CHOPTANK RIVER DREDGED MATERIAL PLACEMENT STUDY

MAIN REPORT
VOLUME I

[redacted]

PREPARED BY

Talbot County Department of Public Works

for

Maryland Department of Natural Resources

Tidewater Administration

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Talbot County Department of Public Works
Easton, Maryland
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SUMMARY

The Choptank River Dredged Material Placement Study assessed the dredging needs for Maryland's Eastern Shore counties of Talbot and Dorchester for the 10-year period 1980-1990. Nineteen Federal and twenty-three State/County dredging projects were identified and historically examined with regard to intervals between maintenance dredging operations, next projected maintenance operation and availability of a dredged material placement (DMP) site. A DMP plan was developed for six projects in Dorchester County and two projects in Talbot County. Each selected project had a high probability of being accomplished within the 10-year period and did not have an approved or potentially suitable DMP site associated with it.

Project specific candidate DMP sites were identified which were expected to be acceptable from both economic and environmental standpoints. The economic analysis included the costs of site acquisition and preparation, facility construction and management, and site reclamation together with the costs of dredging and transporting the channel sediments. The environmental analysis emphasized potential terrestrial sites, agricultural and wooded sites. Aquatic sites were also considered when there was a potential for a constructive use of the dredged material, such as shoreline erosion control.

The economic analysis indicated that DMP operations conducted at two small single-use facilities which accomodate a total volume of dredged material equal to that of single large multi-use facility were approximately 45% more costly than if conducted at the large facility. For Federal dredging projects, local project sponsors

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(county governments) are often responsible for the acquisition and preparation of a suitable DMP site. Because the cost of a DMP site is typically in proportion to the size of the site, and because county governments have limited financial resources local sponsors often opt for the smallest, suitable, single-use DMP site, even though a larger multi-use site could be less costly in the long-term.

The study concluded that long-term DMP planning may depend on the implementation of site management practices (eg. dewatering techniques). Site management could maximize the available volume in both single-use and multi-use DMP facilities. It would also permit a more rapid reclamation of sites for productive uses. However, project funding mechanisms for dredging projects do not normally include provisions for site management or reclamation by either local, State or Federal agencies.

PREFACE

In March, 1979, a meeting was held between representatives of Talbot and Dorchester counties and the Coastal Resource Division of the Maryland Department of Natural Resources to discuss the various problems confronting the county governments with regard to their participation in State and Federally sponsored dredging projects. Subsequent to that meeting, the Coastal Resources Division formulated the scope of work for the Choptank River Dredged Material Placement Study. In June, 1979, funding for accomplishment of the Study was provided by the Coastal Resources Division to Talbot County in the form of a grant which was administered by Talbot County Department of Public Works. The work described in this report was performed by a private consultant retained by Talbot County.

The Study was conducted during the period July, 1979, to October, 1980, under the direction of Paul B. Woller, Study Coordinator. During the course of the Study, meetings were held with representatives of the State and Federal agencies responsible for regulating dredging activities in attendance. The purpose of those meetings was to keep the requisite agencies informed of the progress of the Study and to provide an opportunity to keep the requisite agencies informed of the progress of the Study and to provide an opportunity for said agencies to make recommendations which would improve the utility of the Study. Copies of the draft final report were submitted to the aforementioned agencies for review and the final report was revised in response to comments which were received.

The author wishes to acknowledge the many individuals who provided technical information, guidance and assistance throughout the course of the Study, particularly the following:

Tom Dolan, Coastal Resources Division, Maryland Department of Natural Resources

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Robert Gaudette, Department of Public Works, Talbot County

Benjamin Linthicum, Dredging Division, Maryland Department of Natural Resources

Elridge Lloyd, Department of Roads, Dorchester County

Robert Rauch, Department of Public Works, Talbot County

Alan Visintainer, Department of Planning and Zoning, Caroline County

Reference to specific, potential dredged material placement sites in this report does not constitute any formal endorsement or approval of these sites by County, State or Federal governments or agencies. Discussion of specific sites was necessary in order to evaluate the feasibility of long range dredged material placement planning.

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I. INTRODUCTION

Historically, dredged sediments generated during development and maintenance of navigable waterways and harbors have been deposited primarily in open-water or on emergent wetlands (i.e., marshes). Such sites were generally chosen because of their close proximity to the dredging site and thus minimized dredged material transport costs. More recently, environmental considerations regarding dredged material placement (DMP) practices have promoted the use of land-based containment facilities. The most direct effect of these changes has been a substantial increase in the total cost of a dredging project due to (1) the acquisition of a terrestrial DMP site which meets a variety of environmental and engineeering criteria, (2) construction of the containment facility, and (3) the transport of dredged material greater distances. Additional costs may result in the event that the facility is designed for long-term use or if the site is to eventually be reclaimed as the implementation of specific management and maintenance activities would be required.

The resultant cost increases associated with dredging projects for which the major source of project funding derives from the Federal government can be expected to be partitioned between the local project sponsor and the Federal government in accordance with certain terms of local cooperation. By and large, the governing body of the county in which such projects are located is designated as the local project sponsor. The terms of local cooperation are defined by Federal legislation authorizing the project and require, among other items, that the local sponsor assume responsibility for various aspects of the dredged material placement operation. At a minimum, this responsibility consists of acquiring the DMP site, either through lease, purchase, or landowner donation, and providing said site to the Federal government free of charge. In certain instances, the terms of local cooperation may further require that the local sponsor also assume the costs associated with construction of the DMP facility. As there are currently no general provisions for Federal funding of facility management/maintenance operations and of site reclamation, the costs for these activities, if required, would need to be assumed by the local sponsor. Increases in project costs deriving from dredged material transport will generally be assumed by the Federal government, provided, of course, that such cost increases do not render the project economically unfavorable in terms of the cost-benefit ratio.

It is primarily because of their limited funding capabilities that local governments have found it increasingly difficult to comply with terms of local cooperation regarding DMP operations. This is particularly true of county governments which serve as the local sponsor for a large number of relatively small Federally authorized navigation projects. Within the State of Maryland, such projects are characterized by small dredged material volumes (e.g., 50,000- to 100,000-cy) generated during each maintenance operation and long intervals (e.g., > 10-years) between maintenance operations. Moreover, because of their widespread distribution within a given geographical area, a separate DMP site/facility is required for each project, thus precluding the development of a regional facility to serve several projects. This type of project is in marked contrast to those of much larger scale such as Baltimore Harbor, the C&D Canal, and other dredging projects associated therewith which are expected to generate as much as 145 million cubic yards (mcy) of dredged material during the 20-year period 1975-1995 while only 15-mcy are expected to derive from the former projects which include state and privately funded projects, during the same time period. Maintenance dredging schedules of the former projects, unlike those of the latter, are ill-defined and such work is conducted as the need arises thus necessitating identification and acquisition of DMP sites on relatively short notice and without the benefit of advance planning. Finally, the recent changes in DMP practices have produced an increase in the number and type of engineering and environmental criteria which must be satisfied before a DMP site is judged suitable. As those agencies at the county level of government which are usually responsible for site selection (e.g., Departments of Public Works, Planning and Zoning Commissions, etc.) are generally not well-acquainted with or fully cognizant of those criteria, a large degree of uncertainty can be expected to be associated with the potential suitability of a DMP site identified by these agencies.

These two factors - the apparent inability of local governments to withstand the increased costs of DMP operations and the difficulty with which local sponsors are able to identify suitable DMP sites on relatively short notice - have resulted in increased delays in conducting needed maintenance dredging operations. Moreover, when such operations are delayed to the extent that emergency or critical conditions arise, dredging is oftentimes accomplished utilizing less than optimum DMP methods and sites.

These problems were recognized and addressed in part by the Maryland Coastal Zone Management Program through provision of funding for the Choptank River Dredged Material Placement (CRDMP) Study. The CRDMP Study was formulated as a pilot study intended to assess the feasibility of developing a comprehensive DMP plan for dealing with dredged material expected to result from maintenance and new work dredging projects in the Choptank River Basin on Maryland's Eastern Shore for the 10-year period 1980-1990. The geographical limits of the study area were defined as that encompassed by the Maryland counties of Talbot and Dorchester (Fig. 1).

The Study was basically comprised of two phases, the first of which dealt with assessing the expected dredging needs within the study area for the period 1980-1990. The second phase consisted of developing a DMP plan for those dredging projects which, as determined by the dredging needs assessment, were expected to be accomplished between 1980 and 1990 and did not have associated therewith an approved or potentially suitable DMP site.

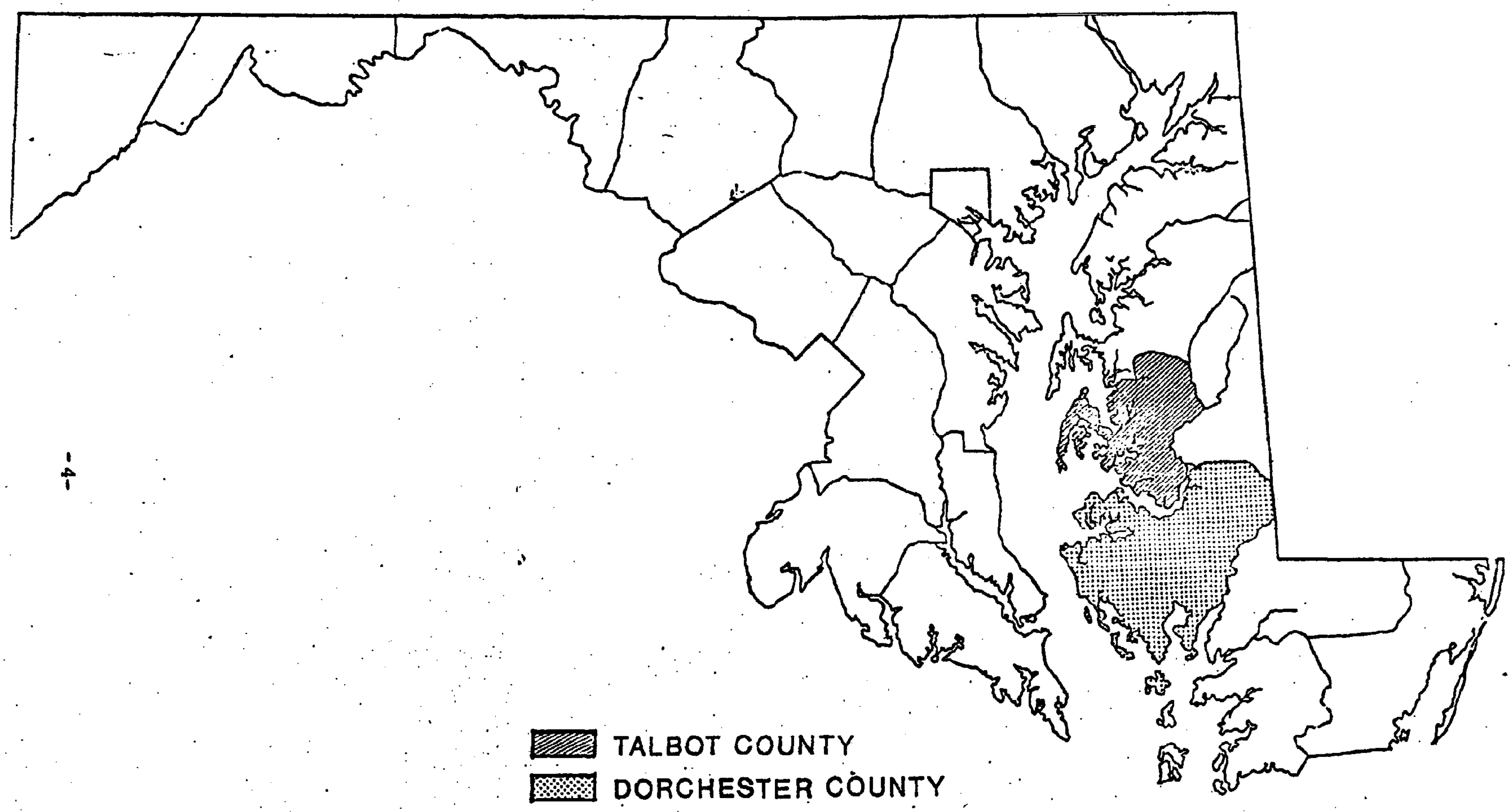

Figure 1. Map of the State of Maryland showing the locations of Talbot and Dorchester Counties.

II. STRUCTURE OF REPORT

This report is the Final Report of the CRDMP Study and describes the 10-year DMP plan which was developed for Talbot and Dorchester counties and the methods and approaches which were utilized. The report represents a revision of the study draft final report which was previously submitted to the requisite regulatory agencies for the purpose of review and to serve as a basis for soliciting comments regarding (1) the potential suitability of the proposed DMP sites and (2) the potential for implementation of the proposed plan in light of existing regulatory agency concerns pertaining to DMP activities. Revision of the proposed plan in response to comments received was expected to provide a more workable document which would be of maximum utility to local dredging project sponsors and to funding and regulatory agencies.

Section III of the report describes the 10-year DMP plan which was developed for Talbot and Dorchester counties. The results of the dredging needs assessment are summarized in Section III-A while Section III-B presents a general discussion of the approach whereby DMP plans were developed and the various factors upon which the approach was based. The DMP plans which were ultimately developed for specific dredging projects identified by the dredging needs assessment phase of the Study are given in Section III-C.

Section IV consists of Appendices A through E which contain data, information, and detailed discussions pertinent to the material presented in Section III.

III. PROPOSED 10-YEAR DREDGED MATERIAL PLACEMENT PLAN

A. Assessment of Dredging Needs

The dredging needs assessment identified a total of nineteen Federally authorized navigation projects within the two county area (Figs. 2 and 3; Table 1). One additional Federal project in Caroline County was included in the Study at the request of county officials. Construction and maintenance of these projects thru July 1980 had resulted in the extraction and relocation of approximately 4-mcy of dredged material.

Non-Federal (i.e., State, County, local) dredging projects within the study area were comparable in number (i.e., 23 projects) but were of considerably smaller scale than the Federal projects (Table 2). It is estimated that the volume of material derived from such projects through July 1980 was on the order of 125,000 cy.

Initially, dredging projects within the private sector were also to be included in the Study. The volume of material generated by individual projects of this type was usually less than 5,000 cy and as such did not present problems of the magnitude associated with the larger scale (e.g., $>$ 10,000 cy) DMP operations. That is, areas of adequate size for containment facilities (i.e., $<$ 0.5 acres with 6-ft high dikes) are more readily available and retaining structures are not so extensive (i.e., 4- to 6-ft dikes) as to present significant engineering and construction problems. Additionally, DMP sites of this size can be readily reclaimed and reclamation plans are usually formulated as a part of the total project. For these reasons, dredging projects within the private sector were excluded from consideration in the development of DMP plans for the study area.

A total of six Federal projects were identified as having a high probability of undergoing maintenance dredging operations during the ten year period 1980-1990 and (1) did not have associated therewith an approved or potentially suitable DMP site and/or (2) presented the potential for the development of long-term use DMP

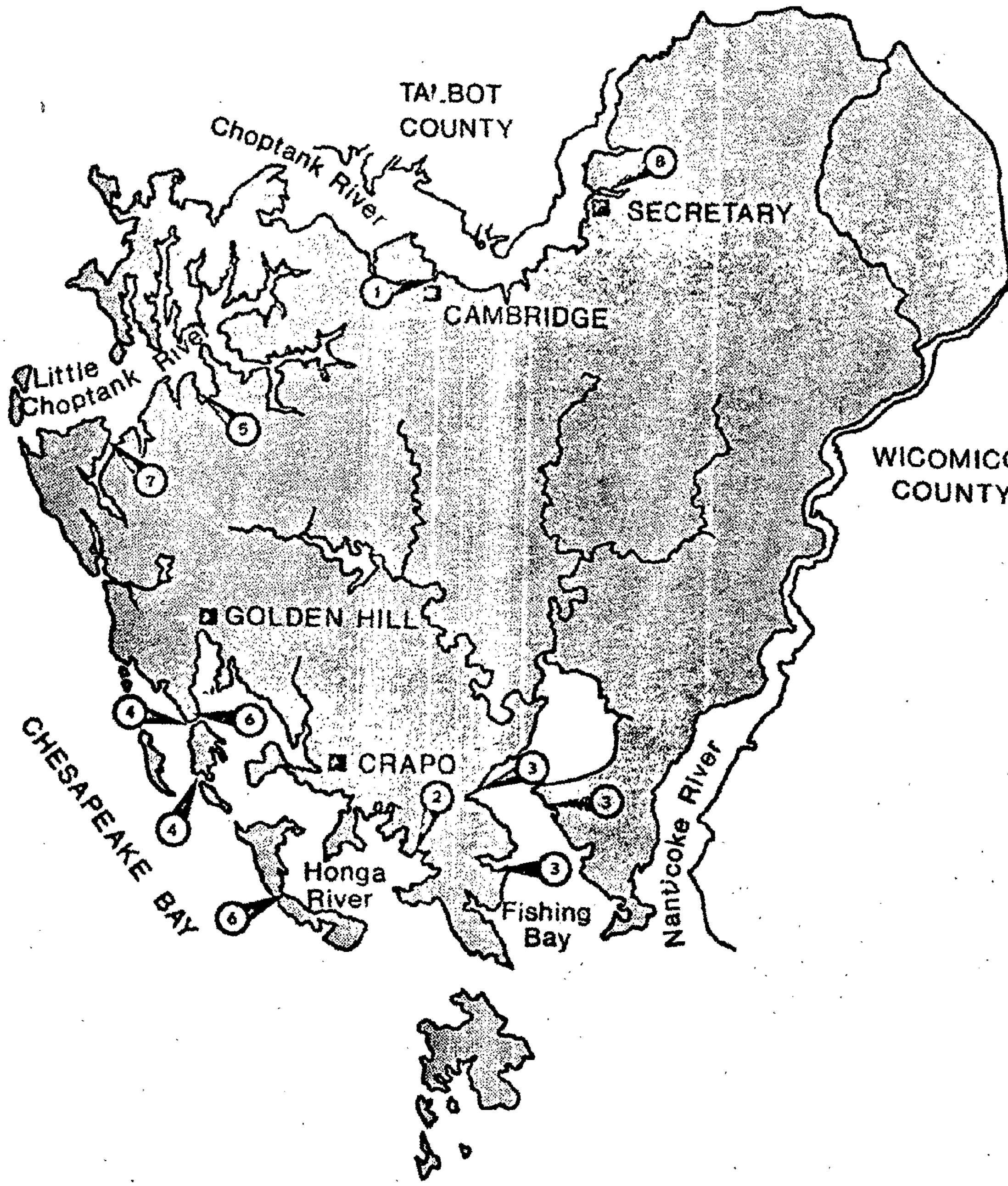

Figure 2. Map showing the locations of Federal dredging projects within Dorchester County, Maryland. Circled numerals correspond to projects listed in Table 1.

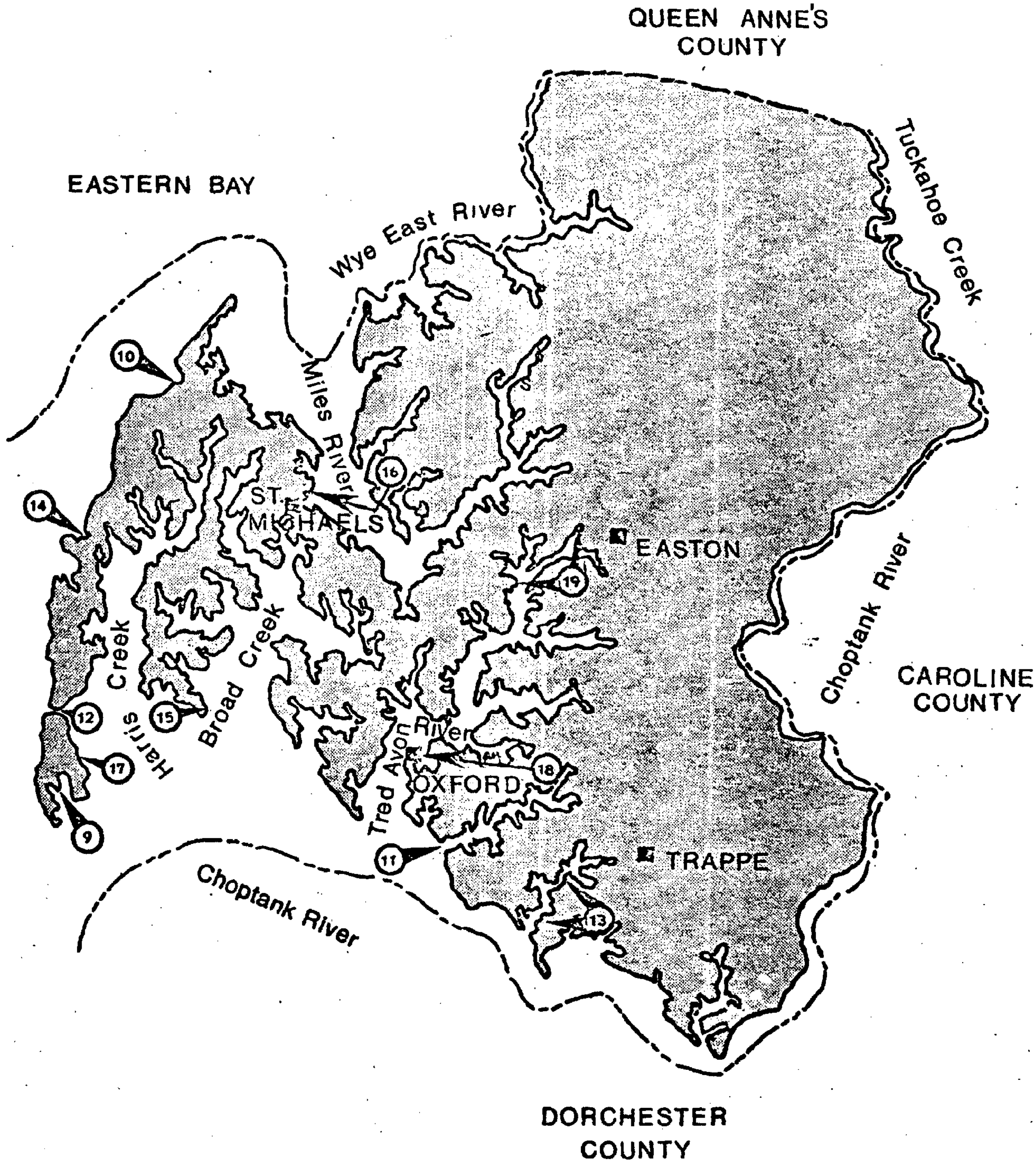

Figure 3. Map showing the locations of Federal dredging projects within Talbot County, Maryland. Circled numerals correspond to projects listed in Table 1.

Table 1

Summary of the Dredging Needs Assessment for Federal Navigation Projects in the Maryland Counties of Caroline, Dorchester, and Talbot

Project[a]	Maintenance Interval[b]	Average Annual Shoaling Volume[c]	Projected Maintenance Date[d]	Projected Maintenance Volume[e]	Availability of DMP Site[f]
DORCHESTER COUNTY					
Cambridge Harbor (1)	8 (0)[g]	9,200[g]	1987[g]	72,000[g]	Yes
Duck Point Cove (2)	16 (1)	2,800	1982	40,000	No
Fishing Bay (3)	10 (4)	7,500	1988	75,000	Yes
Honga River - Tar Bay (4)					
Barren Island Gap	4 (8)	14,000	1981, 85, 89	56,000[h]	No
Tar Bay	8 (6)	12,000	1981, 89	84,000[h]	No
Honga River	12 (5)	8,000	1981	120,000	No
Back Creek	> 24 (0)[m]	2,000[j]	1985[j]	55,000[j]	No
Madison Bay (5)	> 3 (0)[m]	-----[i]	> 1990[l]	------[i]	Yes
Muddy Hook Cove (6)	> 14 (0)[m]	1,500[j]	1985[j]	29,000[j]	No
Tyler Cove (6)	> 14 (0)[m]	1,000[j]	1981[j]	14,000[j]	No
Slaughter Creek (7)	5 (1)	8,000[j]	1981[i]	40,000[j]	No
Warwick River (8)	31 (1)	3,700	> 1990	150,000	No
TALBOT COUNTY					
Black Walnut Harbor (9)	11 (2)	4,300	1982	47,300	Yes
Claiborne Harbor[k] (10)	> 49 (0)[m]	-----[i]	> 1990[l]	------[i]	No
Island Creek (11)	> 41 (0)[m]	-----[i]	> 1990[l]	------[i]	No
Knapps Narrows (12)					
Chesapeake Bay	5 (7)	9,000	1982, 87	45,000[h]	Yes
Harris Creek	8 (6)	5,000	1982, 87	25,000[h]	Yes
LaTrappe River[k] (13)	> 64 (1)	1,400[j]	> 1990[j]	93,000[j]	No

(Cont.)

Table 1 (Cont.)

Project[a]	Maintenance Interval[b]	Average Annual Shoaling Volume[c]	Projected Maintenance: Date[d]	Projected Maintenance: Volume[e]	Availability of DMP Site[f]
Lowe's Wharf (14)	14 (1)	1,100	1985	16,000	No
Neavitt Harbor (15)	>12 (0)[m]	-----[i]	>1990[l]	------[i]	Yes
St. Michaels Harbor (16)	>16 (0)[m]	200[j]	>1990[j]	5,000[j]	No
Tilghman Is. Harbor (17)	10 (1)	2,600	1990	2,600	Yes
Town Creek (18)	> 31 (0)[m]	1,700[j]	>1990[j]	70,000[j]	No
Tred Avon River (19)	> 5 (0)[m]	-----[i]	>1990[l]	------[i]	No
CAROLINE COUNTY					
Choptank River (20)	16 (2)	1,000	1985	22,000	No

a) Parenthetical numbers correspond to project locations indicated in Figures 2 and 3.
b) In years. Parenthetical values denote number of maintenance dredging operations excluding project modifications.
c) In cubic yards/year. Computed as the total volume of material removed for all maintenance operations divided by the total number of years between construction and most recent maintenance operation unless indicated otherwise.
d) Estimate derived by applying average maintenance interval to the date of latest maintenance operation unless indicated otherwise.
e) In cubic yards. Estimate based on maintenance interval and average annual shoaling volume unless indicated otherwise.
f) Indicates availability of approved or potentially suitable dredged material placement site as of January, 1980.
g) Estimate given by COE in Cambridge Harbor Environmental Assessment.
h) Estimated volume for each maintenance operation.
i) Insufficient data.
j) Based on information obtained from 1979-80 COE Project Condition Surveys.
k) Project under study by COE for possible modification.
l) Estimate based on information provided by project sponsor.
m) Indicated interval represents a minimum as no maintenance operations have been accomplished between date of construction and January 1980.

Table 2

Summary of the Dredging Needs Assessment for Non-Federal Navigation Projects in the Maryland Counties of Talbot and Dorchester[a]

Project	Construction Status	Expected Maintenance 1980-1990	Availability of a DMP Site[b]
DORCHESTER COUNTY			
Cambridge Municipal Basin	Completed 1969	Scheduled 1980	Yes
Chapel Cove	Completed 1977	None	Yes
Horn Point	Completed 1976	None	Uncertain
Hurst Creek	Initiated 1978; incomplete	None	Yes
Indian Creek	New work scheduled 1981	----	Yes
Jenkins Creek	Completed 1973	Projected 1982	Yes
Lodge Cliff Canal	Completed 1975	Scheduled 1981	Yes
Madison Bay	Completed 1977	None	Yes
McCready Creek	New work scheduled 1981		Yes
Muddy Hook Cove	New work proposed 1985	----	Uncertain
Ragged Point Marina	New work scheduled 1981	----	Yes
Tedious Creek	Completed 1971	Projected 1981	Yes
Tyler Cove	New work proposed 1981	----	Yes
Wallace Creek	New work scheduled 1980	----	Yes
Warwick River	Completed 1975	None	Yes
Whitehall Creek	Completed 1980	None	Yes

(Cont.)

Table 2 (Cont.)

Project	Construction Status	Expected Maintenance 1980-1990	Availability of a DMP Site[b]
TALBOT COUNTY			
Black Walnut Harbor	Completed 1966	Scheduled 1981	Yes
Bellevue Park Harbor	Completed 1972	Scheduled 1981	Yes
Claiborne Harbor	Completed 1976	None	No
Edge Creek	Completed 1965	Proposed 1981	Yes
Chesapeake Bay Maritime Museum	Completed 1974	None	Yes
Chesapeake Bay Maritime Museum	New work planned 1980 - 85	----	Yes
Oak Creek Park	Completed 1975	None	No
Peach Blossom Creek	New work proposed 1980	----	Uncertain
Papermill Pond Marina	New work planned 1980 - 85	----	Yes
St. Michaels Harbor	New work scheduled 1980	----	Yes
Tonger's Basin	Completed 1935	1980	Yes

[a] Non-Federal refers to State/County/local projects only.

[b] Indicates availability of approved or potentially suitable dredged material placement site as of January 1980.

sites or for the productive use of dredged material. These projects, together with two proposed State/County projects which met the above requirements and were associated with Federal projects, comprised the projects for which DMP plans were developed (Table 3).

B. Development of Dredged Material Placement Plans

1. General Considerations

a. Environmental/Economic Factors

The approach whereby DMP plans were developed for individual projects centered primarily on two broad areas of concern: environmental --any proposed plan should have a high probability of complying with existing guidelines and regulations intended to minimize adverse environmental impacts; economic -- the costs associated with any proposed plan should be such that the plan is economically feasible. Within each of these areas are specific criteria or concerns which are applicable to various aspects of the total project and provide an overall assessment of the project's environmental impact and economic feasibility. It is the actual dredging operation (i.e., sediment extraction, transport, and discharge), however, which receives the closest scrutiny. Moreover, the specific concerns which are applicable and the level of examination is dependent upon project type in terms of new work or maintenance. Maximum environmental concern is associated with new work extraction operations as concerns relevant to maintenance projects will often have been previously identified and addressed. In contrast, the discharge operation (i.e., DMP site and type of facility) for both types of projects are examined in equal detail. As the projects for which DMP plans were developed were almost exclusively maintenance projects, the major emphasis was placed on environmental and economic considerations relevant to DMP facility siting, construction, operation, management, and reclamation and on the economics associated with dredging and dredged material transport.

Environmental considerations were based on concerns identified by existing regulations and guidelines pertaining to DMP activities. The potential impacts identified by certain of these concerns have been

Table 3

Dredging Projects Eligible for Inclusion in Total Dredged Material Placement Plan

Project	Responsible Agency[a] Project Funding	Responsible Agency[a] Site Acquisition	Responsible Agency[a] Facility Construction	Type of Work	Type of DMP Site[b]
			Dorchester County		
Tar Bay-Honga River	Federal	County	Federal	Maintenance	Multi-use
Tyler Cove	Federal	County	County	Maintenance	Single-use
Muddy Hook Cove	Federal	County	County	Maintenance	Single-use
Duck Point Cove	Federal	County	Federal	Maintenance	Single-use
Slaughter Creek	Federal	Federal	Federal	Maintenance	Single-use
Tyler Cove	State	County	State	New Work	Single-use
Muddy Hook Cove	State	County	State	New Work	Single-use
			Talbot County		
Knapps Narrows	Federal	County	Federal	Maintenance	Multi-use
Lowe's Wharf	Federal	County	Federal	Maintenance	Single-use
			Caroline County		
Choptank River	Federal	Federal	Federal	Maintenance	Single-use

a) Indicates governmental agency responsible for indicated functions as determined by current policies and legislation.

b) Multi-use site denotes DMP site/facility designed and developed to accommodate dredged material generated by one or more projects for a minimum 10-year period. Single-use site denotes DMP site/facility designed and developed to accommodate dredged material generated by a single dredging operation.

judged to be of a sufficiently adverse nature that the suitability of a DMP facility location can be evaluated on a yes/no basis. Siting a DMP facility in a location which would result in the placement of dredged material on areas containing shellfish beds, emergent aquatic vegetation (tidal marsh), submerged aquatic vegetation (seagrass beds), endangered species of fish and wildlife, and archeological resources is either strongly discouraged or prohibited by law.

The placement of dredged material in terrestrial areas will lead to modifications in soil characteristics, site surface topography, and drainage patterns and, consequently, to alteration of the ecological function of the area. These changes may be either beneficial or detrimental depending upon the pre-placement function and the ultimate intended use of the area. Disturbed lands within the geographical bounds of the study area are considered to be those which have previously served as borrow areas, dredged material placement sites, or general landfill areas. Depending upon the historical usage of such areas, they may be in a state of recovery to the extent that they now constitute a viable habitat or serve a valuable ecological function. In general, however, areas of this type can be expected to have the highest potential for positive or beneficial impacts associated with dredged material placement activities.

The environmental consequences of dredged material placement in agricultural or woodland areas are potentially more adverse than in disturbed areas. Each of these two area types will have a wide range of acceptability as DMP sites based on their current environmental and ecological significance and the potential impacts of the proposed activity. For example, a woodland area of marginal productivity would be expected to be a more suitable DMP site than a highly productive agricultural area. Reclamation of DMP sites is a method whereby adverse environmental impacts of the placement operation can be mitigated. Ideally, the reclamation of a site would result in restoration to its previous function. The potential for successful reclamation of this type is considerably greater for agricultural than for woodland areas.

A variety of economic factors influence DMP siting. These factors include the costs associated with the extraction and transport of dredged material, DMP facility construction and management, and with site acquisition and reclamation. As dredged material transport costs increase with increasing distance between the DMP site and the dredging area, the distance relationship between the two sites is of primary consideration. Construction activities in the marine environment can generally be expected to be considerably more costly than in terrestrial areas and, within the latter areas, site preparation and DMP facility construction costs associated with woodland areas will be the greatest. Finally, while land acquisition costs for aquatic areas are minimal, such costs for terrestrial areas are significant with disturbed lands being the least costly within the latter category.

The general environmental and economic considerations discussed above, together with the aforementioned specific environmental concerns, led to the following order of preference of environmentally acceptable locations for DMP facilities:

I. Terrestrial Areas
   a. Disturbed Lands
   b. Agricultural Lands
   c. Woodlands

II. Aquatic Areas
   a. Submerged Bottomland
   b. Marshland

While the primary emphasis in DMP siting was thus on terrestrial areas, aquatic areas were not categorically dismissed from consideration. The latter areas were considered as viable alternatives primarily when suitable terrestrial areas were not available or if the placement of dredged material in aquatic areas would have associated therewith the potential for positive enviromental/economic impacts.

b. Type of Dredged Material Placement Plan

Containment facilities can be designed to accommodate the dredged material generated either by a single dredging operation (i.e., single-use) or by several dredging operations conducted over a period of years (i.e., multi- or long-term use). It is generally accepted that it is more economical and environmentally less damaging to construct, operate, and maintain one multi-use facility which will accommodate an expected volume of dredged material rather than a series of smaller single-use facilities which are constructed as the need arises and which accomplish the same purpose.

Ideally, a DMP facility intended for long-term use should be controlled by the project sponsor in order to provide the maximum flexibility in conducting the management/maintenance operations necessary for optimum facility efficiency and utilization. Not only, then, must funds be expended for site acquisition (i.e., purchase or long-term lease) but also for facility management and maintenance. Until recently, DMP site acquisition has either been on short-term (i.e., 3- to 5-years) lease arrangements between the dredging sponsor and the landowner or, more commonly, provided free of charge by the landowner in exchange for rights to the dredged material. While this has generally proved to be a workable and realistic approach, the responsibilities of the landowner and project sponsor with respect to post-dredging facility management and site reclamation, as well as the costs thereof, were rarely defined in the site use agreement. As a result, site management and reclamation either has not been accomplished or has been conducted in such a manner that costs are clearly minimized.

The maintenance intervals for the projects examined by this Study were found to lie within one of the following ranges: 5- to 10-years and 15- to 30-years. Additionally, the volumes of material removed during individual maintenance operations generally do not exceed 50,000 cy and thus require containment facilities of not greater than 10 acres in size. The development of long-term use facilities for projects having maintenance intervals in the latter range would require a minimum 15-year lease arrangement for two DMP operations. Although short-term lease arrangements may be acceptable to the majority of landowners, there exists an understandable reluctance to enter into long-term committments (i.e., 15-years) which remove all or a substantial portion of their property from possible sale or development. Project sponsors, moreover, are either reluctant or feel unable to provide the funds necessary for purchase of a site and for management/ maintenance of a facility which would be utilized as infrequently as at 15- to 30-year intervals.

While it can be expected that there will be an ever-increasing need for the acquisition of DMP sites for long-term use, the preceding discussion suggests that the current practices regarding DMP site acquisition may be the most cost-effective and practical for dredging projects with maintenance intervals ranging between 15- and 30-years and maintenance volumes on the order of 50,000-cy or less. For these reasons, the development of DMP plans for projects of this type centered on the identification of sites for single-use DMP facilities.

From an environmental as well as an economic standpoint dredging projects having maintenance intervals of from 5- to 10-years present an immediate need for the development of long-term use DMP facilities. Thus, the identification of sites for long-term use DMP facilities formed the basis for the development of DMP plans for this type of project. As productive uses of dredged material are considerably more cost-effective for these projects than for projects with longer maintenance intervals, such uses were also considered during DMP plan development.

2. Specific Approach

The approach utilized for the development of a DMP plan for the Choptank River Basin can be summarized as follows:

1. Establish projects eligible for planning:
2. Evaluate the need and/or potential for:
    a. single-use DMP site
    b. multi-use DMP site
    c. productive use of dredged material
3. Identify candidate DMP sites in accordance with results of item 2 above;
4. Conduct environmental/economic analysis, when appropriate, to select optimum plan.

The results of the dredging needs assessment established those projects which are eligible for inclusion in the plan (Item 1). Evaluation of the need and/or potential for the development of DMP plans for individual projects utilizing various types of DMP sites is based on the project maintenance interval and shoaling volume (Item 2). The general methodology whereby these items are accomplished have been discussed in preceding Sections and details regarding Item 1 can be found in Appendix A. The following two Sections describe in general terms the methods and approaches utilized to accomplish Items 3 and 4, details of which can be found in Appendices B and C thru E, respectively.

a. Identification of Candidate Dredged Material Placement Sites

Before a DMP operation can be conducted at a proposed site, a determination of site suitability must be made. Such determinations are ultimately made by the various regulatory agencies based on a detailed and comprehensive assessment of the expected environmental impact of the activity. As the collection and analysis of the data necessary to generate assessments of this type for the large number of projects involved was beyond the scope of this Study the identification of candidate DMP sites was based primarily on general environmental concerns identified by existing regulations and guidelines pertaining to DMP activities. The practicality of actually acquiring the site and constructing, operating, and maintaining the DMP facility is, however, dependent upon a wide variety of economic, legal, social, and institutional factors, all of which must be considered at some point in the site identification procedure. Thus, although the major emphasis in candidate site identification was on environmental factors, those of the aforementioned factors which are of particular importance in DMP siting were also considered.

This approach was deemed appropriate for several reasons. Site suitability may be the limiting factor in the actual implementation of DMP operations at a proposed site in which case a detailed assessment of site suitability may not be warranted prior to an assessment of the site's availability. On the other hand, a determination of a site's availability and the conditions thereof would not be appropriate in the event that the suitability of the site would be highly questionable. Additionally, the application of the aforementioned environmental concerns during the siting procedure was expected to maximize the potential that the sites so identified would meet the minimum regulatory agency requirements regarding site suitability. Finally, the approach would provide the decision makers within the requisite funding and regulatory agencies with the necessary basic information which would enable them to comment on the viability of the proposed DMP plan.

The two types of DMP sites under consideration -- terrestrial and aquatic -- were sufficiently distinct as to necessitate the development of two siting procedures. In both cases, the siting procedure identified areas which are potentially suitable for DMP operations. The two procedures differ primarily in the degree to which a site has been determined to be suitable as a result of the criteria applied during the siting procedure. This difference stems largely from the premise that the environmental consequences of dredged material placement in terrestrial areas are inherently less severe or can be more successfully mitigated than similar activities in aquatic areas. This difference is further established by virtue of the fact that the various guidelines and regulations currently governing DMP activities more clearly define unacceptable aquatic DMP practices than terrestrial DMP practices. Additionally, the existing technology is such that technical and engineering problems associated with DMP operations can be dealt with most effectively if these operations are land-based.

i. Terrestrial Dredged Material Placement Sites

The previously established order of preference of environmentally acceptable locations for land-based DMP facilities played a significant role in the siting procedure. Areas utilized for previous DMP operations were of highest priority and were inventoried and evaluated with respect to suitability and availability for future use. Land currently or formerly in agricultural production and woodland areas were considered as the second and third preferences, respectively, when previously used DMP sites were determined to be either unsuitable or unavailable.

The dominant factors operative in the preliminary identification of prospective DMP sites in terrestrial areas were considered to be:

1. the planar area requirements of the DMP facility,
2. the proximity of the site to the project dredging area,
3. the proximity of the facility to a suitable site effluent discharge point.

The sites identified by the application of these criteria comprised a set of prospective sites which, in light of the criteria whereby they were selected, were potentially suitable for DMP activities. The level of suitability was further refined by evaluating the sites in terms of additional requirements which relate to site suitability. For this purpose, the following additional information was obtained for each site previously selected:

1. proximity of the site and effluent discharge points to freshwater sources, emergent wetlands, and charted shellfish and seagrass beds;
2. proximity of the site to residential, recreational, and industrial areas;
3. general soil characteristics at the site;
4. existing and expected zoning and land use regulations;
5. site accessibility;
6. ownership (multiple, single) of property(ies) on which site is located.

ii. Aquatic Dredged Material Placement Sites

Although not explicitly stated previously, land-based DMP operations basically consist of the hydraulic placement of a dredged material slurry in a sedimentation basin (i.e., a surface area enclosed by retaining structures) with the primary function of the basin being to retain and store the solids fraction and release effluent which meets applicable standards of water quality. Such an operation is relatively well-defined and generally independent of the ultimate use or function of the site, whether the resultant use or function is planned or accidental. While the construction and utilization of aquatic-based DMP facilities which serve the same function (i.e., dredged material retention and storage; compliance with water quality standards) are technically feasible, the costs associated therewith can adversely affect the economic feasiblity thereof. Additionally, aquatic areas are considered to be more sensitive than terrestrial areas to the alterations in the physical characteristics of an area which normally accompany DMP operations as the alterations can produce significant changes in the ecological function of the area. Thus, in order to offset potential adverse environmental consequences as well as the increased costs associated with aquatic DMP operations, benefits other than serving as a means or a site for the placement of dredged material must accompany or provide justification for the use thereof. Clearly, then, the use of aquatic areas for dredged material placement operations is more highly dependent upon project objectives than is the use of terrestrial areas.

Benefits derived from the use of aquatic areas as DMP sites are viewed as productive uses of dredged material and generally center on the creation of land for a variety of functional uses including: recreational, industrial/commercial, agricultural, institutional, material transfer, waterway-related, multiple purposes and habitat creation. Two approaches to the productive use of dredged material were considered by this Study as being applicable with respect to DMP activities in aquatic areas: shore erosion abatement, habitat creation, and/or a combination thereof.

Primary considerations regarding the placement of dredged material in aquatic areas include (1) the environmental impact of the activity and (2) the need for physical structures to retain and protect the dredged material deposited at the site. These two considerations are interrelated as both are influenced to a large degree by the physical forces which prevail at the site.

The environmental impact of DMP activities in aquatic areas can be qualitatively assessed in terms of the change in overall biological productivity at the site. In the broadest and most general sense, adverse environmental impacts can be expected to be minimized if the placement activity occurs in areas of low productivity. Such areas can generally be characterized in terms of the physical forces, primarily waves and currents, which exist at a given site. The deposition of dredged material in high energy aquatic environments can, depending upon the design of the project, result in the creation of a lower energy system. As low biological productivity can generally be equated with high energy environments, the conversion from a high to a low energy system conducive to increased biological productivity can result in a net positive environmental impact.

The need for retaining structures for DMP operations in aquatic areas is established by the requirement that the migration of dredged material from the site be minimized, both during and subsequent to the placement operation. The benefits which result from meeting this requirement would be (1) compliance with applicable water quality standards and (2) minimization of the potential for adverse environmental impacts to the areas adjacent to the site. As was previously indicated, however, the costs associated with aquatic-based DMP facilities which are designed in such a way as to strictly adhere to these requirements may severely impact the economic feasibility of the project. Such facilities generally become cost-effective only if the water quality standards are relaxed thereby reducing the need for extensive and costly retaining structures, or if the composition of the dredged material is such that unconfined placement in aquatic areas will not violate water quality standards. Currently, the Baltimore District Corps of Engineers criteria require that the dredged material be composed of 80% or greater sand-sized particles (i.e., retained by the U.S. No. 200 sieve) before being judged suitable for possible unconfined deposition in the aquatic environment.

In light of the preceding general discussions the following assumptions regarding DMP siting were made for the purpose of developing DMP plans utilizing aquatic areas:

1. The primary emphasis is on high energy areas as
   - such areas are expected to be of lowest biological productivity and thus provide the greatest potential for positive environmental impacts;
   - such areas experience the highest rate of erosion and would thus derive the greatest benefit from shore erosion protection efforts.

2. A retention/protection (R/P) structure is required of all DMP activities in high energy areas as such structures will
   - retain the dredged material until it consolidates and vegetation can be established;
   - aid in controlling the migration of fine-grained dredged material from the area during the DMP operation.

3. Secondary emphasis is placed on low energy areas as
   - such areas have the greatest potential for successful habitat creation;
   - such areas have the greatest potential for unconfined placement of dredged material

4. Only material meeting the criteria of 80% or greater sand-sized particles is suitable for unconfined placement.

These assumptions address, on a qualitative level, the environmental concerns associated with aquatic-based DMP activities and are not intended to replace the detailed environmental impact assessment which is required of all DMP activities as the investigations required to accomplish quantitative assessments of this type are beyond the scope of this Study.

The aforementioned assumptions regarding DMP activities in aquatic areas served as the general basis whereby prospective aquatic DMP sites were identified. The dominant factors operative in the siting procedure were considered to be:

1. proximity of the site to:
   a) the project dredging area,
   b) charted shellfish beds, crabbing bottoms, and seagrass beds;
2. the extent of shoreline development;
3. the expected level of biological productivity at the site.

While the two siting procedures described above achieved the common objective of identifying terrestrial and aquatic areas which, in light of various environmental constraints, would be potentially suitable for DMP operations, the procedures differ in one very important respect. One of the primary considerations in the site selection procedure for terrestrial areas was that regarding the dredged material capacity requirements of the DMP facility. That is, containment facilities were specifically designed to accommodate a known or expected volume of dredged material and site identification was accomplished based on the need to satisfy the facility requirements. In this regard, the primary project objective of DMP activities in terrestrial areas was considered to be the retention and storage of dredged material.

The primary project objective of DMP activities in aquatic areas was, in contrast, considered to be the productive use of dredged material, specifically with regard to shore erosion abatement and habitat creation. Candidate site identification was thus accomplished with the major emphasis on satisfying the requirements associated with these project objectives. These requirements, by and large, centered on environmental issues. Technical and design aspects associated with the projects were given only minor consideration during the siting procedure as information of this type, which was required for the terrestrial DMP siting procedure as well as for the purposes of planning and economic evaluation, could not be reliably determined for aquatic sites prior to site identification. This difficulty derived primarily from the uncertainties associated with the composition (i.e., relative proportions of fine- and coarse-grained sediments) of the material to be dredged and the need for containment facilities of the type required to meet effluent water quality standards during the placement operation (see Appendix D). Proceeding under the assumption that only material meeting the criteria of 80% or greater coarse-grained sediments (i.e., retained by U.S. No. 200 sieve) is suitable for placement in aquatic areas eliminates the need for extensive and/or possibly all retaining structures, depending upon the energy environment in which placement occurs. Even so, reliable estimates of the area and retaining structure design requirements and, hence, the cost of the DMP operation cannot be made without information regarding the volume of coarse-grained material which is expected to be generated. Information of this type can be obtained only by extensive sampling and analysis which was beyond the scope of this Study.

Because of these uncertainties and the complexity of the technical and design requirements for projects of this type (see Appendix D), specific project designs were not formulated for candidate aquatic sites in as great a detail as were those for terrestrial areas. Sufficient information was, however, generated by making certain simplifying assumptions and, although of a qualitative nature, was judged to be adequate for the level of planning and economic evaluation intended for accomplishment by this Study.

b. Environmental/Economic Analysis

Projects involving dredging and DMP operations are evaluated in terms of their environmental and economic significance. By and large, regulatory agencies are primarily concerned with the environmental impacts while project sponsors and funding agencies are largely concerned with the economic impacts of the proposed work.

Both of these areas of concern were addressed during the development of DMP plans for specific dredging projects as the approach to DMP planning was intended to meet two major objectives:

Environmental - any proposed plan should have a high probability of complying with existing guidelines and regulations intended to minimize adverse environmental impacts;

Economic - the costs associated with any proposed plan should be such that the plan is economically feasible.

The major environmental issues associated with DMP operations were addressed by the procedures whereby candidate DMP sites were identified. Economic aspects were also considered by the siting procedure but on a much more general level than were environmental issues. With respect to the former, the major emphasis was on dredged material transport costs as evidenced by the fact that the siting procedure attempted to minimize these costs by identifying sites which, whenever possible, were within reasonable proximity (i.e., < 5,000-ft) to the dredging area. The costs associated with DMP facility construction and management and with site acquisition and reclamation were given very general consideration by recognizing that such activities were expected to be the least costly for terrestrial areas.

In certain instances, more than a single candidate site was identified for an individual dredging project. This was primarily true of DMP plans which utilized multi- or long-term use sites and/or productive uses of dredged material. In these cases it was deemed advisable to conduct a somewhat more detailed environmental/economic analysis of the plan, the objective of which was two-fold. An analysis of the environmental and economic impacts associated with the various DMP site alternatives for a given project would provide a basis for selecting the optimum plan or plans. The second objective applied primarily to economic considerations. Historically, the major contributors to dredging and DMP costs have been considered to be the cost of (1) dredging (i.e., extraction, transport, and discharge) and (2) of constructing the DMP facility. While dredging costs can be expected to continue to constitute the major portion of the project costs, the ever-increasing need to consider the use of long-term use DMP facilities, management/ maintenance of long-term and single-use facilities, and site reclamation as an integral part of dredging will clearly lead to increased costs. Consequently, by including costs associated with these potential needs in addition to those of dredging, the resultant cost information will provide an indication of the economic feasibility of the DMP plan and is thus expected to be of use to those agencies responsible for providing funds for the accomplishment of a proposed project.

The general approach whereby the environmental/economic analyses were accomplished is summarized below:

1. Determine the estimated costs of the dredging and DMP operations for each DMP site alternative identified for a given project.
2. Rank the various dredging/DMP site combinations on the basis of the estimated costs derived in Step 1.
3. Identify the environmental consequences of the placement operation for each DMP site alternative.
4. Rank the various dredging/DMP site combinations on the basis of environmental impacts identified in Step 2.
5. Determine, in so far as is possible, the optimum plan which minimizes both costs and adverse environmental impacts.

The various environmental and economic factors which were considered in the analysis are discussed in the ensuing sections.

i. Economic Analysis

The costs associated with dredging and dredged material placement operations constitute the major portion of the total cost of a dredging project and thus served as the basis whereby DMP plans were developed and evaluated from an economic standpoint. The following discussions provide a summary of the approaches utilized to derive estimates of the costs associated with these operations and the manner in which they were applied in the economic analysis.

Dredging costs arise primarily from (1) the extraction, transport, and discharge of a given volume of shoal material and (2) mobilization and demobilization of the dredge plant and attendant equipment. Costs for the actual dredging operation and for equipment mob/demob are highly project dependent and, for hydraulic pipeline dredges, are a function of the dredge size (i.e., horsepower, pipeline diameter), pipeline length (i.e., distance between extraction and discharge sites), the nature and composition of the material being extracted (i.e., undisturbed (new work) and/or disturbed (maintenance work) sediments composed of coarse-and/or fine-grained material, the speed with which the dredge advances over the dredging area, and the need for booster pumps. Because of the similarities among the dredging projects under consideration, certain simplifying assumptions could be made which permitted the derivation of a range of dredging and mob/demob cost rates for generalized cases and which could be conveniently related to pipeline length (See Appendix E). The determination of the dredging cost rate and mob/demob costs applicable to a specific project was based on the values of various linelength parameters associated with the project. Once established, the dredging cost rate was applied to the volume of material expected to be generated by the project to provide an estimate of the expected project dredging costs.

The dredged material placement operations associated with the various dredging projects covered by this Study basically involve the hydraulic placement of a dredged material slurry in a containment facility consisting of a surface area surrounded by a confining structure. The primary function of the facility is to remove and to retain and/or store the solid fraction and release effluent meeting application water quality standards. The costs associated with a DMP operation of this type were grouped into three catagories, each of which is comprised of various elements contributing to DMP facility costs, as follows:

1. Development Costs - Elements of this category are considered to be those activities which are required in order to conduct dredged material placement operations including land acquisition, engineering, design, and construction;

2. Management Costs - Cost elements comprising this category are all necessary post- and/or interim-dredging activities required in order to meet previously established project objectives and include operation, maintenance, and environmental monitoring, protection, and control;

3. Reclamation Costs - Included in this category are cost elements associated with the implementation of procedures commensurate with the ultimate intended use of the site.

These costs depend upon a complex array of factors including the following:

1. Dredged material volume;
2. Dredged material composition: physical, chemical, and structural properties;
3. Facility size (area) and configuration (shape);
4. Facility location: aquatic, terrestrial, urban, rural, industrial;
5. Site physical characteristics: topography, subsurface soil condition;
6. Site ecological functions: woodland, wetland, cropland;
7. Facility functions and ultimate intended use;
8. Environmental, legal, social, and institutional constraints.

The interrelationships among and between these factors are such that DMP facility costs are clearly site and project specific. In the majority of instances, however, total site costs are dominated by various technical and engineering aspects, thereby making it possible to develop cost estimates for generalized cases.

Under current policies and legislation defining the extent of local cooperation for Federally authorized dredging projects, the local project sponsor (usually designated as the County government) is generally responsible only for provision of a suitable DMP site while the Federal project sponsor (i.e., the U.S. Army Corps of Engineers) is responsible for construction and operation of the facility. The Corps of Engineers consequently assumes the cost facility construction and operation while the County bears the cost of acquiring the site, either through lease or purchase, and for site preparation. Thus, site acquisition and preparation and facility construction constitute the primary economic elements of the current approach to DMP operations.

Dredging project sponsors have traditionally viewed DMP sites or facilities as being utilized for a single dredging operation with little or no consideration given to either the potential or the need for future use. Site acquisition was either on short-term (i.e. 3- to 5-years) lease arrangements or, more commonly, provided free of charge by the landowner. As the DMP sites in the latter cases were generally in what were then considered as "marginally useful" areas (i.e., inter- and supratidal marshes), the landowner was most willing to permit the activity in exchange for rights to the dredged material and, if necessary, assume any costs related to reclamation of the area. All of this generally resulted in low cost DMP operations with only minor expenditures of funds required for land acquisition, facility management/maintenance, and site reclamation.

The unavailability of such "marginally useful" areas for use as DMP sites, either because of environmental concerns or technical and engineering problems associated with DMP facility construction, has necessitated the use of "productive" (i.e., woodland, cropland) areas. Not only is the real estate value of such land high, but landowners which elect to permit the use thereof for DMP activities can be expected to require reclamation of the site at the expense of the project sponsor. Dredged material placement facility management/ maintenance operations are desirable for single-use sites if site reclamation is to be accomplished within the shortest possible time frame and with predictable results. Such operations are effectively required for long-term use sites in order to achieve optimum facility efficiency and utilization and can be most readily accomplished if the facility is controlled by the project sponsor, again necessitating either long-term lease arrangements or, preferably, purchase by the project sponsor. Finally, DMP facility maintenance/management and site reclamation are highly desirable from an environmental standpoint.

In light of the preceding discussions, it is clear that there will be an increasing need for DMP operations to include provisions for management and reclamation as an integral part of the operation. Although there are at present no specific requirements that site management and reclamation be accomplished, neither are there provisions for funding of the costs associated therewith. In most, if not all, instances such costs would need be assumed by the local project sponsor (i.e., County governments). Because of the expected need for future DMP operations to incorporate the elements of management and reclamation, those elements which were considered to be of primary importance with respect to DMP costs included: Development - site acquisition and preparation, facility construction; Management - dredged material dewatering; Reclamation - site grading and stabilization. These elements define the conceptual approach to DMP operations.

Estimates of the costs associated with these elements were derived for the purpose of comparing various DMP site alternatives and can be considered to be project specific in that they were determined for DMP facilities designed to accommodate a given volume of dredged material generated by a specific project. The total of these costs, together with the estimated project dredging cost comprised the total cost for a specific dredging/DMP site combination and was subsequently utilized to rank the various combinations on the basis of cost.

It should be noted that the estimated costs derive from a standardized approach as they ignore various site specific design factors and rely on certain simplifying assumptions. Discussions regarding these, the various factors which must be considered in DMP operations, and the cost estimating procedure are presented in detail in Appendix D. Although judged to be suitable for comparative purposes, the estimated costs are inappropriate for use in definitive planning and/or for funding purposes as a much more detailed evaluation would be required before final selection of a dredging/DMP combination. With regard to the latter purpose, however, the estimated costs are considered

Table 4

Estimated Costs for 12- and 24-Acre Dredged Material Placement Facilities in Woodland Areas[a]

Cost Element	Conceptual Approach[b] Funding Agency[c] Federal	County	Total	Current Approach[b] Funding Agency[c] Federal	County	Total
12-Acre Facility[d]						
Site Preparation	$-------	$30,480	$30,480	$-------	$15,600	$ 15,600
Construction	112,704	-14,400[e]	98,304	112,704	------	112,704
Management	-------	18,147	18,147	-------	------	-------
Reclamation	-------	43,750	43,750	-------	------	-------
Subtotal	$112,704	$77,977	$190,681	$112,704	$15,600	$128,304
Contingencies(15%)	16,906	11,697	28,603	16,906	2,340	19,246
E&D/S&A (12%)[f]	13,524	9,357	22,881	13,524	1,872	15,396
TOTAL	$143,134	$99,031	$242,165	$143,134	$19,812	$162,946
Cost/cy			$ 2.24			$1.51
24-Acre Facility[d]						
Site Preparation	$-------	$64,920	$64,920	$-------	$31,200	$ 31,200
Construction	152,708	-28,800[e]	123,908	152,708	------	152,708
Management	-------	23,169	23,169	-------	------	-------
Reclamation	-------	62,875	62,875	-------	------	-------
Subtotal	$152,708	$122,164	$274,872	$152,708	$31,200	$183,908
Contingencies(15%)	22,906	18,325	41,231	22,906	4,680	27,586
E&D/S&A (12%)[f]	18,325	14,660	32,985	18,325	3,744	22,069
TOTAL	$193,939	$155,149	$349,088	$193,939	$39,624	$233,563
Cost/cy			$ 1.62			$ 1.08

a) Description of the costing procedure can be found in Appendix D.

b) Approaches defined by DMP operations: Conceptual Approach assumes all four operations indicated by cost elements; Current Approach assumes only site preparation and facility construction.

c) Costs are partitioned in accordance with current policies and legislation regarding extent of local cooperation for the majority of Federally authorized dredging projects examined by this Study.

d) Costs for 12- and 24- acre facilities are based on designs for accommodation of 108,000-cy and 216,000-cy, respectively, of dredged material (see Appendix C) and are exclusive of land acquisition costs.

e) Represents credit to county as portion of material used in dike construction derived from site preparation activities.

f) Engineering and design and supervision and administration costs are normally assumed by the Federal interest. Facility management and site reclamation, if the responsibility of the local interest would, however, have costs associated with E&D/S&A and these costs would need be assumed by that party.

to be of general utility as they provide an indication of the order of magnitude of any cost increases which would result from changes in DMP practices.

The cost data compiled in Table 4 is presented to illustrate certain points regarding the economics of land-based DMP operations in general and differences between the approach to dredged material placement DMP operations defined by the aforementioned elements and that which currently prevails. The first point is in regard to the cost differential between DMP operations conducted at a single large facility (i.e., 24-acres) and at two smaller facilities (i.e., 12-acres each) which accommodate a total volume of dredged material equal to that of the large facility. Irrespective of the approach to dredged material placement, operations conducted at two small facilities can be expected to be on the order of 40% more costly than if conducted at one large facility. This difference is most dramatically illustrated in terms of the unit cost (cost/cy) for dredged material placement. For this example, the difference between the unit cost for the 24- and 12-acre facilities are roughly $0.65/cy.

In so far as local sponsor interests are concerned, it is immaterial whether DMP operations are accomplished at two or more smaller sites or at one large site as the land acquisition and site preparation costs are approximately in direct proportion to the planar area requirements of the DMP facility(ies). The cost of DMP operations which include management and reclamation activities, in addition to site preparation and facility construction can, however, be expected to be on the order of 40 - 50% greater than for DMP operations which consist solely of the latter activities (Table 4). Additionally, the local sponsor would bear the increased costs of the additional operations. These increases would be on the order of 300 - 400% greater than for current DMP operations and implies that, excluding land acquisition costs, the local sponsor could finance the site preparation at four to five facilities not utilizing management and reclamation operations with the funds which would be required to be expended for one DMP facility employing these additional operations. Under the current situation, then, there is no economic incentive for the local sponsor either to acquire long-term use sites which require management and maintenance operations or to accomplish site reclamation. In view of the apparent difficulty with which local sponsors were able to provide funds for facility construction as required by previous policies, it would appear that DMP operations will continue to be accomplished without regard for facility management and site reclamation unless additional sources of funding be made available for such activities.

Discussions of economic considerations regarding dredging and DMP operations have thus far centered on the latter. Dredging costs, however, will usually comprise 60 - 80% of the total project costs. In certain instances, then, these costs can be expected to dominate DMP site selection from an economic standpoint. This situation generally arises when, because of land area limitations, a DMP facility of the size required to accommodate the volume of dredged material generated by the project cannot be sited as close to the dredging area as can two or more smaller facilities. The project length, on the other hand, may be sufficiently great that the distances to a single facility result in exceedingly high dredging cost rates. In such cases, the use of two or more smaller facilities is economically preferable as the increased costs associated with the construction of the small facilities is more than offset by the decreases in dredging costs which are achieved by decreasing the distance between the DMP facilities and the project dredging area.

The accessibility of a DMP site plays a significant role with respect to both the technical and economic feasibility of conducting DMP operations. While this is true of both single- and multi-use sites, it is of greatest importance to the latter. Ready accessibility of these sites is required not only to conduct the necessary management/maintenance activities but also for the purpose of increasing the capacity and, hence, useful lifetime of the facility by removal of previously deposited dredged material for other uses (e.g., general fill material, cover material for sanitary landfill operations, etc.). Although not specifically costed and included as a line item in the costing procedure, site accessibility was considered in the overall economic evaluation of dredging/DMP alternatives.

ii. Environmental Analysis

Certain of the major environmental issues associated with DMP operations were addressed by the procedures whereby candidate DMP sites were identified. These issues were concerned primarily with the impacts associated with the direct placement of dredged material on areas containing shellfish beds, emergent aquatic vegetation (tidal marsh), submerged aquatic vegetation (seagrass beds), and endangered species of fish and wildlife. These and other environmental concerns were utilized to establish a preferred order of environmentally acceptable locations for DMP facilities. As site identification proceeded in accordance with that order of preference and under certain other relevant site identification criteria, the sites thus identified have been ranked in general terms of environmental suitability and, to a certain degree, in terms of environmental impact. Although a detailed assessment of a site's suitability was not only desirable for the purposes of this Study but also required before DMP operations can be conducted at a prospective site, such an assessment was beyond the scope of this Study. As a result, ranking of the candidate sites in terms of the environmental impacts associated with proposed DMP activities was accomplished at a general level and, in most cases, without the benefit of on-site inspections. The environmental concerns which served as the basis for ranking the sites and an assessment of the impacts which could be expected to result from DMP activities are discussed below.

The environmental impacts associated with DMP operations were primarily assessed in terms of the potential for pollution of groundwater and surface water and the disruption of valuable natural habitats. With respect to the former, only four of the twenty Federally authorized dredging projects within the study area (Cambridge Harbor, Tred Avon River, Warwick River, and Town Creek) are, because of poor flushing characteristics and high concentrations of commercial, recreational, and waterway-related activities, expected to have a significant potential for pollution (e.g., heavy metals, oil and grease, volatile solids, and bacteriological) as a result of dredging and DMP operations. Analyses of the channel sediments for two of these projects for which maintenance and/or new work dredging was accomplished within the last five years (Cambridge Harbor, 1979; Tred Avon River, 1975) indicated that the concentrations of most pollutants only slightly exceeded the maximum allowed concentration suggested by the EPA for DMP activities in aquatic areas. In view of these results, the potential for pollution of groundwater and surface water by dredging and DMP operations associated with the projects under consideration would be low in terms of the aforementioned parameters.

The potential for contamination of groundwater aquifers as a result of saltwater infiltration is considered to be negligible for the majority of prospective terrestrial DMP sites within the study area with the exception of dredging projects in and around the Warwick River. In that area, sand and gravel layers extend to approximately 35-ft below the surface and some shallow (i.e., $<$ 50-ft) wells still exist and are in use. Because of high iron and nitrate levels, such wells are gradually being abandoned in favor of deep (i.e., $>$ 300-ft) wells which utilize the Calvert Aquifer and the Aquia Formation located at depths in excess of 300-ft and below a 70-ft thick clay barrier. Freshwater supply for the balance of the two county areas derives largely from the Piney Point Aquifer which lies below a 200-ft thick clay layer beginning at approximately the 200-ft depth. Thus, groundwater contamination by saltwater intrusion is expected to be confined to the upper 10-ft or less and does not present a significant pollution potential.

The impacts resulting from DMP operations can be considered as both direct and indirect. Direct impacts result from the deliberate placement of dredged material on a specific area. Impacts of an indirect nature derive primarily from suspended solids within the DMP site effluent leading to increased turbidity and sediment load within the receiving waters and posing a treat to benthic organisms, submerged and emergent aquatic vegetation, and to fish spawning. Appropriate measures were assumed to be instituted to minimize adverse impacts of the latter type and included the following:

1. Site effluent suspended solids concentrations will be reduced to meet applicable water quality standards and/or an acceptable level by (a) proper design of the containment facility, (b) selective placement of dredged material meeting certain particle size criteria, or (c) intermittent dredging.

2. Effluent from the DMP site will be piped across critical areas (e.g., seagrass beds, shellfish beds, tidal marshes) and discharged in non-critical areas.

3. Dredging/DMP activities will be confined to periods of minimum biological activity commensurate with the resource most likely to be affected by the activity.

The direct impact resulting from the deliberate placement of dredged material in a specific area will be the most severe as the placement will lead to the total or partial loss of existing flora and fauna, modifications in soil characteristics, site topography, drainage and water circulation patterns, and ultimately to alteration of the ecological function of the area. The degree to which an area is adversely impacted is highly site specific as these changes may be either beneficial or detrimental depending upon the pre-placement function or ecological significance of the site and the ultimate intended use of the area. Overall, adverse impacts would be minimized if the site could be restored to its original function.. This approach may not be desirable in those instances where placement occurs in areas which were severely disturbed and/or of low productivity prior to the placement operation. Areas of this type, however, present the greatest potential for achieving net positive environmental impacts utilizing dredged material for habitat creation or restoration. The most severe adverse impact can be expected to occur if valuable natural habitats are disrupted or destroyed by the DMP operation with little or no chance for natural or assisted recovery.

The potential for restoration of a site to its pre-placement ecological function was utilized as the basis for assessing the net environmental impact of DMP operations in a given area type. Impact assessments generated in this manner are of a very general nature as site to site variations within an area type (e.g., between two sites, each located in woodland areas) are ignored. The approach is, however, consistent with the level of planning and analysis intended for accomplishment by the Study. The approach is thus judged appropriate for use in ranking the candidate sites identified for a given dredging project in terms of expected environmental impacts. The area types considered for DMP operations, ranked in increasing order of their potential for net adverse impacts, are as follows:

1. Disturbed Lands
2. Agricultural Lands
3. Woodlands
4. Submerged Bottomlands
5. Tidal Marshes

The DMP sites identified for a given dredging project were ranked in accordance with the above order and the results were utilized in conjunction with the estimated costs for dredging/DMP site combinations to select the optimum plan(s) which minimized both costs and potential adverse environmental impacts.

C. Proposed Dredged Material Placement Plans

This section describes the individual DMP plans which were developed for selected dredging projects.

1. Dredged Material Placement Plans Based on Multi-Use Sites

a. Tar Bay-Honga River, Back Creek, and Tyler Cove

Two existing Federal navigation projects and one State/County project are located in the vicinity of Upper Hooper Island in Dorchester County (Figure 4). The Federally authorized Tar Bay-Honga River project provides for a channel 60-ft wide, 7-ft deep, and approximately 4.8 miles long connecting the Chesapeake Bay and the Honga River (Figure 5) and consists of four relatively distinct segments defined by previous project maintenance operations:

* Barren Island Gap Channel - 3,500-ft long channel extending from the 7-ft contour in Chesapeake Bay through Barren Island Gap into Tar Bay;

* Tar Bay Channel - 8,000-ft long channel thru Tar Bay connecting the Barren Island Gap Channel with Fishing Creek;

* Fishing Creek Channel - 5,000-ft long channel thru Fishing Creek connecting Tar Bay and the Honga River;

* Honga River Channel - 9,500-ft long channel from Fishing Creek to the 7-ft contour in the Honga River.

Authorization for the Tar Bay-Honga River project also provides for a 60-ft wide, 7-ft deep channel from the 7-ft depth contour in the Honga River to a turning basin at the head of Back Creek, a distance of approximately one mile (Figure 5). The Federal project in Tyler Cove is part of a separate authorization and consists of a channel from that in Fishing Creek to and including an anchorage basin in Tyler Cove (Figure 6). The proposed State/County project in Tyler Cove involves improvements to existing anchorage and marine facilities.

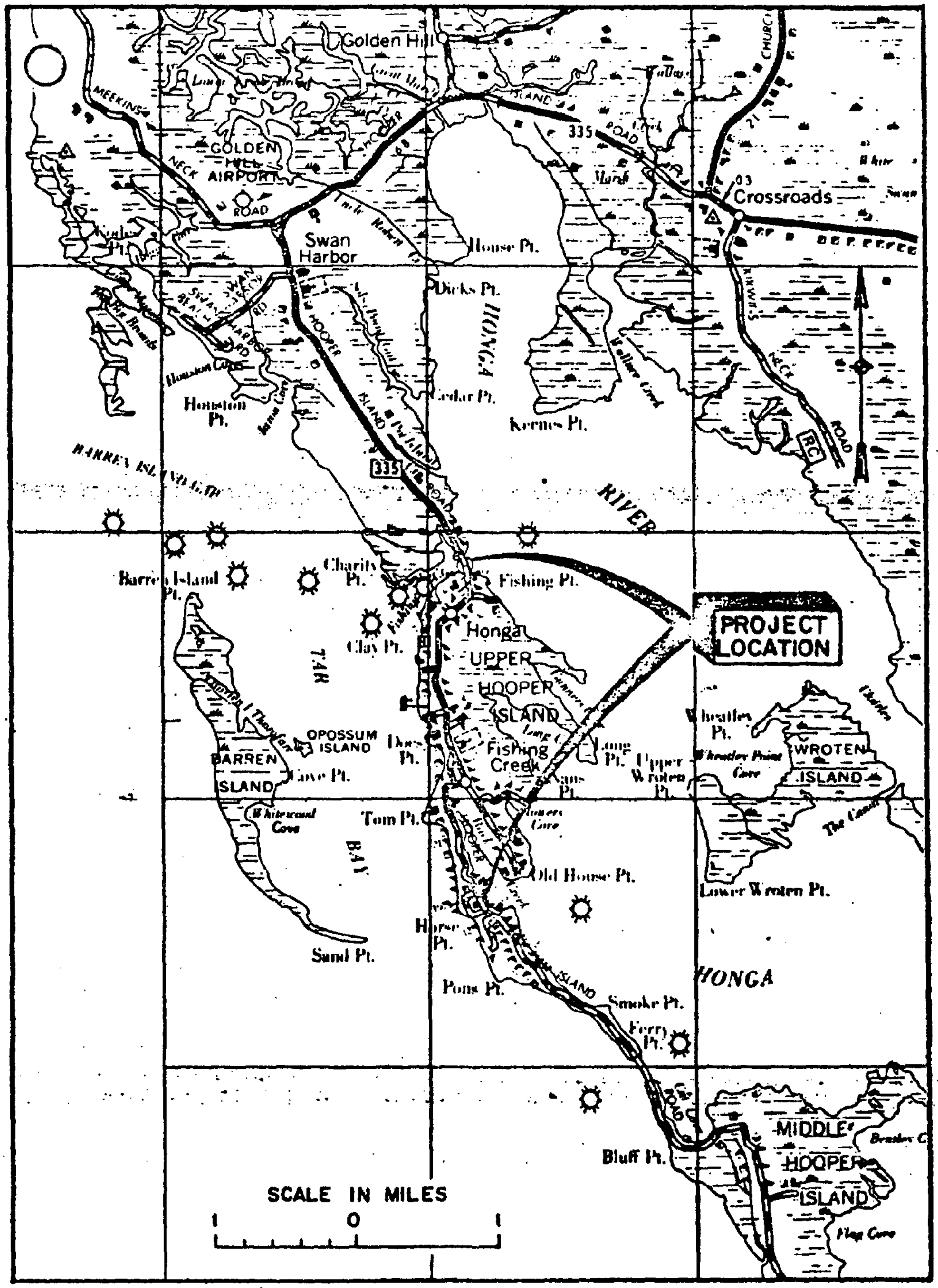

Figure 4. Vicinity map showing the locations of the Tar-Bay-Honga River, Tyler Cove, and Back Creek Federal navigation projects.

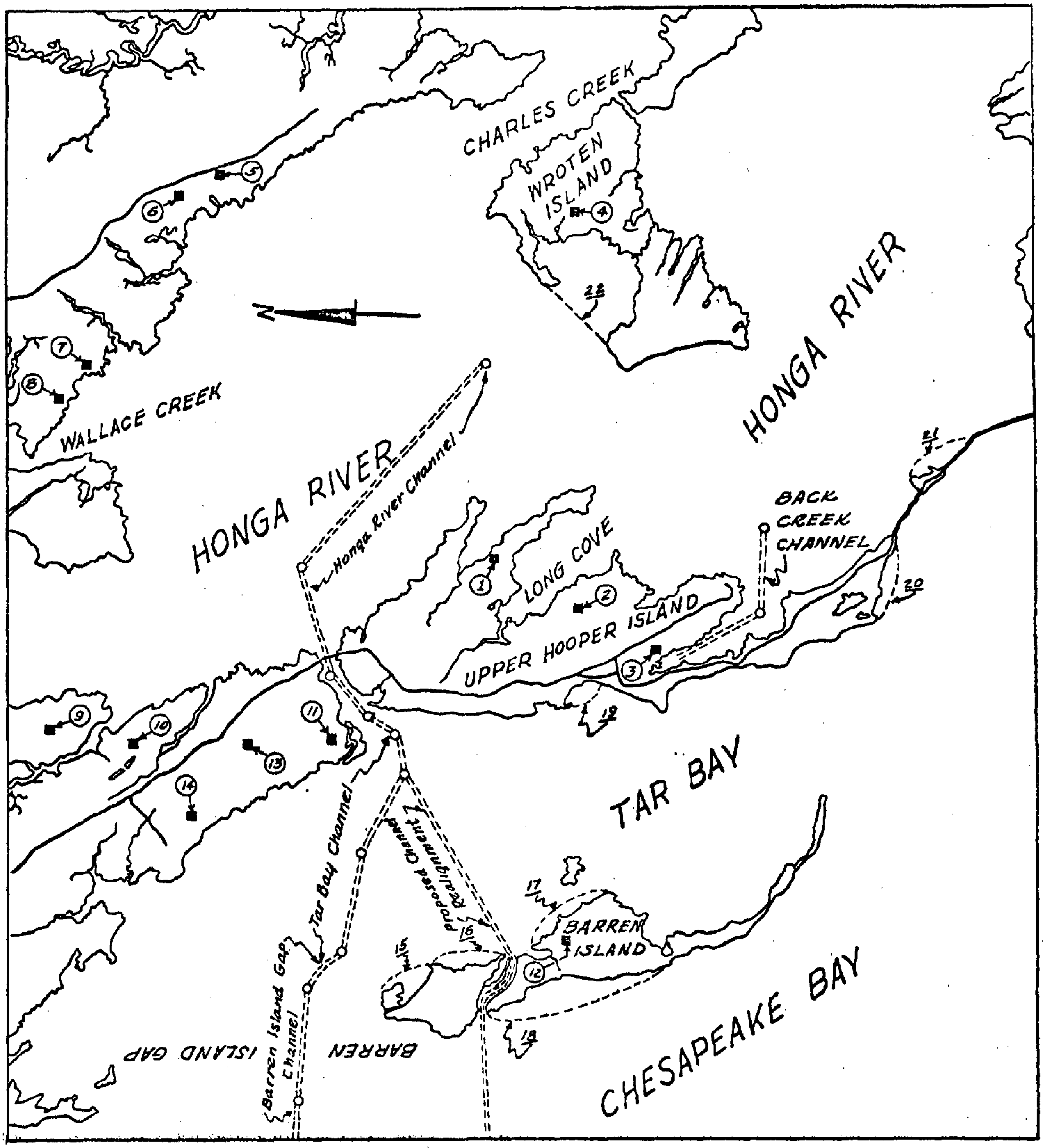

Figure 5. Map showing the locations of the Federal navigation channels comprising the Tar Bay-Honga River and Back Creek projects, the proposed realignment of the Barren Island Gap and Tar Bay Channels, and the candidate dredged material placement sites.

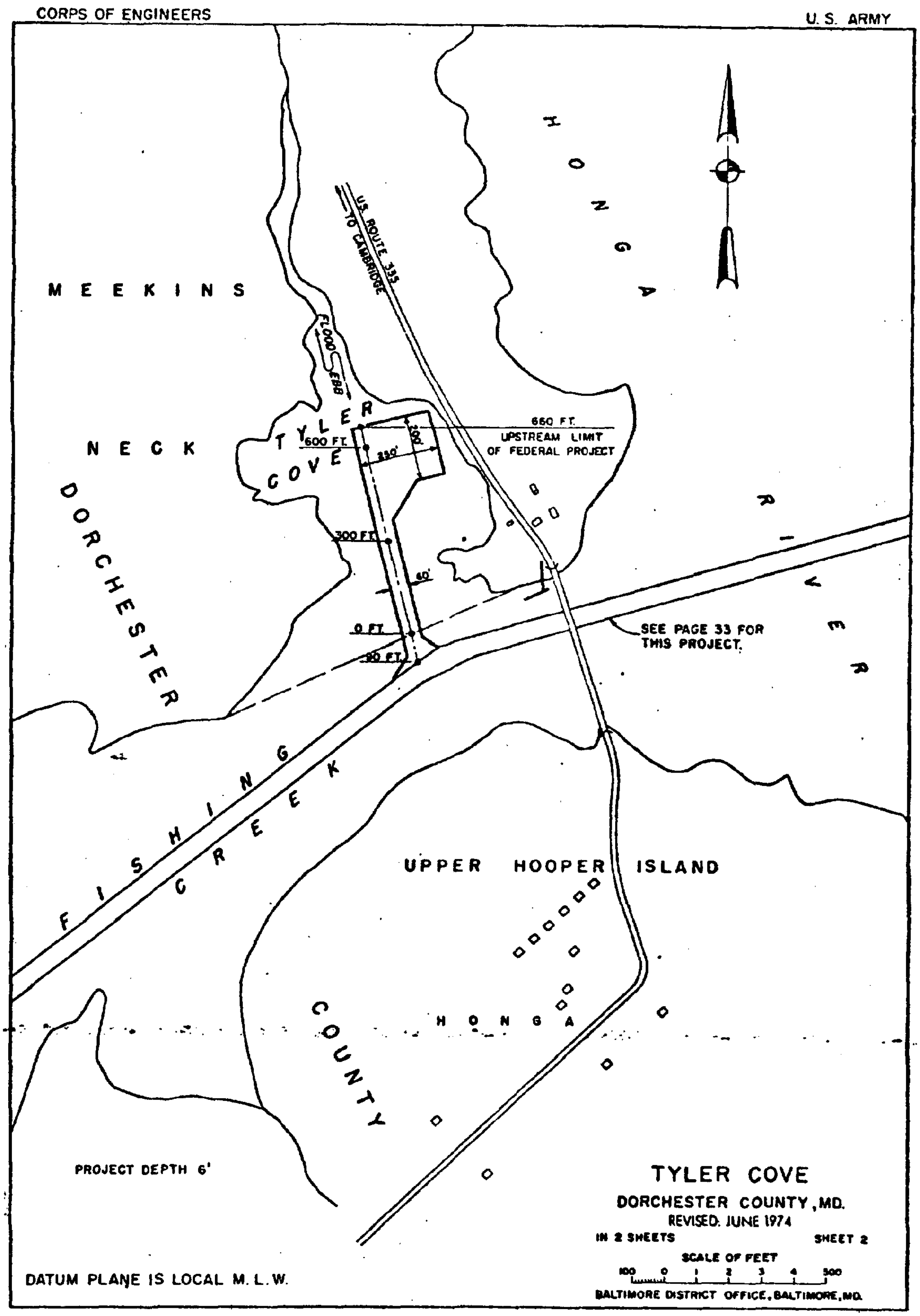

Figure 6. Project map of the Tyler Cove Federal navigation project.

Data and information collected in conjunction with the dredging needs assessment is presented in tables 5 and 6. During the 31-year period subsequent to construction in 1935, portions of the Barren Island Gap (BIG), Tar Bay (TB) and Honga River (HR) channels were maintained on a relatively regular basis. Controlling depths were generally on the order of 4- to 5-ft MLW for the BIG-TB channels and 5- to 6-ft for the HR channel at the time maintenance dredging operations were conducted. Additionally, dredging was routinely accomplished to a minimum of 2-ft project overdepth (i.e., 9-ft). The regularity of the maintenance operations and overdepth dredging can be ascribed to (1) lack of funding constraints and (2) ready availability of DMP sites (i.e., unconfined overboard placement of dredged material). Subsequent to 1966, increased shoaling rates led to the need for more frequent maintenance, particularly with respect to the BIG channel. Funding limitations as well as the reduced availability of DMP sites due to increased environmental concerns regarding DMP activities presumably resulted in delaying maintenance operations until project conditions approached the critical stage at which time controlling depths were on the order of 1- to 2-ft for the BIG and TB channels. Maintenance operations for the HR channel have not been conducted subsequent to that accomplished in 1966.

This data together with that provided by the 1980 condition surveys of the Tar Bay-Honga River, Back Creek, and Tyler Cove projects led to the derivation of the projected maintenance schedule given in Table 7. While the projected schedule was based almost exclusively on data from previous maintenance operations, consideration was also given to the potential savings which could be realized in terms of dredging mobilization/demobilization costs and man hours associated with coordinating the activity with the requisite regulatory and funding agencies if dredging operations for two or more projects could be coordinated and conducted sequentially. Clearly, adherence to any projected schedule may not be possible due

Table 5

Data Sheet for the Federal Navigation Project in Tar Bay and Honga River

Location: Longitude, 76° 15'; Latitude 38° 21'. Waterway connecting the Honga River, Fishing Creek, and Tar Bay, near Hooper Island, Dorchester County, MD.

Project authorization: Emergency Relief Appropriations Act of 1935 and the River and Harbor Act of 30 August 1935 (Rivers and Harbors Committee Doc. 35, 74th Cong., 1st sess). Project modified by the River and Harbor Act of 30 June 1948 (H. Doc. 580, 80th Cong., 2d sess) to include channel in Back Creek. Local interests must furnish dredged material placement sites for maintenance. Project completed 13 November 1935 as per the original authorization and work per the 1948 modification was completed 23 April 1956.

Dredging Operations:

1935	Construction	171,363 cy	(overboard)
1939	Maintenance	68,486	(overboard)
1948	Maintenance	86,600	(overboard)
1955	Maintenance	109,300	(overboard)
1956	Construction*	80,000	(overboard, wetland)
1961	Maintenance	123,300	(overboard)
1966	Maintenance	86,400	(overboard, wetland)
1969	Maintenance	17,765	(overboard)
1974	Maintenance	107,279	(overboard, upland)
1977	Maintenance	71,220	(upland)

* New work as per the 1948 modification.

Latest Available Survey: Condition Survey, Feb. 1980 (File 45, map 304 & 306)

Latest Full Report: Annual Report of the Chief of Engineers (Baltimore District Extract) 1978, p. 408.

Project Costs (Total as of year indicated):

	1935	1939	1948	1956	1961
Constr.	$27,668	27,668	27,668	66,119	66,119
O & M	$------	14,170	51,448	95,655	168,109

	1966	1977	1974	1977	1979
Constr.	66,119	66,119	66,119	66,119	66,119
O & M	224,672	251,499	520,499	605,182	894,434

Average Annual O & M Costs (to 30 Sept 1979): $20,800

Maintenance Interval:

	1935-66	1966-77	1935-77
Honga River	6 yrs.	11 yrs.	3 yrs.
Tar Bay	6	8	5
Barren Island Gap	6	3	5
Back Creek 24 yrs.*			

Projected Maintenance:

	1981	1985	1989	1993
Honga River	X			X
Tar Bay	X		X	
Barren Island Gap	X	X	X	X
Back Creek **		X		

Average Annual Shoaling Volume:

Honga River	8,000 cy
Tar Bay	12,000
Barren Island Gap	14,000
Back Creek **	2,000

* No maintenance dredging required since construction in 1956.
** Estimate based on results of 1980 condition survey. Shoaling volume assumes dredging to 2-ft overdepth.

Table 6

Data Sheet for the Federal Navigation Project in Muddy Hook and Tyler Coves

Location: Muddy Hook Cove - Longitude, 76° 10'; Latitude, 38° 15'; off Honga River near Hoopersville; Tyler Cove - Longitude 76° 14', Latitude, 38° 21', off Fishing Creek, Upper Hooper Island, Dorchester County, MD

Project authorization: Section 107, River and Harbor Act of 1960 and formally adopted in 1964. Local interests must provide dredged material placement sites (including retaining dikes if required) for future maintenance. Project completed 19 April 1966.

Dredging Operations:

1966 Construction 96,020 cy (wetland)

Latest Available Survey: Muddy Hook Cove Condition Survey, Jan 1980 (File 45, map 349); Tyler Cove Condition Survey, Feb 1980 (File 45, map 351A).

Latest Full Report: Annual Report of the Chief of Engineers, 1966, p. 268.

Project Costs (Total as of year indicated):

	1966	1972	1979
Constr.	$64,001	64,001	64,001
O & M****	$------	1,020	3,277

Average Annual O & M Costs (to 30 Sept 1979): $273

Maintenance Interval: Muddy Hook Cove - 14 years*
Tyler Cove - 14 years*

Projected Maintenance: Muddy Hook Cove - 1985**
Tyler Cove - 1981**

Average Annual Shoaling Volume: Muddy Hook Cove - 1,500 cy***
Tyler Cove - 1,000 cy***

* No maintenance dredging required since construction in 1966.
** Estimate based on the results of 1980 Condition Surveys.
*** Estimate based on results of 1980 Condition Surveys. Volumes correspond to dredging to 2-ft overdepth. Both projects were dredged to 2-ft overdepth when originally constructed.
**** Operations and maintenance.

Table 7

Projected Maintenance Dredging Schedule for Federal Navigation Projects in the Vicinity of Upper Hooper Island, Dorchester County, Maryland.[a]

Project Channel	Projected Volume on Date Indicated[b] 1981	1985	1989	1993	Total
Barren Island Gap	56,000	56,000	56,000	56,000	224,000
Tar Bay	84,000		96,000		180,000
Honga River	120,000			96,000	216,000
Back Creek		55,000			55,000
Tyler Cove	24,000[c]				24,000
Total	284,000	111,000	152,000	152,000	699,000

a) Based on history of past maintenance operations and the results of 1979-80 project condition surveys. Projected volumes assume dredging to 2-ft overdepth.

b) In cubic yards.

c) Indicated volume comprised of 15,000-cy and 9,000-cy from Federal and State/County navigation projects, respectively.

to the wide variety of factors (e.g., environmental concerns, availability of funds, changes in shoaling rates, etc.)which influence dredging activities. The schedule is, however, of general utility and necessary for planning purposes.

The volumes of dredged material associated with the projected maintenance operations are estimates based on previous operations and the most recent project condition surveys and assume that maintenance dredging will continue to occur to a 2-ft overdepth. In this regard, the estimates represent the maximum volumes which can be expected to be generated during the next ten years. As the containment facility requirements which were required for site identification and cost estimating purposes were determined on the basis of these volumes, the facility requirements also represent maximums. Although this approach may overestimate project dredging and DMP facility needs, it is judged to be adequate for the level of planning intended for accomplishment by this Study for if DMP sites and facilities are developed to meet these projected needs, their useful lifetime will be extended beyond the planning period in the event that there are significant reductions in the volume of material actually generated by future maintenance activities.

Of the two land-based DMP facilities constructed for maintenance operations in 1974 and 1977, only one was judged capable of accommodating additional dredged material without extensive modifications. As this facility was constructed on a wetland area which was utilized in 1966 for unconfined DMP operations it was felt, however, that foundation conditions would not permit the accomplishment of dike-raising operations required to create additional capacity of the appropriate magnitude. This site was considered to be adequate for dredging/DMP activities associated with the proposed State/County project in Tyler Cove in the event that the work could not be accomplished in conjunction with Federal maintenance operations.

Dredged material placement activities associated with construction of the Back Creek project involved overboard side-casting and deposition on two emergent wetland areas. Residential and commercial development has since encroached on one of the latter areas with the other now supporting vegetation which is periodically maintained by mowing. Only the latter area was considered to be potentially suitable for re-use.

Two factors precluded the development of a single DMP facility to accommodate all of the aforementioned dredging projects. Project dimensions were such that distances between various parts of the project and a centrally located site were expected to result in unreasonably high dredging costs and area limitations were such that a site of the required size was not available without encroaching on wetland areas. As a result, the projects were factored into two sectors and DMP plans were developed for each. Sector A contained the Honga River (HR) and Back Creek (BC) channels and the Tar Bay (TB), Barren Island Gap (BIG) and Tyler Cove (TC) projects comprised Sector B. The DMP plans which were developed for these Sectors are described below.

i. Sector A (Honga River and Back Creek)

Because of the lengths of the HR and BC projects (i.e., 1.6 and 1.1 miles, respectively) and the reasonably close proximity of the two projects, the formulation of DMP plans initially considered the following options:

a) Long-term site for HR (Total) and BC

b) Long-term site for HR (Total)
Single-use site for BC

c) Long-term site for HR (Upper segment)
Long-term site for HR (Lower segment)
Single-use site for BC

d) Long-term site for HR (Upper segment) and BC
Long-term site for HR (Lower segment)

e) Long-term site for HR (Upper segment)
Long-term site for HR (Lower segment) and BC

The planar area required for the DMP facilities associated with the above options were determined and utilized in conjunction with various other criteria in the identification of candidate DMP sites according to the procedures described in Appendices C and B, respectively. A total of 11 prospective sites were identified (Figure 5), three of which were located in agricultural areas (Nos. 8 - 10), seven in woodlands (Nos. 1, 2, 4-7, 11), and one in wetlands (No. 3). Estimated costs of the DMP facilities were computed for the particular area type in which the site was located (Appendix D). Dredging cost rates were determined for each of the project/DMP site combinations and estimated dredging costs were derived based on the projected volume of dredged material for each project and the appropriate dredging cost rate as indicated in Appendix E. The results of these cost determinations are given in Table 8.

The total project costs (i.e., dredging and DMP operations) were dominated by dredging costs which accounted for 69-80% of the total cost. This dominance resulted in certain of the multi-site (i.e., two or more DMP sites) combinations being of lower cost than combinations utilizing a single site to accommodate all dredging activities. Total project unit costs ranged from a low of $5.83/cy to a high of $7.81/cy. As a total estimated cost difference between two project/DMP site combinations of as little as $14,000 would lead to a change in unit costs of $0.05, no definitive criteria could be established to determine whether one particular combination was significantly more cost-effective than another when unit cost differences were small. Unit cost differences were, however, relatively well-defined within the seven lowest cost combinations and the differences between combinations 1, 2 and 3-7 were considered to be real in view of the standardized approach whereby the estimates were derived.

A total of 39 site combinations involving either one, two, or three individual sites to accommodate the HR and BC projects can be developed based on the 11 prospective sites identified by the siting procedure and partitioning of the HR channel into two segments. This

Table 8

Estimated Costs of the Dredging/Dredged Material Placement Site Alternatives for the Honga River and Back Creek Federal Navigation Projects

Rank[a]	Project[b]	DMP Site[c] No.	DMP Site[c] Area	DMP Site[c] Land Type	Estimated Cost[d] Dredging	Estimated Cost[d] Facility	Estimated Cost[d] Total
1.	HR(U) HR(L),BC	1 2	12 14	F F	1.095 (4.04)	0.484 (1.79)	1.579 (5.83)
2.	HR(T),BC	1	24	F	1.277 (4.71)	0.351 (1.30)	1.628 (6.01)
3.	HR(U) HR(L),BC	8,10 1	10 14	D,A F	1.292 (4.77)	0.436 (1.61)	1.728 (6.38)
4.	HR(U) HR(L),BC	8,10 2	10 14	D,A F	1.312 (4.84)	0.436 (1.61)	1.748 (6.45)
5.	HR(U),BC HR(L)	1 4,5,6	14 12	F F	1.292 (4.77)	0.484 (1.79)	1.776 (6.55)
	HR(U) HR(L),BC	7,11 1	12 14	F F	1.292 (4.77)	0.484 (1.79)	1.776 (6.55)
6.	HR(U),BC	2	24	F	1.427 (5.27)	0.351 (1.30)	1.778 (6.56)
7.	HR(U) HR(L),BC	7,11 2	12 14	F F	1.312 (4.84)	0.484 (1.79)	1.797 (6.63)
8.	HR(U) HR(L),BC	9 1	12 14	A F	1.452 (5.36)	0.436 (1.61)	1.888 (6.97)
9.	HR(U) HR(L) BC	8,10 4,5,6 3	10 12 11	D,A F W	1.305 (4.82)	0.594 (2.19)	1.899 7.01
10.	HR(U) HR(L),BC	9 2	10 14	A F	1.472 (5.43)	0.436 (1.61)	1.909 (7.04)
11.	HR(U),BC HR(L)	2 4,5,6	14 12	F F	1.427 (5.27)	0.484 (1.79)	1.912 (7.06)
12.	HR(U) HR(L),BC	6 1	12 14	F F	1.452 (5.36)	0.484 (1.79)	1.936 (7.14)
13.	HR(U) HR(L) BC	7,11 4,5,6 3	12 12 11	F F W	1.305 (4.82)	0.642 (2.37)	1.947 (7.19)
14.	HR(U) HR(L),BC	6 2	12 14	F F	1.472 (5.43)	0.484 (1.79)	1.956 (7.22)
15.	HR(T) BC	8 3	20 11	D&A W	1.737 (6.41)	0.307 (1.13)	2.044 (7.54)

(Cont.)

Table 8 (Cont.)

Rank[a]	Project[b]	DMP Site[c] No.	Area	Land Type	Estimated Cost[d] Dredging	Facility	Total
16.	HR(U)	9	10	A	1.466	0.594	2.060
	HR(L)	6	12	F	(5.41)	(2.19)	(7.60)
	BC	3	11	W			
17.	HR(U)	6	12	F	1.466	0.642	2.108
	HR(L)	4,5	12	F	(5.41)	(2.37)	(7.78)
	BC	3	11	W			
18.	HR(T)	7	24	F	1.809	0.307	2.116
	BC	3	11	W	(6.68)	(1.13)	(7.81)

a) Rank determined by total estimated project cost.
b) Entries HR(U) and HR(L) designate the upper and lower segments, respectively of the Honga River Channel; HR(T) designates the total Honga River Channel; BC designates the Back Creek Channel.
c) Site number corresponds to location indicated in Figure 5. Area is in acres and refers to the planar area requirements of the DMP facility. Land types F, A, W and D designate forested land, agricultural land, wetland, and disturbed land, respectively.
d) Costs are in millions of dollars. Parenthetical values denote unit costs (dollars/cy) and are based on a total dredged material volume of 271,000 cy. Dredging and DMP facility costs were derived as described in Appendices E and D, respectively, and are exclusive of dredging mob/demob and land acquisition costs.

presented a formidable task with regard to ranking the individual site combinations in terms of environmental impacts, particularly when differentiation must be made between two combinations each of which consist of more than one site. Ranking of the site combinations in very general terms of environmental impacts was accomplished utilizing the criteria described previously in this report (see Section III.B.b.ii) and by assuming that the severity of an impact increases as the number of sites developed for a project increases. Application of this approach led to the rankings given in Table 9.

Site combinations within the latter five environmental ranking categories were discarded on the basis of high costs and severity of the expected environmental impacts (Table 10). Within the remaining four categories, those site combinations within a given category which were significantly more costly than the others within the category were dismissed from further consideration leaving a total of 12 multi-site conbinations and two single sites with unit costs ranging from a low of $5.83/cy to $6.63/cy with the majority falling between $6.38/cy and $6.63/cy.

As each of the above combinations rely on the potential use of sites 1 and 2, DMP plan development centered primarily on environmental, economic, and legal considerations associated with the second site comprising the combination. Specific considerations included: accessibility and potential for conversion to reuseable site through removal of dredged material for other uses, compliance with existing zoning regulations, and potential availability. When these factors were applied, the existing rankings in terms of estimated cost and expected impacts were not appreciably altered, the exceptions being as follows:

Site 4 - deleted as the site did not strictly comply with the intent of current land zoning (i.e., 'conservation'), was of extremely limited accessibility (i.e., island), and had a low potential of availability.

Site 11 - deleted because of extremely limited accessibility.

Table 9

Preliminary Environmental Ranking of Dredging/Terrestrial Dredged Material Placement Site Alternatives for the Honga River and Back Creek Federal Navigation Projects

Rank: Environmental[a]	Rank: Economic[b]	Site[c]	Area[d]	Land Type[e]	Project Unit Cost[f]
1	3	8/1	10/14	D/F	6.38
	4	8/2	10/14	D/F	6.45
2	3	10/1	10/14	A/F	6.38
	4	10/2	10/14	A/F	6.45
	8	9/1	10/14	A/F	6.97
	10	9/2	10/14	A/F	7.04
3	6	1	24	F	6.56
4	1	1/2	12/14	F	5.83
	2	1	24	F&W	6.01
	5	1/4,5,6	14/12	F/F	6.55
	5	7,11/1	14/12	F/F	6.55
	7	7,11/2	14/12	F/F	6.63
	11	2/4,5,6	14/12	F/F	7.06
	12	6/1	12/14	F/F	7.14
	14	6/2	12/14	F/F	7.22
5	15	8/3	20/11	D&A/W	7.54
6	18	7/3	24/11	F/W	7.81
7	9	8/4,5,6/3	10/12/11	D/F/W	7.01
8	9	10/4,5,6/3	10/12/11	A/F/W	7.01
	16	9/6/3	10/12/11	A/F/W	7.60
9	13	7,11/4,5,6/3	12/12/11	F/F/W	7.19
	17	6/4,5/3	12/12/11	F/F/W	7.78

a) Ranked on the basis of expected environmental impact as described in text.
b) Economic rank as determined in Table 8.
c) Site number corresponds to location indicated in Figure 5.
d) Area is in acres and refers to planar area requirements of the DMP facility.
e) Land types A, D, F and W designate agricultural land, disturbed land, forested land, and wetland, respectively.
f) In dollars/cy from Table 8.

Table 10

Economically and Environmentally Acceptable Dredging/Terrestrial Dredged Material Placement Alternatives for the Honga River and Back Creek Federal Navigation Projects

Rank: Environmental[a]	Rank: Economic[b]	Site[c]	Area[d]	Land Type[e]	Project Unit Cost[f]
1	3	8/1	10/14	D/F	6.38
	4	8/2	10/14	D/F	6.45
2	3	10/1	10/14	A/F	6.38
	4	10/2	10/14	A/F	6.45
3	6	2	24	F	6.56
4	1	1/2	12/14	F	5.83
	2	1	24	F&W	6.01
	5	1/ 5, 6	14/12	F/F	6.55
	5	7/1	14/12	F/F	6.55
	7	7/2	14/12	F/F	6.63

a) Ranked on the basis of expected environmental impact as described in text.
b) Economic rank as presented in Table 8.
c) Site number corresponds to location indicated in Figure 5.
d) Area is in acres and refers to planar area requirements of the DMP facility.
e) Land types A, D, F and W designate agricultural land, disturbed land, forested land, and wetland, respectively.
f) In dollars/cy from Table 8.

In only one case did the level of analysis accomplished by this Study permit the definitive selection of a preferred dredging/DMP alternative for the HR and BC projects from those given in Table 10. The dredging/DMP alternatives utilizing site combinations 1/8 and 2/8 are expected to generate the least adverse environmental impact as site 8 is located in an area formerly utilized for agricultural production and scheduled to be utilized in 1980 as a DMP site for the State/County dredging project in Wallace Creek. Although not expected to be of lowest cost, the cost of these alternatives are comparable to those which are expected to have environmental impacts of greater severity.

If long-term or multi-use DMP facilities are to be developed for the HR and BC projects, planning should be initiated in the very near future. Not only is adequate advance planning required for the systematic development of such sites but planning of this type is oftentimes lengthy and time consuming. As was previously indicated, each of the dredging/DMP alternatives considered to be economically and environmentally acceptable (Table 10) relies on the potential use of either site 1 or site 2. Additionally, maintenance dredging operations for the HR channel may commence as early as 1981. In this regard it would be advisable to establish as rapidly as possible the availability and environmental suitability of sites 1, 2 and 8 and to conduct a more detailed analysis of the costs expected to be associated with DMP activities at these sites.

In the event that neither site 1 nor site 2 is available or ruled environmentally acceptable, a separate single-use site would need to be developed for the BC project. Aside from sites 1 and 2, only one other terrestrial site was identified which was economically acceptable in terms of dredging cost. This site (No. 3) consists of a combination of wetland and terrestrial area, the latter of which is comprised of disturbed land (previously used DMP site) and woodland. Facility requirements are such that site development intended to utilize the disturbed area and to minimize the impact on wetlands would impact woodlands. Alternatively, site development could be accomplished with minimum impact on woodlands if wetlands are used in conjunction with the disturbed area. Because of the location of the site, neither the woodlands nor wetlands constitute highly valuable natural habitats as they are currently heavily impacted by residential and commercial activities. Were this site determined to be environmentally suitable, then the formulation of DMP plans should concentrate on development of long-term use of the currently used DMP site (site No. 8). It should be noted, however, that this plan would be one of the least favorable alternatives from an economic standpoint ($7.54/cy, Table 9).

ii. Sector B (Barren Island Gap and Tar Bay)

As the dominant dredging projects within Sector B are the Barren Island Gap (BIG) and Tar Bay (TB) channels, the formulation of initial DMP plans considered the following options:

a) Long-term site for TB
   Long-term site for BIG

b) Long-term site for TB and BIG

The Federal and State/County projects in Tyler Cove (TC) were not considered during the initial planning phases as the expected volume of dredged material was sufficiently small (i.e., 24,000 cy) that it could be accommodated by either the existing site constructed for the 1974 dredging operations or by the sites identified in this Study.

Dredged material placement facility reqirements were determined, candidate sites were identified, and estimated costs for the dredging/DMP operations associated with the aforementioned options were derived in the same manner as were those for the projects in Sector A. Three prospective sites were identified (Figure 5) two of which were located in woodland areas (Nos. 12, 13) and a third (No. 14) which was a mixture of woodland and agricultural land. The agricultural portion of the latter site was of sufficient area to meet the DMP facility area requirements for either the TB or BIG channels individually. Depending upon the shape and the orientation of the facility designed to accommodate dredged material from both the TB and BIG channels, the area utilized would consist of a mixture of woodland and cropland or all woodland. The estimated costs derived for this facility did not differentiate between these possibilities and were computed for a facility developed in woodlands. Estimates of the total project costs (i.e., dredging and DMP operations) associated with development options (a) and (b) above are compiled in Table 11.

Dredging costs dominated the total project costs and accounted for 73 - 79% of the latter. Total project unit costs ranged from a low $5.32/cy to a high of $5.74/cy and, because dredging costs rates were the same for all dredging/DMP alternatives, the differences in project unit costs derive solely from differences in DMP operational costs. These differences, which were on the order of $140,000, illustrate the savings which can be realized by the construction of a single large facility to serve the same function as two or more smaller facilities.

The single and multiple site combinations were ranked in terms of potential environmental impacts in the manner described and utilized for this purpose in Sector A and the results are given in Table 12. Based on the cost/environmental impact rankings, site No. 14 is preferred for the development of long-term use facilities for dredging/DMP activities associated with the BIG and TB channels. This site would also conveniently accommodate the Federal and State/County dredging projects in TC. Dredging costs would be low (i.e., $2.83/cy) because of the close proximity (i.e., 5,000-ft) of the site to the dredging area and the facility as designed has adequate capacity for the additional dredged material from this project.

Although the primary difference between sites 12 and 14 appears to be in terms of environmental impacts, additional factors must be considered in the event that the unavailability of site 14 necessitates the development of site 12. The location of site 12 is presently

Table 11

Estimated Costs of the Dredging/Terrestrial Dredged Material Placement Site Alternatives for the Tar Bay and Barren Island Gap Federal Navigation Projects

		DMP Site[c]			Estimated Cost[d]		
Rank[a]	Project[b]	No.	Area	Land Type	Dredging	Facility	Total
1	TB, BIG TB, BIG	14 12	32 32	A&F F	1.461 (4.20)	0.392 (1.13)	1.853 (5.32)
2	TB BIG	14 13	18 15	A F	1.461 (4.20)	0.506 (1.45)	1.967 (5.65)
	TB BIG	14 12	18 15	A F	1.461 (4.20)	0.506 (1.45)	1.967 (5.65)
3	TB BIG	12 13	18 15	F F	1.461 (4.20)	0.536 (1.54)	1.996 (5.74)

a) Rank determined by total estimated project cost.
b) Entries TB and BIG designate the Tar Bay and Barren Island Gap Channels, respectively.
c) Site number corresponds to location indicated in Figure 5. Area is in acres and refers to planar area requirements of the DMP facility. Land types A and F designate agricultural land and forested land, respectively.
d) Costs are in millions of dollars. Parenthetical values denote unit costs (dollars/cy) and are based on a total volume of 348,000 cy. Dredging and DMP facility costs were derived as described in Appendices E and D, respectively, and are exclusive of dredging mob/demob and land acquisition costs.

Table 12

Economically and Environmentally Acceptable Dredging/Terrestrial Dredged Material Placement Alternatives for the Tar Bay and Barren Island Gap Federal Navigation Projects

Rank[a]			DMP Site[c]			Project
Environmental	Economic	Project[b]	Site	Area	Land Type	Unit Cost[d]
1	1	TB,BIG	14	32	A&F	5.32
2	2	TB/BIG	14/13	18/15	A/F	5.65
3	2	TB/BIG	14/12	18/15	A/F	5.65
4	1	TB,BIG	12	32	F	5.32
5	3	TB/BIG	12/13	18/15	F/F	5.74

a) Environmental rank based on expected impact as described in text. Economic rank as determined in Table 11.
b) Entries TB and BIG designate the Tar Bay and Barren Island Gap Channels, respectively.
c) Site number corresponds to location indicated in Figure 5. Area is in acres and refers to planar area requirements of DMP facility. Land types A and F designate agricultural land and forested land, respectively.
d) In dollars/cy from Table 11.

zoned 'Conservation' by the Dorchester County Zoning Ordinance and, although not specifically legislated as unacceptable, DMP activities appear to be contrary to the intent of the zoning. Although previous DMP operations (1977) have, however, been conducted near the proposed site, the environmental impact was not of the severity of that which would result if site 12 were utilized as proposed. Additionally, the relative inaccessibility of the site (i.e., island) would be expected to increase the costs of DMP operations conducted at the site as well as reduce the potential for extending the useful lifetime of the site by removal of dredged material for other purposes. These considerations also apply to combinations involving site 12.

In lieu of development of either site 12 or of site 14 as a single facility to accommodate both the TB and BIG channels, consideration should be given to use of the site combination 14/13 as the area of the agricultural portion of site 14 would permit the construction of a facility for either TB or BIG and reduce the overall environmental impact of developing two small sites as opposed to a single large site.

As maintenance dredging operations for portions of the Tar Bay - Honga River project may commence as early as 1981, it would be advisable to determine the availability and environmental acceptability of the candidate sites and accomplish a more detailed cost analysis in the very near future. Detailed planning must await, however, the results of the recently initiated feasibility study regarding the possible realignment of the TB and BIG channels (Figure 5). The development of sites 13 and/or 14 would accommodate only approximately 30% of the realigned channel with a dredging unit cost rate equal to that for the existing channels and these sites (i.e., $3.65/cy). Dredging unit cost rates for the balance of the realigned channel would range between $4.58 and $5.87/cy and would result in significant dredging cost increases. Development of site 12, on the other hand, would accommodate dredged material generated by the construction and maintenance of the entire realigned channel with dredging unit cost rates of between $2.83/cy and $3.65/cy. Facility development and use would, however, be hindered by environmental, logistical, and legal constraints as previously indicated.

The DMP plans described above were developed on the basis of economic and environmental concerns associated with DMP activities and assumed that all dredged material would be confined in land-based facilities. The approach was relatively well-defined in that by making certain simplifying assumptions and ignoring certain minor site to site variations within an area type, standardized approaches were developed for assessing the environmental and economic impacts associated with various dredging/DMP alternatives. Because of the greater variations which exist between sites and project objectives for DMP activities in aquatic areas relative to terrestrial areas, the development of standardized approaches for accomplishing environmental and economic analyses for the former activities either requires that site specific data be obtained or that any standardized approach be subject to the potential for substantially larger errors than would be the latter. For comparative purposes, a standardized approach was developed for deriving aquatic-based facility costs (Appendix D) and the major environmental issues were addressed during application of the site identification procedure (see Appendix B and Section III.B.b.a of this Report).

As specific project designs and, hence, cost estimates formulated for candidate aquatic sites were not as refined as were those for terrestrial sites, total project costs for DMP activities in terrestrial and aquatic areas are not directly comparable. Even on the most qualitative level, however, the cost differences which exist are of sufficient magnitude that the economic feasibility of aquatic-based DMP activities may be questionable. In general, DMP activities in aquatic areas become cost-effective relative to terrestrial areas only if dredged material placement can be accomplished without the need for extensive retaining structures (i.e., unconfined or semi-confined placement) or if the costs of such structures can be offset by reduced dredging costs (i.e., dredged material transport distances are markedly less to the aquatic site than to the terrestrial site). This generalization ignores, however, the potential economic and environmental benefits which can be realized from the use of aquatic areas for DMP activities. Because of this potential, candidate DMP sites were identified within Sectors A and B intended for the productive use of dredged material through shore erosion abatement and/or habitat creation efforts.

Candidate site identification was accomplished in accordance with the criteria established for DMP siting in aquatic areas (see Appendix B and Section III.B.2.a of this Report). The majority of prospective aquatic sites which were identified were located along the shore of Barren Island (site Nos. 15 - 18, Figure 5) and were intended to accommodate dredged material generated by the TB and BIG channels. These sites were selected primarily on the basis of the high energy regimes prevailing at the Island which, in turn, leads to low biological productivity of the shallow nearshore areas and high shore erosion rates. Thus, use of these sites for DMP activities for the purpose of shore erosion abatement can be expected to (1) result in minimum adverse environmental impacts, (2) provide the greatest potential for positive environmental impacts, and (3) derive the greatest benefit from shore erosion protection efforts. Reductions in shore erosion rates are of environmental and economic significance as such reductions serve to reduce sediment input into the aquatic environment and to prolong the Island's function of providing erosion protection to the west shore of Upper Hooper Island.

Dredged material placement activities at the prospective sites will not directly impact charted seagrass and shellfish beds and will not severely impact archeological resources which may exist as the activities do not involve excavation. The potential for use of these sites is enhanced by their close proximity to the project dredging areas, single ownership of the terrestrial land bordering the sites, and minimal shoreline development.

In order to minimize potential adverse impacts which could result from migration of the dredged material from the site both during and subsequent to the DMP operation, a retention/protection (R/P) structure was assumed to be required. The primary function of the structure was to retain and protect the dredged material until it consolidated and could be vegetatively stabilized and, consequently, increase the potential for successfully accomplishing the project objectives (i.e., shore erosion abatement and habitat creation). As the structure design was primarily in response to the prevailing energy environment, the structure was inadequate to enable the DMP activity to meet applicable water quality standards for all types of dredged materials. Finally, in order to minimize the environmental and legal problems associated with the creation of fast land from aquatic areas, it was assumed that the placement activity would be limited to the creation of intertidal wetlands ranging in elevation from mean low water (MLW) to +0.5-ft above mean high water (MHW).

The major drawback to projects of this type is that the site cannot function as a long-term use site without resulting in adverse environmental impacts. Unlike long-term use terrestrial facilities in which the direct environmental impacts of repeated placements of dredged material are minimal, similar operations at an aquatic-based facility would repeatedly impact an area which had reached a certain level of recovery between DMP operations. Thus projects must be well-designed and appropriately staged in order that project objectives can be met in the shortest possible time and that the site function as a long-term use site without producing repeated adverse environmental impacts. Finally, the successful completion of the project results in the creation of a valuable habitat and unlike terrestrial DMP activitities the site has a low potential for re-use and hence a finite lifetime.

Data pertaining to the estimated dredging/DMP costs for site 15 - 18 are compiled in Table 13. As designed, the use of sites 15 - 17 would

Table 13

Estimated Costs of the Dredging/Aquatic Dredged Material Placement Site Alternatives for the Tar Bay and Barren Island Gap Federal Navigation Projects

Site No.[a]	Area[b]	Capacity[c]	Estimated Cost[d]: Dredging	Facility	Total
Permanent R/P Structure[e]					
15	14.7	94,000	0.306 (3.25)	0.329 (3.50)	0.635 (6.75)
16	13.9	89,000	0.290 (3.25)	0.575 (6.46)	0.865 (9.71)
17	17.7	113,000	0.474 (4.20)	0.877 (7.75)	1.351 (11.95)
TOTAL[f]	46.3	296,000	1.070 (3.61)	1.781 (6.02)	2.851 (9.63)
18	65.3	348,000	1.461 (4.20)	1.534 (4.41)	2.995 (8.61)
Temporary R/P Structure[e]					
15	14.7	94,000	0.306 (3.25)	0.148 (1.57)	0.454 (4.83)
16	13.9	89,000	0.290 (3.25)	0.260 (2.92)	0.549 (6.17)
17	17.7	113,000	0.474 (4.20)	0.396 (3.50)	0.870 (7.70)
TOTAL[f]	46.3	296,000	1.070 (3.61)	0.803 (2.71)	1.873 (6.33)
18	65.3	348,000	1.461 (4.20)	0.692 (1.99)	2.153 (6.19)

a) Site numbers correspond to locations indicated in Figure 5.
b) Area, in acres, of placement site bounded by shoreline and R/P structure.
c) Capacity, in cubic yards, of placement site. Assumes average fill depth of 4-ft and maximum final elevation of +0.5 mean high water.
d) Costs as in millions of dollars. Parenthetical values represent unit costs (dollars/cy). Dredging and DMP facility costs were derived as described in Appendices E and D, respectively and are exclusive of dredging mob/demob costs.
e) Permanent R/P structure refers to rock retaining structure; semi-permanent refers to retaining structure constructed of sand-filled fabric bags.
f) Totals for the sum of sites 15-17. Unit costs represent a weighted average in terms of capacity of the individual sites.

be expected to accommodate effectively all (i.e., 85%) of the dredged material expected to be generated by maintenance dredging of the TB and BIG channels for the ten year period 1980 - 1990, while site 18 alone would accommodate all of the expected material. Two types of R/P structures were considered for cost estimating procedures. The permanent structure basically consists of a rock dike. Sand-filled fabric bags are considered to be a semi-permanent structure. Total project unit costs are significantly greater than that of the least costly land-based dredging/DMP alternative and derive primarily from the costs associated with the R/P structures. Only if a semi-permanent R/P structure is utilized do the aquatic sites become comparable in cost to the most costly land-based sites.

If it were determined that R/P structures were not required, the use of sites 15 and 16 would be economically preferred to sites 17 and 18. From an environmental standpoint, the use of site 18 is expected to generate the least adverse impacts and have the greatest potential for positive impacts deriving from a reduction in shore erosion and from habitat creation. This site also, however, has the greatest need for R/P structures in order to maximize the potential that the project objectives would be realized. It should be noted that dredging cost rates would be substantially reduced were the proposed channel realignment authorized and sites 15 - 18 utilized as DMP sites for construction and future maintenance.

Four additional candidate aquatic sites (Nos. 19 - 22, Figure 5) were identified which were judged to be potentially suitable for use by the navigation projects in Sector A. Either of sites 19 - 21 would accommodate the BC project while site 22 would be appropriate for use by the HR channel. Dredged material placement activities at the prospective sites will not directly impact charted seagrass and shellfish beds and will not severely impact archeological resources which may exist as the activities do not involve excavation of material within the placement area. The high energy environment at sites 19 - 21 precludes unconfined placement operations to ensure success of the project and to minimize the potential for indirect adverse environmental impacts resulting from migration of material from the DMP site. Placement activities conducted at sites 20 and 21 without such structures also presents the potential for shoaling of the natural channel south of the sites. Because of the orientation of site 22 with respect to the dominant and prevailing winds, and because of the configuration of the land mass surrounding this site, R/P structures were considered to be desirable but not a necessity. Because of the low energy which prevails at this site, direct adverse environmental impacts resulting from DMP operations may be of greater severity than at sites 19 - 21. The primary project objective at this site is, however, the creation of an intertidal wetland habitat and may serve to mitigate these impacts.

Estimated dredging/DMP site costs for BC and sites 19 - 21 and for HR and site 22 are given in Table 14. On the basis of environmental and economic considerations, the use of sites 19 - 21 for the BC project are considered to be viable alternatives only if land-based DMP facilities are not developed at sites 1 and 2 as previously described for use by HR and BC and if the terrestrial-wetland site (No. 3) is determined to be unavailable or unsuitable for facility development and use for the BC project.

The dredging cost rate for utilization of site 22 to accommodate the dredged material generated by maintenance of the HR channel is comparable to the majority of those for the various dredging/DMP alternatives described above. Thus, if as is assumed, R/P structures are not required for development and use of this site, considerable savings in project costs can be expected to be realized in the form of DMP facility costs relative to those of the previously identified land-based facilities. The complexity of developing a long-term DMP plan for the BC and HR projects, in terms of the number of dredging/DMP alternatives which result when use of this site is considered, precludes the development of a definitive DMP plan. As the primary emphasis of the Study was on terrestrial sites, additional planning must await a determination of the suitability of site 22 for development as a DMP site. Because of the potential for significant cost savings and for a minimal negative net environmental impact if this site is utilized for DMP activities with habitat creation (i.e., intertidal wetland) as the project objective, the environmental and economic feasibilities for site use should be determined concurrently with those for the terrestrial candidate sites which were previously identified as worthy of further detailed economic and environmental investigations.

Table 14

Estimated Costs of the Dredging/Aquatic Dredged Material Placement Site Alternatives for the Honga River and Back Creek Federal Navigation Projects

			Estimated Cost[d]		
Site No.[a]	Area	Capacity[c]	Dredging	Facility	Total
19-21	10[b]	64,000	0.231[e] (4.20)	0.411[e] (7.47)	0.642[e] (11.67)
19-21	10[b]	64,000	0.231[f] (4.20)	0.185[f] (3.37)	0.416[f] (7.56)
22	135	864,000	1.182 (5.47)	-----[g] -----[g]	1.182 (5.47)

a) Site numbers correspond to locations indicated in Figure 5.
b) Area, in acres, of placement site bounded by shoreline and R/P structure.
c) Capacity, in cubic yards, of placement site. Assumes average fill depth of 4-ft and maximum final elevation of +0.5 mean high water.
d) Costs as in millions of dollars. Parenthetical values represent unit costs (dollars/cy). Dredging and DMP facility costs were derived as described in Appendices E and D, respectively and are exclusive of dredging mob/demob costs.
e) Permanent R/P structure of rock. Costs are for 55,000 cy of dredged material
f) Semi-permanent R/P structure of sand-filled fabric bags. Costs are for 216,000 cy of dredged material.
g) No R/P structure required.

b. Knapps Narrows

The Federally authorized navigation project at Knapps Narrows provides for a 75-ft wide channel extending from the 9-ft depth contour in the Chesapeake Bay through Knapps Narrows (Chesapeake Bay (CB) Channel) to the same depth in Harris Creek (Harris Creek (HC) Channel), a distance of approximately 9,000-ft (Figures 7 and 8). Data and information collected in conjunction with the dredging needs assessment is presented in Table 15. Maintenance of the entire channel was conducted on a fairly regular schedule subsequent to construction in 1935 and up through 1966. During the period 1966-1980, maintenance operations were less frequent, presumably as a result of funding limitations and environmental constraints relevant to DMP activities, and led to alternate maintenance of the CB and HC channels. In general, the CB channel requires more frequent maintenance than does the HC channel.

The maintenance of an anchorage basin adjacent to the CB channel was periodically accomplished concurrently with channel maintenance between 1935 and 1975. It has recently been determined, however, that future maintenance responsibilities must be assumed by local government (i.e., Talbot County).

Prior to 1975, DMP activities associated with dredging operations resulted in the unconfined placement of dredged sediments on tidal wetland areas bordering the channels and in open-water areas. Although DMP operations since that time have utilized land-based containment facilities, one of the previously used open-water areas continues to serve as an environmentally acceptable DMP site (Figure 8). Use of this site, however, is limited to dredged sediments composed of 80% or greater sand-sized particles (i.e., retained by the U.S. No. 200 sieve).

Future maintenance operations of the CB and HC channels are projected to be required at 5-year intervals beginning in 1982. This interval is required primarily by the shoaling rate experienced by

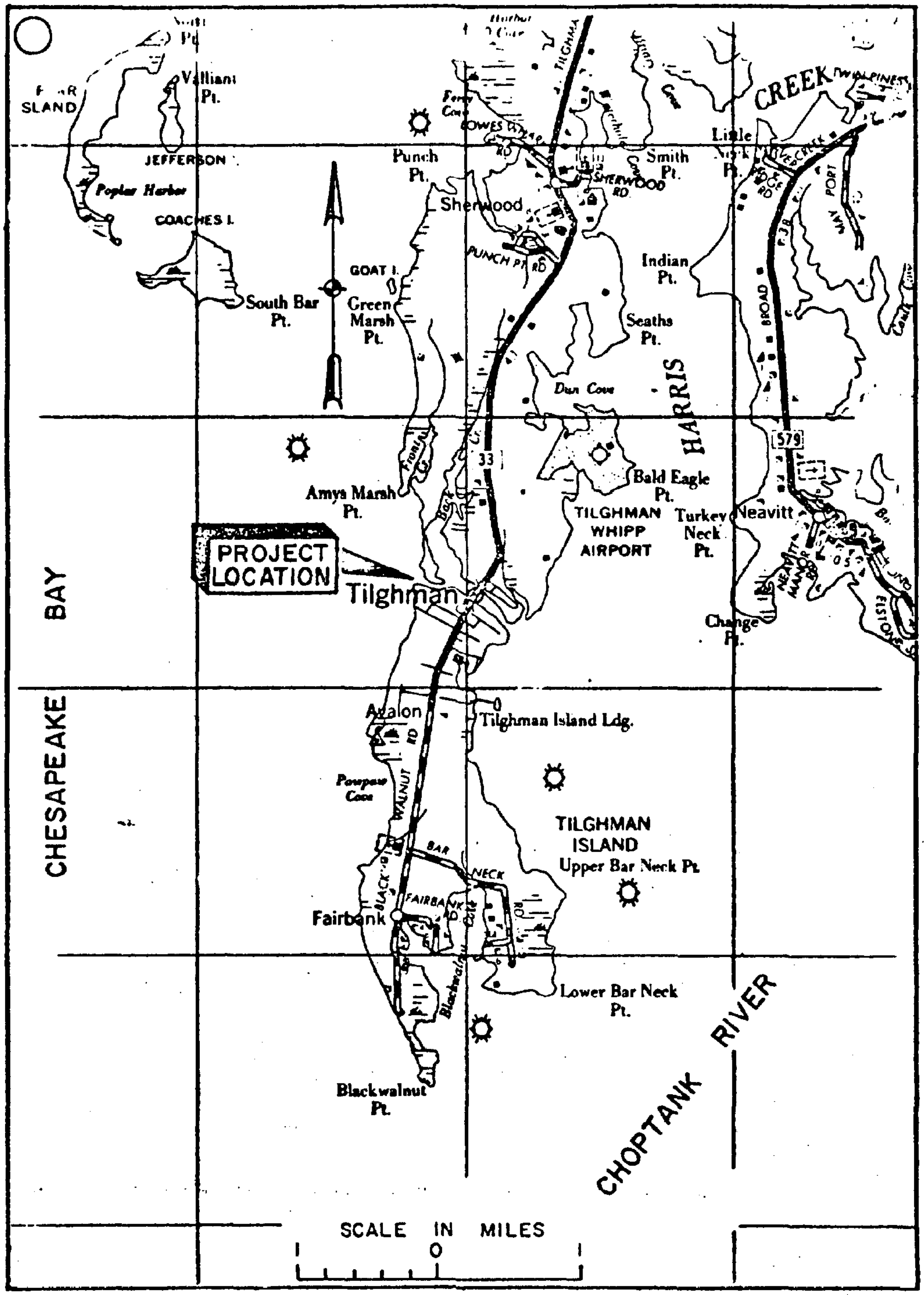

Figure 7. Vicinity map showing the location of the Knapps Narrows Federal navigation project.

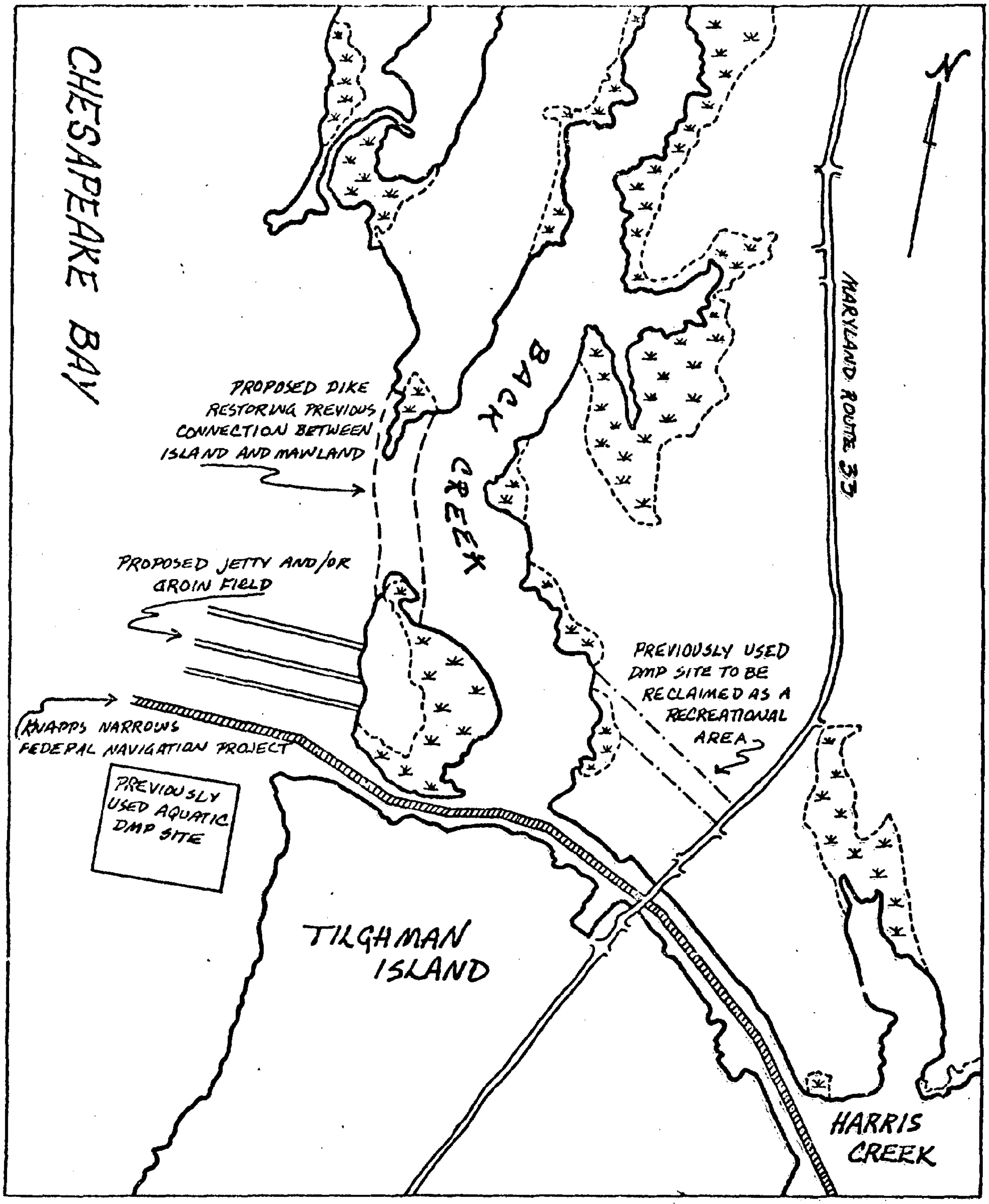

Figure 8. Project map of the Knapps Narrows Federal navigation project showing the locations of the openwater dredged material placement site, the proposed jetty or groin field, the proposed revetment-protected dike connecting the Island and the mainland, and the planned public recreation area.

Table 15

Data Sheet for the Federal Navigation Project at Knapps Narrows

Location: Longitude, 76° 20'; Latitude, 38° 43'. Waterway connecting Harris Creek and Chesapeake Bay, near the town of Tilghman, Talbot County, MD.

Project authorization: 16 September 1933 by the Public Works Administration and adopted by the River and Harbor Act of 20 August 1935 (H. Doc. 308, 72d Cong., 1st sess). Local interests are required to furnish dredged material placement sites for maintenance. Project completed in 1935.

Dredging Operations:

1935	Construction	257,977 cy	(overboard)
1945	Maintenance	81,414	(overboard)
1950	Maintenance	31,015	(overboard, wetland)
1956	Maintenance	90,300	(overboard, wetland)
1962	Maintenance	76,500	(overboard, wetland)
1966	Maintenance**	27,000	(overboard)
1968	Maintenance*	27,400	(overboard)
1975	Maintenance**	85,500	(overboard, upland)
1977	Maintenance*	43,550	(upland)
1980	Maintenance**	64,800	(overboard, upland)

* Harris Creek Channel (West) portion only.
** Bay Channel (East) portion only.

Latest Available Survey: Harris Creek Channel - Condition Survey, Sept. 1979 (File 45, map 347); Bay Channel - Post-dredging Survey, April 1980 (File 45, map 355).

Latest Full Report: Annual Report of the Chief of Engineers (Baltimore District Extract), 1978, p. 4-8.

Project costs (Total as of year indicated):

	1935	1946	1950	1956	1962
Const.	$45,872	46,121	46,121	46,121	46,121
O & M	$------	30,976	45,403	85,094	119,378

	1967	1968	1975	1977	1979
Const.	46,121	46,121	46,121	46,121	46,121
O & M	145,992	173,092	340,701	553,348	578,624

Average O & M Cost (to 30 Sept 1979): $13,456

Maintenance Interval: Approximately 5 years for total project. Bay Channel requires more frequent maintenance than Harris Creek Channel.

Projected Maintenance: 1982, 1987

Average Annual Shoaling Volume: Bay Channel - 9,000 cy
Harris Creek Channel - 5,000 cy

the CB channel. It is uncertain whether the HC channel maintenance interval can be extended to ten years without resulting in project conditions of a critical nature (i.e., shoaled areas which severely hamper navigation). As significant savings in dredging mob/demob costs can be expected to be realized when two dredging operations in close proximity are conducted sequentially, it would be advisable to accomplish maintenance operations for both channels at the same time. This approach would also reduce the cumulative environmental impacts associated with the current practice of alternately maintaining the two channels at 2- to 3-year intervals.

The DMP plan which is proposed for the Knapps Narrows navigation project was not specifically developed on the basis of utilization of a long-term use site as this type of site was constructed and utilized for the 1980 maintenance dredging operations which were accomplished for this project and for the Tilghman Island Harbor project. This site is located immediately adjacent to a general landfill operation and thus has a high potential for serving as a long-term use site in that additional site capacity can be created by removal of dredged material for use as landfill cover material. At present this site appears to have sufficient capacity available to accommodate the material expected to be generated by maintenance operations projected for 1982. Capacity beyond that date is largely dependent upon the rate of removal of material for other uses and the rate at which channel shoaling occurs.

The DMP plan which was developed centered primarily on extending the useful lifetime of the aforementioned site rather than on developing a new site which would serve as a long-term site beyond the year 1982. The primary components of the plan include (Figure 8):

1. the construction of a jetty or groin system intended to:
   - reduce the rate of shoaling in the CB channel
   - retard the rate of erosion of the Island separating the Chesapeake Bay and Back Creek;
2. the use of dredged material deriving from 1982 maintenance of the CB channel for:

- shore erosion protection efforts
- construction of a barrier intended to reduce the rate of shoaling in the CB channel;

3. the removal of dredged material from the existing DMP site for use as:
   - cover material in a nearby landfill operation
   - general fill material in the reclamation of a previously used DMP site.

The complexity of the environmental, economic, technical, and legal factors which are operative in regard to a plan of this type precluded accomplishing even a general economic/environmental analysis of the type which was utilized for other projects examined by the Study. Consequently, the plan is presented and discussed below in very general terms in order to obtain a preliminary assessment of the potential for further investigations.

The feasibility of constructing a jetty extending from the Island separating Back Creek and the Chesapeake Bay was investigated by the COE in 1974. The construction of a groin field along the west shore of the Island was also considered as an alternative to the jetty and was expected to reduce the rate of channel shoaling as well as the rate of erosion of the Island. Although the Island is not the principal source of channel shoal material, the preservation of this natural protective barrier is of extreme importance in providing continued protection to the south shore of the CB channel. Although both of these alternatives were determined at that time to not be economically justified, that situation may no longer prevail in view of the recent dramatic increases in dredging costs.

Shoaling of the CB channel at the confluence of the channel and Back Creek results primarily from the southerly transport of sediment from points north of the Island which passes through the breach between the Island and the mainland into Back Creek and ultimately deposits in the channel. It is primarily shoal material extracted from this portion of the channel which contains appreciable amounts of fine-grained material and thus necessitates placement in land-based containment facilities.

A substantial reduction in the shoaling rate in this area could be expected to be achieved by the construction of a barrier which connects the northernmost point of the Island with the mainland as existed prior to erosion of the natural land mass. Such a barrier could be constructed utilizing dredged material from channel maintenance operations and would clearly require protection by a suitable revetment-type structure to ensure its integrity and longevity. Although Back Creek would continue to contribute to shoaling of the channel, the rate would be significantly reduced. Additionally, the shoal material would be expected to be composed primarily of fine-grained sediments as the primary source of coarse-grained sediments would have been eliminated. The result of the combination of of these effects is a reduction not only in the total volume of material which must be confined in land-based facilities but also in the proportion of coarse-grained material which would otherwise be placed in the facility.

The existing channel currently functions in much the same manner as would either a jetty or a groin field when placed as suggested in that both systems interrupt the alongshore transport and supply of littoral drift to areas south of the channel. This interruption, in turn, can lead to increased shore erosion rates at points south of the channel. The current practice of depositing dredged material of the appropriate composition in nearshore areas south of the CB channel serves to somewhat alleviate this problem. Although a jetty or groin system would initially interrupt the major supply of sediment to more southerly points, re-supply could be achieved when the erosion abatement structures had filled to capacity. At that time, shoal material from the channel as well as a portion of that intercepted by the structures could be dredged and deposited south of the channel. In some respects, then, the groin field or jetty would primarily function as a means of shore erosion abatement for the Island rather than of reducing the channel shoaling rate.

Reclamation of the site developed and utilized for DMP operations associated with the 1977 maintenance work is currently being considered by the local government. Preliminary plans center on the development of a public recreation area and, depending upon the final design, may require substantial volumes of general fill material. If required, the most recently constructed DMP site would be a convenient source of such material.

The proximity of the planned recreation area to Back Creek, the Island, and ultimately, the Chesapeake Bay presents an opportunity to provide access for non-boating water-related activities. Such access is severely limited within the Study area as effectively all waterfront access is either in private ownership or those public facilities which are available are almost exclusively oriented toward boating interests. Conceptually, access to the Island could be provided by an elevated walkway and the beach-type area which would conceivably result from the entrapment of sediment by the groin field (or the jetty) would be available for use by the public.

Clearly, the plan outlined above will be expected to generate numerous environemntal, legal, economic and social impacts. The nature and the degree of these impacts can only be assessed by detailed investigations, the justification for which will depend upon a preliminary assessment of the proposed plan by the appropriate funding and regulatory agencies.

2. Dredged Material Placement Plans Based on Single-Use Sites

a. Muddy Hook Cove, Duck Point Cove, and Lowe's Wharf Projects

The DMP plans which were developed for dredging projects having maintenance intervals ranging between 15- and 30-years and maintenance volumes on the order of 50,000 cy or less centered primarily on the identification of candidate sites which would be utilized for a single dredging operation, i.e., single use sites. As DMP operations (facility construction, operation, management and site reclamation) of this type can generally be accomplished within a 3- to 5-year period, land acquisition does not present problems of the magnitude of those associated with the acquisition of long-term use sites. While DMP sites created as the result of previous placement activities in intertidal wetlands are, because of technical and engineering problems related to retaining structure design and construction, generally not suitable for development of long-term use facilities, their use as single-use sites are technically feasible. Additionally, such sites are preferable from an economic standpoint as their initial use was undoubtedly prompted by their close proximity to the project dredging area and dredged material transport distances can be expected to be minimized. Finally, the least adverse environmental impact would be expected to be generated by use of these sites due to their disturbed nature.

It was primarily for these reasons that once such sites had been identified, an assessment of their potential availability was made by contact with the current landowner. If site availability was reasonably assured, no additional candidate sites were identified or evaluated. Ultimately, however, it will be necessary to clearly determine the availability and environmental suitability of the prospective sites. The DMP plans which were developed for three

Federal navigation projects were based on sites of the type described above and are presented below.

Muddy Hook Cove. The Federally authorized navigation project in Muddy Hook Cove provides for a 60-ft wide channel extending from the 6-ft depth contour in the Honga River to and including an anchorage basin near the county terminal facilities at Hoopersville on Middle Hooper Island (Figures 9 and10) a distance of approximately 3,000-ft. No maintenance dredging operations have been conducted subsequent to project construction in 1966 (Table 6). Based on the results of the Project Condition Survey accomplished by the COE in January 1980, it is expected that maintenance operations will be required by the year 1985 and such operations will generate approximately 30,000-cy of dredged material at 2-ft overdepth. The proposed State/County navigation project involves the construction of a mooring basin in Muddy Hook Cove and is estimated to require dredging of an estimated 5,000-cy of sediment.

Dredged material placement activities associated with project construction resulted in the unconfined deposition of an undetermined volume of dredged material on nearby tidal and supra-tidal wetland areas (Figure 10). The candidate site encompasses approximately 13 acres of upland area surrounded by tidal and supra-tidal wetlands and currently supports a dense stand of Phragmites communis. The site is of sufficient size to satisfy the DMP facility planar area requirements of approximately 6 acres and maintain a 100-ft buffer zone between the facility and the upland-wetland boundary. Dredging costs are expected to be reasonable in view of the close proximity of the site to the project dredging area. It should be noted that possible savings in dredging mob/demob costs could be expected to result if dredging operations were conducted sequentially with those expected for the Federal projects in Back Creek and the Barren Island Gap in the vicinity of Upper Hooper Island (see Section III.C.1.a.of this Report). In view of the scarcity of other upland areas which would be environmentally and economically acceptable, it is recommended

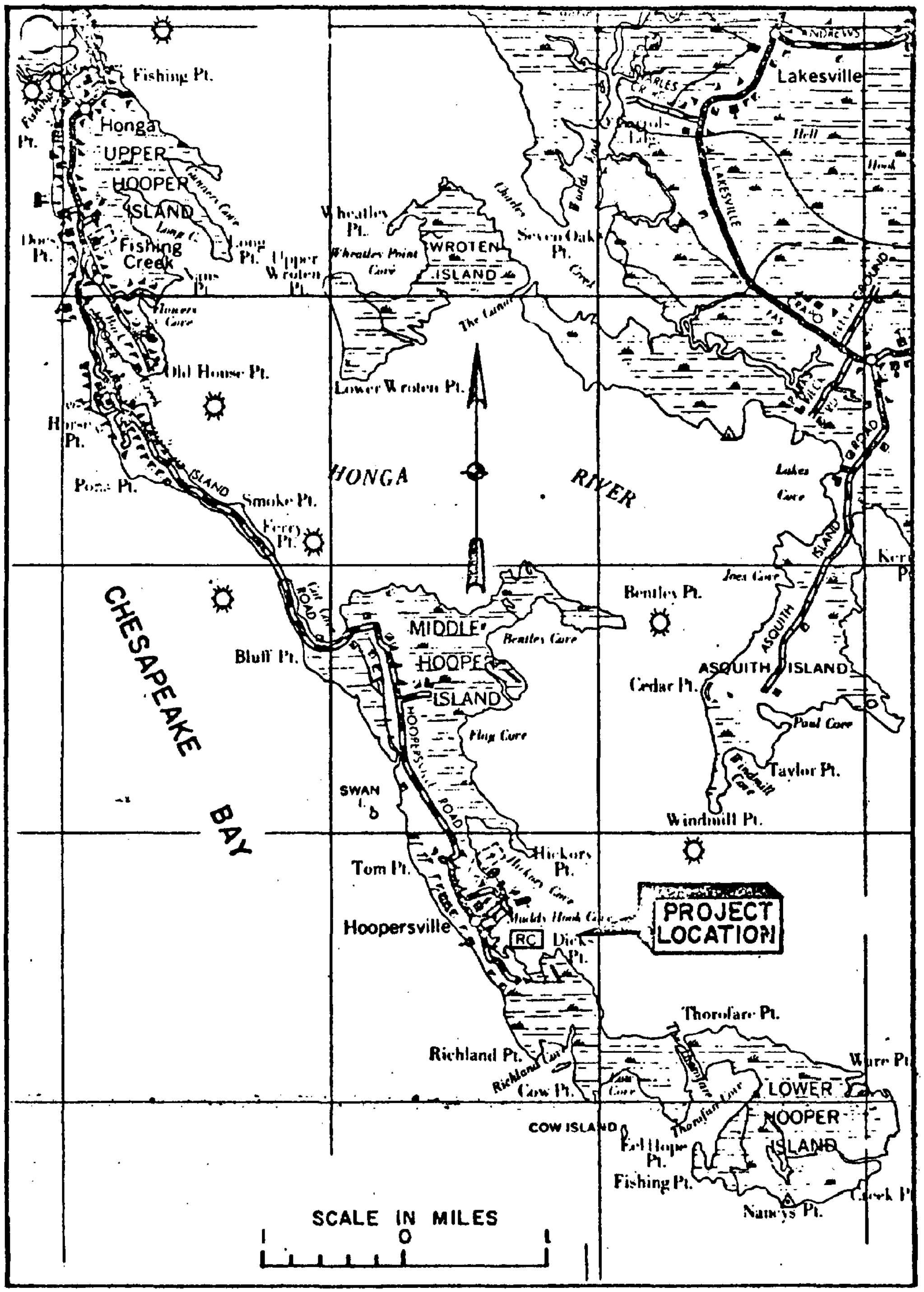

Figure 9. Vicinity map showing the location of the Muddy Hook Cove Federal navigation project.

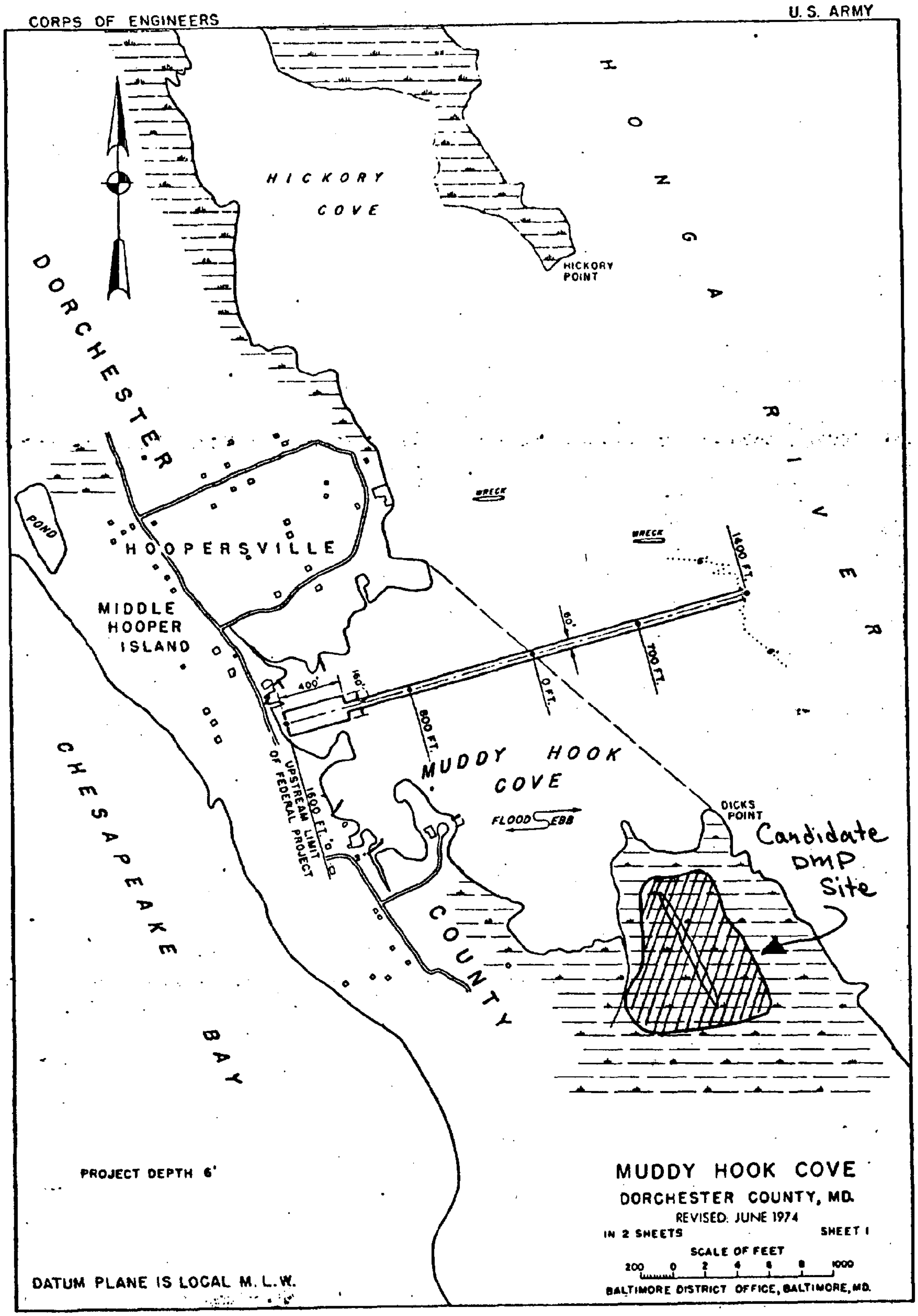

Figure 10. Project map of the Muddy Hook Cove Federal navigation project showing the location of the candidate dredged material placement site.

that the requisite project sponsors pursue the use of this site for future maintenance of the Federal project and construction of the State/County Project.

Duck Point Cove. The Federally authorized navigation project in Duck Point Cove provides for a 4,405-ft long, 60-ft wide channel from the 6-ft depth in Duck Point Cove to and including a mooring basin at the head of the waterway (Figures 11 and 12). Maintenance dredging operations have been conducted only once (1966) since construction of the project in 1950 (Table 16). The previous maintenance history of the project and the results of a Project Condition Survey accomplished by the COE in November 1979 indicate that additional maintenance operations will be required by the year 1982. These operations are expected to generate a maximum of 40,000 cy of dredged material at 2-ft overdepth. The volume of dredged material could be as little as 25,000 cy if, as was accomplished in 1966, only the major shoal areas within the project are removed.

The DMP activities associated with the construction and maintenance dredging operations resulted in the unconfined placement of approximately 73,000 cy of dredged sediments on nearby tidal and supra-tidal wetland areas (Figure 12). The candidate site encompasses approximately 20 acres of upland surrounded by wetlands and containing 7 acres of woodland. The former DMP site comprises the remaining 13 acres and is in various stages of recovery. The shape of the site is such that the DMP facility planar area requirements (i.e., approximately 8 acres) can be met in one of two ways. Construction of a facility and maintenance of a 100-ft buffer zone between the upland-wetland boundary necessitates impacting the woodland area and a portion of the former DMP site while development of the site without severely impacting the woodland area can only be achieved by eliminating the buffer zone requirement. Detailed facility design, however, can only be accomplished after site suitability has been established by the requisite regulatory agencies.

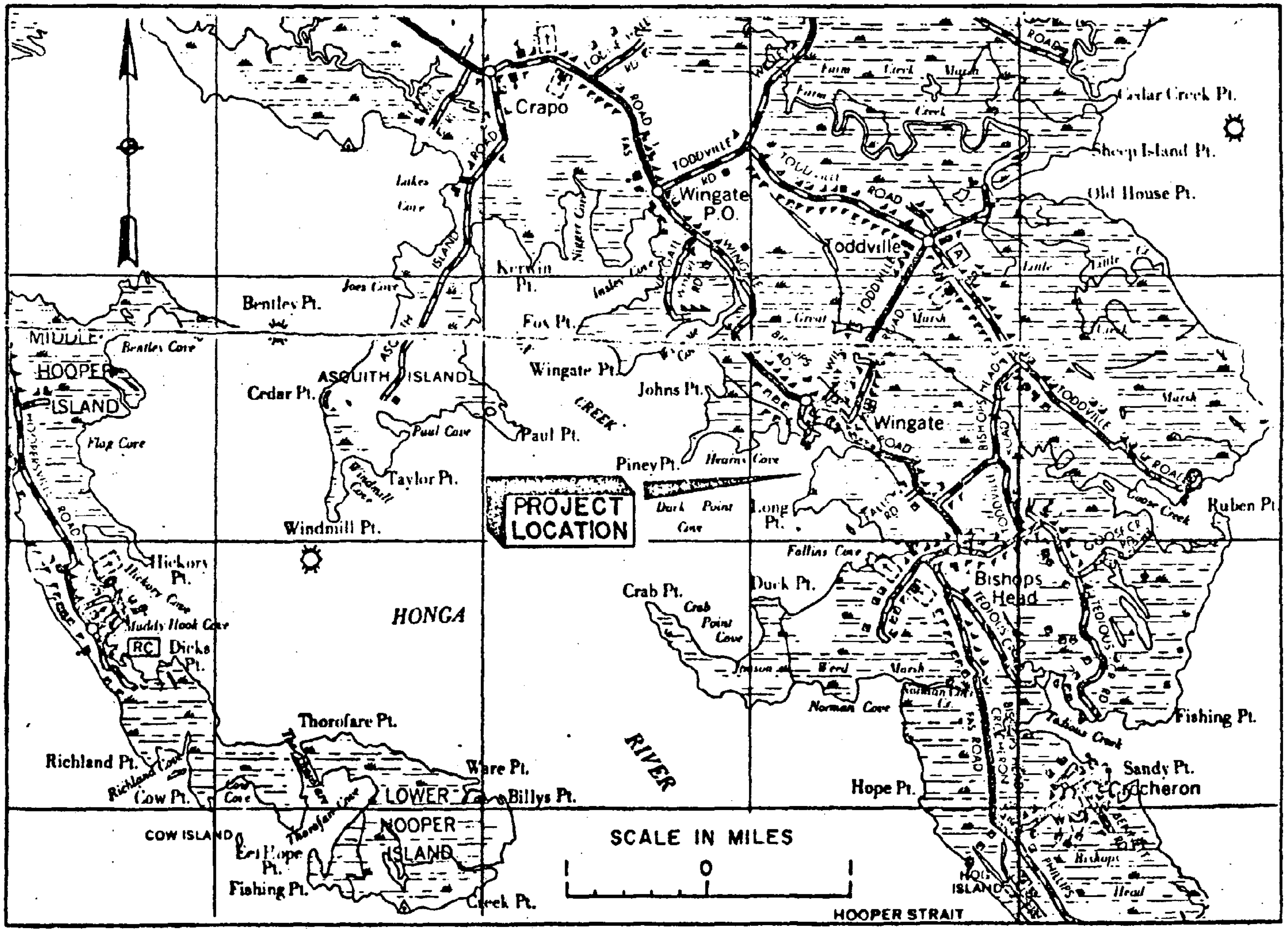

Figure 11. Vicinity map showing the location of the Duck Point Cove Federal navigation project.

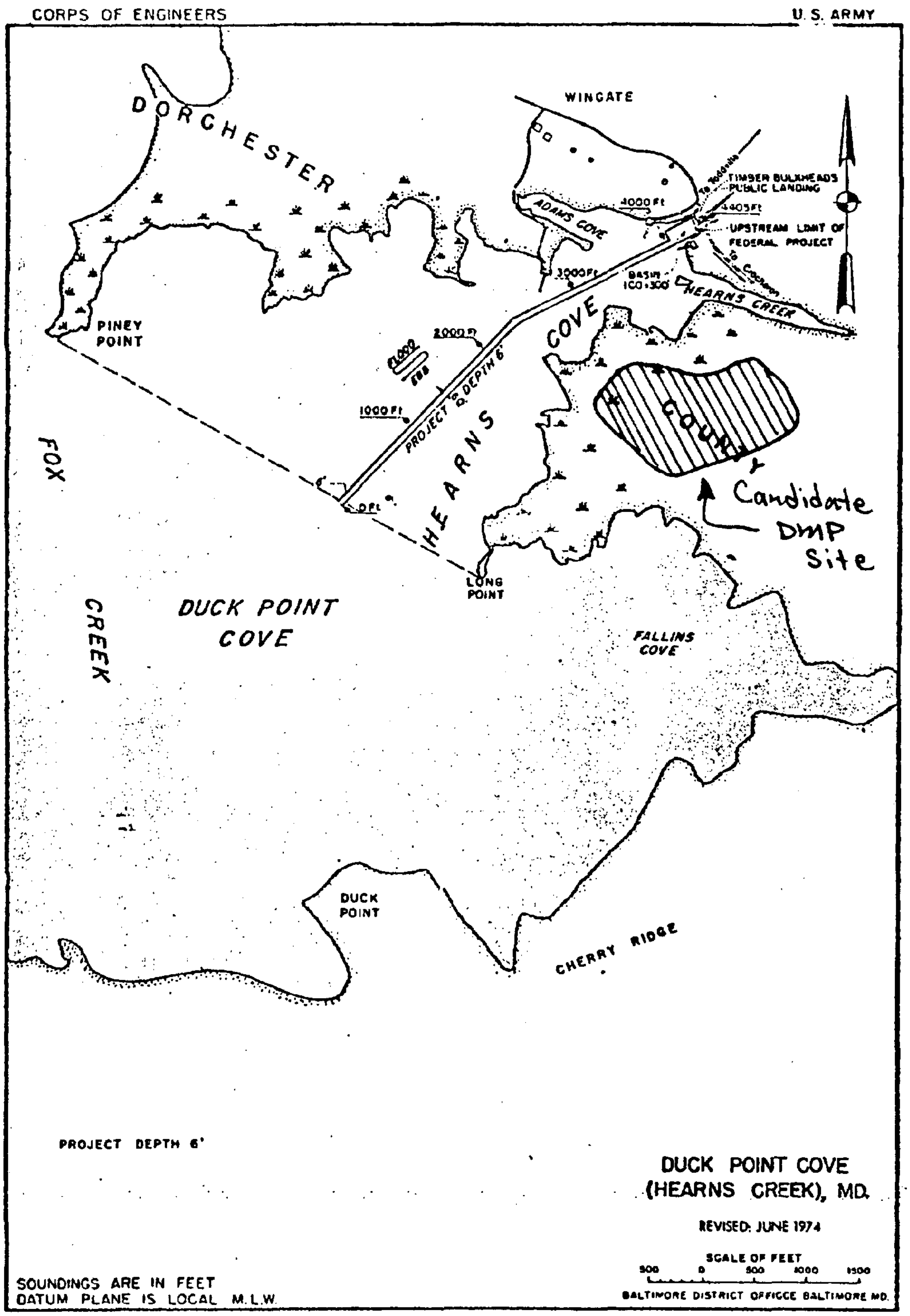

Figure 12. Project map of the Duck Point Cove Federal navigation project showing the location of the candidate dredged material placement site.

Table 16

Data Sheet for the Federal Navigation Project at:
Duck Point Cove

Location: Longitude, 76°15'; Latitude, 38° 17'. Off Honga River, Dorchester County, near the town of Wingate in Dorchester County, MD.

Project authorization: River and Harbor Act of 2 March 1945 (H. Doc. 241, 76th Cong., 1st sess). Local interests must provide dredged material placement sites for future maintenance. Project completed October 1950.

Dredging Operations:

1950	Construction	54,172 cy	(wetland)
1966	Maintenance	19,300	(wetland)

Latest Available Survey: Condition Survey, Nov. 1979 (File 71, map 124).

Latest Full Report: Annual Report of the Chief of Engineers, 1966, p. 264.

Project Costs (Total as of year indicated):

	1951	1966	1979
Const.	$25,289	25,289	25,289
O & M	$------	18,890	24,058

Average Annual O & M Costs (to 30 Sept 1979): $849

Maintenance Interval: 16 years

Projected Maintenance: 1982

Average Annual Shoaling Volume: 1,200 cy* (1,800; 2,800 cy)**

* Based on 1966 maintenance dredging at which time only a portion of the project was dredged.

** Volumes corresponding to dredging to 1-ft and 2-ft overdepths, respectively, based on 1979 Condition Survey.

If further DMP activities are conducted at the site in the near future and the appropriate management and reclamation practices are implemented, it is highly unlikely that the site would be environmentally suitable for future DMP activities. This may be the case even in the absence of site reclamation as foundation stability is expected to preclude the creation of additional capacity to meet future needs utilizing dike-raising techniques. In view of these possibilities it may be advisable to develop the largest facility possible which is compatible with environmental concerns in order that the entire project be restored to project depths. The approach would serve to reduce not only the magnitude of future environmental impacts but also the dredging costs as the entire project will undoubtedly be in need of maintenance at some point beyond 1982.

Lowe's Wharf. The Federally authorized navigation project at Lowe's Wharf provides for a 60-ft wide channel extending from the 7-ft depth contour in Ferry Cove to and including an anchorage basin at Lowe's Wharf, a distance of approximately 1,500-ft (Figures 13 and 14). Maintenance dredging operations have been conducted only once (1971) since project construction in 1957 (Table 17). The previous maintenance history of the project and the results of a Project Condition Survey accomplished by the COE in June 1978 indicate that additional maintenance operations will be required by the year 1985. The volume of dredged material expected to be generated by such operations is on the order of 15,000 cy provided that only the major shoal areas within the project are removed as was accomplished in 1971. In anticipation that the entire project would be in need of maintenance, DMP facility design assumed a dredged material volume of 20,000 cy.

Dredged material placement activities associated with construction and maintenance dredging operations resulted in the unconfined deposition of dredged sediments on nearby tidal and supra-tidal wetland

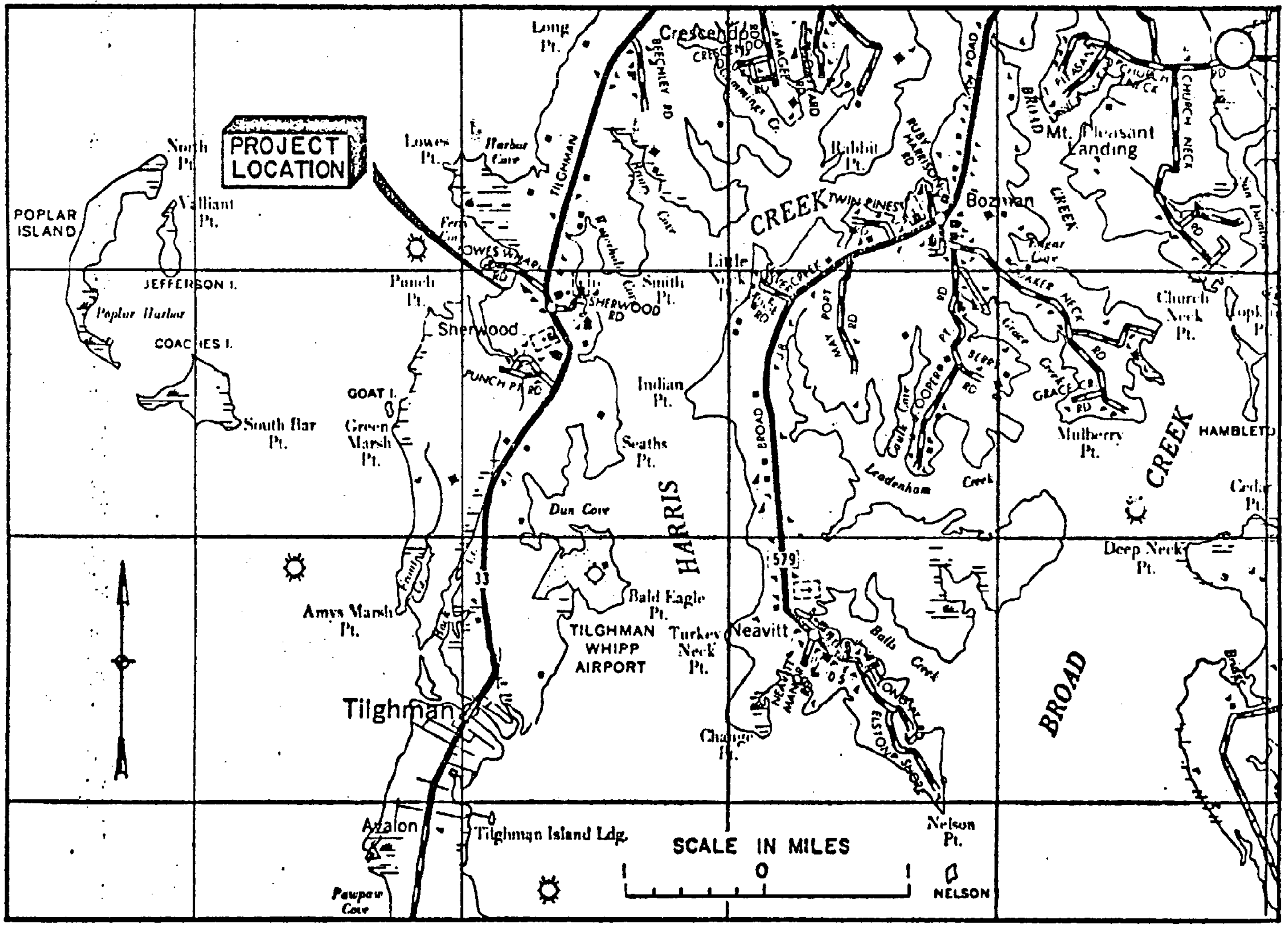

Figure 13. Vicinity map showing the location of the Federal navigation project at Lowe's Wharf.

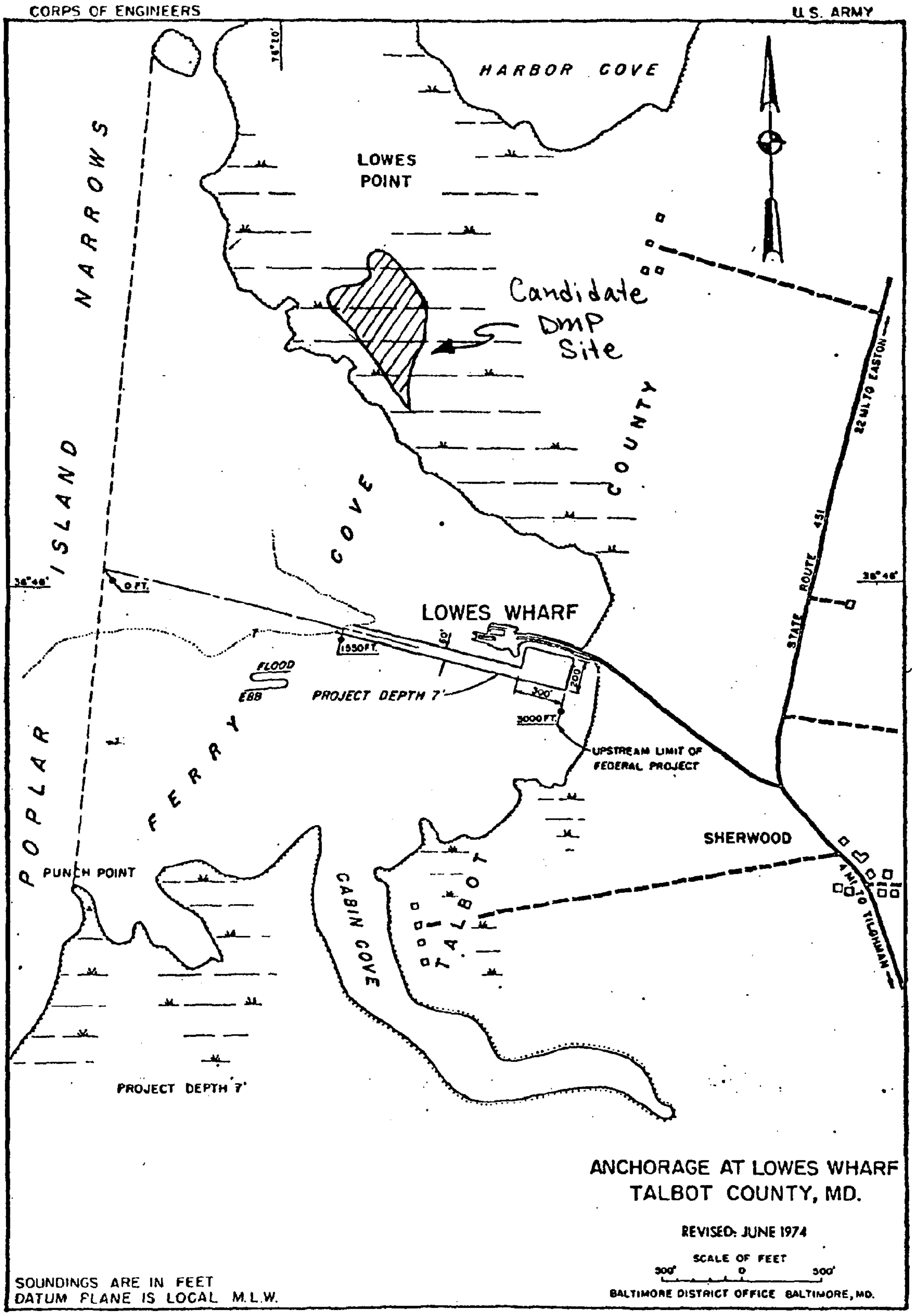

Figure 14. Project map of Federal navigation project at Lowe's Wharf showing the location of the candidate dredged material placement site.

Table 17

Data Sheet for the Federal Navigation Project at Lowe's Wharf

Location: Longitude, 76° 20'; Latitude, 38° 46'. In Ferry Cove, near the village of Sherwood, Talbot County, MD

Project authorization: River and Harbor Act of 3 Sept 1954 (H. Doc. 90, 82d Cong., 1st sess). Local interests to furnish dredged material placement sites for maintenance. Project completed 2 July 1957.

Dredging Operations:

1957	Construction	28,781 cy	(wetland)
1971	Maintenance	15,013	(wetland)

Latest Available Survey: Condition Survey, June 1978 (File 33, map 64).

Latest Full Report: Annual Report of the Chief of Engineers (Baltimore District Extract), 1971, p. 4-7.

Project Costs (Total as of year indicated):

	1958	1971	1979
Constr.	$21,000	21,000	21,000
O & M	$------	34,123	39,122

Average Annual O & M Costs (to 30 Sept 1979): $1,863

Maintenance Interval: 14 years

Projected Maintenance: 1985

Average Annual Sholaing Volume: 1,100 cy areas (Figure 14). The candidate DMP site identified for use in conjunction with the maintenance operations projected for 1985 is the northernmost site. The DMP facility planar area requirements exceeded the area available at the southernmost site and the previously used site closest to the project dredging area is currently maintained and utilized by the landowner for recreational purposes.

The prospective site encompasses approximately 3 acres of upland area contiguous with agricultural land on one side and surrounded by supra-tidal wetlands on the remaining three sides. The site currently supports a sparse stand of Phragmites Communis. The size and shape of the site precludes development with maintenance of a 100-ft buffer zone between the current wetland-upland boundary. As the DMP facility planar area requirements for 20,000 cy of dredged material is 4 acres, it would be necessary to utilize an additional acre of adjacent agricultural land. It may be, however, that a planar area of less than 4 acres would be required as the dredged sediments are expected to be composed primarily of sand-sized particles. Sufficient agricultural land exists in the immedicate vicinity of the site to accommodate a facility of the expected dimensions. This possibility was not, however, explored with the landowner.

b. Slaughter Creek and Choptank River (Pealiquor Shoal)

Of the two above-named Federal navigation projects only the Pealiquor Shoal section of the Choptank River was considered in need of the development of DMP plans as maintenance dredging of the Slaughter Creek project had been accomplished as recently as 1974. A period of 61 years had lapsed between construction of the latter project and maintenance and, as a result, additional maintenance was not expected to be required within the ten year period covered by the Study. The Choptank River project, in contrast, was projected to require maintenance work in the year 1979. Uncertainties regarding the justification for maintenance of the Choptank River project resulted in the latter project replacing the former in order of priority with regard to DMP plan development.

Slaughter Creek. During the course of the development of a DMP plan for the Slaughter Creek Federal navigation project, the need for maintenance dredging became critical as shoaling had occurred to such an extent that the Coast Guard vessels stationed at Taylors Island were severely restricted in their ability to safely navigate the channel. As a result, the COE initiated proceedings to secure a DMP site. The two sites (aquatic and terrestrial) which were identified as a result of this Study were examined and determined to be potentially suitable. Certain environmental concerns associated with the aquatic site and property owner reluctance to permit the proposed activities at either the aquatic or the terrestrial site resulted in their being removed from further consideration. A third candidate site (terrestrial) was identified and its suitability is currently undergoing regulatory agency review.

Choptank River. Legislative modification of the Choptank River project in 1969 resulted in a change in the terms of local cooperation whereby the local sponsor was subsequently responsible for providing a suitable DMP site and required to assume containment facility construction costs. The inability of the local sponsor to provide a DMP site which was economically and environmentally suitable to both the COE and the local sponsor resulted in delaying construction of the project as provided by that authorization. The time delay was of sufficient magnitude (i.e., six years) that commercial traffic utilizing the waterway decreased sufficiently that economic justification for continued maintenance by the COE is highly questionable. These uncertainties led to decreased efforts in developing a DMP plan for the project to the extent that site identification did not proceed past preliminary identification of three prospective terrestrial sites and thus do not warrant discussion at this time.

IV. CONCLUSION

Two factors - the apparent inability of local governments to withstand the increased costs of dredged material placement (DMP) operations and the difficulty with which local sponsors are able to identify suitable DMP sites on short notice - have resulted in increased delays in conducting needed maintenance dredging operations. Moreover, when such operations are delayed to the extent that emergency or critical conditions arise, dredging is oftentimes accomplished utilizing less than optimum DMP methods and sites.

The Choptank River Dredged Material Placement Study was formulated as a pilot study intended to assess the feasibility of developing a comprehensive DMP plan for dealing with dredged material expected to result from maintenance and new work dredging projects in the Choptank River Basin for the 10-year period 1980-1990. The study found that the increasing scarcity of what were previously low-cost and "marginally useful" areas (i.e., wetlands) as DMP sites, either because of environmental concerns or technical/engineering constraints associated with DMP facility development, is necessitating the use of "productive" areas (i.e., woodland, cropland) for DMP operations. Because of the high real estate value and the ecological and economic significance of the latter areas it can be expected that there will be increasing pressure to maximize utilization of these areas through the development of multi-use sites where appropriate and through the reclamation of both single- and milti-use sites. Although there are at present no requirements regarding the type of DMP facility which must be developed for a given dredging project, (the extent to which a facility must be managed/maintained, or the level of reclamation which must be accomplished), neither are there provisions for funding of the costs associated therewith. In the case of most, if not all, Federally authorized projects such costs would need to be assumed by the local sponsor (i.e., county governments).

Estimates of the costs for DMP operations associated with specific dredging projects were derived in order to obtain an economic evaluation of various DMP alternatives. Two approaches to DMP operations were considered in the cost derivations. Dredged material placement facility management/maintenance operations are effectively mandatory for multi-use facilities in order to achieve optimum facility efficiency and utilization. Although not required for single-use facilities, such activities are desirable in the event that the site is to be reclaimed within the shortest possible time and with predictable results. Because of the expected need for future DMP operations to utilize multi-use sites and to accomplish site reclamation, the primary economic elements of the conceptual approach were considered to be site acquisition and preparation, facility construction and management, and site reclamation. The existing general terms of local cooperation defined the cost elements comprising the current approach and consisted of site acquisition and preparation and facility construction.

The results of DMP facility cost estimates which were developed for use in this Study indicated that, irrespective of the approach, DMP operations conducted at two small single-use facilities which accommodate a total volume of dredged material equal to that of a single large multi-use facility were approximately 45% more costly than if conducted at the large facility. The costs associated with facility construction dominated the total cost of a DMP operation and were on the order of 60% for the conceptual approach and in excess of 80% for the current approach. The estimated cost differential between DMP facilities developed under the current and conceptual approaches were on the order of 40-60% greater for the latter relative to the former and derived primarily from the costs associated with facility management and site reclamation.

Facility construction costs dominate the total cost of a DMP operation, and because the land acquisition and site preparation costs are approximately in direct proportion to the size of the facility, the economic incentive for the development of a single large multi-use facility resides with the party or agency responsible for facility construction. Thus, for terms of local cooperation requiring only site acquisition and preparation, it will be immaterial to the local sponsor whether DMP operations are conducted at one large multi-use facility or at two or more smaller single-use facilities. Moreover, because multi-use faiclities require that certain management activities be accomplished while there are currently no requirements regarding management and reclamation of single-use sites, only if the costs for management of a multi-use facility not be incurred by the local sponsor can the acquisition of such sites in view of single-use sites be expected to be actively pursued by the local sponsor. If assumed by the local sponsor, the cost increases deriving from management and reclamation represent an increase of 300-400% relative to local sponsor obligations under the current approach (i.e., site acquisition and preparation). This implies that, excluding land acquisition costs, the local sponsor could finance the site preparation at from four to five facilities not utilizing management and reclamation operations with the funds which would be required to be expended for one DMP facility employing these additional operations.

At the completion of the Study a DMP plan had been formulated for Talbot and Dorchester Counties which provided an assessment of the expected dredging needs within the two county area for the period 1980-1990 and a listing of project specific candidate DMP sites which, on the basis of the site identification procedures whereby they were selected, were expected to have a high probability of acceptability from both environmental and engineering standpoints. The DMP plan and the data and information contained therein will provide the county governments with an opportunity to anticipate the necessary funding requirements for DMP operations associated with future maintenance operations, secure assessments of site suitability from the requisite regulatory agencies, and begin negotiations for site acquisition and thus alleviate or minimize the delays which are currently experienced in conducting maintenance dredging operations.

Although the Study demonstrated the feasibility of developing plans intended to alleviate various problems associated with dredging activities, an assessment of the utility of such planning can be made only if attempts are made to implement any such proposed plan. In this regard, such an assessment will at present depend primarily upon both the long term planning capabilities and the financial resources of the local sponsor.

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