site. Motile species would avoid the work area. Any loss of forage for predators would be temporary because the dredged areas would be recolonized within a few months after dredging. These impacts would be temporary and local.

Disposal Impacts

The 2,700 cubic yards of material would be placed in a scow and towed 9.8 miles south for open water disposal at the Buzzards Bay dumpsite. The additional material that would be dumped would not result in any significant adverse effects. There would be a temporary and local increase in suspended solids. Particles would quickly settle out because of the sandy gravelly nature of the material. Disposal would bury more benthic habitat at the dump site than would the other alternative plans. Large motile forms would be able to move out of the disposal area. Recolonization by opportunistic species would occur soon after disposal.

Impacts on Navigation

Plan C would provide for full utilization of the proposed marina. Plan C would eliminate most tidal delays for the marina fleets and reduce damages for the existing powerboat fleet as well as marina boats. Plan C would allow for the most efficient use of the project by canal-bound boats, which could leave simultaneously to catch the ebb tide and travel down the channel to the canal two abreast, thereby taking less time to clear the channel.

Economic Impacts

Dredging and disposal costs are based upon ocean disposal. The estimated first cost of Plan C is $209,000. The equivalent annual cost (based on 7-7/8%, 50-year project life) including annual project maintenance is $28,000. Project benefits are derived from reduced tidal delays and channel congestion experienced by the marina fleet, and reduced grounding damages incurred by existing powerboats and the projected marina fleet. The annual project benefits are estimated at $43,000.

Annual costs and benefits are shown below.

Annual Cost	Annual Benefits	B/C Ratio	Net Benefits
$28,000	$43,000	1.5:1	$15,000

EVALUATION AND TRADE-OFF ANALYSIS

Plan C would provide for the most efficient navigation of the existing and projected fleets. Marina-based boats would save more time due to reduced tidal delays, channel congestion and damages than with either of the other two plans. Plan C would entail no long-term adverse impacts related to dredging and disposal. Removal and ocean disposal of 2,500 cubic yards of material would create only minor, short-term impacts.

COST APPORTIONMENT

The non-Federal cost share of Plan C is estimated at $104,500, or 50 percent of the first cost of construction.

PUBLIC VIEWS

No party has expressed specific views regarding Plan C, other than those addressed previously in the general assessment section.

COMPARISON OF DETAILED PLANS

Because of the small volumes of dredged material involved, the main differences between the three plans are the benefits derived from each plan and maintenance costs.

Construction costs, maintenance costs, and benefits increase from Plan A to B to C in ascending order. Plans B and C provide the same greater time savings benefits to the various segments of the projected marina fleet than Plan A. Benefits from reduced damages to the existing powerboat fleet and marina fleet increase from Plans A to B to C.

The environmental impacts of the three alternatives on the marine environment would be minor. The plans differ in the area of the bay's bottom habitat that would be altered by dredging. Although no amount of intertidal zone would be altered by any of the plans, different amounts of subtidal bottom habitat would be altered. The amount of subtidal habitat disturbed for Plans A, B, and C would be 0.25, 0.35, and 0.65 acres, respectively. With all plans, benthic organisms associated with the dredged sediments would be removed and destroyed from the dredge site. These impacts would not be significant because of the small amount of material to be dredged. Increases in suspended sediments in the water column would be temporary and local.

Ocean disposal of the dredged material generated by each alternative would result in temporary and minor impacts because of the coarse, clean nature of the sediments and the small volumes involved in the dredging (800, 1,350 and 2,500 cubic yards). Disposal impacts would be negligible when compared to the 37,000 cy dumped at the site in 1980 by the state of Massachusetts.

COST COMPARISON

Table 1 compares the construction and maintenance costs associated with each of the three alternative plans. A more detailed cost breakdown is found in Appendix 3. Annual amortization charges were figured at a rate of 7-7/8 percent over a 50-year project life.

BENEFIT COMPARISON

Each of the three alternative plans provides varying degrees of benefits in costs and time saved to recreational boaters. The existing powerboat fleet would experience reductions in grounding damages from each of the plans, resulting in reduced repair costs and leisure time saved. The immediate and future permanent fleet and transient vessels could expect similar reduced damages as well as leisure time saved due to reduced tidal delays and reduced channel congestion.

TABLE 1

BUTTERMILK BAY CHANNEL

COST OF DETAILED PLANS

	PLAN A	PLAN B	PLAN C
Construction Costs			
Dredging and Boulder Burial with ocean disposal	$ 67,500	$ 81,000	$142,000
Contingencies 25%	16,900	20,300	35,500
Engineering and Design 7%	5,900	7,100	12,400
Supervision and Administration 8%	6,800	8,100	14,200
Aids to Navigation	4,500	4,500	4,500
TOTAL	$101,600	$121,000	$208,600
SAY	$102,000	$121,000	$209,000
Costs If Upland Disposal Utilized (see Appendix 3) Not Recommended	$205,000	$237,000	$343,000

ANNUAL CHARGES

	PLAN A	PLAN B	PLAN C
Interest and Amortization	$ 8,200	$ 9,700	$ 16,800
Annual Maintenance	5,400	6,900	9,300
Maintenance of Aids to Navigation	1,500	1,500	1,500
TOTAL ANNUAL CHARGES	$ 15,100	$ 18,100	$ 27,600
SAY	$ 15,000	$ 18,000	$ 28,000

A detailed discussion of project benefits is contained in Appendix 4. A breakdown of annual recreational benefits for the detailed plans is shown in Table 2.

TABLE 2

ANNUAL RECREATIONAL BENEFITS

	PLAN A	PLAN B	PLAN C
REDUCTION IN DAMAGES	$ 7,200	$ 9,700	$17,400
REDUCED TIDAL DELAY			
Immediate Permanent Fleet	1,800	1,800	1,800
Future Permanent Fleet	1,700	1,700	1,700
Transient Fleet	3,400	3,400	3,400
REDUCED CHANNEL CONGESTION			
Immediate Permanent Fleet	2,300	3,500	3,500
Future Permanent Fleet	2,000	3,000	3,000
Transient Fleet	7,600	11,800	11,800
TOTAL	$26,000	$34,900	$42,600
SAY	$26,000	$35,000	$43,000

Table 3 lists the benefit-cost ratios for the detailed plans along with the net economic benefits for each plan, given on an annual basis.

TABLE 3

ECONOMIC IMPACTS

	PLAN A	PLAN B	PLAN C
B/C Ratio	1.7:1	1.9:1	1.5:1
Net Benefits	$11,000	$17,000	$15,000

COMPARISON SUMMARY

Table 4, entitled "System of Accounts," is a general analysis relevant to plan selection. It presents the determinative factors that underlie each final alternative by displaying the significant beneficial and adverse impacts.

TABLE 4

SYSTEM OF ACCOUNTS
BUTTERMILK BAY CHANNEL

	WITHOUT PROJECT CONDITION	PLAN A	PLAN B	PLAN C
A. PLAN DESCRIPTION	Existing channel 20-feet wide shoal at -4 ft. boulder hazard.	Extend channel 2500 ft. long dredge upper 300 ft. -6 ft. deep 60 ft. wide	Extend channel 2500 ft. long dredge upper 300 ft. -6 ft. deep 80 ft. wide	Extend channel 2500 ft. long dredge upper 300 ft. -6 ft. deep 80 ft. wide with widened cut in up-stream bend
B. IMPACT ASSESSMENT				
1. Economic				
a. First Cost	-	$102,000	$121,000	$209,000
b. Annual Charges	-	$ 15,000	$ 18,000	$ 28,000
c. Annual Benefits	-	$ 26,000	$ 35,000	$ 43,000
d. B/C Ratio	-	1.7:1	1.9:1	1.5:1
e. Net Benefits	-	$ 11,000	$ 17,000	$ 15,000
2. Environmental				
a. Benthic Habitat Disturbed	-	0.25A	0.35A	0.65A
b. Effects on Shoreline	-	No Impact	No Impact	No Impact
c. Wetlands Impacts	-	No Impact	No Impact	No Impact
d. Effect on Basin Flushing	4	3	2	1
e. Dredging Impacts on Water Quality	0	Minimal (1)	Minimal (2)	Minimal (2)
f. Disposal Impacts on Water Quality	0	1	1	1
3. Social				
a. Safety for Vessels	4	3	2	1
b. Employment and Growth	4	3	1	1
C. ACHIEVES PLANNING OBJECTIVES				
1. Full Utilization of Waterway	4	3	2	1
2. Increases Recreational Safety	4	3	2	1
D. IMPLEMENTATION RESPONSIBILITY				
1. Federal (50%)	None	$51,000	$60,500	$104,500
2. Local (50%)	None	$51,000	$60,500	$104,500

IMPACT RATINGS (1-4) 1 = Minimum Adverse Impact 4 = Maximum Adverse Impact

RATIONALE FOR RECOMMENDED PLAN

Plan B is recommended for implementation. Of the three alternative plans it provides maximum net benefits. Environmental impacts for this plan are not significant. This plan has a positive impact on the safety of recreational boaters in this area because it proposes to remove a moderate portion of the shoal and boulder area. The benefit-cost ratio for Plan B is higher than Plans A and C. Removal of a portion of the shoal and boulder area would reduce vessel grounding in this area of hazardous tidal currents and reduce the risk of injury to boaters, however removal of the entire boulder area, as in Plan C, was found to be not economically justifiable.

RECOMMENDED PLAN

Based on the applicable engineering, environmental, and economic criteria, Plan B, consisting of a channel 80 feet wide and 6 feet deep at mlw was found to be the most favorable plan of improvement and has been selected as the recommended plan. The recommended plan, shown in Figure 5, would meet the needs of the recreational fleet of the Buttermilk Bay-Taylor Point area. The recommended plan would provide a channel 2,500 feet long from the upstream end of the existing Federal channel to the railroad bridge across Cohasset Narrows at the entrance to the proposed Bourne marina basin. Dredging would only be required in the upper 300 feet of the channel extension. Sufficient existing depths in the lower 2,200 feet require only the marking of a jurisdictional channel. The recommended plan would require the removal of 1,350 cubic yards of sand and gravel and burial of 10 large boulders beneath the channel. The dredged material would be removed by clamshell bucket, placed in a scow, and towed 9.8 miles south to the Buzzards Bay dump site for open water disposal.

The total construction investment for the recommended plan is estimated to be $121,000. Annual benefits that would result from the recommended plan, principally increased recreation time and reduced damages, amount to $35,000. These benefits when compared to annual charges of $18,000 yield a benefit-cost ratio of 1.9:1.

CONCLUSIONS

As Division Engineer of the New England Division, Corps of Engineers, I have reviewed and evaluated in the overall public interest, all pertinent data concerning the proposed plan of improvement, as well as the stated views of other interested agencies and the concerned public relative to the various practical alternatives for providing navigation improvements in Buttermilk Bay.

The possible consequences of alternatives have been evaluated on the basis of engineering feasibility, environmental impacts, economic factors of regional and national resource development, and social well-being of the public.

In summary, substantial benefits are to be derived by providing the recreational boaters in Buttermilk Bay with reliable access to the proposed marina at all tidal stages.

The proposed improvement would cause a minor disruption of the environment during dredging and disposal operations. However, as those impacts are not considered significant, an environmental assessment has been performed in lieu of an environmental impact statement. This minimum adverse environmental effect is considered to be offset by the improvement and the overall economic growth of the region, due to the significant benefits attributable to the recreational boating industry.

I find that the proposed action, as developed in this report, is based on a thorough analysis and evaluation of various practicable alternative courses of action for achieving the stated objective; that, wherever adverse effects are found to be involved, they cannot be avoided by following reasonable alternatives and still achieve the specified purposes; and that where the proposed action has an adverse effect, this effect is either ameliorated or substantially outweighed by other considerations. The recommended action is consistent with national policy, statutes, and administrative directives, and should best serve the interests of the general public.

RECOMMENDATION

The Division Engineer recommends that modification of the existing Federal navigation project at Buttermilk Bay, Bourne, Massachusetts, be authorized by the Chief of Engineers under the provisions of Section 107 of the River and Harbor Act of 1960, as amended.

The project would extend the existing channel 2,500 feet upstream from the present limit to the site of a proposed public marina to be built by the town of Bourne and the Commonwealth of Massachusetts. The channel extension would be 80 feet wide with a depth of -6 feet at mean low water. The project would have a cost of $121,000. Since the benefits attributable to the improvement are entirely recreational in nature, cost-sharing requirements are 50 percent Federal and 50 percent local.

My recommendation is made subject to the conditions that local interests will:

(1) Provide a cash contribution of 50 percent of the cost of construction, currently estimated at $60,500.

(2) Begin construction of the Taylor Point Marina prior to or concurrent with implementation of the Federal improvement project.

(3) Provide, maintain and operate, without cost to the United States, an adequate public landing with provisions for the sale of motor fuel, lubricants and potable water open and available to the use of all on equal terms.

(4) Provide, without cost to the United States, all necessary lands, easements and rights-of-way required for construction and subsequent maintenance of the project, including suitable dredged material disposal areas with necessary retaining dikes, bulkheads and embankments.

(5) Hold and save the United States free from damages that may result from construction and maintenance of the project.

(6) Accomplish without cost to the United States alterations and relocations as required in sewer, water supply, drainage and other utility facilities.

(7) Provide and maintain berths, floats, piers, and similar marina and mooring facilities as needed for transient and local vessels as well as necessary access roads, parking areas and other needed public use shore facilities open and available to all on equal terms. Only minimum, basic facilities and service are required as part of the project. The actual scope or extent of facilities and services provided over and above the required minimum is a matter of local decision. The manner of financing such facilities and services is a local responsibility.

(8) Assume full responsibility for all project costs in excess of the Federal cost limitation of $2 million.

(9) Establish regulations prohibiting the discharge of untreated sewage, garbage, and other pollutants in the waters of the harbor use thereof, which regulations shall be in accordance with applicable laws and regulations of Federal, State and local authorities responsible for pollution prevention and control.

ENVIRONMENTAL ASSESSMENT

FOR

BUTTERMILK BAY CHANNEL

SMALL NAVIGATION PROJECT

BOURNE, MASSACHUSETTS

ENVIRONMENTAL ASSESSMENT

I. INTRODUCTION AND PROJECT HISTORY

In keeping with the National Environmental Policy Act of 1969, the New England Division, Army Corps of Engineers has examined environmental values as part of the planning and development process of the proposed action plan. Background environmental information was compiled for this report through interviews with various state and local interest groups and a search of published literature. This appendix provides an assessment of environmental impacts and alternatives considered, and contains other data applicable to the Section 404 evaluation requirements.

House Document #552 was the original authorization document for the existing Federal project in Buttermilk Bay. The original study was authorized by the River and Harbor Act of 2 March 1945. A preliminary investigation was completed on 4 August 1945 and a Survey Report was completed on 20 March 1946. The survey report concluded that the formation of a shoal across the natural channel leading to Buttermilk Bay was largely due to the Federal construction of the Cape Cod Canal, which had changed the tidal currents in Buzzards Bay. A survey study to determine the engineering feasibility and economic justification for an improvement project at Buttermilk Bay was authorized by a resolution adopted by the Committee on Public Works of the House of Representatives, United States, dated 19 October 1967. Preliminary investigation indicated that the scope and cost of improvement best suited to meet the needs of navigation in the project area would meet the criteria established under the general authority contained in Section 107 of the River and Harbor Act of 1960.

In 1966, the Taylor Point Study Committee requested that the Corps of Engineers construct a channel to their proposed public marina. Public hearings were subsequently held by the Corps on 18 November 1970 and later on 15 November 1972 to discuss navigation improvements. A preliminary draft environmental impact statement (EIS) and detailed project report were prepared in 1973. However, since no decision was reached regarding disposal of dredged material, the study remained inactive pending the town of Bourne's resolution regarding marina development.

In July 1977, the Bourne Board of Selectmen requested that the Corps of Engineers reactivate its study to construct the Buttermilk Bay Channel. The town also indicated its willingness to accept dredged matrial for disposal at the Bourne sanitary landfill. A final environmental impact statement was circulated in October 1977 by the Massachusetts Department of Environmental Quality Engineering (DEQE), Division of Waterways, for the Bourne marina.

In 1979 the Corps of Engineers updated its previous studies of the Buttermilk Bay Channel. On 2 May 1979 a meeting was held with local officials to present recent study findings including environmental considerations and the project construction estimate.

On 2 July 1981 the New England Division, Corps of Engineers issued a permit to the town of Bourne to construct the marina at Taylor Point. A copy of this permit is contained in Appendix 1 of this report.

In December 1981 a meeting was held between the Corps, the town of Bourne, interested State and Federal agencies and private consultants. At this meeting a more advanced marina plan was proposed. The scope of the new plan along with recent changes in Federal planning regulations necessitated reformulation of alternative plans for the Federal project. This study and report was developed as a result of those efforts and represents a reduced scope of improvement over those recommended in previous studies.

II. PROJECT DESCRIPTION

The proposed improvement project involves the modification of the existing Buttermilk Bay Federal navigation channel in the interest of recreational boating. The improvement dredging would alleviate shoal conditions in the area and provide safer navigation between the Federal channel and the proposed Bourne marina. Navigation to Buttermilk Bay farther upstream would also be improved by the dredging activities.

The proposed improvement would consist of removing approximately 1,350 cubic yards of bottom material from the upper 300 feet of the 2,500 foot channel extension which would have a width of 80 feet throughout. The material to be removed consists mostly of gravel and sand with some boulders. All material would be removed by a clamshell bucket dredge to a minimum depth of 6 feet below mean low water. Maintenance frequency is estimated at 15-year intervals to restore the channel to project dimensions, with an annual shoaling rate of 120 cubic yards.

The 1,350 cubic yards dredged from the upstream end of the channel extension would be placed in a scow and towed 9.8 miles south to the Buzzards Bay (Cleveland Ledge) dump site for open water disposal. Since the material to be removed from the Buttermilk Bay improvement is coarse in nature (rock, sand and gravel), it is considered uncontaminated and ecologically acceptable for open water disposal. Therefore, no chemical or biological testing was necessary. The disposal area is located southeast of Cleveland Ledge and was last used in May 1980 when the State of Massachusetts dumped 37,000 cubic yards of mud, sand, and gravel dredged from berths at the Massachusetts Maritime Academy. Some method of controlled dumping would be used to record the actual dump site.

III. PURPOSE OF AND NEED FOR ACTION

The purpose of the proposed project is to provide a safe channel of adequate design to assure a safe entrance into the proposed Bourne public marina.

There is a need to reduce tidal delays, channel congestion and the risk of grounding, and to assure safe harbor access during storms for transient craft from Buzzards Bay and the nearby Cape Cod Canal.

At present, boulders and shallow conditions in Cohasset Narrows limit access upstream to Buttermilk Bay and to the proposed marina site. Navigation is limited to shallow draft boats as water depths at this point are approximately 3 feet mlw. The unmarked boulders and shoal areas create hazardous navigation conditions, which cause damage to the existing powerboat fleet and would cause greater damage to the deeper draft boats that would use the marina. Delays would occur because of tidal restrictions and channel congestion. The proposed marina would not sustain full usage if the Federal channel is not extended.

The proposed project would also stimulate the town's economy and alleviate shortages of boating facilities in the Cape Cod area.

IV. ALTERNATIVES

A. Dredging Alternatives.

1. Plan A

Plan A entails a channel extension 2,500 feet long, only the upper 300 feet of which would require dredging. Sufficient existing depths in the lower 2,200 feet require only the marking of a jurisdictional channel. The extension would proceed northeasterly from the upstream limit of the existing Federal channel just south of the railroad bridge opposite the inlet into the proposed Bourne marina. Approximately 800 cubic yards of material would be removed from the upper portion of the channel. The resulting channel would be six feet deep at mlw and would have a width of 60 feet. This alternative would also include burial of six boulders that are presently hindering navigation upstream and also limit access to the proposed marina.

Destruction of marine life would be confined primarily to the work area. Turbidity would be limited because of the sandy nature of the dredge material. These impacts would be minimal. Benthic creatures within the work area that have a burrowing capability such as quahogs and soft shell clams would be removed by the dredge. Attached forms such as tube worms, barnacles and hydroids would also be lost. Impacts on lobsters and crabs would not be significant. Larger motile forms such as finfish would move out of the area. Disruption of shellfish resources would be minimized if the project work period took place in the late fall through early spring to avoid spawning times.

This plan was not chosen as the selected alternative because a 60-foot-wide channel could not handle the anticipated volume of traffic. Boats would not be able to travel at higher speeds through the channel. Also, a 60-foot-wide channel would not allow the outbound boats headed for the Cape Cod Canal to simultaneously travel two abreast.

2. Plan B

This plan consists of dredging a channel over the same 2,500-foot distance along the same alignment as Plan A. However, this proposal includes dredging the channel to an 80-foot width and a depth of 6 feet mlw. As with Plan A, dredging would only be necessary in the upper 300 feet of the channel. This plan would require the removal of 1,350 cubic yards of sand and gravel material and burial of 10 boulders. The proposed dredging activity in Plan B is relatively identical to that of Plan A except for the removal of an additional 550 cubic yards of material. The effects on the marine resources would be similar to those discussed for Plan A. Additional bottom habitat would be disturbed with this plan. Plan B was chosen as the recommended plan because it results in the greatest net benefits and there would be no adverse impacts.

3. Plan C

This plan involves dredging a channel 2,500 feet long, along the same alignment as Plans A and B, with an 80-foot width and a depth of 6 feet mlw. Plan C also includes widening the 300-foot-long upstream end of the channel to a maximum width of 180 feet. This additional upstream dredging would increase the amount of material removed to 2,700 cubic yards. A total of 20 boulders would be buried. The impacts associated with this alternative would be similar to those discussed for Plans A and B. Additional bottom habitat would be disturbed. Minor impacts on water quality and benthic habitat would be temporary and local.

This alternative was not chosen as the recommended plan because it is not as cost-effective as Plans A or B.

B. Disposal Alternatives

1. Open Water Disposal

The Buzzards Bay dump site at 41°36'N 70°41'W is located 9.8 miles south of the project site, southeast of Cleveland Ledge (Figure 4). This site has been used previously on several occasions for disposal of sandy shoal material from the Cape Cod Canal. This site was last used in May 1980 for disposal of 37,000 cubic yards of mud and sand dredged from the berthing area at the Massachusetts Maritime Academy.

Disposal of sediment in open water would temporarily increase the amount of suspended solids in the water column. However, the sand and gravel material would fall immediately to the ocean floor, reducing its time of suspension in the water column. Impacts at the disposal site would be temporary and local.

Open water disposal at Buzzards Bay is proposed for the dredged materials because of its past history as a dump site for sand and gravel type material, the location and accessibility of the site, and the favorable benefit/cost ratio based on a comparison of other possible open water disposal sites, and land disposal.

2. Land Disposal Alternative

This alternative would require using a hydraulic dredge and would require a two-step disposal process. The material would be temporarily deposited by pumping onto a staging area in the immediate project area to allow material to dry, and then trucked to the Bourne sanitary landfill.

A temporary disposal area would be constructed within the proposed marina property where a parking lot would later be constructed. A half-acre containment site would be designed above mean high water and enclosed with 7-foot-high earthen dikes. Drainage from the containment site would flow directly into the inlet at the proposed marina. Placement of the dredged material at the containment site on shore would also affect the natural habitat at this location. Any vegetation growing within the proposed temporary containment site would be destroyed during the earthwork operations. A typical "low tide" odor would result from the oxidation process created by exposure of organic material to air during the dewatering process. The 1,350 cubic yards of material dredged from the Buttermilk Bay channel extension would have little impact on shortening the life of the Bourne sanitary landfill area.

Additionally, a 6-yard clamshell bucket dredge would have to be mobilized at the site to bury the boulders in the channel. This additional construction would be added to the costs of hydraulic dredging and of containment dikes and trucks to transport the dewatered spoil to the landfill. As detailed in Appendix 3, this makes the cost of upland disposal approximately twice the cost of open water disposal, which requires use of only one dredging unit. Upland disposal is therefore considered economically prohibitive and is not a viable alternative.

C. No Action Alternative

A no action alternative would forego implementation of any improvement in the Buttermilk Bay area. Without the proposed Federal project, development of the marina would most likely occur; however, its full potential would not be realized. Navigation to and from the marina would be restricted by the stage of the tide. The natural channel presently has a minimum depth of 3 feet at mlw over a width of 20 feet. This presents a hazardous situation at low tide and causes vessels to wait for proper tides to navigate the channel. Also, boats trying to reach Buttermilk Bay or the entrance to the proposed marina would have to cross the dangerous shoal and boulder area just south of the railroad bridge. Boats would have to proceed through this area at such a slow speed (2 knots) that the probability of an incident occurring would be increased because of the longer time spent in the shoal and boulder area. Therefore, the no action alternative is not considered a feasible plan.

V. ENVIRONMENTAL SETTING

A. General

The Buttermilk Bay Channel is located in Cohasset Narrows, at the northern end of Buzzards Bay. The proposed channel would extend approximately 2,500 feet northeast from the upstream limit of an existing Federal navigation channel to the entrance of Buttermilk Bay, where it would provide access to a proposed municipal marina to be developed by the town of Bourne.

Buttermilk Bay is a tidal embayment with general depths of 1 to 7 feet. Cohasset Narrows is a passage 300 to 500 feet wide, characterized by strong tidal currents. A moveable span railroad bridge and a fixed highway bridge cross the Narrows and separate Buzzards Bay from Buttermilk Bay to the north. The area normally experiences a mean tidal range of about 4.0 feet, and a spring tide height of 5.1 feet. The western end of Cape Cod Canal is located approximately one mile to the south. The climate of the area is generally temperate, although winters are cold. Average temperatures range from 29°F in January to 71°F in July. Average annual precipitation is 47 inches. Water temperatures in Buzzards Bay range from a low of approximately 30°F in the winter to a high of 73°F in summer.

The Bourne-Wareham town line traverses the Federal navigational channel, Cohasset Narrows, and Buttermilk Bay. The town of Bourne, located in Barnstable County at the entrance to Cape Cod, is approximately 55 miles from Boston. The town relies heavily on tourist trade and water-related activities, and the Buzzards Bay shoreline is developed to maximum use. The surrounding area consists of low rolling hills, streams with flat gradient, and an abundance of wetlands. Wareham is located west of Bourne on Buzzards Bay in Plymouth County. Much of the development in the town of Wareham is also located along the Buzzards Bay coastline.

The Buzzards Bay/Buttermilk Bay area is used extensively for recreational boating. Approximately 25,000 recreational boats pass through the nearby Cape Cod Canal each year. Tidal currents in Cohasset Narrows and low clearance beneath the railroad and highway bridges limit the size of transient craft in Buttermilk Bay. Several hundred craft are moored in this area.

B. Fisheries

Shellfish are harvested commercially and recreationally along the shores of Cohasset Narrows, as well as along the shoreline at Taylor Point. The town of Wareham has issued an all shellfish grant along the shore on the west side of the channel (2). Shellfisheries were closed in this area following oil spills in 1977 and 1979.

In Bourne, 7,258 bushels of scallops were harvested commercially townwide and 2,264 bushels were harvested for recreation in the last 6 months of 1978. Cohasset Narrows and the Buttermilk Bay Channel, however, do not yield a significant portion of the total crop harvested in the New England region.

Oysters are limited in Buttermilk Bay Channel. Approximately 300 bushels were harvested throughout the town for recreation in the last 6 months of 1978. Soft-shell and hard-shell clams are also indigenous to the channel (2, 3). In the last 6 months of 1978, 1,297 bushels of quahogs were harvested recreationally and 426 bushels were harvested commercially in Bourne. During this same period 326 bushels of soft-shell clams were harvested recreationally in town. Several lobster traps have been observed in the channel. Striped bass, winter flounder and bluefish are popular sport fisheries in the area (1).

C. Sediment and Water Quality

Sediment samples collected at five sites were tested for both physical and chemical parameters. Two of these sites are within the area to be dredged; the remaining three sites are located within the designated channel area and were sampled to determine the nature of future dredged material derived from maintenance operations (Figure 6). Collection and analysis were undertaken by the Corps of Engineers in 1972. Additional sampling was conducted the following spring for total kjeldahl nitrogen (TKN), chemical oxygen demand (COD) and hexane solubles. Table 5 presents the chemical analysis and Table 6 presents the physical characteristics of the samples at that time. The nature of the area has not changed since this testing was performed so we can assume the material to be dredged is the same as sampled.

All material sampled was found to be sand and gravel. Material sampled may be classified as Category One by chemical constituents, according to criteria established in Part III of the Massachusetts Water Resources Commission's "Regulations for Water Quality Certification for Dredging, Material Disposal and Filling in Waters of the Commonwealth." According to physical characteristics, these samples are all Type A, as defined by the same regulation.

The results of the bulk sediment analysis show that the material in the area is coarse grained and uncontaminated.

The Massachusetts Water Resources Commission's Water Quality Standards classifies the water quality in the proposed channel as SA. Class SA waters are "designated for the uses of protection and propagation of fish, other aquatic life and wildlife; for primary and secondary contact recreation; and for shellfish harvesting without depuration in approved areas" (5). Open shellfishing is permitted in these waters.

Table 5

BULK SEDIMENT ANALYSIS DATA
BUTTERMILK BAY CHANNEL, BOURNE, MASSACHUSETTS

Parameter	Samples from Area to Be Dredged		Samples from Natural Channel		
	GE-2	GE-7	GE-8	GE-6	GE-9
% Fines	0.3	0.3	0.7	0.2	0.7
% Volatile Solids - EPA	0.51	0.76	1.04	0.53	0.51
% Volatile Solids - NED	0.39	0.67	0.81	0.37	0.47
Chemical Oxygen Demand (COD) (ppm)	2,920	11,310	6,210	2,390	700
Total Kjeldahl Nitrogen (TKN) (ppm)	140	370	110	90	380
Oil & Grease (ppm)	310	30	100	180	100
METALS					
Mercury (ppm)	0.02	0.02	0.02	0.02	0.04
Lead (ppm)	6.5	266.8	40.0	6.4	96.7
Zinc (ppm)	13.0	23.3	15.0	8.7	9.2
Arsenic (ppm)	5.3	13.6	7.6	4.4	7.5
Cadmium (ppm)	0.5	1.0	1.0	0.5	1.0
Chromium (ppm)	2.3	17.0	2.5	2.3	2.4
Copper (ppm)	9.3	30.1	21.0	15.0	9.7
Nickel (ppm)	5.0	12.1	10.0	5.0	5.0
Vanadium (ppm)	9.3	17.0	10.0	9.1	9.7

NOTES: 1. Tests were performed in accordance with EPA "Chemistry Laboratory Manual." All samples are surface grabs and were found to be non-radioactive.

Table 6

SEDIMENT SAMPLES - PHYSICAL CHARACTERISTICS

Sample	Depth	Description
GE-2[a]	Surface	Sandy Gravel (GP)[c]
GE-6[b]	Surface	Gravelly Coarse to Medium Sand (SP)
GE-7[a]	Surface	Sandy Gravel (GW)
GE-8[b]	Surface	Gravelly Coarse to Fine Sand (SP)
GE-9[b]	Surface	Gravelly Coarse to Fine Sand (SP)

a. Area to be dredged.
b. Existing deep natural channel.
c. Standard Soil Classification System.

The oil tanker Bouchard No. 65 grounded in Buzzards Bay in January 1977, spilling 81,146 gallons of No. 2 fuel. Additional sampling was undertaken following the spill at the proposed marina site and also in the area of the Massachusetts Maritime Academy. According to a report entitled the Frederic E. Bouchard #65 Oil Spill submitted to the National Oceanic and Atmospheric Administration, the severity of this incident was limited because oil was contained by ice in the bay (4).

D. Cultural Resources

There are no known cultural resources in the project area. The Massachusetts Historical Commission indicated that significant historic or archaeological properties are unlikely to exist within the project area. A review of the National Register of Historic Places revealed no properties or sites listed or eligible for listing.

VI. ENVIRONMENTAL CONSEQUENCES

A. Impacts of Dredging

The removal of 1,350 cubic yards of material from the Buttermilk Bay Channel would suspend and expose the dredged material and its constituents to the water column. The result would be a temporary increase in turbidity and oxidation and solution of any sediment contaminants. The benthic organisms associated with the sediments would be destroyed during the dredging process and removed from the site.

Turbidity generated by dredging would not be significant because of the coarse, gravelly nature of the material. Photosynthetic processes could be reduced for a short period of time since suspended sediments modify the quality and quantity of light penetration. Dissolved oxygen levels should be reduced for a short time, resulting from decomposition of organic substances which utilize available supplies. Siltation could clog and damage gills of organisms and reduce the buoyancy of their eggs. The release of hydrogen sulfide (SO_2) and toxic chemicals through dredging, as well as the creation of an oxygen deficit, could be injurious to plankton and fish. These impacts are not expected to be significant. The area affected by dredging is a small portion of the habitat available to the widely distributed populations that inhabit Buttermilk Bay.

The sandy material would rapidly settle out of suspension. Any suspended sediments would be carried with tidal currents and deposited beyond the actual dredging site. Since operations would be completed within one week, these impacts would be short term and minimal. Resident benthic populations would not be affected by increases in turbidity over a long period of time.

Nonburrowing and attached organisms such as crabs, tube worms and barnacles would be removed. The loss of forage for predators such as crabs and finfish would be temporary because the dredged areas would be recolonized within a few months after dredging. More motile forms such as finfish would avoid the work area and should not be seriously affected. Lobsters and crabs in the area would survive in the dredge area as long as they are not physically damaged. Lobster habitat would change, however, because of the burial of boulders in the channel. Disruption of shellfish and finfishery resources would be minimized by dredging during late fall through early spring to avoid spawning times which extend from mid-spring to mid-fall.

Flushing rates present with the harbor after dredging is completed would be sufficient to maintain the existing water quality conditions.

B. Impacts of Disposal

The 1,350 cubic yards of sand and gravel would be removed from the channel by a clamshell bucket dredge. The material would be towed in a scow 9.8 miles south to the Buzzards Bay dump site for open water disposal.

The Buzzards Bay dump site is located southeast of Cleveland ledge. This site was last used in May 1980 when the State of Massachusetts disposed of 37,000 cubic yards of mud, sand, and gravel dredged from berths at the Massachusetts Maritime Academy. Since the material to be removed from the Buttermilk Bay improvement is coarse in nature (rock, sand and gravel) it is considered uncontaminated and ecologically acceptable for open water disposal. Therefore, no further chemical or biological testing is considered to be necessary. After receiving material from Buttermilk Bay, no other dumping is proposed for this site.

Dredging and disposal operations would take approximately one week. Impacts on the environment at the disposal site would not be significant because of the clean, nonorganic composition of the disposal material, and also the small volume of material that would be dumped. Release of the dredged material from the scow may create a minor turbidity plume of material into the water column which would quickly settle. The material would be point-dumped within the recommended site. Disposal would not significantly change the present character of the dump site sediment because of the similarity of the sediments. The disposal of dredged sediments may bury benthic organisms at the dump site. Burrowing sediment feeding organisms would survive better than nonmotile or less motile organisms living on the surface. Burial of the weaker juvenile forms or eggs of fish would probably occur. Dredging should be avoided during the shellfish spawning period. Motile forms such as fish or crabs would be able to move out of the area. Recolonization by small, short-lived pioneering species would occur soon after disposal. Studies of other similar disposal sites have shown that successions of benthic colonies occur until a climax community of long-lived larger species becomes

established. The length of time required for achievement of such a climax community depends on sediment quality, which in this case is very good. Therefore, recolonization should be relatively rapid.

The Buzzards Bay dump site would be considered near shore disposal as opposed to deep ocean disposal. Pelagic life, including those of fisheries importance, is reduced in oceanic versus nearshore waters. Similiarly, the relative abundance of bottom dwelling life becomes reduced as one moves from shore into deeper water. This makes for a very stable environment and the associated organisms are less adapted to a change in an oceanic environment. Impacts at the Buzzards Bay nearshore disposal site environment would not be significant.

C. Cultural Resources

A review of the National Register of Historic Places revealed no properties or sites listed or eligible for listing. Therefore, dredging this channel would have no effect upon any resources listed in or eligible for inclusion on the National Register.

D. Air Quality

Odors would be created during dredging activities by the release of hydrogen sulfide and other gases. This effect would be minor because of the coarse, nonorganic nature of the dredged material. However, it is anticipated that these odors would be similar to those experienced during low tide under existing conditions. This short-term impact would be limited to the dredging period.

Air quality would be affected during the summer months by increased boat traffic in the channel. Outboard motor emissions consist of sulfur oxides, carbon monoxide, hydrocarbons and nitric oxides. An air quality analysis prepared for the proposed Bourne marina stated that the impact of outboard motor emissions on air quality "will be negligible because of the relatively small number of boats operating at any given time and the relatively small length of time during which they will remain in the marina" (7). In the channel itself, these emissions would be readily dispersed.

E. Summary

Physical activities associated with the actual dredging and disposal operations would have short-term effects on the water column and the benthic communities. Long-term impacts include those on the economic, recreational, and aesthetic resources of the project area. Table 7 summarizes the potential impacts that could occur should the project be implemented.

Table 7

SUMMARY OF POTENTIAL IMPACTS

POTENTIAL ENVIRONMENTAL IMPACTS	VERY SHORT TERM (Days to Weeks)	SHORT TERM (Weeks to Months)	LONG TERM (Years)
Impacts on Aquatic Ecosystems	• Suspension of material in water column. • Temporary deterioration of water quality. • Minimal release of nutrients into the water column. • Removal of benthic organisms in dredge and disposal areas. • Potential localized effects on finfish.	• Temporary disruptions of benthic organisms until recolonization occurs. • Benthic organisms become re-established.	• Physical removal of benthic substrate from channel dredge site. • Formation of disposal pile at dump site.
Impacts on Local, Human Environment	• Temporary reduction in visual aesthetic values of water column. • Temporary odors of dredged material at dredge site.	• Construction of channel allows full utilization of marina.	• Improved access to marina. • Improvement in navigation and safety and reduction in grounding damages. • Stimulation of economic growth of area.

VII. COORDINATION

A public hearing on navigation improvements for the Buttermilk Bay Channel was held on 18 November 1970 to discuss problems and needs and to obtain the views of local residents and agencies. A second public hearing was held on 15 November 1972 to present study findings and to obtain comments. In 1973, a detailed project report and environmental impact statement (EIS) on the proposed navigation improvements were circulated to various agencies for review and comment.

In 1979, the Corps of Engineers updated its previous studies of the Buttermilk Bay Channel. Coordination has been maintained with various environmental and planning agencies. On 2 May 1979 a meeting was held with local officials to present recent study findings, including environmental considerations and the project construction estimate.

The present proposed action has also been coordinated with Federal, state and local agencies with interest in or jurisdiction over the proposed project. Federal regulatory agencies include the Environmental Protection Agency, U.S. Fish and Wildlife Service and the National Marine Fisheries Service. State regulatory agencies are the Office of Coastal Zone Management, the Division of Waterways and Division of Water Pollution Control in the Massachusetts Department of Environmental Quality Engineering and the Department of Fisheries, Wildlife and Recreational Vehicles. These state agencies are under the Massachusetts Executive Office of Environmental Affairs. Efforts have also been coordinated with the Massachusetts Historical Commission on the state level. The Board of Selectmen and director of the Department of Natural Resources in Bourne have been involved in the project on a local level.

In December 1981 a meeting was held between the Corps, the town of Bourne, interested state and Federal agencies and private consultants. At this meeting a more advanced marina plan was proposed. The scope of the new plan along with recent changes in Federal planning regulations necessitated reformulation of alternative plans for the Federal project. This study and report were developed as a result of those efforts.

REFERENCES

1. Bourne Director of Natural Resources, Mr. Burke Limeburner, telephone conversation, 28 March 1979.

2. Massachusetts Division of Marine Fisheries, Mr. Andrew Kolek, area biologist, telephone conversation, 26 April 1979.

3. Massachusetts Division of Marine Fisheries, Mr. David Chadwick, area biologist, telephone conversation, 26 April 1979.

4. Massachusetts Department of Environmental Quality Engineering, Division of Waterways, Bourne Marina Final Environmental Impact Statement, Anderson-Nichols, Boston, Massachusetts, Contract No. 2840, 24 October 1977.

5. Massachusetts Water Resources Commission, Water Quality Standards, filed 15 September 1978.

6. U.S. Department of the Army, New England Division, Corps of Engineers, Preliminary Draft Environmental Impact Statement, Buttermilk Bay Channel Bourne, Massachusetts, Waltham, Massachusetts, August 1973.

SECTION 404(b) FACTUAL DETERMINATION

AND FINDING OF COMPLIANCE

FOR

BUTTERMILK BAY CHANNEL

SMALL NAVIGATION PROJECT

BOURNE, MASSACHUSETTS

SECTION 404(b) FACTUAL DETERMINATION
AND FINDING OF COMPLIANCE
BUTTERMILK BAY CHANNEL
SMALL NAVIGATION PROJECT
BOURNE, MASSACHUSETTS

1. References.

a. Section 404(b) of Public Law 92-500, as amended, Clean Water Act.

b. 40 CFR Part 230 Subparts B, C, D, E, F, G and H dated 24 December 1980.

c. EC-1105-2-104 Appendix C, dated 30 September 1980.

2. The Proposed Plan.

The proposed improvement of the existing Buttermilk Bay Federal navigation channel would consist of removing approximately 1,350 cubic yards of clean sandy-gravel material from an area 300 feet long with a maximum width of 80 feet. All material would be removed by a clamshell bucket dredge to a minimum depth of 6 feet below mean low water. This action would provide for a channel extension 2,500 feet long from the upstream limit of the existing Federal channel to the site of the proposed Bourne public marina at Taylor Point. Existing depths are sufficient in the lower 2,200 feet of this channel making dredging necessary only in the upper 300 feet.

The dredged material would be placed in a scow and towed 9.8 miles south to the Buzzards Bay (Cleveland Ledge) dump site for open water disposal. The material would be point dumped within the dump site. The site was last used in May 1980 when the State of Massachusetts dumped 37,000 cubic yards of mud, sand and gravel that was dredged from the berths at the Massachusetts Maritime Academy.

3. Project Authority and Present Status.

The original study for Federal navigation improvements in Buttermilk Bay Channel was authorized by the River and Harbor Act of 1945.

In July 1981 the Corps of Engineers issued a permit to the town of Bourne to construct a marina at Taylor Point. In December 1981 a meeting was held between the Corps, the town of Bourne, Federal and state agencies, and private consultants and a more advanced marina plan was proposed. The scope of this new plan, along with recent changes in Federal planning regulations, necessitated reformulation of alternative plans for the Federal project. The present study is a reduced scope of improvement over those plans previously recommended.

Upon completion of public review and resolution of any outstanding concerns, the Detailed Project Report with the Environmental Assessment and the Section 404(b) Evaluation will be forwarded to the Chief of Engineers for approval and authorization. Appropriation of project funds would initiate development of plans and specifications for construction.

4. Environmental Concerns.

The discharge activity would temporarily suspend and expose the dredged sediments and their constituents to the water column. The benthic organisms associated with the dredged sediments would be buried during disposal. Recolonization by opportunistic benthic species would occur within several months after dredging activities have ceased. Disposal would not significantly change the present character of the dump site sediment. Motile forms would be able to move out of the area. Sediment analyses performed in 1972 show that the material in the area is coarse grained and uncontaminated. The proposed project is considered to have no unacceptable significant impacts.

5. Restriction on Discharge (Section 230.10).

(a) There is no practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem and be capable of achieving the basic purpose of the proposed project. Although upland disposal was considered during project planning, it was not considered a practicable alternative because it was economically prohibited. A "No Action" alternative is not by definition practicable since this would contribute to continued shoaling and unsafe navigation through the Federal channel to the marina area.

(b) The discharge activity would meet applicable state water quality standards; would not violate any applicable toxic effluent standard or prohibition under Section 307 of the Clean Water Act; would not jeopardize the continued existence of species listed as endangered or threatened under the Endangered Species Act of 1973, as amended, and would not destroy or adversely modify habitat determined to be critical under the Endangered Species Act of 1973, as amended; and would not violate any requirement imposed to protect any marine sanctuary designated under Title III of the Marine Protection Research and Sanctuaries Act of 1972.

(c) The discharge activity would not cause or contribute to significant degradation of waters of the United States.

(d) Appropriate and practicable steps would be taken to minimize any potential adverse impacts of the discharge on the aquatic ecosystem.

6. Findings of Compliance (Section 230.12).

(a) Upon review of these guidelines (Subparts C through G) the proposed disposal site for the discharge of fill material has been specified as complying with the requirements of these guidelines.

(b) A factual determination required by Section 230.11 with respect to disposal of dredged material and potential enviromental impacts resulting from such disposal is presented on page 45. Concomitant reading of or adequate familiarity with Section 404(b) Guidelines will insure understanding of results presented in the factual determination.

7. Conclusions.

a. An ecological evaluation has been made following guidance in 40 CFR 230, Subparts B through G. Subpart H was reviewed to determine applicability to the proposed project.

b. Appropriate measures have been identified and incorporated in the proposed plan to minimize adverse impacts on the aquatic environment as a result of the discharge.

c. Consideration has been given to the need for the proposed activity, the availability of alternative sites and methods of disposal that are less damaging to the environment, and such water quality standards as are appropriate and applicable by law.

d. Dredging of the existing Buttermilk Bay Federal navigation channel would require the discharge of dredged material. Impacts on the aquatic environment would be temporary and localized. The disposal material consists of clean sand and gravel which is similar to the sediments found at the Buzzards Bay disposal site. Dredging is necessary to provide a safe channel of adequate design to assure safe navigation and access into the proposed Bourne public marina.

Statement

The proposed disposal site for dredged material from the Buttermilk Bay channel has been specified through the application of Section 404(b) Guidelines.

The project files and Federal regulations were reviewed to properly evaluate the objectives of Section 404(b) of Public Law 92-500, as amended. A public notice with respect to the 404 Evaluation will be issued accompanying this document. Based on information presented in this Section 404 Evaluation, I find that the project will not result in unacceptable impacts to the environment.

13 Dec '82
DATE

CARL B. SCIPLE
Colonel, Corps of Engineers
Division Engineer

FACTUAL DETERMINATION

230.11(a) Physical Substrate Determination.

The proposed discharge activity would not significantly change the characteristics of substrate at the proposed discharge site.

The material to be discharged is composed of clean sand and gravel, and is similar to the sediments found at the disposal site. Discharge of this dredged material at the Buzzards Bay dump site would not significantly change its present character since only clean material has been disposed of here over the years. The dredged material would be point dumped which would mound the sediments and create only a minor increase in the elevation of the dump site. Current velocities are not great enough to cause significant movement of the discharged material. The use of a clamshell dredge would minimize the mixing of sediments witin the water. Although disposal would bury any benthic organisms at the dump site, the disposal mound would be recolonized by opportunistic species soon after disposal is completed. Only small quantities of clean material are disposed of at this site. After receiving material from Buttermilk Bay, no other dumping is proposed at the Buzzards Bay site. Disposal would be carried out in the off-season to avoid the shellfish spawning season.

The proposed project would not involve dredge or fill activities in any wetlands.

(b) Water Circulation, Fluctuation, and Salinity Determination.

The discharge of 1,350 cubic yards of material would not alter current patterns, circulation, normal water fluctuation, or salinity gradients at the disposal site. Flushing rates within the Buttermilk Bay channel would be increased because of the dredging activities.

(c) Suspended Particulate/Turbidity Determination.

Suspended particulate and turbidity levels would temporarily increase at the Buzzards Bay dump site due to discharge activities. The coarse grain size of the sediments would significantly reduce suspension of materials in the water column, and the particles would quickly settle out. Turbidity levels would be minimized through the use of a clamshell dredge and by point discharge. No long-term impacts are expected.

The discharge activities would not violate such water quality standards as are appropriate and applicable by law.

(d) Contaminant Determination.

The discharge material would not introduce, relocate or increase contaminants at the disposal site. Material from the Buttermilk Bay channel consists of clean coarse sand and gravel, and is ecologically

acceptable for open water disposal. Only clean material is allowed to be dumped at the Buzzards Bay site. The bulk sediment analysis shows the material to be relatively clean and coarse in nature.

(e) Aquatic Ecosystem and Organism Determination.

Discharge activities would not significantly disrupt the chemical, physical or biological integrity of the aquatic ecosystems. The food chain would not be significantly disrupted in such a manner as to alter or decrease diversity of plant or animal species.

Discharge activities may temporarily disrupt faunal movement but are not expected to significantly interfere with movement into and out of feeding, spawning, breeding or nursery areas. Potential impacts on shellfishery resources would be mitigated by off-season construction activities to avoid the spawning season. There would not be significant changes in current patterns, salinity patterns and flushing rates which would affect shellfish. Discharge activities are not expected to interfere with reproductive processes or cause undue stress to juvenile shellfish forms.

Discharge of dredged material would bury those benthic organisms inhabiting the immediate disposal areas. The disposal mound at the Buzzards Bay site would be recolonized by opportunistic benthic organisms soon after disposal is completed.

Discharge of the dredged material would not significantly degrade substrate, water quality or hydrological parameters as determined through application of Sections 230.11(a) and (b).

Impacts of turbidity on benthic deposit feeders, filter feeders and finfish would be temporary and localized.

A bulk sediment analysis was conducted on sediment samples collected from the channel area. The physical analysis showed that all material sampled was uncontaminated sand and/or gravel.

(f) Proposed Disposal Site Determination.

Point dumping would minimize dispersion of material at the Buzzards Bay open water dump site. Current velocities at the site are not sufficient enough to result in significant movement of the discharged material. The particle size of the sandy-gravel material would restrict the material from spreading into surrounding waters. The use of a clamshell dredge would also minimize dispersion of material. Once released from the scow, the dredged material would descend rapidly to the bottom.

There would be no change in salinity patterns at the proposed disposal site.

(g) Determination of Cumulative Effects on the Aquatic Ecosystem.

There would be no long-term cumulative effects on the aquatic ecosystem due to the discharge activity. Once the proposed project is completed, no continued discharges at the Buzzards Bay open water dump site are expected.

(h) Determination of Secondary Effects on the Aquatic Ecosystem.

Disposal activities would be scheduled to avoid interference during spawning seasons to insure no secondary impact on reproductive processes of benthic organisms. There would be a temporary loss of benthic productivity for predators which use the existing benthic populations as a food source. There would be no bioaccumulation of contaminants or sporadic releases of contaminants into the water column.

FINDING OF NO SIGNIFICANT IMPACT

After careful consideration of the information in this Environmental Assessment, it is my conclusion that development of the proposed project is in the best overall public interest. Implementation of the proposed project would not require a significant commitment of physical, natural or human resources.

Points considered include the effects of dredging the channel, burial of the boulders in the upstream area, and disposal of the dredged material at the Buzzards Bay dump site. The grain size and chemical analyses of the material to be removed show that it is suitable for open water disposal.

In my evaluation, this assessment has been prepared in accordance with the National Environmental Policy Act of 1969. The determination that an Environmental Impact Statement is not required is based on the information contained in the Environmental Assessment and the following considerations:

1. The proposed plan would not involve wetlands or the intertidal zone, or affect any endangered species, archaeological and/or cultural resources or commercially important shellfish populations.

2. The sediments to be dredged are clean and suitable for open water disposal.

3. The dredging would have a positive long-term effect on water quality within the marina basin.

4. Coordination with appropriate Federal and state agencies insured that concerns and suggestions were made known to the Corps so that these concerns could be addressed during project planning.

There does not appear to be any remaining major environmental problem, conflict or disagreement in implementing the proposed work. I have determined that implementation of the proposed action would not have a significant impact on the human environment.

13 Dec 82
DATE

CARL B. SCIPLE
Colonel, Corps of Engineers
Division Engineer

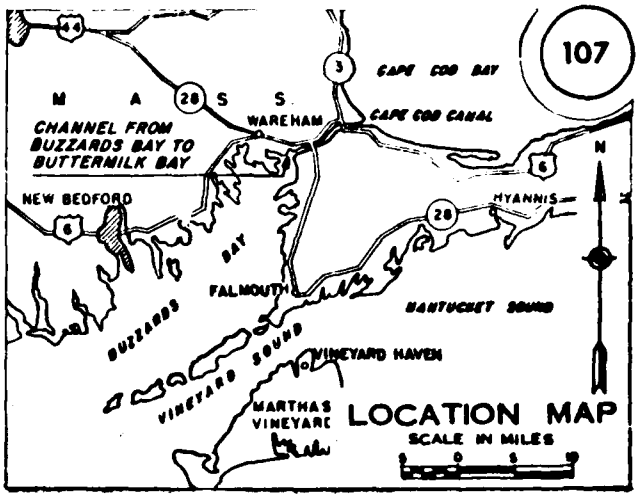
ACKNOWLEDGEMENT AND IDENTIFICATION OF PERSONNEL

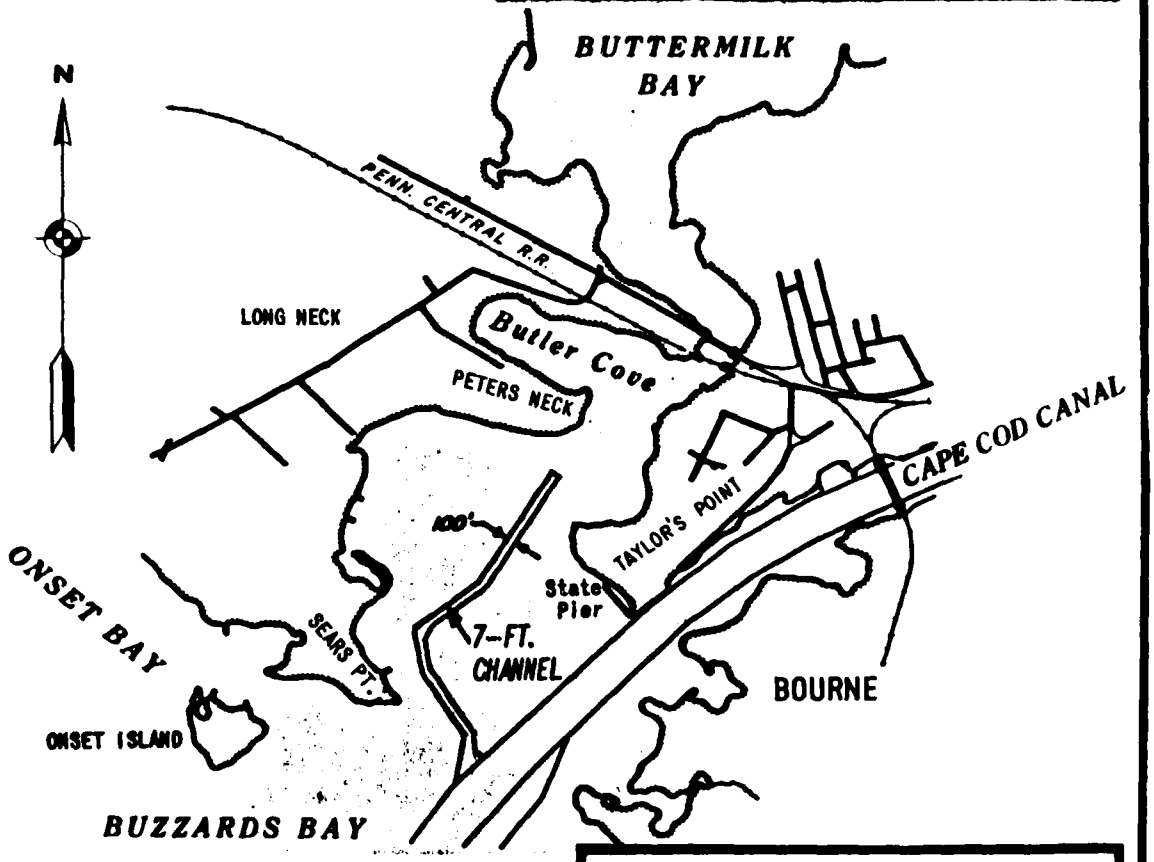
The preparation of this report was administered by:

Colonel Carl B. Sciple, Division Engineer
LTC Arthur N. Rappaport, Deputy Division Engineer
Joseph L. Ignazio, Chief, Planning Division
Donald W. Martin, Chief, Coastal Development Branch
Richard Disemone, Chief, Small Navigation Projects Section

Study management and plan formulation were initiated by project manager, Anthony Garone, and completed by project manager, Mark Habel. The environmental assessment was prepared by Sue Brown and Carl Melberg. The engineering analyses were performed by Anthony Riccio.

The New England Division is appreciative of the cooperation and assistance rendered in connection with this study by personnel of other Federal offices and agencies, by state and municipal authorities, and particularly the Office of the Selectmen - Town of Bourne.





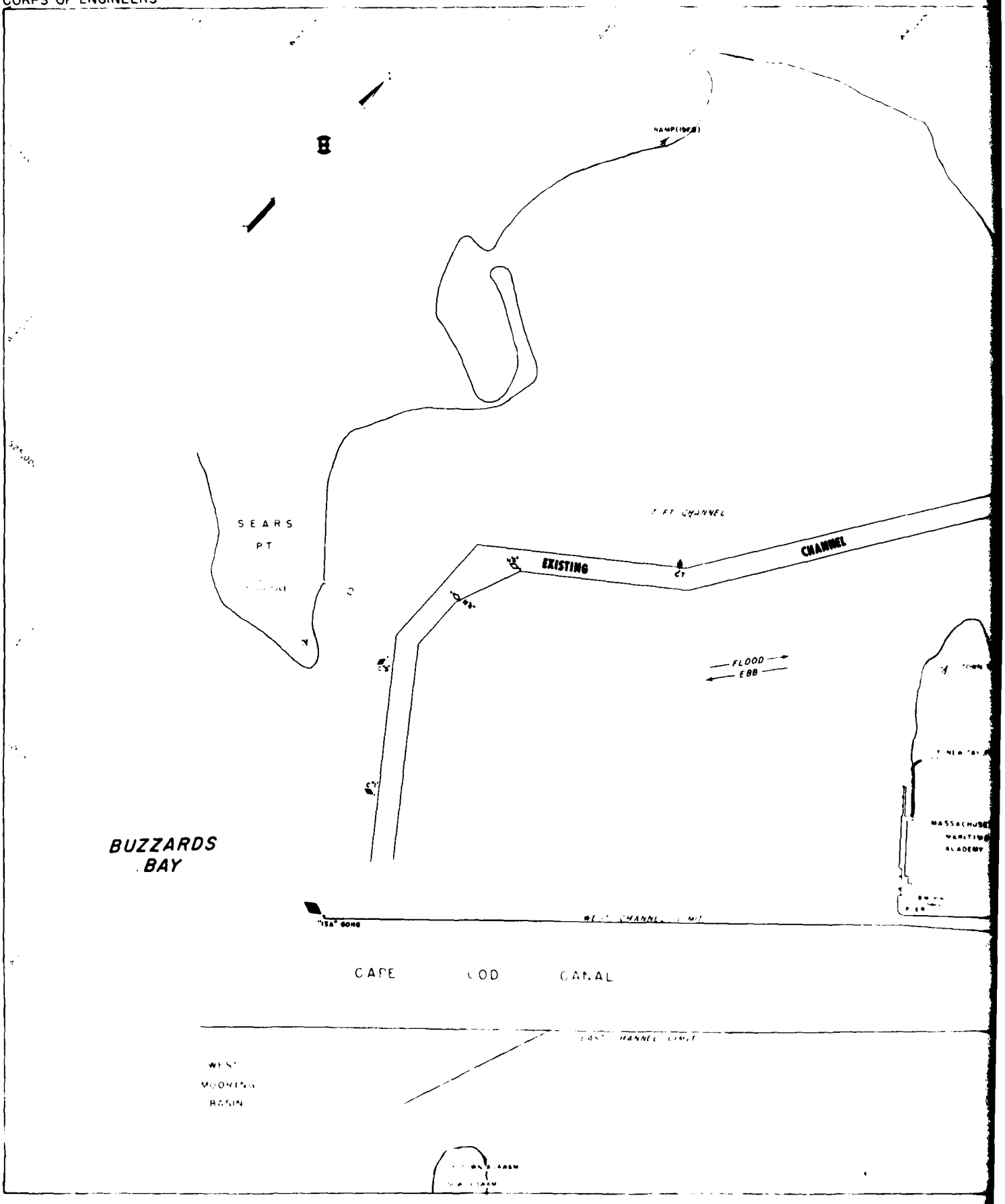
WATER RESOURCES IMPROVEMENT STUDY
BUTTERMILK BAY CHANNEL
BOURNE, MASSACHUSETTS

EXISTING FEDERAL PROJECT
FIGURE 2

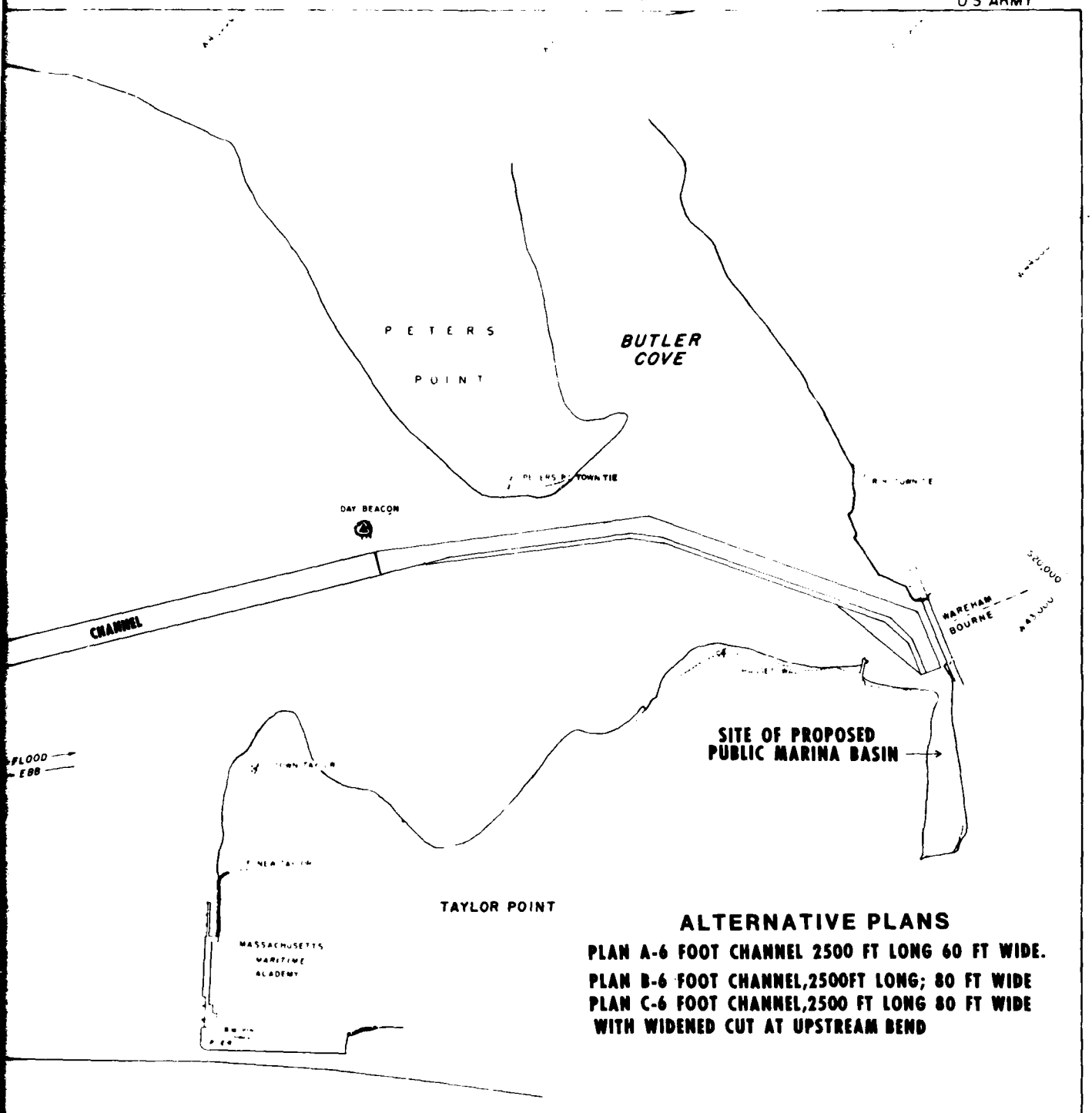
0 1000 2000 3000

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

CORPS OF ENGINEERS



US ARMY



ALTERNATIVE PLANS

PLAN A-6 FOOT CHANNEL 2500 FT LONG 60 FT WIDE.

PLAN B-6 FOOT CHANNEL,2500FT LONG; 80 FT WIDE

PLAN C-6 FOOT CHANNEL,2500 FT LONG 80 FT WIDE WITH WIDENED CUT AT UPSTREAM BEND

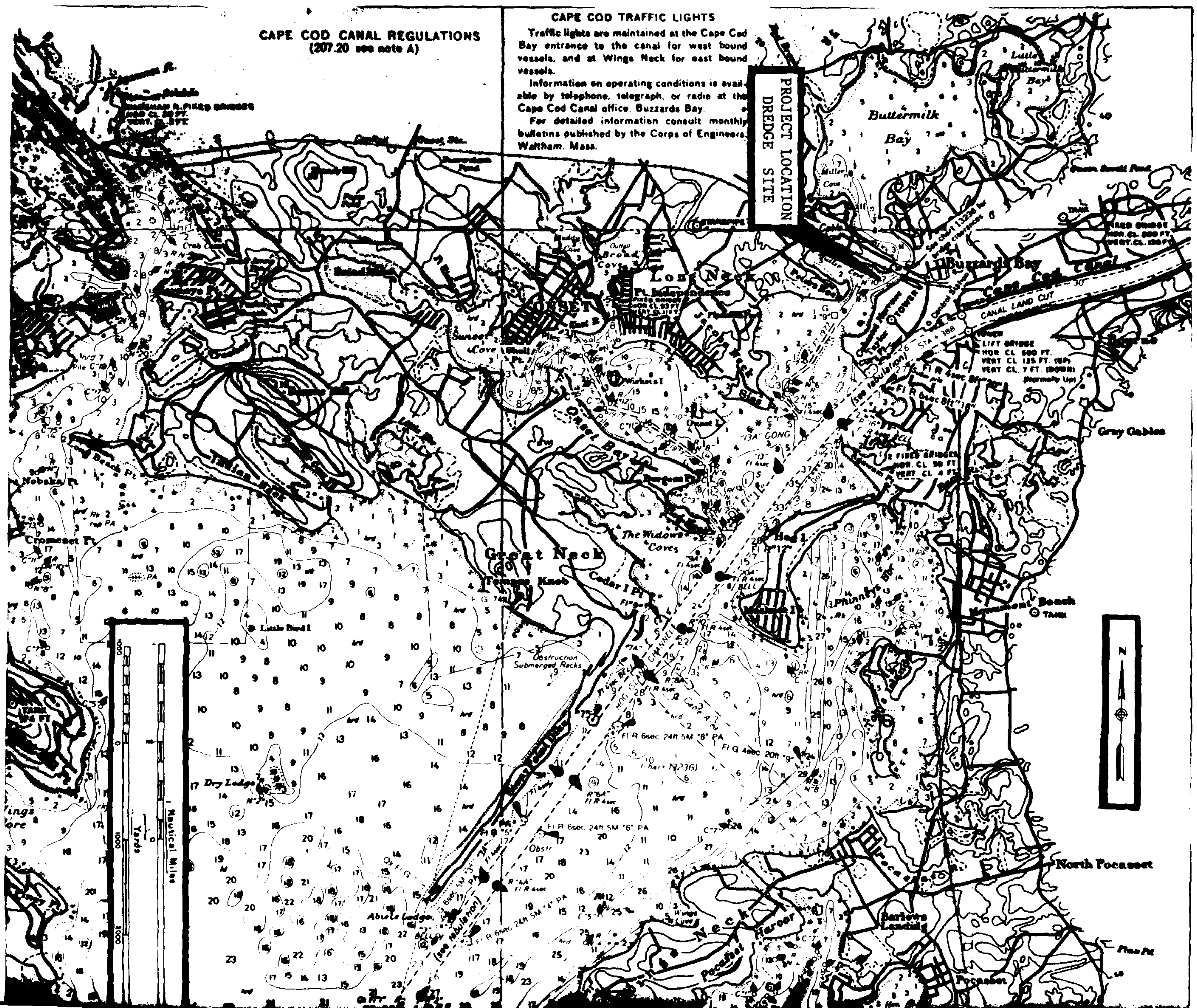
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS

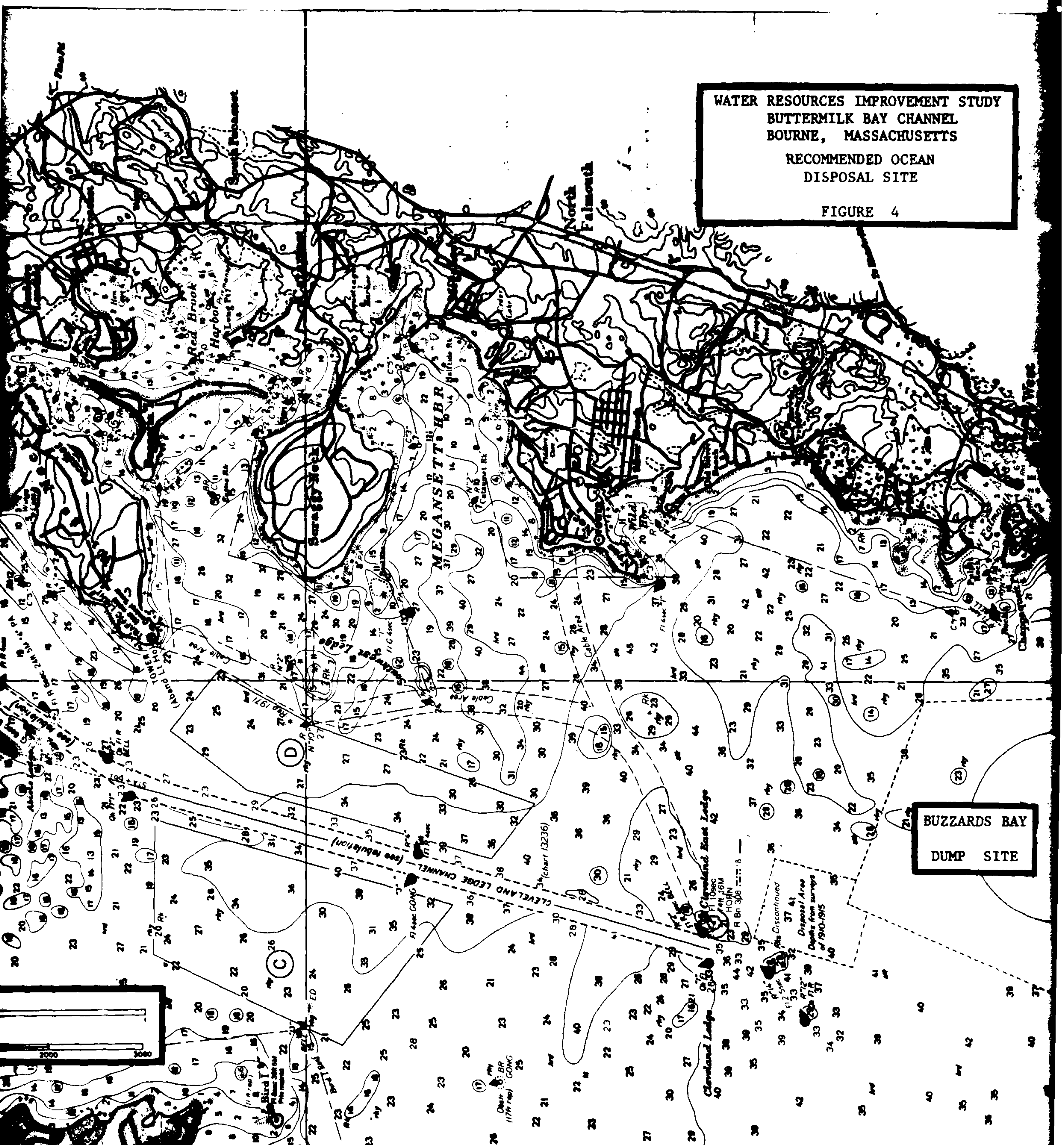
WATER RESOURCES IMPROVEMENT STUDY

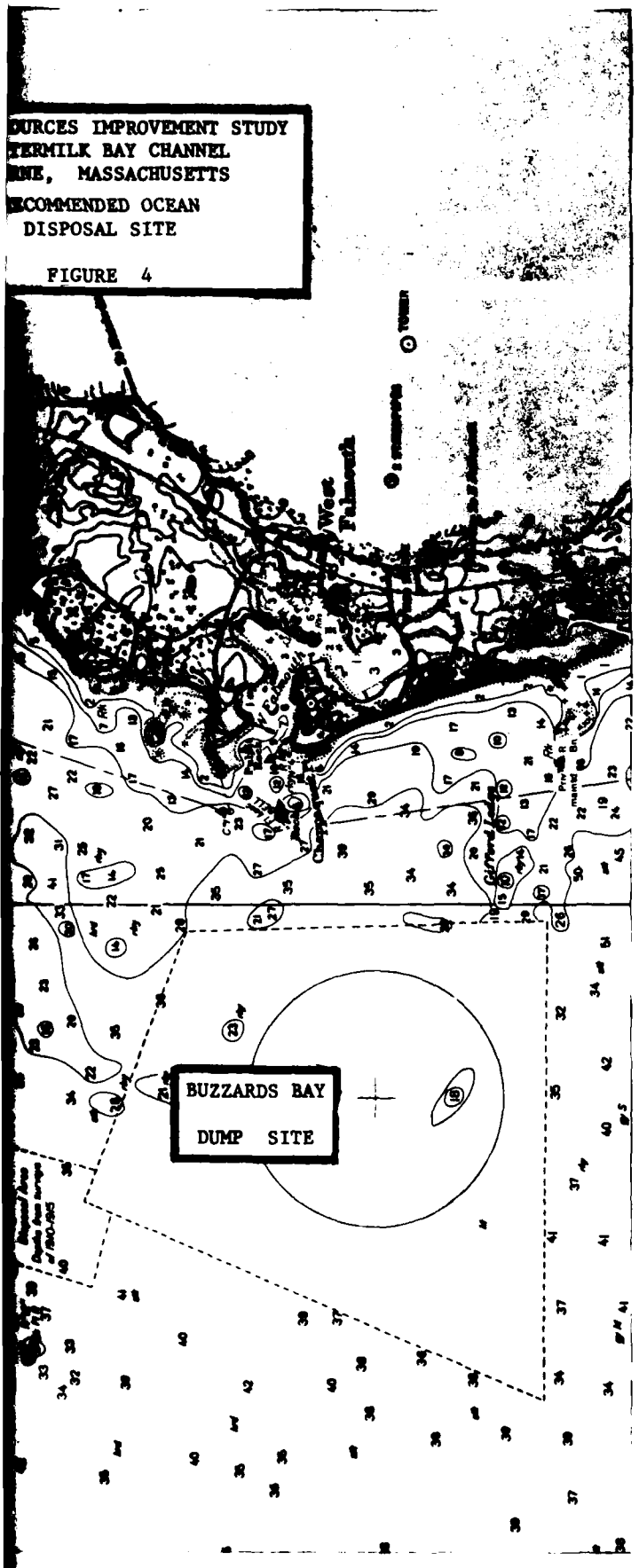
BUTTERMILK BAY CHANNEL
BOURNE, MASS.

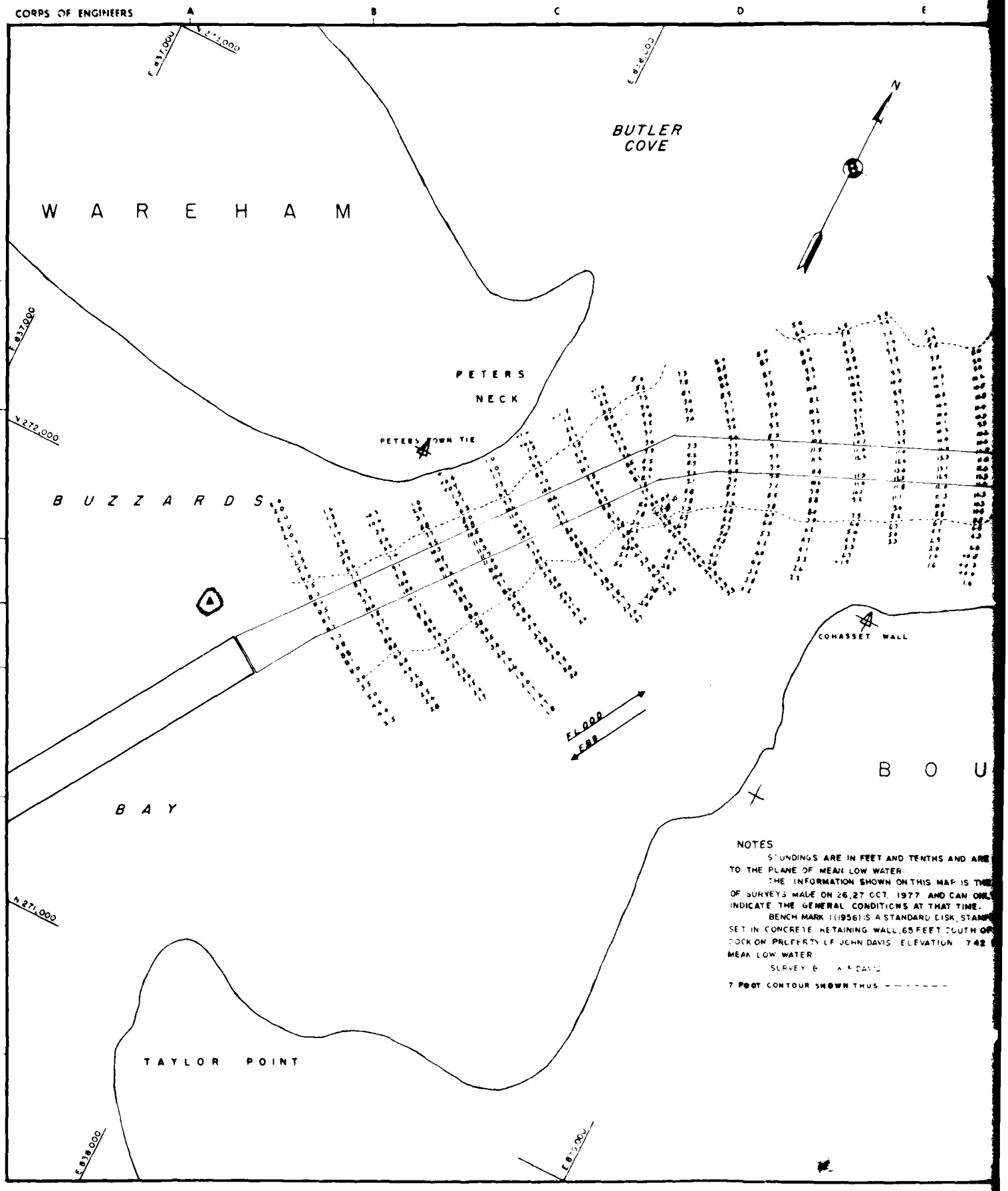
ALTERNATIVE PLANS OF IMPROVEMENT A, B, AND C

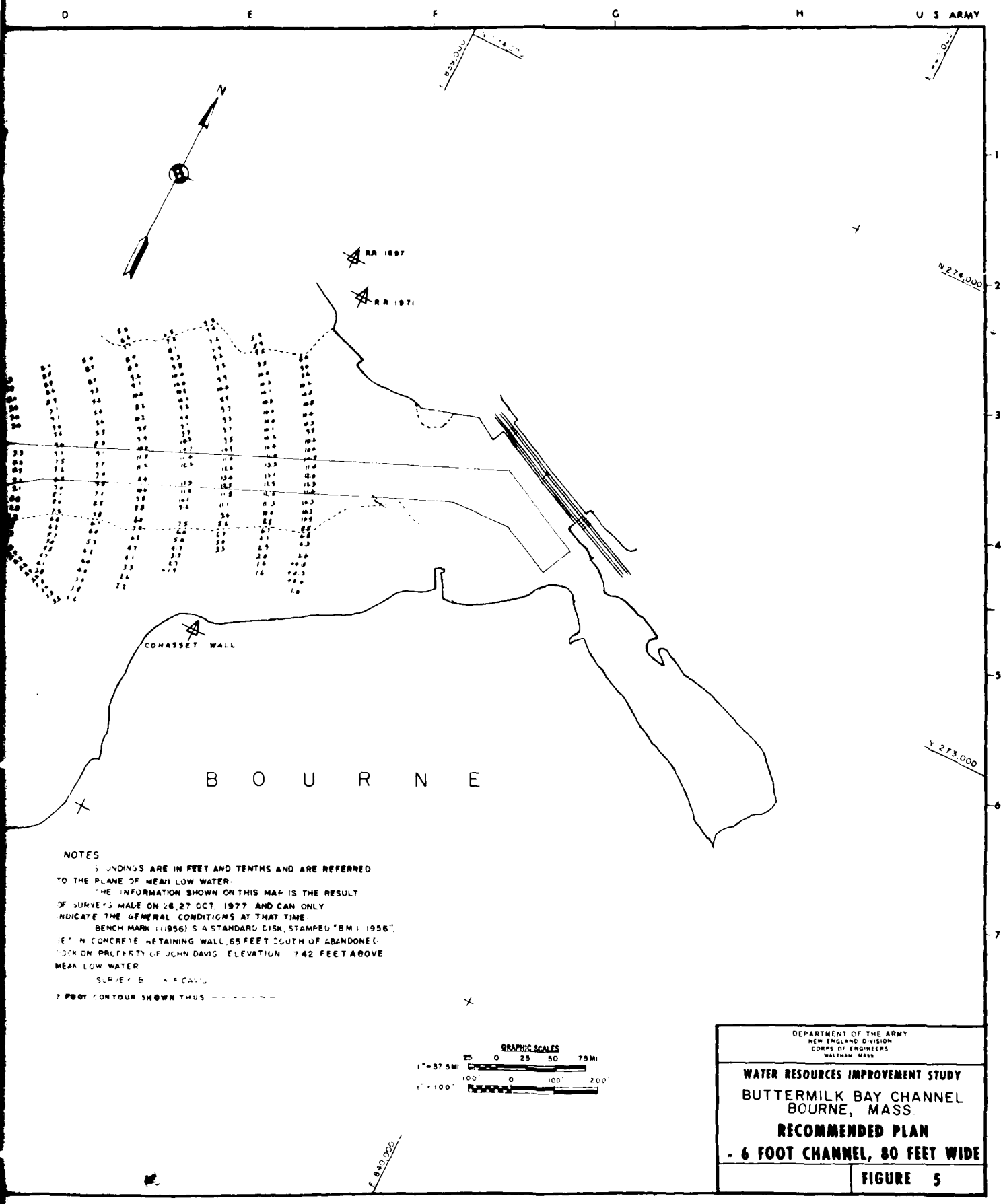
FIGURE -3


CAPE COD CANAL REGULATIONS
(207.20 see note A)
CAPE COD TRAFFIC LIGHTS
Traffic lights are maintained at the Cape Cod Bay entrance to the canal for west bound vessels, and at Wings Neck for east bound vessels.
Information on operating conditions is available by telephone, telegraph, or radio at the Cape Cod Canal office, Buzzards Bay.
For detailed information consult monthly bulletins published by the Corps of Engineers, Waltham, Mass.
PROJECT LOCATION
DREDGE SITE
Buttermilk Bay
Buzzards Bay
Cape Cod Canal
CANAL LAND CUT
LIFT BRIDGE
HOR. CL. 500 FT.
VERT. CL. 135 FT. (UP)
VERT. CL. 7 FT. (DOWN)
(Normally Up)
FIXED BRIDGES
HOR. CL. 50 FT
Gray Gables
Long Neck
Onset Bay
Great Neck
The Widows Coves
Cedar I Pt
Phinneys Bay
Monument Beach
North Pocasset
Barlows Landing
Pocasset
Pocasset Harbor
Wings Neck
Hog Island Channel
Obstruction
Submerged Rocks
Little Bird I
Dry Ledge
Abiels Ledge
Nobska Pt
Cromeset Pt
Long Beach Pt
Sunset Cove
Wickets I
Onset I
"13A" GONG
Nautical Miles
Yards
1000
0
1000
2000


WATER RESOURCES IMPROVEMENT STUDY
BUTTERMILK BAY CHANNEL
BOURNE, MASSACHUSETTS
RECOMMENDED OCEAN
DISPOSAL SITE
FIGURE 4
BUZZARDS BAY
DUMP SITE
North Falmouth
Red Brook Harbor
MEGANSETT HBR
CLEVELAND LEDGE CHANNEL
Cleveland East Ledge
Cleveland Ledge
Cable Area
D
C


URCES IMPROVEMENT STUDY
ERMILK BAY CHANNEL
NE, MASSACHUSETTS
ECOMMENDED OCEAN
DISPOSAL SITE
FIGURE 4
West Falmouth
BUZZARDS BAY
DUMP SITE


CORPS OF ENGINEERS
A
B
C
D
E
1
2
3
4
5
6
7
8
E 837,000
N 277,000
E 838,000
BUTLER COVE
W A R E H A M
PETERS NECK
PETERS TOWN TIE
N 272,000
E 837,000
B U Z Z A R D S
B A Y
COHASSET WALL
EL 000
EBB
B O U
N 271,000
T A Y L O R P O I N T
E 838,000
E 839,000
N
NOTES
SOUNDINGS ARE IN FEET AND TENTHS AND ARE
TO THE PLANE OF MEAN LOW WATER.
THE INFORMATION SHOWN ON THIS MAP IS THE
OF SURVEYS MADE ON 26,27 OCT. 1977 AND CAN ONL
INDICATE THE GENERAL CONDITIONS AT THAT TIME.
BENCH MARK 1 (1956) IS A STANDARD DISK, STAMP
SET IN CONCRETE RETAINING WALL, 65 FEET SOUTH OF
DOCK ON PROPERTY OF JOHN DAVIS ELEVATION 7.42
MEAN LOW WATER
SURVEY B A.R. DAVIS
7 FOOT CONTOUR SHOWN THUS



NOTES

SOUNDINGS ARE IN FEET AND TENTHS AND ARE REFERRED TO THE PLANE OF MEAN LOW WATER.

THE INFORMATION SHOWN ON THIS MAP IS THE RESULT OF SURVEYS MADE ON 26,27 OCT. 1977 AND CAN ONLY INDICATE THE GENERAL CONDITIONS AT THAT TIME.

BENCH MARK (1956) IS A STANDARD DISK, STAMPED "BM ( ) 1956" SET IN CONCRETE RETAINING WALL, 65 FEET SOUTH OF ABANDONED BARN ON PROPERTY OF JOHN DAVIS. ELEVATION 7.42 FEET ABOVE MEAN LOW WATER.

SURVEY BY [illegible]

7 FOOT CONTOUR SHOWN THUS - - - - - - -

GRAPHIC SCALES

1" = 37.5 MI 25 0 25 50 75 MI

1" = 100' 100 0 100 200

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS

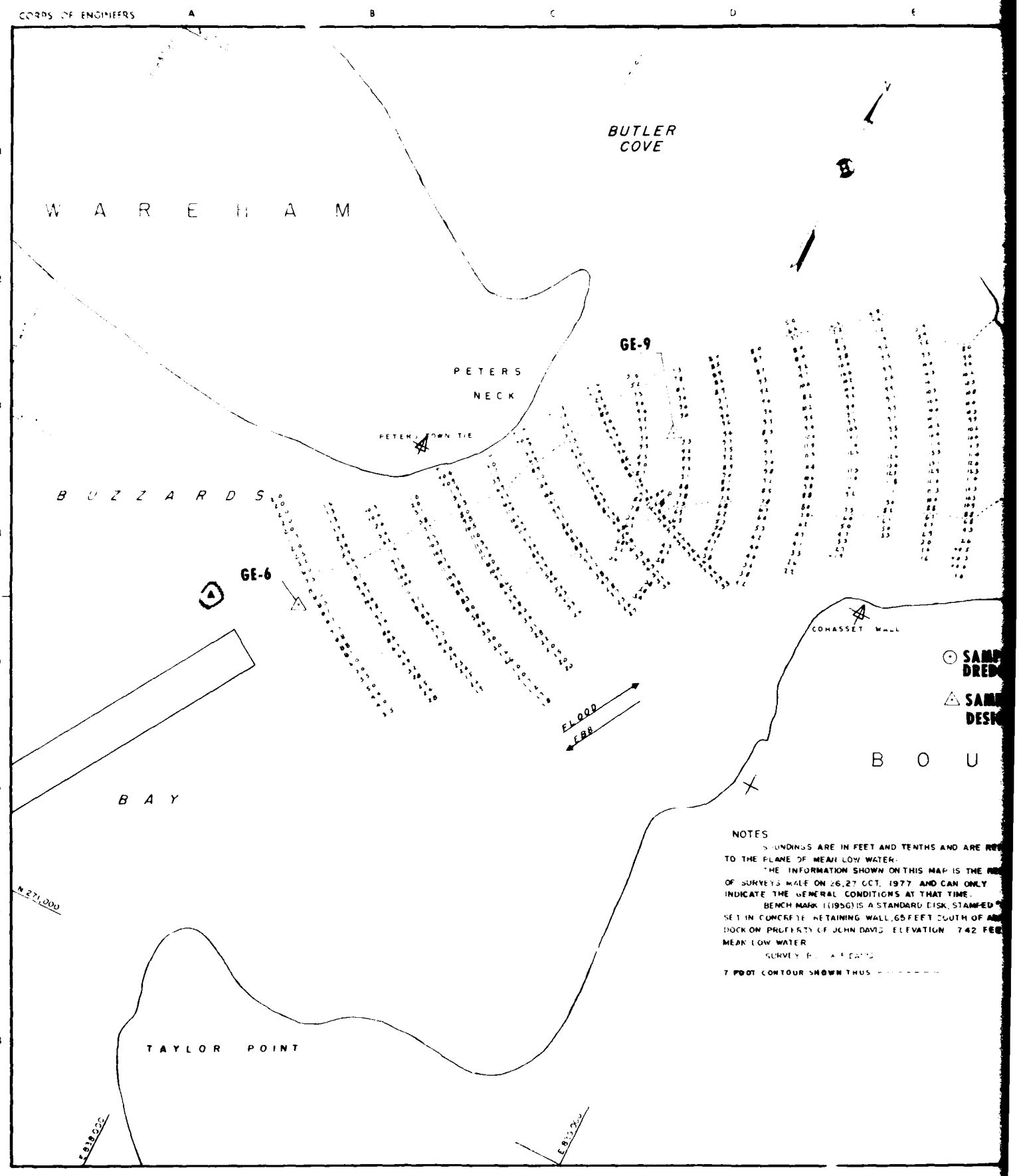
WATER RESOURCES IMPROVEMENT STUDY

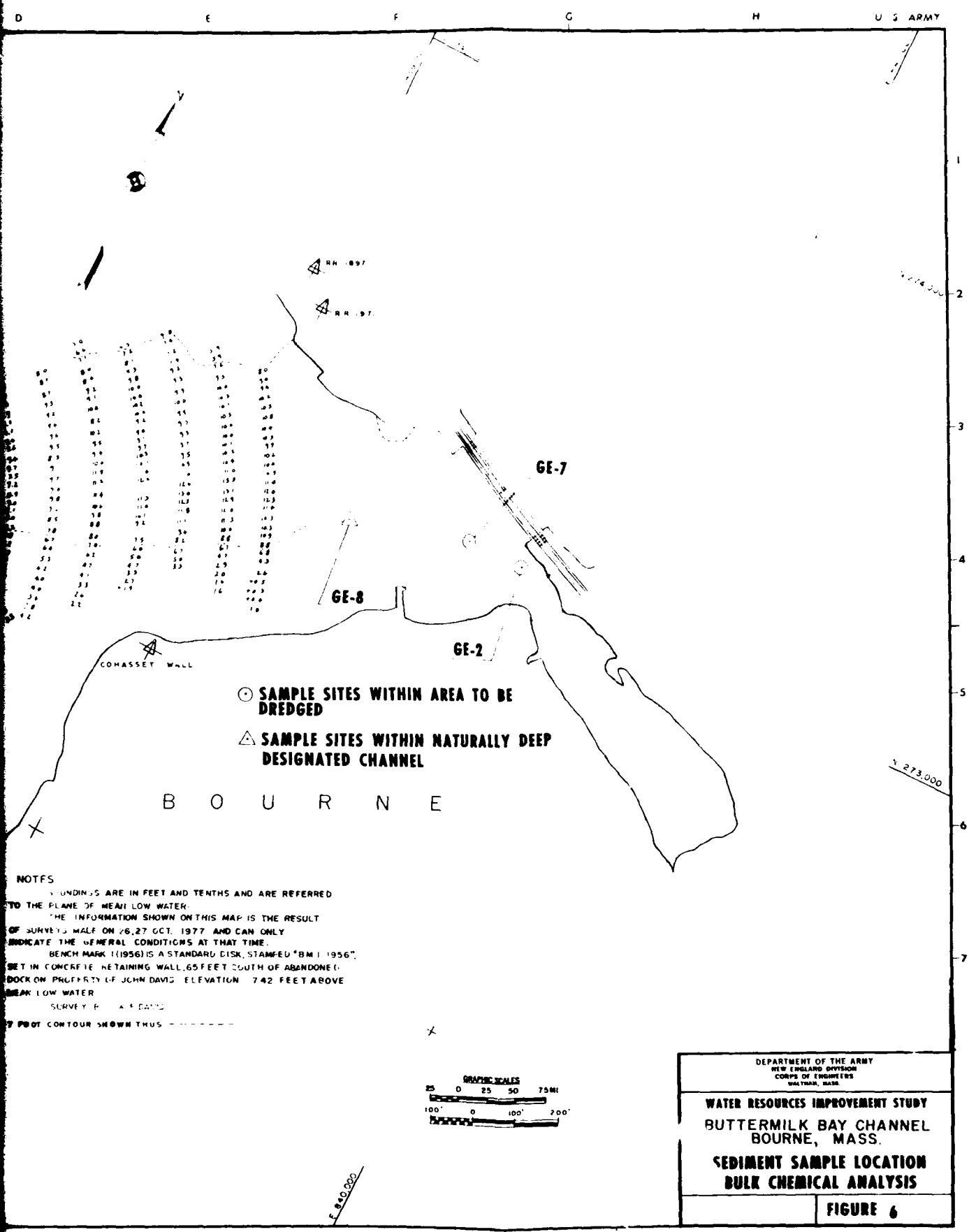
BUTTERMILK BAY CHANNEL
BOURNE, MASS.

RECOMMENDED PLAN

- 6 FOOT CHANNEL, 80 FEET WIDE

FIGURE 5


CORPS OF ENGINEERS
A
B
C
D
E
1
2
3
4
5
6
7
8
BUTLER COVE
WAREHAM
PETERS NECK
PETERSTOWN TIE
BUZZARDS
GE-9
GE-6
COHASSET WALL
EL 000
EBB
BAY
TAYLOR POINT
N 271,000
E 838,000
E 839,000
NOTES
SOUNDINGS ARE IN FEET AND TENTHS AND ARE RE
TO THE PLANE OF MEAN LOW WATER.
THE INFORMATION SHOWN ON THIS MAP IS THE RE
OF SURVEYS MADE ON 26,27 OCT. 1977 AND CAN ONLY
INDICATE THE GENERAL CONDITIONS AT THAT TIME.
BENCH MARK (1956) IS A STANDARD DISK, STAMPED
SET IN CONCRETE RETAINING WALL, 65 FEET SOUTH OF AN
DOCK ON PROPERTY OF JOHN DAVIS ELEVATION 7.42 FEE
MEAN LOW WATER
SURVEY BY A.E. DAVIS
7 FOOT CONTOUR SHOWN THUS



NOTES

SOUNDINGS ARE IN FEET AND TENTHS AND ARE REFERRED TO THE PLANE OF MEAN LOW WATER.

THE INFORMATION SHOWN ON THIS MAP IS THE RESULT OF SURVEYS MADE ON 26,27 OCT. 1977 AND CAN ONLY INDICATE THE GENERAL CONDITIONS AT THAT TIME.

BENCH MARK 1(1956) IS A STANDARD DISK, STAMPED "BM 1 1956", SET IN CONCRETE RETAINING WALL, 65 FEET SOUTH OF ABANDONED DOCK ON PROPERTY OF JOHN DAVIS. ELEVATION 7.42 FEET ABOVE MEAN LOW WATER

SURVEY BY A.S. DAVIS

7 FOOT CONTOUR SHOWN THUS - - - - - - -

GRAPHIC SCALES

25 0 25 50 75MI

100' 0 100' 200'

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

WATER RESOURCES IMPROVEMENT STUDY

BUTTERMILK BAY CHANNEL
BOURNE, MASS.

SEDIMENT SAMPLE LOCATION BULK CHEMICAL ANALYSIS

FIGURE 6

WATER RESOURCES IMPROVEMENT STUDY

BUTTERMILK BAY CHANNEL

BOURNE, MASSACHUSETTS

SMALL NAVIGATION PROJECT
DETAILED PROJECT REPORT
AND ENVIRONMENTAL ASSESSMENT

APPENDIX 1

LOCAL MARINA PLANNING

PREPARED BY:
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

APPENDIX 1

LOCAL MARINA PLANNING

LIST OF TABLES

LIST OF FIGURES

SECTION A

STATE MARINA DESIGN & SITE LOCATION

INTRODUCTION

1. This appendix contains information supplementing the section of the main report entitled Problem Identification. It describes the existing and future (without project) conditions, identifies problems and needs of the study area, describes the national objectives and sets forth the planning objectives and constraints of the town project. Appendix 1 will detail marina development plans. This information has been included in this report because the locally planned public marina development is so closely related to the channel development.

2. The scope of the Federal study is limited to navigation improvements up to the marina entrance. However, because the project is so closely related to the marina construction, these appendices will reflect the planning of the marina as well.

LOCATION AND DESCRIPTION OF THE AREA

3. Buttermilk Bay Channel is located immediately west of the Cape Cod Canal at the northeastern extent of Buzzards Bay. The natural channel extends through Conasset Narrows, connecting an existing Federal channel with the 750-acre Buttermilk Bay (see Figure 1). The sandy shoreline of Conasset Narrows is developed residentially. The towns of Bourne and Wareham are located on both sides of Buttermilk Bay Channel.

4. The locality can be found on nautical chart NOAA #13236 and on U.S. Geological Survey Quadrangle Sheets titled Pocasset, Onset, Wareham and Sagamore. The mean tidal range is 4.0 feet; the spring range is 5.1 feet. Prevailing winds during the boating season are from the southwest with winds of highest velocity, excepting hurricanes, coming from the northeast and northwest. Land along the north, east and south sides of the proposed channel provides good protection from wind and wave action. The average January temperature is $29^{o}F$; the average July temperature is $71^{o}F$. Precipitation averages 47 inches.

5. The town of Bourne is bisected by the Cape Cod Canal and has shoreline along both Buzzards Bay to the southwest and Cape Cod Bay to the northeast. It is located 55 miles from Boston at the base of Cape Cod. The Buzzards Bay shoreline is well developed with little vacant land (Figure 3). Interior sections extend to 200 feet in elevation and are characterized by rolling hills with vegetation typical of sandy soils. Bourne has a tidal shoreline of 39.6 miles.

OBJECTIVES AND CONSTRAINTS FOR MARINA DEVELOPMENT

Marina Need and Location

6. The problem within the study area is the lack of berthing space for recreational boats, especially transients. The Cape Cod Canal is utilized extensively by both recreational craft and large commercial carriers. However, due to the strong tidal currents in the canal, recreational craft must transit the canal with the tides, which often requires waiting for the tide to change. There are only limited areas for boats to wait to transit the canal, and surveys of the area's marinas show a lack of berthing areas.

7. The lack of sufficient berthing areas in the Buzzards Bay area and the town of Bourne specifically results from several factors. These factors are (1) increased demand for adequate berthing due to increased recreational boating, (2) extensive costs of marina development, which prohibits small-scale development, (3) lack of available undeveloped shoreline areas next to sheltered waters, and (4) environmental factors.

8. In attempting to develop the initial plans for the marina several alternatives were evaluated. The town determined that the best area for the marina development was Buttermilk Bay.

Site Selection

9. Several factors must be examined in considering alternative locations for the marina. These factors include: (1) acccessbility, (2) site ownership, (3) proximity to commercial district, (4) location in relation to Cape Cod Canal, (5) location within town limits, and (6) need for some natural protection from the elements or from boat traffic. The following sites within Buzzards Bay were explored but were found deficient in one or more of the above areas:

a. Locate marina immediately adjacent to and south of the cove inlet. This area is privately developed, therefore, an expensive land taking transaction would be necessary. There are numerous mudflats in the area which would likely be impacted by the project. The site also lacks the natural shelter that the cove has to offer.

b. Locate facility in Pocasset River at Bennets Neck. There is a 1.6-acre public land parcel available for development at this location. However, the site is not large enough to accommodate a marina of sufficient size to satisfy the applicant's objectives. The area is rather far removed from the canal and extensive access channel dredging would be necessary. A fixed highway bridge, with a 7-foot high clearance, near the entrance of the river would prohibit sailboats from entering the area. Finally, the area supports extensive shellfish beds which would be disturbed by dredging and other marina related activities.

c. Relocate at Red Brook Harbor. As is the case for Bennets Neck, this site is a considerable distance from the canal and the commercial center of town. The facility would compete with two other existing marinas in the harbor. Additional land-taking would be necessary.

d. Upper Buttermilk Bay. Marina development in upper Buttermilk Bay would likely result in greater ecological impacts then those expected at the proposed location.

e. Onset Bay. This area was not considered since it is not within town limits. Even if this were not the case, the southerly face of the bay is characterized by numerous flats and marshes while the north side is dominated by two major marinas.

f. Widows Cove/Bass Cove. As in the above case, the area is not within town limits and the coves are fringed almost entirely by mudflats and tidal marsh. The location is poor in terms of access and proximity to commercial development.

10. Once the town had made plans for the marina, plans for the channel were developed based on the size of the vessels expected to utilize the marina.

THE MARINA DESIGN AND COST

11. The present design of the marina includes berths for 180 boats, a service building (with laundry, toilets, showers and administration facilities), boat ramp, launching well, parking for 150 automobiles, parking for 36 automobiles with trailers, and pump out facility (Figure 3).

12. The 150 recreational boats expected to use the marina have been divided into permanent and transient fleets. About 70 percent of all boats are expected to be powerboats and 30 percent to be sailboats. About 25 percent or 40 of the marina's 150 berths would be reserved for transient boats. It is anticipated that on an average night 35 transient boats would berth at the marina. Of these, 25 would stay at the marina one night only and leave at the same time to arrive at the canal entrance at the turn of the tide, so as to transit the canal on the favorable ebb tidal flow. Of the 110 slips reserved for the permanent fleet it is estimated that 50 would be filled in the marina's first year of operation, based on waiting lists for berthing space at local marinas. The remaining 60 spaces would be filled over a 10-year growth period. Table 1-1 depicts a breakdown of the anticipated recreational fleet by class and size of vessel and permanent, future permanent, and transient fleets.

TABLE 1-1
BUTTERMILK BAY CHANNEL
TAYLOR POINT MARINA

ANTICIPATED RECREATIONAL FLEET

TYPE OF CRAFT	*LENGTH	*BEAM	*DRAFT	ANTICIPATED RECREATIONAL FLEET NUMBER OF BOATS PERMANENT FLEET IMMEDIATE ADDITIONS	PERMANENT FLEET FUTURE ADDITIONS 10-YEAR GROWTH	TRANSIENT FLEET CANAL BOUND	TRANSIENT FLEET NON-CANAL BOUND
OUTBOARD	15-20	4	1.5	8	9	4	2
	21&UP	5	2	1	-		
STERNDRIVE	15-20	4	1.5	3	3	4	1
	21-25	5	2	4	5	6	2
INBOARDS	15-20	7	2.5	1	2		
	21-30	9	3	14	14	3	2
	31-40	11	3.5	3	4	2	1
CRUISING	15-20	7.5	4.5	1	3		
SAILBOATS	21-30	9.5	5	3	6	4	2
	31-40	11.5	6	1	1	2	
DAYSAILER	8-15	4.5	1.5	10	12		
	16-20	5.5	3	1	1	—	—
TOTAL				50	60	25	10

TOTAL 145 BOATS — Power 98 (@70%) - Sail 47 (@30%)

*All measurements in feet.

13. The marina site occupies 11 acres of which 5 acres would be open water. The construction of the marina would require the dredging of an existing inlet and peripheral wetlands, erection of a bulkhead and backfilling, paving of parking area, the construction of a service building and floating docks and related equipment (Figure 1-1). The town of Bourne would contract for a fuel service franchise to be located at the south side of the basin immediately inside the entrance.

14. The dredging quantity would be approximately 120,500 cubic yards of sand and silt. Some of this material, about 10,500 cubic yards, would be used as fill onsite and the remainder would be disposed of in the Bourne sanitary landfill.

15. Among the services that the marina would offer boaters are laundry, shower, and toilet facilities. The ultimate disposal of these wastes and those from pump-outs of boat holding tanks would be by connection with the existing wastewater treatment plant at the Massachusetts Maritime Academy some 2,000 feet to the south.

16. In order to minimize local water quality impacts during construction and to permit the most economical removal of material, it is proposed that the mouth of the tidal inlet be closed by the construction of a cofferdam. The inlet would then be drained which should permit, depending upon actual subsurface conditions, the use of conventional earthmoving equipment, at least during the initial excavation. Later, at depths beneath the watertable a dragline dredge, operated from the shore, might be required.

17. An earth bulkhead would be constructed on a 1:1 slope around the marina periphery. It is anticipated that onsite material would be used for the bulkhead and as fill in the parking areas. Stone riprap would be used to stabilize and finish the bulkhead slope. The immediate work area would be dewatered as bulkhead sections are formed.

18. It is anticipated that a large quantity of the excavated material would not be utilized in construction and would be disposed of at the town landfill. At a conservative estimate about 110,000 cubic yards would have to be trucked.

19. A boardwalk would be constructed around the bulkhead, extending out over the slope and supported by wooden piles (see details on Figure 1-2). Boat slips would be provided by floating piers which would be anchored to pilings. Access to each pier, and between each pier, would be provided by a single float running along the length of the boardwalk piles. The floating piers would be removed for storage on land during the winter.

20. The estimated cost of the marina is $2.4 million. These costs would be born by the town and the Commonwealth of Massachusetts.

MARINA IMPACTS

21. The environmental impacts of the proposed marina were outlined in the Final Environmental Impact Statement, Bourne Marina, circulated by the Commonwealth of Massachusetts, DEQE in 1977. The impacts were further discussed in the environmental assessment by the New England Division, Corps of Engineers in response to the permit issued to the Commonwealth in 1981. That assessment is included in Section B of this appendix, along with the permit and mitigation guidelines.

22. The contract for construction of the marina facility was awarded by the Massachusetts Division of Waterways in October 1982. The project is scheduled for construction during FY 1983 with completion expected in September.

SECTION B

MARINA PERMIT APPLICATION, AND RELATED DOCUMENTS

FINDINGS OF FACT

1. **Applicant:** Commonwealth of Massachusetts, Department of Environmental Quality Engineering
Application Number: 16-80-375

2. **This permit is being issued under authority delegated to the Division Engineer from the Secretary of the Army and the Chief of Engineers by Title 33, Code of Federal Regulations, Part 325.8, pursuant to:**

X **Section 10 of the River and Harbor Act of 1899**
X **Section 404 of the Clean Water Act**
____ **Section 103 of the Marine Protection, Research, and Sanctuaries Act**

3. **Character, location, and purpose of work:** The purpose is to construct a marina facility to be owned and operated by the Town of Bourne. The work includes enlarging an existing inlet by excavating about one acre of saltmarsh and a couple of acres of upland to provide a boat basin, and filling about 3/4 acres of brackish marsh to provide parking and other facilities. The proposed site is on Taylor's Point, within walking distance of Buzzard's Bay Village and Route 6.

4. **The environmental impacts have been evaluated in accordance with policy and procedures set forth in Title 33, Code of Federal Regulations, Part 325.4. Based on the assessment of probable environmental impacts attached hereto and made part of this finding, the Division Engineer has determined that an environmental impact statement is not required.**

5. **Findings:**

a. **Public notice was issued on** 2 October 1980. 13 **letter(s) of objection ~~was~~ (were) received in response to our notice, and** no **letter(s) ~~was~~ (were) received in favor of the project. All comments have been evaluated and are included in our administrative record of this action.**

b. **Primary authority** is not required.

c. **State water quality certification** was issued on 6 April 1981.

d. Other Agency Comments:

In a letter dated 13 January 1981, the U.S. Environmental Protection Agency recommended denial on the basis that the project would destroy a valuable saltmarsh which will not be compensated for by the applicant's mitigation plan. Alternative sites should be investigated as well as the need for the project.

In a letter dated 21 November 1980, the U.S. Fish and Wildlife Service recommended denial based on the loss of valuable saltmarsh and productive bottom habitat.

In a letter dated 7 January 1981, the National Marine Fisheries Service recommended denial on the basis that the area will not be adequately flushed, leading to an eutrophic condition. Other adverse impacts include the release of pollutants from boats, water turbulence and sediment suspension, reduction in disolved oxygen. The project may be in direct violation of regulatory policies of the Massachusetts Coastal Zone Management Program.

In a 3 March 1981 letter, the Massachusetts Executive Office of Environmental Affairs noted that the Coastal Zone Management Regulatory policies do not apply to the marina project since it was in an advanced design stage before the effective date of the regulations. The office further noted that the marina appears to be consistent with Policy 24 by satisfying a need for recreational boating access in the area.

In a 31 October 1980 letter, the Town of Bourne Selectmen noted that the project is the key to the economic revitalization of Bourne's Main Street business district.

In a letter dated 21 October 1980, the New England River Basin Commission questioned the adequacy of the proposed transplantation program.

e. General Criteria:

(1) Extent of Public and Private Need.

(i) The project will help satisfy a demand for mooring facilities in the Buzzards Bay area. Existing marinas are currently operating at or near capacity levels and demand is likely to continue increasing through the foreseeable future.

(ii) The project will also provide a stimulus for the local economy through employment and the sale of goods and services.

(2) Alternatives to the Proposed Work.

Alternatives are discussed in the Environmental Assessment. The proposed plan appears to be the only practicable alternative available.

(3) Beneficial and Detrimental Impacts.

The project will increase recreational boating opportunities for the general public, and provide a boost for the local economy. The detrimental impacts include disruption of a tidal inlet and its surrounding wetlands. How-

ever, a mitigation plan has been developed which will provide 1 on 1 compensation for the impacted wetlands. Details of this plan are included in the Environmental Assessment.

(4) Cumulative Effects.

Cumulative effects are discussed in the Environmental Assessment. No significant adverse cumulative impacts are foreseen as a result of this project.

f. Public Comment:

(1) We received thirteen letters opposing the project in response to our public notice. Concerns relative to the deterioration of the marsh, the availability of alternatives, the mitigation plan, and potential pollution problems are discussed in the Environmental Assessment. There were also several comments questioning the adequacy of the sewerage disposal plan, while another commenter felt that the marina will create navigational hazards for inexperienced boaters. Others voiced concern relative to the project's financial feasibility, its inconsistency with state regulatory guidelines, its aesthetic impact on nearby properties, as well as trash disposal problems, and increased noise and traffic congestion. There were also three requests for a public hearing. It was later determined that no additional pertinent information would be gained by a hearing.

(2) Control over the discharge of sewerage is primarily the responsibility of other local, state, and Federal agencies. The applicant will have to obtain the appropriate approvals from these agencies before implementing any disposal plan.

(3) The marina will not present any unusual navigational difficulties. It is anticipated that few inexperienced boaters will use the marina because of the navigational skills required to transit the Buzzards Bay area with its strong currents and heavy shipping traffic. Any boater who fails to negotiate the turn into the marina is likely to go aground rather than collide with the railroad trestle. The channel will be marked and there will be adequate channel width at the inlet entrance.

(4) It is the applicant's responsibility for determining the financial feasibility of the project. Funding for this project was voted for at a special town meeting and will be shared by Federal(Bureau of Outdoor Recreation and the Economic Development Administration), state and local interests. The marina should be of long term positive economic benefit to the town.

(5) Aesthetic impacts to properties, noise, traffic congestion, and trash disposal are matters which are addressed by local zoning laws and ordinances. As noted above the project has the approval of the Bourne Town Selectmen.

(6) State and Federal permit review processes are independent of one another, therefore, questions relating to the project's consistency with state license requirements are not properly addressed at the Federal level. It is noted that the project is exempt from the state licensing requirements and that the Massachusetts Coastal Zone Management has submitted a letter in favor of the project.

g. Application of 404(b) guidelines.

The final guidelines of the Environmental Protection Agency for the discharge of dredged or fill material (40 CFR 230) have been applied in evaluating this permit application. The fill is predominately clean granular material and will have no significant effect on water quality.

h. Summary and Conclusions.

The project will result in physical changes to the cove, most notably a change from shallow water to deep water habitat, and a loss of fringe marsh. However, there appears to be no practicable design or locational alternatives available, and ecological impacts have been substantially mitigated. Mitigation includes the transplantation of all impacted [illegible] vegetation and an expansion of open water area in the cove. One [illegible] transplantation will occur within the cove while the balance [illegible] replanted on town owned beach southwest of the [illegible] of the project include increased recreational [illegible] benefits to the region.

p. I have considered all factors affecting the [illegible] servation, economics, aesthetics, general environmental [illegible] values, fish and wildlife values, flood damage prevention, [illegible] tions, navigation, recreation, water supply, water [illegible] energy needs, food production, and in general, the needs [illegible] people. After weighing favorable and unfavorable effects [illegible] Environmental Assessment, I find it to the public interest to issue the permit.

COMMANDER AND DIVISION ENGINEER

2 July 81
DATE

SUPPLEMENT TO FINDINGS OF FACT

1. Applicant: Commonwealth of Massachusetts, Department of Environmental Quality Engineering

Application Number: 16-80-375

2. Character, location, and purpose of work: To construct a marina facility to be owned and operated by the Town of Bourne. The work includes enlarging an existing inlet by excavating about one acre of saltmarsh and a couple of acres of upland to provide a boat basin, and filling about 3/4 acres of brackish marsh to provide parking and other facilities. The proposed site is on Taylor's Point, within walking distance of Buzzard's Bay Village and Route 6.

3. On 2 July 1981, the Division Engineer signed a Findings of Fact with the intention of issuing a permit for the marina project. Prior to the signing of the Findings of Fact, the U.S. Fish and Wildlife Service, the U.S. Environmental Protection Agency, and the National Marine Fisheries Service recommended that the permit be denied on the basis that the work would adversely impact a valuable marsh area. A 6 July 1981 letter sent to the aforementioned agencies conveyed our findings and requested that they inform us within 20 working days as to whether they wish to refer the matter to the Division/Regional Office level. In followup letters the three agencies indicated they would not refer the matter to higher review provided a more detailed mitigation plan be included as part of the final permit. The details of the mitigation plan were agreed upon at a 22 September 1981 meeting involving the applicant, the Federal resource agency and town representatives, and New England Division staff members. Therefore, this permit is being issued.

for Morgan R. Rea
DIVISION ENGINEER

Oct 9, 81
DATE

ENVIRONMENTAL ASSESSMENT

1. Applicant: Commonwealth of Massachusetts, Department of Environmental Quality Engineering, Town of Bourne, Mass.

Application Number: 16-80-375

2. Character, location and purpose of work: The purpose is to construct a marina facility to be owned and operated by the town of Bourne. The work includes enlarging an existing inlet by excavating about one acre of salt marsh and a couple of acres of upland to provide a boat basin, and filling about 3/4 acres of brackish marsh to provide parking and other facilities. The proposed site is on Taylor's Point, within walking distance of Buzzards Bay Village and Route 6.

3. Environmental setting: The proposed boat basin is south of an existing railroad embankment within several hundred feet of businesses along Route 6. South of the site is a residential neighborhood. The site itself is a tidal inlet that was dredged 20 years ago. There is approximately 3/4 acres of fringe salt marsh, one acre of brackish marsh, several acres of undeveloped upland, an abandoned road, and several abandoned houses on the site.

4. Relationship to existing uses: The site is situated between residential and commercial development. The town anticipates that marina patrons will provide a badly needed economic input to Buzzards Bay business district.

5. Possible cumulative effects: The marina is situated in an isolated inlet. No other wetlands or suitable waterways are in close enough proximity to be impacted by future expansion. The project should not encourage secondary development.

6. Alternatives: Several factors must be examined in considering the practicality of alternative locations. Among these factors are: (1) accessibility, (2) site ownership, (3) proximity to commercial district, (4) location in relation to Cape Cod Canal, (5) site must be within town limits, (6) site must offer some natural protection from the elements or from boat traffic. The following sites within Buzzards Bay were explored but were found deficient in one or more of the above areas:

a. Locate facility immediately adjacent to and south of the cove inlet. This area is privately developed, therefore, an expensive land taking transaction would be necessary. There are numerous mudflats in the area which would likely be impacted by the project. The site also lacks the natural shelter that the cove has to offer.

b. Locate facility in Pocasset River at Bennets Neck. There is a 1.6 acre public land parcel available for development at this location. However, the site is not large enough to accommodate a marina of

sufficient size to satisfy the applicant's objectives. The area is rather far removed from the canal and extensive access channel dredging would be necessary. A 7-foot fixed highway bridge near the entrance of the river would prohibit sailboats from entering the area. Finally, the area supports extensive shellfish beds which would be disturbed by dredging and other marina related activities.

c. Relocate at Red Brook Harbor. As is the case for Bennets Neck this site is a considerable distance from the canal and to the commercial center of town. The facililty would compete with two other existing marinas in the harbor. Additional land-taking would be necessitated.

d. Upper Buttermilk Bay. Marina development in upper Buttermilk Bay would likely result in greater ecological impacts then those expected at the proposed location. Access to Buttermilk Bay is limited because of the 9' bridge clearance at the Bay entrance.

e. Onset Bay. This area was not considered since it is not within town limits. Even if this were not the case, the southerly face of the bay is characterized by numerous tidal flats and marshes while the north side is dominated by two major marinas.

f. Widows Cove/Bass Cove. As in the above case, the area is not within town limits and the coves are fringed almost entirely by mudflats and tidal marsh. The location is poor in terms of access and proximity to commercial development.

g. Smaller project. The proposed marina will provide the minimum number of spaces needed for the marina to just break-even, based on mixed sailboat-powerboat usage. The town's purpose for building an essentially non-profit marina is to increase recreational boating opportunity for Bourne residents and to provide an economic input for the downtown businesses.

h. Impacts on physical/chemical characteristics of the aquatic ecosystem:

230.20 Effects on substrate:

The fill will raise the ground surface elevation of .65 acres of wetland so that it will no longer be flushed by the tide. This will change the bulk composition and physical, chemical, and biological character of the substrate. The proposed fill area does not support benthic fauna.

The dredging should not cause long-term changes in the physical, chemical, or biological character of the substrate in the existing inlet. The substrate in the inlet presently consists of organic clay over sand. Dredging will remove the organic clay layer, but because the project should not significantly change flushing velocities, similar material should resettle. Therefore, animals removed by dredging should recolonize at the new depths.

About one acre of wetland peat and about 1-1/2 acres of upland soils will be removed to create the boat basin. The new basin substrate should be similar to that of the existing inlet with similar plant and animal settlement. About 1/4 acre of upland and 1/4 acre of wetland will be changed to riprap.

Organisms favoring intertidal rocky substrate should settle on the riprap surface. Marina structures will provide additional substrate for benthic fauna.

All of the wetland to be removed from the project site will be transplanted, causing substrate changes outside the project site. Approximately 1/3 acre will be transplanted on the north shore of the inlet, replacing some mudflats and some old fill areas. The rest will be transplanted to a strip of town-owned sandy beach on Taylor's Point southwest of the site. This shoreline already supports some salt marsh vegetation. The transplants will be used to fill in open patches and enlarge this marsh.

Dredged material will be used on-site or be disposed at the town's sanitary landfill.

230.21 Suspended particulates/turbidity:

The applicant proposes to dike off and drain the inlet during construction. Therefore, the activity will not affect particulate levels or turbidity outside the inlet. Animals within the inlet will be destroyed or removed by dredging and draining.

The sediments are unpolluted sands, with a top layer of organic clays, wetland peat and silty sand. Analysis of inlet sediments showed levels of oil and grease were .06% and .015%, respectively, which are well below standards for maximum levels. Therefore, dredging should not release toxicants or pathogens.

230.22 Water:

Dredging and construction activities will temporarily reduce water clarity within the inlet and increase odors. Marina activity may cause some degradation of water quality within the basin. Boat exhausts, illegal holding tank discharges, etc., and increased biomass settling on marina structures, may lower dissolved oxygen levels. Although published information conflicts, boat exhaust emissions do not, normally, degrade water quality significantly (Chmura and Ross, 1978). Also, once outside the marina, sewage discharged overboard is readily diluted and has a negligable impact (Chmura and Ross, 1978).

The project will adversely affect organisms, recreation, and aesthetics during dredging and construction. Similar organisms should return to the boat basin. In fact, the dredging will create an additional 3-1/2 acres of habitat for such organisms. The increased diversity of benthic substrate discussed in Section 230.20 should increase diversity of benthic plants and animals, attracting a larger diversity of fish, including sport fish to the basin.

The existing small recreational quahog resources will most likely spread to the newly dredged area, but will most likely be unavailable to recreational shellfishermen after marina construction. However, the marina will increase recreational boating opportunity.

The aesthetic value of the site will be changed.

230.23 Current patterns and water circulation:

The discharge will only obstruct flows to the wetland area to be filled. Dredging will be approximately double the inlet volume, but the finished basin will not be deep enough to stratify. The tidal prism will increase, maintaining sufficient flushing within the basin after construction.

The project will change the structure and population size of the aquatic community. It will decrease shallow water habitat, while increasing deeper water and the overall amount of open water habitat.

The north shore of the inlet presently supports a fringe saltmarsh. In addition, portions of the marsh to be excavated will be transplanted to open patches along the north shore to create a vegetated, 5:1 slope. This slope should be stable enough to resist erosion from boat traffic. Since tidal velocities should not change significantly, the rate of particulate disposition should not increase significantly. The existing top layer of sediments is already composed of fine particulates (organic clay).

230.24 Normal water fluctuations:

Neither the discharge nor other project-related activities will cause prolonged inundation or exaggerated water levels, or a static water level. The only exception will be during dredging when the inlet will be diked off and drained.

i. Impacts on biological characteristics of the aquatic ecosystem.

230.30 Endangered species:

No endangered species or habitat for such exists in the project area. The marina will not facilitate incompatible activities in areas that do provide habitat for such species.

230.31 Fish, crustaceans, mollusks, and other aquatic organisms in the food web:

Neither the discharge of fill material nor dredging will release contaminants or cause benthos, eggs, or spawning areas to be smothered. Nor will it cause a proliferation of undesirable competitive species. It will cause a temporary reduction in food supply by eliminating nutrient exhange during dredging.

The methods of construction will temporarily eliminate fauna within the inlet. The applicant will allow the public to remove quahogs prior to construction. The marsh to be removed by dredge and fill activites will be transplanted to a strip of beach southwest of the inlet opening, on Taylor's Point on the Cohasset Narrows. Therefore, the net detritral export to the Cohasset Narrows/Buttermilk Bay system should not decrease.

When the project is completed, benthos settling on marina structures and riprap should add to the existing food supply. The aquatic food supply will increase with enlargement of the inlet. The terrestrial food supply will decrease due to elimination and alteration of upland habitat.

The activity will permanently change the structure of the food chain within the inlet. Removal of the marsh will decrease primary production from the source, while primary production by attached macroalgae and phytoplankton will increase. Transplanting the marsh will ensure that there is no long term net loss of primary productivity in the Cohasset Narrows/Buttermilk Bay system.

Construction methods will prevent turbidity outside the inlet so there should be no interference with spawning or migration.

After project completion, marina activities will degrade water quality. It is unlikely that degradation would be serious enough to contaminate shellfish within the basin. In any event, shellfish will probably be unavailable during marina operation anyway. The increase in boat traffic should have an immeasurable effect, if any, on water quality outside the basin.

Neither the discharge of fill, the dredging activity, or subsequent marina activity will affect organisms outside the boat basin.

230.32 Other wildlife:

Filling and dredging will eliminate upland habitat that most likely provides general breeding and nesting habitat for small birds and mammals. The applicant will transplant the existing marsh to a strip of town-owned beach on Taylor's Point, about 1500 feet southwest of the inlet mouth. Therefore, there will be no net loss of marsh habitat.

The applicant will also transplant part of the marsh to the north shore of the inlet, filling in bare patches within the existing fringe marsh. In some places, this transplant will eliminate small areas of mudflat (<850 f^2 total) which provide feeding habitat for shorebirds. However, these areas are too small to provide significant habitat. When the marina is completed, the marsh habitat will most likely be of more value than mudflat. Marina operation would limit bird usage much of the day. In addition, Nixon, et al. (1973) suggest that, because of the time of year that emergent marsh plants and marina fouling communities break up and enter the aquatic system, they actually complement each other.

i. Impacts on special aquatic sites:

230.40 Sanctuaries and refuges:

N/A

230.41 Wetlands:

The applicant proposes to remove, but transplant, 1.8 acres of salt and brackish marsh. The applicant will transplant 1/3-acre along the north shore of the inlet, filling in bare patches and enlarging the existing fringe marsh. The remainder will be transplanted the same way to town-owned land on Taylor's Point.

The existing fringe marshes on both north and south shore of the inlet are characterized by Spartina alterniflora and provide good finfish nursery habitat. The high marsh on the south shore is characterized by Spartina patens, Distichlis spicata, and Phragmites australis. It provides limited habitat for redwing blackbird and marsh sparrows.

The marsh tranplanted to Taylor's Point will have a larger interface and, therefore, nutrient exchange with open water. The project should have little net effect on the nutrient exchange of the inlet with other portions of the Cohasset Narrows/Buttermilk Bay system.

The marsh tranplanted to Taylor's Point will also function as a storm and wave buffer, since this area is more exposed to wind and waves than the inlet.

The marsh to be removed from the inlet most likely provides filtration for a small amount of road runoff. Since marina parking surfaces will consist of free-draining compacted gravel, no significant increase in direct runoff into the inlet is expected.

230.42 Mudflats:

Transplanting the marsh to the north shoreline of the inlet will eliminate less than <850 f^2 of mudflat habitat. At present, the small size of these flats limits shorebirds usage. The transplant will increase primary productivity on the mudflat, while reducing foraging habitat for shorebirds.

230.43 Vegetated shallows:

At present, eelgrass (Zostera marina) covers the inlet bottom. The dredging project will temporarily remove the grass, but it should recolonize and spread to the additional 3-1/2 acres dredged for the basin when the marina is completed. Reduction in light transmission by marina structures and boat wake in the entrance channel may limit productivity in some areas. However, the overall abundance of eelgrass should increase.

230.44 N/A

230.45 N/A

j. Impacts on human uses:

230.50 Municipal and private supplies:

N/A

230.51 Recreational and commercial fisheries:

As discussed in Section 230.31, the marina activities will most likely interfere with recreational shellfishing in the inlet. However, according to the Bourne Director of Natural Resources, Bourne has good, large recreational shellfish resources throughout town.

As discussed in Section 230.22, neither the discharge, dredging or marina operation should contaminate shellfish outside of the basin. Neither will the project interfere with reproduction success outside of the basin. Populations of fish and shellfish will be eliminated within the basin during dredging and construction.

230.52 Water-related recreation:

The existing quahog fishery supplies two or three families on Taylor's Point. The marina will provide 149 recreational boating spaces and a public access ramp.

230.53 Aesthetics:

Dredging and construction activities will temporarily create an unpleasant view. The applicant will dispose of excess dredged material at the sanitary landfill, so no new disposal sites are needed.

The marina will permanently change the aesthetic perception of the area. It will replace the semi-natural appearance of the inlet. It will not encourage inappropriate development, but should help to revitalize existing commercial development within the village of Buzzards Bay.

Construction, and to a lesser degree, ongoing marina activity, will change odor, air quality, and noise levels for neighboring residences. In addition, litter within the basin and along neighboring beaches will increase if litter laws are not enforced.

230.54 Parks, national and historic monuments, national seashores, wilderness areas, research sites, and similar properties:

N/A

Energy: The marina will generate more boat traffic, and, therefore, increase fuel consumption.

Navigation: The marina is being constructed in conjunction with a small navigation channel constructed under Setion 107 authority. Therefore, the overall project will improve navigation through Cohasset Narrows.

Safety: The boat basin will provide a safe haven for boaters during storms. However, increased traffic may increase navigation hazards especially through the railroad bridge. However, most traffic should be directed towards Buzzard's Bay or the canal.

k. Evaluation and testing:

N/A

l. Actions to minimize adverse impacts:

230.70 Actions concerning the location of the discharge.

Much of the dredged material will be disposed at the town's sanitary landfill. The rest will be used as fill on site.

(a) The discharge will be confined to .65 acres of wetland. Construction of a temporary cofferdam and draining the inlet will minimize siltation from dredging.

230.71 Action concerning the material to be discharged:

N/A

230.72 Actions controlling the material after discharge:

(c) The applicant will stablize the fill and newly-cut banks with riprap to minimize erosion when the inlet is re-opened to tidal flushing.

230.73 Actions affecting the method of dispersion:

(f) The site is naturally suited to confine and minimize suspended particulates by diking and draining.

230.74 Actions relocated to technology:

N/A

230.75 Actions affecting plant and animal populations:

(d) The applicant will transplant the marsh removed by filling and dredging to a suitable area on Taylor's Point.

230.76 Actions affecting human use:

(a) The applicant will dispose of excess dredged material at the town landfill. The construction procedure will minimize aesthetic damage beyond the immediate project site.

(b) The disposal site is not an aquatic area.

(e) The project will not affect remote fish and wildlife resources, either directly or indirectly.

230.77 Other actions:

(d) The ecosystem in the area of the proposed transplant is primarily shallow water with sandy substrate and patches of existing marsh. The shellfish resources are not significant at the proposed transplant site, but are significant immediately offshore. Therefore, the transplant will not eliminate, but supplement, a significant resource.

7. The above assessment summarizes the anticipated degree of impact on factors listed. On weighing the various factors, the net environmental effects are considered to be insignificant.

8. A preliminary determination was made that an environmental impact statement was not required. That determination was re-evaluated in light of later developments which are addressed in this assessment. I find that based on that initial evaluation and the evaluation of environmental facts set forth above, the decision on the application is not a major Federal action significantly affecting the quality of the human environment. Hence, an environmental impact statement is not required.

25 July 81

COMMANDER AND DIVISION ENGINEER DATE

REFERENCES

Chmura, Gail L. and Neil W. Ross 1978. The Environmental Impacts of Marinas and Their Boats, Marine Memorandum #45, Marine Advisory Service, University of Rhode Island Sea Grant.

Nixon, Scott W., Candance A. Oviatt, and Sharon Northby, 1973. Ecology of Small Boat Marina. Marine Technical Reports Veries No. 5, University of Rhode Island Sea Grant. 20 pp.

404(b) REVIEW

B. Compliance with the Guidelines

230.10 Restrictions on discharge:

(a) Are there available practicable alternatives?

(1)(i) that do not involve discharge into "waters of the U.S." or ocean waters? No

(ii) at other locations within these waters? No

(2) Is there an alternative in (1) above, not presently owned by the applicant, that can be reasonably obtained? No

(3) Is the project water dependent? Yes. If not, has the applicant clearly demonstrated that there are no alternative sites available?

Is the site a special aquatic site? Yes. If so, has the applicant demonstrated other practicable alternatives are more damaging to the aquatic ecosystem? No practicable alternatives.

(b) Will the discharge:

(1) violate state water quality standards? No

(2) violate toxic effluent standards? No

(3) jeopardize endangered species? No

(4) violate standards set by the Department of Commerce to protect marine sanctuaries, etc.? No

If so, the discharge should not be permitted.

(c) Will the discharge contribute to significant degradation of "waters of the U.S."? (see environmental assessment, subparts B and G). No

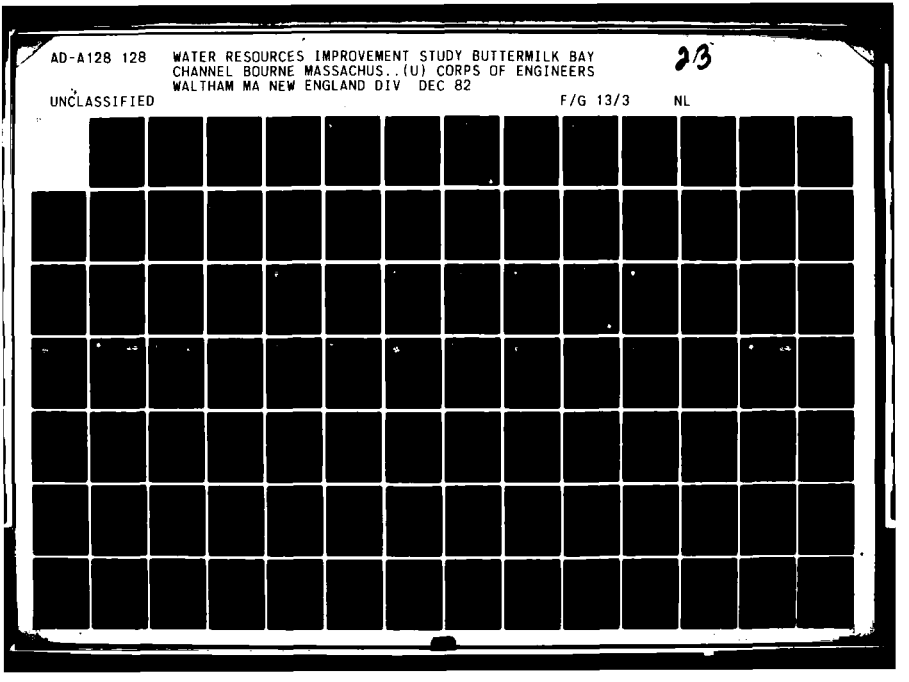
Effects contributing to significant degradation include adverse impacts to:

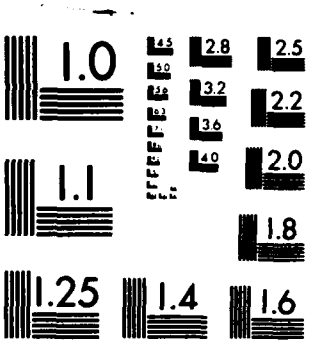
(1) human health or welfare. through pollution of municipal water supplies, fish, shellfish, wildlife, and special aquatic sites?

AD-A128 128 WATER RESOURCES IMPROVEMENT STUDY BUTTERMILK BAY CHANNEL BOURNE MASSACHUS..(U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV DEC 82

2/3

UNCLASSIFIED F/G 13/3 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

The construction activity will temporarily eliminate fish and shellfish in the boat basin. When completed, marina activities may cause some degradation of water quality. However, the degradation should not be significant enough to prevent a return of an even greater diversity of plants and animals to the enlarged basin. The shellfish in the basin will most likely be unavailable after the marina operation begins. However, this resource is insignificant in comparison to Bourne's other shellfish resources.

(2) life stages of aquatic life and other wildlife?

Turbidity and other construction impacts will be confined to the boat basin, so that the adverse impacts will be insignificant.

(3) diversity, productivity and stability of the aquatic ecosystem, such as loss of fish or wildlife habitat, or loss of the capacity of a wetland to assimilate nutrients, purify water, or reduce wave energy?

The diversity and productivity of the aquatic ecosystem will actually increase. The boat basin will provide 3½ acres more aquatic habitat. Most of the marsh to be removed will be transplanted to a strip of shoreline that is more exposed to wave action, its value for this function should increase.

(4) recreational aesthetics, and economic values?

The project will improve recreational and economic values. The aesthetic value of the area will be changed but whether or not it is improved or degraded is subjective.

If so, the discharge should not be permitted except as provided by 404(b)(2).

230.11 Factual Determinations:

(a) Physical substrate determinations:

(summarize individual and cumulative changes in substrate and the loss of environmental values. Refer to 320.20 in environmental assessment. Also discuss potential minimizing measures, Subpart H)

Changes to the physical substrate include replacing 1.8 acres of salt and brackish marsh with open water. The substrate in the existing inlet is fine organic clay over sand. Dredging will temporarily change the substrate, but it should return to a layer of fine particulates over sand with time. The substrate in the newly formed dredged areas will be similar to that of the existing inlet, except on riprapped banks. Marina floats and piers will provide additional substrate. These changes should result in increased numbers and diversity of benthic plants and animals.

(b) Water circulation, fluctuation, and salinity determinations:

(summarize individual and cumulative effects on current patterns, normal fluctuations, downstream flows, etc., and loss of environmental values. Refer to 230.23 to 230.25 in environmental assessment. Also discuss potential minimizing measures, Subpart H).

Although the inlet volume will be more than doubled to provide the basin, the tidal prism should be sufficient to maintain similar flushing patterns.

(c) Suspended particulates/turbidity determinations:

(summarize the effect on kinds and concentrations of suspended particulates/turbidity at the disposal site, and the loss of environmental values. Refer to 230.21 in environmental assessment. Also discuss potential minimizing measures from Subpart H)

The applicant will use dredged material as fill on site, and dispose of excess dredged material at the town sanitary landfill. The contractor will dike and drain the inlet to prevent the release of suspended particulates outside the immediate project area.

(d) To what degree will the discharge introduce, relocate, or increase contaminants?

Testing indicates that the inlet sediments are free of contaminants.

(e) Aquatic ecosystem and organisms determinations:

(summarize the effects, both individual and cumulative, that the discharge will have on the aquatic ecosystem. Consider the potential loss of environmental values as discussed in 230.31 and 230.61 of the environmental assessment, and potential minimizing measures as tested in Subpart H)

The applicant will transplant 1/3 acres of saltmarsh to the northshore of the inlet and the remaining marsh to a suitable area southwest of the inlet opening, on Taylor's Point. Therefore, net detrital export and nutrient exchange with Buttermilk Bay/Cohasset Narrows system should not change. The project will decrease shallow water but increase the overall amount of open water habitat in the inlet. Substrate diversity will increase, causing an increase in benthic, and, therefore predator species diversity. The net result should be a change in community structure with increased diversity and numbers of plants and animals. The marina operations may cause a degradation of water quality, but not so severely as to impact organisms.

(f) Proposed disposal site determinations: N/A

(1) Has the disposal site been confined to the smallest practicable area consistent with the appropriate type of dispersion, or would widespread dispersion be more appropriate? N/A

(2) Is the proposed mixing zone acceptable in light of:

(i) Water depth? N/A

(ii) Current velocity, direction, and variability? N/A

(iii) Turbulence? N/A

(iv) Stratification due to obstructions, salinity, or density profiles? N/A

(v) Discharge vessel speed? N/A

(vi) Rate of discharge? N/A

(vii) Ambient concentrations of constituents of interest? N/A

(viii) Dredged material characteristics, particularly concentrations of constituents, amounts of materials, types of materials (silt, sand, clay), and settling velocities? N/A

(ix) Number of discharges/unit time? N/A

(x) Other factors affecting rates and patterns of mixing? N/A

(g) What are the potential cumulative effects on the aquatic ecosystem?

The proposed project site is situated in an isolated inlet. No other wetlands or suitable waterways are in close enough proximity to be impacted by future expansion. Owners of similar properties may be encouraged to apply for similar projects. However, each project will be evaluated on the basis of its individual merits.

(h) *What are the secondary effects on the aquatic ecosystem?*

The project should not encourage secondary development. There will be an insignificant increase in boat traffic with a resulting insignificant impact on water quality from boat exhaust, etc.

230.12 Findings of compliance or non-compliance.

The proposed discharge:

(1) complies with guidelines

(2) complies with the guidelines with the inclusion of appropriate conditions to minimize adverse effects to the affected ecosystem. Yes

(3) fails to comply with the guidelines because:

(i) There is a practicable, less damaging alternatives.

(ii) The proposed discharge will significantly degrade the aquatic ecosystem.

(iii) The proposed discharge does not include all appropriate and practicable measures to minimize potential harm to the aquatic ecosystem.

(iv) There is not sufficient information to judge whether the proposed discharge will comply with the guidelines.

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
One Gateway Center, Suite 700
NEWTON CORNER, MASSACHUSETTS 02158

JUL 2 2 1981

Colonel C. Ernest Edgar, III
Division Engineer
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254

Dear Colonel Edgar:

I have reviewed Colonel Rappaport's letter, Finding of Facts and Environmental Assessment of July 6, 1981, regarding Public Notice 16-80-375, application of the Massachusetts Department of Environmental Quality Engineering, Bourne, Massachusetts.

I am not satisfied with the mitigation plan to replace habitat losses, which the documents acknowledge will occur.

Issues

Because of piecemeal destruction of saltmarsh and the well documented ecological significance of this resource, I consider it Resource Category Two, according to the Fish and Wildlife Service's Mitigation Policy. The mitigation goal for Category Two is no net loss of in-kind habitat value.

While the proposal to transplant saltmarsh vegetation to the adjacent cove is promising, it lacks specific information and requirements for maintenance that the applicant would have to follow. Information that needs to be developed includes:

1. an accurately scaled map of the mitigation area, showing existing contours, tidal elevations, extent of existing wetlands and mudflats.

2. species of vegetation proposed to be transplanted, and their extent and location within the cove.

3. time of year of transplanting, and other logistical requirements such as who will do the work, how the area will be prepared, how it will be protected while the vegetation is growing, etc.

4. who will manage or oversee the mitigation area, and who would monitor to see that it was successful. If unsuccessful, what additional measures will be taken to mitigate.

8 9 JUL 1981

The goal of mitigation is to replace biological productivity. Thus, since the unvegetated areas in the project area where some of the transplanting will take place, and similar areas in the adjacent cove already has habitat value, it will be necessary to create more saltmarsh habitat than is being lost.

Field Level Coordination

We reported on the Public Notice on November 21, 1980. Our staffs have communicated several times on this matter.

Agreements or Counter-Proposals

No formal agreements or counter-proposals have been made.

Quantitative and qualitative evaluations of expected cumulative or substantial impacts

Piecemeal development has resulted in substantial wetland loss in the New England coastal zone, as documented by the Fish and Wildlife Service in the 1950's and 1960's. The loss of this high value habitat shows a continuation of these losses.

Proposed resolution of policy or other issues

As stated above, I believe a more specific and detailed mitigation plan needs to be put together before a permit is issued. Therefore, I recommend you work with the Concord Field Office in this matter. If a satisfactory mitigation plan cannot be developed with them I request that the issue be elevated to the Regional/Division level. Please keep me appraised of the status of this project.

Sincerely yours,

DEPUTY *Regional Director*

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Habitat Protection Branch
Services Division
7 Pleasant Street
Gloucester, MA. 01930

August 3, 1981

Col. Arthur N. Rappaport
Acting Assistant Deputy Div. Engineer
Corps of Engineers
New England Division
424 Trapelo Road
Waltham, MA. 02254

Dear Col. Rappaport:

This is in reference to your letter and Finding of Fact of July 6, 1981, concerning an application by the Commonwealth of Massachusetts Department of Environmental Quality Engineering to construct a municipal marina facility in a tidal cove adjacent to Buttermilk Bay at Bourne, Massachusetts.

Based upon our review of the Finding of Fact, Environmental Assessment and the additional information your staff has submitted to us, we will not refer this matter to the Division/Regional office level. However, we recommend that the following conditions be incorporated into any permit issued for this project. These conditions are necessary to minimize adverse effects on marine resources, to assure that marsh transplantation efforts are successful, and to ensure that water quality is protected.

In order for these conditions to be accomplished and to allow future evaluation of the degree of success, we recommend the following:

1. The marsh grass transplantation site should be documented to show type and distribution of existing vegetations. Also, the extent of the area that will be transplanted should be documented.

2. The transplantation of saltmarsh should be undertaken in accordance with the method established in attachment 1, pages 1 and 2, paragraph II, B, C, E, F, G, H, of the U.S. Environmental Protection Agency's (EPA) letter dated July 30, 1981, concerning this project. In place of paragraph II D of their letter, we recommend that planting of both vegetation and the nursery stock take place in the early growing season of any year. Planting during this time of year will enhance the possibility for success.

3. The transplanting and nursery stock planting should be monitored and maintained through two growing seasons, and if substantial damage or loss occurs, through a third growing season. If it shows signs of failure, the resource agencies should be notified so that additional measures may be taken to revitalize the affected area.

4. We concur with the recommendations as stated in attachment 1, pages 2-4, paragraphs III, IV, V, VII and VIII of EPA's July 30 letter.

Please keep us informed of any action taken on this project.

Sincerely,

Ruth Rehfus

Ruth Rehfus
Acting Branch Chief

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I

J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203

July 30, 1981

Arthur N. Rappaport
Lt. Colonel, Corps of Engineers
Acting Assistant Deputy Division Engineer
424 Trapelo Road
Waltham, MA 02254

Re: NEDOD-R-15 Bourne Marina
Public Notice 16-80-375

Dear Colonel Rappaport:

This is in response to your July 6, 1981 letter concerning the application by the Commonwealth of Massachusetts, Department of Environmental Quality Engineering, to construct a municipal marina facility in a tidal cove adjacent to Buttermilk Bay at Bourne, Massachusetts. Your letter informed us that you have found it is in the public interest to issue this permit.

Based upon our review of your Findings of Fact, Environmental Assessment and the additional information your staff has developed to document the need for the marina, lack of other available practicable alternatives and flushing characteristics of the proposed basin, we now conclude that the proposed discharge complies with the Section 404(b)(1) guidelines with the inclusion of appropriate conditions to minimize adverse effects to the affected ecosystem.

We have developed a list of conditions (Attachment I) we feel will bring this project into compliance with Subpart H of the 404(b)(1) Guidelines Actions to Minimize Adverse Effects. These conditions have been formulated with the intent to: (a) assure that the marsh transplantation efforts are successful; (b) assure shellfish removal via harvesting prior to construction and; (c) protect water quality.

Some of these conditions have been formulated from a set of requirements imposed by the State on the Nantasket Associates application in Hull, Massachusetts for an elderly housing complex, which involved marsh grass relocation. These shall be considered to be minimum requirements.

We will not refer the matter to the Division/Regional Office level if the permit is conditioned in this fashion, or with acceptable similar requirements.

Please notify us of any decisions made regarding conditioning the permit. We are enclosing a portion of an EPA report which has a section on salt marsh restoration, and discusses transplantation for your information.

Sincerely,

Allen J. Ikalainen

Allen J. Ikalainen
Chief, Special Permits Section

Enclosure

cc: USF&WS, Concord, NH
NMFS, Gloucester, MA
Gregor I. McGregor, Boston, MA

ATTACHMENT I

Bourne Marina - Recommended Permit Conditions

Marina Basin Site

I. A site diagram should be provided of the area of marsh grass to be preserved and the areas to be used for transplantation detailing the following:

For present site conditions - show type and distribution of existing vegetation and where transplantation of marsh vegetation will occur. Show where excavation will be necessary for proper transplantation of marsh grass, and to what elevation excavation should occur. Show diagramatically the extent of marsh vegetation existing at this site now, and the proposed extent of marsh vegetation after transplantation. This should include measurements of the area and distances to fixed landmarks. These diagrams will be used during transplantation as a plan, and for compliance monitoring inspections, to assure its success.

II. Prior to the commencement of construction activities involving the placement of the cofferdam and dredging of the basin:

(A) Notify the Shellfish Warden of the Town of Bourne so that he may assure shellfish removal via harvesting prior to construction;

(B) prepare the areas to be used for transplantation in accordance with the site diagram (Item I);

(C) remove all marsh grass to be transplanted in the form of sods or clumps, with a sufficient soil depth to contain and protect the root system. An Army Corps of Engineers technical expert will supervise the transplantation;

(D) immediately transplant the marsh grass to those areas to be used for transplantation, in accordance with the site diagram. If transplantation cannot be performed immediately, a stockpile area should be prepared at a proper location in the intertidal zone to assure survival of the marsh grass (i.e. protection from desiccation);

(E) the marsh grass sods or clumps shall be tamped in place to assure contact with the subgrade and to provide a reasonably consistent gradient;

(F) a protective barricade, fence, or other approved device should be constructed around the marsh grass that will remain in the basin and shall be maintained and replaced as required for the duration of construction activities;

(G) anchoring of the marsh grass sods or clumps should be used if determined necessary to prevent loss through erosion. Anchoring can be accomplished through the use of 20 gauge wire netting woven into a uniformly spaced 2-inch hexagonal pattern with reinforcing lines at both selvages and a 2 foot lateral intervals. Adjacent ends and selvages of the netting shall be overlapped 2 to 4 inches. All netting ends, selvages and overlaps shall be firmly anchored in place at 6-foot intervals by 2-inch by 3-inch nominal wood stakes 24-inches long driven 18-inches into the soil, and;

(H) all marsh grass necessary to complete the work is available on-site. Any additional quantities that may be required for reasons of damage or other causes for replacement shall be in the form of comparable marsh grass sods. Should comparable sods be unavailable and the Contractor provides acceptable documentation to that effect, then suitable nursery grown culms (sprigs) may be utilized.

III. Construction:

(A) Sedimentation turbidity control devices should be utilized to filter effluent from the dewatering of the basin behind the temporary cofferdam. Filtration through staked hay bales prior to the effluent entering Conasset Narrows is acceptable;

(B) the effluent from the dewatering of stock-piled dredged material should be to the basin area, rather than the Conasset Narrows (State Water Quality Certificate Condition);

(C) all necessary precautions should be taken during construction to avoid damage to the area of marsh grass to remain in place and the transplanted marsh grass which will be within the confines of a protective barricade as set forth in Item II(F);

(D) in order to avoid damage to this area of marsh grass through exposure and desiccation within the dewatered basin, this area should watered daily - or twice daily with brackish or fresh water sufficiently to allow for saturation of the peat and survival of the marsh grass, and;

(E) the temporary cofferdam shall be removed after completion of the dredging operations to allow for normal tidal fluctuations within the basin and thus avoid undue stress and potential damages to the marsh area to remain. In place of the cofferdam, a siltation curtain shall be used across the inlet mouth if determined necessary to avoid sedimentation and turbidity in Cohasset Narrows.

IV. Taylor Point transplantation site located approximately 2000 feet southwest of the marina inlet:

(A) A site diagram should be provided similar to the requirements of Item I. The proposed transplantation of marsh grass will occur in what is now a spotty fringe marsh filling in gaps between the existing stands of marsh grass. These diagrams will be used during transplantation as a plan, and for compliance monitoring inspections, to assure its success;

(B) transplantation to this site should occur shortly after the marsh grass removal in Item II(C), in accordance with Item II(D). Items II(E), (G) and (H) also apply, and;

(C) a protective barricade, fence or other approved device should be constructed around this marsh area if determined necessary for its protection by the Army Corps of Engineers technical expert who will be supervising the transplant operation.

V. Maintenance of the transplantation site:

Maintenance shall include re-setting or replacing the marsh grass sods or clumps including utilizing comparable marsh grass sods or nursery stocks if necessary, and refirming or replacing any necessary netting and stakes used for anchoring purposes for a period of two complete growing seasons.

VI. The acceptance of the marsh grass relocation work shall occur no sooner than at the end of the second growing season and at such time as the grasses are established.

VII. The marsh area to be preserved and enhanced located at the North side of the basin shall not be permitted to be dredged or filled in any future permit applications.

VIII. Recommendation for navigational safety -

To warn boaters of a potential navigational hazard, signs should be placed at strategic locations on both sides of the railroad bridge which reads "Avoid Accidents - Proceed slowly with caution through this intersection" or similar statement.

Application No. 16-80-375

Name of Applicant Commonwealth of Massachusetts, Department of Environmental Quality Engineering

Effective Date

Expiration Date (If applicable)

DEPARTMENT OF THE ARMY
PERMIT

Referring to written request dated 10 July 1980 for a permit to:

(X) Perform work in or affecting navigable waters of the United States, upon the recommendation of the Chief of Engineers, pursuant to Section 10 of the Rivers and Harbors Act of March 3, 1899 (33 U.S.C. 403);

(X) Discharge dredged or fill material into waters of the United States upon the issuance of a permit from the Secretary of the Army acting through the Chief of Engineers pursuant to Section 404 of the Federal Water Pollution Control Act (86 Stat. 816, P.L. 92-500);

( ) Transport dredged material for the purpose of dumping it into ocean waters upon the issuance of a permit from the Secretary of the Army acting through the Chief of Engineers pursuant to Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (86 Stat. 1052; P.L. 92-532);

Commonwealth of Massachusetts
Department of Environmental Quality Engineering
Division of Land and Water Use
1 Winter Street
Boston, MA 02110

is hereby authorized by the Secretary of the Army:

to perform the following work to create a municipal recreational marina:

a. Dredge the two-acre cove and its peripheral wetlands to -6' mean low water, to create a 5.4 acre boat basin. The northerly face of the basin will be finished to a 3:1 slope and the remainder of the embankment area, approximately 1800 linear feet, will be faced with riprap. Approximately 5000 cubic yards of riprap and bedding material will be placed below the high tide line. A temporary cofferdam will be constructed at the inlet side of the cove to prevent sedimentation and to allow the area

in Buttermilk Bay (CONTINUED ON PAGE 4a)

at Bourne, Massachusetts

in accordance with the plans and drawings attached hereto which are incorporated in and made a part of this permit (on drawings: give file number or other definite identification marks.)

entitled, "Proposed Bourne Marina at Taylors Point in Bourne, Massachusetts, County of Barnstable, State of Mass", in 3 sheets, dated "July, 1980".

subject to the following conditions:

I. General Conditions:

a. That all activities identified and authorized herein shall be consistent with the terms and conditions of this permit; and that any activities not specifically identified and authorized herein shall constitute a violation of the terms and conditions of this permit which may result in the modification, suspension or revocation of this permit, in whole or in part, as set forth more specifically in General Conditions j or k hereto, and in the institution of such legal proceedings as the United States Government may consider appropriate, whether or not this permit has been previously modified, suspended or revoked in whole or in part.

b. That all activities authorized herein shall, if they involve, during their construction or operation, any discharge of pollutants into waters of the United States or ocean waters, be at all times consistent with applicable water quality standards, effluent limitations and standards of performance, prohibitions, pretreatment standards and management practices established pursuant to the Federal Water Pollution Control Act of 1972 (P.L. 92-500, 86 Stat. 816), the Marine Protection, Research and Sanctuaries Act of 1972 (P.L. 92-532, 86 Stat. 1052), or pursuant to applicable State and local law.

c. That when the activity authorized herein involves a discharge during its construction or operation, of any pollutant (including dredged or fill material), into waters of the United States, the authorized activity shall, if applicable water quality standards are revised or modified during the term of this permit, be modified, if necessary, to conform with such revised or modified water quality standards within 6 months of the effective date of any revision or modification of water quality standards, or as directed by an implementation plan contained in such revised or modified standards, or within such longer period of time as the District Engineer, in consultation with the Regional Administrator of the Environmental Protection Agency, may determine to be reasonable under the circumstances.

d. That the discharge will not destroy a threatened or endangered species as identified under the Endangered Species Act, or endanger the critical habitat of such species.

e. That the permittee agrees to make every reasonable effort to prosecute the construction or operation of the work authorized herein in a manner so as to minimize any adverse impact on fish, wildlife, and natural environmental values.

f. That the permittee agrees that he will prosecute the construction or work authorized herein in a manner so as to minimize any degradation of water quality.

g. That the permittee shall permit the District Engineer or his authorized representative(s) or designee(s) to make periodic inspections at any time deemed necessary in order to assure that the activity being performed under authority of this permit is in accordance with the terms and conditions prescribed herein.

h. That the permittee shall maintain the structure or work authorized herein in good condition and in accordance with the plans and drawings attached hereto.

i. That this permit does not convey any property rights, either in real estate or material, or any exclusive privileges; and that it does not authorize any injury to property or invasion of rights or any infringement of Federal, State, or local laws or regulations nor does it obviate the requirement to obtain State or local assent required by law for the activity authorized herein.

j. That this permit may be summarily suspended, in whole or in part, upon a finding by the District Engineer that immediate suspension of the activity authorized herein would be in the general public interest. Such suspension shall be effective upon receipt by the permittee of a written notice thereof which shall indicate (1) the extent of the suspension, (2) the reasons for this action, and (3) any corrective or preventative measures to be taken by the permittee which are deemed necessary by the District Engineer to abate imminent hazards to the general public interest. The permittee shall take immediate action to comply with the provisions of this notice. Within ten days following receipt of this notice of suspension, the permittee may request a hearing in order to present information relevant to a decision as to whether his permit should be reinstated, modified or revoked. If a hearing is requested, it shall be conducted pursuant to procedures prescribed by the Chief of Engineers. After completion of the hearing, or within a reasonable time after issuance of the suspension notice to the permittee if no hearing is requested, the permit will either be reinstated, modified or revoked.

k. That this permit may be either modified, suspended or revoked in whole or in part if the Secretary of the Army or his authorized representative determines that there has been a violation of any of the terms or conditions of this permit or that such action would otherwise be in the public interest. Any such modification, suspension, or revocation shall become effective 30 days after receipt by the permittee of written notice of such action which shall specify the facts or conduct warranting same unless (1) within the 30-day period the permittee is able to satisfactorily demonstrate that (a) the alleged violation of the terms and the conditions of this permit did not, in fact, occur or (b) the alleged violation was accidental, and the permittee has been operating in compliance with the terms and conditions of the permit and is able to provide satisfactory assurances that future operations shall be in full compliance with the terms and conditions of this permit; or (2) within the aforesaid 30-day period, the permittee requests that a public hearing be held to present oral and written evidence concerning the proposed modification, suspension or revocation. The conduct of this hearing and the procedures for making a final decision either to modify, suspend or revoke this permit in whole or in part shall be pursuant to procedures prescribed by the Chief of Engineers.

l. That in issuing this permit, the Government has relied on the information and data which the permittee has provided in connection with his permit application. If, subsequent to the issuance of this permit, such information and data prove to be false, incomplete or inaccurate, this permit may be modified, suspended or revoked, in whole or in part, and/or the Government may, in addition, institute appropriate legal proceedings.

m. That any modification, suspension, or revocation of this permit shall not be the basis for any claim for damages against the United States.

n. That the permittee shall notify the District Engineer at what time the activity authorized herein will be commenced, as far in advance of the time of commencement as the District Engineer may specify, and of any suspension of work, if for a period of more than one week, resumption of work and its completion.

o. That if the activity authorized herein is not started on or before N/A day of _____ 19_____, (one year from the date of issuance of this permit unless otherwise specified) and is not completed on or before 31st day of DECEMBER, 19 84. (three years from the date of issuance of this permit unless otherwise specified) this permit, if not previously revoked or specifically extended, shall automatically expire.

p. That this permit does not authorize or approve the construction of particular structures, the authorization or approval of which may require authorization by the Congress or other agencies of the Federal Government.

q. That if and when the permittee desires to abandon the activity authorized herein, unless such abandonment is part of a transfer procedure by which the permittee is transferring his interests herein to a third party pursuant to General Condition t hereof, he must restore the area to a condition satisfactory to the District Engineer.

r. That if the recording of this permit is possible under applicable State or local law, the permittee shall take such action as may be necessary to record this permit with the Register of Deeds or other appropriate official charged with the responsibility for maintaining records of title to and interests in real property.

s. That there shall be no unreasonable interference with navigation by the existence or use of the activity authorized herein.

t. That this permit may not be transferred to a third party without prior written notice to the District Engineer, either by the transferee's written agreement to comply with all terms and conditions of this permit or by the transferee subscribing to this permit in the space provided below and thereby agreeing to comply with all terms and conditions of this permit. In addition, if the permittee transfers the interests authorized herein by conveyance of realty, the deed shall reference this permit and the terms and conditions specified herein and this permit shall be recorded along with the deed with the Register of Deeds or other appropriate official.

II. Special Conditions: (Here list conditions relating specifically to the proposed structure or work authorized by this permit).

1. The permittee is responsible for successfully establishing marsh areas designate on the attached photographs in accordance with the attached mitigation guidelines. The Division Engineer will provide technical advise and supervision. The transplant sites will be inspected by the Division Engineer at the end of two growing seasons and the permittee must replant any of the transplanted marsh area which may have been damaged by erosion, pedestrians, motor vehicles, dewatering, etc.

2. The permittee must notify the Bourne shellfish warden 30 days prior to the start of construction, so that shellfish can be harvested from the inlet.

3. Use sediment and turbidity controls such as hay bales to filter the dewatering effluent before it enters Cohasset Narrows.

4. Route effluent from stockpiled dredged material back into the basin, not to Cohasset Narrows.

5. Remove the cofferdam as soon as possible to restore tidal inundation to the inle marsh.

6. The permittee must erect a sign on both sides of the railroad bridge to warn boaters of increased traffic at the mouth of the inlet.

7. This permit authorizes periodic maintenance dredging of the described area not to exceed ten years from the date of issuance; except that the permittee is required to notify this office, in writing, 90 days in advance of the intended date of any maintenance work. Work may not begin until written authorization is received from the Corps of Engineers. If the permittee desires to continue maintenance dredging beyond the ten year period, he must request a revalidation of that portion of his permit which authorized the maintenance dredging.

The following Special Conditions will be applicable when appropriate:

STRUCTURES IN OR AFFECTING NAVIGABLE WATERS OF THE UNITED STATES:

a. That this permit does not authorize the interference with any existing or proposed Federal project and that the permittee shall not be entitled to compensation for damage or injury to the structures or work authorized herein which may be caused by or result from existing or future operations undertaken by the United States in the public interest.

b. That no attempt shall be made by the permittee to prevent the full and free use by the public of all navigable waters at or adjacent to the activity authorized by this permit.

c. That if the display of lights and signals on any structure or work authorized herein is not otherwise provided for by law, such lights and signals as may be prescribed by the United States Coast Guard shall be installed and maintained by and at the expense of the permittee.

d. That the permittee, upon receipt of a notice of revocation of this permit or upon its expiration before completion of the authorized structure or work, shall, without expense to the United States and in such time and manner as the Secretary of the Army or his authorized representative may direct, restore the waterway to its former conditions. If the permittee fails to comply with the direction of the Secretary of the Army or his authorized representative, the Secretary or his designee may restore the waterway to its former condition, by contract or otherwise, and recover the cost thereof from the permittee.

e. Structures for Small Boats: That permittee hereby recognizes the possibility that the structure permitted herein may be subject to damage by wave wash from passing vessels. The issuance of this permit does not relieve the permittee from taking all proper steps to insure the integrity of the structure permitted herein and the safety of boats moored thereto from damage by wave wash and the permittee shall not hold the United States liable for any such damage.

MAINTENANCE DREDGING:

a. That when the work authorized herein includes periodic maintenance dredging, it may be performed under this permit for 10 years from the date of issuance of this permit (ten years unless otherwise indicated);

b. That the permittee will advise the District Engineer in writing at least two weeks before he intends to undertake any maintenance dredging.

DISCHARGES OF DREDGED OR FILL MATERIAL INTO WATERS OF THE UNITED STATES:

a. That the discharge will be carried out in conformity with the goals and objectives of the EPA Guidelines established pursuant to Section 404(b) of the FWPCA and published in 40 CFR 230;

b. That the discharge will consist of suitable material free from toxic pollutants in other than trace quantities;

c. That the fill created by the discharge will be properly maintained to prevent erosion and other non-point sources of pollution; and

d. That the discharge will not occur in a component of the National Wild and Scenic River System or in a component of a State wild and scenic river system.

DUMPING OF DREDGED MATERIAL INTO OCEAN WATERS:

a. That the dumping will be carried out in conformity with the goals, objectives, and requirements of the EPA criteria established pursuant to Section 102 of the Marine Protection, Research and Sanctuaries Act of 1972, published in 40 CFR 220-228.

b. That the permittee shall place a copy of this permit in a conspicuous place in the vessel to be used for the transportation and/or dumping of the dredged material as authorized herein.

This permit shall become effective on the date of the District Engineer's signature.

Permittee hereby accepts and agrees to comply with the terms and conditions of this permit.

_____ _____

PERMITTEE DATE

BY AUTHORITY OF THE SECRETARY OF THE ARMY

_____ _____

C. E. EDGAR, III DATE
Colonel, Corps of Engineers
Division Engineer
[redacted]

Transferee hereby agrees to comply with the terms and conditions of this permit.

_____ _____

TRANSFEREE DATE

DESCRIPTION OF WORK CONTINUED FROM PAGE 1

to be dewatered to facilitate marina construction. 2000 cubic yards of riprap and bedding material will be used for cofferdam construction. Approximately 120,500 cubic yards of granular material will be excavated for the project, 50,000 cubic yards of which will be dredged below mean high water. 10,500 cubic yards of this material will be used in conjunction with the construction of a 180 car-capacity parking lot and service building, and the balance of the material will be trucked to the Bourne Landfill. Approximately one acre of wetlands bordering the southerly and easterly portions of the cove will be transplanted to two areas, one immediately north of the proposed basin, and the other between the Dolphin Inn and the Massachusetts Maritime Academy.

b. Install 1065 linear feet of 6' wide pile-secured floating docks within the newly created basin consisting of nine main floats varying in length from 40' to 230'. Access ramps and 93-3' wide finger floats varying in length from 14' to 50' will be attached to the main floats. A 106' x 8' fuel dock will be provided at the inlet side of the marina. Also, a 115' x 30' concrete boat ramp with provisions for 40 auto/trailer parking spaces will be constructed at the northeast corner of the basin. Approximately 150 cubic yards of concrete and bedding material will be placed below high tide line for the ramp. Pedestrian walkways will be constructed around the southern periphery of the basin.

MITIGATION GUIDELINES

The permittee must transplant 5892 square feet (1/7 acre) of high marsh and 9528 square feet (1/5 acre) of low marsh at the proposed marina site. There is a total of 14,829 square feet (1/3 acre) available if properly regraded for receiving transplanted material along the north shore of the inlet.

The permittee will also compensate for destruction of the reed marsh at the proposed marina site by planting low and high marsh species along the shoreline of Cohasset Narrows, between the Dolphin Inn and the Massachusetts Maritime Academy. This shoreline can provide about 32,000 square feet (3/4 acre) of transplant area for low marsh, and about 17,500 square feet (slightly more than 1/3 acre) for high marsh species. The permittee will use a source of tranplant material designated by the Division Engineer. The following suggestions should insure success:

a) Regrade where advised by the Division Engineer, and lime and fertilize proposed transplant sites immediately prior to planting. Low marsh should be planted at low tide.

b) For areas to be transplanted within the inlet, at the proposed marina, remove the source material in the form of sods or clumps, with sufficient soil depth to include the root system (about 4-6") and plant that same day in the designated transplant site. Stockpile materials in the intertidal zone to prevent root desiccation.

c) Take source materials for the Cohasset Narrows site from a source designated by the Division Engineer. These materials will be sprigs or plugs from a nearby saltmarsh. Plant these materials within the first two weeks of April, 1982. Plant those species designated in the attached photos, or as recommended by the Division Engineer.

d) Plant materials deep enough so that the roots are below the ground surface, and stems are above the ground surface.

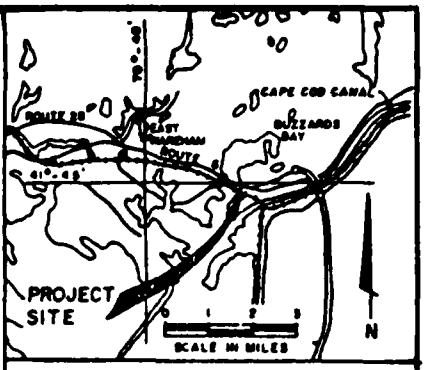
e) Construct a fence around the marsh transplanted to the north shore of the proposed site to protect it during construction. Also, during construction when the inlet is dewatered, the permittee's contractor should thoroughly hose down and saturate the transplanted and natural marsh areas within the inlet, with fresh or brackish water.

f) Construct a fence or barrier along easily accessible portions of the marsh to be planted at Cohasset Narrows to prevent pedestrian and motor vehicle access.

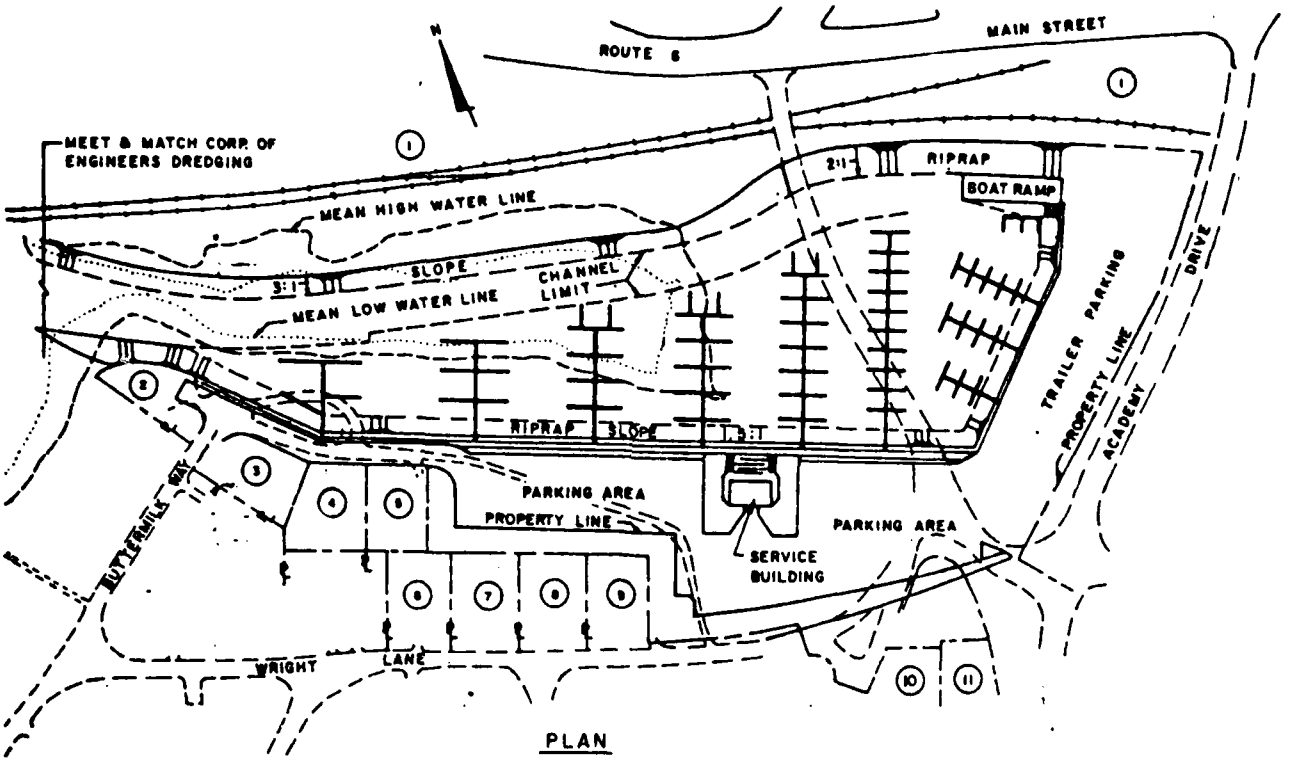
g) If necessary, anchor transplanted materials with wire netting to prevent erosion before the marsh has had time to establish. We recommend this treatment for the north shore of the inlet which will be planted during the fall or winter, and other portions of the Cohasset Narrows marsh placed waterward of the existing marsh.

PURPOSE : TO CONSTRUCT A 156 SLIP PUBLIC MUNICIPAL RECREATIONAL MARINA.
DATUM: M.S.V.D.

NOTE : APPROXIMATELY 120,500 C.Y. OF GRANULAR MATERIAL TO BE DREDGED TO ELEVATION -8.0 M.S.V.D. OF WHICH 110,000 C.Y. WILL BE TRUCKED AND DISPOSED AT THE BOURNE LAND FILL SITE, 10,500 C.Y. WILL BE USED ON SITE FOR FILL OF PARKING AREA AND SERVICE BUILDING AREA.



LOCUS MAP TAKEN FROM USGS QUAD. SHEET PROVIDENCE, R.I.



PLAN

100 50 0 100 200
SCALE IN FEET

PROPERTY OWNERS

(1) CONRAIL REAL ESTATES DEPT., 744 BROAD STREET, SUITE 423, NEWARK, N.J.
(2) LEO SALHAMY, 392 BROADWAY, PAWTUCKET, R.I.
(3) MANUEL J. ROSE, 46 BUTTERMILK WAY, BUZZARDS BAY, MA
(4) MAURICE FORD, 31 WORLEY STREET, W. ROXBURY, MA
(5) THOMAS FORD, 7 HARBOR PLACE, BUZZARDS BAY, MA
(6) MARY VERRIER, 14 WRIGHT LANE, BUZZARDS BAY, MA
(7) BRIAN SULLIVAN & JOSEPH SILVIA, 144 CROSS STREET, BELMONT, MA
(8) ELEANOR R. BODERICK, BROLANDS, UPTON, MA
(9) THERESE LOISEAU, RO. BOX 550, 8 WRIGHT LANE, BUZZARDS BAY, MA
(10) JOSEPH DIGIOVANNI, 52 NORMAN AVENUE, PAWTUCKET, R.I.
(11) BRIAN SULLIVAN & JOSEPH SILVIA, 144 CROSS STREET, BELMONT, MA

PROPOSED BOURNE MARINA

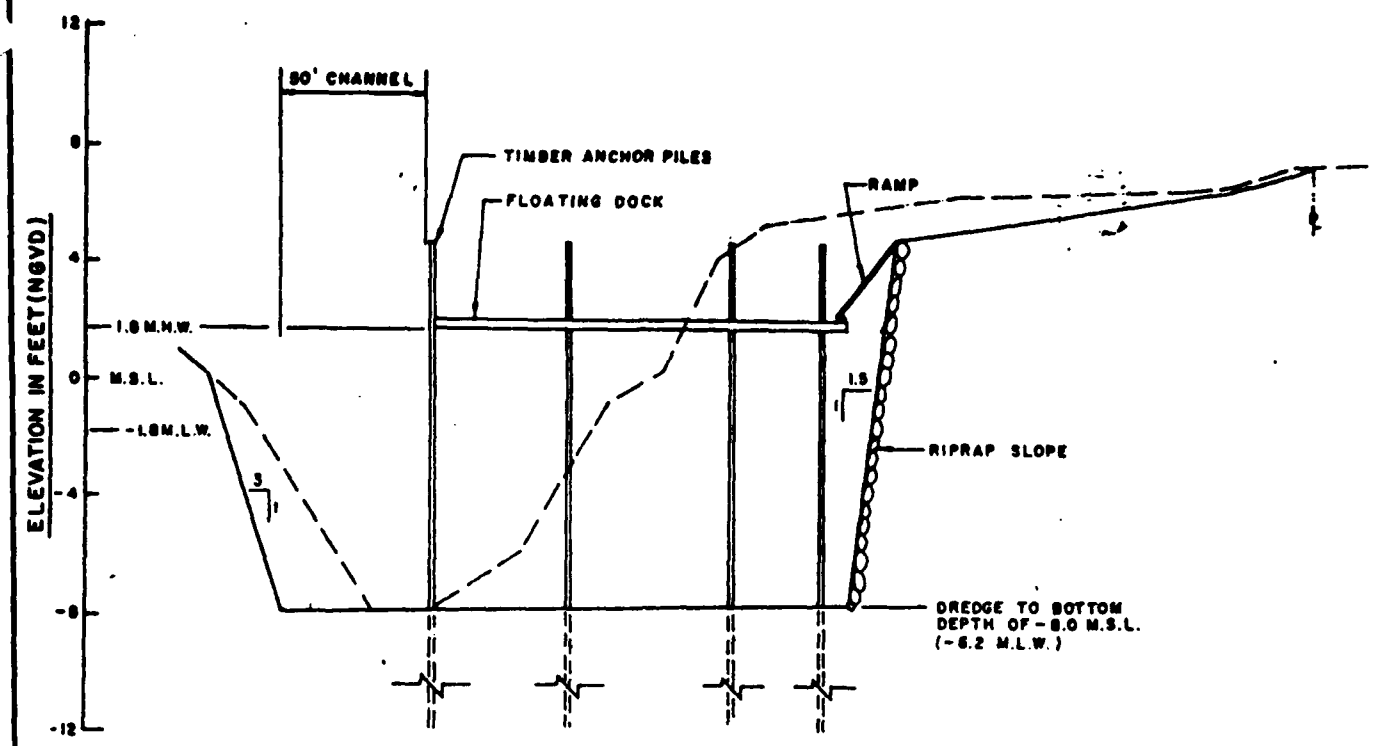
AT TALYORS POINT
IN BOURNE, MASSACHUSETTS

COUNTY OF BARNSTABLE STATE OF MASS.

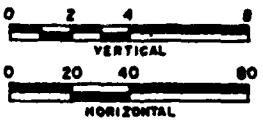
APPLICATION BY MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING-DIVISION OF LAND AND WATER USE

SHEET 1 OF 1 DATE : JULY, 1980

MARINA LOCATION AND DESIGN FIGURE 1-1



TYPICAL SECTION

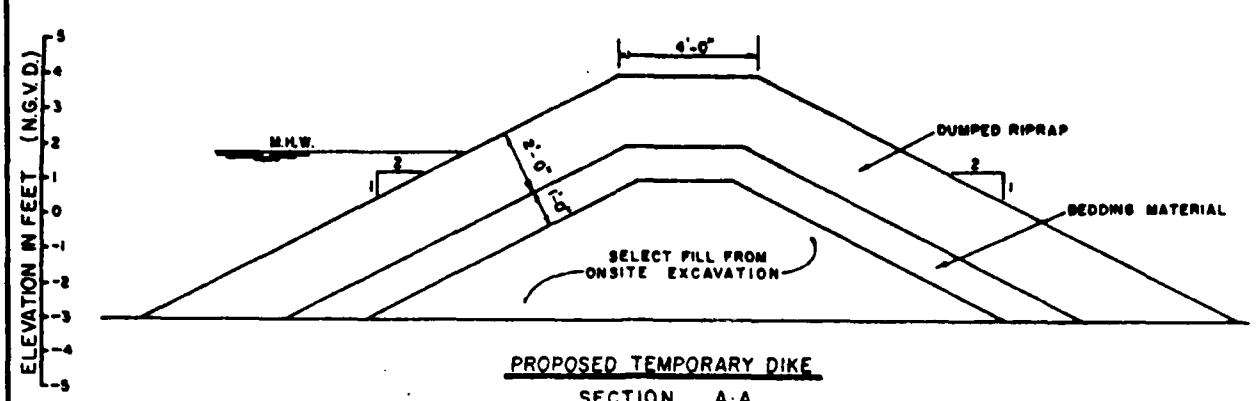


SCALES IN FEET

TAYLOR POINT MARINA STUDY

MARINA BASIN CROSS SECTION

FIGURE 1-2



PROPOSED TEMPORARY DIKE

SECTION A-A

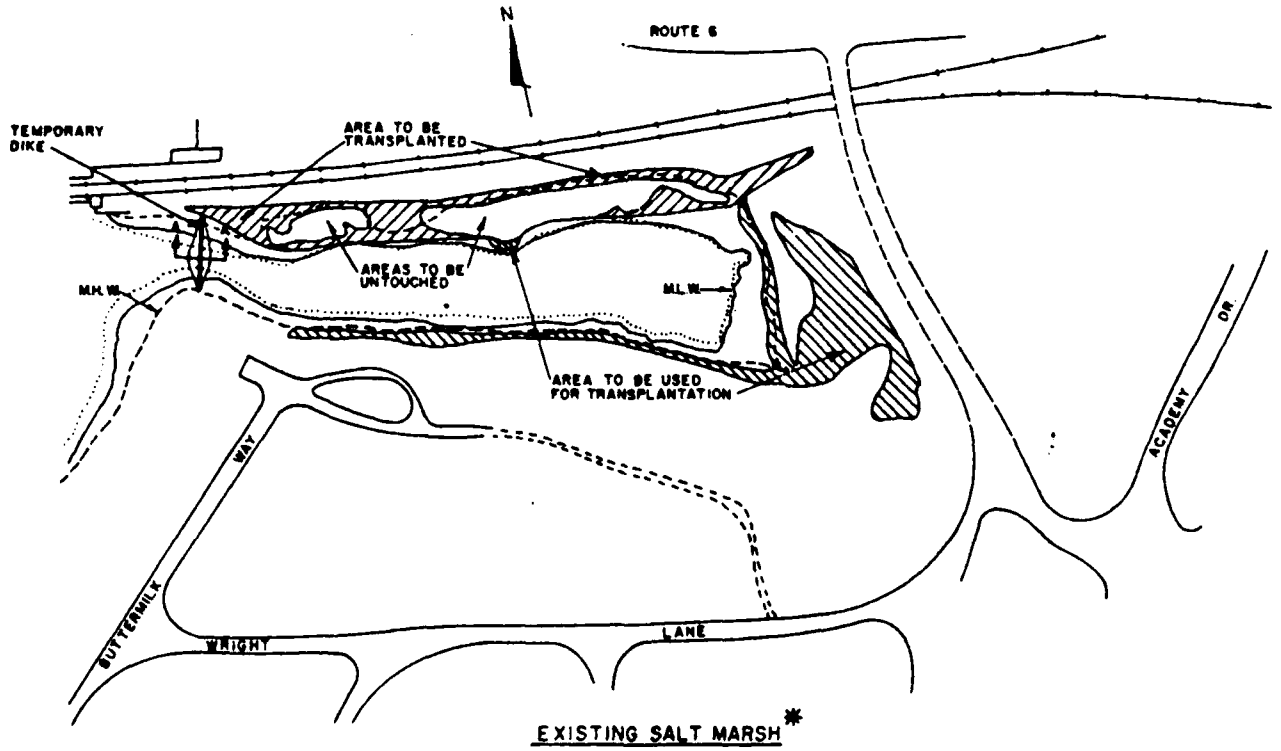
SCALE IN FEET

HORIZ 0 5 10

VERT 0 5 10

NOTES:

1. FILL BELOW M.H.W. FOR TEMPORARY DIKE – 2000 CU Y
2. FILL BELOW M.H.W. FOR CONSTRUCTION OF MARINA 47000 CU.YDS. (RIPRAP AND BEDDING MATERIAL)
3. FILL BELOW M.H.W. ON EXISTING WETLANDS – NONE, (DREDGING ONLY).



EXISTING SALT MARSH*

0 100 200

SCALE IN FEET

PLAN TO ACCOMPANY PERMIT APPLICATION NO. 16-80-375

*as delineated by the Massachusetts DEQE southeast region

TAYLOR POINT MARINA
CONTAINMENT DIKE AND MARSH
TRANSPLANTATION PLAN

FIGURE 1-3

WATER RESOURCES IMPROVEMENT STUDY

BUTTERMILK BAY CHANNEL

BOURNE, MASSACHUSETTS

SMALL NAVIGATION PROJECT
DETAILED PROJECT REPORT
AND ENVRIONMENTAL ASSESSMENT

APPENDIX 2

PUBLIC VIEWS AND RESPONSES

PREPARED BY:
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

APPENDIX 2

PUBLIC VIEWS AND RESPONSES

TABLE OF CONTENTS

PUBLIC VIEWS AND RESPONSES

SECTION A

PUBLIC INVOLVEMENT PROGRAM

1. Views of Government agencies were obtained through initial contacts by telephone, written correspondence, meetings and reviews of the original and draft reports. Meetings were held with Federal, State, and local officials, private interests and concerned citizens to ascertain their views on the proposed improvement project and enlist their aid in determining community needs and trends and developing baseline studies. The following is a summary of the major comments received during the coordination phase.

Public Meetings

2. In 1966, the town of Bourne created the Taylor Point Study Committee to study the feasibility of constructing a public marina and to obtain State and Federal funding, if possible. Subsequently, the U.S. Army Corps of Engineers was directed to make a study of the Buttermilk Bay Channel through a resolution adopted October 19, 1967 by the U.S. House of Representatives, Committee on Public Works. Preliminary investigation, however, indicated that the scope and cost of the project would meet the criteria established under Section 107 of the River and Harbor Act of 1960, as amended in 1965 and 1970. The study was therefore completed under this authority.

3. A public hearing on navigation improvements for the Buttermilk Bay Channel was held 1966. The town of Bourne created the Taylor Point Study Committee to study the feasibility of constructing a public marina and to obtain State and Federal funding, if possible. Subsequently, the U.S. Army Corps of Engineers was directed to make a study of the Buttermilk Bay Channel through a resolution adopted 19 October 1967 by the U.S. House of Representatives, Committee on Public Works. Preliminary investigation, however, indicated that the scope and cost of the project would meet the criteria established under Section 107 of the River and Harbor Act of 1960, as amended in 1965 and 1970. The study was therefore completed under this authority.

4. A public hearing on navigation improvements for the Buttermilk Bay Channel was held on 18 November 1970 to discuss problems and needs and to obtain the views of local residents and agencies. A second public meeting was held on 15 November 1972 to present study findings and to obtain comments. In 1973, the Corps of Engineers published the results of their study in a Detailed Project Report (Ref. 1). At that time, a preliminary draft environmental impact statement was also prepared. However, since the decision as to the method of disposal of the dredged material was unresolved, the study remained in an inactive state pending the town of Bourne's resolution of marina development. Subsequently, in July 1977,

the town formally requested the Corps of Engineers to reactivate its proposal to extend the channel in the Buttermilk Bay area. A Final EIS for Bourne Marina was prepared in October 1977.

REVIEW OF ORIGINAL REPORT

5. A previous draft Detailed Project Report and Environmental Assessment was circulated on 1 April 1980. Subsequent to this comments were received from various Federal, State and local agencies. Several relevant comments were incorporated into this report. Following that review changes in the local project and the recommended construction and disposal methods for the Federal project necessitated a reformulation of plans and the preparation of another draft report. Agency comments relative to the original Federal improvement project as proposed in the 1980 report are as follows.

Federal Agencies

U.S. Department of the Interior, Fish & Wildlife Service

6. Expressed no objection to the Federal project. Stated that while several lobster traps at the basin entrance would be lost, these and other temporary impacts of construction would not be significant.

U.S. Environmental Protection Agency

7. Stated that the proposed channel extension did not raise any objections from that office. Indicated tht construction should take place in late fall to early spring when shellfish are not spawning.

U.S. Department of Transportation, U.S. Coast Guard

8. Stated that they had reviewed the draft report and had no comment.

U.S. Department of Commerce, National Marine Fisheries Service

9. Stated that they have no objections to the work associated with navigation improvements. Indicated that construction should be scheduled to take place in late fall to early spring when shellfish are not spawning.

State Agencies

Executive Office of Environmental Affairs, Office of Coastal Zone Management

10. Requested that dredging and dewatering activities of the Federal and State projects be conducted concurrently to mitigate against the adverse water quality effects of dredging. Concurred with the determination that the proposed project was consistent with State CZM policies.

Water Resources Commission, Division of Water Pollution Control

11. Issued a Water Quality Certification for the proposed project dated 1 December 1980. Expressed concern that the Federal and State projects be conducted concurrently to offset adverse water quality impacts.

Office of the Secretary of State, Massachusetts Historical Commission

12. Reviewed the report for compliance with Section 106 of the National Historic Preservation Act of 1966. Stated that significant historic archaeologic properties are unlikely to exist in the area.

Local Government Offices

Town of Bourne, Board of Selectmen

13. Expressed the view that the project was extremely important and would give a "much needed boost to our main business district." Stated that town meeting votes indicated a great deal of townwide support for the project.

Town of Bourne, Department of Natural Resources

14. Expressed support for the Federal dredging project. Requested 90 days notice prior to construction in order to modify shellfish management procedures.

REVIEW OF DRAFT REPORT

15. Following review of the orginal draft report in April 1980 several changes to the project made reformulation of plans necessary. It was determined that the sizes of the boulders to be removed would require the use of a bucket dredge and other equipment to dig the necessary holes and move the boulders into them. Hydraulic dredging of the sand and gravel material would have required mobilization of a second construction plant making upland disposal economically infeasible. Use of the bucket dredge for sand and gravel removal with ocean disposal became the most viable alternative. This change in disposal site and construction methods invalidated the Water Quality Certification and the CZM consistency determination developed for the upland disposal alternative. Changes in the local marina plan and construction methods made it possible to reduce the scope of the Federal project and still achieve full utilization of the marina.

16. The new Draft Detailed Project Report was circulated for review in September 1982. Copies of correspondence received from the various agencies and local interests following review of this document are contained in Section C. Agency comments relative to the Federal improvement project are as follows.

Federal Agencies

U.S. Environmental Protection Agency - 18 October 1982

Reviewed the draft report. Stated that they had no objection to the proposed project or method of disposal.

U.S. Fish and Wildlife Service - 10 November 1982

Stated that they still would prefer use of the upland disposal site or would rather see the gravel used for beach nourishment. Concluded that disposal at the Buzzards Bay Dumpsite did not offer any benefits to natural resources.

Response - Use of the upland sites would increase first costs by 96 percent and is therefore not the most economically feasible plan and would not maximize net benefits. The use of gravel as beach nourishment material would not be aesthetically acceptable.

State Agencies

Massachusetts Department of Environmental Management

Stated that they were unaware of any rare plant or animal species or aquatic habitats which would be adversely impacted by the project.

Massachusetts Division of Waterways

Stated that the proposed plan would provide for safe navigation at the marina site, and that failure to construct the channel would have a severe impact on their project. Construction of the marina is expected to be complete in September 1983. They urged that the Corps proceed with the channel improvements immediately.

Massachusetts Office of Coastal Zone Management

Concurred with the New England Division's determination consistency with State coastal zone policies, stating that they did not object to disposal at the Buzzards Bay Dumpsite. Asked that dredging be restricted to 15 September thru 15 May and that the town shellfish warden be notified 30 days prior to dredging to allow for removal of shellfish from the dredge site. Found that there would be no adverse environmental impact at either the dredging or disposal site.

Massachusetts Department of Environmental Quality Engineering
Division of Water Pollution Control

The Division issued a Water Quality Certificate for the proposed project dated 15 November 1982. They requested that care be taken to minimize turbidity during dredging and approved the use of the Buzzards Bay Dumpsite.

Local Interests

Town of Bourne, Board of Selectmen

Unanimimously concurred that the proposed project would have no significant environmental impacts. State that safe navigation at the marina would depend on the proposed improvement. Requested that the Corps commence with improvements as soon as possible. Indicated that the town had already acquired the funds necessary for cost-sharing and that they would comply with all other items of local cooperation.

SECTION B

COPIES OF CORRESPONDENCE

RECEIVED BEFORE REVIEW

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
P.O. Box 1518
Concord, New Hampshire 03301

APR 25 1980

Colonel William E. Hodgson
Deputy Division Engineer
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Colonel Hodgson:

Colonel Scheider's letter of April 1, 1980 requested our views on the concept of dredging a channel in Buttermilk Bay at Cohasset Narrows to provide access for a marina to be constructed by the Town of Bourne Massachusetts Taylor's Point. This letter supersedes our report dated February 5, 1971.

We would have no objection to the Federal project, however, our most probable position would be to request denial of the Section 10/404 permit for marina construction because the cove has wetland values. We have no record of the Public Notice for a permit covering the marina.

Dredging of 8,000 cubic yards of material at the entrance to the cove, disposal at the Bourne sanitary landfill, burial of twenty large boulders at the entrance, and assuming Federal jurisdiction of about 2,000 feet of natural channels is not expected to cause significant adverse impacts. The existing lobster fishing with several traps at the cove entrance would be lost and there would be temporary adverse impacts from siltation while the work is under way. While we believe that adverse impacts would not be significant there would be no need for dredging if the marina is not constructed.

We are pleased that you have incorporated specific plans for maintenance and disposal of maintenance spoil in your report. This is an important consideration in project planning because it allows evaluation of the complete project including long term aspects.

28 APR 1980

Circulation of a final environmental impact statement in October, 1977, by the Massachusetts Department of Environmental Quality Engineering was noted on page 2. This statement is for the proposed Bourne Marina. Even though the relationship of the project and the marina has been brought out in the report we recommend that a copy of the final impact statement, or at least a digest of it, be incorporated into your Detailed Project Report. This would help the reader to identify the impacts associated with marina development. Incorporation of the final impact statement by reference is not sufficent to intrepret the impacts of this development.

Sincerely yours,

Gordon E. Beckett
Supervisor

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I

J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203

May 6, 1980

Colonel Max B. Scheider
Division Engineer
U. S. Army, Corps of Engineers
New England Division
424 Trapelo Road
Waltham, MA 02154

Re: NEDPL-C

Dear Colonel Scheider:

We have reviewed the Draft Detailed Project Report and Draft Environmental Assessment concerning the advisability of providing navigational improvements in Buttermilk Bay in the interests of recreational navigation and related purposes.

We have been notified of the errors in reporting the units of measurement for table 2 "Sediment Quality Data," and understand an errata sheet will be provided.

The concept of providing a six foot deep channel at the South end of the Federal Channel extending 2,700 feet to the mouth of the proposed Bourne marina at Taylor Point does not raise any objections from this office by itself. We understand the dredge spoils of the 8,000 cubic yards of material to be excavated from the channel will be placed at the containment site (consisting of 1.2 acres of old field habitat), dewatered and trucked to the Bourne sanitary landfill. Construction will take place in late Fall to early Spring when shellfish are not spawning and fauna metabolism is low.

The marina development plan, which this project is associated with however, may raise some concerns relative to Section 404(b) guidelines. We understand the proposed navigational improvement will not take place unless the marina development is approved. We have not been involved with the marina development planning, and no permit through the Corps has been applied for.

We would welcome a pre-application review of the marina proposal to assess compliance with Section 404(b) guidelines.

Sincerely,

Allen J. Ikalainen

Allen J. Ikalainen
Chief, Special Permits Development Section

cc: USF&WS, Concord, NH
NMFS, Gloucester, MA
MA DEQE, Division of Waterways

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS:
COMMANDER (dpl)
FIRST COAST GUARD DISTRICT
150 CAUSEWAY STREET
BOSTON, MA 02114
Phone: 617-223-6251

16450
29 April 1980

Colonel Max B. Scheider
Division Engineer
U. S. Army Corps of Engineers
New England Division
NEDPL-C
424 Trapelo Road
Waltham, MA 02154

Dear Colonel Scheider:

The Draft Environmental Assessment for Buttermilk Bay Channel has been reviewed and I have no comments at this time.

Sincerely,

S. L. RICHMOND
Commander, U. S. Coast Guard
Coastal Zone Management Officer
By direction of the Commander,
First Coast Guard District

A

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Environmental and Technical Services Division
Environmental Assessment Branch
7 Pleasant Street
Gloucester, Massachusetts 01930

May 28, 1980

Col. Max B. Scheider
Division Engineer
Department of the Army
Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Colonel Scheider:

This is in reference to your letter of April 1, 1980, and the Environmental Assessment concerning navigational improvements in Buttermilk Bay. The project is for the purpose of providing channel access for a proposed marina complex to be constructed by the Town of Bourne, Massachusetts.

Project plans call for creating a 6 foot channel, 100 feet wide at the South end of the Bay, extending 2700 feet to the proposed marina entrance. A total of 8,000 cubic yards of material will be dredged and disposed of at the Bourne sanitary land fill and the proposed marina site. In addition, 20 boulders would be buried, in place, beneath the channel. Dredging is scheduled to take place in late Fall to early Spring, when shellfish are not spawning and finfish activity is minimal.

We understand that the sole purpose of the navigational improvements is to support a town-owned marina complex that has not yet been constructed, and that if the marina complex is not developed, there will be no need to provide the navigational improvements. While we would have no objection to the work that is associated with navigational improvements, we do have some concerns about marina development. It appears that marina construction could involve filling wetlands, destruction of tidal vegetation, and temporary disruption of fish habitat.

Since we do not have sufficient information concerning plans for the marina, and since channel dredging is dependent on marina construction, we recommend that these two activities be reviewed as one project. This would allow us to provide you will a complete evaluation of project impacts. To accomplish this we would welcome a pre-application discussion of the marina proposal.

Sincerely,

Ruth Rehfus

Ruth Rehfus
Acting Branch Chief

2-12

29 MAY 1980

COASTAL ZONE
MANAGEMENT

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, Massachusetts 02202

December 9, 1980

Division Engineer
U.S. ARMY CORPS OF ENGINEERS
New England Division
424 Trapelo Road
Waltham, MA 02154

Re: NEDPL-1 Consistency Determination, Buttermilk Bay Navigation Improvement Project

Dear Sir:

We have had an opportunity to review your determination of consistency dated October 22, 1980 for the proposed Buttermilk Bay Navigation Improvement Project.

As proposed the project will provide for a channel 6 feet deep below mean low water, 60-100 feet wide from the present Cohasset Narrows Channel to the proposed Bourne marina. Approximately 8,000 cubic yards of material will be dredged, with disposal proposed for on-site fill at the Bourne Sanitary Landfill following dewatering.

However, two important features of the project are, as yet, incompletely designed: the dewatering of the spoil and its ultimate disposal. These features have been the subject of several discussions between Waterways, CZM and the Corps staff members. These discussions resulted in your letter of October 21, 1980, in which the Corps agreed to dewater and dispose of its dredged material in the same manner as the Division of Waterways.

Current plans call for construction of a cofferdam across the mouth of the marina basin before any dredging and dewatering begins. The cofferdam is considered to be necessary to prevent any release of pollutants during the dewatering operation from reentering Buttermilk Bay. This cofferdam shall remain in place for 24 hours after dredging operations cease. It will be necessary for the Corps to coordinate its dredging and dewatering with the Waterways project to ensure that the cofferdam will be in place during dewatering.

Based on our review of material accompanying your October 22, 1980 consistency determination and adherence to the dewatering and disposal conditions for the Waterways project, we concur with your consistency determination.

Sincerely,

Richard J. Delaney

for Edward J. Reilly
Assistant Secretary

EJR/MEP:dc

cc: John Hannon, Waterways
Robert MacDonald, Corps
Paul Anderson, DEQE
Richard Tomczyk, WPC

The Commonwealth of Massachusetts
Water Resources Commission
Division of Water Pollution Control
110 Tremont Street, Boston 02108

OFFICE OF THE DIRECTOR

December 1, 1980

Mr. Joseph L. Ignazio
Chief, Planning Division
U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Re: Water Quality Certification
Buttermilk Bay Improvement Dredge
Bourne

Dear Mr. Ignazio:

In response to your letter dated October 21, 1980, this Division has reviewed your application for a permit to conduct dredging of 8000 cubic yards of material from the Buttermilk Bay Channel, to connect the federal channel with the proposed Bourne Marina.

In accordance with the provisions of Section 401 of the Federal Water Pollution Control Act as amended (Public Law 95-217), this Division hereby issues the following Water Quality Certification relative to this project:

1. The dredging portion of the project could result in violation of water quality standards adopted by this Division. Therefore, reasonable care and diligence shall be taken by the contractor to assure that the proposed activity will be conducted in a manner which will minimize violations of said standards.

2. The dredging portion of the project should be coordinated with the dredging activities of the Massachusetts Division of Waterways to facilitate temporary on-site disposal and dewatering of the dredged material. A cofferdam will be constructed by the Division of Waterways, across the mouth of the marina basin entrance. This will assist in minimizing temporary local degradation of water quality attributable to effluent run-off emanating from the temporary disposal site. This cofferdam shall remain in place for twenty-four hours following the completion of all dredging. This is to allow settling of suspended solids due to the dewatering activity.

3. Once dewatered, the dredged material may be used at the marina site as fill, or may be transported to a suitable, approved land site. Therefore, disposal of the dredged material into the waters of the Commonwealth is prohibited.

Should any violation of the water quality standards or the terms of this certification occur as a result of the proposed activity, the Division will direct that the condition be corrected. Non-compliance on the part of the permittee will be cause for this Division to recommend the revocation of the permit(s) issued therefor or to take such other action as is authorized by the General Laws of the Commonwealth. This certification does not relieve the applicant of the duty to comply with any other statutes or regulations.

Very truly yours,

Thomas C. McMahon
Director

TCM/RT/wp

cc: Anthony D. Cortese, Sc.D., Commissioner, Department of Environmental Quality Engineering, 100 Cambridge Street, Boston 02202
Morgan Rees, Chief, Permits Branch, Corps of Engineers, 424 Trapelo Road, Waltham 02154
John J. Hannon, Director, Division of Land & Water Use, Department of Environmental Quality Engineering, 100 Nashua Street, Boston 02114
Richard Cronin, Director, Division of Fisheries & Wildlife, 100 Cambridge Street, Boston 02202
Philip Coates, Director, Division of Marine Fisheries, 100 Cambridge Street, Boston 02202
Michael Penney, Coastal Zone Management, 100 Cambridge Street, Boston 02202
Paul T. Anderson, Regional Environmental Engineer, Department of Environmental Quality Engineering, Lakeville Hospital, Lakeville

MASSACHUSETTS HISTORICAL COMMISSION

COMMONWEALTH OF MASSACHUSETTS
Office of the Secretary of State
294 Washington Street
Boston, Massachusetts
02108
617-727-8470

MICHAEL JOSEPH CONNOLLY
Secretary of State

April 12, 1979

Ms. Pamela Oklita, Environmental Planner
Schoenfeld Associates, Inc.
Consulting Engineers
210 South Street
Boston, Massachusetts 02111

RE: Buttermilk Bay Channel Dredging

Dear Ms. Oklita:

The Massachusetts Historical Commission and the State Archaeologist have reviewed the information you supplied with your letter of March 28, 1979. We feel that significant historic or archaeological properties are unlikely to exist in the project area. No further review in compliance with Section 106 of the National Historic Preservation Act of 1966 is required.

If you have any questions, please contact Val Talmage, Staff Archaeologist.

Sincerely,

Patricia L. Weslowski
State Historic Preservation Officer
Executive Director
Massachusetts Historical Commission

PLW/ej

BARRY H. JOHNSON, CHAIRMAN
ROBERT W. PARADY
ROBERT J. KILDUFF

TOWN OF BOURNE

BOARD OF SELECTMEN

24 Perry Avenue
BUZZARDS BAY, MASS. 02532
TEL. 759-4486

2 April 1981

Mr. James Law
Regulatory Division
Corps of Engineers
424 Trapello Road
Waltham, MA 02154

Dear Mr. Law:

Please find enclosed certified copies of the Town Meeting votes concerning the construction of the Taylor's Point Marina which is to be located in the village of Buzzards Bay within our town. We are forwarding these votes to you in order that you might readily see that there was and still is a great deal of town-wide support for this project.

We feel that this project will be extremely beneficial to our town and will give a much needed boost to our main business district.

Will you kindly keep us advised of any and all developments in this project as it certainly is extremely important that it be accomplished.

Sincerely yours,

BOARD OF SELECTMEN

Barry H. Johnson

Robert W. Parady

Robert J. Kilduff

BHJ:kw

Enclosures - as cited

bcc: Lydia Woods
Coastal Division
Corps of Engineers

BURKE R. LIMEBURNER
DIRECTOR

TOWN OF BOURNE
DEPARTMENT OF NATURAL RESOURCES
24 Perry Avenue
BUZZARDS BAY, MASS. 02532

TEL. 759-3441 OR 759-4451 (POLICE)

October 6, 1980

Department of the Army
New England Division
Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

ATTENTION OF: NEDOD-R-16-80-375-c

Please be advised that I have reviewed the above referenced project and wish to go on record as being in support of the project.

I also support the Federal Dredging Project mentioned in paragraph (a) of the Public Notice but noted that the specific areas to be dredged were not attached to the Public Notice. Although I support both projects I do have some concerns relating to shellfish resources in the area of the channel to be dredged. I need to determine how close the dredging will be to the shellfish flats on the east side of the narrows. If the proposed dredging is to be in close proximity to this shellfish bed I would like to have sufficient notification to allow for either transplant of the shellfish or time to reclassify the area to allow for commercial digging prior to the commencement of any dredging. This area is presently restricted for exclusive recreational use and depending on specific areas to be dredged may be reclassified to allow for commercial harvesting.

I would appreciate it if you could forward to me the plans for the "Federal Project Phase" which I assume will include the channel from the canal into Cohassett Narrows. I also request that I be given at least 90 days notice if at all possible to allow for sufficient time to protect and/or change shellfish management procedures concerning shellfish resources in this area.

Thank you for your consideration in this matter. I remain

Sincerely,

Burke R. Limeburner
Director

BRL:c

cc: Board of Selectmen

SECTION C

COPIES OF CORRESPONDENCE

RECEIVED FOLLOWING REVIEW

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
J. F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203

October 18, 1982

Colonel Carl Sciple
Division Engineer
New England Division
Corps of Engineers
424 Trapelo Road
Waltham, MA 02254

Attn: Coastal Development Branch

Re: NEDPL-C
Buttermilk Bay Channel, Bourne, MA
Small Navigation Project

Dear Colonel Sciple:

We have reviewed the Draft Detailed Project Report and Environmental Assessment for the Small Navigation Project in the Buttermilk Bay Channel at Bourne, Massachusetts.

We have no objection to the proposed dredging of 1,350 cubic yards of clean sand and gravel by bucket dredge, with the material being disposed at the Buzzards Bay Disposal Site.

Sincerely,

Clyde F. Shufelt

Clyde F. Shufelt, Chief
Municipal Permits Section

cc: US F&WS, Concord, NH
NMFS, Gloucester, MA

United States Department of the Interior

FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
P.O. BOX 1518
CONCORD, NEW HAMPSHIRE 03301

Colonel Carl B. Sciple
Division Engineer
U.S. Army Corps of Engineers
New England Division
424 Trapelo Road
Waltham, Massachusetts 02254

[illegible] 1982

Dear Colonel Sciple:

This letter supplements our Fish and Wildlife Report dated December 30, 1980, on your Navigation Study in Buttermilk Bay, Massachusetts. It is submitted in accordance with the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

The project plan presently consists of a 6-foot deep channel, 80 feet wide and 2,500 feet long extending from the existing Federal channel in Buttermilk Bay to the railroad bridge and Bourne Marina at Cohasset Narrows. Dredge material volume has been reduced from 8,000 cubic yards to an estimated 1,350 cubic yards of sand and gravel. The dredge contractor will also be required to bury 10 large boulders beneath the channel. Disposal of the dredge material is now proposed for the Buzzards Bay Disposal Site.

We still prefer the upland disposal option at the Bourne Sanitary Land Fill as originally proposed. As an alternative, an aquatic disposal site would be acceptable provided the dredge material could be used beneficially. The possibility of using the sand and gravel to nourish some nearby beaches should be explored during your final planning process. At this point in time, disposal at the Buzzards Bay site does not appear to offer any appreciable benefits to natural resources in the area.

Sincerely yours,

Gordon E. Beckett
Supervisor

Massachusetts
Natural Heritage
Program

September 23, 1982

Carl B. Sciple
Division Engineer, New England Division
Army Corps of Engineers
424 Trapelo Road
Waltham, Mass. 02254

Re: Navigation improvements at
Buttermilk Bay, Bourne

Dear Mr. Sciple:

The Massachusetts Natural Heritage Program has reviewed the Draft Environmental Assessment for Buttermilk Bay Channel, in Bourne. At this time, we are not aware of any rare plant or animal species populations, or unusual plant communities or aquatic habitats which might be adversely impacted by this project.

Thank you for the opportunity to comment on this document. I enclose a brochure about out program for your further information. Please note that our inventory is continually expanding through ongoing fieldwork and research, so further information may become available in the future.

Yours sincerely,

Alison Scott-Fleming
Environmental Reviewer

ASF:phb
Enc.

100 Cambridge Street Boston Mass. 02202

ANTHONY D. CORTESE, Sc. D.
Commissioner

The Commonwealth of Massachusetts

Executive Office of Environmental Affairs
Department of Environmental Quality Engineering
Division of Waterways
ONE Winter Street, Boston 02108

September 24, 1982

Division Engineer
New England Division
U.S. Corps of Engineers
424 Trapelo Road
Waltham, MA 02254

RE: Proposed Federal Dredging Project
Bourne Contract No. 2921/Waterways

Gentlemen:

We Have reviewed the project report for the proposed channel dredging in Buttermilk Bay, Bourne, Massachusetts and we find that this proposed channel extension conforms to the proposals we had discussed with your staff during the design period of our marina project.

We have received bids on the marina project and we anticipate construction to commence in October of this year. As you are aware, failure to complete your channel extension could have a severe impact on our project. We anticipate completion of the marina by Sept. 1983, at which time it will be turned over to the Town of Bourne, for operation and maintenance. Safe navigation to and from this marina depends greatly on the improvements to the outer channel. The Town and State officials have been of the opinion during the design and planning stages of our project that the corps of Engineers would make the channel improvements as soon as possible.

We urge you to proceed with your channel improvements immediately so the completion of your project will coincide with the opening of this marina.

If we can be of some further assistance, please contact this office at 292 - 5695.

Very truly yours,

John J. Hannon, P.E.
Chief Engineer

CC: Secretary John Bewick 2-24
Commissioner Cortese
Board of Selectmen
Rep. Jeremiah Cahir Sen. Paul Donahue

COASTAL ZONE
MANAGEMENT

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, Massachusetts 02202

November 5, 1982

Col. Carl B. Sciple
NED U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02154

Dear Col. Sciple:

The Massachusetts Coastal Zone Management Office has completed its review of the Navigation Improvement Project in the Buttermilk Bay, Bourne and canz now issue a decision regarding the consistency of the project with our program. That navigation improvement involves the extension of the federal channel in Buttermilk Bay to provide more efficient access to the public marina at Taylor Point.

According to the Corps' "Detailed Report and Environmental Assessment" for the project, three alternative designs which vary in width have been proposed for the channel. Each of these proposed alignments involves the dredging and disposal of Category One Type A sediments (sand and gravel)as classified by the Massachusetts State Water Pollution Control Regulations. Based on the physical and chemical characteristics we do not object to disposal of these materials at the Buzzards Bay Disposal Site as proposed by the Corps.

Of the proposed alternatives, none involves impacts to wetlands vegetation at either the dredging or disposal sites. However, both the state Division of Marine Fisheries and the Corps note that the channel to be dredged and the surrounding area support oyster, scallop, and soft and hard shelled clam populations. Thus to protect these populations, dredging for this project should be restricted during the shellfish spawning period which is May 15 to September 15. In addition, the town shellfish warden should be notified 30 days prior to the commencement of dredging to allow for the commercial harvest of those shellfish present in the area. Undersized shellfish taken during this harvest should be transplanted to other acceptable locations within the town rather than be thrown back into the dredge project area.

Based on our review of the project information we find that none of the alternatives will result in an adverse impact at either the dredging or dredged material disposal site and we concur with your determination. However, we recommend the construction of alternative Plan B (80 feet wide, 6 feet deep) as it offers the greatest benefit/cost ratio. For further correspondence on the project, please contact Harriet Diamond or Michael Penney of my staff.

Sincerely,

Richard F. Delaney
Director

RFD/HD:dn

ANTHONY D. CORTESE, Sc. D.
Commissioner

The Commonwealth of Massachusetts

Executive Office of Environmental Affairs
Department of Environmental Quality Engineering
One Winter Street, Boston 02108

November 15, 1982

Joseph L. Ignazio
Chief, Planning Division
U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Re: Water Quality Certification
Buttermilk Bay Improvement
Dredge
Bourne

Dear Mr. Ignazio:

In response to your request in your letter dated September 20, 1982 submitted to this Division, we have reviewed your request for a Water Quality Certification to conduct a navigational improvement project in Buttermilk Bay, Bourne.

A Water Quality Certification for this project was issued for this project on December 1, 1980; however, changes in the preferred plan have been made by your office. These changes include reducing the amount of dredging from 8,000 cubic yards to 1,350 cubic yards along with burial of 10 large boulders beneath the channel. In addition, ocean disposal rather than land disposal has been selected. The selected disposal site is located in Buzzards Bay, southeast of Cleveland Ledge and opposite West Falmouth.

In accordance with the provisions of Section 401 of the Federal Water Pollution Control Act as amended (Public Law 95-217), this Division issues the following Water Quality Certification relative to this project, subject to the following conditions:

1. The dredging portion of the project could result in a violation of water quality standards adopted by this Division. Therefore, reasonable care and diligence shall be taken by the contractor to assure that the proposed activity will be conducted in a manner which will minimize violations of said standards.

2. The material to be dredged is classified Category III, Type A according to analyses conducted by the Corps in 1972. Due to the location of the project, and since the waters are classified SA according to this Division, it is likely that the sediments are similar to those tested in 1972. Therefore, disposal of this material at the site adjacent to Cleveland Ledge area in Buzzards Bay at coordinates 41°36'00"N and 70° 41'00"W. is approved.

Should any violation of the water quality standards or the terms of this certification occur as a result of the proposed activity, the Division will direct that the condition be corrected. Non-compliance on the part of the permittee will be cause for this Division to recommend the revocation of the permit(s) issued therefor or to take such other action as is authorized by the General Laws of the Commonwealth. This certification does not relieve the applicant of the duty to comply with any other statutes or regulations.

Very truly yours,

Thomas C. McMahon

Thomas C. McMahon
Director

TCM/RT/wp

cc: Anthony D. Cortese, Sc.D., Commissioner, Department of Environmental Quality Engineering, One Winter Street, Boston 02108
Morgan Rees, Chief, Permits Branch, Corps of Engineers, 424 Trapelo Road, Waltham 02154
John J. Hannon, Director, Division of Waterways, Department of Environmental Quality Engineering, One Winter Street, Boston 02108
Richard Cronin, Director, Division of Fisheries & Wildlife, 100 Cambridge Street, Boston 02202
Philip Coates, Director, Division of Marine Fisheries, 100 Cambridge Street, Boston 02202
Michael Penney, Coastal Zone Management, 100 Cambridge Street, Boston 02202

BARRY H. JOHNSON, CHAIRMAN
ROBERT W. PARADY
ROBERT J. KILDUFF

TOWN OF BOURNE

BOARD OF SELECTMEN

24 Perry Avenue
BUZZARDS BAY, MASS. 02532
TEL. 759-4486

October 19, 1982

Colonel Carl B. Sciple
Division Engineer
Department of the Army
U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02254

Dear Colonel Sciple:

This is to inform you that we have thoroughly reviewed the U.S. Army Corps of Engineers Draft Small Navigation Project - Detailed Project Report and Environmental Assessment concerning the Buttermilk Bay Channel which is located in our town.

This project is needed to improve the existing Federal Channel to the site of the proposed Taylor's Point Marina and we unanimously concur with the finding that the proposed channel improvement project will have no significant environmental impact on the area.

We have already acquired the sum of $60,500 which represents 50% of the first cost of the proposed improvement to the channel. Further, we are willing and have the capability to comply with the necessary local assurances as stipulated on pages 26 and 27 of the report.

The construction of the project is to commence within this month, with a proposed completion some time during the month of September 1983. Safe navigation to and from this marina will certainly depend on the improvements that must be made to the outer channel.

Therefore, we are respectfully requesting that the Corps of Engineers to commence these improvements as soon as

possible in order that the opening of the marina may coincide with the channel improvements.

If we can assist you in any way or provide any further information that you may request, please do not hesitate to contact us.

Sincerely,

BOARD OF SELECTMEN

Barry H. Johnson

Barry H. Johnson

Robert W. Parady

Robert W. Parady

Robert J. Kilduff

Robert J. Kilduff

BHJ/pjs
cc: John J. Hannon, Chief Engineer
Joel Berner, Div. of Conservation Services
Secretary John Bewick
Commissioner Cortese
Representative Jeremiah P. Cahir
Senator Paul Doane

WATER RESOURCES IMPROVEMENT STUDY

BUTTERMILK BAY CHANNEL

BOURNE, MASSACHUSETTS

SMALL NAVIGATION PROJECT
DETAILED PROJECT REPORT
AND ENVIRONMENTAL ASSESSMENT

APPENDIX 3

ENGINEERING INVESTIGATIONS, DESIGN
AND
COST ESTIMATES

PREPARED BY:
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

APPENDIX 3

ENGINEERING INVESTIGATION, DESIGN AND COST ESTIMATES

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ENGINEERING INVESTIGATIONS, DESIGN AND COST ESTIMATES

INTRODUCTION

1. A variety of engineering investigations were conducted in the area selected for detailed study. The investigations were limited to the natural channel in Buttermilk Bay upstream of the limit of the existing Federal channel and the entrance to the basin at Taylor Point. The alternative plans of improvement deal solely with providing an access channel to the public marina.

2. The alternative plans as developed in the plan formulation section of the main report and analyzed in detail in the Economic Assessment - Appendix 4 consist of three variations of channel dimensions. These alternative dimensions were developed based on an average design vessel with a length of 24 feet and a draft of 4 feet. The maximum cruising sailboat design vessel would have a length of 38 feet, a beam of 11.5 feet and a draft of 6 feet. The number of these large sailboats in the fleet would be few, two permanent and one transient. The maximum powerboat would have a similar length and beam with a draft of only 4 feet. Wave heights in the area seldom exceed one foot. Vessels would motor through the area at only 4 knots, negating squat as a factor in determining channel depths. It was determined through economic analysis that a channel depth of -6 feet mlw with an overdepth of one foot would be sufficient to accommodate the anticipated fleet. Such a design would only entail delays for the largest cruising sailboats at extreme low tide or in storm conditions when wave heights exceed one foot.

HYDROGRAPHIC SURVEYS

3. A hydrographic condition survey of the project area was performed in the fall of 1977. This survey was done in conjunction with a similar survey of the existing Federal channel done to investigate the need for maintenance dredging. The survey results, as shown in Figure 3-1, show the plotted depths within the natural channel and basin entrance and provide a reasonable estimate of channel bottom contours.

DIVING SURVEY

4. In 1973 a diving survey of the shoal area was conducted at the entrance to the marina to accurately determine bottom conditions. It was found that large boulders lie within the area of the proposed channel dredging. Twenty boulders located by divers were measured and were found to lie at depths of between +1 foot and -3 feet mlw. The size of these boulders is shown in Table 3-1 and the location of the boulder deposit is shown in Figure 3-2.

Table 3-1

MEASUREMENTS OF BOULDERS TO BE DREDGED

#*	Dimensions In Feet (ft^3)	Height of Top of Boulder (mlw)
1"	6 x 6 x 4.5 (162)	+0.3
2"	5 x 4 x 6 (120)	0.9
3	5 x 7 x 5 (175)	+0.3
4"+	3 x 5 x 5 (75)	1.6
5	4 x 5 x 3 (60)	2.2
6	4 x 3 x 4 (48)	1.4
7	4 x 7 x 6 (168)	0.9
8	5 x 4 x 3.5 (70)	2.7
9	4 x 3.5 x 3.5 (49)	1.1
10	5 x 5 x 4 (100)	0.4
11"	8 x 5 x 4 (160)	1.2
12"+	3 x 4 x 5 (60)	1.2
13"+	4 x 3 x 5 (60)	1.3
14	3 x 6 x 4 (72)	3.2
15"+	2 x 4 x 4 (32)	0.1
16"+	3 x 3 x 3 (27)	2.1
17"+	4 x 3 x 5 (60)	2.6
18	6 x 3 x 6 (108)	2.1
19	3 x 4 x 3 (36)	4.1
20"	3 x 5 x 8 (120)	0.3

*Refer to Figure 3-2 for location.

NOTE: All boulders would be buried under Plan C while only those boulders marked thus (+) would be buried under Plan A, and those marked thus (") would buried under Plan B.

CHANNEL CROSS-SECTIONS

5. The data derived from the hydrographic and diving surveys was used to develop several representative cross-sections of the channel area. These cross-sections were used to develop quantity estimates for sediment to be dredged to form the channel and side slopes. Three typical cross-sections are shown in Figure 3-3 and their location is shown in Figure 3-4.

NATURE OF MATERIAL TO BE REMOVED

6. In order to determine the exact nature of the material to be removed, mechanical analyses were performed on five samples taken from area of the proposed channel. Two of these samples were taken from the area to be dredged while the remaining three samples were taken from the bottom of the naturally deep channel to obtain information which could relate to the nature of future maintenance dredging spoils. The location of these samples is shown in Figure 3-5. Physical test results for the samples are shown in Table 3-2. Grain size curves were developed for samples taken from all five sites and are presented in Figure 3-6 a thru e. This data leads us to conclude that the material to be removed is predominantly sandy gravel.

QUANTITY AND COST ESTIMATES

QUANTITIES OF MATERIAL TO BE REMOVED

7. The proposed channel would extend north from the upstream limit of the existing Federal project at the daybeacon 2,500 feet to the outer limit of local dredging at the marina basin entrance. In order to establish a depth of -6 feet mlw dredging would only be necessary in the upper 300 feet of the channel. Designation of the remainder of the Federal channel would only require placement of aids to navigation since natural depths are presently adequate. The natural channel is kept at its present depth by the hydrodynamic regime operating in the area including the strong currents in Cohasset Narrows. Under a worst case scenario it is anticipated that this area will shoal over time a very low rate necessitating future maintenance of this present naturally deep area.

8. The three alternative plans developed during this study involve various channel widths. Plan A, Figure 3-7, is the minimum dredging plan and would entail dredging only a 60-foot-wide channel to allow for two-way traffic. Plan B would involve the maximum amount of dredging with an 80-foot wide channel to provide three traffic lanes. Plan B, Figure 3-8, would not remove the entire shoal and boulder area, entailing a greater risk to vessels using the channel in this area. Plan C, Figure 3-9, would provide the same 80 foot wide channel as Plan B and would also provide for removal of the boulder and shoal area immediately south of the railroad bridge to reduce the hazardous navigation conditions.

Table 3-2

PHYSICAL TEST RESULTS - SEDIMENT SAMPLES
BUTTERMILK BAY CHANNEL, BOURNE, MA

Parameter	Samples from Area to be Dredged		Samples from Naturally Deep Channel		
	GE-2	GE-7	GE-8	GE-6	GE-9
Visual Classification	Light Brown Sandy Gravel (GP) with shell fragments and marine odor	Grayish Brown Sandy Gravel (GW) with shell fragments and marine odor	Gray Gravelly Sand (SP) with shell fragments and marine odor	Grayish Brown Gravelly Coarse to Medium Sand (SP) with shell fragments and marine odor	Grayish Brown Gravelly Sand (SP) with shell fragments and marine odor
Grain Size-Median (mm)	6.0	10.0	4.00	1.10	1.0
" D_{75}	20.0	18.0	12.00	2.70	3.2
" D_{25}	1.3	4.8	0.49	0.68	0.5
Sorting Coef.	3.922	1.936	4.949	1.993	2.530
Normal (N) or Bimodal (B) Curve	N	N	N	N	N
Specific Gravity	2.669	2.714	2.668	2.656	2.657
% Fines	0.3	0.3	0.7	0.2	0.7
Percent Solids	35.89	83.55	78.56	86.68	81.53
% Volatile Solids - EPA	0.51	0.76	0.104	0.53	0.51
% Volatile Solids - NED	0.39	0.67	0.81	0.37	0.47

NOTE: All samples are surface grabs.

9. The cubic yardage of the boulders to be buried was developed from the data gathered during the diving survey as shown previously in Table 3-1. Each boulder would be buried in a hole dug by clamshell bucket so that none of the boulders would lie above -7 feet mlw. Plan A would require burial of 6 boulders totalling 12 cubic yards. Plan B, the recommended plan, would require burial of 10 boulders totalling 32 cubic yards. Plan C would require burial of 20 boulders totalling 62 cubic yards. The recommended plan and its relation to the existing Federal channel are shown in Figure 3-10.

10. Quantity estimates of material to be removed are based on cross-sections developed from the hydrographic survey of the existing bottom. The average cross-sectional area and width were multiplied to determine the volume of each section. In these computations a one-foot overdredge was assumed. No evidence of ledge was found in the project area during the diving survey. It is expected that dredging of side slopes with a slope of 1:3 would be necessary to ensure stability of the channel slope.

11. Using the above methodology the quantities to be removed were calculated for each plan. The cubic yardage (cy) was found to be 800 cubic yards for Plan A, 1,350 cy for Plan B, and 2,700 cy for Plan C. Under each of the alternative plans the material to be removed was determined to be predominantly gravel and sand.

DREDGING AND DISPOSAL

12. Two methods of project implementation were considered. Both methods involve burial of the boulders beneath the channel by digging a hole to implant the boulders at a depth below the overdepth level of -7 feet mlw. With all plans boulder burial would be accomplished by use of a 6 cubic yard clamshell dredge. Two separate methods of removal and disposal of the sand and gravel to be dredged under each plan were identified. One method involves utilizing a hydraulic dredge to remove and pump the material to the containment dike area constructed by local interests for dewatering of spoils from the local marina basin dredging. The other method for removal of the sands and gravels involves use of the same clamshell dredge as would be required for boulder burial. The material would be removed by the bucket and placed in a scow which would transport the material 9.8 miles south to the Buzzards Bay dump site for open water ocean disposal.

13. Hydraulic dredging and land disposal of sands and gravels would require two dredge plants to be used for project construction since boulder burial can only be accomplished with a bucket dredge. While land disposal in conjunction with the local marina project would be the most environmentally acceptable alternative method, the costs involved in mobilizing and utilizing two separate construction plants would be excessive.

14. Hydraulic dredging would require allowing the dredged material to dewater inside the containment dike built by local interests as part of the marina dredging project. Since hydraulically dredged material is about 80% water the 1,350 cubic yards of sand and gravel would equal about 6,800 cy before dewatering.

15. Since it cannot be guaranteed that construction of the Federal and local projects can be scheduled concurrently costs have been assessed for a dike designed to handle the Federal dredging quantities only. Any such dike would encircle a 1/4 acre containment side and have a top width of 10 feet and side slopes of 1:2. A dike to contain this material would be 7 to 10 feet high and would cost about $25,000. This cost would be borne entirely by non-Federal interests. Since the material is coarse it would dewater very quickly within a day or two. After dewatering the material would be loaded into trucks and hauled to the Bourne Sanitary Landfill. The landfill will also be used as a final disposal site for the 110,500 cy removed from the basin by local interests. This site was identified as the most acceptable upland disposal site by local and State agencies. The landfill is located about 3 miles from the dredge site and approximately 140 truckloads would be required to transport the 1,350 cubic yards removed by the Federal project.

16. The Buzzards Bay dump site would be used as the ocean disposal site. The dump site is located 9.8 miles south of the dredge site, as shown in Figure 4 of the main report, southeast of Cleveland Ledge in eastern Buzzards Bay. This site was last used in May 1980 when about 37,000 cy of sand and mud were dredged from berths at the Massachusetts Maritime Academy located on Taylor Point 1/2 mile south of the marina basin. The dump site is a circular area, 500 yards in diameter. The dump site is centered at the coordinates 41°36'00"N-70°41'00"W. During disposal operations the material would be point dumped at the dump site.

17. Ocean disposal allows construction to be accomplished with the use of only one construction plant and is therefore more economical. Dredging and disposal operations would be scheduled so as not to impact on shellfish spawning, which occurs mid-spring thru mid-fall. The recommended plan calls for dredging and boulder burial to be accomplished entirely by bucket dredge with open water disposal at the Buzzards Bay dump site.

COST ESTIMATES

18. Cost estimates have been developed for the three alternative plans of improvement. For purposes of comparison cost estimates have been provided for each plan for both upland and ocean disposal methods.

19. The values presented for upland disposal are based on use of a 12-inch hydraulic dredge, a 6-cy clamshell bucket dredge and barge, a 550-HP tug and a launch. Costs also include the expense of trucking the

material to the disposal site with 10-cy trucks. The costs also include an estimate for construction of a containment dike at the marina site for dewatering of spoils. The dike would be of sufficient capacity to contain the sand and water pumped from the Federal project only.

20. The values presented for ocean disposal are based on use of a 6-cy clamshell bucket dredge and barge, a 550 HP tug, a 500-cy scow and a launch.

21. All costs include mobilization and demobilization costs and a contractor profit of 10 percent. Under the recommended plan, Plan B with ocean disposal, construction would take approximately two weeks. All costs are based on March 1982 price levels.

22. Specific costs for aids to navigation will be obtained from the U.S. Coast Guard, which would be responsible for placing and maintaining any such aids as they may deem necessary for boating safety. For purposes of this report it is assumed that one additional steel can buoy would be required in addition to those now marking the natural channel and shoal. The cost of this, including price and installation, is estimated to be $4,500. A steel can buoy has a life of about 20 years and would require replacement twice during the project life. Replacement costs for buoys will be assessed as part of maintenance costs.

MAINTENANCE DREDGING AND COSTS

23. Following initial dredging the channel would tend to shoal or fill in because of settlement of side slopes, deposition of material derived from upland erosion, and the actions of currents.

24. Channel side slopes would be designed in such a way as to enhance long-term stability, although changes to the bottom contours would occur over time, resulting in a gradual flattening of the slopes. Strong wave or current action occurring during storms may result in the movement of bottom sediments. The propeller wash and waves produced by passing vessels would also tend to disturb the harbor and channel bottom, resulting in redistribution of bottom sediments.

Table 3-3

FIRST COST OF IMPROVEMENT

PLAN A
OCEAN DISPOSAL

Dredging and Rock Burial 800 cy x $84.40/cy		$67,500
Contingencies 25%		16,900
SUBTOTAL		$84,400
Engineering and Design 7%		5,900
Supervision and Administration 8%		6,800
Aids to Navigation		4,500
TOTAL		$101,600
	SAY	$102,000

UPLAND DISPOSAL

Dredging, 800 cy sand & gravel x $63.75/cy		$ 51,000
Rock Burial, 6 Boulders x $9,400		56,400
Containment Dike (entirely local cost)		25,000
Truck to Disposal Site 800 cy x $4.00/cy		3,200
SUBTOTAL		$135,600
Contingencies 25%		38,300
SUBTOTAL		$173,900
Engineering and Design 7%		12,200
Supervision and Administration 8%		13,900
Aids to Navigation		4,500
TOTAL		$204,500
	SAY	$205,000

PLAN B
OCEAN DISPOSAL
RECOMMENDED PLAN

Dredging and Rock Burial 1,350 cy x $60.00/cy	$ 81,000
Contingencies 25%	20,300
SUBTOTAL	$101,300
Engineering and Design 7%	7,100
Supervision and Administration 8%	8,100
Aids to Navigation	4,500
TOTAL	$121,000

UPLAND DISPOSAL

Dredging 1,350 cy sand & gravel x $43.70/cy		$59,000
Rock Burial, 10 boulders x $7,250		72,500
Containment Dike (entirely local cost)		25,000
Truck to Disposal Site 1,350 cy x $4.00/cy		5,400
SUBTOTAL		$161,900
Contingencies 25%		40,500
SUBTOTAL		$202,400
Engineering and Design 7%		14,200
Supervision and Administration 8%		16,200
Aids to Navigation		4,500
TOTAL		$237,300
	SAY	$237,000

PLAN C
OCEAN DISPOSAL

Dredging and Rock Burial 2,700 cy x $52.60/cy		$142,000
Contingencies 25%		35,500
SUBTOTAL		$177,500
Engineering and Design 7%		12,400
Supervision and Administration 8%		14,200
Aids to Navigation		4,500
TOTAL		$208,600
	SAY	$209,000

UPLAND DISPOSAL

Dredging 2,700 cy sand & gravel x $32.20/cy		$ 86,900
Rock Burial, 20 boulders x $5,660		113,200
Containment Dike (entirely local cost)		25,000
Truck to Disposal Site 2,500 cy x $4.00/cy		10,000
SUBTOTAL		$235,100
Contingencies 25%		58,800
SUBTOTAL		$293,900
Engineering and Design 7%		20,600
Supervision and Administration 8%		23,500
Aids to Navigation		4,500
TOTAL		$342,500
	SAY	$343,000

25. It is expected that the strong currents in the area of the railroad bridge would keep this section of the Narrows free from shoals for the life of the project. The hydrodynamic regime operating in the Narrows would continue to keep the channel itself fairly clear also. Minor shoaling would occur along the channel limits and some future maintenance would most likely be necessary. About 50 cubic yards per year would be a high estimate. The area to be dredged at the basin entrance and boulder area would shoal at an annual rate equivalent to no more than 5 percent of the amount of material removed. This is equal to 40, 70 and 125 cubic yards annually for Plans A, B, and C, respectively. When combined with the 50 cubic yards per year estimated for the natural channel, this equals 90, 120, or 175 cubic yards respectively.

26. Based on this, it is concluded that maintenance dredging would be required every 15 years, at 15, 30 and 45 years into the 50-year project life. Quantities of material to be removed during the three maintenance operations expected over the 50-year project life were computed from the expected shoaling rates. Table 3-4 summarizes the combined quantities of gravel and sand to be removed for each alternative during each maintenance operation. This table also shows the cost of each operation at existing price levels and the annual maintenance dredging cost of each alternative plan. Maintenance costs have been developed based on clamshell dredging and ocean disposal of dredged materials at the Buzzards Bay dump site.

Table 3-4

MAINTENANCE DREDGING SUMMARY

	PLAN A	PLAN B	PLAN C
Total cubic yards Shoaling after 15 yrs.	1,350 cy	1,800 cy	2,625 cy
Cost per cubic yard	$60.00	$57.50	$53.00
Total Cost	$81,000	$104,000	$139,000
Annual Shoaling (cy)	90 cy	120 cy	175 cy
Annual Maintenance Dredging Cost	$5,400	$6,900	$9,300

ANNUAL CHARGES

27. In addition to maintenance dredging costs, other annual charges include costs for maintaining new required aids to navigation and interest and amortization charges applied to the first cost of construction.

28. Placement and maintenance of required aids to navigation, in this case channel marking buoys, is the responsibility of the U.S. Coast Guard. These buoys must undergo routine maintenance, repairs to damages, and replacement of lost buoys. The buoys must be removed in the winter to avoid ice damage and replaced in the spring before the boating season

begins. While no specific estimate of necessary aids and their costs have been supplied by the U.S. Coast Guard, it was determined for planning purposes, that one additional steel can buoy would be necessary to mark the upper end of the channel. The cost of this buoy and placement was figured at $4,500. The buoy would have a life of about 20 years necessitating replacement twice during the project life. This amounts to another $9,000 over 50 years or about $200 annually. The buoy's steel anchor chain would require replacement every 2 years and the buoy must be sandblasted and repainted every 6 years. The annual maintenance cost equivalent is estimated at about $1,500.

29. Interest and amortization of the first cost of construction is based on a rate of 7-7/8 percent annually and a project life of 50 years. A summary of all annual charges is provided in Table 3-5.

Table 3-5

ANNUAL CHARGES

PLAN A

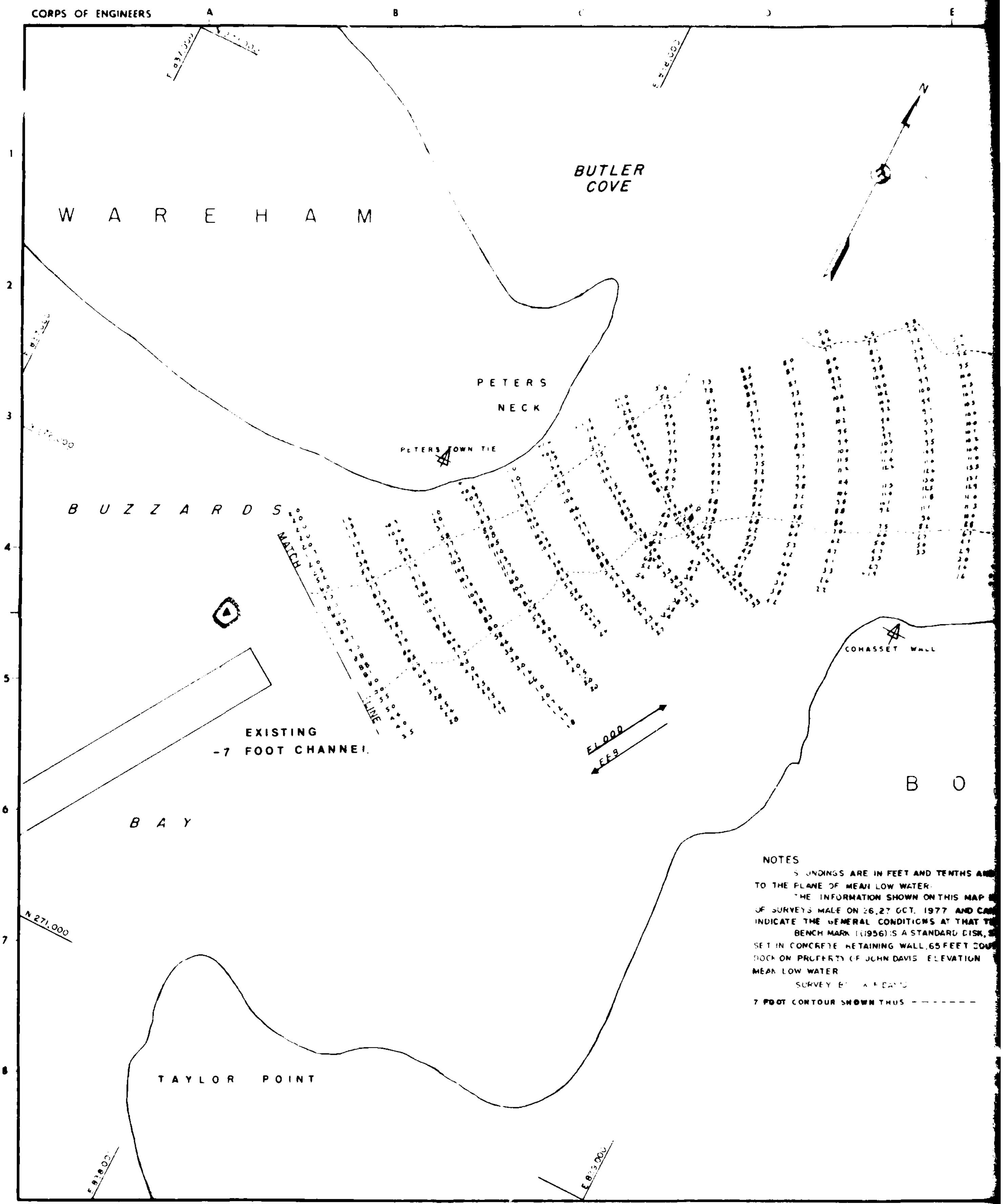
Amortization of First Cost .08057 x $102,000		$ 8,200
Maintenance Dredging		$ 5,400
Maintenance of Aids to Navigation		$ 1,500
TOTAL ANNUAL CHARGES - PLAN A		$15,100
	SAY	$15,000

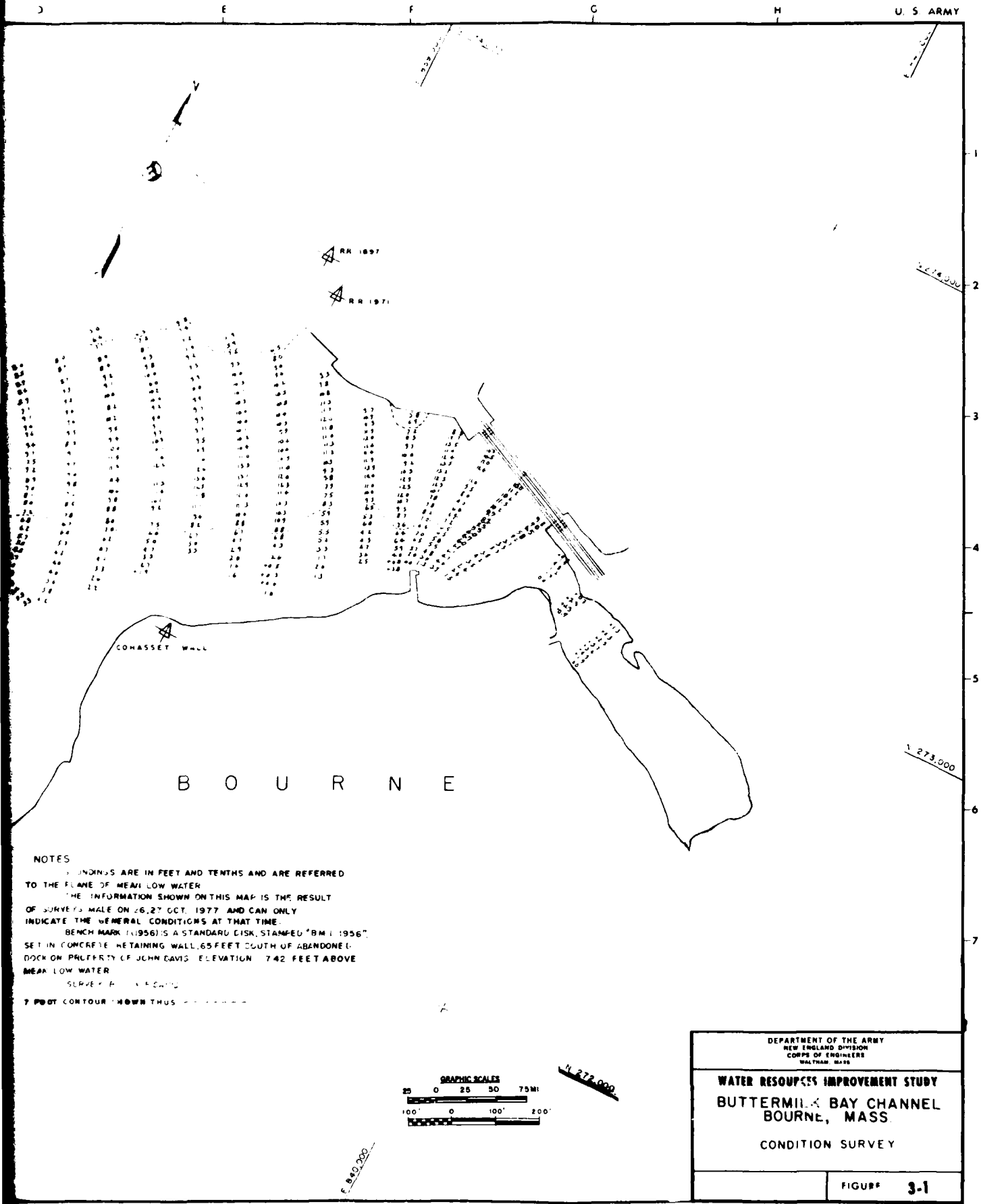
PLAN B
RECOMMENDED PLAN

Amortization of First Cost .08057 x $121,000		$ 9,700
Maintenance Dredging		$ 6,900
Maintenance of Aids to Navigation		$ 1,500
TOTAL ANNUAL CHARGES - PLAN B		$18,100
	SAY	$18,000

PLAN C

Amortization of First Cost .08057 x $209,000		$16,800
Maintenance Dredging		$ 9,300
Maintenance of Aids to Navigation		$ 1,500
TOTAL ANNUAL CHARGES - PLAN C		$27,600
	SAY	$28,000


CORPS OF ENGINEERS
A
B
E
BUTLER COVE
N
W A R E H A M
PETERS NECK
PETERS TOWN TIE
B U Z Z A R D S
B A Y
MATCH LINE
EXISTING -7 FOOT CHANNEL
FLOOD
EBB
COHASSET WALL
B O
N 271,000
TAYLOR POINT
NOTES
SOUNDINGS ARE IN FEET AND TENTHS A
TO THE PLANE OF MEAN LOW WATER.
THE INFORMATION SHOWN ON THIS MAP
OF SURVEYS MADE ON 26,27 OCT. 1977 AND C
INDICATE THE GENERAL CONDITIONS AT THAT T
BENCH MARK (1956) IS A STANDARD DISK,
SET IN CONCRETE RETAINING WALL, 65 FEET
DOCK ON PROPERTY OF JOHN DAVIS. ELEVATION
MEAN LOW WATER
7 FOOT CONTOUR SHOWN THUS



NOTES

SOUNDINGS ARE IN FEET AND TENTHS AND ARE REFERRED TO THE PLANE OF MEAN LOW WATER

THE INFORMATION SHOWN ON THIS MAP IS THE RESULT OF SURVEYS MADE ON 26,27 OCT. 1977 AND CAN ONLY INDICATE THE GENERAL CONDITIONS AT THAT TIME.

BENCH MARK (1956) IS A STANDARD DISK, STAMPED "BM I 1956" SET IN CONCRETE RETAINING WALL, 65 FEET SOUTH OF ABANDONED DOCK ON PROPERTY OF JOHN DAVIS. ELEVATION 7.42 FEET ABOVE MEAN LOW WATER

SURVEYED BY U.S. ARMY

7 FOOT CONTOUR SHOWN THUS

GRAPHIC SCALES

25 0 25 50 75MI

100' 0 100' 200'

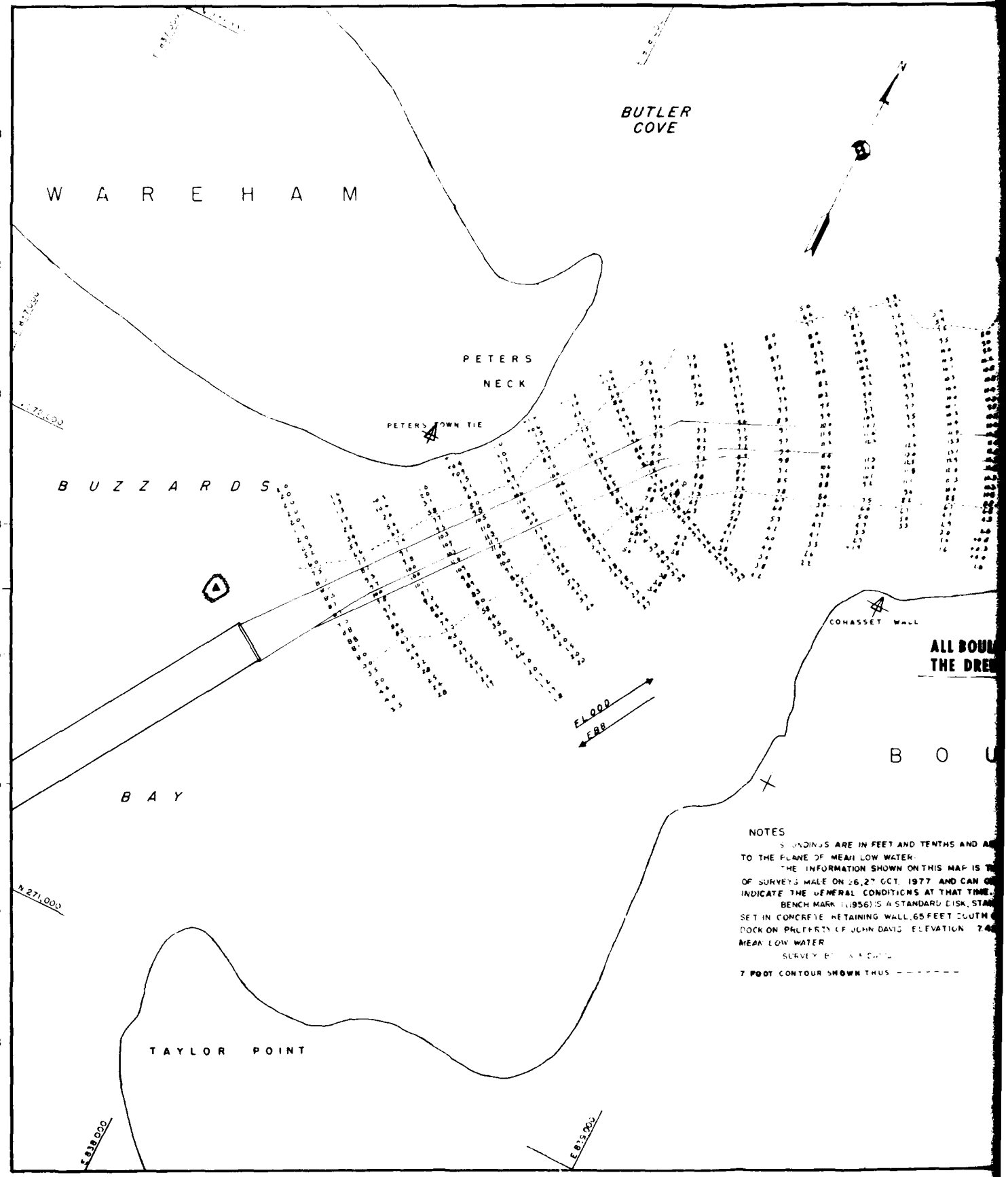
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

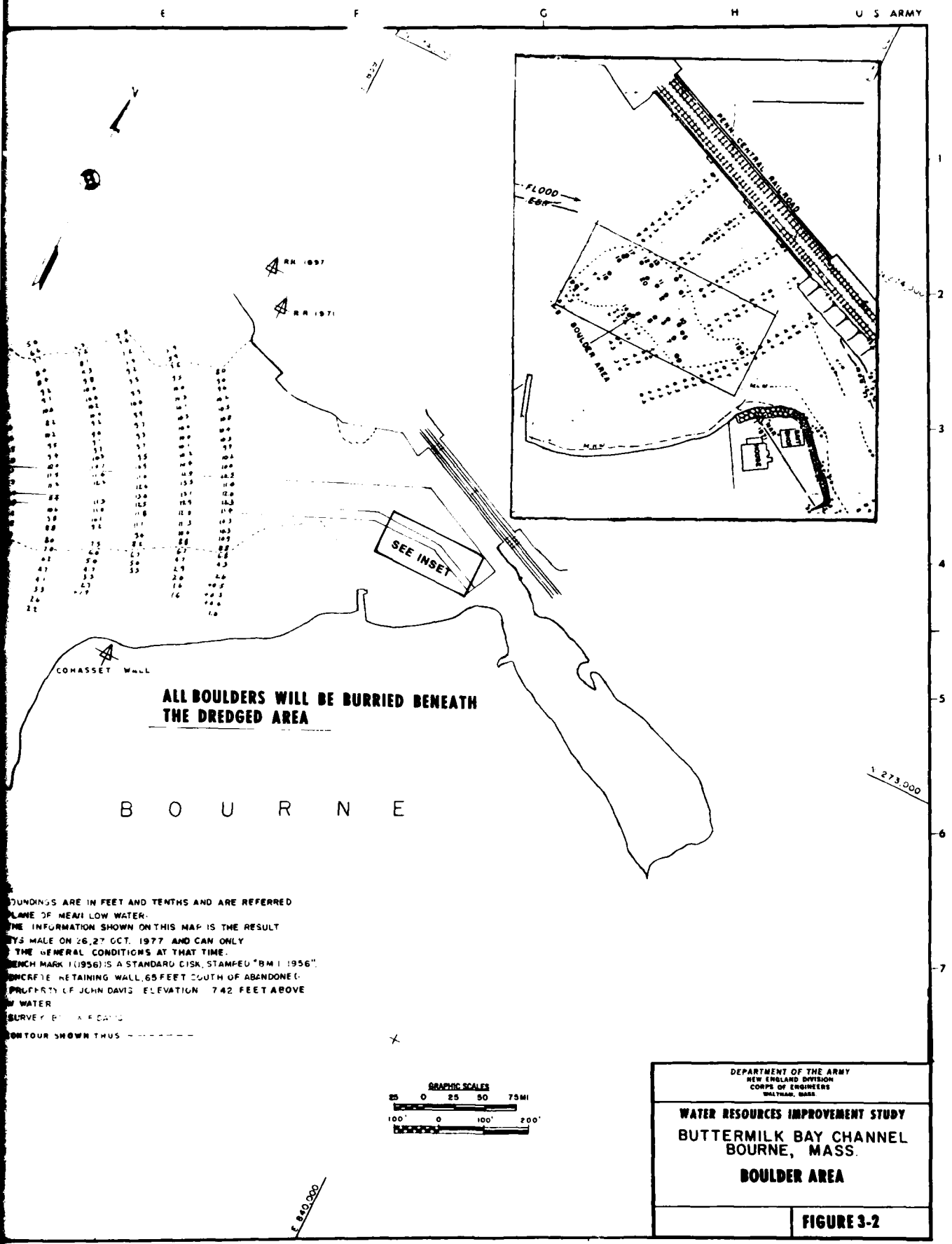
WATER RESOURCES IMPROVEMENT STUDY

BUTTERMILK BAY CHANNEL
BOURNE, MASS.

CONDITION SURVEY

FIGURE 3-1


CORPS OF ENGINEERS
A
B
C
D
E
1
2
3
4
5
6
7
8
BUTLER COVE
W A R E H A M
PETERS NECK
PETERS TOWN TIE
B U Z Z A R D S
COHASSET WALL
FLOOD
EBB
B A Y
TAYLOR POINT
N 271,000
E 838,000
E 835,000
NOTES
7 FOOT CONTOUR SHOWN THUS



UNDINGS ARE IN FEET AND TENTHS AND ARE REFERRED
PLANE OF MEAN LOW WATER.
HE INFORMATION SHOWN ON THIS MAP IS THE RESULT
YS MADE ON 26,27 OCT. 1977 AND CAN ONLY
THE GENERAL CONDITIONS AT THAT TIME.
ENCH MARK 1 (1956) IS A STANDARD DISK, STAMPED "BM 1 1956",
NCRETE RETAINING WALL, 65 FEET SOUTH OF ABANDONED
PROPERTY OF JOHN DAVIS ELEVATION 7.42 FEET ABOVE
W WATER
SURVEY BY A.E.C.O.E.
ONTOUR SHOWN THUS - - - - - - - -

GRAPHIC SCALES
25 0 25 50 75MI
100' 0 100' 200'

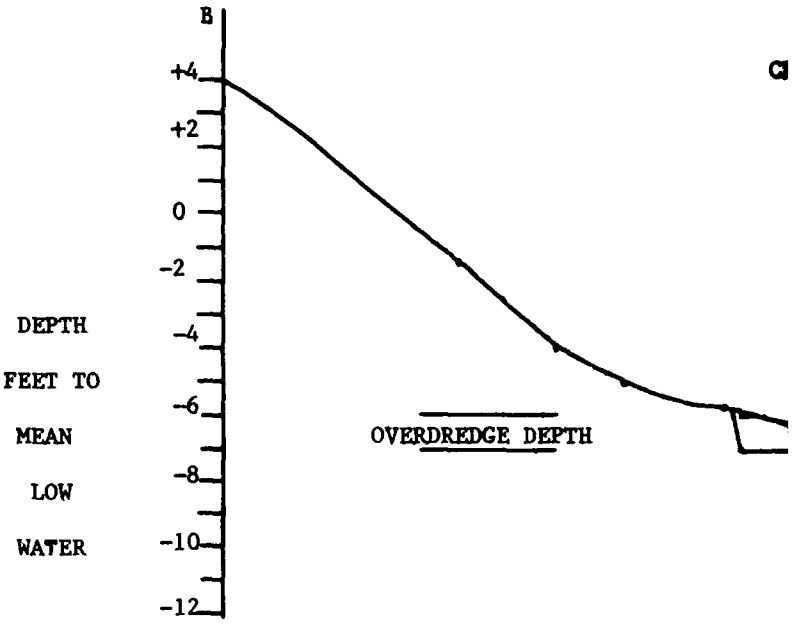
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

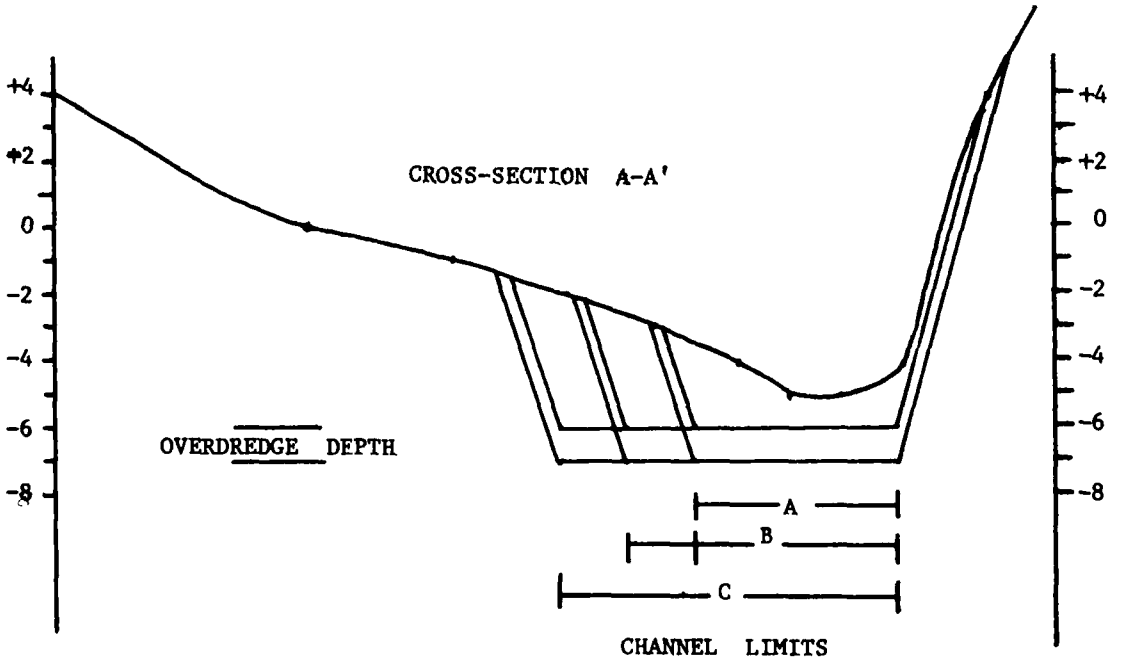
WATER RESOURCES IMPROVEMENT STUDY

BUTTERMILK BAY CHANNEL
BOURNE, MASS.

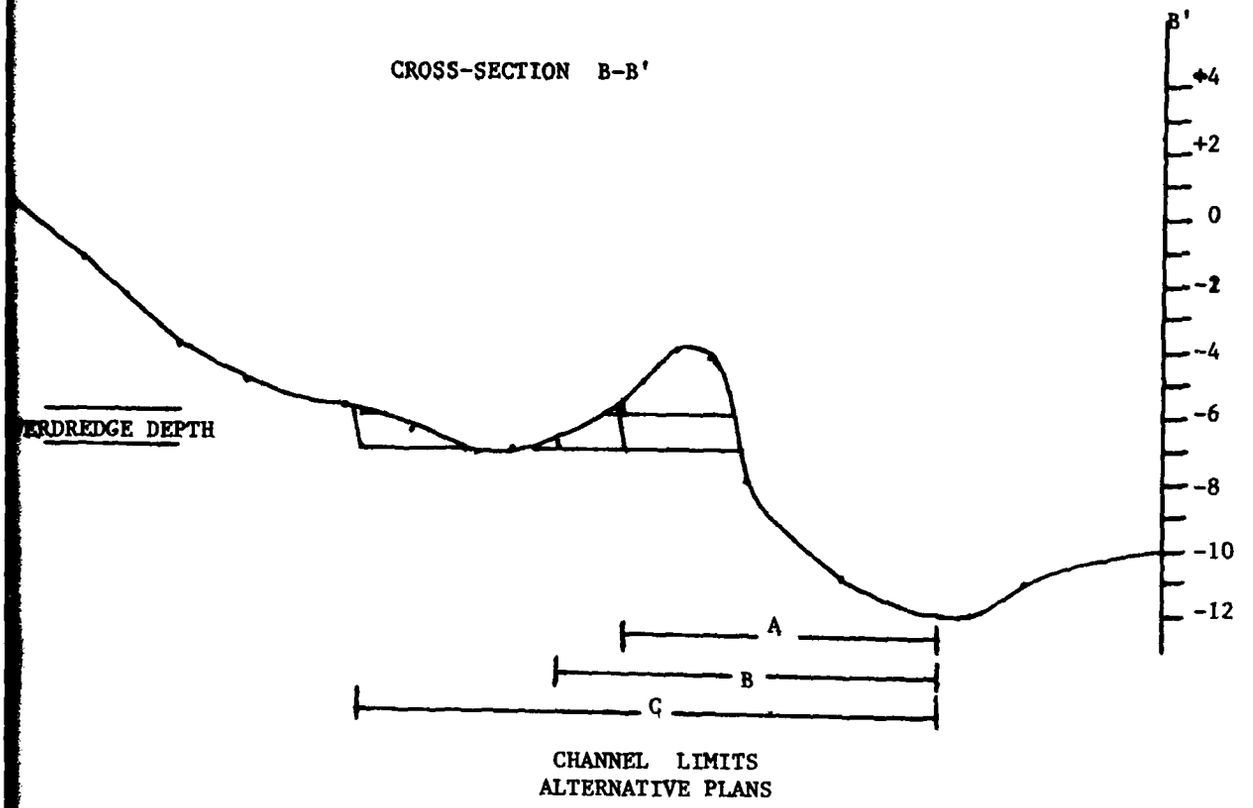
BOULDER AREA

FIGURE 3-2

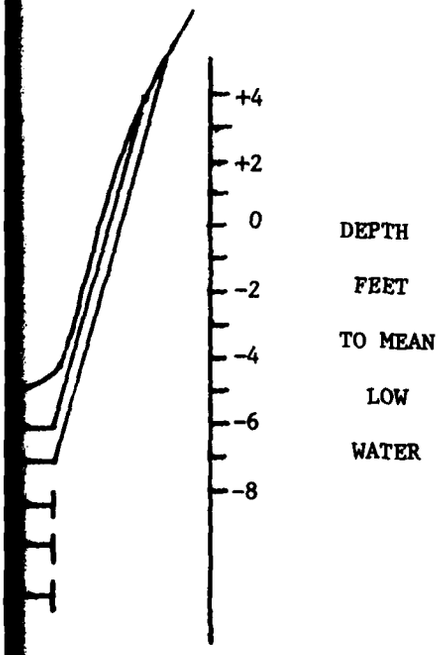




CHANNEL LIMITS
ALTERNATIVE PLANS

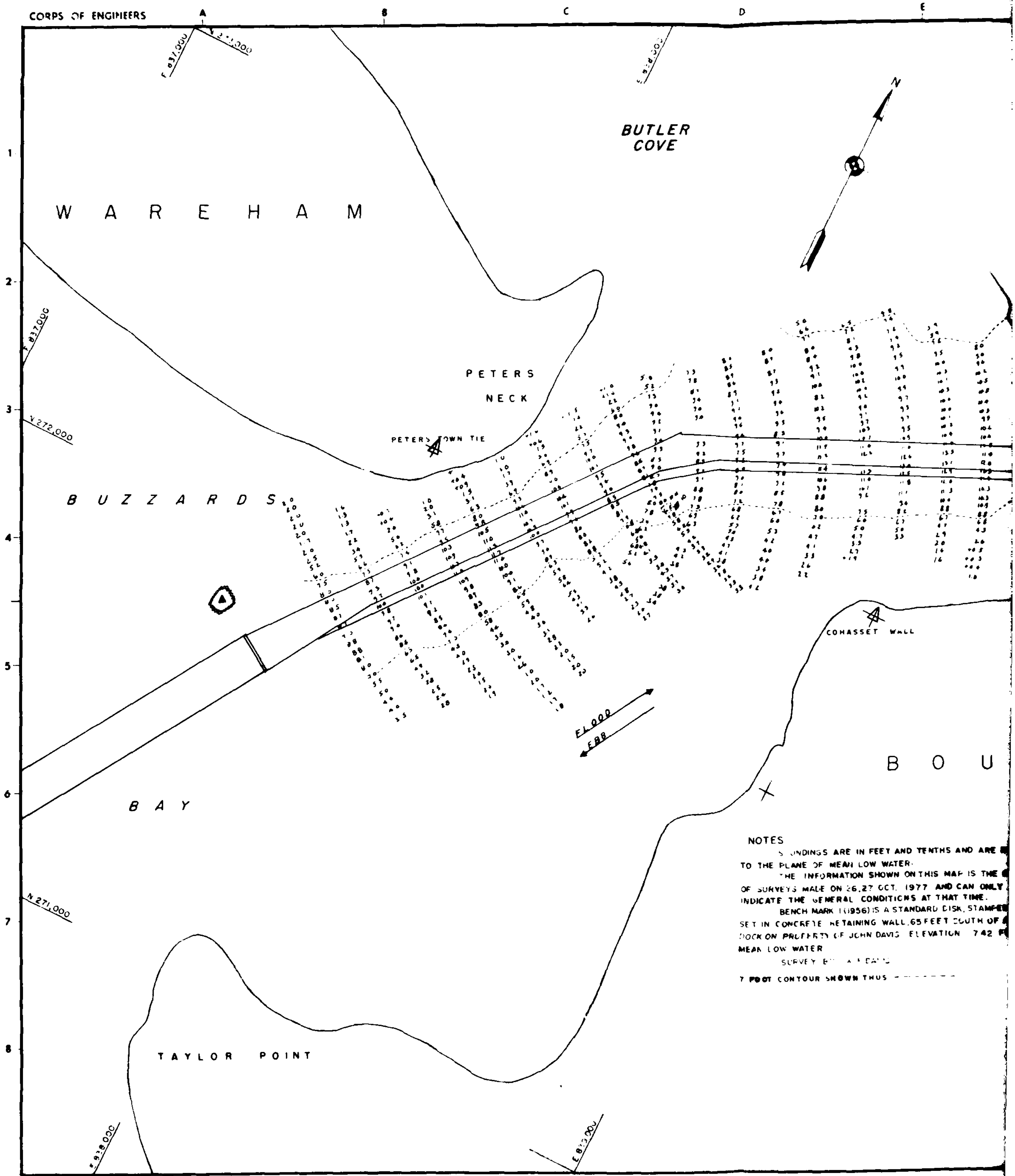


CHANNEL LIMITS
ALTERNATIVE PLANS

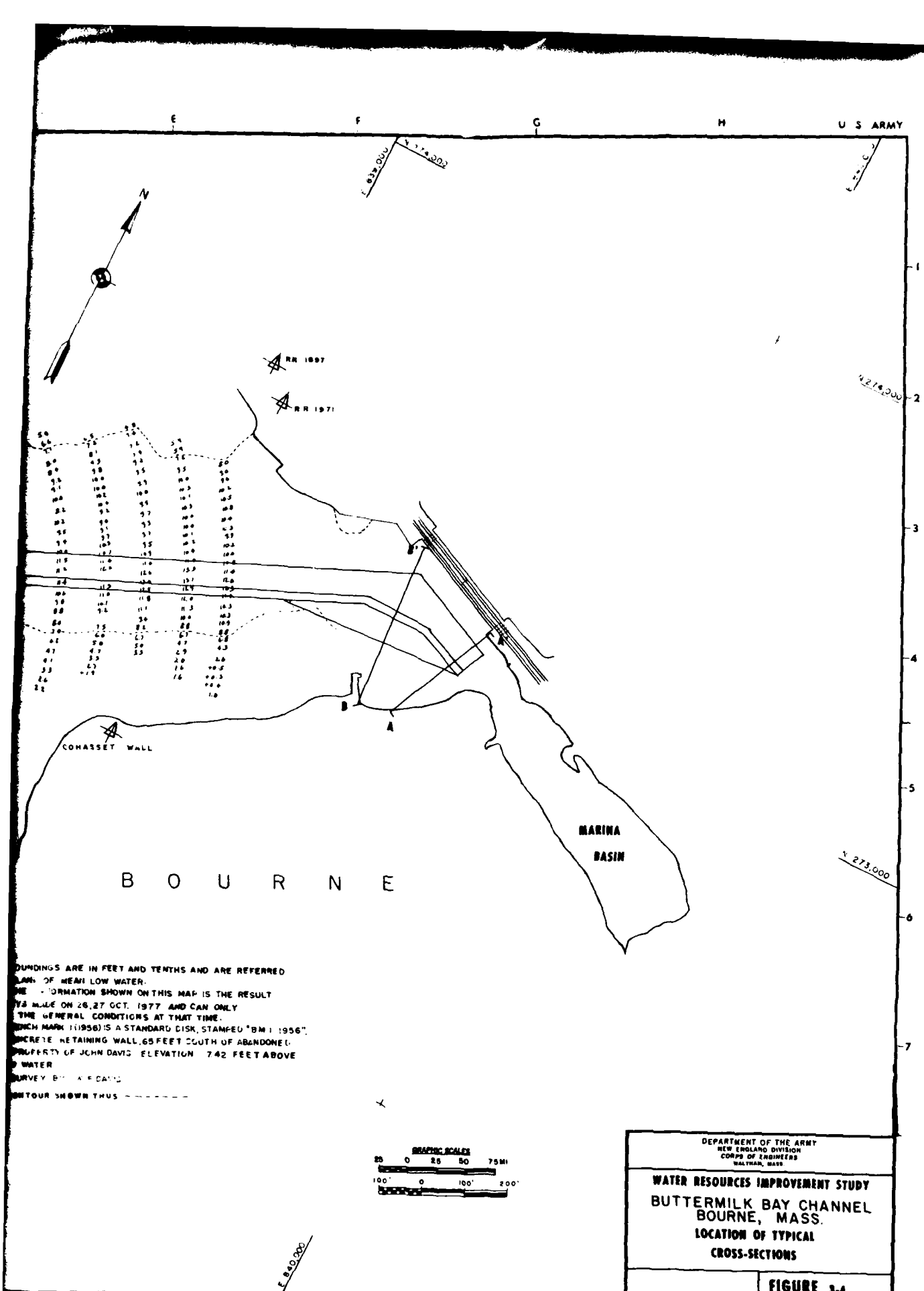


WATER RESOURCES IMPROVEMENT STUDY
BUTTERMILK BAY CHANNEL
BOURNE, MASSACHUSETTS

TYPICAL CROSS-SECTIONS
FIGURE 3-3



CORPS OF ENGINEERS
A
B
C
D
E
1
2
3
4
5
6
7
8
BUTLER COVE
N
W A R E H A M
PETERS NECK
PETERS TOWN TIE
B U Z Z A R D S
B A Y
FLOOD
EBB
COHASSET WALL
B O U
N 272,000
N 271,000
TAYLOR POINT
NOTES
SOUNDINGS ARE IN FEET AND TENTHS AND ARE
TO THE PLANE OF MEAN LOW WATER.
THE INFORMATION SHOWN ON THIS MAP IS THE
OF SURVEYS MADE ON 26,27 OCT. 1977 AND CAN ONLY
INDICATE THE GENERAL CONDITIONS AT THAT TIME.
BENCH MARK 1 (1956) IS A STANDARD DISK, STAMPED
SET IN CONCRETE RETAINING WALL, 65 FEET SOUTH OF
DOCK ON PROPERTY OF JOHN DAVIS. ELEVATION 7.42 F
MEAN LOW WATER
7 FOOT CONTOUR SHOWN THUS



UNDINGS ARE IN FEET AND TENTHS AND ARE REFERRED
LAN. OF MEAN LOW WATER.
NE - FORMATION SHOWN ON THIS MAP IS THE RESULT
VS MADE ON 26,27 OCT. 1977 AND CAN ONLY
THE GENERAL CONDITIONS AT THAT TIME.
NCH MARK (1956) IS A STANDARD DISK, STAMPED "BM I 1956".
NCRETE RETAINING WALL, 65 FEET SOUTH OF ABANDONED
PERTY OF JOHN DAVIS ELEVATION 7.42 FEET ABOVE
WATER
URVEY BY A.E.CATO
NTOUR SHOWN THUS - - - - - - -

GRAPHIC SCALES
25 0 25 50 75MI
100' 0 100' 200'

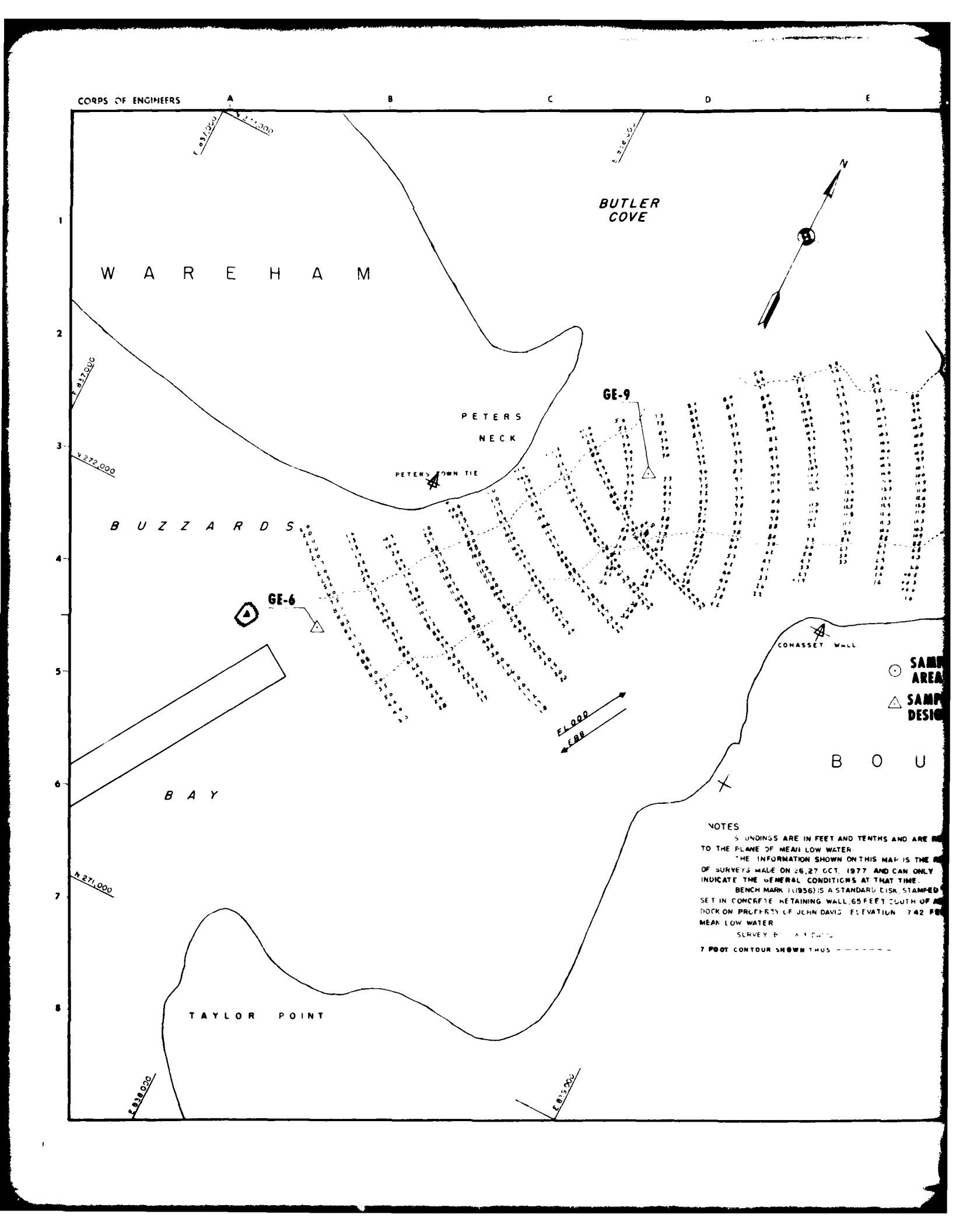
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS

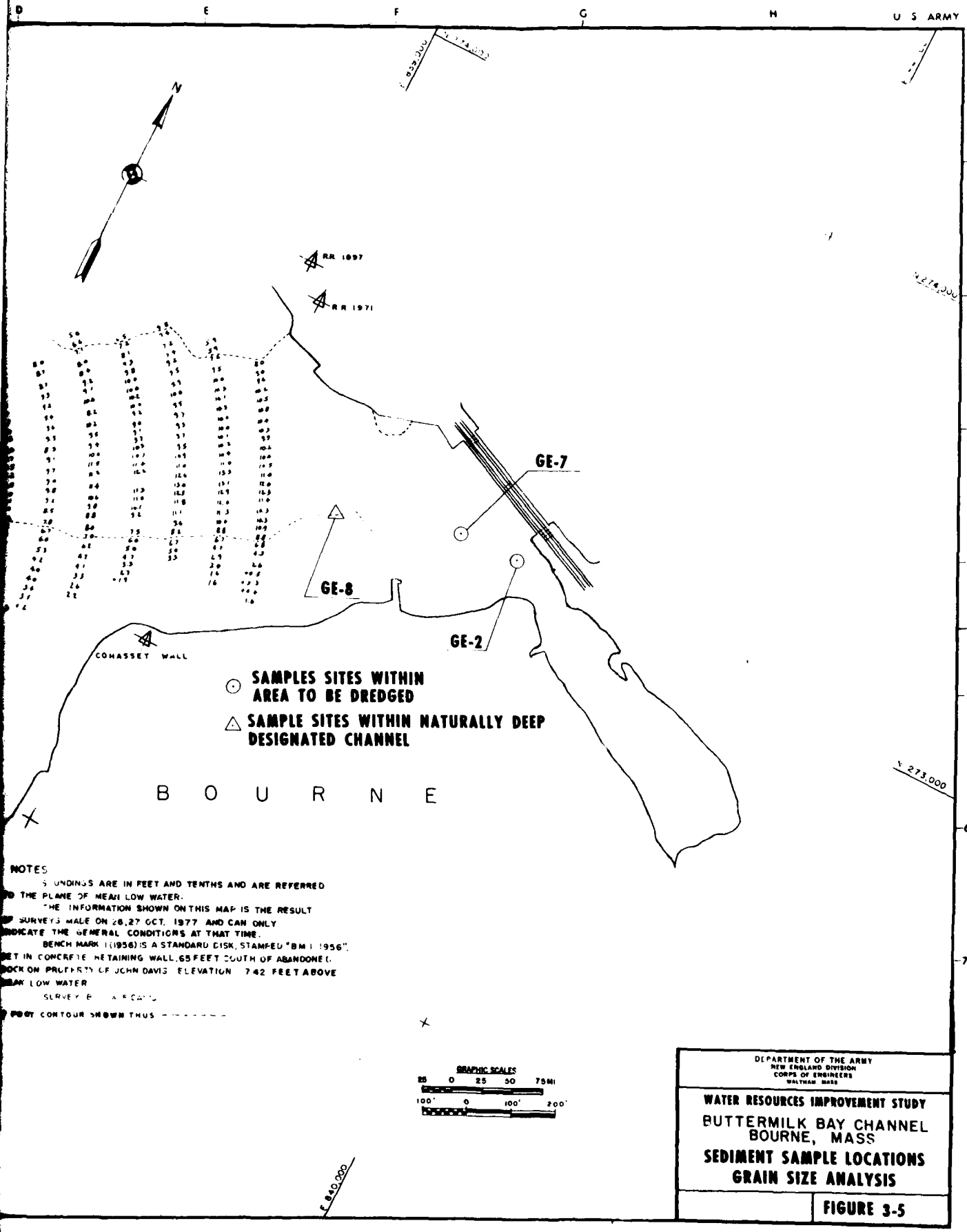
WATER RESOURCES IMPROVEMENT STUDY

BUTTERMILK BAY CHANNEL
BOURNE, MASS.

LOCATION OF TYPICAL
CROSS-SECTIONS

FIGURE 3-4


CORPS OF ENGINEERS
A
B
C
D
E
1
2
3
4
5
6
7
8
E 831,000
N 273,000
E 835,000
BUTLER COVE
N
W A R E H A M
N 272,000
PETERS NECK
PETERS TOWN TIE
GE-9
B U Z Z A R D S
GE-6
COHASSET WALL
FLOOD
EBB
B A Y
B O U
N 271,000
TAYLOR POINT
E 838,000
E 835,000
NOTES
SOUNDINGS ARE IN FEET AND TENTHS AND ARE RE
TO THE PLANE OF MEAN LOW WATER.
THE INFORMATION SHOWN ON THIS MAP IS THE R
OF SURVEYS MADE ON 26,27 OCT. 1977 AND CAN ONLY
INDICATE THE GENERAL CONDITIONS AT THAT TIME.
BENCH MARK 1 (1956) IS A STANDARD DISK, STAMPED
SET IN CONCRETE RETAINING WALL, 65 FEET SOUTH OF
DOCK ON PROPERTY OF JOHN DAVIS ELEVATION 7.42 FE
MEAN LOW WATER
SURVEY BY
7 FOOT CONTOUR SHOWN THUS



NOTES

SOUNDINGS ARE IN FEET AND TENTHS AND ARE REFERRED TO THE PLANE OF MEAN LOW WATER.

THE INFORMATION SHOWN ON THIS MAP IS THE RESULT OF SURVEYS MADE ON 26,27 OCT. 1977 AND CAN ONLY INDICATE THE GENERAL CONDITIONS AT THAT TIME.

BENCH MARK 1 (1956) IS A STANDARD DISK, STAMPED "BM 1 1956", SET IN CONCRETE RETAINING WALL, 65 FEET SOUTH OF ABANDONED DOCK ON PROPERTY OF JOHN DAVIS ELEVATION 7.42 FEET ABOVE MEAN LOW WATER

SURVEY BY [illegible]

6 FOOT CONTOUR SHOWN THUS - - - - - -

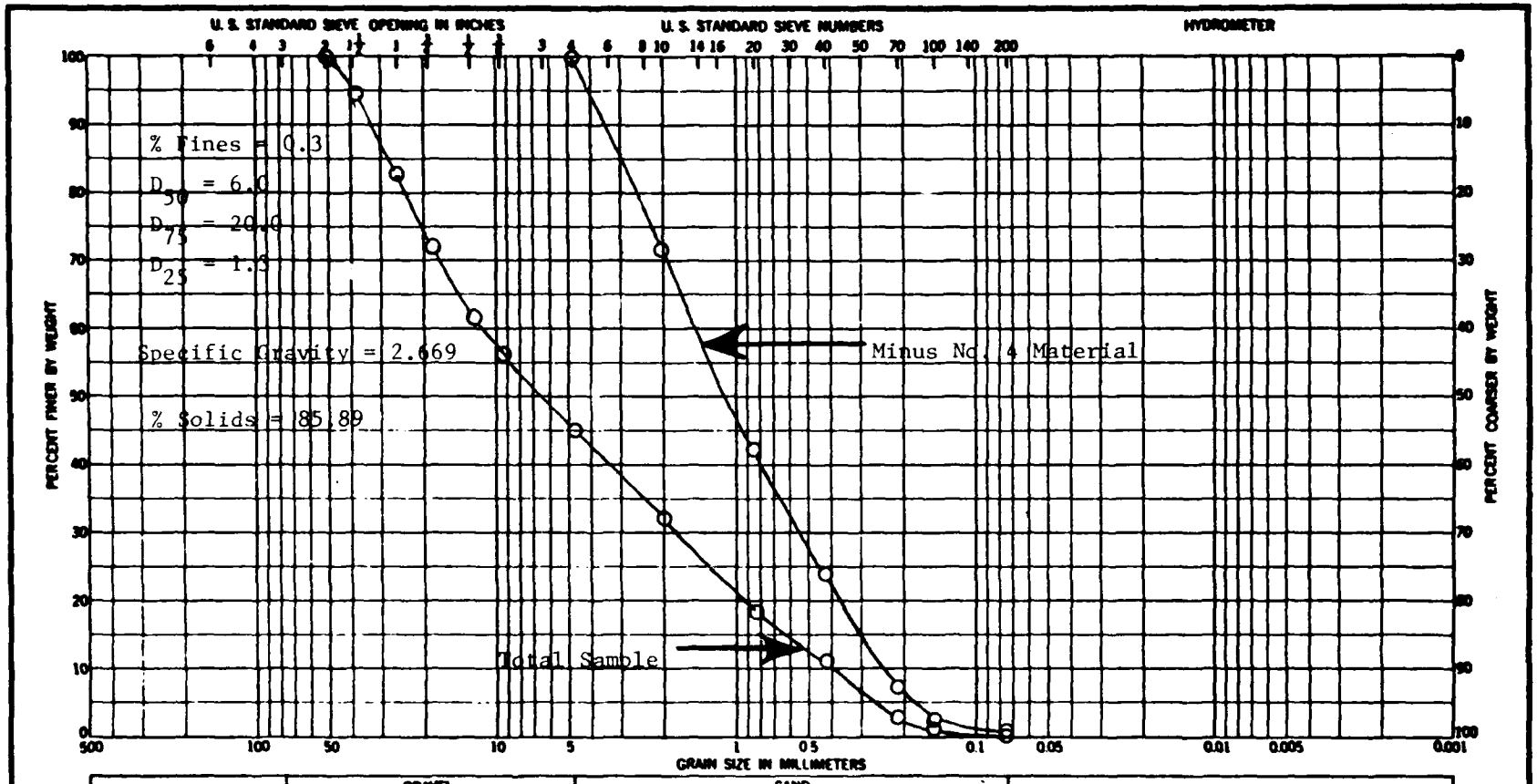
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM MASS

WATER RESOURCES IMPROVEMENT STUDY

BUTTERMILK BAY CHANNEL
BOURNE, MASS

SEDIMENT SAMPLE LOCATIONS
GRAIN SIZE ANALYSIS

FIGURE 3-5



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GE-2	Surface	Sandy GRAVEL (GP)		non-plastic		

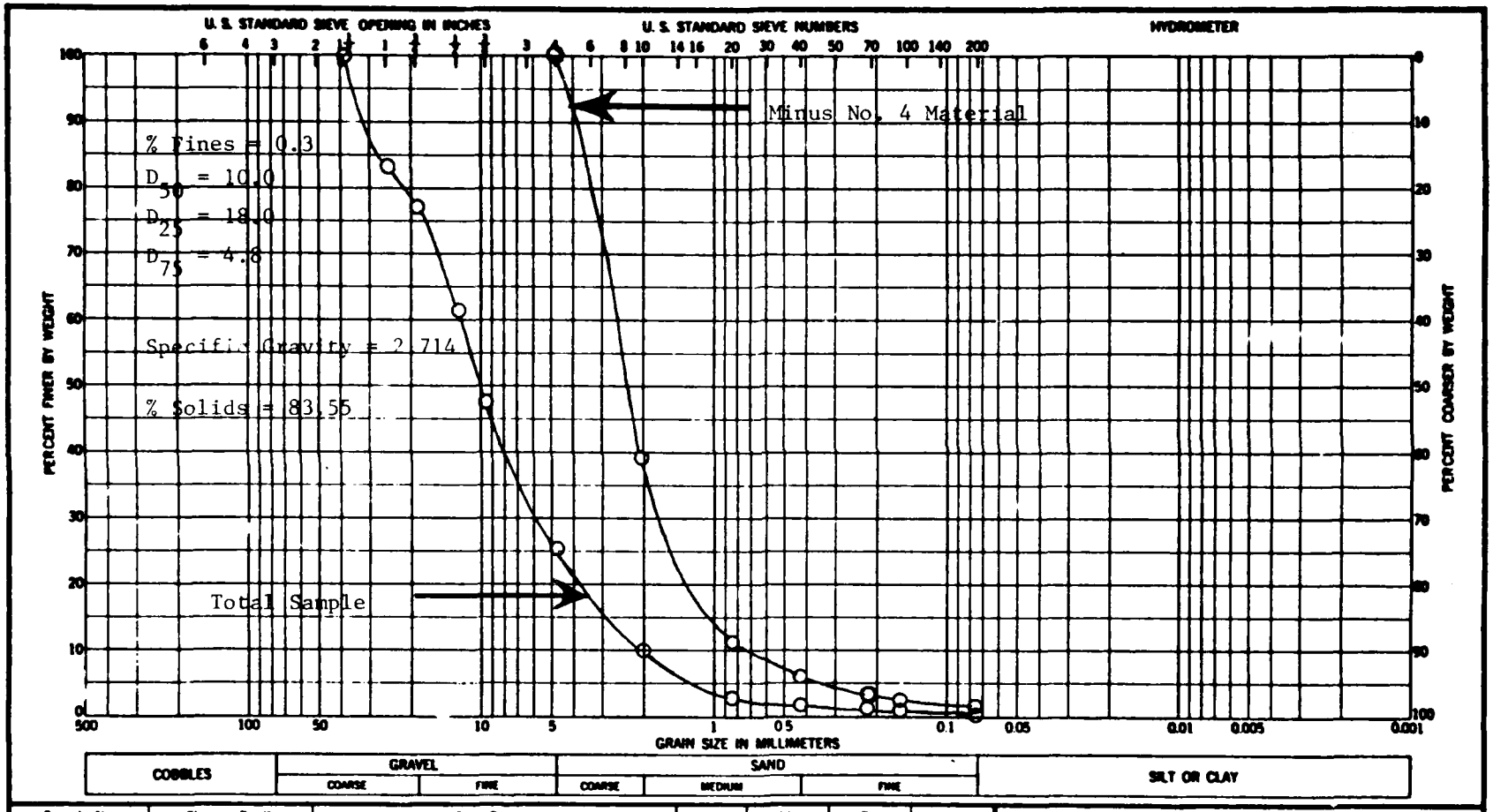
GRADATION CURVES

Project	Buttermilk Bay Channel
	Bourne, MA
Area	Sediment Sieve Analysis
Boring No.	GE-2/B1
Date	November 1972.

ENG FORM 1 MAY 68 2087

GPO 926-280

Figure 3-6A



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GE-7	Surface	Sandy GRAVEL (GW)		non-plastic		

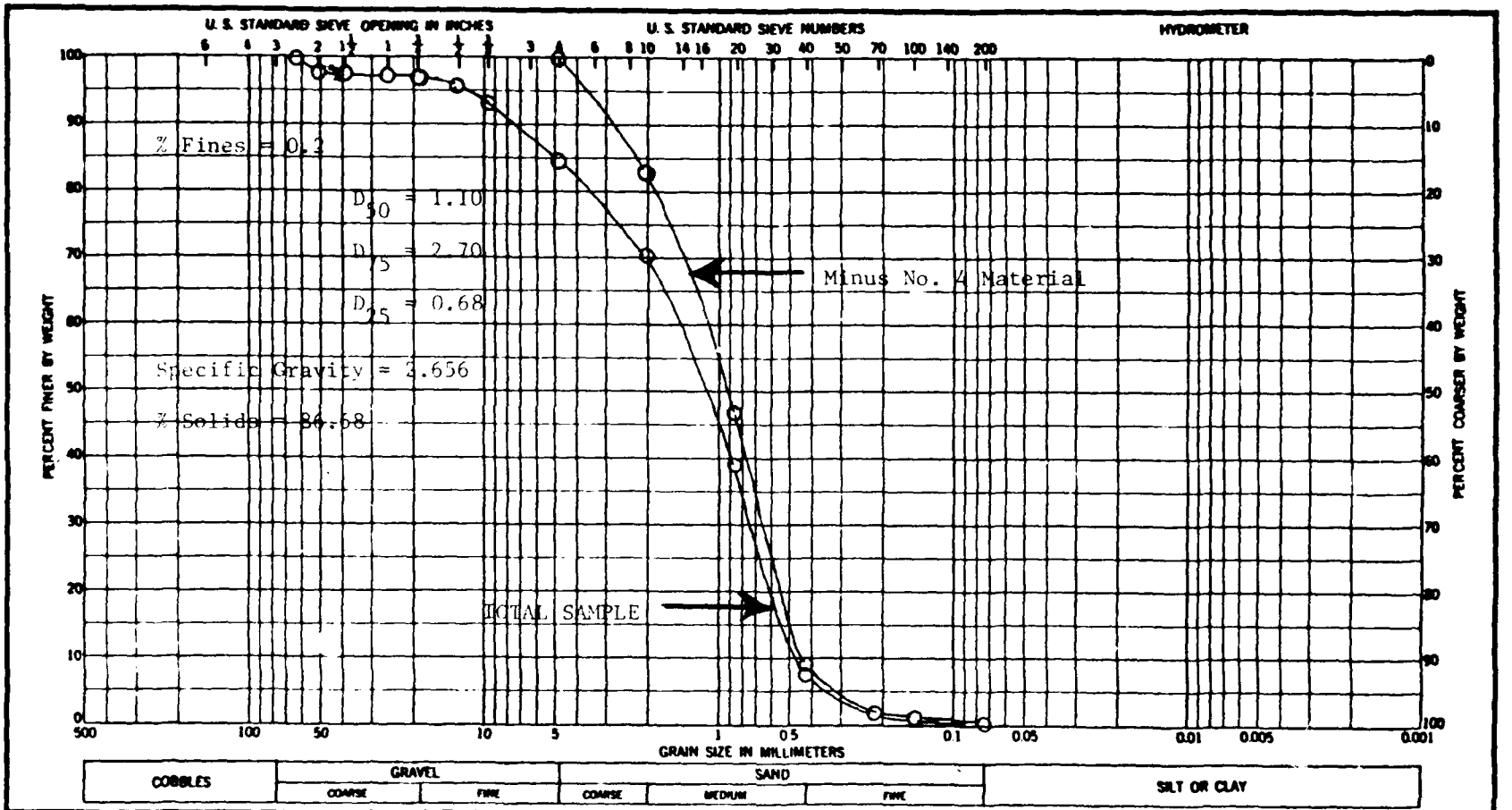
GRADATION CURVES

Project	Buttermilk Bay Channel
	Bourne, MA
Area	Sediment Sieve Analysis
Boring No.	GE-7/B-1
Date	November 1972

ENG FORM 1 MAY 63 2087

GPO 926-280

Figure 3-6B



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GE-6	Surface	Gravelly course to medium SAND (SP)		non-plastic		

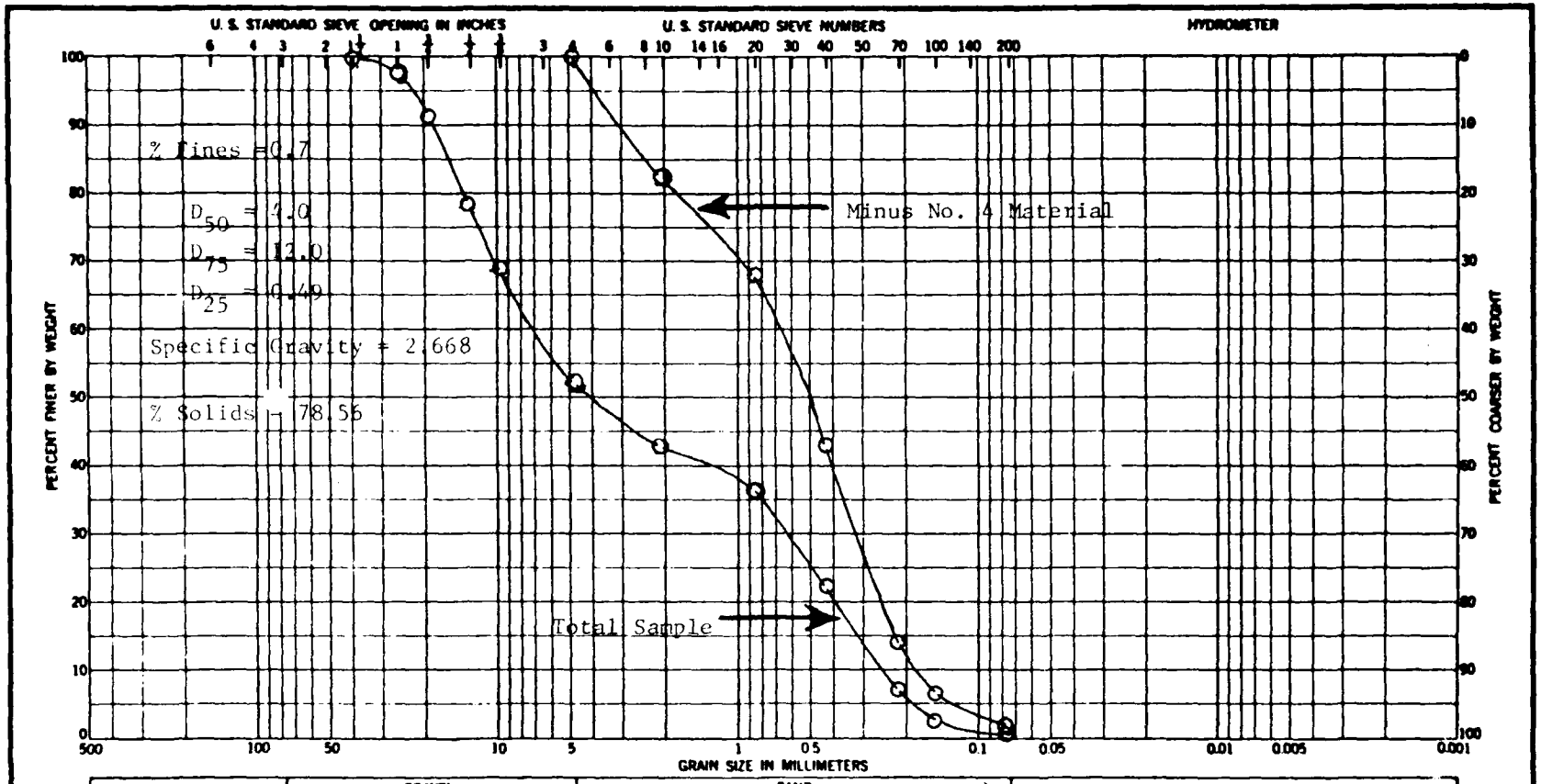
GRADATION CURVES

Project	Buttermilk Bay Channel
	Bourne, MA
Area	Sediment Sieve Analysis
Boring No.	GE-6/B-1
Date	November 1972

ENG FORM 1 MAY 68 2087

GPO 926-250

Figure 3-6C



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GE-8	Surface	Gravelly course to fine SAND (SP)		non-plastic		

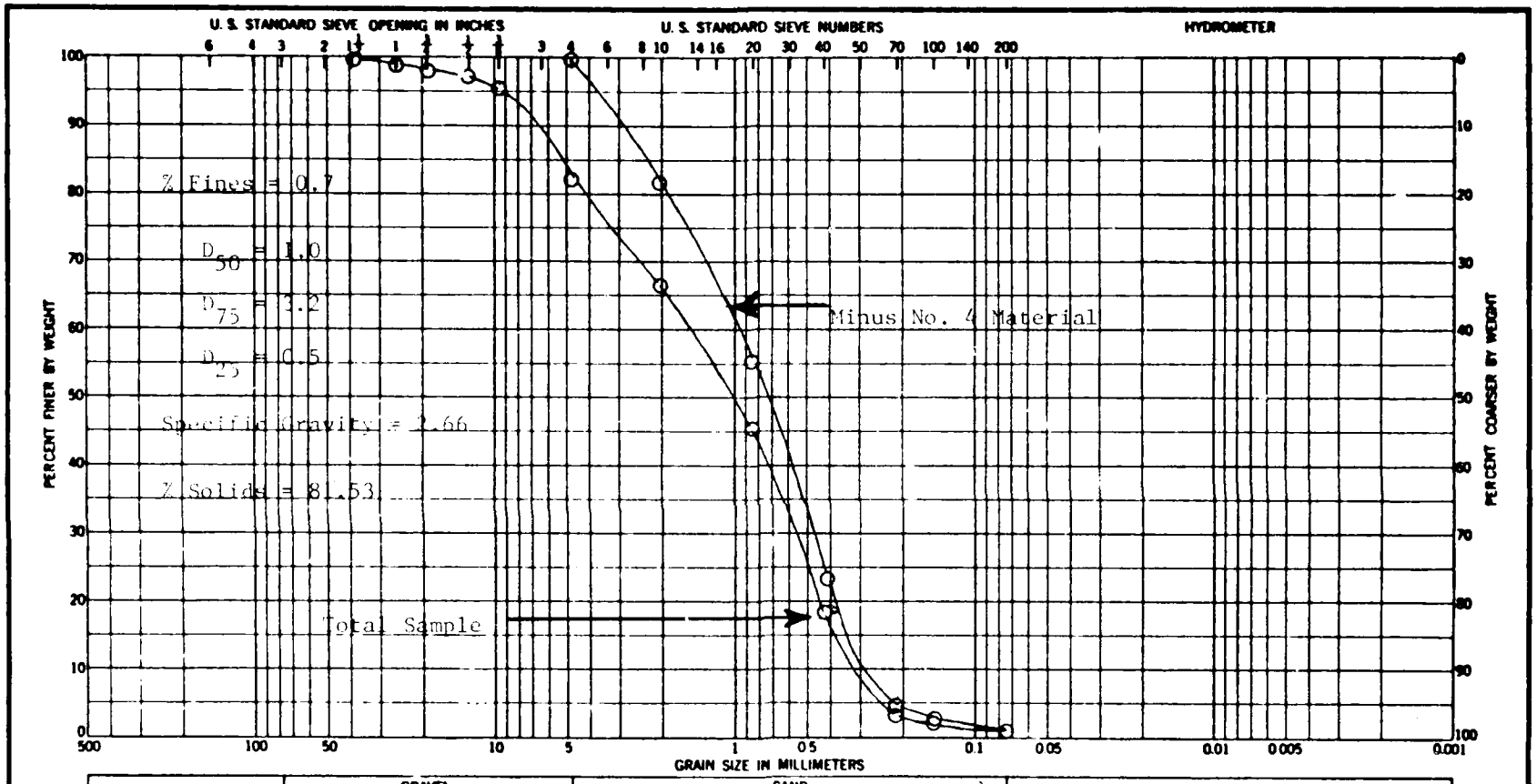
GRADATION CURVES

Project: Buttermilk Bay Channel
Bourne, MA
Area: Sediment Sieve Analysis
Boring No.: GE-8/B-1
Date: November 1972

ENG FORM 1 MAY 63 2087

GPO 926-290

Figure 3-61



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
GE-9	Surface	Gravelly course to fine SAND (SP)		non-plastic		

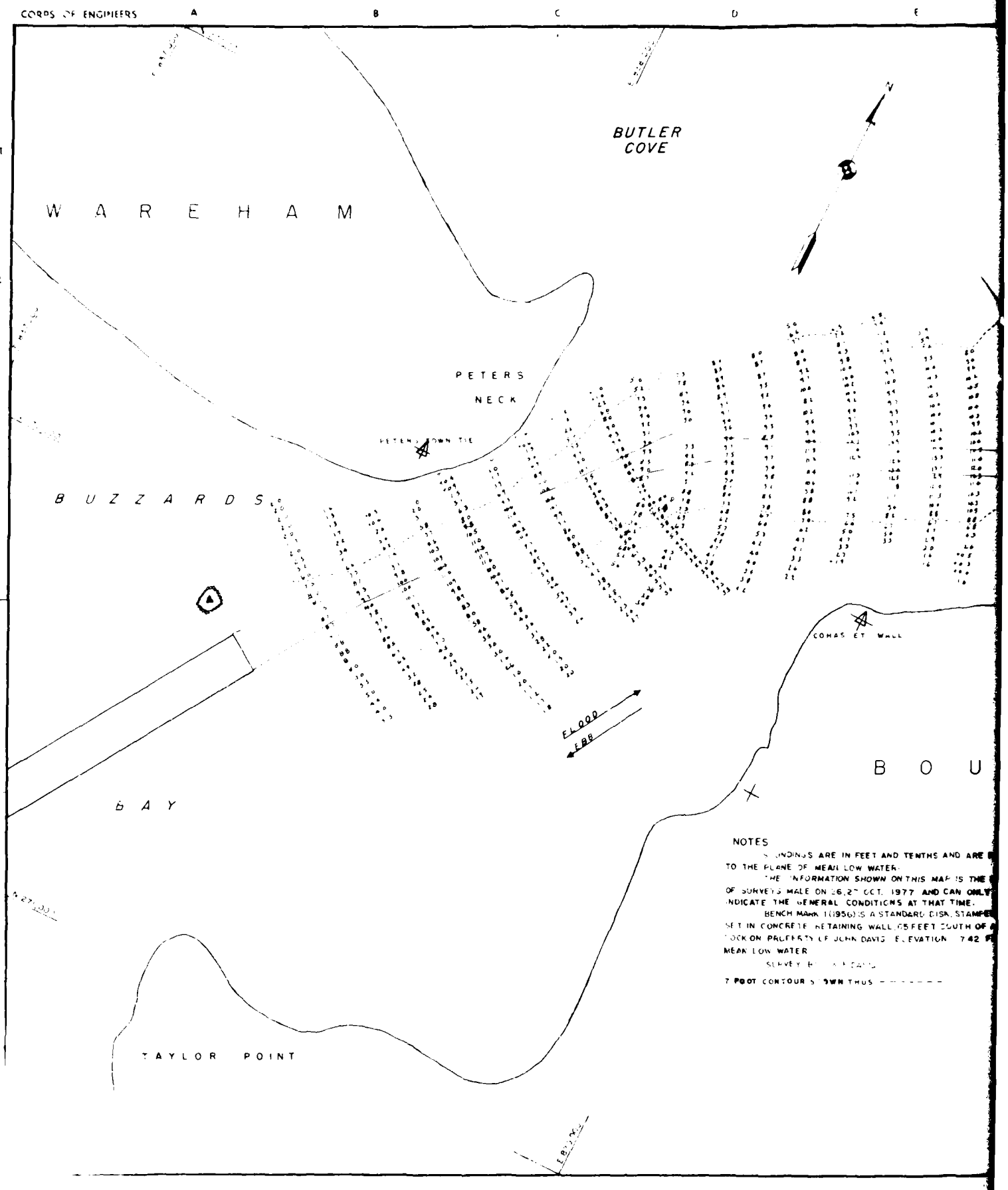
GRADATION CURVES

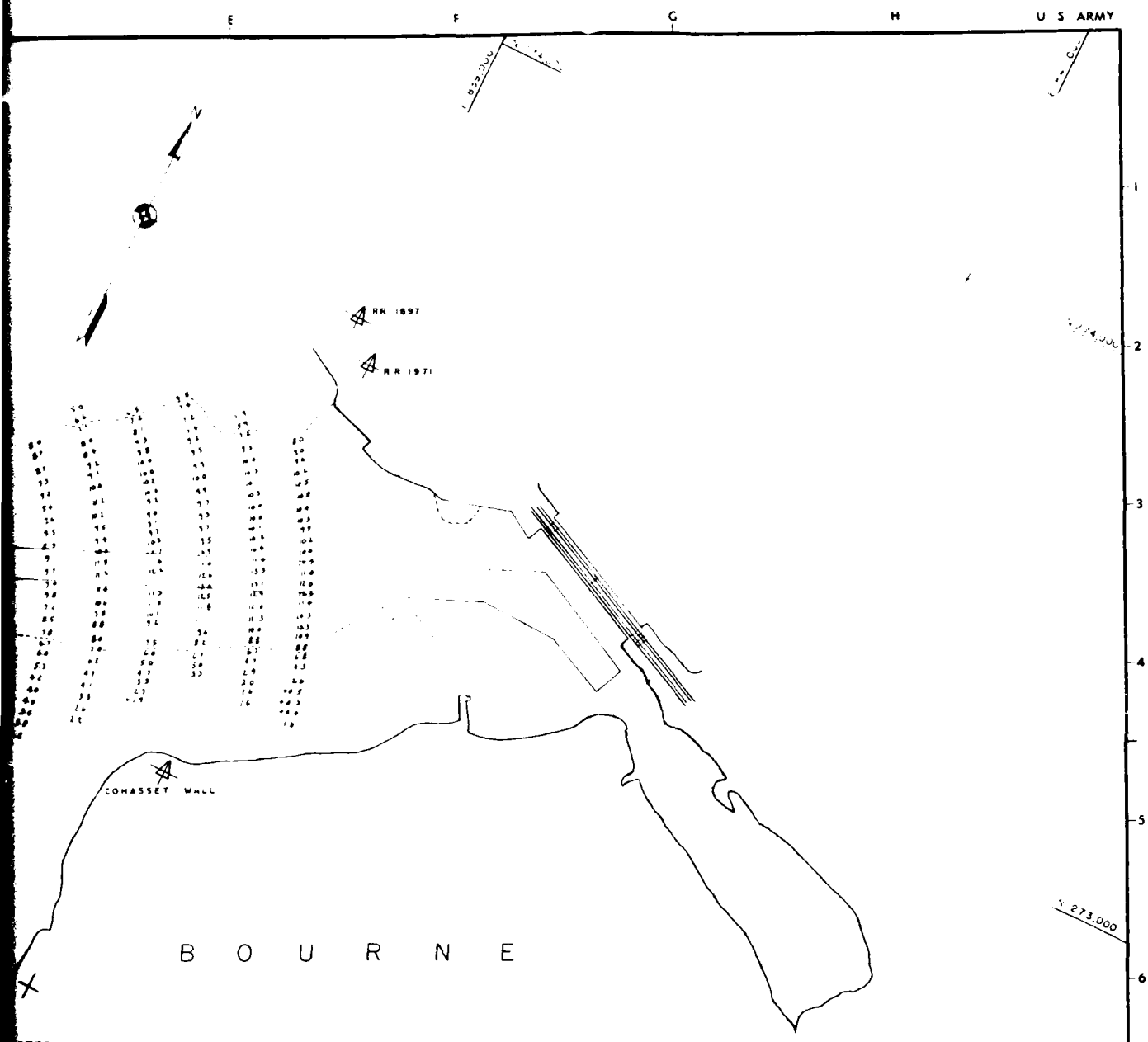
Project	Buttermilk Bay Channel
	Bourne, MA
Area	Sediment Sieve Analysis
Boring No.	GE-9/B-1
Date	November 1972

ENG FORM 1 MAY 63 2087

GPO 926-280

Figure 3-6E


CORPS OF ENGINEERS
A
B
C
D
E
1
2
3
4
5
6
7
BUTLER COVE
WAREHAM
PETERS NECK
PETERS TOWN TIE
BUZZARDS BAY
COMAS ET WALL
FLOOD
EBB
TAYLOR POINT
NOTES
SOUNDINGS ARE IN FEET AND TENTHS AND ARE
TO THE PLANE OF MEAN LOW WATER.
THE INFORMATION SHOWN ON THIS MAP IS THE
OF SURVEYS MADE ON 26,27 OCT. 1977 AND CAN ONLY
INDICATE THE GENERAL CONDITIONS AT THAT TIME.
BENCH MARK 1 (1956) IS A STANDARD DISK STAMPED
SET IN CONCRETE RETAINING WALL 65 FEET SOUTH OF
ROCK ON PROPERTY OF JOHN DAVIS ELEVATION 7.42
MEAN LOW WATER
SURVEY BY
7 FOOT CONTOUR SHOWN THUS



OTES

S INDINGS ARE IN FEET AND TENTHS AND ARE REFERRED
THE PLANE OF MEAN LOW WATER.
THE INFORMATION SHOWN ON THIS MAP IS THE RESULT
URVEYS MADE ON 26,27 OCT. 1977 AND CAN ONLY
ICATE THE GENERAL CONDITIONS AT THAT TIME.
BENCH MARK 1 (1956) IS A STANDARD DISK, STAMPED "BM 1 1956"
IN CONCRETE RETAINING WALL, 65 FEET SOUTH OF ABANDONED
ON PROPERTY OF JOHN DAVIS ELEVATION 7.42 FEET ABOVE
LOW WATER
SURVEY BY [illegible]
OT CONTOUR SHOWN THUS

GRAPHIC SCALES
25 0 25 50 75MI
100' 0 100' 200'

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

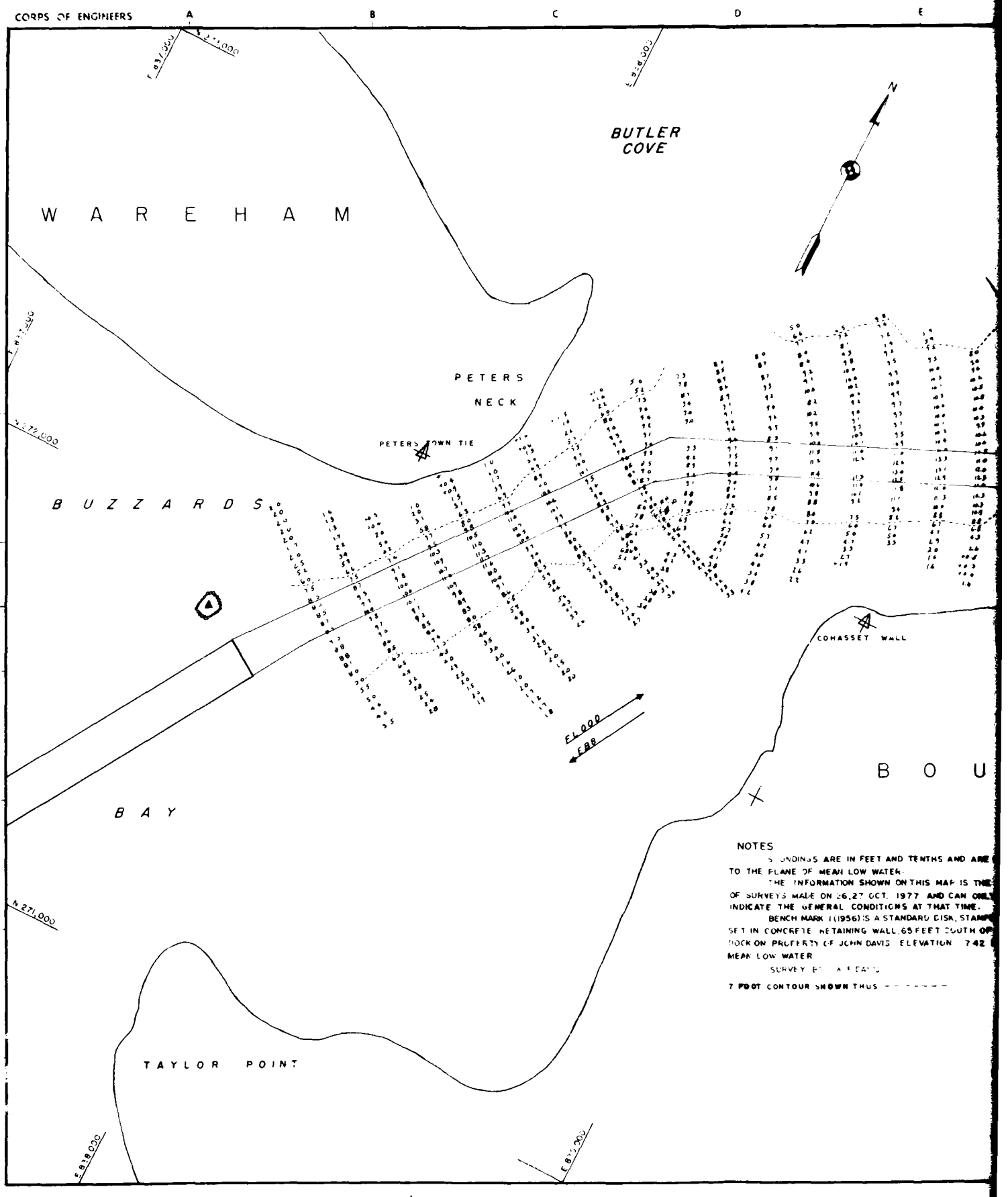
WATER RESOURCES IMPROVEMENT STUDY

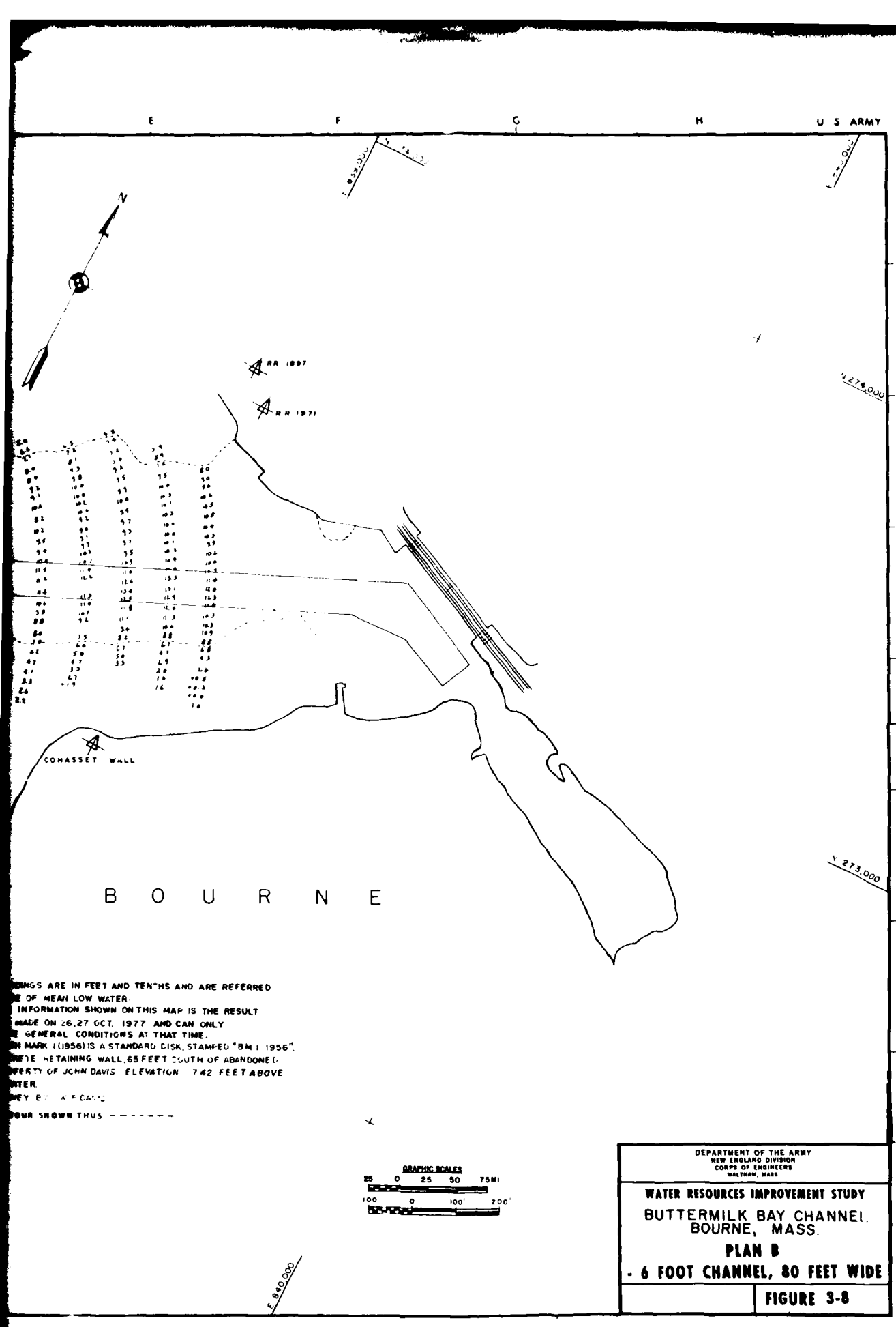
BUTTERMILK BAY CHANNEL
BOURNE, MASS.

PLAN A

-6 FOOT CHANNEL, 60 FEET WIDE

FIGURE 3-7


CORPS OF ENGINEERS
A
B
C
D
E
1
2
3
4
5
6
7
8
E 831,000
E 838,000
N 272,000
N 271,000
BUTLER COVE
W A R E H A M
PETERS NECK
PETERS TOWN TIE
B U Z Z A R D S
B A Y
COHASSET WALL
FLOOD
EBB
B O U
TAYLOR POINT
N
NOTES
SOUNDINGS ARE IN FEET AND TENTHS AND ARE
TO THE PLANE OF MEAN LOW WATER.
THE INFORMATION SHOWN ON THIS MAP IS THE
OF SURVEYS MADE ON 26,27 OCT. 1977 AND CAN ONL
INDICATE THE GENERAL CONDITIONS AT THAT TIME.
BENCH MARK 1 (1956) IS A STANDARD DISK, STAMP
SET IN CONCRETE RETAINING WALL, 65 FEET SOUTH OF
DOCK ON PROPERTY OF JOHN DAVIS. ELEVATION 7.42
MEAN LOW WATER
SURVEY BY A. F. EARLY
7 FOOT CONTOUR SHOWN THUS



INGS ARE IN FEET AND TENTHS AND ARE REFERRED
E OF MEAN LOW WATER.
INFORMATION SHOWN ON THIS MAP IS THE RESULT
MADE ON 26,27 OCT. 1977 AND CAN ONLY
E GENERAL CONDITIONS AT THAT TIME.
N MARK 1 (1956) IS A STANDARD DISK, STAMPED "BM 1 1956".
TE RETAINING WALL, 65 FEET SOUTH OF ABANDONED
PERTY OF JOHN DAVIS ELEVATION 7.42 FEET ABOVE
TER.
EY BY A.E.C.A.E.
OUR SHOWN THUS - - - - - -

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS

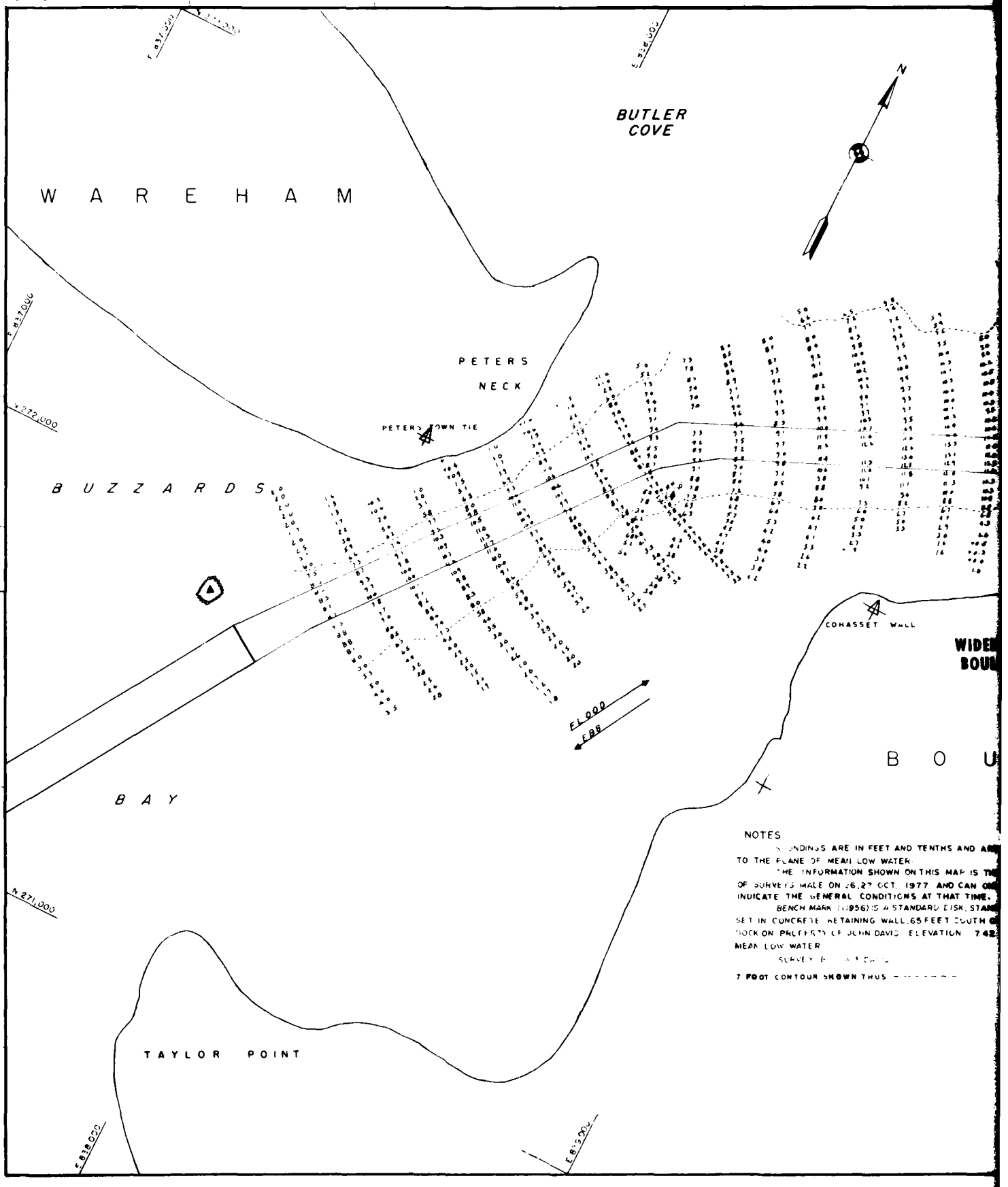
WATER RESOURCES IMPROVEMENT STUDY

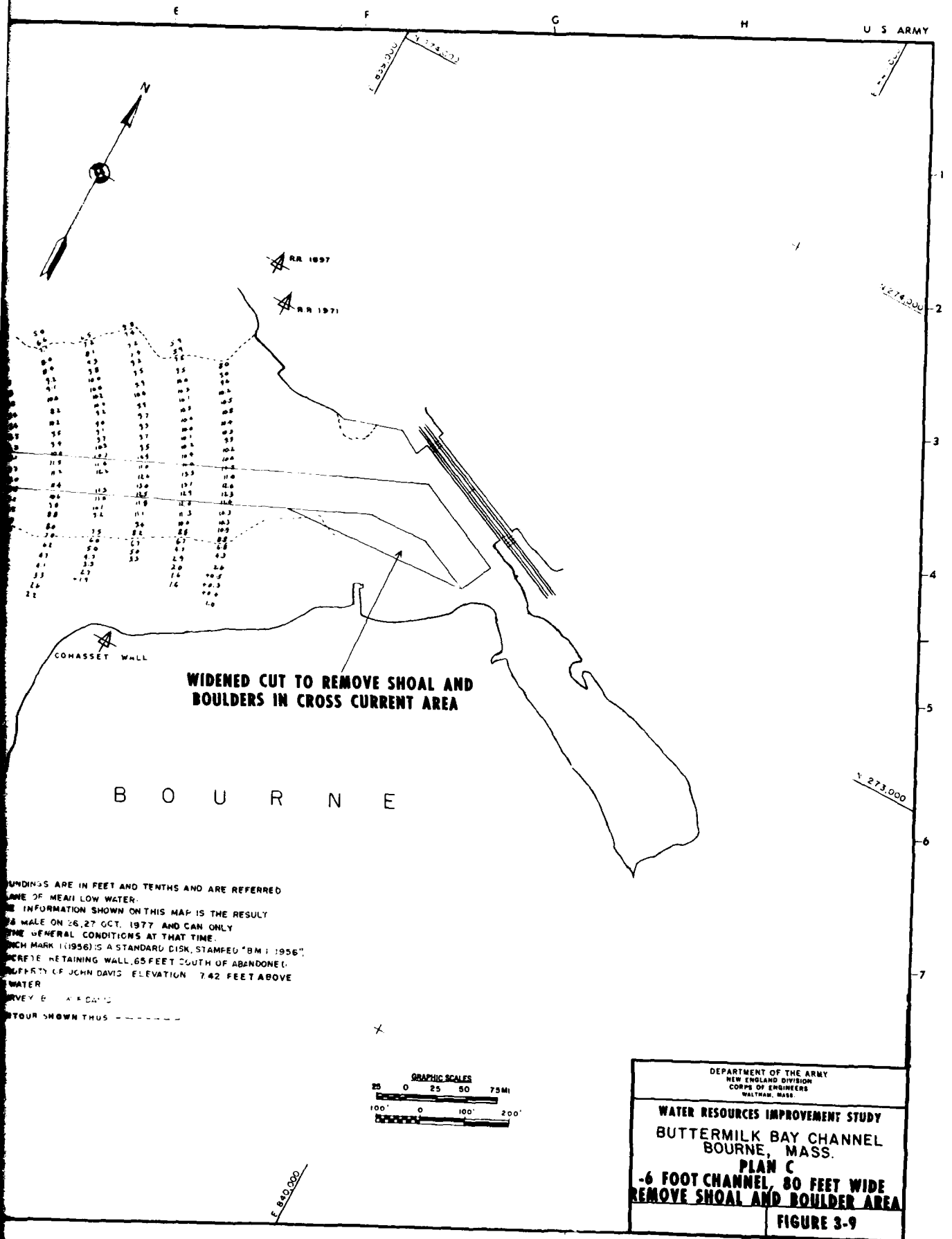
BUTTERMILK BAY CHANNEL
BOURNE, MASS.

PLAN B

- 6 FOOT CHANNEL, 80 FEET WIDE

FIGURE 3-8


CORPS OF ENGINEERS
A
B
C
D
E
1
2
3
4
5
6
7
8
BUTLER COVE
WAREHAM
PETERS NECK
PETERS TOWN TIE
BUZZARDS BAY
COHASSET WALL
TAYLOR POINT
E 837,000
E 838,000
N 272,000
N 271,000
EL 000
EBB
NOTES
SOUNDINGS ARE IN FEET AND TENTHS AND ARE
TO THE PLANE OF MEAN LOW WATER.
THE INFORMATION SHOWN ON THIS MAP IS THE
OF SURVEYS MADE ON 26,27 OCT. 1977 AND CAN ONL
INDICATE THE GENERAL CONDITIONS AT THAT TIME.
BENCH MARK (1956) IS A STANDARD DISK, STAMP
SET IN CONCRETE RETAINING WALL, 65 FEET SOUTH O
ROCK ON PROPERTY OF JOHN DAVIS ELEVATION 7.42
MEAN LOW WATER
7 FOOT CONTOUR SHOWN THUS



UNDINGS ARE IN FEET AND TENTHS AND ARE REFERRED
ANE OF MEAN LOW WATER.
E INFORMATION SHOWN ON THIS MAP IS THE RESULT
A MADE ON 26,27 OCT. 1977 AND CAN ONLY
THE GENERAL CONDITIONS AT THAT TIME.
NCH MARK (1956) IS A STANDARD DISK, STAMPED "BM 1 1956",
CRETE RETAINING WALL, 65 FEET SOUTH OF ABANDONED
OPERTY OF JOHN DAVIS ELEVATION 7.42 FEET ABOVE
WATER
RVEY B A.E. DAVIS
TOUR SHOWN THUS - - - - - - -

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

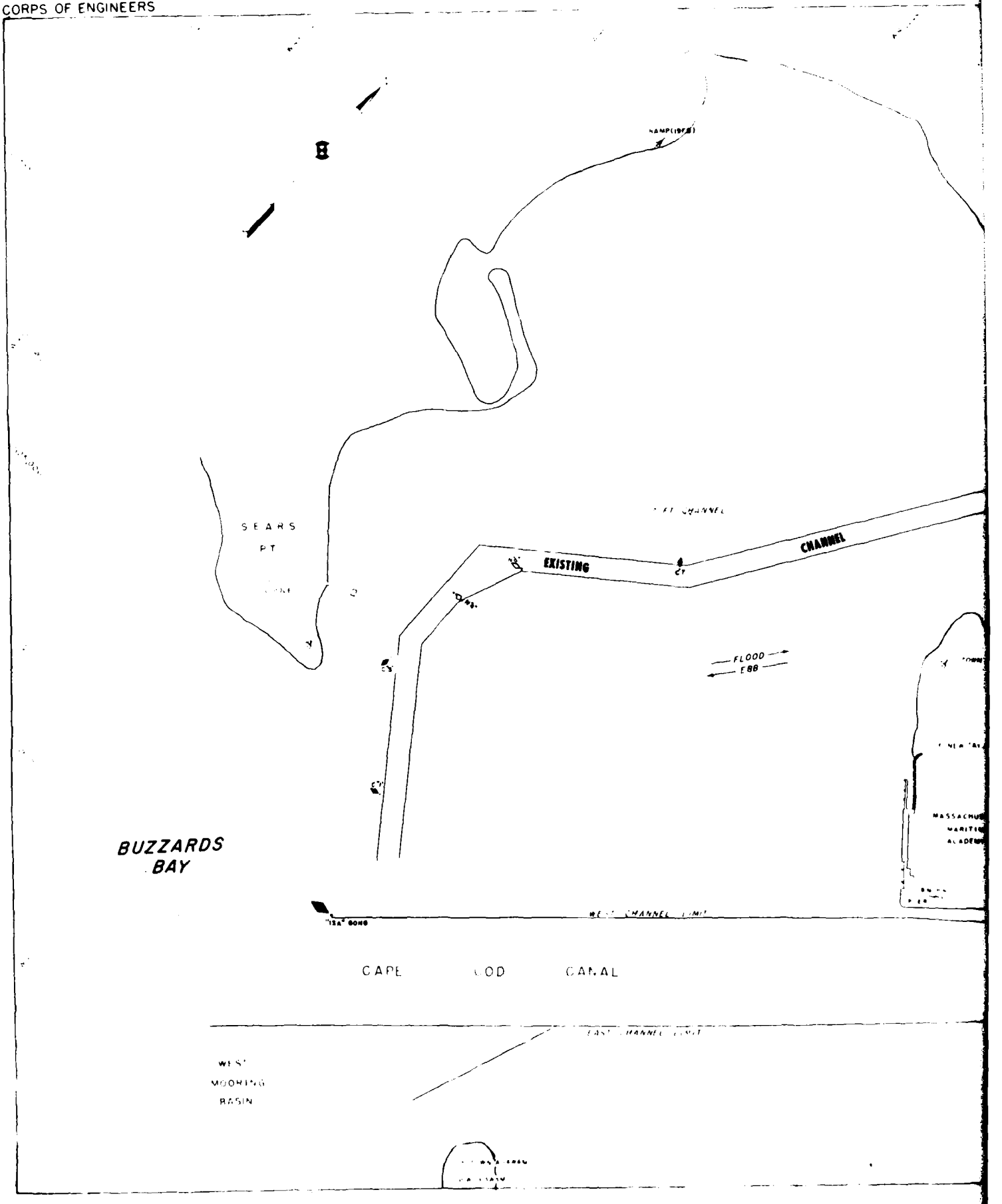
WATER RESOURCES IMPROVEMENT STUDY

BUTTERMILK BAY CHANNEL
BOURNE, MASS.

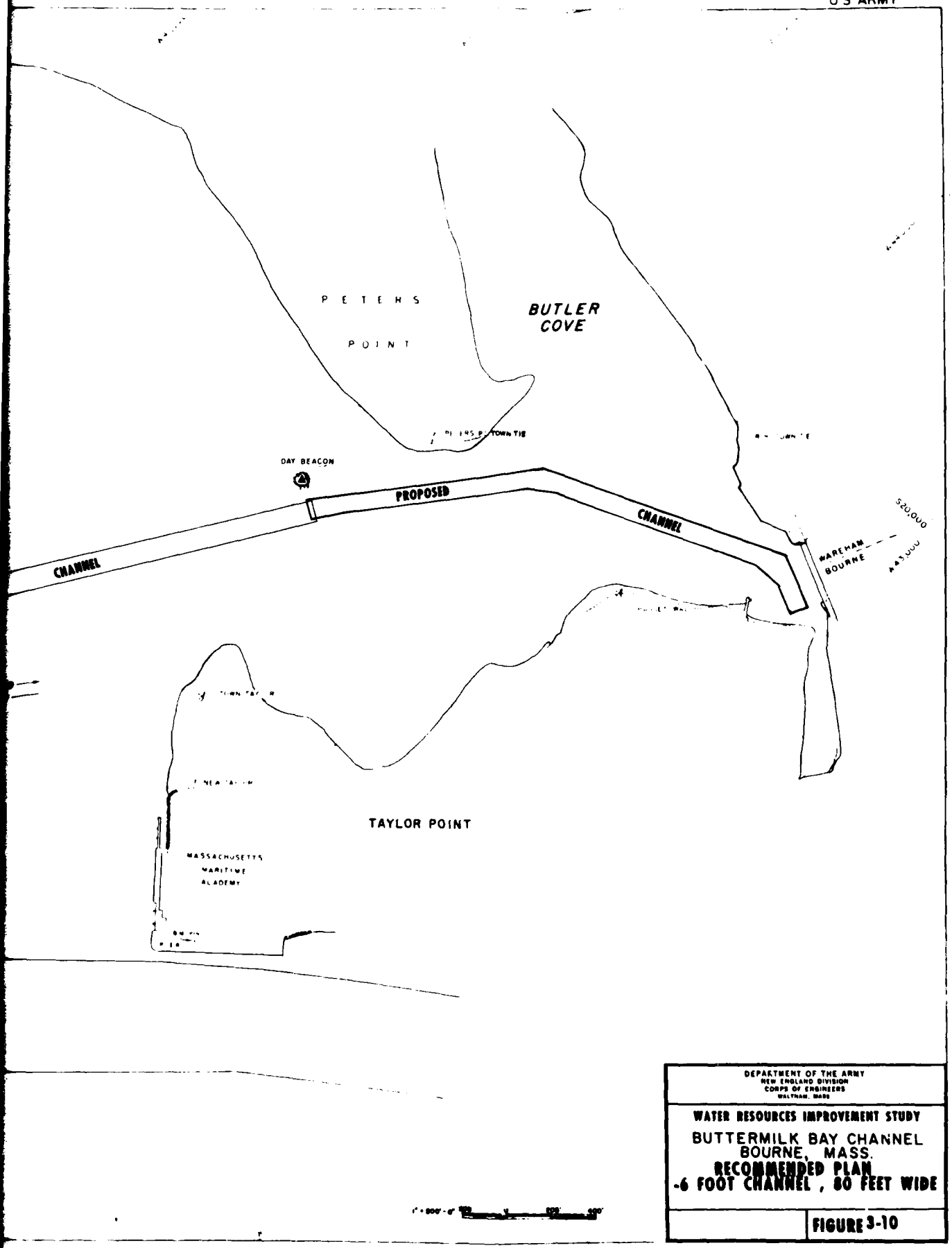
PLAN C
-6 FOOT CHANNEL, 80 FEET WIDE
REMOVE SHOAL AND BOULDER AREA

FIGURE 3-9

CORPS OF ENGINEERS



US ARMY



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS

WATER RESOURCES IMPROVEMENT STUDY

BUTTERMILK BAY CHANNEL
BOURNE, MASS.
RECOMMENDED PLAN
-6 FOOT CHANNEL , 80 FEET WIDE

FIGURE 3-10

WATER RESOURCES IMPROVEMENT STUDY

BUTTERMILK BAY CHANNEL

BOURNE, MASSACHUSETTS

SMALL NAVIGATION PROJECT
DETAILED PROJECT REPORT
AND ENVIRONMENTAL ASSESSMENT

APPENDIX 4

ECONOMIC AND SOCIAL ASSESSMENT

PREPARED BY:
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

APPENDIX 4

ECONOMIC AND SOCIAL ANALYSIS

TABLE OF CONTENTS

LIST OF TABLES

ECONOMIC AND SOCIAL ASSESSMENT

INTRODUCTION

This appendix contains four sections. The first, Section A, describes existing conditions and the local State marina project, and presents an assessment of the without Federal project condition. Section B presents an optimization of project dimensions and a description of each of the three alternative plans of improvement. Section C is the economic analysis of each of the alternative plans concluding with a comparison of the costs and benefits of each plan. The last section, D, presents an assessment of the existing social conditions in the project area and an evalution of the social impacts of the alternative plans.

SECTION A

EXISTING CONDITIONS

The study area centers around a small tidal basin in the town of Bourne on Taylor Point where State and local authorities plan to construct a municipal marina. The basin empties into the upper reaches of Buzzards Bay where the Cohasset Narrows connect that body of water with Buttermilk Bay to the north. The western end of the Cape Cod Canal is located about 1.3 miles south of the basin. Railroad and State highway bridges restrict access to Buttermilk Bay to small powerboats, numbering about 130, which are berthed at several small marinas on the bay. Existing facilities in Buttermilk Bay include three marinas totalling 100 slips, the town landing, ramp, anchorage with 20 moorings and 12 private docks and landings. There are currently no marinas or other facilities north of the canal capable of accommodating the many sailboats which transit the canal daily during the area's 180-day recreational boating season. The few privately operated marinas south of the canal on Cape Cod are presently filled to capacity during the season.

No boats currently make use of the basin since shoaling at the entrance and gradual filling of the basin interior with material derived from upland erosion have restricted depths to 0.0 to 3.0 feet at mean low water. The basin was previously dredged by a private individual many years ago, however, the narrow 20-foot wide entrance channel was never maintained and quickly shoaled. The basin was last used as a mooring area in 1971, 4 years after this study was begun as a general investigation.

Many small powerboats pass beneath the two bridges which span Cohasset Narrows. These boats are based in Buttermilk Bay and must pass through the Narrows and the upper reaches of Buzzards Bay to reach the Canal, the open waters of Buzzards Bay and Vineyard Sound. Swift tidal currents, up to 5 knots, exist in Cohasset Narrows, particularly in the area immediately below the bridges and opposite the entrance to the basin. This is a very hazardous area because of both the swift currents and the shoal which has built up across the basin entrance and extended westward into the Narrows from Taylor Point. This area, as shown in Figure 3-2, is also the site of a deposit of large erratic boulders left during the last ice age. Many boats encounter difficulty navigating this area and have run aground on the shoal or boulders.

The winds in the area are predominantly out of the southwest with an average speed of 12 knots. The area of Cohasset Narrows is sheltered and therefore adverse effects on vessel maneuverability from the wind are not expected. For wind speeds over 15 knots, vessels having their manueverability adversely affected would not be expected to leave the marina. Waves will not be a problem because the area is sheltered. The average wind waves in the channel will be less than 1 foot.

Currents in Cohasset Narrows can be rapid at times. During periods of maximum flood and ebb the current can be up to 5 knots in places. In terms of vessel manueverability, approximately 20 percent of the fleet, those sail vessels with small auxillary power, would sustain minor delays running against a maximum flood or ebb tide.

The Local Marina Project

The Massachusetts Department of Environmental Quality Engineering other State agencies and the town of Bourne have been investigating the feasibility of constructing a municipal marina in the basin at Taylor Point for the past 15 years. The project has gone through various planning stages and changes and is currently undergoing the preparation of detailed plans and specifications by the Massachusetts Division of Waterways. Funding for the project has been secured from local sources, a municipal bond issue, State funds, and a low interest loan from the Farmers Home Loan Association.

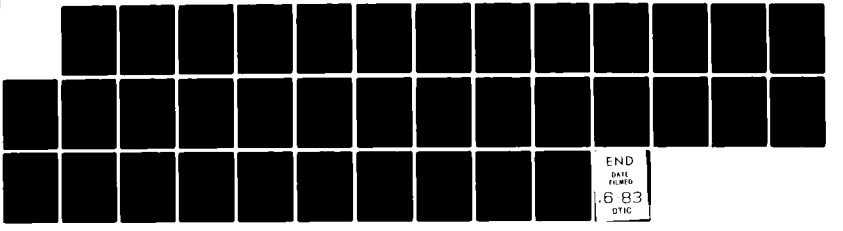
The municipal marina is expected to address area needs for increased recreational berthing space. There is a general lack of space for vessels of all classes and sizes in the upper Buzzards Bay area. This shortage is particularly acute for sailboats whose larger drafts require deeper berthing areas and channels. Many cruising sailboats transit the Cape Cod Canal daily and must wait for the ebb tide to pass from Buzzards Bay in the west to Cape Cod Bay in the east. Currently, many of these boats must anchor in the western mooring basin south of the canal channel along with large commerical vessels while waiting up to 12 hours and sometimes overnight for the proper tide. The marina and its shore facilities are expected to attract as many as 35 transient boats on an average day. Accordingly, about 25 percent or 40 of the marina's 150 berths would be reserved for transient vessels. The remaining 110 berths would be filled by the permanent seasonal local fleet, which would be composed of both power and sailboats of all classes and sizes. Based on waiting lists for berthing space at local marinas and registration records in the town of Bourne, it is estimated that 50 of the slips reserved for the local permanent fleet would be filled in the first year of the marina's operation. The remaining 60 slips would be filled over a 10-year growth period. The anticipated fleet would be composed of about 70 percent powerboats and 30 percent sailboats. All the sailboats would have auxillary engines.

The Without Federal Project Condition

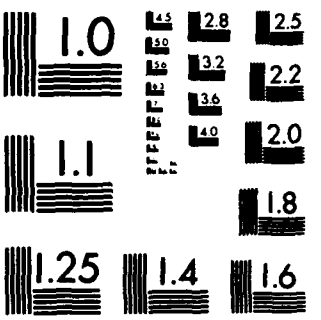
Local marina plans, as detailed in Appendix 1, call for dredging of a 6-foot-deep by 80-foot-wide entrance channel extending about 40 feet west of the shoreline of Taylor Point. This outer limit of dredging was necessitated by the limits on local funding. Between this area and the naturally deep water in Cohasset Narrows a shoal exists which extends north and westward from Taylor Point across the basin entrance. This area also contains the deposit of large erratic boulders. Without the dredging

AD-A128 128 WATER RESOURCES IMPROVEMENT STUDY BUTTERMILK BAY CHANNEL BOURNE MASSACHUS..(U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV DEC 82 3/3

UNCLASSIFIED F/G 13/3 NL



END
DATE FILMED
6 83
DTIC



of the proposed Federal channel extension, this shoal area would restrict navigation into and out of the marina basin. Vessels would be forced to wait for higher stages of the tide in order to pass across the shoal.

This shoal area has depths across the 80-foot-wide local dredging limit ranging between 1.0 and 4.2 feet at mlw. The 4.2-foot-deep area is the remains of an old unmaintained private channel. This area has a width of about 20 feet. The largest boats expected to use the marina would have drafts of about 6 feet. These boats would only be able to pass through this area unhindered for one hour on either side of high tide during calm seas. Smaller boats would experience fewer delays. Boats which draw 4 feet or less would only be delayed by the width of this old channel area and wave conditions. All boats would be forced to use extra caution and take greater risk in navigating from the basin to the natural channel in the Narrows.

The high tidal current velocities would pose a hazard to boats transiting the marina entrance. These boats would experience greater problems with grounding on the shoal and boulders than would those boats presently passing through the Narrows to and from Buttermilk Bay. With a tide range of only 4 feet at maximum, deeper draft sailboats which draw up to 6 feet would encounter difficulty crossing the area in seas of one foot or greater even at high tide.

Under the local and State plan, sewage effluent from the marina pump-out station would be piped to the treatment plant at the Massachusetts Maritime Academy. The academy is located one mile south of the basin on the end of Taylor Point along the Cape Cod Canal. In partial return for this service, smaller academy vessels would find refuge berthing in the marina during storms. Academy boats currently suffer storm damage since their berths on the canal are exposed to waves from most directions. The academy's smaller vessels draw about 6 feet and would not be able to gain entrance to the marina during lower stages of the tide or storm conditions without risking grounding on the shoal and boulders.

The detailed plans for the local marina are presented in Appendix 1 and include projections of the anticipated fleet's composition by size and class of vessel. A tabular presentation of fleet composition is also provided in Section B of this appendix.

SECTION B

OPTIMIZATION OF PROJECT DIMENSIONS

Development of detailed plans for any proposed Federal channel in Buttermilk Bay must take into account the type and size of the vessels expected to use recreational facilities in the area and natural conditions such as wind and currents which affect the ease of navigation. This section will discuss the economic effects of various width and depth alternatives for the proposed access channel. A breakdown of the anticipated recreational fleet by class and size of vessel is given on Table 4-1. This table also provides a breakdown of the fleet into transients and immediate and future permanent vessels. Boat dimensions of length, draft, and beam are considered averages for the types of vessels of each class currently found in popular use along the East Coast.

The largest vessels expected to make regular use of the proposed marina would be cruising sailboats, mostly transients, in the 31-40 foot overall length range. These vessels typically would have drafts of about 6 feet and a beam of 11.5 feet. While boats with larger dimensions may make use of the channel and marina from time to time, this class and size are expected to use the proposed project on a daily basis and have therefore been selected as the design vessel for purposes of optimizing project dimensions.

Boats of all types transiting the Cape Cod Canal are required to motor through, not sail. This restriction would apply to boats using the marina, whenever possible. Because of this and the strong tidal currents in Cohasset Narrows it is expected that most boats, especially those in larger classes, would motor through the Buttermilk Bay Channel. Because of channel restrictions and crowding it is expected that vessel speeds would not exceed 4 to 6 knots, negating squat as a factor in depth optimization. Since the relatively protected nature of the bay limits seas to less than one foot, except in extreme storm conditions, a channel depth of 6 feet with a one foot overdepth would be sufficient to allow passage of these larger sailboats except during extreme low tides.

The width of the channel is dependent upon design vessel beam and the number of traffic lanes desired. A channel which would safely allow for two-way traffic of boats with a maximum beam of 11.5 feet would be 60 feet wide, or five times the vessel beam. Since large numbers of craft would leave the Taylor Point Marina at the same time, in order to make the changing tide at the canal, more than two traffic lanes may be desired. A channel allowing for one inbound and two outbound lanes and safe distances between passing vessels would be seven times the design beam or 80 feet wide. Both the 60-foot two lane and 80-foot three lane channel options will be studied in detail.

TABLE 4-1
BUTTERMILK BAY CHANNEL
TAYLOR POINT MARINA

ANTICIPATED RECREATIONAL FLEET

TYPE OF CRAFT	LENGTH	BEAM	DRAFT	ANTICIPATED RECREATIONAL FLEET NUMBER OF BOATS PERMANENT FLEET IMMEDIATE ADDITIONS	PERMANENT FLEET FUTURE ADDITIONS 10-YEAR GROWTH	TRANSIENT FLEET CANAL BOUND	TRANSIENT FLEET NON-CANAL BOUND
OUTBOARD	15-20	4	1.5	8	9	4	2
	21&UP	5	2	1	-		
STERNDRIVE	15-20	4	1.5	3	3	4	1
	21-25	5	2	4	5	6	2
INBOARDS	15-20	7	2.5	1	2		
	21-30	9	3	14	14	3	2
	31-40	11	3.5	3	4	2	1
CRUISING	15-20	7.5	4.5	1	3		
SAILBOATS	21-30	9.5	5	3	6	4	2
	31-40	11.5	6	1	1	2	
DAYSAILER	8-15	4.5	1.5	10	12		
	16-20	5.5	3	1	1	—	—
TOTAL				50	60	25	10

TOTAL 145 BOATS — Power 98 (@70%) - Sail 47 (@30%)

The existing shoal and boulder area would be partially removed by any of the proposed channel options. This would result in a decrease in navigation hazards and damages to the small powerboats that travel to and from Buttermilk Bay under the bridges and often ground on the shoal because of cross currents created by tidal flow. Vessels transiting the basin entrance would still experience grounding problems since they would travel at a greater angle to the currents. In order to significantly reduce the risk of grounding to vessels using the proposed public marina, the channel width across the shoal area and through the bend into the Narrows must be widened. This would allow both motoring vessels and daysailers without motors to transit the area with a greatly reduced risk of grounding on the shoal or the boulders. A widened cut across the bend and upper channel would extend the channel limit by an additional 60 feet south in order to provide for reasonably safe navigation conditions by reducing the risk of grounding. This widened cut feature has been incorporated into Plan C.

DESCRIPTION OF ALTERNATIVE PLANS

Based on the rationale for project dimensions discussed previously, three alternative plans were developed for detailed analysis. All three plans would provide for a channel extending approximately 2,500 feet northeast from the upstream limit of the existing Federal project to the vicinity of the bridges over Cohasset Narrows and the entrance to the basin and site of the proposed public marina. Based on the class of recreational vessels expected to use the marina and those now based in Buttermilk Bay a channel depth of -6 feet mlw with a one-foot overdepth allowance was determined to be sufficient and is the depth included in each of the three plans. The alignment of the channel is the same for each plan and was selected to conform with naturally deep water so as to minimize improvement dredging and future maintenance costs. The differences between the three plans relate solely to width of the channel and the width of the widened cut across the bend in the upstream end of the channel at the bridges and basin entrance.

An engineering analysis of each of the alternative plans is presented in Appendix 3. It describes the engineering investigations and computations which yielded the quantities of dredged materials, the costs for each plan, and describes the proposed dredging and disposal operations.

Plan A would provide for a channel 60 feet wide and 6 feet deep at mlw. This channel width would allow for safe two-way navigation through most of the channel and would involve the minimum amount of dredging. With this plan, vessels transiting the basin entrance would still face some risk of being driven aground on the shoal and boulders south of the channel by the strong tidal currents which flow through Cohasset Narrows.

Plan B would provide for a channel 80 feet wide and 6 feet deep at mlw. This width would allow for three traffic lanes in order to reduce congestion of transient vessels outbound from the marina at the same time

in order to reach the Cape Cod Canal on a favorable tide. This second outbound traffic lane would allow passing room for outbound vessels and reduce the time involved for boats to travel the 1.3 miles from the marina to the canal.

Plan C would provide the same 80-foot-wide channel as Plan B. This plan would also provide a wider cut across the bend at the upstream end of the channel at the bridges and basin entrance. This wider cut would compensate for the strong tidal currents in the area through removal of a greater portion of the shoal and boulder area, thereby reducing the risk of grounding for vessels transiting the basin entrance.

SECTION C

ECONOMIC ANALYSIS

The proposed Federal channel would significantly reduce delays experienced by recreational boaters attempting to travel from their marina berths to the open water recreational sailing areas of Buzzards Bay, Cape Cod Bay and more distant areas along the southern New England coast. Without the Federal project, delays caused by tidal restrictions and channel congestion would be experienced by recreational boaters. The strong tidal currents would also pose a hazard to boaters using both the proposed marina and Buttermilk Bay who risk being driven aground on the shoal and boulders south of the basin entrance. The varying delays experienced by the different classes and sizes of boats using the marina represent a loss of leisure time to the operators and passengers of the recreational craft. Each of the alternative plans would save a varying amount of leisure time for the users of the different types of transient and permanent vessels, and would also result in a reduction in damages caused by unsafe conditions. This time savings would be a function of vessel length, draft, and beam for each boat class and dimensions of the three alternative improvements.

The local public marina project would have a direct economic effect on the economy of the study area. Development of the marina would attract greater numbers of people to the area who would provide an increased income to the existing commercial infrastructure of Buzzards Bay Village. The town of Bourne would receive increased income from tax revenues levied on the permanent fleet and fees collected for slips, moorings, parking, services and ramp usage. The fuel service franchise would also provide increased employment and expand the area's commercial base. These benefits to the area's economy cannot be assessed or quantified with precision and are not related directly to the proposed Federal channel extension but rather to the locally constructed marina.

Methodology

Recreational benefits are quantified in compliance with the NED Manual of Procedures, Subpart-K Recreation. The unit day value method has been selected for the analysis. This method relies on informed judgment to approximate the average willingness to pay of the users of recreational resources. By applying a unit day value to estimated project use, an approximation is obtained that is used as an estimate of project recreation benefits.

The first step in the unit day value methodology is to assign points to various recreation characteristics. These points may be assigned for either general or specialized recreational activities. Because of the outstanding scenic value of the Buttermilk Bay area, the desirability of the Cape Cod area in general for vacation and recreational purposes, and the high degree of skill and appreciation of boating by the anticipated

project users, the specialized category has been chosen for the analysis. Points have been assigned as shown in Table 4-2. These points are converted to dollar values as displayed in Table 4-3. Buttermilk Bay's 60 points converts to an equivalent $10.00 unit day value.

The future permanent fleet is expected to be the result of a 10-year period of straight line growth. Accordingly, an average annual equivalency factor of 0.72166 will be applied to all annual benefits accrued by the future permanent fleet.

TIDAL DELAY TIME SAVINGS

Boats which are expected to use the marina would experience conditions where the lower stages of the tide coincide with departure or arrival at the marina. Based on an average 6-hour boating day with boats leaving between 0800 and 1000 hours and returning between 1400 and 1600 hours, this condition would occur no less than one-sixth of the time or 10 tidal delays in any given month.

The average tidal delay would occur when exact low tide coincides with a vessel's arrival or departure at the marina. The maximum delay would occur when arrival or departure coincides with the ebb and the vessel must wait through both the falling and rising of the tide. This occurs when the tide reaches the vessel's minimum allowable depth limit in the channel, taking into account such factors as safe clearance under the keel and wave heights. For Buttermilk Bay these factors equate to an additional 1.5 feet over the varying drafts of each type of vessel. The largest draft sailboats expected to use the marina would be forced to move with only one foot of clearance under the keel at high tide. The average length of delay would vary with each type and size of craft according to draft. Based on the existing -3 foot mlw channel depth conditions and a 4-foot average tide, the expected delays for types of craft are presented in Table 4-4. This delay would be the same whether the vessel is inbound to the marina or outbound.

The recreational boating season at Buttermilk Bay lasts about 180 days between mid-April and mid-October. Based on observed practices and traffic at other southern Massachusetts marinas, several assumptions have been made. Each boat would only be used an average of one-third of the time or 60 days. Many boats with a longer range, particularly the cruising sailboats, would take extended cruises and be absent from the marina for periods of 2 to 14 days. The length of cruise and number of extended trips would vary with the size and range of the vessel. Based on previous Corps recreational navigation studies, the average number and lengths of cruises for each type of vessel have been compiled. This data has been used to determine the percentage of the season that the vessels are on cruise and not using the marina. The data for the number of round trips to and from the marina for each type and size of vessel are presented on Table 4-5.

TABLE 4-2

BUTTERMILK BAY CHANNEL
RECREATION POINT VALUE DETERMINATION

SOURCE: Federal Register / Vol. 44, No. 242 / Friday, December 14, 1979 / Rules and Regulations

Table K-3 3 - Guidelines for Assigning Points for Specialized Recreation

Criteria	Judgment Factors				
a) Recreation Experience 8/	Heavy use or frequent crowding or other interference with use	Moderate use, other users evident and likely to interfere with use	Moderate use, some evidence of other users and occasional interference with use due to crowding	Usually little evidence of other users, rarely if ever crowded	Very low evidence of other users, never crowded
Total Points: 30 Point Value: 14	0-4	5-10	11-16	17-23	24-30
b) Availability of Opportunity 7/	Several within 1 hr. travel time; a few within 30 min. travel time	Several within 1 hr. travel time; none within 30 min. travel time	One or two within 1 hr. travel time; none within 45 min. travel time	None within 1 hr. travel time	None within 2 hr. travel time
Total Points: 18 Point Value: 4	0-3	4-6	7-10	11-14	15-18
c) Carrying Capacity 1/	Minimum facility development for public health and safety	Basic facilities to conduct activity(ies)	Adequate facilities to conduct without deterioration of the resource of activity experience	Optimum facilities to conduct activity at site potential	Ultimate facilities to achieve intent of selected alternative
Total Points: 14 Point Value: 12	0-2	3-5	6-8	9-11	12-14
d) Accessibility	Limited access by any means to site or within site	Fair access, poor quality roads to site; limited access within site	Fair access, fair road to site, fair access, good roads within site	Good access, good roads to site; fair access, good roads within site	Good access, high standard road to site; good access within site
Total Points: 18 Point Value: 15	0-3	4-6	7-10	11-14	15-18
e) Environmental Quality	Low esthetic factors 5/ exist that significantly lower quality 6/	Average esthetic quality; factors exist that lower quality to minor degree	Above average esthetic quality; any limiting factors can be reasonably rectified	High esthetic quality; no factors exist that lower quality	Outstanding esthetic quality; no factors exist that lower quality
Total Points: 20 Point Value: 15	0-2	3-6	7-10	11-15	16-20

1/ Value should be adjusted for overuse.
2/ Value for water-oriented activities should be adjusted if significant seasonal water level changes occur.
3/ General activities include those that are common to the region and that are usually of normal quality. These include picnicking, camping, hiking, riding, cycling, and fishing and hunting of normal quality.
4/ High quality value activities include those that are not common to the region and/or Nation and that are usually of high quality.
5/ Major esthetic qualities to be considered include geology and topography, water, and vegetation.
6/ Factors to be considerd in lowering quality include air and water pollution, pests, poor climate, and unsightly adjacent areas.
7/ Likelihood of success at fishing and hunting.
8/ Intensity of use for activity.

TOTAL: 60 points

TABLE 4-3

BUTTERMILK BAY CHANNEL
CONVERSION OF POINTS TO DOLLAR VALUES

Revised Table K-3-1 (FY 1982)

Activity Categories	POINT VALUES										
	0	10	20	30	40	50	60	70	80	90	100
General Recreation (Points from Table K-3 2)	1.50	1.80	2.00	2.30	2.80	3.20	3.50	3.70	4.00	4.30	4.50
General Fishing & Hunting (Points from Table K-3 2)	2.20	2.40	2.60	2.90	3.20	3.50	3.90	4.00	4.30	4.40	4.50
Specialized Fishing & Hunting (Points from Table K-3 3)	10.50	10.80	11.00	11.30	11.60	12.70	13.80	14.70	15.80	16.90	17.90
Specialized Recreation Other than Fishing & Hunting (Points from Table K-3 3)	6.10	6.50	7.00	7.50	8.00	9.00	10.00	12.00	14.00	16.00	17.90

Note: See 44 FR 72963-64 (published December 14, 1979) for Table K-3-2 and K-3-3.

TABLE 4-4

BUTTERMILK BAY CHANNEL

EXPECTED TIDAL DELAYS BY VESSEL TYPE AND SIZE

TYPE OF CRAFT	LENGTH	DRAFT	DRAFT PLUS 1.5 FT CLEARANCE	AVERAGE TIDAL DELAY (MIN) W/EXISTING CONDITION	AVERAGE TIDAL DELAY (MIN) W/SIX FOOT CHANNEL PLUS 1 FOOT OVERDEPTH	TIME SAVED FOR TRIP AT LOW TIDE WITH 6 FT CHANNEL
OUTBOARD	15-20	1.5	3	0	0	0
	21&UP	2	3.5	40	0	40
STERNDRIVE	15-20	1.5	3	0	0	0
	21-25	2	3.5	40	0	40
INBOARDS	15-20	2.5	4	60	0	60
	21-30	3	4.5	80	0	80
	31-40	4	5.5	100	0	100
CRUISING SAILBOATS	15-20	4	5.5	100	0	100
	21-30	5	6.5	140	0	140
	31-40	6	7.5	180	40	140
				AND LOSS OF 1/2 FT CLEARANCE		
DAYSAILERS	8-15	2	3.5	0	0	0
	16-20	3	4.5	80	0	80

TABLE 4-5

BUTTERMILK BAY CHANNEL
PERMANENT FLEET

EXPECTED BOAT TRIPS PER VESSEL TYPE

TYPE OF CRAFT	LENGTH	AVERAGE TOTAL DAYS USE	TIME ON CRUISE		AVE LENGTH OF CRUISE (DAYS)	# OF EXTENDED CRUISES	# OF ONE DAY CRUISES	TOTAL BOAT TRIPS	PERMANENT FLEET			
			% OF SEASON	# OF DAYS					IMMEDIATE		FUTURE	
									# OF BOATS	TOTAL TRIPS	# OF BOATS	TOTAL TRIPS
OUTBOARD	15-20	60					60	60	8	480	9	540
	21&UP	60					60	60	1	60	-	-
STERNDRIVE	15-20	60					60	60	3	180	3	180
	21-25	60	3	5	4	1	55	56	4	224	5	280
INBOARDS	15-20	60	2	4	2	2	56	58	1	58	2	116
	21-30	60	10	18	9	2	42	44	14	616	14	616
	31-40	60	15	27	10	2	33	35	3	105	4	140
CRUISING SAILBOATS	15-20	60	2	4	4	1	56	57	1	57	3	171
	21-30	60	5	9	8	1	51	52	3	156	6	312
	31-40	60	20	36	12	3	24	27	1	27	1	27
DAYSAILERS	8-15	60					60	60	10	600	12	720
	16-20	60	2	4	2	2	56	58	1	58	1	58
TOTAL									50	2,621	60	3,160

By comparing the length and frequency of tidal delays and time saved by the proposed 6-foot channel with the number of boat trips, it is possible to determine the number of hours a single boat of each type would be delayed and save per year. Each boat would experience one delay for every six boat trips either inbound or outbound. This tidal delay time saved per individual permanent boat of each class is shown in Table 4-6.

Of the 35 transient boats which berth at the marina, on an average day, 25 would be outbound for the canal heading east. All these boats would leave the marina at high tide in order to catch the most favorable eastward ebb flow in the canal. These boats would therefore experience no outbound tidal delays. These boats would, however, be subject to inbound tidal delays at a rate of one for each 12 trips since delays are only possible inbound. The remaining 10 boats would not be canal-bound and would stay at the marina for an average of 2 days. These noncanal bound transients would therefore make five round trip equivalents per day, subject to tidal delays one-sixth of the time. Table 4-7 summarizes the tidal annual delay time per individual transient boat for each class included in the expected transient fleets, and total dollar benefit both canal and noncanal bound craft. A 6-foot channel depth would save about 330 hours per year for canal-bound transients attempting to enter the marina and 135 hours per year for noncanal bound transients.

REDUCED CHANNEL CONGESTION - TIME SAVINGS

All three plans entail dredging and maintaining a channel with a depth of -6 feet mlw. The differences between the plans involve project width. The existing natural conditions with a 20-foot wide channel allow for only one-way navigation.

Under the existing conditions a single vessel would be forced to use extreme caution crossing the shoal area, even with optimum conditions at high tide with sufficient depth. With existing conditions a single boat would take 30 minutes to reach the downstream end of the existing Federal channel in Buzzards Bay. As previously stated, one-third of the permanent fleet or 37 boats as well as 5 noncanal bound transients could be expected to make a trip on any given day during the boating season. Under existing conditions these 42 boats leaving at the same time would form a line 5,060 feet long, assuming an average boat length of 25 feet with a safe clearance of 100 feet between boats.

TABLE 4-6

BUTTERMILK BAY CHANNEL
REDUCED TIDAL DELAYS - PERMANENT FLEET

BENEFITS PER BOAT

TYPE OF CRAFT	LENGTH	TRIPS PER YEAR (TABLE 4-5)	DELAYS PER YEAR TRIPS ÷ 6	MINUTES SAVED PER BOAT PER DELAY (TABLE 4-4)	DELAY TIME SAVED PER BOAT ANNUALLY		# OF PEOPLE PER BOAT*	DOLLAR BENEFIT PER BOAT		TOTAL BENEFITS			
					MINUTES SAVED	HOURS SAVED		LEISURE TIME VALUE $ (TABLE 4-3)**	$ BENEFIT PER BOAT	EXISTING BOATS # OF BOATS	EXISTING BOATS TOTAL $ BENEFIT	FUTURE BOATS # OF BOATS	FUTURE BOATS TOTAL $ BENEFIT
OUTBOARD	15-20	60	10	0	0	0	2	$3.33	$ 0	8	$ 0	9	$ 0
	21&UP	60	10	40	400	7	3	5.00	35.00	1	35	-	-
STERNDRIVE	15-20	60	10	0	0	0	2	3.33	0	3	0	3	0
	21-25	56	9	40	360	6	4	6.67	40.02	4	160	5	200
INBOARDS	15-20	58	10	60	600	10	2	3.33	33.30	1	33	2	67
	21-30	44	7	80	560	9	4	6.67	60.03	14	840	14	840
	31-40	35	6	100	600	10	5	8.33	83.30	3	250	4	333
CRUISING SAILBOATS	15-20	57	9	100	900	15	2	3.33	49.95	1	50	3	150
	21-30	52	9	140	1,260	21	3	5.00	105.00	3	315	6	630
	31-40	27	4	140	560	9	4	6.67	60.03	1	60	1	60
DAYSAILERS	8-15	60	10	0	0	0	1	1.67	0	10	0	12	0
	16-20	58	10	80	800	13	2	3.33	43.29	1	43	1	43
										50	$1,786	60	$2,323
										SAY	$1,800		

EXISTING PERMANENT FLEET BENEFITS = $1,800
FUTURE PERMANENT FLEET BENEFITS = TOTAL BENEFITS X AVG ANNUAL EQUIVALENT 10-YEAR STRAIGHT LINE GROWTH OR $2,323 X 0.72166 = $1,676
SAY $1,700

TOTAL BENEFIT TO PERMANENT FLEET = $1,800 + 1,700 = $3,500

* Based on information from similar projects
** $10.00 (Unit Day Value) ÷ 6 hrs/day x number of people per boat

TABLE 4-7

BUTTERMILK BAY CHANNEL

REDUCED TIDAL DELAYS - TRANSIENT FLEET
RECREATIONAL BENEFITS

TYPE OF CRAFT	LENGTH	BOAT TRIPS PER YEAR	TOTAL DELAYS PER YEAR	MINUTES SAVED PER DELAY	HOURS SAVED PER BOAT PER YEAR	LEISURE TIME VALUE PER HOUR	ANNUAL $ BENEFIT PER BOAT	# OF BOATS IN FLEET	TOTAL $ BENEFIT
				CANAL BOUND TRANSIENTS					
OUTBOARDS	15-20	180	15	0	0	$3.33	0	4	$ 0
STERNDRIVE	15-20	180	15	0	0	3.33	0	4	0
	21-25	180	15	40	10	6.67	66.67	6	400
INBOARDS	21-30	180	15	80	20	6.67	133.34	3	400
	31-40	180	15	100	25	8.33	208.25	2	417
CRUISING SAILBOATS	21-30	180	15	140	35	5.00	175.00	4	700
	31-40	180	15	140	35	6.67	233.45	2	467
			TRIPS ÷12			TABLE 4-3		25	$2,384
TOTAL								SAY	$2,400
				NON-CANAL BOUND TRANSIENTS					
OUTBOARDS	15-20	90	15	0	0	$ 3.33	0	2	0
STERNDRIVE	15-20	90	15	0	0	3.33	0	1	0
	21-25	90	15	40	10	6.67	66.67	2	133
INBOARDS	21-30	90	15	80	20	6.67	133.34	2	267
	31-40	90	15	100	25	8.33	208.25	1	208
CRUISING SAILBOATS	21-30	90	15	140	35	5.00	175.00	2	350
			TRIPS ÷6			FROM TABLE 4-6		10	$ 958
								SAY	$1,000

TOTAL TRANSIENT BENEFITS = $2,400 + 1,000
= $3,400

Vessel speeds upstream of the existing Federal project could be expected to be 2 knots over a distance of about 2,500 feet because of the shoal area and lack of future maintenance of the natural channel. Speeds on the 4,400 feet of the existing Federal channel would be 6 knots. If all boats were to leave at the same time, then it would take the first boat 15 minutes and the last boat 45 minutes to reach the upstream end of the existing channel. It would then take each of the boats an additional 8 minutes to reach the open bay after entering the existing channel. Since normally these boats could be expected to leave over a 2-hour period, then clearly no delays would occur for the fleet as a whole. However, the existing transit time for individual boats could be reduced by a wider channel upstream of the existing channel.

Based on the above computations, existing conditions which require boats to move at only 2 knots in the area upstream of the Federal channel result in a 20-minute transit time for a single vessel.

Provision of a 60-foot-wide channel would allow for sufficient maneuvering room and safe clearances to enable boats to motor at a speed of 4 knots through the proposed channel and 6 knots in the existing channel. This trip would take a total of 14 minutes one way, 6 minutes upstream and the existing 8 minutes in the downstream channel. This results in a time savings of about 30 percent over existing transit time or a total of 6 minutes per boat one way or 12 minutes per boat per round trip. This would provide a time savings to all vessels inbound and all but canal-bound transients outbound. Canal-bound boats would be outbound simultaneously. The time and dollar savings from a 60-foot channel to all boats are shown in Tables 4-8 and 4-9.

Provision of an 80-foot-wide channel would allow all boats to motor at a speed of 6 knots safely through the entire channel length in both directions except for outbound canal-bound transients. The one-way transit time per boat at 6 knots would be 11 minutes. This is a 3-minute per boat savings over Plan A or 6 minute per round trip. This represents a 20 percent savings over the round trip transit time of 28 minutes provided with the 60-foot channel of Plan A, or a 45 percent (18 minutes) savings over existing conditions. This would result in a time savings to each boat in all fleets over that accrued with the 60-foot-wide channel of Plan A. The time and dollar savings for each boat class using an 80-foot channel, as in Plans B and C, are presented in Tables 4-8 and 4-9. It is expected that 35 transients will remain overnight at the marina on an average day during the 130-day season. Of these boats 25 are expected to be eastbound and waiting for the proper tide in daylight to transit the canal. Most westbound boats transiting the canal would continue on down Buzzards Bay and would not stop at the Taylor Point marina. The remaining 10 transients, which would not be canal bound, would have transited the canal westbound at dusk and been forced to overnight in Bourne or would not be using the canal at all.

TABLE 4-8

BUTTERMILK BAY CHANNEL
REDUCED CHANNEL CONGESTIONS - PERMANENT FLEET

BENEFITS PER BOAT

TYPE OF CRAFT	LENGTH	ROUND TRIP PER YEAR (TABLE 4-3)	LEISURE TIME VALUE PER HOUR	PLAN A - 60 FT CHANNEL			PLANS B & C - 80 FT CHANNEL		
				MINUTES SAVED PER TRIP	HOURS SAVED PER BOAT PER YEAR	TOTAL $ BENEFIT PER BOAT	MINUTES SAVED PER TRIP	HOURS SAVED PER BOAT PER YEAR	TOTAL $ BENEFIT PER BOAT
OUTBOARD	15-20	60	$ 3.33	12	12	39.96	18	18	59.94
	21&UP	60	5.00	12	12	60.00	18	18	90.00
STERNDRIVE	15-20	60	3.33	12	12	39.96	18	18	59.94
	21-25	56	6.67	12	11	73.37	18	17	113.39
INBOARDS	15-20	58	3.33	12	12	39.96	18	17	56.61
	21-30	44	6.67	12	9	60.03	18	13	86.71
	31-40	35	8.33	12	7	58.31	18	11	91.63
CRUISING SAILBOATS	15-20	57	3.33	12	11	36.63	18	17	56.61
	21-30	52	5.00	12	10	50.00	18	16	80.00
	31-40	27	6.67	12	5	33.35	18	8	53.36
DAYSAILERS	8-15	60	1.67	12	12	20.04	18	18	30.06
	16-20	58	3.33	12	12	39.96	18	17	56.61

TABLE 4-9

BUTTERMILK BAY CHANNEL
REDUCED CHANNEL CONGESTION- TRANSIENT FLEET

BENEFITS - PER BOAT

TYPE OF CRAFT	LENGTH	LEISURE TIME VALUE PER HOUR	ROUND TRIPS PER YEAR	PLAN A - 60 FT CHANNEL				PLANS B OR C - 80 FT WIDTH			
				MINUTES SAVED PER BOAT TRIP		HOURS SAVED PER YEAR	$ SAVED PER BOAT PER YEAR	MINUTES SAVED PER BOAT TRIP		HOURS SAVED PER YEAR	$ SAVED PER BOAT PER YEAR
				INBOUND	OUTBOUND			INBOUND	OUTBOUND		
CANAL BOUND TRANSIENTS											
OUTBOARDS	15-20	$ 3.33	180	6	10	48	159.84	9	16	75	249.75
STERNDRIVE	15-20	3.33	180	6	10	48	159.84	9	16	75	249.75
	21-25	6.67	180	6	10	48	320.16	9	16	75	500.25
INBOARDS	21-30	6.67	180	6	10	48	320.16	9	16	75	500.25
	31-40	8.33	180	6	10	48	399.84	9	16	75	624.75
CRUISING SAILBOATS	21-30	5.00	180	6	10	48	240.00	9	16	75	375.00
	31-40	6.67	180	6	10	48	320.16	9	16	75	500.25
NON-CANAL BOUND TRANSIENTS											
OUTBOARDS	15-20	$ 3.33	90	12		18	59.94	18		27	89.91
STERNDRIVE	15-20	3.33	90	12		18	59.94	18		27	89.91
	21-25	6.67	90	12		18	120.06	18		27	180.09
INBOARDS	21-30	6.67	90	12		18	120.06	18		27	180.09
	31-40	8.33	90	12		18	149.94	18		27	224.91
CRUISING SAILBOATS	21-30	5.00	90	12		18	90.00	18		27	135.00

All of the 25 canal-bound boats would desire to leave the marina at about the same time so as to reach the canal's western limit at the turn of the tide to the ebb. The time it takes to transit the Cape Cod Canal would not be affected by any of the alternative plans. Since these boats presently leave at high tide depth is not considered a delay factor as discussed previously. Under existing conditions with a 20-foot-wide channel and swift tidal currents, these 25 boats would be forced to motor at a speed of 2 knots upstream of the existing channel. The boats would be able to proceed through the existing 100-foot-wide channel at 6 knots. These boats would leave the marina one after the other, forming a line 3,025 feet long based on an average of 25 feet per boat with a safe distance of 100 feet between boats. The first boat in line would reach the existing channel in 12 minutes and reach open water in Buzzards Bay or the canal in another 8 minutes yielding a total transit time of 20 minutes. The last boat in line would wait its turn at the basin and reach the existing channel in 27 minutes and the canal in another 8 minutes, yielding a total transit time of 35 minutes. Thus the average transit time is about 28 minutes.

Providing a 60-foot channel would allow these boats to travel at a speed of 4 knots within the proposed upstream channel. These boats would still travel in single file. The first boat would have a total transit time of 14 minutes and the last boat 22 minutes, yielding an average time of 18 minutes. This is a time savings of about 10 minutes per boat over existing conditions with a 60-foot-wide channel as provided in Plan A. When these boats are inbound they will arrive at random times and would each under existing conditions take 20 minutes to travel upstream from open water or the canal to the marina basin. With the 60-foot-wide channel extension they would each transit the distance in 14 minutes, yielding a time savings of 6 minutes per boat inbound. Therefore, the total round trip savings generated by a 60-foot-wide channel is about 16 minutes per boat.

Construction of an 80-foot-wide channel as provided in Plans B and C would allow canal-bound transients to travel down channel in double file while maintaining one open inbound lane. The 80-foot width would allow for greater speeds in the upstream channel so that all boats could travel at 6 knots for the entire 6,900-foot distance to the canal. The first boat in line would reach the canal in 13 minutes, the last boat would arrive in 17 minutes. The average time of 15 minutes is 3 minutes or 18 percent less than the 18 minute average transit time provided with the 60-foot channel and 13 minutes (46%) less than existing conditions.

Time and dollar savings for all transient boat classes under each of the plans is summarized in Table 4-9.

The dollar savings for each boat class under each plan when multiplied by the number of boats in that class would equal the total dollar benefit for leisure time saved by each boat class. Adding the total benefits for all classes would equal the total benefit for a plan accrued

by each segment of the fleet, immediate and future permanent and transient. Since the future permanent fleet is a result of a 10-year straight line growth, the benefit for each plan must be adjusted by the average annual equivalent factor of 0.72166. The total benefits for reduced channel congestion for all plans are shown in Table 4-10 for the permanent fleet and 4-11 for the transient fleet.

DAMAGE REDUCTION BENEFITS

The shoal and boulder area located just south of the marina entrance, when combined with this area's swift tidal currents, presents a hazard to boats navigating through the Narrows. The existing powerboat fleet of Buttermilk Bay currently experiences an average of 10 groundings each season. These groundings result in damages to hulls, engines, gear, minor chaffing and occasional sinkings. An estimated average of $5,500 in grounding damage occurs each year or about $550 per boat for the 10 boats. This is equal to about $42 per boat for the 130 boats in the existing fleet. These damages and repair costs are those over and above routine annual maintenance.

The 10 boats damaged each year are subject to repair times averaging one week. Assuming a boat is used for recreation one-third of the time, this equates to 2 days of leisure time lost to each damaged boat annually. An average recreation day for these small powerboats is 6 hours. Thus, grounding damages result in a total of 120 hours and $5,500 lost to the existing recreational fleet each year.

The boats expected to use the public marina must pass directly across the shoal and closer to the boulder area than the boats in the existing fleet. These marina boats would also have larger dimensions and would face a greater probability of grounding and incurring damage than boats in the existing fleet.

TABLE 4-10

BUTTERMILK BAY CHANNEL
REDUCED CHANNEL CONGESTION BENEFITS

PERMANENT FLEET

TYPE OF CRAFT	LENGTH	PLAN A - 60 FT WIDE CHANNEL: TOTAL $ BENEFIT PER BOAT (TABLE 4-8)	EXISTING BOATS: # OF BOATS IN FLEET	EXISTING BOATS: TOTAL BENEFIT $	FUTURE BOATS: # OF BOATS IN FLEET	FUTURE BOATS: TOTAL BENEFIT	PLANS B OR C - 80 FT CHANNEL: TOTAL $ BENEFIT PER BOAT (TABLE 4-8)	EXISTING BOATS: # OF BOATS IN FLEET	EXISTING BOATS: TOTAL BENEFIT	FUTURE BOATS: # OF BOATS IN FLEET	FUTURE BOATS: TOTAL BENEFIT
OUTBOARD	15-20	$ 39.96	8	$ 320	9	$ 360	$ 59.94	8	$ 480	9	$ 539
	21&UP	60.00	1	60	-	-	90.00	1	90	-	-
STERNDRIVE	15-20	39.96	3	120	3	120	59.94	3	180	3	180
	21-25	73.37	4	293	5	367	113.39	4	454	5	567
INBOARDS	15-20	39.96	1	40	2	80	56.61	1	57	2	113
	21-30	60.03	14	840	14	840	86.71	14	1,214	14	1,214
	31-40	58.31	3	175	4	233	91.63	3	275	4	367
CRUISING SAILBOATS	15-20	36.63	1	37	3	110	56.61	1	57	3	170
	21-30	50.00	3	150	6	300	80.00	3	240	6	480
	31-40	33.35	1	33	1	33	53.36	1	53	1	53
DAYSAILERS	8-15	20.04	10	200	12	240	30.06	10	301	12	361
	16-20	39.96	1	40	1	40	56.61	1	57	1	57
TOTAL			50	$2,308	60	$2,723		50	$3,458	60	$4,101

TOTAL REDUCED CHANNEL CONGESTION BENEFIT

IMMEDIATE PERMANENT FLEET = PLAN A $2,300 PLAN B OR C $3,500

FUTURE FLEET = TOTAL BENEFIT X AVERAGE ANNUAL EQUIVALENT 10-YEAR STRAIGHT LINE GROWTH OR $2,723 AND $4,101 X 0.72166 = $1,965 AND $2,959

= PLAN A $2,000 PLAN B OR C $3,000
TOTAL $4,300 $6,500

TABLE 4-11

BUTTERMILK BAY CHANNEL

REDUCED CHANNEL CONGESTION BENEFITS - TRANSIENT FLEET

TYPE OF CRAFT	LENGTH	PLAN A - 60 FT CHANNEL $ BENEFIT PER BOAT PER YEAR	# OF BOATS IN FLEET	TOTAL BENEFIT	PLAN B OR C - 80 FT CHANNEL $ BENEFIT PER BOAT PER YEAR	# OF BOATS IN FLEET	TOTAL BENEFIT
CANAL BOUND TRANSIENTS							
OUTBOARDS	15-20	$ 159.84	4	$ 639	$ 249.75	4	$ 999
STERNDRIVE	15-20	159.84	4	639	249.75	4	999
	21-25	320.16	6	1,921	500.25	6	3,002
INBOARDS	21-30	320.16	3	960	500.25	3	1,501
	31-40	399.84	2	800	624.75	2	1,250
CRUISING SAILBOATS	21-30	240.00	4	960	375.00	4	1,500
	31-40	320.16	2	640	500.25	2	1,001
TOTAL		TABLE 4-9		$6,559			$10,252
				SAY $6,600			SAY $10,300
NON-CANAL BOUND TRANSIENTS							
OUTBOARDS	15-20	$ 59.94	2	$ 120	$ 89.91	2	$ 180
STERNDRIVE	15-20	59.94	1	60	89.91	1	90
	21-25	120.06	3	240	180.09	2	360
INBOARDS	21-30	120.06	2	240	180.09	2	360
	31-40	149.94	1	150	224.91	1	225
CRUISING SAIL	21-30	90.00	2	180	135.00	2	270
TOTAL		TABLE 4-9		$ 990			$1,485
				SAY $1,000			SAY $1,500

	PLAN A	PLANS B OR C
TOTAL BENEFIT TRANSIENT FLEET	$7,600	$11,800

These boats would experience an amount of repair time comparable to the existing fleet. The 10 existing boats damaged represent 8 percent of the 130 boat total. Because of the greater probability of the marina boats grounding on the shoal and boulders it is reasonable to assume that 12 percent of the marina fleet would experience grounding annually. Thus, the 50-boat immediate permanent fleet and 60-boat future permanent fleet would experience six and seven groundings respectively each year. Because of their greater average depreciated value and larger dimensions, a conservative estimate of cost per permanent marina boat damaged is $750 or about $90 per boat for the 110 permanent boats. Each of the 13 damaged boats would be tied up for repairs for an average of 10 days, thereby loosing 3 recreational days or 18 hours of leisure time each. This equals $4,500 and 108 hours lost to the immediate permanent fleet and $5,250 and 126 hours lost to the future permanent fleet.

Transient boats using the marina could expect navigation restrictions similar to the permanent marina fleet. The immediate permanent marina fleet makes a total of 2,620 boat trips or 5,240 one-way transits of the channel each year. It is assumed that since canal-bound transients would leave at high tide they would incur only negligible damages outbound. The total number of inbound transits of canal bound transients is 25 daily or 4,500 annually. Noncanal bound transients would incur damage while traveling in either direction. These noncanal bound boats make 900 round trips or 1,800 one-way transits annually. This yields a total of 5,300 one-way transits by transient vessels subject to grounding. This 5,300 transits is 2 percent greater than the 5,240 passages made by the immediate permanent fleet. Thus, the transient fleet will incur 2 percent greater damages and down time than the immediate permanent fleet. Damage losses to the transient fleet therefore would equal $4,590. Using the same percentage increase, the total leisure time loss would be 110 hours. Transient vessels would most likely be on cruise and nearly all of the 10 days lost to repairs would be lost recreational time, not the 3 days represented by the 110 hours. The length of the recreational boating day for these boats would be longer than the 6 hours for the permanent fleet. A reasonable assumption is that a transient boating day is at least 8 hours long and that 7 of the 10 days lost to repair time are recreational days. The length of day for transients is 1-1/3 times greater than that for permanent boats and the time lost is 2-1/3 times greater. Applying these factors to the 110 hours yields a total time lost to the transient fleet to repairs of about 340 hours annually.

Each of the three alternative plans would remove differing portions of the shoal and boulders. Each plan would therefore offset damages to different degrees. All boats entering or leaving the marina must make a 50° turn to enter or leave the Narrows channel. To ease navigation at this turn, the channel limit on the inside of the turn is extended to widen the channel at the bend. The maximum channel cut widths at the bend for each plan are Plan A - 100 feet, Plan B - 120 feet; and Plan C - 180 feet. It is assumed that a maximum of 80 percent of the damages in any fleet category could be prevented allowing for hazardous or inexperienced

operators, weather conditins, and boaters unfamiliar with the channel. The existing fleet has clearances of 80 feet in the natural Narrows channel. The marina fleet has the existing 20-foot clearance provided by the existing channel into the basin. The percentage reduction in damages for each plan and fleet category is shown in Figure 4-12.

It cannot be determined which sizes and classes of vessels from the existing, permanent and transient fleets would be damaged. It is therefore necessary to determine the average leisure time values for each segment of the fleet. These rates will be applied to the leisure time lost to repairs for the existing, immediate, future and transient fleets. The derivation of these average rates is shown in Table 4-13.

Using the methodology above, it can now be determined what the total dollar value is of the benefit derived from reducing the probability of vessels grounding on the shoal and boulders. The number of hours saved by each plan, as shown in Table 4-12, is multiplied by the average values shown in Table 4-13 to give the dollar value of leisure time lost. The total benefit from damage reduction provided by each of the three plans is shown in Table 4-14.

TABLE 4-12

BUTTERMILK BAY CHANNEL

PERCENT REDUCTION IN DAMAGES - ALL PLANS

EXISTING FLEET

PLAN	CLEARANCE FEET	% DAMAGES	DAMAGES SAVED - %	TOTAL $ DAMAGES	HOURS LEISURE TIME LOST	$ DAMAGE SAVED ANNUALLY	HOURS LEISURE TIME SAVED
EXISTING	80	100%	0	$5,500	120	$ 0	0
PLAN A	100	85%	15	5,500	120	825	18
PLAN B	120	70%	30	5,500	120	1,650	36
PLAN C	180	20%	80	5,500	120	4,400	96

PERMANENT MARINA FLEET

				IMMEDIATE PERMANENT FLEET				FUTURE PERMANENT FLEET			
PLAN	CLEARANCE FEET	% DAMAGES	DAMAGES SAVED - %	TOTAL $ DAMAGES	HOURS LEISURE TIME LOST	$ DAMAGE SAVED ANNUALLY	HOURS LEISURE TIME SAVED ANNALLY	TOTAL $ DAMAGES	HOURS LEISURE TIME LOST	$ DAMAGE SAVED ANNUALLY	HOURS LEISURE TIME SAVED ANNUALLY
EXISTING	20	100%	0	$4,500	108	$ 0	0	$5,250	126	$ 0	0
PLAN A	100	60%	40	4,500	108	1,800	43	5,250	126	2,100	50
PLAN B	120	50%	50	4,500	108	2,250	54	5,250	126	2,630	63
PLAN C	180	20%	80	4,500	108	3,600	86	5,250	126	4,200	101

TRANSIENT FLEET

PLAN	CLEARANCE FEET	% DAMAGES	DAMAGES SAVED - %	TOTAL $ DAMAGES	HOURS LEISURE TIME LOST	$ DAMAGE SAVED ANNUALLY	HOURS LEISURE TIME SAVED
EXISTING	20	100%	0	$4,600	340	$ 0	0
PLAN A	100	60%	40	4,600	340	1,840	136
PLAN B	120	50%	50	4,600	340	2,300	170
PLAN C	180	20%	80	4,600	340	3,680	272

TABLE 4-13

BUTTERMILK BAY CHANNEL

AVERAGE LEISURE TIME VALUE COMPUTATIONS

TYPE OF CRAFT	LENGTH	LEISURE TIME VALUE PER HOUR	EXISTING FLEET # OF BOATS	EXISTING FLEET TOTAL LEISURE TIME VALUE BY CLASS	IMMEDIATE PERMENT # OF BOATS	IMMEDIATE PERMENT TOTAL LEISURE TIME VALUE BY CLASS	FUTURE PERMANENT # OF BOATS	FUTURE PERMANENT TOTAL LEISURE TIME VALUE BY CLASS	TRANSIENT FLEET # OF BOATS	TRANSIENT FLEET TOTAL LEISURE TIME VALUE BY CLASS
OUTBOARD	15-20	$ 3.33	30	$ 99.90	8	$ 26.64	9	$ 29.97	6	$ 19.98
	21&UP	5.00	20	100.00	1	5.00	-	0	-	0
STERNDRIVE	15-20	3.33	25	83.25	3	9.99	3	9.99	5	16.65
	21-25	6.67	20	133.40	4	26.68	5	33.35	8	53.36
INBOARDS	15-20	3.33	20	66.60	1	3.33	2	6.66	-	0
	21-30	6.67	15	100.05	14	93.38	14	93.38	5	33.35
	31-40	8.33	-	0	3	24.99	4	33.32	3	24.99
CRUISING SAILBOATS	15-20	3.33	-	0	1	3.33	3	9.99	-	0
	21-30	5.00	-	0	3	15.00	6	30.00	6	30.00
	31-40	6.67	-	0	1	6.67	1	6.67	2	13.34
DAYSAILERS	8-15	1.67	-	0	10	16.70	12	20.04	-	0
	16-20	3.33	-	0	1	3.33	1	3.33	-	0
TOTALS			130	$583.20	50	$235.04	60	$276.70	35	$191.67
AVERAGE LEISURE TIME VALUE RATES $ TOTAL ÷ # OF BOATS				$4.49		$4.70		$4.61		$5.48

TABLE 4-14
BUTTERMILK BAY CHANNEL

BENEFITS FROM REDUCTION IN DAMAGES

	PLAN A		PLAN B		PLAN C	
	HOURS LOST	TOTAL $ BENEFIT	HOURS LOST	TOTAL $ BENEFIT	HOURS LOST	TOTAL $ BENEFIT
EXISTING FLEET						
Recreational Value per hour = $4.49						
Damages		825		1,650		4,400
Repair Time	18	81	36	162	96	431
SUBTOTAL		$906		$1,812		$4,831
TRANSIENT FLEET						
Recreational Value per hour = $5.48						
Damages		1,840		2,300		3,680
Repair Time	136	745	170	932	272	1,491
SUBTOTAL		$2,585		$3,232		$5,171
IMMEDIATE PERMANENT FLEET						
Recreational Value per hour = $4.70						
Damages		1,800		2,250		3,600
Repair Time	43	202	54	254	86	404
SUBTOTAL		$2,002		$2,504		$4,004
FUTURE PERMANENT FLEET						
Recreational Value per hour = $4.61						
Damages		2,100		2,630		4,200
Repair Time	50	231	63	290	101	466
SUBTOTAL		$2,331		$2,920	$	4,666
X AVG ANNUAL EQUIVALENT OF 0.72166		$1,682		$2,107		$ 3,367
TOTAL		$7,179		$9,655		$17,373
	SAY	$7,200		$9,700		$17,400

Adding together the dollar benefits from reduced tidal delay, reduced channel congestion and reduced damages for each plan will yield the total recreational benefit accured. This summary of recreational benefits is shown in Table 4-15.

TABLE 4-15
BUTTERMILK BAY CHANNEL

RECREATIONAL BENEFITS SUMMARY

BENEFIT	PLAN A $ BENEFIT	PLAN B $ BENEFIT	PLAN C $ BENEFIT
REDUCED TIDAL DELAY			
Permanent Fleet	3,500	3,500	3,500
Transient Fleet	3,400	3,400	3,400
SUBTOTAL	$ 6,900	$ 6,900	$ 6,900
REDUCED CHANNEL CONGESTION			
Permanent Fleet	4,300	6,500	6,500
Transient Fleet	7,600	11,800	11,800
SUBTOTAL	$11,900	$18,300	$18,300
REDUCED DAMAGES			
All Vessels	$ 7,200	$ 9,700	$17,400
TOTAL BENEFIT	$26,000	$34,900	$42,600
SAY	$26,000	$35,000	$43,000

TABLE 4-16
BUTTERMILK BAY CHANNEL

BENEFIT/COST COMPARISON

	PLAN A	PLAN B	PLAN C
ANNUAL CHARGES	$15,000	$18,000	$28,000
TOTAL BENEFIT	$26,000	$35,000	$43,000
NET BENEFIT	$11,000	$17,000	$15,000
BENEFIT/COST RATIO	1.7:1	1.9:1	1.5:1

COST BENEFIT COMPARISON

Comparison of the annual charges of the cost of each plan and the annual benefits will determine the degree of economic justification of each plan. A benefit/cost ratio of greater than 1:1 means that the plan is economically justified. Table 4-16 shows the benefit/cost comparison of each plan. Based on the benefit/cost ratios the plan which best serves the present and future needs of the Buttermilk Bay/Taylor Point area is Plan B.

SECTION D

SOCIAL ASSESSMENT

INTRODUCTION

Buttermilk Bay Channel extends from the Federal channel in Buzzards Bay, near the west entrance of the Cape Cod Canal, through Cohasset Narrows to the entrance of Buttermilk Bay in the town of Bourne. The town of Wareham is located immediately west of the proposed channel. This channel is one of many extending northward from Buzzards Bay into rivers and bays in southeastern Massachusetts and Cape Cod.

With over 90 miles of tidal shoreline in both Wareham and Bourne, access to the ocean is very important. As recreational boating increases in popularity, previously unimproved channels become more important. Although Cohasset Narrows and Buttermilk Bay Channel are currently used by hundreds of recreational craft each year, strong tidal currents and shoals have limited its use. The Federal channel would be extended 2,500 feet northward to the entrance of the proposed Bourne marina, by dredging to a depth of 6 feet, plus a one-foot overdepth. This facility will provide a boat ramp and docking and other services for 179 boats. Parking will also be provided for 180 cars and 49 automobile-trailer combinations.

Although engineering and environmental considerations have been addressed regarding improvements to Buttermilk Bay Channel, the planning process requires consideration of other factors as well. This phase of the study is concerned with social and economic elements that may be affected by implementation of the project.

POPULATION CHARACTERISTICS

Population growth in Cape Cod area communities has far exceeded growth experienced across the state of Massachusetts. Population in Barnstable County increased 53 percent between 1970 and 1980, having increased 37.5 percent over the previous decade. The town of Bourne, however, did not show much change between 1960 and 1980. Bourne's population fluctuates with changes in military personnel levels at Otis Air Force Base. Growth in Plymouth County matched Barnstable's between 1960 and 1980 but fell off somewhat between 1970 and 1980. The town of Wareham, however experienced population growth of just over 60 percent between 1970 and 1980. Table 4-17 provides population data for Bourne, Wareham, their respective counties, and the state.

As shown in Table 4-17, the year-round population of Bourne increased 9.3 percent from 12,636 in 1970 to 13,874 in 1980. In Wareham, the population increased 60.6 percent between 1970 and 1980, from 11,492 to 18,457. Statewide, the population increased 0.8 percent in that 10-year period.

Table 4-17

POPULATION STATISTICS

	1960	1970	Percent Change 1960-1970	1980	Percent Change 1970-1980
Bourne	14,011	12,636	-9.8	13,874	9.8
Barnstable County	70,286	96,656	37.5	147,925	53.0
Wareham	9,461	11,492	21.5	18,457	60.6
Plymouth County	248,449	333,314	34.2	405,437	21.6
Massachusetts	5,148,578	5,689,170	10.5	5,737,037	0.8

Source: U.S. Census

As indicated in Table 4-18, based upon the 1970 U.S. census, the median age in Bourne is significantly lower than the median age in Barnstable County. Bourne's median age is also lower than that in Wareham and Plymouth County. The 25.1 median age in Bourne reflects the number of young families in the town as well as the presence of Otis Air Force Base. The elderly population, those age 65 and above, make up 9.0 percent of the population in Bourne and 14.1 percent in Wareham. Bourne's figure is substantially lower than that for Cape Cod as a whole while Wareham's is higher than the Plymouth County average.

Table 4-18

AGE GROUP DISTRIBUTION
1970 CENSUS

Age Group	Bourne	Barnstable County	Wareham	Plymouth County
Under 5	9.6%	7.4%	9.1%	10.1%
5-14	24.7%	18.7%	19.7%	22.1%
15-19	8.4%	7.8%	8.4%	8.4%
20-64	48.3%	49.2%	48.7%	49.9%
65+	9.0%	16.9%	14.1%	9.6%
Median Age	25.1	34.2	30.6	27.1

Source: (Refs. 2 and 4)

In Bourne the number of elderly residents, age 65 and above, increased 41.9 percent between 1970 and 1975. In Barnstable County that age group increased 48.4 percent; statewide it increased 6.2 percent during that period. Of the 11,362 residents in Bourne in 1975, approximately 15 percent of the population was above age 65 which compares with close to 20 percent for Barnstable County.

Significnt seasonal fluctuations, consistent with a summer resort area, characterize the population in Bourne and Wareham. Summer population in Bourne in 1980 was estimated to peak at 33,954, about 2.5 times the year-round level. Summer increases for all of Barnstable County nearly tripled in 1980. In Wareham, summer population was estimated to be 2.4 times the year-round count.

Population projections were prepared by the Cape Cod Planning and Economic Development Commission for Bourne and Barnstable County. By 1995, the year-round population in Bourne is expected to increase to 16,000 with the summer population reaching 43,000. The county population is expected to have a year-round population of 190,000 with a summer peak of 571,000 in 1995. The Southeastern Regional Planning and Economic Development District has projected Wareham's population at 22,550 in 2000.

THE ECONOMY OF THE STUDY AREA

Historically, Bourne and Wareham have utilized their coastal resources for economic development. Although oyster and fishing industries employed many people in Bourne at one time, the tourist business, cranberry growing and dairying are chief industries. The wholesale and retail trade sector provided about 29 percent of the jobs in Bourne in 1980. The services sector followed providing about 15 percent of the job opportunities in Bourne. These sectors, however, are Bourne's second and third largest employers. The largest employer is the government sector, accounting for 30.3 percent of the jobs. A significant contributor to this sector is Otis Air Force Base. In 1980, the annual payroll of the 347 Bourne firms reporting to the Massachusetts Division of Employment Security (DES) was $44,345,800.

Wareham's economy has remained dependent upon its coastal resources throughout its history. Shipbuilding and the extraction of salt from sea water were important to the early economy of Wareham. The town is now a resort community, again utilizing its coastal resources. In 1980, approximately 1/3 of Wareham's employment was in the wholesale and retail trade sector. The services sector was second, followed by the government sector. A total of 321 firms reported to the Massachusetts DES in 1980 with a payroll totalling $36,894,400. Table 4-20 presents a breakdown of employment by industry in Bourne and Wareham.

Table 4-19

EMPLOYMENT BY INDUSTRY

1980

	Bourne		Wareham	
	Number of Employees	Percent of Total	Number of Employees	Percent of Total
Agriculture, Forestry, Fisheries	40	1.0	211	6.0
Mining & Construction	156	3.9	108	3.1
Trans., Comm., Util.	283	7.1	222	6.4
Manufacturing	448	11.3	243	6.9
Wholesale/Retail Trade	1,171	29.4	1,170	33.4
Finance, Insurance Real Estate	54	1.3	163	4.7
Services	625	15.7	696	19.9
Government	1,205	30.3	685	19.6
TOTAL	3,982	100.0	3,498	100.0

Source: Massachusetts Division of Employment Security

Unemployment in Bourne and Wareham follows a seasonal pattern that generally coincides with the tourist industry. Their average yearly unemployment rates run in excess of state and national averages. In 1981, Bourne's unemployment rate averaged 8.8 percent and Wareham's averaged 10.3 percent. The state's rate for that year was 6.4 percent.

LAND USE CHARACTERISTICS

The land use pattern in both Bourne and Wareham is changing in response to residential growth and associated development. Residential pressure is created by tourist demands, second home construction, and the movement of families from high density urban areas in Fall River, Boston, Taunton and Providence.

Approximately 40 percent of the land area in Bourne is occupied by the U.S. Military Reservation which includes Camp Edwards and Otis Air Force Base. Most homes in the town are single family dwellings,

30 percent of which are seasonal (Ref. 8). The Cape Cod Canal bisects this 41-square-mile town. Developed areas are located on the east shore of Buzzards Bay, west of Route 28 and north of the canal. Commercial areas are found in the village centers, along the major arterials including Routes 6/25 and 28, and near the Bourne and Sagamore Bridges across the canal.

In the future land use in Bourne will become more residential. Pastures and abandoned fields will continue to be used for this development. Bourne will serve as a bedroom community for Fall River and Boston since it has easy highway access to these urban areas. It also has the vacationland attraction of Cape Cod and the pressures caused by Otis Air Force Base.

In Wareham residential development is centered on Buttermilk Bay, Broad Cove/East River, Onset, and the Union Pond/Mill Pond area. Commercial areas are located in Wareham Center, Onset, and along Routes 6 and 28. Commercial developments serve both tourist and resident needs. Presently 50 percent of those employed commute to the Fall River-New Bedford-Providence area. Others commute north toward Boston. Future residential development will probably use forested land and not agricultural land or cranberry bogs.

The Buttermilk Bay Channel is located at the northeast end of Buzzards Bay, west of the Cape Cod Canal. The channel extends through Cohasset Narrows to Buttermilk Bay. A moveable railroad bridge and a fixed highway bridge span the narrows, limiting access of larger boats to Buttermilk Bay. The 750-acre bay is shallow, ranging in depth from 1 to 7 feet, mlw. Most of the shoreline of Cohasset Narrows and Buttermilk Bay is residential or wooded, although there are several commercial establishments including motels and marinas (north of the railroad bridge). The shoreline is used for shellfishing and swimming. Several hundred boats are based in this area. Dangerous currents and tides through the Narrows and limited clearance beneath the bridges, however, constrain use of this area for boating.

According to a demand and market feasibility study prepared for the proposed Taylor Point marina by Gladstone Associates, in March 1977 there were four marinas in the Buzzards Bay area. These marinas had, between them, 4 ramps, 110 boat slips, 20 moorings, storage facilities for 40 boats, and 30 boats for rent. The overall occupancy of three of the four facilities ranges from 90 to 100 percent. The State does not maintain any boat launch ramps in this area (Ref. 9).

THE PROPOSED ACTION

The selectmen of the town of Bourne requested that the Corps of Engineers designate the Buttermilk Bay Channel a Federal channel and dredge material at its northern end. This project was requested in conjunction with the town's efforts to construct a municipal marina at

Taylor Point. The town's alternatives were other marina sites in Bourne. The Corps of Engineers alternatives are limited to Buttermilk Bay Channel and entail different channel dimensions. The selected alternative entails dredging 1,350 cubic yards of material from the proposed channel.

Several options have been addressed for the disposal of material dredged from Buttermilk Bay Channel. Land disposal at sea is no longer considered a viable alternative because two construction plants would be required, increasing costs.

The no improvement alternative would not meet project objectives and is inconsistent with recreational boating needs and the town of Bourne's plan to develop a marina at Taylor Point. The marina cannot be fully utilized without the removal of material from the marina entrance. No improvement reflects the project condition previously identified.

DISCUSSION OF IMPACTS

Project impacts may be short or long term with site specific or regional implications. Short-term effects will be felt during the construction phase as a result of the dredging and the disposal of the dredged material. It has been estimated that the dredging process would take 2 weeks to complete. If construction takes place anytime from fall to spring, impacts upon the community and the boating public would be minimized. During the construction phase there would be increased odors, noise.

Based upon estimates of shoaling rates from previous dredging operations in the area, it is assumed that maintenance dredging will be required about once every 15 years. Therefore, the impacts occurring during the construction period would be repeated every 15 years, although the impacts will be considerably less.

Long-term effects (assuming maintenance operations are undertaken every 15 years) would be realized once the Buttermilk Bay Channel extension and the Bourne municipal marina at Taylor Point are constructed. Safer navigation conditions would result, additional boating facilities would be provided to meet increasing demand, and the nearby Buzzards Bay Village would benefit from increased patronage from transient boaters. The channel would also serve as a refuge for small craft caught in summer storms.

With construction of the channel and adjacent marina, facilities would be provided for 150 boats. None of these boats are currently moored at the site. Due to the existing demand for marina facilities on Cape Cod and Buzzards Bay, this increase in ships would not adversely affect other local marinas. Many marinas currently have waiting lists in this area. In addition, the New England River Basins Commission projected a demand in the year 1990 for an additional 1,800 boat spaces in the Buzzards Bay planning area. (Ref. 10)

Operation of the Taylor Point marina would help bolster the local economy with increased tax revenues and increased business. This would be particularly welcome since a State Route 25 bypass around the village of Buzzards Bay has been proposed. Patrons at the marina would be encouraged to seek services at nearby Buzzards Bay Village. Transient boaters are typically on vacation and willing to spend more money than those who rent slips on a seasonal basis, contributing to the revitalization of the small business district which has historically thrived on transient automobile traffic. The project therefore complements the town of Bourne's desires to meet the increasing needs of recreational boaters in the Buzzards Bay - Buttermilk Bay area.

REFERENCES

1. Mass. Dept. of Commerce & Development, "Massachusetts Profile of Bourne," undated.

2. Mass. Dept. of Commerce & Development, "Massachusetts Profile of Wareham," undated.

3. Cape Cod Regional Planning and Economic Development Commission, "Estimates of Total, 60+ and 65+ Population of Barnstable County Towns and State."

4. Cape Cod Regional Planning and Economic Development Commission, "Barnstable County Population by Age and Sex, 0-19, 20-75+."

5. Cape Cod Regional Planning and Economic Development Commission, "Barnstable County Summer and Winter Population," estimates by Philip B. Herr and Associates.

6. MacConnel, Wm. P., Plymouth County, Massachusetts, 1959-1971, Cooperative Extensive Service Publication #95, December 1973.

7. MacConnell, Wm. P., Barnstable, Dukes and Nantucket Counties, Massachusetts, 1951-1971, Massachusetts Agricultural Experiment Station Bulletin #623, November 1974.

8. U.S. Dept. of Transportation Federal Highway Administration and Mass. Dept. of Public Works, Final Environmental Impact/4(f) Statement for Routes 25 and 28 in the Towns of Wareham, Plymouth and Bourne, 1978.

9. Gladstone Associates, "Demand Market Feasibility, Taylor Point Marina, Bourne, Massachusetts," Prepared for Anderson-Nichols, Appendix D of the Bourne Marina Final Environmental Impact Statement, July 12, 1977.

10. New England River Basins Commission, Report of the Southeastern New England Study Buzzards Bay Planning Area Report, Boston, December 1975.


ED
83