BALTIMORE HARBOR ANCHORAGES AND CHANNELS, MARYLAND

LIMITED RE-EVALUATION REPORT

EXECUTIVE SUMMARY

Vessels arrive at and depart from the Port of Baltimore via the southern Chesapeake Bay route or the northern Chesapeake Bay route through the Chesapeake and Delaware Canal. Anchorage areas within the Port of Baltimore have been established for vessels requiring layover for various reasons. The anchorage areas were authorized between 1909 and 1945 and were designed to accommodate the types of vessels calling on the Port at that time. In recent years, the trend is toward using larger, more efficient vessels over using smaller ones. Large vessels requiring anchorage typically anchor 25 miles south of the Port of Baltimore in naturally deep water at the Annapolis Anchorage Grounds. The *Baltimore Harbor Anchorages and Channels, Maryland and Virginia, Integrated Feasibility Report and Environmental Impact Statement*, which was issued in March 1997, recommended navigation improvements to enhance efficiency and provide for the increasing demand on Port facilities by the current and expected vessel fleet. These improvements were authorized by Congress in Section 101(a)(22) of the Water Resources Development Act of 1999:

- Deepening and widening a portion of Anchorage #3 (42 feet deep, 2,200 feet long, and 2,200 feet wide) at the north corner of the intersection of Fort McHenry Channel and Dundalk West Channel, while the unimproved portion of the existing anchorage (2,300 feet long by 1,500 feet wide) will be maintained at its current 35-foot depth;

- Deepening and widening a portion of Anchorage #4 (42 feet deep, 1,800 feet long, 1,800 feet wide) between Dundalk East and Dundalk West Channels and adjacent to Fort McHenry Channel;

- Widening the East Dundalk Channel to 400 feet wide with widening at the bends and entrance, at a depth of 38 feet;

- Widening the Seagirt-West Dundalk Connecting Channel to 500 feet wide with widening at the bends and entrances, at its current depth of 42 feet;

- Widening the West Dundalk Channel to 500 feet wide with widening at the bends and entrance, at its current depth of 42 feet;

- Providing cutoff angles at the intersection of the Connecting Channel and the west side of the Dundalk Marine Terminal;

- Completing the loop channel at South Locust Point Marine Terminal (36 feet deep and 400 feet wide with widening at the bends and entrance);

- Constructing a turning basin at the head of the Fort McHenry Channel (50 feet deep, 1,200 feet long, and 1,200 feet wide);

- Deauthorization of Anchorage #1;
- Placement of the dredged material (an estimated 4.4 million cubic yards (mcy) at the Hart-Miller Island placement site; and
- Federal assumption of the maintenance of the existing State channels at Dundalk, Seagirt, and South Locust Point, exclusive of berthing areas.

The total cost of the authorized project was estimated to be $28,426,000 and the annual benefit was five times the annual cost (5.2 to 1).

The Corps of Engineers process for project implementation encourages its project delivery teams to continue to improve a project's design throughout its development. Even in the period between authorization and the award of a construction contract, the Corps challenges itself to re-evaluate project components and the conditions under which they will be implemented. During the pre-construction engineering and design phase of a project, these evaluations manifest themselves through value engineering studies, continued coordination with the sponsor and the project stakeholders, and continued coordination with the public.

This limited re-evaluation report documents the design changes that will improve on the authorized project. These changes were a by-product of a value engineering study, a ship simulation study, advice from the Association of Maryland Pilots, and coordination with the public. The revised project includes a minor adjustment to the loop channel at South Locust Point, realignment of the turning basin at the head of the Fort McHenry Channel, channel and anchorages (#3 and #4) modifications in the vicinity of the Dundalk and Seagirt marine terminals, and a reduction in the quantity of dredged material. A deepening of the recommended channel-widening improvement to the East Dundalk Channel will be conducted as a betterment to the project and funded by the Maryland Port Administration. As a result of the overall Baltimore Harbor Anchorages and Channels project, this channel will be Federally maintained at 42 feet. These changes were coordinated with environmental agencies and the public as part of the National Environmental Policy Act process and a finding of no significant impact has been prepared.

The report affirms the feasibility findings and the National Economic Development plan. The economic merits of these modifications were analyzed in light of changes to trade and operating costs since the completion of the feasibility report in 1997 and the risk and uncertainty in projections of vessel traffic in the Port of Baltimore. The existing conditions and critical parameters have not changed significantly enough to alter the feasibility conclusions. The result of these analyses is that the Federal involvement in improvements to the anchorages and channels that serve the Port of Baltimore continues to be warranted. The optimized authorized project cost is $29,401,000 and the benefit to cost ratio is 1.3. Therefore, the minor modifications developed to improve upon the authorized project are recommended for implementation.

BALTIMORE HARBOR ANCHORAGES AND CHANNELS, MARYLAND

LIMITED RE-EVALUATION REPORT

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BALTIMORE HARBOR ANCHORAGES AND CHANNELS, MARYLAND

LIMITED RE-EVALUATION REPORT

1.0 PURPOSE

The purpose of this limited re-evaluation report (LRR) is to document minor design changes that have occurred since the authorization of the Baltimore Harbor Anchorages and Channels, Maryland and Virginia, (Anchorages) project. The LRR presents information on the authorized project and recommended modifications thereto, the environmental effect of the modifications, and a project benefit-cost analysis.

2.0 DESCRIPTION OF THE AUTHORIZED PROJECT

2.1 LOCATION

The Anchorages project is located within Baltimore City, Maryland, on the Patapsco River, approximately 12 miles northwest of the Chesapeake Bay and approximately 172 miles north of the Bay entrance at the Virginia Capes (Figure 1).

2.2 FUNCTIONS

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. Anchorage areas within the Port of Baltimore have been established for vessels requiring layover for various reasons. The anchorage areas were authorized between 1909 and 1945 and were designed to accommodate the types of vessels calling on the Port at that time. In recent years, the trend is toward using larger, more efficient vessels over using smaller ones. Large vessels (drafting deeper than 33 feet) requiring anchorage typically anchor 25 miles south of the Port of Baltimore in naturally deep water at the Annapolis Anchorage Grounds. The *Baltimore Harbor Anchorages and Channels, Maryland and Virginia, Integrated Feasibility Report and Environmental Impact Statement*, which was issued in March 1997, recommended navigation improvements to enhance efficiency and provide for the increasing demand on Port facilities by the current and expected vessel fleet.

2.3 SIZE

The improvements include expansion and/or reconfiguration of existing anchorages and branch channels and a new turning basin for the Port of Baltimore. Shown in Figure 2, the authorized project consists of:

- Deepening and widening a portion of Anchorage #3 (42 feet deep, 2,200 feet long, and 2,200 feet wide) at the north corner of the intersection of Fort McHenry Channel and Dundalk West Channel, while the unimproved portion of the existing anchorage (2,300 feet long by 1,500 feet wide) will be maintained at its current 35-foot depth;

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FIGURE 1 – PROJECT AREA

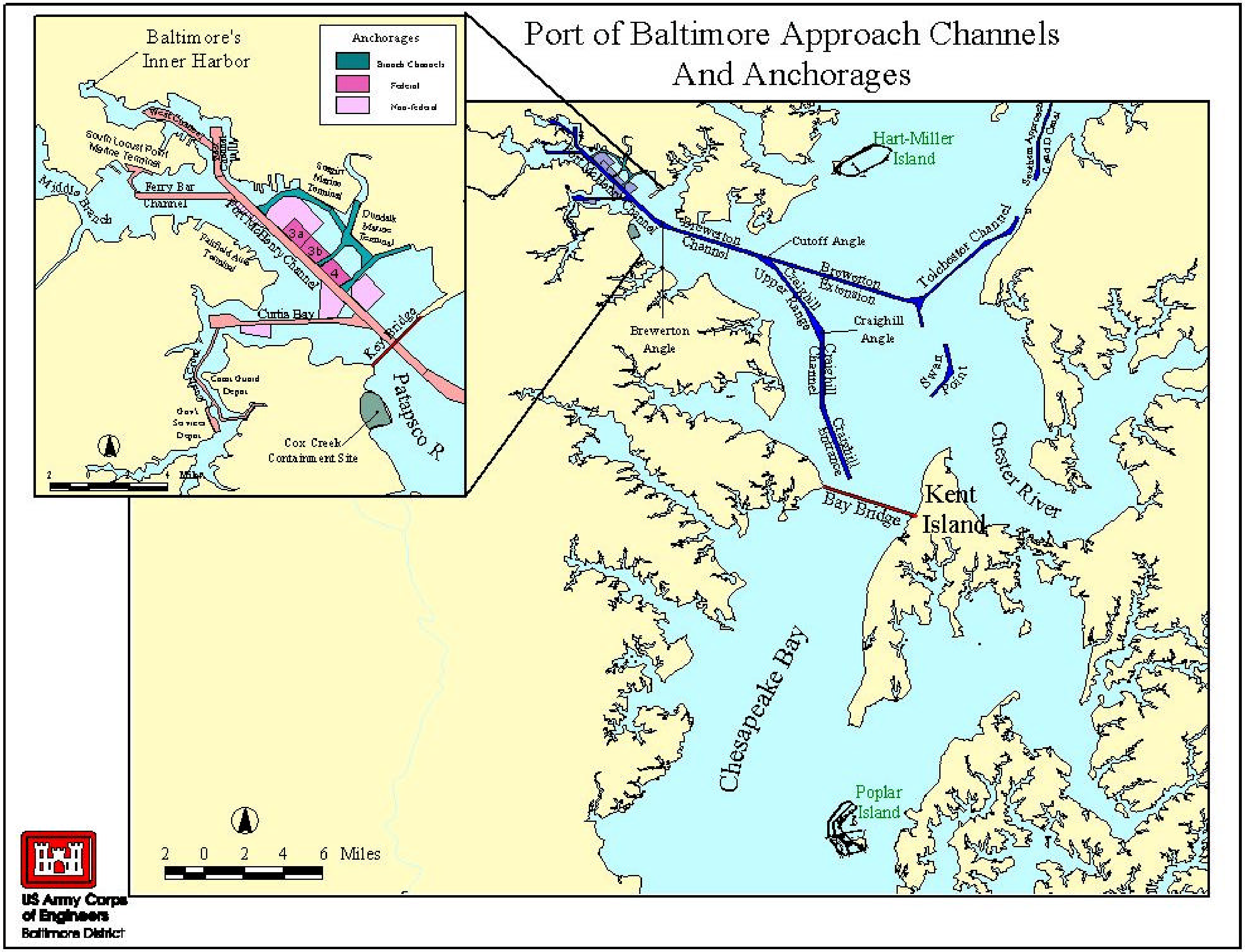
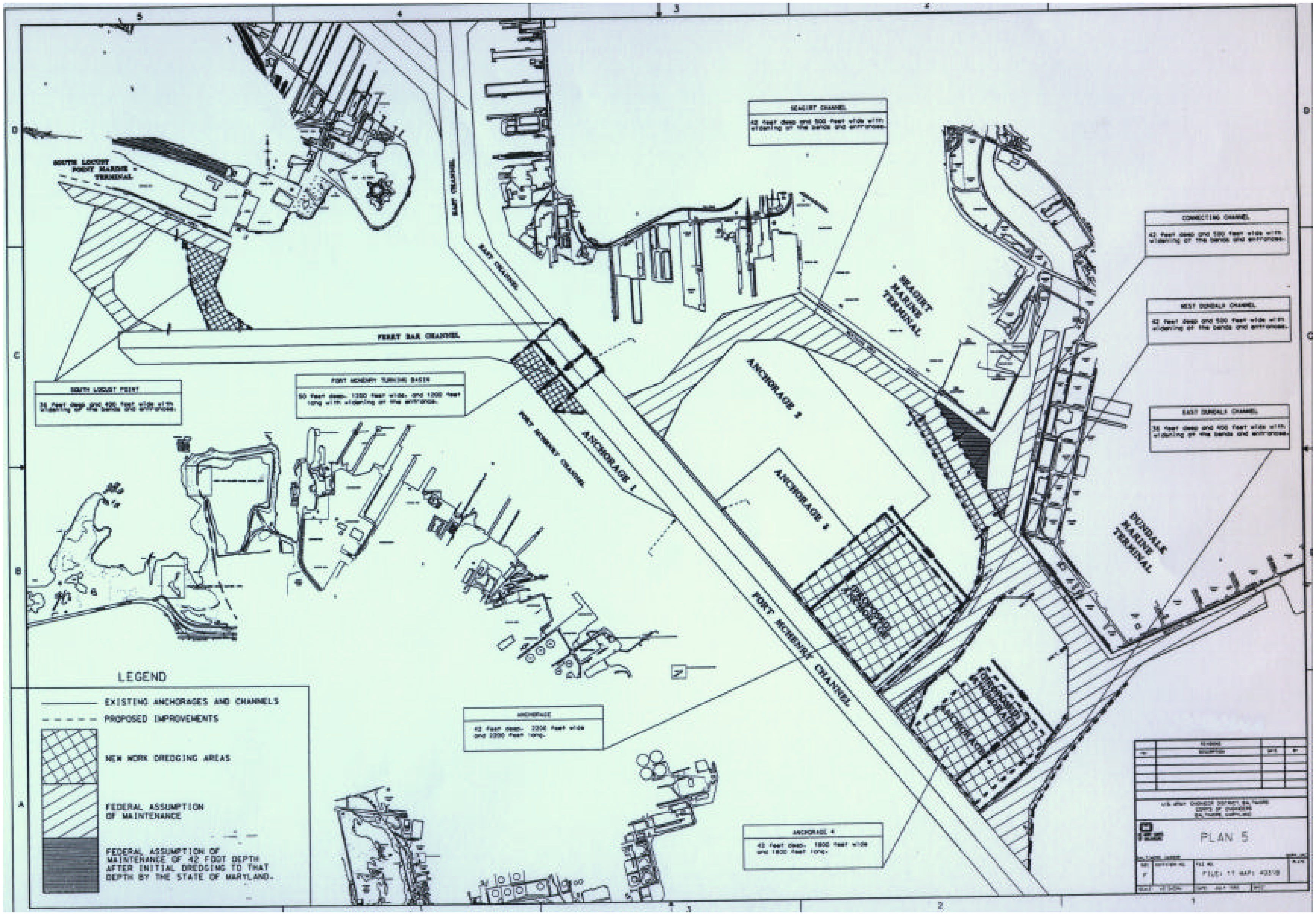


FIGURE 2 – THE AUTHORIZED PROJECT



- Deepening and widening a portion of Anchorage #4 (42 feet deep, 1,800 feet long, 1,800 feet wide) between Dundalk East and Dundalk West Channels and adjacent to Fort McHenry Channel;

- Widening the East Dundalk Channel to 400 feet wide with widening at the bends and entrance, at a depth of 38 feet;

- Widening the Seagirt-Dundalk Connecting Channel to 500 feet wide with widening at the bends and entrances, at its current depth of 42 feet;

- Widening the West Dundalk Channel to 500 feet wide with widening at the bends and entrance, at its current depth of 42 feet;

- Providing cutoff angles at the intersection of the Connecting Channel and the west side of the Dundalk Marine Terminal;

- Completing the loop channel at South Locust Point Marine Terminal (36 feet deep and 400 feet wide with widening at the bends and entrance);

- Constructing a turning basin at the head of the Fort McHenry Channel (50 feet deep, 1,200 feet long, and 1,200 feet wide);

- Deauthorization of Anchorage #1;

- Placement of the dredged material (an estimated 4.4 million mcy at the Hart-Miller Island (HMI) placement site; and

- Federal assumption of the maintenance of the existing State channels at Dundalk, Seagirt, and South Locust Point, exclusive of berthing areas.

2.4 LOCAL COOPERATION REQUIREMENTS

The Maryland Port Administration (MPA) is the non-Federal sponsor. The MPA's obligations under the Project Cooperation Agreement include the following:

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.

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 de-watering 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”, the Davis Bacon Act, Contract Work Hours and Safety Standards Act, and the Copeland Anti-Kickback Act.

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.

16) Operate and maintain at no cost to the Government the capacity at Hart-Miller Island specifically created to handle the dredged material from the initial construction of this Project.

3.0 AUTHORIZATION

3.1 AUTHORIZATIONS ACT

The project was authorized in Section 101(a)(22) of the Water Resources Development Act (WRDA) of 1999:

"BALTIMORE HARBOR ANCHORAGES AND CHANNELS, MARYLAND AND VIRGINIA. —

(A) IN GENERAL. —The project for navigation, Baltimore Harbor Anchorages and Channels, Maryland and Virginia, Report of the Chief of Engineers dated June 8, 1998, at a total cost of $28,426,000, with an estimated Federal cost of $18,994,000 and an estimated non-Federal cost of $9,432,000.

(B) CREDIT OR REIMBURSEMENT. —If a project cooperation agreement is entered into, the non-Federal interest shall receive credit toward, or reimbursement of, the Federal share of project costs for construction work performed by the non-Federal interest before execution of the project cooperation agreement if the Secretary finds the work to be integral to the project.

(C) STUDY OF MODIFICATIONS. —During the preconstruction engineering and design phase of the project, the Secretary shall conduct a study to determine the feasibility of undertaking further modifications to the Dundalk Marine Terminal access channels, consisting of—

(i) deepening and widening the Dundalk access channels to a depth of 50 feet and a width of 500 feet;

(ii) widening the flares of the access channels; and

(iii) providing a new flare on the west side of the entrance to the east access channel.

(D) REPORT.—

(i) IN GENERAL.—Not later than March 1, 2000, the Secretary shall submit to Congress a report on the study under subparagraph (C).

(ii) CONTENTS.—The report shall include a determination of—

(I) the feasibility of performing the project modifications described in subparagraph (C); and

(II) the appropriateness of crediting or reimbursing the Federal share of the cost of the work performed by the non-Federal interest on the project modifications."

The Maryland Port Administration has decided to forgo the credit referenced in subsection B of the authorization. The credit is, therefore, not considered further in this report.

The study identified in subsection C of the authorization has not yet been conducted. The impetus for the authorization was the possibility of a large container contract with the Maersk shipping line, which ultimately went to the Port of New York/New Jersey. Without the new contract, the benefits of further deepening and widening of the Dundalk channels were not expected to be great enough to warrant Federal participation at this time.

3.2 HOUSE/SENATE DOCUMENT NUMBER

The House/Senate Document Number is 106-184, 106th Congress, 2nd Session, February 1, 2000.

4.0 PROJECT FUNDING

Since its conception in the early 1990's, the Anchorages project has received timely and adequate funding from Congress. Through its first three phases, the project was allocated nearly $2.4 million in General Investigations funds. In Fiscal Year 2001, the Anchorages project received an initial construction appropriation of $3 million. In the President's Fiscal Year 2002 budget, $8 million has been programmed to continue the construction phase. A summary of the project funding to date is illustrated in Table 1. The non-Federal share for the feasibility phase was $1,385,000, and for preconstruction engineering and design (PED), the share was $225,000.

5.0 CHANGES IN SCOPE OF AUTHORIZED PROJECT

Due to the scope and magnitude of the project recommendations, a value engineering (VE) study was conducted in October 1997 to identify ways to lower the project cost and/or improve project performance. Also during the course of the PED phase, a ship simulation study was conducted. Both of these efforts resulted in proposed modifications to the authorized project.

5.1 SHIP SIMULATION STUDY

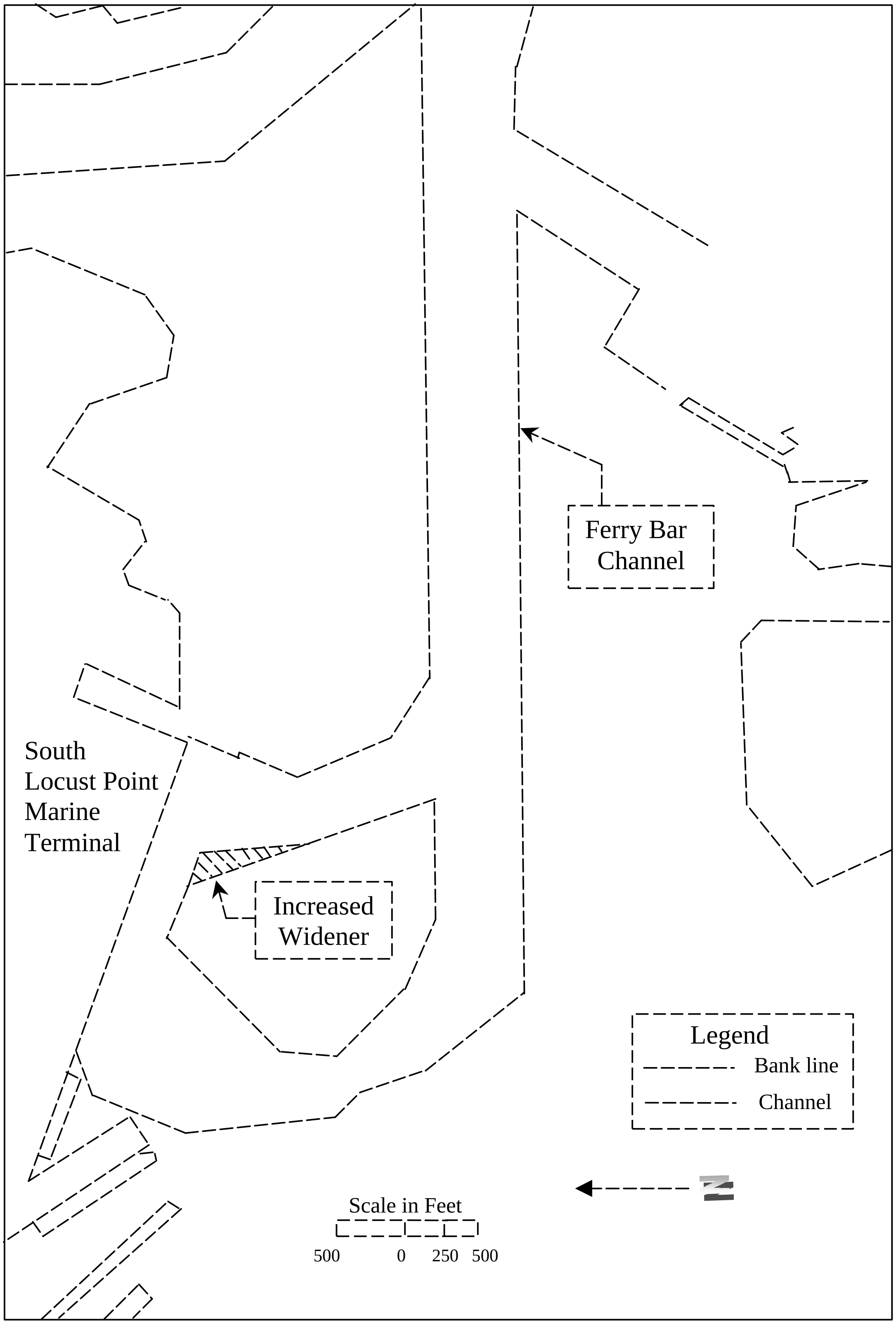
During the course of the PED phase, the design of the channels and turning basin for the authorized project was subjected to a ship simulation study. This study was conducted by the Waterways Experiment Station with assistance from the Association of Maryland Pilots (AMP). The final report is included as Appendix A. The ship simulation report confirmed the authorized channel configurations except for the South Locust Point loop channel component. Exiting from the existing channel in front of the berthing area through the loop channel in the authorized project proved difficult. Increasing the size of the widener on the outbound side of the loop channel where it intersects the existing channel in front of the berthing area relieved this problem. This modified channel configuration will increase efficiency and increases safety by reducing the risk that a ship will clip the bank of the channel. Consequently, it was recommended as a modification to the authorized project. Figure 3 shows the modified channel configuration relative to the authorized project.

TABLE 1 – FEDERAL APPROPRIATIONS, FISCAL YEARS 1991 THROUGH 2002

Project Phase	Fiscal Year	Funds Received in FY
Reconnaissance Phase	1991	$113,000
	1992	$207,000
	Total	$320,000
Feasibility Phase	1993	$155,000
	1994	$446,000
	1995	$300,000
	1996	$358,000
	1997	$126,000
	Total	$1,385,000
Preconstruction Engineering and Design Phase	1997	$150,000
	1998	$368,000
	1999	$157,000
	2000	$0
	Total	$675,000
Construction *	2001	$314,000
Construction **	2002	$8,000,000

NOTES:
* $3 million appropriated by Congress; $2,686,000 transferred as of 31 October 2001.
** Funding request in the proposed budget.

FIGURE 3 – SOUTH LOCUST POINT LOOP CHANNEL



5.2 VALUE ENGINEERING STUDY

The authorized project was also reviewed by the Baltimore District Value Engineer and subjected to a VE study. As an initial recommendation, cost savings were identified by abutting Anchorages #3 and #4 to their adjacent branch channels. By moving the anchorages southeastward 100 to 200 feet, this small design change took advantage of the deeper areas associated with the channel dredging and "clipped" the anchorage corners. Not only will these minor changes decrease the quantity of dredged material required for construction, but they will also allow for more efficient vessel movements into and out of the anchorages and branch channels.

In addition, the VE study found that additional benefits could be realized by altering the size and configuration of Anchorages #3 and #4. The authorized project includes Anchorage #3 at 2,200 feet long by 2,200 feet wide at a depth of 42 feet and 2,300 feet long by 1,500 feet wide at a depth of 35 feet (the remnant of the prior 4,500-foot long, 1,500-foot wide, 35-foot deep anchorage in this area); and Anchorage #4 at 1,800 feet long, 1,800 feet wide and 42 feet deep (Figure 2). The November 1997 VE study recommended that the 42-foot anchorages be co-located in Anchorage #3, essentially doubling the anchorage length. The advantage of having two 42-foot deep anchorages located together would be to enhance navigation flexibility. This uninterrupted area for the use of deep draft vessels could be used for anchoring two large ships, or one anchorage space could be used as a holding area for passing. Concurrent with this recommendation, the VE team suggested reviewing the Anchorage #4 configuration and depth, and that further economic analysis be conducted to identify the most cost-effective anchorage configuration.

Subsequently, the project team undertook a re-analysis of 11 possible anchorage configurations, which included the original authorized project and ten other possible combinations of Anchorages #3 and #4. The costs and benefits for each alternative were then calculated. Other factors involved in plan selection were dredged material quantity and pilot's preference. The alternative that provided the greatest net benefits, as discussed in more detail in Section 10, offered three large, deep-water berths, and had co-located anchorages as preferred by the pilots. In effect, this plan exchanges the 42-foot depth and 35-foot depth locations in Anchorage Areas #3 and #4 of the authorized project. The selected anchorage configuration also includes a small remnant of the existing anchorage (500 feet long, 1,500 feet wide, 35 feet deep). The total area of Anchorages #3 and #4 is only slightly increased (4.7%) from the authorized project. For these reasons, this modified plan was determined by the project team to be the optimum plan.

6.0 CHANGES IN LOCAL COOPERATION REQUIREMENTS

In the March 1997 feasibility report, the project team identified the WRDA 1986 cost-sharing requirements to be applicable for the Anchorages project. As part of the WRDA 1986 cost-sharing provisions, a portion of the real estate and development costs associated with the HMI placement facility would be credited against the 10-percent payback required following completion of construction. In March 1997, this credit was estimated as $2,065,000. It was also envisioned that the State of Maryland would continue operating the HMI facility. The June 1998 Chief of Engineers' report concurred in this application of the cost-sharing provisions.

In a 2 December 1999 letter to Congress, the Assistant Secretary of the Army for Civil Works (ASA(CW)) differed with this interpretation of the cost-sharing requirements. Specifically, ASA(CW) asserted that the WRDA 1996 cost-sharing provisions do apply to the Anchorages project. The pertinent WRDA 1996 provisions require that the disposal cost (such as HMI) would be treated as a general navigation feature of the project and that the Federal government would operate and maintain the facility. The ASA(CW)'s determination for the Anchorages project was based on the fact that the dredging construction contract had not been awarded as of 12 October 1996 (WRDA 1996 enactment). As such, the Anchorages project would fall under the revised cost-sharing provisions in WRDA 1996. However, ASA(CW) recognized that given the particular situation at HMI, it would be more efficient for the sponsor to continue to be responsible for its operation. Accordingly, ASA(CW) recommended that the cost-sharing requirements and facility maintenance responsibility for HMI be in accord with the cost-sharing provisions of WRDA 1986. Other dredged material containment sites are subject to the cost sharing provisions of WRDA 1996.

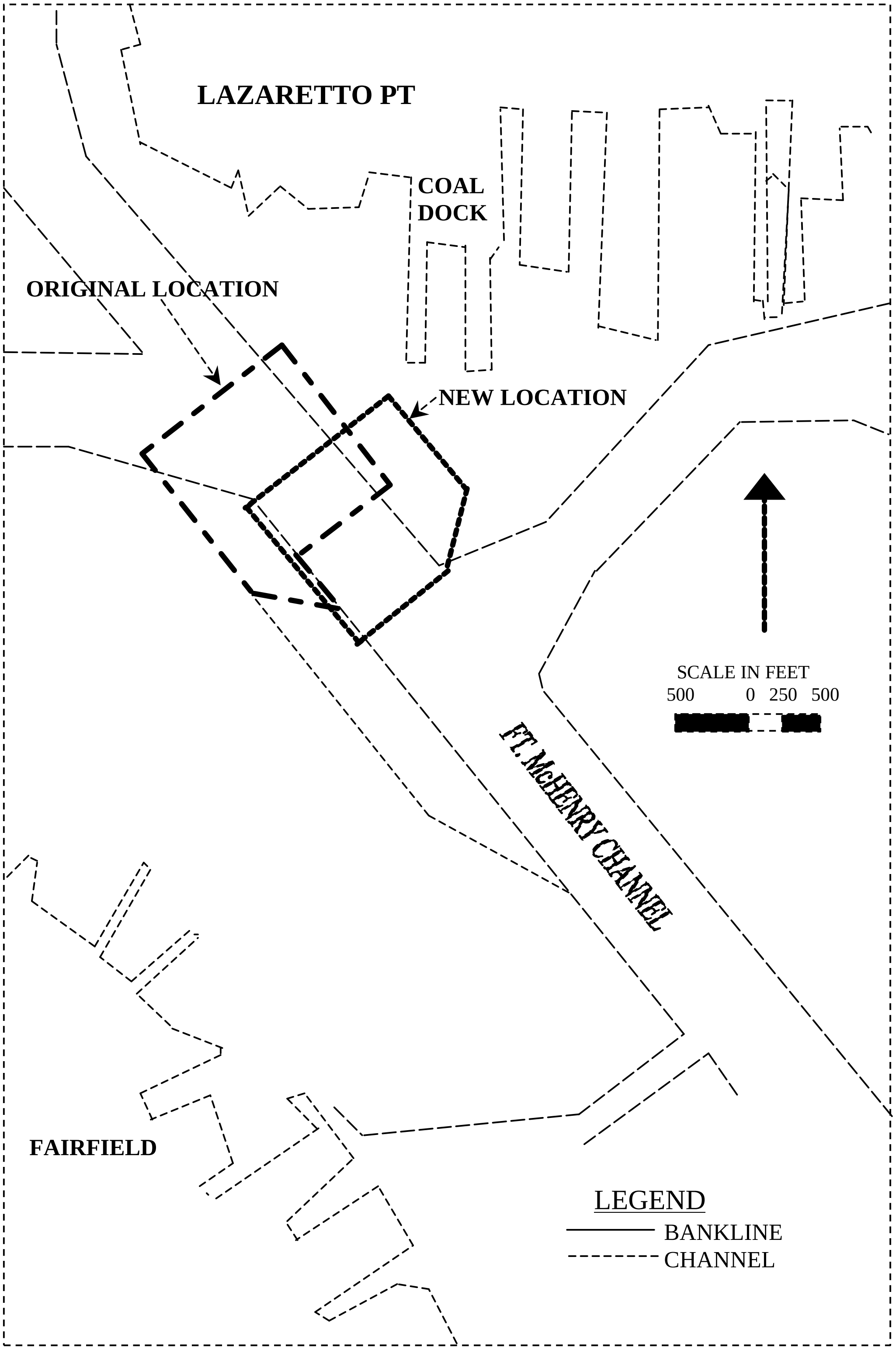
In addition, specific language for the items of local cooperation was provided in the December 1999 letter. Subsequently, this language will be incorporated into the project cooperation agreement. Since the most recent model for the navigation project cooperation agreement has been modified to include the WRDA 1996 provisions, the project cooperation agreement will include deviations to accommodate the ASA(CW)'s cost-sharing determination and required language. These deviations are currently being reviewed by Headquarters USACE and North Atlantic Division Offices of Counsel.

Near the completion of the feasibility phase for the Baltimore Harbor Anchorages and Channels project, the MPA deepened the East Dundalk Channel to 42 feet from the previous depth of 38 feet to accommodate new traffic needs on the eastern side of the terminal. However, this deepening was not evaluated for economic justification. Subsequently, the project authorized in WRDA 1999 included widening this channel from 300 feet to 400 feet at the depth of 38 feet only. At the request of the MPA, the channel widening to 400 feet will be constructed to a depth of 42 feet as a betterment. This will result in a 24,000-cubic yard (cy) increase in construction dredging, from 38,000 cy to 62,000 cy. The estimated cost associated with the depth change is $141,000 (October 2000 price levels). As a betterment, this cost will be paid 100 percent by the State of Maryland. Maintaining the channels at 42 feet will not change the maintenance dredging volume for the project. Since the 42-foot depth of the East Dundalk Channel existed prior to completion of the feasibility study and authorization of the project, the maintenance of the improved channel at a depth of 42 feet will be a Federal responsibility.

7.0 DESIGN CHANGE – REALIGNMENT OF THE FORT MCHENRY TURNING BASIN

In additional discussions with the maritime pilots, concerns were raised about the Fort McHenry turning basin (Figure 4). The turning basin configuration recommended in the feasibility report was not considered by the pilots to be optimal for its primary use of turning vessels of 1,000 feet or longer that are exiting from piers just north of the proposed basin. These ships are backed stern first into the channel with the assistance of two and sometimes three tugs, and as the bow clears the pier, the ship is then turned in a clockwise direction until it is aligned along the centerline of the channel. The ship turns very slowly pushing its bow through the mud. The pilots consider it critical that the ship begins the clockwise turn as soon as possible to keep the ship from backing too far across the channel and possibly into the opposite bank. Also, as the ship is backing across the channel the pilots prefer to keep the bridge, which is about 200 feet from the stern, on the centerline of the channel so the maritime pilot can keep visually aligned with the channel range lights. This will ensure that the stern does not drift into the bank and cause possible damage to the rudder and propellers. Not only would this be unsafe for the vessel with the damaged rudder, but would be unsafe for other vessels and structures that may be in the vicinity of the damaged vessel.

FIGURE 4 – FORT MCHENRY TURNING BASIN



On average, the colliers departing Consolidation Coal Sales Company take 45 minutes to complete this maneuver. The maneuver completely closes the Fort McHenry Channel until the collier is clear and under sail in the main channel. Vessels north and west of this section wanting to depart their berth (Fairfield, Clinton Street, Canton, South Locust Point, and North Locust Point) will wait 40-60 minutes while the vessel in the channel completes its turn. Vessels waiting to come to port and dock north or west of the coal pier must wait for the channel to clear.

To improve navigation safety and efficiency, the turning basin has been shifted to the southeast 350 feet. This modification was made in the interest of safety and efficiency. Also, to eliminate unnecessary dredging, the east corner of the turning basin has been removed. This area comprises a triangle in which the hypotenuse is a line connecting a point on the northeast side 350 feet from the east corner to a point on the southeast side 450 feet from the easternmost corner.

The final turning basin alignment was chosen to avoid any possible cultural resources. Based on a Phase 1 cultural investigation, conducted as part of the PED phase and in consultation with the Maryland State Historic Preservation Office, the alignment as discussed above was shifted down the Fort McHenry Channel centerline about 500 feet. The investigation was triggered by the request, as discussed above, to move the proposed basin to an area that had not previously been surveyed for cultural resources. During the investigation an anomaly was detected. Although the anomaly was never positively identified, it is potentially a barge of historic interest to the Port, and to safely avoid the object, the 150-foot shift was made to the alignment. The pilots contend that this shift will not affect project performance. The final alignment and dimensions of the turning basin result in a decrease in the estimated volume of dredged material from 356,000 cy, as reported in the March 1997 feasibility report, to 322,000 cy for initial construction.

The changes to the Fort McHenry turning basin are also noted in Figure 4. They have been coordinated with the Waterways Experiment Station, MPA, and AMP, and are recommended as a modification to the authorized project.

8.0 REMAINING DESIGN CHANGES

Figure 5 presents the recommended plan. A comparison of this plan to the authorized project is provided in Table 2 and the modifications consist of:

- Reconfiguring Anchorage #3 to include two sections (42 feet deep, one section (#3A) to be 2,200 feet long and 2,200 feet wide, and the other section (#3B) to be 1,800 feet long and 1,800 feet wide) at the north corner of the intersection of Fort McHenry Channel and the Dundalk West Channel, while the unimproved portion of the existing anchorage (500 feet by 1,500 feet) will be maintained at its current 35-foot depth (see Section 5.2);

- Modify the authorized depth from 42 feet to 35 feet in Anchorage #4 (see Section 5.2);

- Modify the depth of the authorized widening of the East Dundalk Channel to 42 feet as a sponsor-requested betterment (see Section 6.1);

- Slightly widen the South Locust Point loop channel at the northern end (see Section 5.1);

- Moving the turning basin at the head of the Fort McHenry Channel slightly eastward of the authorized site (see Section 7.0); and

FIGURE 5 – RECOMMENDED PLAN

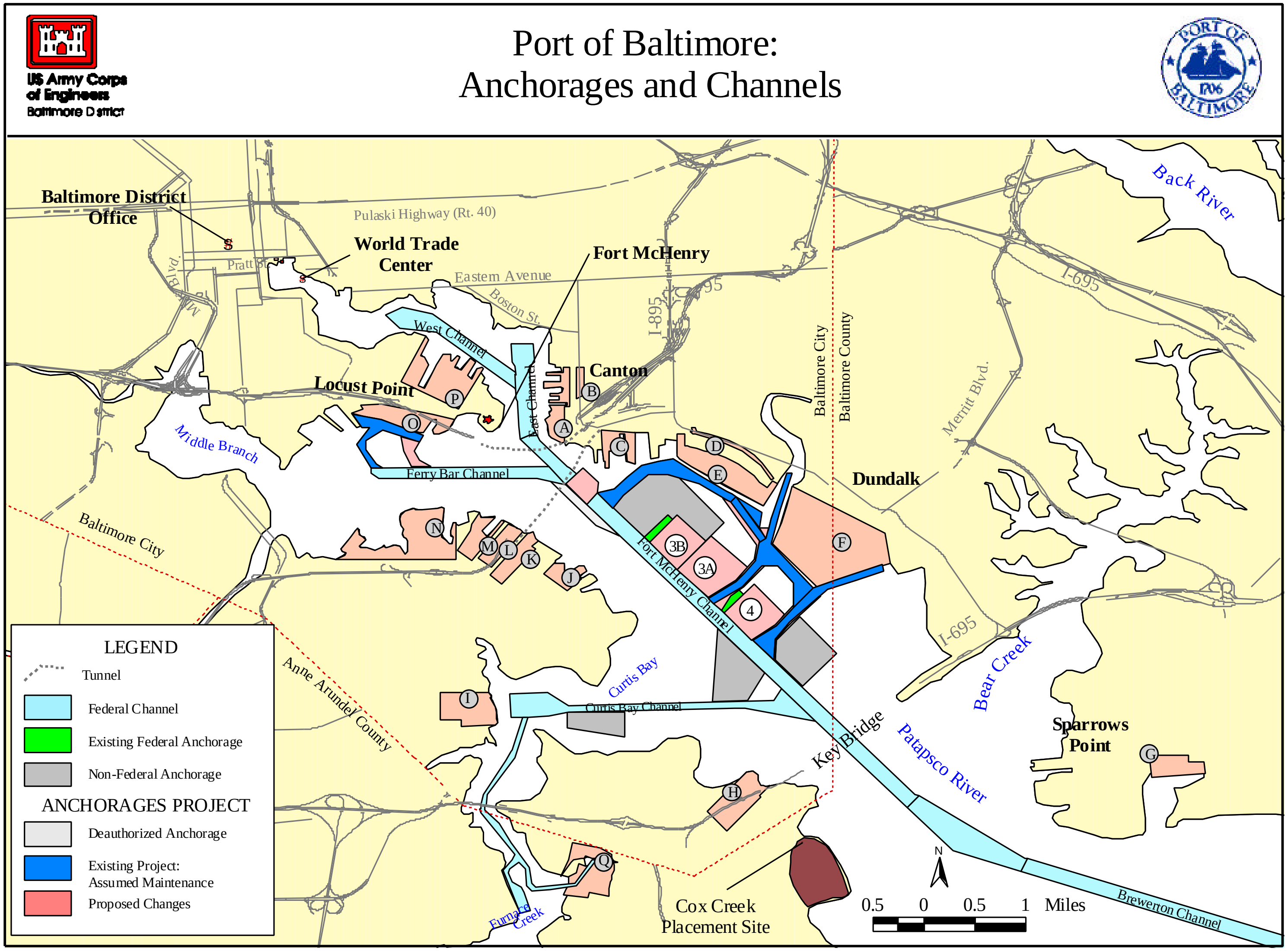


TABLE 2 – COMPARISON OF THE AUTHORIZED PROJECT TO THE RECOMMENDED MODIFICATION

Feature	Existing Condition	Authorized Project	Recommended Project
Anchorage #3	4,500 ft long x 1,500 ft wide x 35 ft deep	2,200 ft long x 2,200 ft wide x 42 ft deep 2,300 ft long x 1,500 ft wide x 35 ft deep *	2,200 ft long x 2,200 ft wide x 42 ft deep 1,800 feet long x 1,800 ft wide x 42 ft deep 500 feet long x 1,500 ft wide x 35 ft deep *
Anchorage #4	2,400 ft long x 1,200 ft wide x 30 ft deep	1,800 feet long x 1,800 ft wide x 42 ft deep	1,800 feet long x 1,800 ft wide x 35 ft deep
East Dundalk Channel	300 ft wide x 42 ft deep	400 ft wide x 38 ft deep with widening at bends and entrances	400 ft wide x 38 ft deep with widening at bends and entrances **
Seagirt/West Dundalk Connecting Channel	350 ft wide x 42 ft deep	500 ft wide x 42 ft deep	500 ft wide x 42 ft deep
South Locust Point Channel	28 ft deep	400 ft wide x 36 ft deep with widening at the bends and entrances	400 ft wide x 36 ft deep with widening at the bends and entrances and slightly widen the loop channel at the northern end
Ft. McHenry Turning Basin	N/A	1,200 ft long x 1,200 ft wide x 50 ft deep with widening at the entrance	1,200 ft long x 1,200 ft wide x 50 ft deep with east corner deleted (location realigned)

- * These anchorages are remnants of the original 4,500 x 1,500 x 35 anchorage that was authorized in the Rivers and Harbors Act of July 3, 1930 (Public Law 71-520).

- ** A portion of this channel (300 feet) has already been dredged to a 42-foot depth. The remainder (the widening from 300 to 400 feet) will be dredged to – 42 feet as a betterment, and MPA will pay 100% of this cost.

- Reduce the volume of dredged material being placed at HMI from 4.4 mcy to an estimated 3.9 mcy.

9.0 CHANGES IN TOTAL PROJECT FIRST COSTS

As shown in Table 3, the authorized project cost for the general navigation features for the Baltimore Harbor Anchorages and Channels Project totaled $26,419,000 at October 1998 price levels. The current full funding cost for the general navigation features of the modified project, including inflation allowances for a two-year construction cycle beginning in December 2001, is estimated at $28,016,000 (does not include the East Dundalk betterment). This is summarized in Table 4 and detailed in Appendix B. This estimate was generated after a review of the cost estimate assumptions. The following adjustments to the assumptions were made:

§ The clean-up time was reduced from 5 percent to 2 percent, based on the Baltimore District's experiences with recent contracts. This change decreased the cost slightly.

§ The cycle time for the Fort McHenry turning basin dredging was slowed from 55 seconds to 60 seconds based on recent experiences with dredging at this depth (50 feet). This change increased the cost slightly.

§ The contractor's profit was increased from 6.5 percent to 10 percent to reflect a conservative approach to the estimate. This change increased the cost slightly.

§ The cost of the planning, engineering, and design analyses was increased to reflect costs from the ongoing economic model update. This change increased the cost slightly.

After a review of the drilling logs, it was determined that the material to be dredged was lighter and softer than previously assumed. Therefore, the material will be easier to remove and the size of the dredging bucket would be increased from 16 cy to 21 cy. This change decreased the cost slightly.

Accounting for inflation since the 1999 authorization, the authorized cost for the project's general navigation features would amount to $28,942,000 (Table 3). Accordingly, the current full funding estimate of $28,016,000 for the modified project (Table 4) is $926,000 less than the authorized cost with inflationary factors. This reduction in cost is primarily attributed to the assumption changes noted above. In addition, MPA's dredging of the cutoff angles contributed to the lower cost. MPA recently widened the entrance and bends in the Dundalk Marine Terminal West Channel. This work eliminated approximately 150,000 cy from the project since these improvements were part of the authorized project. Additional savings are the result of moving the turning basin to include deeper water and moving the anchorage locations to abut the branch channels.

9.1 DREDGED MATERIAL MANAGEMENT PLANNING

Dredged material management planning for Federal navigation projects is conducted by the Corps to ensure that maintenance dredging activities are performed in an environmentally acceptable manner, use sound engineering techniques, are economically warranted, and have sufficient placement sites available for at least the next 20 years. These plans address dredging needs, placement techniques, capacity of placement areas, environmental compliance requirements, potential for beneficial use of dredged material, and indicators of continued economic justification. Dredged material management plans are updated periodically by the Corps as needed to identify any potentially changed conditions.

TABLE 3 – AUTHORIZED PROJECT COSTS

Description of Project Features	WRDA 1999 Authorized Cost * Oct 1998 Value	WRDA 1999 Authorized Cost * 4thQtrFY2001 Value	Last Estimate to Congress
12 Navigation Ports and Harbors			
2 Harbors			
1 Mob, Demob and Preparatory Work	$2,422,000	$2,653,000	$3,200,000
15 Mechanical Dredging			
2 Site Work			
AA East Dundalk Channel	$373,000	$409,000	$300,000
BB Seagirt/Connecting/West Dundalk	$2,105,000	$2,306,000	$2,200,000
CC South Locust Point	$1,606,000	$1,759,000	$1,700,000
DD Cutoff Angle	$1,018,000	$1,115,000	$0
EE Anchorage #3 Modification	$8,015,000	$8,781,000	$12,800,000
FF Anchorage #4 Modification	$7,697,000	$8,432,000	$4,400,000
GG Turning Basin	$1,661,000	$1,820,000	$1,800,000
30 Planning Engineering and Design	$989,000	$1,083,000	$1,000,000
31 Construction Management	$533,000	$584,000	$900,000
Total Cost of General Navigation Features	**$26,419,000**	**$28,942,000**	**$28,300,000**
East Dundalk Betterment	$0	$0	$0
Total Construction Cost Without Placement Site	$26,419,000	$28,942,000	$28,300,000
Estimated LERRD Cost	$2,007,000	$2,007,000	$2,100,000
Total Construction Cost With Placement Site	$28,426,000	$30,949,000	$30,400,000

NOTES:

* The authorization language in WRDA 1999 identified the project authorization cost as $28,426,000; this value incorrectly included the dredged material disposal facility as a general navigation feature. The ASA(CW) December 1999 letter corrected the value for the general navigation features to $26,419,000.

TABLE 4 – FULL FUNDING COST FOR THE MODIFIED PROJECT

Project Features	Current Full Funding Estimate	Federal Share %	Federal Share Cost	Non-Federal Share %	Non-Federal Share Cost
12 Navigation Ports and Harbors					
02 Harbors					
01 Mob, Demob and Preparatory Work	$4,162,000	75%	$3,121,500	25%	$1,040,500
15 Mechanical Dredging					
02 Site Work					
AA East Dundalk Channel	$222,000	75%	$166,500	25%	$55,500
BB Seagirt/Connecting/West Dundalk	$2,242,000	75%	$1,681,500	25%	$560,500
CC South Locust Point	$1,282,000	75%	$961,500	25%	$320,500
DD Cutoff Angle	$0	75%	$0	25%	$0
EE Anchorage #3 Modification	$12,755,000	75%	$9,566,250	25%	$3,188,750
FF Anchorage #4 Modification	$3,340,000	75%	$2,505,000	25%	$835,000
GG Turning Basin					
to 45-Foot	$1,069,000	75%	$801,750	25%	$267,250
to 50-Foot	$801,000	50%	$400,500	50%	$400,500
Effective Cost-Sharing Percentage		74.23%		25.77%	
30 Planning Engineering and Design	$1,247,000	74.23%	$925,599	25.77%	$321,401
~~31 Construction Management~~	~~$896,000~~	74.23%	~~$665,065~~	25.77%	~~$230,935~~
Total Project Cost of General Navigation Features	**$28,016,000**		**$20,795,000**		**$7,221,000**
East Dundalk Betterment	**~~$141,000~~**	~~0%~~	~~$0~~	~~100%~~	~~$141,000~~
Total Construction Cost without Placement Site	**$28,157,000**		**$20,795,000**		**$7,362,000**

~~Summary of Federal and Non-Federal Requirements~~		
Total Construction Cost without Placement Site	**$28,157,000**	[General navigation features only]
Federal Share	**$20,795,000**	
Non-Federal Share		
Construction Cash Requirement	**$7,362,000**	
PED Cash Provided	$170,000	
In-Kind Services (IKS) During PED to Date	$13,307	
Additional Cash/IKS to be Provided During Constructio	$7,178,693	
10-Percent Post Construction Payback	**$2,801,600**	
Estimated Credit for HMI Raising	$1,385,000	
Amount to be Paid by Sponsor over 30 Years	$1,416,600	

The plan for dredged material from the Anchorages project includes the use of the permitted HMI containment facility, and the Cox Creek dredged material containment facility (DMCF), currently under permit review by the Baltimore District. These placement sites accommodate the project's needs for at least 20 years.

9.1.1 Hart-Miller Island

HMI is an existing State-owned and operated confined placement facility. It is located in the upper Chesapeake Bay (Figure 6). The site is approximately 14 miles due east of Baltimore City, near the mouth of Back River in Baltimore County. Initial construction of the placement site began in 1981 and was concluded in December 1983. The island covers 1,140 acres and has approximately 6 miles of dike. It is oval shaped and is approximately 2 miles long by 1 mile wide.

The facility has received new work and maintenance sediments dredged from Baltimore Harbor and the approach channels since 1984. Sediments from the inner harbor are considered to be contaminated by State law and are required by the Code of Maryland Regulations (COMAR) to be placed in a containment facility or within the inner harbor. The HMI facility has also received smaller volumes of dredged sediments from State, local, and private channel maintenance projects.

The site is divided into two cells, a South Cell (approximately 300 acres), and a North Cell (approximately 800 acres). The South Cell is prohibited from receiving more dredged material by the Annotated Code of the Public General Laws of Maryland, Environmental Article, §16-202(e)(1)(ii) and its use was discontinued in 1990. Thereafter, a crust management program was undertaken by MPA to assist in consolidation of sediments and a gradual reduction in elevation in order to satisfy requirements of the State of Maryland wetlands license that required an eventual lowering of the dike system to the 18-foot elevation. The South Cell is currently being developed for environmental restoration and passive recreation under a provision of Section 1135 of WRDA 1986.

The North Cell was increased in elevation to +44 feet mean low water (MLW) by MPA in 1997. There is an estimated 18 mcy of capacity remaining in the site as of August 2001. The entire site will be converted to habitat and passive recreation after dredged material placement ceases by the end of 2009 in compliance with State law. The capacity that is still available in the North Cell has been programmed to receive the initial 3.9-mcy dredging from the Anchorages project, as well as maintenance material from this and other harbor projects.

9.1.2 Cox Creek

Although HMI will accommodate all the project's dredged material from initial construction, additional capacity may be required for future maintenance cycles. A proposed facility known as Cox Creek is likely to receive dredged material from future maintenance of the project. The Cox Creek DMCF is located approximately 1 mile south of the Francis Scott Key Bridge, on the western side of the Patapsco River, near Foreman's Corner in Anne Arundel County, Maryland (Figure 7). The two cells of this facility were originally constructed by the Baltimore District in the 1960's for the containment of dredged material from the deepening of the Baltimore Harbor Federal Channels from -39 feet to -42 feet. The site was acquired and used periodically by non-Federal interests for dredged material placement from the mid-1970's to early 1980's. The last reported use of the site was in 1984.

FIGURE 6 – HART-MILLER ISLAND

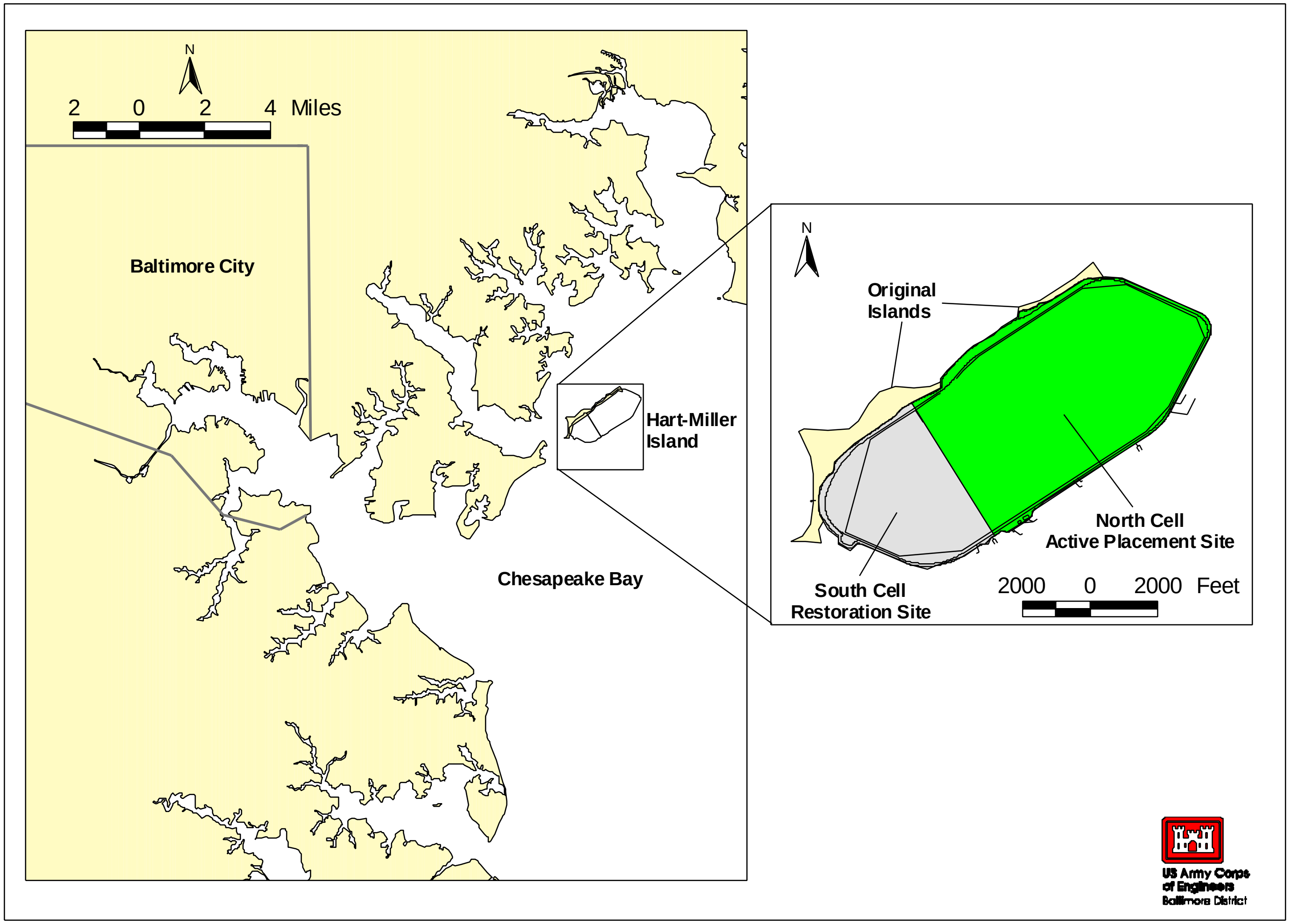
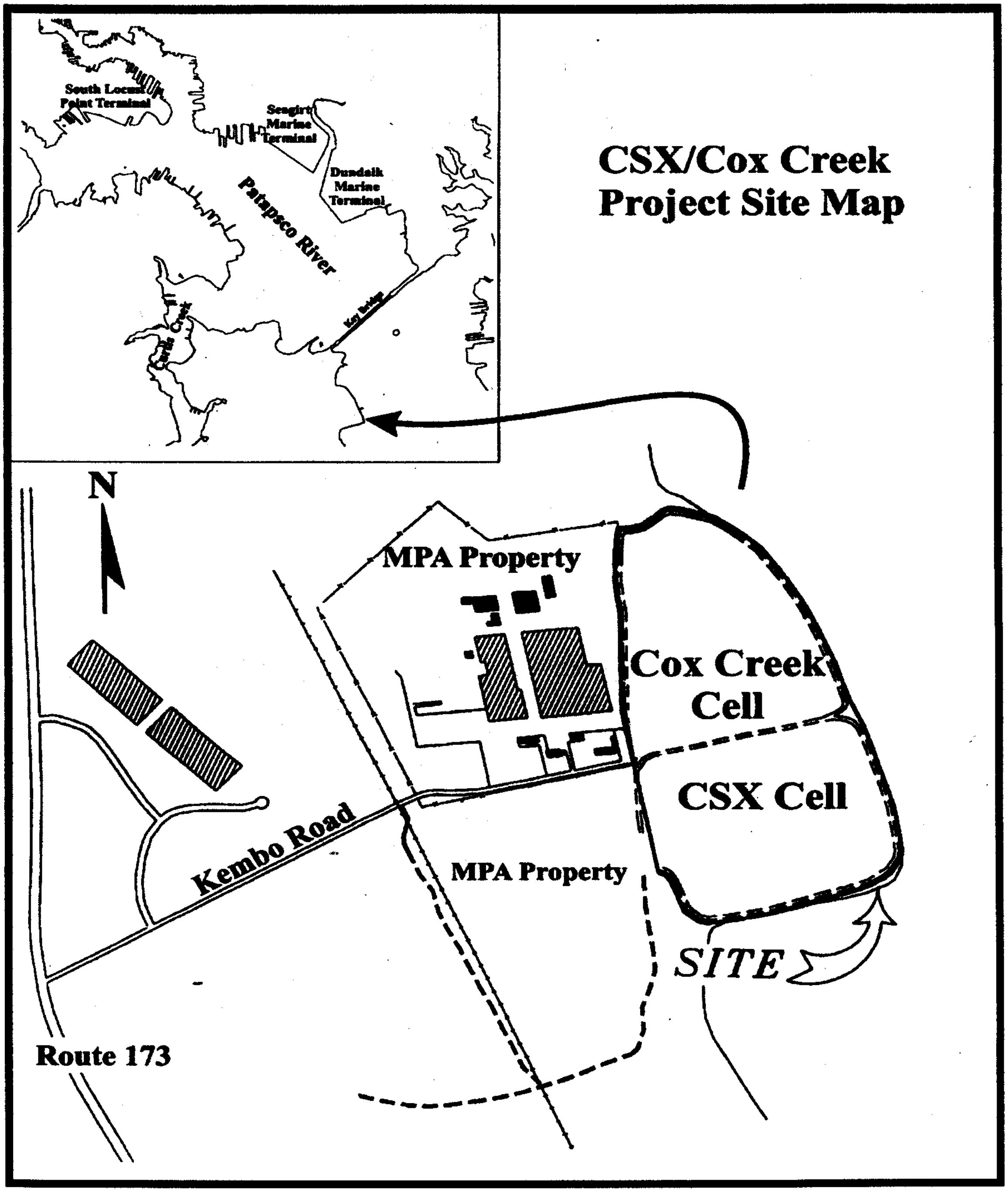


FIGURE 7 – COX CREEK



MPA is proposing to reactivate the existing 133-acre Cox Creek DMCF to accommodate an additional 6 mcy of dredged material from the Port of Baltimore channels over a 12-year period. The project is being pursued under the provisions of Section 217(c) of WRDA 1996 whereby MPA will design, construct and operate the facility and the Corps would pay a tipping fee per cubic yard of dredged material placed in the facility.

The Baltimore District submitted a decision document entitled *CSX/Cox Creek Dredged Material Placement Site, Anne Arundel County, Maryland* to higher authority in June 2000. A study was conducted to determine whether the site is eligible to be cost-shared as a general navigation feature of the Baltimore Harbor and Channels 50-foot project. Once the MPA completes and the District approves the new slurry wall design, the document will be revised. Approval of the document is contingent upon completion of environmental documentation and issuance of a Department of the Army permit by the Baltimore District.

The Cox Creek site is planned to be brought on line by the State of Maryland in 2002 and will be reserved for inner harbor material. At an average fill rate of 500,000 cy per year, which is typical for the inner harbor's annual dredged material requirement, capacity at Cox Creek would be exhausted by 2014. MPA, however, is considering options to extend the life of the site through reuse and possible recycling of the material, as reflected in a letter dated 29 June 2001 (Annex 2). If these options are successful, the site could provide capacity in perpetuity.

10.0 CHANGES IN PROJECT BENEFITS

10.1 THE FEASIBILITY ECONOMIC ANALYSIS

Federal interest in navigation is established by the Commerce Clause of the Constitution, and subsequent court decisions, defining the right to regulate navigation and improvement of the navigable waterways. The merits of Civil Works projects for improvement of navigation include measurement against a Federal objective of national economic development (NED), in accord with the Water Resources Council's Principles and Guidelines (P&G). The basic economic benefits from navigation management and development plans are the reduction in the value of resources required to transport commodities and the increase in the value of output for goods and services. When there is no change in either the origin or destination of a commodity, such as the case for this project, the benefit is the reduction in transportation costs of the commodities that would move with and without the plan resulting from the proposed improvement.

The benefit analysis from the feasibility study was based on the premise that operating costs for the entire Port of Baltimore system could be reduced with improvements to the anchorages and channels of the system. For any given year, a variety of vessel classes (container, bulk, tanker, etc.) call on the Port. Vessels in each class incur hourly operating costs. In using the Port system, vessels will also sustain costs for the use of Bay pilots and docking pilots. These costs accrue on an hourly basis, and the quicker a vessel can move into and out of the Port, the greater the cost savings that are realized.

Arrival times to the system are based on historical and projected distributions of each vessel class. For future years, the number and classes of vessels in the system can be expected to increase, decrease, or remain constant. This will be largely based on the type and level of commodities expected to call on the Port. During the feasibility study, projections of the types and level of commodities were developed through an exhaustive program of interviews and research on the global movement of cargo and world commerce and was based on 1993 data. This information was then applied to a vessel profile for the Port of Baltimore to determine the number and types of vessels required to bring the commodities to and through the Port. Table 5 shows the growth of commodities as projected for the feasibility study.

TABLE 5 – PROJECTED GROWTH IN TONNAGE FOR THE PORT OF BALTIMORE
(metric tons)

	2000	2010	2020	2030	2040	2050
Imports	16,037,539	21,436,159	33,623,924	42,138,982	59,083,835	82,429,053
Exports	13,748,951	16,154,427	23,310,702	27,640,665	31,759,131	36,358,456
Total	29,786,490	37,590,586	56,934,626	69,779,647	90,842,966	118,787,509

To move these increasing commodity flows through the Port of Baltimore, vessel calls, and vessel sizes are projected to increase in the "without project" condition based on the results of analyses conducted by DRI/McGraw-Hill. Total vessel calls to the Port of Baltimore, based on the commodity flows above, are forecast to increase from a 1993 total of 2,200 vessels to over 3,400 vessels a year by the year 2000. The vessel fleet calling on Baltimore is forecast to be 4,800 vessels by the year 2010, almost doubling by the year 2020 to a total of 7,700 vessels, and reaching more than 20,000 annual vessel calls by the year 2050 (Table 6). The vessel calls increase faster than projected tonnage since vessel calls are required to serve the dominant direction of trade (imports in the base forecast). Due to the procedures utilized, calls can increase faster than tonnage in situations where imbalances in trades are growing. This is because the vessel calls necessary to carry the projected cargo are developed and then the computed ballast voyages required to balance the vessel movements are added. The mix of vessels forecast to call on the Port of Baltimore will continue to consist of various sizes of container vessels; dry bulk vessels; tankers; general cargo-break bulk vessels; and vehicle carriers. For purposes of the feasibility analysis, the vessel fleet was disaggregated to 38 vessel classes defined by ranges of design capacities. Based on these vessel classes, the vessel fleet likely to call on the Port of Baltimore was identified, as was the relative share provided by each class.

TABLE 6 – PROJECTED GROWTH IN VESSEL CALLS

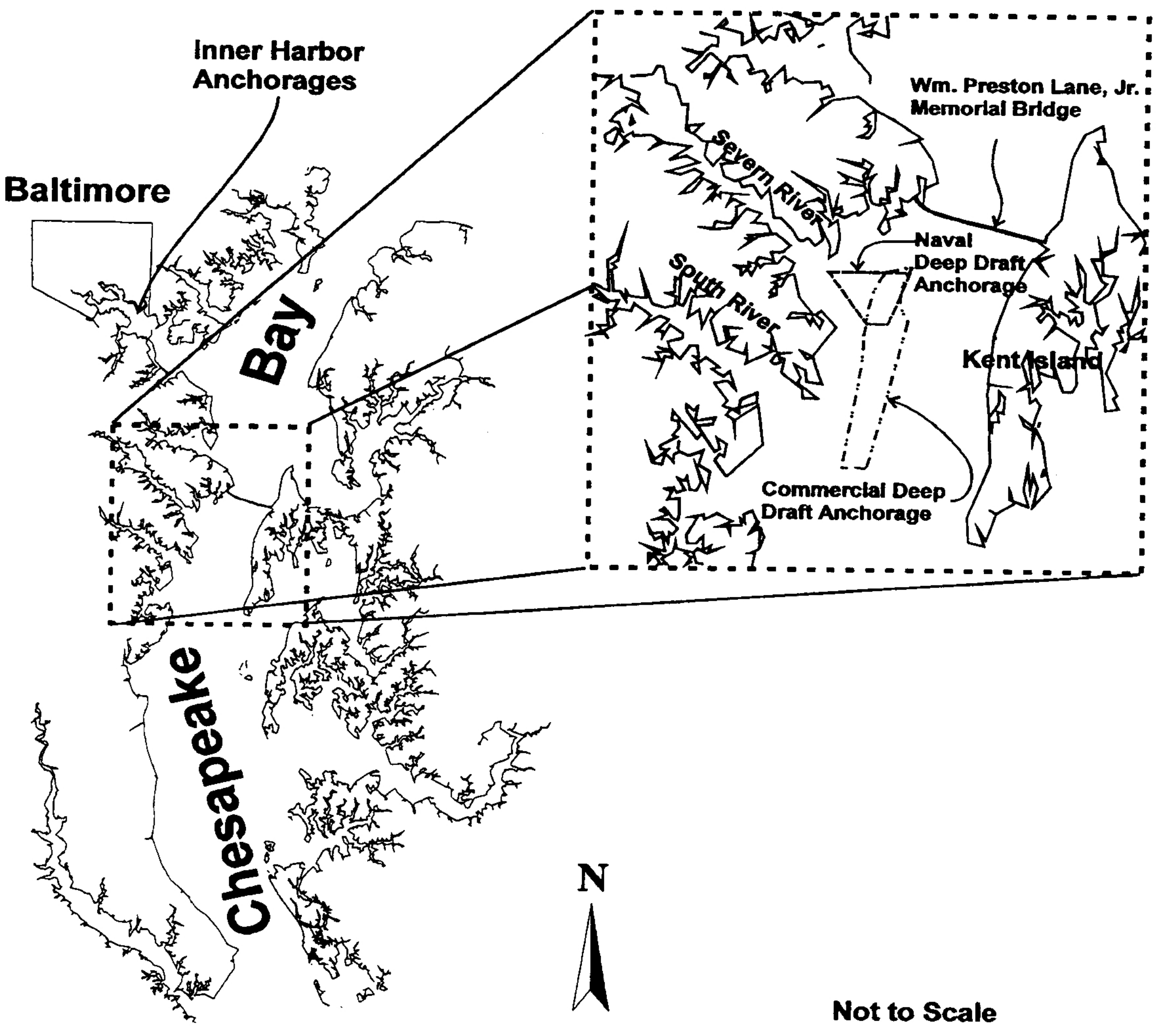
	2000	2010	2020	2030	2040	2050
Inbound	3,429	4,793	7,667	10,435	14,595	20,323
Outbound	3,430	4,793	7,667	10,435	14,595	20,323
Total	6,859	9,586	15,334	20,870	29,190	40,646

A simulation model was developed that incorporated major physical and operational features of the Port of Baltimore vessel movement system. The model was commissioned by the Corps and was prepared by an independent academician, Dr. Michael Racer (Ph.D., Operations Research) of the Industrial Systems and Engineering Department, University of Memphis. A similar model had previously been employed by the Galveston District on a study of the Houston Ship Channel. The model "moves" vessels through the Port to berth and out again, stops in anchorages first if berths are not available, calculates the total time in the system, and applies an average operating cost to arrive at a system operating cost.

The simulation model divides the Port system into a number of cells – basically superimposes blocks of known physical parameters (width, length, depth, speed, etc.) onto a map of the Port. Physical parameters (length overall, beam, draft, speed, etc.) of each vessel class using the Port are inputs to the model.

Knowing the physical parameters of each cell and the physical parameters of each vessel class, the model can "move" a vessel through a cell and calculate the time it takes. Not all vessels calling on the Port go directly to their berth. Some larger vessels anchor in the Annapolis anchorage area located below the William Preston Lane, Jr., Memorial Bridge (Chesapeake Bay Bridge) until a berth is available (Figure 8). Where the vessel size and draft permit, vessels anchor in Baltimore to wait for a berth to

FIGURE 8 – ANNAPOLIS ANCHORAGE



clear. Other information collected on the typical operating characteristics observed in the port system included nautical miles traveled by vessels; route used to access the terminals; bay pilot and tug interaction with vessels; use of anchorages; length of stay at anchorages; distribution of vessel calls to the various terminal facilities; and average vessel time at berth to load and unload. The simulation model captured these nuances. Table C-1 in Appendix C is an example of the output from one simulation "run." A more detailed description of the model and how it functions is presented in Appendix E.

Compiling a vessel “trip” through all cells necessary to bring it to and from berth yields a total operating time per vessel, allowing calculation of a total operating cost per vessel trip. Figure 9 provides an illustration of a common vessel movement that could occur while vessels are moving within the navigation system. In this instance, a vessel that is awaiting a berth occupied by another vessel is required to wait near Annapolis if two conditions exist. First, the vessel is assumed to be too large to use the existing inner harbor anchorages. Second, the vessel at berth, and the anchored vessel have a combined beam width that exceeds the Corps of Engineers channel design limits for passing in the channels between Baltimore and Annapolis. Further compiling of operating cost information for all vessel classes results in a total operating cost for the navigation system. This total system operating cost is determined for the existing, or “without project,” condition. By changing the physical parameters of the system (anchorage alignment, channel width, etc.), but keeping the physical parameters of the vessel classes constant, new system operating costs can be calculated. This is the “with project” condition, which is compared to the “without project” condition to determine project benefits. Figure 10 demonstrates the with-project condition for the example discussed previously (Figure 9) in which the vessel awaiting berth can anchor in the inner harbor and needs only to wait for the vessel at berth to clear the branch channel area. The authorized project exhibited a final benefit-cost ratio (BCR) of 5.2 to 1.

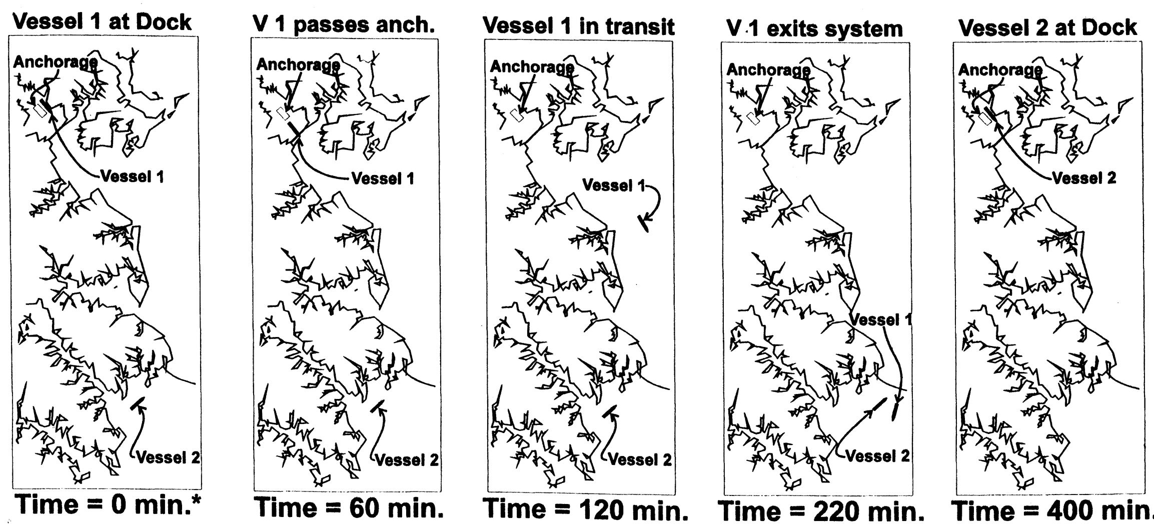
10.2 VALUE ENGINEERING STUDY

As part of a VE study, previously discussed in Section 5.2, the project delivery team undertook a re-analysis of 11 possible anchorage configurations, which included the authorized project and ten other possible combinations of Anchorages #3 and #4. A summary of this re-analysis is presented in Table 7.

For the economic analyses of the 11 plans, modifications were made in the analysis to highlight near-term differences in the plans. Traffic forecasts from the 1997 feasibility report were used. Although the analyses considered a 50-year project life, it was conservatively assumed that there would be no change in the traffic profile after 2010. This was done to save the cost of additional simulation modeling for the out-years. Simulation scenarios were run to calculate the economic benefits of each plan using projected 2000 and 2010 traffic. The benefits for 2020, 2030, 2040, and 2050 were assumed to be identical to 2010. For this reason, the BCR’s from this analysis are significantly below the BCR presented in the feasibility report and other documents describing the authorized project. As a result of the re-analysis, the alternative suggested by the VE study fared worse than the authorized project, but several other alternatives fared better. The plans were formulated by the project delivery team including MPA, with input from the AMP. The plans ranged in first cost from $20.9 million to almost $31 million. Dredged material volumes varied from 3.2 mcy to 5.6 mcy. Since the authorized project had an associated yardage of 4.4 mcy, it was assumed that any plan that resulted in an equal or lesser amount was acceptable. MPA stressed that if the yardage exceeded the authorized amount, then their future placement capacity plans may be compromised (Subsequently, a recalculation dredging quantities required for the authorized project based on updated surveys resulted in a reduction to 3.8 mcy).

Five of the alternatives were eliminated from consideration due to dredged material volumes being greater than 4.4 mcy. In addition, these five eliminated alternatives did not yield the greatest net benefits or the highest BCR. Of the remaining six alternatives, four had lower BCR’s and net benefits than other similar plans and were therefore eliminated from consideration. Of the remaining two alternatives, the one that provided the greatest net benefits (Plan 7) also was well within the dredged material volume constraints at 3.9 mcy, offered three large deep-water berths, and had co-located anchorages as preferred by the pilots. In effect, this plan exchanges the 42-foot depth and 35-

FIGURE 9 – EXAMPLE OF VESSEL MOVEMENTS, EXISTING



Narrative:

Vessel 1 departing berth

Vessel 2 next at berth; too large to anchor in harbor. Anchors at Annapolis

*** Time estimates are for illustrative purposes only**

FIGURE 10 – EXAMPLE OF VESSEL MOVEMENTS, IMPROVED

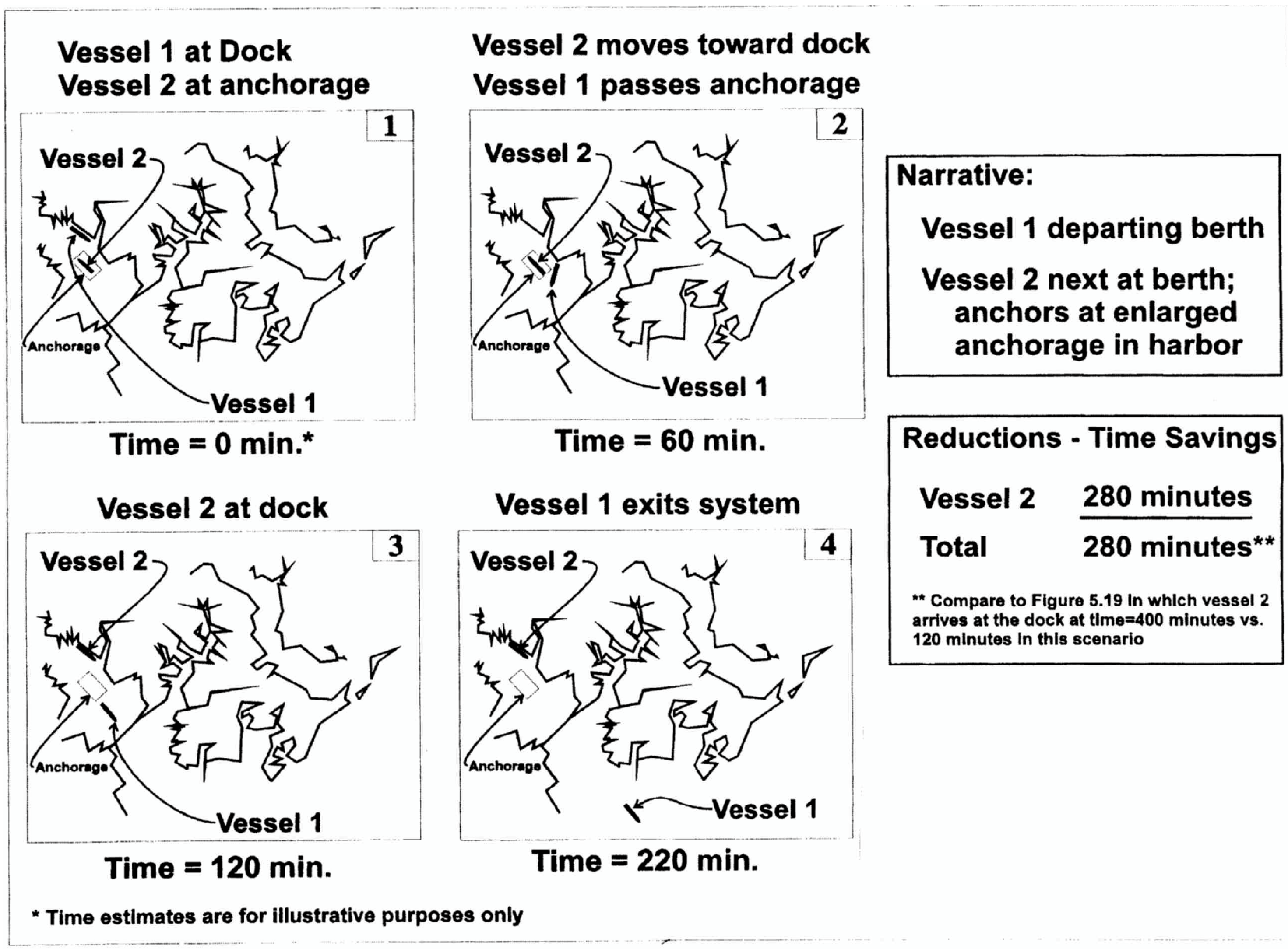


TABLE 7 – VE ANALYSIS OF ANCHORAGE CONFIGURATIONS

Description of Item	Plan 1*	Plan 2	Plan 3	Plan 4	Plan 5	Plan 6	Plan 7**	Plan 8	Plan 9	Plan 10	Plan 11
Description of Project											
Anchorage #3											
Length x Width	2200 x 2200	2200 x 2200	2200 x 2200	2200 x 2200	2200 x 2200	2200 x 2200	2200 x 2200	2200 x 2200	2200 x 2200	2200 x 2200	2200 x 2200
Depth	42	42	42	42	42	42	42	42	42	42	42
Anchorage #3B	no change										
Length x Width		2200 x 2200	1800 x 1800	2200 x 2200	1800 x 1800	2200 x 2200	1800 x 1800	2200 x 2200	1800 x 1800	2200 x 2200	1800 x 1800
Depth		42	42	42	42	42	42	42	42	42	42
Anchorage #4		no change	no change								
Length x Width	1800 x 1800	1800 x 1200	1800 x 1200	1800 x 1800	1800 x 1800	1800 x 1800	1800 x 1800	1800 x 1800	1800 x 1800	1800 x 1500	1800 x 1500
Depth	42	30	30	42	42	35	35	30	30	35	35
Volume to be Dredged, cy***	**3,771,279**	**4,105,598**	**3,228,632**	5,568,054	4,691,088	4,788,693	**3,911,727**	4,437,204	**3,560,238**	4,492,098	**3,615,132**
Project Costs											
Total Investment Cost	$22,640,416	$24,881,670	$20,942,745	$31,017,303	$27,089,125	$28,664,309	$24,725,385	$27,857,228	$23,875,317	$27,470,911	$23,531,986
Annual OMRR&R	$70,000	$70,000	$70,000	$70,000	$70,000	$70,000	$70,000	$70,000	$70,000	$70,000	$70,000
Total Annual Cost	$1,841,262	$2,016,605	$1,708,445	$2,496,623	$2,189,304	$2,312,538	$2,004,378	$2,249,396	$1,937,873	$2,219,173	$1,911,013
Project Benefits											
Total Annual Benefits	$3,532,089	$3,317,952	$3,643,970	$3,428,446	$3,644,869	$3,659,556	$3,971,154	$3,666,425	$3,672,784	$3,437,158	$3,664,772
Net Annual Benefits	$1,690,827	$1,301,347	$1,935,525	$931,823	$1,455,565	$1,347,018	$1,966,776	$1,417,029	$1,734,911	$1,217,985	$1,753,759
Benefit-Cost Ratio	1.92	1.65	2.13	1.37	1.66	1.58	1.98	1.63	1.9	1.55	1.92
Other Concerns and Criteria											
Economic and Sociopolitical Concerns				X							
Maritime Community Preference				X	X	X	X			X	X
Local Sponsor Preference			X				X				X
Decreases Required Placement Capacity	X	X	X				X		X		X

* Plan 1 was the project authorized in WRDA 1999.

** Recommended Plan

*** Includes branch channel and turning basin improvements, bold type indicates that total volume is less than or equal to that for the authorized project

**** Values are in October 1996 price levels, using an interest rate of 7 3/8 %.

foot depth locations in Anchorage Areas #3 and #4 of the authorized project. The total area of these two anchorages is only slightly increased (4.7%) from the authorized project. For these reasons, this modified plan was determined by the project team to be the optimum plan.

An improved vessel traffic management system (VTMS) was not recommended nor discussed during the VE study. The Port has an existing VTMS that includes the rules by which vessels travel the port system. An improved VTMS as a non-structural option was presented in the feasibility report, Sections 5.1.2 and 5.3.2. Under the current system, the Baltimore Maritime Exchange is responsible for tracking vessels calling on the Port. All vessels operating in foreign trade are required to take a pilot from the AMP while the vessel is underway. The pilots are equipped with marine radios and cellular telephones to communicate expected arrival and departure times to more effectively track the movement and location of vessels in the system. These communications help to coordinate passing, anchorage, and berthing requirements. The pilots are also equipped with laptop computers and global positioning systems to help navigate the channels. The AMP is currently conducting field trails with a Starlink Electronic Navigation Data System (SENDS) and expects to implement this system within the next several months. The system will enable the AMP main office and other pilots to track the location of all ships in the Port System that have AMP pilots onboard. The International Maritime Organization is mandating the implementation of an Automated Identification System (AIS). This system would require transponders with unique frequencies to be installed on vessels so that the vessel, its course, speed, etc, could be identified on displays located on other vessels, or shore-based facilities. The AIS will be implemented over the next eight years. The combination of these two systems will greatly improve the pilot's capabilities to track and manage vessels in the system.

The feasibility report recommended non-structural improvements to the Port system including better management of the Annapolis Anchorage, improved placement of buoys and range lights, and more strict enforcement of anchorage use rules. It is this last recommendation that, in conjunction with the VTMS improvements above, could yield significant benefits in future years. As discussed in Appendix E, the model used to analyze the VE plan alternatives did not allow for future improvements to the VTMS and showed "disbenefits" in some future with-project analyses. With a more efficient VTMS in place including more stringent adherence to the rules of anchorage use, more future "with-project" benefits would have been realized. It was the conclusion of the feasibility study, that whereas an improved VTMS would yield increasing benefits as traffic growth continues, structural improvements are needed within the Port system and are solidly justified economically.10.3 Verification of Project Economic Justification

As part of this LRR, the Baltimore District conducted an analysis of the project benefits identified in the 1997 feasibility report. The simulation model used in the feasibility study to evaluate the impact of channel and anchorage improvements on the Port of Baltimore navigation system was used again for this analysis. The analysis focused on changes to the fleet calling on the Port of Baltimore, volume of traffic calling on the Port, cost changes, and changes in design of the authorized project. More details on the model and its applications during the LRR process are presented in Appendix E.

10.3.1 Adjustments to the Simulation Model

The traffic simulation model was slightly adjusted so that it more accurately reflected the dimensions and properties of the areas to be modeled. The data used for Plan 7 of the VE study were re-run through the updated model to determine the impact that these changes would have on the justification of the project (Tables 8 and 9). The resulting annual benefits ($3,718,646) are 6% less than those calculated previously (3,971,154) and would have reduced the BCR for this alternative in the VE analysis from 1.98 to 1.86.

TABLE 8 – VE SIMULATION RUNS

Without Project Simulation Run #	YEAR 2000	Vessel Calls	Unit Cost	**With Project** Simulation Run #	YEAR 2000	Vessel Calls	Unit Cost
1	$52,497,874.00	1459	$35,982.09	1	$51,701,074.00	1460	$35,411.69
2	$48,448,425.00	1367	$35,441.42	2	$47,546,787.00	1367	$34,781.85
3	$49,101,133.00	1403	$34,997.24	3	$48,149,359.00	1403	$34,318.86
4	$45,742,994.00	1303	$35,105.90	4	$44,880,505.00	1303	$34,443.98
5	$50,660,477.00	1402	$36,134.43	5	$49,588,632.00	1402	$35,369.92
6	$47,863,651.00	1402	$34,139.55	6	$47,004,738.00	1402	$33,526.92
7	$50,481,178.00	1451	$34,790.61	7	$49,440,139.00	1451	$34,073.15
8	$47,747,217.00	1368	$34,902.94	8	$46,935,942.00	1368	$34,309.90
9	$50,552,623.00	1441	$35,081.63	9	$49,715,429.00	1442	$34,476.72
10	$51,668,645.00	1475	$35,029.59	10	$50,375,942.00	1477	$34,106.93
11	$47,639,489.00	1365	$34,900.72	11	$46,871,183.00	1365	$34,337.86
12	$47,726,045.00	1369	$34,861.98	12	$46,701,879.00	1369	$34,113.86
13	$46,852,336.00	1353	$34,628.48	13	$46,121,995.00	1354	$34,063.51
14	$48,245,566.00	1361	$35,448.62	14	$46,184,681.00	1361	$33,934.37
15	$49,795,353.00	1457	$34,176.63	15	$49,009,605.00	1458	$33,614.27
16	$50,415,632.00	1408	$35,806.56	16	$49,565,912.00	1408	$35,203.06
17	$47,531,084.00	1360	$34,949.33	17	$46,714,988.00	1360	$34,349.26
18	$49,173,791.00	1394	$35,275.32	18	$48,287,856.00	1395	$34,614.95
19	$50,964,764.00	1461	$34,883.48	19	$50,015,510.00	1463	$34,186.95
20	$49,959,542.00	1417	$35,257.26	20	$ -	0	$ -
21	$48,471,789.00	1387	$34,947.22	21	$47,688,362.00	1387	$34,382.38
22	$48,940,012.00	1355	$36,118.09	22	$47,941,759.00	1355	$35,381.37
23	$49,378,393.00	1445	$34,171.90	23	$48,378,432.00	1445	$33,479.88
24	$49,106,206.00	1403	$35,000.86	24	$48,288,645.00	1403	$34,418.14
25	$46,535,117.00	1330	$34,988.81	25	$45,499,948.00	1331	$34,184.78
AVERAGE	$49,019,973.44	1397.4	$35,080.83	AVERAGE	$48,025,387.58	1397.0	$34,378.52
	150-day savings		$994,585.86		150-day unit savings		$702.31
	365-day savings		$2,420,158.92				

Note: Runs with no associated operating costs were terminated prior to completion. Values are in October 1996 price levels, using an interest rate of 7 3/8 %.

TABLE 8 (Continued) – VE SIMULATION RUNS

Without Project Simulation Run #	YEAR 2010	Vessel Calls	Unit Cost	With Project Simulation Run #	YEAR 2010	Vessel Calls	Unit Cost
1	$75,744,051.00	2018	$37,534.22	1	$74,065,725.00	2018	$36,702.54
2	$72,911,392.00	1964	$37,123.93	2			
3	$75,386,379.00	1969	$38,286.63	3	$73,419,704.00	1971	$37,249.98
4	$70,287,977.00	1867	$37,647.55	4	$68,187,163.00	1867	$36,522.32
5	$76,541,742.00	1961	$39,031.99	5			
6	$71,091,549.00	1939	$36,664.03	6	$69,500,190.00	1939	$35,843.32
7	$70,987,283.00	1971	$36,015.87	7			
8	$70,033,596.00	1907	$36,724.49	8	$68,241,376.00	1907	$35,784.68
9	$70,678,359.00	1994	$35,445.52	9	$69,056,310.00	1994	$34,632.05
10	$73,415,927.00	2012	$36,489.03	10	$70,616,014.00	2013	$35,079.99
11	$70,794,211.00	1945	$36,398.05	11	$69,491,872.00	1945	$35,728.47
12	$70,930,255.00	1909	$37,155.71	12	$69,515,918.00	1909	$36,414.83
13	$67,687,255.00	1889	$35,832.32	13			
14	$72,467,881.00	1894	$38,261.82	14	$65,191,678.00	1898	$34,347.56
15	$71,975,291.00	2009	$35,826.43	15	$70,297,803.00	2009	$34,991.44
16	$73,943,558.00	1992	$37,120.26	16	$72,465,855.00	1992	$36,378.44
17	$69,133,720.00	1939	$35,654.32	17	$67,778,087.00	1939	$34,955.18
18	$71,687,249.00	1941	$36,933.15	18	$69,921,535.00	1941	$36,023.46
19	$73,994,876.00	2025	$36,540.68	19	$70,453,466.00	2027	$34,757.51
20	$75,427,999.00	2014	$37,451.84	20	$73,923,531.00	2014	$36,704.83
21	$72,537,831.00	1949	$37,217.97	21	$70,984,310.00	1950	$36,402.21
22	$73,837,678.00	1904	$38,780.29	22	$71,945,557.00	1904	$37,786.53
23	$70,488,294.00	1982	$35,564.23	23	$67,746,936.00	1982	$34,181.10
24	$72,348,310.00	1965	$36,818.48	24	$70,416,413.00	1965	$35,835.32
25	$69,809,662.00	1886	$37,014.67	25	$67,828,372.00	1886	$35,964.14
AVERAGE	$72,165,693.00	1953.8	$ 36,941.34	AVERAGE	$70,049,895.95	1955.7	$35,823.14
	150-day savings		$2,115,797.05		150-day unit savings		$1,118.20
	365-day savings		$5,148,439.48				

Note: Runs with no associated operating costs were terminated prior to completion. Values are in October 1996 price levels, using an interest rate of 7 3/8 %.

TABLE 9 – VE BENEFIT ANALYSIS

		Calendar Year	Project Year	Nominal Benefits	Present Value 7.375 Percent	Present Worth
YEAR 2000	$2,420,159	2000	1	$2,420,159	0.931315483	$2,253,932
		2001	2	$2,420,159	0.867348529	$2,099,121
YEAR 2010	$5,148,439	2002	3	$2,420,159	0.807775114	$1,954,944
		2003	4	$2,420,159	0.752293471	$1,820,670
YEAR 2020	$5,148,439	2004	5	$2,420,159	0.700622557	$1,695,618
		2005	6	$2,420,159	0.652500635	$1,579,155
YEAR 2030	$5,148,439	2006	7	$2,420,159	0.607683945	$1,470,692
		2007	8	$2,420,159	0.565945466	$1,369,678
YEAR 2040	$5,148,439	2008	9	$2,420,159	0.527073775	$1,275,602
		2009	10	$2,420,159	0.490871968	$1,187,988
YEAR 2050	$5,148,439	2010	11	$5,148,439	0.457156664	$2,353,643
		2011	12	$5,148,439	0.425757079	$2,191,984
		2012	13	$5,148,439	0.39651416	$2,041,429
		2013	14	$5,148,439	0.369279776	$1,901,214
		2014	15	$5,148,439	0.343915973	$1,770,630
		2015	16	$5,148,439	0.320294271	$1,649,016
		2016	17	$5,148,439	0.298295014	$1,535,754
		2017	18	$5,148,439	0.277806765	$1,430,271
		2018	19	$5,148,439	0.258725741	$1,332,034
		2019	20	$5,148,439	0.240955289	$1,240,544
		2020	21	$5,148,439	0.224405391	$1,155,337
		2021	22	$5,148,439	0.208992215	$1,075,984
		2022	23	$5,148,439	0.194637686	$1,002,080
		2023	24	$5,148,439	0.181269091	$933,253
		2024	25	$5,148,439	0.168818711	$869,153
		2025	26	$5,148,439	0.157223479	$809,455
		2026	27	$5,148,439	0.14642466	$753,858
		2027	28	$5,148,439	0.136367553	$702,080
		2028	29	$5,148,439	0.127001214	$653,858
		2029	30	$5,148,439	0.118278197	$608,948
		2030	31	$5,148,439	0.110154316	$567,123
		2031	32	$5,148,439	0.10258842	$528,170
		2032	33	$5,148,439	0.095542184	$491,893
		2033	34	$5,148,439	0.088979915	$458,108
		2034	35	$5,148,439	0.082868373	$426,643
		2035	36	$5,148,439	0.077176599	$397,339
		2036	37	$5,148,439	0.071875761	$370,048
		2037	38	$5,148,439	0.066939009	$344,631
		2038	39	$5,148,439	0.062341336	$320,961
		2039	40	$5,148,439	0.058059451	$298,916
		2040	41	$5,148,439	0.054071666	$278,385
		2041	42	$5,148,439	0.05035778	$259,264
		2042	43	$5,148,439	0.04689898	$241,457
		2043	44	$5,148,439	0.043677746	$224,872
		2044	45	$5,148,439	0.040677761	$209,427
		2045	46	$5,148,439	0.037883829	$195,043
		2046	47	$5,148,439	0.035281796	$181,646
		2047	48	$5,148,439	0.032858483	$169,170
		2048	49	$5,148,439	0.030601614	$157,551
		2049	50	$5,148,439	0.028499757	$146,729
				$230,139,150	Pres. Value	$48,985,300
					BENEFIT	$3,718,646

Values are in October 1996 price levels, using an interest rate of 7 3/8 %.

10.3.2 Existing Conditions in 2000

For the feasibility study, the base year for economic evaluation is calendar year 2000. Information on traffic levels, commodities, and operating costs are now available for this base condition and are discussed below. Traffic calling on the Port of Baltimore in 2000 was only 52% of the 2000 projections from the 1997 feasibility report, and vessel operating costs are about 15% lower in 2000 than they were in the feasibility report. It is important to understand the causes of the reduced traffic and operating costs and their impact on project justification.

Commodity levels are very important to the analysis of vessel traffic. There is a direct link between the commodities and the number of vessels required to bring them to and through port. In the feasibility study, forecasts of cargo carriage by vessel type was produced based on forecasts from the World Sea Trade Service (WSTS) and World Fleet Forecast Service (WFFS). These were combined with WSTS forecasts for the Port of Baltimore and detailed vessel calls and sailing drafts derived from the Waterborne Commerce Statistics Center data (WCSC) and vessel entrance and clearance data plus vessel characteristics from Lloyds Maritime Information Services (LMIS) and Fairplay. The analysis also related the forecasts to inland distribution patterns derived from Journal of Commerce PIERS data (JoC) and Reebie Associates Transearch data. Finally the projected vessel calls by sailing draft were combined with the vessel movements by terminal and anchorage within the Port of Baltimore from the Baltimore Maritime Exchange (BME). The BME database provided information on the arrival/departure patterns (C&D vs. Cape Henry) and the detailed terminal and anchorage activity utilized in the simulation models.

The forecasts of vessel calls were derived by applying the WSTS forecast growth by commodity and trade partner to the commodities identified on each WCSC vessel call to and from the Port of Baltimore. This procedure produced an initial forecast of vessel calls by vessel type based on projected commodity growth. The results of the vessel call forecast based on cargo growth were then combined with the vessel type forecasts from the WFFS to incorporate changes in activity levels by vessel type. The projected vessel calls by direction were then modified to reflect future ballast voyages necessary to accommodate the vessel calls required in the dominant direction of cargo carriage. The individual vessel calls from the WCSC database were also linked to the Lloyd's vessel characteristics and sailing drafts from entrance and clearance files. These data sources allowed the projected vessel calls to reflect vessel characteristics and sailing drafts.

To gauge the likelihood that traffic will meet projections made for the feasibility report, it is necessary to assess the changes in trade that may have led to the "lower than projected" values in 2000. The planner's primary role in dealing with risk and uncertainty is to identify the areas of sensitivity and describe them clearly so that decisions can be made with knowledge of the degree of reliability of available information. Uncertainty is inherent in any future-oriented planning effort. Uncertainties can involve data that may be incomplete, unavailable, or prohibitively expensive to collect and assimilate.

The complex interrelationships among economic, engineering, environmental, natural, social, and political systems inherent in water resources planning require simplification through the use of assumptions. Level of detail is limited because there is neither enough time nor money. Decisions and choices must be made based on gathered information. In dealing with this inherent lack of certainty, it is important to identify the areas of sensitivity and describe them clearly so that decisions can be made with knowledge of the degree of reliability of available information.

To analyze the uncertainty of traffic projections, the project delivery team collected information on commodity trends following the release of the feasibility report as well as information on new service contracts executed by the Port of Baltimore within the last year. This information was analyzed in light of global socio-economic impacts, and an assessment of the viability of the traffic projections from the feasibility report was prepared.

All summaries presented here are based on the total vessel traffic reported unless otherwise noted. The majority of the data made available for analysis recorded vessel traffic by ships that are deep-draft ocean-going vessels registered in foreign countries. Recreational powerboats, fishing boats, sailboats and other small vessel traffic were not included in the data or analysis of vessel traffic, nor were deep-draft domestic vessels. A vessel fleet profile and review of navigation system operating costs for the Port of Baltimore in the year 2000 were created. This analysis required the data processing and analysis of several different data sources providing information on Baltimore-calling vessels in 2000.

10.3.2.1 Vessel Call Methodology

A detailed discussion of the vessel call methodology is included in Appendix C. The primary approach to this effort has been to match various sources of data providing information about vessel activity in Baltimore in the year 2000 into one combined database of vessel activity and vessel characteristics. The primary resulting database was developed based on government and maritime exchange information on Baltimore-calling vessels in the year 2000. Primary data sources used included vessel activity identified in the U.S. Maritime Administration's Vessel Entrances and Clearances (VEC) files for the Port of Baltimore, the BME vessel arrival and departure records, and vessel characteristics from Clarkson Research Studies (CRS) and vessel characteristics included in the BME data. Based on the different sources of vessel movements, a master list of vessels calling the port with characteristics was developed and vessel class (type and size) assignments incorporated based on the vessel characteristics. The vessel characteristics were detailed by the vessel class and the vessel movements from the BME data, combined with the vessel characteristics and vessel class identification to produce output data using the arrival and departure dates and the vessel route (Cape Henry versus C&D) information in the BME database. The arrival dates were also used to prepare a summary of daily, weekly and monthly vessel flow rates. The terminal berth and anchorage information was used to develop arrival, departure, and elapsed time use of these facilities. Other databases were also provided, and were processed to confirm and crosscheck the results from the combinations of the data sources. The Baltimore 2000 master vessel file was subsequently matched against the BME vessel arrival file to identify times and berth and anchorage use within the harbor system. In conjunction with the routing information already analyzed, this provided the data necessary for the identification of vessel activity by route and the times at berth and at anchorage in Baltimore. Then, in coordination with Dr. Michael Racer from the University of Memphis, the resulting year 2000 vessel activity data was produced as output for use in the Baltimore vessel simulation models. Vessels were grouped by class and size categories for use in the simulation models.

10.3.2.2 Vessel Call Detail

From the data for the year 2000, there were 1,895 vessel calls to the Port of Baltimore. Table 10 provides a summary of the number of vessel calls by vessel class. The ship types with the highest number of identified calls on the port in 2000 were the A2 (Cellular 100-2,499 TEU), AA (General Cargo >10,000 DWT), AE (Roll-on/Roll-off >10,000 DWT), DB (Bulk 20,000–40,000 DWT), DC (Bulk 40,000–80,000 DWT), and HB (Vehicle Carrier) vessel classes. With 415 calls during the year, HB (Vehicle Carriers) were the most frequently observed vessel type in the Port of Baltimore. The vessel types A1 (Cellular <1,000), DD (Bulk 20,000–40,000 DWT), PA (Product Tanker < 10,000 DWT), DE (Bulk 100,000–175,000), EC (Combination 40,000–80,000 DWT), and ED

TABLE 10 - CALENDAR YEAR 2000 BALTIMORE VESSEL CALLS

(Number of Vessel Calls by Vessel Class)

Vessel Class	Vessel Calls
A1 (Cellular <1000 TEU)	8
A2 (Cellular 1000-2,499 TEU)	252
A3 (Cellular 2,500-3,999 TEU)	43
A4 (Cellular 4,000-5,999 TEU)	53
AA (General Cargo > 10,0000 DWT)	169
AB (General Cargo < 10,0000 DWT)	91
AE (Roll-on/Roll-off >10,000 DWT)	115
AF (Roll-on/Roll-off <10,000 DWT)	32
DA (Bulk <20,000 DWT)	86
DB (Bulk 20,000-40,000 DWT)	132
DC (Bulk 40,000-80,000 DWT)	172
DD (Bulk 80,000-100,000 DWT)	10
DE (Bulk 100,000-175,000 DWT)	15
EC (Combination 40,000-80,000 DWT)	19
ED (Combination 80,000-100,000 DWT)	18
FB (Tanker 10,000 - 40,000 DWT)	61
FC (Tanker 40,000 - 80,000 DWT)	25
HB (Vehicle Carrier)	415
PA (Product Tanker < 10,000 DWT)	13
PB (Product Tanker 10,000 - 40,000 DWT)	42
PC (Product Tanker 40,000 - 80,000 DWT)	21
XMIL (Military)	46
XOTH (Other)	36
XPAX (Passenger)	21
Total	1895

Source: Baltimore Maritime Exchange

(Combination 80,000–100,000 DWT) were seen least frequently calling the port. All made fewer than 20 calls through the entire calendar year 2000.

From the data available for 2000, 922 unique vessels were identified that called on the Port of Baltimore. Table 11 summarizes the number of unique vessels by vessel type and size class. Analyzed by type and size of vessel, those vessels with the most frequency visiting the port included types AA (General Cargo), DB (Bulk Carrier), DC (Bulk Carrier), and HB (Vehicle Carrier). The vessel types that called the port the least include A1 (Cellular <1000 TEU), DE (Bulk 100,000–175,00 DWT), and PA (Product Tanker (10,000–40,000 DWT).

TABLE 11 - CALENDAR YEAR 2000 BALTIMORE VESSELS
(Number of Unique Vessels by Vessel Type and Size Class)

Vessel Class	Vessels
A1 (Cellular <1000 TEU)	2
A2 (Cellular 1000-2,499 TEU)	51
A3 (Cellular 2,500-3,999 TEU)	8
A4 (Cellular 4,000-5,999 TEU)	10
AA (General Cargo > 10,0000 DWT)	108
AB (General Cargo < 10,0000 DWT)	69
AE (Roll-on/Roll-off >10,000 DWT)	29
AF (Roll-on/Roll-off <10,000 DWT)	13
DA (Bulk <20,000 DWT)	32
DB (Bulk 20,000-40,000 DWT)	110
DC (Bulk 40,000-80,000 DWT)	113
DD (Bulk 80,000-100,000 DWT)	4
DE (Bulk 100,000-175,000 DWT)	14
EC (Combination 40,000-80,000 DWT)	15
ED (Combination 80,000-100,000 DWT)	9
FB (Tanker 10,000 - 40,000 DWT)	29
FC (Tanker 40,000 - 80,000 DWT)	22
HB (Vehicle Carrier)	153
PA (Product Tanker < 10,000 DWT)	6
PB (Product Tanker 10,000 - 40,000 DWT)	35
PC (Product Tanker 40,000 - 80,000 DWT)	14
XMIL (Military)	39
XOTH (Other)	29
XPAX (Passenger)	8
Total	922

Source: Baltimore Maritime Exchange

10.3.2.3 Vessel Calls by Route

For vessels calling Baltimore, their use of channels and anchorages can be influenced, in part, by their route between the port and the ocean. From the BME data, the route choice for vessels calling Baltimore in 2000 was analyzed for the choice between the two access routes to and from the sea, via the C&D Canal and via Cape Henry. Of the two, the Cape Henry route is the more heavily trafficked route. In 2000, 74% of all incoming calls to the Port of Baltimore sailed via Cape Henry. The Cape Henry route saw 84% of vessel departures. The C&D Canal captured a relatively larger share of arrivals than departures—approximately 26% of arrivals, compared to 16% of departures, were routed through the Canal. Tables 12 and 13 summarize this activity.

TABLE 12 - CALENDAR YEAR 2000 BALTIMORE ARRIVALS
(Baltimore Arrivals by Route)

Route Name	Vessel Calls
C&D Canal	490
Cape Henry	1404
Not Available	1
Total	1895

Source: Baltimore Maritime Exchange

TABLE 13 - CALENDAR YEAR 2000 BALTIMORE DEPARTURES
(Baltimore Departures by Route)

Route Name	Vessel Calls
C&D Canal	299
Cape Henry	1583
Not Available	13
Total	1895

Source: Baltimore Maritime Exchange

10.3.2.4 Vessel Berth Use

Due to the variety of terminals and port facilities in Baltimore, the patterns of vessel berth use are important for an understanding of the use of the branch channels and anchorages in Baltimore harbor. Berth use information is also important to establish patterns of vessel activity for the simulation models. In this section the results of the analysis of the berth use data available for Baltimore calling vessels in 2000 are described.

From the recorded data and actual practice in berth utilization, the definitions of berths used terminals are not precise. In the data set, berth definitions at Canton, Clinton, Dundalk (DMT), Seagirt, and South Locust Point (SLPT) have recorded use for different berth categories that overlap others (e.g. DMT #03, DMT #03-04, DMT #04). This is not an error in the data but rather reflects the operating situation that can happen when a vessel is too long for one berth or a vessel ties up across adjacent berth boundaries. The records and analysis maintain these berth definition distinctions.

Seagirt #02 was the most frequently utilized berth in 2000, with 120 of 1895 total vessel calls. The top ten berths used through the course of the year include ATLTERM, CLINTON #05, CONSOL W, DMT #01, DMT#05, DMT #09, Seagirt #01, Seagirt #02, SLPT #10, and Toyota. Each of the top ten berths had greater than 50 calls for the calendar year.

Table 14 details the calls by berth for the 1,895 vessel calls in the year 2000.

10.3.2.5 Vessel Anchorage Use

As with berth use, an understanding of vessel activity in Baltimore also requires knowledge of the patterns of use of the various anchorages available to ships for waiting periods. This information is also an important input to the simulation models for vessel activity.

In the year 2000, the data available records 365 total anchorages, of which 168 were Annapolis anchorages and 197 were Baltimore anchorages. There were 37 vessel calls that used both Baltimore and Annapolis anchorages during the year 2000.

10.3.2.5.1 Annapolis Anchorage Detail

Table 15 provides a summary of the number of anchorages at the Annapolis Anchorage by vessel class. The ship types with the highest number of identified anchorages at Annapolis in 2000 were the DC (Bulk 40,000–80,000 DWT) and DB (Bulk 20,000–40,000 DWT). Table 16 provides a summary of the number of anchorages at the Annapolis Anchorage by sailing draft. About 80% of the vessels that used the Annapolis Anchorage in 2000 drafted at or below 35 feet. Table 17 provides a summary of the number of anchorages at the Annapolis Anchorage by arrival route. Of those using the anchorage upon arrival, about 98% are arriving via the Cape Henry route. Table 18 provides a

TABLE 14 - CALENDAR YEAR 2000 BALTIMORE BERTH USE
(Number of Vessel Calls by Berth)

Berth Name	Vessel Calls
AMOCO CB	1
AMSTAR	33
ANCHORAGE MARINA	1
APEX	34
ATLTERM	54
BALTIMORE MARINE CENTER	1
BALTO ANCHOR	2
BAYSIDE	2
BITIMAR	2
BLUECIRCLE	8
BMI	16
BROADWAY	2
CANTON #10	11
CANTON #10	1
CANTON #11	2
CANTON #13	1
CANTON #13 E	12
CANTON #13 W	3
CARGO @ ANCHOR	1
Cargo @ anchorage	1
CHESA	25
CHEVRON	2
CITGO	2
CLINTON #01 N	6
CLINTON #03	2
CLINTON #05	53
CLINTON #05 N	21
CLINTON #07	1
CLINTON #07 N	21
CLINTON #07 S	45
CONSOL E	7
CONSOL W	79
CSXORE	6
DMT #01	112
DMT #02	12
DMT #03	7
DMT #03-04	1
DMT #04	4
DMT #04-05	11
DMT #05	71
DMT #06	7
DMT #07	32
DMT #07-08	2
DMT #08	7
DMT #09	55

Source: Baltimore Maritime Exchange

TABLE 14 (continued) - CALENDAR YEAR 2000 BALTIMORE BERTH USE
(Number of Vessel Calls by Berth)

Berth Name	Vessel Calls
DMT #11	37
DMT #11-12	1
DMT #12	9
DMT #13	6
FTMCHEN	13
HAWKINS N	19
HAWKINS S	27
HESS	32
INNHAR	11
LAZA	42
LAZB	9
LAZC	2
LIQUID	20
N/A	2
NATGYP	18
NLPT #03	9
NLPT #04	21
NLPT #05	25
NLPT #07	18
NLPT #10	6
NONE	2
PENNWOOD	1
PORT COV #06	4
PPT	22
PRATT #03	1
PRATT #04	2
PRATT #05	2
PRATT #06	1
SEAGIRT #01	75
SEAGIRT #02	120
SEAGIRT #02-03	2
SEAGIRT #03	62
SLPT #09	2
SLPT #10	103
SLPT #10-11	1
SLPT #11	21
SLPT #12	71
SPPTORE E	28
SPPTORE W	49
SPPTWHF	1
SPPTWHF E	25
SPPTWHF MID	1
SPPTWHF W	33
STT	30
TOYOTA	81

Source: Baltimore Maritime Exchange

TABLE 14 (continued) - CALENDAR YEAR 2000 BALTIMORE BERTH USE
(Number of Vessel Calls by Berth)

Berth Name	Vessel Calls
TYCO	**9**
USCGYARD	**1**
USGYP	**37**
VISTA	**2**
Total All Berths	**1895**

Source: Baltimore Maritime Exchange

TABLE 15 - CALENDAR YEAR 2000 ANNAPOLIS ANCHORAGES BY VESSEL CLASS

Vessel Class	Anchorages
A2(Cellular 1000-2,499 TEU)	8
A3(Cellular 2,500-3,999 TEU)	1
AA(General Cargo > 10,0000 DWT)	15
AB(General Cargo < 10,0000 DWT)	7
AE(Roll-on/Roll-off >10,000 DWT)	2
DA(Bulk <20,000 DWT)	5
DB(Bulk 20,000-40,000 DWT)	38
DC(Bulk 40,000-80,000 DWT)	39
DD(Bulk 80,000-100,000 DWT)	5
DE(Bulk 100,000-175,000 DWT)	5
EC(Combination 40,000-80,000 DWT)	9
ED(Combination 80,000-100,000 DWT)	5
FB(Tanker 10,000 - 40,000 DWT)	6
FC(Tanker 40,000 - 80,000 DWT)	5
HB(Vehicle Carrier)	10
PC(Product Tanker 40,000 - 80,000 DWT)	4
XMIL(Military)	2
XOTH(Other)	2
Total	168

Source: Baltimore Maritime Exchange

TABLE 16 - CALENDAR YEAR 2000 ANNAPOLIS ANCHORAGES BY SAILING DRAFT

Sailing Draft (feet)	# of Vessels
N/A	7
Less than 25	25
Between 25 and 30	39
Between 30 and 35	63
Between 35 and 40	17
Between 40 and 45	8
Between 45 and 50	9

Source: Baltimore Maritime Exchange

TABLE 17 - CALENDAR YEAR 2000 ANNAPOLIS ANCHORAGES BY ARRIVAL ROUTE

Arrival Route	# of Anchorages
C & D Canal	4
Cape Henry	164
Total	168

Source: Baltimore Maritime Exchange

TABLE 18 - CALENDAR YEAR 2000 ANNAPOLIS ANCHORAGES BY DEPARTURE ROUTE

Departure Route	# of Anchorages
C & D Canal	19
Cape Henry	149
Total	168

Source: Baltimore Maritime Exchange

summary of the number of anchorages at the Annapolis Anchorage by departure route. Of those using the anchorage upon arrival, about 89% are departing via the Cape Henry route.

10.3.2.5.2 Baltimore Anchorage Detail

There are seven Baltimore anchorage areas in which use was recorded during 2000, including those named anchorages one through six and also one vessel at PPT, Piney Point. As shown in the following table, over ten percent of year 2000 vessel calls used an anchorage, with 197 of the 1,895 vessel calls using Baltimore anchorages.

Table 19 provides a summary of the number of anchorages at the Baltimore anchorage areas by vessel class. The ship types with the highest number of identified anchorages at Baltimore in 2000 were DB (Bulk 20,000-40,000 DWT) AA (General Cargo > 10,0000 DWT) and AB(General Cargo < 10,0000 DWT). Table 20 provides a summary of the number of anchorages at the Baltimore anchorage areas by sailing draft. About 73% of the vessels that used the Baltimore anchorages in 2000 drafted at or below 30 feet. Table 21 provides a summary of the number of anchorages at the Baltimore anchorages by arrival route. Of those using the anchorages upon arrival, about 81% are arriving via the Cape Henry route. Table 22 provides a summary of the number of anchorages at the Baltimore anchorages by departure route. Of those using the anchorage upon arrival, about 89% are departing via the Cape Henry route.

The most frequent anchorage location used was #3, accounting for 61% of all vessels anchored at Baltimore anchorages. Vessel anchorage detail has been summarized in Table 23.

Berth activity was reported for about one hundred different berths at terminals around the Port. Of these, Berth #02 at Seagirt was the most frequently used berth in 2000, followed by Berth #01 at Dundalk and South Locust Point #10.

Over 10 percent of foreign vessel calls to the Port of Baltimore made use of either the Baltimore or Annapolis anchorages. The Annapolis anchorage was most frequently utilized by bulk cargo ships that have drafts more than 30 feet. The Baltimore Anchorage #3 was the most utilized anchorage during 2000 and ships with drafts under 35 feet made the most frequent use of the Baltimore anchorages. Military vessels and smaller bulk carriers had the highest average elapsed times in port.

TABLE 19 - CALENDAR YEAR 2000 BALTIMORE ANCHORAGES BY VESSEL TYPE

Vessel Class	# of Anchorages
A2(Cellular 1000-2,499 TEU)	7
AA(General Cargo > 10,0000 DWT)	35
AB(General Cargo < 10,0000 DWT)	29
AE(Roll-on/Roll-off >10,000 DWT)	3
AF(Roll-on/Roll-off <10,000 DWT)	2
DA(Bulk <20,000 DWT)	15
DB(Bulk 20,000-40,000 DWT)	46
DC(Bulk 40,000-80,000 DWT)	8
FB(Tanker 10,000 - 40,000 DWT)	10
FC(Tanker 40,000 - 80,000 DWT)	5
HB(Vehicle Carrier)	14
PB(Product Tanker 10,000 - 40,000 DWT)	6
PC(Product Tanker 40,000 - 80,000 DWT)	6
XMIL(Military)	2
XOTH(Other)	9
Total	197

Source: Baltimore Maritime Exchange

TABLE 20 - CALENDAR YEAR 2000 BALTIMORE ANCHORAGE BY SAILING DRAFT

Sailing Draft (feet)	Number of Vessels
N/A	8
Less than 25	72
Between 25 and 30	63
Between 30 and 35	53
Between 35 and 40	1
Between 40 and 45	0
Between 45 and 50	0

Source: Baltimore Maritime Exchange

TABLE 21 - CALENDAR YEAR 2000 ANCHORAGE BY ARRIVAL ROUTE

Baltimore Arrival Route	Vessel Calls
C&D Canal	38
Cape Henry	159
Total # of Anchorages	197

Source: Baltimore Maritime Exchange

TABLE 22 - CALENDAR YEAR 2000 ANCHORAGE BY DEPARTURE ROUTE

Baltimore Departure Route	Vessel Calls
C&D Canal	21
Cape Henry	176
Total # of Anchorages	197

Source: Baltimore Maritime Exchange

TABLE 23 - CALENDAR YEAR 2000 BALTIMORE VESSEL CALLS BY ANCHORAGE

Baltimore Anchorage Number / Name	Vessel Calls
#1	2
#2	35
#3	121
#4	30
#5	4
#6	4
PPT	1
Total # of Anchorages	197

Source: Baltimore Maritime Exchange

10.3.2.6 Imports and Exports

Information on foreign imports and exports was received from WCSC. Table 24 provides comparative total import and export data for 1993 and 2000 (both projected and actual 2000 data).

TABLE 24 – TOTAL IMPORTS AND EXPORTS SUMMARY
(metric tons)

	Imports	Exports	Total
1993 Actual Foreign Commerce	11,259,577	11,644,742	22,904,319
2000 Actual Foreign Commerce	15,710,956	7,932,224	23,643,180
2000 Projected Foreign Commerce	16,037,722	13,748,951	29,786,673
Total change from 1993 to 2000	39.5%	-31.9%	3.2%
Annualized growth from 1993 to 2000	4.87%	-5.34%	0.45%
Growth from 1999 to 2000	15.26%	15.01%	15.17%
2000 actual as a percent of projected	98.0%	57.7%	79.4%

The table shows that total foreign ocean-borne commerce for 2000 at the Port of Baltimore was lower than projected. Actual total commerce was 79% of projected (23.6 versus 29.8 million metric tons). The total increase from 1993 to 2000 was 3.2% (0.45% per year, annualized). Table C-2 in Appendix C provides detailed import and export data grouped by World Sea Trade (WST) code. In addition to providing 1993 and 2000 data (actual and projected), this table shows 1999 data obtained from the WCSC. The growth in total commerce was 15.17% during the most recent period (1999 to 2000). The top three commodities by weight are unchanged: coal and coke, iron ore, and cement, lime and stone. These three groups constituted 64% of all commodities in 2000, versus 61% in 1993. Table C-2 also shows combined export and import commodity volume segregated into two broad groups: commodities that are transported in bulk in their natural state (coal and coke, grain, iron ore, etc.) and commodities that have been processed in some way and are typically containerized. This segregation reveals that bulk commodities have experienced extreme variability during the period 1993 to 2000, and have actually decreased slightly, by approximately 0.05% per year. Conversely, containerized commodities appear to have experienced slow, steady growth of approximately 2.52% per year from 1993 to 2000.

10.3.2.6.1 Imports

Total imports increased by 40% from the period 1993 to 2000 (Table C-3). On an annualized basis, imports increased by 4.87% per year from 1993 to 2000. The growth in imports was 15.26% during the most recent period (1999 to 2000). Actual imports were 98% of projected (15.7 versus 16.0 million metric tons). Table C-4 provides a comparison of actual vs. projected imports. The top three imports by weight remained the same (iron ore; cement, lime and stone; and coal and coke). Table C-5 provides annual import data from 1993 to 2000 for these three commodities. The table also provides the individual commodity forecast for 2000. These commodities increased from 56% of all imports in 1993 to 59% in 2000. During 2000, these three imports were above projected levels (9.2 million metric tons [actual] versus 8.6 million metric tons [projected]). The growth rate for these commodities (combined) was 23.72% from 1999 to 2000.

10.3.2.6.2 Exports

Analysis of existing data indicates that total exports declined by 32% from the period 1993 to 2000, as presented in Table C-6. On an annualized basis, exports declined by 5.34% per year from 1993 to 2000. However, exports grew 15.01% during the most recent period (1999 to 2000). Coal and coke increased from 65% of all exports in 1993 to 73% in 2000. Actual exports were 58% of projected (7.9 million metric tons [actual] versus 13.8 million metric tons [projected]). Table C-7 provides a comparison of actual vs. projected exports. Table C-8 provides annual export data from 1993 to 2000 for coal and coke, grain, and oilseeds. The table also provides the individual commodity forecast for 2000. During 2000, coal and coke exports were at 65% of projected levels. The growth rate for this commodity was 16.12% from 1999 to 2000. The difference in this commodity (3.1 million metric tons) equals 53% of the total export change. The other large export difference is grain. During 2000, grain exports were approximately 11% of projected levels. The growth rate for this commodity was 412% from 1999 to 2000. There is an extreme amount of variability observed over the last eight years with a high of 1.4 million metric tons (1993) and a low of 31,000 metric tons (1999). The difference in this commodity (1.3 million metric tons) equals 22% of the total export change. Table C-9 shows the projected and actual commodity movement tonnage for coal and coke and grain, and provides graphic representations of visible trends for the commodities.

10.3.2.7 Market Share Analysis

Total foreign ocean-borne commerce at the Port of Baltimore is below the levels projected during the 1993 analysis. This difference is primarily attributable to factors external to the Port itself, as the growth rate in total U.S. volume has declined since 1993, and the entire North Atlantic Region has a smaller share of the U.S. market. Despite an overall decrease in the Port of Baltimore's share of the North Atlantic region, there are actually positive signs in data from recent years.

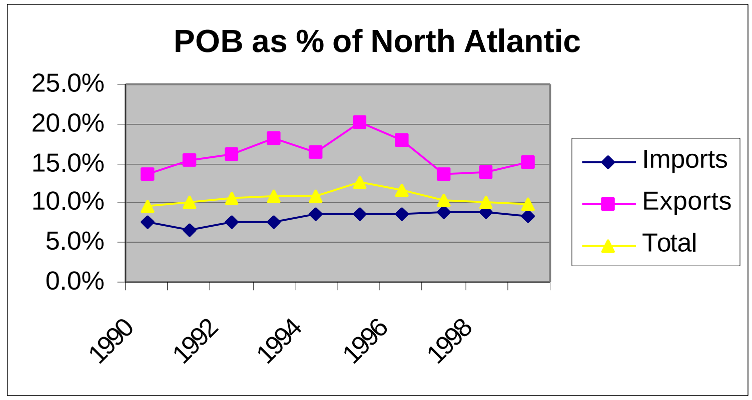
The Port of Baltimore share of the North Atlantic region’s imports have stabilized at approximately 8.5%, compared to 7.7% in 1993. The Port’s share of the North Atlantic’s exports are lower than in 1993, but increased from 13.8% in 1997 and 1998, to 15.1% in 1999.

Table 25 shows imports, exports, and total trade as a percentage of the North Atlantic region and the entire U.S. The table also shows the North Atlantic region share of the U.S. market. Port of Baltimore market shares have declined since the early 1990's. The share of the total U.S. market declined from 2.5% in 1993 to 1.9% in 1999, and the Port of Baltimore’s market share of the North Atlantic region declined from 10.8% in 1993 to 9.8% in 1999. Imports to the Port of Baltimore as a percent of the North Atlantic market have climbed slightly since the early 90's. The 1993 value was 7.7% and it increased to 8.8% in 1998. In 1999, the import percentage fell slightly from 8.8% to 8.4%.

TABLE 25 – PORT OF BALTIMORE AND N. ATLANTIC MARKET SHARE

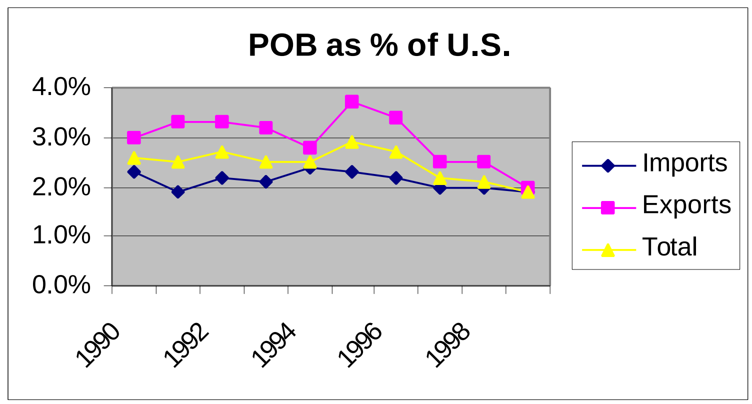
Port of Baltimore as Percent of North Atlantic Region

	Imports	Exports	Total
1990	7.5%	13.6%	9.6%
1991	6.5%	15.5%	10.0%
1992	7.7%	16.1%	10.7%
1993	7.7%	18.2%	10.8%
1994	8.7%	16.4%	10.8%
1995	8.7%	20.2%	12.6%
1996	8.5%	17.9%	11.5%
1997	8.8%	13.7%	10.3%
1998	8.8%	13.8%	10.1%
1999	8.4%	15.1%	9.8%



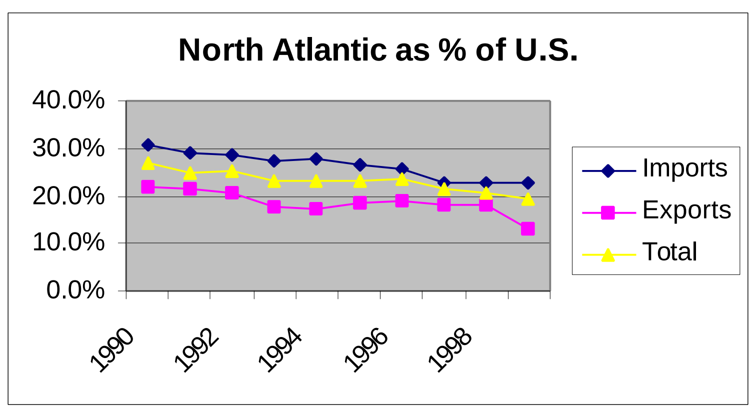
Port of Baltimore as Percent of Total U.S. Market

	Imports	Exports	Total
1990	2.3%	3.0%	2.6%
1991	1.9%	3.3%	2.5%
1992	2.2%	3.3%	2.7%
1993	2.1%	3.2%	2.5%
1994	2.4%	2.8%	2.5%
1995	2.3%	3.7%	2.9%
1996	2.2%	3.4%	2.7%
1997	2.0%	2.5%	2.2%
1998	2.0%	2.5%	2.1%
1999	1.9%	2.0%	1.9%



North Atlantic Region as Percent of Total U.S. Market

	Imports	Exports	Total
1990	30.7%	22.1%	27.1%
1991	29.2%	21.3%	25.0%
1992	28.6%	20.5%	25.2%
1993	27.3%	17.6%	23.1%
1994	27.6%	17.1%	23.1%
1995	26.4%	18.3%	23.0%
1996	25.9%	19.0%	23.5%
1997	22.7%	18.2%	21.4%
1998	22.7%	18.1%	20.8%
1999	22.6%	13.2%	19.4%



Source: Waterborne Commerce Statistics Center

Exports have been highly volatile over the time period. The Port of Baltimore's share of North Atlantic exports was 18.2% in 1993 and climbed to 20.2% by 1995. After falling to 13.8% in 1998, the Port's share of the North Atlantic's exports rebounded to 15.1% in 1999. North Atlantic Region imports as a percent of total U.S. market have been falling since the early 1990's. The 1993 value was 27.3%, which was down from 30.7% in 1990, and values have leveled off at around 22.6% since 1997. Exports have been more volatile. The 1993 value was 17.6%, which was down from 22.1% in 1990. Values seemed to have leveled off between 18% and 19%, and then dropped to 13.2% in 1999. The total market share dropped from 23.1% in 1993 to 19.4% in 1999.

10.3.2.7.1 Coal

Baltimore as a percentage of U.S. exports of coal and coke has remained steady at 7.5% to 8% since 1997. The North Atlantic region as a percentage of the U.S. market has declined sharply, from 47.5% in 1997 to 34.9% in 2000. Baltimore as a percentage of the North Atlantic region has increased sharply, from 15.7% in 1997 to 22.4% in 2000. In addition, total U.S. exports of coal and coke declined from 95 million metric tons in 1997 to 69 million in 1999, and then rebounded to 74 million in 2000. The difference at Baltimore is likely due in large part to changes in national export trends.

10.3.2.7.2 Grain

Baltimore as a percentage of the North Atlantic region grain exports fluctuated wildly, from 3% to 15%. Baltimore as a percentage of U.S. has remained fairly constant at 0.2% or less since 1997; however, this is a significant decrease from 1.4% in 1993. And since the 2000 projections were based on the 1993 actuals, this has led to a fairly large difference in the 2000 data. Exports of unmilled wheat and feeding stuff for animals declined from 735,000 metric tons in 1993 to 416,698 in 1999 at Norfolk (versus a decrease at Baltimore of 1.4 million in 1993 to 160,000 in 2000), which may indicate a regional problem.

10.3.2.8 Trade Routes

Trade is becoming more concentrated in the top ten trade routes (79% of the total in 2000 vs. 68% in 1993). The two largest trade routes remain strong (Northern Europe and the East Coast of South America). There are significant changes in the composition of the remaining top ten trade routes, with Canada beginning to play a major role in foreign ocean-borne commerce through the Port of Baltimore.

The composition of foreign ocean-borne commerce is shifting away from exports and toward imports. The largest increases in imports (versus projections) are in iron ore and cement, lime and stone. The largest decreases in exports (versus projections) are in coal and coke, and grain. The largest differences are seen in exports to developed nations (Europe and Japan). The top ten trade routes made up 67.9% of all foreign commerce in 1993. Table 26 shows that the top ten trade routes made up 79.4% of all foreign ocean-borne commerce at the Port of Baltimore in the year 2000.

Tables C-10 and C-11, respectively, show that the top two trade routes (by tonnage) remain unchanged from 1993 to 2000. Exports to Northern Europe increased from 3.3 to 3.9 million metric tons, and imports from the East Coast of South America increased from 2.1 to 3.8 million metric tons. The effect of the North American Free Trade Agreement (NAFTA) is clear in this analysis. Imports from the Caribbean Basin (including Mexico) increased from 1.1 to 1.4 million metric tons, and this trade route increased from 7 to 5 on the top ten list of trade routes (by tonnage). In fact, trade with Canada did not appear on the top ten list of trade routes in 1993, though exports to Canada are now the third largest, with 3.3 million metric tons in 2000. Imports from Canada are now the number 8

TABLE 26 – MAJOR TRADE ROUTES 2000

WSTS Partner Region	Metric Tons
Port of Baltimore to Northern Europe	3,892,478
East Coast of South America to Port of Baltimore	3,760,428
Canada to Port of Baltimore	3,261,560
Northern Europe to Port of Baltimore	1,864,709
Caribbean Basin to Port of Baltimore	1,379,033
Japan to Port of Baltimore	1,105,975
Port of Baltimore to Other Mediterranean	1,091,296
Port of Baltimore to Canada	849,043
West Coast of South America to Port of Baltimore	806,157
Port of Baltimore to Southern Europe	760,306
Australia / New Zealand to Port of Baltimore	659,094
Port of Baltimore to East Coast of South America	373,072
Port of Baltimore to Japan	213,771
Port of Baltimore to Eastern Europe	40,377
Total	**20,057,300**
Total Foreign Trade During 2000	**23,643,180**
Major Trade Routes - Percent of Total	**84.8%**
Top Ten Trade Routes as a Percent of Total	**79.4%**

*WSTS = World Sea Trade Service

trade route, with 0.8 million metric tons in 2000. Trade with Canada constitutes 17.4% of all foreign trade through the Port of Baltimore during 2000.

Table C-13 shows that of the original top ten trade routes, the largest positive difference between 2000 actual and projected volume is seen in imports from the East Coast of South America, which are 0.7 million metric tons higher than projected. The table also shows that trade with Northern Europe is also slightly higher than projected for 2000. Exports to Northern Europe are 0.3 million metric tons higher than projected, and imports from Northern Europe are 0.4 million metric tons higher than projected. Of the original top ten trade routes, there are quite a few significant differences in 2000 actual versus projected volume. Exports to Eastern Europe are 1.9 million metric tons lower than projected. Exports to Japan and Southern Europe are both 1.1 million metric tons lower than projected. Exports to Other Mediterranean countries are 1.0 million metric tons lower than projected. Exports to the East Coast of South America are 0.8 million metric tons lower than projected. Imports from Australia and New Zealand are 0.5 million metric tons lower than projected.

Tables C-14 and C-15 show that among the top ten trade routes, the mix is more heavily weighted toward imports. Table C-14 shows that 2000 imports along the top ten trade routes are approximately 5.1 million metric tons higher than projected. Imports of iron ore are 2.5 million metric tons higher than projected. Imports of cement, lime, and stone are 1.7 million metric tons higher than projected. Table C-15 shows that 2000 exports along the top ten trade routes are approximately 5.4 million metric tons lower than projected. Exports of coal and coke are 3.1 million metric tons lower than projected. Exports of grain are 0.9 million metric tons lower than projected.

10.3.2.9 Recent Contracts for the Port of Baltimore

The Port of Baltimore's strategic plan focuses on four key niche cargo areas: Roll-on/Roll-off (Ro/Ro) cargo, automobiles, forest and paper products, and container cargo. Since developing this plan five years ago, Baltimore has secured new and larger business deals in each area. Six major agreements have been finalized for the Port of Baltimore in the past thirteen months.

- On 10 July 2000, the Port signed an agreement with HUAL. It is the first line to introduce direct Ro/Ro service from the U.S. to West and South Africa.

- A three-year contract for Lloyd Triestino to ship as many as 15,000 new containers to Baltimore was signed November 14, 2000. This was the first contract representing a trend in the rise of containers handled by Baltimore.

- A five-year agreement was signed with UPM-Kymmene and Metsa-Serla on January 16, 2001. It is a significant forest and paper products agreement with one of Europe's finest manufacturers, and includes a 550,000 ton-per-year guarantee. The deal consolidates all of UPM-Kymmene's tonnage in Baltimore.

- On January 25, 2001, the Port signed its largest business deal ever in its 300-year history. This 20-year deal with Wallenius Wilhelmsen primarily focuses on Ro/Ro cargo and has up to three five-year extensions. It is expected to generate a minimum of $50 million in revenue over the next two decades.

- A three-year agreement was signed with Volvo Cars of North America on February 8, 2001. Baltimore will handle at least 33,000 Volvos during the first year, and the deal will boost the number of Ford family autos handled by Baltimore by 41 percent.

- On March 13, 2001, the Port signed its largest container agreement ever with Mediterranean Shipping Company, the 4th largest container shipper in the world. The 10-year agreement is expected to generate $75 million in revenue.

10.3.3 Findings

The analysis included an examination of the commodities (import and export) moving through the Port of Baltimore. The data show that while total ocean-borne commerce was lower than projected in 2000, recent growth trends are very positive. Imports remain quite strong, and are basically in line with projections made during the feasibility study. The bulk of the difference stems from exports. The difference in total foreign commerce (actual versus projected) equals 6.2 million metric tons. About 71% of the difference during 2000 stems from exports of coal and coke (3.1 million) and grain (1.3 million).

10.3.3.1 Imports

The trend in the growth of imports is important because imports are expected to play an increasingly larger role in total tonnage brought through the Port of Baltimore over the next 50 years. The trade gap between imports and exports is projected to grow from 2.3 million metric tons in 2000 to 46.1 million metric tons by 2050. During this period, imports are expected to grow from 54% of the total tonnage in the Port to 69% of the total tonnage. Due to the forecast of this gap, the growth (or reduction) in imports will have a far greater impact on the project economics than the growth (or reduction) in exports.

Annual growth rates for imports are expected to range between 2.5% and 5.7% over the 50-year period of evaluation. Imports increased 4.9% per year from 1993 through 2000. The Port of Baltimore share of the North Atlantic region's imports have been stabile at about 8.5%, and its share of the national imports has been around 2.1%, though slightly decreasing for the past few years. The East Coast of South America was the largest importing partner in 1993, and remains such in 2000. Imports from the East Coast of South America increased from 2.1 to 3.8 million metric tons during this period. In addition, the Port has been aided by NAFTA, with the Caribbean Basin (including Mexico) and Canadian trade routes establishing footholds on the top ten list of trade routes. Imports from Canada are now the number 8 trade route, although it failed to make the top ten in 1993.

Imports in 2000 were 98% of the projected value from the feasibility report. Based on this small differential, the expectation that imports will continue to grow with new trading partners such as Canada, and in light of recent contracts signed by the Port, it is expected that imports will continue to closely follow the level forecasted in the feasibility report.

10.3.3.2 Exports

Actual exports were 58% of projected. Total exports declined by 32% from 1993 to 2000, a decline of 5.34% per year. Coal and coke, and grain affected exports. During 2000, coal and coke exports were at 65% of projected levels. Grain exports were approximately 11% of projected levels. These two commodities account for three-quarters of the difference between projected 2000 exports and actual 2000 exports. Both of these commodities were up significantly in the most recent period (1999 – 2000). Coal and coke exports grew 16.12% and grain exports grew 412%.

10.3.3.2.1 Coal

U.S. coal exports began declining in 1992 when world supply began to exceed demand. They reached an initial low point for the decade in 1994 before recovering prior to bottoming out in 1999. They are now projected only to moderately exceed their present level during the next decade (International Trade Administration, U.S. Department of Commerce). While U.S. coal exporters are efficient producers and supply nearly 15 percent of world demand, the high cost of transportation makes U.S. coal marginally price-competitive in certain key foreign markets, and foreign producer subsidies (which remain in several European Union countries) continue to limit opportunities for U.S. coal in Western Europe, its major export market.

The United States is the largest coal producer in the world (with production over 1 billion tons) and one of a handful of major coal exporters. The 1993 total was a 28-million ton decline from the 1992 level because of certain factors, which continued into 1994. U.S. exports were negatively impacted by the availability of low-priced coal, primarily from South Africa, but also from Indonesia, Colombia, and Venezuela. That glut depressed a market already weakened by a worldwide recession, mounting power plant stockpiles (particularly in Europe), and expanded competition from other fuels. Also, coal contracts for 1994 were made while portions of the U.S. industry were on strike in late 1993, causing some customer reluctance to commit to shipments during this period. The 1994 total was 3 million tons less than that of 1993, but the 1995 total was a 16-million ton increase from the 1994 level. The 1994 decline was partly the result of the European economy's failure to turn around until late in the year. In 1995, with a pickup in the European economy and competitors sold out, the U.S. regained some market share and significantly increased sales in most of the western European markets. Total 1996 overseas exports held at the 1995 level, but exports to Canada increased by 2 million tons. In 1997, exports declined by 6 million tons, the result of competition from lower-cost producers and the substitution of natural gas for coal in the European utility sector. In 1998, exports declined by 5 million tons, again the result of competition from lower-cost producers and the continued substitution of natural gas for coal in the European utility sector. In 1999, exports fell to a record low level of 58 million tons, as the result of price cuts by Australia, the world's leading coal exporter, attributed to both strong productivity growth and a favorable exchange rate against the U.S. dollar. In 2000, exports maintained the previous year's level of 58 million tons, but there were several positive developments on the world market. Midway through the year, the price of Australian export coal began to rise, as excess stocks began to diminish (in tandem with increasing ocean freight rates). Also, worldwide steel production began to rebound.

The U.S. is the swing supplier in overseas steam coal markets. When competitors fail to exceed capacity, the U.S. expands market share. At present, however, competitors in Colombia, South Africa, Australia, and Indonesia are shipping lower-priced steam coal to European and Asian markets, driving down U.S. exports. Export markets for metallurgical coal have been declining over the past few years because of the expansion of new steel-making technologies requiring less high-grade coking coal. Consequently many U.S. metallurgical coal operations have closed, and increased amounts of metallurgical coal have been sold into the domestic utility steam coal market. However, U.S. world market share should not significantly decline, as only Australia and Canada offer significant competition to the U.S. in supplying coal used in steel-making and other manufacturing processes.

The national and Port of Baltimore trends are comparable for coal and coke. The peaks and valleys are more exaggerated in the Port of Baltimore data, but the overall trends are similar. The level of coal exports is generally affected by the exchange rate for the U.S. dollar. When the dollar is strong, as it has been through the mid to late 1990's, imports typically lead exports. On a cumulative basis (1994-2000), the total amount of coal and coke shipped through the Port of Baltimore (imports plus exports) is 94.2% of that projected.

It is expected that the Port of Baltimore's exports of coal will continue to mirror the national trend.

10.3.3.2.2 Grain

Like others in the U.S. economy, grain producers merged to create fewer, larger, more sophisticated farm production operations. Similar consolidation occurred in the areas of farm input, food processing, food wholesaling, food service and food retailing. U.S. grain exports have been cyclical and often volatile from year to year. The world grain market grows as incomes improve globally, and markets which previously had been closed (such as the former Soviet Union) become major customers for grain. With a growth in U.S. grain production and exports comes a corresponding growth in infrastructure to provide the necessary storage, rail, barge, and ocean freight distribution system. U.S. feed grain exports peaked in 1979-80, and dropped significantly in the mid-1980's. In the early 1990's, exports rebounded to but dropped again in the mid-1990's. The drop coincided with problems in the economies of the former Soviet Union and Asian customers (Japan, Thailand, Korea, etc.). Concurrently, Argentina and Brazil became major competitors in corn and soybean export markets, and Western Europe became a net exporter in the late 1980's, reducing the U.S. share of world exports.

Also during this period, the growth of the U.S. poultry and livestock feeding sector and the domestic grain industries led to greater domestic use of grain and soybeans, and a reduced role for exports in the U.S. marketing system. With the extreme volatility of U.S. grain exports in relatively short periods of time, substantial excess infrastructure capacity is needed to accommodate unanticipated surges in demand. In two out of the last seven years, these export surges caused volume changes of 55% from the high to the low export volumes. With excess capacity in the storage and distribution system in recent years, operating costs are often quite low, and "paper traders" have been effective competitors. Grain sold by a farmer to a local elevator and ultimately destined for export may have several changes of ownership, with prices established several times at different locations - at rail terminals, river terminals and export terminals. Grain may be diverted from that distribution stream by competitive bidding from livestock producers, feed companies, or corn and soybean processors along the way.

ADM/Countrymark Grain is the exporter of grain from the Port of Baltimore, and was contacted regarding recent exports of grain. The facility manager indicated that for their most recent fiscal year (1 July 2000 – 30 June 2001) his facility realized a large increase in grain exports from their facility over their previous fiscal year. During their 2000 fiscal year, their facility exported 420,914 tons of grain. During their 2001 fiscal year, they exported 1.3 million tons of grain. This represents 93% of the projected value for 2000 and may represent just a minor lag in the commodity growth. Over time, the forecast in the feasibility report projected bulk commodities to decline in importance to 81 percent of Baltimore's exports by weight in 2000 and 69 percent in 2020. The trade in these commodities through Baltimore was not forecasted to grow rapidly over the years. By the year 2000, these commodities were expected to exhibit a modest average decline of 2 percent. A generally negative trend was expected to continue in the following decade, as tonnage of oilseeds and grain declined. In the years after 2010 (to 2050) small declines were projected based on growth in alternative global grain sources.

Although the trends in grain exports are volatile, the Port of Baltimore's export of grain appears to have rebounded. Based on the projections from the feasibility report, a minor negative trend for the next decade is forecast. It is expected that grain exports will closely follow the level forecasted in the feasibility report.

10.3.3.3 Growth

Commodities and tonnages handled through the Port of Baltimore were forecast to grow from 22.9 million metric tons in 1993 to 37.6 million metric tons by 2010, a growth rate of about 2.95%. Between 2010 and 2050, the growth rate is expected to be 2.93%, to a total of 118.8 million metric tons. Slower than anticipated growth between 1993 and 2000 has resulted, primarily due to three factors. The growth rate in total U.S. foreign ocean-borne commerce has declined. The North Atlantic Region has a smaller market share of the total U.S. market. The Port of Baltimore currently has a slightly smaller market share of the North Atlantic Region than in 1993. Table C-15 shows imports, exports, and total commodity movements for the entire U.S. The table also provides calculated growth rates from 1990 to 1999. Annual growth rates have been highly volatile over the period 1990-1999. After annual growth rates of around 4% during the period 1993 to 1995, annual growth dropped off to around 1.5% per year during the period 1997 to 1999.

This period of "slower growth" makes it unlikely that the Port of Baltimore will reach the projections made in the feasibility report for total tonnage. This reduction in tonnage results in a reduction in the number of vessels calling the Port and affects the projected future use of the anchorages within the Port system. However, there are some positive signs for the Port. Total foreign commerce for the first quarter of 2001 is 3.6% over the same period in 2000, led largely by a 5.7% increase in imports. Exports were up 0.4%. The increase is being driven by total bulk cargo, which has an 8.7% increase (13.6% imports, 2.7% exports) for the first quarter. Subsequently, there was a 4.4% increase in the number of vessel arrivals, and traffic through the C&D Canal is up 17.4%. This could be an indication of the growth expected in light of the recent Port contracts. Recent, but less complete, data from the MPA and BME that include the second and third quarters of 2001 indicate that foreign commodity traffic is up 5.8% over 2000. With import tonnage arriving as forecasted, a rebound in the export of grain, and several new, large contracts for the Port, conditions are in place to realize the 2.93% to 2.95% annual growth projected for the 50-year period of evaluation. This growth, however, will begin from the 2000 commodity levels, not the 1993 commodity levels. The result of this shift from 1993 to 2000 is a 21% reduction in each of the forecasted commodity levels.

The reduction in forecasted commodity levels has a carry-over impact on traffic volumes. The traffic growth based on the commodity projections in the feasibility report was 4% per year between 2000 and 2010, 6% between 2010 and 2020, and 4% between 2020 and 2050. As with the commodity levels, conditions are in place to realize the annual growth projected for the 50-year period of evaluation. The 4% annual growth will begin with the 2000 traffic levels and result in about a 48% reduction in each of the forecasted traffic levels.

10.3.3.4 Vessel Operating Costs

The costs of operating vessels are different for domestic and foreign vessels due mostly to differences in construction and crewing costs between the two sets of vessels. The vessel operating costs used in Corps deep draft navigation projects are established each fiscal year based on research performed at the Institute for Water Resources (IWR). These vessel-operating costs are intended to be common across all studies so that economic evaluations are done consistently nationwide. For this analysis, the latest available operating costs were utilized. These costs were derived from Economics Guidance Memorandum 00-06 and are dated June 2000. The costs were reviewed from the perspective of their influence on Baltimore Harbor traffic economic analysis.

For foreign vessels, several vessel operating cost components have decreased during the past five years, in real terms, as foreign vessel owners have been able to continue to increase efficiency in operations. New vessel designs permit fewer crew to operate vessels while incremental improvements in technology have improved maintenance and operational costs as well. Vessel insurance markets have been very competitive within the last few years with resulting low rates, though some substantial losses in recent years have some marine insurance market analysts predicting rate increases for the next several years.

Unit costs of newly constructed vessel capacity have continued to decrease due in part to strong competition in the global ship building market between Korea, Japan, and shipbuilders in Europe and China. True resource-based construction costs for foreign vessels are difficult to establish due to the unavailability of accurate cost data for intermediate goods and services used in ship construction in the primary ship building countries. There is a substantial disagreement between European and Asian ship building countries on the levels or existence of government subsidies to the industry. There are also disagreements as to the level or existence of subsidies in major foreign supply industries such as steel manufacturing. Regardless of the causes, the net result has been a reduction in the real purchase prices of new vessels in recent years, which has been reflected in the lower operating foreign vessel cost data as produced by the IWR. Domestic vessel operators must purchase their vessels from U.S. shipyards, so are not able to take advantage of lower world vessel construction prices. However, U.S. shipyards still compete for the domestic business that does exist, and decreasing international commodity prices, such as for steel, are available to U.S. shipyards.

The major exception to this decreasing vessel cost trend has been in fuel costs that have recently increased substantially. Fuel costs can be a significant variable cost for both foreign and domestic vessel operators and bunker fuel prices in the United States are the same for a foreign or domestic vessel operator buying fuel. The specific methodology used by IWR has had the effect of dampening the impact of fuel price increases in recent years. Though the multi-year moving average cost approach reduces the influence of rapidly increasing or decreasing costs, if prices reach a new real plateau, the moving average approach will eventually catch up. However, for the fiscal year 2000 vessel operating costs, the recent increase in fuel costs is not yet fully reflected in the official cost data. If world oil prices stay at or around current levels for another year, then future year vessel operating cost data calculated the same way will reflect the higher fuel prices.

10.3.4 Updated Simulation Modeling

With the knowledge of the current system of operating and routing vessels, the various terminal locations and berths, and the distribution of traffic to the terminals, the simulation model was used to identify operating costs for each of the six benchmark years (2000, 2010, 2020, 2030, 2040, and 2050).

The traditional outputs of the model include the number of trips completed, time of travel, cumulative operating costs (for each vessel class), aggregate number of trips, time of travel, and costs, number of vessel meetings, and number of vessel passings. For the current study, additional code was added to the simulation in order to capture time in anchorage (for each vessel class), number of anchorages (for each anchorage, and vessel class), and average travel rates (for each vessel class and each travel cell in the system).

One question raised during the study process dealt with the number of simulation arrivals, relative to historical rates. The model is set up in such a manner that the actual arrival rate of vessels to the system is reduced in the case of a backlog of entering vessels. Thus the simulated arrival rate might be less than the true arrival rate. The rationale for this is that any improvements to the system may have an immediate impact on those vessels utilizing the system. In addition, such improvements provide increased capacity, in terms of faster throughput, to the system. By capturing the arrival process as it is, the system may recognize not only the impact on actual vessels using the system, but also the value of being able to accommodate additional traffic. Economists refer to this as an "opportunity value." While changes have been made to the program to force the arrival rate to match reality, this feature was not employed in this study.

Repeated simulations of vessels moving through the harbor system and the multiple vessel/pilot/tug/interactions that typically occur yielded estimates of elapsed time and costs incurred while in the Port of Baltimore harbor system. Summaries of these simulation runs are included in Appendix C. Through the use of this simulation modeling capability, coupled with the forecasts of commodity tonnages and vessel calls to the Port of Baltimore, the effects of proposed modifications to the authorized project were evaluated. Randomly generated simulations were conducted with the intent to produce 25 output scenarios for each benchmark year (2000 – 2050). During the course of the simulation modeling process, total cost outputs indicated increasing demands were being placed on the available port infrastructure. This is due to a combination of factors including but not limited to increased vessel calls, limited loading/unloading capacity, and unloading/loading productivity rates. In several instances in the 2050 time frame, the modeling efforts revealed port infrastructure limitations were creating unreliable output. Because of this, the outputs and benefits identified were truncated at year 2040 and were held constant for the 2050 benchmark year. A similar situation during the feasibility study resulted in the truncation of outputs and benefits at year 2030. The results of the LRR analysis are displayed in Tables 27 and 28.

TABLE 27 – SIMULATION RUNS, LRR

WITHOUT PROJECT				WITH PROJECT			
Simulation Run #	Year 2000	Vessel Calls	Unit Cost	Simulation Run #	Year 2000	Vessel Calls	Unit Cost
1	$26,546,037	783	$33,902.98	1	$26,241,795	783	$33,514.43
2	$24,611,766	750	$32,815.69	2	$24,330,305	750	$32,440.41
3	$23,392,938	728	$32,133.16	3	$22,858,320	728	$31,398.79
4	$22,565,818	697	$32,375.64	4	$22,044,510	697	$31,627.70
5	$24,166,222	732	$33,013.96	5	$23,881,033	732	$32,624.36
6	$24,262,388	752	$32,263.81	6	$23,956,192	752	$31,856.64
7	$24,450,491	754	$32,427.71	7	$24,147,048	754	$32,025.26
8				8			
9	$25,787,990	761	$33,886.98	9	$25,243,714	761	$33,171.77
10	$23,534,544	737	$31,932.90	10	$23,104,502	737	$31,349.39
11	$23,854,567	704	$33,884.33	11	$23,547,764	704	$33,448.53
12	$23,980,447	730	$32,849.93	12	$23,716,983	730	$32,489.02
13	$23,134,315	716	$32,310.50	13	$22,870,660	716	$31,942.26
14	$22,276,670	686	$32,473.28	14	$21,942,630	686	$31,986.34
15	$24,662,529	777	$31,740.71	15	$24,377,915	777	$31,374.41
16				16			
17	$23,758,767	716	$33,182.64	17	$23,504,619	716	$32,827.68
18	$22,715,129	690	$32,920.48	18	$22,429,003	690	$32,505.80
19				19			
20	$23,702,122	737	$32,160.27	20	$23,418,985	737	$31,776.10
21	$22,394,417	689	$32,502.78	21	$22,059,817	689	$32,017.15
22	$22,399,403	683	$32,795.61	22	$22,244,964	685	$32,474.40
23				23			
24	$23,734,341	725	$32,737.02	24	$23,310,489	725	$32,152.40
25	$22,694,935	694	$32,701.64	25	$22,484,455	695	$32,351.73
Average	$23,744,087	725.8	$32,714.86	Average	$23,415,033	725.9	$32,254.98
	150-day savings:		$329,054	150-day unit savings:	$459.88		
	365-day savings:		**$800,698**				

Note: Runs which contained duplicate seeds were deleted from the economic analysis. Values are at October 1999 price levels.

TABLE 27 (continued) – SIMULATION RUNS, LRR

WITHOUT PROJECT				WITH PROJECT			
Simulation Run #	**Year 2010**	**Vessel Calls**	**Unit Cost**	**Simulation Run #**	**Year 2010**	**Vessel Calls**	**Unit Cost**
1	$35,984,819	1060	$33,947.94	1	$35,531,636	1060	$33,520.41
2	$34,434,256	1025	$33,594.40	2	$33,928,588	1023	$33,165.78
3	$35,603,631	1001	$35,568.06	3	$31,907,164	1002	$31,843.48
4	$31,711,517	969	$32,726.02	4	$31,222,346	969	$32,221.20
5	$33,307,978	1009	$33,010.88	5	$32,774,170	1009	$32,481.83
6	$33,750,690	1045	$32,297.31	6	$33,254,689	1045	$31,822.67
7	$34,897,910	1051	$33,204.48	7	$34,252,895	1052	$32,559.79
8				8			
9	$34,857,580	1049	$33,229.34	9	$34,584,696	1049	$32,969.20
10	$35,158,174	1045	$33,644.19	10	$34,476,877	1045	$32,992.23
11	$34,527,612	990	$34,876.38	11	$33,814,622	991	$34,121.72
12	$33,011,288	994	$33,210.55	12	$34,703,270	994	$34,912.75
13	$32,761,997	1003	$32,664.00	13	$32,229,892	1003	$32,133.49
14	$31,633,931	975	$32,445.06	14	$30,960,650	975	$31,754.51
15	$34,401,456	1065	$32,301.84	15	$33,967,030	1065	$31,893.92
16				16			
17	$33,879,583	997	$33,981.53	17	$33,270,478	996	$33,404.09
18	$33,766,383	1002	$33,698.99	18	$33,234,150	1002	$33,167.81
19				19			
20	$33,861,973	1024	$33,068.33	20	$32,997,531	1025	$32,192.71
21	$32,847,617	1000	$32,847.62	21	$32,532,424	1000	$32,532.42
22	$33,077,309	982	$33,683.61	22	$32,360,705	982	$32,953.87
23				23			
24	$35,105,686	1017	$34,518.87	24	$34,818,587	1017	$34,236.57
25	$32,226,995	980	$32,884.69	25	$31,562,979	980	$32,207.12
Average	$33,848,018	1013.5	$33,400.19	Average	$33,256,447	1013.5	$32,813.69
	150-day savings:		$591,572	150-day unit savings:	$586.50		
	365-day savings:		**$1,439,491**				

Note: Runs which contained duplicate seeds were deleted from the economic analysis. Values are at October 1999 price levels.

TABLE 27 (continued) – SIMULATION RUNS, LRR

WITHOUT PROJECT				WITH PROJECT			
Simulation Run #	**Year 2020**	**Vessel Calls**	**Unit Cost**	**Simulation Run #**	**Year 2020**	**Vessel Calls**	**Unit Cost**
1	$46,135,897	1356	$34,023.52	1	$45,370,515	1356	$33,459.08
2	$46,141,332	1284	$35,935.62	2	$43,495,392	1284	$33,874.92
3	$60,677,493	1289	$47,073.31	3	$58,307,033	1289	$45,234.32
4	$43,090,752	1221	$35,291.36	4	$40,363,113	1221	$33,057.42
5	$45,872,374	1294	$35,450.06	5	$44,767,951	1295	$34,569.85
6	$44,405,658	1302	$34,105.73	6	$43,328,075	1303	$33,252.55
7	$46,155,357	1353	$34,113.35	7	$44,914,400	1355	$33,147.16
8				8			
9	$49,576,463	1345	$36,859.82	9	$44,817,548	1349	$33,222.79
10	$49,682,766	1368	$36,317.81	10	$48,336,697	1368	$35,333.84
11	$42,901,260	1270	$33,780.52	11	$41,857,813	1270	$32,958.91
12	$43,163,620	1281	$33,695.25	12	$42,478,651	1282	$33,134.67
13	$43,893,944	1257	$34,919.61	13	$41,608,770	1265	$32,892.31
14	$42,038,807	1269	$33,127.51	14	$41,523,973	1270	$32,696.04
15	$44,575,470	1368	$32,584.41	15	$43,553,570	1368	$31,837.40
16				16			
17	$43,445,211	1275	$34,074.68	17	$42,748,539	1275	$33,528.27
18	$42,961,530	1296	$33,149.33	18	$42,442,634	1297	$32,723.70
19				19			
20	$56,191,734	1306	$43,025.83	20	$54,947,483	1307	$42,040.92
21	$42,204,435	1279	$32,997.99	21	$41,541,708	1280	$32,454.46
22	$43,430,682	1279	$33,956.75	22	$42,460,640	1279	$33,198.31
23				23			
24	$51,025,760	1302	$39,190.29	24	$49,877,874	1302	$38,308.66
25	$43,110,984	1237	$34,851.24	25	$42,094,685	1237	$34,029.66
Average	$46,222,930	1296.7	$35,644.00	Average	$44,801,765	1297.7	$34,521.68
	150-day savings:		$1,421,165	150-day unit savings:	$1,122.32		
	365-day savings:		**$3,458,168**				

Note: Runs which contained duplicate seeds were deleted from the economic analysis. Values are at October 1999 price levels.

TABLE 27 (continued) – SIMULATION RUNS, LRR

WITHOUT PROJECT				WITH PROJECT			
Simulation Run #	**Year 2030**	**Vessel Calls**	**Unit Cost**	**Simulation Run #**	**Year 2030**	**Vessel Calls**	**Unit Cost**
1	$56,753,728	1635	$34,711.76	1	$55,382,726	1635	$33,873.23
2	$78,152,669	1555	$50,258.95	2	$77,327,518	1555	$49,728.31
3	$89,536,863	1574	$56,884.92	3	$89,201,182	1574	$56,671.65
4	$66,086,338	1496	$44,175.36	4	$65,927,789	1497	$44,039.94
5	$65,275,744	1566	$41,683.11	5	$52,123,540	1580	$32,989.58
6	$60,617,216	1573	$38,536.06	6	$52,691,441	1588	$33,181.01
7	$74,938,607	1595	$46,983.45	7	$74,178,341	1594	$46,535.97
8				8			
9	$75,410,152	1607	$46,926.04	9	$72,979,363	1608	$45,385.18
10	$70,759,527	1657	$42,703.40	10	$70,294,639	1655	$42,474.10
11	$53,637,414	1563	$34,316.96	11	$52,850,938	1564	$33,792.16
12	$81,655,771	1533	$53,265.34	12	$81,849,357	1533	$53,391.62
13	$51,095,394	1520	$33,615.39	13	$50,134,652	1521	$32,961.64
14	$71,867,193	1545	$46,515.98	14	$72,208,433	1546	$46,706.62
15	$68,332,496	1625	$42,050.77	15	$52,757,534	1636	$32,247.88
16				16			
17	$62,755,352	1553	$40,409.11	17	$59,541,252	1554	$38,314.83
18	$66,681,951	1588	$41,991.15	18	$66,391,294	1587	$41,834.46
19				19			
20	$89,526,599	1586	$56,448.04	20	$88,549,303	1585	$55,867.07
21	$75,653,112	1566	$48,309.78	21	$75,987,888	1565	$48,554.56
22	$73,991,839	1522	$48,614.87	22	$72,212,519	1522	$47,445.81
23				23			
24	$82,733,868	1584	$52,230.98	24	$85,464,148	1582	$54,022.85
25	$65,279,759	1512	$43,174.44	25	$64,425,530	1511	$42,637.68
Average	$70,511,504	1569.3	$44,943.14	Average	$68,213,304	1571.0	$43,459.82
	150-day savings:		$2,298,200	150-day unit savings:	$1,483.32		
	365-day savings:		**$5,592,287**				

Note: Runs which contained duplicate seeds were deleted from the economic analysis. Values are at October 1999 price levels.

TABLE 27 (continued) – SIMULATION RUNS, LRR

WITHOUT PROJECT				WITH PROJECT			
Simulation Run #	**Year 2040**	**Vessel Calls**	**Unit Cost**	**Simulation Run #**	**Year 2040**	**Vessel Calls**	**Unit Cost**
1	$71,594,972	1939	$36,923.66	1	$69,963,170	1939	$36,082.09
2	$105,278,695	1839	$57,247.79	2	$104,994,928	1840	$57,062.46
3	$118,147,149	1833	$64,455.62	3	$115,051,582	1835	$62,698.41
4	$96,009,101	1755	$54,706.04	4	$95,090,050	1754	$54,213.26
5	$66,092,790	1894	$34,895.88	5	$64,891,762	1894	$34,261.75
6	$86,467,341	1845	$46,865.77	6	$83,189,779	1846	$45,064.89
7	$103,366,891	1841	$56,147.14	7	$103,679,372	1840	$56,347.48
8				8			
9	$71,797,518	1914	$37,511.76	9	$101,581,706	1876	$54,148.03
10	$96,956,867	1913	$50,683.15	10	$90,956,354	1917	$47,447.24
11	$82,649,775	1829	$45,188.50	11	$64,447,174	1862	$34,611.80
12	$102,598,452	1788	$57,381.68	12	$100,151,881	1787	$56,044.70
13	$80,445,143	1781	$45,168.52	13	$60,085,871	1813	$33,141.68
14	$104,653,338	1778	$58,860.15	14	$105,314,989	1778	$59,232.28
15	$95,472,853	1884	$50,675.61	15	$91,929,345	1884	$48,794.77
16				16			
17	$94,514,419	1804	$52,391.58	17	$88,260,702	1811	$48,735.89
18	$93,029,015	1818	$51,171.08	18	$93,793,074	1815	$51,676.62
19				19			
20	$115,376,379	1863	$61,930.42	20	$114,952,857	1862	$61,736.23
21	$101,780,060	1827	$55,708.85	21	$102,701,757	1828	$56,182.58
22	$99,465,926	1768	$56,259.01	22	$95,807,965	1773	$54,037.21
23				23			
24	$112,046,303	1843	$60,795.61	24	$111,553,794	1842	$60,561.23
25	$93,527,414	1776	$52,661.83	25	$91,981,886	1775	$51,820.78
Average	$94,822,400	1834.9	$51,791.89	Average	$92,875,238	1836.7	$50,661.97
	150-day savings:		$1,947,162	150-day unit savings:	$1,129.92		
	365-day savings:		**$4,738,094**				

Note: Runs which contained duplicate seeds were deleted from the economic analysis. Values are at October 1999 price levels.

TABLE 28 – BENEFIT ANALYSIS

Calendar Year	Project Year	Nominal Benefits *	Present Value	Present Worth
2000		$800,698		
2001		$864,577		
2002	1	$928,457	0.942285041	$874,871
2003	2	$992,336	0.887901099	$881,096
2004	3	$1,056,215	0.836655924	$883,689
2005	4	$1,120,095	0.788368361	$883,047
2006	5	$1,183,974	0.742867714	$879,536
2007	6	$1,247,853	0.699993134	$873,489
2008	7	$1,311,733	0.659593060	$865,210
2009	8	$1,375,612	0.621524673	$854,977
2010	9	$1,439,491	0.585653402	$843,043
2011	10	$1,641,359	0.551852440	$905,788
2012	11	$1,843,227	0.520002300	$958,482
2013	12	$2,045,094	0.489990388	$1,002,077
2014	13	$2,246,962	0.461710613	$1,037,446
2015	14	$2,448,830	0.435063004	$1,065,395
2016	15	$2,650,697	0.409953361	$1,086,662
2017	16	$2,852,565	0.386292920	$1,101,926
2018	17	$3,054,433	0.363998040	$1,111,808
2019	18	$3,256,300	0.342989908	$1,116,878
2020	19	$3,458,168	0.323194259	$1,117,660
2021	20	$3,671,580	0.304541116	$1,118,147
2022	21	$3,884,992	0.286964538	$1,114,855
2023	22	$4,098,404	0.270402392	$1,108,218
2024	23	$4,311,816	0.254796129	$1,098,634
2025	24	$4,525,228	0.240090581	$1,086,465
2026	25	$4,738,640	0.226233763	$1,072,040
2027	26	$4,952,052	0.213176690	$1,055,662
2028	27	$5,165,463	0.200873207	$1,037,603
2029	28	$5,378,875	0.189279818	$1,018,113
2030	29	$5,592,287	0.178355541	$997,415
2031	30	$5,506,868	0.168061758	$925,494
2032	31	$5,421,449	0.158362081	$858,552
2033	32	$5,336,029	0.149222220	$796,254
2034	33	$5,250,610	0.140609865	$738,288
2035	34	$5,165,191	0.132494573	$684,360
2036	35	$5,079,771	0.124847654	$634,198
2037	36	$4,994,352	0.117642077	$587,546
2038	37	$4,908,933	0.110852369	$544,167
2039	38	$4,823,514	0.104454529	$503,838
2040	39	$4,738,094	0.098425940	$466,351
2041	40	$4,738,094	0.092745291	$439,436
2042	41	$4,738,094	0.087392501	$414,074
2043	42	$4,738,094	0.082348646	$390,176
2044	43	$4,738,094	0.077595897	$367,657
2045	44	$4,738,094	0.073117453	$346,437
2046	45	$4,738,094	0.068897483	$326,443
2047	46	$4,738,094	0.064921067	$307,602
2048	47	$4,738,094	0.061174150	$289,849
2049	48	$4,738,094	0.057643487	$273,120
2050	49	$4,738,094	0.054316595	$257,357
2051	50	$4,738,094	0.051181715	$242,504
	TOTAL	$187,481,861		$39,443,932
			ANNUAL BENEFIT	**$2,546,300**

* Values are at October 1999 price levels, using 6 1/8% interest rate.

10.3.5 Benefit to Cost Ratio

The benefit-cost ratio and net benefits for the recommended modification to the authorized project are shown below. The modification exhibits a final BCR of 1.3. This plan continues to provide the most net benefit return of all plans considered, with annual net benefits of $609,000 and is the NED plan. To calculate the annualized investment costs, the project cost estimate noted in Appendix B (October 2000 price levels) was first converted to October 1999 price levels to match the benefit values. This calculation is shown in Table 29. The project investment cost includes interest during construction and associated placement site costs. A summary of the economic analysis is shown below:

Total Investment Cost	$29,010,000
Annualized Investment Cost	$1,873,000
OMRR&R	$64,000
Total Annual Cost	$1,937,000
Total Annual Benefits	$2,546,000
Benefit-Cost Ratio	1.3
Net Benefits	$609,000

Given the variability in the simulation model's output for the years 2030 through 2050, the project team performed a break-even analysis of the project's economics. For this analysis, the cumulative benefits were compared to the cumulative project costs (investment costs plus operation and maintenance costs) year by year to see when the cumulative benefits start to exceed the cumulative costs. This "break-even" point represents the point where benefits would not need to grow further to justify the project. As shown in Table 30, this point is reached in Year 18 (2019) for the Anchorages project. Accordingly, any commodity or vessel growth beyond this year would enhance the project's economic justification.

11.0 CHANGES IN COST ALLOCATION

The Baltimore Harbor Anchorages and Channels Project was authorized by Congress to serve the needs of navigation only, and no other water use or purpose was identified. Accordingly, cost allocation was not warranted, since all benefits accrue to navigation. The current recommended plan continues this cost allocation to the navigation purpose. There are no changes in cost allocation.

12.0 CHANGES IN COST APPORTIONMENT

The project cost features for the Anchorages project were apportioned to the Federal and non-Federal entities in the March 1997 feasibility report. This apportionment was based on project costs for the general navigation features between the depths of 20 and 45 feet being shared at 75 percent Federal and 25 percent non-Federal; this cost-sharing requirement applies to nearly all of the project features. The one exception is the Fort McHenry turning basin. For this feature, the cost of the dredging increment below 45 feet is cost-shared at 50 percent Federal and 50 percent non-Federal. The project costs for design and construction management were then prorated based on the effective cost-sharing percentage for the navigation features (74.23 percent Federal and 25.77 percent non-Federal). All betterments for the project are to be borne 100 percent by the non-Federal sponsor.

TABLE 29 – ANNUALIZED COST CALCULATION

Project Features	Current Full Funding Estimate [1]	FY01 Baseline Estimate [1]	FY00 Baseline Estimate [2]
12 Navigation Ports and Harbors			
02 Harbors			
01 Mob, Demob and Preparatory Work	$4,162,000	$4,033,000	$3,904,000
15 Mechanical Dredging			
02 Site Work			
AA East Dundalk Channel	$222,000	$216,000	$209,000
BB Seagirt/Connecting/West Dundalk	$2,242,000	$2,172,000	$2,103,000
CC South Locust Point	$1,282,000	$1,242,000	$1,202,000
DD Cutoff Angle	$0	$0	$0
EE Anchorage #3 Modification	$12,755,000	$12,359,000	$11,964,000
FF Anchorage #4 Modification	$3,340,000	$3,237,000	$3,134,000
GG Turning Basin			
to 45-Foot	$1,069,000	$1,036,000	$1,003,000
to 50-Foot	$801,000	$776,000	$751,000
30 Planning Engineering and Design	$1,247,000	$1,247,000	$1,226,000
31 Construction Management	$896,000	$896,000	$855,000
Total Construction Cost w/o Placement Site & Betterment	**$28,016,000**	**$27,214,000**	**$26,351,000**
Hart-Miller Island Placement Site	**$1,385,000**	**$1,385,000**	**$1,385,000**
Subtotal	**$29,401,000**	**$28,599,000**	**$27,736,000**
Interest During Construction [3]			**$1,274,000**
Total Investment Cost			**$29,010,000**
Annualized Investment Cost @ 6 1/8%, 50 years			**$1,873,000**

NOTES:

(1) Current full funding estimate and the Fiscal Year 2001 baseline estimate values are derived from the M-CACES estimate presented in Append B of the LRR; these values are at October 2000 price levels.

(2) The Fiscal Year 2000 estimate is calculated by de-escalating the FY01 values by 1.033 for subaccount 12 costs and by 1.048 for subaccount 3(and 31 accounts. Some design costs and the HMI placement site expansion occurred prior to FY01, and subsequently were excluded from this de-escalation. These values are at October 1999 price levels.

(3) The interest during construction is based on an estimated 18-month construction schedule, using an interest rate of 6 1/8%.

TABLE 30 – BREAK-EVEN ANALYSIS

CALENDAR YEAR	INVESTMENT COSTS	CUMULATIVE INVESTMENT	PROJECT YEAR	NOMINAL BENEFITS	CUMULATIVE BENEFITS
2000	$ -	$ -		$800,698	$0
2001	$ 29,010,000	$ 29,010,000	**0**	$864,577	$0
2002		$ 29,010,000	**1**	$928,457	$928,457
2003		$ 29,010,000	**2**	$992,336	$1,920,793
2004		$ 29,010,000	**3**	$1,056,215	$2,977,008
2005		$ 29,010,000	**4**	$1,120,095	$4,097,102
2006	$ 320,000	$ 29,330,000	**5**	$1,183,974	$5,281,076
2007		$ 29,330,000	**6**	$1,247,853	$6,528,929
2008		$ 29,330,000	**7**	$1,311,732	$7,840,662
2009		$ 29,330,000	**8**	$1,375,612	$9,216,273
2010		$ 29,330,000	**9**	$1,439,491	$10,655,764
2011	$ 320,000	$ 29,650,000	**10**	$1,641,359	$12,297,123
2012		$ 29,650,000	**11**	$1,843,226	$14,140,349
2013		$ 29,650,000	**12**	$2,045,094	$16,185,443
2014		$ 29,650,000	**13**	$2,246,962	$18,432,405
2015		$ 29,650,000	**14**	$2,448,830	$20,881,235
2016	$ 320,000	$ 29,970,000	**15**	$2,650,697	$23,531,932
2017		$ 29,970,000	**16**	$2,852,565	$26,384,497
2018		$ 29,970,000	**17**	$3,054,433	$29,438,929
2019		**$ 29,970,000**	**18**	**$3,256,300**	**$32,695,230**
2020		$ 29,970,000	**19**	$3,458,168	$36,153,398
2021	$ 320,000	$ 30,290,000	**20**	$3,671,580	$39,824,978
2022		$ 30,290,000	**21**	$3,884,992	$43,709,969
2023		$ 30,290,000	**22**	$4,098,404	$47,808,373
2024		$ 30,290,000	**23**	$4,311,816	$52,120,189
2025		$ 30,290,000	**24**	$4,525,228	$56,645,416
2026	$ 320,000	$ 30,610,000	**25**	$4,738,639	$61,384,056
2027		$ 30,610,000	**26**	$4,952,051	$66,336,107
2028		$ 30,610,000	**27**	$5,165,463	$71,501,570
2029		$ 30,610,000	**28**	$5,378,875	$76,880,445
2030		$ 30,610,000	**29**	$5,592,287	$82,472,732
2031	$ 320,000	$ 30,930,000	**30**	$5,506,868	$87,979,600
2032		$ 30,930,000	**31**	$5,421,448	$93,401,048
2033		$ 30,930,000	**32**	$5,336,029	$98,737,077
2034		$ 30,930,000	**33**	$5,250,610	$103,987,687
2035		$ 30,930,000	**34**	$5,165,191	$109,152,878
2036	$ 320,000	$ 31,250,000	**35**	$5,079,771	$114,232,649
2037		$ 31,250,000	**36**	$4,994,352	$119,227,001
2038		$ 31,250,000	**37**	$4,908,933	$124,135,933
2039		$ 31,250,000	**38**	$4,823,513	$128,959,447
2040		$ 31,250,000	**39**	$4,738,094	$133,697,541
2041	$ 320,000	$ 31,570,000	**40**	$4,738,094	$138,435,635
2042		$ 31,570,000	**41**	$4,738,094	$143,173,729
2043		$ 31,570,000	**42**	$4,738,094	$147,911,823
2044		$ 31,570,000	**43**	$4,738,094	$152,649,917
2045		$ 31,570,000	**44**	$4,738,094	$157,388,011
2046	$ 320,000	$ 31,890,000	**45**	$4,738,094	$162,126,105
2047		$ 31,890,000	**46**	$4,738,094	$166,864,199
2048		$ 31,890,000	**47**	$4,738,094	$171,602,293
2049		$ 31,890,000	**48**	$4,738,094	$176,340,387
2050		$ 31,890,000	**49**	$4,738,094	$181,078,481
2051	$ 320,000	$ 32,210,000	**50**	$4,738,094	$185,816,575

* Values are at October 1999 price levels, using an interest rate of 6 1/8%.

This cost apportionment method from the feasibility study was applied to the revised costs for the current full funding estimate; there is no change in the cost apportionment methodology. The current cost apportionment figures are shown in Table 4. As noted in Table 4, the total Federal share of the construction cost amounts to $20.8 million, while the non-Federal sponsor will be required to pay nearly $7.4 million during the construction period. The 10-percent construction payback amounts to $2.8 million, of which about one-half ($1.38 million) will be credited for the sponsor's cost of the disposal site and one-half ($1.42 million) is required to be paid over a 30-year period beginning in 2003.

13.0 ENVIRONMENTAL CONSIDERATIONS IN RECOMMENDED CHANGES

In compliance with the National Environmental Policy Act of 1969, as amended, a supplemental environmental assessment (EA) has been prepared that evaluates and documents the potential environmental effects associated with proposed modifications to the authorized Anchorages project. The supplemental EA is included as Appendix D. Potential impacts from the proposed action are assessed with regard to the physical, chemical, and biological characteristics of the aquatic and terrestrial ecosystem, endangered and threatened species, hazardous and toxic materials, aesthetics and recreation, cultural resources, and the general needs and welfare of the public.

Potential impacts to the environment associated with implementation of the revised project will be minor and temporary in nature. The dredging will occur in water that does not currently support significant aquatic resources. The area is located in a highly developed area that is heavily used by the shipping industry. Temporary impacts from the dredging, such as an increase in turbidity, an unavoidable disturbance of benthic habitat, and disruption to fish species in the area, will occur. However, all of these resources will revert back to the pre-construction condition within 18 months after the dredging activity has ceased.

The proposed revisions to the dredging plan for the anchorages and channels are still within the scope and study area of the original proposal discussed in the 1997 integrated feasibility report and EIS. Although design changes are proposed, the degree of impact to the area has not changed substantially from the 1997 proposal, other than the reconfiguration of the anchorage within the same work area and the decrease in amount of depth required for Anchorage #4. Dredging volumes have been reduced from 4.4 million cubic yards to 3.9 million cubic yards. The placement site for initial construction material remains at Hart-Miller Island. As a result of the Supplemental EA, a finding of no significant impact has been signed, 30 August 2001, and included in Appendix D.

14.0 CONCLUSIONS AND RECOMMENDATIONS

This limited re-evaluation study considered environmental, social, economic, and engineering concerns. Modifications to the Congressionally authorized and funded Anchorages project have been carefully reviewed and evaluated. For the Baltimore maritime community, as well as for the rest of the Nation, improvements to the anchorages and branch channels serving the Port of Baltimore continue to represent a cost-effective plan for reducing delays and increasing efficiency and safety. These modifications 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 MPA, I recommend that the authorized project for Baltimore Harbor Anchorages and Channels be modified to provide for:

- Reconfiguring Anchorage #3 to include two sections (42 feet deep, one section (#3A) to be 2,200 feet long and 2,200 feet wide, and the other section (#3B) to be 1,800 feet long and 1,800 feet wide) at the north corner of the intersection of Fort McHenry Channel and the Dundalk West Channel, while the unimproved portion of the existing anchorage (500 by 1,500 feet) will be maintained at its current 35-foot depth (see Section 5.2);

- Modifying the authorized depth from 42 feet to 35 feet in Anchorage #4 (see Section 5.2);

- Modifying the depth of the authorized widening of the East Dundalk Channel to 42 feet as a sponsor-requested betterment (see Section 6.1) and maintaining this depth at Federal expense in subsequent dredging cycles;

- Slightly widening the South Locust Point loop channel at the northern end (see Section 5.1);

- Moving the turning basin at the head of the Fort McHenry Channel slightly eastward of the authorized site (see Section 7.0); and

- Reducing the volume of dredged material being placed at HMI from 4.4 mcy to an estimated 3.9 mcy.

The cost of implementing the general navigation features, including initial deepening of the turning basin to a depth of 45 feet, is currently estimated to be approximately $27.2 million and will be shared 75 percent Federal ($20.4 million) and 25 percent non-Federal ($6.8 million). The remaining cost to deepen the turning basin from the depth of 45 feet to 50 feet will be shared 50 percent Federal ($400,000) and 50 percent non-Federal ($400,000). Consequently, the total combined cost for the proposed improvements will be approximately $20.8 million for the Federal government and approximately $7.2 million for the non-Federal sponsor, for a total cost of $28.0 million (not including the East Dundalk betterment).

In addition to these costs, the non-Federal sponsor is also required to pay 10 percent of the total project costs at the completion of construction, which is currently estimated to be approximately $2.8 million. Based on the costs to prepare the Hart-Miller Island placement site, currently estimated to be $1.38 million, the non-Federal sponsor will receive credit towards the 10-percent payment leaving a $1.42-million contribution required.

The recommendations contained herein reflect information that is currently available at this time and reflect 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. The recommendations and conclusions in this report are based on the best data available at this time to the Baltimore District. They have not undergone Washington level review by either the Corps of Engineers or the Administration, so this report’s conclusions and recommendations are subject to change. Subsequent to the Washington level review, the report will be finalized and the Corps of Engineers recommendations will be made.

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