US Army Corps
of Engineers
Baltimore District

Maryland Port
Administration

# Baltimore Harbor and Channels, Maryland and Virginia, 42-Foot Project

# Brewerton Channel Eastern Extension, Maryland

## *Limited Reevaluation Report and Environmental Assessment*

**Draft Report**
**April 1997**

# BALTIMORE HARBOR AND CHANNELS, MARYLAND AND VIRGINIA, 42-FOOT PROJECT BREWERTON CHANNEL EASTERN EXTENSION LIMITED REEVALUATION REPORT

## EXECUTIVE SUMMARY


The purpose of the study is to address widening the Brewerton Channel Eastern Extension to its authorized 600-foot width in order to safely and efficiently accommodate modern container ships calling on the Port of Baltimore via the Chesapeake and Delaware Canal.

The Port of Baltimore is one of America's busiest deep water ports. It is located on a 32-square- mile area of the Patapsco River and its tributaries, approximately 12 miles northwest of the Chesapeake Bay. From its central location nearly 150 miles inland from the Atlantic Ocean, Baltimore can easily provide service to America's Midwestern markets as well as other ports along the Atlantic coast. The Port has experienced a growth in commodity movements in recent years, with more than 2,200 vessel calls and nearly 23 million metric tons of foreign cargo being handled in the Port in 1993. By 1995, this had increased to 28 million metric tons of foreign cargo, valued at almost $21 billion. Commerce through the Port of Baltimore is expected to continue to increase over the next 50 years. In recent years, the MPA has worked towards maintaining the Port of Baltimore as a thriving world-class port. Since 1980, over one-half billion dollars has been invested in maritime-related improvements. As the commercial shipping industry continues to grow, the Port of Baltimore is anticipated to expand to meet the demands of the market.

The Brewerton Channel Eastern Extension is a key link in the channel system leading from the Port through the Chesapeake and Delaware Canal. The channel was authorized to a depth of 35 feet and a width of 600 feet by the River & Harbor Act of 1958. The channel was constructed to a depth of 35 feet and a width of 450 feet in 1986, and the eastern nautical mile of the channel was widened to 600 feet in 1991. The recommended plan would widen the remaining 5 miles of channel, from 450 feet wide to the authorized width of 600 feet to provide safe and efficient navigation for the modern container vessels calling on the Port of Baltimore. The plan requires the removal of 2.3 million cubic yards of dredged material, which would be placed in the State of Maryland's Hart-Miller Island Dredged Material Containment Facility. The plan would cost $13.8 million, resulting in a benefit-cost ratio of 11.5 to 1, and provide annual economic benefits of $14.1 million.

**BALTIMORE HARBOR AND CHANNELS, MARYLAND AND VIRGINIA, 42-FOOT PROJECT BREWERTON CHANNEL EASTERN EXTENSION LIMITED REEVALUATION REPORT**

## TABLE OF CONTENTS


| | |
|---|---|
| **Executive Summary** | i |
| **Table of Contents** | ii |
| **1. Introduction** | 1 |
| Project Authorization | 4 |
| Project Description | 4 |
| Background | 6 |
| Status of Existing Project | 9 |
| **2. Engineering & Design** | 11 |
| Introduction | 11 |
| Field Investigations | 12 |
| Site Conditions | 15 |
| Channel Design | 17 |
| Ship Simulation Studies | 20 |
| Relative Risk Assessment | 22 |
| Quantity Calculations | 23 |
| Cost Estimates | 28 |
| **3. Operation & Maintenance** | 43 |
| **4. Environmental** | 47 |
| Environmental Resources | 47 |
| Brewerton Channel Eastern Extension | 47 |
| Hart-Miller Island--Designated Placement Site for Proposed Dredging | 50 |
| Environmental Consequences | 50 |
| Environmental Permits, Regulatory Compliance, and Monitoring | 52 |
| Summary | 54 |
| **5. Economics** | 59 |
| **6. Real Estate Plan** | 65 |

**7. Plan Selection and Implementation** 69
Introduction 69
Plan Selection 69
Plan Implementation 71

**8. Cost Allocation and Apportionment** 73
Cost Allocation 73
Cost Apportionment 73
Identification of Local Sponsor 76
Items of Non-Federal Cooperation 78
Financial Analysis 80

**9. Conclusions and Recommendations** 81
Conclusions 81
Recommendations 83

**Appendix A** Correspondence
**Appendix B** Ship Simulation Studies
**Appendix C** Relative risk assessment
**Appendix D** M-CACES Cost Estimate (Summary)
**Appendix E** Environmental Assessment
**Appendix F** Economics

# BALTIMORE HARBOR AND CHANNELS, MARYLAND AND VIRGINIA, 42-FOOT PROJECT BREWERTON CHANNEL EASTERN EXTENSION LIMITED REEVALUATION REPORT

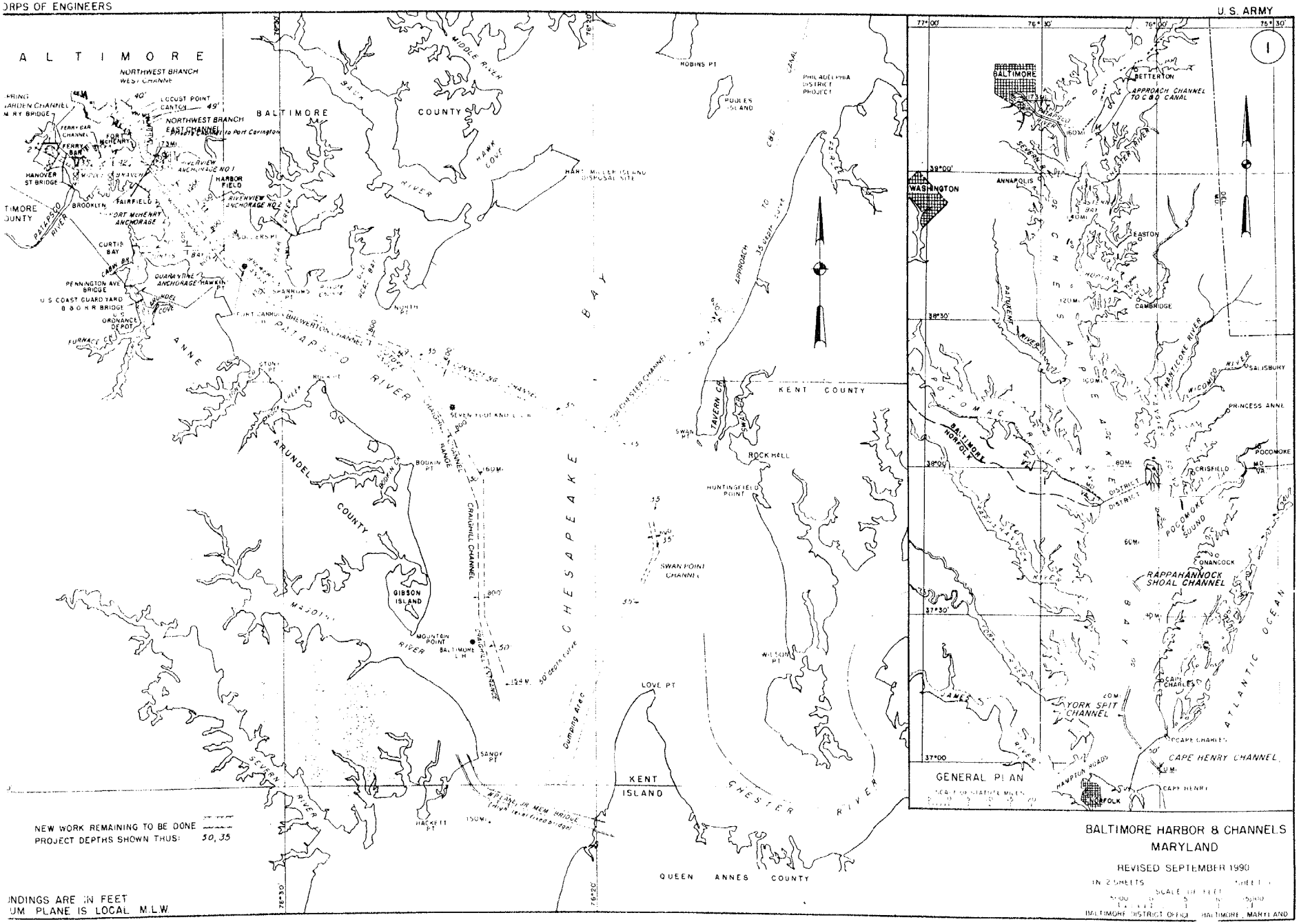
## SECTION 1

## INTRODUCTION

The Port of Baltimore is located on a 32-square-mile area of the Patapsco River and its tributaries, approximately 12 miles northwest of the Chesapeake Bay and approximately 172 miles north of the Virginia Capes entrance to the Chesapeake Bay. The Baltimore Harbor and Channels project lies in Baltimore City and Anne Arundel, Baltimore, and Kent Counties in Maryland, and in Northampton and Accomack Counties in Virginia; and it is located in the first, second, third, and fourth Congressional districts in Maryland and the first Congressional district in Virginia.

Vessels arrive at and depart from the Port of Baltimore via the southern Chesapeake Bay (Cape Henry) route or the northern Chesapeake Bay route through the Chesapeake and Delaware (C&D) Canal. The U.S. Army Corps of Engineers (Corps) is responsible for operating and maintaining the 126 miles of Federal navigation channels that serve the Port of Baltimore. The State of Maryland Department of Transportation, Maryland Port Administration, is the Non-Federal sponsor.

The Brewerton Channel Eastern Extension (also known as the Connecting Channel to the C&D Canal) is located in the northern portion of the Chesapeake Bay, and extends from the main ship channels at the mouth of the Patapsco River in an east-southeasterly direction across the Chesapeake Bay, Maryland (see Figure 1). The authorized dimensions of the channel are 35 feet deep and 600 feet wide. The channel was deepened to 35 feet Mean Lower Low Water (MLLW) and widened to 450 feet in 1986, and the eastern nautical mile of the channel was widened to 600 feet. The western 5 miles of the Brewerton Channel Eastern Extension have not been widened from 450 feet to the authorized width of 600 feet. The Maryland Port Administration requests that the Brewerton Channel Eastern Extension be constructed to its authorized width to improve navigation safety, and to reduce navigation delays associated with vessels waiting for other vessels to clear the Brewerton Channel Eastern Extension or navigating the longer 12.2 nautical mile route south through the Swan Point Channel and north through the main approach channels. This longer route results in a 1-1/4 hour delay for the vessels traveling to and from Baltimore. The proposed action, which is to dredge 5 miles of the channel to a width of 600 feet and a depth of 35 feet, will complete authorized construction for the project (see Figure 2).


ORPS OF ENGINEERS
U. S. ARMY
BALTIMORE
NORTHWEST BRANCH WEST CHANNEL
NORTHWEST BRANCH EAST CHANNEL
BALTIMORE COUNTY
MIDDLE RIVER
BACK RIVER
HAWK COVE
ROBINS PT
POOLES ISLAND
PHILADELPHIA DISTRICT PROJECT
HART MILLER ISLAND DISPOSAL SITE
APPROACH TO C&D CANAL
35 depth curve
FAIRLEE
HANOVER ST BRIDGE
BROOKLYN
FAIRFIELD
FORT McHENRY ANCHORAGE
HARBOR FIELD
RIVERVIEW ANCHORAGE NO 1
RIVERVIEW ANCHORAGE NO 2
CURTIS BAY
PENNINGTON AVE BRIDGE
U S COAST GUARD YARD
B & O R R BRIDGE
ORDNANCE DEPOT
QUARANTINE ANCHORAGE
HAWKIN PT
SPARROWS PT
FORT CARROLL
BREWERTON CHANNEL
PATAPSCO RIVER
ANNE ARUNDEL COUNTY
SEVEN FOOT KNOLL L H
CRAIGHILL CHANNEL
BOUKIN PT
GIBSON ISLAND
MOUNTAIN POINT
BALTIMORE L H
CHESAPEAKE BAY
TAVERN CR
SWAN PT
KENT COUNTY
ROCK HALL
HUNTINGFIELD POINT
SWAN POINT CHANNEL
WILSON PT
LOVE PT
Dumping Area
SANDY PT
HACKETT PT
KENT ISLAND
CHESTER RIVER
QUEEN ANNES COUNTY
SEVERN RIVER
NEW WORK REMAINING TO BE DONE
PROJECT DEPTHS SHOWN THUS: 50, 35
UNDINGS ARE IN FEET
UM PLANE IS LOCAL M.L.W.
BALTIMORE
BETTERTON
APPROACH CHANNEL TO C&D CANAL
WASHINGTON
ANNAPOLIS
EASTON
CAMBRIDGE
SALISBURY
PRINCESS ANNE
POCOMOKE
CRISFIELD
POCOMOKE SOUND
ONANCOCK
RAPPAHANNOCK SHOAL CHANNEL
ATLANTIC OCEAN
CAPE CHARLES
YORK SPIT CHANNEL
CAPE HENRY CHANNEL
CAPE HENRY
HAMPTON ROADS
NORFOLK
GENERAL PLAN
BALTIMORE HARBOR & CHANNELS
MARYLAND
REVISED SEPTEMBER 1990
IN 2 SHEETS
SHEET 1
SCALE OF FEET
BALTIMORE DISTRICT OFFICE BALTIMORE, MARYLAND

FIGU

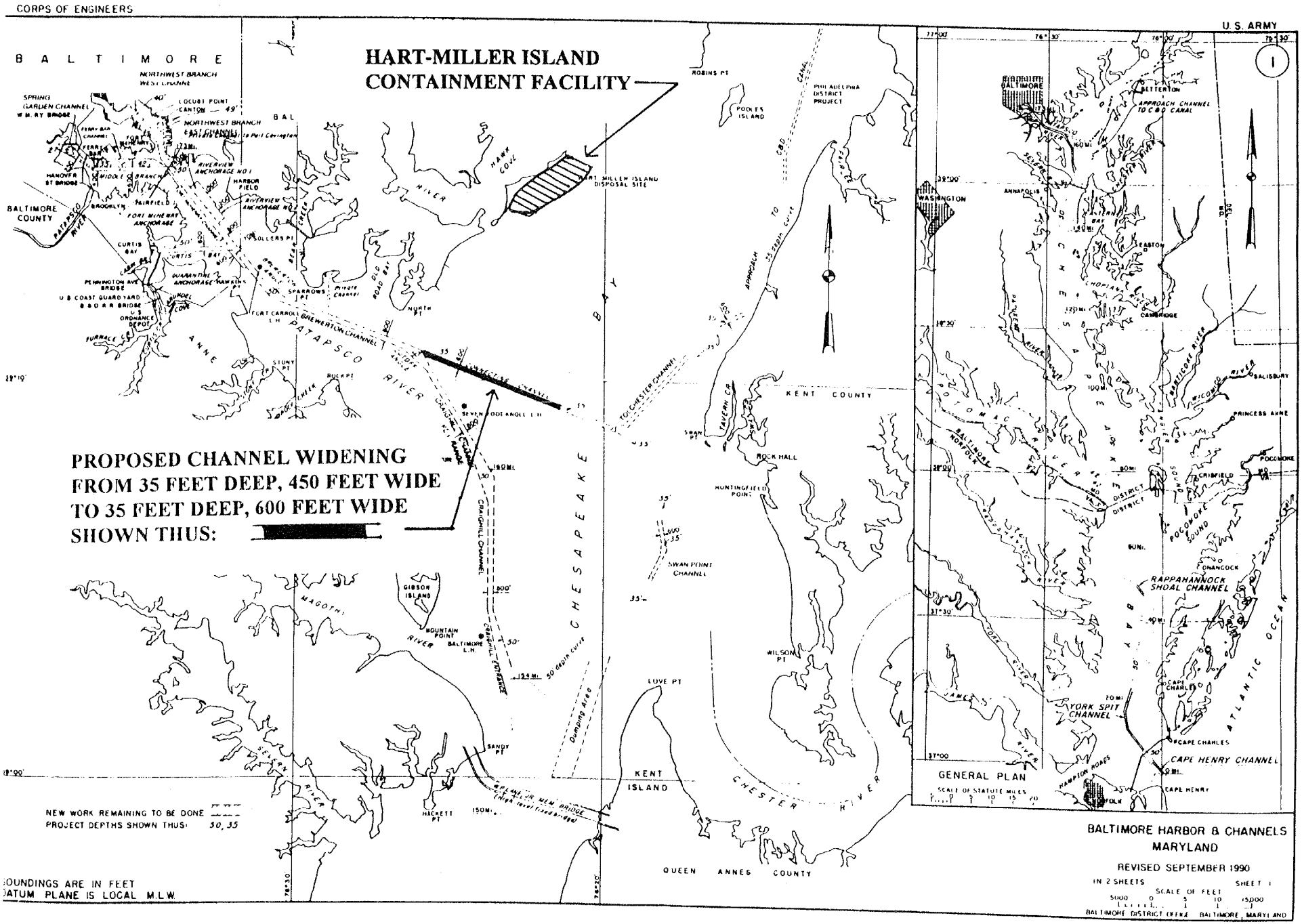

CORPS OF ENGINEERS
U.S. ARMY
HART-MILLER ISLAND
CONTAINMENT FACILITY
PROPOSED CHANNEL WIDENING
FROM 35 FEET DEEP, 450 FEET WIDE
TO 35 FEET DEEP, 600 FEET WIDE
SHOWN THUS:
BALTIMORE
BALTIMORE COUNTY
PATAPSCO RIVER
CHESAPEAKE BAY
KENT COUNTY
KENT ISLAND
QUEEN ANNES COUNTY
CHESTER RIVER
ATLANTIC OCEAN
GENERAL PLAN
NEW WORK REMAINING TO BE DONE
PROJECT DEPTHS SHOWN THUS: 30, 35
SOUNDINGS ARE IN FEET
DATUM PLANE IS LOCAL M.L.W.
BALTIMORE HARBOR & CHANNELS
MARYLAND
REVISED SEPTEMBER 1990
IN 2 SHEETS
SHEET 1
SCALE OF FEET
BALTIMORE DISTRICT OFFICE BALTIMORE, MARYLAND

FIGURE 2

The purpose of this Limited Reevaluation Report (LRR) is to analyze the viability of completing the authorized project. In accordance with Engineering Regulation (ER) 1105-2-100, a reevaluation of the benefit-cost ratio computations is required when more than 2 years have elapsed since the latest approved analysis. This analysis is required to ensure that the project economic justification is still current for follow-on funding and for sponsor acceptance of the recommended plan. This analysis considered navigation design safety, economic feasibility, and compliance with applicable environmental laws and regulations in arriving at a recommendation for completion. This Limited Reevaluation Report provides a description of the project history, a discussion of the design safety analyses, a discussion of the benefits and cost of completing the authorized project, and the environmental documentation necessary for compliance with the National Environmental Policy Act (NEPA) of 1969.

**Project Authorization**

The existing project for Baltimore Harbor was adopted by the River and Harbor Act of August 8, 1917, and modified by the River and Harbor Acts of January 21, 1927; July 3, 1930; October 7, 1940; March 2, 1945; July 3, 1958; and December 31, 1970. The existing navigation project is shown in Figure 1.

**Project Description**

The existing project includes a main channel, 50 feet deep, between Cape Henry, Virginia, and Fort McHenry at Baltimore. The authorized dimensions of the channels are as follows:

1. Cape Henry Channel: 50 feet deep and 1,000 feet wide from the 50-foot depth curve in the Atlantic Ocean to that depth in the Chesapeake Bay, a distance of 3 miles.

2. York Spit Channel: 50 feet deep and 1,000 feet wide connecting the 50-foot depth curves in the Chesapeake Bay opposite the York River near York Spit, a distance of 18.4 miles.

3. Rappahannock Shoal Channel: 50 feet deep and 1,000 feet wide connecting the 50-foot depth curves in the Chesapeake Bay opposite the Rappahannock River, a distance of 10.3 miles.

4. Craighill Approach Channel to Fort McHenry: 50 feet deep and generally 800 feet wide, widened at the entrance and bends, from the 50-foot depth curve in the Chesapeake Bay opposite the mouth of the Magothy River to Fort McHenry on the Patapsco River, a distance of 20.7 miles.

The existing project also authorizes a series of branch channels that provide access to the various public and private terminals serving the Port of Baltimore and that connect the main channel with the C&D Canal. The dimensions of the branch channels are as follows:

1. Connecting Channels to the Chesapeake and Delaware Canal Approach Channel: 35 feet deep, 600 feet wide, and 15.6 miles long from the Cutoff Angle of the main approach channel to the 35-foot depth curves in the natural channel on the east side of the Chesapeake Bay, to the Inland Waterway from the Delaware River to the Chesapeake Bay, Chesapeake and Delaware Canal project. The connecting channels include the Brewerton Channel Eastern Extension, the Swan Point Channel, and the Tolchester Channel.

2. Curtis Bay Channel: 50 feet deep, 600 feet wide, and 2.2 miles long from the Fort McHenry Channel of the main approach channel, to and including a 1,275-foot-wide turning basin at the head of Curtis Bay.

3. Curtis Creek Channel:

   a. A channel 35 feet deep and 200 feet wide in Curtis Creek, from the 50-foot Curtis Bay Channel, to 750 feet downstream of the Pennington Avenue Bridge, a distance of 0.9 miles.

   b. A channel 22 feet deep and 200 feet wide, from the 35-foot channel, to and along the marginal wharf of the Curtis Bay Ordnance Depot.

   c. An irregularly shaped basin 18 feet deep and 320 feet wide, adjacent to the head of the 22-foot channel, a distance of 600 feet.

   d. A basin 15 feet deep and 450 feet wide, from the end of the 22-foot channel to the end of the marginal wharf, a distance of 0.2 miles.

   e. A channel 22 feet deep and 200 feet wide, from the 22-foot channel, to the vicinity of Arundel Cove, a distance of 2,800 feet, then 100 feet wide in Arundel Cove for a distance of 2,100 feet, with an anchorage basin 700 feet square adjacent to the channel and southwest of the wharf of the U.S. Coast guard Depot at Curtis Bay.

4. Middle Branch: Ferry Bar East Section: A channel 42 feet deep, 600 feet wide, and 1.4 miles long from the Fort McHenry Channel of the main approach channel, to Ferry Bar. The West Ferry Bar and Spring Garden sections of the channel were deauthorized by Section 1001 of the Water Resources Development Act of 1986, PL 99-662.

5. Northwest Branch:

a. East Channel: A channel 49 feet deep, 600 feet wide, and 1.3 miles long, with a 950-foot-wide turning basin at the head of the channel.

a. West Channel: A channel 40 feet deep, 600 feet wide, and 1.3 miles long, with a 1,050-foot-wide turning basin at the head of the channel.

Four anchorages with the following dimensions were authorized by the existing project:

1. Fort McHenry Anchorage (Anchorage No. 1): 35 feet deep, 400 feet wide, and 3,500 feet long, southwest of the intersection of the Fort McHenry Channel of the main approach channel and the Ferry Bar Channel.

2. Riverview Anchorage No. 1 (Anchorage No. 3): 35 feet deep, 1,500 feet wide, and 4,500 feet long, on the northeast side of the Fort McHenry Channel of the main approach channel, in the vicinity of the Seagirt Marine Terminal.

3. Riverview Anchorage No. 2 (Anchorage No. 4): 30 feet deep, 1,200 feet wide, and 2,400 feet long, on the northeast side of the Fort McHenry Channel of the main approach channel, southeast of Riverview Anchorage No. 1, in the vicinity of the Dundalk Marine Terminal.

4. Quarantine Anchorage: 35 feet deep, 600 feet wide, and 3,500 feet long, southwest of the intersection of the Fort McHenry Channel of the main approach channel and the Curtis Bay Channel. The anchorage was deauthorized in 1970 to permit construction of the Francis Scott Key Memorial Bridge.

**Background**

Section 101 of the River and Harbor Act of July 3, 1958, PL 85-500, authorized the deepening and widening of the main channels to Baltimore Harbor from 39 feet to 42 feet deep and from 600 feet to 800 feet wide, and the deepening and widening of the connecting channels to the Chesapeake and Delaware (C&D) Canal from 27 feet deep and 400 feet wide to 35 feet deep and 600 feet wide. The connecting channels are comprised of the Brewerton Channel Eastern Extension, the Swan Point and Tolchester Channels. In addition, the Act authorized maintenance of channels up to 39 feet deep in the Northwest Branch, provided that local interests first deepen the channels to that depth. All of the improvements authorized by the 1958 Act have been constructed with the exception of widening the western 5 miles of the Brewerton Channel Eastern Extension from 450 to 600 feet.

Initial planning and construction began in FY 61. The State of Maryland provided the necessary assurance of local cooperation for construction of the main channels, branch channels, and a portion of the Swan Point and Tolchester Channels. Deepening and widening of the main ship channels and branch channels were completed in FY 67. The Swan Point and Tolchester approach channels to the C&D Canal were constructed to 35 feet deep and 450 feet wide (authorized to 600 feet) during FY 68. No work was accomplished to deepen or widen the Brewerton Channel Eastern Extension from its existing dimensions of 27 feet deep and 400 feet wide. No progress was made on the uncompleted portions of the Swan Point and Tolchester Channels from 1969 through 1978, since construction of the C&D Canal to 35 feet deep and 450 feet wide was not complete and since the State of Maryland was unable to furnish suitable dredged material placement areas. Ships transiting the C&D Canal having drafts in excess of those that could transit the Brewerton Channel Eastern Extension, navigated the Tolchester and Swan Point Channels toward the Chesapeake Bay Bridge and then turned north and used the main approach channels to the Port of Baltimore.

The Maryland Department of Transportation's May 14, 1979, letter identified the Pooles Island Deep open water placement area to receive material dredged from widening the Swan Point and Tolchester Channels to their authorized width of 600 feet. Construction funds were appropriated, and the work was completed in 1981. The Maryland Port Administration (MPA) notified the District in its letters of May 14, 1979, and July 6, 1979, that construction of the Brewerton Channel Eastern Extension should be deferred until such time as the State's program for containment structures could be implemented. In March 1981, the District advised the MPA of its intention to reclassify the channel to the "deferred" category until a suitable dredged material placement area could be identified. On January 18, 1982, the channel was reclassified from the "active" to the "deferred" category by the Headquarters, U.S. Army Corps of Engineers (HQUSACE). No work was accomplished to deepen or widen the Brewerton Channel Eastern Extension from its existing dimensions of 27 feet deep and 400 feet wide through 1984, since the State of Maryland was unable to provide suitable placement areas for the dredged material

The MPA's January 14, 1985, letter requested the Brewerton Channel Eastern Extension be reactivated and designated the Hart-Miller Island Dredged Material Containment Facility for the deposition of dredged material from the channel. HQUSACE reclassified the channel from the "deferred" to the "active" category on May 15, 1985. The District then conducted the engineering and the design, economic, and environmental studies for the project. Several alternatives were formulated to determine the best plan for deepening and widening the channel. Construction of the channel to the authorized depth of 35 feet and width of 600 feet was determined to be economically justified. The February 1986 Baltimore Harbor & Channels, Maryland and Virginia (42-Foot) Project - Supplement to the General Design Memorandum dated March 1961 recommended deepening and widening the Brewerton Channel Eastern Extension from 27 feet deep and 400 feet wide to 35 feet deep and 600 feet wide. The Supplement was approved by HQUSACE on

March 7, 1986. The Assistant Secretary of the Army for Civil Works (ASA-CW) concurred with the 600-foot width, but recommended reducing the channel depth to 32 feet. After meeting with Congresswoman Helen Delich Bentley, Maryland Secretary of Transportation William K. Hellmann, and President of the Association of Maryland Pilots Captain Michael R. Watson; considering the analysis of existing and future vessel passing situations, the pilot's vessel operating procedures, and the safe operation of the existing 400-foot wide Brewerton Channel Eastern Extension and the 450-foot-wide channels through the C&D Canal; and receiving Secretary Hellmann's May 14, 1986, letter acknowledging the operating constraints of a 450-foot-wide channel, the ASA-CW approved construction of a channel 35 feet deep and 450 feet wide. Construction of a 450-foot-wide channel reduced the amount of dredging from 6.7 million to 4 million cubic yards. Construction funds were appropriated in FY 86, and a contract for deepening and widening the Brewerton Channel Eastern Extension from 27 feet deep and 400 feet wide to 35 feet deep and 450 feet wide was awarded in July 1986. Dredging commenced in August 1986 and was completed in December 1986, with the removal of 4.0 million cubic yards at a cost of $9 million.

Minor widening of the turn at the eastern end of the Brewerton Channel Eastern Extension to extend the turn 400 feet to the west and widen the turn from 1,200 to 1,280 feet was accomplished in April 1988, removing 125,408 cubic yards of material at a cost of $443,944 to improve navigation safety.

During the design of the Brewerton Channel Eastern Extension and preparation of the Supplement to the General Design Memorandum, self-propelled vessels navigating the C&D Canal were limited to a maximum length of 840 feet by the Philadelphia District. The Philadelphia District increased the maximum vessel length restriction to 886 feet on October 17, 1985, and rescinded the self-propelled vessel length restrictions on May 2, 1988. The Association of Maryland Pilots and the Pilots' Association for the Bay and River Delaware have since increased the lengths of vessels permitted to navigate the C&D Canal from 886 to 965 feet. Due to the acuteness and the relatively short radius of curvature of the turn at the intersection of the Brewerton Channel Eastern Extension and the Tolchester Channel, some of the larger vessels experienced difficulty navigating the turn. After a Maersk vessel grounded at the eastern end of the Brewerton Channel Eastern Extension in January 1989, the MPA and the Association of Maryland Pilots (AMP) requested the turn at the eastern end of the channel and the eastern portion of the channel be widened. The ASA-CW approved widening the eastern nautical mile of the channel from 450 feet to 600 feet and widening the angle at the eastern end by 400 feet in January 1990 to improve navigation safety. Dredging commenced in May 1990 and was completed in April 1991, removing approximately 725,000 cubic yards at a cost of approximately $1,786,750.

Since there was no further new work activity proposed for the channel, the District advised the MPA in May 1991 of its intentions to reclassify the remaining unconstructed portion

of the project (widening the channel from 450 to 600 feet) from the "active" to the "deferred" budgeting category. HQUSACE reclassified the remaining work to the "deferred" category on September 13, 1991.

**Status of the Existing Project**

All of the improvements authorized by the 1958 Act have been constructed with the exception of the Brewerton Channel Eastern Extension.

In January 1992, the MPA, after consulting with the Association of Maryland Pilots and surveying shipping lines, developed an Action Plan for improving the channels leading to the Port of Baltimore. The Action Plan included widening the Brewerton Channel Eastern Extension to its authorized width. During the February 11, 1992, meeting, the District advised the MPA that widening the channel was considered new work construction and that the MPA should submit a letter that: (1) requested the project be reclassified from the "deferred" to the "active" budgeting category, (2) provided justification for widening the channel, (3) identified a suitable dredged material placement area for the estimated 2.5 million cubic yards of dredged material, and (4) indicated the State's willingness to cost share the work in accordance with the Water Resources Development Act of 1986. Congresswoman Helen Delich Bentley endorsed the MPA's Action Plan in her July 7, 1992, letter to Major General Edgar, HQUSACE. HQUSACE's August 6, 1992, response reiterated the action required to initiate work on the project (see Appendix A for pertinent correspondence).

The MPA's February 18, 1993, letter (see Appendix A) requested that the Corps reclassify the project to the "active" category and widen the Brewerton Channel Eastern Extension to the authorized width of 600 feet. The MPA indicated it would provide the required lands, easements, rights-of-way, and suitable placement areas for the estimated 2.5 million cubic yards of dredged material, as well as the non-Federal share of project costs as set forth in the Water Resources Development Act of 1986.

HQUSACE reclassified the Brewerton Channel Eastern Extension from the deferred to the active budgeting category on September 28, 1993, and requested that a decision document be prepared to justify the work (see Appendix A). HQUSACE previously indicated that a resumption of construction would require cost sharing in accordance with Section 101 of the Water Resources Development Act of 1986, PL 99-662.

The Association of Maryland Pilots indicates that the channel widening is an important safety and high priority issue, and fully supports the widening as stated in their June 6, 1994, letter (see Appendix A).

THIS PAGE LEFT BLANK INTENTIONALLY

# BALTIMORE HARBOR AND CHANNELS, MARYLAND AND VIRGINIA, 42-FOOT PROJECT BREWERTON CHANNEL EASTERN EXTENSION LIMITED REEVALUATION REPORT

## SECTION 2

## ENGINEERING & DESIGN

### Introduction

The Brewerton Channel Eastern Extension crosses the Chesapeake Bay in an east southeasterly direction, from the Cutoff angle of the main approach channel to Baltimore Harbor at the mouth of the Patapsco River, to the eastern side of the Chesapeake Bay where it intersects with the Tolchester Channel. The channel is authorized to a depth of 35 feet and a width of 600 feet. The existing channel is 35 feet deep MLLW, 450 feet wide from Station 0+000 to Station 25+000 (the western 25,000 feet), 600 feet wide from Station 25+000 to Station 30+600, with a cutoff angle that widens to 1,630 feet between Station 30+600 to Station 33+600 where there is a 70 degree turn at the intersection with the Tolchester Channel. Based upon the Corps' design constraints for a 450-foot wide channel, two-way traffic in the western 5 miles is limited to the passing of ships with a combined beam width of 160 feet, which essentially limits many ships to one-way traffic.

The Maryland Port Administration and Association of Maryland Pilots request that the western 5 miles of the channel be widened from 450 feet to the authorized width of 600 feet, since the 450-foot width limits navigation for most ships to one-way traffic. In addition, the prevailing currents and winds that cross the channel, and the rapid shoaling in the outside quarters of the channel can make navigation difficult. These limitations result in navigation delays and increased costs, since pilots must wait for ships to clear the channel or take a longer (additional 12 nautical miles), more circuitous route to avoid using the Brewerton Channel Eastern Extension. The wider channel would help alleviate navigation delays, save costs, and provide increased safety for vessels transiting the channel.

This section presents the results of engineering evaluations of the proposed widening of the western 5 miles of the Brewerton Channel Eastern Extension for the purpose of providing safer and more efficient movement of vessels calling on the Port of Baltimore. The following information is presented in this section:

Field Investigations
Site Conditions

Channel Design
Ship Simulation Studies
Relative Risk Assessment
Quantity Calculations
Cost Estimates

The overall intent of this study is to assess the need for widening the Brewerton Channel Eastern Extension of the Baltimore Harbor and Channel 42-Foot Project and to recommend the optimum means for accomplishing this improvement.

**Field Investigations**

Hydrographic Surveys

Hydrographic surveys of the Brewerton Channel Eastern Extension were conducted by the Baltimore District's survey vessel *Linthicum* during May and June 1995, using a Sercel global positioning system. Surveys were conducted every 100 feet perpendicular to the channel centerline, and three soundings per second were collected along the cross sections. The surveys are referenced to Mean Lower Low Water (MLLW) vertical datum and North American Datum (NAD) of 1983, Maryland State Plane Coordinate Grid horizontal datum. The surveys were used to provide baseline information for the ship simulation and hydrodynamic modeling studies, to determine the proposed alternative channel widening configurations, and to compute dredging quantities for the proposed channel widening alternatives. The surveys are shown on Plates 1 through 5 of this section.

Sidescan Sonar and Magnetometer Surveys

The Karrel Institute conducted sidescan sonar and proton magnetometer surveys of the Brewerton Channel Eastern Extension in 1979 to identify possible obstructions and archeologically significant artifacts. Twenty-one sonar targets and 123 magnetic anomalies were identified. Based upon the relatively small size and location of the targets, the Karrel Institute concluded that none of the targets was historically significant, and that the targets were most likely artifacts associated with channel buoys such as anchor chains or weights, or scattered pieces of cable, iron, or steel debris. No further investigations were warranted. New work dredging operations in 1986, 1988, 1990, and 1991 to deepen and widen the channel, as well as subsequent maintenance dredging operations, did not find any significant artifacts or debris that required special dredging techniques or that resulted in additional contract costs. No further sidescan sonar and proton magnetometer surveys were deemed necessary for this study.

Geotechnical Investigations

Bottom sediments of the upper Chesapeake Bay in the vicinity of the Brewerton Channel Eastern Extension are predominantly clayey silt, with some occurrences of sand-silt-clay. The upper Chesapeake Bay is a zone of net deposition of sediments as a result of fresh water rivers bringing sediments to the Bay where the saline waters act as a flocculent. The Susquehanna River is the primary source of new sediment. Sediments that shoal in the Brewerton Channel Eastern Extension are comprised of fine silts and clays. Due to the channel's location in the middle of the upper Chesapeake Bay and the shallow waters on either side of the channel, the primary sources of sediments are runoff from the Susquehanna River, shoreline erosion, and resuspension of bay bottom sediments from wave action and ship energy. Sediments settling in the center of the channel typically are resuspended by ships transiting the channel, and most of the noticeable shoaling occurs in the outside quarters of the channel and along the channel toes.

Extensive soil investigations were made in the Brewerton Channel Eastern Extension to determine the character of the materials to be dredged. Sixteen borings were taken in the 1960's, and an additional 34 borings were taken in June and July of 1985 for the proposed widening and deepening of the Brewerton Channel Eastern Extension from its previous dimensions of 27 feet deep and 400 feet wide to its authorized dimensions of 35 feet deep and 600 feet wide. The geotechnical analyses indicate that the material is predominantly inorganic silty clays of high plasticity. Some borings showed traces of fine sand or shell and some borings showed sandy clays, clayey silts, and organic clayey silts of high plasticity. There were no soil problems anticipated with dredging the Brewerton Channel Eastern Extension. Subsequent deepening and widening of the channel from 27 feet deep and 400 feet wide to 35 feet deep and 600 feet wide in 1986, and widening of the eastern nautical mile of the channel to 600 feet in 1990 and 1991 confirmed the material types reflected in the borings and did not result in any dredging difficulties or increased contract costs. Therefore, no further geotechnical investigations were deemed necessary for this study.

Utility Investigations

There are no utilities or other structures that cross the Brewerton Channel Eastern Extension or that are in the immediate vicinity of the channel.

Aids to Navigation

The Brewerton Channel Eastern Extension is well marked with range lights and floating aids to navigation. The centerline of the Brewerton Channel Eastern Extension is an extrapolation of the centerline of the Brewerton Channel of the main approach channels to Baltimore Harbor. Two fixed range lights are located west of the Brewerton Channel and two fixed range lights are located east of the Brewerton Channel Eastern Extension to

mark the centerlines of both channels. Therefore, any proposed channel widening will be accomplished symmetrically about the existing centerline to maintain navigation safety.

There are nine floating aids from Station 0+000, at the western end of the channel, to Station 25+200, where the channel widens to 600 feet (see Plates 1-4). One aid is located on the north side of the channel where it intersects the Cutoff Angle and the remaining eight buoys are paired or "gated," with one buoy on each side of the channel. The pairs or "gates" are positioned approximately every nautical mile.

Since the channel would be widened symmetrically about the existing centerline and the channel is well marked with floating aids to navigation, no changes to the existing range lights will be required and no new aids to navigation will be required.

The U.S. Coast Guard sets the buoy sinkers approximately 75 feet outside of the channel toe. Therefore, the nine floating aids to navigation will need to be moved in order to accommodate the dredging operations and then repositioned to mark the wider channel. The U.S. Coast Guard removes the regular floating aids during the late fall and early winter and replaces them with lighted ice buoys, which are designed to withstand the forces of shifting and flowing ice for winter operations. The lighted ice buoys are replaced with the regular buoys in the spring. The lighted ice buoys are generally used between December 1, and March 15. Since dredging would be scheduled to occur between October and March to facilitate drying and consolidation of the dredged material at Hart-Miller Island, the U.S. Coast Guard indicates that it would remove the regular aids and replace them with ice buoys positioned sufficiently far outside the channel to accommodate dredging operations in the fall and then replace the regular buoys in the proper position in the spring when dredging is complete. The U.S. Coast Guard, therefore, would relocate the buoys as part of its routine operation and maintenance and there would be no incremental cost to the project.

Regulations and Restrictions

The Code of Federal Regulations was reviewed for restrictions and regulations for the Port of Baltimore and its approach channels. There are currently no restrictions specifically associated with the use of the Brewerton Channel Eastern Extension published in 33 CFR. The Brewerton Channel Eastern Extension is included in the area subject to navigation restrictions during ice conditions as specified in 33 CFR 165.503, Chesapeake Bay Ice Navigation Season.

The Annotated Code of Maryland, Article 74, Section 10, requires "Every foreign vessel and every American vessel engaged in foreign trade, including such vessels towing or being towed, when underway on navigable waters and within the boundaries of the State of Maryland, except when maneuvering during berthing or unberthing operations or shifting within the confine of a port with tug assistance and a docking master aboard the

vessel, shall employ a pilot holding a valid warrant of appointment and license issued by the Board of Examiners of Maryland Pilots, or in case of refusal to take such a pilot shall themselves, their master, shipowner, charterers or ship's husband pay the said pilotage as if a pilot had been employed." Article 74, Section 11, exempts American vessels employed in the coastwise trade. Federal regulation require pilots in coastwise trade to have a U.S. Coast Guard license.

As a condition for widening the Brewerton Channel Eastern Extension to a width of 450 feet in 1986, the Baltimore District advised the Maryland Department of Transportation that the Brewerton Channel Eastern Extension was designed for the passage of vessels with a maximum combined beam of 160 feet. This restriction precludes the passing of two Panamax class container vessels (vessels with beams of 106 feet) and essentially limits traffic to one way for vessels with beams of 106 feet or greater.

**Site Conditions**

Additional site conditions in the study area were condensed from existing data as presented in previous Corps of Engineers reports, National Oceanic and Atmospheric Administration Tide and Current Tables, the United States Coast Pilot No. 3, and other available sources. These conditions were used for conducting the ship simulation studies and designing the channel.

Tides

Tides in the Chesapeake Bay are semidiurnal, generally exhibiting two high tides and two low tides per day. The mean tidal range in Baltimore Harbor is 1.1 feet at Ft. McHenry. Mean High Water (MHW) is 1.35 feet above Mean Lower Low Water (MLLW) and mean tide level is 0.8 feet above MLLW. Hurricanes and storms periodically strike the Baltimore area causing extreme high and low tides. Prolonged winds from the northwest will move water out of the upper Chesapeake Bay, lowering water levels, while prolonged southeast winds will move water into the upper Chesapeake Bay, increasing water levels. Water levels at Ft. McHenry have been recorded as low as 4.9 feet below MLLW and as high as 7.9 feet above MLLW.

Current Conditions

Currents affecting the study area are generally caused by tidal currents, fresh water runoff, and storm-induced surges. Since the Brewerton Channel Eastern Extension crosses the upper Chesapeake Bay, it is exposed to tidal currents and winds. Tidal currents are semidiurnal (generally two flood tides and two ebb tides per day), with predicted tidal currents aligned almost perpendicular to the channel, reversing approximately 180 degrees during flood and ebb tide cycles. Tidal currents have average maximum velocities of 0.2 and 0.4 knots for ebb and flood currents, respectively, at the western end of the channel,

and 0.7 and 0.6 knots for ebb and flood currents, respectively, at the eastern end of the channel. However, actual current velocities can frequently exceed 1 knot. Storm-induced surges and heavy runoff during and following storm events will increase current velocities throughout the area.

Wind Conditions

Wind conditions vary. The most critical conditions for navigating the Brewerton Channel Eastern Extension occur when prevailing northerly winds coincide with an ebb tide and, to a lesser degree, when prevailing southerly winds combine with a flood tide. The upper Chesapeake Bay is exposed to predicted as well as sudden storms with high winds, which can adversely affect navigation. Wind speeds can easily reach 30 to 50 miles per hour. Hurricanes can occur in the area from June through November.

Wave Conditions

Wave conditions in the upper Chesapeake Bay are caused by waves propagating through the Chesapeake Bay and by locally generated wind waves. Wave heights in the upper Chesapeake Bay can reach several feet. Surface waves are not of a sufficient magnitude to adversely affect larger vessels.

Ice Conditions

The upper Chesapeake Bay is frequently subject to freezing conditions during the period of December through February each year, resulting in ice coverage of several inches to 1 foot thick. Subsequent breaking and movement of the ice with the tides and winds results in the ice piling up to form ice flows that can be several feet thick in areas. The U.S. Coast Guard implements vessel hull and minimum horse power restrictions, depending upon the severity of the ice conditions. Ice conditions increase maneuvering difficulty due to the increased resistance and the need to cut through the ice, and the movement of large ice floes with the tides, which may move vessels off the intended course. The ice also obscures navigation buoys which make it more difficult to judge the layout of the channel and the vessel's location in the channel.

Weather Conditions

Fog conditions are common during the fall and spring months of the year and at other times. Such conditions make navigation more difficult since range lights, buoys, and other vessels can be obscured by the fog, and pilots must rely upon the vessel's radar. Thunderstorms are also frequent, particularly during the summer months. The storms can be accompanied by high gusts of wind, that can move vessels off course, and by heavy downpours that obscure range lights, buoys, and other vessels, and can attenuate radar performance.

Salinity

The Chesapeake Bay exhibits a typical, two-layered estuarine circulation pattern with a net seaward or southward flow of lighter, lower salinity water in the upper layers, and a net upstream or northward flow of denser, more saline waters in the deeper layers. Tidal currents cause some mixing of the two layers, which cause variations in salinity throughout the Bay. Salinity varies seasonally depending on the amount of freshwater introduced into the Bay. Salinity at the mouth of the Chesapeake Bay is close to that of open ocean conditions. Salinity in the upper Bay generally varies from an average of 5 parts per thousand during the spring when rainfall and snow melt increase freshwater inflow, to an average of 10 parts per thousand in the fall. Due to the decrease in salinity and density, from open ocean conditions near the mouth of the Chesapeake Bay or Delaware Bay, to the less dense, lower salinity conditions in the upper Chesapeake Bay, ship drafts may increase by a foot due to the loss of buoyancy. Salinity generally does not have a significant impact on the design of channel widths, although it does have significant impacts on channel depths. However, if channel depths are not sufficient in areas of lower salinity, the increase in ship draft and loss of underkeel clearance can result in increased maneuvering difficulty for ships, and the need for wider channels.

**Channel Design**

Engineer Regulation (ER) 1110-2-1404, Hydraulic Design of Deep Draft Navigation Projects, dated June 1, 1994, and Engineer Manual 1110-2-1613, Hydraulic Design of Deep Draft Navigation Projects, dated January 8, 1994, provide guidance for designing deep-draft channels. The design criteria for the Brewerton Channel Eastern Extension were established after a review of existing published data, the site conditions described previously, and the vessel characteristics described in the following paragraphs. These criteria were used for the development of the ship simulation studies and for the development and evaluation of alternative channel widths.

Vessel Characteristics

Vessel traffic using the Brewerton Channel Eastern Extension is limited to vessels that can transit the Chesapeake and Delaware (C&D) Canal. The existing C&D Canal project is authorized to a depth of 35 feet MLLW and has several bridge and pipeline crossings that limit the air draft of vessels to 136 feet at MHW. The Philadelphia District is responsible for regulating traffic in the C&D Canal, and it limits passing vessels to a maximum combined beam of 190 feet. The Philadelphia District previously limited the length of vessels, but rescinded its restrictions on self-propelled vessel lengths on May 2, 1988. The Association of Maryland Pilots and the Pilots' Association for the Bay and River Delaware currently limit vessels navigating the C&D Canal to a maximum length of 965 feet if the vessels have bow thrusters, and limit vessels without bow thrusters to a maximum length

of 760 feet. The Pilots have also set a maximum vessel draft limitation of 33 feet for the existing 35-foot-deep channels.

A review of the existing fleet using the Brewerton Channel Eastern Extension indicates that container vessels up to 965 feet long with beams of 106 feet account for 32 percent of the vessels. The design vessel selected was a Panamax container vessel 965 feet long, with a 106-foot beam, since vessels of this size frequently call on the port. It should be noted that Post-Panamax container vessels (with beams ranging from 135 to 145 feet) are in operation today, and several container lines have numerous ships either under construction or planned for construction in the next several years. The Port of Baltimore is already capable of handling these larger container vessels at its Seagirt Marine Terminal.

An analysis of the existing and future fleet was conducted to determine the vessels to be used in the channel width design. Two fourth-generation container ships, with beams of 106 feet, were selected to represent the typical passing situation between large vessels. These design vessels were selected for the following reasons:

a. Container ships currently represent approximately 32 percent of the benefitting fleet.

b. A significant proportion of the general cargo and bulk carrier vessels (34 percent of the fleet) have been retrofitted to carry containerized cargo, and will be replaced by the fourth-generation container ships over time.

c. Approximately 27 percent of the benefitting fleet have beam widths of 106 feet or greater.

d. As the fleet is replaced, the proportion of vessels with beam widths of 106 feet will increase, consistent with the maximum allowable beam for traversing the Panama Canal (Panamax design standard).

Channel Design

Engineer Manual (EM) 1110-2-1613, Hydraulic Design of Deep Draft Navigation Projects, dated January 8, 1994, divides channels into various lanes depending on whether there is one-way or two-way traffic. For channels with two-way traffic, the channel is divided into five lanes: a bank clearance lane between the channel edge and one of the ships; a maneuvering lane for the one ship; a ship clearance lane between the two ships; a maneuvering lane for the second ship, and a bank clearance lane between the other channel edge and the second ship.

Bank clearance provides a minimum distance between the ship and the channel edge to avoid the effects of bank suction or repulsion that may adversely impact ship handling and

may result in groundings. The maneuvering lane is the area within which the ship navigates, taking into account the beam of the ship and any yawing forces that may cause the ship to navigate at an angle or deviate from a straight line. Ship clearance is the minimum distance required between ships to avoid collisions or loss of control as a result of ship-to-ship interaction. EM 1110-2-1613 specifies the width of the bank clearance lanes, maneuvering lanes, and ship clearance lanes as a percentage of the vessel beams, based upon ship-handling characteristics, climatic conditions, and the composition of the channel bottom and banks. The April 8, 1983, version of EM 1110-2-1613, Hydraulic Design of Deep Draft Navigation Projects, suggested percentages ranging from 60 to 150 percent for bank clearance, 160 to 200 percent for maneuvering lanes, and 80 to 100 percent for ship clearance.

Bank clearance allowances of 70 percent of the vessel beam were selected since yawing forces are minimal, vessel controllability is good, navigation aids are good, and the channel edge materials consist primarily of fine silty material, offering little hazard to the vessels traversing the Brewerton Extension. Maneuvering lanes of 175 percent of the design vessel's beam were selected since the vessels have good controllability, and pilotage practices in the area are excellent, as exhibited by the absence of collisions in the project area and minimal incidences of groundings. The channel is also well marked by fixed-range lights at both ends of the channel and by floating aids to navigation, which are paired, one on each side of the channel, and located approximately every nautical mile. Tidal currents and winds cross the channel, causing some yawing forces. A ship clearance allowance of 90 percent of the vessel beam was selected, since the vessels have good maneuverability, the channel is well marked, and yawing forces are minimal.

Based on the selection of the percentage allowances described above for the design vessel, a channel width of 600 feet was derived for two-way traffic in the Brewerton Channel Eastern Extension, and is shown in Table 1.

Guidance provided in the January 8, 1994, version of EM 1110-2-1613, Hydraulic Design of Deep Draft Navigation Projects, suggest using a factor of 5.5 times the beam of the ship to determine the channel width of a two-way channel when dealing with a dredged channel of constant cross section, good aids to navigation, and maximum currents of 0.5 to 1.5 knots. Using a factor of 5.5 times the design vessel beam of 106 feet yields a design channel width of 583 feet, or about 600 feet.

TABLE 1

CHANNEL WIDTH FOR TWO-WAY TRAFFIC

| Channel Element | Percentage Allowance | Element Widths (feet) 106 ft + 106 ft Beam Passing |
|---|---|---|
| Bank Clearance | 70 | 74 |
| Maneuvering Lane | 175 | 186 |
| Ship Clearance | 100 | 106 |
| Maneuvering Lane | 175 | 186 |
| Bank Clearance | 70 | 74 |
| TOTALS | 590 | 626 |

**Ship Simulation Studies**

Engineer Regulation (ER) 1110-2-1461, Design of Navigation Channel Using Ship-Simulation Techniques, dated October 31, 1989, indicates that studies for the design of navigation channels should include ship simulation studies to determine the effects of proposed channel improvements on navigation and to optimize channel configurations and alignment to provide for safe and efficient navigation. Accordingly, the U.S. Army Corps of Engineers Waterways Experiment Station (WES) was tasked to conduct a navigation study that consisted of ship simulation modeling, two-dimensional hydrodynamic modeling, sedimentation modeling, and a differential global positioning system study that tracked vessels transiting the channel.

Differential Global Positioning System Tracking

The WES conducted differential global positioning system (DGPS) tracking of vessels transiting the channel in March 1995. DGPS transmitters were positioned on the bow and stern of the vessels in order to track the movement of the vessels through the channel. Using the configuration of the existing channel, the paths of the ships were plotted to determine the actual course of the ships through the channel and to determine whether there were any difficulties in navigating the channel. Since two-way traffic in the channel is limited to a combined beam of 160 feet, only one-way traffic could be tracked in the channel. The DGPS plots are included in Appendix B.

Ship Simulation Studies

The ship simulation studies utilized WES' Ship/Tow Simulator which is a "real-time" simulator. The simulator utilizes mathematical and hydrodynamic models of the waterways and vessel characteristics to model the behavior of the vessels. A two-dimensional hydrodynamic model of the waterway was developed, using the actual waterway depths of the channel and its immediate vicinity (obtained from the District's hydrographic surveys), National Ocean Service nautical charts for other areas of the upper Chesapeake Bay, and known current and tidal conditions throughout the upper Chesapeake Bay and tributaries. The simulator provides the pilot with an animated view of the project area, including nearby land features, floating navigation aids, range lights, and other vessels; radar displays; a precision navigation display that includes vessel speed (absolute and relative to the water), lateral velocities of the bow and stern, ship heading, rudder angle, engine speed, wind, and rate-of-turn indicator.

Pilots from the Association of Maryland Pilots were used to validate and conduct the studies since they have experience piloting the vessels in the channel. A picture of the simulator is shown in Figure 3 and a more detailed discussion of the simulator is contained in Appendix B. A container ship with a length of 965 feet, beam of 106 feet, and a draft of 33 feet was selected as the design vessel. The simulation runs modeled wind speeds of 25 knots from the northwest, and tidal currents corresponding to maximum ebb and maximum flood conditions.

Alternative channel widths of 500, 550, and 600 feet were investigated to optimize the channel width for two-way traffic. The existing 450-foot channel was modeled to provide a comparison for the proposed improvements and to provide a basis for pilots to compare the simulator to actual piloting conditions. Preliminary runs for two-way traffic using a 500-foot-wide channel resulted in numerous groundings, therefore, the 500-foot channel was dropped from further consideration for two-way traffic. Simulation runs of the 550- and 600-foot widths were conducted with both flood and ebb tide conditions.

Results of the simulations are recorded as track plots showing the paths of the vessels in the channel along with minimum clearances between the vessels and the banks and between vessels, vessels parameter plots (which show rudder angle, engine rpm, and vessel speeds), and pilot questionnaires.

The ship simulation study showed that the existing 450-foot and proposed 500-foot widths for the Brewerton Channel Eastern Extension are inadequate for the meeting of two Panamax containerships (965-foot length, 106-foot beam, and 33-foot draft). The simulation runs for the proposed 550-foot width resulted in fewer incidents of vessels leaving the channel than the 600-foot-wide channel. The greater incidence of vessels leaving the 600-foot channel could not be explained. Analyses of the track plots, however, indicate that the average bank clearances, particularly on the south side during ebb currents

FIGUR

and on the north side during flood currents, and ship clearances, were very low in the 550-foot channel. Since the bank clearance and ship clearance values were higher in the 600-foot channel, the 600-foot channel was recommended as the safer alternative. Results of the studies are included in Appendix B.

**Relative Risk Assessment**

The United States Coast Guard Fifth District performed a Relative Risk Assessment to evaluate the existing 450-foot channel and the proposed 600-foot channel for one-way and two-way traffic. The Relative Risk Assessment is a measure of the safety of the channel with respect to specific waterway conditions, the design vessel, environmental conditions, aids to navigation, and other pertinent factors. The Relative Risk Assessment used a container ship (length 965 feet, beam 106 feet) as the design vessel, cross currents of 0.7 knots, and three different aids to navigation scenarios, (1) only floating aids during daylight conditions, (2) only floating aids during nighttime conditions, and (3) only range lights.

The output from Relative Risk Assessments is a Relative Risk Factor (RRF). The RRF is assumed to be proportional to an actual or realistic probability of a vessel grounding or colliding with another vessel, for a given set of conditions. Relative Risk Factors do not represent actual or absolute probabilities of vessels grounding or colliding with other vessels. The RRF is a conservative measure and will yield higher estimates of the risks of grounding than would be expected to occur in actual transits of the channel.

The results of the Relative Risk Assessment are included in Appendix C. The relative risk factors for one-way and two-way traffic in the 450-foot wide channel, utilizing floating aids to navigation during both day and night conditions, were 0.02 and 0.6, respectively. This result indicates that the channel is safe for one-way traffic, but there is a high probability of a vessel running aground or colliding with another vessel if the channel is used for two-way traffic. The relative risk factors for one-way and two-way traffic in the 600-foot wide channel utilizing floating aids to navigation during both day and night conditions, were 0.000 and 0.3, respectively. This indicates that widening the channel would improve navigation safety for one-way traffic and two-way traffic. The relative probability of grounding was essentially eliminated for one-way traffic. The relative probability of grounding or colliding with two-way traffic was cut in half. A RRF of 0.3 is not uncommon and can be considered adequate for safe navigation.

**Quantity Calculations**

Dredging quantities for the alternative channel widths were calculated from the May and June 1995 surveys and include 2 feet of advanced maintenance dredging, plus 2 feet of allowable overdepth dredging, with side slopes of 3 horizontal to 1 vertical (3H:1V).

Quantities do not include any required maintenance dredging within the limits of the existing 35-foot-deep, 450-foot-wide channel prism, including 2 feet of advanced maintenance and 2 feet of allowable overdepth. Any existing maintenance material would be removed under the same contract as the proposed new work widening, but would be apportioned to the Operation & Maintenance, General Appropriation. Typical channel cross sections showing the existing 450-foot-wide channel and the proposed widening alternatives are shown in Figures 4 through 7. The estimated dredging quantities for the 500-, 550-, and 600-foot-wide channel alternatives are shown in Table 2.

TABLE 2

ESTIMATED DREDGED MATERIAL QUANTITIES (Cubic Yards)

| Dredging Depth | Alternative Channel Widths | | |
|---|---|---|---|
| | 500 Feet | 550 Feet | 600 Feet |
| Project Depth - 35 Feet MLLW | 299,600 | 869,900 | 1,487,700 |
| Plus 2 Feet Advanced Maintenance | 193,000 | 299,100 | 396,700 |
| Plus 2 Feet Allowable Overdepth | 173,800 | 276,400 | 373,200 |
| Total to 39 Feet MLLW | 666,400 | 1,445,400 | 2,257,600 |

FIGURE 4

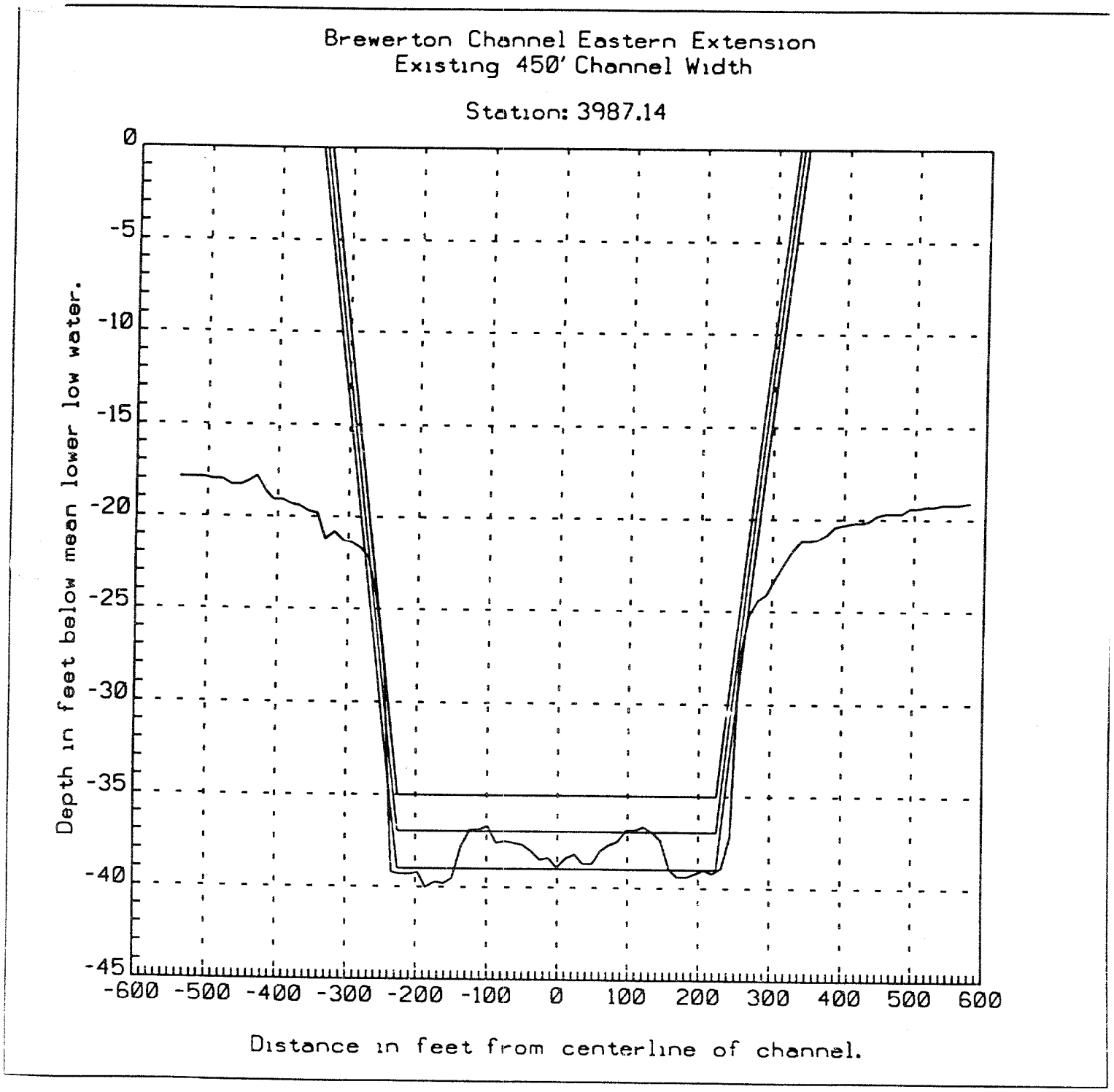

Brewerton Channel Eastern Extension
Existing 450' Channel Width
Station: 3987.14
Depth in feet below mean lower low water.
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-600 -500 -400 -300 -200 -100 0 100 200 300 400 500 600
Distance in feet from centerline of channel.

FIGURE 5

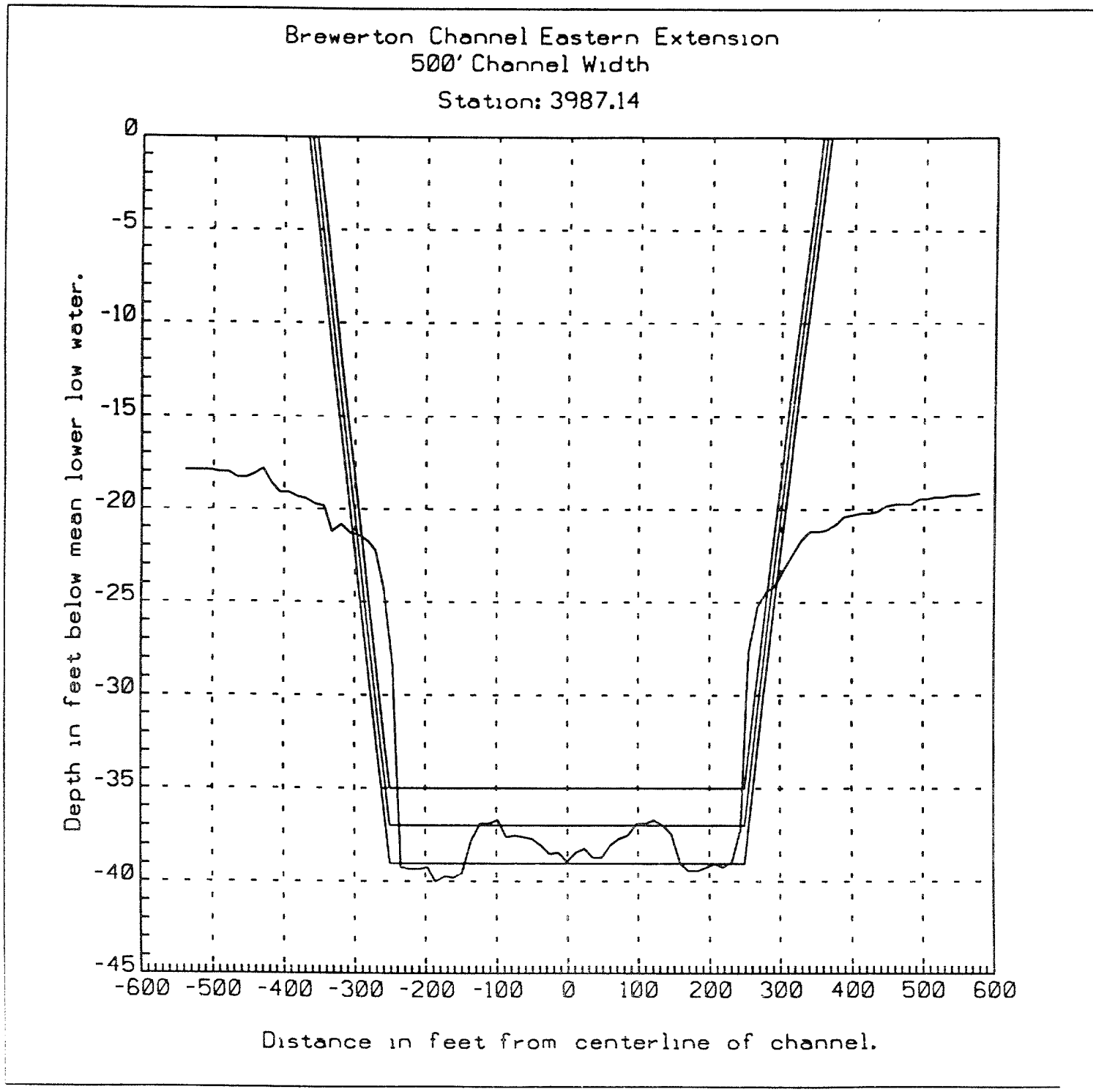

Brewerton Channel Eastern Extension
500' Channel Width
Station: 3987.14
Depth in feet below mean lower low water.
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-600 -500 -400 -300 -200 -100 0 100 200 300 400 500 600
Distance in feet from centerline of channel.

FIGURE 6

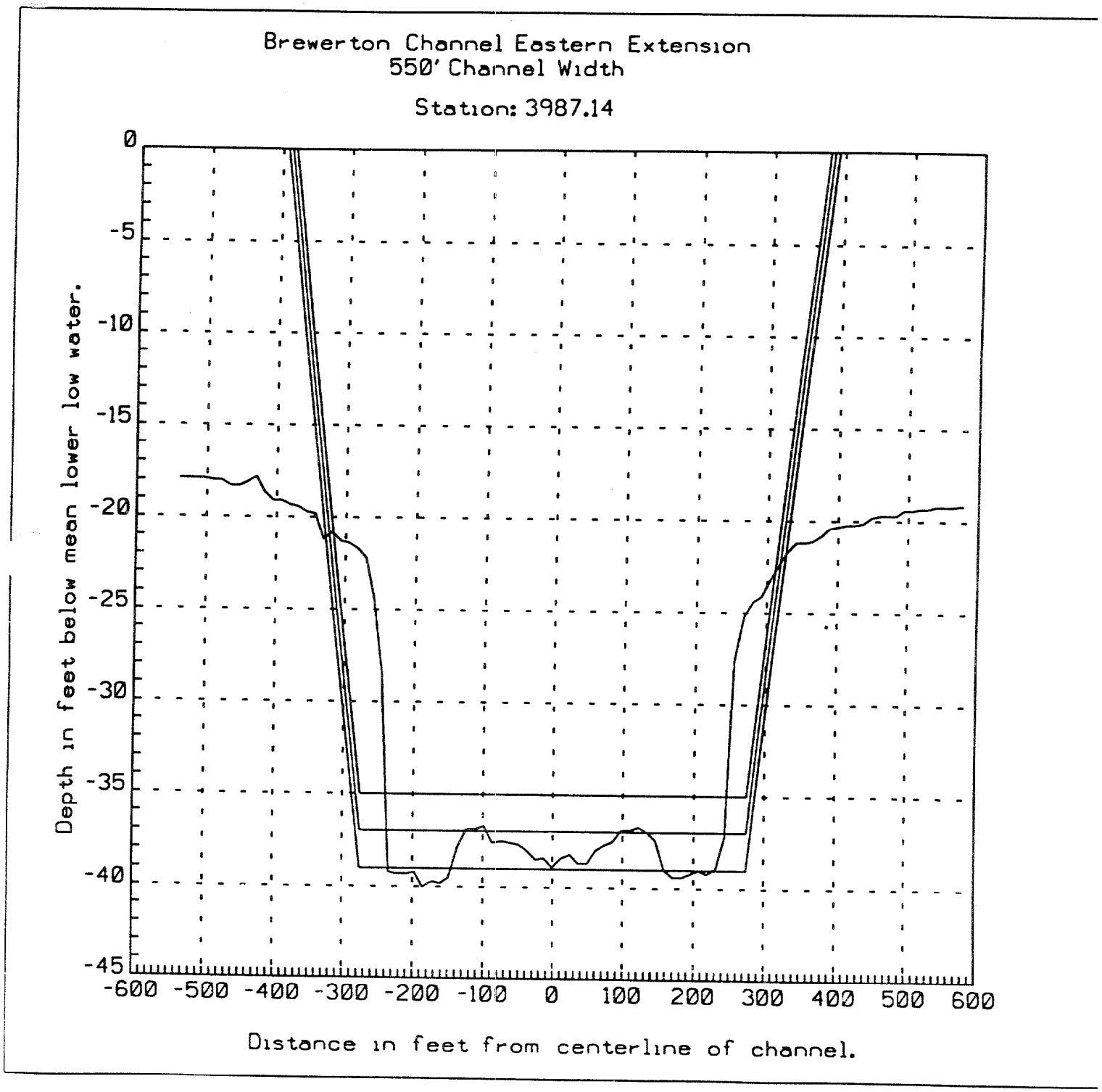
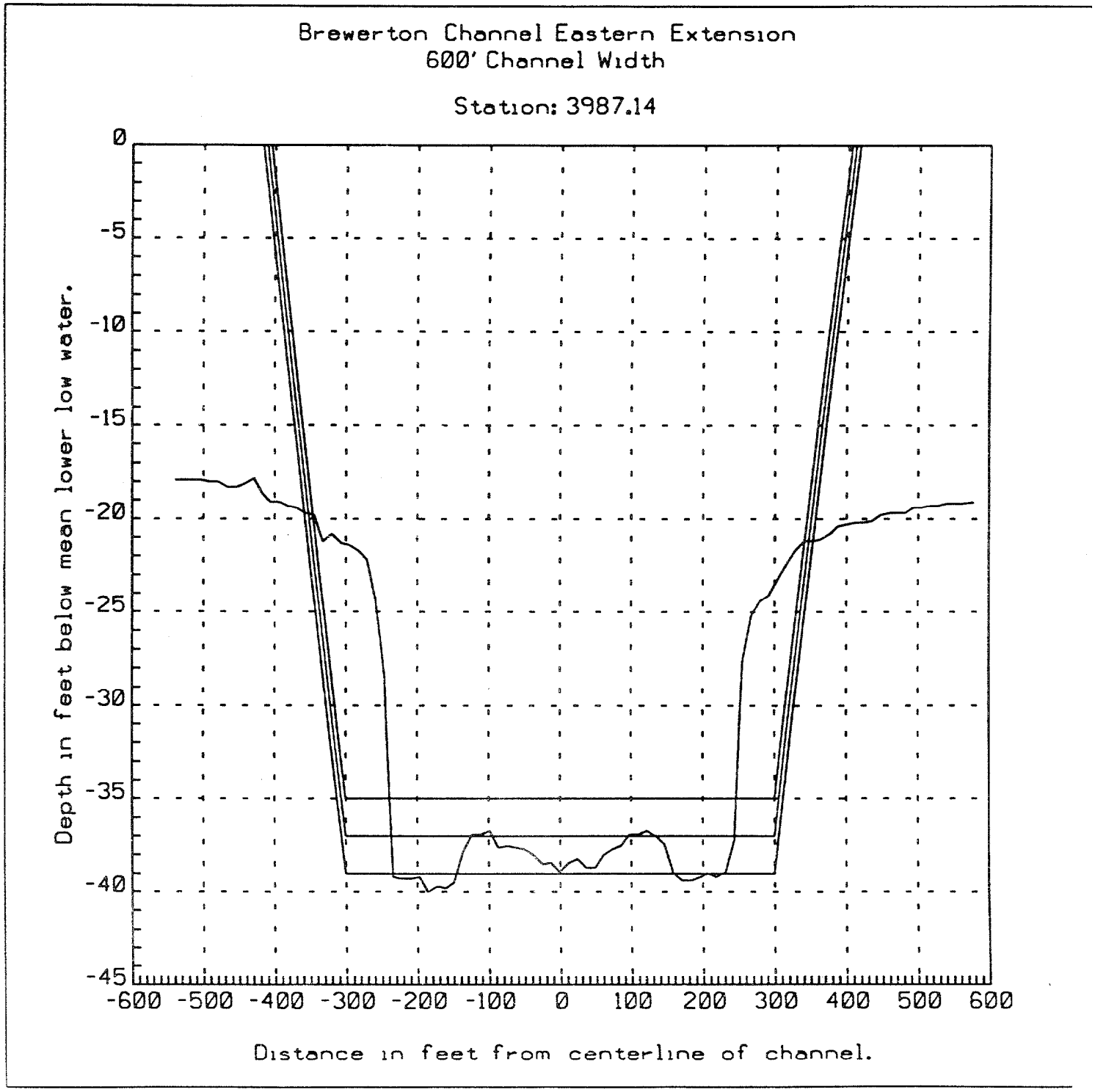

Brewerton Channel Eastern Extension
550' Channel Width
Station: 3987.14
Depth in feet below mean lower low water.
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-600 -500 -400 -300 -200 -100 0 100 200 300 400 500 600
Distance in feet from centerline of channel.

FIGURE 7


Brewerton Channel Eastern Extension
600' Channel Width
Station: 3987.14
Depth in feet below mean lower low water.
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-600 -500 -400 -300 -200 -100 0 100 200 300 400 500 600
Distance in feet from centerline of channel.

## Cost Estimates

### General

Cost estimates prepared for the proposed widening of the Brewerton Channel Eastern Extension are shown in Appendix D. The following methodology was used in preparing the Baseline Cost Estimate:

a. The estimate is prepared in accordance with guidance contained in ER 1110-2-1302, Civil Works Cost Engineering.

b. The estimate is presented in the standard Civil Works Breakdown Structure.

c. The price level for the estimate is October 1, 1994.

d. Construction costs developed by Cost Engineering Branch, Engineering Division, are based on input and dredged material quantities provided by the Operations Division. Mobilization, demobilization, and dredging unit costs were developed using the Cost Engineering Dredge Estimating Program (CEDEP). The estimates are documented with notes to explain the specific information used to develop the costs.

e. The labor costs are based on the prevailing Davis-Bacon wage rates for dredging.

f. Operations Division provided costs for Construction Engineering and Design based upon actual costs to date and projected costs, and provided costs for Construction Management based on historical data from similar dredging projects.

g. Costs for the Hart-Miller Island Dredged Material Placement Facility are based on estimated costs provided by the Maryland Port Administration for raising the north cell dikes to 44 feet, and prorating the capacity of the site that would be used by the dredged material from widening the Brewerton Channel Eastern Extension.

### Scope of Estimate

The estimates reflect the cost for widening the existing channel from 450 feet to 500, 550, and 600 feet. All dredged material would be placed in the Hart-Miller Island Dredged Material Containment Facility. The dredging will be accomplished in one dredging contract. Due to the need to maximize drying and consolidation of the dredged material at the Hart-Miller Island facility, dredging will be limited to the period of October through March. The plans and specifications allow any type of dredging equipment to perform the work. However, historical dredging of the channel with dredged material placement at Hart-Miller Island has been performed by clamshell dredges due to the following factors:

(1) The distance from the channel to Hart-Miler Island is a minimum of 5 miles, (2) access to Hart-Miller Island is limited to vessels with drafts generally less than 15 feet, (3) the overflow of dredged material (economic loading) from scows and hopper dredges is prohibited, and (4) the material is generally located along the channel edges rather than being distributed across the entire channel width. The cost estimates, therefore, are based upon the following dredging scenario: (1) material will be dredged by clamshell dredges and loaded into scows, (2) tugs will push the scows to Hart-Miller Island, and (3) a hydraulic unloader (similar to a hydraulic pipeline dredge), moored at the island, will pump the material from the scows into Hart-Miller Island.

Contingencies

Contingency amounts for the construction cost items are based on uncertainties within individual project elements. Contingencies are assigned to individual cost items or groups of related cost items to protect against the risk of potential cost increases. The following is a list, by element, of the uncertainties that are identified and the corresponding contingency percentages used in the estimates:

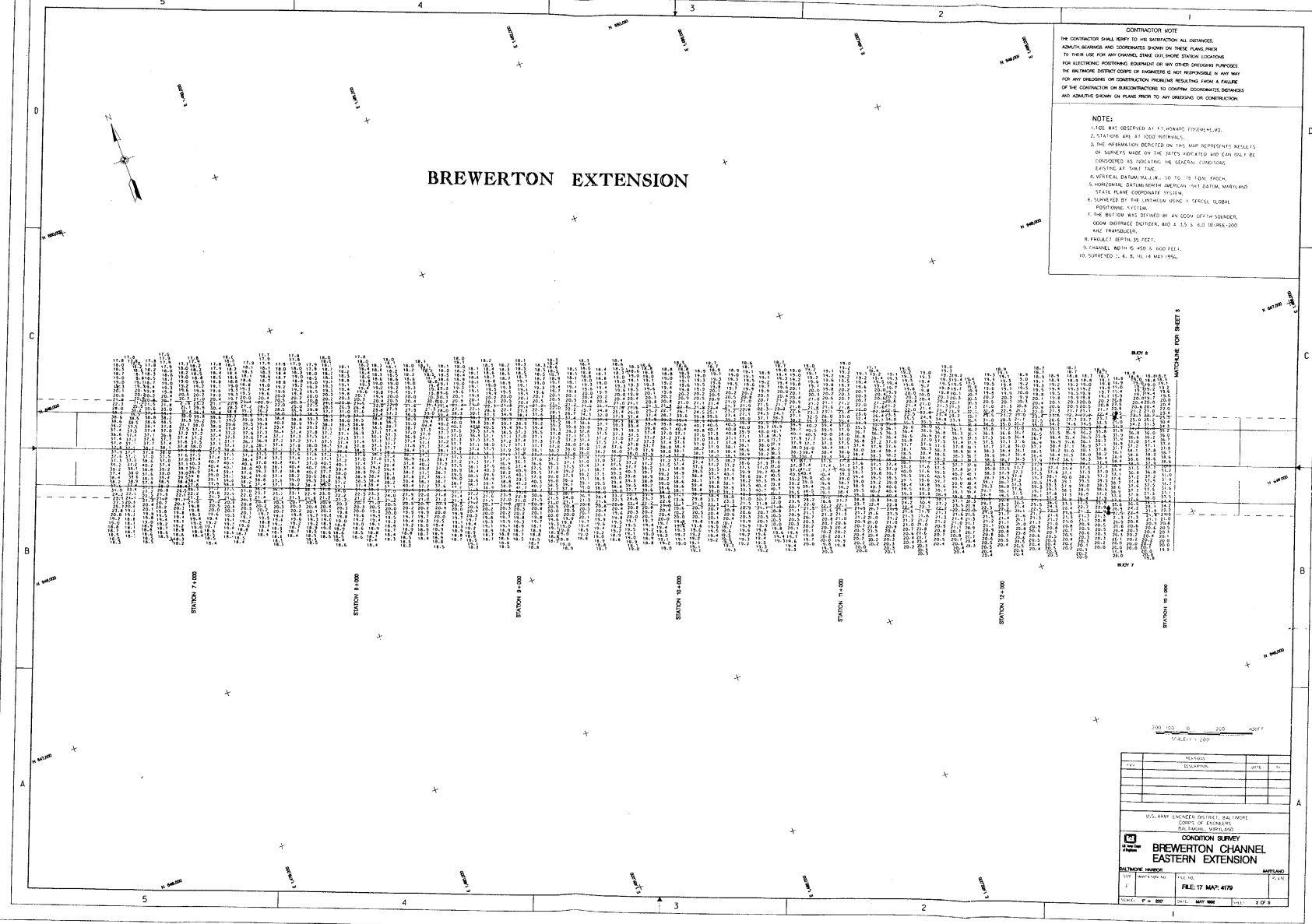
a. Construction Engineering and Design - 5 percent - The uncertainty associated with the remaining construction engineering and design costs are low. However, design changes could be triggered by a variety of future conditions, such as local sponsor requested changes due to unanticipated public pressure, new Federal or local laws and regulations, and site changes prior to construction. Therefore, a 5 percent contingency is considered reasonable.

b. Construction Management - 10 percent - The uncertainty associated with construction management costs is moderate. Since construction is a future task, design and site conditions could change, and construction contract administration requirements could change. Therefore, a 10 percent contingency is considered reasonable.

c. Dredging Contract Cost Items - 15 percent - The uncertainty associated with the dredging quantities, fuel costs, and equipment location and availability is moderate. Since construction is a future task, design and site conditions, fuel prices, and construction contractor availability could change. Therefore, a 15 percent contingency is considered reasonable.

Aids to Navigation

Since the proposed channel improvements will be accomplished symmetrically about the existing channel centerline, and the channel is well marked with floating aids to navigation, no new aids to navigation will be required. The U.S. Coast Guard will relocate the existing floating aids to navigation as part of its routine operation and




CONTRACTOR NOTE

THE CONTRACTOR SHALL VERIFY TO HIS SATISFACTION ALL DISTANCES, AZIMUTH BEARINGS AND COORDINATES SHOWN ON THESE PLANS, PRIOR TO THEIR USE FOR ANY CHANNEL STAKE OUT, SHORE STATION LOCATIONS FOR ELECTRONIC POSITIONING EQUIPMENT OR ANY OTHER DREDGING PURPOSES. THE BALTIMORE DISTRICT CORPS OF ENGINEERS IS NOT RESPONSIBLE IN ANY WAY FOR ANY DREDGING OR CONSTRUCTION PROBLEMS RESULTING FROM A FAILURE OF THE CONTRACTOR OR SUBCONTRACTORS TO CONFIRM COORDINATES, DISTANCES AND AZIMUTHS SHOWN ON PLANS PRIOR TO ANY DREDGING OR CONSTRUCTION.

NOTE:

1. TIDE WAS OBSERVED AT KT. HOWARD ESSEX BLVD.
2. STATIONS ARE AT 1000 INTERVALS.
3. THE INFORMATION DEPICTED ON THIS MAP REPRESENTS RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME.
4. VERTICAL DATUM: MLLW, 1.0 TO 1.8 FROM FROCH.
5. HORIZONTAL DATUM: NORTH AMERICAN 1983 DATUM, MARYLAND STATE PLANE COORDINATE SYSTEM.
6. SURVEYED BY THE LINTHICUM USING A SERCEL GLOBAL POSITIONING SYSTEM.
7. THE BOTTOM WAS DEFINED BY AN ODOM DEPTH SOUNDER, ODOM DIGITRACE DIGITIZER, AND A 3.5 & 8.0 DEGREE-200 KHZ TRANSDUCER.
8. PROJECT DEPTH 35 FEET.
9. CHANNEL WIDTH IS 450 & 600 FEET.
10. SURVEYED 1, 6, 8, 11, 14 MAY 1986.

| REVISIONS | | | |
|---|---|---|---|
| NO. | DESCRIPTION | DATE | BY |
| | | | |
| | | | |
| | | | |
| | | | |

U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND

US Army Corps of Engineers

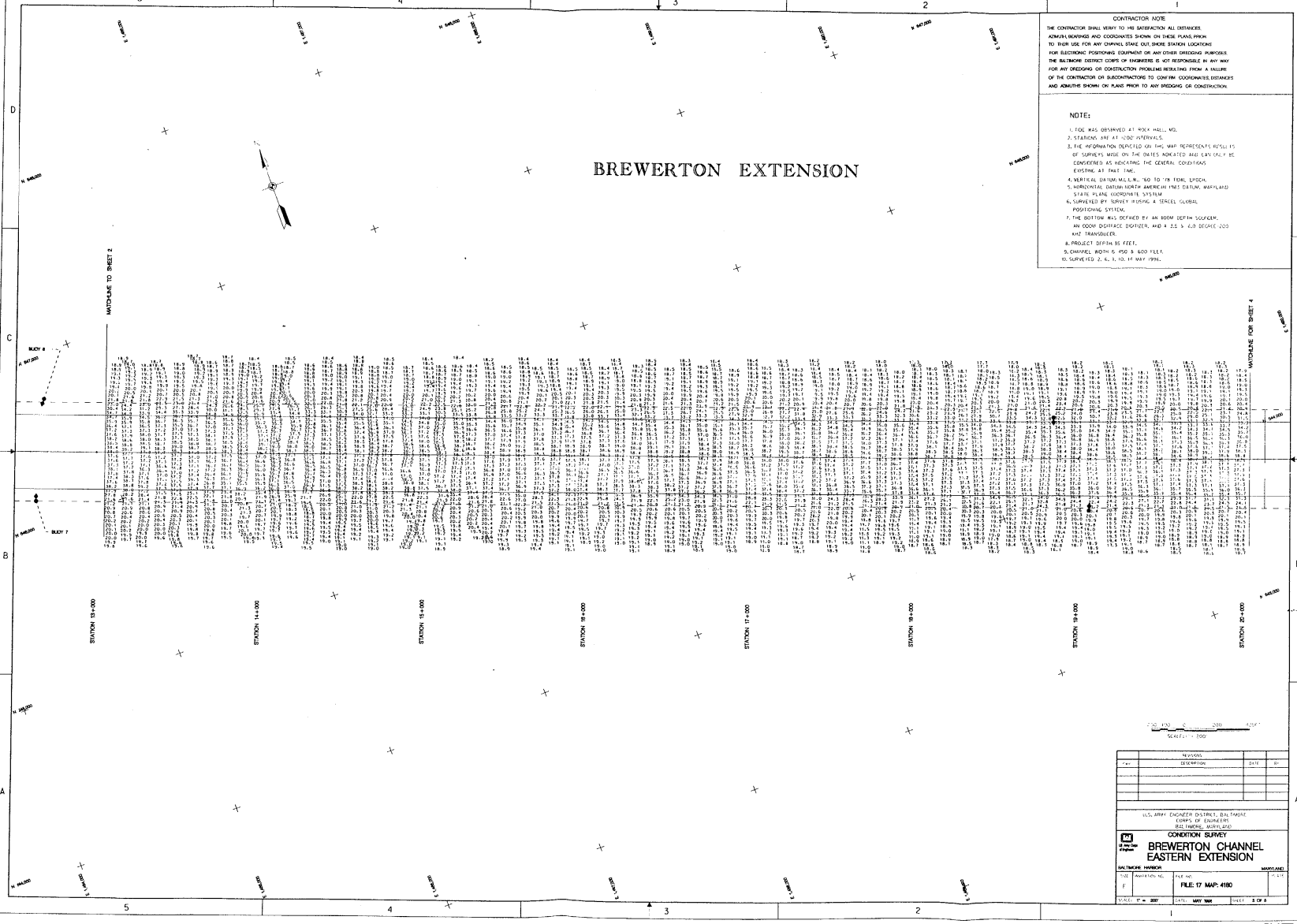
CONDITION SURVEY
# BREWERTON CHANNEL EASTERN EXTENSION

BALTIMORE HARBOR — MARYLAND

| SITE | MAINTENANCE NO. | FILE NO. | PLATE |
|---|---|---|---|
| F | | FILE: 17 MAP: 4179 | |
| SCALE: 1" = 200' | | DATE: MAY 1986 | SHEET 2 OF 5 |

PLATE 2

DESIGN FILE: C:\BREWERTON.DGN




CONTRACTOR NOTE

THE CONTRACTOR SHALL VERIFY TO HIS SATISFACTION ALL DISTANCES, AZIMUTH, BEARINGS AND COORDINATES SHOWN ON THESE PLANS, PRIOR TO THEIR USE FOR ANY CHANNEL STAKE OUT, SHORE STATION LOCATIONS FOR ELECTRONIC POSITIONING EQUIPMENT OR ANY OTHER DREDGING PURPOSES. THE BALTIMORE DISTRICT CORPS OF ENGINEERS IS NOT RESPONSIBLE IN ANY WAY FOR ANY DREDGING OR CONSTRUCTION PROBLEMS RESULTING FROM A FAILURE OF THE CONTRACTOR OR SUBCONTRACTORS TO CONFIRM COORDINATES, DISTANCES AND AZIMUTHS SHOWN ON PLANS PRIOR TO ANY DREDGING OR CONSTRUCTION.

NOTE:

1. TIDE WAS OBSERVED AT ROCK HALL, MD.
2. STATIONS ARE AT 1200' INTERVALS.
3. THE INFORMATION DEPICTED ON THIS MAP REPRESENTS RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME.
4. VERTICAL DATUM: M.L.L.W., 160 TO 178 TIDAL EPOCH.
5. HORIZONTAL DATUM: NORTH AMERICAN 1983 DATUM, MARYLAND STATE PLANE COORDINATE SYSTEM.
6. SURVEYED BY SURVEY WIDING & SERCEL GLOBAL POSITIONING SYSTEM.
7. THE BOTTOM WAS DEFINED BY AN 400M DEPTH SOUNDER, AN ODOM DIGITRACE DIGITIZER, AND A 3.5 & 4.0 DEGREE 200 KHZ TRANSDUCER.
8. PROJECT DEPTH 35 FEET.
9. CHANNEL WIDTH 6 450 & 600 FEET.
10. SURVEYED 2, 6, 9, 10, 14 MAY 1996.

| REVISIONS | | | |
|---|---|---|---|
| CAV | DESCRIPTION | DATE | BY |
| | | | |
| | | | |
| | | | |
| | | | |

U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND

CONDITION SURVEY

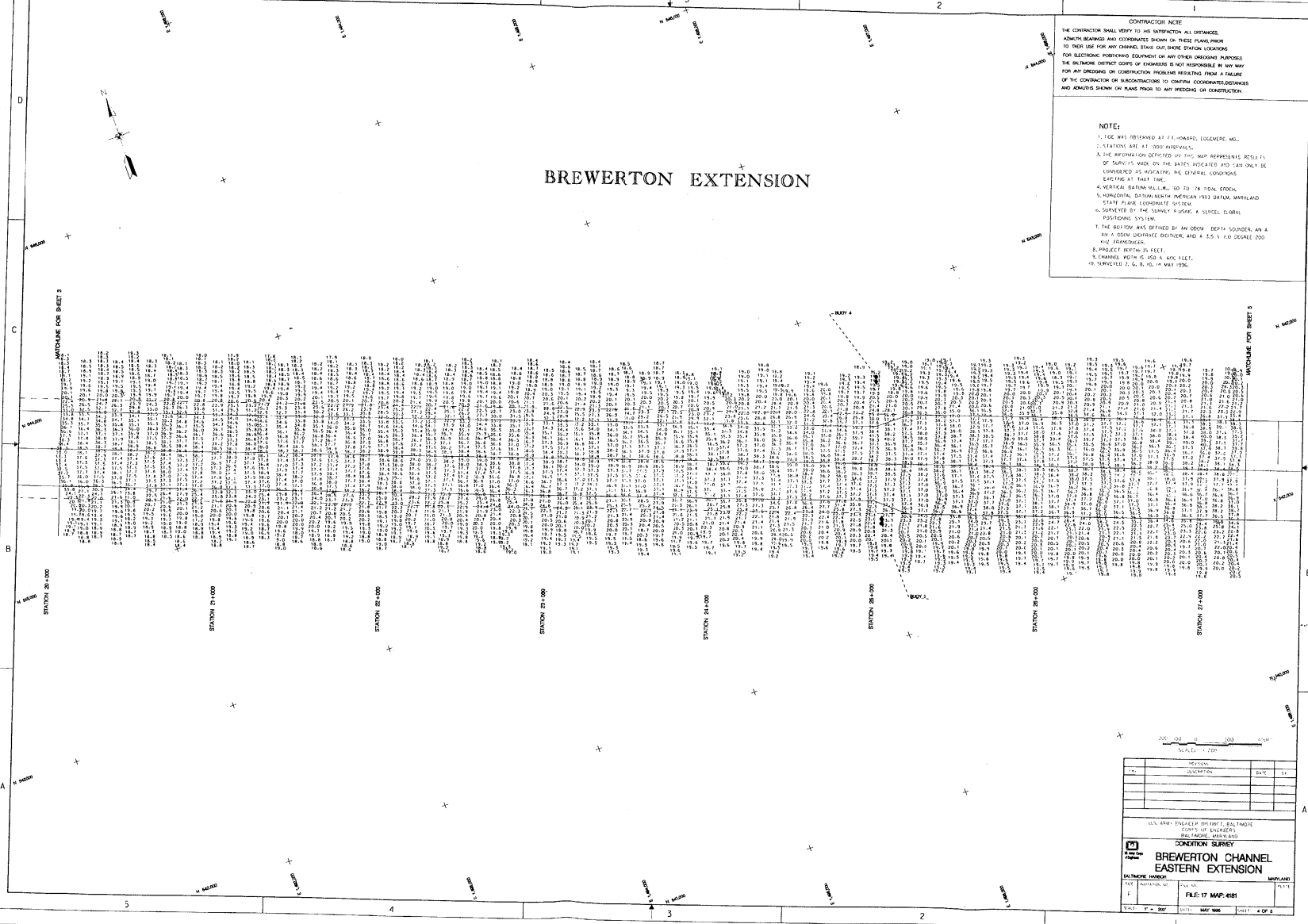
# BREWERTON CHANNEL EASTERN EXTENSION

BALTIMORE HARBOR — MARYLAND

| SIZE | ANALYSIS NO. | FILE NO. | PLATE |
|---|---|---|---|
| F | | FILE: 17 MAP: 4180 | |
| SCALE: 1" = 200' | | DATE: MAY 1996 | SHEET 3 OF 8 |

PLATE 3

DESIGN FILE: CYBERSIC.DGN




CONTRACTOR NOTE

THE CONTRACTOR SHALL VERIFY TO HIS SATISFACTION ALL DISTANCES, AZIMUTH, BEARINGS AND COORDINATES SHOWN ON THESE PLANS, PRIOR TO THEIR USE FOR ANY CHAINS, STAKE OUT, SHORE STATION LOCATIONS FOR ELECTRONIC POSITIONING EQUIPMENT OR ANY OTHER DREDGING PURPOSES. THE BALTIMORE DISTRICT CORPS OF ENGINEERS IS NOT RESPONSIBLE IN ANY WAY FOR ANY DREDGING OR CONSTRUCTION PROBLEMS RESULTING FROM A FAILURE OF THE CONTRACTOR OR SUBCONTRACTORS TO CONFIRM COORDINATES, DISTANCES AND AZIMUTHS SHOWN ON PLANS PRIOR TO ANY DREDGING OR CONSTRUCTION.

NOTE:

1. TIDE WAS OBSERVED AT F.F. HOWARD, EDGEMERE, MD.
2. STATIONS ARE AT 1000' INTERVALS.
3. THE INFORMATION DEPICTED ON THIS MAP REPRESENTS RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME.
4. VERTICAL DATUM: M.L.L.W., TO 1.78 TIDAL EPOCH.
5. HORIZONTAL DATUM: NORTH AMERICAN 1983 DATUM, MARYLAND STATE PLANE COORDINATE SYSTEM.
6. SURVEYED BY THE SURVEY VESSEL USING A SERCEL GLOBAL POSITIONING SYSTEM.
7. THE BOTTOM WAS DEFINED BY AN ODOM DEPTH SOUNDER, AN A AN A ODOM DRAFRACE DIGITIZER, AND A 3.5 & 5.0 KHZ DEGREE 200 KHZ TRANSDUCER.
8. PROJECT DEPTH IS 45 FEET.
9. CHANNEL WIDTH IS 450 & 600 FEET.
10. SURVEYED 2, 6, 8, 10, 14 MAY 1996.

| REVISIONS | | | |
|---|---|---|---|
| NO. | DESCRIPTION | DATE | BY |
| | | | |
| | | | |
| | | | |
| | | | |

U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND

CONDITION SURVEY

# BREWERTON CHANNEL EASTERN EXTENSION

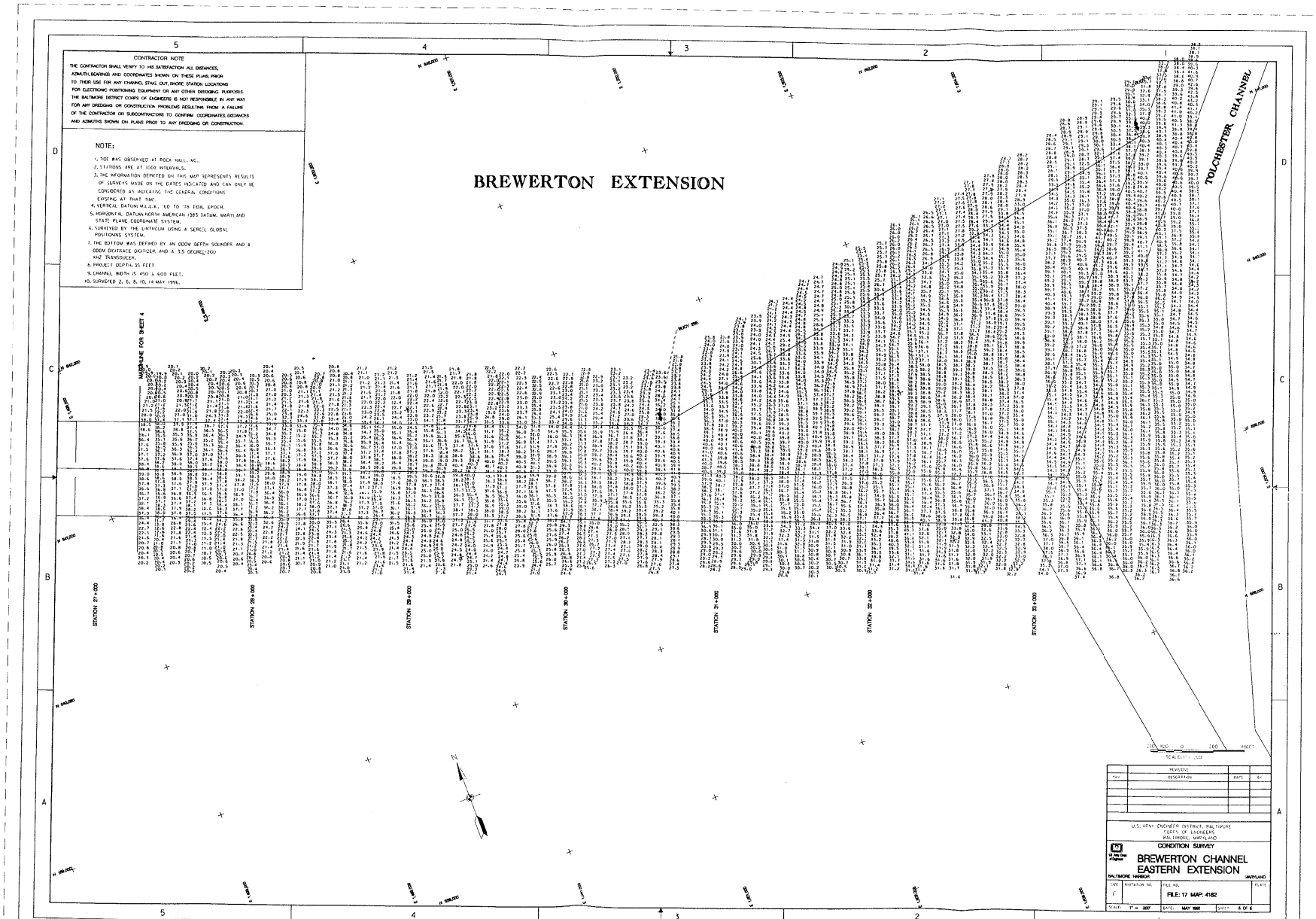
BALTIMORE HARBOR — MARYLAND

| SIZE | INVITATION NO. | FILE NO. | PLATE |
|---|---|---|---|
| F | | FILE: 17 MAP: 4181 | |

| SCALE | DATE | SHEET |
|---|---|---|
| 1" = 200' | MAY 1996 | 4 OF 5 |

PLATE 4

DESIGN FILE: C:\BREWCHD.DGN




CONTRACTOR NOTE

THE CONTRACTOR SHALL VERIFY TO HIS SATISFACTION ALL DISTANCES, AZIMUTH, BEARINGS AND COORDINATES SHOWN ON THESE PLANS, PRIOR TO THEIR USE FOR ANY CHANNEL STAKE OUT, SHORE STATION LOCATIONS FOR ELECTRONIC POSITIONING EQUIPMENT OR ANY OTHER DREDGING PURPOSES. THE BALTIMORE DISTRICT CORPS OF ENGINEERS IS NOT RESPONSIBLE IN ANY WAY FOR ANY DREDGING OR CONSTRUCTION PROBLEMS RESULTING FROM A FAILURE OF THE CONTRACTOR OR SUBCONTRACTORS TO CONFIRM COORDINATES, DISTANCES AND AZIMUTHS SHOWN ON PLANS PRIOR TO ANY DREDGING OR CONSTRUCTION.

NOTE:

1. TIDE WAS OBSERVED AT ROCK HALL, MD.
2. STATIONS ARE AT 1000' INTERVALS.
3. THE INFORMATION DEPICTED ON THIS MAP REPRESENTS RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME.
4. VERTICAL DATUM: M.L.L.W., TED TO 78 TOTAL EPOCH.
5. HORIZONTAL DATUM: NORTH AMERICAN 1983 DATUM, MARYLAND STATE PLANE COORDINATE SYSTEM.
6. SURVEYED BY THE LINTHICUM USING A SERCEL GLOBAL POSITIONING SYSTEM.
7. THE BOTTOM WAS DEFINED BY AN ODOM DEPTH SOUNDER AND A ODOM DIGITRACE DIGITIZER, AND A 3.5 DECREE-200 KHZ TRANSDUCER.
8. PROJECT DEPTH 35 FEET.
9. CHANNEL WIDTH IS 450 & 600 FEET.
10. SURVEYED 2, 6, 8, 10, 14 MAY 1996.

PLATE 5

DESIGN FILE C:\BEWERSE.DGN

# BALTIMORE HARBOR AND CHANNELS, MARYLAND AND VIRGINIA, 42-FOOT PROJECT BREWERTON CHANNEL EASTERN EXTENSION LIMITED REEVALUATION REPORT

## SECTION 3

## OPERATION AND MAINTENANCE

Current operation and maintenance activities for the Brewerton Channel Eastern Extension consist of (1) performing semiannual hydrographic surveys of the channel to report channel conditions to the Association of Maryland Pilots and other navigation interests and to forecast future maintenance dredging episodes and quantities to be dredged and (2) performing periodic maintenance dredging. Maintenance dredging is generally scheduled every other year and dredging is typically performed along the channel toes where most of the shoaling occurs. The District received approval from the North Atlantic Division in 1991 to perform 2 feet of advanced maintenance dredging of the channel due to the rapid shoaling rate. The channel has subsequently been dredged to a required depth of 37 feet MLLW (35-foot project depth plus 2 feet of advanced maintenance) plus 2 feet of allowable overdepth. Two feet of advanced maintenance dredging will continue to be performed, providing sufficient funds and dredged material placement capacity are available. Maintenance dredging is usually accomplished in conjunction with maintenance dredging of other channels of the Baltimore Harbor and Channels, 42 and 50-Foot projects.

Bottom sediments of the upper Chesapeake Bay in the vicinity of the Brewerton Channel Eastern Extension are predominantly clayey silt, with some occurrences of sand-silt-clay. The upper Chesapeake Bay is a zone of net deposition of sediments as a result of fresh water rivers bringing sediments to the Bay, where the saline waters act as a flocculent. The Susquehanna River is the primary source of new sediment. Sediments that shoal in the Brewerton Channel Eastern Extension are comprised of fine silts and clays. Due to the channel's location in the middle of the upper Chesapeake Bay and the shallow waters on either side of the channel, the primary sources of sediments are runoff from the Susquehanna River, shoreline erosion, and resuspension of bay bottom sediments from wave action and ship energy. Sediments settling in the center of the channel typically are resuspended by ships transiting the channel, and most of the noticeable shoaling occurs in the outside quarters of the channel and along the channel toes. Since the channel cuts across the Chesapeake Bay, it acts as a sediment trap for sediments being carried by ebb and flood currents that cross perpendicular to the channel.

Following maintenance dredging of the 27-foot-deep and 400-foot-wide channel in 1970, no maintenance was performed until the channel was deepened to 35 feet MLLW and

widened to 450 feet in 1986. Maintenance dredging is generally scheduled every other year, and will be performed five times since 1986 (1990/1991, 1992, 1994, 1996, and 1997 (1997 dredging is underway)). After the 1997 dredging, an estimated total of 4,074,063 cubic yards of maintenance material will have been removed since 1970. This yields an average annual shoaling rate of 150,900 cubic yards per year for the 1970 through 1997 time period. However, 3,717,315 cubic yards of this material will have been dredged since 1986, resulting in an average annual shoaling rate of 337,900 cubic yards for the 1986 through 1997 time period. Some of the increased shoaling is attributable to the stabilization of the side slopes and typical increase in shoaling expected as a result of increasing the channel dimensions in 1986 and 1990/1991, and some is attributable to the severe storms in January of 1996 and the subsequent high runoff from the Susquehanna River. Since no dredging was performed between 1970 and 1986, and the channel dimensions have increased since 1986, the average annual shoaling rate of 337,900 cubic yards is considered a more accurate reflection of maintenance dredging requirements of the channel.

The hydrodynamic modeling studies conducted by the Waterways Experiment Station predicted that currents in the Brewerton Channel Eastern Extension would be unaffected by the channel widening. The sediment modeling results indicated that the shoaling rate per unit area of the channel would be the same for the existing and the proposed channel configurations. Therefore, shoaling of the channel is expected to increase proportionally with the increase in the area of the channel. The increase in shoaling is estimated to be 6.8, 13.7, and 20.5 percent based upon the increase in the channel areas resulting from widening the western 5 miles of channel from 450 feet to 500, 550, and 600 feet, respectively. Based upon the annual estimated shoaling rate of 337,900 cubic yards, widening of the channel to 500, 550, and 600 feet would result in estimated increases in annual shoaling of 23,000; 46,300; and 69,300 cubic yards, respectively. In order to calculate the projected annual increase in operation and maintenance costs, a unit price of $3.60 per cubic yard was used (based upon recent Government Estimates and contractor bid prices for dredging the Brewerton Channel Eastern Extension and placing the material at Hart-Miller Island). Table 3, ESTIMATED ANNUAL INCREASE IN MAINTENANCE, summarizes the estimated incremental increase in annual shoaling and maintenance dredging costs associated with the widening alternatives for the channel.

TABLE 3

ESTIMATED ANNUAL INCREASE IN MAINTENANCE

| Channel Width | Percent Increase In Channel Area | Increase in Quantity | Estimated Unit Price | Estimated Cost |
|---|---|---|---|---|
| 500 Feet | 6.8% | 23,000 cy | $3.60 | $ 82,800 |
| 550 Feet | 13.7% | 46,300 cy | $3.60 | $166,700 |
| 600 Feet | 20.5% | 69,300 cy | $3.60 | $249,500 |

The District will continue to survey the channel semiannually and to schedule maintenance dredging every other year if the channel widening is approved, and if adequate funding and dredged material placement areas are available. The U.S. Coast Guard will continue to maintain the aids to navigation. The Maryland Port Administration will continue to be responsible for all costs associated with operation and maintenance of the Hart-Miller Island Dredged Material Containment Facility.

THIS PAGE LEFT BLANK INTENTIONALLY

# BALTIMORE HARBOR AND CHANNELS, MARYLAND AND VIRGINIA, 42-FOOT PROJECT BREWERTON CHANNEL EASTERN EXTENSION LIMITED REEVALUATION REPORT

## SECTION 4

## ENVIRONMENT

### Environmental Resources

The Baltimore District, U.S. Army Corps of Engineers, currently maintains the Brewerton Channel Eastern Extension Federal navigation channel. The River and Harbor Act of July 3, 1958, authorized the deepening and widening of the connecting channels to the Chesapeake and Delaware (C&D) Canal from 27 feet to 35 feet deep and from 400 feet to 600 feet wide. The connecting channels are comprised of the Brewerton Channel Eastern Extension, and the Tolchester and Swan Point Channels. All of the improvements authorized by the 1958 Act have been constructed with the exception of the Brewerton Channel Eastern Extension. Construction of the Brewerton Channel Eastern Extension to its authorized dimensions of 35 feet deep and 600 feet wide was addressed in the "Final Environmental Impact Statement - Proposed Plan for Completing the Navigation Improvements, Authorized by the 1958 River and Harbor Act for the Baltimore Harbor and Channels, Maryland and Virginia". The Brewerton Channel Eastern Extension has an authorized depth of 35 feet and width of 600 feet and was constructed to a depth of 35 feet and width of 450 feet in 1986. The eastern end of the channel was widened from 450 feet to 600 feet to improve safety in 1991.

The proposed action in this study is to widen the remaining 5 miles of the Brewerton Channel Eastern Extension to its authorized width of 600 feet. The dredging requires the removal of approximately 2,500,000 cubic yards of material and includes 2 feet of advanced maintenance dredging and 2 feet of allowable overdepth dredging. The State of Maryland has designated the Hart-Miller Island containment facility for the deposition of the dredged material. Figure 2 (Section 1) is a map of the proposed dredging and placement area. An environmental Assessment (EA) addressing the impacts of the proposed improvement is contained in Appendix E.

### Brewerton Channel Eastern Extension

Sediment Analysis

Sediments were analyzed to determine the chemical concentrations in accordance with the "Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual (draft), U.S. Environmental Protection Agency and the Department of the Army,

U.S. Army Corps of Engineers, June 1994." The test results are included in the "Data Report - FY 1995 Sediment Sampling and Chemical Analysis for Baltimore Harbor and Chesapeake Bay, Maryland, September 1996."

For the most part, the 1996 chemical analysis of sediments from core samples in the area proposed for widening, and sediments from grab samples collected in the existing channel confirmed earlier tests that indicated that the sediments are generally free of priority-pollutants. The sediments in the vicinity of the Brewerton Channel Eastern Extension are removed from known sources of anthropogenic contaminants and are generally free of priority pollutants. When contaminants are measured, they are generally in such low concentrations that they are unlikely to have any negative impacts on sensitive marine organisms that might come in contact with sediments.

In the 1996 testing, however, core samples (most notably BEV-3 and, to a lesser extent, grab samples) were found to be contaminated with detectable levels of diverse polynuclear aromatic hydrocarbons (PAHs). PAHs can occur naturally or as byproducts of combustion; examples would be coal or burnt wood. PAHs can also occur as byproducts of diverse manufacturing and processing operations. The District considers this latter source unlikely because of the location of the PAHs in the central reaches of the Bay.

The low levels of PAHs detected at most stations are not statistically significant when compared to the Kent Island Reference and are not present at levels prompting environmental concern. The higher values at station BEV-3 are statistically significant when compared to the Kent Island Reference, but do not appear representative of most of the sediments to be dredged. Consequently, no significant adverse contaminant-related impacts are expected to result from placement of these sediments at any of the aquatic or upland placement sites addressed in this report. Additional information on sediment may be found in EA Appendix VI.

Air and Water Quality

Sections 109 and 301(a) of the Clean Air Act as amended in 1990 [42 U. S. C. 7409(a)], and Environmental Protection Agency (EPA) implementing regulations (40 CFR Part 50) define national, primary, and secondary ambient air quality standards as judged necessary to protect public health and welfare for "criteria" pollutants. EPA regulations establish National Ambient Air Quality Standards (NAAQS). The agency publishes a list of all geographic areas in relation to their compliance with NAAQS. Areas where NAAQS are being achieved are designated as "attainment" areas and are subject to Prevention of Significant Deterioration (PSD) regulations. Areas not in compliance are designated as "nonattainment" areas. The proposed project is in a nonattainment area for ozone, and therefore, is not subject to PSD regulations for ozone. Coordination with the Maryland Department of the Environment (MDE) indicates that emissions produced by the proposed

project will be low enough that a conformity determination with the State Implementation Plan (SIP) will not be needed.

Water Quality conditions in the Chesapeake Bay Area vary due to many factors (proximity to urban areas, type and extent of industrial activity, stream flow characteristics, amount and type of upstream land, and water usage). The water quality in the project area is fair to poor. The project area lies within the turbidity maximum of the Upper Bay, and suspended sediment levels may reach 150 mg/liter.

Dredged Material Placement Site

The management of dredged material is an ongoing concern for the Port of Baltimore as the need for larger and deeper channels creates a greater demand for identification and development of dredged material placement sites. Additional information on placement sites and development initiatives is included in the attached EA. Currently, alternatives for dredged material placement are limited. In response to the need for placement sites, the MPA and the Corps of Engineers are developing alternative dredged material placement areas to accommodate both current and future dredging projects. The MPA developed a Master Plan in the 1980's to identify dredged material placement alternatives for sediments removed from channels serving the Port of Baltimore. The plan identifies dredged material placement options that were selected based on the results of a two-phase screening process. These sites were chosen to meet the Port's placement needs in a cost-effective and an environmentally acceptable manner. The MPA is currently pursuing various options for the management of dredged material through their Dredging Needs and Placement Options Program (DNPOP). The goal of this program is to identify sites for the placement of dredged material from construction and maintenance of projects under the jurisdiction of the MPA. The program identifies short-term capacity shortfalls as well as long-range alternatives for dredged material placement. The DNPOP is not intended to be a one-time study effort to develop a fixed plan, but is a program that is constantly changing to meet the dynamic needs of the Port of Baltimore.

The MPA and the USACE are working closely to develop a multi-phased study to culminate in the Dredged Material Management Plan (DMMP). The objective of this study is to identify placement capacity for the next 20 to 50 years. Plan formulation was initiated in Fiscal Year 1995, and will include consideration of all dredging maintenance and construction of Federal projects, as well as state and private projects. The study will focus on long-term solutions, including beneficial uses of dredged material. At this time, Hart-Miller Island has been identified as the placement site. If other sites become available prior to construction of the prosed improvements, the sites will be evaluated for potential use.

**Hart-Miller Island -- Designated Placement Site for Proposed Dredging**

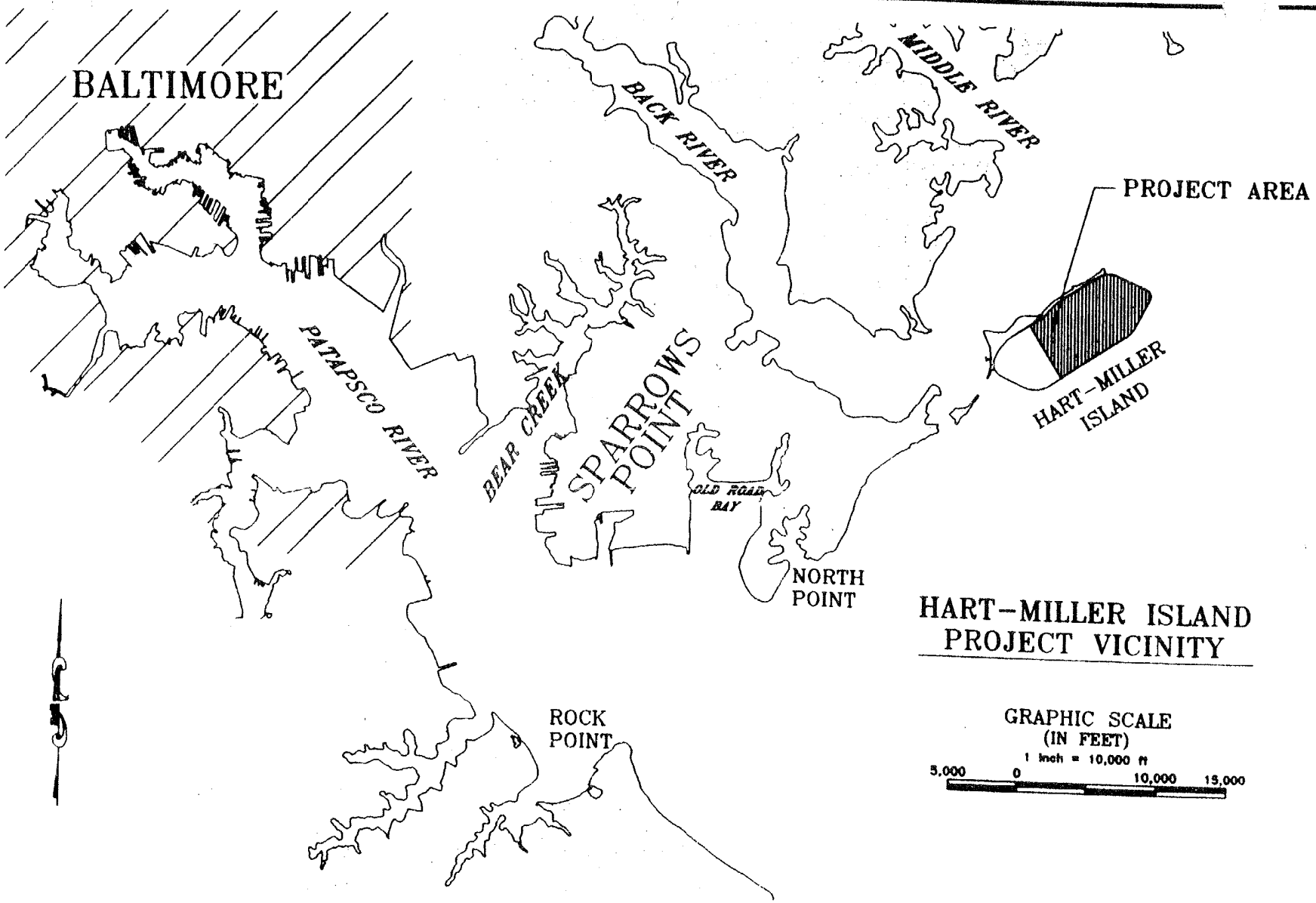
Description

Hart-Miller Island (HMI) is located in the Upper Chesapeake Bay, north of the mouth of the Patapsco River. The site is approximately 14 miles due east of Baltimore City, near the mouth of Back River in Baltimore County (see Figure 8). HMI covers approximately 1,140 acres, has approximately 6 miles of dike, and is oval shaped, approximately 2 miles long and 1 mile wide (see Figure 9). Construction of the placement site began in 1981 and was completed in December 1983. The site is owned by MPA, and operated by the Maryland Environmental Service (MES). Hart-Miller Island has been used for the placement of dredged material removed from Baltimore Harbor & Channels projects as well as State and private dredging projects since 1984. The 1,140-acre oval placement site was originally designed to hold approximately 45 million cubic yards of dredged material.

The original sand dike has an elevation of +18 feet above mean low water (MLW) and is 164 feet wide at MLW, with 3 horizontal (H) to 1 vertical (V) outer slopes, and 5H to 1V inner slopes (see Figure 10). The dike has a 20-foot roadbed on top, with bay side slopes protected by revetment consisting of filter cloth on the sand dike, covered by a layer of gravel, which is covered by a layer of riprap weighing up to 8,500 pounds per stone. The dikes were raised to +28 feet in 1988 to increase the site's capacity to 62 million cubic yards. The +28-foot, raised portion of the dike has 2H:1V outer slopes and 3H:1V inner slopes, with a 10-foot roadbed on top. The site has been divided into two cells. In accordance with the Maryland Wetlands License, the south cell stopped receiving dredged material in October 1990 following construction of the Baltimore Harbor and Channels 50-Foot Project. Since then, a program has been underway to prepare a foundation for recreational development in the south cell. To facilitate restoration of the approximate 300-acre south cell, a 10-foot layer of clean dredged material has been placed at the surface of the cell. The MPA is increasing the dike height of the north cell to +44 feet (see Figure 11). This will provide up to an additional 30 million cubic yards of capacity at an approximate placement rate of 2.5 million cubic yards per year. The site is now scheduled to close by the year 2009. After the north cell closes, it will be capped with clean material and developed to provide recreational opportunities and habitat.

**Environmental Consequences**

As stated in 40 CFR 93.153(c)(1), the proposed actions are exempt from the Clean Air Act Conformity Requirements (58 Fed. Reg. 63214, 30 Nov. 1993). The project will result in a temporary increase in emissions from construction vehicles (mobile sources). Emissions produced by the project are not expected to exceed ambient air quality standards. Temporary construction activities are generally accounted for in the Maryland State Implementation Plan (SIP). Coordination with the MDE indicates that emissions



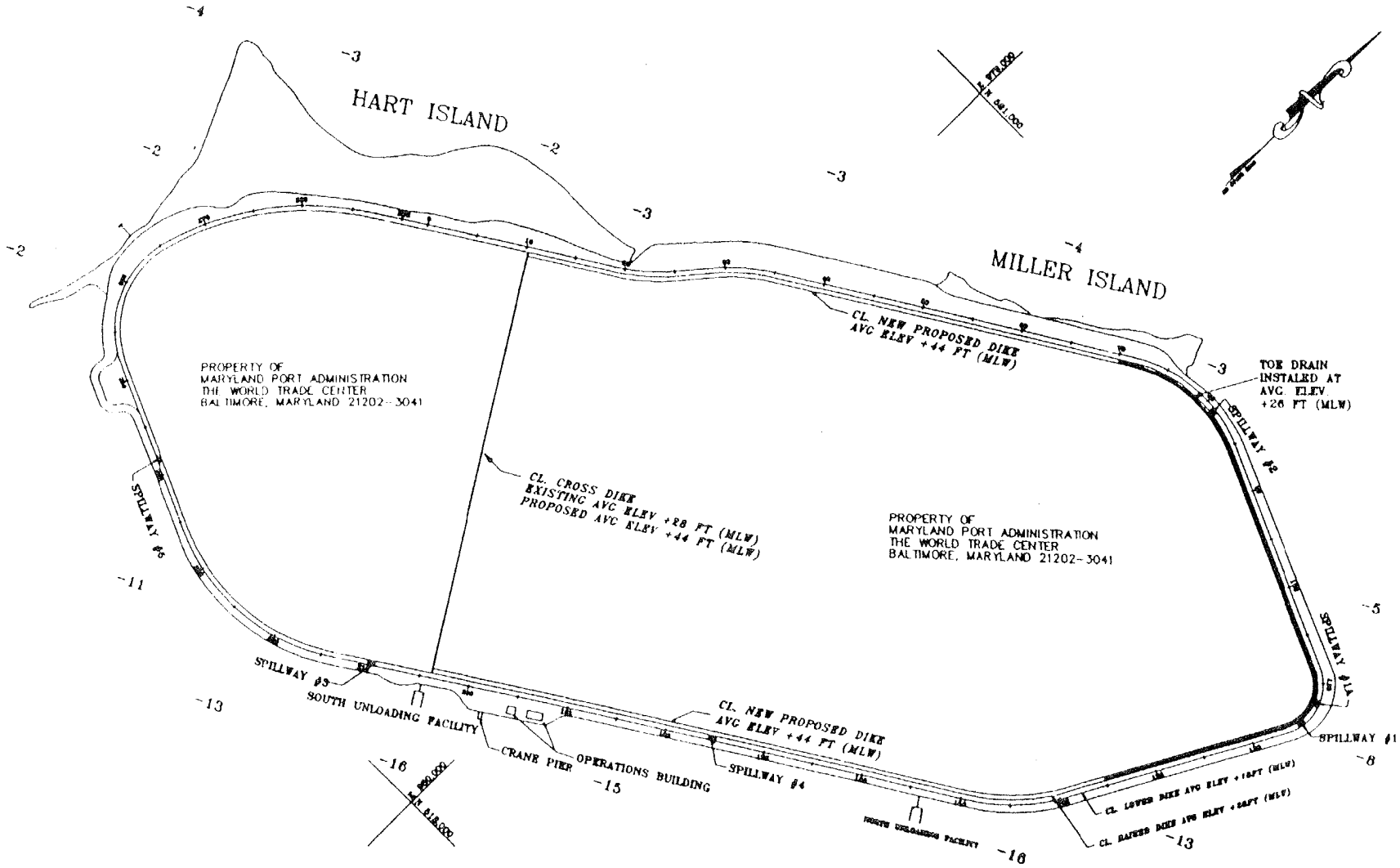

MARYLAND PORT ADMINISTRATION

MARYLAND ENVIRONMENTAL SERVICE

IN: CHESAPEAKE BAY
NEAR: MOUTH OF BACK RIVER, BALTIMORE CO.
APPL. BY: MARYLAND PORT ADMINISTRATION
DATE: MARCH 27, 1996
ENCLOSURE 1 SHEET 1 OF 4

FIGURE 8

FIGURE 9




NOTES:
1. TIDAL RANGE IS 1.3 FEET.
2. SOUNDINGS IN FEET & REFER TO MLW
3. SAND FILL FOR CONSTRUCTION TO BE OBTAINED ON-SITE.
4. THIS DRAWING IS FOR OUTLINE PURPOSES ONLY. DESIGN DRAWINGS ARE TO BE PROVIDED SEPARATELY

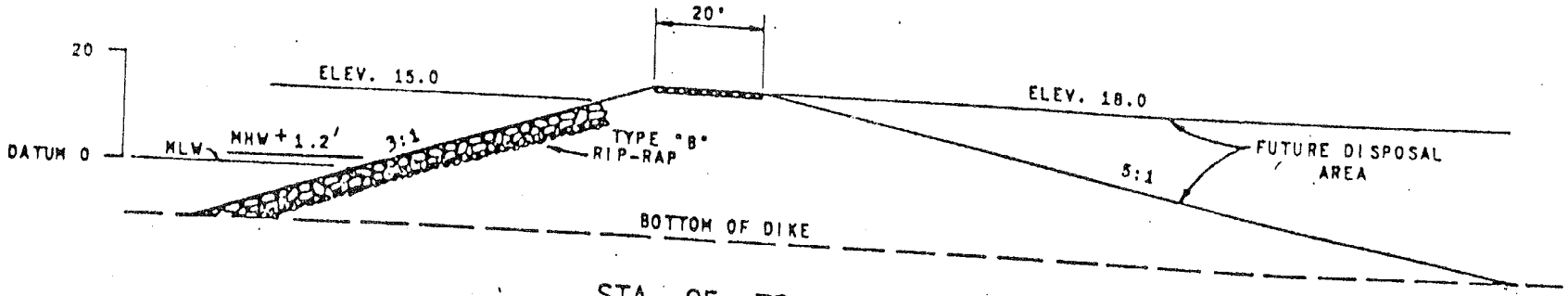
GRAPHIC SCALE

( IN FEET )

MARYLAND PORT ADMIN'TION

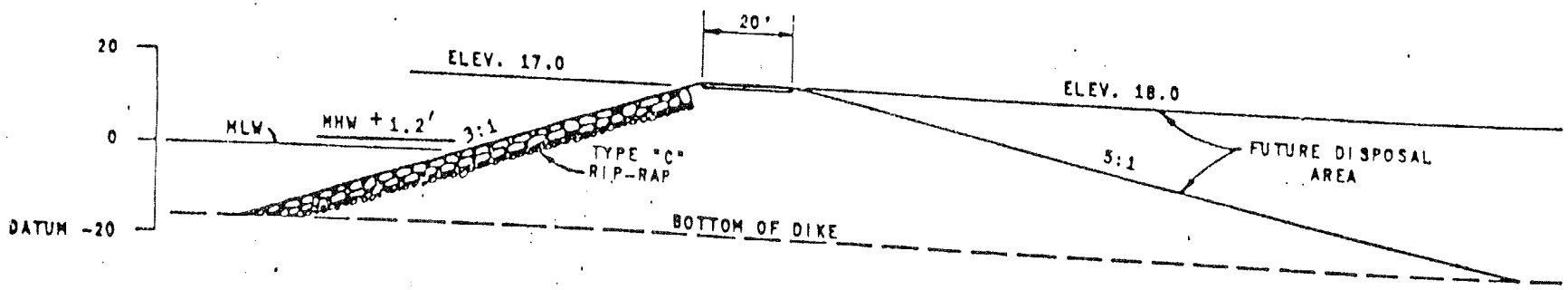
MARYLAND ENVIRONMENTAL SERVICE

IN: CHESAPEAKE BAY
NEAR: MOUTH OF BACK RIVER, BALTIMORE CO.
APPL. BY: MARYLAND PORT ADMINISTRATION
DATE: MARCH 27, 1996
ENCLOSURE 1 SHEET 2 OF




STA. 95 TO 105
STA. 240+ TO 250+

0 5 10
SCALE IN FEET

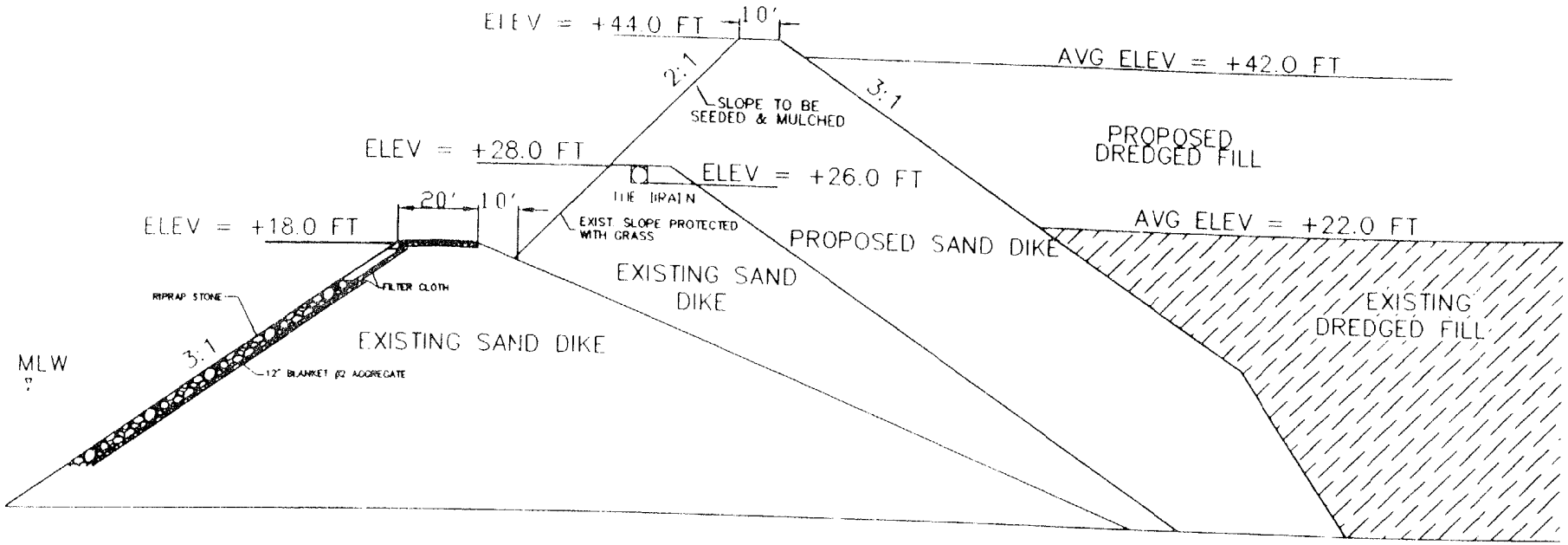



STA. 105+ TO 240+

0 5 10
SCALE IN FEET

PROPOSED DIKED DISPOSAL AREA
IN
CHESAPEAKE BAY
AT MILLER AND HART ISLANDS
BALTIMORE COUNTY, MARYLAND
TYPICAL SECTIONS
APPLICATION BY
MARYLAND STATE DEPT. OF GENERAL SERVICES

FIGURE 10




TYPICAL SECTION
PERIMETER DIKE CONCEPT
(NOT TO SCALE)

FIGURE 11

MARYLAND PORT ADMINISTRATION

MARYLAND ENVIRONMENTAL SERVICE

IN: CHESAPEAKE BAY
NEAR: MOUTH OF BACK RIVER, BALTIMORE CO.
APPL. BY: MARYLAND PORT ADMINISTRATION
DATE: MARCH 27, 1996
ENCLOSURE 1 SHEET 3 OF 4

produced by the proposed project will be low enough that a conformity determination with the SIP will not be needed.

The discharge of return water from the placement site may result in temporary turbidity. Appropriate measures to minimize turbidity will be implemented. Erosion and sediment control measures will also be implemented in accordance with local, state, and Federal regulations. Turbidity associated with dredging and placement is expected to be temporary and minor. No significant contamination from dredging and placement is expected. No significant impacts to water quality are expected.

No significant impacts to aquatic resources are expected as a result of the proposed action. Benthos in the area to be dredged are expected to be destroyed, but recolonization is expected within 1 to 2 years. The proposed action will not result in significant impacts to vegetation. The placement site is currently a diked disposal area and does not contain mature or native vegetation. When the placement site is no longer operational, it will be revegetated and restored for habitat and recreational uses.

Wildlife in the channel may be temporarily displaced while dredging occurs. Birds will be attracted to the ponds created during material placement. Impacts to wildlife resources will be temporary, and no significant changes to wildlife habitat will occur. The proposed action will not impact any Rare, Threatened, or Endangered species.

The Maryland Historical Trust has indicated that the proposed project will not have a significant impact on underwater or terrestrial cultural resources.

The proposed project is not expected to result in the use or production of hazardous materials. No HTRS sites are in the vicinity, or are expected to be impacted by the proposed project.

The proposed project will require the use of clamshell dredges, tugs and scows; hydraulic pipeline dredges; or hopper dredges to remove the material. It will also require the use of vehicles and equipment to place the material. The proposed construction activities will be short-term, and will be accomplished in a manner which minimizes any impact on vessel traffic. The District works closely with the MPA, Association of Maryland Pilots (AMP), U.S. Coast Guard (USCG), and dredging contractors to minimize disruption of ship traffic during dredging projects. The MPA, AMP, and the USCG are consulted prior to preparation of the plans and specifications to include necessary conditions for performing the work. All contract specifications for dredging projects require contractors to minimize obstructions to navigation and to move their equipment to provide safe passage of vessels. The MPA, AMP, and USCG are invited to the Preconstruction Conferences with the contractor to: (1) familiarize all parties with vessel and dredging operations, (2) establish a means for communicating between vessels and dredges, (3) provide for daily updates on the dredge plant location and progress, and (4) determine the

timing and locations for repositioning aids to navigation. Since the channel will be widened, the contractor will likely position his dredging equipment outside of the existing channel, over the area to be widened, so as not to obstruct the channel.

The proposed project is not expected to contribute significantly to cumulative adverse impacts in the area. It will improve navigational access and will result in beneficial impacts to the local and regional economy. No significant adverse impacts to existing infrastructure are expected. The use of HMI will reduce the availability of that site for use in other dredging projects. Since contaminated material from Baltimore Harbor can be legally placed in HMI, this type of placement capacity will be lost. However, the state proposes to expand the CSX-Cox Creek placement area to provide an additional 6 million cubic yards of capacity for Baltimore Harbor dredged material.

**Environmental Permits, Regulatory Compliance, and Monitoring**

Environmental monitoring at the HMI facility and surrounding area has been going on since before construction began in 1981. Several different environmental permits control the operations. Information on permits is given below. The State and Federal agencies administering permits require that the owners and operators of HMI expend every effort to ensure that the facility is operated in an environmentally sound manner.

A State Discharge Permit, issued by the Maryland Department of the Environment, regulates the quality of effluent discharged from the facility and sets monitoring requirements. This permit has been modified to allow raising of the north cell dikes to +44 feet.

Each of the five outfalls at HMI is permitted as a point source discharge, with monitoring requirements and discharge limitations for pH, total suspended solids (TSS), and five metals. In the first seven years of operation, there were a total of ten violations of discharge permit limits. None of these violations has been for toxic parameters. No violations have occurred since 1991.

There are additional monitoring requirements for one specific outfall that require the analysis of over 120 other potential contaminants on a quarterly basis. This quarterly monitoring is also repeated in adjacent Bay waters. Aquatic toxicity testing of the effluent is performed every 6 months.

A Wetlands License issued by the Board of Public Works sets guidelines for development into a recreational area and requires monitoring of the effects of operations on the environment and on resources outside the facility. This License was modified in June 1996 to allow raising of the north cell dikes to +44 feet. The monitoring is performed by principal investigators from the University of Maryland and the Maryland Geological Survey under contract to the MPA. The monitoring efforts, which were supervised by the

Maryland Department of Natural Resources (DNR), and are presently supervised by MDE. The Wetlands License also requires that the operator monitor wells in the dike of the facility. This is done on a monthly basis and is reported to the Hart Miller Island Technical Review Committee.

An Army Corps of Engineers Construction Permit contains requirements and oversight provisions for construction and development activities on the site. Corps personnel also perform inspection duties during Federal projects to ensure operational requirements such as freeboard limitation (maintaining a 2-foot separation between the slurry elevation and top of the dike) are enforced. The Corps permit was modified in August 1996 to allow raising of the north cell dikes to +44 feet.

A Water Quality Certification, issued by the Department of Natural Resources in 1975 (now regulated under the Maryland Department of the Environment), ensures that construction and operations are performed in accordance with the Corps of Engineers approved plans and Maryland water quality standards. This regulation requires the permit holder to provide adequate sediment erosion control, to prevent fuel spills into the waterway, and to develop crust management techniques and a water quality monitoring system.

A Water Appropriations Permit, issued by the Department of Natural Resources, allows withdrawal of water from the Chesapeake Bay. At HMI, water is used by hydraulic unloaders during inflow of dredged material and at dredging sites where hydraulic dredges are used. Semi-annual reports are submitted on water used during the previous 6 months.

In accordance with Section 404 of the Clean Water Act, an evaluation was conducted to assess impacts of the proposed actions to waters of the United States ( EA Appendix IV). The State of Maryland has indicated that a water quality certificate will be received and that the project will be in compliance with the Coastal Zone Management Act. A summary of the project's compliance with applicable environmental statutes is given in EA Appendix V.

The MPA applied for a Corps permit in March 1996 to raise the HMI north cell dikes to +44 in order to provide an additional 20 to 30 million cubic yards of capacity. The MPA received a Wetlands License from the State in June and a Corps permit in August 1996. Dike construction is nearing completion and the site is expected to have sufficient capacity for the proposed dredging of the Brewerton Extension, as well as and other dredging projects. An analysis of sediments from Brewerton Channel Eastern Extension indicates that the material is suitable for open water placement and need not be placed in a containment site. However, HMI has been selected by the local sponsor because it is the only site that is currently available. The difficulty in using the Brewerton Extension material for beneficial use is the material's fine-grained characteristic of over 50 percent clay and less than 10 percent sand, which limits its structural use.

The provision of suitable placement sites is the responsibility of the local sponsor, and HMI is the only site presently available. The MPA and the Corps are developing a variety of dredged material placement options that include beneficial use, confined and open water alternatives. If the MPA proposes to use other sites such as the Poplar Island Habitat Restoration project or the Kent Island Deep (Site 104) open water placement site for the Brewerton Channel Eastern Extension, and if environmental and economic evaluations support their use, the District will consider these sites.

**Summary**

The proposed widening of the Brewerton Channel Eastern Extension and placement of the material at HMI will have no significant adverse environmental impacts. Over the next twenty years, there is more material that requires dredging than there is placement site capacity, leaving a placement shortfall. This is especially important since HMI is available to accept contaminated material, and such sites are difficult to site and costly to construct.

The MPA has raised most of the HMI north cell dikes to +44 feet and has informed the District that HMI will be available to accept material from the proposed widening of the Brewerton Channel Eastern Extension. The District will continue its coordination with MPA, MES, and other agencies to ensure efficient utilization of placement areas.

While HMI is presently the only site available for this project, other sites may become available in the near future and may be feasible. Upon completion of environmental studies on these sites, the Baltimore District will determine whether these sites are environmentally acceptable, technically feasible, and cost-effective for placement of material from the Brewerton Channel Eastern Extension.

# BALTIMORE HARBOR AND CHANNELS, MARYLAND AND VIRGINIA, 42-FOOT PROJECT BREWERTON CHANNEL EASTERN EXTENSION LIMITED REEVALUATION REPORT

## SECTION 5

## ECONOMICS

The purpose of this economic analysis of the Brewerton Channel Eastern Extension is to assess the need for widening improvements and to identify economic impacts of such modifications. The Brewerton Channel Eastern Extension is an important link for vessels traversing the Chesapeake and Delaware Canal into and out of the Port of Baltimore. Anecdotal information indicates that 98 percent of the vessels carrying foreign waterborne commence, that use the C&D Canal, choose to traverse the Brewerton Channel Eastern Extension, with the remaining 2 percent using the longer route through the Swan Point and Craighill Channels to reach the Port of Baltimore. Widening of the Brewerton Channel Eastern Extension will safely provide for more effective use of this channel section and will contribute to improved operating efficiencies for those vessels operating in the Port of Baltimore navigation system.

To evaluate the impacts of widening the Brewerton Channel Eastern Extension, a computer model simulated the operating environment of the Brewerton Channel Eastern Extension together with the operating environment of the C&D Canal and the Port of Baltimore navigation system. The purpose of this simulation study was to assess impacts of widening the Brewerton Extension on traffic patterns and on the general operation of the Port of Baltimore. An increase in the width of the Brewerton Extension would improve the flow of vessels already utilizing the Extension and would encourage other vessels to use the Brewerton Extension.

The economic analysis of alternatives considered a "without project" condition of a 450-foot wide channel. The several "with project" scenarios include widening of the channel to 550 feet and widening of the channel to 600 feet. This analysis did not consider channel deepening as an alternative to be evaluated. Project benefits that accrue to the "with project" alternatives are based on transportation savings realized by the vessel fleet calling on the Port of Baltimore as a result of the improved passage through the Brewerton Channel Eastern Extension. The benefits are manifested primarily through reduced vessel operating costs, reduced pilotage costs, and time savings that are achieved as a result of the improvement. Vessel movements and vessel fleet composition are based on detailed analysis and forecasts of commodity flows and vessel fleet conducted by DRI/McGraw-Hill. Vessel operating costs are based on FY 1995 Deep Draft Vessel Cost information published by the Institute for Water Resources.

Multiple simulations were executed for the existing 450-foot-wide channel, and the proposed 550- and 600-foot-wide channel alternatives. Simulations were conducted for each of the benchmark years 2000 through 2020. Analysis of later benchmark years (2030 through 2050) was not conducted because of system infrastructure limitations revealed in earlier analyses conducted during the Baltimore Harbor Anchorages and Channels Feasibility study. Year 2020 operating conditions (and savings related to channel improvements) were held constant for the duration of the 50-year period of analysis due to the system limitations. The analysis revealed that movement of vessels through the system would improve with widening and that efficiencies associated with more effective use of the Brewerton Channel Eastern Extension would be realized. A detailed discussion of the analysis is found in Appendix F - Economics.

Benefits were computed at 1995 prices based on the operating savings identified. For purposes of the economic analysis, costs were also computed at October 1, 1994 (FY 95), prices. These baseline costs include mobilization, demobilization, dredging of material, transport of material, and placement of material. Also included are construction engineering and design costs and construction management costs. Costs associated with raising of the dike at Hart-Miller Island are also included in this estimate. Through discussions with the U.S. Coast Guard, it was determined there are no new project-related costs for aids to navigation. A detailed discussion of the project costs is found in Section 2.

First costs for widening of the Brewerton Channel Eastern Extension to 550-feet were computed to be $9,681,000. First costs for the 600-foot wide alternative have been computed to be $12,673,000. Total investment costs are based on a six-month construction period. For the 550-foot widening alternative, total investment costs are $9,855,000. For the 600-foot widening alternative, total investment costs are $12,901,000. Annualized investment costs for the two alternatives are estimated to be $748,000 and $979,000, respectively. Annual incremental operation and maintenance costs for these alternatives are estimated to be $166,700 and $249,500, respectively.

Total annual cost for the 550-foot alternative is $870,000. Total annual cost for the 600-foot alternative is $1,229,000. Widening of the Brewerton Channel Eastern Extension to 550 feet results in a benefit-cost ratio of 8.9 to 1 and produces net benefits of $7,252,000 as shown in Table 3. Construction of the 600-foot-wide channel alternative results in a benefit-cost ratio of 11.5 to 1 and produces net benefits of $12,877,000 as shown in Table 4. The incremental annual cost of moving from the 550-foot-wide channel to the 600-foot-wide channel is estimated to be $314,000. The incremental expenditure of $314,000 associated with this additional 50-foot width is estimated to yield incremental benefits of $5,939,000 for an incremental benefit-incremental cost ratio of 18.9 to 1. Based on the analysis presented, it is recommended that the Brewerton Channel Eastern Extension be improved from its current width of 450 feet to a width of 600 feet.

TABLE 3

**BREWERTON CHANNEL EASTERN EXTENSION**
**550-FOOT WIDENING ALTERNATIVE**
**BENEFIT-COST SUMMARY**
**( 1995 PRICE LEVELS, $1,000's)**

| ITEM | COSTS |
|---|---|
| **INVESTMENT COST** | |
| Project First Cost | $ 9,681 |
| Interest During Construction | 174 |
| Total Investment Cost | $ 9,855 |
| **AVERAGE ANNUAL COST** | |
| Annualized Investment Cost | $ 748 |
| O, M, R, R, & R | 167 |
| Total Annual Cost | $ 915 |
| **AVERAGE ANNUAL BENEFITS** | |
| Navigation Cost Savings | $ 8,167 |
| **BENEFIT-COST RATIO** | **8.9** |
| **NET BENEFITS** | **$ 7,252** |

## TABLE 4

## BREWERTON CHANNEL EASTERN EXTENSION
## 600-FOOT WIDENING ALTERNATIVE
## BENEFIT-COST SUMMARY
## ( 1995 PRICE LEVELS, $1,000's)

| ITEM | COSTS |
|---|---|
| **INVESTMENT COST** | |
| Project First Cost | $12,673 |
| Interest During Construction | 228 |
| Total Investment Cost | $12,901 |
| **AVERAGE ANNUAL COST** | |
| Annualized Investment Cost | $ 979 |
| O, M, R, R, & R | 250 |
| Total Annual Cost | $ 1,229 |
| **AVERAGE ANNUAL BENEFITS** | |
| Navigation Cost Savings | $14,106 |
| **BENEFIT-COST RATIO** | **11.5** |
| **NET BENEFITS** | **$12,877** |

THIS PAGE LEFT BLANK INTENTIONALLY

**BALTIMORE HARBOR AND CHANNELS, MARYLAND AND VIRGINIA, 42-FOOT PROJECT BREWERTON CHANNEL EASTERN EXTENSION LIMITED REEVALUATION REPORT**

## SECTION 6

## REAL ESTATE PLAN (REP)

1. The Brewerton Channel Eastern Extension is a portion of a project that includes 126 miles of Federal navigation channels that serve the Port of Baltimore. The overall Baltimore Harbor and Channels Project was adopted by the River and Harbor Act of August 8, 1917, and was modified by the River and Harbor Acts of January 21, 1927; July 3, 1930; October 7, 1940; March 2, 1945; July 3, 1958; and December 31, 1970. The Brewerton Channel Eastern Extension is located in the northern portion of the Chesapeake Bay and extends eastward across the Chesapeake Bay from the main ship channels at the mouth of the Patapsco River. The authorized dimensions of the channel are 35 feet deep and 600 feet wide. The channel was deepened to 35 feet and widened to 450 feet in 1986, and the eastern nautical mile of the channel was widened to 600 feet in 1991. The purpose of the Limited Reevaluation Report (LRR) for which this REP was prepared is to analyze the viability of completing the widening of the remaining 5 miles of the channel from 450 feet to the 600 feet that is authorized. The February 1986 Baltimore Harbor and Channels Maryland and Virginia 42-Foot Project, Supplement to General Design Memorandum No. 1, dated March 1961, documented the results of previous evaluations to deepen and widen the Brewerton Channel Eastern Extension.

2. The entire Brewerton Channel Eastern Extension is located below the ordinary high water mark of the Chesapeake Bay and is subject to the Government's right of navigational servitude. The dredged material placement site, Hart-Miller Island, is currently the only placement site for the Brewerton Channel Eastern Extension widening project. The real estate requirements for the selected plan are discussed in the following paragraphs.

Since 1984, Hart-Miller Island has been used for placement of dredged material removed from Baltimore Harbor and other navigational projects. The State of Maryland purchased the original island area in fee in 1978, and has expanded the island with dredged material. The expanded portions of Hart-Miller Island are located on areas that were originally located below the ordinary high water mark in the Chesapeake Bay, are subject to the Government's right of navigational servitude, and were previously under the ownership of the State of Maryland. A portion of the island has been developed into a state park, and the South Cell is scheduled for development into an environmental and recreational area. The site was expected to reach its capacity by the year 2000. However, raising the north cell dikes to +44 feet MLW was recently authorized by State of Maryland and Corps of

Engineers permits, which will allow increased capacity of 20 to 30 million cubic yards. The North Cell portion of the placement area to be raised contains approximately 840 acres.

No other ownership interests are required for the project, since the dredging and dredged material placement areas are all under navigational servitude.

a. There is no Federal land located within the project area or the placement site.

b. As previously discussed, the channel project area and portions of Hart-Miller Island are under navigational servitude.

3. No P.L. 91-646 relocations will be necessary for this project.

4. Although no specific real estate acquisition is necessary for this project, the Maryland Port Administration, the Non-Federal Sponsor, does have the necessary experience, manpower, and resources to acquire any real estate required for the project. They also have condemnation authority.

5. Since no acquisition is required for the Government to proceed with this project, a Real Estate Baseline Cost Estimate is not necessary. The only portion of the project that is not under navigational servitude is the original land for Hart and Miller Islands that was purchased in fee by the State of Maryland in 1978 for $550,000. It was initially purchased primarily for the Baltimore Harbor and Channels 42-Foot and 50-Foot Projects. The 50-Foot Project Cooperation Agreement provided (1) that the value of the Hart-Miller Island facility would include the acquisition costs of lands, easements, and rights-of-way, escalated from the date the costs were incurred to the date construction of the Initial Phase was initiated; (2) the cost of constructing the dikes and appurtenant facilities escalated from the midpoint of construction to the date construction of the Initial Phase was initiated; (3) and the value of settling construction claims and providing any relocation assistance. The credit to the state was based on the percentage of the Hart-Miller Island containment facility's capacity utilized for construction, operation, and maintenance of the Initial Phase, together with the cost of operating and maintaining the Hart-Miller Island facility for the Initial Phase during construction of the Initial Phase.

A new Project Cooperation Agreement will be required for the current proposed project; agreement would only provide credit for the value of the LERRDs and acquisition costs incurred within 5 years of execution of the Project Cooperation Agreement. Also, the Non-Federal Sponsor may only receive credit for those costs that have not already been credited to a previous Federal project. Therefore, for the Brewerton Channel Eastern Extension widening project, the original cost of $550,000 for the purchase of Hart-Miller Island is the only amount that may be considered for credit. Due to the crediting provided, based on the percentage of capacity used by the 50-Foot project and several

other Federal projects that have since utilized Hart-Miller Island as a placement site, it has been determined that the full value of $550,000 has long since been credited to previous Federal projects. The Non-Federal Sponsor shall receive LERRD credit for the proportionate share of construction costs for preparation of the disposal areas as shown in the project MCACES cost estimate.

6. A real estate map is not required, since there is currently no specific real estate acquisition required for implementation of the project.

7. There is no present or anticipated mineral activity in the vicinity of this project.

8. Since the project site and most of the placement areas are subject to the Government's right of navigational servitude, no interests need to be acquired on these properties. The Non-Federal Sponsor was required to purchase fee interest (Estate No. 1) for the original Hart and Miller Islands, which it previously purchased. Since the Non-Federal Sponsor already owns the bottom of the waterways, it will own fee interest (Estate No. 1) in all project lands, described as follows:

The fee simple title to the land, subject, however, to existing easements for public roads and highways, public utilities, railroads, and pipelines.

9. A schedule of real estate acquisition activities or milestones is not applicable to this project since project lands and sufficient placement sites are already owned by the Non-Federal Sponsor.

10. There are no utilities or facilities to be relocated.

11. Surveys conducted at both the proposed dredge site and the placement site have shown that there is little potential for HTRW or other environmental contaminants.

12. Since this project has little to no effect on local landowners, and the Baltimore Harbor has been deepened and maintained continuously for years, there has been no adverse public reaction to the project.

THIS PAGE LEFT BLANK INTENTIONALLY

# BALTIMORE HARBOR AND CHANNELS, MARYLAND AND VIRGINIA, 42-FOOT PROJECT BREWERTON CHANNEL EASTERN EXTENSION LIMITED REEVALUATION REPORT

## SECTION 7

## PLAN SELECTION AND IMPLEMENTATION

### Introduction

This section summarizes the rationale for selecting the proposed improvement to the Brewerton Channel Eastern Extension and the steps necessary to implement the project.

### Plan Selection

No Action Alternative

The no action alternative would retain the existing channel configuration of 35 feet deep, 450 feet wide for the western 5 miles, 600 feet wide for approximately 1 mile, and widening to 1,630 feet at the turn at the eastern end. The Corps would continue to survey the channel and schedule periodic maintenance dredging to provide the current channel dimensions. As a result, Panamax ships would continue to be precluded from passing in the channel and would have to delay their transit, waiting for another vessel to complete its transit of the Brewerton Channel Eastern Extension, or would have to take the longer, more circuitous route through the Swan Point and Craighill approach channels, incurring further delays. These delays would continue to negatively impact the efficiency and transportation costs of vessels calling on the Port of Baltimore.

Channel Width

Widening the channel from 450 feet to 500, 550, or 600 feet would improve navigation safety for one-way traffic in the Brewerton Channel Eastern Extension. The ship simulation studies, however, demonstrated that widening the channel to 500 feet would not provide a safe channel for two-way traffic of Panamax size vessels. Widening the channel to 550 feet would provide only a marginally safe channel for two-way traffic of Panamax size vessels. Based upon the design analyses presented in Section 2, the 600-foot wide channel would provide a safe channel for two-way traffic of Panamax vessels, under most conditions.

Operations and Maintenance

The various channel alternatives would not measurably impact hydrographic surveying costs, but would increase maintenance dredging costs proportionately to the channel widening. The increases would range from 23,000 cubic yards at a cost of $82,800 per year for the 500-foot widening alternative, to 69,300 cubic yards at a cost of $249,500 per year for the 600-foot widening alternative. The projected increases in quantities and cost are small when compared to the annual maintenance dredging quantity of 2.5 million cubic yards, and the annual Operations & Maintenance, General, budget of $12 million for the Baltimore Harbor & Channels projects. Therefore, the increase in operation and maintenance dredged material quantities and costs is not considered a significant factor in selecting a widening alternative.

Environmental

The project will result in no significant adverse environmental impacts. Dredging for any of the widening alternatives will be conducted in a manner that minimizes any adverse environmental impacts. Several dredged material placement alternatives were evaluated, but the Hart-Miller Island Dredged Material Containment Facility is the only site that is currently available for this project. Use of Hart-Miller Island will decrease the amount of valuable confined dredged material capacity available, but will not result in any significant adverse environmental impacts. If other sites become available in the future and studies determine that these sites are environmentally acceptable, technically feasible, and cost-effective, the sites will be considered for the placement of material from the Brewerton Channel Eastern Extension.

Dredging quantities for the 500-, 550-, and 600-foot-wide channel alternatives are 666,400, 1,445,400, and 2,257,600 cubic yards, respectively. Selection of either the wider 550- or 600-foot-wide channel alternatives requires significantly more dredged material placement capacity, which is at a premium in the port, than the 500-foot-wide alternative. However, the need to provide a channel that is safe for navigation far outweighs the increase in dredging quantities to provide a wider channel.

Economics

A traffic simulation program was developed to model one-way and two-way traffic in the Brewerton Channel Eastern Extension, to estimate navigation delays and diversions, and to assess the impact of various channel-widening alternatives. Channel widths of 550 feet and 600 feet were analyzed to evaluate operational impacts. Both channel widths were found to be economically justified, with the 550-foot alternative having a benefit-cost ratio of 8.9 to 1 and producing net benefits of $7,252,000, and the 600-foot alternative having a benefit-cost ratio of 11.5 to 1 and producing net benefits of $12,877,000. Widening the channel to 600 feet was selected as the best plan since it maximizes National Economic Development (NED) benefits.

Selected Plan

The design analyses indicate that a 600-foot-wide channel is required to provide safe navigation for two-way traffic of Panamax container vessels and the economic analysis indicates that the 600-foot alternative is the NED Plan. Hart-Miller Island is the only dredged material placement site that is currently available. Therefore, widening the Brewerton Channel Eastern Extension from 450 to 600 feet wide, with dredged material placement at the Hart-Miller Island Dredged Material Containment Facility, is the recommended plan.

**Plan Implementation**

The following actions must be accomplished prior to the resumption of project construction: (1) The District must finalize the LRR and the Environmental Assessment (2) HQUSACE must approve the project (Congress authorized the project in the River & Harbor Act of July 3, 1958); (3) the District must finalize plans and specifications upon approval of the LRR; (4) the Department of the Army and the State must negotiate and execute a project cooperation agreement (PCA); (5) the Corps and the State must budget and receive Federal and non-Federal appropriations, respectively; and (6) the State must complete the Hart-Miller Island north cell dike raising.

The earliest that Federal funds could be budgeted for construction would be FY 1999. Pending the availability of funds and approval to advertise, a contract would be solicited in the late summer of the fiscal year preceding the year in which construction funds are budgeted. Bids would be opened, and a contract awarded in October of the budget year. Construction would be scheduled for completion in the spring, with project fiscal closeout scheduled for September of the budget year. Upon completion of the project, the Corps will operate and maintain the widened channel at Federal expense.

THIS PAGE LEFT BLANK INTENTIONALLY

# BALTIMORE HARBOR AND CHANNELS, MARYLAND AND VIRGINIA, 42-FOOT PROJECT BREWERTON CHANNEL EASTERN EXTENSION LIMITED REEVALUATION REPORT

## SECTION 8

## COST ALLOCATION AND APPORTIONMENT

### Cost Allocation

The cost of the recommended plan for widening the Brewerton Channel Eastern Extension is allocated entirely to commercial deep-draft navigation.

### Cost Apportionment

The Water Resources Development Act (WRDA) of 1986, Public Law 99-662, established the basis for Federal and non-Federal cost-sharing of responsibility in the construction, operation, and maintenance of Federal water resources projects. For general navigation features such as the construction and/or improvement of navigation channels (including associated costs, such as design, construction management, etc.), non-Federal interests are required to pay 10 percent of the initial costs for design and construction of the project where dredging depths are less than or equal to 20 feet; 25 percent of the initial costs for design and construction of the project where the dredging depths are greater than 20 and less than or equal to 45 feet, and 50 percent of the initial costs for design and construction of the project where the dredging depths are greater than 45 feet. These costs would be paid during the period of construction. Since the dredging depths are greater than 20 feet and less than 45 feet, the non-Federal sponsor will be required to pay 25 percent of the costs of design and construction of the channel. The Federal Government will be responsible for 100 percent of the costs of operating and maintaining the general navigation features of the project, since the project depth is less than 45 feet.

In addition, Section 101 of WRDA 1986 requires the non-Federal sponsor to pay 10 percent of the construction costs that are cost-shared upon completion of construction, or with interest over a period not to exceed 30 years. Due to the policy of navigational servitude, which dictates that the Federal government has the rights to any lands created by the government in an area that previously was under water, the local sponsor cannot claim the cost of acquiring these lands as credit for providing the necessary lands, easements, rights-of-way, relocations, and dredged material containment areas, including retaining dikes (LERRD). However, the local sponsor may still claim, as an LERRD credit, the cost of any improvements required to make the site functional, such as the

incremental cost of raising the dikes at Hart-Miller Island. This credit may be applied against the 10 percent contribution at the end of construction.

Federal participation in navigation project costs, as set forth in WRDA 1986, is limited to sharing costs for the general navigation features such as entrance channels, primary branch channels leading to public facilities, anchorage areas, and turning basins and associated engineering and design and construction management costs. Non-Federal interests are responsible for and bear the costs of providing terminal facilities; dredging in berthing areas; and acquiring necessary LERRD. The non-Federal sponsor is also responsible for assuring the relocation and/or alteration of affected utilities, pipelines, cables, and sewer outlets.

Effect of WRDA 1996 on Project Cost-Sharing

The Water Resources Development Act (WRDA) of 1986 required the non-Federal sponsor to pay 100 percent of the cost of construction, operation and maintenance of dredged material placement areas. WRDA 1996 authorizes changes in cost-sharing for construction, operations and maintenance of new dredged material placement areas. The WRDA 1996 cost sharing requires the Federal Government to cost-share the construction of new dredged material placement areas commensurate with cost-sharing requirements for new navigation projects (i.e. 90 percent for projects with channel depths to 20 feet, 75 percent for channel depths from 21 to 45 feet, and 50 percent for channels with depths deeper than 45 feet) and to pay 100 percent of the costs for all operation and maintenance of the placement areas. Existing placement areas or modifications to existing placement areas started before enactment of WRDA 96 are excluded from the new cost-sharing requirements. Since Hart-Miller Island was initially constructed in December 1983, and subsequent modifications to raise the north cell dikes were initiated prior to October 1996, the new cost sharing does not apply for Hart-Miller Island. The MPA, therefore, is responsible for all construction costs to raise the dikes to +44 feet, and for all operation and maintenance costs for the site.

Full Funding Project Cost Estimate

The total Baseline Cost Estimate for widening the Brewerton Channel Eastern Extension from 450 to 600 feet is $12.7 million, at October 1, 1994, price levels, with no price escalation. This estimate was prepared for direct economic comparison to project benefits. Plan formulation, evaluation, and selection were conducted on the basis of the costs, benefits, benefit-cost ratios, and net benefits developed at this price level.

Price escalation may occur during the design and construction phases. To provide the Federal Government and the non-Federal sponsor with a project cost estimate that reflects anticipated price escalation, a "full funding estimate" has been developed in the required M-CACES format (see Appendix D). This estimate is based on standardized escalation

factors (provided by the U.S. Office of Management and Budget) for future years, and is used to identify projected actual construction costs. Both the baseline cost estimate and the full funding estimate are summarized in Table 5.

## Table 5

**Brewerton Channel Eastern Extension**
**Baseline and Full Funding Project Cost Estimates**
**(October 1, 1994 Price Level ($1,000))**

**Selected Plan - Widen Channel to 600 Feet**

| Feature Account | Baseline Estimate (1) | Full Funding Estimate (2) |
|---|---|---|
| 09 Channels and Canals | | |
| 01 Channels | | |
| 01 Mob, Demob, and Preparatory Work | $ 1,334 | $ 1,462 |
| 15 Mechanical Dredging - Total | | |
| 02 Widen Channel to 600 Feet | $ 8,776 | $ 9,618 |
| 20 Dredged Material Placement Areas | | |
| 02 HMI Dike Construction | $ 1,116 (3) | $ 1,224 (3) |
| 30 Construction Engineering and Design | $ 992 | $ 996 |
| 31 Construction Management | $ 455 | $ 515 |
| **Total Construction Cost** | **$12,673** | **$13,815** |

(1) Baseline construction cost estimate prepared in accordance with EM 1110-2-538 using Army Corps of Engineers M-CACES system; values are October 1, 1994, price levels.

(2) Full funding estimate, assuming unconstrained Federal and non-Federal funding.

(3) Portion of Hart-Miller Island dike raising associated with the Baltimore Harbor & Channels, 42-Foot project - Brewerton Channel Eastern Extension.

Financial Obligations

The financial obligations of the Federal and non-Federal participants are based on the total fully funded cost of the proposed improvement, currently estimated to be $13.8 million (October 1, 1994, price base). As discussed above, project costs for the general navigation features between the depths of 20 and 45 feet are shared 75 percent Federal, and 25 percent non-Federal. Accordingly, the fully funded cost of $12.6 million for the general navigation features, will be shared 75 percent Federal ($9.4 million), and

25 percent non-Federal ($3.2 million). In addition, the non-Federal sponsor is required to pay an additional 10 percent of the total costs of the general navigation features, currently estimated to be approximately $1.3 million, upon completion of construction, or over a period of time not to exceed 30 years. The non-Federal sponsor may receive credit against this 10-percent payment for LERRD costs incurred. Credit for the incremental cost of raising the dikes at the HMI placement site will be given to the MPA as a LERRD cost. The MPA estimates the total cost for raising the HMI north cell dikes, from +28 feet to +44 feet, to be $13 million. Since the project would only require a portion of the capacity provided by the dike raising, the non-Federal sponsor would receive credit for a prorated share of the cost of the dike raising used on this project ($1.2 million fully funded cost) as credit toward the 10 percent payment. The financial obligations are summarized in Table 6.

**Identification of Local Sponsor**

The State of Maryland, Department of Transportation, Maryland Port Administration is the non-Federal sponsor for the Baltimore Harbor and Channels 42-Foot Project and 50-Foot Project. The State executed a Section 221 Agreement on August 11, 1981, and a Local Cooperation Agreement, as amended, on February 5, 1987, to provide the necessary items of local cooperation for the 42-Foot Project and for the 50-Foot Project, respectively. The State continues to comply with its responsibilities under these agreements. The MPA has participated in the study activities and indicated in its February 18, 1993, letter that it would provide the necessary items of local cooperation.

The Baltimore District met with the MPA throughout the study process. The MPA is aware of the cost-sharing requirements described in this Section and their responsibilities to provide the necessary items of local cooperation, particularly the necessary dredged material placement areas. The MPA has demonstrated its interest in the study by participating in meetings, providing various kinds of information, and reviewing preliminary findings. The MPA has also initiated construction to raise the Hart-Miller Island north cell dikes to ensure adequate capacity is available for the dredged material.

**Items of Non-Federal Cooperation**

The following list of items constitutes the non-Federal cooperation that is normally required for project implementation.

(1) *Provide and maintain, at its own expense, the local service facilities.*

*(2) Provide all lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas, and perform or ensure the performance of all relocations determined by the Federal Government to be necessary for the construction, operation, and maintenance of the general navigation features and the local service facilities.*

## Table 6

### Brewerton Channel Eastern Extension
### Financial Obligations
**(October 1, 1994 fully funded price levels)**

| Features | Total Cost | Federal Share % | Federal Share Cost | Non-Federal Share % | Non-Federal Share Cost |
|---|---|---|---|---|---|
| Mob, Demob and Prep Work | $1,462,300 | 75 | $1,096,700 | 25 | $365,600 |
| Dredging Brewerton Channel Eastern Extension | $9,617,700 | 75 | $7,213,300 | 25 | $2,404,400 |
| Construction Engineering and Design | $995,600 | 75 | $746,700 | 25 | $248,900 |
| Construction Management | $515,300 | 75 | $386,500 | 25 | $128,800 |
| **Total Up-Front Cash** | $12,590,900 | | $9,443,200 | | $3,147,700 |
| 10% Payback | $1,259,100 | | $ -35,500 | 100 | $ 35,500* |
| **Subtotal** | $12,590,900 | | $9,407,700 | | $3,183,200 |
| Placement Area Dike Construction | $1,223,600** | | $ 0 | 100 | $1,223,600 |
| **Totals** | $13,814,500 | | $9,407,700 | | $4,406,800 |

* 10% post-construction contribution ($1,259,100 maximum) has been reduced by credit for improvements to the HMI dredged material placement area (LERRD).

** Reflects the total LERRD costs for the project which are a non-Federal responsibility, but are not shown as part of the non-Federal cash contribution.

*(3) Provide all improvements required on lands, easements, and rights-of-way to enable the proper disposal of dredged or excavated material associated with the construction, operation, and maintenance of the general navigation features and the local service facilities. Such improvements may include, but are not necessarily limited to, retaining dikes, waste weirs, bulkheads, embankments, monitoring features, stilling basins, and dewatering pumps and pipes.*

*(4) Provide, during the period of construction, a cash contribution equal to the following percentages of the total cost of construction of the general navigation features:*

* *10 percent of the costs attributable to dredging to a depth up to but not in excess of 20 feet;*

* *25 percent of the costs attributable to dredging to a depth in excess of 20 feet but not in excess of 45 feet;*

* *50 percent of the costs attributable to dredging to a depth in excess of 45 feet.*

*(5) Repay with interest, over a period not to exceed 30 years following completion of the period of construction of the Project, an additional 0 to 10 percent of the total cost of construction of general navigation features depending upon the amount of credit given for the value of lands, easements, rights-of-way, relocations, and borrow and dredged or excavated material disposal areas provided by the Non-Federal Sponsor for the general navigation features. If the amount of credit exceeds 10 percent of the total cost of construction of the general navigation features, the Non-Federal Sponsor shall not be required to make any contribution under this paragraph, nor shall it be entitled to any refund for the value of lands, easements, rights-of-way, relocations, and dredged or excavated material disposal areas, in excess of 10 percent of the total cost of construction of the general navigation features.*

*(6) For so long as the Project remains authorized, operate and maintain the local service facilities and any dredged or excavated material disposal areas, in a manner compatible with the Project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government.*

*(7) Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the Non-Federal Sponsor owns or controls for access to the general navigation features for the purpose of inspection, and, if necessary, for the purpose of operating and maintaining the general navigation features.*

*(8) Hold and save the United States free from all damages arising from the construction, operation, and maintenance of the Project, any betterments, and the local service facilities, except for damages due to the fault or negligence of the United States or its contractors.*

*(9) Keep, and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the Project, for a minimum of three years after completion of the accounting for which such books, records, documents, and other evidence is required, to the extent and in such detail as will properly reflect total cost of construction of the general navigation features, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 C.F.R. Section 33.20.*

*(10) Perform, or cause to be performed, any investigations for hazardous substances as are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, and maintenance of the general navigation features. However, for lands that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigations unless the Federal Government provides the Non-Federal Sponsor with prior specific written direction, in which case the Non-Federal Sponsor shall perform such investigations in accordance with such written direction.*

*(11) Assume complete financial responsibility, as between the Federal Government and the Non-Federal Sponsor, for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, or maintenance of the general navigation features.*

*(12) To the maximum extent practicable, perform its obligations in a manner that will not cause liability to arise under CERCLA.*

*(13) Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way, required for construction, operation, and maintenance, of the general navigation features, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.*

*(14) Comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as*

*Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army."*

*(15) Provide a cash contribution equal to the following percentages of total historic preservation mitigation and data recovery costs attributable to commercial navigation that are in excess of one percent of the total amount authorized to be appropriated for commercial navigation:*

* *10 percent of the costs attributable to dredging to a depth up to but not in excess of 20 feet;*

* *25 percent of the costs attributable to dredging to a depth in excess of 20 feet but not in excess of 45 feet;*

* *50 percent of the costs attributable to dredging to a depth in excess of 45 feet.*

**Financial Analysis**

The earliest the Federal Government could budget for this work would be Federal Fiscal Year 1999, which begins October 1, 1998. The non-Federal sponsor must have the necessary funding mechanisms in place to provide the non-Federal share of project costs in a timely fashion. Based on the involvement and interest of the MPA in the project to date, its extensive efforts to construct and have placement sites available, its letter of intent to cost-share the work, and the MPA's financing of past projects, the MPA has the interest and the financial capability to provide the required non-Federal sponsor items of local cooperation for the project. The MPA will be requested to provide its financing plan and statement of financial capability upon approval of the draft report.

# BALTIMORE HARBOR AND CHANNELS, MARYLAND AND VIRGINIA, 42-FOOT PROJECT BREWERTON CHANNEL EASTERN EXTENSION LIMITED REEVALUATION REPORT

## SECTION 9

## CONCLUSIONS AND RECOMMENDATIONS

### Conclusions

Introduction

The Port of Baltimore is one of America's busiest deep water ports, and has experienced a growth in commodity movements in recent years. In 1993, more than 2,200 vessel calls and nearly 23 million metric tons of foreign cargo were handled in the Port of Baltimore. By 1995, this increased to 28 million metric tons of foreign cargo valued at almost $21 billion. Commerce in the Port of Baltimore is expected to continue to increase over the next 50 years. In recent years, the MPA has worked towards maintaining the Port of Baltimore as a thriving world-class port. Since 1980, over one-half billion dollars have been invested in maritime-related improvements. As the commercial shipping industry continues to grow, the Port of Baltimore is anticipated to expand to meet the demands of the market.

With the increase in commerce, there is a steadily growing need for improvements to the existing Baltimore Harbor and Channels project. The width of the Brewerton Channel Eastern Extension is inadequate and can not accommodate two-way traffic for many of the container ships and other large vessels that are now calling on the port via the Chesapeake and Delaware Canal. The western 5 miles of channel need to be widened from the channel's width of 450 feet to its authorized width of 600 feet to provide safer navigation and more efficient navigation by allowing larger ships to pass, thereby reducing transit and delay costs.

Channel Design

Design analyses were performed to assess navigation safety in the Brewerton Channel Eastern Extension. Panamax class container vessels were used as the design vessel. Based upon the design vessel, the climatic and channel site conditions, and the need for two-way traffic in the channel, the design analyses recommended widening the channel to 600 feet to improve navigation safety for one way traffic and to permit Panamax size container vessels to safely meet in the Brewerton Channel Eastern Extension.

Economics

A traffic simulation program was developed to model the Baltimore Harbor channel system and vessel movements within this system. The model was used to estimate the demand for two-way traffic in the Brewerton Channel Eastern Extension, to estimate navigation delays and diversions, and to assess the impact of various channel-widening alternatives. Multiple channel width alternatives were analyzed and the model was used to evaluate their operational impacts. Based on the results of the simulation analysis, economically justified alternatives for channel widening were identified. Widening of the channel to 600 feet was selected as the best plan since it improves navigation efficiency and maximizes National Economic Development benefits.

Environmental

Dredging will temporarily increase turbidity within the immediate dredging area. Some benthic habitat may be lost as a result of dredging activities, but this habitat is expected to recolonize shortly after dredging is complete. Finfish and other mobile animals will leave the area during construction in search of less active areas and will return following construction. Sediment testing was conducted during the study, and no HTRW substances were detected in the project area.

Dredged Material Management

The Port of Baltimore has a long maritime history dating back to the 1600's. The placement of dredged material has always been problematic due to socio-political concerns, the naturally shallow depths and continuous shoaling in the Chesapeake Bay, the environmental sensitivity of the Bay, and the need to construct and maintain deeper and wider channels commensurate with navigation needs. In order to accommodate construction of the Baltimore Harbor & Channels 50-foot Project, the State of Maryland constructed the Hart-Miller Island Dredged Material Containment Facility in 1983. The dikes were increased from 18 feet to 28 feet in 1988 to increase the site's capacity, and the dikes of the north cell are being raised to 44 feet to increase capacity by approximately 30 million cubic yards. The total volume of dredged material associated with initial implementation of this project is currently estimated to be 2.3 million cubic yards. Dredged material from the construction of this project will be placed at Hart-Miller Island, since it is the only site currently available to contain the material. All compliance actions necessary to prepare the site for dredged material containment will be completed by the MPA. Construction of the channel is anticipated to be conducted over one dredging season between March and October. The MPA assures that adequate capacity will be available at Hart-Miller Island.

Views of the Sponsor

The Maryland Port Administration, the non-Federal sponsor, has demonstrated its support for this study through its attendance at meetings, participation in the ship simulation studies, review of preliminary findings, and its commitment to provide a suitable dredged material placement area. The MPA is aware of the required items of local cooperation, including the need to provide suitable dredged material placement areas, up-front cash contribution equal to 25 percent of the general navigation features of the project, and the need to execute a new Project Cooperation Agreement, and the MPA has signed a letter indicating its intent to provide the required items of local cooperation.

**Recommendations**

As part of this Limited Reevaluation study, consideration was given to all aspects of the overall public interest, including environmental, social, economic, and engineering concerns. Navigation problems affecting the Port of Baltimore, specifically problems with the inadequate width of the Brewerton Channel Eastern Extension, have been carefully reviewed, and potential plans of improvement have been identified and evaluated. For the Baltimore maritime community, as well as for the rest of the Nation, improvements to the Brewerton Channel Eastern Extension serving the Port of Baltimore represent a cost-effective plan for reducing delays and increasing navigation efficiency and safety. These improvements were found to have no significant adverse impacts on the quality of the environment or to the region's economic, cultural, environmental, recreational, or social uses.

In view of these findings and the expression of non-Federal support by the MPA, I recommend construction of the remaining authorized work under the existing Baltimore Harbor and Channels, Maryland and Virginia, 42-Foot Project, to widen the western 5 miles of the Brewerton Channel Eastern Extension from 35 feet deep and 450 feet wide to 35 feet deep and 600 feet wide.

The total fully funded first cost of implementing the project is presently estimated to be $13.8 million with an estimated annual incremental increase in operation and maintenance costs of $249,500. The cost of constructing the general navigation features of the channel is estimated to be $12.6 million and will be shared 75 percent Federal ($9.4 million) and 25 percent non-Federal ($3.2 million). In addition to these costs, the non-Federal sponsor is also required to reimburse the Federal Government up to an additional 10 percent of the general navigation features costs at the completion of construction, which is currently estimated to be approximately $1.3 million. Based on the costs to prepare the Hart-Miller Island placement site, currently estimated to be $1.2 million, the non-Federal sponsor will receive credit towards the 10 percent payment, leaving a balance of $35,500 to be repaid after construction. The Federal Government will be responsible for 100 percent of the $249,500 annual incremental increase in operation and maintenance costs.

This recommendation is made with the provision that, prior to commencing construction, the non-Federal sponsor will comply with all requirements of law pertaining to non-Federal sponsorship of the project.

The recommendations contained herein reflect information that is available at this time and current Departmental policies governing formulation of individual projects. The recommendations do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher level reviews within the Executive Branch. Consequently, the recommendations may be modified before they are approved by the Department of the Army, and transmitted to the Congress as proposals for implementation funding. However, prior to changing the recommendations, the non-Federal sponsor, interested state and Federal agencies, and other interested parties will be advised of any modifications and will be afforded an opportunity to comment further.

**RANDALL R. INOUYE, P.E.**
Colonel, Corps of Engineers
Commander and District Engineer